ADVANTEST®
ADVANTEST CORPORATION

D5312B

ISDN TESTER

INSTRUCTION MANUAL

MANUAL NUMBER OED00 9304

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No. ESB002

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.

Careful attention to personal safety should be paid when operating and servicing this instrument. Please be sure to always use this instrument correctly and safely.

■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. Do not place anything heavy on top of the power cable.

- 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.

- Be sure to plug the power cable into an electrical outlet which has a safety ground terminal. Grounding will be defeated if you use an extension cord which does not include a safety 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 objects on top of this 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.

■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.

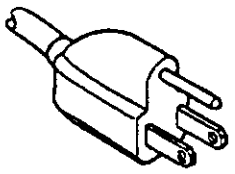
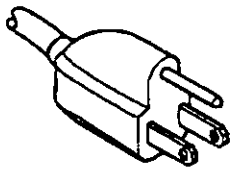
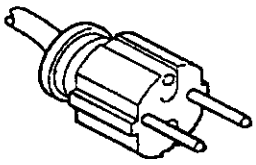
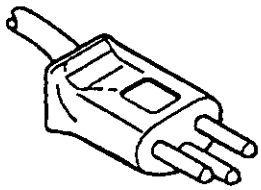
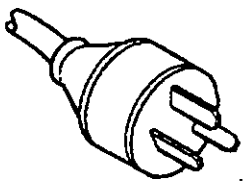
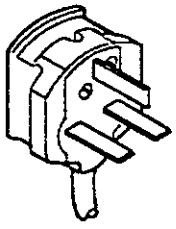
■Precautions when Disposing of this Instrument

When disposing of harmful substances and batteries, 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).

Table of Power Cable options

There are six power cable options (refer to following table).
Order power cable options by Accessory Codes.

	Plug Configuration	Standards	Rationg, Color and Length	Accessory Codes (Option Number)
1		JIS: Japan Law on Electrical Appliances	125V at 7A Black 2m (6ft)	Straight: A01402 (Standard) Angled: A01412
2		UL: United States of America CSA: Canada	125V at 7A Black 2m (6ft)	Straight: A01403 (Option 95) Angled: A01413
3		CEE: Europe VDE: Germany OVE: Austria SEMKO: Sweden DEMKO: Denmark KEMA: Holland FIMKO: Finland NEMKO: Norway CEBEC: Belgium	250V at 6A Gray 2m (6ft)	Straight: A01404 (Option 96) Angled: A01414
4		SEV: Switzerland	250V at 6A Gray 2m (6ft)	Straight: A01405 (Option 97) Angled: A01415
5		SAA: Australia, New Zealand	250V at 6A Gray 2m (6ft)	Straight: A01406 (Option 98) Angled: ———
6		BS: United Kingdom	250V at 6A Black 2m (6ft)	Straight: A01407 (Option 99) Angled: A01417

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1. GENERAL

1.1 Outline of the Tester

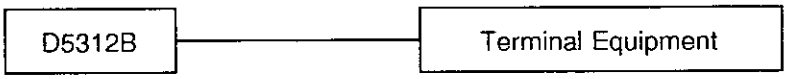
The ISDN tester is intended to determine the electrical characteristics of the network termination (NT) connected to the interface of the ISDN basic user network and the layer 1 of the terminal equipment (TE).
The tester is connected to the interface definition points S and T in the interface I to execute various tests defined in CCITT I.430.

1.2 Test Types

The tester is applied between the points to test the NT or TE.

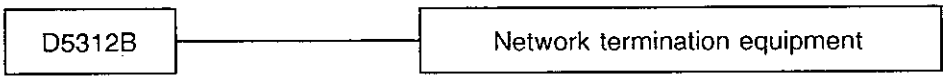
(1) TE test

In the TE test, the D5312B operates as the NT to test the terminal equipment.



(2) NT test

In the NT test, the D5312B operates as the TE to test the network termination equipment.



1.3 Test Functions

Three test functions, ALL, SELECT and SINGLE, can be selected.

ALL : All the items on the menu screen are automatically tested.
SELECT : The items specified on the menu screen are tested.
SINGLE : The only one item selected on the menu screen is tested continuously.

1.4 Before Starting Test

1.4.1 Checking the external view and accessories

Upon receiving the taster package, check the external view of the tester first any scratches or breakage caused during transportation. Then, check the number and specifications of the standard accessories.
If any breakage or missing accessories is found, contact the ATCE or the nearest branch.
Their addresses and telephone numbers are listed at the end of this manual.

Table 1-1 Standard Accessories

Parts name	Specification	Parts code	Q'ty	Remarks
Fuse	218002	DFT-AA2A	1	Timelag2A
Measuring cable	QTC1-001K-6.5WQ	DCB-RR4591X01	1	
AC cable	MP-43 (A01402)	DCB-DD2428X01	1	
Instruction Manual	——	JD5312B	1	Japanese version
	——	ED5312B		English version

1.4.2 Environmental Precautions

(1) Do not use the tester in a dusty place or wher corrosive gas exists, or in a place subject to direct sunlight. The ambient temperature should be with in the range of 0 to 50°C, and the humidity from 20% to 80% (no condensation is allowed).

(2) The cooling ventilator takes in air from the front and sides and blows it out through the rear panel. Place the tester so as not to obstruct this ventilation.

(3) Although the tester is designed to eliminate noise from the AC power source line, use it in place with minimum noise.

(4) Do not use the tester in a place subjecxt to vibration.

(5) The tester CRT display may be come distorted due to external magnetic fields or the earth's magnetism.

(6) Since the tester analog measurement block employs an integrated-type A/D converter, the frequency of the AC power source to be used should be specified from the tester.
If the power source frequency differs from the tester setting, the measurement values obtained may fluctuate.

1.4.3 Power Connection

(1) Connecting the power cable to the tester
Confirm that the POWER switch on the front panel of the tester is OFF and connect the attached power cable to the AC LINE connector on the rear panel.

(2) Power cable and adapter
The power cable plug is a three-pin type, consisting of two flat blades for power connection and the round grounding pin in the center.
When connecting the power cable plug via the adapter to the receptacle, do not forget to connect the grounding line of the adapter, see Fig. (a), or the grounding terminal on the tester's rear panel to an external grounding terminal.
The KPR-18 adapter provided meets Electric Equipment Regulations.

The KPR-18 adapterhas two flat blades A and B of different widths as illustrated in Fig. (b). When inserting the adapter into the receptacle, confirm its direction. If case the KPR-18 cannot be connected to the receptacle, purchase a KPR-13 adapter

Note: Keys and switches located on the front panel of the tester are underlined.

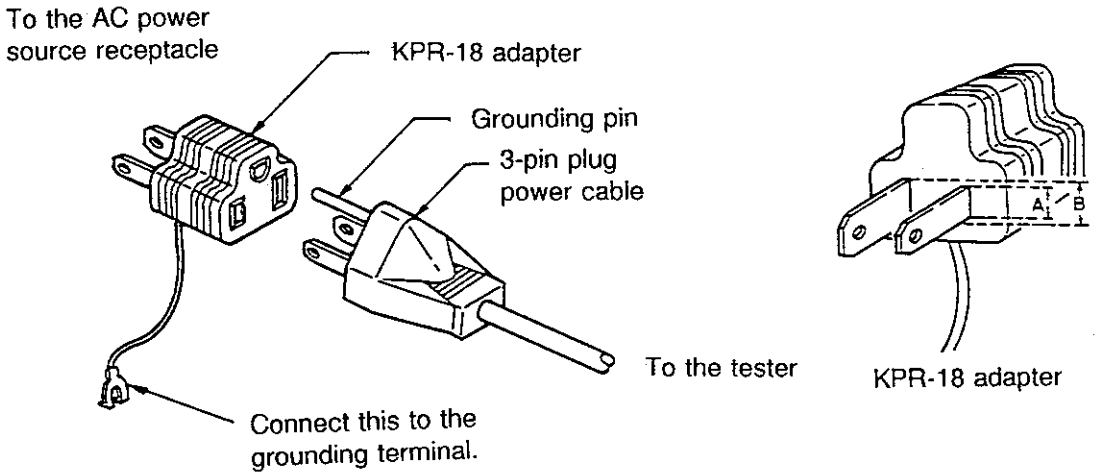


Fig. 1-1 Power Cable Plug and Adapter

1.4.4 Fuse Replacement

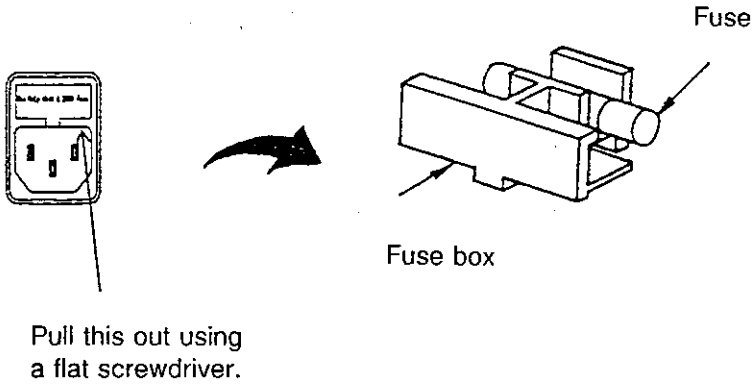


Fig. 1-2 Fuse Replacement

<Basic Procedure>

① Loosen the fuse holder cap with a flat screwdriver and pull the fuse out along with the cap.

② Replace the fuse with a new one.

③ Insert the cap with the new fuse into the holder.

Table 1-2 Fuse Specifications

Specification	Parts code
Time lag 2A	DFT-AA2A

CAUTION

1. When replacing the fuse, do not forget to turn the tester power OFF and disconnect the power cable from the receptacle.
2. The fuse specifications cannot be checked visually. Measure the resistance value and check whether it is 15Ω or below.
3. To eliminate the danger of fire, do not use fuses other than the one provided with the tester or its equivalent.

2. BASIC OPERATIONS

This chapter describes the tester panels, screen menus and basic operations according to the menu specifications.

2.1 Panels

2.1.1 Front Panel

The functions of the front panel keys can be divided into several groups which are referred to as fields below. (The panel keys are underlined.)

(1) EXECUTE field : Makes specifications related to test execution.
- ① START key : Used to start and stop the test. When START is specified, the LED lamp lights, and toggle operation is enabled.
- ② HELP key : HELP function operates on the each screen. During the error bit test, an error is inserted manually.

(2) DISPLAY field : Selects the screen menu.
- ③ SETUP key : The test item select screen appears or the current screen is closed.
- ④ RESULT key : The test results appear on the screen.

(3) MODE field : Selects the test mode.
- ⑤ SINGLE key : Selects the SINGLE test mode.
- ⑥ SELECT key : Selects the SELECT test mode.
- ⑦ ALL key : Selects the ALL test mode.

(4) EDIT field : Used to shift the input item or modify the set value.
- ⑧ ↑, ↓keys : Used to move the input cursor or to scroll the RESULT screen.
- ⑨ SUB key : A subscreen such as Measurement condition appears.
- ⑩ PREV key : The preceding screen of the set values appears.
- ⑪ NEXT key : The next screen of the set values appears.

(5) TEST field : Selects the item to be tested.
- ⑫ TE key : Test is executed to the TE.
- ⑬ NT key : Test is executed to the NT.

(6) INTERFACE field : Connects the connector for interface I.
(See the illustration in the Fig.2-2 I-interface Connector .)

(7) Others
- ⑭ REMOTE : The tester is set to the remote mode on the GPIB bus. In the remote mode, keys other than LOCAL are ignored.
- ⑮ LOCAL key : Used to set the tester from remote to local mode so that the panel keys can be used.
- ⑯ POWER switch : Used to turn power to the tester ON and OFF. power to the tester. Power is fed while the switch is ON and is shut off abruptly when the switch is turned OFF.

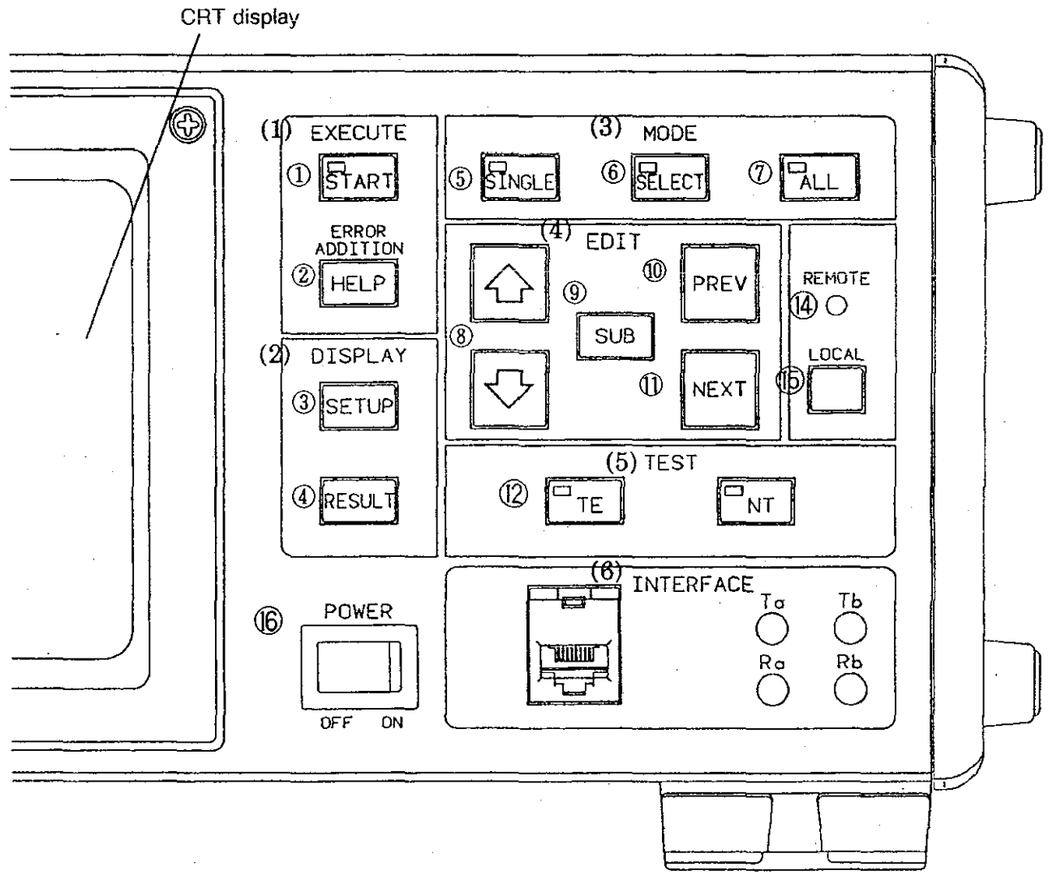
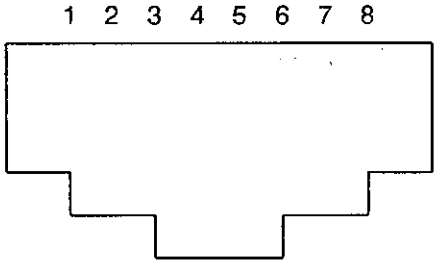


Fig. 2-1 Front Panel



Terminal No.	Name	Direction		Polarity	Remarks
		NT	TE		
1	—	—			For power feeding to optional device (Not use)
2	—	—			
3	TA	←		+	For signals
4	RA	→		+	
5	RB	→		–	
6	TB	←		–	
7	—	—			For power feeding to optional device (Not use)
8	—	—			

(ISO standard)

Fig. 2-2 I-interface Connector

2.1.2 Rear Panel

The following are located on the rear panel.

①	EIA-232D connector	:	An EIA-232D-based serial printer can be connected here to print out the measurement results.
②	GPIB connector	:	An IEEE 488-based controller is connected here for external control through GBIP.
③	D IN connector	:	Terminal for the D channel signal.
④	CLOCK connector	:	Clock for the D channel I/O timing.
⑤	D OUT connector	:	Terminal for the D channel signal output.
⑥	GND terminal	:	Grounding terminal.
⑦	Power cable connector	:	When connecting the power cable, confirm that the tester power switch is OFF.

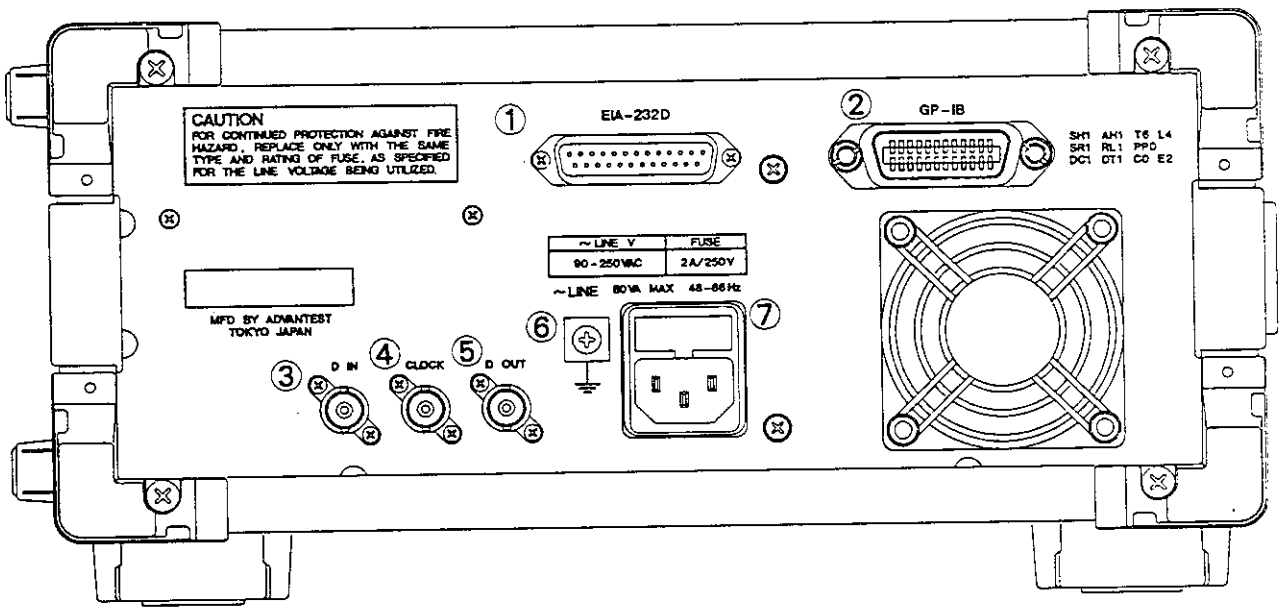
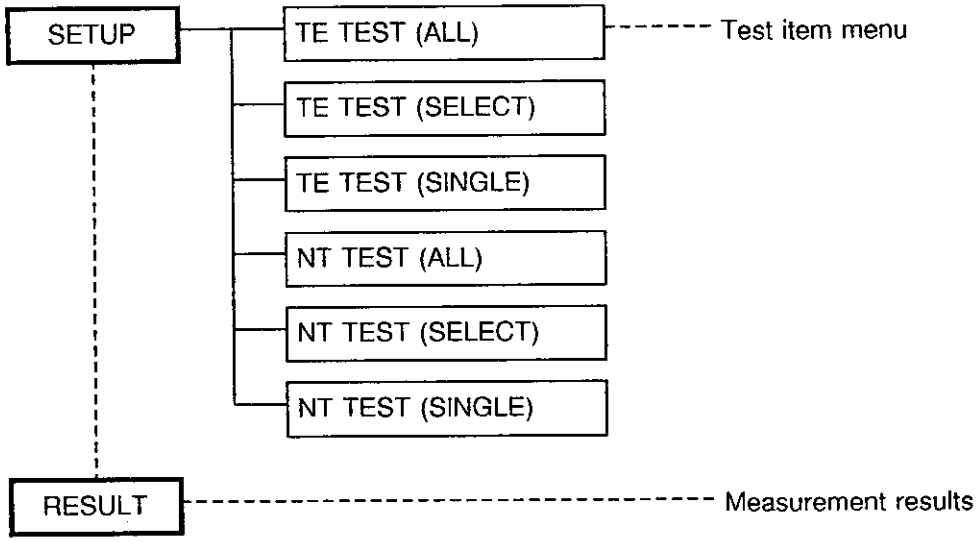


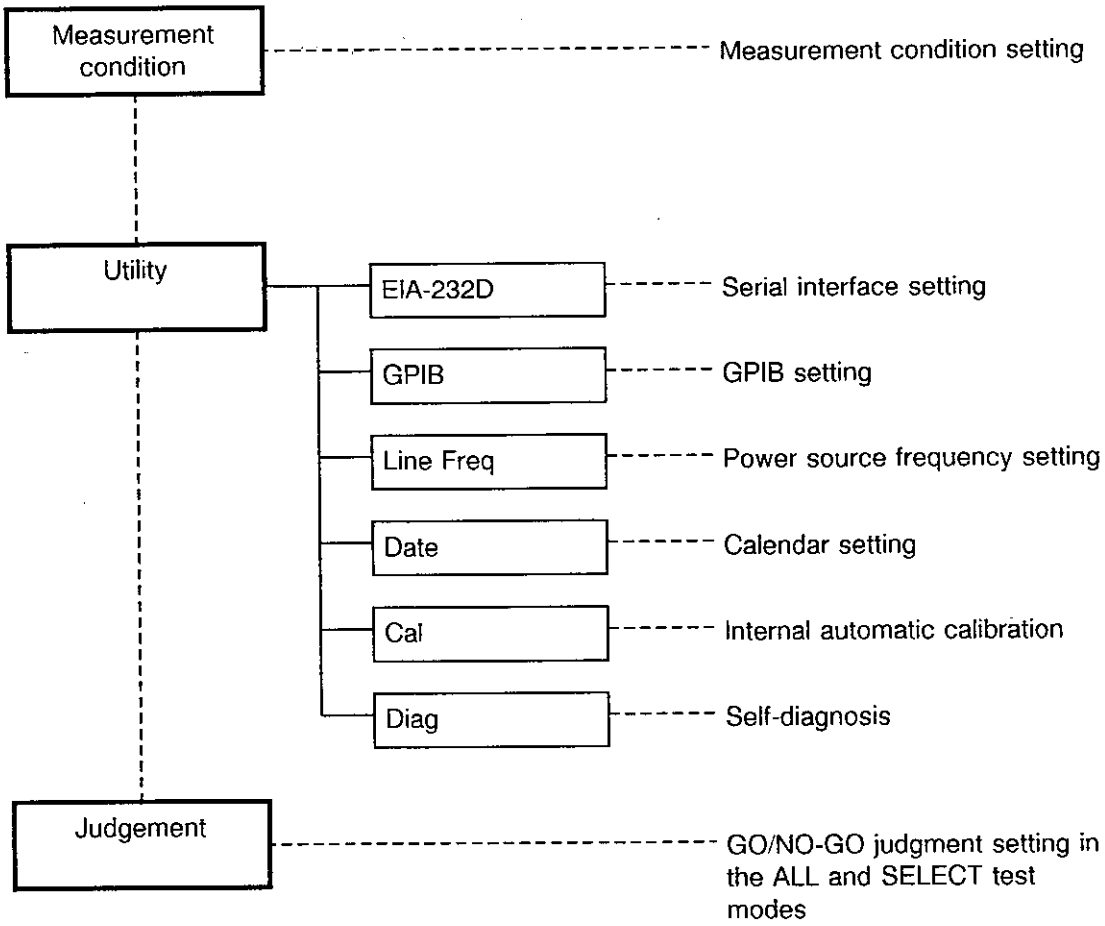
Fig. 2-3 Rear Panel

2.2 Screen Configuration

(1) Main screen

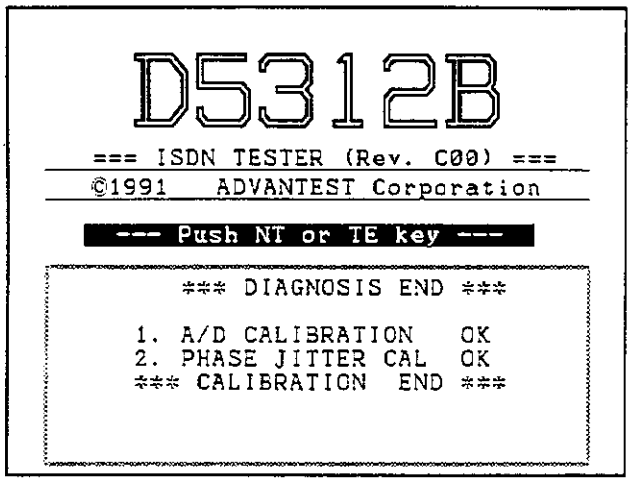


(2) Subscreen


Measurement condition
Measurement condition setting
Utility
EIA-232D
Serial interface setting
GPIB
GPIB setting
Line Freq
Power source frequency setting
Date
Calendar setting
Cal
Internal automatic calibration
Diag
Self-diagnosis
Judgement
GO/NO-GO judgment setting in the ALL and SELECT test modes

2.3 Initial screen

When the tester power is turned on, the following screen appears.
When the power is turned on, the tester promptly starts internal self-diagnosis and automatically calibrates the internal measurement system. About two minutes are required for self-diagnosis and the calibration. (Details of the self-diagnosis function are given in Section 4.4.)
Confirm that no errors are found during self-diagnosis and select the test object using the TE key or NT key operation in the TEST field (TEST mode selection field).
When the test object is selected, the SETUP screen appears to start the test.

