ADVANTEST®
ADVANTEST CORPORATION

D3286

Error Detector

Operation Manual

MANUAL NUMBER FOE-8324233K00

First printing September 1, 1994
Printed in Japan

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

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 be 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

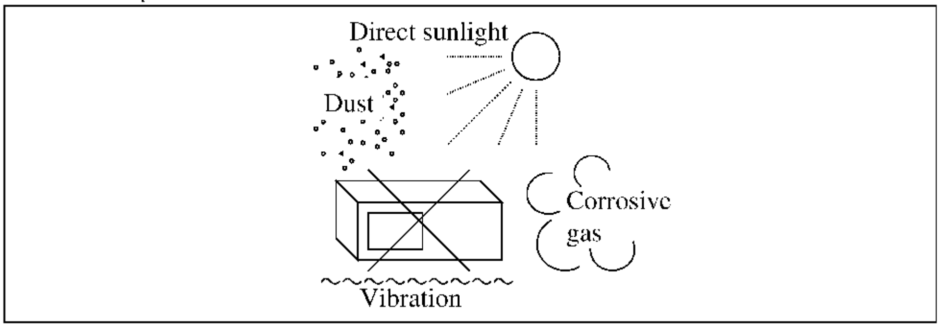
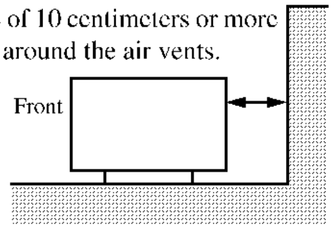


Figure-1 Environmental Conditions

- Operating position

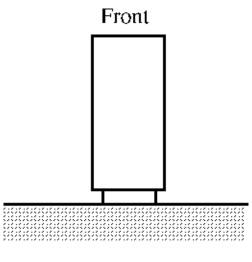
A clear space of 10 centimeters or more must be kept around the air vents.



The instrument must be used in a horizontal position.
A cooling fan, which prevents the internal temperature from rising, is equipped with the instrument.
The air vents on the case must be unblocked.

Figure-2 Operating Position

- Storage position



This instrument should be stored in a horizontal position.
When placed in a vertical (upright) position for storage or transportation, ensure the instrument is stable and secure.

-Ensure the instrument is stable.
-Pay special attention not to fall.

Figure-3 Storage Position

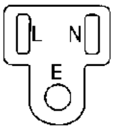
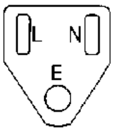
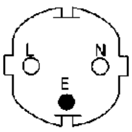
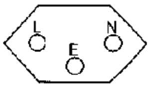
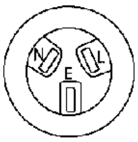
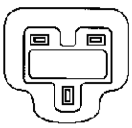
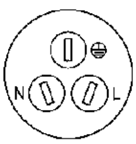
- The classification of the transient over-voltage, which exists typically in the main power supply, and the pollution degree is defined by IEC61010-1 and described below.

  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

Certificate of Conformity

This is to certify, that

Error Detector

D3286

instrument, type, designation

complies with the provisions of the EMC Directive 89/336/EEC in accordance with EN61326 and Low Voltage Directive 73/23/EEC in accordance with EN61010.

ADVANTEST Corp.

Tokyo, Japan

ROHDE&SCHWARZ

Engineering and Sales GmbH
Munich, Germany

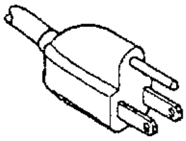
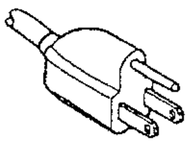
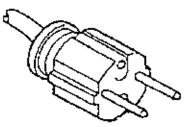
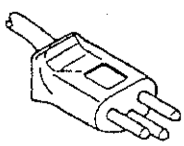
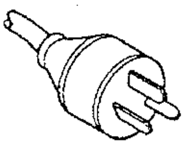
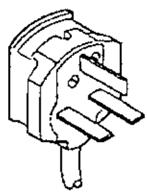
3286.01

No. ECA01

Table of Power Cable Options

There are six power cable options (refer to following table).

Order power cable options by Model number.

	Plug configuration	Standards	Rating, color and length	Model number (Option number)
1		JIS: Japan Law on Electrical Appliances	125 V at 7 A Black 2 m (6 ft)	Straight: A01402 Angled: A01412
2		UL: United States of America CSA: Canada	125 V at 7 A Black 2 m (6 ft)	Straight: A01403 (Option 95) Angled: A01413
3		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
4		SEV: Switzerland	250 V at 6 A Gray 2 m (6 ft)	Straight: A01405 (Option 97) Angled: A01415
5		SAA: Australia, New Zealand	250 V at 6 A Gray 2 m (6 ft)	Straight: A01406 (Option 98) Angled: ---------
6		BS: United Kingdom	250 V at 6 A Black 2 m (6 ft)	Straight: A01407 (Option 99) Angled: A01417

PREFACE

- The following type of device is related to this manual.

D3186 Pulse Pattern Generator

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1. OUTLINE

1.1 Outline of Product

D3286 is a high-performance error detector which is combined with the D3186 pulse pattern generator to evaluate the bit error rate of super-high speed optical communication devices and compound semiconductors at very high speed from 150 Mb/s to 12 Gb/s using 7 types of pseudo-random (PRBS) patterns from 2^7-1 to 2^{31}-1, programmable (WORD) patterns up to 8M (2^{23}) bits, or frame patterns of SDH or SONET structure.

[Measuring functions]

① Bit error rate

② Error count

③ Error interval (EI)

④ Error free interval (EFI)

⑤ Frequency

⑥ Frame count

⑦ Threshold EI or EFI

⑧ Error performance

Note: Only printout is available for items ⑦ and ⑧.

> **CAUTION**
>
> The explanation of the FRAME function described in this manual is applicable when the option 70 is installed.

The advantages of the D3286 include:

[Features]

① For PRBS patterns, mark ratio can be changed between 8 values.

② For FRAME pattern, the type of payload can be selected from WORD, PRBS and CID.

③ ALTERNATE mode is available which changes over 2 patterns (WORD and FRAME) to execute measurement.

④ For error detection, inserting error (0 → 1) and omitting error (1 → 0) can be measured separately. Besides, the measurement of a designated portion in a pattern is available.

⑤ Burst measurement is available which is effective for the circulating loop of optical fiber amplifier.

⑥ Result of measurement is displayed on an easy-to-see large green LED.

⑦ Input terminator voltage can be selected either from 0 V or -2 V.

⑧ From the motor drive type delay line, the phase of clock input can be changed in steps of 1 ps resolution up to ±400 ps.

⑨ The AUTO SEARCH function automatically sets the threshold level of data input and the phase of clock input to optimum values.

⑩ Using the master-slave function, the content of pattern setting can be linked with the D3186 pulse pattern generator.

⑪ The GPIB (IEEE 488) feature enables full remote control, making it easy to construct a measurement and test system.

⑫ The built-in floppy disk drive enables storing/loading the set conditions and the content of pattern setting as well as storing measured data and alarms (MS-DOS® format)

⑬ External printout of measured data and alarms are also available.

⑭ Monitor output, synchronous output and error output functions are prepared.

◆ MS-DOS is a registered trademark of Microsoft Inc. of the U.S.A.

1.2 Before Using

1.2.1 Checking the Appearance and Accessories

When you received the D3286, first check for damage during transportation. Then check the number and type of standard accessories according to Table 1-1.
If the device is damaged or a standard accessory is missing, contact the ATCE (Advantest Customer Engineering) Department or a nearby Advantest office.
For where to contact, see the list attached at the end of this document.

Note : Order the addition of the accessory etc. with the model name.

Table 1-1 List of Standard Accessories

No.	Name	Model name	Q'ty	Remarks
1	Power cable	*	1	
2	SMA-SMA cable	SF104-11SMA-1000	3	
3	GPIB cable	408JE-101	1	
4	3-pole/2-pole conversion adapter for power plug	---	---	
5	2.92mm adapter	02K121-K00S3	4	
6	Operation manual	ED3286	1	
7	Ferrite core for the power cable	ESD-SR-25	1	

* Advantest provides the power cables for each country.
Refer to yellow page of "Table of Power Cable Options" at this manual.

We recommend using the cables shown below in order to meet EMI and EMS standards. These cables are available separately as an optional accessory.

Name	Model name	Remarks
BNC-BNC cable	81-001-0099-004	Double shielded cable 1.5m
External printer cable	57FE-336-201W	Shielded cable with 36-pin connectors at the ends

1.2.2 Working Environment

(1) Avoid using the device in a dusty place or a place where the device is exposed to direct sunlight or where corrosive gas is generated.

(2) Always use the device in a place where ambient temperature is 0 °C to 40 °C, and relative humidity is 40% to 85%.

(3) Because the D3286 has quartz oscillator and precision components, avoid applying too strong mechanical impact on it.

(4) Because the D3286 has a cooling fan of discharge type, be sure to keep 10 cm or larger space between the rear panel and the wall. Also avoid blocking the air intake holes on both sides of the device.

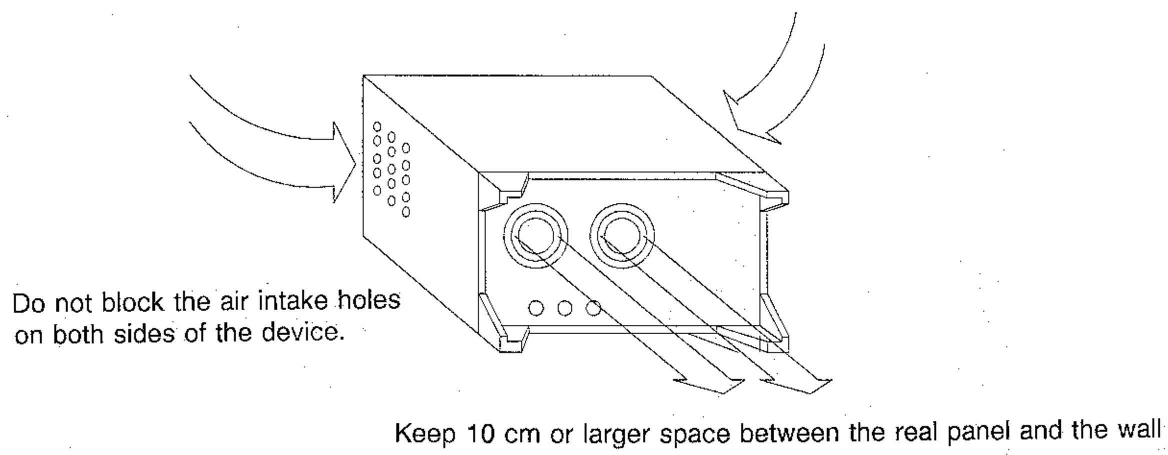


Figure 1-1 Ventilation by the Cooling Fan

1.2.3 Setup

(1) Supply voltage

Supply voltage shall be within 90 VAC to 132 VAC or 198 VAC to 250 VAC, 48 Hz to 63 Hz.
The 100 V and 200 V power circuits are automatically changed over.
Because the device consumes maximum 500 VA power, use a power supply with sufficient capacity.

(2) Power cable and grounding

Advantest provides the power cables for each country.
Refer to yellow page of "Table of Power Cable Options" at this manual.

WARNING

1. If the unit seems abnormal, unplug the power cable immediately.
2. Power cable
   - To avoid electrical and fire hazards, use the supplied power cable.
   - When using the unit overseas, use a power cable which complies with the safety standard of the country where it is used.
   - When plugging or unplugging the cable, always hold the plug.
3. Protective ground
   - Plug the power cable into an AC outlet with a protective ground terminal.
   - Using an extension cord without a protective ground terminal will disable the protective ground.

1.2.4 Precautions for Connecting the I/O Signal Lines

CAUTION

The device internal circuit includes ultra-high frequency electronic components, which are likely to be affected and damaged by static electricity. Use the device with the following precautions in your mind.

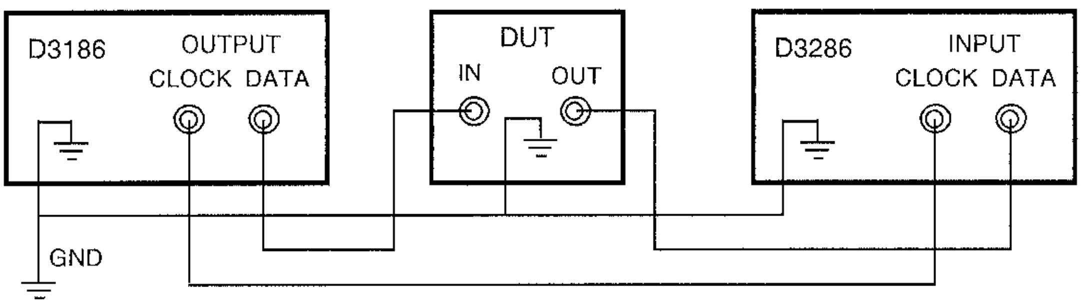
(1) Permissible input voltage for the device input terminal is as shown in Table 1-2. Be sure not to apply a voltage exceeding this limit.

Table 1-2 Permissible Input Voltage of the Input Terminal

Input terminal	Permissible input voltage
DATA INPUT	-4.5 V to +2.5 V
CLOCK INPUT	-2.5 V to +2.5 V (at 0 V terminator voltage) -4.5 V to +0.5 V (at -2 V terminator voltage)

(2) The output terminals for high-speed signal (MONITOR OUTPUT, TRIG OUTPUT, DIRECT ERROR OUTPUT) shall be loaded a 50 Ω pure resistance which is terminated at ground potential and shall not be applied a voltage.

(3) Ground the device with the ground terminal on the device rear panel or the ground pin of the power plug. Also ground the housing of the devices which are connected to the I/O terminals of this device at the same potential (see Figure 1-2).



Be sure to ground the GND terminal of measuring instrument and tested devices before their I/O terminals are connected.

Figure 1-2 Grounding of Measuring Instrument and Tested Device

(4) Discharge the static electricity of the cables and devices which are connected to the I/O terminals before connecting them. Besides, the operator shall wear an each band or the like to prevent electro static charging from occurring on his or her body.

1.2.5 Storage, Transportation and Cleaning

(1) Storage

To store the D3286 for a long time, put it in a corrugated paper box and store the box in a place where humidity is low and direct sunlight does not come in.
Storage temperature and humidity are -20 °C to +60 °C, and 30% to 85%, respectively.

(2) Transportation

To transport the D3286, use the packing material with which the device was packed when delivered to you. When you have no longer the packing material, pack the device in the following manner:

① Wrap the D3286 in a vinyl sheet (with desiccant put in it to prevent influence of moisture).

② Prepare a corrugated paper box with 5 mm or more thickness. Put cushioning material in the box to approximately 40 mm thickness so that the D3286 is surrounded by the cushioning material.

③ After wrapping the D3286 by cushioning material, put accessories in the box, and put cushioning material again in the box. Then close the box, and bind it by packing string.

(3) Cleaning

To clean the D3286, observe the following precaution.

CAUTION

To maintain or clean the device, do not use any solvent which may degrade plastics (organic solvent such as benzene, toluene and acetone).

1.3 Replacing Parts with Limited Life

The D3286 uses the following parts with limited life that are not listed in Safety Summary.
Replace the parts listed below after their expected lifespan has expired.

Part name	Life
Battery	5 years
Delay line	10,000 times
Relay	200,000 times
Key switch	5,000,000 times
Rotary encoder	2,000,000 cycle

2. WHEN YOU USE THE DEVICE FOR THE FIRST TIME

This chapter explains the name and functions of each section on the front and rear panels. For how to operate them, see Chapter 3.

2.1 Front Panel

Figure 2-1 shows the sketch drawing of the front panel, while Figures 2-2, 2-3, 2-4, 2-5 and 2-6 show the input setting/connectors section, pattern setting section, measuring section, timer/clock/printer control section and file/GPIB control section of the front panel, respectively.
The function of each sections is described as follows in order of figure 2-2 to 2-6.

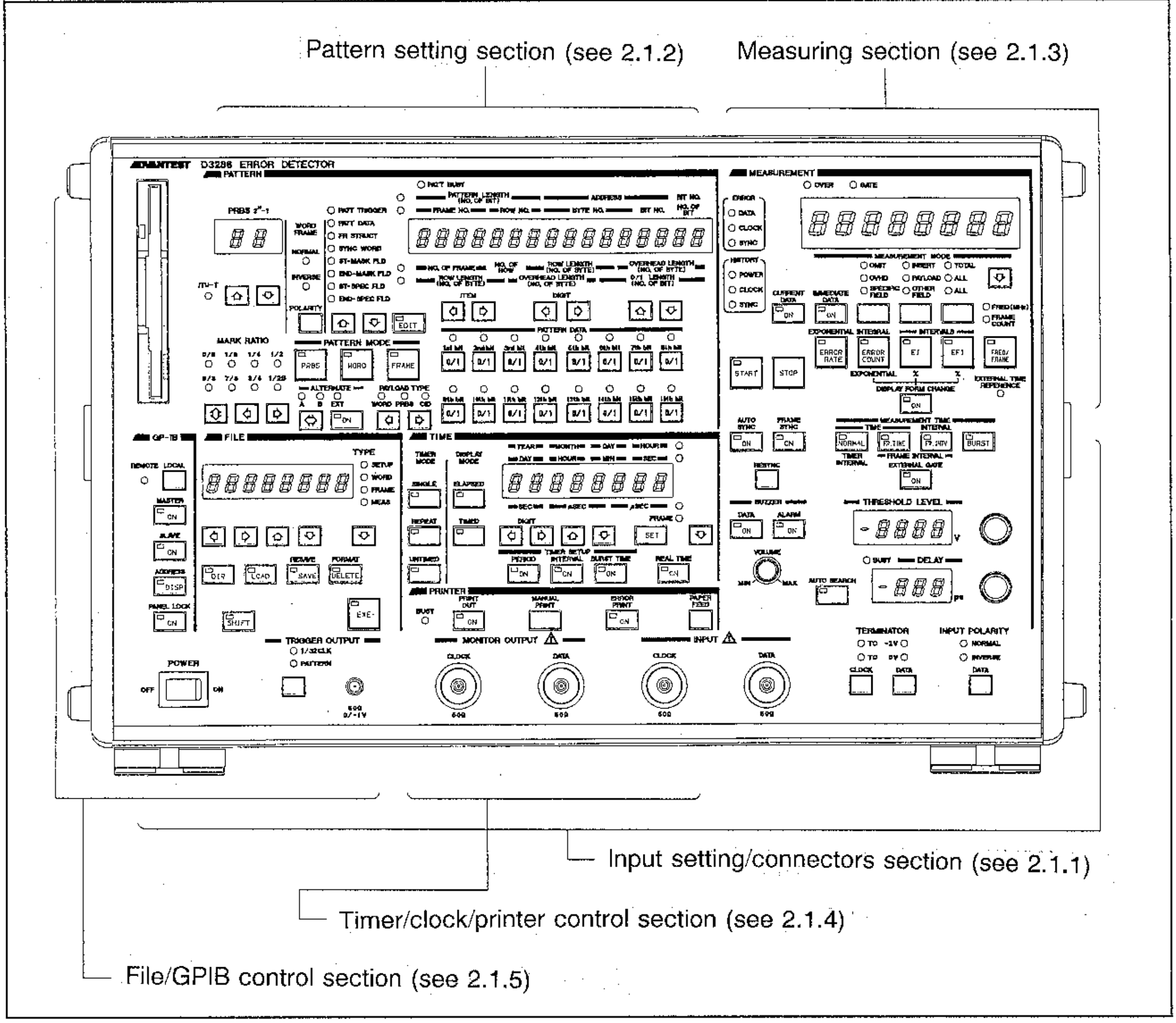


Figure 2-1 Front Panel

2.1.1 Input Setting/Connectors Section

① POWER switch
Turns ON/OFF the power of the D3286. Pressing the right side of the button turns ON the power.

② TRIGGER OUTPUT select key ( ) and 1/32 CLK and PATTERN lamps
This key changes over the type of signal which is output to TRIGGER OUTPUT connector explained in the following item ③: 1/32 divided clock signal or pattern synchronization signal.

③ TRIGGER OUTPUT connector
Outputs trigger signal for observing waveform by oscilloscope.

④ MONITOR OUTPUT - CLOCK connector
Monitor output for clock input

⑤ MONITOR OUTPUT - DATA connector
Monitor output for data input

⑥ INPUT - CLOCK connector
The connector to input clock signal

⑦ INPUT - DATA connector
The connector to input data

⑧ TERMINATOR - CLOCK key ( ) and "TO 0V" and "TO -2V" lamps
The key and lamps to select the terminator voltage for clock input

⑨ TERMINATOR - DATA key ( ) and "TO 0V" and "TO -2V" lamps
The key and lamps to select the terminator voltage for clock input

⑩ INPUT POLARITY key ( ) and NORMAL and INVERSE lamps
The key and lamps to change over the polarity of data input

⑪ DELAY setting section
The control volume and indicator to set the delay time of clock input

⑫ THRESHOLD LEVEL setting section
This section is described the displays and knobs that are used to set the threshold level for the data input.

⑬ AUTO SEARCH key ( )
Executes/cancels the AUTO SEARCH function which automatically adjusts the delay time of clock input and the threshold level for data input.

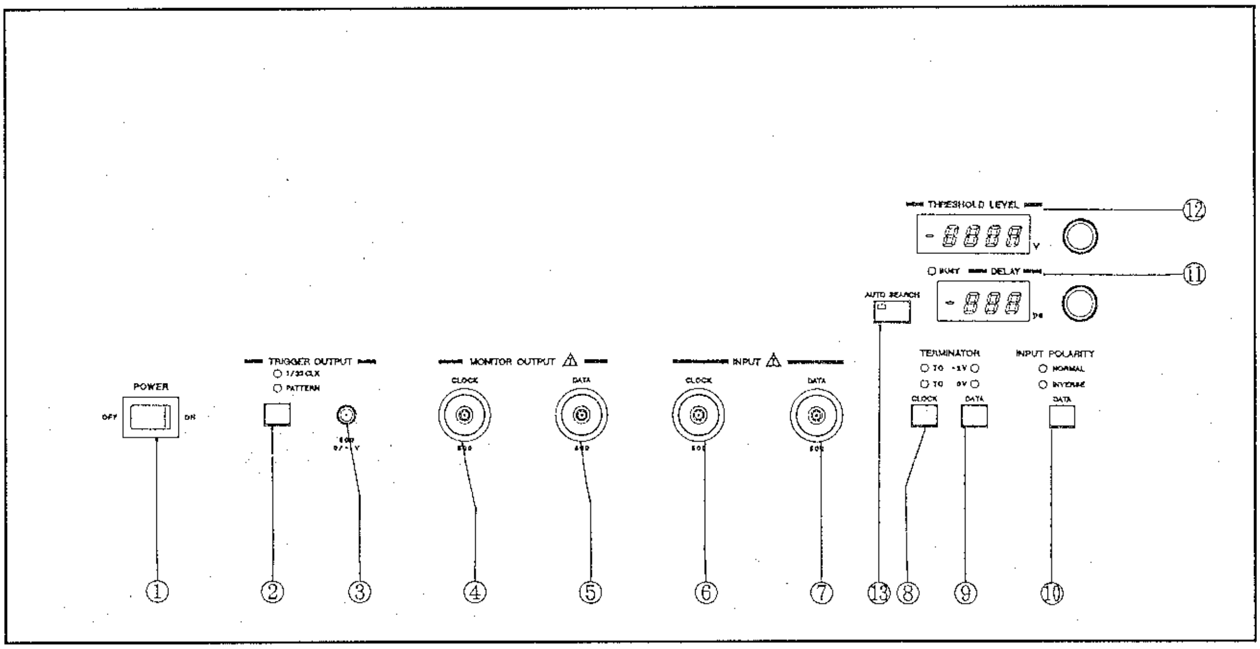


Figure 2-2 Input Setting/Connectors Section

2.1.2 Pattern Setting Section

This pattern setting section determines the patterns used to compare data for error detection. The panel layout is the same as that of D3186, except for a small modification.

(1) Pseudo-random pattern setting section

① PATTERN MODE - PRBS key ( )
Changes over the pattern setting for data comparison to pseudo-random mode.

② PRBS column count (N) select key (⇧, ⇩) and indicator
Select from 7 types of PRBS pattern: 7, 9, 10, 11, 15, 23 and 31 columns.

③ MARK RATIO select key (⇳, ⇦, ⇨)and "0/8", "1/8", "1/4", "1/2", "8/8", "7/8", "3/4" and "1/2B" lamps
Select one from 8 mark ratios (0/8 to 8/8).

④ ITU-T lamp
Lights up when the set PRBS column count and mark ratio conform to the international recommendation.

(2) Word pattern and frame pattern setting section

⑤ PATTERN MODE - WORD key ( )
Changes over the pattern for data comparison to WORD mode.

⑥ PATTERN MODE - FRAME key ( )
Changes over the pattern for data comparison to FRAME mode.

⑦ ALTERNATE key ( )
Turn this switch ON to use the ALTERNATE mode which compares and measures data by changing over between two (A and B) patterns.

⑧ A/B select key (⇔) and A and B lamps
In ALTERNATE mode, changes over the pattern for comparison and measurement or editing to A or B.

⑨ EXIT lamp
In ALTERNATE mode, lights up when pattern is changed over according to external signal. Internal/external change-over is made by bit 1 of SW1 on the rear panel (see Figure 2-6 ⑥).

⑩ PAYLOAD TYPE select key (⇦, ⇨) and WORD, PRBS, CID lamps
This key selects the type of payload in FRAME mode.

⑪ POLARITY select key ( ) and NORMAL and INVERSE lamps
Selects the logic of data compare patterns in WORD or FRAME mode.

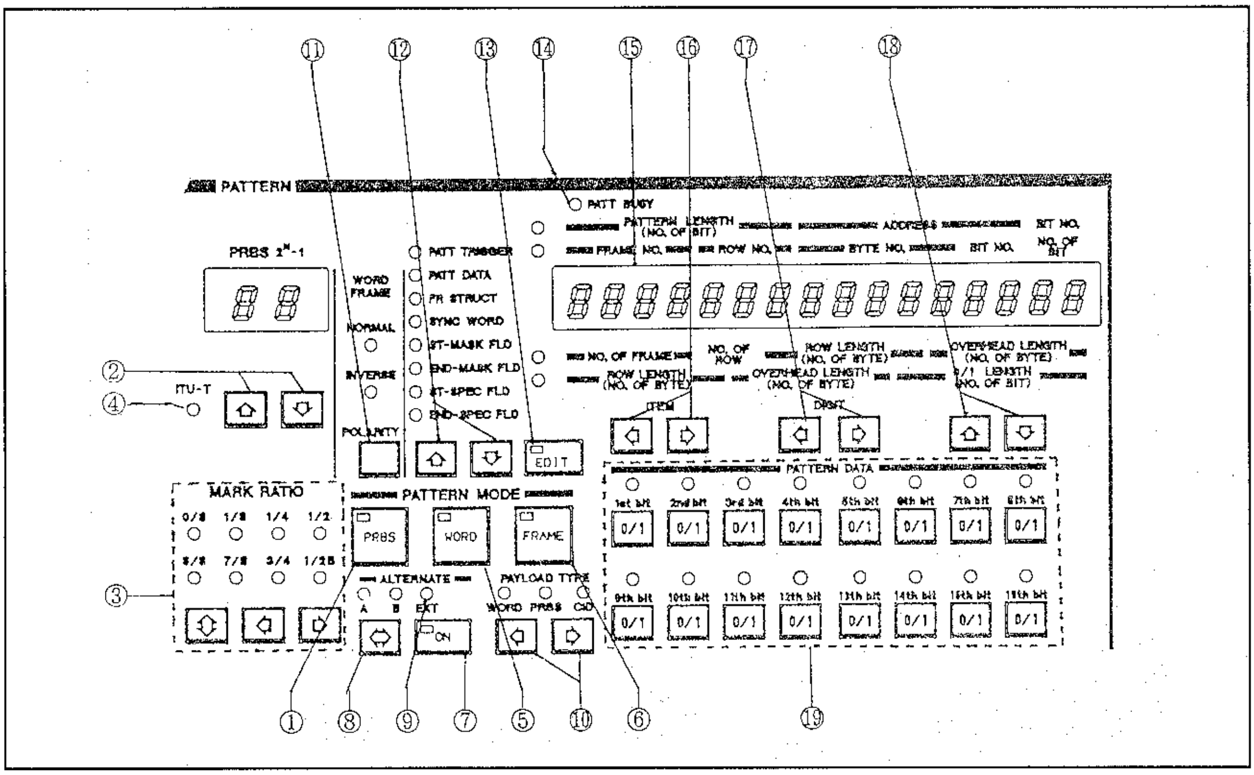


Figure 2-3 Pattern Setting Section

⑫ Group select key (⇧, ⇩) and lamps

Selects the group of items to display on the pattern length/address indicator ⑮.

⑬ EDIT key (▭)

Turns ON while WORD or FRAME mode patterns are being edited.

⑭ PATT BUSY lamp

Lights up while the content of pattern setting is being transferred to the pattern generating circuit.

⑮ Pattern length/address indicator

Displays the length, address and byte number of pattern.

This indication changes with set pattern modes and set items. What item to indicate is shown by the lamp on the left.

⑯ ITEM key (⇦, ⇨)

Selects what item to set from those displayed on the pattern length/address indicator ⑮.

⑰ DIGIT key (⇦ , ⇨)

Shifts left- or rightwards the digit (at which the pointer is lighting) for setting pattern length or address.

⑱ Pattern length/address set key (⇧ , ⇩)

Increments/decrements the value of the digits which is higher in order than that at which the pointer is lighting in the pattern length/address indicator.

⑲ PATTERN DATA lamp and 1st to 16th keys (☐ ,···, ☐)

Displays/sets the content of the patterns for 16 bits of the address shown by the pattern length/address indicator.

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2.1.3 Measuring Section

① to ③ ERROR - DATA, CLOCK and SYNC lamps
Light up on real time when a bit error occurred on data input, when clock input is short, or when pattern synchronization error occurred.

④ to ⑥ HISTORY - POWER, CLOCK and SYNC lamps
Light up when power was turned off or power outage occurred during measurement, when clock input is short, or when pattern synchronization error occurred.

⑦ OVER lamp
Lights up when the measuring or display range is exceeded

⑧ GATE lamp
Lights up during measurement.

⑨ Measurement result indicator
Displays the result of measurement. Display format differs with measuring functions.

⑩ CURRENT DATA key ( )
Selects whether or not to display the current data of measurement.

⑪ IMMEDIATE DATA key ( )
Changes over in which type to display the current data of measurement: cumulative value or instantaneous value.

⑫ to ⑯ MEASUREMENT MODE - OMIT, INSERT, TOTAL, OVHD, PAYLOAD, ALL, SPECIFIC FIELD, OTHER FIELD and ALL lamps and the select key (, , ⇩)
The key and lamps to select which type of error to detect/display in which range.

⑰ to ㉒ ERROR RATE, ERROR COUNT, EI, EFI and FREQ/FRAME keys (,···,) and FREQ (MHz) and FRAME COUNT lamps
The keys set the measurement result display function to "error rate", "error count", "error interval", "error free interval", "frequency" or "frame count".

㉓ DISPLAY FORM CHANGE key ( )
Changes over in which format to display the result of error detection.

㉔ EXTERNAL TIME REFERENCE lamp
Indicates that reference signal for measuring time is externally input.

㉕ to ㉖ START and STOP keys (,)
Starts/stops measurement.

㉗ AUTO SYNC key ( )
Turns ON/OFF the auto pattern synchronize function.

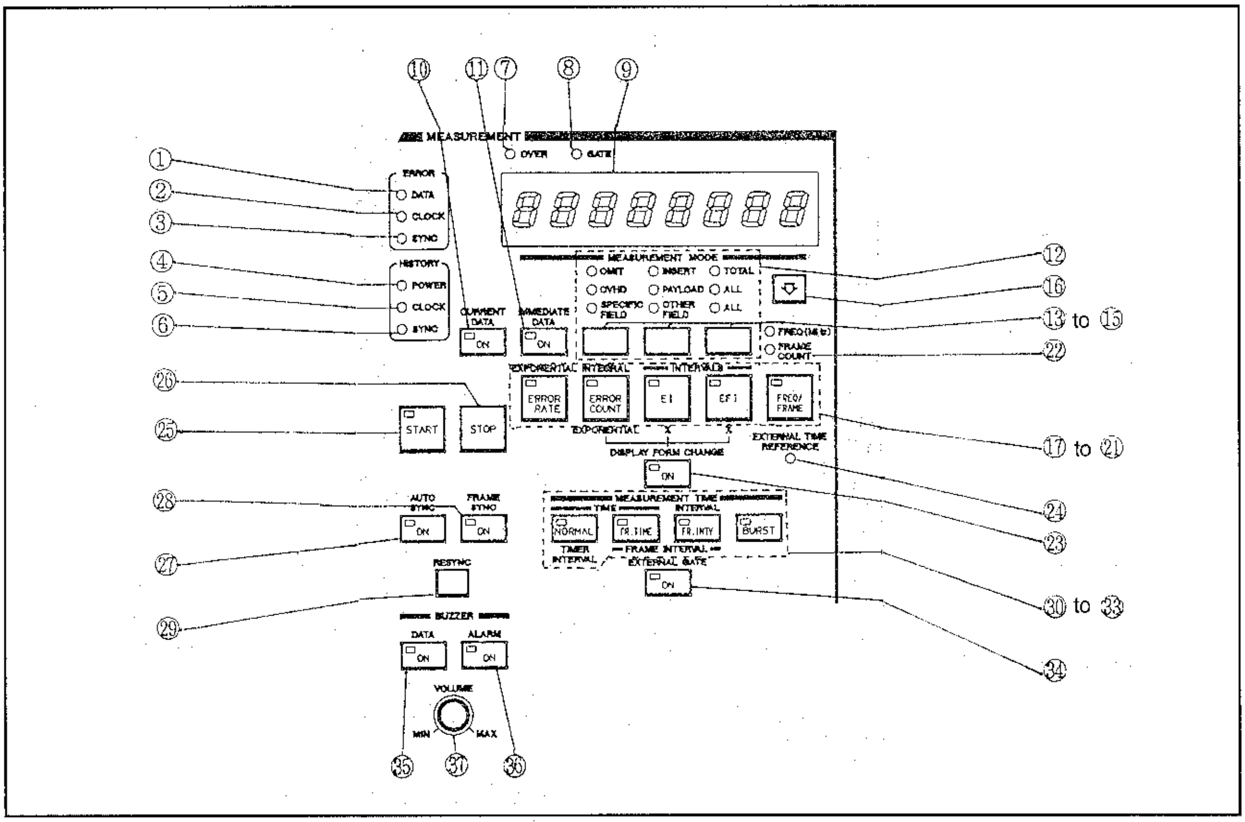


Figure 2-4 Measuring Section

㉘ FRAME SYNC key (▭)
Turns ON/OFF the frame synchronize function.

㉙ RESYNC key (□)
Executes re-synchronization of pattern.

㉚ to ㉝ MEASUREMENT TIME - NORMAL, FR TIME, FR INTV and BURST keys (▭ , ▭ , ▭ , ▭)
Change over the measurement time mode between normal, frame time, frame interval and burst.

㉞ EXTERNAL GATE key (▭)
Changes over whether the gate control of measurement should be executed internally or according to external signal.

㉟ to ㊱ BUZZER - DATA and ALARM keys (▭ , ▭)
Determines the buzzer sounding conditions: turns ON/OFF the buzzer when a bit error is detected or when an alarm condition occurs.

㊲ BUZZER - VOLUME control
Adjusts the buzzer sound volume.

2.1.4 Timer/Clock/Printer Control Section

(1) Timer/clock section

① to ③ TIMER MODE - SINGLE, REPEAT and UNTIMED keys (, ,)
Select the timer operation mode.

④ to ⑤ DISPLAY MODE - ELAPSED and TIMED keys (,)
Selects the timer display mode.

⑥ Timer/clock indicator
Displays the date, hours and minutes of timer or clock.

⑦ DIGIT key (⇦ , ⇨)
Shifts left- or rightwards the digit to set for the timer or clock.

⑧ Timer/clock change key (⇧ , ⇩)
Increments/decrements the value of the digit of timer/clock selected in above ⑦ by the DIGIT key.

⑨ SET key ( )
Starts/ends the setting of timer/clock.

⑩ Timer/clock display range select key (⇩) and lamps

The key and lamps to select in which range and units to display the timer/clock value: years:month:day:hours, day:hours:minutes:seconds, seconds:milliseconds:microseconds, and frame.

⑪ to ⑬ TIMER SETUP - PERIOD, INTERVAL and BURST TIME keys (, ,)
Change over the timer/clock display modes among measuring time, measuring intervals and burst measuring time.

⑭ REAL TIME key ( )

Changes over the timer/clock display mode to real time.

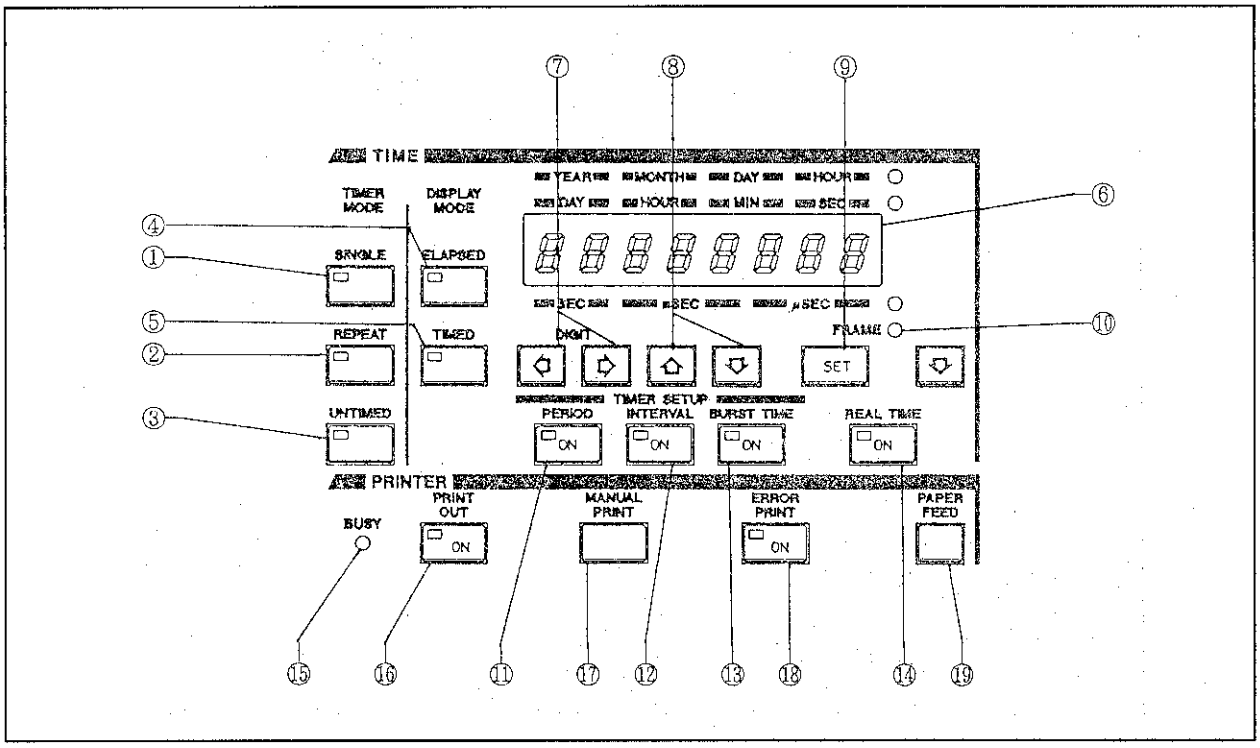


Figure 2-5 Timer/Clock/Printer Control Section

(2) Printer control section

⑮ BUSY lamp
Indicates that the printer is now outputting or paper feeding.

⑯ PRINT OUT key ( )
Automatically prints out measured data.

⑰ MANUAL PRINT key ( )
Manually prints out measured data.

⑱ ERROR PRINT key ( )
Prints out information at the occurrence or restoration of or from an error or alarm condition.

⑲ PAPER FEED key ( )
Feeds paper of the printer.

2.1.5 File/GPIB Control Section

(1) File control section

① File number indicator
Displays the file number according to the key setting in ④ to ⑨.
Displays the GPIB device address when the address display key is set to ON in ⑯.

② DIGIT key (⇦ , ⇨)
Shifts left- or rightwards the digit to set a file number.

③ File number set keys (⇧ , ⇩)
Increments/decrements the value of the digits which are higher in order than that selected with the DIGIT key in above ②.

④ File type set key (⇩) and SETUP, WORD, FRAME and MEAS lamps
The key and indicating lamps to set the type of the file which is subject to DIR, LOAD, SAVE or RESAVE processing.

⑤ DIR key ( )
Displays a directory on the file number indicator. Valid only when the SHIFT key is set to OFF in ⑨.

⑥ LOAD key ( )
Instructs file reading. Valid only when SHIFT key is set to OFF in ⑨.

⑦ SAVE/RESAVE key ( )
Saves/re-saves data in a file. Saves when the SHIFT key is set to OFF in ⑨, while re-saves when set to ON.

⑧ DELETE/FORMAT key ( )
Deletes a file or initializes a disk. Deletes when the SHIFT key is set to OFF in ⑨, while initializes when set to ON.

⑨ SHIFT key ( )
Changes over functions of the above ⑦ and ⑧ keys.

⑩ EXE key
Executes the file operations specified by above ⑤ to ⑨ keys.

⑪ Eject button
The push-button to take out the floppy disk.

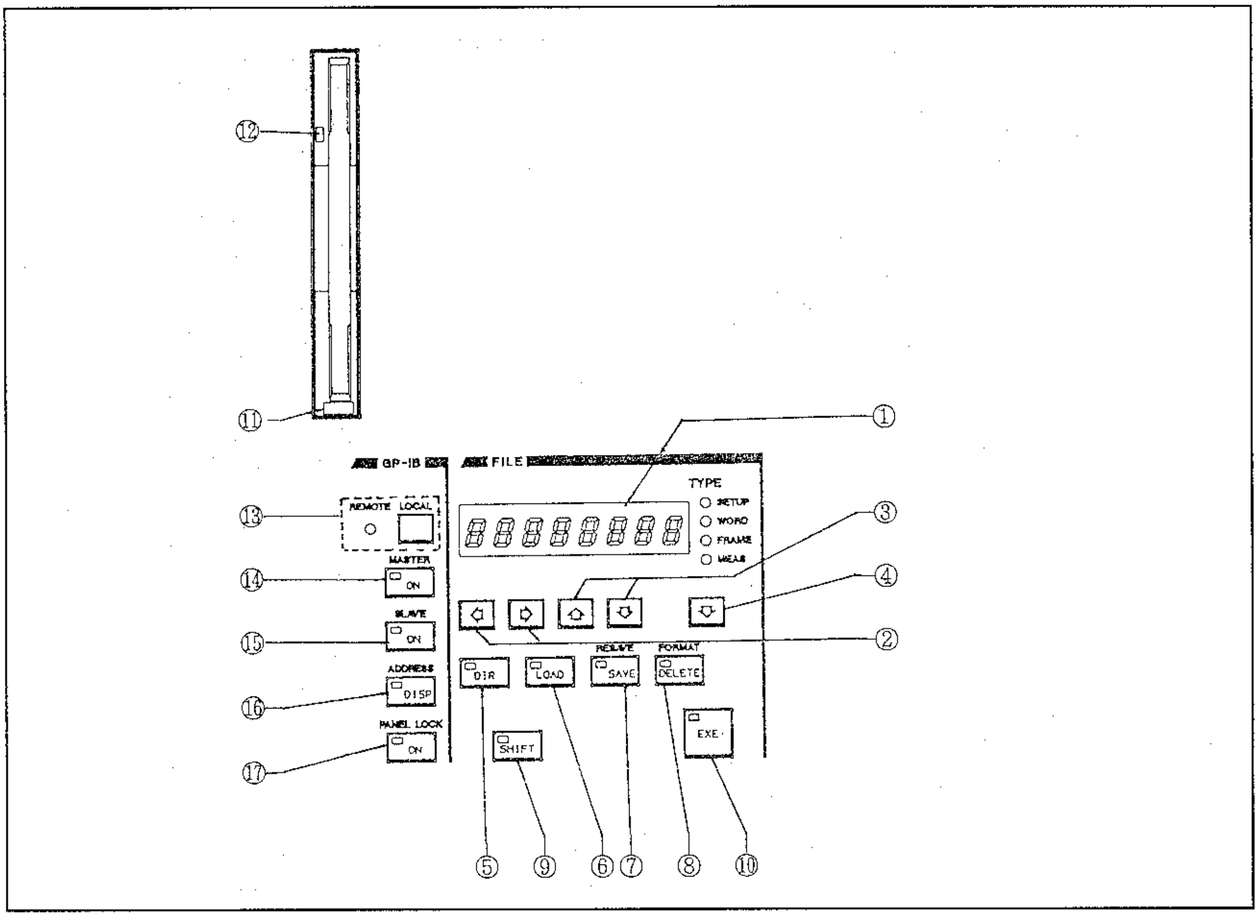


Figure 2-6 File/GPIB Control Section (1 of 2)

⑫ Access lamp

Lights up when the floppy disk is being accessed.

Do not press the EJECT button while this lamp is lighting.

(2) GPIB control section

⑬ REMOTE lamp and LOCAL key ( )

In remote mode, the REMOTE lamp lights up. Pressing the LOCAL key returns to local mode.

⑭ MASTER key ( )

Turn this key ON to use the master control function which interlocks the D3286 with the pattern setting section of the D3186 pulse pattern generator.

⑮ SLAVE key ( )

Turn this key ON to use the slave control function which interlocks the pattern setting section of the D3286 with the D3186 pulse pattern generator.

⑯ ADDRESS DISP key ( )

Turn this key ON to display the GPIB device address on the file number indicator ① to confirm or change the address.

⑰ PANEL LOCK key ( )

Turning this key ON disables all other keys and control volumes except the LOCAL key ⑬.

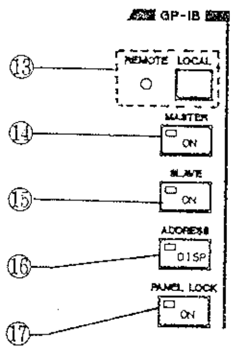


Figure 2-6 File/GPIB Control Section (2 of 2)

2.2 Rear Panel

① LINE inlet
The inlet for AC power line. Connect this to an AC receptacle by the attached power cable.

② BREAKER
Turns OFF if an excess current flows through the AC line.

③ Ground terminal
The terminal to ground the housing of the device.

④ PRINTER connector
Used to output measured data to an external printer.

⑤ GPIB connector
Used to control the D3286 from a personal computer through GPIB or to use the master/slave function linking with D3186 pulse pattern generator.

⑥ DIP switch SW1
Set to select additional functions of the device (see Table 3-15).

⑦ DIP switch SW2
Set to select additional functions of the device (see Table 3-16).

⑧ DIP switch SW3
Set to select additional functions of the device (see Table 3-17).

Note : When the setting of SW1 to SW3 in above ⑥ to ⑧ has been changed, turn the power once OFF, and turn the power ON again after 5 or more seconds.

⑨ EXT REF INPUT connector
Used to externally input 10 MHz reference signal for measuring time.

⑩ EXT GATE INPUT connector
Used to externally input measurement gate signal.
To use this input terminal, set the EXTERNAL GATE key ㉞ on the front panel (see Figure 2-4) to ON.

⑪ EXT ALT INPUT connector
Used to externally changing over between pattern A and B in ALTERNATE pattern mode.
To use this input terminal, set bit 1 of SW1 to ON (1) in above ⑥.

⑫ STRETCHED ERROR OUTPUT connector
Outputs error detect signal with pulse width widened.

⑬ DIRECT ERROR OUTPUT connector
Outputs error detect signal.

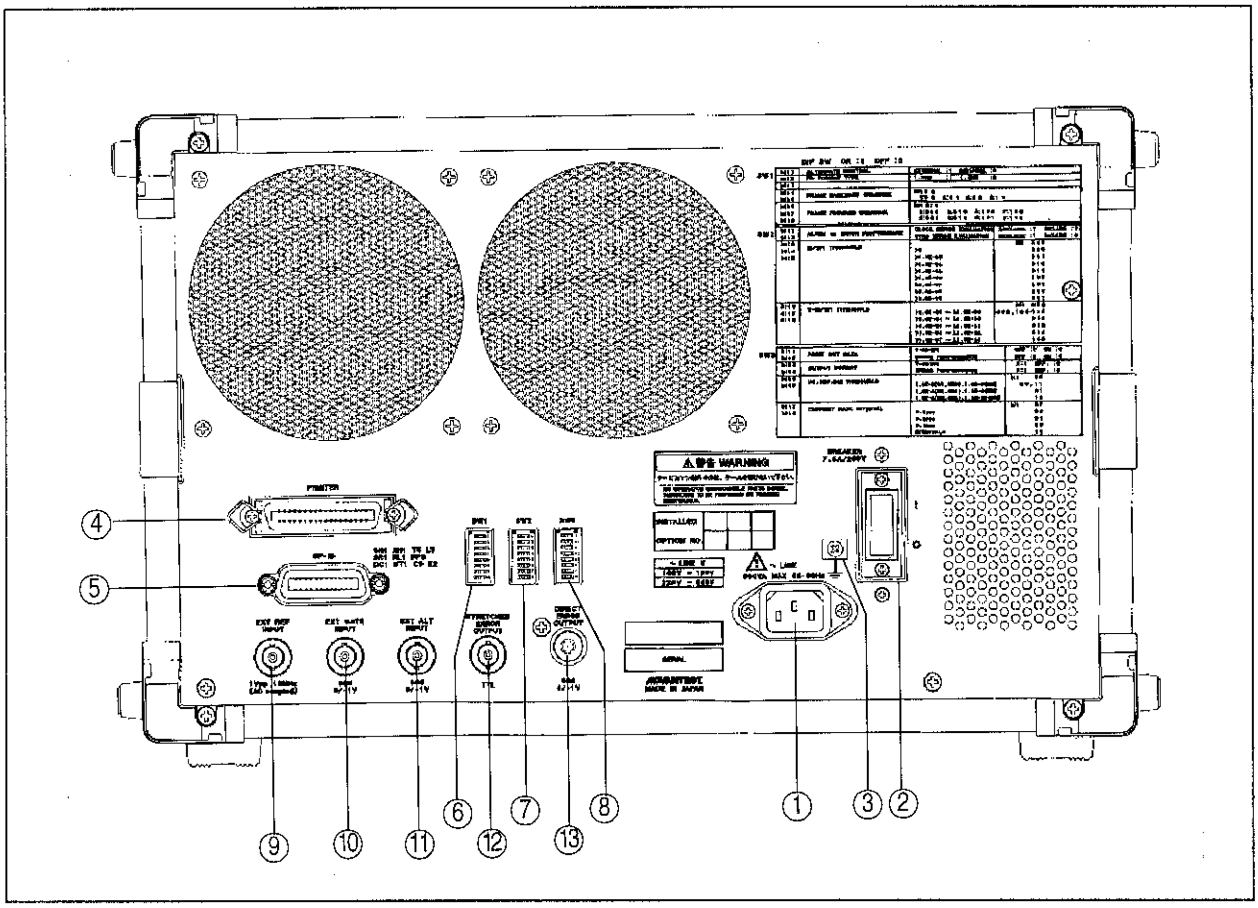


Figure 2-7 Rear Panel

3. OPERATION

3.1 Power On

With the POWER switch (① in Figure 2-2) on the front panel turned OFF (by pressing the left side of the switch) and the breaker on the rear panel (② in Figure 2-7) turned ON (by pressing the "." mark side), connect the LINE inlet (① in Figure 2-7) on the rear panel to a receptacle using the attached power cable.
Turning the POWER switch ON turns on the power.
Avoid frequently turning ON/OFF the breaker, instead of the POWER switch, to turn on/off the power.

CAUTION

1. Supply voltage shall be within 90 VAC to 132 VAC or 198 VAC to 250 VAC, 48 Hz to 63 Hz.
   The 100 V and 200 V power circuits are automatically changed over.
2. Because the device consumes maximum 500 VA power, use a power source with sufficient capacity.
3. Do not turn on the power with a disk including a file of the name shown below inserted in the floppy disk drive.
   If a disk with one of these files is inserted in the floppy disk drive at powering up, the device does not work correctly.
   File names: AUTOEXEC.BAT
   CONFIG.SYS
   RAMDISK.SYS
   SLOT.SYS

3.2 Operation on the Panel

3.2.1 Operation on the Front Panel

Followings are the explanation of how to operate each section on the front panel. Read the explanation referring to Figures 2-1 to 2-6.

(1) Input Setting/Connectors Section

The following item numbers correspond to those in Figure 2-2.

① POWER switch

This switch is used to turn ON/OFF the power of the D3286.
Pressing the right side of the switch turns ON the power. When the power is turned on, the device comes in ready state after all indicators and lamps on the panel light up for a certain period of time.
If pressing this switch does not turn on the power, check whether or not the breaker on the rear panel (② in Figure 2-7) is set to OFF.

② TRIGGER OUTPUT select key ($\square$) and 1/32 CLK and PATTERN lamps

The key and lamps for selecting which of 1/32 divided clock (1/32 CLK) signal and pattern synchronization (PATTERN) signal to output to the TRIGGER OUTPUT connector ③.
Each time this key is pressed, output signal is changed over and the corresponding lamp lights up.

③ TRIGGER OUTPUT connector

This connector is used to output the trigger signal for observing waveform by oscilloscope.
Which signal to output can be selected in above ②: 1/32 divided clock signal or pattern synchronization signal.
In observing data monitor output, triggering by 1/32 divided clock signal overlays waveforms to display an eye pattern, while triggering by pattern synchronization signal enables observing a given part of a period of the pattern by still image.
However, in observing the payload part of a pattern whose payload type is PRBS and whose pattern mode is FRAME, eye pattern is observed even when triggered by pattern synchronization signal.

To change the pattern synchronization signal generating position, select PATT TRIGGER with the group select key (⇩) ⑫ in the pattern setting section (see Figure 2-3) and set an address number with the DIGIT key (⇦ , ⇨) ⑰ and the pattern length/address set keys (⇧ , ⇩) ⑱ when pattern mode is PRBS or WORD. When pattern mode is FRAME, select a set item from FRAME NO., ROW NO. and BYTE NO. with the ITEM key (⇦ , ⇨) ⑯, and set a frame number, row number or byte row number or byte number with the DIGIT key (⇦ , ⇨) ⑰ and the pattern length/address set keys (⇧ , ⇩) ⑱. Only odd number is available for byte number. Incrementing/decrement address number by 1 or byte number by 2 corresponds to the change in pattern synchronization generating position by ±16 bits.

When the pattern is long, such as PRBS 23 columns or more, the period of pattern synchronization signal becomes long, resulting in less number of triggering operations on the oscilloscope. Thus the observed waveform becomes weaker in intensity. In such a case, make the oscilloscope display time (or persist time) longer.

The level of this trigger signal is approximately 0 V/-1 V. The load shall be terminated at 0 V by 50 Ω resistance.

④ MONITOR OUTPUT - CLOCK connector

The output for monitoring clock input. This connector outputs a signal which has passed through the internal clock amplifier and variable delay line. The load shall be terminated at 0 V by 50 Ω resistance.

⑤ MONITOR OUTPUT - DATA connector

The output for monitoring data input. This connector outputs a signal which has passed through the internal data amplifier. The load shall be terminated at 0 V by 50 Ω resistance.

Figure 3-1 shows the relation in optimum phase between MONITOR OUTPUT - CLOCK output ④ and MONITOR OUTPUT - DATA output ⑤ when clock and data are input.

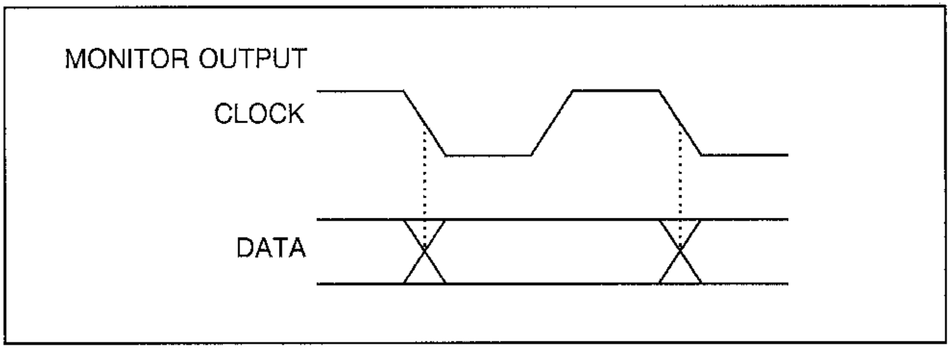


Figure 3-1 Optimum Phase of MONITOR OUTPUT

⑥ INPUT - CLOCK connector

Clock input connector. To this connector, connect the clock output of the device to be tested or measured, or either CLOCK1 or $\overline{\text{CLOCK1}}$ or CLOCK2 output of D3186.

⑦ INPUT - DATA connector

Data input connector. To this connector, connect the data output of the device to be tested or measured.
Be sure not to apply a voltage exceeding +2.5 V/-4.5 V on this connector.

⑧ TERMINATOR - CLOCK key (□) and "TO 0V" and "TO -2V" lamps

The key and lamps for selecting the terminator voltage for clock input ⑥.
The internal terminating resistance is approximately 50 Ω, which is connected to 0 V terminator voltage when "TO 0V" is selected, while to -2 V terminator voltage when "TO -2V" is selected.

⑨ TERMINATOR - DATA key (□) and "TO 0V" and "TO -2V" lamps

The key and lamps for selecting the terminator voltage for data input ⑦.
The internal terminating resistance is approximately 50 Ω, which is connected to 0 V terminator voltage when "TO 0V" is selected, while to -2 V terminator voltage when "TO -2V" is selected.

⑩ INPUT POLARITY key (□) and NORMAL and INVERSE lamps

The key and lamps for changing over the polarity of data input.
Each time this key is pressed, the polarity is changed over between NORMAL (positive) and INVERSE.
When the pattern setting section of D3186 is set the same as that of D3286 and the data logic is inverted internally in the device to be tested or measured, or because $\overline{\text{DATA}}$ output of D3186 is used, this key shall be set to INVERSE.

⑪ DELAY setting section

This section includes the volume for controlling the delay of clock input against data input and an indicator.
To change the delay, the motor driven trombone type delay line is used.
Setting range is -400 ps to +400 ps, and resolution is 1 ps.
Turning this volume counterclockwise decreases the delay, resulting in faster timing of the internal clock. Turning it clockwise increases the delay, resulting in slower timing.
The motor starts approximately 0.2 second after turning the volume. While the motor is running, the BUSY lamp at upper left lights up.
The relation in phase between clock input and data input on the internal CLOCK RETIMING (decision) circuit can be monitored by MONITOR OUTPUT - CLOCK ④ and MONITOR OUTPUT - DATA ⑤.

When delay error exceeds the permissible limit, the system automatically enters the self calibration routine with " C A L " displayed on the indicator. This routine ends within 12 seconds at longest. While this routine is activated, all keys on the panel are disabled.

⑫ THRESHOLD LEVEL setting section

This section includes the volume for controlling the threshold level of data input and an indicator.
Turning the volume counterclockwise decreases the threshold level, while turning it clockwise increases the threshold level.
The variable range of threshold level differs, as shown in the table below, according to the setting of TERMINATOR - DATA ⑨. Here, resolution is 0.01 V (1 mV).

TERMINATOR - DATA	Threshold level variable range
TO 0 V	-2.040 V to +2.040 V
TO -2 V	-1.850 V to -0.750 V

⑬ AUTO SEARCH key ( )

This key is used to execute/cancel the AUTO SEARCH function which automatically adjust the delay of clock input and the threshold level of data input.
In addition to delay and threshold level, this function automatically sets mark ratio when pattern mode is pseudo random (PRBS) while polarity when pattern mode is WORD or FRAME.
(When the master function of D3286 and the slave function of D3186 are both turned ON, the above automatic setting is made only on the D3286 side.)
To execute auto search, the following conditions are necessary.

The conditions for executing auto search:

Both D3186 and D3286 are in the same pattern mode. • When pattern mode is pseudo random (PRBS), the column count of D3186 and that of D3286 are the same. • When pattern mode is WORD or FRAME, programmable pattern of D3186 and that of D3286 are the same. • Range of mark ratio: 1/8 to 7/8 (also in WORD or FRAME mode) • D3286 input data level range: High level is +2.00 V or less, and low level is -2.00V or more.