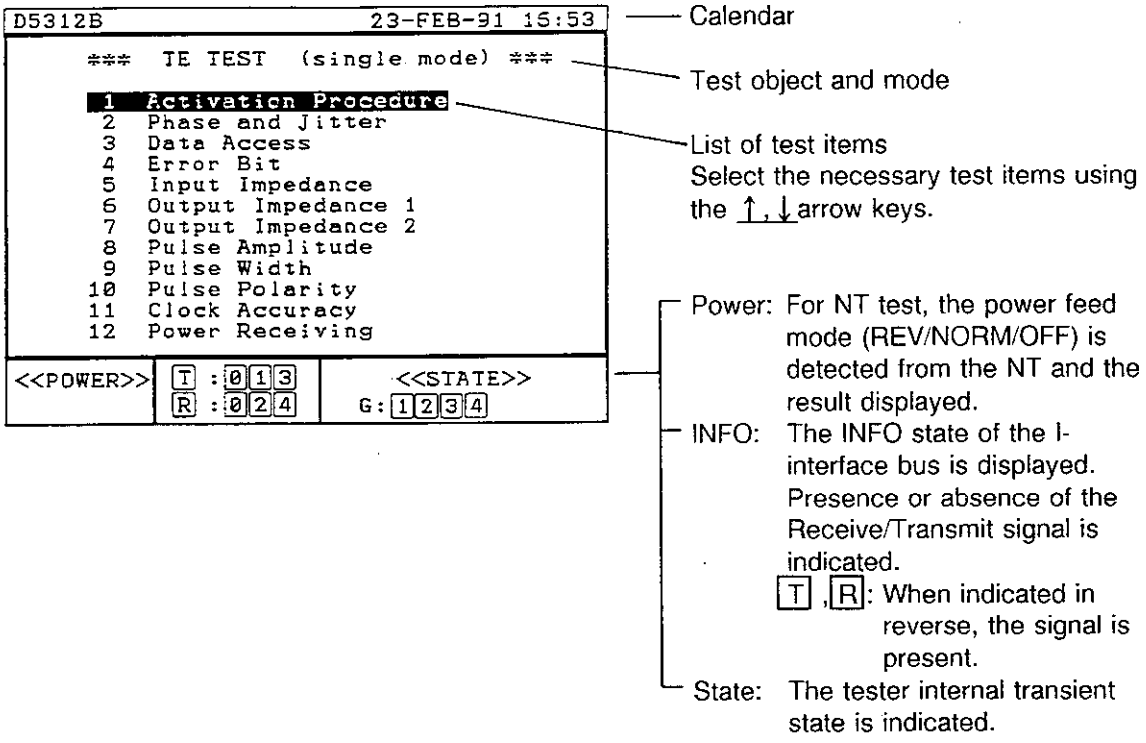


2.4 Setup Screen

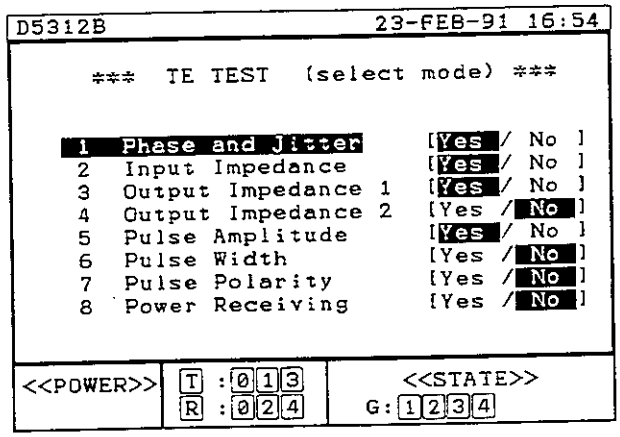
Select the test item in the NT/TE test on the Setup screen.
The corresponding screen appears.

Screen for selecting the test mode

① SINGLE mode



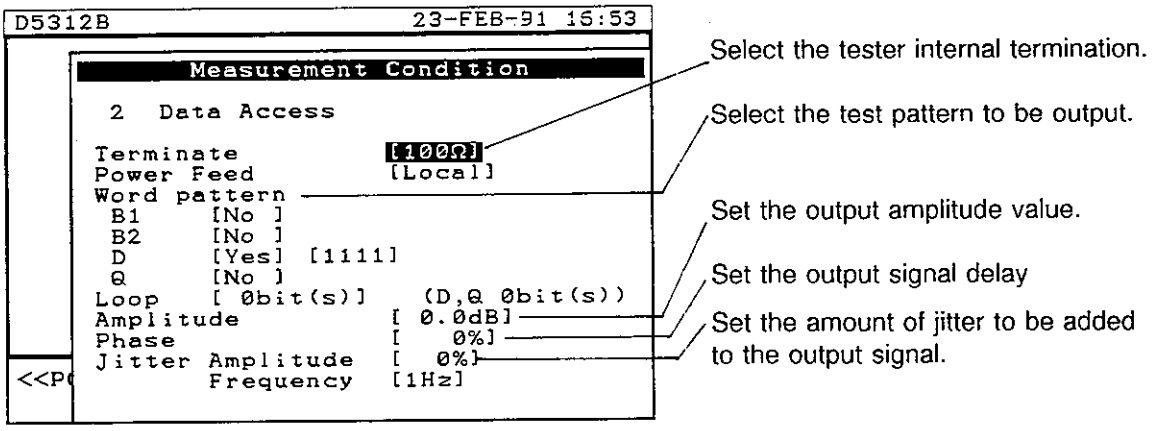
② SELECT mode



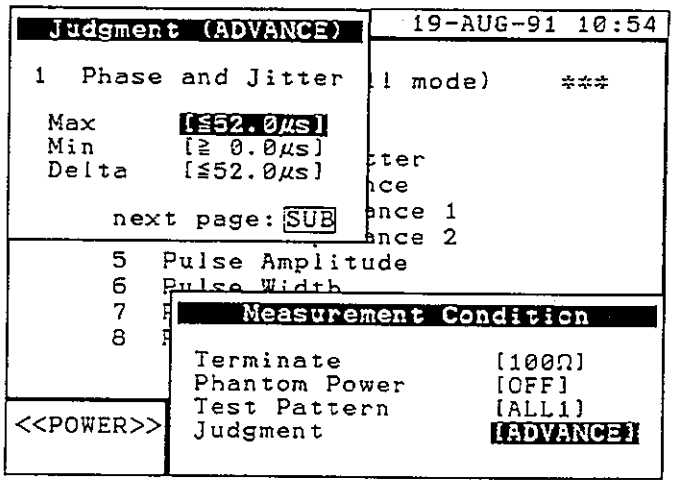
2.5 Screen for Setting the Measurement Conditions

① Measurement condition screen

The Measurement Condition screen appears when the SUB key in the EDIT field is pressed. Move the cursor to the item field using the ↑,↓ arrow keys and select the necessary items by pressing PREV and NEXT.



② Judgment screen



Move the cursor to the item to be specified using the po↑,↓ arrow keys and enter it by pressign PREV and NEXT. (If ADVANCE has been specified)

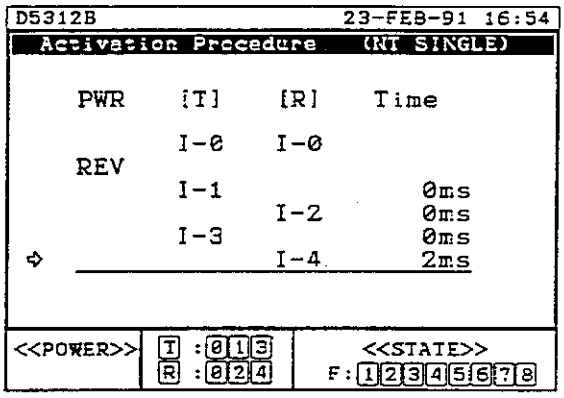
Setting of the GO/NO-GO judgment value in the ALL or SELECT test mode
Select the Judgment screen with the SUB key in the EDIT field.

2.6 Screen for Displaying the Results (RESULT)

The measurement results corresponding to the item specified appear. when the measurement is executed, the screen for displaying the results is automatically displayed. To change other screens to result display screen, press the RESULT key in the DISPLAY field.

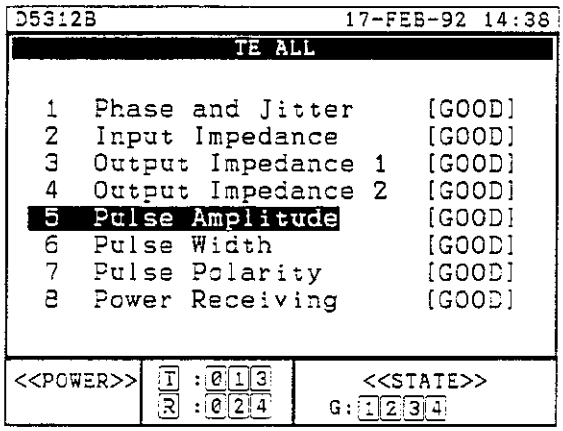
2.6.1 Screen for Displaying the Results in SINGLE test

The measurement result of the correspondence to the item of each test is displayed with numerical values etc.



2.6.2 Screen for Displaying the Results in ALL/SELECT test

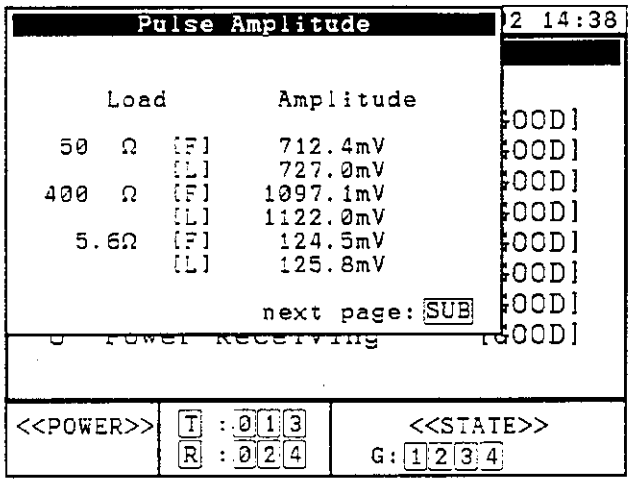
The result is displayed by judging GOOD/NG for the test judgment value set beforehand.



Select the item reversed using the ↑,↓ arrow keys in the EDIT field.

2.6.3 Screen for Displaying the Measurement Value in ALL/SELECT test

This screen is displayed by pressing the RESULT key in the DISPLAY field on the result display screen in ALL/SELECT test. The measurement value is displayed in the item that is reversed on the result display screen.

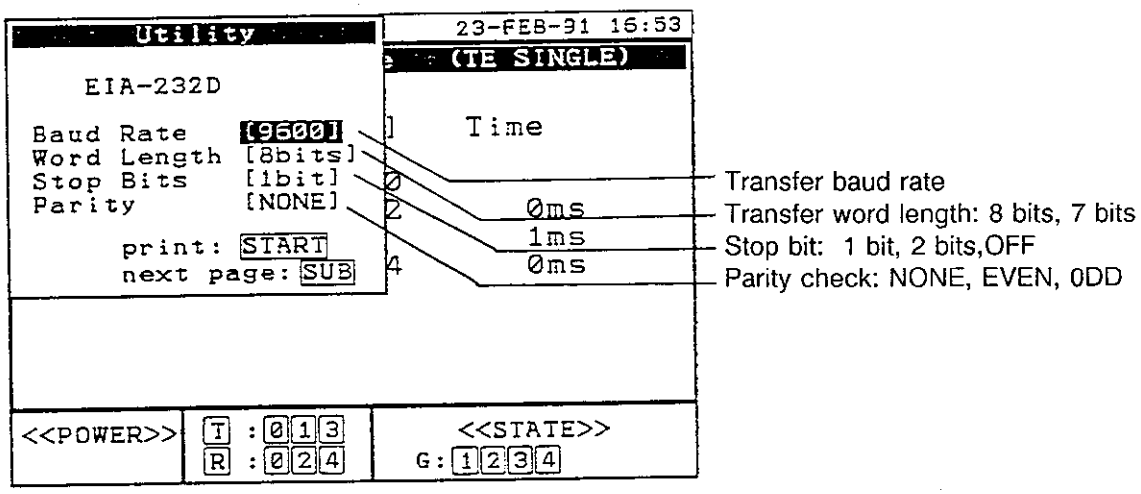


2.7 Utility Screen

Press RESULT in the DISPLAY field to select the result display screen (RESULT screen). When the SUB key in the EDIT field is pressed, the Utility screen appears.
The following tester utility functions are available: EIA232D, GPIB, Line freq., Date, Calibration and Init Memory. select the necessary function on the Utility screen when PREV and NEXT are pressed in the EDIT field.

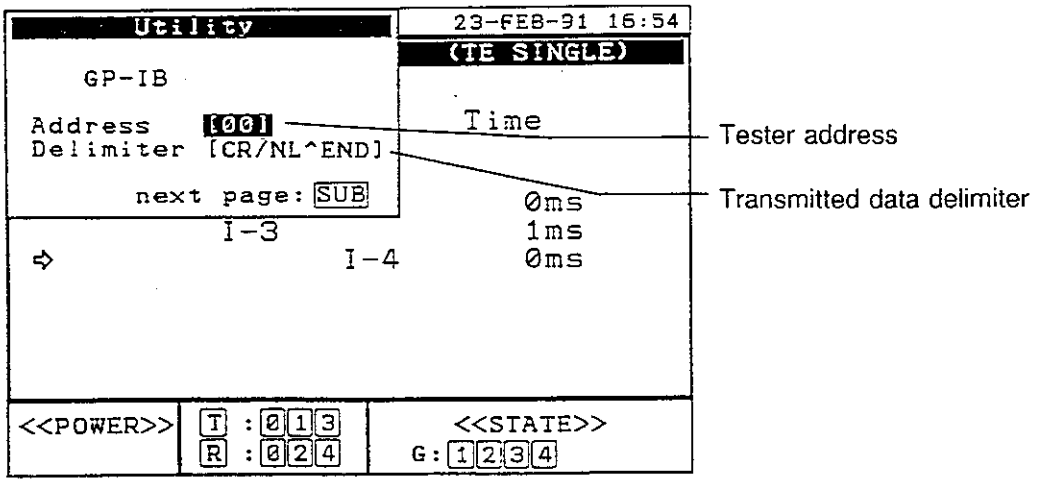
2.7.1 EIA-232D

To set the EIA-232D serial interface.
Move the input cursor using the ↑, ↓ arrow keys in the EDIT field and select the necessary item by pressing PREV and NEXT.
Pressing START starts printing.



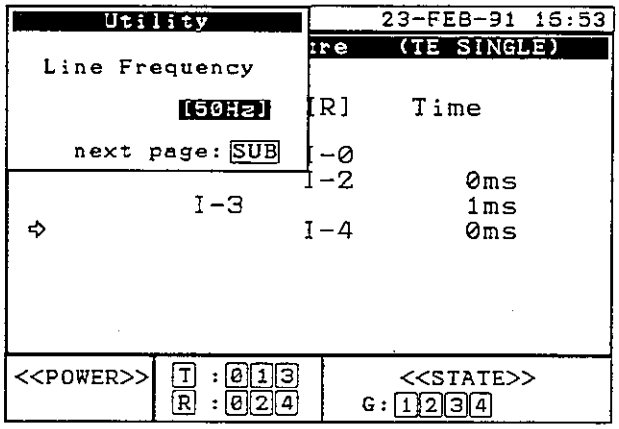
2.7.2 GPIB

To select the tester GPIB interface address.
Move the input cursor using the ↑, ↓ arrow keys in the EDIT field and select the necessary item by pressing PREV and NEXT.



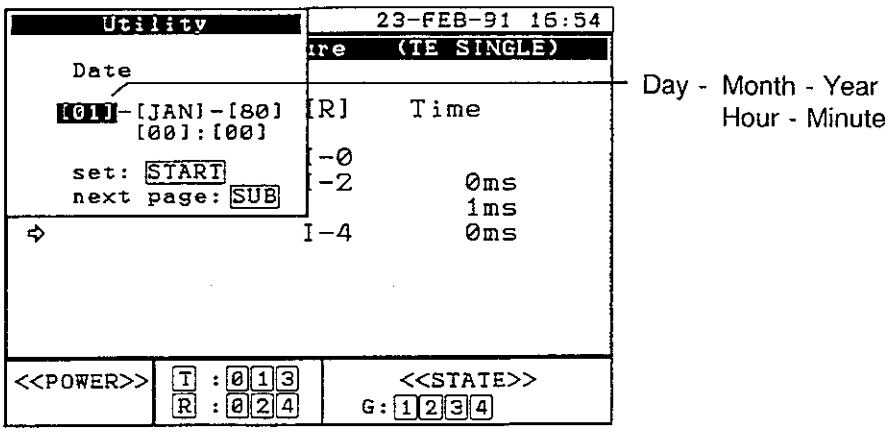
2.7.3 Line Freq

Select 50Hz or 60Hz for the AC power source frequency by pressing PREV and NEXT. After the setting was changed, be sure to execute the calibration(Refer to subsection 2.7.5).



2.7.4 Date

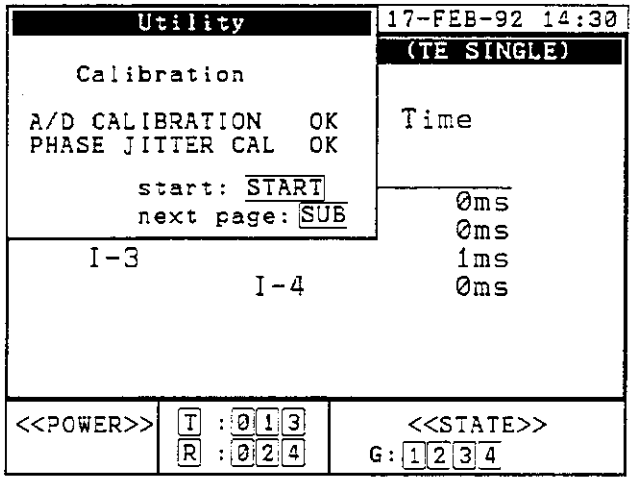
To modify the date of the built-in calendar.
Move the input cursor with the ↑, ↓ arrow keys in the EDIT field and select the necessary item by pressing PREV and NEXT.
Press START to enter the selected item.



2.7.5 Calibration

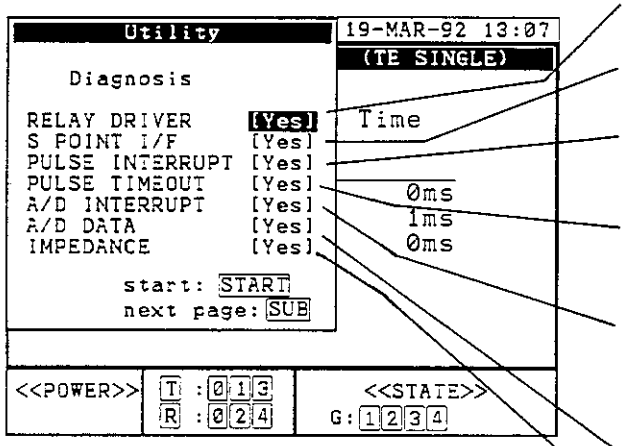
Self-calibration of the tester measurement system is executed.
Press START to execute self-calibration.

Calibration time: About 1 minute
When calibration is completed, the "CAL END" message appears.



2.7.6 Diagnosis

Self-diagnosis of the tester measurement system is executed.
When [Yes] is selected, diagnosis of the corresponding item is executed. If an error occurs during diagnosis, contact the nearest branch or agent for repair.



Diagnosis of the tester's relay control system

Diagnosis of the S-interface control block

Diagnosis of the interrupt system of the tester's digital measurement block

Diagnosis of the measurement counter of the tester's digital measurement system

Diagnosis of the Analog-Digital converter (A/D) interrupt system in the tester's analog measurement block

Diagnosis of the A/D converter in the tester's analog measurement block

Diagnosis of the signal generator and measurement sections in the impedance measurement block

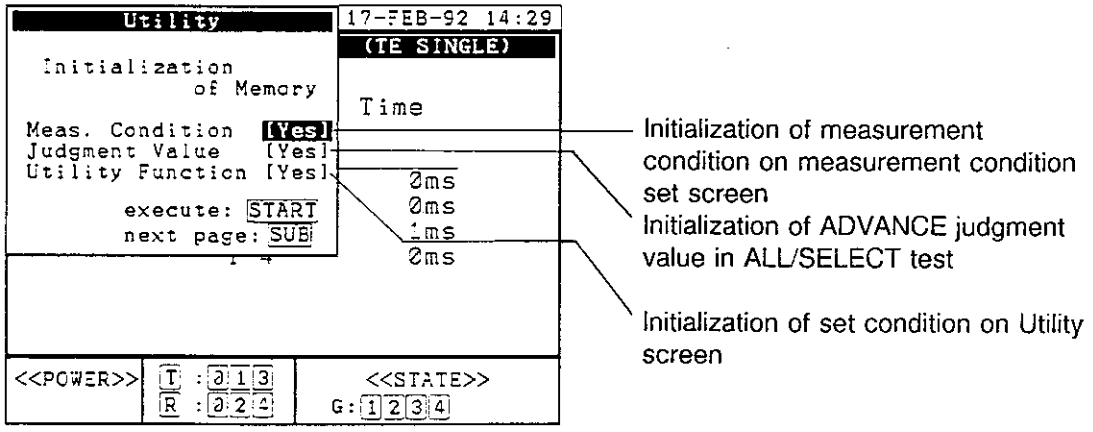
2.7.7 Initialization of Memory

The backup memory of D5312B is initialized.

When [Yes] is selected at each item, a set value of the corresponding screen is set to the initial value. When initialization is executed, the message of the confirmation is displayed so as not to be initialized by mistake. Select whether to execute or to cancel initialization according to the instruction.

when execute : Press the START key.

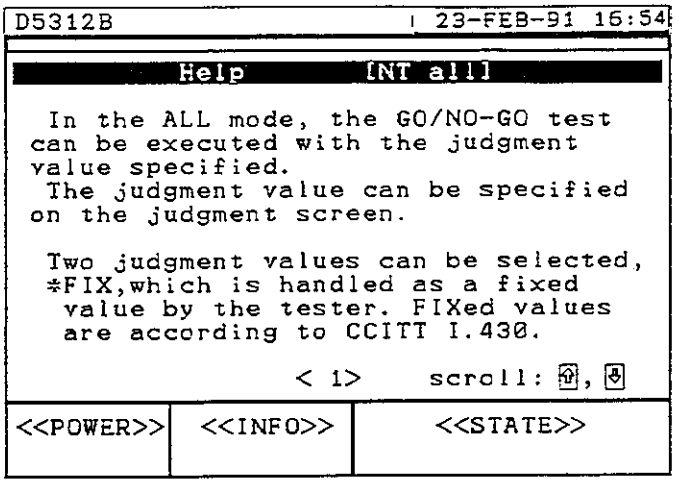
when cancel : Press the HELP key.



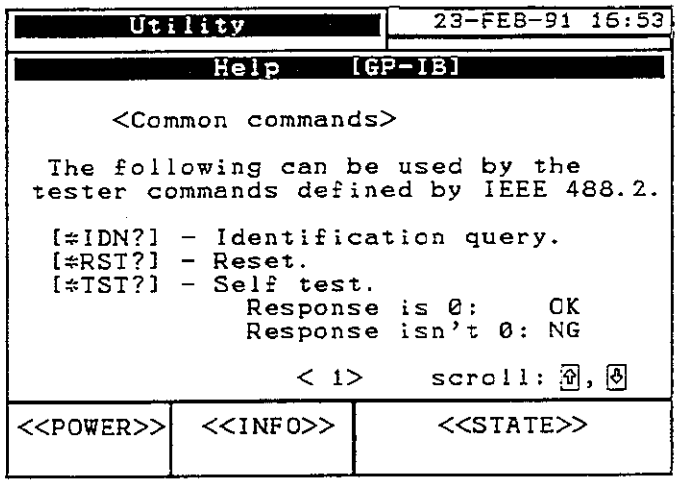
2.8 Help Screen

Pressing the HELP key in the EXECUTE field, the Help screen appears on the each screen. "HELP" is displayed in Setup screen, measurement condition set screen in the SINGLE test and Utility screen.
Described on the Help screen are the contents of test, measurement conditions, correspondence to GPIB commands and so on.
The Help screens are used as a operation guidance of the D5312B.

[Description of test mode]



[Description of GPIB commands]



3. TEST FUNCTIONS

3.1 Test Modes and Test Items

The test items available for TE and 2 mode NT tests are as follows:

(1) TE test

SINGLE mode

① Activation Procedure
② Phase and Jitter
③ Data Access
④ Error Bit
⑤ Input Impedance
⑥ Output Impedance 1
⑦ Output Impedance 2
⑧ Pulse Amplitude
⑨ Pulse Width
⑩ Pulse Polarity
⑪ Clock Accuracy
⑫ Power Receiving

ALL & SELECT modes

① Phase and Jitter
② Input Impedance
③ Output Impedance 1
④ Output Impedance 2
⑤ Pulse Amplitude
⑥ Pulse Width
⑦ Pulse Polarity
⑧ Power Receiving

(2) NT test

SINGLE mode

① Activation Procedure
② Data Access
③ Error Bit
④ Echo Check
⑤ Input Impedance
⑥ Output Impedance 1
⑦ Output Impedance 2
⑧ Pulse Amplitude
⑨ Pulse Width
⑩ Pulse Polarity
⑪ Power Feeding
⑫ Loop Back Monitor

ALL & SELECT modes

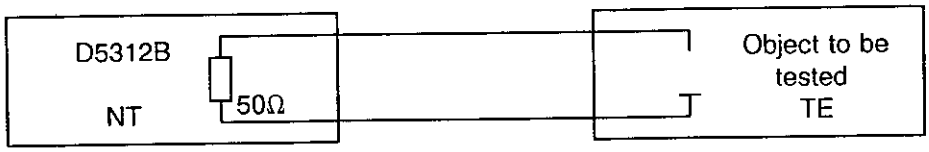
① Input Impedance
② Output Impedance 1
③ Output Impedance 2
④ Pulse Amplitude
⑤ Pulse Width
⑥ Pulse Polarity
⑦ Power Feeding

3.2 Termination Selection

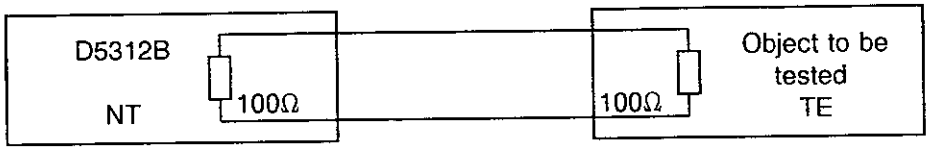
Internal termination of the tester is selected during TE and NT tests as follows:

(1) TE test

When the 100Ω termination resistor is not connected at the TE:

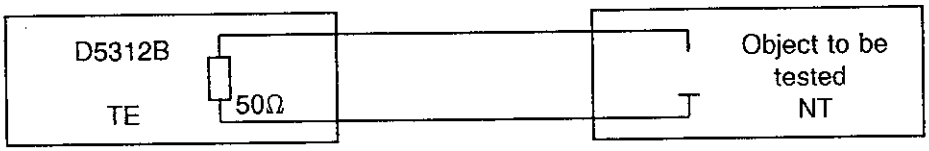


When the 100Ω termination resistor is connected at the TE:

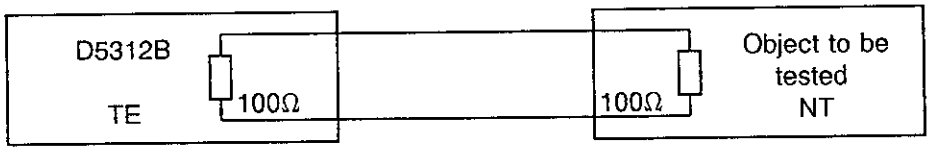


(2) NT test

When the 100Ω termination resistor is not connected at the NT:



When the 100Ω termination resistor is connected at the NT



CAUTION

If the type of termination is not correctly selected, correct measurement of some test items may not be obtained.

3.3 Test Items and Additional Functions

The output amplitude variation, jitter addition and phase delay functions can be added to several test items.

Test item	Additional function		
	Output amplitude variation	Jitter addition	Phase delay
Activation Procedure	–	–	–
Phase and Jitter	–	○	–
Data Access	○	○	○
Error Bit	○	○	○
Echo Check	–	–	–
Input Impedance	–	–	–
Output Impedance 1	–	–	–
Output Impedance 2	–	–	–
Pulse Amplitude	–	–	–
Pulse Width	–	–	–
Pulse Polarity	–	–	–
Clock Accuracy	–	–	–
Power Receiving	–	–	–
Power Feeding	–	–	–
Loop Back Monitor	○	○	○

○: Can be added.
Note: Phase delay only operates in the NT test.

3.4 Test Items and Conditions

The tester executes various test items the I-interface bus under the following conditions. Measurement of the object is executed after calling it, excluding the Activation Procedure test.

Table 3-1 Test Items and I-interface Bus State

Test item	I-interface bus state	
	TE test	NT test
Activation Procedure	Activate	Activate
Data Access	I-3	I-4
Error Bits	I-3	I-4
Echo Check	–	I-4
Input Impedance	I-0 or inactive state	I-0 or inactive state
Output Impedance 1	I-0 or inactive state	I-0 or inactive state
Output Impedance 2	I-3	I-4
Pulse and Jitter	I-3	–
Pulse Amplitude	I-3	I-2, 4
Pulse Width	I-3	I-4
Pulse Polarity	I-3	I-4
Clock Accuracy	I-1	–
Power Receiving	–	–
Power Feeding	–	–
Loop Back Monitor	–	I-4

I- : INFO state
– : Not I-interface bus dependent
No test of the object is executed.

CAUTION

If no reply is received from the object to be tested in about 10 seconds in TE test mode or in about 30 seconds in NT test mode after calling it, the "Illegal State: Restart Measurement" message appears to indicate that the measurement specified cannot be executed.
In this case, the possible cause may be found in the tester cable connecting the I-interface or a synchronization failure due to the object's abnormal state.
Press START to stop measurement and identify the cause of the error before executing the test.

3.5 INFO and Status Displays

The tester INFO display in the TE and and NT tests is based on Layer 1 start at the TE or NT/Stop state transient table (CCITT I.430).

The tester INFO display is identified by the status transient number detected by the tester as follows:

Fig. 3-2 INFO display in the TE test

Event	Status name	Stop	Start operation	Start	Stop operation
	Status No.	G1	G2	G3	G4
	Transmit INFO	INFO0	INFO2	INFO4	INFO0
PH-start		T: I-0 R: I-2	–	–	
MPH-stop request		–			–
Timer 1 end				×	
Timer 2 end					
INFO 0 received		T: I-0 R: I-0	T: I-0 R: I-2		
INFO 1 received		T: I-0 R: I-1	T: – R: I-2	×	
INFO 3 received		×	T: I-3 R: I-4	T: I-3 R: I-4	
Out of frame		×	×	T: – R: I-2	

× : Impossible state as defined by the same physical layer procedure and the system internal cause.

– : Impossible state as defined by the physical layer service.

R:I- : R line INFO display.

T:I- : T line INFO display.

R:- : No INFO display.

T:- : No INFO display.

▨ : State not defined by the tester.

Fig. 3-3 INFP display in the NT test

Event	Status name	Inactive	Sensing	Stop	Waiting for signal	Input identification	Synchronization	Start	Out of frame
	Status No.	F1	F2	F3	F4	F5	F6	F7	F8
	Transmit INFO	INFO0	INFO0	INFO0	INFO1	INFO0	INFO3	INFO3	INFO0
Power ON, Power feed detect		R: – T: –	R: – T: –	R: – T: –	R: – T: –	R: – T: –	R: – T: –	R: – T: –	R: – T: –
Power loss		R: – T: –	R: – T: –	R: – T: –	R: – T: –	R: – T: –	R: – T: –	R: – T: –	R: – T: –
Power OFF		R: – T: –	R: – T: –	R: – T: –	R: – T: –	R: – T: –	R: – T: –	R: – T: –	R: – T: –
PH- start		×	–	R: I-0 T: I-1	–	–	*	–	*
Timer 3 end		×							
INFO 0 received		×	R: I-0 T: I-0 (F3)	R: I-0 T: I-0 (F3)	R: I-0 T: I-1	R: – T: –	R: I-0 T: I-0 (F3)	R: I-0 T: I-0 (F3)	R: I-0 T: I-0 (F3)
Signal received		×	R: – T: –	R: – T: –	R: – T: –	R: – T: –	×	×	R: – T: –
INFO 2 received		×	R: I-2 T: I-3 (F6)	R: I-2 T: I-3 (F6)	×	R: I-2 T: I-3 (F6)	R: I-2 T: I-3 (F6)	R: I-2 T: I-3 (F6)	R: I-2 T: I-3 (F6)
INFO 4 received		×	R: I-4 T: I-3 (F7)	R: I-4 T: I-3 (F7)	×	R: I-4 T: I-3 (F7)	R: I-4 T: I-3 (F7)	R: I-4 T: I-3 (F7)	R: I-4 T: I-3 (F7)
Out of frame		×	×	×	×	×	R: – T: –	R: – T: –	R: – T: –

× : Impossible state as defined by the same physical layer procedure and the system internal cause.
– : Impossible state as defined by the physical layer service.

R:I- : R line INFO display.
T:I- : T line INFO display.

R : No INFO display.
T : No INFO display.

▒ : State not defined by the tester.
* : Only the F3 state is enabled for start request from the tester.

CAUTION

1. The INFO and STATUS displays only appear during measurement execution (START).
2. No INFO or STATUS display appears during the following measurements:

   Input impedance
   Output impedance 1
   Power receiving
   Power feeding

MEMO

4. BASIC MEASUREMENT OPERATIONS

This chapter describes the basic operations for each test item.

4.1 Basic Operations

(1) Selecting the object to be tested
The tester can select the NT or TE to be the object of the test.
Select the object to be tested using the NT or TE key in the TEST field.

(2) Selecting the test mode
The tester can select ALL/SELECT/SINGLE as the test mode.
Select the test mode using the ALL, SELECT or SINGLE key in the MODE field.
The corresponding test items appear on the screen.

(3) Setting the measurement condition
On the SETUP screen, press the SUB key in the EDIT field to select the measurement condition screen for setting the measurement conditions of the test items.
The Measurement Condition screen appears as a subscreen of the main screen.

(4) Executing measurement
Press START in the EXECUTE field to start measurement.
To stop measurement midway, press START again.

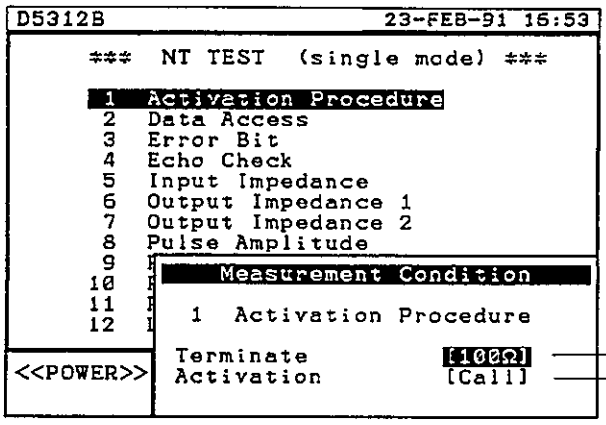
(5) Checking the measurement results
The measurement results automatically appear upon completion of each test item.
The measurement results can also be referenced by pressing RESULT in the DISPLAY field.
GOOD or NG for test judgment value and measurement value can be displayed in the ALL/SELECT test.

4.2 Examples of Measurement

Examples of measurement conditions for each test item and the corresponding results are given below.

(1) Activation Procedure

The T line INFO state (INFO0, INFO1, INFO3) and the R line INFO state (INFO0, INFO2, INFO4) are detected and their state transient time measured.

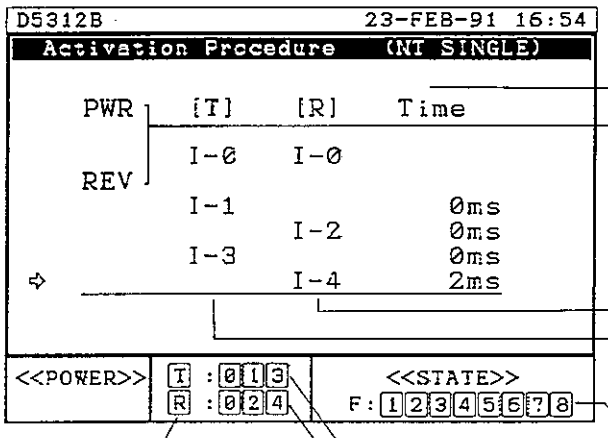


Tester internal termination 100/50Ω is selected.

Start procedure CALL/ANSWER is selected.

CALL : Call from the tester

ANSWER : Waiting for a call from the test object



State transient time

Power state (only indicated in the NT test)

R line INFO

T line INFO

State indication

T line INFO indicated

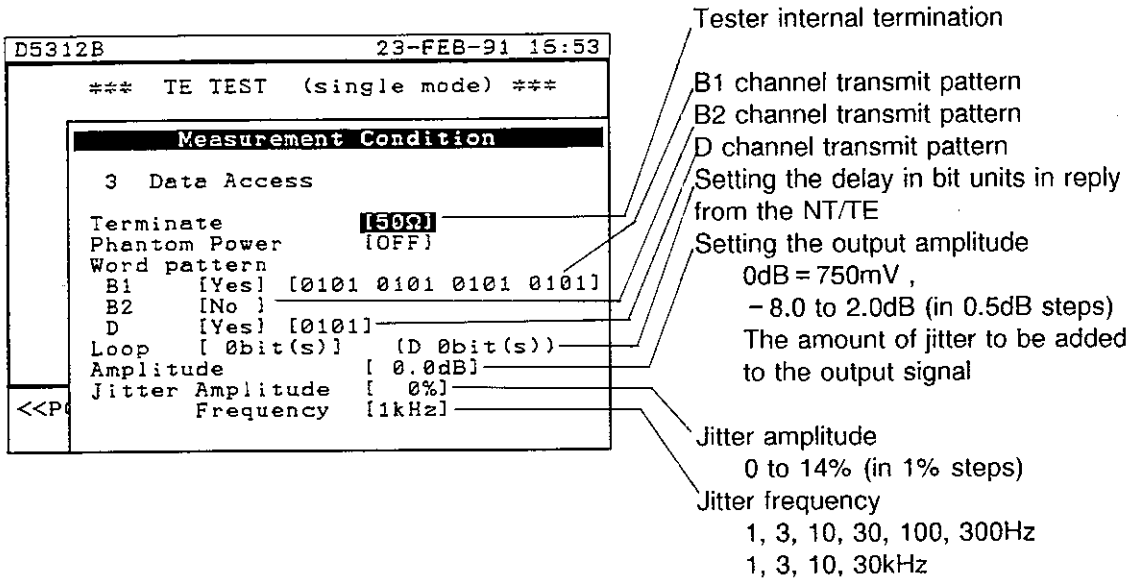
R line INFO indicated

Reverse : Signal detected or transmitted.

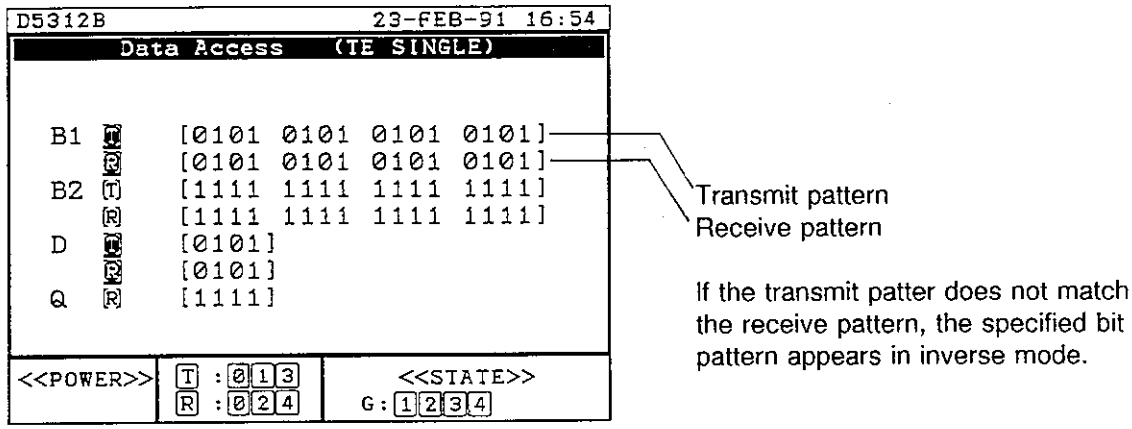
Normal : No signal detected or transmitted.

(2) Data Access

Data transmitted from the tester is compared with that received from the NT or TE and the results displayed.

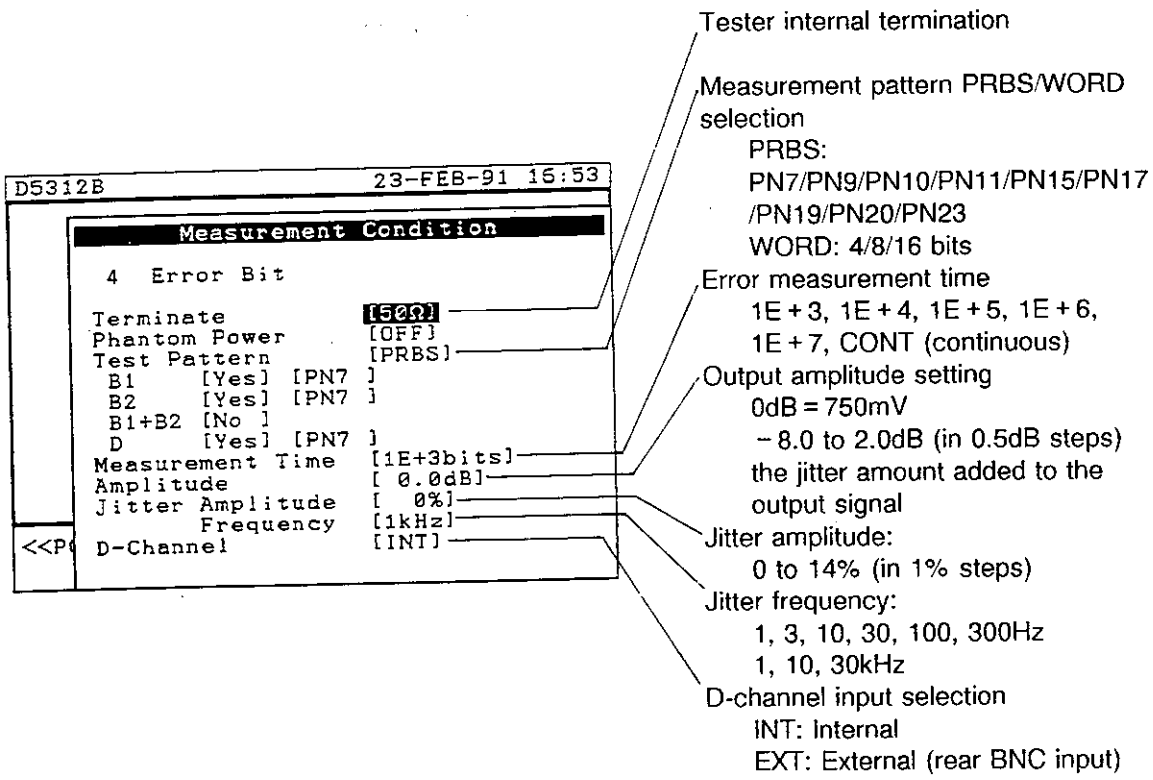


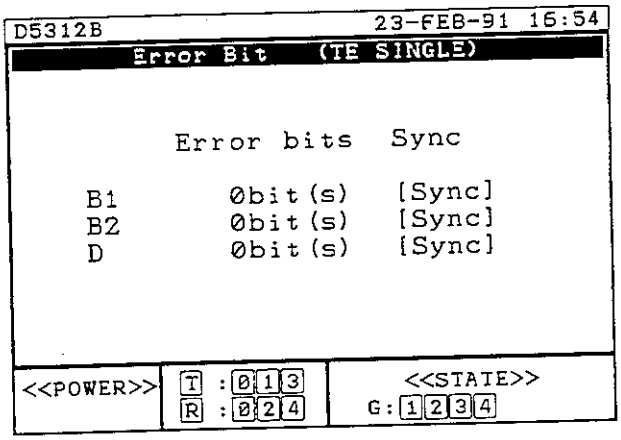
Note: If Yes is selected for the transmit pattern in the Word Pattern item, it is compared with the data received.
If [No] is selected for the transmit pattern, the signal received is displayed without being compared.



(3) Error Bits

The bit error in the data received is detected according to the data transmitted.



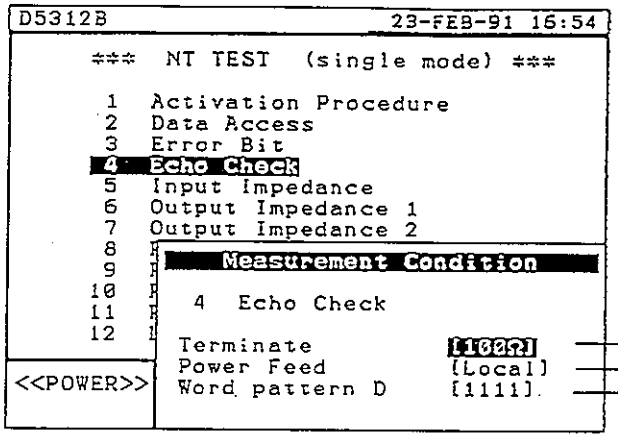


The error bit numbers in the measurement time
'Sync' appears if the pattern is synchronized, and 'Loss' appears if pattern synchronization fails.

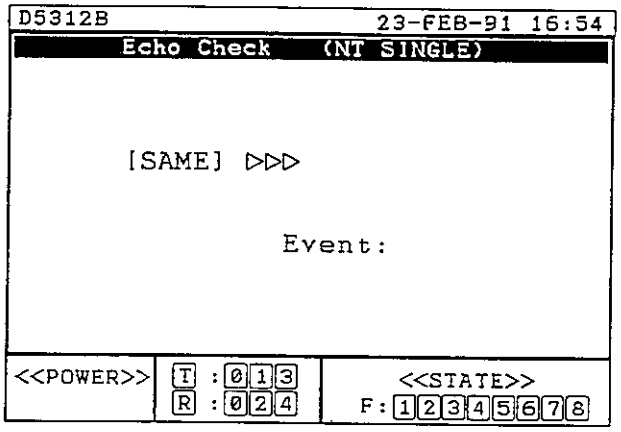
Note: if pattern synchronization fails in this measurement, the synchronization procedure is repeated and the error count is incremented.

(4) Echo Check (NT test)

A check is made to determine whether the E bit received in response from the NT is identical to the D-channel data transmitted from the tester.



Tester internal termination
Power feed mode to the NT
LOCAL/NORMAL/REVERSE
Transmit D-channel data. channel data

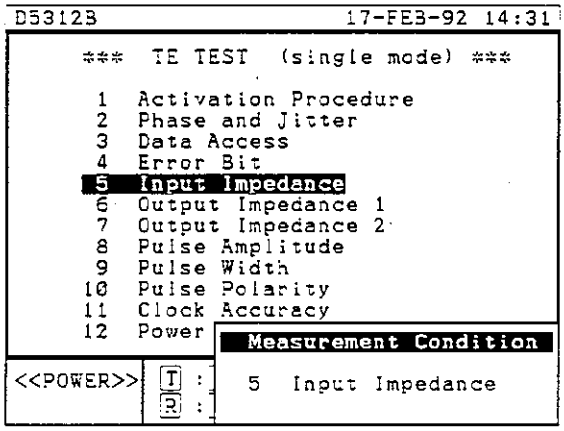


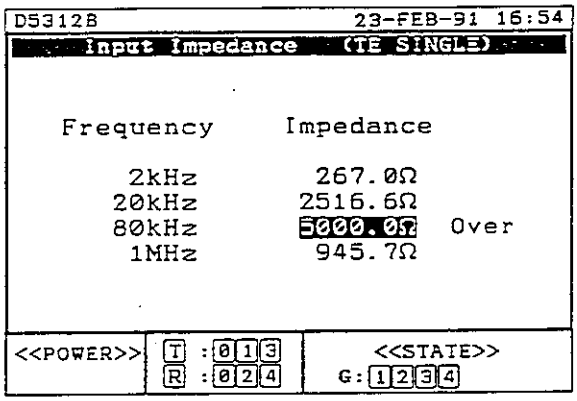
SAME: Same as the D-channel data transmitted
DIFF: Different from the D-channel data transmitted

The number of DIFF occurrences:
SAME/DIFF is checked every one second and the number of DIFF occurrences indicated.