Pressing this key while the lamp on the key is turned off executes auto search once.
During execution, the lamp on the key lights up, and the following message is displayed on the measurement result indicator:

SEArCh

Besides, the following message is displayed on the DELAY and THRESHOLD LEVEL indicators:

- - - -

These messages disappear when execution ends.
When the optimum values of delay and threshold level are found, they are displayed on the DELAY and THRESHOLD LEVEL indicators, and the device returns to the state before execution.
If no optimum value could be found, the following message is displayed on the measurement result indicator:

not Found

And the set values of delay and threshold level are reset to those before the execution of auto search.
To cancel auto search halfway, press this key again while the lamp on the key is lighting up. After canceled, the set conditions are reset to those before execution.
If the auto search is cancelled halfway through a task, the following message is displayed on the measurement result indicator:

CAnCEL

Note: When the pattern mode is set to WORD or FRAME, even if the auto search is executed on the above conditions without using the frame synchronization function (see ㉘ FRAME SYNC key of (3) in Section 3.2.1), "not Found" may occasionally result because the synchronization takes a long time. In such a case, use the frame synchronization function.

When the auto search execution still results in "not Found", it is possible to adjust only the delay and threshold level to the optimum values by executing the auto search after having set the pattern mode to PRBS .

(2) Pattern Setting Section

The pattern setting section is used to set the pattern for comparing data in error detection. The D3286 has 3 types of pattern modes: PRBS, WORD and FRAME.
Table 3-1 shows the combination of patterns which can be set.

Table 3-1 Combination of Patterns which Can Be Set

PATTERN MODE	PAYLOAD TYPE	PRBS column count (N) Pattern length: $2^N - 1$	PRBS MARK RATIO	ALTERNATE
PRBS	-	N = 7 to 31; 7 types	0/8 to 8/8; 8 types	OFF
WORD	-	-	-	ON/OFF
FRAME	WORD	-	-	ON/OFF
	PRBS	N = 15 to 31; 3 types	0/8 to 8/8; 8 types	ON/OFF
	CID	N = 7; 1 type	1/2; 1 type	OFF

Followings are the explanation of this section, in the order of the numbers in Figure 2-3.

① PATTERN MODE - PRBS key ($\boxed{}$)

This key is used to change over pattern mode to pseudo random (PRBS).
In pseudo random mode, the lamp on the key lights up.

② PRBS column count (N) select keys ($\boxed{⇧}$, $\boxed{⇩}$) and indicator

The number of PRBS columns is displayed by 2 digit 7-segment LED. 7 types are available: 7, 9, 10, 11, 15, 23 and 31 columns. Table 3-2 shows the generating function.

Pressing $\boxed{⇧}$ key increases the number of columns, while pressing $\boxed{⇩}$ key decreases it.
Pressing $\boxed{⇧}$ key when the number of columns is 31 returns to "7", while pressing $\boxed{⇩}$ key while the number of columns is 7 returns to "31".
Keeping either of these keys pressed continuously increases/decreases the number of PRBS columns.
When pattern mode is set to WORD or FRAME, the column count indicator is blanked, disabling the modification of the setting. However, when pattern mode is FRAME and payload type is PRBS, only 3 types of columns (15, 23 and 31 columns) can be selected.

③ MARK RATIO select keys ([⇳] , [⇦] , [⇨]) and 0/8, 1/8, 1/4, 1/2, 8/8, 7/8, 3/4 and 1/2B lamps

8 values of mark ratio (0/8, 1/8, 1/4, 1/2, 8/8, 7/8, 3/4 and 1/2B) can be selected, and the set value is displayed by the lamps arranged in 4 (horizontally) × 2 (upper and lower lines). The lamps of the upper line correspond to 0/8, 1/8, 1/4 and 1/2 from the leftmost one in order. The lamps of the lower line correspond to 8/8, 7/8, 3/4 and 1/2B which are the logical inversion of the patterns of the upper line.

[⇳] key selects a mark ratio of the upper line and that of the lower line alternately. [⇦] key shifts the selected mark ratio leftwards, while [⇨] key rightwards.
Pressing [⇦] key when mark ratio is set to 0/8 or 8/8 changes to 1/2 or 1/2b. On the other hand, pressing [⇨] key when mark ratio is set to 1/2 or 1/2b changes to 0/8 or 8/8.
When pattern mode is set to WORD or FRAME, all lamps are turned off, disabling the modification of the setting. However, when pattern mode is FRAME and payload type is PRBS, above mentioned 8 types can be selected.

④ ITU-T lamp

This lamp lights up when PRBS column count and mark ratio selected in above ② and ③ conform to the recommendation of ITU-T.
Table 3-2 shows the relation among PRBS pattern columns, generating function, mark ratio and applicable standard.

Table 3-2 PRBS Pattern Generating Function and Applicable Standard

Columns	Generating function	Mark ratio	Standard	ITU-T lamp
7	X^7+X^6+1	1/2	ITU-T V.29	ON
		Other than 1/2		OFF
9	X^9+X^5+1	1/2	ITU-T V.52	ON
		Other than 1/2		OFF
10	$X^{10}+X^7+1$	All		OFF
11	$X^{11}+X^9+1$	1/2	ITU-T 0.152	ON
		Other than 1/2		OFF
15	$X^{15}+X^{14}+1$	1/2B	ITU-T 0.151	ON
		Other than 1/2B		OFF
23	$X^{23}+X^{18}+1$	1/2B	ITU-T 0.151	ON
		Other than 1/2B		OFF
31	$X^{31}+X^{28}+1$	All		OFF

⑤ PATTERN MODE - WORD key ( )

This key is used to change over pattern mode to WORD.
In WORD mode, the lamp on the key lights up.
In WORD mode, pattern length is set by the bits, and each bit can freely be set to 1 or 0.
The content of edited patterns is stored in the internal WORD pattern memory.

⑥ PATTERN MODE - FRAME key ( )

This key is used to change over pattern mode to FRAME.
In FRAME mode, the lamp on the key lights up.
In FRAME mode, 3 payload types (WORD, PRBS and CID) are available and selected with the PAYLOAD TYPE select key ⑩.

When payload type is WORD, all bits of pattern can freely be set. Frame structure is set by the number of frames, the number of rows per frame and the number of bytes per row as well as the number of bytes in the overhead part of a row.
The content of edited patterns is stored in the internal FRAME pattern memory.
The overhead part and frame structure of the FRAME pattern memory are the same as those when payload type is PRBS. Therefore, changing the content of pattern in the overhead part of either payload type equally changes that of another payload type.

When payload type is PRBS, the content of pattern only in the overhead part can freely be set or edited, and PRBS is set in the parts other than overhead (payload part). Like in WORD payload type, frame structure can be set by the number of frames, the number of rows per frame and the number of bytes per row as well as the number of bytes in the overhead part of a row. The number of PRBS columns is selected with the PRBS column count select key ② from 15, 23 and 31. Mark ratio can be changed.
The content of edited patterns in overhead part is stored in the internal FRAME pattern memory. The FRAME pattern memory and the frame structure are the same as those when payload type is WORD. Therefore, changing the content of pattern in the overhead part of either payload type equally changes that of another payload type.

Figure 3-2 shows the frame pattern structure when payload type is WORD or PRBS.

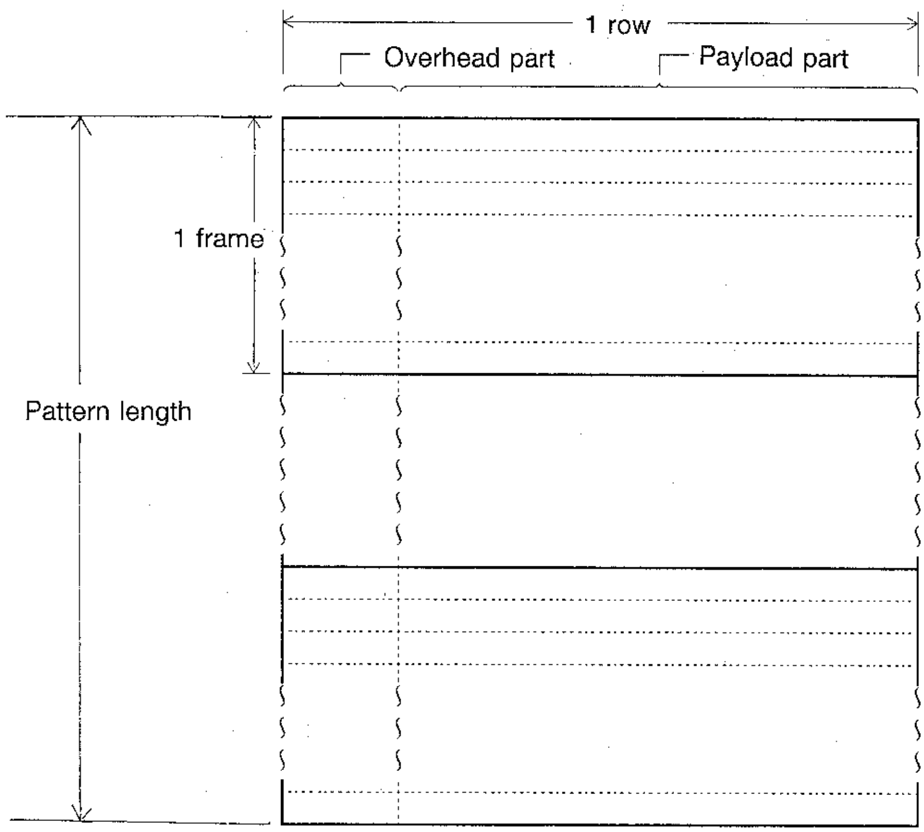


Figure 3-2 Frame Pattern when Payload Type is WORD or PRBS

When payload type is CID, pattern becomes that for same sign continuous resistance test. For frame structure, the number of frames is fixed to 2, and the number of rows per frame is fixed to 1. Therefore, setting is made only for the number of bytes per row, the number of bytes in the overhead part of a row, and the number of bits for continuous 0/1 patterns.

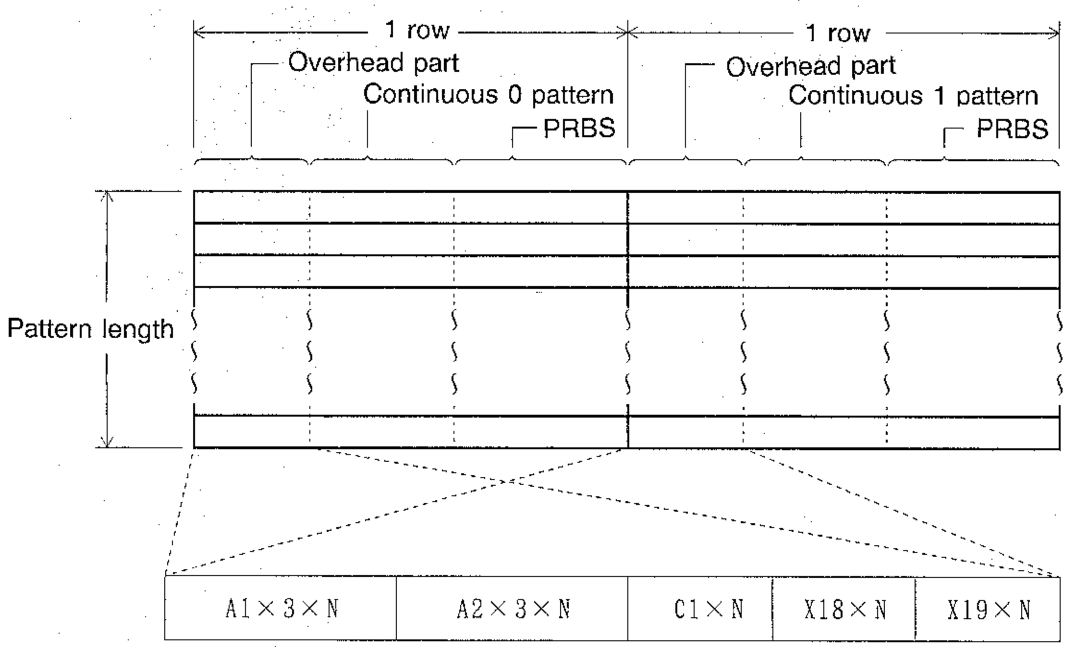
In the overhead part, SOH pattern of the first row of SDH frame, namely frame synchronization bytes (A1 and A2), STM multiplex number (C1 byte) and national use bytes (X18 and X19), is set. And the pattern of the overhead part of all frames become the same.

In the payload part, continuous 0 or 1 pattern of specified length is set. 1 and 0 of the continuous pattern change alternately frame by frame.

For the remaining portion of the payload part, PRBS pattern of 7 columns and 1/2 mark ratio is set. When one row is longer than 1036 bytes, PRBS may be discontinuous at a frame boundary.

The content of pattern in each part is automatically set according to the frame structure, which cannot be edited.

Figure 3-3 shows the frame pattern when payload is CID.



(Unit: byte)

N = (No. of bytes in the overhead part of a row) ÷ 9

A1: 11110110 (Fixed)

A2: 00101000 (Fixed)

C1: Serial number from 00000001 to N. The next to 11111111 is 00000000. (Fixed)

X18: 10101010 (Fixed)

X19: 10101010 (Fixed)

Figure 3-3 Frame Pattern when Payload Type is CID

⑦ ALTERNATE key ( )

Turn this key ON to use the ALTERNATE mode where measurement is made by changing over two (A and B) patterns.
Repeatedly pressing this key changes over ON/OFF state in order. When the key is turned ON, the lamp on the key lights up.
ALTERNATE mode can be turned ON only when pattern mode is WORD or when pattern mode is FRAME and payload type is WORD or PRBS.
Besides, the available pattern length of the entire WORD pattern or the available number of frames of the entire FRAME pattern differs with ON/OFF of ALTERNATE mode (see Tables 3-5 and 3-8).
If the set pattern length or frame count is invalid when ALTERNATE mode is turned ON, changing the state of ALTERNATE mode from OFF to ON sounds the alarm buzzer, displaying the following message on the pattern length/address indicator ⑮. And ALTERNATE mode will be kept OFF. In such a case, turn on ALTERNATE mode after modifying pattern length or frame count to a value which is valid when ALTERNATE mode is ON.

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⑧ A/B select key (⇔) and A and B lamps

The key and lamps for changing over the pattern for measurement, conditions setting or editing between A and B in ALTERNATE mode. The control method for changing over between A and B patterns in ALTERNATE mode is set to INTERNAL or EXTERNAL by bit 1 (ALTERNATE CONTROL) of DIP switch SW1 (⑥ in Figure 2-7) on the rear panel (see Table 3-10). When the setting of this switch was modified, turn the power off once, and turn it on again after 5 or more seconds.

When ALTERNATE CONTROL is set to INTERNAL, pressing this key changes over A and B patterns alternately, and the corresponding lamp lights up.

When ALTERNATE CONTROL is set to EXTERNAL, in general, pattern A or B is selected according to the level of external input signal EXT ALT INPUT (⑪ in Figure 2-7). However, this key is enabled when the group select key ⑫ is set to PATT DAT and the EDIT key ⑬ is set to ON, changing over the pattern to measure or edit between A and B, independent of the level of EXT ALT INPUT. And the corresponding lamp lights up.

Measuring pattern is changed over after pressing this key and reaching the end of the previous pattern.
When ALTERNATE mode is turned OFF, this key is disabled, and A and B lamps are turned off.

⑨ EXT lamp

This lamp lights up when pattern is changed over according to the level of external input signal EXT ALT INPUT (⑪ in Figure 2-7) in ALTERNATE mode. External/internal change-over is made by bit 1 of DIP switch SW1 (⑥ in Figure 2-7) on the rear panel (see Table 3-10). When the setting of this switch was modified, turn the off power once, and turn it on again after 5 or more seconds.

⑩ PAYLOAD TYPE select keys (⇦ , ⇨) and WORD, PRBS and CID lamps

This key is used to select payload type when pattern mode is FRAME.
3 payload types are available: WORD, PRBS and CID. The lamp corresponding to the selected payload type lights up.

Pressing ⇦ key shifts the selected payload type leftwards, while pressing ⇨ key shifts rightwards.

Pressing ⇦ key when payload type is WORD changes to CID, while pressing ⇨ key when payload type is CID changes to WORD.

These keys are enabled when pattern mode is FRAME. In other modes, the 3 lamps are all turned off.

When payload type is WORD, all bits for the content of pattern can freely be set. For frame structure, the number of frames, the number of rows per frame and the number of bytes per row as well as the number of bytes in the overhead part of a row are set.
The content of edited patterns is stored in the FRAME pattern memory.
The overhead part and frame structure of the FRAME pattern memory are the same as those when payload type is PRBS. Therefore, changing the content of pattern in the overhead part of either payload type equally changes that of another payload type.

When payload type is PRBS, the content of pattern only in the overhead part can freely be set or edited, and PRBS is set in the parts other than overhead (payload part). Like in WORD payload type, frame structure can be set by the number of frames, the number of rows per frame and the number of bytes per row as well as the number of bytes in the overhead part of a row. The number of PRBS columns is selected with the PRBS column count select key ② from 15, 23 and 31. Mark ratio can be changed.
The content of edited patterns in overhead part is stored in the internal FRAME pattern memory. The FRAME pattern memory and the frame structure are the same as those when payload type is WORD. Therefore, changing the content of pattern in the overhead part of either payload type equally changes that of another payload type.

When payload type is CID, pattern becomes that for same sign continuous resistance test. For frame structure, the number of frames is fixed to 2, and the number of rows per frame is fixed to 1. Therefore, setting is made only for the number of bytes per row, the number of bytes in the overhead part of a row, and the number of bits for continuous 0/1 patterns.
In the overhead part, SOH pattern of the first row of SDH frame, namely frame synchronization bytes (A1 and A2), STM multiplex number (C1 byte) and national use bytes (X18 and X19), is set. And the pattern of the overhead part of all frames become the same.
In the payload part, continuous 0 or 1 pattern of specified length is set. 1 and 0 of the continuous pattern changes alternately frame by frame.
For the remaining portion of the payload part, PRBS pattern of 7 columns and 1/2 mark ratio is set. When one row is longer than 1036 bytes, PRBS may be discontinuous at a frame boundary.
The content of pattern in each part is automatically set according to the frame structure, which cannot be edited.

Figures 3-2 and 3-3 show the frame pattern structure of each payload type.

⑪ POLARITY select key (□) and NORMAL and INVERSE lamps

This key is used to select the polarity of the pattern for comparing data when pattern mode is WORD or FRAME.
Polarity is either NORMAL or INVERSE, which are logically inverted each other.
Pressing the POLARITY key changes over the polarity.
In NORMAL mode, set patterns are compared as they are, while in INVERSE MODE comparison is made with inverted patterns. The pattern display lamp ⑲ shows a comparison pattern according to the polarity setting.

⑫ Group select keys (⇧ , ⇩) and lamp

This key selects a group of items to be displayed on the pattern length/address indicator ⑮.
8 groups are available: PATT TRIGGER, PATT DATA, FR STRUCT, SYNC WORD, ST-MASK FLD, END-MASK FLD, ST-SPEC FLD and END-SPEC FLD. The lamp corresponding to currently selected group lights up.
These group names are marked by abbreviation on the front panel. Their full names are:

PATT TRIGGER:	PATTERN TRIGGER (pattern trigger output position)
PATT DATA:	PATTERN DATA (pattern data edit position)
FR STRUCT:	FRAME STRUCTURE
SYNC WORD:	SYNCHRONIZATION WORD (hunting pattern)
ST-MASK FLD:	START OF MASK FIELD
END-MASK FLD:	END OF MASK FIELD

ST-SPEC FLD: START OF SPECIFIC FIELD
END-SPEC FLD: END OF SPECIFIC FIELD

Which groups can be selected changes with the setting of pattern mode, as shown in Table 3-3.

Table 3-3 Available Groups in Each Pattern Mode

Pattern Mode	Available groups
PRBS	PATT TRIGGER only
WORD	PATT TRIGGER, PATT DATA, SYNC WORD, ST-MASK FLD, END-MASK FLD, ST-SPEC FLD, END-SPEC FLD
FRAME	PATT TRIGGER, PATT DATA, FR STRUCT, SYNC WORD, ST-MASK FLD, END-MASK FLD, ST-SPEC FLD, END-SPEC FLD

Pressing [⇧] key shifts the selected group upwards along the indication lamps, while pressing [⇩] key shifts downward.
Pressing [⇧] key when the uppermost group (PATT TRIGGER) is selected changes to the lowermost group (END-SPEC FLD when pattern mode is WORD).

Pressing [⇩] key when the lowermost group is selected changes to the uppermost group.

PATT TRIGGER is used to set the position to output trigger signal to the TRIGGER OUTPUT connector (③ in Figure 2-2) with respect to the data pattern which is output from the MONITOR DATA OUTPUT connector (⑤ in Figure 2-2) when the TRIGGER OUTPUT select key (② in Figure 2-2) of the Input setting/connectors section is set to PATTERN.

PATT DATA is used to monitor or edit the content of data pattern.

FR STRUCT is used to set frame structure. Frame structure is the same when payload type is WORD or PRBS. Therefore, changing the frame structure of either payload type equally changes that of another payload type.

SYNC WORD is used to set the hunting pattern for pattern synchronization for the measuring section.

ST-MASK FLD is used to set the starting position of the pattern mask field which is to be excluded from the object of pattern synchronization or error detection.

END-MASK FLD is used to set the end position of the pattern mask field which is to be excluded from the object of pattern synchronization or error detection.

ST-SPEC FLD is used to set the starting position of the specific field of a pattern which is to be the object of error detection.

END-SPEC FLD is used to set the end position of the specific field of a pattern which is to be the object of error detection.

When the SLAVE key in the GPIB operation section (⑮ in Figure 2-6) is set to ON, neither SYNC WORD, ST-MASK FLD, END-MASK FLD, ST-SPEC FLD nor END-SPEC FLD can be set even with the master control function of the D3186 pulse pattern generator. To set these items, turn the SLAVE key once OFF.

⑬ EDIT key ( )

Turn this key ON to change pattern length or frame structure or to edit the content of pattern when pattern mode is WORD or FRAME.
Turning this key OFF disables the modification of pattern length or frame structure or the editing of the content of pattern.
The conditions allowing turning on this key differ with pattern modes or the setting of the group select key ⑫ (see Table 3-4).
Under the conditions allowing turning on this key, ON/OFF state changes alternately each time the key is pressed. While the key is turned ON, the lamp on the key lights up, and the pointer for the display item lights up on the left of the number displayed on the pattern length/address indicator ⑮.

⑭ PATT BUSY lamp

While the content of pattern setting is being transferred to the data comparison pattern generating circuit, this lamp lights up.
The time required for the transfer is almost proportional to the length of pattern. The maximum is approximately 8 seconds.
While this lamp is lighting, data comparison pattern is undefined.

⑮ Pattern length/address indicator

This indicator displays pattern length, pattern address or byte number.
The display format differs with set pattern modes, payload types or which group of display items to select. Which item is displayed now is indicated by the lamp on the left.
Table 3-4 shows the items which can be displayed on this indicator and the pattern content display lamp ⑲, as well as the items which can be set.

When multiple items which can be set are displayed on this indicator, select one with the ITEM key ⑯.

The meaning of each display item in Table 3-4 is as follows:

PATTERN LENGTH (NO. OF BIT) ..... Length of pattern (in bits)
ADDRESS .... 1 address = 16 bits
NO. OF FRAME .... Number of frames of a whole pattern
NO. OF ROW .... Number of rows per frame
ROW LENGTH (NO. OF BYTE) .... Number of bytes per row
OVERHEAD LENGTH (NO. OF BYTE) .. Number of bytes of overhead part
0/1 LENGHT (NO. OF BIT) .... Number of bits for continuous 0/1 pattern
FRAME NO. .... Frame number from the head of pattern
ROW NO. .... Row number in a frame
BYTE NO. .... Byte number in a row
BIT NO. .... Bit number in a address or byte
NO. OF BIT .... Number of bits of SYNC WORD

Table 3-4 Pattern Display/Set Items (1 of 3)

PATTERN MODE	PAYLOAD TYPE	GROUP SELECT	EDIT	DISPLAY ITEMS (The item of boldface letter shows practicable set)
PRBS	-	PATT TRIGGER	OFF	**ADDRESS,** CONTENT OF PATTERN
WORD	-	PATT TRIGGER	OFF	PATTERN LENGTH, **ADDRESS,** CONTENT OF PATTERN
		PATT DATA	OFF	PATTERN LENGTH, **ADDRESS,** CONTENT OF PATTERN
			ON	**PATTERN LENGTH, ADDRESS, CONTENT OF PATTERN**
		SYNC WORD	OFF	**PATTERN LENGTH, ADDRESS,** CONTENT OF PATTERN
		ST-MASK FLD	OFF	PATTERN LENGTH, **ADDRESS, BIT NO.,** CONTENT OF PATTERN
		END-MASK FLD	OFF	PATTERN LENGTH, **ADDRESS, BIT NO.,** CONTENT OF PATTERN
		ST-SPEC FLD	OFF	PATTERN LENGTH, **ADDRESS, BIT NO.,** CONTENT OF PATTERN
		END-SPEC FLD	OFF	PATTERN LENGTH, **ADDRESS, BIT NO.,** CONTENT OF PATTERN

Table 3-4 Pattern Display/Set Items (2 of 3)

PATTERN MODE	PAYLOAD TYPE	GROUP SELECT	EDIT	DISPLAY ITEMS (The item of boldface letter shows practicable set)
FRAME	WORD	PATT TRIGGER	OFF	**FRAME NO., ROW NO., BYTE NO.**, CONTENT OF PATTERN
		PATT DATA	OFF	**FRAME NO., ROW NO., BYTE NO.**, CONTENT OF PATTERN
			ON	**FRAME NO., ROW NO., BYTE NO., CONTENT OF PATTERN**
		FR-STRUCT	OFF	NO. OF FRAME, NO. OF ROW, ROW LENGTH, OVERHEAD LENGTH
			ON	**NO. OF FRAME, NO. OF ROW, ROW LENGTH, OVERHEAD LENGTH**
		SYNC WORD	OFF	**FRAME NO., ROW NO., BYTE NO.**[*5)], **NO. OF BIT**, CONTENT OF PATTERN
		ST-MASK FLD	OFF	**FRAME NO., ROW NO., BYTE NO., BIT NO.**, CONTENT OF PATTERN
		END-MASK FLD	OFF	**FRAME NO., ROW NO., BYTE NO., BIT NO.**, CONTENT OF PATTERN
		ST-SPEC FLD	OFF	**FRAME NO., ROW NO., BYTE NO., BIT NO.**, CONTENT OF PATTERN
		END-SPEC FLD	OFF	**FRAME NO., ROW NO., BYTE NO., BIT NO.**, CONTENT OF PATTERN
	PRBS	PATT TRIGGER	OFF	**FRAME NO., ROW NO., BYTE NO.**, CONTENT OF PATTERN[*1)]
		PATT DATA	OFF	**FRAME NO., ROW NO., BYTE NO.**[*3)], CONTENT OF PATTERN
			ON	**FRAME NO., ROW NO., BYTE NO.**[*3)], **CONTENT OF PATTERN**
		FR-STRUCT	OFF	NO. OF FRAME, NO. OF ROW, ROW LENGTH, OVERHEAD LENGTH
			ON	**NO. OF FRAME, NO. OF ROW, ROW LENGTH, OVERHEAD LENGTH**

Table 3-4 Pattern Display/Set Items (3 of 3)

PATTERN MODE	PAYLOAD TYPE	GROUP SELECT	EDIT	DISPLAY ITEMS (The item of boldface letter shows practicable set)
FRAME	PRBS	SYNC WORD	OFF	**FRAME NO., ROW NO., BYTE NO.** *5), **NO. OF BIT,** CONTENT OF PATTERN
		ST-MASK FLD	OFF	**FRAME NO., ROW NO., BYTE NO., BIT NO.,** CONTENT OF PATTERN *1)
		END-MASK FLD	OFF	**FRAME NO., ROW NO., BYTE NO., BIT NO.,** CONTENT OF PATTERN *1)
		ST-SPEC FLD	OFF	**FRAME NO., ROW NO., BYTE NO., BIT NO.,** CONTENT OF PATTERN *1)
		END-SPEC FLD	OFF	**FRAME NO., ROW NO., BYTE NO., BIT NO.,** CONTENT OF PATTERN *1)
	CID	PATT TRIGGER	OFF	**FRAME NO.,** ROW NO., **BYTE NO.,** CONTENT OF PATTERN *2)
		PATT DATA	OFF	**FRAME NO.,** ROW NO., **BYTE NO.** *4), CONTENT OF PATTERN
		FR-STRUCT	OFF	ROW LENGTH, OVERHEAD LENGTH, 0/1 LENGTH
			ON	**ROW LENGTH, OVERHEAD LENGTH, 0/1 LENGTH**
		SYNC WORD	OFF	**FRAME NO.** ROW NO., **BYTE NO.** *5), **NO. OF BIT,** CONTENT OF PATTERN
		ST-MASK FLD	OFF	**FRAME NO.** ROW NO., **BYTE NO., BIT NO.,** CONTENT OF PATTERN *2)
		END-MASK FLD	OFF	**FRAME NO.** ROW NO., **BYTE NO., BIT NO.,** CONTENT OF PATTERN *2)
		ST-SPEC FLD	OFF	**FRAME NO.** ROW NO., **BYTE NO., BIT NO.,** CONTENT OF PATTERN *2)
		END-SPEC FLD	OFF	**FRAME NO.** ROW NO., **BYTE NO., BIT NO.,** CONTENT OF PATTERN *2)

Note: *1) When pattern mode is FRAME, payload type is PRBS, group selection is PATT TRIGGER, ST-MASK FLD, END-MASK FLD, ST-SPEC FLD or END-SPEC FLD, and byte number is within payload range, the content of pattern is not displayed.

*2) When pattern mode is FRAME, payload type is CID, group selection is PATT TRIGGER, ST-MASK FLD, END-MASK FLD, ST-SPEC FLD or END-SPEC FLD, and byte number is within the PRBS range of payload, the content of pattern is not displayed.

*3) When pattern mode is FRAME, payload type is PRBS, and group selection is PATT DATA, byte number cannot be set in payload range.

*4) When pattern mode is FRAME, payload type is CID, and group selection is PATT DATA, byte number cannot be set in the PRBS range of payload.

*5) When pattern mode is FRAME and group selection is SYNC WORD, byte number cannot be set in payload range.

⑯ ITEM keys (⇦ , ⇨)

This key is used to select the item to set from those displayed on the pattern length/address indicator ⑮.

Which items can be set differs with pattern modes or the setting of the group select key ⑫ (see Table 3-4).

When there is only one item which can be set, this key is disabled.

Which item to set is indicated by the pointer on the left of the number displayed.

Pressing ⇦ key shifts the set item leftwards, while pressing ⇨ key shifts rightwards.

Pressing ⇦ key when the leftmost item is selected shifts to the rightmost item.

Pressing ⇨ key when the rightmost item is selected shifts to the leftmost item.

⑰ DIGIT keys (⇦ , ⇨)

These keys are used to shift the digit to set pattern length or address left- or rightwards.

Which items can be set differs with pattern modes or the setting of the group select key ⑫.

The digit to set is indicated by the pointer on the left of the number displayed.

Pressing ⇦ key shifts the digit to set leftwards, while pressing ⇨ key shifts rightwards.

Pressing ⇦ key when the leftmost digit is selected shifts to the right most digit.
Pressing ⇨ key when the rightmost digit is selected shifts to the left most digit.

⑱ Pattern length/address set keys (⇧ , ⇩)

These keys are used to increment/decrement the digits which are higher in order than the digit at which the pointer is lighting on the pattern length/address indicator.

Pressing ⇧ key increment the number, while pressing ⇩ key decrement the number.

Keeping either key pressed continuously increment/decrement the number.

The setting range and step differ with which item to set, as follows:

(a) PATTERN LENGTH (NO. OF BIT)

This item is used to set the pattern length of a whole WORD pattern or that of the hunting pattern for synchronizing a WORD pattern by the bits.

Pattern length of a whole WORD pattern can be set when pattern mode is WORD, the group select key ⑫ is set to PATT DATA, and the EDIT key ⑬ is turned ON. The setting range differs with ON/OFF state of the ALTERNATE key ⑦ (see Table 3-5).

Pattern length of the hunting pattern for synchronizing a WORD pattern can be set when pattern mode is WORD, the group select key ⑫ is set to SYNC WORD. The setting range and step is from 4 to 32 bits and 1 bit, respectively.

Table 3-5 Setting Range and Step of Pattern Length of a Whole WORD Pattern

ALTERNATE	Range of pattern length (bits)	Step (bits)
OFF	1 to 32,768	1
	32,770 to 65,536	2
	65,540 to 131,072	4
	131,080 to 262,144	8
	262,160 to 524,288	16
	524,320 to 1,048,576	32
	1,048,640 to 2,097,152	64
	2,097,280 to 4,194,304	128
	4,194,560 to 8,388,608	256
ON	1 to 16,384	1
	16,386 to 32,768	2
	32,772 to 65,536	4
	65,544 to 131,072	8
	131,088 to 262,144	16
	262,176 to 524,288	32
	524,352 to 1,048,576	64
	1,048,704 to 2,097,152	128
	2,097,408 to 4,194,304	256

(b) ADDRESS

This item is used to set the address of a WORD or PRBS pattern.
1 address is made up of 16 bits.
Address is set when pattern mode is WORD and the group select key ⑫ is set to PATT TRIGGER, PATT DATA, SYNC WORD, ST-MASK FLD, END-MASK FLD, ST-SPEC FLD or END-SPEC FLD, or when pattern mode is FRAME and the group select key ⑫ is set to PATT TRIGGER.

The address setting range is as shown in Table 3-6. The setting step is 1 (address).

Table 3-6 Address Setting Range and Maximum Value

Pattern mode	Address setting range	Maximum value
WORD	0 to (Pattern length of a whole pattern) ÷ 16-1 (Raise the decimals to a unit.)	524287
PRBS	0 to (2^N-1) ÷ 16-1 (N: Number of PRBS columns. Raise the decimals to a unit.)	134217727

For PATT TRIGGER, the address is the timing to output trigger signal to the TRIGGER OUTPUT connector (③ in Figure 2-4) when pattern mode is PRBS or WORD and the TRIGGER OUTPUT select key (② in Figure 2-4) is set to PATTERN.

For PATT DATA, the address is that of the data pattern to monitor or edit when pattern mode is WORD.

For SYNC WORD, the address is the top address of the hunting pattern for synchronization when pattern mode is WORD.

For ST-MASK FLD or END-MASK FLD, the address is the starting or end address of the mask field of a pattern which is to be excluded from the object of pattern synchronization and error detection.
When the digits of the address for ST-MASK FLD is all " – ", it means that no mask field is set. In this state, the address indicator for END-MASK FLD turns off, disabling the setting.

To set no mask field, press the pattern length/address set key (⇩) when the address displayed for ST-MASK FLD is 0, or press the pattern length/address set key (⇧) when the address displayed is the maximum value in the setting range.

Mask field can be set only when the pattern length of the whole WORD pattern satisfies the conditions defined in Table 3-7. If the setting is tried when impossible, the alarm buzzer sounds and the following message is displayed. And no mask field can be set. In such a case, set a mask field after modifying the pattern length to a value which allows the setting.

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When the digits of the address for ST-MASK FLD is all " _ ", it means that no mask field is set. In this state, the address indicator for END-MASK FLD turns off, disabling the setting.
The address for ST-SPEC FLD or END-SPEC FLD is the starting or end address of the specific field of a pattern which is to be the object of error detection when pattern mode is WORD.

To set no specific field, press the pattern length/address set key (⇩) when the address displayed for ST-SPEC FLD is 0, or press the pattern length/address set key (⇧) when the address displayed is the maximum value in the setting range.

Specific field can be set only when the pattern length of the whole WORD pattern satisfies the conditions defined in Table 3-7. If the setting is tried when impossible, the alarm buzzer sounds and the following message is displayed. And no specific field can be set. In such a case, set a specific field after modifying the pattern length to a value which allows the setting.

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Table 3-7 Pattern Length of a Whole Pattern for which Mask or Specific Field Can Be Set

ALTERNATE	Range of pattern length (bits)	Available pattern length (bits)
ON, OFF	2 to 16	2, 4, 8, 16
	32 to 262,144	Integral multiple of 32
OFF	262,400 to 8,388,608	Integral multiple of 256
ON	262,400 to 4,194,304	
ON, OFF	Other than the above	Cannot be set

(c) NO. OF FRAME

This item is used to set the number of frames of a whole FRAME pattern.
The number of frames is set when pattern mode is FRAME, the PAYLOAD TYPE key ⑩ is set to WORD or PRBS, and the group select key ⑫ is set to FR STRUCT. When PAYLOAD TYPE is CID, the number of frames is fixed to 2.

The setting range differs with ON/OFF state of the ALTERNATE key ⑦ or the setting of NO. OF ROW (the number of rows per frame) and ROW LENGTH (the number of bytes per row).
To set the number of frames at a value greater than the maximum value in Table 3-8, the number of rows per frame and the number of bytes per row must be set in advance.
Changing the setting of the number of rows per frame or the number of bytes per row initializes the number of frames to 1.
The setting step is 1 (frame).

Table 3-8 Maximum Available Number of Frames (NO. OF FRAME)
(FS = ROW LENGTH (bytes) × NO. OF ROW)

ALTERNATE	FS	Maximum number of frames (fractions to be rounded down)
OFF	Integral multiple of 32	1,048,576 ÷ FS (8,192 or less)
	Integral multiple of 16	524,288 ÷ FS (4,096 or less)
	Integral multiple of 8	262,144 ÷ FS (2,048 or less)
	Other than integral multiple of 8	131,072 ÷ FS (1,024 or less)
ON	Integral multiple of 32	524,288 ÷ FS (4,096 or less)
	Integral multiple of 16	262,144 ÷ FS (2,048 or less)
	Integral multiple of 8	131,072 ÷ FS (1,024 or less)
	Other than integral multiple of 8	65,536 ÷ FS (512 or less)

Table 3-9 shows the maximum number of frames which can be set for representative STM-N frame (NO. OF ROW = 9).

Table 3-9 Maximum Number of STM-N Frames which Can Be Set (NO. OF FRAME)
(FS = ROW LENGTH (bytes) × NO. OF ROW)

STM multiplex number N	ROW LENGTH (bytes)	FS (bytes)	Maximum No. of frames	
			ALTERNATE OFF	ALTERNATE ON
4	1,080	9,720	26	13
8	2,160	19,440	26	13
16	4,320	38,880	26	13
32	8,640	77,760	13	6
64	17,280	155,520	6	3

(d) NO. OF ROW

This item is used to set the length of one frame (the number of rows per frame) when pattern mode is FRAME.
The number of rows is set when pattern mode is FRAME, the PAYLOAD TYPE key ⑩ is set to WORD or PRBS, and the group select key ⑫ is set to FR STRUCT. When PAYLOAD TYPE is CID, the number of rows is fixed to 2.

The setting range and step is from 1 to 16 (rows) and 1 (row), respectively.
Changing the setting of the number of rows per frame initializes the number of frames of the whole pattern to 1.

(e) ROW LENGTH (NO. OF BYTE)

This item is used to set the length of row (the number of bytes per row) when pattern mode is FRAME.
The length of row is set when pattern mode is FRAME and the group select key ⑫ is set to FR STRUCT.

The setting range differs with the setting of the PAYLOAD TYPE key ⑩ and ON/OFF state of the ALTERNATE key ⑦, as shown in Table 3-10.
Changing the setting of the length of row initializes the number of frames of the whole pattern to 1.

Table 3-10 Setting Range and Step of Row Length

PAYLOAD TYPE	ALTERNATE	Range of row length (bytes)	STEP (bytes)
WORD, PRBS	OFF	44 to 8,192	4
		8,200 to 16,384	8
		16,400 to 32,768	16
	ON	44 to 4,096	4
		4,104 to 8,192	8
		8,208 to 16,384	16
		16,416 to 32,768	32
CID	OFF	40 to 32,768	4

(f) OVERHEAD LENGTH (NO. OF BYTE)

This item is used to set the overhead length of a row (the number of bytes per row) when pattern mode is FRAME.
Overhead length is set when pattern mode is FRAME and the group select key ⑫ is set to FR STRUCT.

The setting range differs with the setting of the PAYLOAD TYPE key ⑩, as shown in Table 3-11.

Table 3-11 Setting Range and Step of Overhead Length

PAYLOAD TYPE	Note: Range of overhead length (bytes)	STEP (bytes)
WORD, PRBS	4 to (Length of a row)-40 (maximum 32,728)	4
CID	36 to 32, 760 *1)	36

Note:*1) The following limitation is imposed:
Overhead length < Row length.

(g) 0/1 LENGTH (NO. OF BIT)

This item is used to set the length of continuous 0/1 pattern (the number of bits per row) when pattern mode is FRAME and the PAYLOAD TYPE key ⑩ is set to CID.
The length of continuous 0/1 pattern is set when pattern mode is FRAME, PAYLOAD TYPE is CID, and the group select key ⑫ is set to FR STRUCT.

The setting range is from 0 to {Length of a row (bytes)-Overhead length (bytes)} × 8 (bits)-1 (bit), and the maximum length is (32,768-36) × 8-1 = 261,855 bits.
The setting step is 1 (bit).

(h) FRAME NO.

This item is used to set the frame number from the top of the FRAME pattern.
Frame number is set when pattern mode is FRAME, the group select key ⑫ is set to PATT TRIGGER, PATT DATA, SYNC WORD, ST-MASK FLD, END-MASK FLD, ST-SPEC FLD or END-SPEC FLD.

The setting range for frame number is from 1 to the number of frames of the whole set pattern (NO. OF FRAME), and the setting step is 1 (frame).

The frame number for PATT TRIGGER is the timing to output trigger signal to the TRIGGER OUTPUT connector (③ in Figure 2-4) when the TRIGGER OUTPUT select key (② in Figure 2-4) on the front panel is set to PATTERN.

For PATT DATA, the frame number is that for the data pattern to monitor or edit.

For SYNC WORD, the frame number is the starting frame number of the hunting pattern for synchronization and can be set only when the FRAME SYNC key (㉗ in Figure 2-7) of the measurement section is turned OFF.

For ST-MASK FLD or END-MASK FLD, the frame number is the starting or end frame number of the mask field of a pattern which is to be excluded from the object of pattern synchronization or error detection.
When the digits of the frame number for ST-MASK FLD are all " – ", it means that no mask field is set. In this state, the indicator for the frame number of END-MASK FLD are turned off, disabling the setting.

When the indicator for the frame number of ST-MASK FLD is "ALL", it means that all frames are specified as mask field. Also in this case, the indicator for the frame number of END-MASK FLD is turned off, disabling the setting.

To set no mask field, press the pattern length/address set key (⇩) when the frame number displayed for ST-MASK FLD is "1", or press the pattern length/address set key (⇧) when the indication for the frame number is "ALL".

To designate all frames as mask field, press the pattern length/address set key (⇩) when the digits of the frame number displayed for ST-MASK FLD are all " – ", or press the pattern length/address set key (⇧) when the frame number displayed is the maximum value in the setting range.

For ST-SPEC FLD or END-SPEC FLD, the frame number is the starting or end frame number of the specific field of a pattern which is to be the object of error detection.
When the digits of the frame number displayed for ST-SPEC FLD are all " – ", it means that no specific field is set. In this case, the indicator for the frame number of END-SPEC FLD is turned off, disabling the setting.
When the frame number displayed for ST-SPEC FLD is "ALL", it means that all frames are designated as specific field. Also in this case, the indicator for the frame number of END-SPEC FLD is turned off, disabling the setting.

To set no specific field, press the pattern length/address set key (⇩) when the frame number displayed for ST-SPEC FLD is "1", or press the pattern length/address set key (⇧) when the indication for the frame number is "ALL".

To designate all frames as specific field, press the pattern length/address set key (⇩) when the digits of the frame number displayed for ST-SPEC FLD are all " – ", or press the pattern length/address set key (⇧) when the frame number displayed is the maximum value in the setting range.

(i) ROW NO.

This item is used to set the row number from the top of a frame when pattern mode is FRAME.
Row number is set when pattern mode is FRAME, the PAYLOAD TYPE key ⑩ is set to WORD or PRBS, the group select key ⑫ is set to PATT TRIGGER, PATT DATA, SYNC WORD, ST-MASK FLD, END-MASK FLD, ST-SPEC FLD or END-SPEC FLD.
When PAYLOAD TYPE is CID, row number is fixed to 1 and cannot be changed.

The setting range for row number is from 1 to the number of rows per set frame (NO. OF ROW), and the setting step is 1 (row).

The row number for PATT TRIGGER is the timing to output trigger signal to the TRIGGER OUTPUT connector (③ in Figure 2-2) when the TRIGGER OUTPUT select key (② in Figure 2-2) on the front panel is set to PATTERN.

For PATT DATA, the row number is that for the data pattern to monitor or edit.

For SYNC WORD, the row number is the starting row number of the hunting pattern for synchronization.

For ST-MASK FLD or END-MASK FLD, the row number is the starting or end row number of the mask field of a pattern which is to be excluded from the object of pattern synchronization or error detection.
When no mask field is set, the indicator for the row number of ST-MASK FLD and END-MASK FLD is turned off, disabling the setting.

When the indicator for the row number of ST-MASK FLD is "ALL", it means that all rows are designated as mask field. Also in this case, the indicator for the row number of END-MASK FLD is turned off, disabling the setting.

To designate all rows as mask field, press the pattern length/address set key (⇩) when the row number displayed for ST-MASK FLD is "1", or press the pattern length/address set key (⇧) when the row number displayed is the maximum value in the setting range.

For ST-SPEC FLD or END-SPEC FLD, the row number is the starting or end row number of the specific field of a pattern which is to be the object of error detection.
When no specific field is set, the indicator for the row number of ST-SPEC FLD and END-SPEC FLD is turned off, disabling the setting.
When the row number displayed for ST-SPEC FLD is "ALL", it means that all rows are designated as specific field. Also in this case, the indicator for the row number of END-SPEC FLD is turned off, disabling the setting.

To designate all row as specific field, press the pattern length/address set key (⇩) when the row number displayed for ST-SPEC FLD is "1", or press the pattern length/address set key (⇧) when the row number displayed is the maximum value in the setting range.

(j) BYTE NO.

This item is used to set the byte number from the top of a row when pattern mode is FRAME.
Byte number is set when pattern mode is FRAME, the group select key ⑫ is set to PATT TRIGGER, PATT DATA, SYNC WORD, ST-MASK FLD, END-MASK FLD, ST-SPEC FLD or END-SPEC FLD.

The byte number for PATT TRIGGER is the timing to output trigger signal to the TRIGGER OUTPUT connector (③ in Figure 2-2) when the TRIGGER OUTPUT select key (② in Figure 2-2) on the front panel is set to PATTERN.
The setting range for byte number is from 1 to the number of bytes per set row (ROW LENGTH) - 1, and only odd numbers are available.

For PATT DATA, the byte number is that for the data pattern to monitor or edit.
The setting range is from 1 to the number of bytes per set row (ROW LENGTH) - 1, and only odd numbers are available.
However, when payload type is PRBS, byte number cannot be set in the payload range. Besides, when payload type is CID, byte number cannot be set in the PRBS range of payload.

For SYNC WORD, the byte number is the starting byte number of the hunting pattern for synchronization.
The setting range is from 1 to the number of bytes per set overhead (OVERHEAD LENGTH) - 1, and only odd numbers are available.

For ST-MASK FLD or END-MASK FLD, the byte number is the starting or end byte number of the mask field of a pattern which is to be excluded from the object of pattern synchronization or error detection.
Their setting range is from 1 to the number of bytes per set row (ROW LENGTH) - 1, and the setting step is 1 (byte).

When no mask field is set, the indicator for the byte number of ST-MASK FLD and END-MASK FLD is turned off, disabling the setting.

For ST-SPEC FLD or END-SPEC FLD, the byte number is the starting or end byte number of the specific field of a pattern which is to be the object of error detection.
The setting range is from 1 to the number of bytes per set row (ROW LENGTH), and the setting step is 1 (byte).

When no specific field is set, the indicator for the byte number of ST-SPEC FLD and END-SPEC FLD is turned off, disabling the setting.

(k) BIT NO.

This item is used to set the bit number from the top of an address when pattern mode is WORD, or the bit number from the top of a byte (8 bits) when pattern mode is FRAME.
Byte number is set when pattern mode is WORD or FRAME, the group select key ⑫ is set to ST-MASK FLD, END-MASK FLD, ST-SPEC FLD or END-SPEC FLD.

The setting range for bit number in WORD pattern mode is from 1 to 16 (bits), and the setting step is 1 (bit).
The setting range for bit number in FRAME pattern mode is from 1 to 8 (bits), and the setting step is 1 (bit).

For ST-MASK FLD or END-MASK FLD, the bit number is the starting or end bit number of the mask field of a pattern which is to be excluded from the object of pattern synchronization or error detection.
When no mask field is set, the indicator for the bit number of ST-MASK FLD and END-MASK FLD is turned off, disabling the setting.

For ST-SPEC FLD or END-SPEC FLD, the bit number is the starting or end bit number of the specific field of a pattern which is to be the object of error detection.
When no specific field is set, the indicator for the bit number of ST-SPEC FLD and END-SPEC FLD is turned off, disabling the setting.

(l) NO. OF BIT

This item is used to set the length (the number of bits) of the hunting pattern for synchronization when pattern mode is FRAME.
The length of the hunting pattern is set when pattern mode is FRAME and the group select key ⑫ is set to SYNC WORD.

The setting range is from 4 to 32 (bits), and the setting step is 1 (bit)
However, hunting pattern can be set only for overhead part. Therefore, a length which exceeds overhead with respect to the starting byte number cannot be set.

⑲ PATTERN DATA lamp and 1st to 16th keys ($\square$,⋯, $\square$)

This lamp shows the pattern for 16 bits of the address which is displayed on the pattern length/address indicator ⑮ when pattern mode is PRBS or WORD."
When pattern mode is FRAME, it shows the pattern for the 16 bits following the frame number (FRAME NO.), row number (ROW NO.) or byte number (BYTE NO.) displayed on the pattern length/address indicator ⑮.
This lamp is turned off when the group select key ⑫ is set to FR STRUCT, when the PAYLOAD TYPE key ⑩ is set to PRBS and the byte number is within the payload range, or when the payload type is CID and the byte number is within the PRBS range of payload.
Lighting of the pattern display lamp means "logical 1" (the data output is HIGH).
The 1st to 16th pattern set keys are enabled only when the group select key ⑫ is set to PATT DATA and the EDIT key ⑬ is turned ON. The status (logical 1 or 0) of the corresponding bit changes alternately, each time one of these keys is pressed.
When pattern mode is FRAME and the PAYLOAD TYPE key ⑩ is set to CID, the 1st to 16th pattern set key are disabled, and editing cannot be executed.

(3) Measuring section

The D3286 has 5 types of measuring function: error rate, error count, error interval (EI), error free interval (EFI) and frequency (FREQ). When pattern mode is FRAME and measuring time mode (㉚ to ㉝) is frame time (FR TIME) or frame interval (FR INTV), frame count can be measured.
These measuring functions are executed at the same time. During execution, display of measurement result can be changed over without interrupting the measurement.
Besides, for 4 types of error detection other than frequency and frame count, 3 types of measuring mode are prepared: OMITTING, INSERTING and TOTAL. These modes can be changed over without interrupting measurement.
When pattern mode is WORD, error detecting range can be selected from total 6 fields: SPECIFIC FIELD, OTHER FIELD and ALL in addition to the above mentioned three.
When pattern mode is FRAME, error detecting range can be selected from total 9 fields: OVERHEAD, PAYLOAD and ALL in addition to above explained 6 types in WORD mode.
In addition to these, display format and the display of current data can be selected. Table 3-12 shows the possible combination.
When the following operations are executed while taking a measurement, the measurements obtained up to this moment are reset and a new measurement starts.

- Switching the pattern mode
- Setting or changing the mask field
- Setting or changing the specific field
  (Only when the measurement mode is set to SPECIFIC FIELD, OTHER FIELD, or ALL.)
- Changing the step count of PRBS
- Changing the mark ratio
- Turning ALTERNATE ON or OFF
- Switching ALTERNATE between A and B
- Changing POLARITY
- Changing a pattern
- Changing FRAME structure
- Changing SYNC WORD
- Changing PAYLOAD type
- Changing the measurement mode
- Changing MEASUREMENT TIME
- Turning FRAME SYNC ON or OFF
- Changing INPUT POLARITY
- Auto search

Part of these measurement mode names marked on the front panel is abbreviation. Their full names are:

OMIT:	OMITTING ERROR
INSERT:	INSERTING ERROR
TOTAL:	TOTAL ERROR (Omitting error + Inserting error)
OVHD:	OVERHEAD PART
PAYLOAD:	PAYLOAD TART
ALL:	ALL PART
SPECIFIC FIELD:	SPECIFIC FIELD
OTHER FIELD:	OTHER FIELD (except specific field)
ALL:	ALL FIELD

The result of measurement of TOTAL and 2 ALLs is the same.

Table 3-12 Measuring Functions, Measurement Modes and Display Format

FUNCTION	MEASUREMENT MODE	DISPLAY FORM	CURRENT DATA
ERROR RATE	OMIT INSERT OVHD PAYLOAD SPECIFIC FIELD OTHER FIELD TOTAL, ALL	EXPONENTIAL	PROGRESSIVE IMMEDIATE
ERROR COUNT	OMIT INSERT OVHD PAYLOAD SPECIFIC FIELD OTHER FIELD TOTAL, ALL	INTEGRAL EXPONENTIAL	PROGRESSIVE IMMEDIATE
Error Interval EI	OMIT INSERT OVHD PAYLOAD SPECIFIC FIELD OTHER FIELD TOTAL, ALL	INTERVALS %	PROGRESSIVE
Error Free Interval EFI	OMIT INSERT OVHD PAYLOAD SPECIFIC FIELD OTHER FIELD TOTAL, ALL	INTERVALS %	PROGRESSIVE
Frequency FREQ (MHz)		MHz	IMMEDIATE (1 sec)
FRAME COUNT		EXPONENTIAL	PROGRESSIVE IMMEDIATE

Followings are the explanation of the measuring section in the order of the numbers in Figure 2-4.

① ERROR -DATA lamp

This lamp lights up on real-time when bit error was detected in data input, and goes out when the bit error is corrected.

② ERROR - CLOCK lamp

This lamp lights up on real-time when the amplitude or frequency of clock input becomes short or too low (CLOCK ERROR), and goes out when the clock input is corrected.

③ ERROR - SYNC lamp

This lamp lights up when pattern synchronization error (SYNC ERROR) occurred, and goes out when pattern synchronization is recovered.

④ HISTORY - POWER lamp

When the power was turned off or a power outage occurred during measurement (POWER ERROR), this lamp lights up after restoration of the power and continues to light until the next measurement start command is issued.

⑤ HISTORY - CLOCK lamp

When the amplitude or frequency of clock input becomes short or too low during measurement, this lamp lights up and continues to light until the next measurement start command is issued.

⑥ HISTORY - SYNC lamp

When pattern synchronization error (SYNC ERROR) occurred during measurement, this lamp lights up and continues to light until the next measurement command is issued.

⑦ OVER lamp

This lamp lights up when the result of measurement is at the upper limit of the measuring range or exceeds the display capacity (OVERFLOW).
Table 3-13 shows the upper limit for the measuring range of each function.

Table 3-13 Upper Limit of Measuring Range

Measurement function	Display format	Upper limit of measuring range
Error rate	EXPONENTIAL	9.9999×10^{-1}
Error count	INTEGRAL	99999999
	EXPONENTIAL	9.9999×10^{18}
Error interval, Error free interval	INTERVALS	4.2949×10^{9}
	%	100.0000
Frequency	MHz	No limit
Frame count	EXPONENTIAL	9.9999×10^{18}

Note: For the measurement of error interval and error free interval, overflow occurs when measurement intervals exceed 4.2949×10^{9}.

⑧ GATE lamp

This lamp lights up during measurement.
This lamp goes out while measurement is interrupted due to clock error or synchronization error in the period from start to stop of measurement.

⑨ Measurement result indicator

This indicator displays the result of measurement, measuring condition or error condition. Display format for each measuring function is as follows.

(a) Error rate

Bit error rate is displayed in the format of maximum 5 digits of (including decimal point) + symbol for exponent (E) + maximum 2 digits of exponent (including negative sign).

Example: 1.2345 E -5

Exponent (-1 to -18)
Symbol for exponent (E)
Mantissa (0.0000 to 9.9999)

In this example, error rate is 1.2345×10^{-5}.
Error rate is calculated as follows:
Error rate = (No. of error bits) ÷ (No. of input bits)

When measuring mode (⑫ to ⑯) is set to OVERHEAD, PAYLOAD, SPECIFIC FIELD or OTHER FIELD, error rate is calculated from the number of error bits and that of input bits in the corresponding range.

When a mask field is set on the pattern setting section, the number of error bits in the mask field is not included in the calculation, but the number of input bits in the mask field is included.

When error rate exceeds 0.99999, ⊔ . ⊔ ⊔ ⊔ ⊔ E0 is displayed, and the OVER lamp ⑦ lights up.

When the CURRENT DATA (intermediate result display) key ⑩ is turned on, the period for updating display is set by the bit 7 and bit 8 of the DIP switch SW3 (⑧ in Figure 2-7) on the rear panel while the measurement time mode is set to NORMAL (see Table 3-18). When the measurement time mode is set to FR TIME or FR INTV, press the INTERVAL key (⑫ in Figure 2-5) on the timer clock/printer control section to set the period. When the setting of SW3 was changed, turn the power off , and then turn it on again after 5 or more seconds.

(b) Error count

The display format can be changed over between EXPONENTIAL and INTEGRAL with the DISPLAY FORM CHANGE key ㉓.

i) In EXPONENTIAL mode, the number of error bits is displayed in the format of maximum 5 digits of mantissa (including decimal point) + symbol for exponent (E) + maximum 2 digits of exponent.

   Example: 4.2836E06 (4.2836×10^6 bits)

   When error bit rate exceeds 9.9999×10^{18}, ⊔ . ⊔ ⊔ ⊔ ⊔ E19 is displayed, and the OVER lamp ⑦ lights up.

ii) In INTEGRAL mode, the number of error bits is displayed by maximum 8 digits of integer.

   Example: 42836435 (bits)

   When the number of error bits exceeds 99999999, the OVER lamp ⑦ lights up, and lower 8 digits of the measured value is displayed.

When the CURRENT DATA key ⑩ is turned ON, the period for updating display is set by bit 7 and bit 8 of the DIP switch SW3 (⑧ in Figure 2-7) on the rear panel (see Table 3-18). When the setting of SW3 was changed, turn the power once OFF, and then turn it ON again after 5 or more seconds.

(c) Error interval (EI) or error free interval (EFI)
Display format (unit) can be changed over between percent (%) and intervals with the DISPLAY FORM CHANGE key ㉓.

i) In percent mode, the result is displayed in the format of maximum 3 digits of integral part + decimal point + 4 digits of decimal part.
(Resolution: 0.0001%; maximum: 100.0000%)

Example: 0.7451 (0.7451%)

Percentage is calculated as follows:
Percentage (EI) = (No. of error intervals ÷ No. of measuring intervals) × 100
Percentage (EFI) = (No. of no error intervals ÷ No. of measuring intervals) × 100

When measuring intervals exceed 4.2949×10^9, ⊔ ⊔ ⊔ . ⊔ ⊔ ⊔ ⊔ is displayed, and the OVER lamp ⑦ lights up.

ii) In INTERVALS mode, the number of intervals is displayed in the format of maximum 5 digits of mantissa (including decimal point) + symbol for exponent (E) + 2 digits of exponent.

Example: 3.26E02 (3.26×10^2 intervals)

When the number of intervals exceed 4.2949×10^9, ⊔ . ⊔ ⊔ ⊔ ⊔ E09 is displayed, and the OVER lamp ⑦ lights up.

Measuring interval is set by pressing the INTERVAL key (⑫ in Figure 2-5) of the timer/clock/printer control section.

(d) For measuring frequency (FREQ)
The frequency of input clock is displayed in the format of maximum 4 digits of integral part + decimal point + 3 digits of decimal part in MHz (resolution: 1 kHz).

Example: 3120.523 (3120.523 MHz)

A gate time for measurement 1 second.

The upper limit of working frequency range is 12 GHz. However, even exceeding this limit does not display ⊔ ⊔ ⊔ ⊔ . ⊔ ⊔ ⊔ nor light up the OVER lamp ⑦.

(e) For measuring frame count
The number of frames is displayed in the format of maximum 5 digits of mantissa (including decimal point) + symbol for exponent (E) + 2 digits of exponent.