(5) Input Impedance

The input impedance of the receive block in inactive mode is measured.
A sinusoidal wave signal of about 100mV is applied to the object to be tested.
The measurement is made at four frequency points: 2kHz, 20kHz, 106kHz and 1MHz in NT mode; and 2kHz, 20kHz, 80kHz and 1MHz in TE mode.



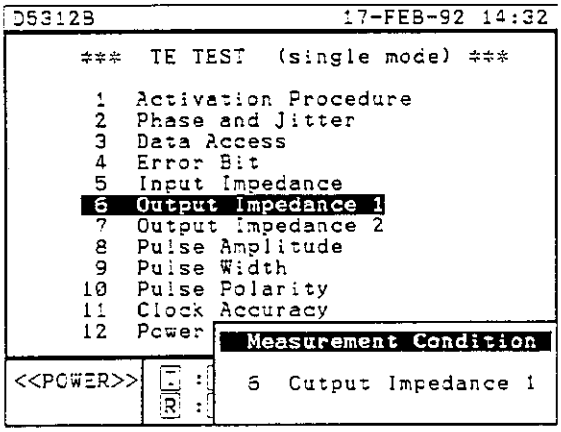


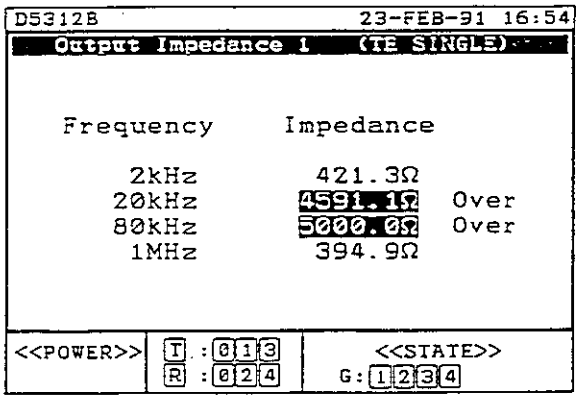
Over appears when the measurement range is exceeded.

Note: If termination is at the object to be tested, the above measurement results will be the parallel impedance with the termination resistor.

(6) Output Impedance 1

The transmitter output impedance is measured in inactive mode or when "1" is transmitted. A sinusoidal wave signal of about 100mV is applied to the object to be tested. The measurement is made at: 2kHz, 20kHz, 106kHz and 1MHz in NT mode, and 2kHz, 20kHz, 80kHz and 1MHz in TE mode.



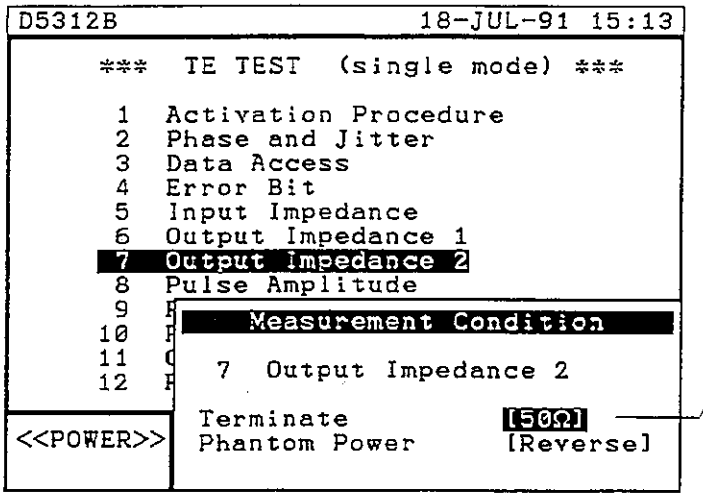


Note: If termination is at the object to be tested, the above measurement results will be the parallel impedance with the termination resistor.

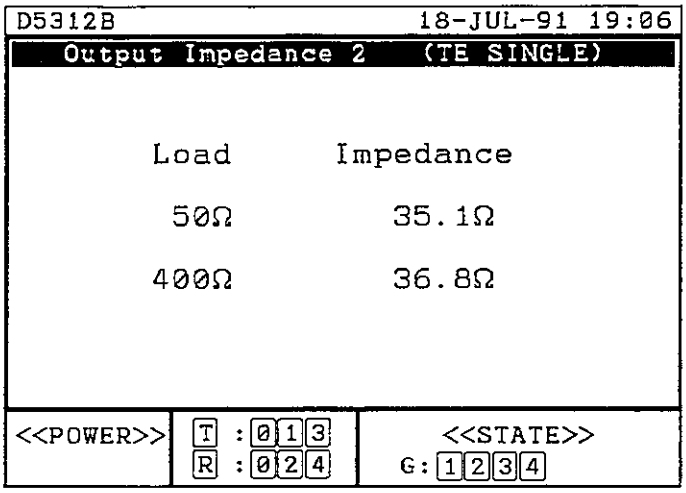
(7) Output Impedance 2

The transmitter output impedance is measured when binary "0" is transmitted.

The output impedance is determined from the pulse amplitude measurement within ±10% of the nominal loads of 50Ω and 400Ω.



Tester internal termination 100/50Ω is selected.

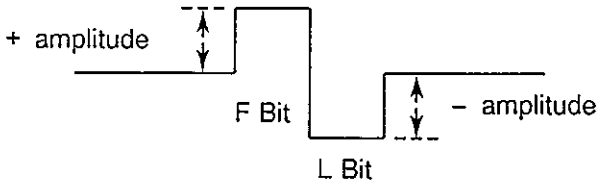


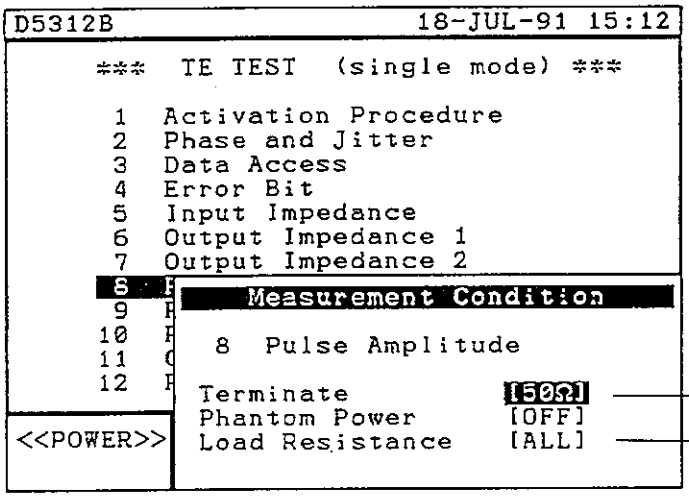
Note: When 100Ω is selected for the tester internal termination, no measurement is made of the output impedance with a nominal load of 400Ω.

(8) Pulse Amplitude

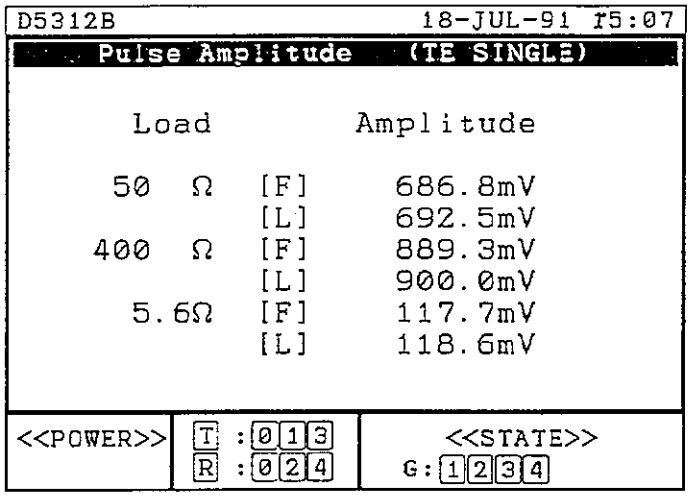
The center amplitude of the frame bit (F bit) and the frame balance bit (L bit) of the signal received (R/T line) is measured.

In the TE test, amplitude is measured at load resistances of 50, 400 and 5.6Ω.





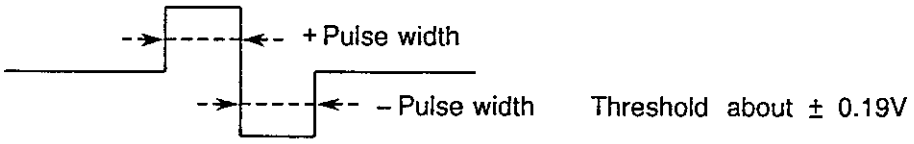
Tester internal termination 100/50Ω is selected.
Selection of load resistances
ALL: 50Ω, 400Ω and 5.6Ω are automatically switched.
50Ω: Fixed at 50Ω
400Ω: Fixed at 400Ω
5.6Ω: Fixed at 5.6Ω

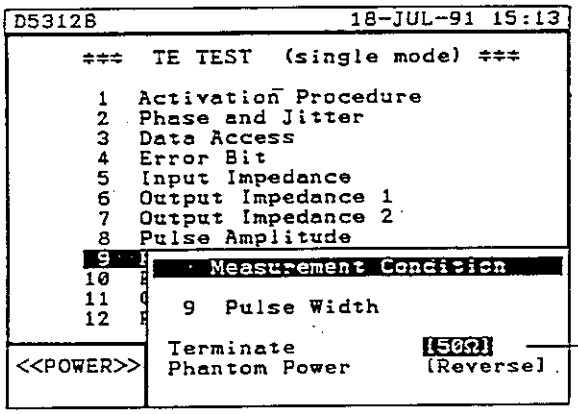


Note: When the tester internal termination is set at 100Ω, no measurement is made to the amplitude when termination is 400Ω or 5.6Ω. In this case, disconnect the NT/TE termination resistor and set the internal termination to 50Ω for amplitude measurement.

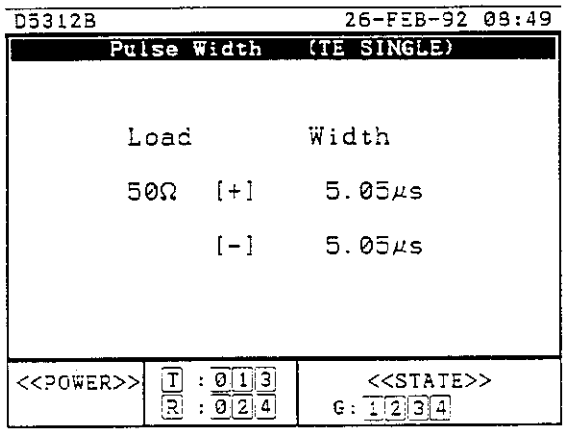
(9) Pulse Width

The time duration of the +Pulse and -Pulse of the received signal (R/T line) is measured.



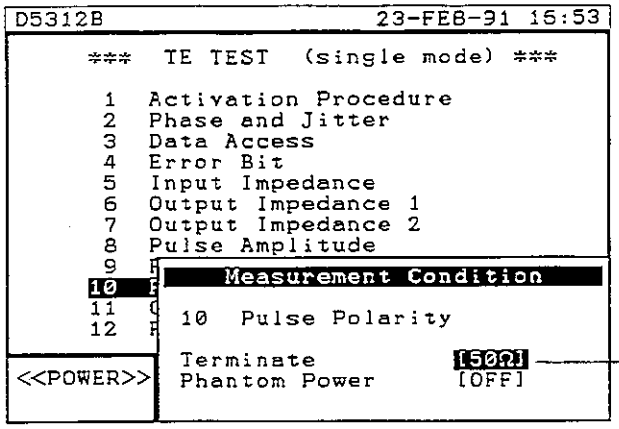


Tester internal termination 100/50Ω is selected.

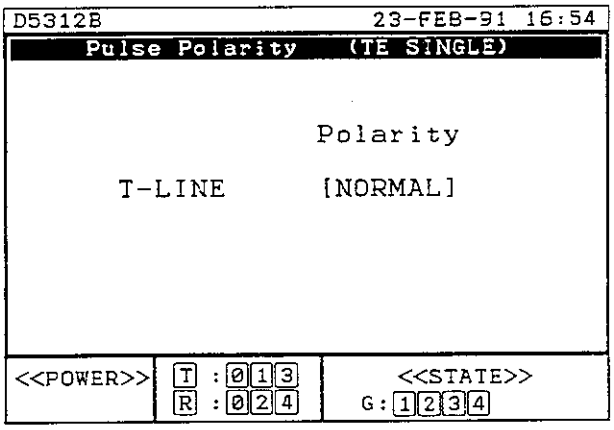


(10) Pulse Polarity

The pulse polarity of the frame bit (F bit) and the frame balance bit (L bit) of the received signal (R/T line) is measured.

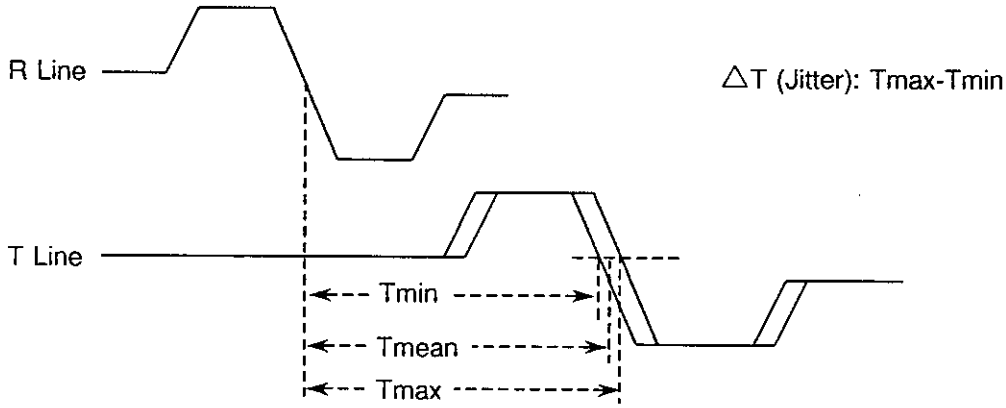


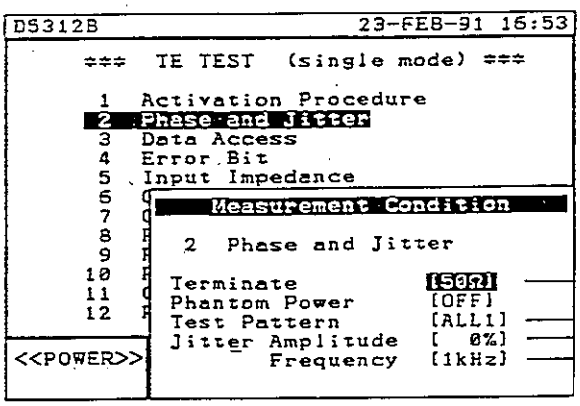
Tester internal termination 100/50Ω is selected.



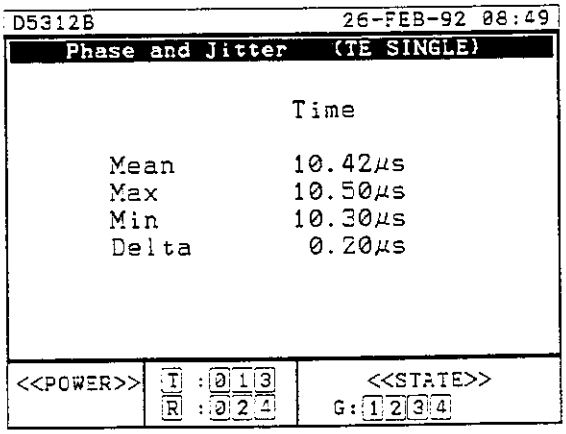
(11) Phase and Jitter (TE test)

Measurement is made of the phase difference between the R line frame pulse "0" level intersection point and the T line frame pulse "0" level intersection point.





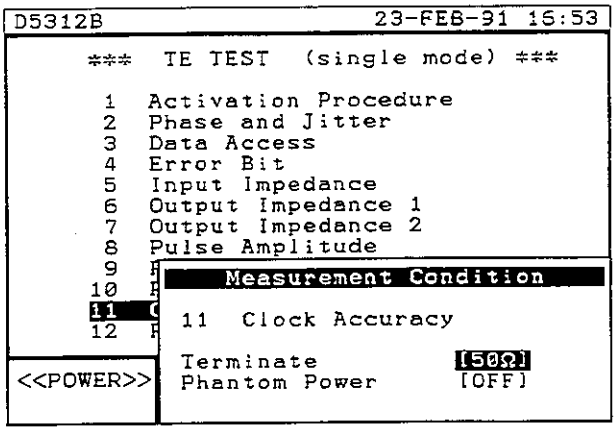
Tester internal termination 50/100Ω is selected.
Test pattern
PN19, ALL"1", 40 frame patterns
Output signal jitter
Jitter amplitude:
0 to 14% (in 1% steps)
Jitter frequency:
1, 3, 10, 100, 300Hz
1k, 3k, 10k, 300kHz

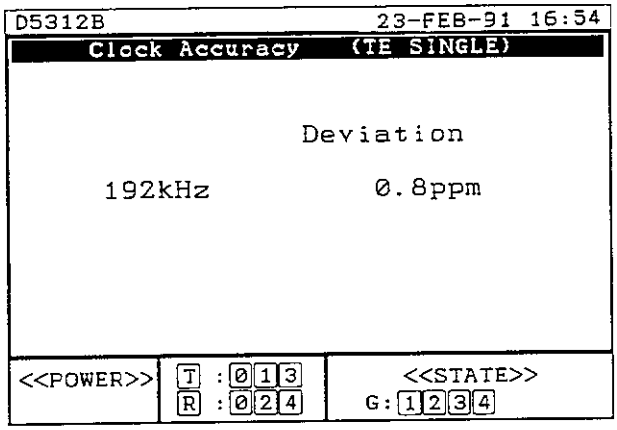


In the ALL/SELECT test, measurement is executed individually by three conditions (output pulse of D5312B, frequency 1Hz, and the jitter of the amplitude 0%, 4% or 8%).

(12) Clock Accuracy (TE test)

Measurement is made of the frequency deviation at the nominal bit rate of 192kHz when INFO1 is transmitted in the TE test.

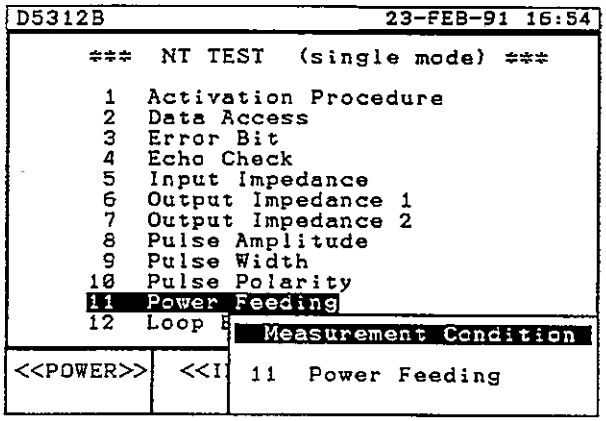


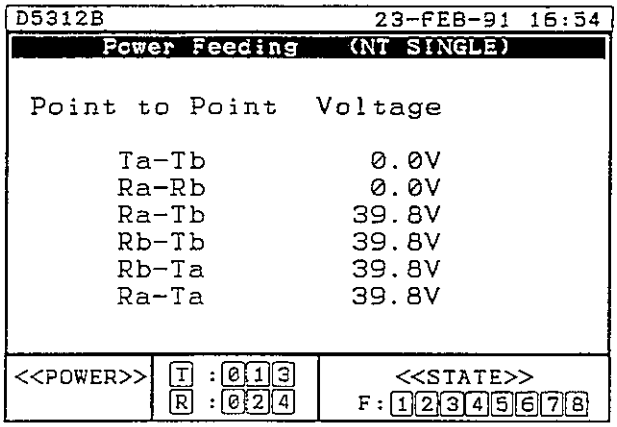


(13) Power Feeding (NT test)

Voltage is measured between the T and R (at Ta, Tb, Ra, Rb) lines and the power feeding characteristics from the NT are tested.

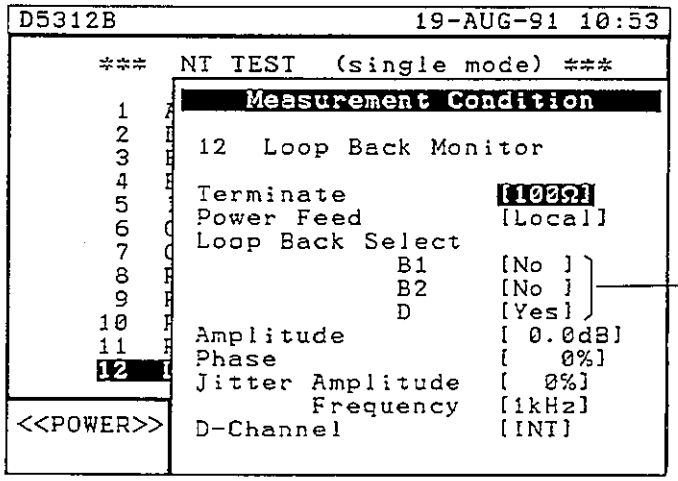
Power feeding characteristics is measured by the 3.8 kΩ pure resistance load. (Output 40V: 420mW)



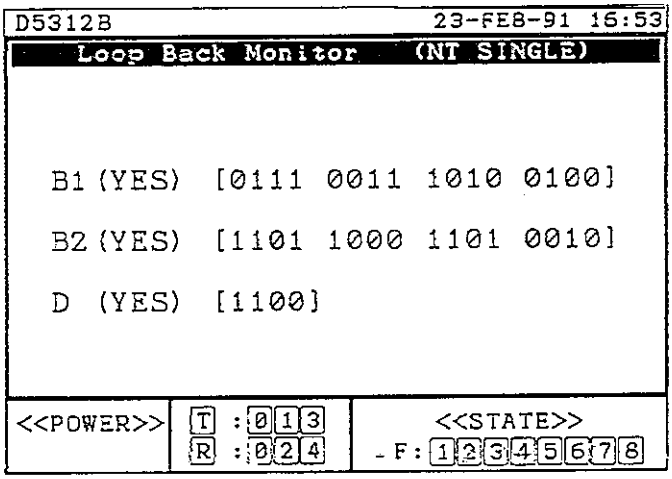


(14) Loop Back Monitor (NT test)

The data received from NT is indicated. And the data received is sent back to NT.

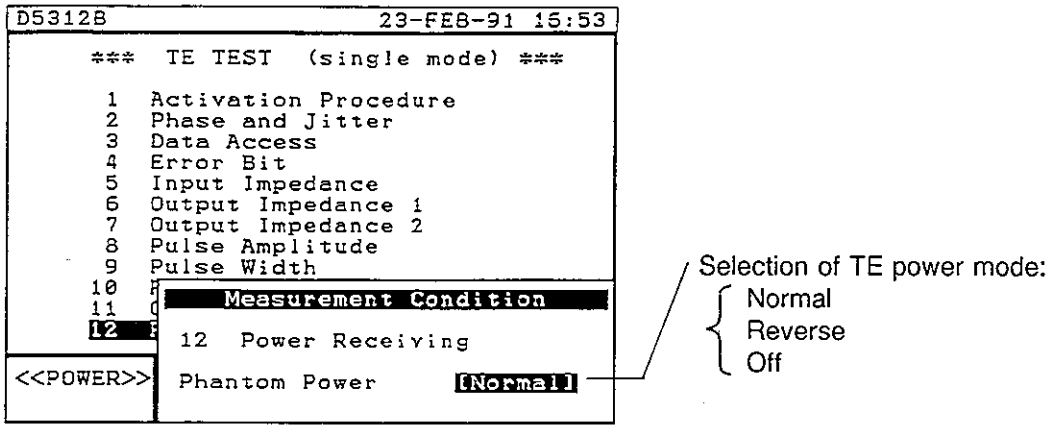


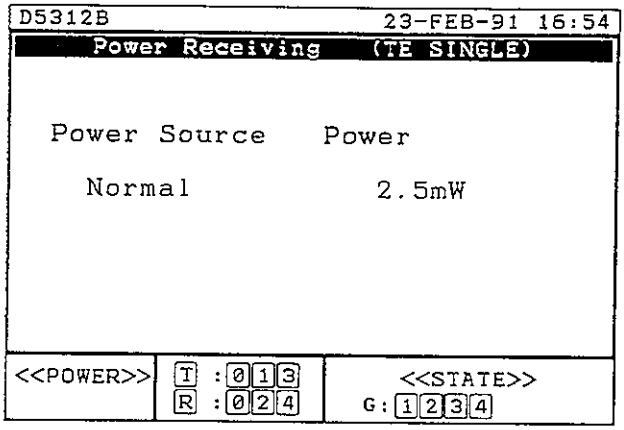
Set the Loop Back functions in Yes/No.
- Yes: Send back
- No: Not send back



(15) Power Receiving (TE test)

Power of 40V is fed to the TE and the TE power consumption measured.