Example: 9.5238E04 (9.5238×10^4 frames)

The number of frames is calculated as follows:
The number of frames = (No. of input clocks) ÷ {(No. of rows per frame (NO. OF ROW)) × (No. of bytes per row (ROW LENGTH) × 8}

When the number of frames exceeds 9.9999×10^{18}, U . U U U U E19 is displayed, and the OVER lamp ⑦ lights up.

When the CURRENT DATA (intermediate result display) key ⑩ is turned on, the period for updating display is set by bits 7 and 8 of the DIP switch SW3 (⑧ in Figure 2-7) on the rear panel while the measurement time mode is set to NORMAL (see Table 3-18). When the measurement time mode is set to FR TIME or FR INTV, press the INTERVAL key (⑫ in Figure 2-5) on the timer clock/printer control section to set the period. When the setting of SW3 was changed, turn the power off once, and then turn it on again after 5 or more seconds.

The measurement of frame count is possible only when pattern mode is FRAME and measuring time mode (㉚ to ㉝) is FR TIME or FR INTV.

(f) Clock error

When the amplitude or frequency of clock input is short or too low, measurement is interrupted and the following message is displayed.

C L o c . E r r

(g) SYNC error

When pattern synchronization error occurred, measurement is interrupted and the following message is displayed.

S E n c . E r r

(h) While AUTO SEARCH is being executed

While AUTO SEARCH is being executed, measurement is interrupted and the following message is displayed.

S E r C h

(i) Before starting measurement (HALT)

Before measurement is started, the following message is displayed.

H A L t

(j) Just after starting measurement (BUSY)

The following message is displayed until the first measurement result is displayed after measurement has started.

b u S Y

(k) The moment FREQUENCY ERROR occurred

When the measurement time mode is set to RF TIME or FR INTV, if an attempt is made to start the measurement with the setting outside of the following condition:
input frequency $\times$ 1/10 $\leq$ the number of bits of one frame $\times$ measurement interval (number of frames) $<$ 2^{41}, or if the input frequency changes to fall outside of the above condition during measurement, the measurement is stopped and the following message is displayed.

F r q E r r

This display disappears when the cause of another display occurs.

⑩ CURRENT DATA key ( )

This key is used to select whether or not to display current data.
When this key is turned ON, current data (intermediate result of measurement) is displayed on the measurement result indicator ⑨, which is updated at specified intervals.

The period for updating display is set by the bit 7 and bit 8 of the DIP switch SW3 (⑧ in Figure 2-7) on the rear panel in the error rate or error count measurement mode when the measurement mode is set to NORMAL, or by pressing the INTERVAL key (⑫ in Figure 2-5) on the timer/clock/printer control section in the error rate, error count, error interval, error free interval, or frame count measurement mode when the measurement time mode is set to FR TIME or FR INTV.
In the frequency measurement mode, the period for updating display of the current data is fixed to 1 second.

When CURRENT DATA is set to OFF, the message "BUSY" is displayed until measurement ends, and the final result of measurement is displayed after the end of measurement.

ON/OFF of this key can be changed over even during measurement. ON/OFF state is changed over each time this key is pressed. While this key is turned ON, the lamp on the key lights up.

⑪ IMMEDIATE DATA key ( )

This key is used to change over the mode to display current data of error rate, error count or frame count measurement between PROGRESSIVE and IMMEDIATE. The change-over is enabled when the CURRENT DATA key ⑩ is turned ON.
PROGRESSIVE value includes all errors measured till now since starting the measurement, while IMMEDIATE value includes the errors measured in one period before updating the display.
ON/OFF of this key can be changed over even during measurement. Each time this key is pressed, ON/OFF state is changed over. When set to IMMEDIATE mode, the lamp on the key lights up.

When the CURRENT DATA key ⑩ is turned off or the measurement time mode is set to BURST, this key is disabled, and the indicator on the key goes out.

⑫ to ⑯ MEASUREMENT MODE - OMIT, INSERT, TOTAL, OVHD, PAYLOAD, ALL, SPECIFIC FIELD, OTHER FIELD, ALL lamp and select keys
([ ] , [ ] , [ ] , [⇩])
These keys and lamps are used to select the type of error to measure or display in error rate, error count, error interval or error free interval measurement.
There are 9 types of error which are grouped into 3 measuring modes: (a) OMIT/INSERT/TOTAL, (b) OVHD/PAYLOAD/ALL, and (c) SPECIFIC FIELD/OTHER FIELD/ALL.

Measuring mode group is selected by the measuring mode group select key ([⇩]), while error type in each measuring mode group is selected with 3 measuring mode select keys ([ ] , [ ] , [ ]).
According to selected measuring mode, one of the 9 lamps (OMIT, INSERT, TOTAL, OVHD, PAYLOAD, ALL, SPECIFIC FIELD, OTHER FIELD and ALL) lights up.
In measuring frequency or frame count, these keys are disabled, and all lamps are turned off.
When pattern mode is PRBS, only OMIT, INSERT or TOTAL can be selected, and the measuring mode group select key is disabled.
When pattern mode is WORD, OMIT, INSERT, TOTAL, SPECIFIC FIELD, OTHER FIELD or ALL can be selected. When pattern mode is FRAME, all 9 types are available.

Even when measuring mode is changed over within the same group with the measuring mode select key during measurement, display is changed over without interrupting the measurement.
When measuring mode group is changed over with the measuring mode group select key during measurement, the current measurement is stopped halfway, and measurement is started newly.

Followings are the explanation of the errors which are the object of measurement or display in each measuring mode.

(a-1) OMIT
The bit errors where "0" were input when logical "1" should have been input are measured and displayed.
For error rate, the error rate with respect to all bits is measured and displayed.

(a-2) INSERT
The bit errors where "1" were input when logical "0" should have been input are measured and displayed.
For error rate, the error rate with respect to all bits is measured and displayed.

(a-3) TOTAL
The total of OMISSION and INSERTION bit errors, namely all bit errors, is measured and displayed.

(b-1) OVHD
Bit errors in the overhead part of a FRAME pattern is measured and displayed.
For error rate, the error rate with respect to the number of bits in the overhead part is measured and displayed.

(b-2) PAYLOAD
Bit errors in the payload part of a FRAME pattern is measured and displayed.
For error rate, the error rate with respect to the number of bits in the payload part is measured and displayed.

(b-3) ALL
The total of OVERHEAD and PAYLOAD bit errors, namely all bit errors, is measured and displayed.

(c-1) SPECIFIC FIELD
For WORD or FRAME pattern, bit errors in the specific field set from the pattern setting section is measured and displayed.
For error rate, the error rate with respect to the number of bits in the specific field is measured and displayed.

(c-2) OTHER FIELD
For WORD or FRAME pattern, bit errors in the fields other than the specific field set from the pattern setting section is measured and displayed.
For error rate, the error rate with respect to the number of bits in the fields other than specific field is measured and displayed.

(c-3) ALL
The total of SPECIFIC FIELD and OTHER FIELD bit errors, namely all bit errors, is measured and displayed.

Note: The relation between logical 1/0 and High/Low voltage level of data input is defined as follows, according to the setting of the INPUT POLARITY key (⑩ in Figure 2-2) of the input setting/connectors section.

INPUT POLARITY	Data input	
	Logic	Level
NORMAL	"1"	High
	"0"	Low
INVERSE	"1"	Low
	"0"	High

⑰ to ㉒ ERROR RATE, ERROR COUNT, EI, EFI, FREQ/FRAME keys (,…,) and FREQ (MHz), FRAME COUNT lamp

These keys and lamps are used to change over the measuring/displaying function to ERROR RATE, ERROR COUNT, EI (error interval), EFI (error free interval), FREQ (frequency) or FRAME (frame counter).
The change-over can be done even during measurement without interrupting it.
However, the measurement of frame count is available only when pattern mode is FRAME and measuring time mode (㉚ to ㉝) is FR TIME or FR INTV.

⑰ ERROR RATE key ( )

This key is used to measure and display error rate (bit error rate).
Error rate is calculated as follows:
Error rate = (No. of error bits) ÷ (No. of input bits)
where
No. of input bits = No. of input clocks

When measuring mode (⑫ to ⑯) is set to OVERHEAD, PAYLOAD, SPECIFIC FIELD or OTHER FIELD, error rate is calculated from the number of error bits and the number of input bits in the corresponding field.
When mask field is set on the pattern setting section, the number of error bits in the mask field is not included in the calculation, but the number of input bits in the mask field is included.

There are 2 modes to display current data until measurement ends: PROGRESSIVE and IMMEDIATE, which can be changed over with the IMMEDIATE DATA key ⑪.

In PROGRESSIVE mode, error rate is calculated using the cumulative values until now after starting measurement for both the number of error bits and that of input bits. Suppose, the frequency of input clock does not change. Then,

No. of input bits = (Frequency of input clock) × (Elapsed time since starting measurement) (sec)

Therefore, resolution becomes higher as elapsed time increases.

In the IMMEDIATE mode, calculation is made for the period between the previous display and the current display. The display period is set by the bit 7 and bit 8 of the DIP switch SW3 (⑧ in Figure 2-7) on the rear panel when the measurement time mode is set to NORMAL (see Table 3-18). When the measurement time mode is set to FR TIME or FR INTV, press the INTERVAL key (⑫ in Figure 2-5) on the timer/clock/printer control section to set the period. When the setting of SW3 was changed, turn the power off once, and then turn it on again after 5 or more seconds.

Measurement is not executed while clock error, SYNC error or power error is occurring. When restored from these error condition, measurement is automatically resumed.

⑱ ERROR COUNT key ( )

This key is used to measure and display error count (the number of error bits).
For error count, 2 display modes are prepared: EXPONENTIAL, INTEGRAL. These modes can be changed over with the DISPLAY FORM CHANGE key ㉓.

In EXPONENTIAL mode, the number of error bits is displayed in the range from 0 to 9.9999×10^{18}.
In INTEGRAL mode, lower 8 digits of the number of error bits is displayed in the range from 0 to 99999999 (00000000 when overflow occurred).

To display current data until measurement ends, 2 modes are prepared: PROGRESSIVE and IMMEDIATE. The modes can be changed over with the IMMEDIATE DATA key ⑪.
In PROGRESSIVE mode, the cumulative value (number of error bits) after starting measurement till now is displayed.
In the IMMEDIATE mode, the value (the number of error bits) in the period between the previous display and the current display is displayed. The display period is set by the bit 7 and bit 8 of the DIP switch SW3 (⑧ in Figure 2-7) on the rear panel when the measurement time mode is set to NORMAL (see Table 3-18). When the measurement time mode is set to FR TIME or FR INTV, press the INTERVAL key (⑫ in Figure 2-5) on the timer/clock/printer control section to set the period. When the setting of SW3 was changed, turn the power off once, and then turn it on again after 5 or more seconds.

Measurement is not executed while clock error, SYNC error or power error is occurring. When restored from these error condition, measurement is automatically resumed.

⑲ EI key ($\boxed{}$)

This key is used to measure and display the number of error intervals whose error rate are equal to or greater than the threshold level (which is set by the bits 3, 4, and 5 of the DIP switch SW2 (⑦ in Figure 2-7) on the rear panel).

For error intervals, two display modes (unit) are available: the number of intervals and percentage (%). These modes can be changed over with the DISPLAY FORM CHANGE key ㉓.

When the setting of the SW2 was changed, turn the power off, and then turn it on again after 5 or more seconds.

In the INTERVALS mode, the number of error intervals whose error rate is equal to or greater than the threshold level is displayed.

In the PERCENT mode, (the number of error intervals whose error rate is equal to or greater than the threshold level) ÷ (the number of intervals after starting the measurement) × 100 is displayed in %.

The length of interval is as follows: 0.1 second, 0.2 second, 0.5 second or 1 second to 1 day (in increments of 1 second) with the INTERVAL key (⑫ in Figure 2-5) on the timer clock/print control section.

In an error interval measurement, until measurement ends, the display of the current data can be turned on or off. However, for the current data in this case, only the cumulative value up to the present after starting the measurement is displayed.

Measurement is not executed while a clock error, SYNC error or power error is occurring.

When restored from these error conditions, measurement is automatically resumed.

⑳ EFI key ( )

This key is used to measure and display) the number of error intervals whose error rate is equal to or greater than the threshold level (which is set by the bits 3, 4, and 5 of the DIP switch SW2 (⑦ in Figure 2-7) on the rear panel).

For error free intervals, two display modes (unit) are available: INTERVALS and PERCENT (%). These modes can be changed over with the DISPLAY FORM CHANGE key ㉓. The displayed format is the same as for the error intervals.

When the setting of the SW2 was changed, turn the power off once, and then turn it on again after 5 more seconds.

In the INTERVALS mode, the number of error intervals whose error rate is equal to or less than the threshold level is displayed.

In the PERCENT mode, (the number of error intervals whose error rate is equal to or less than the threshold level) ÷ (the number of intervals after starting the measurement) × 100 is displayed in %.

The following relationship between the result of measurement of error intervals and that of error free intervals is as follows.

In the INTERVALS mode:

(Measurement result of error intervals) + (Measurement result of error free intervals) = (The number of intervals after starting the measurement)

In the PERCENTAGE mode:

(Measurement result of error intervals) + (Measurement result of error free intervals) = 100 (%)

The length of interval is the same as that for error interval: 0.1 second, 0.2 second, 0.5 second or 1 second to 1 day (in increments of 1 second) with the INTERVAL key (⑫ in Figure 2-5) on the timer clock section.

In an error free interval measurement, until measurement ends, the display of the current data can be turned on or off. However, for the current data in this case, only the cumulative value up to the present after starting the measurement is displayed.

Measurement is not executed while a clock error, SYNC error or power error is occurring.

When restored from these error conditions, measurement is automatically resumed.

㉑ to ㉒ FREQ/FRAME key ( ) and FREQ (MHz), FRAME COUNT lamp

These key and lamps are used to measure and display the frequency of input clock or frame count (the number of frames).
When the measurement result indicator ⑨ displays a frequency value, the FREQ(MHz) lamps lights up; when it displays a frame count value, the FRAME COUNT lamp lights up. When other measuring function is selected, both lamps go out.
Pressing this key while the FREQ(MHz) lamp is lighting changes the display over to frame count mode; pressing this key while the FRAME COUNT lamp is lighting changes the display over to frequency mode.

Frequency is calculated from the number of clocks input in the period of 0.1 second and displayed in MHz (resolution: 1 kHz).

The number of frames is calculated as follows:

No. of frames = (No. of input clocks) ÷ (No. of rows per frame (NO. OF ROW)) × (No. of bytes per row (ROW LENGTH)) × 8

For frame count, 2 modes are prepared for displaying current data until measurement ends: PROGRESSIVE and IMMEDIATE. The modes are changed over with the IMMEDIATE DATA key ⑪.
In PROGRESSIVE mode, the cumulative value (number of frames) after starting measurement till now is displayed.
In IMMEDIATE mode, the value (the number of frames) in the period between previous display and current display is displayed. Display period is set by bit 7 and bit 8 of the DIP switch SW3 (⑧ in Figure 2-7) on the rear panel (see Table 3-18). When the setting of SW3 was changed, turn the power once off, and then turn it on again after 5 or more seconds.
Measurement of frame count is available only when pattern mode is FRAME and measuring time mode (㉚ to ㉝) is FR TIME or FR INTV.

Measurement is not executed while clock error, SYNC error or power error is occurring. When restored from these error condition, measurement is automatically resumed.

㉓ DISPLAY FORM CHANGE key ($\boxed{}$)

This key is used to select the format to display the result of error count, error interval or error free interval measurement.

For error count, 2 display modes are prepared: INTEGRAL and EXPONENTIAL. Each time this key is pressed, the display modes are changed over. In EXPONENTIAL mode, the lamp on the key lights up.

For error interval and error free interval, 2 display modes are prepared: INTERVALS and PERCENT (%). Each time this key is pressed, the display modes are changed over. In PERCENT mode, the lamp on the key lights up.

㉔ EXTERNAL TIME REFERENCE lamp

This lamp lights up when reference signal for measuring time is input through the EXT REF INPUT connector (⑨ in Figure 2-7) on the rear panel.
While this lamp is lighting, external reference clock is used. When this lamp is turned off, internal reference clock is used.

㉕ START key ($\boxed{}$)

This key is used to start measurement or to reset the HISTORY lamps ④ to ⑥.
Pressing this key when measurement is stopped starts all measuring functions. However, when the EXTERNAL GATE key ㉞ is turned ON, this key is disabled.
When measurement is started, the lamp on the key lights up. When measurement is stopped with the STOP key ㉖ or the timer, the lamp goes out.
Pressing this key during measurement resets the current measurement to newly start measurement.

In addition, if the START key is pressed with the setting outside of the condition of (k) of (3) in Section 3.2.1 when the measurement mode is set to FR TIME or FR INTV, measurement will not start and "Frq Err" is displayed on the measurement result indicator (⑨ in Figure 2-4).

㉖ STOP key ($\boxed{}$)

This key is used to stop measurement.
Pressing this key during measurement stops all measuring functions. When the measurement stop function by timer is used or when the EXTERNAL GATE key ㉞ is turned ON, this key is disabled.

㉗ AUTO SYNC key ( )

This key is used to change over the ON/OFF state of the auto pattern synchronization function.
Each time this key is pressed, ON/OFF of the auto pattern synchronization function is changed over. When this key is turned ON, the lamp on the key lights up.
When this key is turned ON, the device automatically comes in pull out (SYNC ERROR) condition if error rate is high, and the phase where the input pattern coincides with the internal comparison pattern. When these patterns coincides with each other, the device comes in synchronous state.
When this key is turned OFF, the device does not automatically come in pull out condition even if error rate is high, and remains in pull in condition until the RESYNC key ㉙ is pressed.

The error rate threshold between pull in and pull out differs with pattern modes and pattern length, as shown in Table 3-14.
In this table, the pattern length in FRAME pattern mode is calculated as follows:
When payload type is WORD or PRBS,

Pattern length = (No. of frames of the whole pattern) × (No. of rows per frame) × (No. of bytes per row) × 8 (bits)

When payload type is CID,

Pattern length = (No. of rows of the whole pattern) × (No. of bytes per row) × 8 (bits)

where the number of rows of the whole pattern is set internally according to the number of bytes per row (maximum 1016 rows).

Table 3-14 Error Rate Threshold for Pattern Synchronization (approximate value)

Pattern mode	Measurement time mode	Pattern length (bits)	Error rate threshold	
			Pull out→Pull in	Pull in→Pull out
WORD and FRAME	ALL	1 to 1,024	4.88×10^{-4}	9.77×10^{-4}
		1,025 to 2,048	2.44×10^{-4}	4.88×10^{-4}
		2,049 to 4,096	1.22×10^{-4}	2.44×10^{-4}
		4,097 to 8,192	6.10×10^{-5}	1.22×10^{-4}
		8,193 to 16,384	3.05×10^{-5}	6.10×10^{-5}
		16,385 to 32,768	1.53×10^{-5}	3.05×10^{-5}
		32,770 to 65,536	7.63×10^{-6}	1.53×10^{-5}
		65,540 to 131,072	3.81×10^{-6}	7.63×10^{-6}
		131,080 to 262,144	1.91×10^{-6}	3.81×10^{-6}
		262,160 to 524,288	9.54×10^{-7}	1.91×10^{-6}
		524,320 to 1,048,576	4.77×10^{-7}	9.54×10^{-7}
		1,048,640 to 2,097,152	2.38×10^{-7}	4.77×10^{-7}
		2,097,280 to 4,194,304	1.19×10^{-7}	2.38×10^{-7}
		4,194,560 to 8,388,608	5.96×10^{-8}	1.19×10^{-7}
PRBS	Other than BURST	2^7-1 to $2^{31}-1$	4.88×10^{-4}	9.77×10^{-4}
	BURST	2^7-1 to $2^{31}-1$	9.76×10^{-4}	1.95×10^{-3}

㉘ FRAME SYNC key ( )

This key is used to change over ON/OFF state of the frame synchronization function.
Each time this key is pressed, ON/OFF state of the frame synchronization function is changed over. When this key is turned ON, the lamp on the key lights up.
This key is enabled when pattern mode is WORD or FRAME. Turning this key ON executes pattern synchronization at high speed using the synchronization hunting pattern which was set from the pattern setting section (SYNC WORD).
When pattern mode is FRAME and this key is turned ON, the number of synchronization protected columns is set as Table 3-16 by bits 4 to 8 of the DIP switch SW1 (⑥ in Figure 2-7) on the rear panel. When the setting of SW1 was changed, turn the power once off, and on again after 5 or more seconds.

Method of Synchronization and ON/OFF of FRAME SYNC

When pattern mode is WORD or FRAME, 2 methods of synchronization are available.
In WORD pattern mode, hunting method and bit shift method can be selected. In FRAME pattern mode, the method to synchronize by frame synchronization pattern (the pattern which exists in each frame and is identical in position and content) and that to synchronize by a specific pattern in a specific frame can be selected. Followings are the explanation of each method of synchronization.

(1) Hunting method (WORD, FRAME SYNC ON)
Shifts to protect rearward when a part (hunting pattern) of the whole pattern coincides.
The hunting pattern used here to detect coincidence must be a characteristic one. If many patterns which are the same as hunting pattern exist in the whole pattern, pull in time becomes long and, in the worst, synchronization error occurs or synchronization cannot be attained at all.
When pull in time is too long or synchronization cannot be attained at all due to no characteristic pattern existing in the whole pattern, you had better select bit shift method explained below.

(2) Bit shift method (WORD, FRAME SYNC OFF)
This method compares patterns first by random pattern phase.
If too many errors exist, pattern phase is shifted by 1 bit, and comparison is re-executed. Pattern phase continues to be shifted by 1 bit until the number of errors become small. In this way, a correct synchronization can be obtained.
In general, pull in time is shorter in hunting method than in this method. However, it may be longer in hunting method than in this method, depending on pattern length, the content of pattern or the error rate of input signal. Taking this into consideration, select a proper method.

(3) Frame synchronization (FRAME, FRAME SYNC ON)
First frame synchronization is attained using frame synchronization pattern of each frame (for example, A1 and A2 patterns of SDH) and then multiple frame synchronization is attained.

(4) Non-frame synchronization (FRAME, FRAME SYNC OFF)
This synchronization method is used when patterns are of frame structure but there is no frame synchronization pattern. Operation is the same as that of the hunting method in WORD pattern mode.

㉙ RESYNC key ($\boxed{}$)

This key is used to re-synchronize patterns.
In dependent of ON/OFF state of the auto pattern synchronization function, pressing this key cancels once pull in condition to come in pull out condition, and executes searching until pattern coincidence is obtained.
When pattern coincidence is obtained, the device comes in synchronous condition.

When the content of pattern or the setting of the INPUT POLARITY key was changed, like in the case pressing the RESYNC key, cancel once pull out condition to come in pull out condition. When pattern coincidence is obtained, the device comes in synchronous condition.

㉚ to ㉝ MEASUREMENT TIME - NORMAL, FR TIME, FR INTV, BURST keys (,···,)

The D3286 has 4 types of measuring time mode: NORMAL, FR TIME (frame time), FR INTV (frame interval) and BURST. The modes are selected with these keys.
Pressing one of the 4 keys activates the corresponding measuring time mode, while other modes are inactivated.

㉚ NORMAL key ( )

Pressing this key sets measuring time mode to NORMAL and lights up the lamp on it.
In NORMAL mode, measurement is executed continuously, and both measuring time (PERIOD) and interval are set by time.
Start/stop of measurement are controlled according to the setting of the EXTERNAL GATE key ㉞, as (a) or (b) below.

(a) When EXTERNAL GATE is OFF (internal gate control)

To start measurement, press the START key ㉕.
To stop measurement, press the STOP key ㉖. When the timer is set, measurement is automatically stopped the moment the set time elapses after the measurement has started.
The timer is set with the PERIOD key (⑪ in Figure 2-5) in the timer/clock/printer control section.

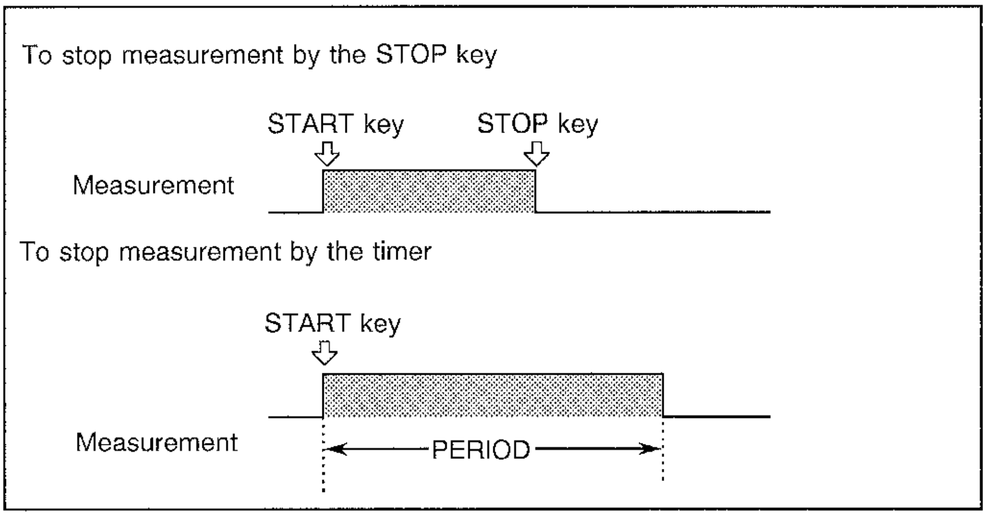


Figure 3-4 Operation of Internal Gate Control in NORMAL Mode

(b) When EXTERNAL GATE is ON (external gate control)

Start/stop of measurement are controlled by external gate signal which is input to the EXT GATE INPUT connector (⑩ in Figure 2-7) on the rear panel, as below.

Input signal voltage	Level	Measurement
0 0 V	HIGH	STOP
-1.0 V	LOW	START

In this mode, the START key ㉕ is disabled, and the setting of timer is invalid.
After making the input signal low to start measurement, measurement can be stopped with the STOP key on the front panel. To start measurement the next time, make the input signal once HIGH and then LOW again.
Input signal voltage must not be changed within one second.

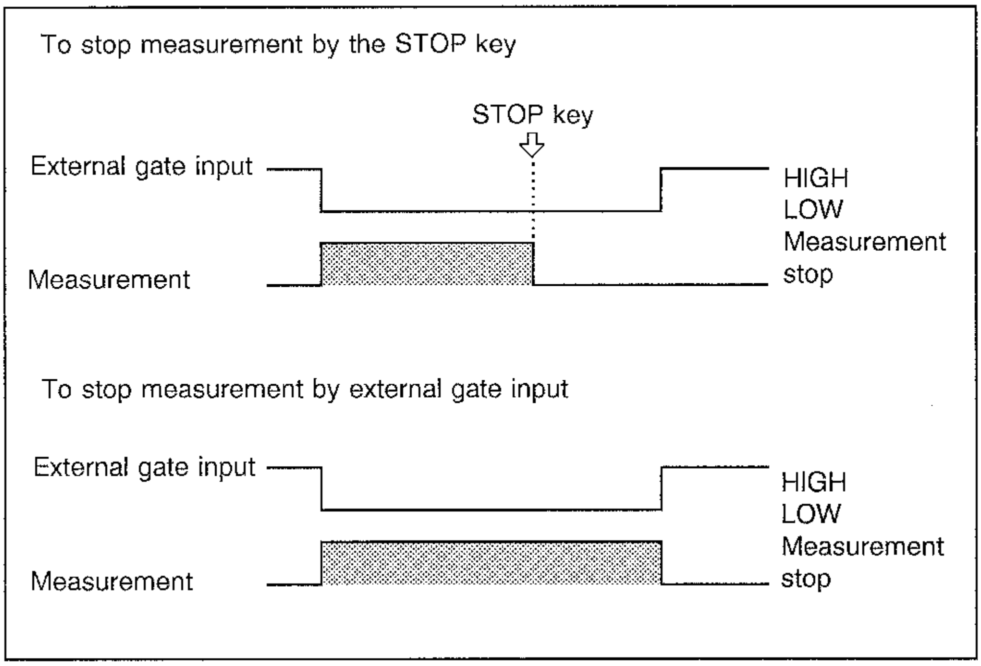


Figure 3-5 Operation of External Gate Control in NORMAL Mode

㉛ FR TIME key ( )

Pressing this key sets measuring time mode to FR TIME (frame time) and lights up the lamp on it.
In FR TIME mode, measuring interval (INTERVAL) and measuring period (PERIOD) are set by the number of frames and by time, respectively, and measurement is executed continuously, like in NORMAL mode.
However, TIMER MODE is automatically set to SINGLE.
This mode can be selected only when pattern mode is FRAME.

㉜ FR INTV key ( )

Pressing this key sets measuring time mode to FR INTV (frame interval) and lights up the lamp on it.
In FR INTV mode, measuring interval (INTERVAL) and measuring period (PERIOD) are set by the number of frames and that of intervals, respectively, and measurement is executed continuously, like in NORMAL mode. However, TIMER MODE is automatically set to SINGLE.
This mode can be selected only when pattern mode is FRAME.

33 BURST key ($\boxed{}$)

Pressing this key sets measuring time mode to BURST and lights up the lamp on it.

In BURST mode, within the entire measuring time from start to stop, error rate and error count in intermittent burst-like sections are measured without reset halfway.
In this mode, other items such as error interval, error free interval, frequency, frame count threshold EI/EFI and error performance are not measured, and the ALTERNATE key is automatically turned OFF.

To start measurement of the entire range in burst mode, press the START key 22.
Measurement stops immediately after measuring time mode has been changed over to BURST. Measurement also stops when measuring time mode is changed over to other mode during BURST mode measurement.

Measurement is started when pattern synchronization is obtained and the gate control conditions are turned ON after the START key has been pressed. Measurement stops when the set burst time elapses, when gate control conditions are turned OFF, or when the device comes out of pattern synchronization. However, there is a time delay until measurement is stopped after coming out of pattern synchronization, during which additional bit errors are counted. To avoid this, before coming out of pattern synchronization, the burst timer shall end, or gate control conditions shall be turned OFF.
Burst time is set by the BURST TIME key (11 in Figure 2-5) in the timer/clock/printer control section on the front panel.
After stopped, measurement is restarted when pattern synchronization is obtained again and gate control conditions are turned ON. In this case, measurement count is incremented without reset.
To stop measurement of entire range in BURST mode, press the STOP key 23.
In BURST mode, the timer to automatically stop measurement when the set time (PERIOD) elapses after measurement has been started is disabled, and TIMER MODE is set to UNTIMED.

Gate control in BURST mode is executed as (a) or (b) below, according to the setting of the EXTERNAL GATE key 34.

(a) When EXTERNAL GATE is OFF (internal gate control)

In this case, external gate input is not used.
Burst measuring period is the period since pattern synchronization has been obtained till the set BURST TIME elapses or coming out of pattern synchronization, within the period from pressing the START key till pressing the STOP key.

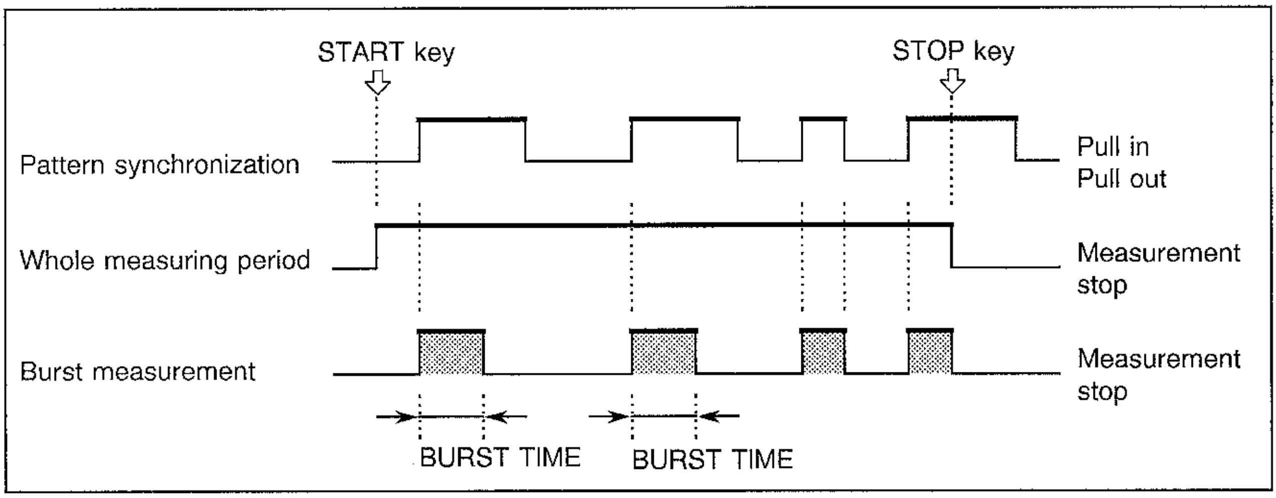


Figure 3-6 Operation of Internal Gate Control in BURST Mode

(b) When EXTERNAL GATE is ON (external gate control)

In this case, the external gate input signal which is input to the EXT GATE INPUT connector (⑩ in Figure 2-7) on the rear panel is used.
When the BURST mode is set, the external gate input signal becomes a trigger signal to start measurement.
The burst measuring period is the period after the trailing edge of the external gate input signal was input and pattern synchronization was changed from a pull out state to a pull in state till the set BURST TIME elapses, or pattern synchronization comes out, within the period from pressing the START key till pressing the STOP key.
The relationship between the voltage of the external gate input signal and the burst measurement is as follows.

Input signal voltage	Level	Measurement
0.0 V	HIGH	STOP
-1.0 V	LOW	START

The measurement start condition is turned on by inputting the trailing edge of the external gate input signal within the period from pressing the START key till pressing the STOP key.
However, this condition is tuned off by the edge of the measurement start.

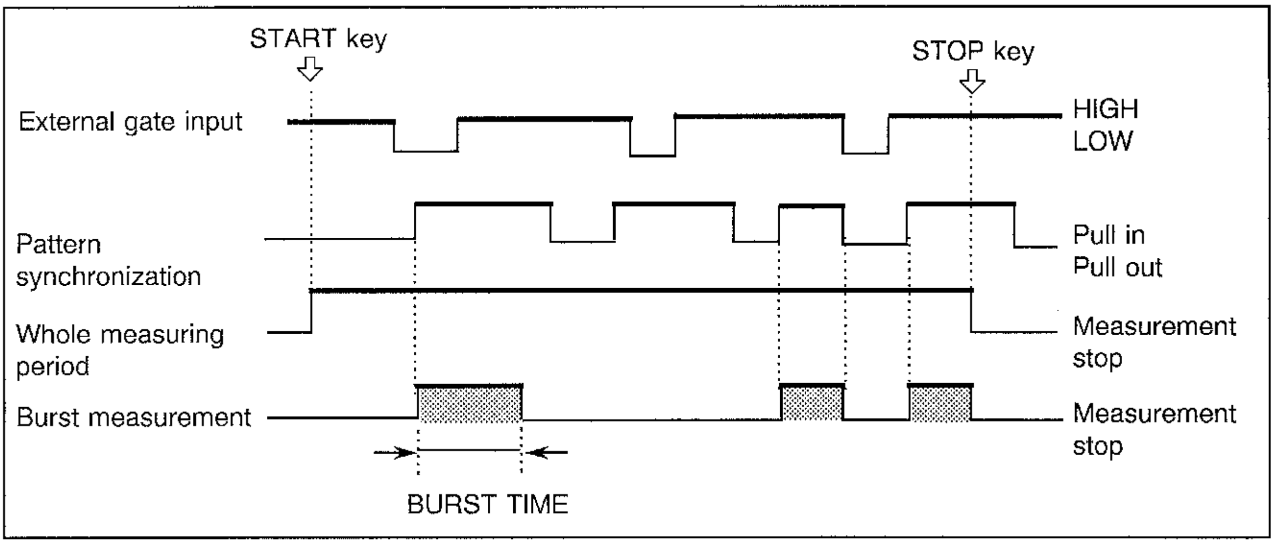


Figure 3-7 Operation of External Gate Control in BURST Mode

㉞ EXTERNAL GATE key ( )

This key is used to select whether gate control in measurement is executed by internal timer or by external signal.
Each time this key is pressed, ON/OFF state of external gate control is changed over. While this key is turned ON, the lamp on it lights up.

Operation of external gate control differs with the setting of MEASUREMENT TIME mode (㉚ to ㉝).

When measuring time mode is NORMAL, FR TIME or FR INTV, measurement is executed continuously. In internal gate control mode, measurement is started with the START key ㉕ and stopped with the STOP key ㉖ or the timer (PERIOD).
In external gate control mode, start and stop of measurement are controlled by the voltage of external gate signal which is input to the EXT GATE INPUT connector (⑩ in Figure 2-7) on the rear panel. Measurement can be stopped also with the STOP key ㉖.

When measuring time mode is BURST, measurement of the whole range is started with the START key ㉕ and stopped with the STOP key ㉖. In this mode, the timer is disabled (UNTIMED).

In internal gate control mode, measurement of each burst section is started when pattern synchronization is obtained, and stopped when the set burst time elapses or when coming out of pattern synchronization.

In external gate control mode, measurement of each burst section is started when the external gate signal input to the EXT GATE INPUT connector (⑩ in Figure 2-7) on the rear panel becomes LOW and pattern synchronization is obtained, and stopped when the set burst time elapses, when external gate signal becomes HIGH or when coming out of pattern synchronization.

For details of gate control, see the paragraph for the MEASUREMENT TIME keys ㉚ to ㉝.

Table 3-15 Measuring Time Mode and Gate Control

<table>
<tr><td>MEASUREMENT TIME MODE</td><td colspan="2">NORMAL (normal)
FR TIME (frame time)
FR INTV (frame interval)</td><td colspan="4">BURST (burst)</td></tr>
<tr><td rowspan="2">EXTERNAL GATE</td><td colspan="2">Overall measurement</td><td colspan="2">Overall measurement</td><td colspan="2">Measurement of burst period</td></tr>
<tr><td>START</td><td>STOP</td><td>START</td><td>STOP</td><td>START</td><td>END</td></tr>
<tr><td>OFF (Internal)</td><td>START key</td><td>STOP key or PERIOD timer</td><td>START key</td><td>STOP key</td><td>Pattern sync pull in</td><td>BURST timer or pattern sync pull out</td></tr>
<tr><td>ON (External)</td><td>EXTERNAL GATE input LOW</td><td>EXTERNAL GATE input HIGH or STOP key</td><td>START key</td><td>STOP key</td><td>Pattern sync pull in after trailing edge of EXTERNAL GATE input</td><td>BURST timer or pattern sync pull out</td></tr>
</table>

㉟ BUZZER - DATA key ( )

This key is used to select whether or not to sound the buzzer when a bit error is detected. Each time this key is pressed, ON/OFF state of the buzzer for bit error detection is changed over. When this key is turned ON, the lamp on it lights up.

The frequency of the buzzer tone at detection of bit error changes approximately in proportion to the number of error bits per unit time. The upper limit is approximately 4 kHz. Therefore, when the number of error bits is too small, the buzzer tone may not be heard because of too low frequency.

㊱ BUZZER - ALARM key ( )

This key is used to select whether or not to sound the buzzer when an alarm condition (clock error or SYNC error) occurred.
Clock error occurs when the amplitude or frequency of clock input is short or too low, while SYNC error occurs when coming out of pattern synchronization.
Each time this key is pressed, ON/OFF state of the buzzer for alarm occurrence is changed over. When this key is turned ON, the lamp on it lights up.

㊲ BUZZER - VOLUME knob

This control is used to control the sound volume of the buzzer for detection of bit error or alarm condition (clock error or SYNC error).
Turning this control clockwise increases the sound volume, while turning it counterclockwise decreases the sound volume.

(4) Timer/clock/printer control section

Explanation below is given according to the numbers in Figure 2-5.

(4-1) Timer/clock section

① to ③ TIMER MODE - SINGLE, REPEAT, UNTIMED keys (, ,)

These keys are used to select the operation mode of the timer.
Pressing one of the 3 keys selects the corresponding mode and lights up the lamp on the key, with the lamps on other keys turned off.
The setting of these timer modes cannot be changed during measurement.

① TIMER MODE - SINGLE key ( )

This key selects the mode to execute measurement only once.
Measurement is started when the START key in the measurement section (㉕ in Figure 2-4) is pressed, and stopped when the time set with the PERIOD key ⑪ in the timer/clock section elapses. Measurement is also stopped halfway with the STOP key (㉖ in Figure 2-4) in the measurement section.
When the FR TIME key in the measurement section (㉛ in Figure 2-4) is turned ON, timer mode is forcibly set to SINGLE.

② TIMER MODE - REPEAT key ( )

This key selects the mode to repeatedly execute measurement.
Measurement is started when the START key in the measurement section (㉕ in Figure 2-4) is pressed. When the time set with the PERIOD key ⑪ in the timer/clock section elapses, the final data of the current measurement is displayed, and then the next measurement is started. Thus measurement is repeated until the STOP key in the measurement section (㉖ in Figure 2-4) is pressed.

③ TIMER MODE - UNTIMED key ( )

This key selects the mode to execute measurement continuously, independent of the setting of the PERIOD key ⑪ in the timer/clock section.

Measurement is started when the START key in the measurement section (㉕ in Figure 2-4) is pressed, and continued until the STOP key in the measurement section (㉘ in Figure 2-4) is pressed.
In this mode, the operation the same as setting the timer PERIOD value to 00_{DAY} 00_{HOUR} 00_{MIN} 00_{SEC} or to 0 (interval) is executed. Operation can be changed over without changing the setting of PERIOD.
When the BURST key in the measurement section (㉝ in Figure 2-4) is turned ON, timer mode is forcibly set to UNTIMED.

④ to ⑤ DISPLAY MODE - ELAPSED, TIMED keys (,)

These keys are used to select the display mode for measuring time.
Pressing either key selects the corresponding mode and lights up the lamp on it.
When the lamps ⑪ to ⑬ in the TIMER SETUP section and the lamp on the REAL TIME key ⑭ are all turned off, the value of measuring time selected with ④ or ⑤ key is displayed on the timer/clock indicator ⑥.

④ DISPLAY MODE - ELAPSED key ( )

This key selects the mode to display the time elapsed after starting the measurement.
When the FR INTV key in the measurement section (㉜ in Figure 2-4) is turned OFF, elapsed time is displayed in the format of DAY-HOUR-MIN -SEC. The display range is from 00_{DAY} 00_{HOUR} 00_{MIN} 00_{SEC} to 99_{DAY} 23_{HOUR} 59_{MIN} 59_{SEC}. When exceeding this range, pointer lights up at upper left of each digit.
When the FR INTV key in the measurement section is turned ON, elapsed time is displayed by the number of intervals. The display range is from 0 to 99999999. When exceeding this range, pointer lights up at upper left of each digit.

⑤ DISPLAY MODE - TIMED key ( )

This key selects the mode to display the remaining time till the end of the the measuring time preset with the timer PERIOD key ⑪. When the remaining time becomes 0, measurement is automatically stopped.
When the FR INTV key in the measurement section (㉜ in Figure 2-4) is turned OFF, remaining time is displayed in the format of DAY-HOUR-MIN-SEC. The display range is from 00_{DAY} 00_{HOUR} 00_{MIN} 00_{SEC} to 99_{DAY} 23_{HOUR} 59_{MIN} 59_{SEC}.
When the FR INTV key in the measurement section is turned ON, remaining time is displayed by the number of intervals. The display range is from 0 to 99999999.
When measurement is not started yet or when the timer function is not used, " _ " is displayed at all digits.

⑥ Timer/clock indicator

This indicator displays the date and time value of the timer/clock.

When the lamps on the TIMER SETUP keys ⑪ to ⑬ and the lamp on the REAL TIME key ⑭ are all turned off, the measuring time data for either ④ or ⑤ DISPLAY MODE key, the lamp on which is lighting, is displayed.
Namely, when the lamp on the DISPLAY MODE-ELAPSED key ④ is lighting, the time elapsed after starting measurement is displayed. When the lamp on the DISPLAY MODE - TIMED key ⑤ is lighting, the remaining measuring time is displayed.

Display format in ELAPSED (elapsed time) and TIMED (remaining time) modes (when FR INTV is OFF):
The DAY-HOUR-MIN-SEC lamp lights up.

dd hh mm ss

- Second; 00 to 59
- Minute; 00 to 59
- Hour; 00 to 23
- Day; 00 to 99

When elapsed time exceeds 99 days 23 hours 59 minutes 59 seconds, pointer lights up at upper left of each digit.
When measurement is not started yet or when the timer function is not used, " _ " is displayed at all digits.
Display format in ELAPSED (elapsed time) and TIMED (remaining time) modes (when FR INTV is ON):

XXXXXXXX

- Number of intervals; 0 to 99999999

When elapsed time exceeds 99999999 intervals, pointer lights up at upper left of each digit.
When measurement is not started yet or when the timer function is not used, " _ " is displayed at all digits.

When any lamp of the TIMER SETUP keys ⑪ to ⑬ and the REAL TIME key ⑭ is lighting, the timer set value corresponding to the key whose lamp is lighting is displayed, independent of the state of the lamps of the DISPLAY MODE keys ④ and ⑤.

Namely, when the lamp on the TIMER SETUP - PERIOD key ⑪ is lighting, the set value of measuring time is displayed. When the lamp on the TIMER SETUP - INTERVAL key ⑫ is lighting, the set value of measuring interval is displayed. When the lamp on the TIMER SETUP - BURST TIME key ⑬ is lighting, the set value of burst time is displayed. When the lamp on the REAL TIME key ⑭ and the YEAR-MONTH-DAY-HOUR lamp ⑩ are lighting, real-time value of year, month, day and hour is displayed. And when the lamp on the REAL TIME key ⑭ and the DAY-HOUR-MIN-SEC lamp ⑩ are lighting, real time value of day, hour, minute and second is displayed.
Pointers light up at upper left of the digits which can be set.

Display format of measuring period (when FR INTV is OFF):
The DAY-HOUR-MIN-SEC lamp lights up.

dd hh mm ss

Second; 00 to 59
Minute; 00 to 59
Hour; 00 to 23
Day; 00 to 99

Display format of measuring period (when FR INTV is ON):

X X X X X X X X

Number of intervals;
0 to 99999999

Display format of measuring interval (when FR TIME and FR INTV are both OFF):
When the SEC-mSEC-μSEC lamp is lighting

xx yyy zzz

μsec; 000 (Fixed)
msec; 100, 200
or 500
sec; 00 (Fixed)

Display format of measuring interval (when FR TIME and FR INTV are both OFF):
When the DAY-HOUR-MIN-SEC lamp is lighting

dd hh mm ss

- Second; 00 to 59
- Minute; 00 to 59
- Hour; 00 to 23
- Day; 00 to 01

Minimum: 00(DAY) 00(HOUR) 00(MIN) 00(SEC); Maximum: 01(DAY) 00(HOUR) 00(MIN) 00(SEC)

Display format of measuring interval (when FR TIME or FR INTV is ON):
The FRAME lamp lights up

xx E y

- Exponent; 1 to 6
- Mantissa; 01 to 99

Minimum: 1E1 (10 frames); Maximum: 99E6 (99,000,000 frames)

Display format of burst time:
The SEC-mSEC-μSEC lamp lights up.

xx yyy zzz

- μsec; 000 to 990
- msec; 000 to 010
- sec; 00 (Fixed)

Minimum: 00sec000msec000μsec; Maximum 00sec010msec000μsec

Display format of real time:
When the DAY-HOUR-MIN-SEC lamp is lighting

dd hh mm ss

Second; 00 to 59
Minute; 00 to 59
Hour; 00 to 23
Day; 01 to 31

Display format of real time:
When the YEAR-MONTH-DAY-HOUR lamp is lighting

yy mm dd hh

Hour; 00 to 23
Day; 01 to 31
Month; 01 to 12
Year; 00 to 99
(Lower 2 digits of A.D. year)

⑦ DIGIT keys ([⇦] , [⇨])

These keys are used to shift the digit to set a value left- or rightwards on the timer/clock indicator.

A pointer lights up at upper left of the digit to set, which is shifted leftwards when [⇦] key is pressed while rightwards when [⇨] key is pressed.

⑧ Timer/clock change keys ([⇧] , [⇩])

This key is used to increment/decrement the value of the digit selected with the DIGIT key ⑦.

Pressing [⇧] key increments the value by 1, while pressing [⇩] key decrements the value by 1.

⑨ SET key ($\boxed{}$)

This key is used to start/end the setting of the timer/clock.
This key is enabled when one of the TIMER SETUP keys ⑪ to ⑬ and the REAL TIME key ⑭ is lighting.
When the lamp on the PERIOD key is lighting, measuring period is set; when the lamp on the INTERVAL key ⑫ is lighting, measuring interval is set; when the lamp on the BURST key ⑬ is lighting, burst time is set; when the lamp on the REAL TIME ⑭ and the YEAR-MONTH-DAY-HOUR lamp ⑩ are lighting, real time year-month-day-hour value is set; and when the lamp on the REAL TIME key ⑭ and the DAY-HOUR-MIN-SEC lamp ⑩ are lighting, real time day-hour-second value is set.
Each time this key is pressed, the pointer at the digit to set a value on the timer/clock indicator lights up or goes out.
During measurement, the SET key is disabled.

To set the timer/clock, execute the following (a) to (f) procedure while measurement is stopped.

(a) Press the PERIOD, INTERVAL, BURST TIME or REAL TIME key to display the time data you want to set.
When the INTERVAL key is pressed and the FR TIME and FR INTV keys in the measurement section are both turned OFF, select DAY-HOUR-MIN-SEC or SEC-mSEC-μSEC with the timer/clock display range select key ⑩ ($\boxed{⇩}$ key).

When the REAL TIME key is pressed, select YEAR-MONTH-DAY-HOUR or DAY-HOUR-MIN-SEC with the timer/clock display range select key ⑩ ($\boxed{⇩}$ key).

(b) Press the SET key to light up the pointer.

(c) With the DIGIT keys ($\boxed{⇦}$, $\boxed{⇨}$), move the pointer to the digit you want to set.

(d) With the timer/clock change key ⑧ ($\boxed{⇧}$, $\boxed{⇩}$), set. a value

(e) Repeat steps (c) and (d) until desired value is obtained.

(f) Press again the SET key to turn off the pointer and end the setting.

When the PERIOD, INTERVAL, BURST TIME or REAL TIME key or the timer/clock display range select key is pressed to change the time data displayed on the indicator after the pointer has been lit in above step (b) with the SET key and before the SET key is pressed again to end the setting, the previously executed modification of time setting is canceled.

For real-time setting, if setting is terminated by pressing again the SET key in above step (f) without pressing the timer/clock change key ⑧ at all after pressing the SET key to light the pointer in (b), the set real-time value is canceled, and no setting is made on the internal clock.
For real time setting, the digits smaller than 1 second are set to 0 when the SET key is pressed to end setting.

⑩ Timer/clock display range select key (⇩) and lamp

This key is used to change over display range when PERIOD, INTERVAL or REAL TIME value is displayed on the timer/clock indicator ⑥.

Each time this key is pressed when measuring interval is displayed, display format is changed over between day-hour-minute-second mode and msec-μsec mode. When day-hour-minute-second mode is selected, the DAY-HOUR-MIN-SEC lamp lights up; when msec-μsec mode is selected, the SEC-mSEC-μSEC lamp lights up. However, when the FR TIMER key (㉛ in Figure 2-4) or the FR INTV key (㉜ in Figure 2-4) in the measurement section is turned ON, measuring interval is displayed by the number of frames, and the FRAME lamp lights up. In this case, this key is disabled.

Each time this key is pressed when a real time value is displayed, display format is changed over between year-month-day-hour mode and day-hour-minute-second mode. When year-month-day-hour mode is selected, the YEAR-MONTH-DAY-HOUR lamp lights up; when day-hour-minute-second mode is selected, the DAY-HOUR-MIN-SEC lamp lights up.

When the set value for elapsed time, remaining time or measuring period is displayed, the DAY-HOUR-MIN-SEC lamp lights up; when the set value of burst time is displayed, the SEC-mSEC-μSEC lamp lights up. However, when the FR INTV key in the measurement section (㉜ in Figure 2-4) is turned ON, measuring period is displayed by the number of intervals, and all lamps go out.

⑪ to ⑬ TIMER SERUP - PERIOD, INTERVAL, BURST TIME keys (▭ , ▭ , ▭)

These keys are used to change over the display mode for the timer/clock ⑥ to measuring period, measuring interval or burst time.
Pressing one of these keys whose lamp is turned off selects the corresponding display mode and lights the lamp on it, with the lamps of other keys and the REAL TIME key ⑭ turned off.
Pressing one of the keys whose lamp is lighting turns off the lamp on it, and the value for the measuring time selected with ④ or ⑤ key is displayed on the timer/clock indicator ⑥.

⑪ TIMER SERUP - PERIOD key ([▭])

This key is used to set/display the measuring period from starting measurement to automatically stopping by timer on the timer/clock indicator ⑥.
The unit for display or setting changes according to ON/OFF state of the FR INTV key in the measurement section (㉜ in Figure 2-4).

When the FR INTV key in the measurement section is turned OFF, the display/setting range is from 00_{DAY} 00_{HOUR} 00_{MIN} 00_{SEC} to 99_{DAY} 23_{HOUR} 59_{MIN} 59_{SEC} in 1_{SEC} step.
Setting to 00_{DAY} 00_{HOUR} 00_{MIN} 00_{SEC} activates the mode which does not use the function to automatically stop measurement by timer.

When the FR INTV key in the measurement section is turned ON, the unit becomes intervals (a multiple of the measuring interval set with the INTERVAL key ⑫), and the display/setting range is from 0 to 99999999 (intervals) in steps of 1 interval.
Setting to 0 activates the mode which does not use the function to automatically stop measurement by timer (measurement is stopped only by the STOP key).

To change the setting, operate the SET key, the DIGIT key ([⇦] , [⇨]) and the timer/clock change key ([⇧] , [⇩]).

When TIMER MODE is set to UNTIMED, "00_{DAY} 00_{HOUR} 00_{MIN} 00_{SEC}" or "0 (interval)" is displayed for PERIOD. When the SET key is pressed to come in timer setting mode, the previously set value is displayed, allowing to change the setting. When the SET key is pressed again to exit from timer setting mode, the display returns to "00_{DAY} 00_{HOUR} 00_{MIN} 00_{SEC}" or "0 (interval)".
The setting of measuring period cannot be changed during measurement.

⑫ TIMER SERUP - INTERVAL key ([▭])

This key is used to display/set measuring interval on the timer/clock indicator ⑥.
The unit for display or setting changes according to ON/OFF state of the FR TIME key (㉛ in Figure 2-4) and the FR INTV key (㉜ in Figure 2-4) in the measurement section.

When FR INTV and FR INTV keys in the measurement section are both turned OFF, the display/setting range is 00_{SEC} 100_{mSEC} $000_{\mu SEC}$, 00_{SEC} 200_{mSEC} $000_{\mu SEC}$, 00_{SEC} 500_{mSEC} $000_{\mu SEC}$ and from 00_{DAY} 00_{HOUR} 00_{MIN} 01_{SEC} to 01_{DAY} 00_{HOUR} 00_{MIN} 00_{SEC} in steps of 1_{SEC}.
Use the timer/clock display range select key ⑩ to change over between SEC-mSEC-μSEC and DAY-HOUR-MIN-SEC modes.

When the FR TIMER or FR INTV key in the measurement section is turned ON, the unit becomes frames, and the display/setting range becomes from 1E1 $(=10)_{FRAME}$ to 99E6 $(=99{,}000{,}000)_{FRAME}$ in steps of 1 for both exponent and mantissa.

At this time measurement will not be executed unless the condition is set within the following range.
Input frequency (Hz) × 1/10 ≤ The number of bits of one frame x measurement interval (number of frames) < 2^{41}

To change the setting, operate the SET key, the DIGIT key (⇦ , ⇨) and the timer/clock change key (⇧ , ⇩).

The setting of measuring interval cannot be changed during measurement.

⑬ TIMER SETUP - BURST TIME key (▭)

This key is used to display/set the value of burst time on the timer/clock indicator ⑥.
The display/setting range is from 00_{SEC} 000_{mSEC} $000_{\mu SEC}$ to 00_{SEC} 010_{mSEC} $000_{\mu SEC}$ in 10 $_{\mu SEC}$ steps.
Setting to 00_{SEC} 000_{mSEC} $000_{\mu SEC}$ activates the mode which does not use the burst timer (a burst measuring section ends when the gate control conditions are turned OFF or when coming out of pattern synchronization).

The set burst time is used when measuring time mode is BURST (when the BURST key in the measurement section (㉝ in Figure 2-4) is turned ON).
Here each burst measuring section is the period after pattern synchronization has been obtained and the gate control conditions has been turned ON until the set burst time elapses, the gate control conditions are turned OF, or coming out of pattern synchronization, within the entire period from pressing the START key till pressing the STOP key. For details of gate control conditions, see the paragraph for the BURST key ㉝ in the measurement section.

To change the setting, operate the SET key, the DIGIT key (⇦ , ⇨) and the timer/clock change key (⇧ , ⇩).

The setting of measuring interval cannot be changed during measurement.

⑭ REAL TIME key (▭)

This key is used to display/set a real-time value on the timer/clock indicator ⑥.
Pressing this key when the lamp on it is turned off selects the real-time display mode and lights up the lamp on it, with the lamps on ⑪ to ⑬ keys in the TIMER SETUP section turned off.

Pressing this key when the lamp on it is lighting turns off the lamp and displays the real time value set with ④ or ⑤ key on the timer/clock indicator ⑥.

The display/setting range is from 01_{DAY} 00_{HOUR} 00_{MIN} 00_{SEC} to 31_{DAY} 23_{HOUR} 59_{MIN} 59_{SEC} in steps of 1_{SEC} or from 00_{YEAR} 01_{MONTH} 01_{DAY} 00_{HOUR} to 99_{YEAR} 12_{MONTH} 31_{DAY} 23_{HOUR} in steps of 1_{HOUR}.
The timer/clock display range select key ⑩ (⇩) changes over between DAY-HOUR-MIN-SEC and YEAR-MONTH-DAY-HOUR modes.

A DAY-HOUR value which is input in either DAY-HOUR-MIN-SEC or YEAR-MONTH-DAY-HOUR mode is also input in another mode.
This clock uses the Christian Era. For years, set lower two digits of A.D. year.

To change the setting, operate the SET key, the DIGIT key (⇦ , ⇨) and the timer/clock change key (⇧ , ⇩).

The setting of measuring interval cannot be changed during measurement.

(4-2) Printer control section

The D3286 is possible to output the result of measurement to an external printer (of Centronics specification) connected to the connector on the rear panel of this device.
What and in which format to print out is set by the ERROR PRINT key ⑱ and bits 1 to 4 of the DIP switch SW3 on the rear panel (⑧ in Figure 2-7).

⑮ BUSY lamp

This lamp lights up while data is being transferred to the printer or during paper feed.
If no printer is connected to this device or if data cannot be transferred because printer paper ran out when the PRINT OUT key ⑯ or the ERROR PRINT key ⑱ is turned ON or when the MANUAL PRINT key ⑱ is pressed to transfer data to the printer, this BUSY lamp lights up continuously. The BUSY lamp goes out when data transfer ends normally, and lights up again when the next data transfer is started.

⑯ PRINT OUT key (▭)

This key is used to turn ON/OFF the automatic print out of measurement result.
Each time this key is pressed, ON/OFF state is changed over. When this key is turned ON, the lamp on it lights up.

When this key is turned ON, measurement starting time, measurement end time, the summary of measuring conditions, error rate, error count, error interval, error free interval, frequency, power-off time, clock error time, SYNC error interval, etc. are automatically printed out.

⑰ MANUAL PRINT key ($\boxed{}$)

This key is used to manually print out the result of measurement.
Pressing this key at any time prints out the result of measurement currently displayed on the measurement section.

⑱ ERROR PRINT key ($\boxed{}$)

This key is used to turn ON/OFF the function to automatically print out the information of error or alarm occurrence and their restoration.
Each time this key is pressed, ON/OFF state is changed over. When this key is turned ON, the lamp on it lights up.
When this key is turned ON, the time of occurrence and restoration of power off, clock error and SYNC error as well as the result of measurement displayed on the measurement section when bit error was detected in the data input were printed out.

⑲ PAPER FEED key ($\boxed{}$)

This key is used to feed printer paper.
Each time this key is pressed, printer paper is fed by 1 line. When this key is pressed continuously for approximately 0.5 second or more, printer paper is fed continuously.