4.3 Judgment in the ALL and SELECT test modes

In the ALL and SELECT modes, the GO/NO-GO test can be executed with the judgment value specified.
The judgment value can be specified on the Judgment screen.
Two judgment values can be selected: FIX, which is handled as a fixed value by the tester; and ADVANCE, which can be modified by the user.

4.3.1 FIX judgment value

For the FIXed judgment value, select it according to CCITT I.430.
The judgment value limits are given in the table below.

(1) TE test

Measurement item		Upper Limit	Lower Limit
Phase and Jitter	Max. Min. Delta	11.2 µs 0.8 µs	10.1 µs
Input Impedance	2 kHz 20 kHz 80 kHz 1 MHz	—	250 Ω 2500 Ω 2500 Ω 200 Ω
Output Impedance 1	2 kHz 20 kHz 80 kHz 1 MHz	—	250 Ω 2500 Ω 2500 Ω 200 Ω
Output Impedance 2	50 Ω 400 Ω	—	20 Ω 20 Ω
Pulse Amplitude	5.6 Ω 50 Ω 400 Ω	150 mV 825 mV 1200 mV	— 675 mV 675 mV
Pulse Width *1	1T 2T	6.1 µs 11.3µs	4.7 µs 9.9 µs
Pulse Polarity		Normal	
Power Receiving	Normal Reverse	— —	1000mW 380mW

*1: Pulse width has the judgment value of two pulse widths 2T internally besides the judgment value of standard pulse width 1T. The judgment is GOOD in case of either of the judgment value of both.

(2) NT test

Measurement item		Upper Limit	Lower Limit
Input Impedance	2 kHz 20 kHz 106 kHz 1 MHz	—	250 Ω 2500 Ω 2500 Ω 265 Ω
Output Impedance 1	2 kHz 20 kHz 106 kHz 1 MHz	—	250 Ω 2500 Ω 2500 Ω 265 Ω
Output Impedance 2	50 Ω 400 Ω	—	20 Ω 20 Ω
Pulse Amplitude	50 Ω	825 mV	675 mV
Pulse Width *1	1T 2T	6.1 µs 11.3 µs	4.7 µs 9.9 µs
Pulse Polarity		Normal	
Power Receiving *2	Ta-Tb Ra-Rb Ra-Tb Rb-Tb Rb-Ta Ra-Ta	0.1V 0.1V 42.0 V 42.0 V 42.0 V 42.0 V	— — 34.0 V 34.0 V 34.0 V 34.0 V

*1: Pulse width has the judgment value of two pulse widths 2T internally besides the judgment value of standard pulse width 1T. The judgment is GOOD in case of either of the judgment value of both.

*2: Power feeding is judged compared with the absolute value of measured value.
(The precessing of *1 and *2 is applied only to the FIX judgment value.

4.3.2 ADVANced judgment value

The ADVANced judgment value can be set within the range specified in the table below.
Note that the upper limit is not executed if is selected for Input Impedance, Output Impedance 1 and Output Impedance 2.

(1) TE test

Measurement item		Setting range		Resolution
		Upper Limit	Lower Limit	
Phase and Jitter	T T. △	52.0 µs 52.0 µs	0.0 µs 0.0 µs	0.1 µs
Input Impedance	2 kHz 20 kHz 80 kHz 1 MHz	4000 Ω 4000 Ω 4000 Ω 1000 Ω	40 Ω 40 Ω 40 Ω 40 Ω	1 Ω
Output Impedance 1	2 kHz 20 kHz 80 kHz 1 MHz	4000 Ω 4000 Ω 4000 Ω 1000 Ω	40 Ω 40 Ω 40 Ω 40 Ω	1 Ω
Output Impedance 2	50 Ω 400 Ω	100 Ω 100 Ω	10 Ω 10 Ω	1 Ω
Pulse Amplitude	5.6 Ω 50 Ω 400 Ω	2000 mV 2000 mV 2000 mV	110 mV 220 mV 220 mV	1 mV
Pulse Width		20.0 µs	0.0 µs	0.1 µs
Pulse Pol		Normal or Reverse		
Power Receiving	NORM REV	1000 mW 1000 mW	0 mW 0 mW	1 mW —

(2) NT test

Measurement item		Setting range		Resolution
		Upper Limit	Lower Limit	
Input Impedance	2 kHz 20 kHz 106 kHz 1 MHz	4000 Ω 4000 Ω 4000 Ω 1000 Ω	40 Ω 40 Ω 40 Ω 40 Ω	1 Ω
Output Impedance 1	2 kHz 20 kHz 106 kHz 1 MHz	4000 Ω 4000 Ω 4000 Ω 1000 Ω	40 Ω 40 Ω 40 Ω 40 Ω	1 Ω
Output Impedance 2	50 Ω 400 Ω	100 Ω 100 Ω	10 Ω 10 Ω	1 Ω
Pulse Amplitude	50 Ω	2000 mV	220mV	1 mV
Pulse Width		20.0 µs	0.0 µs	0.1 µs
Pulse Pol		Normal or Reverse		
Power Receiving	Ta-Tb Ra-Rb Ra-Tb Rb-Tb Rb-Ta Ra-Ta	±100.0V		0.1 V

4.4 Self-diagnosis Function

The tester is equipped with two self-diagnosis functions: SELF DIAG and EXT DIAG .
SELF DIAG is executed on peripheral devices of the CPU system when the power is turned ON.
EXT DIAG can be executed on the tester measurement system when required.

SELF DIAG Messages

Message	Description
CPU I/F check ...	CPU interface LSI check
ROM check ...	ROM sum check
RAM check ...	RAM read/write check
VRAM check ...	Display VRAM read/write check
DMA check ...	DMA function check
SIO check ...	Serial interface check
GPIB check ...	GPIB function check
RTC check ...	Real time clock function check
TIMER check ...	Timer function check
KEY check ...	Panel key check

4.5 Self-Calibration Function

The self-calibration function is executed when the tester power is turned on, and it is used for calibration of the tester measuring system. This function is also provided by the utility and the calibration can be made any time when necessary. The measuring system can be calibrated as follows:

(1) A/D CALIBRATION

Calibrates the analog measuring system of the tester. It can calibrate the following three items:

① Offset error of A/D converter
The inputs of A/D converter are shorted and its voltage is measured and used as the offset voltage. The offset error of A/D converter is corrected by the use of this data.

② Offset error of sample hold circuit
The inputs of sample hold circuit are shorted and its voltage is measured and used as the offset voltage. The output of sample hold circuit is corrected by the use of this data.

③ Error of current and voltage measuring system during impedance measurement
The internal reference resistance is measured, and the error of the current and voltage measuring system is corrected during impedance measurement.

(2) PHASE JITTER CAL.

Measures the time delay of signal transfer from the internal driver to the receiver. The resulting delay time is used to correct the measured phase and jitter.

The correction data must be obtained for calibration. If this value exceeds the limit of ordinary values, the failure or NG message is displayed, the reference value is used as the correction data, and the measurement is continued. If the NG message is output, the measuring system may fail. Contact to the sales dealer or the support offices for repair.

5. EXTERNAL INTERFACE

5.1 GPIB

The GPIB (general-purpose interface bus) enables tester measurement condition setting and measurement execution to be controlled from an external controller, making an automatic measurement system possible.
The GPIB is based on IEEE 488.2 specifications and supports "upper node protocol" so that the measurement condition can be easily referenced upon query from the controller.

5.1.1 GPIB General Specifications

General specifications

Basic specifications	:	IEEE 488.2-1987
Logic level	:	Logic 0 "High" state; +2.4V or above
		Logic 1 "Low" state; +0.4V or above
Interface functions	:	SH1, AH1, T6, L3, SR1, RL1, PP0, DC1, DT1, C0, E2

Table 5-1 Interface Functions

Code	Description
SH1	Source handshake
AH1	Accept handshake
T6	Basic Talker function. Talker is released when Listener is specified. Serial polling
L3	Basic Listener function. Listener is released when Talker is specified. Listen only mode
SR1	Service request
RL1	Remote/Local switching
PP0	No parallel poll
DC1	Device clear
DT1	Device trigger
C0	No controller
E2	Try state output

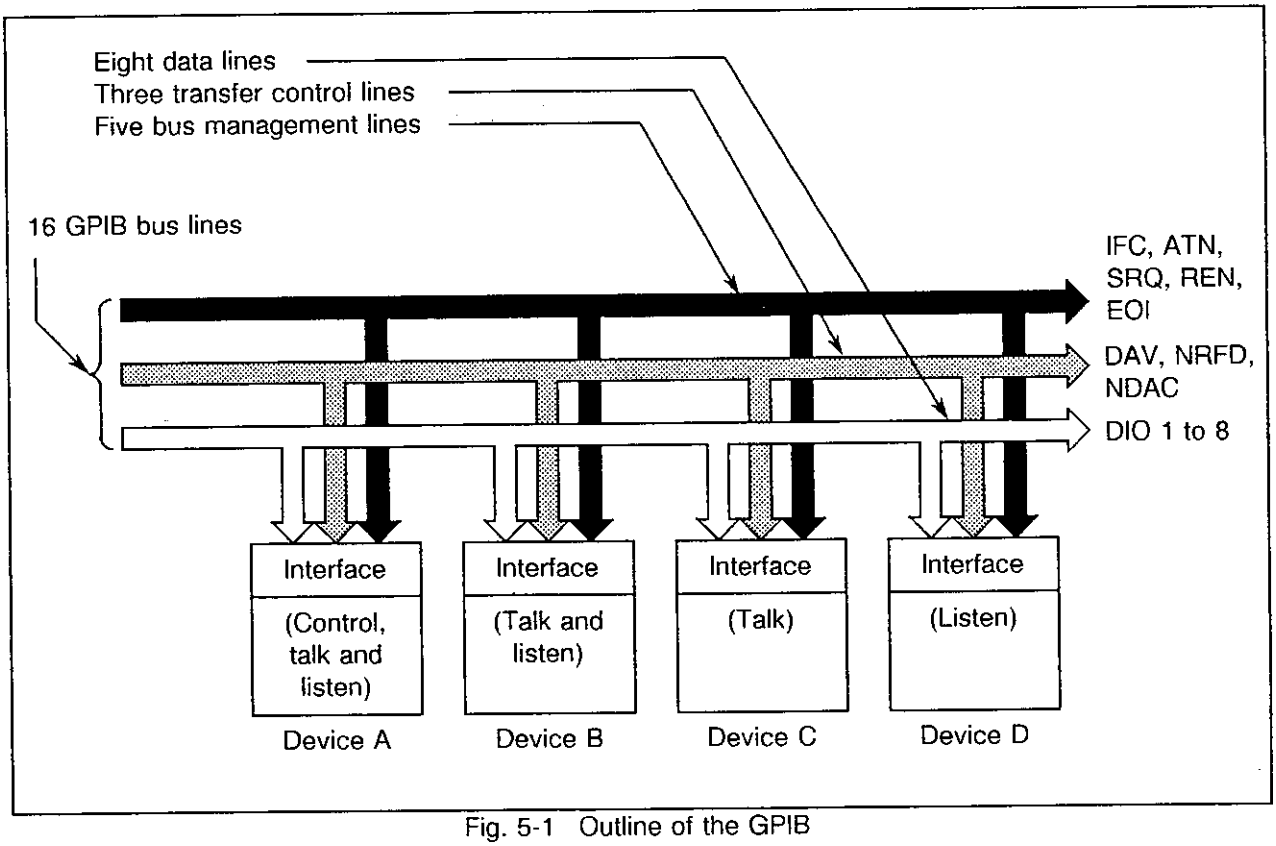


Fig. 5-1 Outline of the GPIB

5.1.2 GPIB specifications

(1) GPIB specifications

Basic specifications	:	IEEE 488.2-1987
Logic level	:	Logic 0 "High" state; +2.4V or above
		Logic 1 "Low" state; +0.4V or above
Signal line termination	:	The 16 bus lines are terminated as follows:

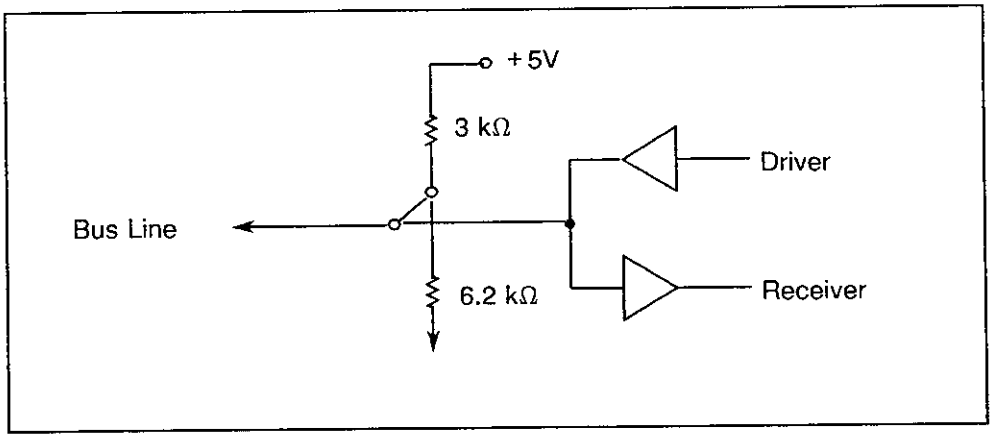


Fig. 5-2 Signal Line Termination

Driver specifications	:	Open collector type
"Low" state output voltage	:	+0.4V or below, 48mA
"High" state output voltage	:	+2.4V or above, −5.2mV
Receiver specifications	:	"Low" state if +0.6V or below "High" state if +2.0V or above
Bus cable length	:	The entire length of the bus cable should not exceed (the number of devices connected to the bus) × 2m, or 20m.
Address specifications	:	31 talk/listen addresses can be specified on the menu screen.
Connector	:	24-pin GPIB connector 57-20240-D35A (produced by Amphenol or its equivalent)

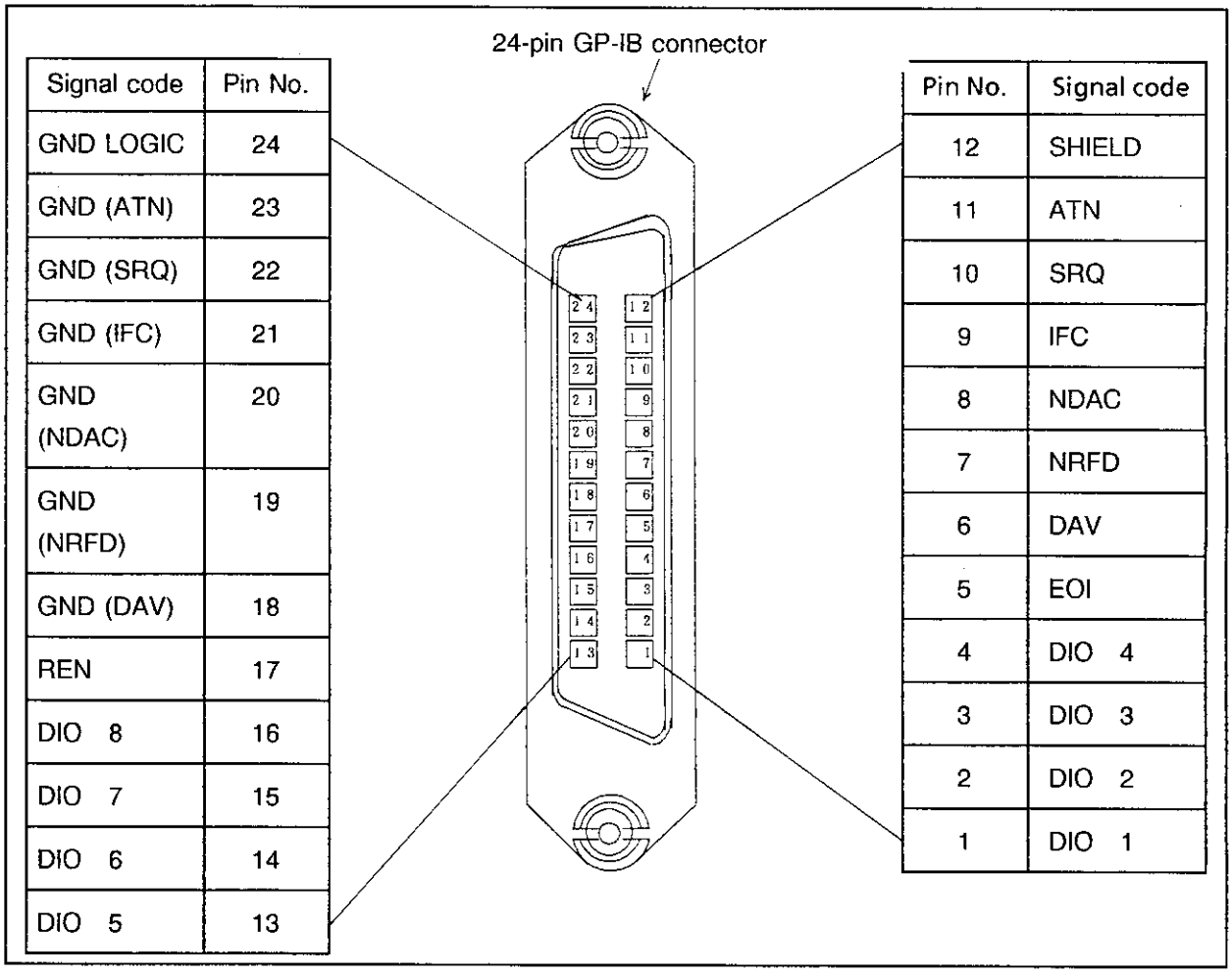


Fig. 5-3 GPIB Connector Pin Assignment

5.1.3 GPIB Handling

(1) Handling precautions

① Connection to component devices
Since the GPIB system consists of multiple devices, pay special attention to the following:

- Do not use a longer cable than necessary to connect the measurement device and controller.
  The total length of the cable should not exceed 20m.

- Before turning power on to the component devices, confirm the power conditions, grounding and other settings of each device.

② GPIB cable connection and disconnection
Before connecting or disconnecting the GPIB cable, turn power to all connected devices off.

(2) Address specifications

The tester address can be set to any of the following 31 addresses given in Table 5-2 in the ADDRESS field of the Utility interface screen.

The address can be modified by pressing PREV and NEXT.

Table 5-2 Address Codes

ASCII code character		5-bit decimal code
LISTEN	TALK	
SP	@	0
!	A	1
"	B	2
#	C	3
$	D	4
%	E	5
&	F	6
'	G	7
(	H	8
)	I	9
*	J	10
+	K	11
,	L	12
-	M	13
.	N	14
/	O	15

ASCII code character		5-bit decimal code
LISTEN	TALK	
0	P	16
1	Q	17
2	R	18
3	S	19
4	T	20
5	U	21
6	V	22
7	W	23
8	X	24
9	Y	25
:	Z	26
;	[	27
<	\	28
=	]	29
>	~	30

(3) Message and Data Formats

The following message and data formats can be used.format.

Table 5-3 Message and Data Formats

			Format	
Separa-tor	Talker	Response message, unit separator	;	
		Response data separator	,	
		Response header separator	Space	
		Response message terminator	NL <END>	
	Listener	Program message separator	;	
		Program data separator	,	
		Program header separator	Space	
		Program message terminator	NL, NL<END>, END, CR, (NL<END>)	
Data format		Decimal	12345, 23.45, 12.3e-9	
		Hexadecimal	#H32F, #h12b	
		Octal	#Q2473, #q77	
		Binary	#B1011, #b1000	
		Character string	"ABCD", "abcd"	
Command format		Single command	○○	
		Complex command	○○;○○;○○	
		Common command	*○○	
Queries		Single command	○○?	Reply in response to measurement condition parameter
		Complex command	○○?:○○?	
		Common command	*○○?	

(4) Common commands

The following can be used by the tester commands defined by IEEE 488.2.

Table 5-4 Common Commands (1/2)

Command		Description
*IDN?	Identification Query	ADVANTEST,D5312B, 0 001LF <EOI> Tester revision
*RST	Reset	Initializes the tester.
*TST?	Self test	Executes Extended Diag of the tester and sends back the result. Response = 0: Diag result OK Response ≠ 0: Diag result NG
*CAL?	Calibration	Executes self-calibration of the tester and sends back the result. Response = 0: Normal completion Rxponse ≠ 0: Error (The calibrated value becomes the default value.)
*OPC	Operation Complete	Completes all operations in progress and sets LSB of SESR.
*OPC?	Operation Query	Sends back ASCII "1" when all operations are complete.
*WAI	Wait to complete	Keeps the command in wait status until all preceding commands and queries are complete. When they are, executes the command following *WAI.
*CLS	Clear status	Clears the status byte.
*ESE	Event Status enable	Sets the standard event status enable register. The data is <NRf>0 through 255.
*ESE?	Event Status Query	Reads data from the standard event status enable register. The data is <NRf> 0 through 255.
*ESR?	Event Status Resuster Query	Reads data from the standard event status register. The status is cleared after read is completed.
*SRE	Service Request Enable	Sets the service request enable register. The data is <NRf>.

Table 5-4 Common Commands (2/2)

Command		Description
*SRE?	Service Request Query	Reads data from the service request enable register. Replies with the data <NR1> integer.
*STB?	Statrus Byte Query	Reads out the status byte. The data for response is <NR1> integer.

(5) List of Commands to be Specified

Command headers used in the measurements are listed in Table 5-5.

The commands used by the tester are divided into the following groups: Test mode and test item, measurement condition, execution and tead command.

The commands corresponding to the measurement conditions reply to the queries from the controller.

A question mark "?" is added to the command header for queries from the controller.