(5) File/GPIB operation section

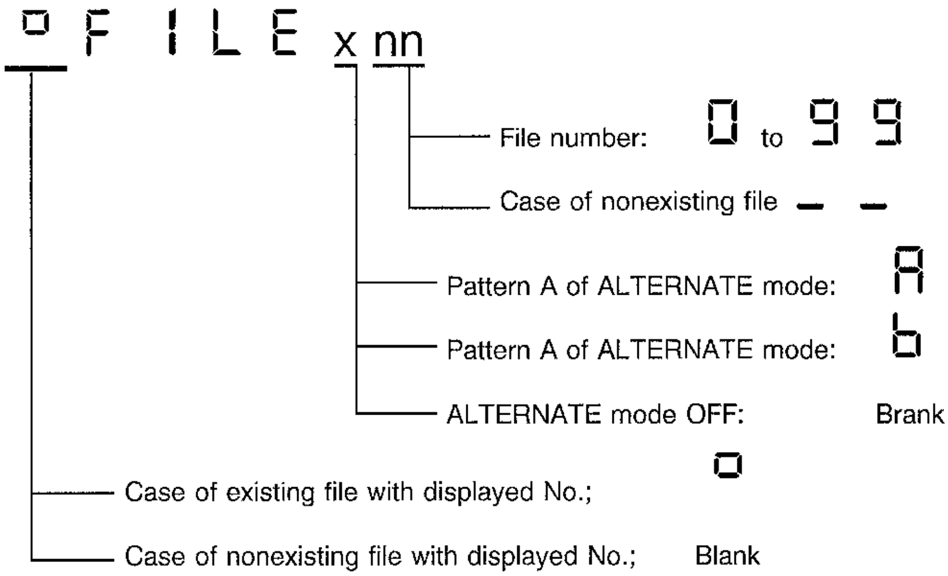
The following explanation follows the sequential order in Figure 2-6.

(5-1) File operation section

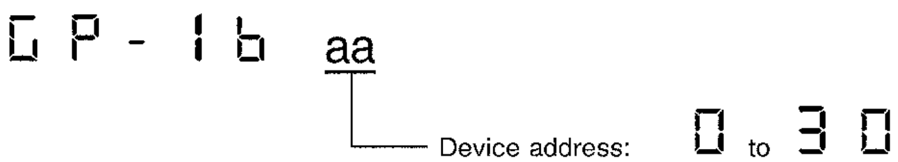
The D3286 with an integrated 3.5" floppy disk drive can save/read the set operating conditions and pattern settings to/from floppy disk. However, it can only save measurement results to the floppy disk; it cannot read them from disk. The saved measurement results can be read and processed by a personal computer (PC).
The floppy disk is formatted MS-DOS® Rev. 4.0; 720 KB (2DD), 1.2 MB (2HD), or 1.4 MB (2HD). The disk type is automatically identified, except for 2HD-type disk formatting (FORMAT).

◆ MS-DOS is a registered trademark of Microsoft Corporation, U.S.A.

① File No. indicator
Displays file No. according to key settings of ④ to ⑨. Displays GPIB device address when address display key ⑯) is ON.
When both the MASTER key ⑭ and the SLAVE key ⑮ are turned on, their conditions are displayed according to the master-slave function status.
File No. display format:



GPIB device address display format:



Master control function status display format:

The following message is displayed when waiting for turning on of the D3186 SLAVE key

ms init

The following message is displayed when data is being transferred to D3186.

ms SEnd

Slave control function status display format:

The following message is displayed when waiting for turning on of the D3186 MASTER key.

SL init

The following message is displayed when data is being received from D3186.

SL rEc

② DIGIT keys ([⇦] , [⇨])

Moves the digit pointer to set file No. or GPIB address (changes the digit at which the pointer is lit).

Press [⇦] key to move the pointer to the left and [⇨] key to the right.

These keys are active only while the pointer is lit.

③ File No. setup keys ([⇧] , [⇩])

Increments/decrements a digit value higher than the one at which the pointer is lit on file No. indicator.

Press [⇧] key to increment the value and [⇩] key to decrement.

Sets GPIB device address while address display key ⑯) is ON. These keys are active only while the pointer is lit.

④ File type setup key ([⇩]) and SETUP, WORD, FRAME, MEAS lamp

Changes the type of file for DIR, LOAD, SAVE, RESAVE or DELETE to the general setting (SETUP), word pattern setting (WORD), frame pattern setting (FRAME) or measurement results (MEAS); the corresponding SETUP, WORD, FRAME or MEAS lamp is lit.

Pressing the [⇩] key sequentially changes the above file type.

The file type of measurement results (MEAS) is not available for LOAD.

⑤ DIR key ( )

Displays the directory on file No. indicator. Active only while SHIFT key ⑨ is OFF (keylamp is not lit).

To display the directory, use the following procedure:

1. Load a disk with data.
2. Select type of a file to display using file type setup key ④.
3. Check that SHIFT key ⑨ is OFF. If ON, press to set to OFF.
4. Press DIR key ⑤, the keylamp goes on.
5. Press EXE key ⑩ to display on the file No. indicator ① the lowest file No. of the specified file type existing on disk.
6. Subsequently, the displayed file No. can be sequentially changed with DIGIT key ② and file No. setup key ③.

Note: Only files in the root directory can be displayed.

⑥ LOAD key ( )

Specifies file read. A file of measurement results (MEAS) cannot be LOADed. Active only while SHIFT key ⑨ is OFF (keylamp is not lit).

To read a file, use the following procedure:

1. Load a disk with data.
2. Select type of a file to read using file type setup key ④.
3. Check that SHIFT key ⑨ is OFF. If ON, press to set to OFF.
4. Press DIR key ⑤, the keylamp goes on.
5. Press EXE key ⑩ to display on the file No. indicator ① the lowest file No. of the specified file type existing on disk.
6. Check that SHIFT key ⑨is OFF. If ON, press to set to OFF.
7. Press LOAD key ⑥, the keylamp goes on.
8. Select the file No. to read using DIGIT key ② and file No. setup key ③. Specify whether to read as pattern A or B if the file type is WORD or FRAME and the ALTERNATE mode is ON in the pattern setting section. To select between patterns A and B, use the file No. setup key after moving the pointer to the left of the selected file No. using the DIGIT key.
9. Pressing the EXT key ⑩ displays the following confirmation message.

   L O A d · y n

   To execute reading, let the pointer light up on the upper-left of y, or to cancel reading, let the pointer light up on the upper-left of n using the DIGIT key.

10. When the EXT key ⑩ is pressed again, the selected file is read if the pointer is located on the upper-left of y. As for a file reading time, it takes approximately 8 minutes to read the file of the maximum size (1M bytes). While reading the file, the ACCESS indicator ⑫ lights up. When the file type is WORD or FRAME and it takes 5 seconds or longer to read the file, pressing the EXT key ⑩ again displays the following cancellation message to forcibly terminate the processing.
    While the ACCESS indicator ⑫ lights up, key operations except for the above EXT key are disabled.

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    When the pointer is located on the upper-left of n, the above cancellation message is displayed and the processing is terminated.
    When any key other than EXT key on the file operation section is pressed, the cancellation message is also displayed and the processing is terminated.
11. Upon completion of file read, the access lamp goes off and the indicators and lamps change according to the setup conditions read.

    Note 1: When reading is forcibly terminated, the contents of the WORD pattern memory or FRAME pattern memory become undefined.

    Note 2: While using the slave control function, files of all file types cannot be read.

    Note 3: While using the master control function, reading cannot be forcibly terminated.

⑦ SAVE/RESAVE key ( )

Saves/resaves data to a file. Saves when SHIFT key ⑨ is OFF (keylamp is not lit) and resaves when it is ON (keylamp is lit).
Here, 'Save' and 'Resave' refer to creating a new file and overwriting an existing file, respectively.

To save data to a file, use the following procedure:
1. Load a disk with data.
2. Select type of a file to save using file type setup key ④.
3. Check that SHIFT key ⑨ is OFF. If ON, press to set to OFF.
4. Press DIR key ⑤, the keylamp goes on.
5. Press EXE key ⑩ to display on the file No. indicator ① the lowest file No. of the specified file type existing on disk.
6. Check that SHIFT key ⑨ is OFF. If ON, press to set to OFF.
7. Press SAVE/RESAVE key ⑦, the keylamp goes on.

8. Specify a file No. to save using DIGIT key ② and file No. setup key ③. Each time the file No. setup key is pressed, the file No. is incremented/decremented. If a file with the displayed No. exists, " □ " is displayed on the leftmost portion of the file No. indicator. In this case, the file cannot be saved with this No. Specify whether to save as pattern A or B if the file type is WORD or FRAME and the ALTERNATE mode is ON in the pattern setting section. To select between patterns A and B, use the file No. setup key after moving the pointer to the left of the selected file No. using the DIGIT key. (Set the SHIFT key to ON for changeover to file resave.)
9. When the EXT key ⑩ is pressed, data is saved in the file with the specified number.
   As for a file saving time, it takes approximately 8 minutes to save the file of the maximum size (1M bytes). While saving the file, the ACCESS indicator ⑫ lights up. When the file type is WORD or FRAME and it takes 5 seconds or longer to save the file, pressing the EXT key ⑩ again displays the following message to forcibly terminate the processing.
   While the ACCESS indicator ⑫ lights up, key operations except for the above EXT key are disabled.

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10. Upon completion of file save, the access lamp goes off.

   Note 1: When saving is forcibly terminated, the file to be saved is automatically deleted.

   Note 2: While using the master control function or slave control function, saving cannot be forcibly terminated.

To resave to a file, use the following procedure:

1. Load a disk with data.
2. Select type of a file to resave using file type setup key ④.
3. Check that SHIFT key ⑨ is OFF. If ON, press to set to OFF.
4. Press DIR key ⑤, the keylamp goes on.
5. Press EXE key ⑩ to display on the file No. indicator ① the lowest file No. of the specified file type existing on disk.
6. Specify a file No. to resave using DIGIT key ② and file No. setup key ③. Specify whether to save as pattern A or B if the file type is WORD or FRAME and the ALTERNATE mode is ON in the pattern setting section. To select between patterns A and B, use the file No. setup key after moving the pointer to the left of the selected file No. using the DIGIT key.
7. Press SHIFT key ⑨ to set to ON.
8. Press SAVE/RESAVE key ⑦, the keylamp goes on.
   (Set the SHIFT key to OFF for changeover to file save.)

9. When the EXT key ⑩ is pressed, data is re-saved in the file with the selected number. As for a file re-saving time, it takes approximately 8 minutes to re-save the file of the maximum size (1M bytes). While re-saving the file, the ACCESS indicator ⑫ lights up. When the file type is WORD or FRAME and it takes 5 seconds or longer to re-save the file, pressing the EXT key ⑩ again displays the following message to forcibly terminate the processing.
   While the ACCESS indicator ⑫ lights up, key operations except for the above EXT key are disabled.

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10. Upon completion of file resave, the access lamp goes off.

   Note 1: When re-saving is forcibly terminated, the file to be re-saved is automatically deleted.

   Note 2: While using the master control function or slave control function, re-saving cannot be forcibly terminated.

⑧ DELETE/FORMAT key ($\boxed{-}$)

Deletes a file when SHIFT key ⑨ is OFF (keylamp is not lit) and initializes a floppy disk when SHIFT key is ON (keylamp is lit).

To delete a file, use the following procedure:

1. Load a disk with data.
2. Select type of a file to delete using file type setup key ④.
3. Check that SHIFT key ⑨ is OFF. If ON, press to set to OFF.
4. Press DIR key ⑤, the keylamp goes on.
5. Press EXE key ⑩ to display on the file No. indicator ① the lowest file No. of the specified file type existing on disk.
6. Check that SHIFT key ⑨ is OFF. If ON, press to set to OFF.
7. Press the DELETE/FORMAT key ⑧, the keylamp goes on.
8. Select a file No. to delete using DIGIT key ② and file No. setup key ③. (Set the SHIFT key to ON for disk formatting.)
9. Press EXE key ⑩ to display the following confirmation message:

   dELE' y n

   Light the pointer on the upper left of y using the DIGIT key to execute file delete; light the pointer on the upper left of n to cancel the file delete.
10. Press again EXE key ⑩ to delete the file with the selected file No. if the pointer is located on the upper left of y. While deleting, the access lamp ⑫ is lit and the keys in the file operation section are inactive. If the pointer is located on the upper left of n, the following cancel message is displayed to terminate the processing:

   CAnCEL

If a key in the file operation section other than the EXE key is pressed, the cancel message is displayed to terminate processing.

11. Upon completion of file delete, the access lamp goes off.

To initialize a floppy disk, use the following procedure:

1. To initialize a 2HD-type disk (1.2 MB or 1.4 MB), set the capacity using Bit 2 of rear panel SW1 (⑥ in Figure 2-7). (See Table 3-16.)
   Initialization of a 2DD-type disk (720 KB) has nothing to do with the Bit 2 setting of SW1.
   If SW1 setting is modified, turn off the power, wait 5 seconds or more, then turn on the power.
2. Load the floppy disk to initialize.
3. Press SHIFT key ⑨ to set to ON.
4. Press DELETE/FORMAT key ⑧, the keylamp goes on.
   (Set the SHIFT key to OFF for changeover to file delete.)
5. Press EXE key ⑩ to display the following confirmation message:

   F r M t ' y n

   Light the pointer on the upper left of y using the DIGIT key to execute disk initialization; light the pointer on the upper left of n to cancel the disk initialization.
6. When the EXT key ⑩ is pressed again, the floppy disk is initialized if the pointer is located on the upper-left of y. During the initialization, the ACCESS indicator ⑫ lights up and all keys are disabled. When the pointer is located on the upper-left of n, the following cancellation message is displayed to terminate the processing.

   C A n C E L

   If a key in the file operation section other than the EXE key is pressed, the cancel message is displayed to terminate the processing.
7. Upon completion of disk initialization, the access lamp goes off.

Note: When disk initialization is complete, all previous data on the disk is lost.

⑨ SHIFT key ( )

Changes the functions of keys ⑤ to ⑧. When the SHIFT key is OFF, the functions indicated on these key tops are selected; the functions displayed on the panel face are selected when ON. Pressing the SHIFT key alternately changes ON and OFF; the keylamp is lit when ON.

⑩ EXE key ( )

Executes the file operation specified with keys ⑤ to ⑨. For detail operation, see the explanation of keys ⑤ to ⑨.

⑪ Eject button
Pushbutton to remove the floppy disk from the drive. Do not press this button while the access lamp ⑫ is lit.

⑫ Access lamp
Lit while the disk is being accessed. Do not press the eject button ⑪ while this lamp is lit.

(5-2) GPIB operation section

⑬ REMOTE lamp and LOCAL key ( )

REMOTE lamp is lit while GPIB is in the remote state. In this state, only the LOCAL key, BUZZER VOLUME control in the measurement section, and rear panel DIP switches SW1, SW2, and SW3 are active; all other keys and controls are inactive. Press the LOCAL key to change the remote state to the local state. It is not possible to change to the local state using the LOCAL key while in the LOCAL LOCKOUT state.

⑭ MASTER key ( )

Set to ON to interlock the settings of the pattern setting section in D3186 Pulse Pattern Generator with the D3286.
Pressing this key alternately changes the master control function ON and OFF. When ON, the keylamp is lit.
When the key is set to ON, SLAVE key ⑮ turns OFF.
When the master control function is ON, the settings of the pattern setting section in the D3186 Pulse Pattern Generator are automatically set to the same conditions as those of the D3286 pattern setting section.

To use the D3286 master control function, use the following procedure:

1. Connect the GPIB connector on the D3286 rear panel (⑤ in Figure 2-7) to the GPIB connector (other than ONLY FOR SG) on the rear panel of the D3186 pulse pattern generator using a GPIB cable. Do not connect any other controller or equipment to the same GPIB.

2. Set the D3286 MASTER key ⑭ to ON. The following message is displayed on the file number indicator ①.

   n S i n i t

3. Set the D3186 SLVE key to ON. The display on the file number indicator ① changes to the following message and the transmission of the contents of the WORD and FRAME pattern memories, and setting information of the pattern setting section starts. During the transmission of the information, keys other than the MASTER and SLAVE keys are disabled.

   n S S E n d

It takes approximately 10 to 70 seconds to transfer the contents of the memories and setting information (the time differs depending on the set pattern).

4. When the transmission of the information is completed, the message on the file number indicator ① changes to the file number display format and the settings of the D3186 pattern setting section are interlocked with the D3286 until the D3286 master control function is turned off. In this state, values cannot be set in the pattern setting section using the D3186 panel operation.

5. To turn off the master control function, set the D3286 MASTER key and the D3186 SLAVE key to off.

   Note: When a file of SETUP, WORD, or FRAME type is read during master-slave operation, or when the slave is out of sync with the master for some reason or other, the contents of the memories and setting information are transferred again.
   If the loss of synchronization occurs and the transmission is not performed with the display message of Step 2 in the procedure left unchanged, turn off the master control function using Step 5 in the procedure and retry the procedure beginning with Step 1.
   When an auto search is executed during master-slave operation, the polarity of the D3186 pattern section and the D3286 pattern section may occasionally be inverted depending on the polarity of input data. In this case, when the master pattern section is changed, the slave pattern section is simultaneously changed with the pattern section left inverted.
   To restore the pattern section inverted by the auto search to the same polarity on the master and slave sides, match each other's polarities using the INPUT POLARITY function and execute the auto search again, or turn off the master control function using Step 5 in the procedure and retry the procedure from Step 1.

⑮ SLAVE key ( )

Set to ON, the opposite of the MASTER key ⑭, to interlock the settings of the D3286 pattern setting section with the D3186 Pulse Pattern Generator. Pressing this key alternately changes the slave control function ON and OFF.
When ON, the keylamp is lit. When this key is set to ON, MASTER key ⑭ turns OFF. While in the ON state, values cannot be set in the pattern setting section using the D3286 panel operation.

To use the D3286 slave control function, use the following procedure:

1. Connect the GPIB connector on the D3286 rear panel (⑤D in Figure 2-7) to the GPIB connector (other than ONLY FOR SG) on the rear panel of the D3186 pulse patterngenerator using a GPIB cable. Do not connect any other controller or equipment to the same GPIB.

2 Set the D3286 SLAVE key ⑮ to ON. The following message is displayed on the file number indicator ①. The ADDRESS keys on the pattern setting, file operation, and GPIB operation sections are disabled.

SL init

3. Set the D3186 MASTER key to ON. The display on the file number indicator ① changes to the following message and reception of the contents of the WORD and FRAME pattern memories, and setting information of the pattern setting section starts. During the reception of the information, keys other than the MASTER and SLAVE keys are disabled.

SL rEc

It takes approximately 10 to 70 seconds to receive the contents of the memories and setting information (the time differs depending on the set pattern).

4. When the reception of the information is completed, the message on the file number indicator ① changes to the file number display format and the settings of the D3286 pattern setting section are interlocked with the D3186 until the D3286 slave control function is turned off. In this state, values cannot be set in the pattern setting section using the D3286 panel operation.

5. To turn off the slave control function, set the D3286 SLAVE key and the D3186 MASTER key to off.

Note: When the slave is out of sync with the master for some reason or other, the contents of the memories and setting information are received again.
If the loss of synchronization occurs and the reception is not performed with the display message of Step 2 under the procedure left unchanged, turn off the slave control function using Step 5 in the procedure and retry the procedure beginning with Step 1.
When an auto search is executed during master-slave operation, the polarity of the D3186 pattern section and the D3286 pattern section may occasionally be inverted depending on the polarity of input data. In this case, when the master pattern section is changed, the slave pattern section is simultaneously changed with the pattern section left inverted.
To restore the pattern sections inverted by the auto search to the same polarity on the master and slave sides, match each other's polarities using the INPUT POLARITY function and execute the auto search again, or turn off the slave control function using Step 5 in the procedure and retry the procedure from Step 1.

⑯ ADDRESS DISP key ( )

Set to ON to display GPIB device address on file No. indicator ① and to confirm/modify the address setting. Pressing this key alternately changes ON and OFF. When ON, the keylamp is lit.

To display the device address, use the following procedure:

1. Press ADDRESS DISP key ⑯ to set to ON.
2. Use DIGIT key ② and file No. setup key ③ to modify the device address displayed.
3. Press the ADDRESS DISP key again to set to OFF, and the pointer goes off to terminate address setting.

Note 1: The device address can be set within the range of 0 to 30.

Note 2: The changed device address is enabled when the ADDRESS DISP key is set to off.

⑰ PANEL LOCK key ( )

When set to ON, only the PANEL LOCK key, LOCAL key ⑱, BUZZER VOLUME control in the measurement section, rear panel DIP switches SW1, SW2, and SW3 are active; all other keys and controls are inactive. Pressing this key alternately changes ON and OFF. When ON, the keylamp is lit.

(6) Setting the initial state

To set the D3286 to the initial state shown in Section 5.12.2, turn off the D3286 power, wait 5 seconds or more, and turn on the power while pressing the PATTERN DATA - 2nd key in the pattern setting section (⑲ in Figure 2-3). Keep pressing the PATTERN DATA - 2nd key until Initial is displayed on the file No. indicator (① in Figure 2-6) in the file operation section. This operation initializes GPIB device address to 8.

3.2.2 Rear Panel Operation Method

This section describes the operation method of each component on the rear panel. See Figure 2-7.
The explanation follows the sequential order in Figure 2-7.

① ~ LINE

To input AC power line. Connect to AC outlet through the attached power cable.
When connecting the power cable, see Section 1.2.3 Setup.

② BREAKER

Automatically turns OFF if an overcurrent is detected in the AC line.
Breaker can be manually turned ON/OFF; press the upper portion (side marked with ·) to turn ON and the lower portion (side without · mark) to turn OFF.
If the breaker automatically turns OFF, there was a possible overcurrent in the AC line.
Remove the cause of the overcurrent before setting the breaker to ON. Avoid using the breaker ON/OFF as the power switch.

③ Ground terminal

Terminal to ground the case of this equipment.
To prevent electric shock, static electricity damage, and line noise generation/trouble, be sure to ground using the 3-pin power cable plug or this ground terminal.

④ PRINTER connector

To output measurement results to an external printer.
The interface specification is explained in Section 7.1.

⑤ GPIB connector

To control this equipment from a computer or to use the master/slave control function in combination with the D3186 Pulse Pattern Generator through the GPIB.

⑥ to ⑧ DIP switches SW1, SW2, SW3

Set to select additional functions of this equipment.
Each switch consists of 8 bits; downward Bit 1 to Bit 8. Each bit is set to the left for OFF (0) and to the right for ON (1).
The settings of these switches are read only when the power switch is turned ON.
Therefore, if any modifications are made in the settings, turn OFF the power, wait 5 seconds or more, then turn ON the power for the new settings to be effective.
Tables 3-16 to 3-18 show the function and setting method for each bit switch.

Table 3-16 DIP Switch SW1 Settings

SW1	Function	Settings (0: (OFF), 1: (ON))	
bit 1	ALTERNATE CONTROL	INTERNAL	0
		EXTERNAL	1
bit 2	FD FORMAT TYPE	1.4MB	0
		1.2MB	1
bit 3	---	---	
bit 4 bit 5	FRAME BACKWARD GUARDING		bit 5, 4
		1	0, 0
		2	0, 1
		3	1, 0
		4	1, 1
bit 6 bit 7 bit 8	FRAME FORWARD GUARDING		bit 8, 7, 6
		1	0, 0, 0
		2	0, 0, 1
		3	0, 1, 0
		4	0, 1, 1
		5	1, 0, 0
		6	1, 0, 1
		7	1, 1, 0
		8	1, 1, 1

SW1 bit 1: Selects changing between patterns A and B in WORD and FRAME pattern ALTERNATE mode by either using the front panel A/B select key (⑧ in Figure 2-3) or control from the GPIB, or by using the signal input to the rear panel EXT ALT INPUT connector (⑪ in Figure 2-7).

0 (OFF) . . . . Internal control (A/B select key or GPIB)

1 (ON) . . . . . External control (EXT ALT INPUT)

When external control is specified, the EXT lamp(⑨ in Figure 2-3) is lit on the front panel.

SW1 bit 2: Selects 2HD-type floppy disk capacity as 1.2 MB or 1.4 MB for initialization (FORMAT) on the D3286.

0 (OFF) . . . . 1.4 MB

1 (ON) . . . . . 1.2 MB

The 2DD-type floppy disk is automatically recognized and initialized as 720 KB.

SW1 bit 3: Not used. Any value can be set.

SW1 bit 4, 5: Sets the No. of synchronous backward guarding steps when the pattern mode is FRAME and FRAME SYNC is ON.

SW1 bit 6 to 8: Sets the No. of synchronous forward guarding steps when the pattern mode is FRAME and FRAME SYNC is ON.

Table 3-17 DIP Switch SW2 Settings

SW2	Function	Settings (0: (OFF), 1: (ON))	
bit 1	ALARM on ERROR PERFORMANCE CLOCK ERROR EVALUATION	INCLUDE	0
		EXCLUDE	1
bit 2	ALARM on ERROR PERFORMANCE SYNC ERROR EVALUATION	INCLUDE	0
		EXCLUDE	1
bit 3 bit 4 bit 5	EI/EFI THRESHOLD		bit 5, 4, 3
		>0	0, 0, 0
		>1E-03	0, 0, 1
		>1E-04	0, 1, 0
		>1E-05	0, 1, 1
		>1E-06	1, 0, 0
		>1E-07	1, 0, 1
		>1E-08	1, 1, 0
		>1E-09	1, 1, 1
bit 6 bit 7 bit 8	T-EI/EFI THRESHOLD		bit 8, 7, 6
		>1E-03 to ≧1E-09	0, 0, 0
			1, 0, 1
			1, 1, 0
			1, 1, 1
		>1E-04 to ≧1E-10	0, 0, 1
		>1E-05 to ≧1E-11	0, 1, 0
		>1E-06 to ≧1E-12	0, 1, 1
		>1E-07 to ≧1E-13	1, 0, 0

SW2 bit 1: Selects inclusion of the clock error time in measured value evaluation during error performance measurement.

0 (OFF) .... Includes the clock error time.
1 (ON) ..... Excludes the clock error time.

SW2 bit 2: Selects inclusion of the sync error time in measured value evaluation during error performance measurement.

0 (OFF) .... Includes the sync error time.
1 (ON) ..... Excludes the sync error time.

SW2 bit 3 to 5: Selects the interval error rate threshold regarded as the error interval in error interval (EI) measurement and error free interval (EFI) measurement.

For example, if Bits 5, 4, and 3 are set to 0, 1, and 1, respectively, the threshold will be 1×10^{-5}; measuring each interval as

$1 \times 10^{-5} <$ Error rate ... Error interval
$1 \times 10^{-5} \geqq$ Error rate .. Error free interval.

SW2 bit 6 to 8: Selects the measured error rate threshold range (upper/lower limits) in the threshold error interval (T-EI) and threshold error free interval (T-EFI) measurement.

The threshold value to measure the threshold error interval has 8 stages divided by every 10-times step between selected upper and lower limits.

For example, if Bits 5, 4, and 3 are set to 0, 0, and 1, respectively, the upper and lower limits will be 1×10^{-4} and 1×10^{-10}. The error rate range to measure the threshold error interval will have the following 8 stages;

$1 \times 10^{-4} <$ Error rate
$1 \times 10^{-5} <$ Error rate
$1 \times 10^{-6} <$ Error rate
$1 \times 10^{-7} <$ Error rate
$1 \times 10^{-8} <$ Error rate
$1 \times 10^{-9} <$ Error rate
$1 \times 10^{-10} <$ Error rate
$0 <$ Error rate $\leqq 1 \times 10^{-10}$

And, the error rate range to measure the threshold error free interval will have the following 8 stages;

Error rate $\leqq 1 \times 10^{-4}$
Error rate $\leqq 1 \times 10^{-5}$
Error rate $\leqq 1 \times 10^{-6}$
Error rate $\leqq 1 \times 10^{-7}$
Error rate $\leqq 1 \times 10^{-8}$
Error rate $\leqq 1 \times 10^{-9}$
Error rate $\leqq 1 \times 10^{-10}$
Error rate = 0

The measurement results will be the No. of intervals in this range for which error rate falls or the percentage (%).

Table 3-18 DIP Switch SW3 settings

SW3	Function	Settings (0: (OFF), 1: (ON))		
bit 1	PRINT OUT DATA T-EI/EFI	ON		0
		OFF		1
bit 2	PRINT OUT DATA ERROR PERFORMANCE	ON		0
		OFF		1
bit 3	OUTPUT FORMAT T-EI/EFI	EXP		0
		%		1
bit 4	OUTPUT FORMAT ERROR PERFORMANCE	EXP		0
		%		1
bit 5 bit 6	US, SES, DM THRESHOLD	US, SES	DM	bit 6, 5
		1E-3	1E-6	0, 0
				1, 1
		1E-4	1E-8	0, 1
		1E-5	1E-10	1, 0
bit 7 bit 8	CURRENT DATA INTERVAL			bit 8, 7
		0.1sec		0, 0
		0.2sec		0, 1
		0.5sec		1, 0
		INTERVALS		1, 1

SW3 bit 1: Selects printer output of the threshold error interval (T-EI) and threshold error free interval measurement results.

0 (OFF) .... Output to printer (ON).
1 (ON) ..... Does not output to printer (OFF).

SW3 bit 2: Selects printer output of the error performance measurement results.

0 (OFF) .... Output to printer (ON).
1 (ON) ..... Does not output to printer (OFF).

SW3 bit 3: Selects printer output format of threshold error interval (T-EI) and threshold error free interval (T-EFI) measurement results.

0 (OFF) .... No. of intervals (exponential format)
1 (ON) ..... Percentage (%, fixed point format)

SW3 bit 4: Selects printer output format of error performance measurement results.

0 (OFF) .... Exponential format
(ES, EFS, SES, US: No. of seconds, DM: No. of minutes)

1 (ON) ..... Fixed point format (ES, EFS, SES, US, DM: %)

SW3 bit 5, 6: Selects the period error rate threshold to include in calculation of unavailable seconds (US), severely errored seconds (SES), and degraded minutes (DM).
For example, if Bits 6 and 5 are set to 0 and 1, respectively, the period to include in the US and SES calculation will be $1\times10^{-4}<$ Error rate, and the period to include in the DM calculation will be $1\times10^{-8}<$ Error rate.

SW3 bit 7, 8: Selects the interim results display cycle of error rate measurement and error count measurement.
For example, if Bits 8 and 7 are set to 1 and 0, respectively, the display will be updated every 0.5 seconds.
If Bits 8 and 7 are set to 1 and 1, respectively, the display will be updated for each measurement interval set by the INTERVAL key (⑫ in Figure 2-5) in timer/clock section on the front panel.

⑨ EXT REF INPUT connector

Used to input frequency measurement reference clock from external source.
Use a reference clock with a frequency of 10 MHz and an amplitude of 1 Vp-p to 10 Vp-p.
When external reference clock is input, the external reference clock use is automatically selected to light the EXTERNAL TIME REFERENCE lamp (㉔ in Figure 2-4) on front panel measurement section.
When external reference clock is not input, the internal reference clock is used.

⑩ EXT GATE INPUT connector

Used to control the measurement by input of gate signal from external source.
To use this input, set to ON the EXTERNAL GATE key (㉞ in Figure 2-4) on front panel measurement section.
The input level is 0 V as HIGH (stop) and -1 V as LOW (measuring).
The input is terminated to 0 V with approximately 50 Ω.

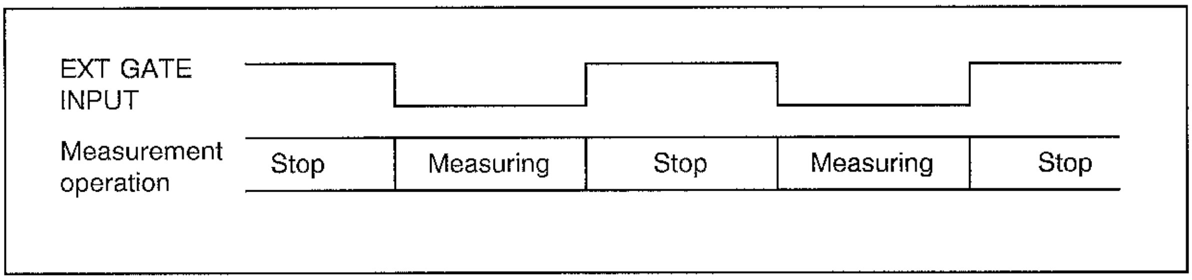


Figure 3-8 Operation of EXT GATE INPUT

For operation detail, see Items ㉚ NORMAL key and ㉝ BURST key in the measurement section.

⑪ EXT ALT INPUT connector

Used when the external signal is input to switch the pattern between A and B in the WORD or FRAME (PAYLOAD type of WORD or PRBS) pattern ALTERNATE mode as shown in Figure 3-6.
The input level is 0 V as HIGH (pattern A) and -1 V as LOW (pattern B).
The input is terminated to 0 V with approximately 50 Ω.
Set both HIGH and LOW level widths of input signal to equal to or greater than 1 second, and set both rise and fall times to equal to or less than 10 ns.
The pattern for comparison/measurement will toggle the pattern between A and B according to this input level when this input level is read.
To use this input, set the bit 1 of SW1 in ⑥ to ON (1).

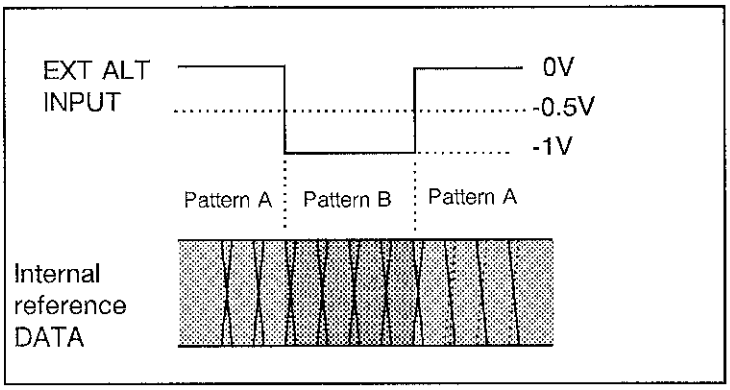


Figure 3-9 Operation of EXT ALT INPUT

⑫ STRETCHED ERROR OUTPUT connector

Outputs the bit error detection signal with an enlarged pulse width.
Output level is TTL positive logic, pulse width is approximately 100 ns.

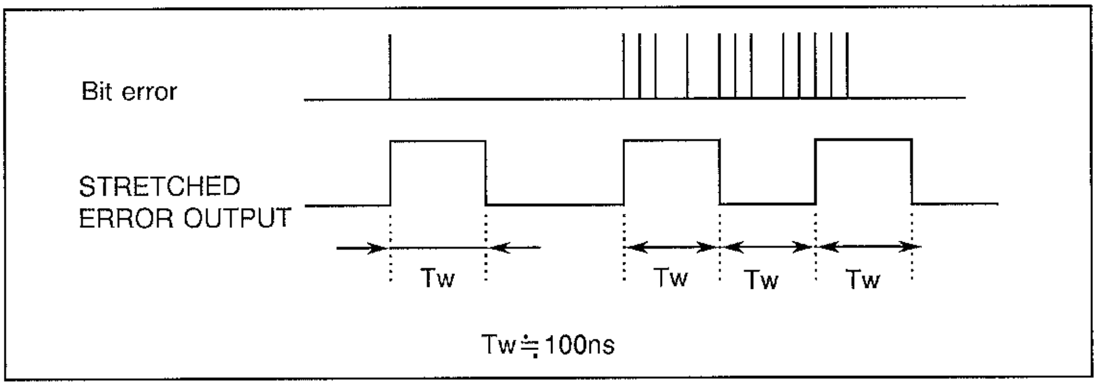


Figure 3-10 Operation of STRETCHED ERROR OUTPUT

⑬ DIRECT ERROR OUTPUT connector

Outputs the direct bit error detection signal.
Rate is 1/32 of input clock frequency in RZ format.
Output level is approximately 0 V as HIGH and approximately - 1 V as LOW; positive logic.
For the load, terminate to 0 V with 50 Ω.

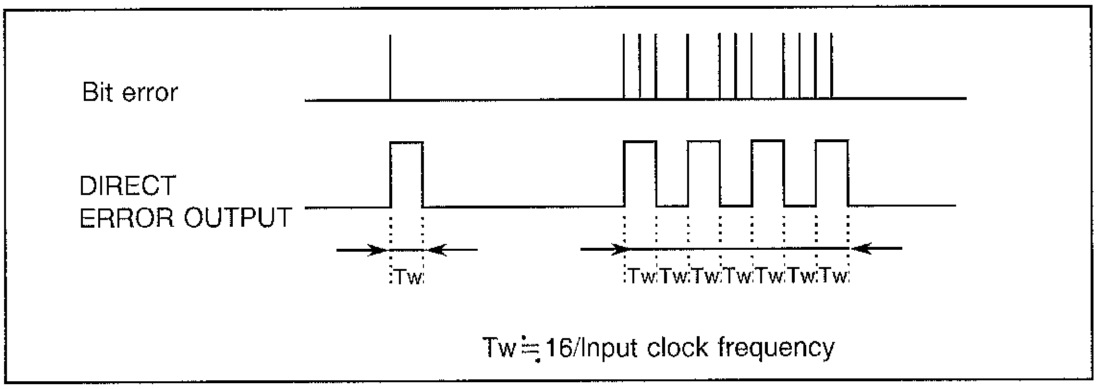


Figure 3-11 Operation of DIRECT ERROR OUTPUT

4. SYSTEM OPERATION METHOD

This chapter describes the error test operation performed by connecting the D3186 Pulse Pattern Generator, the unit under test (UUT), or the device under test (DUT) to the D3286.

4.1 Setting the D3186

4.1.1 Connecting Clock Input

D3186 has an optional built-in clock signal generator which can be used with the D3286. And external generator can also be used.

(1) To use the built-in clock signal generator (option)

The built-in clock signal generator outputs to the CLOCK OUTPUT connector on the front panel. Connect this CLOCK OUTPUT to the CLOCK INPUT connector on the front panel using the attached SMA-SMA coaxial cable.

(2) To use an external clock signal generator

Input the sinusoidal external clock signal with amplitude of 0.7 Vp-p to 1.5 Vp-p to the CLOCK INPUT connector on the front panel. This CLOCK INPUT is terminated to 0 V with approximately 50 Ω.

The external clock signal generator can also be controlled from the frequency setting section on the D3186 front panel using the GPIB. Use of this function requires setting the control code system by DIP switch SW1 Bits 3 and 4 on D3186 rear panel and connecting GPIB (ONLY FOR SG) connector on the rear panel to the GPIB connector of the external clock signal generator. Set the external clock signal generator to addressable mode and device address to "20" (decimal). This function can also be used to remotely control the D3186 from a computer through the GPIB.

4.1.2 Setting Data Output

Set data output (DATA, $\overline{\text{DATA}}$) level according to UUT/DUT input conditions.

(1) When the UUT/DUT data input connection is DC and the terminator voltage is 0 V (see Figure 4-1.):

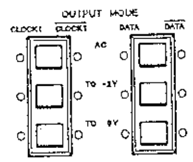
Set output level by pressing the OUTPUT MODE key so that the TO 0V lamps of $\overline{\text{DATA}}$ and DATA are lit on the front panel. Since the data output offset and amplitude are variable, use the OFFSET and AMPLITUDE controls of $\overline{\text{DATA}}$ and DATA to set each value.

(2) When the UUT/DUT data input connection is DC and the terminator voltage is -2 V, ECL level (see Figure 4-2.):

Set output level by pressing the OUTPUT MODE key so that the TO -2V lamps of $\overline{\text{DATA}}$ and DATA are lit on the front panel.
Data output offset (HIGH level) and amplitude will be set to approximately -0.8 V and approximately 0.8 Vp-p, respectively, (± 0.2 V variable for each).

(3) When the UUT/DUT data input connection is AC (see Figure 4-3.):

Set output level by pressing the OUTPUT MODE key so that the AC lamps of $\overline{\text{DATA}}$ and DATA are lit on the front panel.
Setting of data output offset is insignificant and only the amplitude becomes variable.



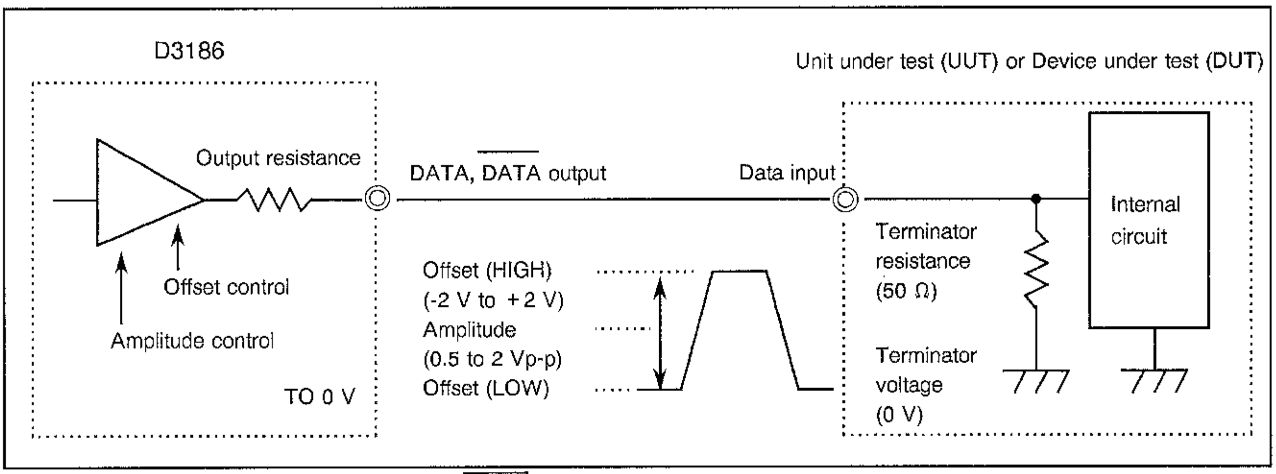


Figure 4-1 DATA and $\overline{\text{DATA}}$ Output, DC Connection, and 0 V Termination

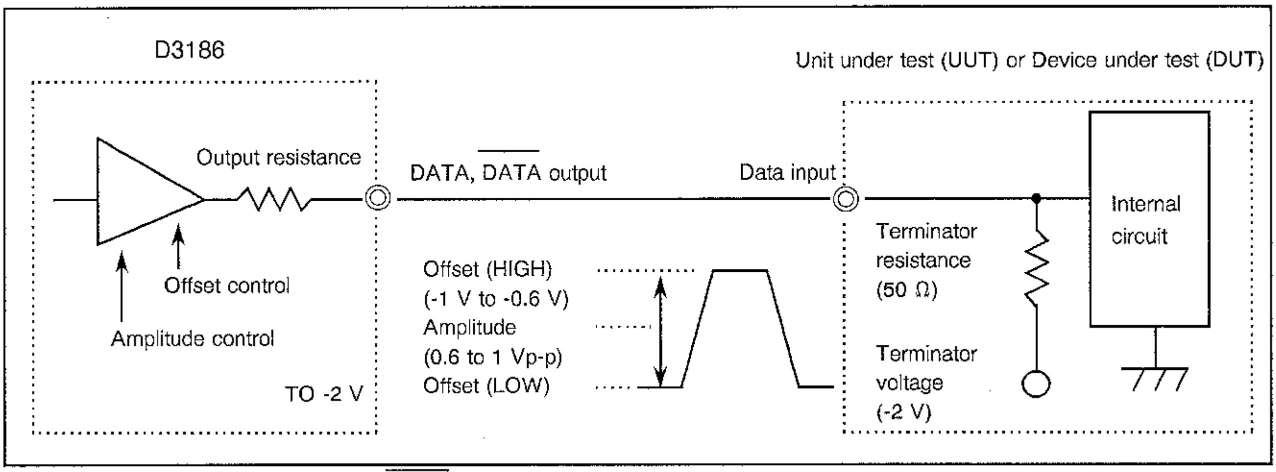


Figure 4-2 DATA and $\overline{\text{DATA}}$ Output, DC Connection, - 2 V Termination, and ECL Level

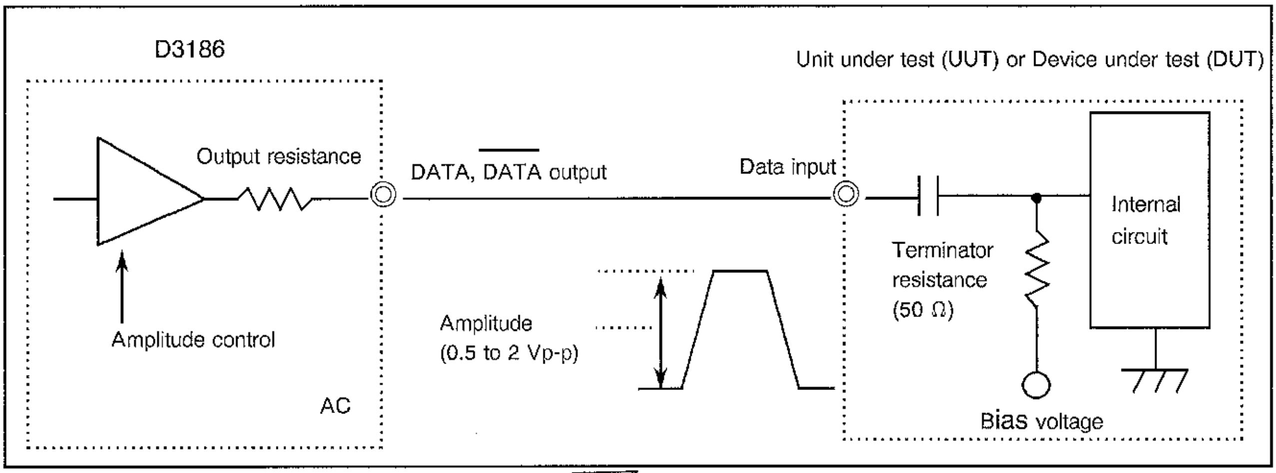


Figure 4-3 DATA and $\overline{\text{DATA}}$ Output and AC Connection

4.1.3 Setting Clock Output

When the UUT/DUT requires a clock, select the clock output from CLOCK1, $\overline{\text{CLOCK1}}$, and CLOCK2 according to the UUT/DUT input conditions. If CLOCK1 and/or $\overline{\text{CLOCK1}}$ is used, set the respective output level.

(1) When the UUT/DUT clock input connection is DC and the offset value should be set: Use CLOCK1 or $\overline{\text{CLOCK1}}$.

(a) When the terminator voltage of the UUT/DUT clock input is 0 V (see Figure 4-4.):
Set output level by pressing the OUTPUT MODE key so that the TO 0V lamp of CLOCK1 or $\overline{\text{CLOCK1}}$ is lit on the front panel. Offset and amplitude of the clock output are variable; use the OFFSET and AMPLITUDE controls of CLOCK1 or $\overline{\text{CLOCK1}}$ to set each value.

(b) When the terminator voltage of the UUT/DUT clock input is -2 V (ECL level) (see Figure 4-5.):
Set output level by pressing the OUTPUT MODE key so that the TO -2V lamp of CLOCK1 or $\overline{\text{CLOCK1}}$ is lit on the front panel. Offset (HIGH level) and amplitude of the clock output will be set to approximately -0.8 V and approximately 0.8 Vp-p, respectively, ($\pm$ 0.2 V variable for each).

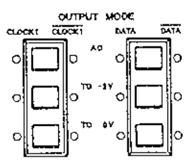
(2) When the UUT/DUT clock input connection is AC:

(a) To use variable UUT/DUT clock input amplitude (See Figure 4-6.):
Use CLOCK1 or $\overline{\text{CLOCK1}}$. Set output level by pressing the OUTPUT MODE key so that the CLOCK1 or $\overline{\text{CLOCK1}}$ AC lamp is lit on the front panel. The setting of clock output offset becomes insignificant and only the amplitude becomes variable.

(b) To use fixed UUT/DUT clock input amplitude (see Figure 4-7.):
Use CLOCK2. The CLOCK2 output connection is AC and the amplitude is approximately 1 Vp-p fixed. If a smaller amplitude is required, use an external attenuator, too.

(3) When the UUT/DUT clock input connection is DC and the central voltage of the amplitude should be equal to the terminator voltage (see Figure 4-8.):

Use CLOCK2. Since the CLOCK2 output connection is AC, the central voltage of the amplitude will be nearly equal to the terminator voltage. The amplitude is fixed at approximately 1 Vp-p.



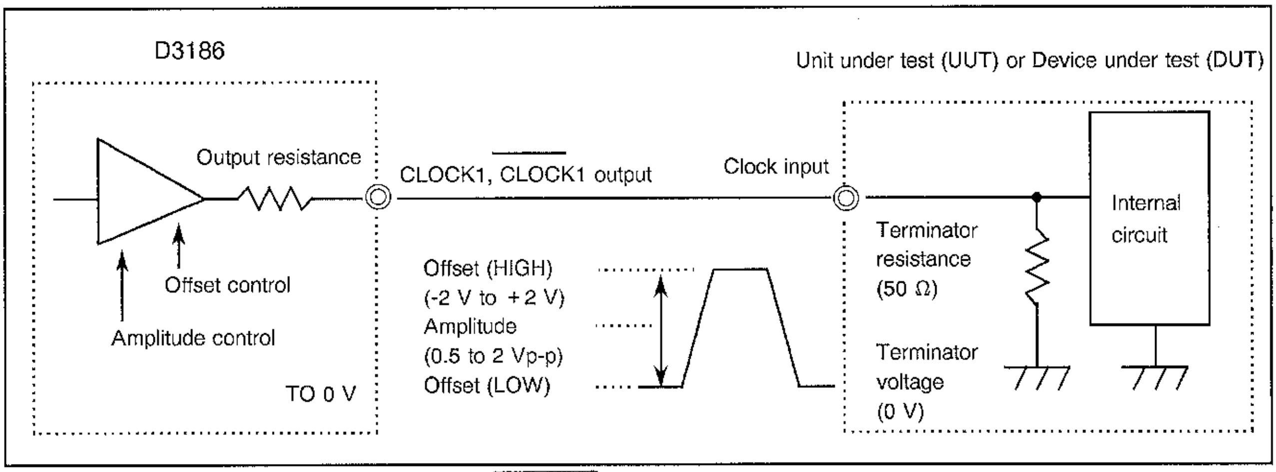


Figure 4-4 CLOCK1 and $\overline{\text{CLOCK1}}$ Output, DC Connection, 0 V Termination

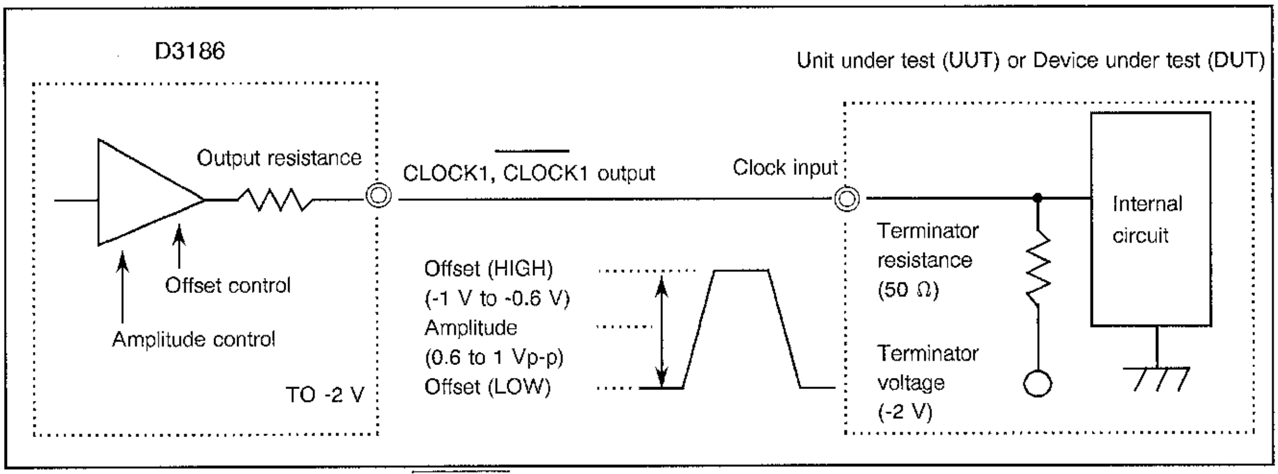


Figure 4-5 CLOCK1 and $\overline{\text{CLOCK1}}$ Output, DC Connection, - 2 V Termination, ECL Level

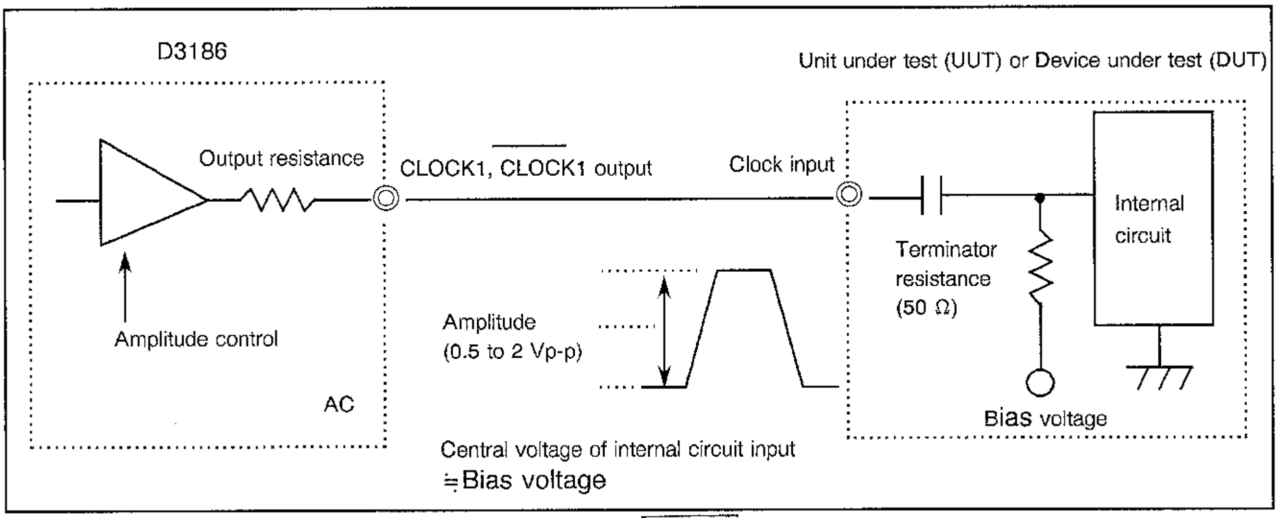


Figure 4-6 CLOCK1 and $\overline{\text{CLOCK1}}$, AC Connection

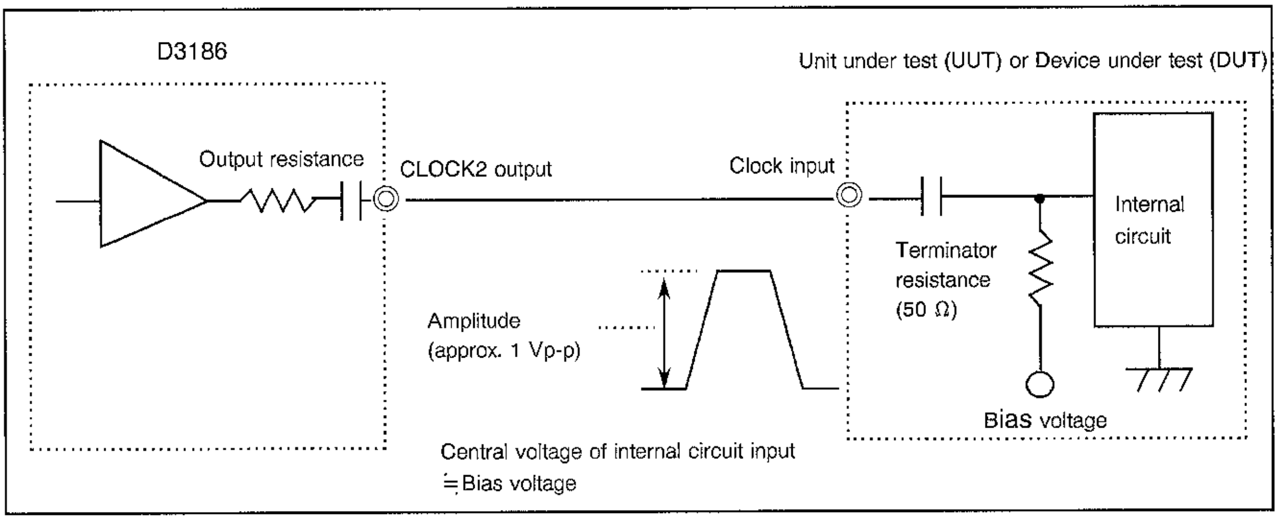


Figure 4-7 CLOCK2 Output, AC Connection Terminator

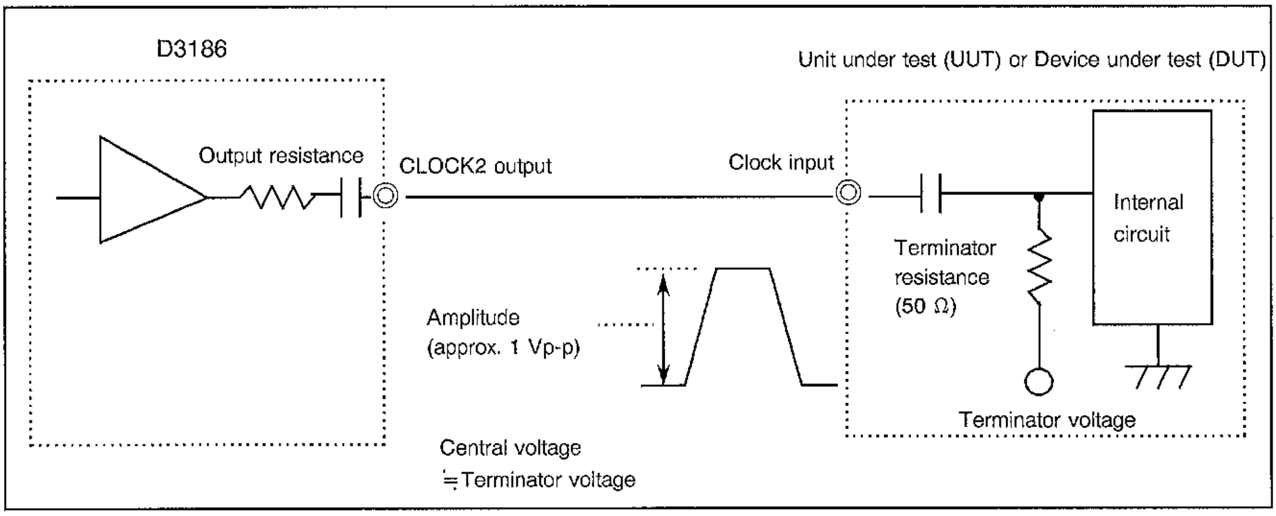


Figure 4-8 CLOCK2 Output, DC Connection Terminator

4.1.4 Setting the Pattern

Set the pattern mode to PRBS, WORD, or FRAME. For PRBS, set the pattern length 2^N-1 and the mark ratio. For WORD, set the pattern length and the logic (0, 1) for each bit. For FRAME, first set the payload type and frame configuration. If the payload type is WORD or PRBS, set as frame configuration the frame count, the row count per frame, the byte count per row, and the overhead byte count of a single row. If the payload type is CID, set the byte count per row, the overhead byte count of a single row, and the bit count of the 0/1 continuous pattern.
Second, if the pattern mode is FRAME and the payload type is WORD, set the logic (0, 1) for every bit in the pattern. If the pattern mode is FRAME and the payload type is PRBS, set the logic (0, 1) for every bit in the overhead, the PRBS pattern length 2^N-1 in the payload, and the mark ratio.

For manual setting by front panel key operation, it is convenient to use the master/slave control function so that the patterns of the D3186 and the D3286 Error Detector will be both set simultaneously
This function has two different methods. In the first method, the D3186 and D3286 are used as the master and slave, respectively, so that the D3286 pattern setting section will be interlocked with the D3186 pattern setting section. In the second method, the D3286 and D3186 are used as the master and slave, respectively, so that the D3186 pattern setting section will be interlocked with the D3286 pattern setting section.
Use of this function requires connecting the D3186 and D3286 by GPIB cable. The first method requires turning ON the D3186 front panel MASTER key and the D3286 front panel SLAVE key; turn ON the D3286 front panel MASTER key and the D3186 front panel SLAVE key for the second method. Key operations of the pattern setting section on the slave machine side become ineffective.

CAUTION

1. Do not connect any other controller or equipment to the D3186 and D3286 GPIB connectors when using the master/slave function.
2. Be sure to turn OFF the MASTER key and SLAVE key when executing remote control with the GPIB controller.