① Test mode and test item

Table 5-5 Test Items

Item	Header			Description
TeSt mode	TS	1		TE test mode is selected.
		2		NT test mode is selected.
ACTivation	ACT			NT/TE state transient time is measured.
Input iMpedance	IM			Input impedance is measured.
Output iMpedance	OM	1		Output impedance 1 is measured.
		2		Output impedance 2 is measured.
Pulse Amplitude	PA			Pulse amplitude is measured.
Pulse Width	PW			Pulse width is measured.
Phase & Jitter	PJ			Phase and jitter are measured.
Clock Accuracy	CA			Clock accuracy in the TE test is measured.
Pulse Polarity	PP			Pulse polarity is measured.
Power Feeding	PF			NT power characteristics in the NT test are measured
Power Receiving	PR			TE power consumption in the TE test is measured.
Data Access	DA			Data sent back from the NT/TE is tested.
Error Bits	EB			Error detection in the data from the NT/TE
Echo Check	EC			Echo check test in the NT test
Loop Back Monitor	LBM			Monitor sent back in the NT test

② Measurement conditions

Table 5-6 Measurement Conditions (1/3)

Item	Header			Description
Activation Procedure	AP			Start procedure in the start/stop test is selected.
		0		CALL
		1		ANSWER
TerMinate	TM	0		The 100Ω termination resistor is selected.
		1		The 50Ω termination resistor is selected.
Phase Deviation	PD	–20 to 400		The phase delay is set. Setting range: –20 to 400(%)
Jitter Amplitude	JA	0 to 14		The amount of jitter to be added to the output is set. Setting range: 0 to 14(%)
Jitter Frequency	JF	0		Jitter frequency: 1Hz
		1		Jitter frequency: 3Hz
		2		Jitter frequency: 10Hz
		3		Jitter frequency: 30Hz
		4		Jitter frequency: 100Hz
		5		Jitter frequency: 300Hz
		6		Jitter frequency: 1kHz
		7		Jitter frequency: 3kHz
		8		Jitter frequency: 10kHz
		9		Jitter frequency: 30kHz
Output Pulse amplitude	OP	–8.0 to 2.0		The output signal pulse width is set. Setting range: –8.0 to 2.0 (dB) in 0.5dB steps
CHannel select	CH			The measurement channel is specified for the error bit or data access test. The <data> specifies the word pattern or the number of PRBS steps: WP1, CH0, 1100.
		0	<data>	B1: Channel measurement
		1	<data>	B2: Channel measurement
		2	<data>	B1 + B2: Channel measurement
		3	<data>	D: Channel measurement
		4	<data>	Q: Q data setting for data access

Table 5-6 Measurement Conditions (2/3)

Item	Header			Description
Word Pattern	WP			Measurement pattern selection for error bit measurement
		0		Quasi-random pattern (PRBS)
		1		Word pattern (4 bits)
		2		Word pattern (8 bits)
		3		Word pattern (16 bits)
Load Resistance	LR			Measurement load resistances selection for pulse amplitude measurement in the TE test
		0		Select 50Ω
		1		Select 400Ω
		2		Select 5.6Ω
		3		Select ALL(50/400/5.6Ω)
Loop Back Select	LCH			Loop back channel is switched ON/OFF.
		0	N	B1ch; Only monitor
			Y	B1ch; Loop back
		1	N	B2ch; Only monitor
			Y	B2ch; Loop back
		3	N	Dch; Only monitor
			Y	Dch; Loop back
PRBS				The number of steps in the quasi-random pattern is set: WP0, CH0, <n>
		0		2^7-1
		1		2^9-1
		2		$2^{10}-1$
		3		$2^{11}-1$
		4		$2^{15}-1$
		5		$2^{17}-1$
		6		$2^{19}-1$
		7		$2^{20}-1$
		8		$2^{23}-1$

Table 5-6 Measurement Conditions (3/3)

Item	Header			Description
Measurement Time	MT			The measurement time is set for error bit measurement
		0		Continuous measurement (CONT)
		1		1×10^3
		2		1×10^4
		3		1×10^5
		4		1×10^6
		5		1×10^7
D-Channel Select	DS			The external signal is selected for the error test.
		0		Internal (INT)
		1		External (EXT)
Error Addition	EA			Manual error insertion for execution of error measurement (continuous measurement only)
PHantom power	PH			Power feed mode to the TE is selected for the TE test.
		0		OFF
		1		NORMAL
		2		REVERSE
Power Source	PS			Power feed mode from the NT is selected for the NT test.
		0		LOCAL
		1		NORMAL
		2		REVERSE
Test Pattern	TP			The test pattern is selected for phase/jitter measurement.
		0		ALL1
		1		40 frames
		2		2^{19} -1PRBS pattern

③ Measurement execution

Item	Header			Description
STart	ST			Measurement execution
StoP	SP			Measurement stop

④ Read command

Item	Header			Description
Read Data	RD	0		Only the measurement value is output.
		1		The measurement result is output in D5312B display format.
Read Status	RS			The transient status is output.

⑤ Output format control command

Item	Header			Description
Output MODE	OMODE	0		No query header is output.
		1		A query header is output.
		2		No query header is output in response to common commands.

⑥ Service request control command

Item	Header			Description
Service Request	S	0		SRQ is transmitted.
		1		No SRQ is transmitted.

⑦ Terminator control command

Item	Header			Description
DeLimiter	DL	0		Message terminator NL^END
		1		Message terminator NL
		2		Message terminator END
		3		Message terminator CR(NL^END)

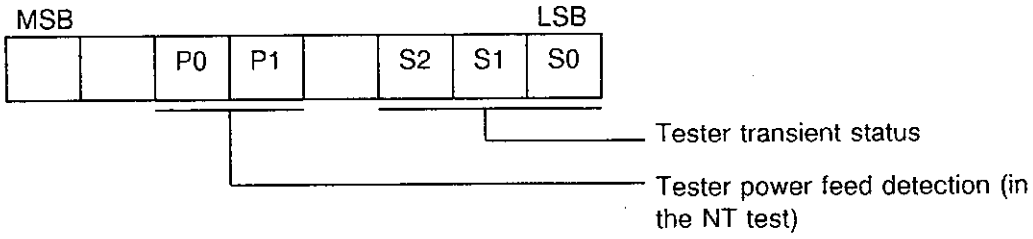
CAUTION

The numeric parameters are handled is integer format by this tester. In commands with numeric parameters such as PD, JA and LP, the values are set, discarding the fractions. These parameters will not cause errors.

(6) Read command

The tester setting conditions can be read out using the following read command.

Reading the transient status: RS



- NT test

S2	S1	S0	Transient status
0	0	0	F1
0	0	1	F2
0	1	0	F3
0	1	1	F4
1	0	0	F5
1	0	1	F6
1	1	0	F7
1	1	1	F8

P0	P1	NT power feed detection
0	0	OFF
0	1	NORMAL
1	0	REVERSE
1	1	Not use

- TE test

S2	S1	S0	Transient status
0	0	0	G1
0	0	1	G2
0	1	0	G3
0	1	1	G4

(7) Event status and status byte registers

The event status and status byte registers are defined in the tester as follows:

① Event status register

The standard event status register is defined as follows:

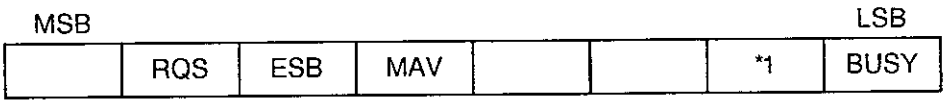
MSB LSB

PON	(URQ)	CME	EXE	DDE	QYE	(RQC)	OPC

Bit name		Description
PON	Power ON	Power source status
URQ	User Request	Undefined (= 0)
CME	Command error	An undefined command was received or a syntax error occurred.
EXE	Execution error	A command or parameter outside the specification range or not allowed was received.
DDE	Device dependent error	• Measurement failed because the I-interface bus status was modified during measurement execution. • The buffer was over at the start time measurement
QYE	Query error	Data read was tried when no transmit data was found in the output queue.
RQC	Request control	Undefined (= 0)
OPC	Operation complete	The next command can be received.

② Status byte register

The status byte register used to make service requests between the active controller from the tester is defined as follows:



*1 Measurement impossible

Bit name		Description
RQS	Request Service	Service request bit
ESB	Event summary bit	The logical sum of the event status register
MAB	Message Available	The output queue contains data to be transmitted.
Measurement impossible		No measurement can be executed because the I-interface status has not entered a status which can be measured by the tester. (Illegal state) System initialization is in progress.
BUSY		Measurement completed.

5.1.4 GPIB Program

Examples of GPIB programs for an NEC PC-98 are given below along with explanations.

(1) Program 1

For executing output impedance measurement in the TE test, the common command *WAI is issued to poll measurement completion and the measurement results to be output are read.

```
100 '************************************************************
110 '
120 '          D5312B GPIB (TE Output Impedance 1)
130 '
140 '                                1991.3.15 ADVANTEST CORP.
150 '************************************************************
160 '
170 CONSOLE ,,0,1: COLOR 7: CLS
180 DIM R$(1000):MAX=0:MIN=0:AVE=0
190 '******** GPIB Init. ******************
200 ADDR = 8                                  :'D5312B Address = 8
210 ISET IFC
220 WBYTE &H14;                               :'DCL
230 TIME$="00:00:00"
240 ON TIME$="00:00:02" GOSUB *TIM
250 PRINT"BUSY": TIME$ ON
260 GOTO 260
270 *TIM : RETURN 280
280 ISET REN
290 CMD DELIM = 0
300 CMD TIMEOUT = 0
310 SRQ OFF
320 PRINT@ADDR;"*CLS"@                        :'Status Clear
330 PRINT@ADDR;"OMODE 1"@                     :'Output Mode Set
340 PRINT@ADDR;"*RST"@                        :'D5312B RESET
350 PRINT@ADDR;"S1"@                          :'SPOLL DESABLE
360 PRINT @ADDR;"TS1;OM1;ST"@                  :'OutputImpedance1 & Start
370 PRINT@ADDR;"*WAI;RD0?"@                   :'Wait & Read
380 LINE INPUT @ADDR;R$:GOSUB *DOUT
390 PRINT@ADDR;"ST"@ : GOTO 370
400 '
410 '************************************************
420 '             DATA FORMAT
430 '************************************************
440  *DOUT
450  PRINT B$
460  B=INSTR(R$," "):B$=MID$(R$,B,50):D0=VAL(MID$(B$,2,B+1))
470  P0=INSTR(B$,","):B$=MID$(B$,P0+1,50):D1=VAL(MID$(B$,1,P0+1))
480  P1=INSTR(B$,","):B$=MID$(B$,P1+1,50):D2=VAL(MID$(B$,1,P1+1))
490  P2=INSTR(B$,","):B$=MID$(B$,P2+1,50):D3=VAL(MID$(B$,1,P2+1))
500  CLS 3 : LOCATE 20,6,1 : PRINT "***  TE Output Impedance 1 TEST  ***"
510  LOCATE 24,8,1
520  PRINT "Frequency   Impedance"
530  LOCATE 23,10,1
540  PRINT USING "&          & ####.# &   &";"   2 kHz    [ ",D0,"OHM] "
550  LOCATE 23,11,1
560  PRINT USING "&          & ####.# &   &";"  20 kHz    [ ",D1,"OHM]"
570  LOCATE 23,12,1
580  PRINT USING "&          & ####.# &   &";"  80 kHz    [ ",D2,"OHM] "
590  LOCATE 23,13,1
600  PRINT USING "&          & ####.# &   &";"   1 MHz    [ ",D3,"OHM]"
610  RETURN
620  END
```

A typical output (result)

```
***  TE Output Impedance 1 TEST ***

Frequency Impedance
   2 kHz   [  491.6 OHM]
  20 kHz   [ 5000.0 OHM]
  80 kHz   [ 3987.1 OHM]
   1 MHz   [  248.8 OHM]
```

Line	Description
	Initialization (**** GPIB Init. *****)
200	D5312B listener address is set .....Address = 8
210	The interface is cleared with the IFC.
220 through 270	The D5312B sequence is initialized (DCL) with device clear. Up to two seconds are required for initialization.
280	The interface bus is set to remote mode.
290	The controller command delimiter is specified: CR + LF
300	The command time out is specified: TIMEOUT = 0 No check
310	Service request is inhibited.
330	The output format of the D5312B transmit data is specified.
340	The D5312B measurement sequence is initialized.
350	Serial polling from the controller is disabled.
360	The TE test is set to the output impedance measurement mode and measurement is started.
370	After waiting until D5312B measurement is complete with the *WAI command,the measurement result is read out.
440 through 610	Measurement result format (**** DATA FORMAT *****)
	The measurement results are formatted into the D5312B display format and output.

Note: The *WAI command does not execute the next command unless the preceding command is complete. Do not use the *WAI command for the next measurement items:

1. Activation procedure
2. Continuous measurement of the measurement time in the error bit (CONT)

If the *WAI command is executed after the ST command for these two items, wait status will be kept for ever and the next command cannot be executed. This state can only be interrupted only by issuing the IFC command.

(2) Program 2

For input impedance measurement in the TE test, after executing measurement start, the measurement result is read and output using the service request (SRQ).

```
100 '************************************************************
110 '
120 '          D5312B GPIB (TE Input Impedance )
130 '
140 '                                1991.3.14 ADVANTEST CORP.
150 '************************************************************
160 '
170 CONSOLE ,,0,1: COLOR 7: CLS
180 DIM R$(1000):MAX=0:MIN=0:AVE=0
190 '******** GPIB Init. ******************
200 ADDR = 8                                    :'D5312B Address = 8
210 ISET IFC
220 WBYTE &H14;                                 :'DCL
230 TIME$="00:00:00"
240 ON TIME$="00:00:02" GOSUB *TIM
250 PRINT"BUSY": TIME$ ON
260 GOTO 260
270 *TIM : RETURN 280
280 ISET REN
290 CMD DELIM = 0
300 CMD TIMEOUT = 0
310 SRQ OFF
320  POLL ADDR,STB
330 PRINT@ADDR;"*CLS"@                          :'Status Clear
340 PRINT@ADDR;"OMODE 1"@                       :'Output Mode Set
350 PRINT@ADDR;"*RST"@                          :'D5312B RESET
360 PRINT@ADDR;"*SRE #H01"@                     :'SRE="MAV"
370 PRINT@ADDR;"S0"@                            :'SPOLL ENABLE
380 SRQ ON                                      :'SRQ Active
390 ON SRQ GOSUB *SPOLL                         :'SRQ
400 PRINT @ADDR;"TS1;IM;ST"@
410 SRQ ON
420 GOTO 410
430  ' ****************************************
440  '            SERIAL POLL
450  ' ****************************************
460  *SPOLL
470  POLL ADDR,STB
480  STB=STB-64
490  PRINT"Status Byte=";STB;".......";
500  IF STB=1 THEN PRINT :GOSUB *RD
510  RETURN
520 '************************************************
530 '             DATA READING
540 '************************************************
550  *RD
560  PRINT@ADDR;"RD0?"@                         :'Measurement End
570  LINE INPUT @ADDR;R$:GOSUB *DOUT
580  PRINT@ADDR;"ST"@
590  RETURN
```

```
600 '************************************************
610 '             DATA FORMAT
620 '************************************************
630  *DOUT
640  PRINT B$
650  B=INSTR(R$," "):B$=MID$(R$,B,50):D0=VAL(MID$(B$,2,B+1))
660  P0=INSTR(B$,","):B$=MID$(B$,P0+1,50):D1=VAL(MID$(B$,1,P0+1))
670  P1=INSTR(B$,","):B$=MID$(B$,P1+1,50):D2=VAL(MID$(B$,1,P1+1))
680  P2=INSTR(B$,","):B$=MID$(B$,P2+1,50):D3=VAL(MID$(B$,1,P2+1))
690  CLS 3 : LOCATE 25,6,1 : PRINT "TE Input Impedance TEST"
700  LOCATE 24,8,1
710  PRINT "Frequency   Impedance"
720  LOCATE 23,10,1
730  PRINT USING "&           & ####.# &   &";"   2 kHz    [ ",D0,"OHM] "
740  LOCATE 23,11,1
750  PRINT USING "&           & ####.# &   &";"  20 kHz    [ ",D1,"OHM]"
760  LOCATE 23,12,1
770  PRINT USING "&           & ####.# &   &";"  80 kHz    [ ",D2,"OHM] "
```

A typical output (result)

```
        TE Input Impedance TEST

        Frequency Impedance
           2 kHz  [  278.0 OHM]
          20 kHz  [ 2728.3 OHM]
          80 kHz  [ 5000.0 OHM]
           1 MHz  [  842.9 OHM]
```

Line	Description
200	Initialization (**** GPIB Init. *****) The D5312B listener address is specified....Address = 8
210	The interface is cleared with IFC.
220 through 270	The D5312B internal sequence is initialized with device clear (DCL). Up to two minutes are required for initialization.
280	The interface bus is set to remote mode.
290	The controller command delimiter is specified: CR + LF.
300	The command time out is specified: TIMEOUT = 0 No check
310	Service request is inhibited.
330	The status byte is cleared.
340	The output format of the D5312B transmit data is specified.
350	The D5312B measurement sequence is initialized.
360	The service request enable register is set: Measurement end bit.
370	Serial polling from the controller is enabled.
380 through 390	Service request interrupt is allowed.
400	The TE mode is set to impedance measurement and measurement is executed.
410 through 420	Waiting for the service request interrupt
470 through 510	SRQ interrupt routine (**** SERIAL POLE*****) Interrupt upon measurement completion Bit 1 = 1: Measurement complete
550 through 590	Measurement result read (**** DATA READING *****) The measurement results are read out.
630 through 800	Result output (**** DATA FORMAT ****) The measurement results are formatted into the display format of the D5312B and output into the terminal.

(3) Program 3

For error bit measurement in the TE test, after executing measurement start, an interrupt is caused using service request (SRQ) and the measurement results are reduced output.

```
100 '************************************************************
110 '
120 '          D5312B GPIB (TE Error Bit )
130 '
140 '                                  1991.3.14 ADVANTEST CORP.
150 '************************************************************
160 '
170 CONSOLE 0,25,0,1: COLOR 7: WIDTH 80, 25: CLS
180 DIM R$(1000):MAX=0:MIN=0:AVE=0
190 '******** GPIB Init. **********************
200 ADDR = 8                                    :'D5312B Address = 8
210 ISET IFC
220 WBYTE &H14;                                 :'DCL
230 TIME$="00:00:00"
240 ON TIME$="00:00:02" GOSUB *TIM
250 PRINT"BUSY": TIME$ ON
260 GOTO 260
270 *TIM : RETURN 280
280 ISET REN
290 CMD DELIM = 0
300 CMD TIMEOUT = 0
310 SRQ OFF
320 POLL ADDR,STB
330 PRINT@ADDR;"*CLS"@                          :'Status Clear
340 PRINT@ADDR;"OMODE 1"@                       :'Output Mode Set
350 PRINT@ADDR;"*RST"@                          :'D5312B RESET
360 PRINT@ADDR;"*SRE #H03"@                     :'SRE="MAV"
370 PRINT@ADDR;"S0"@                            :'SPOLL ENABLE
380 ON SRQ GOSUB *SPOLL                         :'SRQ
390 *RESTART
400 PRINT @ADDR;"TS1;EB;PH2;WP0"@               :'TE ErrorBit & PRBS
410 PRINT @ADDR;"CH0 2;CH1 5;CH3 8"@            :'ch Pattern
420 PRINT @ADDR;"MT3;OP 0.0;JA 0;JF6;DS0;ST"@ :'Jitter & Ampulitude
430 SRQ ON                                      :'SRQ Active
440 GOTO 430
450  ' ****************************************
460  '            SERIAL POLL
470  ' ****************************************
480  *SPOLL
490  POLL ADDR,STB
500  STB=STB-64
510  PRINT"Status Byte=";STB;".......";
520  IF STB=1 THEN PRINT :GOSUB *RD             :'Measurement End
530  IF STB=2 THEN PRINT "Measurement not Avalable" : GOSUB *ER
540  RETURN
```

```
550 '************************************************
560 '             DATA READING
570 '************************************************
580  *RD
590  PRINT @ADDR;"RD0?"@   : LINE INPUT @ADDR;R$
600  PRINT @ADDR;"TM?"@    : LINE INPUT @ADDR;TM$
610  PRINT @ADDR;"PH?"@    : LINE INPUT @ADDR;PH$
620  PRINT @ADDR;"WP?"@    : LINE INPUT @ADDR;WP$
630  PRINT @ADDR;"MT?"@    : LINE INPUT @ADDR;MT$
640  PRINT @ADDR;"OP?"@    : LINE INPUT @ADDR;OP$
650  PRINT @ADDR;"JA?"@    : LINE INPUT @ADDR;JA$
660  PRINT @ADDR;"JF?"@    : LINE INPUT @ADDR;JF$
670  PRINT @ADDR;"DS?"@    : LINE INPUT @ADDR;DS$
680  PRINT @ADDR;"CH0?"@   : LINE INPUT @ADDR;CHA$
690  PRINT @ADDR;"CH1?"@   : LINE INPUT @ADDR;CHB$
700  PRINT @ADDR;"CH3?"@   : LINE INPUT @ADDR;CHD$
710  GOSUB *DOUT
720  PRINT@ADDR;"ST"@
730  RETURN
740 '************************************************
750 '             DATA FORMAT
760 '************************************************
770  *DOUT
780 B=INSTR(R$," "):B$=MID$(R$,B,50):B1$=MID$(B$,2,(INSTR(B$,",")-2))
790 P0=INSTR(B$,","):B$=MID$(B$,P0+1,50):D1$=MID$(B$,1,6)
800 P1=INSTR(B$,","):B$=MID$(B$,P1+1,50):B2$=MID$(B$,1,(INSTR(B$,",")-1))
810 P2=INSTR(B$,","):B$=MID$(B$,P2+1,50):D2$=MID$(B$,1,6)
820 P3=INSTR(B$,","):B$=MID$(B$,P3+1,50):DD$=MID$(B$,1,(INSTR(B$,",")-1))
830 P4=INSTR(B$,","):B$=MID$(B$,P4+1,50):D3$=MID$(B$,1,6)
840 CLS 3
850    TMR$ = MID$(TM$,3,4)
860    PHR$ = MID$(PH$,3,8)
870    WPR$ = MID$(WP$,3,5)
880    MTR$ = MID$(MT$,3,8)
890    OPR$ = MID$(OP$,3,4)
900    JAR$ = MID$(JA$,3,2)
910    JFR$ = MID$(JF$,3,5)
920    DSR$ = MID$(DS$,3,4)
930    CHAR$ =MID$(CHA$,4,5)
940    CHBR$ =MID$(CHB$,4,5)
950    CHDR$ =MID$(CHD$,4,5)
960 LOCATE 20,3,1
970 PRINT "*****   ERROR BIT TEST   *****"
980 LOCATE 20,5,1
990 PRINT "---  Measurement Condition  ---"
1000 LOCATE 20,6,1
```

```
1010 PRINT USING "&                  &!&    &@@@@";"Terminate","[",TMR$,"OHM]"
1020 LOCATE 20,7,1
1030 PRINT USING "&                  &!&       &!";"Phantom Power","[",PHR$,"]"
1040 LOCATE 20,8,1
1050 PRINT USING "&                  &!&       &!";"Test Pattern","[",WPR$,"]"
1060 LOCATE 20,9,1
1070 PRINT USING "&                  &!&       &!";"  B1 ch","[",CHAR$,"]"
1080 LOCATE 20,10,1
1090 PRINT USING "&                  &!&       &!";"  B2 ch","[",CHBR$,"]"
1100 LOCATE 20,11,1
1110 PRINT USING "&                  &!&       &!";"  D  ch","[",CHDR$,"]"
1120 LOCATE 20,12,1
1130 PRINT USING "&                  &!&       &!";"Measurement Time","[",MTR$,"]"
1140 LOCATE 20,13,1
1150 PRINT USING "&                  &!&     &@@@";"Ampulitude","[",OPR$,"dB]"
1160 LOCATE 20,14,1
1170 PRINT USING "&                  &!&      &@@";"Jitter Amplitude","[",JAR$,"%]
1180 LOCATE 20,15,1
1190 PRINT USING "&                  &!&       &!";"       Frequency","[",JFR$,"]"
1200 LOCATE 20,16,1
1210 PRINT USING "&                  &!&       &!";"D-Channel","[",DSR$,"]"
1220 LOCATE 20,18,1
1230 PRINT USING "&                        &"; "-----  Result  -----"
1240 LOCATE 23,19,1
1250 PRINT USING "&     & &  & @@@@@@ &    &";"B1 ch :",B1$,"bit(s)",D1$
1260 LOCATE 23,20,1
1270 PRINT USING "&     & &  & @@@@@@ &    &";"B2 ch :",B2$,"bit(s)",D2$
1280 LOCATE 23,21,1
1290 PRINT USING "&     & &  & @@@@@@ &    &";"D  ch :",DD$,"bit(s)",D3$
1300  RETURN
1310 '  ********************************************
1320 '               ERROR
1330 '  ********************************************
1340 '
1350 *ER
1360   PRINT "ERROR STOP !!"
1370   PRINT "RESTART ??"
1380   PRINT "(Y:RESTART   N:END)
1390   CHK$ = INKEY$
1400   IF CHK$="Y" GOTO *START ELSE *EN
1410 *START
1420   PRINT@ADDR;"SP"@ : GOTO *RESTART
1430 *EN
1440   IF CHK$<>"N" GOTO 1390 ELSE 1450
1450   PRINT@ADDR;"SP"@
1460   END
```

A typical output (result)

```
***  ERROR BIT TEST ***

---  Measurement Condition  ---
Terminate         [100 OHM]
Phantom power     [Reverse]
Test Pattern      [PRBS]
  B1 ch           [PN10]
  B2 ch           [PN17]
  D ch            [PN23]
Measurement Time  [1E+5 bit]
Ampulitude        [0.0 dB]
Jitter Amplitude  [0 %]
       Frequency  [1kHz]
D-Channel         [INT]
-----  Result  -----
B1 ch: 0    bit(s)[Sync]
B2 ch: 0    bit(s)[Sync]
D ch : 0    bit(s)[Sync]
```

Line	Description
	Initialization (**** GPIB Init. *****)
200	The D5312B listener address is specified...Address = 8
210	The interface is cleared with the IFC.
220 through 270	The D5312B internal sequence is initialized with device clear (DCL) Initialization requires up to two seconds.
280	The interface bus is set to remote mode.
290	The controller command delimiter is specified: CR + LF.
300	The command time out is set: TIMEOUT = 0 No check
310	Service request is inhibited.
330	The status byte is cleared.
340	The output format of the D5312B transmit data is specified.
350	The D5312B measurement sequence is initialized.

Line	Description
360	The service request enable register is set to: measurement end bit and measurement disabled bit (event register DDE bit detection).
370	Serial polling from the controller is enabled.
380 through 390	Service request interrupt is allowed.
400 through 420	TE test mode error bit measurement Power feed mode : Reverse Test pattern : PRBS Measurement channel : B1, 2^{10}-1 B2, 2^{17}-1 D, 2^{23}-1 Measurement time : 1×10^5 Output amplitude : 0.0 (dB) Jitter amplitude : 0(%) Jitter frequency : 1 (kHz) D-channel selection : INT
430 through 440	SRQ interrupt is allowed.
480 through 540	SRQ interrupt routine (**** SERIAL POLE ****) STB = 1: Measurement complete STB = 2: Measurement impossible
580 through 730	Reading the measurement result (**** DATA READING *****) The measurement results and conditions are read out using query.
770 through 1300	Output of the results (**** DATA FORMAT *****) The measurement results and conditions are formatted into the D5312B display format and output.
1350 through 1450	Error processing of the measurement disabled condition (**** ERROR *****) As a result of serial polling, measurement disabled (STB = 2) occurs and (DISCONNECTION) measurement is interrupted or re-started.

5.2 Output to the Printer

Using the tester EIA-232D interface, the measurement results can be output to an external serial printer.

<Operation>
Set the interface condition on the Utility screen.
The measurement results corresponding to the test items can be output to the printer.
(See Section 2.7.)

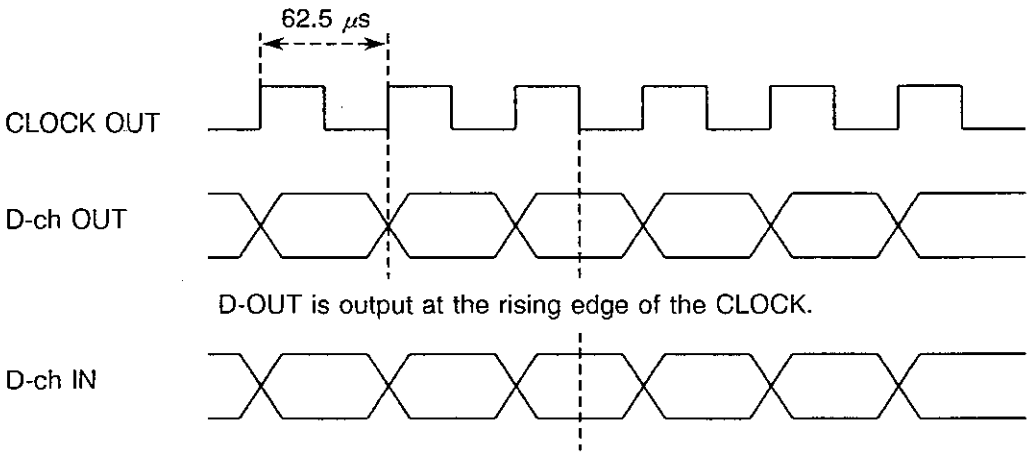
<A typical print out>

```
01-JAN-80 00:03       Page 1

TEST         : NT
TEST MODE    : SINGLE
TEST ITEM    : Output impedance 2
Measurement
  Condition :
              Terminate          [50]
              Power Feed         [Reverse]
-------------------------------------------------------------
Result       :
              Frequency  Impedance

                 500HM     47.1 OHM

                4000HM     37.7 OHM
```

5.3 External I/O Interface

The D-channel signal input/output as well as the clock output signal timing are shown below.
Input and output are executed using logical level TTL.
The tester is enabled for interfacing with an external device in the error bits test

I/O timing



Data is fetched at the trailing edge of the CLOCK output from the tester.

6. CAUTIONS WHEN STORING, CLEANING AND TRANSPORTING THE TESTER

6.1 Tester Storage

The temperature range for tester storage is from -10°C to +60°C. If the tester is left unused for a long time, cover it with vinyl or put it in a corrugated cardboard box and store it in a place not subject to direct sunlight.

6.2 Cleaning and Maintaining the CRT Display

Periodically remove the protective filter from the CRT display and clean its interior and the surface of the CRT display with a piece of soft cloth moistened with alcohol.

CAUTION

The CRT used in the tester contains a high-voltage block.
In case adjustment or replacement is required due to insufficient brightness, contact the ATCE, your nearest branch or agent.

6.3 Tester Transportation

For transporting the tester, use the packing material used when it was shipped from the factory. If no packing material can be found, pack the tester as follows:

① Cover the tester with vinyl.

② Prepare a corrugated cardboard box at least 5mm thickand enclose the tester in 50mm-thick shock absorbing material.

③ Put the accessories in the box and place additional shock absorbing material over them and the tester. Close the lid of the corrugated cardboard box and secure it with packing string.

MEMO

7. PERFORMANCE

(1) Test object : TE and NT based on CCITT I.430 basic interface

(2) Test type : Point-to-point

(3) Test function : ALL test: All test items are executed one after another.
SELECT test: The test items specified are executed.
SINGLE test: Only one item specified is executed.

(4) Test item

① Start/Stop procedure
The R and T line INFO state is detected and the status transient time measured.
Measurement range: 0 to 9999ms
Resolution: 1ms

② Data access
Display data: Binary display of the B1, B2, D, E and Q received
Transmit data: B1, B2 - 16 bits; D - 4 bits; Q - 4 bits

③ Bit error measurement
Bit error measurement of the data received in response to the transmitted data

Measurement channel	:	B1, B2, D, B1 + B2. Up to three channels can be measured at once.
Test pattern	:	PRBS pattern 2^7-1, 2^9-1, 2^{10}-1, 2^{11}-1, 2^{15}-1, 2^{17}-1, 2^{19}-1, 2^{20}-1, 2^{23}-1 WORD pattern 4-bit, 8-bit, 16-bit
Error measurement time	:	10^3, 10^4, 10^5, 10^6, 10^7 bits and continuous
Error insertion	:	Manual insertion through panel key operation (only in continuous measurement mode)

④ Pulse polarity
The polarity of the F and L bits of the received signal appears on the screen.

⑤ Pulse width judgment

The amplitude of the F and L bits of the received signal is determined.

Measurement accuracy:

Measurement load	Measurement range	Resolution	Measurement accuracy 23 ± 5°C < 85RH%
50,400 Ω	0.3 to 2V	1 mV	±(2% + 0.02V)
5.6 Ω	0.1 to 2V	1 mV	±(3% + 0.02V)

Measurement timing: At an amplitude of about 2.5µs from the front edge of the received F/L bits.

⑥ Pulse width measurement

Pulse width measurement of both the positive and negative pulses is executed.

Measurement range: 0 to 20.0µs

Resolution: 50ns

Measurement accuracy: ±100ns

⑦ Phase jitter and difference measurements

The phase difference of the T line F bit against the R line F bit is determined and the maximum value (MAX), the minimum value (MIN), the average (MEAN) and the deviation (DELTA) appear on the screen.

Measurement pattern: For the B1, B2, D and E
(1) ALL "1" pattern
(2) Pattern for every 40 frames
(3) 2^{19}-1PRBS pattern

Measurement range: 0 to 52.0µs

Resolution: 50ns

Measurement accuracy: ± 100ns

⑧ Output impedance

Impedance measurement when logical "0" is output

Measurement resistance change	Measurement range	Resolution	Measurement accuracy 23 ± 5°C < 85RH%
50 Ω ± 10%	10 to 100 Ω	0.1 Ω	±(5% + 2 Ω)
400 Ω ± 10%			±(10% + 2 Ω)

Measurement signal amplitude : $750mV_{0\text{-}P}$

Measurement resistance change : 50Ω ± 10%, 400Ω ± 10%

⑨ I/O impedance measurement

The I/O impedance is measured in the INFO 0 or inactive mode.

Measurement frequency : NT test 2kHz, 20kHz, 106kHz, 1MHz
TE test 2kHz, 20kHz, 80kHz, 1MHz

Measurement accuracy: Within the specification given below under pure resistor load

Measurement frequency	Measurement range	Resolution	Measurement accuracy 23 ± 5°C < 85RH%
2 kHz to 106 kHz	40 to 4000 Ω	0.1 Ω	±3%
1 MHz	40 to 1000 Ω	0.1 Ω	±5%

⑩ Power feed characteristics

The voltage between the R and T lines is determined in the NT test.

Measurement accuracy:

Measurement range	Resolution	Measurement accuracy 23 ± 5°C < 85RH%
0 to 100V	0.1 V	±(1% + 0.1V)

The maximum voltage applied: 300Vmax

⑪ Power receiving characteristics

The TE power consumption is measured in the TE test.

Measurement accuracy:

Measurement range	Resolution	Measurement accuracy 23 ± 5°C < 85RH%
0 to 1000 mW	1 mW	±(1% + 1mW)

Power feed block characteristics

Power voltage : 40V ± 5%

Maximum load : 30mA

⑫ Frequency deviation

The frequency deviation is measured against the nominal frequency in the INFO 1, free run state.

Measurement range: 192kHz ± 1000ppm

Temperature range	Resolution	Accuracy	Accuracy
23 ± 5°C	5 ppm	± 10 ppm	± 2ppm/year
0 to 50°C		± 15 ppm	

⑬ Loop back monitor

The receiving data is sent in the NT test.

(5) Transmit signal addition

① Transmit pulse amplitude modification

Setting range : −8.0 to +2.0dB (0dB = 750m$V_{0\text{-}P}$)
Resolution : 0.5dB
Setting accuracy : ± 1dB

② Jitter addition

Amplitude : 0 to 14% (0 to peak)
Resolution : 1%
Frequency : 1, 3, 10, 30, 100, 300Hz, 1, 3, 10, 30kHz

③ Phase delay addition

Setting range : −20 to 400%
Resolution : 1%

Note that the jitter and the phase delay should satisfy the following condition:
−20% < phase delay - jitter

(6) INFO display

: The INFO state received appears on the screen.

(7) External I/O (Rear BNC)

D-channel data input : Logic level TTL
D-channel data output : Logic level TTL
Clock output : Logic level TTL

(8) Test item backup

Backup item	:	Test parameter

(9) Help

Explanation of GPIB commands in the test functions and the test items

(10) External interface specifications

GPIB interface

Basic specifications	:	Based on IEEE 488.2-1987
Interfaces	:	SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, E2

EIA-232D interface

Basic specifications	:	Based on EIA-232D
Transfer speed	:	300, 600, 1200, 2400, 4800, 9600, 19200bps All dual, start-stop synchronization type
Output	:	Measurement results output to a printer.

(11) General specifications

Display	:	5.5-inch CRT
Operating temperature	:	0 to 50°C
Operating humidity	:	85RH% or below
Power source	:	90 to 250VAC (continuous) 48 to 66Hz
Storage temperature	:	−10 to 60°C
Power consumption	:	80VA maximum
External dimensions	:	300 (width) × 132 (height) × 450 (depth) mm
Weight	:	11kg or less
Warming up time	:	30 minutes or more

MEMO

8. EXPLANATION OF OPERATIONS

The tester consists of input, analog, digital, CPU and power source blocks as illustrated in Fig. 9-1, and executes 1,430 layer 1 evaluation and testing.
The operation of each block is briefly described below.

8.1 Input block

(1) Power detection block
In the TE mode (NT test), the tester detects the power feed state from the NT NORM/REV/OFF.

(2) TE power feed block
In the NT state (TE test), the tester feeds 40V power in reverse or normal mode to the TE.

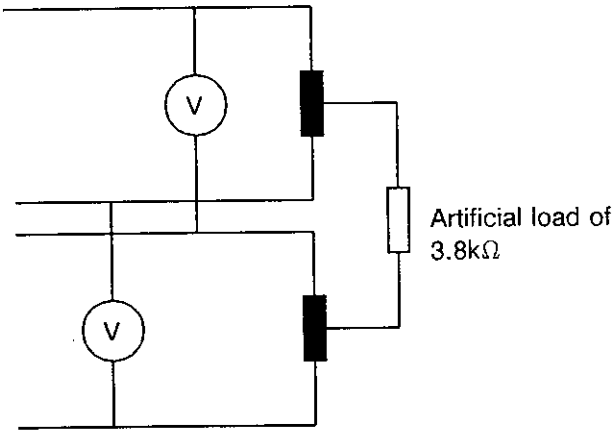
(3) Termination block
Tester internal termination is selected.

8.2 Analog block

(1) Voltage measurement block

Power feed the NT in the NT test or the power received by the TE in the TE test is measured.

Power feed voltage measurement



(2) Amplitude measurement block

The pulse width of the signal received and the output impedance when signal "0" is transmitted are measured.

(3) Sinusoidal wave signal generator block

The reference sinusoidal wave signal is generated here when the I/O impedance is measured in the NT/TE state.

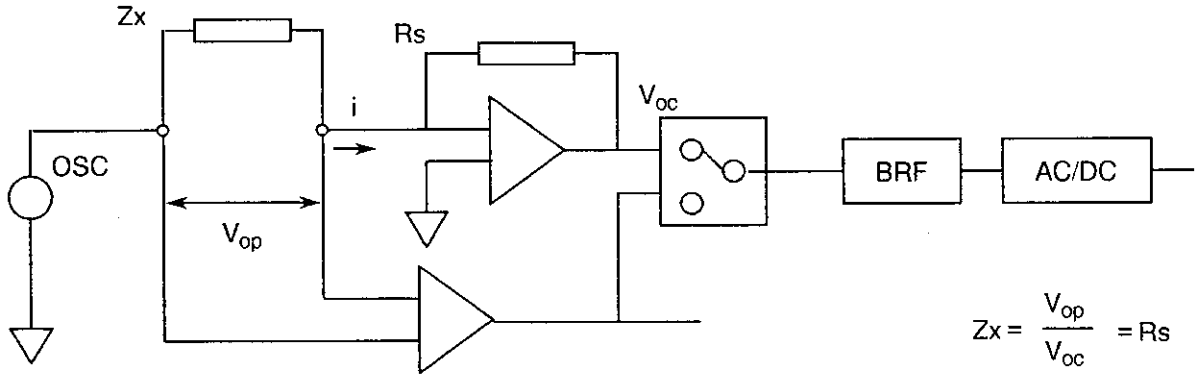
The sinusoidal wave generated by the synthesizer method is of high purity and the frequency of the generated signal can be set at 2k, 20k, 80k, 106k and 1MHz.

The output voltage is about 100mV rms.

(4) Impedance measurement block

This block is used for I/O impedance measurement in the NT/TE state. It consists of voltage and current circuits to be applied to the object to be tested and the impedance of the object to be tested is determined from the voltage/current.

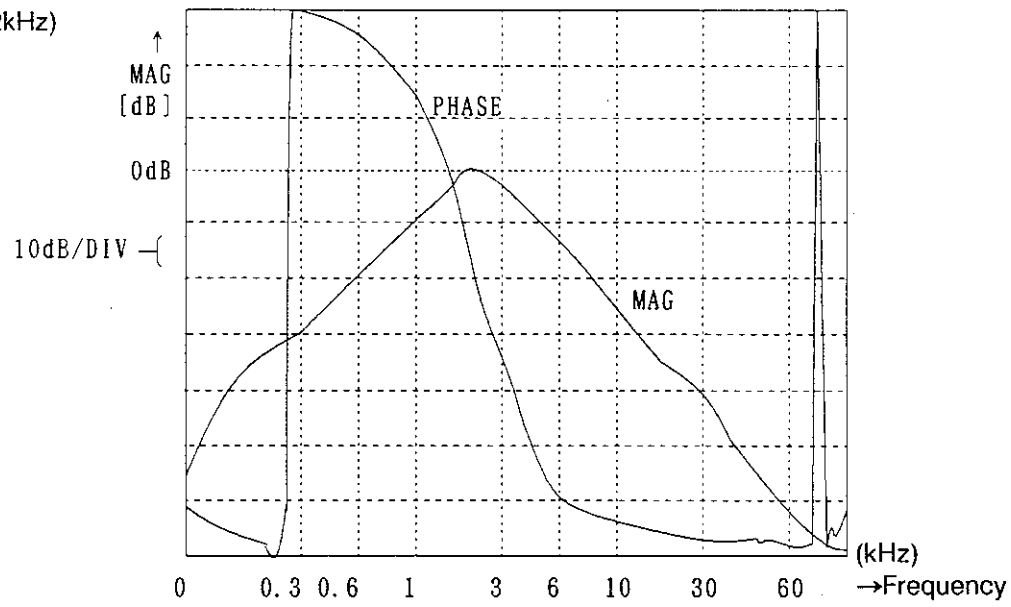
The four-terminal measurement system enables high-accuracy measurement.



f: 2, 20, 80
105Hz, 1MHz

Note that a bandwidth limit filter (BPF) is added to the measurement system to eliminate the frequency component other than the measurement frequency (induced noise and others).

BPF characteristics
(at 2kHz)



(5) Dual Slope A/D

The outputs of the voltage, amplitude and impedance measurement blocks are converted from analog to digital.

The converted data items are transferred to the CPU and appear as measurement results.

The converter used here is a single-chip integer-type A/D which facilitates 40,000-count resolution and 20 measurement times per second.

8.3 Digital Block (SI/F control block)

Receiver section

The receiver section consists of a converter for converting the received AMI signal into an RS signal, a synchronizer and an analyzer for the received signal (INFO), and functions for managing the transient state defined in CCITT 1.430 and controling the digital measurement block.

Transmitter section

The signal is fed to the transmit output amplitude controller, jitter and phase delay addition circuit and converted into an AMI signal for transmission.

Pulse width measurement section

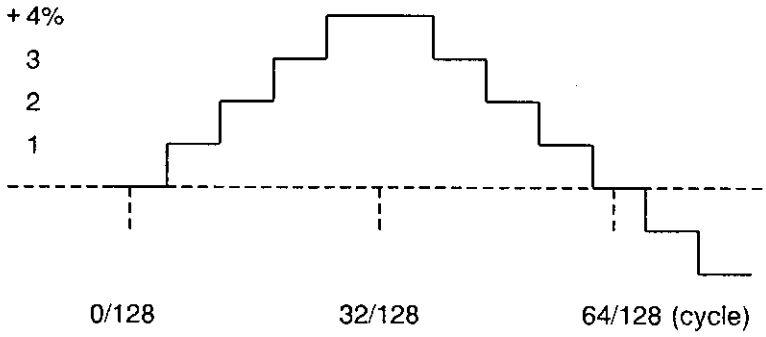
This section consists of a 20bits/50ns resolution counterwhich executes measurement of the pulse width, phase difference of the received signals and clock deviation.

Pattern generator/ERD measurement section

This section consists of a pattern generator for generating patterns corresponding to each of channels B1, B2 and D (PN pattern and WORD pattern) and an error measurement device for measuring the bit error from the received data.

Jitter

Approximate sinusoidal wave jitter is added in the tester.



The approximate sinusoidal wave is the time unit determined by the jitter cycle divided by 128 and the sinusoidal wave displacement is quantified in 1% steps.

Phase delay

Phase delay is added to the transmit signal (T line) according to the received signal (R line) in the NT test.

8.4 CPU Block

(1) CPU

16-bit CPU 68000 (8MHz) is used as the main CPU. It contains the following for executing control and management of the measurement block.

ROM: 512kbytes
RAM: 128kbytes
B.RAM: 8kbytes (for saving the measurement parameters)

(2) External interface control section

CRT controller : For tester display control such as Setup and Result screens
Panel key controller : For controlling the panel keys.
External interface:

- EIA-232D : The measurement results are output to ageneral-purpose serial printer via the EIA-232D interface.
- GPIB : Tester measurement is controlled by an IEEE-488-based interface via the GPIB.

MEMO

9. COMPONENT BLOCKS

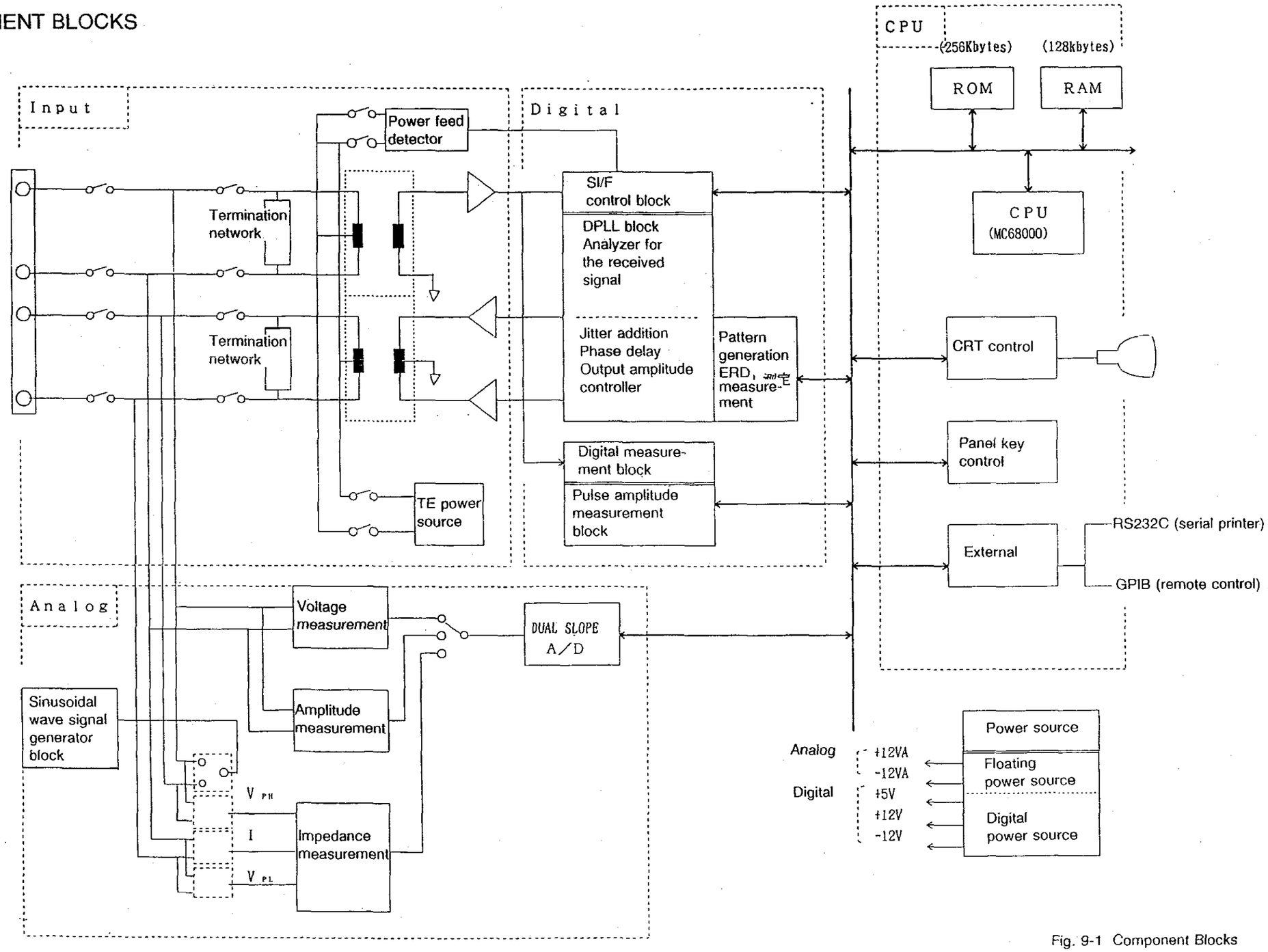


Fig. 9-1 Component Blocks

10. PERFORMANCE TEST (CALIBRATION)

10.1 Introductory Description and UUT Performance Requirements

This procedure describes the performance test of D5312B ISDN tester.

The unit being tested will be referred to herein as the UUT (Unit Under Test).

UUT environmental range	:	Temperature	:	18 to 28°C
		Relative humidity	:	85% or less
UUT warm-up/stabilization period requirements	:	30 minutes		

Table 10-1 UUT Performance Requirements

Unit-Under-Test (UUT) Parameter/Function	Performance Specifications	Test Method
Activation Procedure	Record the INFO signal and its transition time interval.	Perform the activation procedure test and record the INFO signal change at the UUT opposite to the reference D5312B.
Data Access	Word pattern send function TE test : B1, B2 and D channels NT test : B1, B2, D and Q channels Receive data display function TE test : B1, B2, D and Q channels NT test : B1, B2, D and E channels	Perform the data access test to check the set data send function and receive data display function at the UUT opposite to the reference D5312B.
Phase and Jitter	$-0.10\mu s \leqq Mean \leqq 0.10\mu s$ $-0.10\mu s \leqq Max \leqq 0.10\mu s$ $-0.10\mu s \leqq Min \leqq 0.10\mu s$ $0.00\mu s \leqq Delta \leqq 0.20\mu s$	Plug the modular connector of the straight loopback wiring into the socket of UUT and check the phase and jitter.
Error Bit	Test channel: B1, B2 and D Test pattern : PRBS PN7 to PN23, 16-bit word pattern Error free for 1 minute or more	Perform the error bit test to check the error free at the UUT opposite to the reference D5312B.
Input Impedance Output impedance 1	$\leqq \pm 3\%$ (2kHz to 106kHz) $\leqq \pm 5\%$ (1MHz)	Measure the impedance of the reference resistor.
Pulse Amplitude	$635.1mV \leqq [F] \leqq 878.3mV$ $635.1mV \leqq [L] \leqq 878.3mV$	Plug the modular connector of the straight loopback wiring into the socket of UUT and perform the pulse amplitude test.
Pulse Width	$4.70\mu s \leqq [+] \leqq 6.10\mu s$ or $9.90\mu s \leqq [+] \leqq 11.30\mu s$ $4.70\mu s \leqq [-] \leqq 6.10\mu s$	Plug the modular connector of the straight loopback wiring into the socket of UUT and perform the pulse width test.