4.2 Setting the D3286

4.2.1 Setting Data Input

(1) Set the data input terminator voltage according to the UUT/DUT output conditions. When the TO 0V lamp on the DATA side of TERMINATOR on the front panel is lit, the terminator voltage is 0 V; when the TO -2V lamp is lit, the terminator voltage is -2V. The voltage setting is alternately changed each time the DATA key is pressed.

(2) Set the data input threshold level according to the UUT/DUT output voltage. Set the THRESHOLD LEVEL display voltage on the front panel to the central value of the UUT/DUT output voltage amplitude by rotating the control. The setting range varies depending on the data input terminator voltage.

4.2.2 Setting Clock Input

There are three types of source clock input supply as shown below. Set the terminator voltage of the clock input according to the output conditions of each supply source.

(1) To use UUT/DUT clock output:

Set the clock input terminator voltage according to the UUT/DUT output conditions. When the TO 0V lamp on the CLOCK side of TERMINATOR on the front panel is lit, the terminator voltage is 0 V; when the TO -2V lamp is lit, the terminator voltage is -2V. The voltage setting is alternately changed each time the CLOCK key is pressed. If the UUT/DUT clock output connection is AC, the terminator voltage setting of the D3286 clock input can be 0 V or -2 V.

(2) To use D3186 CLOCK1 and $\overline{\text{CLOCK1}}$ output:

Both TO 0V and TO -2V can be used in the D3186 clock output mode (CLOCK1, $\overline{\text{CLOCK1}}$ OUTPUT MODE). AC is not available. If the clock output mode has been set to TO 0V, set the D3286 clock input to TO 0V; set to TO -2V if TO -2V has been set.
When the TO 0V lamp on the CLOCK side of TERMINATOR on the front panel is lit, the terminator voltage is 0 V; when the TO -2V lamp is lit, the terminator voltage is -2V. The voltage setting is alternately changed each time the CLOCK key is pressed.

(3) To use D3186 CLOCK2 output

Since the D3186 CLOCK2 output connection is AC, the terminator voltage setting of the D3286 clock input can be 0 V or - 2 V.

4.2.3 Setting the Pattern

Set in the same way as the D3186 pattern setting. For manual setting by front panel key operation, it is convenient to use the master/slave control function so that the patterns of the D3186 and the D3286 Error Detector will be both set simultaneously.
This function has two different methods. In the first method, the D3186 and D3286 are used as the master and slave, respectively, so that the D3286 pattern setting section will be interlocked with the D3186 pattern setting section. In the second method, the D3286 and D3186 are used as the master and slave, respectively, so that the D3186 pattern setting section will be interlocked with the D3286 pattern setting section.
Use of this function requires connecting the D3186 and D3286 by GPIB cable. The first method requires turning ON the D3186 front panel MASTER key and the D3286 front panel SLAVE key; turn ON the D3286 front panel MASTER key and the D3186 front panel SLAVE key for the second method. Key operations of the pattern setting section on the slave machine side become ineffective.

CAUTION

1. Do not connect any other controller or equipment to the D3186 and D3286 GPIB connectors when using the master/slave function.
2. Be sure to turn OFF the MASTER key and SLAVE key when executing remote control with the GPIB controller.

4.2.4 Setting Data Input Polarity

For the relationship between UUT/DUT input and output, set INPUT POLARITY on the front panel depending on whether the data polarity is inverted or not. Press the INPUT POLARITY key so that the INVERSE lamp will be lit if the polarity is inverted and the NORMAL lamp will be lit if it is not inverted.

4.2.5 Adjusting Clock Delay

Rotate the DELAY control on the front panel to adjust the phase relationship between data input and clock input so that the pattern sync will be established to minimize the bit error rate.

When the AUTO SEARCH key is set to ON on the front panel, the data input threshold level mentioned previously and the clock delay are automatically adjusted.

The D3286 is equipped with monitor output of both clock input and data input. For clock monitor output (MONITOR OUTPUT - CLOCK), the clock input signal through the internal clock amplifier and variable delay line is output. For data monitor output (MONITOR OUTPUT - DATA), the data input signal through the internal data amplifier is output. Figure 4-9 shows the optimum phase relationship between the clock monitor output and the data monitor output while clock and data are input.

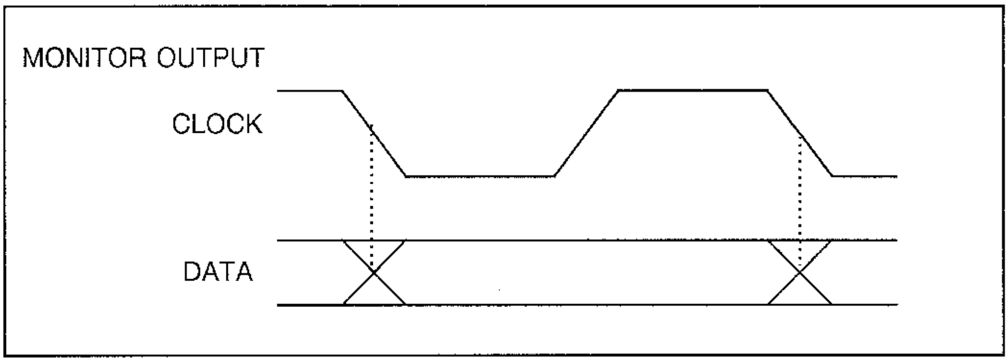


Figure 4-9 Optimum Phase of Monitor Output

4.3 Connecting Signal Lines

Figure 4-7 shows an example of connecting the signal lines.
Connect the clock I/O signal lines according to presence of UUT/DUT clock I/O and each voltage level and terminating method.

CAUTION

To prevent damage to equipment and device, execute the following preparation before signal line connection:

(1) Ground equipment by bundling grounding terminals of each device's case at one location.
(2) Protect the operator's body by using a ground band, etc.
(3) Be sure to discharge in advance the static electricity on coaxial cable conductor used for signal line connection.
(4) Correctly set output voltage level and terminator voltage for each device.

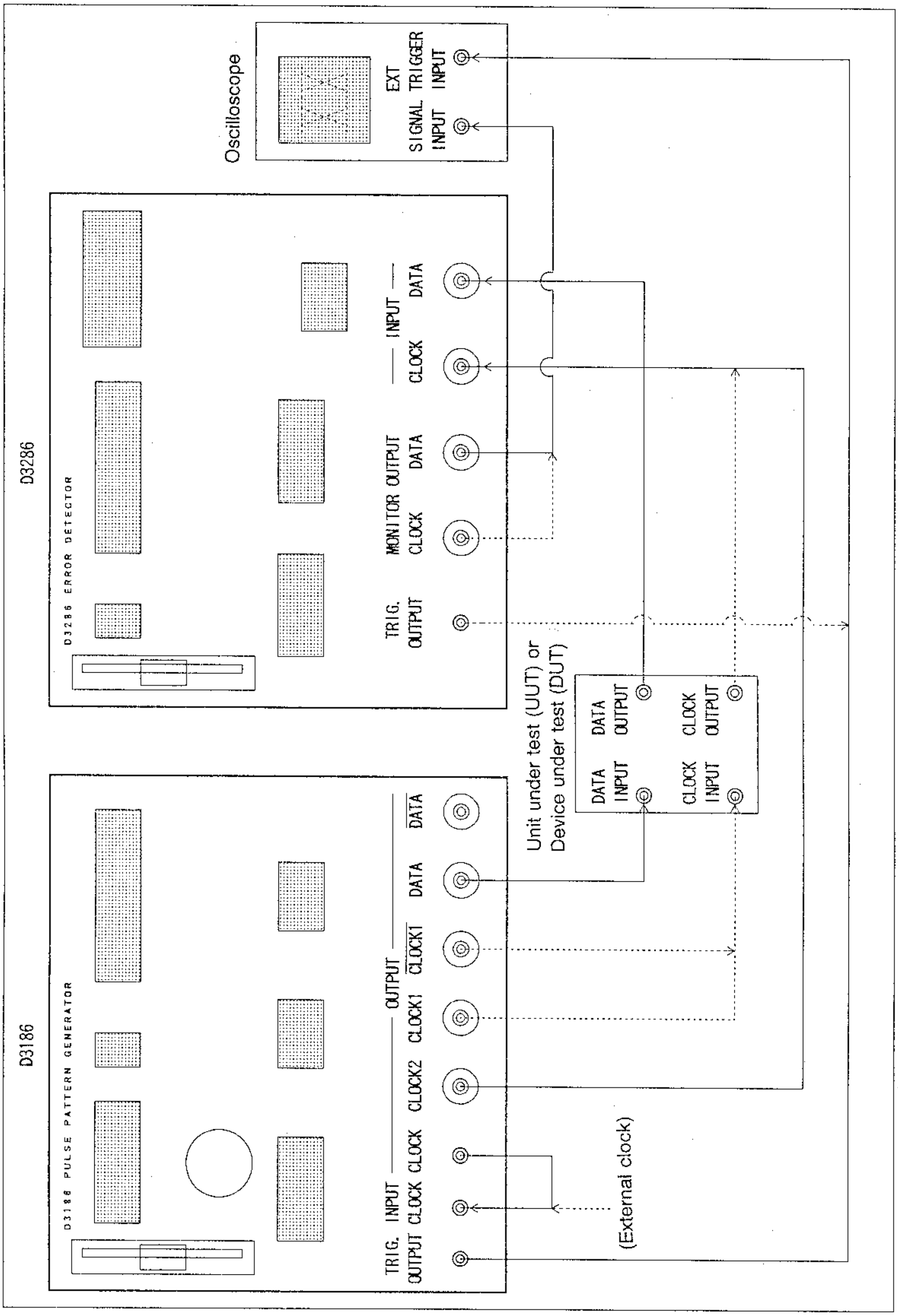


Figure 4-10 Signal Line Connections

5. GPIB

5.1 Outline of GPIB

The GPIB is an interface system which can connect measurement devices to controllers and peripheral equipment via a simple cable (bus line). It is more extendable and easy to use than other existing interface methods. Due to electrical, mechanical, and functional compatibility with other companies' products, the GPIB can configure from a simple system to an automatic instrumentation system with high-level functions through a single bus cable.

The GPIB system first requires setting each "address" of the respective components connected to the bus line. Components can play one or more roles as controller, talker, and listener. During system operation, only one "talker" can send data to the bus line, and more than one "listener" can receive that data. The controller specifies addresses of "talker" and "listener" to transfer data from "talker" to "listener" or sets as "talker" measurement conditions for "listener".

For data transfer between equipment, 8 bit-parallel and byte-serial data lines are used to perform asynchronous bidirectional transmission. Because it is an asynchronous system, components can be interconnected regardless of their transmission speed. Data (messages) sent/received between components include measurement data, measurement conditions (programs), various commands; primarily using ASCII code.

In addition to the eight data lines, the GPIB has three handshake lines to control asynchronous data send/receive between devices and five control lines to control 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

- The following signals are used for the control lines.

ANT (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

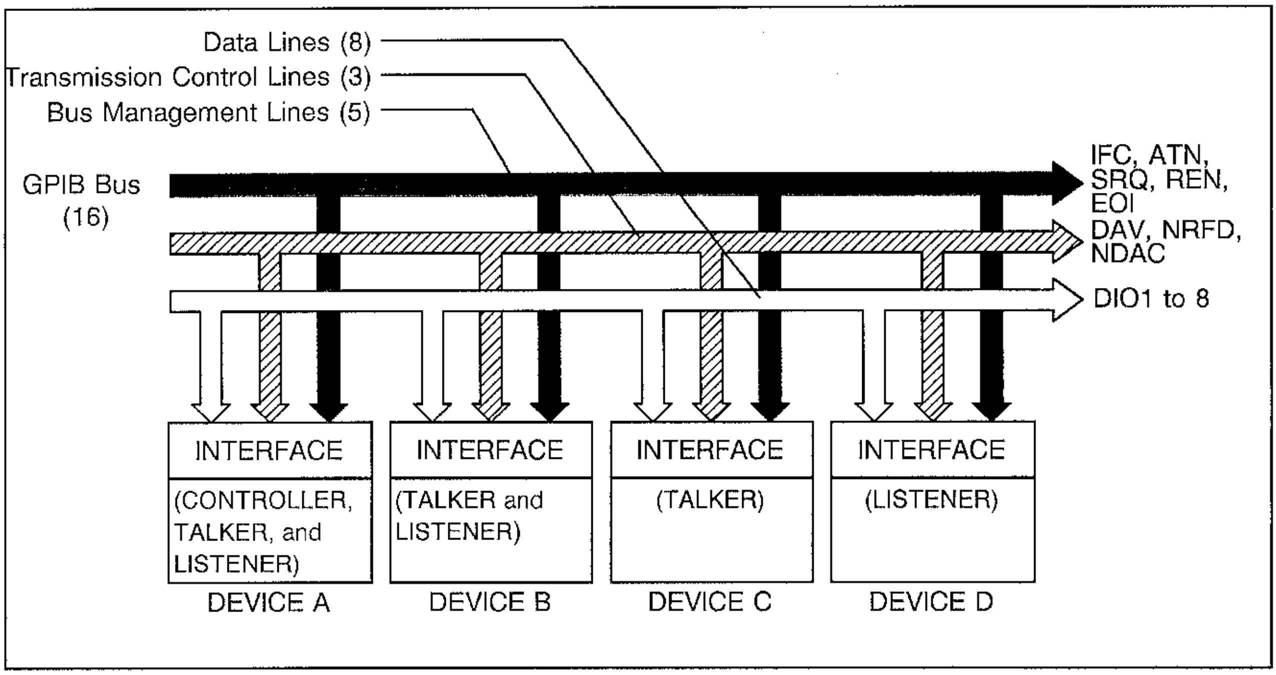


Figure 5-1 Outline of GPIB

5.2 Functional Specification

5.2.1 GPIB Specification

Conforming standards: IEEE standard 488-1978

Used code: ASCII code and binary code

Signal level: "High" state; + 2.4 V or more
"Low" state; + 0.4 V or less

Signal line termination: 16 bus lines are terminated as follows:

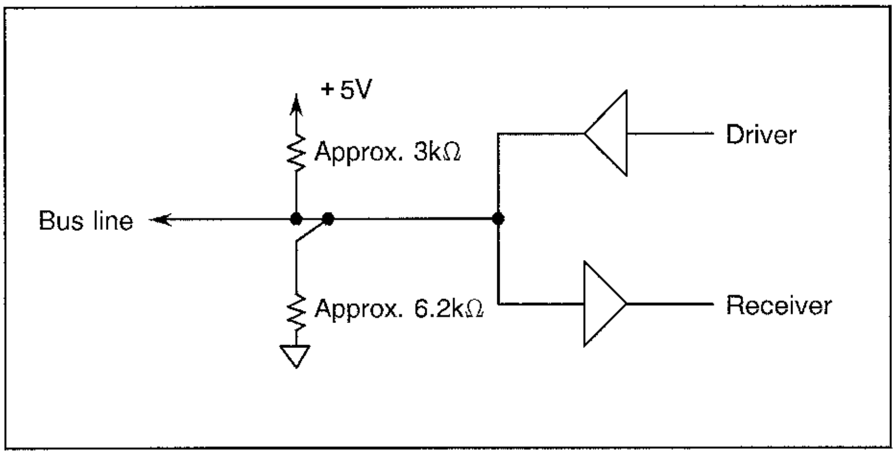


Figure 5-2 Signal Line Termination

Driver specification: Open collector type
"Low" state output voltage: +0.4 V or less, 4.8 mA
"High" state output voltage: +2.4 V or more, −5.2 mA

Receiver specification: "Low" state at +0.6 V or less
"High" state at +2.0 V or more

Bus cable length: Total bus cable length must be (No. of components connected to bus) x 2 m or less and must not exceed 20 m.

Address specification: 31 types of talk address/listen address can be arbitrarily set with front panel address select switch.

Connector: 24-pin GPIB connector,
57-20240-D35 (equivalent to products manufactured by Amphenol)

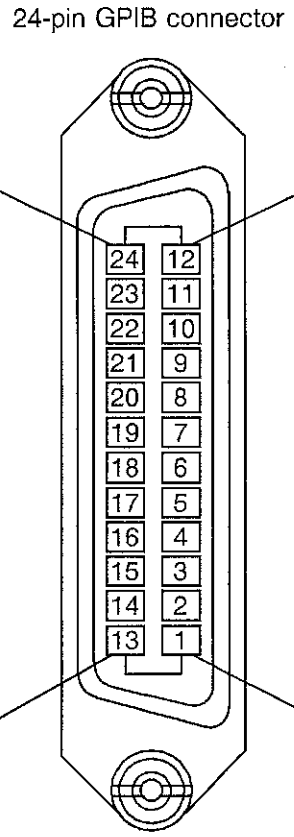
5.2.2 Interface Functions

Table 5-1 shows interface functions.

Table 5-1 Interface Functions

Code	Function/description
SH1	Source handshake function available
AH1	Accepter handshake function available
T5	Basic talker function, serial pole function, listener-specified talker release function, talk-only mode function (during MASTER ON)
L3	Basic listener function, talker-specified listener release function, listen-only mode function (during SLAVE ON)
SR1	Service request function available
RL1	Remote function available
PP0	Parallel pole function not available
DC1	Device clear function available ("SDC" and "DCL" commands available)
DT1	Device trigger function available ("GET" command available)
C0	Controller function not available
E2	Three-state bus driver used

Signal name	Pin No.
GND LOGIC	24
GND (ATN)	23
GND (SRQ)	22
GND (IFC)	21
GND (NDAC)	20
GND (NRFD)	19
GND (DAV)	18
REN	17
DIO 8	16
DIO 7	15
DIO 6	14
DIO 5	13



Pin No.	Signal name
12	SHIELD
11	ATN
10	SRQ
9	IFC
8	NDAC
7	NRFD
6	DAV
5	EOI
4	DIO 4
3	DIO 3
2	DIO 2
1	DIO 1

Figure 5-3 Pin Assignment of GPIB Connector

5.3 Notes on GPIB Usage

This section describes notes for using GPIB.

(1) Cable connection/disconnection
Before GPIB cable connection/ disconnection, turn off power of all equipment to be connected. Connect/disconnect GPIB cable only when ground cable of each equipment case is connected to the ground (grounded).

(2) Device address setting
Set D3286 device address using front panel keys. Be sure to avoid address duplication between controllers and other equipment connected to the same GPIB.

(3) Master/slave control operation
If equipment other than D3186 Pulse Pattern Generator is connected while MASTER key (⑭ in Figure 2-6) or SLAVE key (⑮ in Figure 2-6) is ON on D3286 front panel, D3286 Error Detector may occasionally operate abnormally. In this case, set D3286 MASTER or SLAVE key to OFF or disconnect equipment other than D3186.
For remote control from controller via GPIB, first send an instruction to set IFC line to low level (active) as a precaution. This will set both MASTER and SLAVE keys to OFF.

(4) ATN interrupt during message transmission
When ATN request occurs during inter-device message transmission, priority is given to ATN, so that the message transmission is halted.

(5) Conforming standards version
D3286 GPIB message syntax and status byte configuration conform to IEEE488.1 standards to maintain compatibility with existing products. Does not conform to IEEE488.2 standards.

5.4 Setting Device Address

D3286 device address is displayed on file No. indicator (① in Figure 2-6) when ADDRESS DISP switch (⑯ in Figure 2-6) is ON on D3286 front panel. Use of ⇧ and ⇩ keys under this indicator enables modifying device address. Setting range is 0 to 30.

In addition, the changed device address is enabled when the ADDRESS DISP switch (⑯ in Figure 2-6) is turned off.

Set device address to prevent duplication between controllers and other equipment connected to GPIB. When shipped, D3286 GPIB address is set to 8.

5.5 Canceling Master/Slave Control Function

D3286 remote control from a controller requires deactivating D3286 master/slave control function. Master/slave control function can be canceled by interface clear instruction from controller as well as by panel key operation.
To cancel the master/slave function from controller, send an instruction to set GPIB connector IFC pin (pin 9) to low level (active) before remote control; e.g., instruction "abort 7" in HP BASIC.

5.6 Program Message (Listener Format)

This section describes program messages for D3286 remote control with the GPIB controller. Program messages are two types: (a) command program message for operation condition setup and start/stop instruction execution, and (b) query program message for setup state inquiry. See Section 5.7 for query program message and its response message. Basic syntax is common to both types of program messages.

5.6.1 Basic format

Normally, ASCII code is used for program messages. Binary code can also be used for WORD and FRAME pattern settings. Figure 5-4 shows basic syntax of a program message in ASCII code.

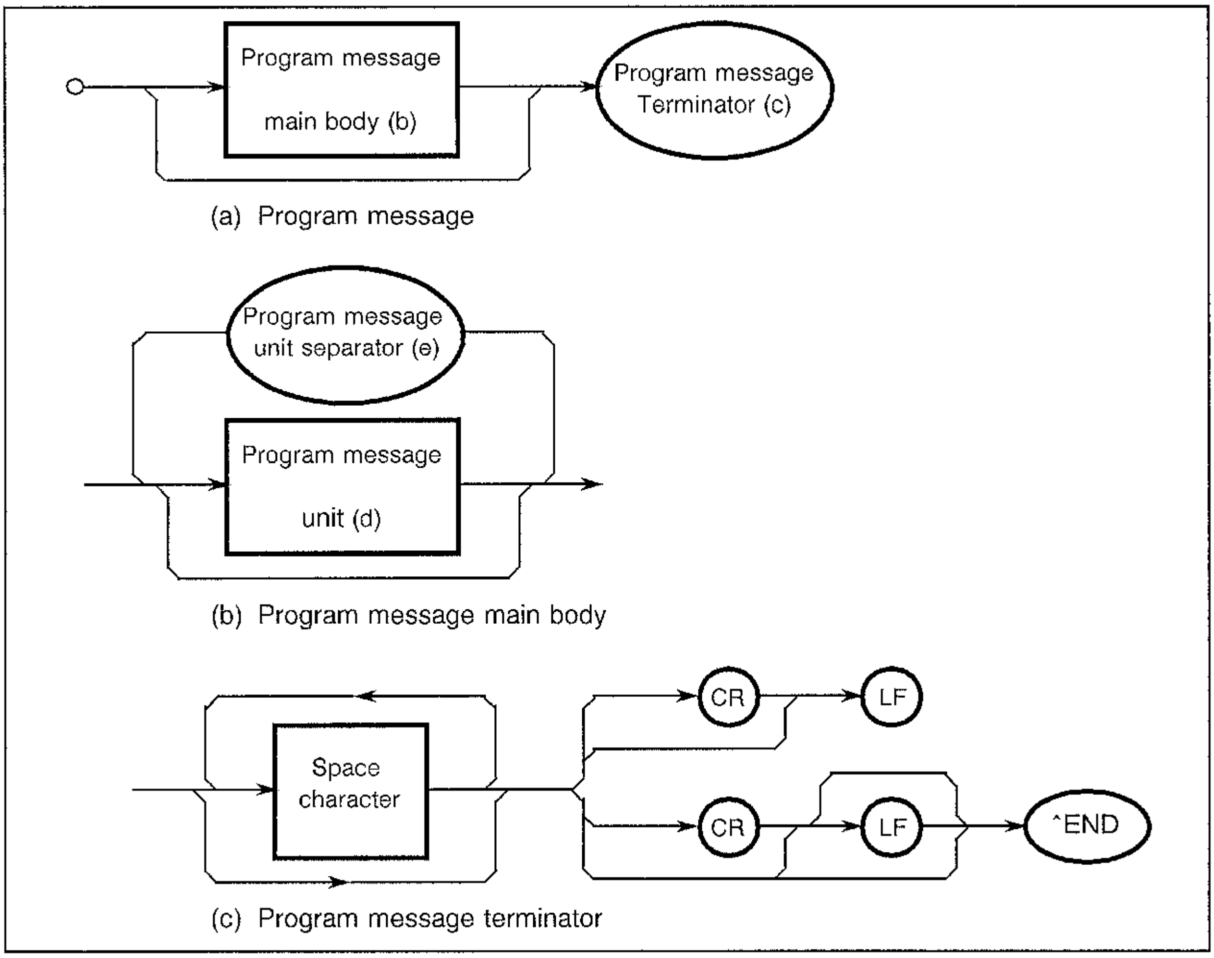
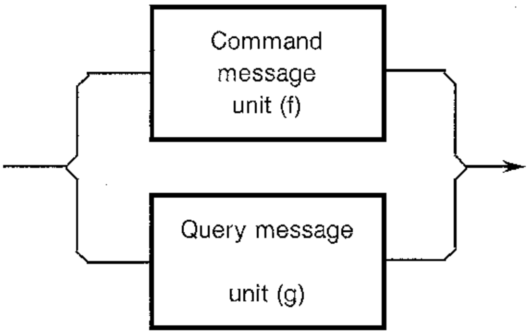
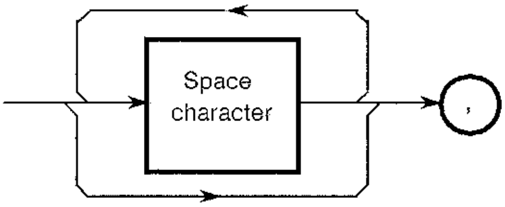


Figure 5-4 Basic Syntax of Program Message (1 of 3)

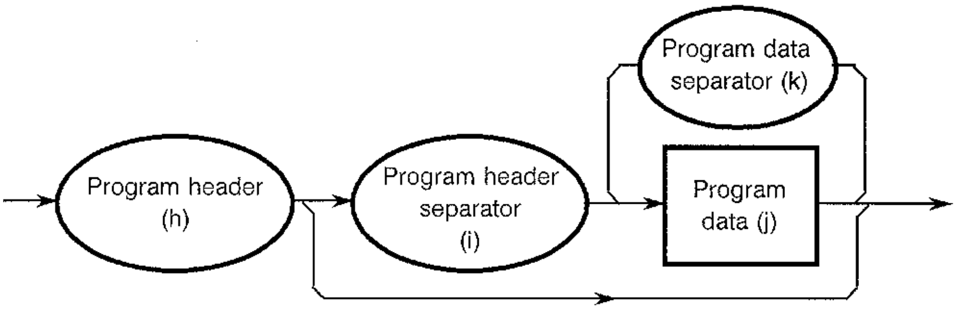
*END: EOI and ATN must be true and false, respectively, with the immediately preceding byte.



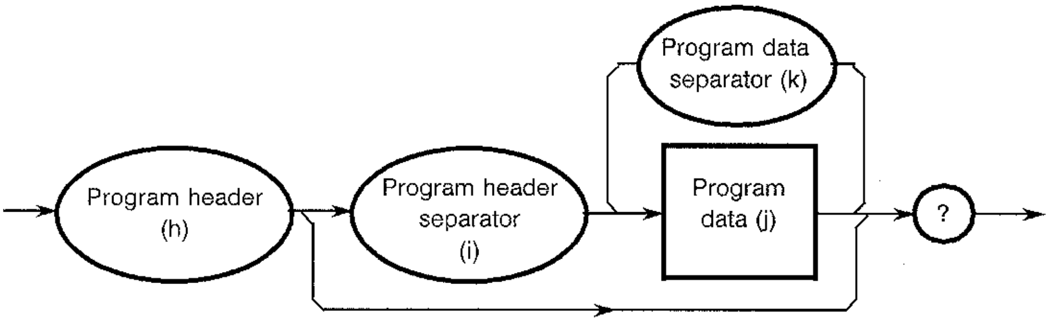
(d) Program message unit



(e) Program message unit separator



(f) Command message unit



(g) Query message unit

Figure 5-4 Basic Syntax of Program Message (2 of 3)

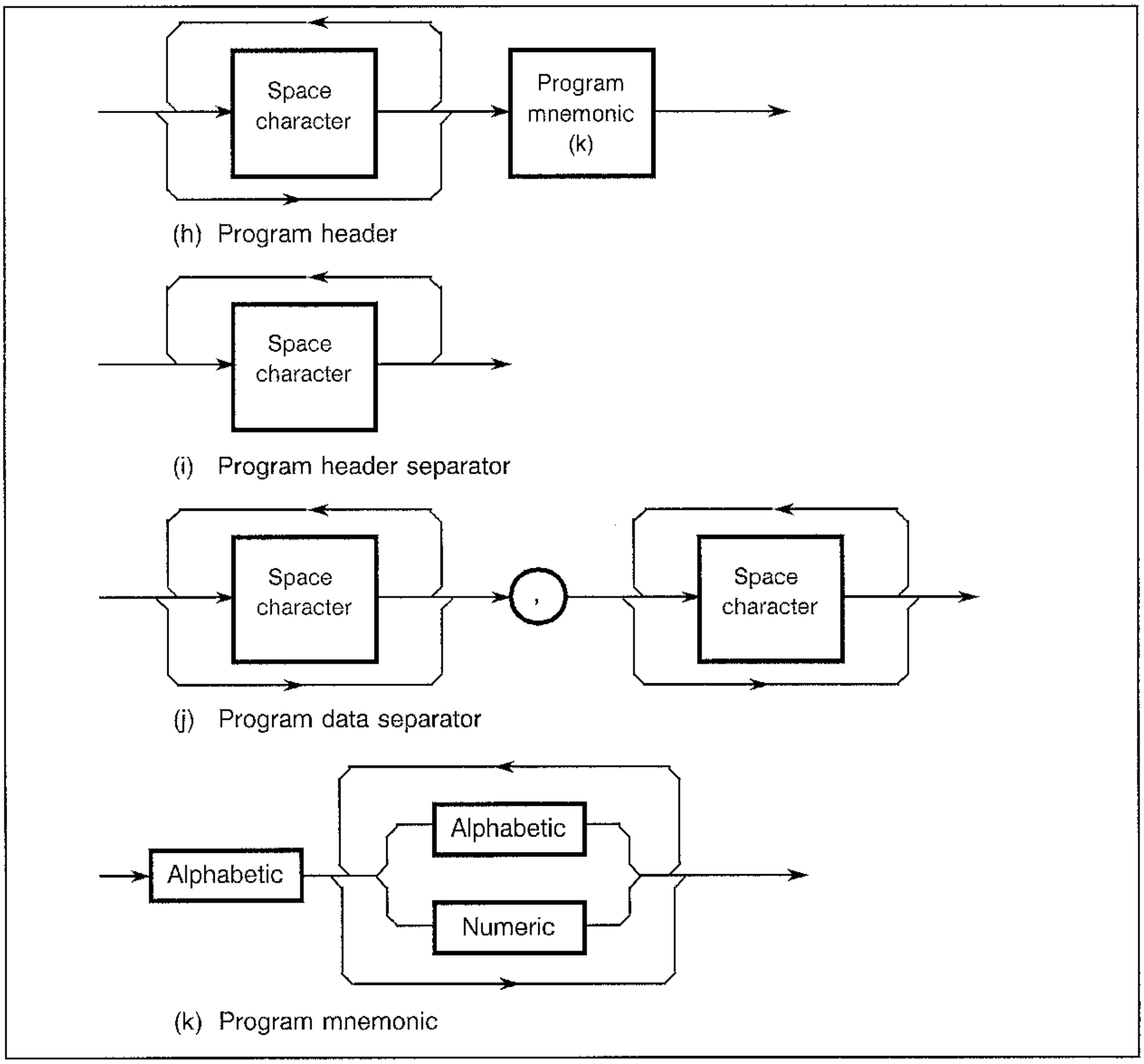


Figure 5-4 Basic Syntax of Program Message (3 of 3)

For program message terminator (record delimiter) in ASCII, the following coding can be used as shown in (c) of Figure 5-4; CR and LF ASCII codes are 13 and 10 (decimal), respectively:

a.	CR, LF^END	Adds END message with the CR and LF.
b.	CR, LF	CR and LF
c.	LF^END	Adds END message with the LF.
d.	LF	LF only
e.	CR^END	Adds END message with the CR.
f.	^END	Adds END message with the final byte of program message

END message: Single-line signal EOI and ATN must be true and false, respectively.

^END: END message must be added with the immediately preceding byte.

For program message terminator use with binary code, only END message added with the the final byte can be used.

Length of program message received by D3286 is maximum 512 characters, excluding the setting WORD or FRAME pattern, including program message unit separator and program data separator, but excluding program message terminator. If program message length exceeds 512 characters and it contains incorrect code, a syntax error occurs, in which case, all subsequent coded up to program message terminator will be ignored.

5.6.2 Initialization Program Message

Code	Description
"Z"	Initializes each parameter (panel status initialization). *1)
"C"	Initializes GPIB. *2)

Notes*1) : Initialization by the "Z" command takes approximately 10 seconds.
In addition, other commands cannot be accepted during the "Z" command execution.

Notes*2) : For more information on how to initialize GPIB using the "C" command, refer to Section 5.12.1, "Initial State of Operation."

5.6.3 Service Request ("SRQ") Program Message

Code	Description
"S0"	Sends SRQ.
"S1"	Does not send SRQ.

If "S0" mode is specified, a syntax error occurrence will initiate a service request to controller. When an "SPE" command in serial polling execution is received, a status byte is sent.

5.6.4 Command Program Message (Remote Code)

Table 5-2 shows D3286 command program messages.

In Table 5-2, other settings may result in errors or setting descriptions may differ from those listed in the table by setting PATTERN MODE (including PAYLOAD types when setting FRAME), MEASUREMENT and so on.

Therefore, set parameters using the following procedure when using the command program message.

① Set PATTERN MODE (including PAYLOAD types when setting FRAME).

② A Set PRBS
- Step count
- Mark ratio

Set WORD
- WORD ALTERNATE mode
- WORD pattern length

Set FRAME
- FRAME ALTERNATE mode
- FRAME structure

③ Set MEASUREMENT TIME.

④ Set EXTERNAL GATE.

⑤ Set others.

Table 5-2 Command Program Message

(1 of 23)

Function name	Command Program Message	Description
(1) Input setting		
TERMINATOR - DATA		Sets data input terminator:
TO 0V	"DGND"	TO 0V
TO -2V	"DM2V"	TO -2V
TERMINATOR - CLOCK		Sets clock input terminator:
TO 0V	"CGND"	TO 0V
TO -2V	"CM2V"	TO -2V
THRESHOLD LEVEL	"TLVL x" x = -2.040 to +2.040 (when TO 0V) x = -1.850 to -0.750 (when TO -2V) " + " can be omitted. Up to three digits after the decimal point are effective. The fourth and subsequent digits are rounded down .	Sets data input threshold level. Unit: V
DELAY	"DLY x" x = -400 to +400 " + " can be omitted.	Sets clock input delay. Unit: ps
AUTO SEARCH	"SRHGO"	Executes auto search.
INPUT POLARITY		Data input polarity is:
NORMAL	"MPN"	Noninverted
INVERSE	"MPI"	Inverted
TRIGGER OUTPUT		Sets trigger output:
1/32 CLOCK	"TGCLK"	To 1/32 clock
PATTERN	"TGPTN"	To pattern sync signal

(2 of 23)

Function name	Command Program Message	Description
(2) Pattern setting		
PATTERN MODE		Sets pattern mode:
PRBS	"PRBS"	To pseudo random
WORD	"WORD"	To WORD
FRAME	"FRAM"	To FRAME
PRBS 2^N-1		Sets step count N of pseudo random pattern:
N=7	"PB 07,0" or "PB 7,0"	To 7
N=9	"PB 09,0" or "PB 9,0"	To 9
N=10	"PB 10,0"	To 10
N=11	"PB 11,0"	To 11
N=15	"PB 15,0"	To 15
N=23	"PB 23,0"	To 23
N=31	"PB 31,0"	To 31
	, 0 can be omitted.	
MARK RATIO		Sets mark ratio:
0/8	"MR 0/8"	To 0/8
1/8	"MR 1/8"	To 1/8
1/4	"MR 1/4"	To 1/4
1/2	"MR 1/2"	To 1/2
8/8	"MR 8/8"	To 8/8
7/8	"MR 7/8"	To 7/8
3/4	"MR 3/4"	To 3/4
1/2B	"MR 1/2B	To 1/2B

(3 of 23)

Function name	Command Program Message	Description
PATTERN TRIGGER ADDRESS	"ADR x" x = 0 to 134217727 (PRBS) x = 0 to 524287 (WORD)	Sets trigger address of currently selected pattern mode.
PRBS PATTERN TRIGGER ADDRESS	"PBTAD x" x = 0 to 134217727	Sets trigger address of pseudo random pattern.
ALTERNATE MODE		Sets alternate mode:
ON	"ALTON"	To ON
OFF	"ALTOF"	To OFF
ALTERNATE PATTERN		Alternate pattern:
OUTPUT A	"ALTA"	A is output.
OUTPUT B	"ALTB"	B is output.
WORD PATTERN LENGTH	"BL x" or "PL x" x = 1 to 8388608	Sets word pattern length (bit count).
WORD PATTERN TRIGGER ADDRESS	"WDTAD x" x = 0 to 524287	Sets word pattern trigger address.
WORD SYNC WORD	"WDSW ad,pl" ad: Address ad = 0 to 524287 pl: Bit length pl = 4 to32	Sets word hunting pattern.
WORD SYNC WORD ADDRESS	"WDSWAD x" x = 0 to 524287	Sets word hunting pattern address.
WORD SYNC WORD PATTERN LENGTH	"WDSWPL x" x = 4 to 32	Sets word hunting pattern bit length.

(4 of 23)

Function name	Command Program Message	Description
WORD START OF MASK FIELD	"WDMSST ad,bn" ad: Address ad = 0 to 524287 ad = -1: Does not set mask field. bn: Bit number bn = 1 to 16	Sets mask field start position of word pattern.
WORD START OF MASK FIELD ADDRESS	"WDMSSTAD x" x = 0 to 524287 x = -1: Does not set mask field.	Sets mask field start address of word pattern.
WORD START OF MASK FIELD BIT No.	"WDMSSTIN x" x = 1 to 16	Set mask field start bit number of word pattern.
WORD END OF MASK FIELD	"WDMSEN ad,in" ad: Address ad = 0 to 524287 in: Bit number in = 1 to 16	Sets mask field end of word pattern.
WORD END OF MASK FIELD ADDRESS	"WDMSENAD x" x = 0 to 524287	Sets mask field end address of word pattern.
WORD END OF MASK FIELD BIT No.	"WDMSENIN x" x = 1 to 16	Sets mask field end bit number of word pattern.
WORD START OF SPECIFIC FIELD	"WDSPST ad,in" ad: Address ad = 0 to 524287 ad = -1: Does not set specific area. in: Bit number in = 1 to 16	Sets specific field start position of word pattern.
WORD START OF SPECIFIC FIELD ADDRESS	"WDSPSTAD x" x = 0 to 524287 x = -1: Does not set specific field.	Sets specific field start address of word pattern.

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Function name	Command Program Message	Description
WORD START OF SPECIFIC FIELD BIT No.	"WDSPSTIN x" x = 1 to 16	Sets specific field start bit No. of word pattern.
WORD END OF SPECIFIC FIELD	"WDSPEN ad,in" ad: Address ad = 0 to 524287 in: Bit number in = 1 to 16	Sets specific field end of word pattern.
WORD END OF SPECIFIC FIELD ADDRESS	"WDSPENAD x" x = 0 to 524287	Sets specific field end address of word pattern.
WORD END OF SPECIFIC FIELD BIT No.	"WDSPENIN x" x = 1 to 16	Sets specific field end bit No. of word pattern.
WORD PATTERN transmission, hex pattern data type	"WP x,y,z" x: Address x = 0 to 524287 y: Size y = 1 to 512 z: Pattern data array according to size z = Array of 0 to 9 and A to F	• Pattern data array consists of 4-bit character data. Characters are arranged according to the number specified by size. • Specified address is set as start address. • Single character data has LSB as start bit.
WORD PATTERN transmission, binary pattern data type	"BIN x,y" x: Address x = 0 to 524287 y: Byte count y = 1 to 1048576	• After receit of program message terminator following the code on the left, binary data transmission mode is active until byte count is sent or END message is received. • Specified address is set as start address. • Binary data has LSB as start bit.

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Function name	Command Program Message	Description
WORD ALTERNATE PATTERN transmission, hex pattern data type	"WwP x,y,z" w: Pattern w = A (Pattern A) w = B (Pattern B) x: Address x = 0 to 262143 y: Size y = 1 to 512 z: Pattern data array according to size z = Array of 0 to 9 and A to F	• Pattern data array consists of 4-bit character data. Characters are arranged according to the number specified by size. • Specified address is set as start address. • Single character data has LSB as start bit.
WORD ALTERNATE PATTERN transmission, binary pattern data type	"WwBIN x,y" w: Pattern w = A (Pattern A) w = B (Pattern B) x: Address x = 0 to 262143 y: Byte count y = 1 to 524288	• After receipt of program message terminator following the code on the left, binary data transmission mode is active until byte count is sent or END message is received. • Specified address is set as start address. • Binary data has LSB as start bit.
POLARITY (WORD)		Word pattern polarity is:
NORMAL	"WPN"	Noninverted
INVERSE	"WPI"	Inverted
PAYLOAD TYPE		Sets payload type:
WORD	"PLW"	To WORD
PRBS	"PLP"	To pseudo random
CID	"CID"	To CID

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Function name	Command Program Message	Description
FRAME STRUCTURE	"FRSTR nf,fl,rl,ol,cl" nf: Frame count nf=1 to 8192 (WORD, PRBS) nf=2 (CID) fl: Row count fl=1 to 16 (WORD, PRBS) fl=1 (CID) rl: Byte count per row rl=44 to 32768 (WORD, PRBS) rl=40 to 32768 (CID) ol: Overhead byte count ol=4 to rl-40 (WORD, PRBS) ol=36 to 32760 (ol<rl) (CID) cl: Bit count of 0/1 continuous pattern cl=0 (WORD, PRBS) cl=0 to (rl-ol)×8-1 (CID) For WORD and PRBS, cl can be omitted.	Sets frame pattern configuration.
FRAME STRUCTURE No. OF FRAME	"NF x" x=1 to 8192 (WORD, PRBS) x=2 (CID)	Sets frame pattern length (frame count).
FRAME STRUCTURE No. OF LOW	"FL x" x=1 to 16 (WORD, PRBS) x=1 (CID)	Sets frame length (row count) of frame pattern.
FRAME STRUCTURE ROW LENGTH	"RL x" x=44 to 32768 (WORD, PRBS) x=40 to 32768 (CID)	Sets row length (byte count) of frame pattern.
FRAME STRUCTURE OVERHEAD LENGTH	"OL x" x=4 to 32728 (WORD, PRBS) x=36 to 32768 (CID)	Sets overhead length (byte count) of frame pattern.

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Function name	Command Program Message	Description
FRAME STRUCTURE CID 0/1 LENGTH	"CL x" x = 0 (WORD, PRBS) x = 0 to 261855 (CID)	Sets 0/1 continuous pattern length (bit count) of frame pattern (CID).
FRAME PATTERN TRIGGER	"FRT fn,rn,bn" fn: Frame number fn = 1 to 8192 (WORD, PRBS) fn = 1 to 2 (CID) rn: Row number rn = 1 to 16 (WORD, PRBS) rn = 1 (CID) bn: Byte number bn = 1 to 32767	Sets trigger position of frame pattern.
FRAME PATTERN TRIGGER FRAME No.	"FRTFN x" x = 1 to 8192 (WORD, PRBS) x = 1 to 2 (CID)	Sets trigger frame number of frame pattern.
FRAME PATTERN TRIGGER ROW No.	"FRTRN x" x = 1 to 16 (WORD, PRBS) x = 1 (CID)	Sets trigger row number of frame pattern.
FRAME PATTERN TRIGGER BYTE No.	"FRTBN x" x = 1 to 32767	Sets trigger byte number of frame pattern.
FRAME SYNC WORD	"FRSW fn,rn,bn,nb" fn: Frame number fn = 1 to 8192 (WORD, PRBS) fn = 1 to 2 (CID) rn: Row number rn = 1 to 16 (WORD, PRBS) rn = 1 (CID) bn: Byte number bn = 1 to 32767 nb: Bit count nb = 4 to 32	Sets frame hunting pattern position.

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Function name	Command Program Message	Description
FRAME SYNC WORD FRAME No.	"FRSWFN x" x = 1 to 8192 (WORD, PRBS) x = 1 to 2 (CID)	Sets frame hunting pattern frame.
FRAME SYNC WORD ROW No.	"FRSWRN x" x = 1 to 16 (WORD, PRBS) x = 1 (CID)	Sets frame hunting pattern row number.
FRAME SYNC WORD BYTE No.	"FRSWBN x" x = 1 to 32767	Sets frame hunting pattern byte number.
FRAME SYNC WORD No. OF BIT	"FRSWNB x" x = 4 to 32	Sets frame hunting pattern bit count.
FRAME START OF MASK FIELD	"FRMSST fn,rn,bn,in" fn: Frame number fn = 1 to 8192 (WORD, PRBS) fn = 1 to 2 (CID) fn = -1: Does not set mask field. fn = 9999: Sets all frames. rn: Row number rn = 1 to 16 (WORD, PRBS) rn = 1 (CID) rn = 99:Sets all rows. bn: Byte number bn = 1 to 32768 in: Bit number in = 1 to 8	Sets mask field start position of frame pattern.
FRAME START OF MASK FIELD FRAME No.	"FRMSSTFN x" x = 1 to 8192 (WORD, PRBS) x = 1 to 2 (CID) x = -1: Does not set mask field. x = 9999: Sets all frames.	Sets mask field start frame number of frame pattern.

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Function name	Command Program Message	Description
FRAME START OF MASK FIELD ROW No.	"FRMSSTRN x" x = 1 to 16 (WORD, PRBS) x = 1 (CID) x = 99: Sets all rows.	Sets mask field start row number of frame pattern.
FRAME START OF MASK FIELD BYTE No.	"FRMSSTBN x" x = 1 to 32768	Sets mask field start frame number of frame pattern.
FRAME START OF MASK FIELD BIT No.	"FRMSSTIN x" x = 1 to 8	Sets mask field start bit number of frame pattern.
FRAME END OF MASK FIELD	"FRMSEN fn,rn,bn,in" fn: Frame number fn = 1 to 8192 (WORD, PRBS) fn = 1 to 2 (CID) rn: Row number rn = 1 to 16 (WORD, PRBS) rn = 1 (CID) bn: Byte number bn = 1 to 32768 in: Bit number in = 1 to 8	Sets mask field end position of frame pattern.
FRAME END OF MASK FIELD FRAME No.	"FRMSENFN x" x = 1 to 8192 (WORD, PRBS) x = 1 to 2 (CID)	Sets mask field end frame number of frame pattern.
FRAME END OF MASK FIELD ROW No.	"FRMSENRN x" x = 1 to 16 (WORD, PRBS) x = 1 (CID)	Sets mask field end row number of frame pattern.
FRAME END OF MASK FIELD BYTE No.	"FRMSENBN x" x = 1 to 32768	Sets mask field end byte number of frame pattern.

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Function name	Command Program Message	Description
FRAME END OF MASK FIELD BIT No.	"FRMSENIN x" x = 1 to 8	Sets mask field end bit number of frame pattern.
FRAME START OF SPECIFIC FIELD	"FRSPST fn,rn,bn,in" fn: Frame number fn = 1 to 8192 (WORD, PRBS) fn = 1 to 2 (CID) fn = -1: Does not set specific field. fn = 9999: Sets all frames. rn: Row number rn = 1 to 16 (WORD, PRBS) rn = 1 (CID) rn = 99:Sets all rows. bn: Byte number bn = 1 to 32768 in: Bit number in = 1 to 8	Sets specific field start address of frame pattern.
FRAME START OF SPECIFIC FIELD FRAME No.	"FRSPSTFN x" x = 1 to 8192 (WORD, PRBS) x = 1 to 2 (CID) x = -1: Does not set specific field. x = 9999: Sets all frames.	Sets specific field start frame number of frame pattern.
FRAME START OF SPECIFIC FIELD ROW No.	"FRSPSTRN x" x = 1 to 16 (WORD, PRBS) x = 1 (CID) x = 99: Sets all rows.	Sets specific field start row number of frame pattern.
FRAME START OF SPECIFIC FIELD BYTE No.	"FRSPSTBN x" x = 1 to 32768	Sets specific field start byte number of frame pattern.

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Function name	Command Program Message	Description
FRAME START OF SPECIFIC FIELD BIT No.	"FRSPSTIN x" x = 1 to 8	Sets specific field start bit No. of frame pattern.
FRAME END OF SPECIFIC FIELD	"FRSPEN fn,rn,bn,in" fn: Frame number fn = 1 to 8192 (WORD, PRBS) fn = 1 to 2 (CID) rn: Row number rn = 1 to 16 (WORD, PRBS) rn = 1 (CID) bn: Byte number bn = 1 to 32768 in: Bit number in = 1 to 8	Sets specific field end position of frame pattern.
FRAME END OF SPECIFIC FIELD FRAME No.	"FRSPENFN x" x = 1 to 8192 (WORD, PRBS) x = 1 to 2 (CID)	Sets specific field end frame number of frame pattern.
FRAME END OF SPECIFIC FIELD ROW No.	"FRSPENRN x" x = 1 to 16 (WORD, PRBS) x = 1 (CID)	Sets specific field end row number of frame pattern.
FRAME END OF SPECIFIC FIELD BYTE No.	"FRSPENBN x" x = 1 to 32768	Sets specific field end byte number of frame pattern.
FRAME END OF SPECIFIC FIELD BIT No.	"FRSPENIN x" x = 1 to 8	Sets specific field end bit number of frame pattern.

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Function name	Command Program Message	Description
FRAME PATTERN transmission, hex pattern data type	"FP v,w,x,y,z" v: Frame number v = 1 to 8192 w: Row number w = 1 to 16 x: Byte number x = 1 to 32768 y: Size y = 1 to 512 z: Pattern data array according to size z = Array of 0 to 9 and A to F	• Pattern data array consists of 4-bit character data. Characters are arranged according to the number specified by size. • Specified address is set as start address. • Single character data has LSB as start bit.
FRAME PATTERN transmission, binary pattern data type	"FBIN v,w,x,y" v: Frame number v = 1 to 8192 w: Row number w = 1 to 16 x: Byte number x = 1 to 32768 y: Byte count y = 1 to 1048576	• After receit of program message terminator following the code on the left, binary data transmission mode is active until byte count is sent or END message is received. • Specified address is set as start address. • Binary data has LSB as start bit.
FRAME ALTERNATE PATTERN transmission, hex pattern data type	"FuP v,w,x,y,z" u: Pattern u = A (Pattern A) u = B (Pattern B) v: Frame number v = 1 to 8192 w: Row number w = 1 to 16 x: Byte number x = 1 to 32768 y: Size y = 1 to 512 z: Pattern data array according to size z = Array of 0 to 9 and A to F	• Pattern data array consists of 4-bit character data. Characters are arranged according to the number specified by size. • Specified address is set as start address. • Single character data has LSB as start bit.

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Function name	Command Program Message	Description
FRAME ALTERNATE PATTERN transmission, binary pattern data type	"FuBIN v,w,x,y" u: Pattern u = A (Pattern A) u = B (Pattern B) v: Frame number v = 1 to 8192 w: Row number w = 1 to 16 x: Byte number x = 1 to 32768 y: Byte count y = 1 to 1048576	• After receit of program message terminator following the code on the left, binary data transmission mode is active until byte count is sent or END message is received. • Specified address is set as start address. • Binary data has LSB as start bit.
POLARITY (FRAME)		Word pattern polarity is:
NORMAL	"FPN"	Noninverted
INVERSE	"FPI"	Inverted
FRAME PRES 2^N -1		Sets the step count N of pseudo random pattern of frame pattern:
N = 15	"FPB 15"	To 15
N = 23	"FPB 23"	To 23
N = 31	"FPB 31"	To 31
FRAME PRES MARK RATIO		Sets the mark ratio of pseudo random pattern of frame pattern:
0/8	"FPB 0/8"	To 0/8
1/8	"FPB 1/8"	To 1/8
1/4	"FPB 1/4"	To 1/4
1/2	"FPB 1/2"	To 1/2
8/8	"FPB 8/8"	To 8/8
7/8	"FPB 7/8"	To 7/8
3/4	"FPB 3/4"	To 3/4
1/2B	"FPB 1/2B"	To 1/28
FRAME ALTERNATE MODE		Sets the alternate mode of frame pattern:
ON	"FALTON"	To ON
OFF	"FALTOF"	To OFF
FRAME ALTERNATE PATTERN		Sets the output of the alternate pattern of frame pattern:
OUTPUT A	"FALTA"	To A
OUTPUT B	"FALTB"	To B

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Function name	Command Program Message	Description
(3) Measurement control		
MEASUREMENT FUNCTION		Sets measurement function:
ERROR RATE	"ERR"	To error rate
ERROR COUNT	"ERC"	To error count
EI	"EI"	To error interval
EFI	"EFI"	To error-free interval
FREQUENCY (MHz)	"FRQ"	To frequency (MHz)
FRAME COUNT	"FRC"	To frame count
MEASUREMENT MODE		Sets measurement mode:
OMITTING	"OMI"	To omission (1→0) error
INSERTING	"INS"	To insertion (0→1) error
TOTAL	"TOT"	To total (1→, 0→1) error
OVERHEAD	"OVH"	To overhead section
PAYLOADO	"PLD"	To payload section
ALL PART	"ALP"	To entire frame
SPECIFIC FIELD	"SPF"	To specific field
OTHER FIELD	"OTF"	To other than specific field
ALL FIELD	"ALF"	To all fields
DISPLAY FORM (of ERROR COUNT)		Sets error count measurement display form:
EXPONENTIAL	"EXP"	To exponential format
INTEGRAL	"INT"	To integer format

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Function name	Command Program Message	Description
DISPLAY FORM (of EI & EFI)		Sets display format of error interval and error-free interval:
PERCENT	"PCT" or "PTON"	To % format
INTERVALS	"ITV" or "PTOF"	To interval count format
CURRENT DATA		Interim measurement result is:
ON	"CNON"	Displayed
OFF	"CDOF"	Not displayed
CURRENT DATA FORM (of ERR RATE, ERROR COUNT & FRAME COUNT)		Interim results of error rate, error count, and frame count measurement are displayed in:
PROGRESSIVE	"PRG"	Cumulative value
IMMEDIATE	"IMD"	Periodic value
MEASUREMENT TIME		Sets measurement time mode:
NORMAL	"NORM" or "BMOF"	To normal
FR TIME	"FTIM"	To frame time
FR INTV	"FINT"	To frame interval
BURST	"BRST" or "BMON"	To burst
EXTERNAL GATE		Measurement gate control:
OFF	"GTINT"	By internal signal
ON	"GTEXT"	By external signal
START	"STT" or "E"	Starts or resets measurement.
STOP	"STP"	Stops measurement.

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Function name	Command Program Message	Description
AUTO SYNC		Sets auto pattern sync function:
ON	"ASON"	To ON
OFF	"ASOF"	To OFF
FRAME SYNC(WORD)		FRAME SYNC function to be used for the word pattern:
ON	"WSON"	To ON
OFF	"WSOF"	To OFF
FRAME SYNC(FRAME)		FRAME SYNC function to be used for the frame pattern:
ON	"FSON"	To ON
OFF	"FSOF"	To OFF
RESYNC	"SYN"	Executes pattern resync.
BUZZER - DATA		Bit error detection buzzer is:
ON	"BZON"	Activated
OFF	"BZOF"	Not activated
BUZZER - ALARM		Alarm occurrence buzzer is:
ON	"BAON"	Activated
OFF	"BAOF"	Not activated
(4) Timer/clock setting		
TIMER MODE		Sets timer mode:
SINGLE	"SIN"	To single measurement mode
REPEAT	"REP"	To repeat measurement mode
UNTIMED	"UNT"	To use no timer

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Function name	Command Program Message	Description
DISPLAY MODE		Sets timer display mode:
ELAPSED	"ELP"	To elapsed time
TIMED	"TMD"	To remaining time
PERIOD	"PRS" or "PER"	To measurement continue time
INTERVAL	"TINT"	To interval
BURST TIME	"BMT"	To burst time
REAL TIME - YMDH	"RTU" or "YMDH"	To year/month/day/hour
REAL TIME - DHMS	"RTL" or "DHMS"	To day/hour/minute/second
TIMER SETUP - PERIOD	To set in time units "PRS dd:hh:nn:ss" or "PER dd:hh:nn:ss" dd: day, dd = 00 to 99 hh: hour, hh = 00 to 23 nn: minute, nn = 00 to 59 ss: second, ss = 00 to 59 To set in interval count units "PRS x" or "PER x" x: Interval count x = 0 to 99999999	Sets measurement continue time.

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Function name	Command Program Message	Description
TIMER SETUP - INTERVAL	To set in time units In case of 1 second or more "TINT dd:hh:nn:ss" dd: day, dd = 00 to 99 hh: hour, hh = 00 to 23 nn: minute, nn = 00 to 59 ss: second,ss = 00 to 59 However, min. 00:00:00:01 max. 01:00:00:00 In case of less than 1 second "TINT 00:00:00:00.s" 00.s: second,00.s = 00.1 or 00.s = 00.2 or 00.s = 00.5 To set in frame count units "TINT xE + y" x: Mantissa of frame count x = 1 to 99 Y: Exponent of frame count y = 1 to 6	Sets measurement interval.
TIMER SETUP - BURST TIME	"BMT x-6" or "BMT x" x = 0 to 10000	Sets burst measurement time. Unit: sec for the former μsec for the latter
REAL TIME - YMDHMS	"YMDHMS yy:mm:dd:hh:nn:ss" or "RTS yy:mm:dd:hh:nn:ss" yy: year, yy = 00 to 99 mm: month,mm = 01 to 12 dd: day, dd = 00 to 99 hh: hour, hh = 00 to 23 nn: minute, nn = 00 to 59 ss: second,ss = 00 to 59	Sets real time in year, month, day, hour, minute, and second.
REAL TIME - YMDH	"YMDH yy:mm:dd:hh" or "RTU yy:mm:dd:hh" yy: year, yy = 00 to 99 mm: month,mm = 01 to 12 dd: day, dd = 00 to 99 hh: hour, hh = 00 to 23	Sets real time in year, month, day, and hour.

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Function name	Command Program Message	Description
REAL TIME - DHMS	"DHMS dd:hh:nn:ss" or "RTL dd:hh:nn:ss" dd: day, dd = 00 to 99 hh: hour, hh = 00 to 23 nn: minute, nn = 00 to 59 ss: second, ss = 00 to 59	Sets real time in day, hour, minute, and second.
(5) Printer control		
PRINT OUT		Auto print of measurement result is:
ON	"PRION"	Executed
OFF	"PRTOF"	Not executed
MANUAL PRINT	"MPRT"	Measurement result is temporarily printed.
ERROR PRINT		Error and alarm print is:
ON	"EPRON"	Executed
OFF	"EPROF"	Not executed
PAPER FEED	"FEED"	Paper feed is executed.

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Function name	Command Program Message	Description
(6) File operation		
LOAD	"LOAD x,y,z" x: File type x = S .. SETUP x = W .. WORD x = F ... FRAME y: File number y = 0 to 99 z: Pattern type z = A .. ALTERNATE A Z = B .. ALTERNATE B For ALTERNATE OFF, ,z is ignored (optional).	Read
SAVE, RESAVE	"SAVE x,y,z" x: File type x = S .. SETUP x = W .. WORD x = F ... FRAME x = M .. MEAS y: File number y = 0 to 99 z: Pattern type z = A .. ALTERNATE A Z = B .. ALTERNATE B For ALTERNATE OFF, ,z is ignored (optional).	Save or resave
DELETE	"DELE x,y" x: File type x = S .. SETUP x = W .. WORD x = F ... FRAME x = M .. MEAS y: File number y = 0 to 99	Delete
FORMAT	"FRMT"	Format (initialization)

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Function name	Command Program Message	Description
(7) System and GPIB setting		
PANEL LOCK		Sets panel lock:
ON	"PLKON"	To ON
OFF	"PLKOF"	To OFF
CLEAR		Initialization:
PARAMETERS	"Z"	Initializes each setting parameter.
GPIB	"C"	Initializes GPIB.
SERVICE REQUEST		Service request (SRQ) is:
ON	"S0"	Sent
OFF	"S1"	Not sent
STATUS BYTE MASK	"MS x" x: Mask bit pattern x = 0 to 63	Status byte mask ● Status byte bit corresponding to bit value 0 resulting from binary conversion of decimal value x is masked and fixed to 0.
RESPONSE DATA		Sets response data:
MEASUREMENT	"MES"	To measurement result
TIME	"TIM"	To measurement time
HEADER of RESPONSE DATA		Response data header is:
ON	"HDON"	Provided
OFF	"HDOF"	Not provided

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Function name	Command Program Message	Description
RESPONSE MESSAGE TERMINATOR		Sets response message terminator:
CR, LF˄END	"DL0"	To CR, LF˄END
LF	"DL1"	To LF only
˄END	"DL2"	To ˄END only

˄END: Single-line signal EOI and ATN must be true and false, respectively, with the immediately preceding byte.

5.6.5 Word Pattern and Frame Pattern Settings

There are two ways of setting word pattern and frame pattern from the GPIB to D3286, (a) hex mode and (b) binary mode.
In hex mode, ASCII code is used to separate a pattern in units of 4 bits which are transmitted after conversion to a 1-byte hex character. In binary mode, a pattern is transmitted as binary values using a 1-byte code of 8 bits.
ASCII data type, hex mode, is readily edited with general computer edit software. Since the pattern is transmitted as is, binary mode is efficient and reduces transmission time to approximately half that in hex mode, depending on computer transmission software.

(1) Setting word pattern

(a) Hex mode setting format

"WP dddd, ddd, dddd⋯⋯"

① ② ③ ④

① Command program header

ALTERNATE mode OFF: ———— "WP"
ALTERNATE mode pattern A: ———— "WAP"
ALTERNATE mode pattern B: ———— "WBP"

Insert one or more spaces between above header characters and following ②.

② Start address of set pattern length (decimal)

ALTERNATE mode OFF: ———— 0 to pattern length/16 - 1 (max. 524287)
ALTERNATE mode pattern A, B: ———— 0 to pattern length/16 - 1 (max. 262143)

Add a single comma (",") between above numeric and following ③.

③ Pattern string character count (decimal)

1 to 512

Add a single comma (",") between above numeric and following ④.

④ Pattern character string (hex character string)

Hex character string of character count specified in ③. Data is sequentially transmitted starting from start bit (Bit 1) of start address specified in ②. 4-bit pattern is set for each character and least significant bit (LSB) in hex is assigned as bit nearest head of pattern.

The part of pattern character strings exceeding set pattern length and/or exceeding character count specified in ③ are ignored. If pattern character string is shorter than character count specified in ③, sets the pattern up to end of pattern character string and terminates setting. If program message terminator or following program message unit is placed at end of pattern character string, add program message unit separator.

[Example] Setting code: "WP 12,5,E4BA2"

Results:

Address \ Bit	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	-	-	-	-	-	-	-	-	-	-	-	-

- indicates unchanged bit.

(b) Binary mode setting format:

"BIN dddd, ddd" [LF] dd……

① ② ③ ④ ⑤

① Command program header

ALTERNATE mode OFF: ———— "BIN"
ALTERNATE mode pattern A: ———— "WABIN"
ALTERNATE mode pattern B: ———— "WBBIN"

Insert one or more spaces between above header characters and following ②.

② Start address of set pattern length (decimal)

ALTERNATE mode OFF: ———— 0 to pattern length/16 - 1 (max. 524287)
ALTERNATE mode pattern A, B: ———— 0 to pattern length/16 - 1 (max. 262143)

Add a single comma (",") between above numeric and following ③.

③ Pattern string byte count (decimal)

ALTERNATE mode OFF: ———— 1 to 1048576
ALTERNATE mode pattern A, B: ———— 1 to 524288

④ Program message terminator

Completes program message to transmit binary pattern data string in following ⑤.

⑤ Binary pattern data string

8-bit binary code string of byte count specified in ③. Data is sequentially transmitted starting from start bit (Bit 1) of start address specified in ②. 8-bit pattern is set for each byte and LSB of 8 bits is assigned as bit nearest head of pattern.
The part of binary pattern data strings exceeding set pattern length and/or exceeding character count specified in ③ are ignored. If binary pattern data string is shorter than byte count specified in ③, sets the pattern up to last byte of binary data string and terminates setting.
Add END message (single-line signal EOI and ATN are true and false, respectively) as program message terminator to last byte of binary pattern data string. When END message is received or byte count specified in ③ is received, D3286 completes pattern transmission and returns to normal ASCII receive mode.

[Example] Setting code: "BIN 12,3"
Binary code (decimal): 78,171,2

Results:

Address \ Bit	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	-	-	-	-	-	-	-	-

- indicates unchanged bit.

(2) Setting frame pattern

(a) Hex mode setting format

"FP dddd, dd, dddd, ddd, dddd······

① ② ③ ④ ⑤ ⑥

① Command program header

ALTERNATE mode OFF: ———— "FP"
ALTERNATE mode pattern A: ———— "FAP"
ALTERNATE mode pattern B: ———— "FBP"

Insert one or more spaces between above header characters and following ②.

② Start frame No. of set pattern length (decimal)

ALTERNATE mode OFF: ———— 1 to frame count (max. 8192)
ALTERNATE mode pattern A, B: ———— 1 to frame count (max. 4096)

Add a single comma (",") between above numeric and following ③.

③ Start row No. of set pattern length (decimal)

1 to row count (max. 16)

Add a single comma (",") between above numeric and following ④.

④ Start byte No. of set pattern length (decimal)

Payload type PRBS: ———— 1 to byte count per row (max. 32768)
Payload type PRBS: ———— 1 to overhead byte count (max. 32728)

Add a single comma (",") between above numeric and following ⑤.

⑤ Pattern string character count (decimal)

1 to 512

Add a single comma (",") between above numeric and following ⑥.

⑥ Pattern character string (hex)

Hex character string of character count specified in ⑤. Data is sequentially transmitted starting from start bit (Bit 1) of frame No., row No. and byte No. specified in ②, ③, and ④. 4-bit pattern is set for each character and least significant bit (LSB) in hex is assigned as bit nearest head of pattern.
The part of pattern character strings exceeding set pattern length and/or exceeding character count specified in ⑤, and the payload part in payload type PRBS are ignored. If pattern character string is shorter than character count specified in ⑤, sets the pattern up to end of pattern character string and terminates setting. If program message terminator or following program message unit is placed at end of pattern character string, add program message unit separator.

(b) Binary mode setting format

```
"FBIN dddd, dd, dddd, ddd" [LF] dd……
  |    |    |    |    |     |    |
  ①    ②    ③    ④    ⑤     ⑥    ⑦
```

① Command program header

ALTERNATE mode OFF:	————————	"FBIN"
ALTERNATE mode pattern A:	————————	"FABIN"
ALTERNATE mode pattern B:	————————	"FBBIN"

Insert one or more spaces between above header characters and following ②.

② Start frame No. of set pattern length (decimal)

ALTERNATE mode OFF:	————————	1 to frame count (max. 8192)
ALTERNATE mode pattern A, B:	————————	1 to frame count (max. 4096)

Add a single comma (",") between above numeric and following ③.

③ Start row No. of set pattern length (decimal)

1 to row count (max. 16)

Add a single comma (",") between above numeric and following ④.

④ Start byte No. of set pattern length (decimal)

Payload type WORD:	————————	1 to byte count per row (max. 32768)
Payload type PRBS:	————————	1 to overhead byte count (max. 32728)

Add a single comma (",") between above numeric and following ⑤.

⑤ Pattern string byte count (decimal)

ALTERNATE mode OFF: ———————— 1 to 1048576
ALTERNATE mode pattern A, B: ———— 1 to 524288

⑥ Program message terminator

Completes program message to transmit binary pattern data string in following ⑦.

⑦ Binary pattern data string

8-bit binary code string of byte count specified in ⑤. Data is sequentially transmitted starting from start bit (Bit 1) of frame No., row No. and byte No. specified in ②, ③, and ④. 8-bit pattern is set for each byte and LSB of 8 bits is assigned as bit nearest head of pattern.
The part of binary pattern data strings exceeding set pattern length and/or exceeding character count specified in ⑤, and the payload part in payload type PRBS are ignored. If binary pattern data string is shorter than byte count specified in ⑤, sets the pattern up to last byte of binary data string and terminates setting.
Add END message (single-line signal EOI and ATN are true and false, respectively) as program message terminator to last byte of binary pattern data string. When END message is received or byte count specified in ⑤ is received, D3286 completes pattern transmission and returns to normal ASCII receive mode.

5.7 Query Program Message and Response Message

5.7.1 What is Query Program Message?

A query program message is an instruction used by controller to acquire parameter, function, or mode status of equipment (D3286) and to request a response from equipment (D3286) to the GPIB. When assigned as talker after receipt of query program message, D3286 sends current set values including parameters specified by query program message. D3286 then returns to normal mode for measurement data and time data transmission until receipt of another query program message after set value transmission. Parameter set value format sent is same as command program message format in Section 5.6.4.

Query program message can be used to read the error alarm history which cannot be set from GPIB and the internal/external setup state of frequency measurement reference clock. When programming, "?" is sent following the code - specifying parameter, function or mode inquired. D3286 partially implements the "OP" (Output Interrogated Parameter) command which has a function equivalent to query program message.

Use of "OP" command requires sending code - specifying parameter, function, or mode inquired following "OP" characters. Response to both commands becomes code to set inquired parameter, function, or mode.

The "OP" command has been prepared for maintaining compatibility between the GPIB programs used for D3285 (10 GHz error detector) and D3273 (3 GHz error detector).

Use the query program message when creating new programs used for D3286.

[Example] In case of HP200 Series (BASIC)

```
10 DIM A$ [20]
20 OUTPUT 701 : "DLY 123"
30 OUTPUT 701 : "DLY? " (or "OPDLY ")
40 ENTER 701 : A$
50 DISP A$
60 END
```

(Program explanation)

Line number	Description
10	Reserves 20 bytes for character string variable A$.
20	Sets delay to 123 ps.
30	Inquires delay setting state.
40	Specifies D3286 for talker and reads response to A$.
50	Displays response A$.
60	Terminates program.

(Execution results)

DLY 123

5.7.2 Query Program Message and Response Message Formats

Table 5-3 shows formats of D3286 query program message, "OP" command, and corresponding response message.

Table 5-3 Query Program Message and Response Message

(1 of 23)

Function name	Query program message, OP command	Response message format	Description
(1) Input setting			
TERMINATOR - DATA	"TD?" or "OPTD"		Data input terminator:
TO 0V		"DGND"	TO 0V
TO -2V		"DM2V"	TO -2V
TERMINATOR - CLOCK	"TC?" or "OPTC"		Clock input terminator:
TO 0V		"CGND"	TO 0V
TO -2V		"CM2V"	TO -2V
THRESHOLD LEVEL	"TLVL?" or "OPTLVL"	"TLVL x" x = -2.040 to +2.040 (when TO 0V) x = -1.850 to -0.750 (when TO -2V)	Data input threshold level. Unit: V
DELAY	"DLY?" or "OPDLY"	"DLY x" x = -400 to +400 " + " can be omitted.	Clock input delay. Unit: ps
INPUT POLARITY	"MP?" or "OPMP"		Data input polarity:
NORMAL		"MPN"	Noninverted
INVERSE		"MPI"	Inverted
TRIGGER OUTPUT	"TG?"		Trigger output:
1/32 CLOCK		"TGCLK"	1/32 clock
PATTERN		"TGPTN"	Pattern sync signal

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Function name	Query program message, OP command	Response message format	Description
(2) Pattern setting			
PATTERN MODE	"PM?" or "OPPM"		Pattern mode:
PRBS		"PRBS"	Pseudo random
WORD		"WORD"	WORD
FRAME		"FRAM"	FRAME
PRBS 2^N-1	"PB?" or "OPPB"		Step count N of pseudo random pattern
N = 7		"PB 07,0"	7
N = 9		"PB 09,0"	9
N = 10		"PB 10,0"	10
N = 11		"PB 11,0"	11
N = 15		"PB 15,0"	15
N = 23		"PB 23,0"	23
N = 31		"PB 31,0"	31
MARK RATIO	"MR?" or "OPMR"		Mark ratio
0/8		"MR 0/8"	0 of 8
1/8		"MR 1/8"	1 of 8
1/4		"MR 1/4"	1 of 4
1/2		"MR 1/2"	1 of 2
8/8		"MR 8/8"	8 of 8
7/8		"MR 7/8"	7 of 8
3/4		"MR 3/4"	3 of 4
1/2B		"MR 1/2B	1 of 2B

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Function name	Query program message, OP command	Response message format	Description
PATTERN TRIGGER ADDRESS	"ADR?" or "OPADR"	"ADR x" x = 000000000 to 134217727 (PRBS) x = 000000000 to 000524287 (WORD)	Trigger address of currently selected pattern mode
PRBS PATTERN TRIGGER ADDRESS	"PBTAD?"	"PBTAD x" x = 000000000 to 134217727	Trigger address of pseudo random pattern
ALTERNATE MODE	"ALT?"		Alternate mode
ON		"ALTON"	ON
OFF		"ALTOF"	OFF
ALTERNATE PATTERN OUTPUT	"ALTMD?"		Alternate output pattern
A		"ALTA"	A
B		"ALTB"	B
WORD PATTERN LENGTH	"BL?" or "OPBL"	"BL x" x = 0000001 to 8388608	Word pattern length (bit count)
	"PL?"	"PL x" x = 0000001 to 8388608	
WORD PATTERN TRIGGER ADDRESS	"WDTAD?"	"WDTAD x" x = 000000000 to 000524287	Word pattern trigger address
WORD SYNC WORD	"WDSW?"	"WDSW ad,pl" ad: Address ad = 000000 to 524287 pl: Bit length pl = 0 4 to32	Word hunting pattern
WORD SYNC WORD ADDRESS	"WDSWAD?"	"WDSWAD x" x = 000000000 to 000524287	Word hunting pattern address

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Function name	Query program message, OP command	Response message format	Description
WORD SYNC WORD PATTERN LENGTH	"WDSWPL?"	"WDSWPL x" x = 04 to 32	Word hunting pattern bit length
WORD START OF MASK FIELD	"WDMSST?"	"WDMSST ad,in" ad: Address ad = 000000 to 524287 ad = -00001 : Does not set mask field in: Bit number in = 01 to 16	Mask field start of word pattern
WORD START OF MASK FIELD ADDRESS	"WDMSSTAD?"	"WDMSSTAD x" x = 000000 to 524287 x = -00001: Does not set mask field	Mask field start address of word pattern
WORD START OF MASK FIELD BIT No.	"WDMSSTIN?"	"WDMSSTIN x" x = 01 to 16	Mask field start bit number of word pattern
WORD END OF MASK FIELD	"WDMSEN?"	"WDMSEN ad,in" ad: Address ad = 000000 to 524287 in: Bit number in = 01 to 16	Mask field end of word pattern
WORD END OF MASK FIELD ADDRESS	"WDMSENAD?"	"WDMSENAD x" x = 000000 to 524287	Mask field end address of word pattern
WORD END OF MASK FIELD BIT No.	"WDMSENIN?"	"WDMSENIN x" x = 01 to 16	Mask field end bit number of word pattern

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Function name	Query program message, OP command	Response message format	Does not set specific field.
WORD START OF SPECIFIC FIELD	"WDSPST?"	"WDSPST ad,in" ad: Address ad = 000000 to 524287 ad = -00001 : Does not set specific field. in: Bit number in = 01 to 16	Specific field start position of word pattern
WORD START OF SPECIFIC FIELD ADDRESS	"WDSPSTAD?"	"WDSPSTAD x" x = 000000 to 524287 x = -00001: Does not set specific field.	Specific field start address of word pattern
WORD START OF SPECIFIC FIELD BIT No.	"WDSPSTIN?"	"WDSPSTIN x" x = 01 to 16	Specific field start bit number of word pattern
WORD END OF SPECIFIC FIELD	"WDSPEN?"	"WDSPEN ad,in" ad: Address ad = 000000 to 524287 in: Bit number in = 01 to 16	Specific field end of word pattern
WORD END OF SPECIFIC FIELD ADDRESS	"WDSPENAD?"	"WDSPENAD x" x = 000000 to 524287	Specific field end address of word pattern
WORD END OF SPECIFIC FIELD BIT No.	"WDSPENIN?"	"WDSPENIN x" x = 01 to 16	Specific field end bit No. of word pattern

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Function name	Query program message, OP command	Response message format	Description
WORD PATTERN contents, hex pattern data type	"WP x,y?" or "OPWP x,y" x: Address x = 0 to 524287 y: Size y = 1 to 512	"WP x,y,z" x: Address x = 000000 to 524287 y: Size y = 001 to 512 z: Pattern data array according to size z = Array of 0 to 9 and A to F	• Pattern data array consists of 4-bit character data. Characters are arranged according to the number specified by size. • Specified address is set as start address. • Single character data has LSB as start bit.
WORD ALTERNATE PATTERN contents, hex pattern data type	"WwP x,y?" w: Pattern w = A (Pattern A) w = B (Pattern B) x: Address 0 to 262143 y: Size 1 to 512	"WwP x,y,z" w: Pattern w = A (Pattern A) w = B (Pattern B) x: Address x = 000000 to 262143 y: Size y = 001 to 512 z: Pattern data array according to size z = Array of 0 to 9 and A - F	• Pattern data array consists of 4-bit character data. Characters are arranged according to the number specified by size. • Specified address is set as start address. • Single character data has LSB as start bit.
POLARITY (WORD)	"WP?" or "OPWP"		Word pattern polarity:
NORMAL		"WPN"	Noninverted
INVERSE		"WPI"	Inverted
PAYLOAD TYPE	"PLT?"		Payload type:
WORD		"PLW"	WORD
PRBS		"PLP"	Pseudo random
CID		"CID"	CID

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Function name	Query program message, OP command	Response message format	Description
FRAME PRBS 2^N -1	"FPB?"		Sets the step count N of pseudo random pattern of frame pattern:
N=15		"FPB 15"	To 15
N=23		"FPB 23"	To 23
N=31		"FPB 31"	To 31
FRAME PRES MARK RATIO	"FMR?"		Sets the mark ratio of pseudo random pattern of frame pattern:
0/8		"FPB 0/8"	To 0/8
1/8		"FPB 1/8"	To 1/8
1/4		"FPB 1/4"	To 1/4
1/2		"FPB 1/2"	To 1/2
8/8		"FPB 8/8"	To 8/8
7/8		"FPB 7/8"	To 7/8
3/4		"FPB 3/4"	To 3/4
1/2B		"FPB 1/2B"	To 1/28
FRAME ALTERNATE MODE	"FALT?"		Sets the alternate mode of frame pattern:
ON		"FALTON"	To ON
OFF		"FALTOF"	To OFF
FRAME ALTERNATE PATTERN OUTPUT	"FALTMD?"		Sets the output of the alternate pattern of frame pattern:
A		"FALTA"	To A
B		"FALTB"	To B

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Function name	Query program message, OP command	Response message format	Description
FRAME STRUCTURE	"FRSTR?"	"FRSTR nf,fl,rl,ol,cl" nf: Frame count nf = 0001 to 8192 (WORD, PRBS) nf = 0002 (CID) fl: Row count fl = 01 to 16 (WORD, PRBS) fl = 01 (CID) rl: Byte count per row rl = 00044 to 32768 (WORD, PRBS) rl = 00040 to 32768 (CID) ol: Overhead byte count ol = 00004 to 32728 (WORD, PRBS) ol = 00036 to 32760 (CID) cl: Bit count of 0/1 continuous pattern cl = 000000 (WORD, PRBS) cl = 000001 to 261855 (CID)	Frame pattern configuration. Payload type configuration set at that time is returned as response.
FRAME STRUCTURE No. OF FRAME	"NF?"	"NF x" x = 0001 to 8192 (WORD, PRBS) x = 0002 (CID)	Frame pattern length (frame count)
FRAME STRUCTURE No. OF LOW	"FL?"	"FL x" x = 01 to 16 (WORD, PRBS) x = 01 (CID)	Frame length (row count) of frame pattern
FRAME STRUCTURE ROW LENGTH	"RL?"	"RL x" x = 00044 to 32768 (WORD, PRBS) x = 00040 to 32768 (CID)	Row length (byte count) of frame pattern

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Function name	Query program message, OP command	Response message format	Description
FRAME STRUCTURE OVERHEAD LENGTH	"OL?"	"OL x" x = 00004 to 32728 (WORD, PRBS) x = 00036 to 32760 (CID)	Overhead length (byte count) of frame pattern
FRAME STRUCTURE CID 0/1 LENGTH	"CL?"	"CL x" x = 000000 (WORD, PRBS) x = 000001 to 261855 (CID)	0/1 continuous pattern length (bit count) of frame pattern (CID)
FRAME PATTERN TRIGGER	"FRT?"	"FRT fn,rn,bn" fn: Frame number fn = 0001 to 8192 (WORD, PRBS) fn = 0001 to 0002 (CID) rn: Row number rn = 01 to 16 (WORD, PRBS) rn = 01 (CID) bn: Byte number bn = 00001 to 32767	Trigger position of frame pattern. Trigger position set at that time is returned as response.
FRAME PATTERN TRIGGER FRAME No.	"FRTFN?"	"FRTFN x" x = 0001 to 8192 (WORD, PRBS) x = 0001 to 0002 (CID)	Trigger frame number of frame pattern
FRAME PATTERN TRIGGER ROW No.	"FRTRN?"	"FRTRN x" x = 01 to 16 (WORD, PRBS) x = 01 (CID)	Trigger row number of frame pattern
FRAME PATTERN TRIGGER BYTE No.	"FRTBN?"	"FRTBN x" x = 00001 to 32767	Trigger byte number of frame pattern

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Function name	Query program message, OP command	Response message format	Description
FRAME SYNC WORD	"FRSW?"	"FRSW fn,rn,bn,nb" fn: Frame number fn = 0001 to 8192 (WORD, PRBS) fn = 0001 to 0002 (CID) rn: Row number rn = 01 to 16 (WORD, PRBS) rn = 01 (CID) bn: Byte number bn = 00001 to 32767 nb: Bit count nb = 04 to 32	Frame hunting pattern position. Hunting pattern position of payload type set at that time is returned as response.
FRAME SYNC WORD FRAME No.	"FRSWFN?"	"FRSWFN x" x = 0001 to 8192 (WORD, PRBS) x = 0001 to 0002 (CID)	Frame number of frame hunting pattern
FRAME SYNC WORD ROW No.	"FRSWRN?"	"FRSWRN x" x = 01 to 16 (WORD, PRBS) x = 01 (CID)	Frame hunting pattern row number
FRAME SYNC WORD BYTE No.	"FRSWBN?"	"FRSWBN x" x = 00001 to 32767	Frame hunting pattern byte number
FRAME SYNC WORD No. OF BIT	"FRSWNB?"	"FRSWNB x" x = 04 to 32	Frame hunting pattern bit count

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Function name	Query program message, OP command	Response message format	Description
FRAME START OF MASK FIELD	"FRMSST?"	"FRMSST fn,rn,bn,in" fn: Frame number fn = 0001 to 8192 (WORD, PRBS) fn = 0001 to 0002 (CID) fn = -001: Does not set mask field. fn = 9999: Sets all frames. rn: Row number rn = 01 to 16 (WORD, PRBS) rn = 01 (CID) rn = 99:Sets all rows. bn: Byte number bn = 00001 to 32768 in: Bit number in = 1 to 8	Mask field start position of frame pattern. Mask field start position of payload type set at that time is returned as response.
FRAME START OF MASK FIELD FRAME No.	"FRMSSTFN?"	"FRMSSTFN x" x = 0001 to 8192 (WORD, PRBS) x = 0001 to 0002 (CID) x = -001: Does not set mask field. x = 9999: Sets all frames.	Mask field start frame number of frame pattern
FRAME START OF MASK FIELD ROW No.	"FRMSSTRN?"	"FRMSSTRN x" x = 01 to 16 (WORD, PRBS) x = 01 (CID) x = 99: Sets all rows.	Mask field start row number of frame pattern
FRAME START OF MASK FIELD BYTE No.	"FRMSSTBN?"	"FRMSSTBN x" x = 00001 to 32768	Mask field start byte number of frame pattern

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Function name	Query program message, OP command	Response message format	Description
FRAME START OF MASK FIELD BIT No.	"FRMSSTIN?"	"FRMSSTIN x" x = 1 to 8	Mask field start bit number of frame pattern
FRAME END OF MASK FIELD	"FRMSEN?"	"FRMSEN fn,rn,bn,in" fn: Frame number fn = 0001 to 8192 (WORD, PRBS) fn = 0001 to 0002 (CID) rn: Row number rn = 01 to 16 (WORD, PRBS) rn = 01 (CID) bn: Byte number bn = 00001 to 32768 in: Bit number in = 1 to 8	Mask field end position of frame pattern. Mask field end position of payload type set at that time is returned as response.
FRAME END OF MASK FIELD FRAME No.	"FRMSENFN?"	"FRMSENFN x" x = 0001 to 8192 (WORD, PRBS) x = 0001 to 0002 (CID)	Mask field end frame No. of frame pattern
FRAME END OF MASK FIELD ROW No.	"FRMSENRN?"	"FRMSENRN x" x = 01 to 16 (WORD, PRBS) x = 01 (CID)	Mask field end row number of frame pattern
FRAME END OF MASK FIELD BYTE No.	"FRMSENBN?"	"FRMSENBN x" x = 00001 to 32768	Mask field end byte number of frame pattern
FRAME END OF MASK FIELD BIT No.	"FRMSENIN?"	"FRMSENIN x" x = 1 to 8	Mask field end bit number of frame pattern

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Function name	Query program message, OP command	Response message format	Description
FRAME START OF SPECIFIC FIELD	"FRSPST?"	"FRSPST fn,rn,bn,in" fn: Frame number fn = 0001 to 8192 (WORD, PRBS) fn = 0001 to 0002 (CID) fn = -001: Does not set specific field. fn = 9999: Sets all frames. rn: Row number rn = 01 to 16 (WORD, PRBS) rn = 01 (CID) rn = 99:Sets all rows. bn: Byte number bn = 00001 to 32768 in: Bit number in = 1 to 8	Specific field start position of frame pattern. Specific field start position of payload type set at that time is returned as response.
FRAME START OF SPECIFIC FIELD FRAME No.	"FRSPSTFN?"	"FRSPSTFN x" x = 0001 to 8192 (WORD, PRBS) x = 0001 to 0002 (CID) x = -001: Does not set specific field. x = 9999: Sets all frames.	Specific field start frame number of frame pattern
FRAME START OF SPECIFIC FIELD ROW No.	"FRSPSTRN?"	"FRSPSTRN x" x = 01 to 16 (WORD, PRBS) x = 01 (CID) x = 99: Sets all rows.	Specific field start row number of frame pattern

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Function name	Query program message, OP command	Response message format	Description
FRAME START OF SPECIFIC FIELD BYTE No.	"FRSPSTBN?"	"FRSPSTBN x" x = 00001 to 32768	Specific field start byte number of frame pattern
FRAME START OF SPECIFIC FIELD BIT No.	"FRSPSTIN?"	"FRSPSTIN x" x = 1 to 8	Specific field start bit number of frame pattern
FRAME END OF SPECIFIC FIELD	"FRSPEN?"	"FRSPEN fn,rn,bn,in" fn: Frame number fn = 0001 to 8192 (WORD, PRBS) fn = 0001 to 0002 (CID) rn: Row number rn = 01 to 16 (WORD, PRBS) rn = 01 (CID) bn: Byte number bn = 00001 to 32768 in: Bit number in = 1 to 8	Specific field end position of frame pattern. Specific field end position of payload type set at that time is returned as response.
FRAME END OF SPECIFIC FIELD FRAME No.	"FRSPENFN?"	"FRSPENFN x" x = 0001 to 8192 (WORD, PRBS) x = 0001 to 0002 (CID)	Specific field end frame number of frame pattern
FRAME END OF SPECIFIC FIELD ROW No.	"FRSPENRN?"	"FRSPSTRN x" x = 01 to 16 (WORD, PRBS) x = 01 (CID)	Specific field end row number of frame pattern
FRAME END OF SPECIFIC FIELD BYTE No.	"FRSPENBN?"	"FRSPENBN x" x = 00001 to 32768	Specific field end byte number of frame pattern

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Function name	Query program message, OP command	Response message format	Description
FRAME END OF SPECIFIC FIELD BIT No.	"FRSPENIN?"	"FRSPENIN x" x = 1 to 8	Specific field end bit number of frame pattern
FRAME PATTERN contents, hex pattern data type	"FP v,w,x,y?" v: Frame number v = 1 to 8192 w: w = 1 to 16 x: Byte number x = 1 to 32768 y: Size y = 1 to 512	"FP v,w,x,y,z" v: Frame number v = 0001 to 8192 w: Row number w = 01 to 16 x: Byte number x = 00001 to 32768 y: Size y = 001 to 512 z: Pattern data array according to size z = Array of 0 to 9 and A to F	• Pattern data array consists of 4-bit character data. Characters are arranged according to the number specified by size. • Specified address is set as start address. • Single character data has LSB as start bit.
FRAME ALTERNATE PATTERN contents, hex pattern data type	"FuP v,w,x,y?" u: Pattern u = A (Pattern A) u = B (Pattern B) v: Frame number v = 1 to 4196 w: Row number w = 1 to 16 x: Byte number x = 1 to 32768 y: Size y = 1 to 512	"FuP v,w,x,y,z" u: Pattern u = A (Pattern A) u = B (Pattern B) v: Frame number v = 0001 to 4196 w: Row number w = 01 to 16 x: Byte number x = 00001 to 32768 y: Size y = 001 to 512 z: Pattern data array according to size z = Array of 0 to 9 and A to F	• Pattern data array consists of 4-bit character data. Characters are arranged according to the number specified by size. • Specified address is set as start address. • Single character data has LSB as start bit.
POLARITY (FRAME)	"FP?"		Frame pattern polarity:
NORMAL		"FPN"	Noninverted
INVERSE		"FPI"	Function name

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Function name	Query program message, OP command	Response message format	Description
(3) Measurement control			
MEASUREMENT FUNCTION	"MF?" or "OPMF"		Measurement function
ERROR RATE		"ERR"	Error rate
ERROR COUNT		"ERC"	Error count
EI		"EI"	Error interval
EFI		"EFI"	Error-free interval
FREQUENCY		"FRQ"	Frequency (MHz)
FRAME COUNT		"FRC"	Frame count
ERROR MEASUREMENT MODE	"DM?" or "OPDM"		Error measurement mode
OMITTING		"OMI"	Omission (1→0) error
INSERTING		"INS"	Insertion (0→1) error
TOTAL		"TOT"	Total (1→, 0→1) error
OVERHEAD		"OVH"	Overhead section
PAYLOADO		"PLD"	Payload section
ALL PART		"ALP"	Entire frame
SPECIFIC FIELD		"SPF"	Specific field
OTHER FIELD		"OTF"	Other than specific field
ALL FIELD		"ALF"	All fields

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Function name	Query program message, OP command	Response message format	Description
DISPLAY FORM (ERROR COUNT)	"FMT?" or "OPFMT"		Error count measurement display format:
EXPONENTIAL		"EXP"	Exponential format
INTEGRAL		"INT"	Integer format
DISPLAY FORM (EI & EFI)	"PT?" or "OPPT"		Display format of error interval and error-free interval measurement
PERCENT		"PTON"	% format
INTERVALS		"PTOF"	Interval count format
CURRENT DATA	"CD?" or "OPCD"		Interim measurement result
ON		"CNON"	Displayed
OFF		"CDOF"	Not displayed
CURRENT DATA FORM (ERR RATE, ERROR COUNT, FRAME COUNT)	"DF?" or "OPDF"		Interim results display of error rate, error count, and frame count measurement
PROGRESSIVE		"PRG"	Cumulative value
IMMEDIATE		"IMD"	Periodic value
BURST MODE	"BM?" or "OPBM"		Burst mode
OFF		"BMOF"	ON
ON		"BMON"	OFF

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Function name	Query program message, OP command	Response message format	Description
MEASUREMENT TIME MODE	"MT?"		Measurement time mode
NORMAL		"NORM"	Normal
FR TIME		"FTIM"	Frame time
FR INTV		"FINT"	Frame interval
BURST		"BRST"	Burst
EXTERNAL GATE	"GT?" or "OPGT"		Measurement gate control
OFF		"GTINT"	Internal signal
ON		"GTEXT"	External signal
AUTO SYNC	"AS?" or "OPAS"		Auto pattern sync function
ON		"ASON"	ON
OFF		"ASOF"	OFF
FRAME SYNC (WORD)	"WS?"		FRAME SYNC function to be used for the word pattern:
ON		"WSON"	ON
OFF		"WSOF"	OFF
FRAME SYNC (FRAME)	"FS?"		FRAME SYNC function to be used for the frame pattern:
ON		"FSON"	ON
OFF		"FSOF"	OFF
BUZZER - DATA	"BZ?" or "OPBZ"		Bit error detection buzzer
ON		"BZON"	Activated
OFF		"BZOF"	Not activated
BUZZER - ALARM	"BA?" or "OPBA"		Alarm occurrence buzzer
ON		"BAON"	Activated
OFF		"BAOF"	Not activated

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Function name	Query program message, OP command	Response message format	Description
MEASUREMENT GATE	"GS?" or "OPGS"		Measurement gate condition
OPEN		"GSOPN"	Open
CLOSE		"GSCLS"	Closed
HISTORY	"HST?" or "OPHST"	"HST x" x = 00 to 15 Each bit of binary converted from decimal x corresponds to error, alarm status (Bit 0 = LSB).	History status E.g. "HST 00": No error "HST 01": Data error "HST 02": Clock error "HST 05": Data error and sync error
POWER FAIL		Bit 3: Power failure	
SYNC ERROR		Bit 2: Sync error	
CLOCK ERROR		Bit 1: Clock error	
DATA ERROR		Bit 0: Data error	
REFERENCE CLOCK	"REF?" or "OPREF"		Reference clock selection
INTERNAL		"REFINT"	Internal clock
EXTERNAL		"REFEXT"	External clock
(4) Timer/clock setting			
TIMER MODE	"TM?" or "OPTM"		Timer/clock setting
SINGLE		"SIN"	Single measurement mode
REPEAT		"REP"	Repeat measurement mode
UNTIMED		"UNT"	No timer used

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Function name	Query program message, OP command	Response message format	Description
DISPLAY MODE	"TM?" or "OPTM"		Timer display mode
ELAPSED		"ELP"	Elapsed time
TIMED		"TMD"	Remaining time
PERIOD		"PRS"	Measurement continue time
INTERVAL		"TINT"	Measurement interval
BURST TIME		"BMT"	Burst time
REAL TIME H (YMDH)		"RTU"	Real time: year, month, day, hour
REAL TIME L (DHMS)		"RTL"	Real time: day, hour, minute, second
TIMER SETUP - PERIOD	"PRS?" or "PER?"	To set in time units "PRS dd:hh:nn:ss" or "PER dd:hh:nn:ss" dd: day, dd = 00 to 99 hh: hour, hh = 00 to 23 nn: minute, nn = 00 to 59 ss: second, ss = 00 to 59 Interval count "PRS x" or "PER x" x: x = 00000000 to 99999999	Measurement continue time

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Function name	Query program message, OP command	Response message format	Description
TIMER SETUP - INTERVAL	"TINT?"	To set in time units In case of 1 sec. or more "TINT dd:hh:nn:ss" dd: day, dd = 00 to 99 hh: hour, hh = 00 to 23 nn: minute, nn = 00 to 59 ss: second, ss = 00 to 59 In case of less than 1 sec. "TINT 00:00:00:00.s" 00.s: second, 00.s = 00.1 or 00.s = 00.2 or 00.s = 00.5 To set in units of frame count "TINT xE + y" x: Mantissa of frame count x = 01 to 99 Y: Exponent of frame count y = 1 to 6	Measurement interval
TIMER SETUP - BURST TIME	"BMT?"	"BMT xE-6" x = 00000 to 10000	Burst measurement time Unit: sec.
(5) Printer control			
PRINT OUT ON OFF	"PRT?" or "OPPRT"	 "PRION" "PRTOF"	Auto print of measurement results Printed Not printed
ERROR PRINT ON OFF	"EPR?" or "OPEPR"	 "PRION" "PRTOF"	Error, alarm print Printed Not printed

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Function name	Query program message, OP command	Response message format	Description
(6) File operation			
FDD ACCESS STATUS	"FDSTS?"	"FDSTS 00" "FDSTS 01" "FDSTS 02" "FDSTS 03" "FDSTS 04" "FDSTS 05" "FDSTS 06" "FDSTS 07" "FDSTS 08" "FDSTS 09" "FDSTS 10" "FDSTS 11"	Error status SICCESS DISC ERROR PROTECTED DISC FULL FILE ERROR TYPE ERROR DATA ERROR NOT FOUND ALREADY NO DATA LENGTH ERROR CANCEL For details on error status, refer to Section 8.4, "File Error Display."
(7) System and GPIB setting			
PANEL LOCK ON OFF	"PLK?" or "OPPLK"	 "PLKON" "PLKOF"	Panel lock ON OFF
SRQ ON OFF	"S?" or "OPS"	 "S0" "S1"	Service request Sent Not sent
STATUS BYTE MASK	"MS?" or "OPMS"	"MS x" x: Mask bit pattern x = 0 to 63 • Status byte bit corresponding to a bit which becomes "0" during binary conversion of decimal x was masked and fixed to 0.	Status byte masking

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Function name	Query program message, OP command	Response message format	Description
RESPONSE DATA	"OD?" or "OPOD"		Response data
MEASUREMENT		"MES"	Measurement results
TIME		"TIM"	Measurement time
HEADER of RESPONSE DATA	"HD?" or "OPHD"		Response data header
ON		"HDON"	Provided
OFF		"HDOF"	Not provided
RESPONSE MESSAGE TERMINATOR	"DL?" or "OPDL"		Response message terminator
CR, LF^END		"DL0"	CR, LF^END
LF		"DL1"	LF only
^END		"DL2"	^END only
IDENTIFY	"IDN?"	"ADVANTEST, D3286, REV addad" add:Revision code =A00 to Z99 ad: Special specification code =A0 to Z9 (None for standard specification)	Device identification code

^END: Single-line signal EOI and ATN must be true and false, respectively, with the immediately preceding byte.

5.8 Response Message (Talker Format)

This section describes the response message used to send data from D3286 to the GPIB. There are two types of response message, (a) measurement results and time data, and (b) response to setup status inquiry of query program message.
The following items describe syntax and contents of measurement results and time data. For query program message and response message, see previous section 5.7. When specified by the GPIB controller to talker, a response message is sent according to send data type specified in advance.

5.8.1 Basic Format

Response message uses ASCII code. Figure 5-5 shows basic syntax.

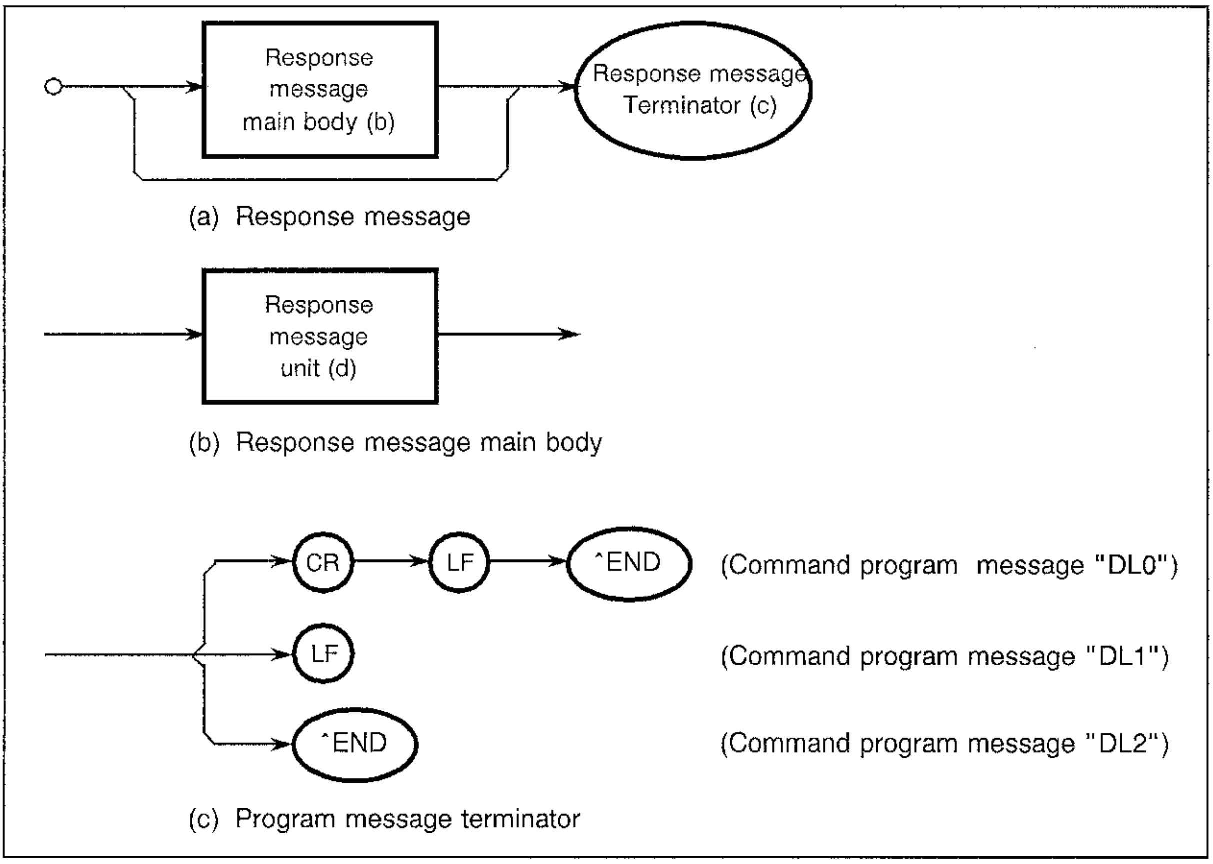
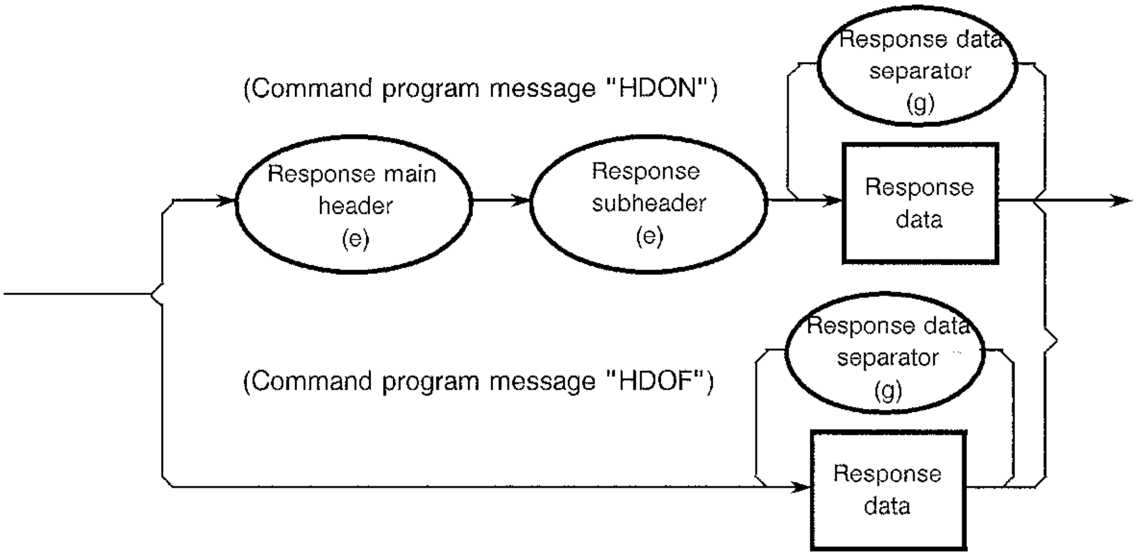


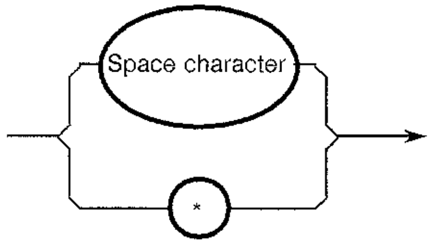
Figure 5-5 Response Message Basic Syntax (1 of 2)

ˆEND: EOI and ATN must be true and false, respectively, with the immediately preceding byte.

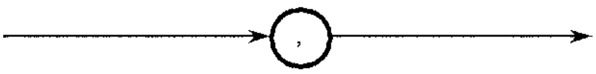


(d) Response message unit

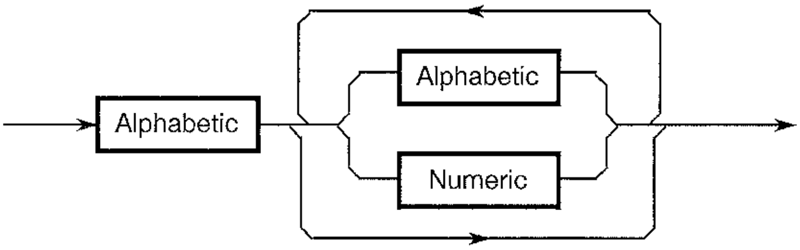
(e) Response main header



(f) Response subheader



(g) Response data separator



(h) Response mnemonic

Figure 5-5 Response Message Basic Syntax (2 of 2)

5.8.2 Measurement Data Format

D3286 uses following format to send measurement results.

```
xxx y dd.dddE±dd CR LF^END
 ①  ②     ③        ④
```

① Response main header (3-digit alphabetic or omitted)

Indicates measurement function. Not sent when header is set to OFF ("HDOF").

Response main header	Measurement Function
ERR	Error rate measurement
ERC	Error count measurement
EI△	Error interval measurement
EFI	Error- free interval measurement
FRQ	Frequency measurement
FRC	Frame count measurement

△: Space character (ASCII code 32 (decimal))

② Response subheader (1-digit alphabetic or omitted)

Indicates overflow of measured value. Not sent when header is set to OFF ("HDOF").

Response subheader	Overflow
△ (space character)	None occurred
* (asterisk symbol)	Occurred

③ Response data (measured value)

Measured value is divided as mantissa (dd.ddd) and exponent (E+/-dd), of which digit count, decimal point position, presence of exponent vary depending on measurement function and display format.

(a) Error rate measurement (ERR)

d.ddddE-dd
-18 to -01
00000. to 9.9999

It becames as shown below when there is an overflow:
9.9999E+00

(b) Error count measurement (ERC)

i) For exponent display

d.ddddE+dd
+00 to +18
00000. to 9.9999

It becames as shown below when there is an overflow:
9.9999E+19

ii) For integer display

dddddddd
00000000 to 99999999

(c) Error interval measurement (EI) and Error free interval measurement (EFI)

i) For interval count display (ITV or PTOF)

d.ddddE+dd
+00 to +09
00000. to 9.9999
Maximum 4.2949E+09

It becames as shown below when there is an overflow:
9.9999E+09

ii) For % display (PCT or PTON)

ddd.dddd
└──000.0000 to 100.0000

It becames as shown below when there is an overflow:
999.9999

(d) Frequency measurement (FRQ)

ddddd.dddE+6
└──00150.000 to 12000.000
Unit: MHz

Upper limit of operational frequency is 12000 MHz, however, higher frequency does not cause overflow.

(e) Frame count measurement

d.ddddE+dd
└── +00 to +18 (dd)
└── 00000. to 9.9999 (d.dddd)

It becames as shown below when there is an overflow:
9.9999E+19

④ Response message terminator

Set as follows depending on command program message "DL0", "DL1", and "DL2":

"DL0" .... CR, LF^END

"DL1" .... LF

"DL2" .... ^END

(
CR: ASCII code 13 (decimal)
LF: ASCII code 10 (decimal)
^END: END message is added to end byte.
END message: Single-line signal EOI and ATN must be true and false, respectively.
)

5.8.3 Time Data Format

D3286 uses following format to send time data. Use query program message to read measurement interval and burst time values.

```
xxx y dd:dd:dd:dd CR LF^END
 |  |      |          |
 ①  ②      ③          ④
```

① Response main header (3- or 4-digit alphabetic or omitted)

Indicates data type. Not sent when header is set to OFF ("HDOF").

Response main header	Data type
ELP	Elapsed time (ELAPSED): day:hour:minute:second
TMD	Remaining time (TIMED): day:hour:minute:second
PRS	Measurement continue time (PERIOD):day:hour:minute:second
RTU	Real time (REAL TIME): year:month:day:hour
RTL	Real time (REAL TIME): day:hour:minute:second

② Response subheader (1-digit symbol or omitted)

Indicates data overflow occurrence. For data type other than elapsed time (ELP), always indicates no overflow occurred. Not sent when header is set to OFF ("HDOF").

Response subheader	Overflow
△ (space character)	None occurred
* (asterisk symbol)	Occurred

③ Response data (time data)

Time data is sent with each value separated by colon (:) for units of year:month:day:hour:minute:second and without colon separation for units of frame count or interval count.

(a) Elapsed time (ELP), remaining time (TMD), and measurement continue time (PRS)

(a-1) Sent in units of year:month:hour:minute:second when FR INTV key is OFF in measurement section.

dd:dd:dd:dd

second: 00 to 59
minute: 00 to 59
hour: 00 to 23
day: 00 to 99

When measurement has not started and when automatic measurement stop function by timer is not used, remaining time becomes as follows:

--:--:--:--

When elapsed time data overflows, elapsed time data becomes 99:99:99:99.

(a-2) Sent in units of interval count when FR INTV key is ON in measurement section.

dddddddd

interval count: 00000000 to 99999999

When measurement has not started and when automatic measurement stop function by timer is not used, remaining time becomes as follows:

When elapsed time data overflows, elapsed time data becomes 99999999.

(b) Real time year:month:day:hour (RTU)

dd:dd:dd:dd

hour: 00 to 23
day: 01 to 31
month: 01 to 12
year: 00 to 99 (Least 2 digits)

(c) Real time day:hour:minute:second (RTL)

dd:dd:dd:dd

- second: 00 to 59
- minute: 00 to 59
- hour: 00 to 23
- day: 01 to 31

④ Response message terminator

Set as follows depending on command program message "DL0", "DL1", and "DL2":

"DL0" .... CR, LF^END

"DL1" .... LF

"DL2" .... ^END

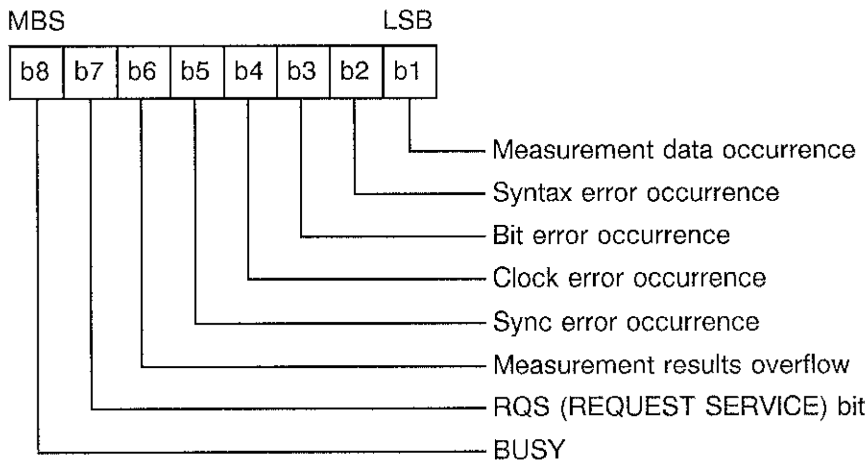
CR: ASCII code 13 (decimal)
LF: ASCII code 10 (decimal)
^END: END message is added to end byte.
END message: Single-line signal EOI and ATN must be true and false, respectively.

5.9 Service Request and Status Byte

D3286 indicates various status conditions including measurement completion and step-out (sync error) using status bytes. Issues service request signal (SRQ) to GPIB controller if status change occurs.

5.9.1 Status Byte

Status byte consists of following 8 bytes.D3286 receives SPE command result from serial polling execution from controller and sends this status byte when specified as talker.



(1) b1 bit (measurement data occurrence)

Set to "1" when measurement data sent due to measurement completion. Cleared to "0" upon completion of measurement data transmission.

(2) b2 bit (syntax error occurrence)

Set to "1" when undefined program message was received, when parameter value in program message is outside limits, or when program message is too long. Cleared to "0" when correct program message was received.

(3) b3 bit (bit error occurrence)

Result of bit error check at interval of 0.1 second, set to "1" if bit error was found in data signal input within immediately previous interval; otherwise, cleared to "0".

(4) b4 bit (clock error occurrence)

Result of clock error check at measurement interval, set to "1" if clock error was found within immediately previous interval; otherwise, cleared to "0". Clock error implies insufficient clock input amplitude or extremely low input frequency.

(5) b5 bit (sync error occurrence)

Result of sync error check at measurement interval, set to "1" if sync error was found within immediately previous interval; otherwise, cleared to "0". Sync error implies pattern out of step.

(6) b6 bit (measurement results overflow)

Set to "1" when overflow occurs in measurement results displayed on front panel measurement section; cleared to "0" when normal.

(7) b7 bit (RQS bit)

Set to "1" when any of Bits b1 to b6 are "1". Cleared to "0" when all bits are "0".

(8) b8 bit (BUSY)

Set to "1" during delay setting of clock input, during pattern setting section modification, disk access, or during auto search. Cleared to "0" upon completion. This bit cannot be used to generate service request.

5.9.2 Service Request (SRQ)

When SRQ bit of status byte is set to "1" while D3286 is in "S0" mode, D3286 sends single-line signal SRQ (SERVICE REQUEST) to notify status change to GPIB controller. SRQ is cleared by serial polling.

5.9.3 Status Byte Masking

D3286 can mask unnecessary bits of status byte bits b1 to b6 and fix them to "0". This masking enables sending SRQ based on necessity. To mask status byte, use program code "MSdd". "dd" is assigned 0 to 63 decimal. Status byte bits corresponding to bits which are "0" as a result of "dd" conversion to 6-bit binary are fixed to "0"; only status byte bits corresponding to bits which are "1" are active.

Example: "MS24"

2 digit: 0 1 1 0 0 0

Measurement data occurrence (unavailable)
Syntax error occurrence (unavailable)
Bit error occurrence (unavailable)
Clock error occurrence (active)
Sync error occurrence (active)
Measurement results overflow (unavailable)

5.10 Device Trigger (GET Command)

D3286 starts measurement by GET (GROUP EXECUTE TRIGGER) command. GET command functions are equivalent to program messages "STT" or "E".

5.11 Device Clear (SDC, DCL Command)

D3286 initializes operation when it receives SDC (SELECTED DEVICE CLEAR) or DCL (DEVICE CLEAR) command. SDC and DCL command functions are equivalent to program message "C". For status after initialization, see Section 5.12 Initial State.

5.12 Initialize State

5.12.1 Initial State of Operation

D3286 initializes operation as follows when it receives SDC, DCL command, or program code "C":

(1) Measurement state

Measurement is stopped to nullify measurement data.

(2) Status byte

All bits are cleared to "0".

(3) Service request

Enters "S1" (not sending SRQ) mode.

(4) Query program message, OP command

Canceled.

(5) Word pattern setting mode

Binary mode is canceled. Not canceled by program code "C".

5.12.2 Setup Parameter Initialization

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

(1) Input setting

Data input terminator:	TO 0V (DGND)
Clock input terminator:	TO 0V (CGND)
Data input threshold level:	
TO 0V:	-0.500V (TLVL -0.500)
TO -2V:	-1.300V (TVL -1.300)
Clock input delay:	Not initialized
Data input polarity:	NORMAL (MPN)
Trigger output:	1/32CLK (TGCLK)

(2) Pattern setting

Pattern mode:	WORD (WORD)
Alternate mode:	OFF (ALTOF)
Alternate pattern	
ALTERNATE EXT OFF:	A (ALTA)
ALTERNATE EXT ON:	Dependent on the EXT input signal
Edit (EDIT):	OFF
PRBS:	
PRBS 2^N-1:	N = 15 (PB 15)
Mark ratio:	1/2 (MR 1/2)
Trigger address:	0 (PBTAD 0)
WORD:	
Polarity:	NORMAL (WPN)
Bit length:	16 (BL 16)
Trigger address:	0 (WDTAD 0)
Hunting pattern address:	0 (WDSWAD 0)
Hunting pattern length:	4 (WDSWPL 4)
Mask field start address:	Not set (WDMSSTAD -1)
Specific field start address:	Not set (WDSPSTAD -1)
Pattern contents:	0101 0101 0101 0101 (Binary) (WP 0, 4, AAAA)
FRAME:	
Polarity:	NORMAL FPN)
Payload type:	WORD (PLW)
Frame count:	1 (FN 1)
Frame length:	9 (FL 9)
Row length:	1080 (RL 1080)
Overhead length:	36 (OL 36)
Length of 0/1 continuous pattern:	72 (CL 72)
Trigger frame number:	1 (FMTFN 1)
Trigger row number:	1 (FMTRN 1)
Trigger byte number:	1 (FMTBN 1)
Hunting pattern frame number:	1 (FRSWFN 1)
Hunting pattern row number:	1 (FRSWRN 1)
Hunting pattern byte number:	1 (FRSWBN 1)
Hunting pattern bit count:	4 (FRSWNB 4)
Mask field start frame number:	Not set (FRMSSTFN 0)
Specific field start frame number:	Not set (FRSPSTFN 0)

Pattern contents: (Hex pattern x decimal byte count)
(Payload type: WORD)
F6×12, 28×12, 01×1, 02×1, 03×1, 04×1, AA×8, 55×1044,
00×36, 55×1044, 00×36, 55×1044, 00×36, 55×1044, 00×36, 55×1044,
00×36, 55×1044, 00×36, 55×1044, 00×36, 55×1044, 00×36, 55×1044

(FP 1, 1, 1, 72, F6F6F6F6F6F6F6F6F6F6F6F6414141414141414141414141
08040C025555555555555555

FP 1,1, 37, 512, subsequently A continues for 512 characters.
FP 1,1, 293, 512, subsequently A continues for 512 characters.
FP 1,1, 549, 512, subsequently A continues for 512 characters.
FP 1,1, 805, 512, subsequently A continues for 512 characters.
FP 1, 1, 1061, 40, subsequently A continues for 40 characters
FP 1, 2, 1, 72, subsequently A continues for 72 characters
FP 1, 2, 37, 512, subsequently A continues for 512 characters.
FP 1, 2, 293, 512, subsequently A continues for 512 characters.
FP 1, 2, 549, 512, subsequently A continues for 512 characters.
FP 1, 2, 805, 512, subsequently A continues for 512 characters.
FP 1, 2, 1061, 40, subsequently A continues for 40 characters
FP 1, 3, 1, 72, subsequently A continues for 72 characters
FP 1, 3, 37, 512, subsequently A continues for 512 characters.
FP 1, 3, 293, 512, subsequently A continues for 512 characters.
FP 1, 3, 549, 512,subsequently A continues for 512 characters.
FP 1, 3, 805, 512, subsequently A continues for 512 characters.
FP 1, 3, 1061, 40, subsequently A continues for 40 characters
FP 1, 4, 1, 72, subsequently A continues for 72 characters
FP 1, 4, 37, 512, subsequently A continues for 512 characters.
FP 1, 4, 293, 512, subsequently A continues for 512 characters.
FP 1, 4, 549, 512, subsequently A continues for 512 characters.
FP 1,4, 805, 512, subsequently A continues for 512 characters.
FP 1, 4, 1061, 40, subsequently A continues for 512 characters.
FP 1, 4, 1061, 40, subsequently A continues for 40 characters
FP 1, 5, 1, 72, subsequently A continues for 72 characters
FP 1,5, 37, 512, subsequently A continues for 512 characters.
FP 1,5, 293, 512, subsequently A continues for 512 characters.
FP 1,5, 549, 512, subsequently A continues for 512 characters.
FP 1,5, 805, 512, subsequently A continues for 512 characters.
FP 1, 5, 1061, 40, subsequently A continues for 40 characters
FP 1, 6, 1, 72, subsequently A continues for 72 characters
FP 1, 6, 37, 512, subsequently A continues for 512 characters.
FP 1, 6, 293, 512, subsequently A continues for 512 characters.

FP 1, 6, 549, 512, subsequently A continues for 512 characters.
FP 1, 6, 805, 512, subsequently A continues for 512 characters.
FP 1, 6, 1061, 40, subsequently A continues for 40 characters
FP 1, 7, 1, 72, subsequently A continues for 72 characters
FP 1, 7, 37, 512, subsequently A continues for 512 characters.
FP 1, 7, 293, 512, subsequently A continues for 512 characters.
FP 1, 7, 549, 512,subsequently A continues for 512 characters.
FP 1, 7, 805, 512, subsequently A continues for 512 characters.
FP 1, 7, 1061, 40, subsequently A continues for 40 characters
FP 1, 8, 1, 72, subsequently A continues for 72 characters
FP 1, 8, 37, 512, subsequently A continues for 512 characters.
FP 1, 8, 293, 512, subsequently A continues for 512 characters.
FP 1, 8, 549, 512, subsequently A continues for 512 characters.
FP 1, 8, 805, 512, subsequently A continues for 512 characters.
FP 1, 8, 1061, 40, subsequently A continues for 40 characters
FP 1, 9, 1, 72, subsequently A continues for 72 characters
FP 1, 9, 37, 512, subsequently A continues for 512 characters.
FP 1, 9, 293, 512, subsequently A continues for 512 characters.
FP 1, 9, 549, 512, subsequently A continues for 512 characters.
FP 1, 9, 805, 512, subsequently A continues for 512 characters.
FP 1, 9, 1061, 40, subsequently A continues for 40 characters)

Pattern contents: (Hex pattern x decimal byte count)
(Payload type: WORD)
F6×12, 28×12, 01×1, 02×1, 03×1, 04×1, AA×8, 55×1044,
00×36, 55×1044, 00×36, 55×1044, 00×36, 55×1044, 00×36, 55×1044,
00×36, 55×1044, 00×36, 55×1044, 00×36, 55×1044, 00×36, 55×1044
(FP 1, 1, 1, 72, F6F6F6F6F6F6F6F6F6F6F641414141414141414141414141
08040C025555555555555555

FP 1, 2, 1, 72, subsequently A continues for 72 characters
FP 1, 3, 1, 72, subsequently A continues for 72 characters
FP 1, 4, 1, 72, subsequently A continues for 72 characters
FP 1, 5, 1, 72, subsequently A continues for 72 characters
FP 1, 6, 1, 72, subsequently A continues for 72 characters
FP 1, 7, 1, 72, subsequently A continues for 72 characters
FP 1, 8, 1, 72, subsequently A continues for 72 characters
FP 1, 9, 1, 72, subsequently A continues for 72 characters)

(3) Measurement section

Measurement function:	ERROR RATE (ERR)
Display format:	TOTAL (TOT)
Error count measurement:	EXPONENTIAL (EXP)
Error interval, error-free interval measurement:z	
	% (PTON)
Interim measurement results display:	
	ON (CDON)
Interim results display data:	PROGRESSIVE (PPG)
Measurement time mode:	NORMAL (NORM)
Gate control:	INTERNAL (GTINT)
Automatic sync function:	ON (ASON)
Frame sync function:	OFF (FSOF)
Buzzer (data):	OFF (BZOF)
Buzzer (alarm):	OFF (BAOF)

(4) Timer/clock section

Timer mode:	SINGLE (SIN)
Display mode:	ELAPSED (ELP)
Measurement continue time:	00:00:00:00 (PRS 00:00:00:00)
Measurement interval:	00:00:00:00 (TINT 00:00:00:00)
Burst time:	10μsec (BMT 10)
Real time: :	Not initialized

(5) Printer section

Measurement results auto print:	OFF (PRTOF)
Error, alarm print:	OFF (EPROF)

(6) System, GPIB

Panel lock:	OFF (PLKOF)
Service request:	Not sent (S1)
Status byte mask:	All 1 bits (MS63)
Response data:	Measurement results (MES)
Response header:	Added HDON)
Response message terminator:	CR, LF, ^END (DL0)

5.13 Program Example

This section describes a program example as a reference for GPIB program creation. HP9000 Series 300 controller and BASIC are used.

5.13.1 Operation Condition Setup

This program measures error rate after automatic adjustment to optimize phase between clock input delay and data input by varying clock input delay. It is necessary to adjust threshold level to optimum point in advance.

(1) Program list

(1 of 3)

```
1000  Erd=708
1010  OUTPUT Erd;"ASON ERR TOT MS 63"
1011  OUTPUT Erd;"CDOF NORM GTINT SIN PRS 00:00:00:01"
1020  !
1030 Begin: !
1040  Dly=0
1050  GOSUB Dly
1060  IF Se=0 THEN Se0
1070  !
1080 Sel: !
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 Sell
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 Sell: !
1280  Dly=0
1290  LOOP
```

(2 of 3)

```
1300    Dly=Dly-1
1310   EXIT IF Dly<=-400
1320    GOSUB Dly
1330   EXIT IF Se=0
1340   END LOOP
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   OUTPUT Erd;"STT"
1701   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"
```

(3 of 3)

```
1750  STOP
1760  !
1770 Re_try : !
1780  PRINT "Re_try"
1790  GOTO Begin
1800  !
1810 Error: !
1820  BEEP
1830  PRINT "Synchronization Error !"
1840  STOP
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) Example execution results

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

(3) Program explanation

(1 of 3)

Line Number	Description
1000	Sets GPIB select code and D3286 address to 7 and 8, respectively.
1000 to 1011	Sets AUTO SYNC to ON, measurement function to error rate, error display mode to TOTAL, status byte mask to all "1" bits, interim result output to OFF, measurement time mode to normal, gate control to internal, timer mode to single measurement, and measurement continue time to 1 sec., respectively.
1030	Label Begin (start of automatic adjustment)

(2 of 3)

Line Number	Description
1040 to 1050	Sets DELAY to 0ps.
1060	Branches to Label Se0 if not sync error.
1080	Label Se1 (sync error occurred with DELAY = 0ps)
1090 to 1140	Increments DELAY by +1ps until sync error is removed.
1150	Branches to Label Se1l if sync error is not removed when DELAY is incremented to +400ps.
1160	Specifies Dly1 for DELAY when sync error is removed.
1180 to 1230	Further increments DELAY by +1ps until sync error occurs.
1240	Specifies Dly2 for DELAY when sync error occurs.
1250	Branches to Label Fin (end processing).
1270	Label Se1l.
1280 to 1340	Increments DELAY from -1ps by -1ps until sync error is removed.
1350	Branches to Label Error if sync error is not removed when DELAY is incremented -400ps.
1360	Specifies Dly2 for DELAY when sync error is removed.
1380 to 1430	Further increments DELAY by -1ps until sync error occurs.
1440	Specifies Dly1 for DELAY when sync error occurs.
1450	Branches to Label Fin (end processing).
1470	Label Se0 (no sync error with DELAY = 0ps)
1480 to 1530	Increments DELAY from +1ps by +1ps until sync error occurs.
1540	Specifies Dly2 for DELAY when sync error occurs.
1560 to 1620	Increments DELAY from -1ps by -1ps until sync error occurs.
1630	Specifies Dly1 for DELAY when sync error occurs.
1640	Branches to Label Fin (end processing).
1660	Label Fin (end processing)
1670 to 1680	Specifies DELAY for central value (Dly1 + Dly2)/2 in DELAY range without no sync error.

(3 of 3)

Line Number	Description
1690	Branches to Label Re_try if sync error has occurred.
1700 to 1701	Starts measurement and get error rate measured value.
1710 to 1740	Prints width and central value of DELAY range without sync error, error rate measured value at central DELAY value.
1750	Stops program.
1770	Label Re_try (retry)
1780 to 1790	Prints Re_try and returns Label Begin.
1810	Label Error (no range without sync error)
1820 to 1830	Activates buzzer and prints error message.
1840	Stops program.
1860	Label Dly of DELAY setting subroutine
1870	Sets DELAY for D3286.
1880	Waits until D3286 internal controller completes processing. Specify WAIT time (approx. 1 sec.) required for SYNC.
1890 to 1920	Executes serial polling and waits until status byte b8 (BUSY) becomes 0.
1930	Sets status byte b5 (sync error) to Se.
1940	Returns from subroutine.
1950	End of program

5.13.2 Operation Condition Read

This program reads status of parameters currently set by Query (? code).

(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) Example execution results

```
ERR
TOT
DLY 000
TLVL -1.300
WORD
BL 0000016
WP 000000,004,AAAA
```

(3) Program explanation

(1 of 2)

Line Number	Description
100 to 140	Uses DATA statement to prepare code corresponding to parameter to read. Null character string " " is set for final parameter.
150	Sets GPIB select code and D3286 address to 7 and 8, respectively.
160	Declares start of repetitive loop.
170	Reads code corresponding to parameter to read one by one from DATA statement.

(2 of 2)

Line Number	Description
180	Exits loop when " " is read.
190	Adds ? to end of code read and sends to D3286.
200	Reads parameter from D3286.
210	Prints parameter read.
220	Loop end (returns to start of loop.)
230	End of program

5.13.3 Error Measurement with SRQ

This program gets and prints measured values including interim error interval (EI). Interrupt with SRQ is used to get measured values. For status byte elements other than measurement data generation, the program prints message if any has been generated.

(1) Program list

```
100   Erd=708
110   ON INTR 7 GOSUB Srq
120   ENABLE INTR 7;2
130   OUTPUT Erd;"S0 EI PTON CDON NORM GTINT HDON MS 63"
140   OUTPUT Erd;"TINT 00:00:00:01 PRS 00:00:00:10 SIN ELP"
150   PRINT "ELAPSED TIME","ERROR INTERVAL"
160   I=0
170   TRIGGER Erd
180 Loop: !
190   ! *** Other Transaction 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;"MES"
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
```

(2) Example execution results

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

(3) Program explanation

(1 of 2)

Line Number	Description
100	Sets GPIB select code and D3286 address to 7 and 8, respectively.
110	Defines branch to Label Srq subroutine during interrupt from GPIB.
120	Permits interrupt with SRQ from GPIB.
130	Sets D3286 to S0 mode (SRQ effective), error interval measurement, % display, normal measurement, internal gate control, header ON, status byte mask all "1" bits.
140	Sets measurement interval to 1 sec., measurement continue time to 10 sec., timer mode to single measurement, and timer display mode to elapsed time, respectively.
150	Prints title.
160	Clears measurement counter value to 0.
170	Sends measurement start instruction (GET) to D3286.
180	Label Loop (start of SRQ wait loop)
190	Other processing can be executed.
200	Returns to Label Loop if measurement counter value is less than 10.
210	Stops program when measurement has executed 10 times.
230	Label Srq (SRQ interrupt processing subroutine)

(2 of 2)

Line Number		Description
240		Executes serial polling to get status byte value to variable S.
250 to 320		Executes following series of processing if Bit 0 (LSB) of variable S is 1 (measurement data generated).
	260	Sets D3286 data output to time data.
	270	Gets time data.
	280	Sets D3286 data output to measurement data.
	290	Gets measurement data.
	300	Prints time data and measurement data.
	310	Increments measurement count by +1.
330		Prints syntax error message if Bit 1 of variable S (status byte) is 1.
340		Prints data error message if Bit 2 of variable S (status byte) is 1.
350		Prints clock error message if Bit 3 of variable S (status byte) is 1.
360		Prints sync error message if Bit 4 of variable S (status byte) is 1.
370		Prints OVER message if Bit 5 of variable S (status byte) is 1.
380		Prints BUSY message if Bit 7 of variable S (status byte) is 1.
390		Permits following interruption with SRQ.
400		Returns from subroutine.
410		End of program

5.13.4 Word Pattern Setup (Hex mode)

This program sets a word pattern by converting binary (0 and 1 character string) input from GPIB controller keyboard to hex character string.

(1) Program list

(1 of 2)

```
100    DIM P$[600],Q$[512],H$[128]
110    Erd=708
120    OUTPUT Erd;"WORD ALTOF"
130    LOOP
140      INPUT "PATTERN LENGTH = ?",B1
150    EXIT IF B1>0 AND B1<=32768 AND (B1 MOD 1)=0
160    EXIT IF B1>32768 AND B1<=65536 AND (B1 MOD 2)=0
170    EXIT IF B1>65536 AND B1<=131072 AND (B1 MOD 4)=0
180    EXIT IF B1>131072 AND B1<=262144 AND (B1 MOD 8)=0
190    EXIT IF B1>262144 AND B1<=524288 AND (B1 MOD 16)=0
200    EXIT IF B1>524288 AND B1<=1048576 AND (B1 MOD 32)=0
210    EXIT IF B1>1048576 AND B1<=2097152 AND (B1 MOD 64)=0
220    EXIT IF B1>2097152 AND B1<=4194560 AND (B1 MOD 128)=0
230    EXIT IF B1>4194560 AND B1<=8388608 AND (B1 MOD 256)=0
240      BEEP
250    END LOOP
260    PRINT "PATTERN LENGTH ;";B1
270    OUTPUT Erd;"BL";B1
280    LOOP
290      LOOP
300        INPUT "TOP ADDRESS = ?",Adrs
310      EXIT IF Adrs>=0 AND Adrs<=-INT(-B1/16)-1
320        BEEP
330      END LOOP
340      PRINT "TOP ADDRESS ;";Adrs
350      INPUT "PATTERN = ?",P$
360      L=LEN(P$)
370    EXIT IF L=0
380      !
390      Q$=""
400      FOR I=1 TO L
410        IF P$[I,I]="0" OR P$[I,I]="1" THEN
420          IF LEN(Q$)<128 THEN Q$=Q$&P$[I,I]
430        END IF
440      NEXT I
450      L=LEN(Q$)
460    EXIT IF L=0
```

(2 of 2)

```
470     !
480     IF (L MOD 4)>0 THEN
490       FOR I=1 TO 4-(L MOD 4)
500         Q$=Q$&"0"
510       NEXT I
520       L=LEN(Q$)
530     END IF
540     !
550     PRINT "BINARY PATTERN ;"
560     FOR I=1 TO L STEP 4
570       PRINT Q$ I,I+3 ;" ";
580     NEXT I
590     PRINT
600     !
610     H$=""
620     FOR I=1 TO L STEP 4
630       H=0
640       FOR J=0 TO 3
650         H=H+VAL(Q$[I+J,I+J])*2^J
660       NEXT J
670       IF H<10 THEN
680         H$=H$&VAL$(H)
690       ELSE
700         H$=H$&CHR$(NUM("A")-10+H)
710       END IF
720     NEXT I
730     Lh=LEN(H$)
740     !
750     PRINT "HEXADECIMAL PATTERN ;"
760     FOR I=1 TO INT(Lh/4)*4+1 STEP 4
770       PRINT H$[I,I+3];" ";
780     NEXT I
790     PRINT
800     OUTPUT Erd;"WP";Adrs;",";LEN(H$);",";H$
810   END LOOP
820   END
```

(2) Example execution results

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

(3) Program explanation

(1 of 2)

Line Number		Description
100		Declares character strings P$ (max. 600 characters), Q$ (max. 512 characters), and H$ (max. 128 characters) as array.
110		Sets GPIB select code and D3286 address to 7 and 8, respectively.
120		Sets D3286 pattern mode to WORD and ALTERNATE to OFF, respectively.
130 to 250		Pattern length is input from keyboard.
260 to 270		Prints pattern length and sets pattern length for D3286.
280 to 810		Pattern setting start address and pattern are input. Converts and sets them in D3286. Repeats until null character string " " is input as patter.
	290 to 330	Start address to set pattern is input from keyboard.
	340	Prints start address.
	350	Pattern is input in binary format (0 and 1 character string) from keyboard. Character other than 0 or 1 can be inserted in string as delimiter.
	360	Sets L for length of character string input.
	370	Exits loop if character string length is 0.
	390 to 450	Gets 0's and 1's from character string input, creates new character string Q$, and sets L for Q$ length. Ignores excess characters if Q$ length exceeds 128 characters.

(2 of 2)

Line Number		Description
	460	Exits loop if character string Q$ length is 0.
	480 to 530	Adds 0's to end of Q$ so that character string Q$ length will be integer multiple of 4, and sets L for new character string.
	550 to 590	Prints character string Q$. Prints space every 4 characters for clarity.
	610 to 730	Groups every 4 characters sequentially from start of character string Q$ and converts to decimal value. Converts to hex character to create hex character string, and sets Lh for length of hex character string.
	750 to 790	Prints hex character string. Prints space every 4 characters for clarity.
	800	Sets start address and pattern in D3286.
	810	Loop end (returns to start of loop.)
820		End of program

5.13.5 Word Pattern Setup (Binary mode)

This program sets word pattern by converting binary (0 and 1 character string) input from GPIB controller keyboard to byte-unit value.

(1) Program list

(1 of 2)

```
100   DIM P$[600],Q$[512],B(64)
110   Erd=708
120   OUTPUT Erd;"WORD ALTOF"
130   LOOP
140     INPUT "BIT LENGTH = ?",B1
150   EXIT IF B1>0 AND B1<=32768 AND (B1 MOD 1)=0
160   EXIT IF B1>32768 AND B1<=65536 AND (B1 MOD 2)=0
170   EXIT IF B1>65536 AND B1<=131072 AND (B1 MOD 4)=0
180   EXIT IF B1>131072 AND B1<=262144 AND (B1 MOD 8)=0
190   EXIT IF B1>262144 AND B1<=524288 AND (B1 MOD 16)=0
200   EXIT IF B1>524288 AND B1<=1048576 AND (B1 MOD 32)=0
210   EXIT IF B1>1048576 AND B1<=2097152 AND (B1 MOD 64)=0
220   EXIT IF B1>2097152 AND B1<=4194560 AND (B1 MOD 128)=0
230   EXIT IF B1>4194560 AND B1<=8388608 AND (B1 MOD 256)=0
240     BEEP
250   END LOOP
260   PRINT "PATTERN LENGTH ;";B1
270   OUTPUT Erd;"BL";B1
280   LOOP
290     LOOP
300       INPUT "TOP ADDRESS = ?",Adrs
310     EXIT IF Adrs>=0 AND Adrs<=-INT(-B1/16)-1
320       BEEP
330     END LOOP
340     PRINT "TOP ADDRESS ;";Adrs
350     INPUT "PATTERN = ?",P$
360     L=LEN(P$)
370   EXIT IF L=0
380     !
390     Q$=""
400     FOR I=1 TO L
410       IF P$[I,I]="0" OR P$[I,I]="1" THEN
420         IF LEN(Q$)<128 THEN Q$=Q$&P$[I,I]
430       END IF
440     NEXT I
450     L=LEN(Q$)
460   EXIT IF L=0
```

(2 of 2)

```
470     !
480     IF (L MOD 8)>0 THEN
490       FOR I=1 TO 8-(L MOD 8)
500         Q$=Q$&"0"
510       NEXT I
520       L=LEN(Q$)
530     END IF
540     !
550     PRINT "BINARY PATTERN ;"
560     FOR I=0 TO L STEP 4
570       PRINT Q$[I,I+3];" ";
580     NEXT I
590     PRINT
600     !
610     N=0
620     FOR I=1 TO L STEP 8
630       B(N)=0
640       FOR J=0 TO 7
650         B(N)=B(N)+VAL(Q$[I+J,I+J])*2^J
660       NEXT J
670       N=N+1
680     NEXT I
690     !
700     PRINT "BYTE PATTERN ;"
710     FOR I=0 TO N-1
720       PRINT USING "#,4D;B(I)
730     NEXT I
740     PRINT
750     !
760     OUTPUT Erd;"BIN";Adrs;",";N
770     FOR I=0 TO N
780       IF I<N THEN
790         OUTPUT Erd;CHR$(B(I));
800       ELSE
810         SEND 7;DATA B(N) END
820       END IF
830     NEXT I
840   END LOOP
850   END
```

(2) Example execution results

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

(3) Description of program

(1 of 2)

Line Number		Description
100		Declares character strings P$ (max. 600 characters), Q$ (max. 512 characters), and H$ (max. 128 characters) as array.
110		Sets GPIB select code and D3286 address to 7 and 8, respectively.
120		Sets D3286 pattern mode to WORD and ALTERNATE to OFF, respectively.
130 to 250		Pattern length is input from keyboard.
260 to 270		Prints pattern length and sets pattern length for D3286.
280 to 840		Pattern setting start address and pattern are input. Converts and sets them in D3286. Repeats until null character string " " is input as patter.
	290 to 330	Start address to set pattern is input from keyboard.
	340	Prints start address.
	350	Pattern is input in binary format (0 and 1 character string) from keyboard. Character other than 0 or 1 can be inserted in string as delimiter.
	360	Sets L for length of character string input.
	370	Exits loop if character string length is 0.
	390 to 450	Gets 0's and 1's from character string input, creates new character string Q$, and sets L for Q$ length. Ignores excess characters if Q$ length exceeds 128 characters.

(2 of 2)

Line Number		Description
	460	Exits loop if character string Q$ length is 0.
	480 to 530	Adds 0's to end of Q$ so that character string Q$ length will be integer multiple of 8, and sets L for new character string.
	550 to 590	Prints character string Q$. Prints space every 4 characters for clarity.
	610 to 680	Groups every 8 characters sequentially from start of character string Q$ and converts to decimal values (0 to 255). Specifies N for the number of these values.
	700 to 740	Prints decimal values sequentially.
	760	Sets binary mode, start address and byte count N in D3286.
	770 to 830	Sets pattern in D3286 for each byte. Sends EOI with end byte.
	840	End of loop (returns to start of loop.)
850		End of program

6. FILE FUNCTION

This chapter describes file functions available for built-in floppy disk drive. File function operation method and file operation error messages are explained in Sections 3.2.1 (5-1) and 8.4, respectively.

6.1 Outline

D3286 has a built-in 3.5-inch floppy disk drive which can save/read set operation conditions, pattern setup contents and measurement results to/from floppy disk.
Disk is formatted with MS-DOS® Rev. 4.0; 720 KB (2DD), 1.2 MB (2HD), or 1.4 MB (2HD). Disk type is automatically identified, except for disk initialization (FORMAT).

6 types of file functions can be executed on D3286:

(1) DIR .... Directory display
(2) LOAD .... File read
(3) SAVE .... File save (new file create)
(4) RESAVE .... File resave (overwrite)
(5) DELETE .... File deletion
(6) FORMAT .... Disk initialization

4 file types can be handled on D3286:

(1) SETUP .... General operation settings other than pattern contents
(2) WORD .... Pattern contents with pattern mode WORD
(3) FRAME .... Pattern contents with pattern mode FRAME
(4) MEAS .... Measurement results (write only)

Note 1: For the file type FRAME, a file to be read, saved, or deleted is the file with the contents of the FRAME pattern memory used when the payload type is WORD.
For the payload type of PRBS, the overhead part of this FRAME pattern memory is used.
Since the contents of the pattern of the payload type of CID are automatically set, this is excluded from the file functions.

Note 2: When reading a file with the file type of WORD or FRAME, the following settings are cleared.

File type	Payload type	Group selection	Setting item
WORD	-	PATT TRIG	ADDRESS: 0
		PATT DATA	ADDRESS: 0
		SYNC WORD	PATTERN LENGTH: 32 ADDRESS: 0
		ST-MASK FLD	NO SETTING
		END-MASK FLD	NO SETTING
		ST-SPEC FLD	NO SETTING
		END-SPEC FLD	NO SETTING
FRAME	WORD, PBRS PATT TRIG	PATT TRIG	FRAME NO.: 1, ROW NO.: 1 BYTE NO.: 1
		PATT DATA	FRAME NO.: 1, ROW NO.: 1 BYTE NO.: 1
		SYNC WORD	FRAME NO.: 1, ROW NO.: 1 BYTE NO.: 1 NO, OF BIT:32
		ST-MASK FLD	NO SETTING
		END-MASK FLD	NO SETTING
		ST-SPEC FLD	NO SETTING
		END-SPEC FLD	NO SETTING

Max. 100 files can be created for each file type; assigned file Nos. 0 to 99. File type, file No. and actual MS-DOS® file name are related as follows:

xxxxx.yy. zzz
① ②

① File name
xxxxx = D3286: File type SETUP or MEAS
xxxxx = BERTS: File type WORD or FRAME
yy = 00 to 99: File No.

② Extension
zzz = SET: File type SETUP
zzz = WRD: File type WORD
zzz = FRM: File type FRAME
zzz = MES: File type MEAS

Note : Error occurs if extension does not match file contents.

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6.2 File Format

File type MEAS (measurement results) uses MS-DOS text format, in which data can be read and processed by other application software. Files of other file types use original binary format, which cannot be handled with other general-purpose application software.

ADVANTEST provides dedicated software which can set D3186 and D3286 operation conditions and pattern contents, and display measurement results.
The following is an example of file type MEAS:

```
   ADVANTEST  D3286  ERROR DETECTOR          }..............Title
           MEASUREMENT  DATA
-------------------------------------

***** MEASURED  DATA *****               ..................Final measurement data
-----------------------
*START
    94/01/01 00:02:18                    ..................Measurement start time
*STOP
    94/01/01 00:03:26                    ..................Measurement finish time
    PRBS 23 1/4                          }..............Measurement condition summary
    NORMAL INT TOTAL
ERR 4.7468E-11                           ..................Error rate measurement results
ERC 00003.E+00                           ..................Error count measurement results
>0                                       ..................EI/EFI measurement threshold
EI  00003.E+00                           ..................Error interval measurement results
EFI 006.29E+02                           ..................Error free interval measurement results
FRQ 01000.008E+6                         ..................Frequency measurement results
PFS 00000.E+00                           ..................Power failure time (second)
CES 00000.E+00                           ..................Clock error time (second)
YES 00005.E+00                           ..................Sync error time (second)
>E-3
TEI  00000.E+00
TEFI 006.32E+02
>E-4
TEI  00000.E+00
TEFI 006.32E+02
>E-5                                     }..............Threshold EI/EFI measurement data
TEI  00000.E+00
TEFI 006.32E+02
>E-6
TEI  00000.E+00
TEFI 006.32E+02
>E-7
TEI  00000.E+00
TEFI 006.32E+02
```

(continued)

>E-8	
TEI 00000.E+00	
TEFI 006.32E+02	
>E-9	
TEI 00000.E+00	
TEFI 00000.E+00	
<=E-9	
TEI 00000.E+00	
TEFI 00000.E+00	
ES 00000.E+00	
EFS 0006.0E+00	
DM >E-6 SES/US >E-3	················Error performance measurement data
DM 00000.E+00	
SES 00000.E+00	
US 00000.E+00	

**** ERROR PRINT DATA ****	···················Error, alarm data
*START 94/01/01 00:02:18	···················Measurement start time
SYNC ERROR 94/01/01 00:02:24	···················Sync error occurrence time
SYNC RECOVERY 94/01/01 00:02:27	···················Sync error recovery time
ERR 0.0000E-09 94/01/01 00:02:27	···················Error rate measurement results at sync error recovery
ERR 8.6956E-11 94/01/01 00:02:32	···················Error rate measurement results at bit error detection
SYNC ERROR 94/01/01 00:03:03	···················Sync error occurrence time
SYNC RECOVERY 94/01/01 00:03:05	···················Sync error recovery time
EFI 004.20E+02 94/01/01 00:03:05	···················EFI measurement results at sync error recovery
EFI 004.76E+02 94/01/01 00:03:11	···················EFI measurement results at bit error detection
EFI 005.12E+02 94/01/01 00:03:14	···················EFI measurement results at bit error detection
**** CURRENT DATA LOG ****	···················Current data log
ERR 0.0000E-08 94/01/01 00:02:18	···················Error rate measurement results
ERR 0.0000E-08 94/01/01 00:02:18	···················Error rate measurement results
ERR 0.0000E-08 94/01/01 00:02:18	···················Error rate measurement results
ERR 0.0000E-08 94/01/01 00:02:18	···················Error rate measurement results
ERR 0.0000E-08 94/01/01 00:02:18	···················Error rate measurement results
ERR 0.0000E-08 94/01/01 00:02:19	···················Error rate measurement results
ERR 0.0000E-08 94/01/01 00:02:19	···················Error rate measurement results
ERR 0.0000E-08 94/01/01 00:02:19	···················Error rate measurement results
ERR 0.0000E-08 94/01/01 00:02:19	···················Error rate measurement results
ERR 0.0000E-09 94/01/01 00:02:19	···················Error rate measurement results
ERR 0.0000E-09 94/01/01 00:02:19	···················Error rate measurement results
ERR 0.0000E-09 94/01/01 00:02:19	···················Error rate measurement results
ERR 0.0000E-09 94/01/01 00:02:19	···················Error rate measurement results
ERR 0.0000E-09 94/01/01 00:02:19	···················Error rate measurement results
ERR 0.0000E-09 94/01/01 00:02:19	···················Error rate measurement results
ERR 0.0000E-09 94/01/01 00:02:20	···················Error rate measurement results
ERR 0.0000E-09 94/01/01 00:02:20	···················Error rate measurement results

(continued)

```
ERR 0.0000E-09      94/01/01 00:02:20     ..................Error rate measurement results
ERR 0.0000E-09      94/01/01 00:02:20     ..................Error rate measurement results
ERR 0.0000E-09      94/01/01 00:02:20     ..................Error rate measurement results
            (Skip over)
ERR 6.0975E-11      94/01/01 00:02:37     ..................Error rate measurement results
ERR 6.0606E-11      94/01/01 00:02:37     ..................Error rate measurement results
ERR 6.0240E-11      94/01/01 00:02:38     ..................Error rate measurement results
ERR 5.9880E-11      94/01/01 00:02:38     ..................Error rate measurement results
ERR 5.9523E-11      94/01/01 00:02:38     ..................Error rate measurement results
ERC 00001.E+00      94/01/01 00:02:38     ..................Error count measurement results
ERC 00001.E+00      94/01/01 00:02:38     ..................Error count measurement results
ERC 00001.E+00      94/01/01 00:02:38     ..................Error count measurement results
ERC 00001.E+00      94/01/01 00:02:38     ..................Error count measurement results
ERC 00001.E+00      94/01/01 00:02:38     ..................Error count measurement results
ERC 00001.E+00      94/01/01 00:02:38     ..................Error count measurement results
ERC 00001.E+00      94/01/01 00:02:38     ..................Error count measurement results
ERC 00001.E+00      94/01/01 00:02:39     ..................Error count measurement results
EI  000.4831        94/01/01 00:02:39     ..................Error count measurement results
EI  000.4808        94/01/01 00:02:39     ..................Error interval measurement results
EI  000.4785        94/01/01 00:02:39     ..................Error interval measurement results
EI  000.4762        94/01/01 00:02:39     ..................Error interval measurement results
EI  000.4739        94/01/01 00:02:39     ..................Error interval measurement results
EI  000.4717        94/01/01 00:02:39     ..................Error interval measurement results
EI  000.4695        94/01/01 00:02:39     ..................Error interval measurement results
EFI 085.5140        94/01/01 00:02:39     ..................Error free interval measurement results
EFI 085.5814        94/01/01 00:02:39     ..................Error free interval measurement results
EFI 085.6481        94/01/01 00:02:40     ..................Error free interval measurement results
EFI 085.7143        94/01/01 00:02:40     ..................Error free interval measurement results
EFI 085.7798        94/01/01 00:02:40     ..................Error free interval measurement results
EFI 085.8447        94/01/01 00:02:40     ..................Error free interval measurement results
           (Skip over)
EFI 003.41E+02      94/01/01 00:02:55     ..................Error free interval measurement results
EFI 003.42E+02      94/01/01 00:02:55     ..................Error free interval measurement results
EFI 003.43E+02      94/01/01 00:02:55     ..................Error free interval measurement results
EFI 003.44E+02      94/01/01 00:02:55     ..................Error free interval measurement results
FRQ 01000.008E+6    94/01/01 00:02:56     ..................Frequency measurement results
```

The following shows the data format of file type MEAS. End of each line is terminated with carriage return (CR: ASCII 13 (decimal)) and line feed (LF: ASCII 10 (decimal)).

(1) Measurement results

Measurement result format varies depending on measurement function, however, it generally goes as follows:

hhhsd.ddddE ± dd

or

hhhsddd.dddd%

or

hhhsdddddddd

hhh:	3- or 4-digit alphabet header to indicate measurement function (⌴ shows space)
ERR	Error rate (3 digits)
ERC	Error count (3 digits)
EI⌴	Error interval (3 digits)
EFI	Error free interval (3 digits)
FRQ	Frequency (3 digits)
FRC	Frame count (3 digits)
PFS	Power failure time (3 digits)
CES	Clock error time (3 digits)
YES	Sync error time (3 digits)
TEI	Threshold error interval digit
TEFI	Threshold error free interval (4 digits)
ES⌴	Error seconds (3 digits)
EFS	Error free seconds (3 digits)
DM	Degraded minutes (3 digits)
SES	Severely errored seconds (3 digits)
US⌴	Unavailable seconds (3 digits)
s:	Normally, space, but asterisk (*) in case of measurement results overflow
d.ddddE ± dd:	Measurement results in exponential format
ddd.dddd%:	Measurement results in % format
dddddddd:	Measurement results in integer format

(2) Time data

Time data has the following format:

yy/mm/dd hh:nn:ss

yy:	Year	00 to 99
mm:	Month	01 to 12
dd:	Day	01 to 31
hh:	Hour	00 to 23
nn:	Minute	00 to 59
ss:	Second	00 to 59

(3) Final measurement data (MEASURED DATA)

Measurement start time, measurement finish time, measurement condition summary, and final measurement results.

Table 6-1 Format of Final Measurement Data (1 of 2)

Item		Record format
Measurement start time		*STOP yy/mm/dd hh:nn:ss
Measurement finish time		*STOP yy/mm/dd hh:nn:ss
Measurement condition summary 1)	PRBS	PRBS nn m/m mmmmm ggg eeeee
	WORD	WORD llllll mmmmm ggg eeeee
	FRAME	FRAM ffff rr bbbbb mmmmm ggg eeeee
Error rate measurement results		ERR d.ddddE-dd
Error count measurement results (exponential format) 2)		ERC d.ddddE+dd
EI/EFI measurement threshold		>E-d or >0
Error interval measurement results (% format) 2)		EI ddd.dddd%
Error free interval measurement results (interval count format) 2)		EFI d.ddddE+d

Table 6-1 Format of Final Measurement Data (2 of 2)

Item	Record format
Frequency measurement results	FRQ ddddd.dddE + 6
Frame count measurement results 3)	FRC d.ddddE + dd
Power failure time (second)	PFS d.ddddE + d
Clock error time (second)	CES d.ddddE + d
Sync error time (second)	YES d.ddddE + d

1) Measurement condition summary has the following contents:

If pattern mode is PSEUDO RANDOM:
PRBS nn m/m
nn: Stage count 7, 9, 10, 11, 15, 23, 31
mm/mm: Mark ratio 0/8, 1/8, 1/4, 1/2, 8/8, 7/8, 3/4, 1/2B

If pattern mode is WORD:
WORD lllllll
lllllll: Pattern length 0000001 to 8388608 (bits)

If pattern mode is FRAME:
FRAM ffff rr bbbbb
ffff: Frame count 0001 to 8192 (frames)
rr: Single-frame length 01 to 16 (rows)
bbbbb: Single-row length 00001 to 32768 (bytes)

Measurement mode, etc.
mmmmm ggg eeeee
mmmmm: Measurement time mode
NORML ... NORMAL
F.TIM ..... Frame time (FR TIME)
F.INT ..... Frame interval (FR INTV)
BURST .... BURST

ggg: Gate control
INT .... INTERNAL
EXT ...... EXTERNAL

eeeee: Error measurement mode
OMISN .... OMISSION
INSRT .... INSERTION
TOTAL .... TOTAL
OVRHD ... OVERHEAD
PAYLD .... PAYLOAD
SPFLD .... SPECIFIC FIELD
OTFLD .... Other than specific field (OTHER FIELD)
ALL ...... Entire field (ALL)

2) For output format of error count, error interval, and error free interval measurement results, only one format is output according to display type set at that time.

3) Frame count measurement is available only when pattern mode is FRAME, payload type is other than CID, and measurement time mode is FR TIME or FR INTV.

(4) Threshold EI/EFI measurement data

Threshold EI/EFI (T-EI/E-EFI) measurement results are recorded following final measurement results. This data is recorded regardless of ON/OFF of DIP switch SW3 PRINT OUT DATA - T-EI/EFI (Bit 1 of ⑧ in Figure 4-7) on front panel.

Table 6-2 Format of Threshold EI/EFI Measurement Data

Item	Record format
Threshold 4)	>E-d
T-EI measurement results 4, 5) (% format)	TEI ddd.dddd%
T-EFI measurement results 4, 5) (Interval count format)	TEFI d.ddddE+d

4) For threshold and corresponding measurement results, 8-stage values are recorded according to Bits 6 to 8 setting of DIP switch SW2 (⑦ in Figure 4-7) on rear panel.
SW2 bit 8, 7, 6 = 0 (OFF), 0 (OFF), 0 (OFF) ... >1E-3 to ≧ 1E-9
1 (ON), 0 (OFF), 1 (ON) .... >1E-3 to ≧ 1E-9
1 (ON), 1 (ON), 0 (OFF) .... >1E-3 to ≧ 1E-9
1 (ON), 1 (ON), 1 (ON) ..... >1E-3 to ≧ 1E-9
0 (OFF), 0 (OFF), 1 (ON) .... >1E-4 to ≧ 1E-10
0 (OFF), 1 (ON), 0 (OFF) .... >1E-5 to ≧ 1E-11
0 (OFF), 1 (ON), 1 (ON) .... >1E-6 to ≧ 1E-12
1 (ON), 0 (OFF), 0 (OFF) .... >1E-7 to ≧ 1E-13
Rear panel DIP switches are read only when D3286 power is turned on. If any setting is modified, turn off the power, wait 5 seconds or more, then turn on the power.

5) T-EI and T-EFI measurement results are recorded in either format according to OUTPUT FORMAT - T-EI/EFI set by Bit 3 of DIP switch SW3 (⑧ in Figure 4-7) on rear panel.
SW3 bit 3 = 0 (OFF) .... Exponential format (interval count)
1 (ON) .... Fixed point format (%)
Rear panel DIP switches are read only when D3286 power is turned on. If any setting is modified, turn off the power, wait 5 seconds or more, then turn on the power.

(5) Error performance measurement data

Error performance measurement results are recorded following threshold EI/EFI measurement data. This data is recorded regardless of ON/OFF of DIP switch SW3 PRINT OUT DATA - ERROR PERFORMANCE (Bit 2 of ⑧ in Figure 4-7) on rear panel.

Table 6-3 Format of error performance measurement data

Item	Record format
ES measurement results 6) (Fixed point format: %)	ES ddd.dddd%
EFS measurement results 6) (Exponential format: sec.)	EFS d.ddddE + d
Threshold 7)	DM >E-d SES/US >E-d
DM measurement results 6, 7) (Fixed point format: %)	DM ddd.dddd%
SES measurement results 6, 7) (Exponential format: sec.)	SES d.ddddE + d
US measurement results 6, 7) (Exponential format: sec.)	US d.ddddE + d

6) ES, EFS, DM, SES, and US measurement results are recorded in the format according to OUTPUT FORMAT - ERROR PERFORMANCE set by Bit 4 of DIP switch SW3 (⑧ in Figure 4-7) on rear panel.
SW3 bit 4 = 0 (OFF) .... Exponential format
(ES, EFS, SES, US: No. of seconds,
DM: No. of minutes)
1 (ON) .... Fixed point format
(ES, EFS, SES, US, DM: %)
Rear panel DIP switches are read only when D3286 power is turned on. If any setting is modified, turn off the power, wait 5 seconds or more, then turn on the power.

7) Threshold and corresponding measurement results are recorded according to Bits 5 and 6 setting of DIP switch SW3 (⑧ in Figure 4-7) on rear panel.
SW3 bit 6, 5 = 0 (OFF), 0 (OFF) .... SES, US: 1E-3, DM: IE-6
1 (ON), 1 (ON) ...... SES, US: 1E-3, DM: IE-6
0 (OFF), 1 (ON) ..... SES, US: 1E-4, DM: IE-8
1 (ON), 0 (OFF) ..... SES, US: 1E-5, DM: IE-10
Rear panel DIP switches are read only when D3286 power is turned on. If any setting is modified, turn off the power, wait 5 seconds or more, then turn on the power.

(6) Error, alarm data

Regardless of ERROR PRINT key ON/OFF (⑱ in Figure 2-5), measurement start time, state, time and measurement results at error and/or alarm occurrence and recovery results are recorded.
For error, alarm data, last (max.) 1024 data items are retained as record.

Table 6-4 Error, Alarm Data Format

Item	Record format 9)	
Sync error occurrence	SYNC ERROR	yy/mm/dd hh:nn:ss
Sync error recovery	SYNC RECOVERY	yy/mm/dd hh:nn:ss
Clock error occurrence	CLOCK ERROR	yy/mm/dd hh:nn:ss
Clock error recovery	CLOCK RECOVERY	yy/mm/dd hh:nn:ss
Power failure occurrence	POWER FAIL	yy/mm/dd hh:nn:ss
Power failure recovery	POWER RECOVERY	yy/mm/dd hh:nn:ss
Sync error recovery, clock error recovery, power failure recovery, and bit error detection 8)	ERR d.ddddE-dd	yy/mm/dd hh:nn:ss
	ERC d.ddddE + dd	yy/mm/dd hh:nn:ss
	EI ddd.dddd%	yy/mm/dd hh:nn:ss
	EFI d.ddddE + d	yy/mm/dd hh:nn:ss
	FRQ ddddd.dddE + 6	yy/mm/dd hh:nn:ss
10)	FRC d.ddddE + dd	yy/mm/dd hh:nn:ss

8) For measurement results at sync error recovery, clock error recovery, power failure recovery and bit error detection, only one of them is recorded according to specified measurement function and display type.

9) Error/alarm data and measurement results are separated from time data by single horizontal tab (ASCII 9 (decimal)) and 4 spaces (ASCII 32 (decimal)).

10) Frame count measurement is available only when pattern mode is FRAME, payload type is other than CID, and measurement time mode is FR TIME or FR INTV.

(7) Current data log

Regardless of CURRENT DAT key ON/OFF (⑩ in Figure 2-4), interim results of measurement are recorded at specified intervals.

Current data log recording cycle is set by Bits 7 and 8 of rear panel DIP switch SW3 (⑧ in Figure 2-7) for error rate, error count, and frame count measurement; it is set by pressing INTERVAL key (⑫ in Figure 2-5) in timer/clock/printer control section for error interval and error free interval measurement.
Display update cycle of interim frequency measurement results is fixed to 0.1 sec.

SW3 bit 8, 7 = 0 (OFF), 0 (OFF) .... 0.1 sec.
0 (OFF), 1 (ON) ..... 0.2 sec.
1 (ON), 0 (OFF) ..... 0.5 sec.
1 (ON), 1 (ON) ...... INTERVALS (set with INTERVAL key)

Rear panel DIP switches are read only when D3286 power is turned on. If any setting is modified, turn off the power, wait 5 seconds or more, then turn on the power.

Max. final 9000 data items of current data log remain as records.

Table 6-5 Current Data Log Format

Item 11)	Record format 12)	
Error measurement results	ERR d.ddddE-dd	yy/mm/dd hh:nn:ss
Error count measurement results (exponential format)	ERC d.ddddE + dd	yy/mm/dd hh:nn:ss
Error interval measurement results (% format)	EI ddd.dddd%	yy/mm/dd hh:nn:ss
Error free interval measurement results (interval count format)	EFI d.ddddE + d	yy/mm/dd hh:nn:ss
Frequency measurement results	FRQ ddddd.dddE + 6	yy/mm/dd hh:nn:ss
Frame count measurement results 13)	FRC d.ddddE + dd	yy/mm/dd hh:nn:ss

11) Only one measurement result is recorded according to the set measurement function and display format.
12) Each measurement result is separated from time data by single horizontal tab (ASCII 9 (decimal)) and 4 spaces (ASCII 32 (decimal)).
13) Frame count measurement is available only when pattern mode is FRAME, payload type is other than CID, and measurement time mode is FR TIME or FR INTV.

6.3 File Size

Each file type has the following size:

(1) SETUP: 578 bytes

(2) WORD: PL + 92 bytes

PL = pattern length (bits) ÷ 8 (round up)

(3) FRAME: PL + 92 bytes

If payload type is WORD or PRBS;

PL = (frame count of entire pattern) x (row count of single frame) x (single row length (bytes)).

If payload type is CID;

PL = single row length (bytes).

(4) MEAS: Max. 500 KB (variable)

7. EXTERNAL PRINTER

D3286 is equipped with Centronix specification printer interface for output to external printer.
Printer used as D3286 external printer must conform to Centronix specification and be able to print alphanumeric and symbols from ASCII code.
D3286 external printer interface outputs carriage return code (CR) and line feed code (LF) at end of each line. It does not send any other control codes.
It outputs measurement results displayed on front panel, error performance measurement results and threshold EI/EFI measurement results in addition to error and alarm messages.
Output items are set with Bits 1 and 2 of DIP switch SW3 (⑧ in Figure 2-7) on rear panel; output type is set with Bits 3 and 4 of same DIP switch. (See Table 3-18.)

7.1 Interface Specification

① Handshake

2-line handshake using *STROBE and BUSY signals.

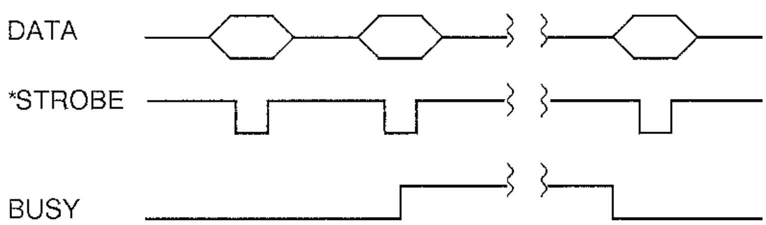
② Logic level

Interface signal is equivalent to TTL level (i8255 or equivalent is used as LSI).

③ Connector

57-30360 36-pin plug connector (Amphenol) or equivalent (Minimize interface cable length.)

④ Timing chart

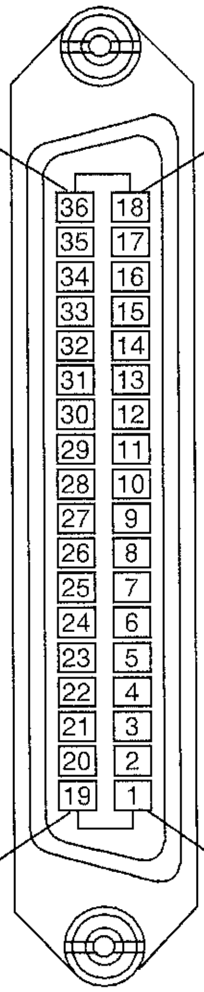


⑤ Code

Available to print alphanumeric and symbol from ASCII code. Printer with buffer memory is recommended.

7.2 Connector Pin Arrangement

Signal name	Pin No.
	36
	35
	34
GND	33
	32
*INIT	31
GND (PE)	30
GND (BUSY)	29
GND (*ACKNLG)	28
GND (DATA 8)	27
GND (DATA 7)	26
GND (DATA 6)	25
GND (DATA 5)	24
GND (DATA 4)	23
GND (DATA 3)	22
GND (DATA 2)	21
GND (DATA 1)	20
GND (*STROBE)	19



Pin No.	Signal name
18	
17	F·GND
16	GND
15	
14	
13	SLCT
12	PE
11	BUSY
10	*ACKNLG
9	DATA 8
8	DATA 7
7	DATA 6
6	DATA 5
5	DATA 4
4	DATA 3
3	DATA 2
2	DATA 1
1	*STROBE

Figure 7-1 Printer Connector Pin Arrangement

7.3 Explanation of Interface Signals

Table 7-1 Printer Interface Signal

PIN No.	Signal name	Signal direction	Function
1	*STROBE	OUTPUT	Synchronizes for printer side to read DATA 1 to 8.
2 3 4 5 6 7 8 9	DATA 1 DATA 2 DATA 3 DATA 4 DATA 5 DATA 6 DATA 7 DATA 8	OUTPUT	Sends information from 1st to 8th bits of parallel data to printer side.
10	*ACKNLG	INPUT	Indicates being ready for next data after printer data receive.
11	BUSY	INPUT	Indicates that data cannot be received on printer side.
12	PE	INPUT	Indicates presence of paper on printer side.
13	SLCT	INPUT	Indicates whether printer side will connect equipment on send side.
14			Unused
15			Unused
16	GND		Signal ground
17	F·GND		Frame ground (internally connected to signal ground)
18			Unused
19 to 30	GND		Signal ground
31	*INIT	OUTPUT	Initializes printer side.
32			Unused
33	GND		Signal ground
34 to 36			Unused

7.4 Operation Method

External printer can be operated from the timer clock/printer control section (Figure 2-5) on front panel in same way as built-in printer.

BUSY lamp:	Indicates the printer is in print or paper feed mode.
PRINT OUT key:	Automatically prints measured data.
MANUAL PRINT key:	Manually prints measured data.
ERROR PRINT key:	Prints information at error/alarm occurrence and recovery.
PAPER FEED key:	Feeds paper.

For detailed operation method, see Item (4-2) Printer control section in Section 3.2.1.

7.5 Print Output Format

The following describes output data and output timing at each status change.

(1) Measurement data

Measurement data output format varies depending on measurement function, but basically as follows:

hhhsd.ddddE ± dd
or
hhhsddd.dddd%
or
hhhsdddddddd

hhh:	3- or 4-digit alphabet header indicating measurement function (— shows space)
ERR	Error rate (3 digits)
ERC	Error count (3 digits)
EI—	Error interval (3 digits)
EFI	Error free interval (3 digits)
FRQ	Frequency (3 digits)
FRC	Frame count (3 digits)
PFS	Power failure seconds (3 digits)
CES	Clock error seconds (3 digits)
YES	Sync error seconds (3 digits)
TEI	Threshold error interval digits
TEFI	Threshold error free interval (3 digits)
ES—	Error seconds (3 digits)
EFS	Error free seconds (3 digits)
DM—	Degraded minutes (3 digits)
SES	Severely errored seconds (3 digits)
US—	Unavailable seconds (3 digits)
s:	Normally indicates space, asterisk (*) if measurement results overflow.
d.ddddE ± dd:	Measurement results in exponential format
ddd.dddd%:	Measurement results in % format
dddddddd:	Measurement results in integer format

(2) Time data

Time data is output in following format:

yy/mm/dd hh:nn:ss

yy:	Year	00 to 99
mm:	Month	01 to 12
dd:	Day	01 to 31
hh:	Hour	00 to 23
nn:	Minute	00 to 59
ss:	Second	00 to 59

(3) Measurement start time data

When front panel PRINT OUT key (⑯ in Figure 2-5) is ON, measurement start time is output when measurement starts.

Table 7-2 Output Format of Measurement Start Time Data

Output timing	Output format	Contents
Measurement start	*START yy/mm/dd hh:nn:ss	Measurement start time

(4) Error, alarm data

When front panel PRINT OUT key (⑯ in Figure 2-5) and ERROR PRINT key (⑱ in Figure 2-5) are ON, error/alarm status, time and measurement results are output.

Table 7-3 Error, Alarm Data Output Format

Output timing	Output format	Contents
Sync error occurrence (out of step)	SYNC ERROR yy/mm/dd hh:nn:ss	Sync error occurrence time
Sync error recovery (after sync established)	SYNC RECOVERY yy/mm/dd hh:nn:ss	Sync error recovery time
Clock error occurrence	CLOCK ERROR yy/mm/dd hh:nn:ss	Clock error occurrence time
Clock error recovery	CLOCK RECOVERY yy/mm/dd hh:nn:ss	Clock error recovery time
Power failure recovery	POWER FAIL yy/mm/dd hh:nn:ss	Power failure occurrence time
	POWER RECOVERY yy/mm/dd hh:nn:ss	Power failure recovery time
Sync error recovery, clock error recovery, power failure recovery, and bit error detection	ERR d.ddddE-dd [1] yy/mm/dd hh:nn:ss	Error rate measurement value and time
	ERC d.ddddE+dd [1] yy/mm/dd hh:nn:ss	Error count measurement value and time
	EI ddd.dddd% [1] yy/mm/dd hh:nn:ss	Error interval measurement value and time
	EFI d.ddddE+d [1] yy/mm/dd hh:nn:ss	Error free interval measurement value and time
	FRQ ddddd.dddE+6 [1] yy/mm/dd hh:nn:ss	Frequency measurement value and time
	FRC d.ddddE+dd [1, 2] yy/mm/dd hh:nn:ss	Frame count measurement value and time

1) When bit error is detected, only one measurement result is output according to set measurement function and display type.

2) Frame count can be measured only when pattern mode is FRAME and measurement time mode is FR TIME or FR INTV.

(5) Data in manual print mode

Only one measurement result is output according to set measurement function and display type when front panel MANUAL PRINT key (⑰ in Figure 2-5) is depressed.
In this case, character M is added following time data.

Table 7-4 Data Output Format in Manual Print Mode

Output timing	Output format	Contents
MANUAL PRINT key depressed	ERR d.ddddE-dd yy/mm/dd hh:nn:ss M	Error rate measurement value and time
	ERC d.ddddE+dd yy/mm/dd hh:nn:ss M	Error count measurement value and time
	EI ddd.dddd% yy/mm/dd hh:nn:ss M	Error interval measurement value and time
	EFI d.ddddE+d yy/mm/dd hh:nn:ss M	Error free interval measurement value and time
	FRQ ddddd.dddE+6 yy/mm/dd hh:nn:ss M	Frequency measurement value and time
	FRC d.ddddE+dd 2) yy/mm/dd hh:nn:ss M	Frame count measurement value and time

2) Frame count can be measured only when pattern mode is FRAME, and measurement time mode is FR TIME or FR INTV.

(6) Data at measurement completion

When front panel PRINT OUT key (⑯ in Figure 2-5) is ON, measurement start time, measurement completion time, measurement condition summary, and final measurement results are output when measurement is completed.

Table 7-5 Data Output Format at Measurement Completion

Output timing	Output format	Contents
Measurement completion	*START yy/mm/dd hh:nn:ss	Measurement start time
	*STOP yy/mm/dd hh:nn:ss	Measurement completion time
	PRBS nn m/m 3) mmmmm ggg eeeee	Summary of measurement conditions (PRBS)
	WORD lllllll 3) mmmmm ggg eeeee	Summary of measurement conditions (WORD)
	FRAM ffff rr bbbbb 3) mmmmm ggg eeeee	Summary of measurement conditions (FRAME)
	ERR d.ddddE-dd	Error rate measurement results
	ERC d.ddddE+dd 4)	Error count measurement results
	>E-d	Threshold of EI/EFI measurement
	EI ddd.dddd% 4)	Error interval measurement results (% format)
	EFI d.ddddE+d 4)	Error free interval measurement results (interval count format)
	FRQ ddddd.dddE+6	Frequency measurement results
	FRC d.ddddE+dd 2)	Frame count measurement results
	PFS d.ddddE+d	Power failure duration (sec.)
	CES d.ddddE+d	Clock error duration (sec.)
	YES d.ddddE+d	Sync error duration (sec.)

2) Frame count can be measured only when pattern mode is FRAME, and measurement time mode is FR TIME or FR INTV.

3) Summary of measurement conditions is as follows:

If pattern mode is pseudo random:
PRBS nn m/m
nn: No. of steps 7, 9, 10, 11, 15, 23, 31
m/m: Mark ratio 0/8, 1/8, 1/4, 1/2, 8/8, 7/8, 3/4, 1/2B

If patter mode is WORD:
WORD lllllll
lllllll: Pattern length 0000001 to 8388608 (bits)

If pattern mode is FRAME:
FRAM ffff rr bbbbb

ffff:	Frame count	0001 to 8192 (frames)
rr:	Single frame length	01 to 16 (rows)
bbbbb:	Single row length	00001 to 32768 (bytes)

Measurement mode, etc.
mmmmm ggg eeeee
mmmmm: Measurement time mode
NORML ...... NORMAL
F.TIM .... Frame time (FR TIME)
F.INT .... Frame interval (FR INTV)
BURST ...... BURST
ggg: Gate control
INT .... INTERNAL
EXT .... EXTERNAL
eeeee: Error measurement mode
OMISN ...... OMISSION
INSRT .... INSERTION
TOTAL ...... TOTAL
OVRHD ...... OVERHEAD
PAYLD ...... PAYLOAD
SPFLD ...... SPECIFIC FIELD
OTFLD ...... Other than specific field (OTHER FIELD)
ALL .... All fields (ALL)

4) For measurement results output formats of error count, error interval, and error free interval, only one format is output according to display type set at that time.

(7) Threshold EI/EFI measurement data

Results of threshold EI/EFI (T-EI/T-EFI) measurement are output when measurement is completed if front panel PRINT OUT key (⑯ in Figure 2-5) and PRINT OUT DATA - T-EI/EFI, rear panel DIP switch SW3 (Figure 2-7) are ON (Bit 1 of ⑧ in Figure 2-7 is 0 (OFF)). Rear panel DIP switch is read only when the D3286 power is turned on. If any setting is modified, turn off the power, wait 5 seconds or more, then turn on the power.

Table 7-6 Output Format of Threshold EI/EFI Measurement Data

Output timing	Output format	Contents
Measurement completion	>E-d 5)	Threshold
	TEI ddd.dddd% 5, 6)	T-EI measurement results (% format)
	TEFI d.ddddE+d 5, 6)	T-EFI measurement results (interval count format)

5) For threshold and corresponding measurement results, 8-step values are output according to settings of DIP switch SW2 Bits 6 to 8 (⑦ in Figure 2-7) on rear panel.
SW2 bit 8, 7, 6 = 0 (OFF), 0 (OFF), 0 (OFF) ... >1E-3 to ≧1E-9
1 (ON), 0 (OFF), 1 (ON) .... >1E-3 to ≧1E-9
1 (ON), 1 (ON), 0 (OFF) .... >1E-3 to ≧1E-9
1 (ON), 1 (ON), 1 (ON) ..... >1E-3 to ≧1E-9
0 (OFF), 0 (OFF), 1 (ON) .... >1E-4 to ≧1E-10
0 (OFF), 1 (ON), 0 (OFF) .... >1E-5 to ≧1E-11
0 (OFF), 1 (ON), 1 (ON) .... >1E-6 to ≧1E-12
1 (ON), 0 (OFF), 0 (OFF) .... >1E-7 to ≧1E-13

6) For T-EI and T-EFI measurement results, either one output format is used according to OUTPUT FORMAT - T-EI/EFI set by DIP switch SW3 Bit 3 (⑧ in Figure 2-7) on rear panel.
SW3 bit 3 = 0 (OFF) .... Exponential format (interval count)
1 (ON) .... Fixed point format (%)

(8) Error performance measurement data

Error performance measurement results are output when measurement is completed if front panel PRINT OUT key (⑯ in Figure 2-5) and PRINT OUT DATA - ERROR PERFORMANCE, DIP switch SW3 on rear panel, are ON (Bit 2 of ⑧ in Figure 2-7 is 0(OFF)). Rear panel DIP switch is read only when D3286 power is turned on. If any setting is modified, turn off the power, wait 5 seconds or more, then turn on the power.

Table 7-7 Output Format of Error Performance Measurement Data

Output timing	Output format	Contents
Measurement completion	ES ddd.dddd% 7)	ES measurement results (fixed point format: %)
	EFS d.ddddE + d 7)	EFS measurement results (exponential format: sec., min.)
	DM > E-d SES/US > E-d 8)	Threshold
	DM ddd.dddd% 7, 8)	DM measurement results (fixed point format: %)
	SES d.ddddE + d 7, 8)	SES measurement results (exponential format: sec., min.)
	US d.ddddE + d 7, 8)	US measurement results (exponential format: sec., min.)

7) For ES, EFS, DM, SES, and US measurement results, one output format is used according to OUTPUT FORMAT - ERROR PERFORMANCE set by DIP switch SW3 Bit 4 (⑧ in Figure 2-7) on rear panel.
SW3 bit 4 = 0 (OFF) . . . . Exponential format
(ES, EFS, SES, US: No. of seconds,
DM: No. of minutes)
1 (ON) . . . . Fixed point format
(ES, EFS, SES, US, DM: %)

8) Threshold and corresponding measurement results are output according to settings of DIP switch SW3 Bits 5 and 6 (⑧ in Figure 2-7) on rear panel.
SW3 bit 6, 5 = 0 (OFF), 0 (OFF) . . . . . SES, US: IE-3, DM: 1E-6
1 (ON), 1 (ON) . . . . SES, US: IE-3, DM: 1E-6
0 (OFF), 1 (ON) . . . . . . SES, US: IE-4, DM: 1E-8
1 (ON), 0 (OFF) . . . . . . SES, US: IE-5, DM: 1E-10

8. MESSAGE DISPLAY

This chapter describes the meaning of and operator response to messages displayed on the front panel.

8.1 Measurement Related Display

Special messages related to measurement operation are displayed on measurement result indicator (⑨ in Figure 2-4) on the front panel.

Table 8-1 Measurement Related Message Display

Display	Meaning
Clock Error CLoc.Err	Displayed when clock input amplitude is insufficient or frequency is too low.
Sync Error SYnc.Err	Displayed when pattern sync is out of step.
Halt HALt	Displayed before measurement start and when no data is provided.
Busy buSY	Displayed until first measurement results are displayed after measurement start.
Search SEArCh	Displayed while auto search is in execution.
Not Found notFound	Displayed when optimum value cannot be found by auto search.
Frequency Error FrqErr	Displayed when an attempt was made to start measurement with the setting outside of the condition of (k) in (3) of Section 3.2.1, or the input frequency fell outside of the above condition during the measurement.

8.2 MPU Error Display

This section describes error display when MPU (microprocessor unit) for D3286 internal control operates abnormally. This error is displayed on pattern length/address indicator (⑮ in Figure 2-3) of pattern setting section on front panel. If this error is displayed, turn off the D3286 power, wait 5 seconds or more, then turn on the power while pressing PATTERN DATA - 2nd key of pattern setting section (⑲ in Figure 2-3).

Keep pressing PATTERN DATA - 2nd key until Initial is displayed on the file No. indicator of file operation section on the front panel (① in Figure 2-6). This operation sets D3286 to initial state. Initial parameter values are same as those set by GPIB program code "Z" (see Section 5.12.1). GPIB device address is initialized to 8.

Error code 0005 indicates that contents of memory storing set parameters are lost. If it is displayed, D3286 is initialized in same way as D3286 power is turned on with PATTERN DATA - 2nd key depressed on pattern setting section.

If an MPU error is frequently displayed, that indicates the MPU has failed. Contact ATCE (ADVANTEST Customer Engineering), nearest ADVANTEST sales office, or agency. Also inform them of displayed error code (4-digit numeric). See the back of this document for location and telephone No. of ADVANTEST offices and agencies.

Display format: E r r XXXX

Error code (4-digit numeric)

Error code	Contents
0001 to 1717	Abnormal memory
8000 or more	Abnormal MPU peripheral circuit

8.3 Low Battery Display

When D3286 power is turned on if the following is displayed on pattern length/address indicator of front panel pattern setting section (⑮in Figure 2-3), the voltage of memory backup NiCd battery is low and previous set parameters have been lost. This low battery indication is displayed for several seconds, and then normal operation subsequently resumes.

L o b A t

In this case, Initial is displayed on file No. indicator of the front panel file operation section (① in Figure 2-6) and D3286 is set to initial state. Parameter initial values are same as those set by program code "Z" (see Section 5.12.2). GPIB device address is initialized to 8. To charge to full charge condition from low battery state, turn on D3286 power continuously for 12 hours or more.

If low battery indication is still displayed after sufficient charging, the battery has failed and requires replacement. Contact ATCE, nearest ADVANTEST sales office, or agency. See the back of this document for location and telephone No.

8.4 File Error Display

This section describes floppy disk error messages displayed on file No. indicator of front panel file operation section (① in Figure 2-6).

Table 8-2 Floppy Disk Related Error Message (1 of 2)

Error message	Meaning	Operator response
Disk Error dISc Err	• Disk is not loaded. • Disk is not correctly formatted. • Disk cannot be formatted.	• Check that disk is fully inserted. • Check that disk is either 720 KB, 1.2 MB, or 1.4 MB and MS-DOS formatted. • Reformat or replace disk according to situation.
Protected ProtEct	• Disk is write-protected.	• Cancel disk write protect (slide notch to close hole).
Disk Full dIScFuLL	• Disk is full, no space to write file.	• Delete unnecessary files. • Replace disk.
File Error FILE Err	• File is specified as write protect, cannot be resaved or deleted.	• Check file attribute using a PC. • Cancel write protect attribute.
Type Error tyPE Err	• File type name and contents do not match each other.	• Check whether file extension has been changed. If changed, correct it.
Data Error dAtA Err	• Data read from file has error.	• Retry data read. • If error still occurs after retry, delete that file which cannot be used.
Not Found notFound	• File with specified file type and No. cannot be found.	• Check whether file type and No. are correct. If incorrect, specify file type and/or No. again.

Table 8-2 Floppy Disk Related Error Message (2 of 2)

Error message	Meaning	Operator response
Already A L r E A d y	• Specified file already exists and cannot be saved.	• Execute RESAVE if it may be overwritten. • Specify other file No. if not overwritten.
No Data n o d A t A	• No measurement was performed, no data exists and measurement results cannot be saved or resaved.	• Save or resave after measurement.
Diff. Length d I F F L E n	• Set pattern length and file pattern length different from each other during ALTERNATE pattern read. • Different length message on upper stage is displayed for approx. 1 second and it is subsequently changed to lower stage display Load n y on left side.	• To execute pattern read, light pointer in upper left portion of y using DIGIT key (⇦, ⇨) and depress EXE key. • To stop pattern read, light pointer in upper left portion of n and depress EXE key.
Load y n L o A d ˙ y n		
Initial I n I t I A L	• D3286 has been set to initial state (not file error).	• See Sections 3.2.1 (6) Initial State Setting, 5.12.2 Set Parameter Initialization, 8.2 MPU Error Display, and 8.3 Low Battery Display.
Length Error L E n E r r	• The pattern length exceeds 4M bits when reading the ALTERNATE pattern.	• Specify another file whose pattern length is 4M (4104304) bits or less. • Read the file with ALTERNATE turned off.
Default d E F A U L t	• D3286 was set to the initial state by the "Z" command program message (this is not a file error).	• Refer to Section 5.12.2, "Initialization of Set Parameters."
Cancel C A n C E L	• The file operation was cancelled (this is not a file error).	• Refer to (5-1), "File operation section" of Section 3.2.1.

8.5 Displays Relating to Delay Lines

If variation in the absolute value of the value displayed in the delay setting section (⑪ in Figure 2-2) exceeds the tolerance, control is passed to the self-calibration routine automatically and "CAL" is displayed for up to 12 seconds.

CAL

At this time, the upper and lower limits are checked by the upper and lower limit detection function. If an error is detected, the following error message is displayed.

Err

If this message is displayed, contact ATCE (Advantest Customer Engineering), our sales office nearby, or your sales representative. Location and phone number of ATCE and sales offices are printed on the back cover of this manual.

While this message is displayed, the delay value setting knob does not operate. Turn off the power, wait for at least five seconds, and then turn the power back on. If the error is recovered, the above error message disappears and the knob becomes operative; otherwise, the two messages are displayed again.

9. CONFIRMATION OF FUNCTION AND SPECIFICATION

This chapter describes how to check the functions and specifications of the D3286 error detector using the D3186 pulse pattern generator.

9.1 Confirming Measurement Functions

9.1.1 Connection and Basic Settings of the D3186 and D3286

(1) Connect the following connectors with a cable.
Connect CLOCK2 OUTPUT on the D3186 front panel to CLOCK INPUT on the D3286 front panel
Connect DATA OUTPUT on the D3186 front panel to DATA INPUT on the D3286 front panel
Connect GPIB on the D3186 rear panel to GPIB on the D3286 rear panel

(2) Make the following D3186 panel settings.

CLOCK RATE:	Any frequency
OUTPUT MODE - DATA:	TO 0 V
DATA OFFSET MODE:	MIDDLE
DATA OFFSET:	-0.50 V
DATA AMPLITUDE:	1.00 V_{P-P}
DATA C - P ADJ:	OFF
ERROR ADDITION:	OFF
GP-IB MASTER:	ON

(3) Make the following D3286 panel settings.

TERMINATOR - CLOCK:	TO 0 V
TERMINATOR - DATA:	TO 0 V
INPUT POLARITY:	NORMAL (INVERSE for testing $\overline{\text{DATA}}$ output of the D3186)
THRESHOLD LEVEL:	-0.500 V
MEASUREMENT:	ERROR RATE
MEASUREMENT MODE:	TOTAL
CURRENT DATA:	ON
IMMEDIATE:	ON
MEASUREMENT TIME:	NORMAL
EXTERNAL GATE:	OFF (INT)
AUTO SYNC:	ON

BUZZER - DATA:	ON
BUZZER - ALARM:	ON
TIMER MODE:	UNTIMED
GP-IB SLAVE:	ON

9.1.2 Checking the Frequency

(1) Make the following D3286 panel settings.
MEASUREMENT: FREQ (MHz)

(2) Press the START key on the D3286 panel to start measurement.
If the value which is almost the same as the frequency set with D3186 CLOCK RATE is displayed on the D3286 measurement result indicator, the frequency is evaluated as normal.

9.1.3 Checking the PRBS Pattern

(1) Make the following D3186 panel settings.

PATTERN MODE:	PRBS
PRBS 2^N-1:	Arbitrary
MARK RATIO:	1/2

Make sure that the settings on the pattern setting section of the D3286 error detector are the same as those of the D3186 pulse pattern generator.

(2) Make the following D3286 panel settings.
MEASUREMENT: ERROR RATE

(3) Press the AUTO SEARCH key on the D3286 panel. The optimum threshold level of data entry and the optimum delay amount of clock input are searched for automatically. During the search operation, the following message is displayed on the measurement result indicator.

SEArCH

When the optimum value is found, this message disappears.

(4) Press the START key on the D3286 panel to start measurement.
If the measurement result of error rate is 0.0000E-x (x depends on the condition), the PRBS pattern is evaluated as normal.

(5) Make the following D3186 panel settings.
ERROR ADDITION: REPEAT 1×10^{-4}

(6) Make sure that the DATA ERROR indicator of the D3286 goes on, the buzzer sounds, and the measurement result of the error rate becomes approx. 1.0000E-4.

(7) Make the following D3186 panel settings.
ERROR ADDITION: OFF

(8) Make sure that the measurement result of the error rate is 0.0000E-x (x depends on the condition) even if the following settings of the D3186 are changed.
PRBS 2^N-1: Arbitrary
MARK RATIO: 1/8 to 7/8
However, when the above settings are changed, a SYNC ERROR occurs and measurement is canceled.
If the SYNC ERROR is recovered, measurement result becomes zero; otherwise, press the AUTO SEARCH key on the D3286 panel.

9.1.4 Checking the WORD Pattern

(1) Make the following D3186 panel settings.

PATTERN MODE:	WORD
ALTERNATE:	OFF
POLARITY:	Arbitrary
PATTERN LENGTH:	Arbitrary
Pattern :	Arbitrary

Using the master slave function, make sure that the settings on the pattern setting section of the D3286 error detector are the same as those of the D3186 pulse pattern generator.

(2) Make the following D3286 panel settings.
MEASUREMENT: ERROR RATE

(3) Press the AUTO SEARCH key on the D3286 panel. The optimum threshold level of data entry and the optimum delay amount of clock input are searched for automatically. During the search operation, the following message is displayed on the measurement result indicator.
SEArCH
When the optimum value is found, this message disappears.

If the contents of the pattern set in step (1) (ratio of 0s to 1s) is too large or too small, no optimum value is found and the following message is displayed on the measurement result indicator.

not Found

In this case, change the contents of the pattern so that the marking ratio (ratio of 1s to all bits) falls within 1/8 to 7/8.

(4) Press the START key on the D3286 panel to start measurement.
If the measurement result of error rate is 0.0000E-x (x depends on the condition), the WORD pattern is evaluated as normal.

(5) Make the following D3186 panel settings, then make sure that the measurement result of error rate is 0.0000E-x (x depends on the condition).
POLARITY: Arbitrary
PATTERN LENGTH: Arbitrary
Pattern : Arbitrary
However, when the above settings are changed, a SYNC ERROR occurs and measurement is canceled.
If the SYNC ERROR is recovered, measurement result becomes zero; otherwise, press the AUTO SEARCH key on the D3286 panel.

9.2 Checking Specifications

This section discusses the procedure for checking output waveform of the D3286 using an oscilloscope. Prepare an oscilloscope with calibrated an input impedance of 50 Ω and a bandwidth which is wide enough with respect to waveforms under measurement. For example, to observe data monitor output waveform with 12 Gb/s, an oscilloscope with a bandwidth of at least 20 GHz (40 GHz ideally) is required.
Use the supplied coaxial cable to connect the D3286 and an oscilloscope and a connector adapter as required.
See section 9.1.1 for details on connection of the D3186 and the D3286 and their basic settings.

9.2.1 Checking the 1/32 CLK TRIGGER Output Signal

This section describes the procedure for checking the 1/32 CLK TRIGGER (1/32-dividing clock) signal.
The 1/32 CLK TRIGGER signal is output from the TRIGGER OUTPUT connector on the front panel.

(1) Make the following oscilloscope settings:

Input impedance:	50 Ω
Input coupling:	DC
Vertical scale:	0.5 V/div
Vertical offset:	-0.5 V (center voltage)
Horizontal scale:	5 ns/div
Trigger mode:	AUTO
Trigger source:	CH1
Trigger coupling:	DC
Trigger input impedance:	50 Ω
Trigger level:	-0.5 V

(2) Make the following D3186 panel settings.

RATE:	12000 MHz
PATTERN MODE:	PRBS
PRBS 2^N-1:	Arbitrary
MARK RATIO:	1/2

Using the master slave function, make sure that the settings on the pattern setting section of the D3286 error detector are the same as those of the D3186 pulse pattern generator.

(3) Make the following D3286 panel settings.
TRIGGER OUTPUT: 1/32 CLK

(4) Connect the TRIGGER OUTPUT connector (③ in Figure 2-2) on the D3286 panel and the CH1 input connector of the oscilloscope.

(5) If the waveform on the oscilloscope is a square wave which is similar to the one shown in Figure 9-1, the 1/32 CLK TRIGGER signal is evaluated as normal.

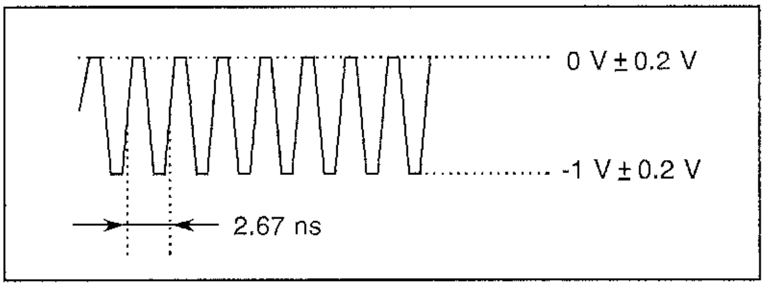


Figure 9-1 Waveform of the 1/32 CLK TRIGGER Output Signal (f = 12000 MHz)

9.2.2 Checking the PATTERN TRIGGER Output Signal

This section describes the procedure for checking the PATTERN TRIGGER (pattern synchronization) signal.
The PATTERN TRIGGER signal is output from the TRIGGER OUTPUT connector on the front panel. The period of this signal depends on the pattern mode.

(a) Checking the PATTERN TRIGGER output in the pseudo-random (PRBS) mode

(1) Make the following oscilloscope settings:

Input impedance:	50 Ω
Input coupling:	DC
Vertical scale:	0.5 V/div
Vertical offset:	-0.5 V (center voltage)
Horizontal scale:	5 ns/div
Trigger mode:	AUTO
Trigger source:	CH1
Trigger coupling:	DC
Trigger input impedance:	50 Ω
Trigger level:	-0.5 V
Trigger polarity:	Rising

(2) Make the following D3186 panel settings.

RATE: 12000 MHz
PATTERN MODE: PRBS
PRBS 2^N-1: 23
MARK RATIO: 1/2

Using the master slave function, make sure that the settings on the pattern setting section of the D3286 error detector are the same as those of the D3186 pulse pattern generator.

(3) Make the following D3286 panel settings.

TRIGGER OUTPUT: PATTERN

(4) Connect the TRIGGER OUTPUT connector (③ in Figure 2-2) on the D3286 panel and the CH1 input connector of the oscilloscope.

(5) Press the AUTO SEARCH key on the D3286 panel. The optimum threshold level of data entry and the optimum delay amount of clock input are searched for automatically. During the search operation, the following message is displayed on the measurement result indicator.

SEArCH

When the optimum value is found, this message disappears.

(6) If the waveform on the oscilloscope is a square wave which is similar to the one shown in Figure 9-2, the PATTERN TRIGGER signal is evaluated as normal.

The pulse width is represented by the following expression.

PATTERN TRIGGER pulse width (PRBS) = 32 ÷ (Clock frequency)

If the number of triggers supplied to the oscillator is low and the observed waveform is faint, set a longer time (DISPLAY TIME or PERSIST TIME) of the oscillator.

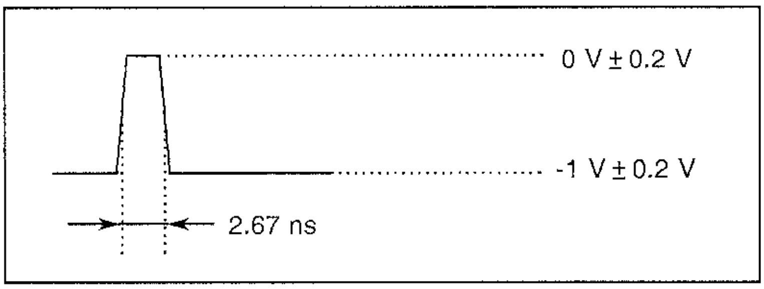


Figure 9-2 Waveform of the PATTERN TRIGGER Output Signal (f = 12000 MHz, 5 ns/div)

(7) Make the following oscilloscope setting.
Horizontal scale: 5 ms/div
(Leave other settings unchanged.)

(8) If the waveform on the oscilloscope has the period shown in Figure 9-3, the PATTERN TRIGGER signal is evaluated as normal.
The period is represented by the following expression.
PATTERN TRIGGER period (PRBS) = $(2^N-1) \times 32 \div$ (Clock frequency)
However, N is the PRBS step number. In case of $N<15$, the WORD equation is applied to it.

If the number of triggers supplied to the oscillator is low and the observed waveform is faint, set a longer time (DISPLAY TIME or PERSIST TIME) of the oscillator.

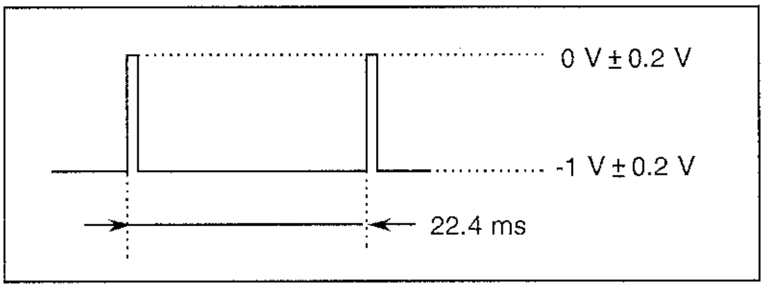


Figure 9-3 Waveform of the PATTERN TRIGGER Output Signal (PRBS, N = 23, f = 12000 MHz, 5 ms/div)

(b) Checking the PATTERN TRIGGER output in the WORD mode

(1) Make the following oscilloscope settings:

Input impedance:	50 Ω
Input coupling:	DC
Vertical scale:	0.5 V/div
Vertical offset:	-0.5 V (center voltage)
Horizontal scale:	5 ns/div
Trigger mode:	AUTO
Trigger source:	CH1
Trigger coupling:	DC
Trigger input impedance:	50 Ω
Trigger level:	-0.5 V
Trigger polarity:	Rising

(2) Make the following D3186 panel settings.

RATE:	12000MHz
PATTERN MODE:	WORD
POLARITY:	NORMAL
ALTERNATE:	OFF
Group :	PATT DATA
EDIT:	ON
ITEM:	PATTERN LENGTH
Pattern Length (PL):	3 (bits)
ITEM:	ADDRESS
Address:	0
Pattern:	010

Using the master slave function, make sure that the settings on the pattern setting section of the D3286 error detector are the same as those of the D3186 pulse pattern generator.

(3) Make the following D3286 panel settings.
TRIGGER OUTPUT: PATTERN

(4) Connect the TRIGGER OUTPUT connector (③ in Figure 2-2) on the D3286 panel and the CH1 input connector of the oscilloscope.

(5) Press the AUTO SEARCH key on the D3286 panel. The optimum threshold level of data entry and the optimum delay amount of clock input are searched for automatically. During the search operation, the following message is displayed on the measurement result indicator.

SEArCH

When the optimum value is found, this message disappears.

(6) If the waveform on the oscilloscope is a square wave which is similar to the one shown in Figure 9-2, the PATTERN TRIGGER signal is evaluated as normal.
The pulse width is represented by the following expression.
PATTERN TRIGGER pulse width (WORD) = 32 ÷ (Clock frequency)

(7) Make the following oscilloscope setting.
Horizontal scale: 20 ns/div
(Leave other settings unchanged.)

(8) If the waveform on the oscilloscope has the period which is similar to the one shown in Figure 9-4, the PATTERN TRIGGER signal is evaluated as normal.
The period is represented by the following expression.
PATTERN TRIGGER period (WORD) = (Least common multiple of the pattern length and 256) × N ÷ (Clock frequency)
(N = 2 when the pattern length is 3 bits.)

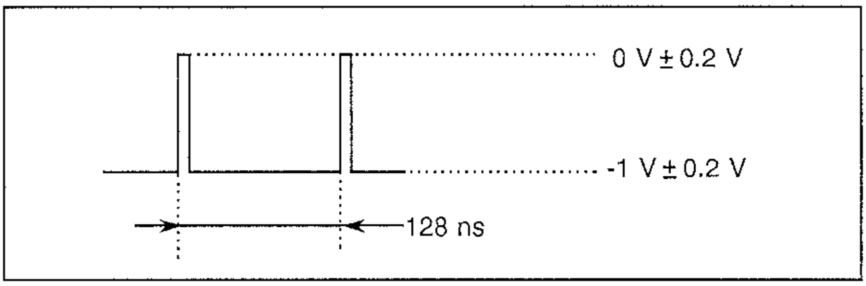


Figure 9-4 Waveform of the PATTERN TRIGGER Output Signal
(WORD, PL = 3, f = 12000 MHz, 20 ns/div)

9.2.3 Checking the CLOCK MONITOR Output Signal

This section describes the procedure for checking the CLOCK MONITOR signal.
The CLOCK MONITOR signal is output from the CLOCK MONITOR OUTPUT connector on the front panel.

(1) Make the following oscilloscope settings:

Input impedance:	50 Ω
Input coupling:	DC
Vertical scale:	0.5 V/div
Vertical offset:	0 V (center voltage)
Horizontal scale:	20 ps/div
Trigger mode:	AUTO
Trigger source:	EXTERNAL
Trigger coupling:	DC
Trigger input impedance:	50 Ω
Trigger level:	-0.5 V

(2) Make the following D3186 panel settings.

RATE: 12000 MHz
PATTERN MODE: PRBS
PRBS 2^N-1: Arbitrary
MARK RATIO: 1/2
TRIGGER OUTPUT: 1/32 CLK

Using the master slave function, make sure that the settings on the pattern setting section of the D3286 error detector are the same as those of the D3186 pulse pattern generator.

(3) Connect the TRIGGER OUTPUT connector on the D3186 panel and the trigger input connector of the oscilloscope.

(4) Connect the CLOCK MONITOR connector (④ in Figure 2-2) on the D3286 panel and the CH1 input connector of the oscilloscope.

(5) If the waveform on the oscilloscope is a square wave which is similar to the one shown in the upper half of Figure 9-5, the CLOCK MONITOR signal is evaluated as normal.

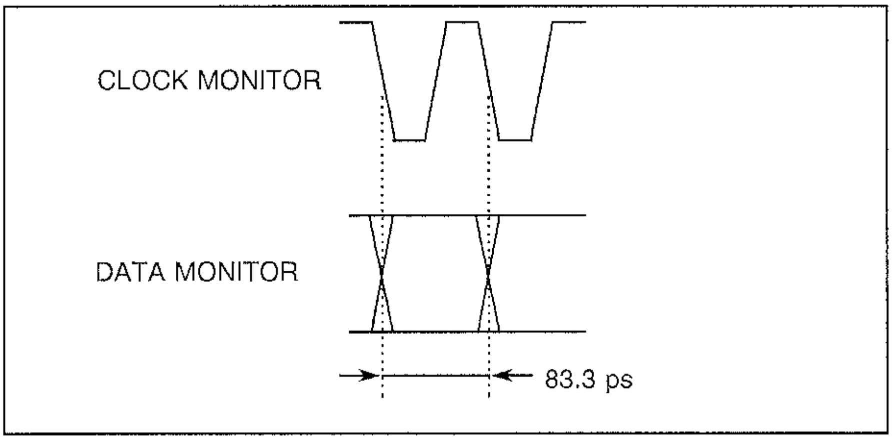


Figure 9-5 Waveform of the CLOCK MONITOR and DATA MONITOR Output Signals (f = 12000 MHz)

9.2.4 Checking the DATA MONITOR Output Signal

This section describes the procedure for checking the DATA MONITOR output signal.
The DATA MONITOR signal is output from the DATA MONITOR OUTPUT connector on the front panel.

(1) Make the following oscilloscope settings:

Input impedance:	50 Ω
Input coupling:	DC
Vertical scale:	0.5 V/div
Vertical offset:	0 V (center voltage)
Horizontal scale:	20 ps/div
Trigger mode:	AUTO
Trigger source:	EXTERNAL
Trigger coupling:	DC
Trigger input impedance:	50 Ω
Trigger level:	-0.5 V

(2) Make the following D3186 panel settings.

RATE:	12000 MHz
PATTERN MODE:	PRBS
PRBS 2N-1:	23
MARK RATIO:	1/2
TRIGGER OUTPUT:	1/32 CLK

Using the master slave function, make sure that the settings on the pattern setting section of the D3286 error detector are the same as those of the D3186 pulse pattern generator.

(3) Connect the TRIGGER OUTPUT connector (③ in Figure 2-2) on the D3186 panel and the trigger input connector of the oscilloscope.

(4) Connect the DATA MONITOR connector (⑤ in Figure 2-2) on the D3286 panel and the CH1 input connector of the oscilloscope.

(5) Press the AUTO SEARCH key on the D3286 panel. The optimum threshold level of data entry and the optimum delay amount of clock input are searched for automatically. During the search operation, the following message is displayed on the measurement result indicator.

SEArCH

When the optimum value is found, this message disappears.

(6) If the waveform on the oscilloscope is an eye pattern which is similar to the one shown in the lower half of Figure 9-5, the DATA MONITOR output signal is evaluated as normal.
However, the relationship between phases of the CLOCK MONITOR and DATA MONITOR signals depends on the delay setting.

9.2.5 Checking the DIRECT ERROR Output Signal

This section describes the procedure for checking the DIRECT ERROR output signal.
The DIRECT ERROR signal is output from the DIRECT ERROR OUTPUT connector on the rear panel.

(1) Make the following oscilloscope settings:

Input impedance:	50 Ω
Input coupling:	DC
Vertical scale:	0.5 V/div
Vertical offset:	-0.5 V (center voltage)
Horizontal scale:	5 ns/div
Trigger mode:	AUTO
Trigger source:	CH1
Trigger coupling:	DC
Trigger input impedance:	50 Ω
Trigger level:	-0.5 V
Trigger polarity:	Rising

(2) Make the following D3186 panel settings.

RATE:	1000 MHz
PATTERN MODE:	PRBS
PRBS 2^N-1:	23
MARK RATIO:	1/2
ERROR ADDITION:	REPEAT 1×10^{-4}

Using the master slave function, make sure that the settings on the pattern setting section of the D3286 error detector are the same as those of the D3186 pulse pattern generator.

(3) Connect the DIRECT ERROR OUTPUT connector (⑬ in Figure 2-7) on the D3286 panel and the CH1 input connector of the oscilloscope.

(4) Press the AUTO SEARCH key on the D3286 panel. The optimum threshold level of data entry and the optimum delay amount of clock input are searched for automatically. During the search operation, the following message is displayed on the measurement result indicator.

SEArCH

When the optimum value is found, this message disappears.

(5) If the waveform on the oscilloscope is a square wave which is similar to the one shown in Figure 9-6, the DIRECT ERROR output signal is evaluated as normal.

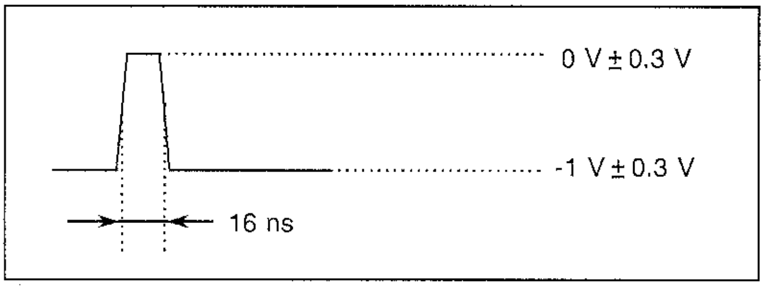


Figure 9-6 Waveform of the DIRECT ERROR Output Signal
(f = 1000 MHz, 5 ns/div)

9.2.6 Checking the STRETCHED ERROR Output Signal

This section describes the procedure for checking the STRETCHED ERROR output signal.
The STRETCHED ERROR signal is output from the STRETCHED ERROR OUTPUT connector on the rear panel.

(1) Make the following oscilloscope settings:

Input impedance:	50 Ω
Input coupling:	DC
Vertical scale:	2 V/div
Vertical offset:	+2 V (center voltage)
Horizontal scale:	50 ns/div
Trigger mode:	AUTO
Trigger source:	CH1
Trigger coupling:	DC
Trigger input impedance:	500 Ω or more
Trigger level:	+1.5 V
Trigger polarity:	Rising

(2) Make the following D3186 panel settings.

RATE:	1000 MHz
PATTERN MODE:	PRBS
PRBS 2^N-1:	23
MARK RATIO:	1/2
ERROR ADDITION	REPEAT 1×10^{-4}

Using the master slave function, make sure that the settings on the pattern setting section of the D3286 error detector are the same as those of the D3186 pulse pattern generator.

(3) Connect the STRETCHED ERROR OUTPUT connector (⑫ in Figure 2-7) on the D3286 panel and the CH1 input connector of the oscilloscope.

(4) Press the AUTO SEARCH key on the D3286 panel. The optimum threshold level of data entry and the optimum delay amount of clock input are searched for automatically. During the search operation, the following message is displayed on the measurement result indicator.

SEArCH

When the optimum value is found, this message disappears.

(5) If the waveform on the oscilloscope is a square wave which is similar to the one shown in Figure 9-7, the STRETCHED ERROR output signal is evaluated as normal.

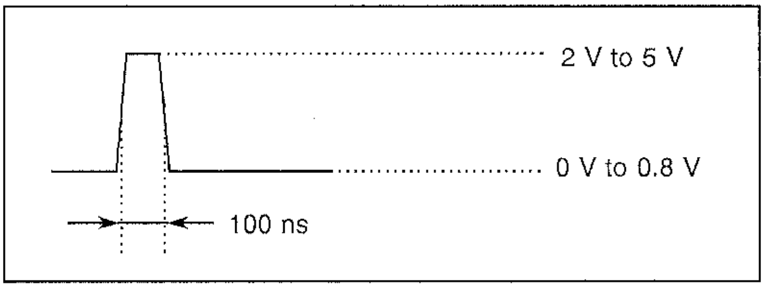


Figure 9-7 Waveform of the STRETCHED ERROR Output Signal (f = 1000 MHz, 50 ns/div)

9.3 Calibration

ADVANTEST Calibration Center takes on the task of calibrating the user's instrument. ADVANTEST recommends that the instrument be calibrated once a year. For details on calibration, contact ADVANTEST sales offices.

10. SPECIFICATIONS

10.1 Operating Frequency

- Operating frequency range: 150 MHz to 12 GHz
  150 MHz to 12.5 GHz (Option 72)

10.2 Measurement Functions

- Basic measurement functions: Simultaneous measurement with six functions, selective display of one function

  Error rate measurement
  Error count measurement
  Error interval measurement
  Error free interval measurement
  Frequency measurement
  Frame count measurement;
  Frame count measurement is possible when the pattern mode is FRAME, the payload format is WORD or PRBS, and the measurement time mode is FR.TIME or FR.INTV.

- Display format: Simultaneous measurement

  Error rate measurement (Fixed to one type.)
  Exponential format; Displays the ratio of the error bit count to the input bit count, with a mantissa of up to five digits and an exponent part.
  Error count measurement (One out of two types is selected and displayed.)
  Exponential format; Displays the error bit count, with a mantissa of up to five digits and an exponent part.
  Integer format; Displays the lowest eight digits of the error bit count, with an integer.
  Error interval measurement (One out of two types is selected and displayed.)
  % format; Displays the ratio of the error interval count to the measured interval count, in the form of percentage with an integer part of up to three digits and four decimal places.
  Interval count format; Displays the error interval count, with a mantissa of up to five digits and an exponent part.
  Error free interval measurement (One out of two types is selected and displayed.)
  % format; Displays the ratio of the error free interval count to the measured interval count, in the form of percentage with an integer part of up to three digits and four decimal places.
  Interval count format; Displays the error free interval count, with a mantissa of up to five digits and an exponent part.

Frequency measurement (Fixed to one type.)

Fixed-decimal format; Displays the frequency of the input clock in MHz unit, with an integer part of up to five digits and three decimal places.

Frame count measurement (Fixed to one type.)

Exponential format; Displays the value obtained by converting the input bit count into the frame count, with a mantissa of up to five digits and an exponent part.

- Measurement display range :

Error rate measurement;	0.0000×10^{-18} to 9.9999×10^{-1}
Error count measurement;	$0. \times 10^{0}$ to 9.9999×10^{18} (Exponential format)
	0 to 99999999 (Integer format)
Error interval measurement;	0.0000% to 100.0000% (% format)
	$0. \times 10^{0}$ to 4.2949×10^{9} (Interval format)
Error free interval measurement;	0.0000% to 100.0000% (% format)
	$0. \times 10^{0}$ to 4.2949×10^{9} (Interval format)
Frequency measurement;	150.000 MHz to 12800.000 MHz (Without overflow display)
Frame count measurement;	$0. \times 10^{0}$ to 9.9999×10^{18}

- Error measurement mode: Three groups can be selected, three types can be measured at the same time for each group, one type is selected and displayed

Omission/insertion group

OMISSION; Displays the measured value for an OMISSION error with which logic 0 is input when logic 1 is expected.

INSERTION; Displays the measured value for an INSERTION error with which logic 1 is input when logic 0 is expected.

TOTAL; Displays the sum of the measured value for OMISSION and INSERTION errors.

Overhead/payload group

Can be selected only in the FRAME pattern mode.

OVERHEAD; Displays the measured value for an error in the OVERHEAD section.

PAYLOAD; Displays the measured value for an error in the PAYLOAD section.

ALL; Displays the sum of the measured value for errors in the OVERHEAD and PAYLOAD sections.

Specific area groups

Can be selected only in the WORD or FRAME pattern mode.

SPECIFIC FIELD; Displays the measured value for an error inside the specified area.

OTHER FIELD; Displays the measured value for an error outside the specified area.

ALL; Displays the sum of the measured value for errors inside and outside the specified area.

- Intermediate result display: Can be turned on or off.

  Error rate measurement (One out of two types is selected and displayed.)

  Accumulated value; Calculated from the input bit and error bit counts measured since the measurement start point.

  Section value; Calculated from the input bit and error bit counts within the measurement period.

  Error count measurement (One out of two types is selected and displayed.)

  Accumulated value; Displays the error bit count measured since the measurement start point.

  Section value; Displays the error bit count within the measurement period.

  Error interval measurement (Fixed to one type.)

  Accumulated value; Calculated from the error interval count measured since the measurement start point and then displayed.

  Error free interval measurement (Fixed to one type.)

  Accumulated value; Calculated from the error free interval count measured since the measurement start point and then displayed.

  Frequency measurement (Fixed to one type.)

  Section value; Calculated from the input clock count within in 0.1 seconds and then displayed.

  Frame count measurement (One out of two types is selected and displayed.)

  Accumulated value; Displays the frame count measured since the measurement start point.

  Section value; Displays the frame count within the measurement period.

- Error rate threshold for error interval and error free interval measurement can be selected from the following eight values; >0

  $>1\times10^{-3}$

  $>1\times10^{-4}$

  $>1\times10^{-5}$

  $>1\times10^{-6}$

  $>1\times10^{-7}$

  $>1\times10^{-8}$

  $>1\times10^{-9}$

- Threshold EI/EFI measurement:

    Measurement results can be printed to a printer and stored in files. (Measured at the same time as execution of the basic measurement function.)

  Error rate threshold can be selected from the following eight values;

    $>1\times10^{-3}$ to $\geqq 1\times10^{-9}$
    $>1\times10^{-4}$ to $\geqq 1\times10^{-10}$
    $>1\times10^{-5}$ to $\geqq 1\times10^{-11}$
    $>1\times10^{-6}$ to $\geqq 1\times10^{-12}$
    $>1\times10^{-7}$ to $\geqq 1\times10^{-13}$

- Error performance measurement:

    Measurement results can be printed to a printer and stored in files.

  The following five items can be measured at the same time as execution of the basic measurement function.

    Errored seconds (ES)
    Error free seconds (EFS)
    Severely errored seconds (SES)
    Unavailable seconds (US)
    Degraded minutes (DM)

  Output format

    Seconds and minutes format;
    Displays the error time, with a mantissa of up to five digits and an exponent part.

    % format; Displays the ratio of the error time to the measured time, in the form of percentage with an integer part of up to three digits and four decimal places.

  Error rate threshold for SES, US, and DM;

SES and US	DM
$>1\times10^{-3}$,	$>1\times10^{-6}$
$>1\times10^{-4}$,	$>1\times10^{-8}$
$>1\times10^{-5}$,	$>1\times10^{-10}$

- Measurement control:

START;	Starts, stops, and restarts simultaneous measurement of all measurement functions. Measurement can be started by means of the front panel keys, GPIB interface, or an external gate input signal. The start command also functions as the reset command for the history function.
STOP;	Stops simultaneous measurement of all measurement functions. Measurement can be stopped by means of the front panel keys, GPIB interface, built-in timer, or an external gate input signal.

- Measurement time mode can be selected from one of the following four modes:

NORMAL;	Sets the measurement interval in units of seconds and measurement period in units of days, hours, minutes, and seconds. The time between the start and stop measurement points is recognized as one continuous interval. Measurement is interrupted during occurrence of an alarm.
FR.TIME;	Can be selected only in the FRAME pattern mode. Sets the measurement interval in units of frame count and measurement period in units of days, hours, minutes, and seconds. The time between the start and stop measurement points is recognized as one continuous interval. Measurement is interrupted during occurrence of an alarm.
FR.INTV;	Can be selected only in the FRAME pattern mode. Sets the measurement interval in units of frame count and measurement period in units of days, hours, minutes, and seconds. The time between the start and stop points is recognized as one continuous interval. Measurement is interrupted during occurrence of an alarm.
BURST;	Each time pattern synchronization is established during the time between the start and stop points, measurement is performed during the time set by the burst timer or the time specified by the external gate input signal. Measurement is interrupted during occurrence of an alarm. In this mode, only the error rate and error count are measured and the timer mode becomes UNTIMED.

- Pattern synchronization:

Automatic synchronization;	Can be turned on or off. When ON, re-synchronization is made automatically when the error rate exceeds the predefined value.
Frame synchronization;	Can be turned on or off in the FRAME pattern mode. In the PRBS or WORD pattern mode, can only be turned off. When ON, the specified hunting pattern is searched for to perform high-speed pattern synchronization.
Re-synchronization;	Can be specified by the front panel keys or the GPIB interface.

- Measurement status indicators:

GATE;	Goes on during measurement.
OVER;	Goes on if an overflow of measurement results occurs.

- Error alarm indicators:

DATA error;	Goes on if one or more erroneous bits are detected. Goes off when the error is recovered.
CLOCK error;	Goes on if the input clock is interrupted or if the frequency is too low. Goes off when the input clock is supplied properly.
SYNC error;	Goes on if out of pattern synchronization occurs. Goes off if pattern synchronization is established.

- History display indicators:

POWER failure;	If power failure occurs during measurement, goes on upon recovery of the power. Goes off when the next measurement is started.
CLOCK error;	Goes on if the input clock is interrupted or if the frequency is too low. Goes off when the error is recovered and the next measurement is started.
SYNC error;	Goes on if out of pattern synchronization occurs. Goes off when the error is recovered and the next measurement is started.

- Buzzer:

Error;	Sounds if a DATA error occurs. The error buzzer can be turned on or off. The sound volume is variable, which is common to alarms.
Alarm;	Sounds if a CLOCK or SYNC error occurs. The error buzzer can be turned on or off. The sound volume is variable, which is common to alarms.

10.3 Input Signals for Measurement

- Data input:

Input format;	DC termination, DC coupling
Sign;	NRZ
Polarity;	Logic inversion possible.
Amplitude;	0.1 Vp-p to 2 Vp-p
Threshold level;	-2.040 V to +2.040 V in 0.001V steps (with a terminating voltage of 0 V) -1.850 V to -0.750 V in 0.001V steps (with a terminating voltage of -2 V)
Terminating voltage;	-2 V / 0 V (GND)
Input impedance;	Approx. 50 Ω
Connector;	2.92mm (Plug)

- Clock input:

Input format;	DC termination, AC coupling
Duty;	50% ± 5%
Polarity;	Recognized at the rising edge.
Variable delay amount;	-400 ps to +400 ps in 1-ps steps with respect to data (at monitor output)
Amplitude;	0.5 to 2 Vp-p
Terminating voltage;	-2 V / 0 V (GND) (Can be set independently of the terminating voltage of data input)
Input impedance;	Approx. 50 Ω
Connector;	2.92mm (Plug)
Input waveform;	Sinusoidal wave or rectangular wave

- Auto search function:

  The optimum threshold level of data entry and the optimum delay amount of clock input are searched for automatically.

10.4 Auxiliary Output Signals

- Monitor output:

Data monitor;	Data input is output through an amplifier.
Load impedance;	50 Ω with respect to 0 V
Connector;	2.92mm (Plug)
Output voltage;	No setting
Clock monitor;	Clock input is output through an amplifier and variable delay line.
Load impedance;	50 Ω with respect to 0 V
Connector;	2.92mm (Plug)
Output voltage;	No setting

- Error output:

Direct output	
Rate;	1/32 times the clock input
Signal form;	Logical sum of 32 phases
Sign;	RZ
Output voltage;	High level: -0.0 ± 0.3 V
	Low level: -1.0 ± 0.3 V
Load impedance;	50 Ω with respect to 0 V
Connector;	SMA (Jack)
Stretched output	
Level;	TTL positive pulse
Pulse width;	Approx. 100 ns
Load impedance;	50 Ω with respect to 0 V
Connector;	BNC (Jack)

- Trigger signal output:

Output signal;	Clock synchronization or pattern synchronization selectable
Clock synchronization;	Outputs frequency which is 1/32 times the clock frequency
Pattern synchronization;	Output position can be changed in 16-bit units.
Output level;	High level: 0 V $\pm$ 0.2 V
	Low level: -1 V $\pm$ 0.2 V
Load impedance;	50 Ω with respect to 0 V
Connector;	SMA (Jack)

10.5 Control Input Signals

- External gate input:

Function;	Controls start and stop of measurement.
Input level;	0 V / -1 V
Load impedance;	50 Ω with respect to 0 V
Connector;	BNC (Jack)
Rise/fall time;	10 ns or less

- External alternate input:

Function;	Switches between patterns A and B in alternate mode. High level select pattern A and low level pattern B.
Input level;	0 V / -1 V
Input pulse width;	1 s or more
Rising/falling time;	10 ns or less
Input impedance;	Approx. 50 Ω with respect to 0 V
Connector;	BNC (Jack)

10.6 Pattern

- Pattern mode is selected from the following three:
  Pseudo-random pattern (PRBS)
  Full programmable pattern (WORD)
  Frame pattern (FRAME)

- PRBS
  Pattern length; 2^N-1, N = 7,9,10,11,15,23,or 31
  Number of stages (N) and generating function;

Number of stages (N)	Generating function	Applied standard
7	X^7+X^6+1	ITU-T recommendation V.29
9	X^9+X^5+1	ITU-T recommendation V.52
10	$X^{10}+X^7+1$	
11	$X^{11}+X^9+1$	ITU-T recommendation 0.152
15	$X^{15}+X^{14}+1$	ITU-T recommendation 0.151
23	$X^{23}+X^{18}+1$	ITU-T recommendation 0.151
31	$X^{31}+X^{28}+1$	

  Marking ratio; Selected from 1/2, 1/4, 1/8, 0/8, 1/2B, 3/4, 7/8, or 8/8. Patterns 1/2B, 3/4, 7/8, and 8/8 are logical inversion of patterns 1/2, 1/4, 1/8, and 0/8, respectively.
  AND bit shift; 1 bit

- WORD
  Pattern length; 1 to 8,388,608 (2^{23}) bits (When alternate mode is off)
  1 to 4,194,304 (2^{22}) bits (When alternate mode is on)

Pattern length variable step;

ALTERNATE	Pattern length (bits)	Step (bits)
OFF	1 to 32,768	1
	32,770 to 65,536	2
	65,540 to 131,072	4
	131,080 to 262,144	8
	262,160 to 524,288	16
	524,320 to 1,048,576	32
	1,048,640 to 2,097,152	64
	2,097,280 to 4,194,304	128
	4,194,560 to 8,388,608	256
ON	1 to 16,384	1
	16,386 to 32,768	2
	32,772 to 65,536	4
	65,544 to 131,072	8
	131,088 to 262,144	16
	262,176 to 524,288	32
	524,352 to 1,048,576	64
	1,048,704 to 2,097,152	128
	2,097,408 to 4,194,304	256

Logical inversion; Possible
Alternate mode; Can be turned on or off.
When on, switchover between patterns A and B is possible.
Switching control; Internal and external switchable
Internal switching; By means of front panel keys and GPIB interface
External switching; By means of an external alternate input signal

- FRAME

Payload format; Can be selected from the following three types.
Full programmable (WORD)
Pseudo-random (Only the overhead section is programmable.) (PRBS)
0/1 continuous pattern + PRBS (CID)
Frame configuration;
When the payload format is WORD or PRBS
Frame count; 1 to 8,192 frames (when alternate mode is off)
1 to 4,096 frames (when alternate mode is on)
In 1-frame steps
Up to the maximum frame count shown below

Maximum frame count;

Byte count / frame = (Line count / frame) × (Byte count / line)

ALTERNATE	Byte count / frame	Maximum frame count
OFF	Multiple of 32	1,048,576 ÷ (Byte count / frame)
	Multiple of 16	524,288 ÷ (Byte count / frame)
	Multiple of 8	262,144 ÷ (Byte count / frame)
	Other than multiple of 8	131,072 ÷ (Byte count / frame)
ON	Multiple of 32	524,288 ÷ (Byte count / frame)
	Multiple of 16	262,144 ÷ (Byte count / frame)
	Multiple of 8	131,072 ÷ (Byte count / frame)
	Other than multiple of 8	65,536 ÷ (Byte count / frame)

Line count / frame; 1 to 16 lines in 1-steps

Byte count / line; 44 to 32,768 bytes

Byte count with variable steps;

ALTERNATE	Byte count / line	Steps (bytes)
OFF	44 to 8,192	4
	8,200 to 16,384	8
	16.400 to 32,768	16
ON	44 to 4,096	4
	4,104 to 8,192	8
	8,208 to 16,384	16
	16,416 to 32,768	32

Overhead byte count / line;

4 to (Byte count for one line) - 40 bytes in 4-byte steps

When the payload format is CID

Byte count / line; 40 to 32768 in 4-byte steps

Overhead byte count / line;

36 to (Byte count for one line) - 4 bytes in 36-byte steps

Bit count for 0/1 continuous pattern;

0 to ((Byte count / line) - (Overhead byte count / line)) × 8 bits in one-bit steps

Number of stages of PRBS;

Seven (Non-continuous section may exist.)

Alternate mode;	Can be turned on or off. (When the payload format is WORD or PRBS.) When on, switchover between patterns A and B is possible.
Switching control;	Internal and external switchable
Internal switching;	By means of front panel keys and GPIB interface
External switching;	By means of the external alternate input signal

10.7 Timer and Clock

- Timer and clock settings:

ELAPSED; Displays the time elapsed since the start of measurement, with a number from 00(DAY)00(HOUR)00(MIN)00(SEC) to 99(DAY)23(HOUR)59(MIN)59(SEC).
When the measurement time mode is FR.INTV, displays the elapsed time with an interval count from 0 to 99999999.

TIMED; Displays the remaining time of measurement, with a number from 00(DAY)00(HOUR)00(MIN)00(SEC) to 99(DAY)23(HOUR)59(MIN)59(SEC).
When the measurement time mode is FR.INTV, displays the remaining time with an interval count from 0 to 99999999.

PERIOD; Displays and sets the measurement time, with a number from 00(DAY) 00(HOUR)00(MIN)00(SEC) to 99(DAY)23(HOUR)59(MIN)59(SEC) in one-second steps.
When 00(DAY)00(HOUR)00(MIN)00(SEC) is set, the measurement time is unlimited.
When the measurement time mode is FR.INTV, displays the measurement time with an interval count from 0 to 99999999.

INTERVAL; Displays and sets the measurement period, with a number from 00(DAY)00(HOUR)00(MIN)01(SEC) to 01(DAY)00(HOUR)00(MIN)00(SEC) in 0.1-second, 0.2-second, 0.5-second, or one-second steps.
When the measurement time mode is FR.TIME or FR.INTV, displays the measurement period with a frame count from 1×10^1 to 99×10^6. (The mantissa and exponent part can be changed in one increments.)

BURST TIME; Displays and sets the measurement time for each burst when the measurement time mode is BURST, with a value from 0 μs to 10 ms in 10 μs steps.
When 0 μs is set, this burst timer is not used.

REAL TIME; Displays and sets the date and time in the form of YY:MM:DD:HH or DD:HH:MM:SS.

- Timer mode:

SINGLE; When the specified measurement period has elapsed since the start of measurement, measurement is stopped.

REPEAT; When the specified measurement period has elapsed since the start of measurement, the present measurement is stopped and the next measurement is started. This process is repeated until the stop command is issued.

UNTIMED; Measurement is continued until the stop command is issued, regardless of the specified measurement period.

- Time reference clock: Internal and external switchable

Internal clock stability;	10 ppm/year
External clock input;	10 MHz, 1 Vp-p, AC-coupling
Connector;	BNC (Jack)

10.8 System Functions

- Printer: Outputs measurement results to external printer.

  External printer interface

  Applied standard; Centronics

  Connector; 36-pin micro ribbon

- File function (with a built-in floppy disk drive)

Function;	Stores, overwrites, reads, deletes, and initializes files.
Storage data;	Operating conditions, pattern contents, and measurement results
Read data;	Operating conditions and pattern contents
Disk used;	3.5-inch floppy disks 720 KB (2DD), 1.2 MB (2HD), 1.4 MB (2HD)
Disk format;	MS-DOS® Rev. 4.0

  File format

  Operating conditions and pattern contents; Unique binary format

  Measurement results; MS-DOS® text format

  ◆ MS-DOS is a registered trademark of Microsoft Inc. of the U.S.A.

- Remote control

Interface;	GPIB (IEEE488-1978)
Interface function;	SH1, AH1, T5, L3, SR1, RL1, PP01, DC1, DT1, C0, and E2
Control;	All front panel settings and read out excluding power on/off, GPIB address, and buzzer sound volume
Data output;	Measurement results and time and clock values
Status read;	Errors, alarm conditions, and presence/absence of measured data (in the form of status byte)

- Master slave function

Function;	When the D3286 error detector is used together with the D3186 pulse pattern generator, associates D3186 and D3286 pattern settings.
Association mode;	Associates D3286 pattern settings with D3186 pattern settings and vice versa.
Connecting method;	Connected with GPIB connectors and a GPIB cable.

- Panel locking;

  All condition settings, excluding power on/off, panel lock on/off, GPIB LOCAL recovery, settings with rear panel DIP switches, buzzer sound volume, can be locked.

10.9 General Specifications

Numeral indicator:	Seven-segment green LED
Condition setting memory:	Retained for more than two weeks after power on for 12 hours (Backed up by a secondary battery.)
Operating temperature:	0°C to +40°C +20°C to +30°C (Option 72)
Operating humidity:	40% to 85% RH
Storage temperature:	-20°C to +60°C
Storage humidity:	30% to 85% RH (Without condensation)
Power supply:	100 VAC - 120 VAC, 220 VAC - 240 VAC (Automatic switching) 50 / 60 Hz, Sine wave
Power dissipation:	500 VA or less
Mass:	35 kg or less
Dimensions:	Approx. 266 (H) × 424 (W) × 550 (D) mm

LIST OF ABBREVIATIONS

[A]

AC: Alternating Current
ASCII: American Standard Code for Information Interchange
ATN: Attention

[C]

CID: Consecutive Identical Digit

[D]

DAV: Data Valid
DC: Direct Current
DCL: Device Clear
DIR: Directory
DM: Degraded Minutes
DOS: Disk Operating System
DUT: Device under Test

[E]

EFI: Error Free Intervals
EFS: Error Free Seconds
EI: Errored Intervals
EOI: End or Identify
ERD: Error Detector
ES: Errored Seconds

[G]

GET: Group Execute Trigger
GPIB: General Purpose Interface Bus

[I]

IEEE: The Institute of Electrical and Electronics Engineers, Ins.
IFC: Interface Clear
ITU-T: International Telecommunication Union - Telecommunication Standardization Sector

[M]

MPU: Micro Processing Unit

[N]

NDAC: Not Data Accepted
NRFD: Not Ready for Data

[P]

PPG:	Pulse Pattern Generator
PRBS:	Pseudo - Random Binary Sequence

[R]

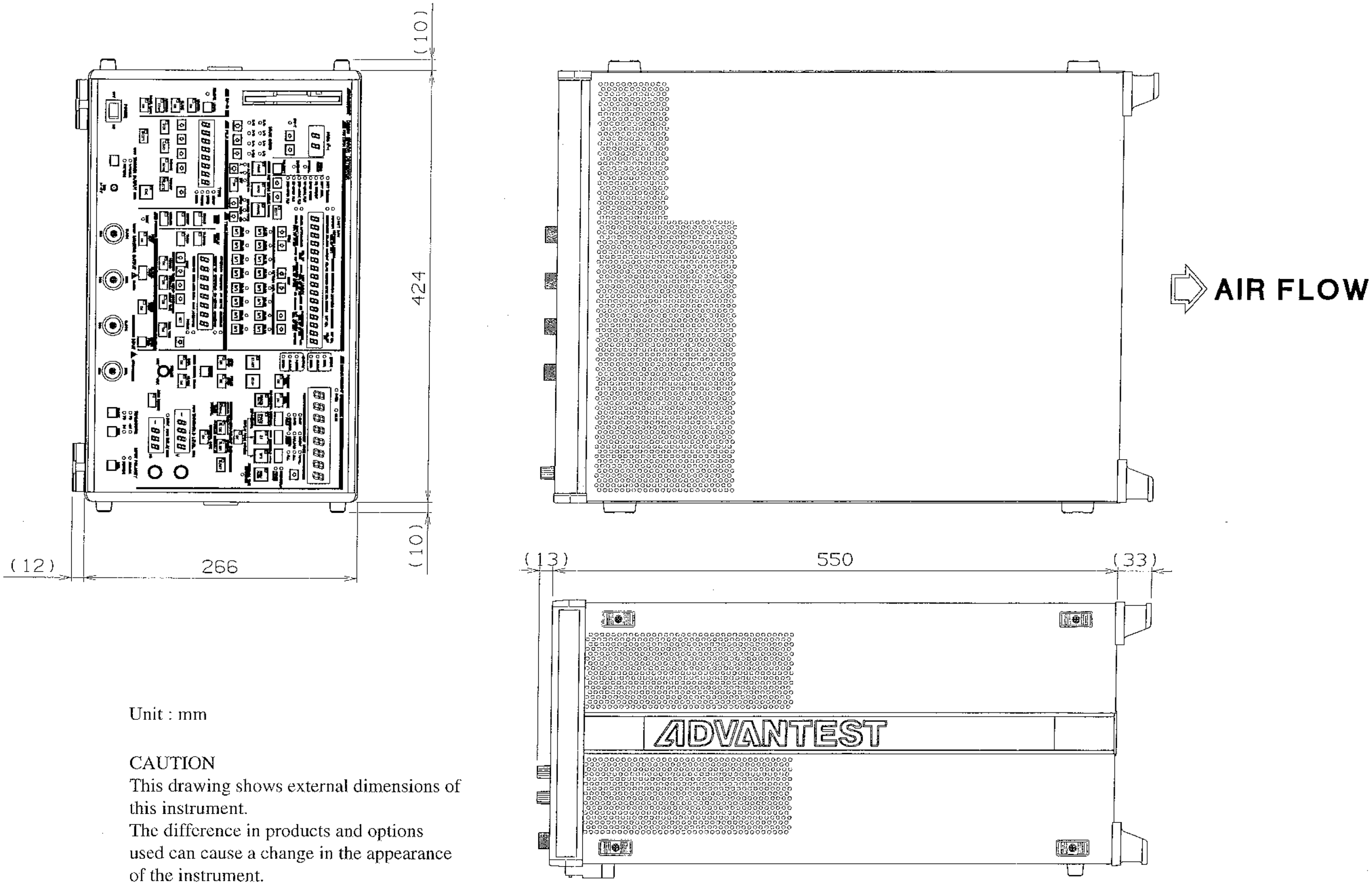
REN:	Remote Enable
RQS:	Request Service

[S]

SDC:	Selected Device Clear
SDH:	Synchronous Digital Hierarchy
SES:	Severely Errored Seconds
SOH:	Section Overhead
SONET:	Synchronous Optical Network
SRQ:	Service Request
STM:	Synchronous Transport Module

[U]

US:	Unavailable Seconds
UUT:	Unit under Test



Unit : mm

CAUTION
This drawing shows external dimensions of this instrument.
The difference in products and options used can cause a change in the appearance of the instrument.

DIMENSIONAL OUTLINE DRAWING

ALPHABETICAL INDEX

[F]

[G]

[H]

[P]

IMPORTANT INFORMATION FOR ADVANTEST SOFTWARE

PLEASE READ CAREFULLY: This is an important notice for the software defined herein. Computer programs including any additions, modifications and updates thereof, operation manuals, and related materials provided by Advantest (hereafter referred to as "SOFTWARE"), included in or used with hardware produced by Advantest (hereafter referred to as "PRODUCTS").

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1. Unless otherwise specifically agreed by Seller and Purchaser in writing, Advantest will warrant to the Purchaser that during the Warranty Period this Product (other than consumables included in the Product) will be free from defects in material and workmanship and shall conform to the specifications set forth in this Operation Manual.

2. The warranty period for the Product (the "Warranty Period") will be a period of one year commencing on the delivery date of the Product.

3. If the Product is found to be defective during the Warranty Period, Advantest will, at its option and in its sole and absolute discretion, either (a) repair the defective Product or part or component thereof or (b) replace the defective Product or part or component thereof, in either case at Advantest's sole cost and expense.

4. This limited warranty will not apply to defects or damage to the Product or any part or component thereof resulting from any of the following:

   (a) any modifications, maintenance or repairs other than modifications, maintenance or repairs (i) performed by Advantest or (ii) specifically recommended or authorized by Advantest and performed in accordance with Advantest 's instructions;

   (b) any improper or inadequate handling, carriage or storage of the Product by the Purchaser or any third party (other than Advantest or its agents);

   (c) use of the Product under operating conditions or environments different than those specified in the Operation Manual or recommended by Advantest, including, without limitation, (i) instances where the Product has been subjected to physical stress or electrical voltage exceeding the permissible range and (ii) instances where the corrosion of electrical circuits or other deterioration was accelerated by exposure to corrosive gases or dusty environments;

   (d) use of the Product in connection with software, interfaces, products or parts other than software, interfaces, products or parts supplied or recommended by Advantest;

   (e) incorporation in the Product of any parts or components (i) provided by Purchaser or (ii) provided by a third party at the request or direction of Purchaser or due to specifications or designs supplied by Purchaser (including, without limitation, any degradation in performance of such parts or components);

   (f) Advantest's incorporation or use of any specifications or designs supplied by Purchaser;

   (g) the occurrence of an event of force majeure, including, without limitation, fire, explosion, geological change, storm, flood, earthquake, tidal wave, lightning or act of war; or

   (h) any negligent act or omission of the Purchaser or any third party other than Advantest.

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6. **THE REMEDY SET FORTH HEREIN SHALL BE THE SOLE AND EXCLUSIVE REMEDY OF THE PURCHASER FOR BREACH OF WARRANTY WITH RESPECT TO THE PRODUCT.**

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CUSTOMER SERVICE DESCRIPTION

In order to maintain safe and trouble-free operation of the Product and to prevent the incurrence of unnecessary costs and expenses, Advantest recommends a regular preventive maintenance program under its maintenance agreement.

Advantest's maintenance agreement provides the Purchaser on-site and off-site maintenance, parts, maintenance machinery, regular inspections, and telephone support and will last a maximum of ten years from the date the delivery of the Product. For specific details of the services provided under the maintenance agreement, please contact the nearest Advantest office listed at the end of this Operation Manual or Advantest 's sales representatives.

Some of the components and parts of this Product have a limited operating life (such as, electrical and mechanical parts, fan motors, unit power supply, etc.). Accordingly, these components and parts will have to be replaced on a periodic basis. If the operating life of a component or part has expired and such component or part has not been replaced, there is a possibility that the Product will not perform properly. Additionally, if the operating life of a component or part has expired and continued use of such component or part damages the Product, the Product may not be repairable. Please contact the nearest Advantest office listed at the end of this Operation Manual or Advantest's sales representatives to determine the operating life of a specific component or part, as the operating life may vary depending on various factors such as operating condition and usage environment.

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