(Cont'd)

Unit-Under-Test (UUT) Parameter/Function	Performance Specifications	Test Method
Pulse Polarity	Straight loopback modular connector: Normal Cross loopback modular connector: Reverse	Perform the pulse polarity test using both the straight loopback modular connector and cross loopback modular connector.
Clock Accuracy	≦ ±10ppm, ±2ppm/year	Enter 24kHz square waves from the function generator.
Phantom Power Voltage	39.8V≦V≦40.6V	Measure the voltage using a DVM.
Power Receiving	≦ ±(1% + 1mW)	Measure the power consumption during no load and during test load.
Power Feeding	≦ ±(1% + 0.1V)	Enter the reference voltage from the VIG.
Output Pulse Amplitude	≦ ±1dB	Observe the center amplitude of the output pulse on an oscilloscope.
Echo Check	Transmission D channel = Receive E bit: [SAME] display Transmission D channel ≠ Receive E bit: [DIFF] display	Enter E bits from the reference D5312B.
Transmitting of Echo bit	Send the received D channel signal to the E bit through loopback.	Enter the D channel signal from the reference D5312B and monitor the E bits.
Phase Delay of transmitting Signal	10.16μs≦Mean≦10.68μs	Measure the phase delay on the reference D5312B.
D channel External Input/Output	Send the data, entered into D IN terminal, as the D channel data. Output the received D channel data to the D OUT terminal. Output the 16kHz D-channel timing signal to the CLOCK terminal.	Loop back the D channel by connecting the D-channel external input and output connectors of the UUT using the cable. and perform the error test using reference D5312B. Observe the clock output on the oscilloscope.

10.2 Measurement Standards and Support Test Equipment Performance Requirements

The Minimum Use Specifications (MUS) are the calculated minimum performance specifications criteria needed for the Measurement Standards (MS) and support M&TE to be used for the comparison measurements required in the Test Procedure (TP) process.

The MUS is developed through uncertainty analysis and is calculated through assignment of the defined and documented uncertainty/accuracy ratio or margin between the specified tolerance of the UUT and the capability (uncertainty specification) required for the measurement standards system. The MUS is required to assist a measurement specialist in the evaluation of existing or selection of alternate measurement standards equipment.

The uncertainty/accuracy ratio applied in this TP is 10:1.

CAUTION

The instructions in this TP relate specifically to the equipment and conditions listed in Section 10.2. If other equipment is substituted, the information and instructions must be interpreted and revised accordingly.

MS and SM&TE environmental range : Temperature : 18 to 28°C
Relative humidity : 30 to 70%

MS and SM&TE warm-up/stabilization period requirements: 60 minutes

Table 10-2 Measurement Standards (MS) Performance Requirements

Equipment Generic Name (Qty)	Minimum-Use-Specifications	Mfr., Model/Option Applicable
ISDN Tester	Unique	D5312B
Function Generator	Output Frequency : 24kHz Frequency Accuracy : ±1ppm Wave Form : Rectangular Wave Output Impedance : 50Ω Output Voltage : 1.5Vpp	HP3325B + OPT001
DC Volt Meter	Input Impedance : 10MΩ Accuracy : 0.1%	TR6846
DC Voltage Generator	Output Voltage : DC 40V Accuracy : 0.1%	TR6143
Oscilloscope	Band Width : 20MHz Number of Channel : 2ch Input Impedance : 1MΩ Vertical Accuracy : 1% (with Probe Accuracy)	Tek DSA601A + 11A32
10:1 Probe (2)	Input Impedance : 10MΩ	Tek P6134

Table 10-3 Support Measuring and Test Equipment (M&TE) Performance Requirements

Equipment Generic Name (Qty)	Minimum-Use-Specifications	Mfr., Model/Option Applicable
Calibration Unit	Unique	ADVANTEST D5312B Calibration Unit
Cable	Length : about 150cm Connector : BNC (male), Alligator clips	ADVANTEST MI-03 or Generic Equivalent
	Length : about 30cm Connector : BNC (male) at both ends	ADVANTEST MC-06 or Generic Equivalent
	Length : about 200cm Connector : 8 pole modular plug at both ends	D5312B accessory (DCB-RR4591×01)

10.3 Preliminary Operations

WARNING

Always make sure that the ISDN TESTER's power supply cord is plugged into a 3-hole grounded outlet or 2-hole outlet with the grounded adapter. You can be fatally shocked if you fail to follow this rule.
Do not touch live circuits when calibrating the instrument. Never touch the contact area of the interface connector on the D5312B front panel as the high voltage (40 Vdc) applies onto it.

(1) Review this entire procedure before starting the calibration procedure.

(2) Always operate the instrument at the 90 to 250Vac voltage with the line frequency of 50 or 60Hz.

(3) Since the tester analog measurement block employs an integrated A/D converter, the frequency of the AC power source must be set by the tester itself. When modifying the AC power source frequency, execute the CALIBRATION on the Utility menu.

(4) Always confirm that the POWER switch is OFF before connecting the power cable to the AC line.

10.4 Performance Test Process

10.4.1 Activation Procedure

- Description

  This test performs the startup and stop procedure, and checks the normal monitoring.

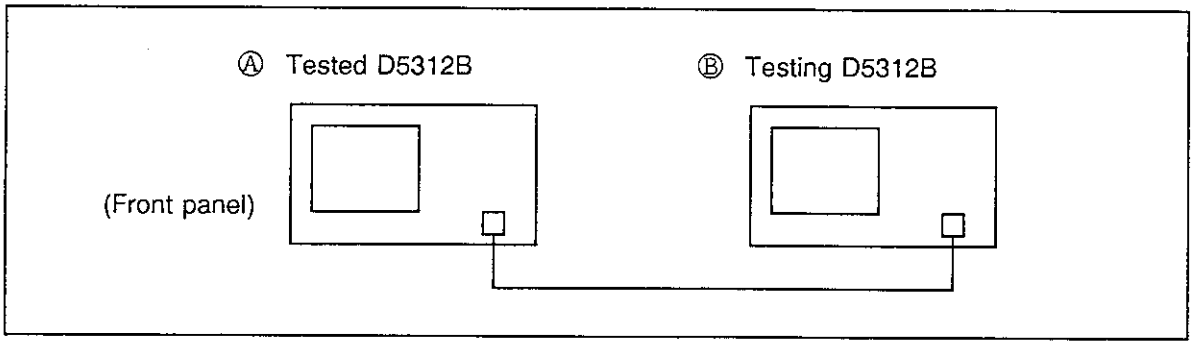


Figure 10-1 Setup of Activation Procedure Test

- Equipment and cables

  - D5312B's whose calibration and operation have been tested
  - Modular cable (attached to the D5312B)

- Procedure

  TE TEST

(1) Press the TE and SINGLE keys in this sequence on the tested D5312B (Ⓐ of Figure 10-1), select the "Activation Procedure" option on the SETUP screen, press the SUB key to call the Measurement Condition screen, and set the following parameters:

Terminate	[100Ω]
Phantom Power	[Reverse]
Activation	[Call]

Figure 10-2 Setup on UUT Measurement Condition Screen

(2) Press the NT and SINGLE keys in this sequence on the testing D5312B (Ⓑ of Figure 10-1), select the "Activation Procedure" option on the SETUP screen, press the SUB key to call the Measurement Condition screen, and set the following parameters:

Terminate	[100Ω]
Activation	[Answer]

Figure 10-3 Setup on Measurement Condition Screen of Testing D5312B

(3) Press the START key on the testing D5312B, and start both of D5312B's by pressing the START key on the tested D5312B after approximately one second.

(4) Wait for 2 or 3 seconds, and make sure that the UUT information of Figure 10-4 is provided on the tested D5312B. The measurement of the testing D5312B stops when the START key is pressed on the testing D5312B.

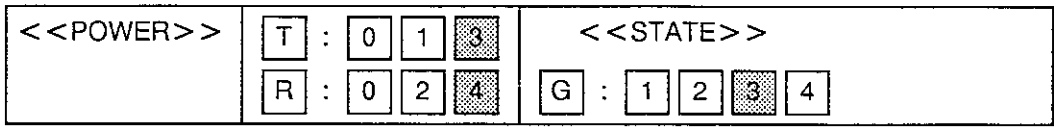


Figure 10-4 UUT Information Display

(5) Wait one or more seconds, and press the START key on the tested D5312B and the measurement of the testing D5312B will stop. Make sure that the test results of the tested D5312B are output as shown in Figure 10-5.

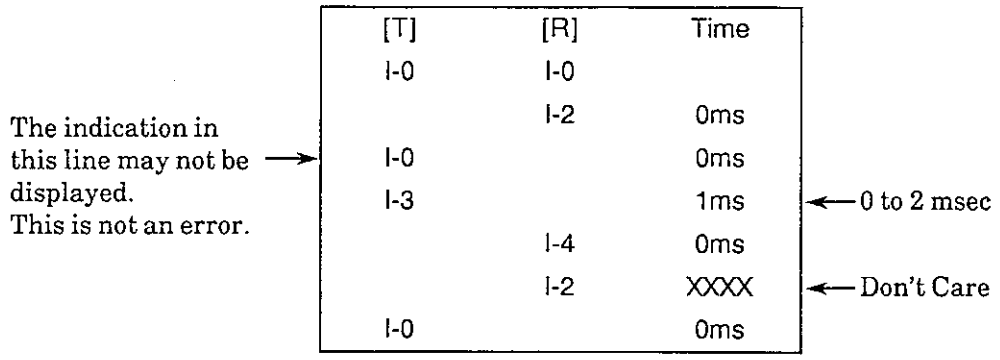


Figure 10-5 UUT Result Display

(6) Press the SETUP and SUB keys in this sequence on the tested D5312B, and modify the test parameters on the UUT Measurement Condition screen as shown in Figure 10-6.

Terminate	[100Ω]
Phantom Power	[Reverse]
Activation	[Answer]

Figure 10-6 Setup on UUT Measurement Condition Screen

(7) Press the SETUP and SUB keys in this sequence on the testing D5312B, and modify the test parameters on the UUT Measurement Condition screen as shown in Figure 10-7.

Terminate	[100Ω]
Activation	[Call]

Figure 10-7 Setup on Measurement Condition Screen of Testing D5312B

(8) Press the START key on the tested D5312B, and start both of D5312B's by pressing the START key on the testing D5312B after approximately 1 second.

(9) Repeat Step (4).

(10) Wait one or more seconds, and press the START key on the tested D5312B. The measurement of the tested D5312B will stop. Make sure that the results of the tested D5312B are as shown in Figure 10-8.

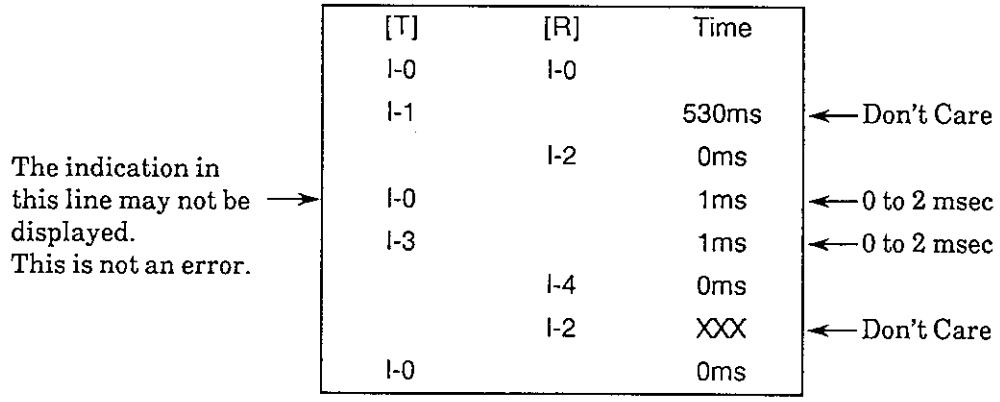


Figure 10-8 UUT Test Result Display

NT TEST

(11) Press the NT and SINGLE keys in this sequence on the tested D5312B, select the "Activation Procedure" option on the SETUP screen, press the SUB key to call the Measurement Condition screen, and set the following parameters:

Terminate	[100Ω]
Activation	[Call]

Figure 10-9 Setup on UUT Measurement Condition Screen

(12) Press the TE and SINGLE keys in this sequence on the testing D5312B, select the "Activation Procedure" option on the SETUP screen, press the SUB key to call the Measurement Condition screen, and set the following parameters:

Terminate	[100Ω]
Phantom Power	[Reverse]
Activation	[Answer]

Figure 10-10 Setup on Measurement Condition Screen of Testing D5312B

(13) Press the START key on the testing D5312B, wait for approximately one second, and press the START key on the tested D5312B. Both of the D5312B's will start.

(14) Wait two or three seconds, and make sure that the information about the tested D5312B is displayed as shown in Figure 10-11. Then press the START key on the testing D5312B, the measurement of the testing D5312B will stop.

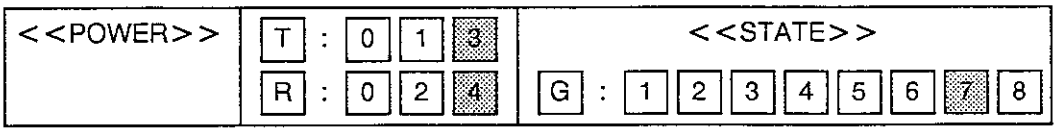


Figure 10-11 UUT Information Display

(15) Wait one or more seconds, and press the START key on the tested D5312B and the measurement of the tested D5312B will stop. Make sure that the test result of the tested D5312B is displayed as shown in Figure 10-12.

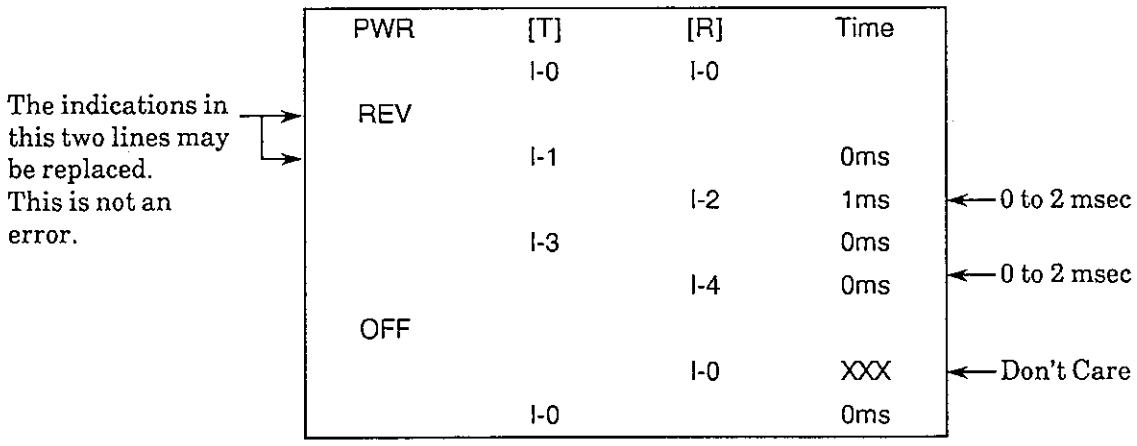


Figure 10-12 UUT Result Display

(16) Press the SETUP and SUB keys in this sequence on the tested D5312B, call the Measurement Condition screen, and set the test parameters as shown in Figure 10-13.

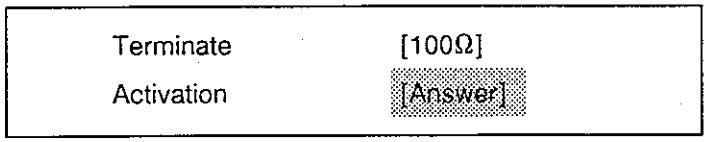


Figure 10-13 Setup on UUT Measurement Condition Screen

(17) Press the SETUP and SUB keys in this sequence on the testing D5312B, call the Measurement Condition screen, and set the test parameters as shown in Figure 10-14.

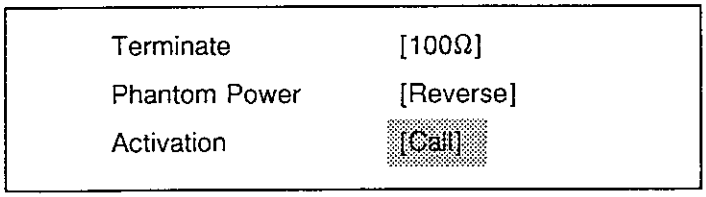


Figure 10-14 Setup on Measurement Condition Screen of Testing D5312B

(18) Press the START key on the tested D5312B, wait for approximately 1 second, and press the START key on testing D5312B. Both of the D5312B's will start.

(19) Repeat Step (14).

(20) Wait one or more seconds, and press the START key on the tested D5312B. The measurement of the tested D5312B will stop. Make sure that the results of the tested D5312B are as shown in Figure 10-15.

PWR	[T]	[R]	Time	
	I-0	I-0		
REV				
		I-2	55ms	←Don't Care
	I-3		0ms	
		I-4	0ms	←0 to 2 msec
OFF				
		I-0	XXX	←Don't Care
	I-0		0ms	

Figure 10-15 UUT Test Result Display

10.4.2 Data Access

- Description

  This test verifies that the receive data monitor function and the set data send function operate normally.

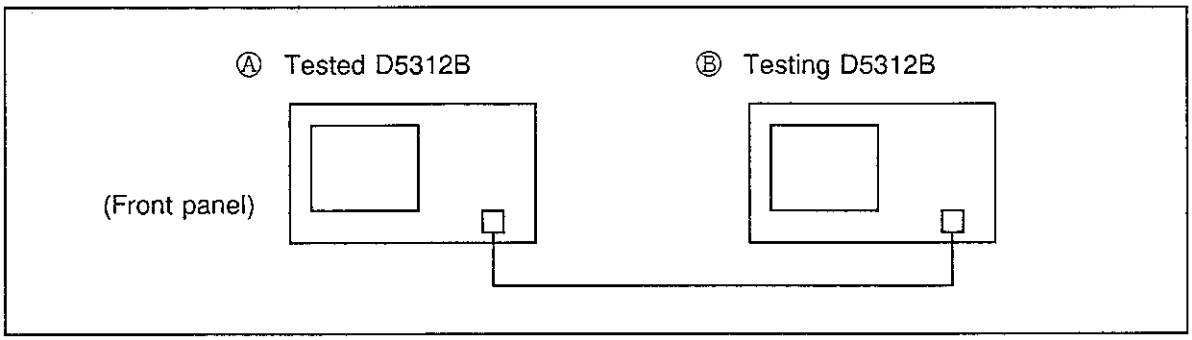


Figure 10-16 Setup of Data Access Test

- Equipment and cables

  - D5312B's whose calibration and operation have been tested
  - Modular cable (attached to the D5312B)

- Procedure

  TE TEST

(1) Press the TE and SINGLE keys in this sequence on the tested D5312B (Ⓐ of Figure 10-16), select the "Data Access" option on the SETUP screen, press the SUB key to call the Measurement Condition screen, and set the parameters as shown in Figure 10-17:

Terminate			[100Ω]
Phantom Power			[OFF]
Word Pattern			
B1	[YES]	[*1	]
B2	[YES]	[*2	]
D	[YES]	[*3	]
Loop	[0 bit (s)]	(D: 0 bit (s))	
Amplitude			[0.0dB]
Jitter	Amplitude		[0%]
	Frequency		[1kHz]

Figure 10-17 Setup on Measurement Condition Screen (1)

Terminate			[100Ω]
Power Feed			[Local]
Word Pattern			
B1	[YES]	[*1	]
B2	[YES]	[*2	]
D	[YES]	[*3	]
Q	[YES]	[*4	]
Loop	[0 bit (s)]	(D: 0 bit (s))	
Amplitude			[0.0dB]
Phase			[0%]
Jitter	Amplitude		[0%]
	Frequency		[1kHz]

Figure 10-18 Setup on Measurement Condition Screen (2)

*1 to *3 : Any data can be set. And both data on the screens of Figure 10-17 and 10-18 are the same.

*4 : Any data can be set.

(2) Press the NT and SINGLE keys in this sequence on the testing D5312B (Ⓑ of Figure 10-16), select the "Data Access" option on the SETUP screen, press the SUB key to call the Measurement Condition screen, and set the parameters as shown in Figure 10-18.

(3) Press the START key on both the testing and tested D5312B's to start them, and check the display result. The data set on the tested D5312B must be displayed as the received data on the testing D5312B. Also, the data set on the testing D5312B must be displayed as the received data on the tested D5312B. Characters R and T at the end of each channel name of the result display screen represent the receive data and send data, respectively.

Note : The receive data may be displayed as all one's immediately after the frame synchronization has been established. This is not an error as a time lag of 1 or 2 frame period exists until data is inserted into the frame after synchronization. During this time lag, the data is set to All 1.

(4) Press the START key on both the testing and tested D5312B's to stop them.

NT TEST

(5) Press the NT key on the tested D5312B, select the "Data Access" option on the SETUP screen, press the SUB key to call the Measurement Condition screen, and set the parameters as shown in Figure 10-18.

(6) Press the TE key on the testing D5312B, select the "Data Access" option on the SETUP screen, press the SUB key to call the Measurement Condition screen, and set the parameters as shown in Figure 10-17.

(7) Repeat Steps (2) and (3).

10.4.3 Phase and Jitter

- Description

  This test checks the normal operation of phase difference measuring counter.

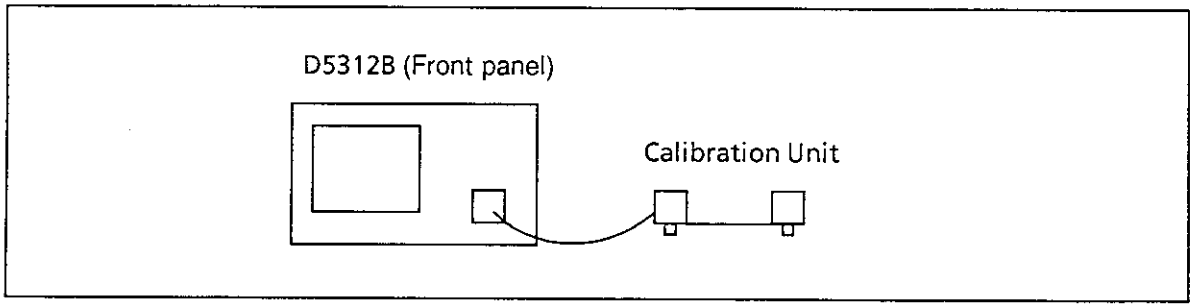


Figure 10-19 Setup of Phase and Jitter Test

- Equipment and cables

  - Calibration unit
  - Modular cable (a short cable attached to the calibration kit)

- Procedure

(1) Press the TE and SINGLE keys in this sequence on the D5312B, select the "Phase and Jitter" option on the SETUP screen, press the SUB key to call the Measurement Condition screen, and set the following parameters:

Terminate		[100Ω]
Phantom Power		[OFF]
Test Pattern		[ALL1]
Jitter	Amplitude	[0%]
	Frequency	[1kHz]

Figure 10-20 Setup on Measurement Condition Screen

CAUTION

Always turn the phantom power off during test. If it is not turned off, the internal fuse may blow during test.

(2) Connect a modular cable between the straight loopback modular jack of the calibration unit and the D5312B modular jack. Press the START key to start measurement and make sure that the result display is within the allowance given on Table 10-4.

Table 10-4 Allowance of Phase and Jitter Test Results

Item	Allowance
Mean	–0.10μs to 0.10μs
Max	–0.10μs to 0.10μs
Min	–0.10μs to 0.10μs
Delta	0.00μs to 0.20μs

Note : The Phase and Jitter function measures the D5312B internal delay using the calibration, subtracts it from the actually measured value, and displays the result on the screen. Therefore, if the delay is 0.00μs, a negative value may be displayed due to a counter error. This is not an error.

10.4.4 Error Bits

- Description

  This test checks the normal operation of the pattern generator and error detector for error test.

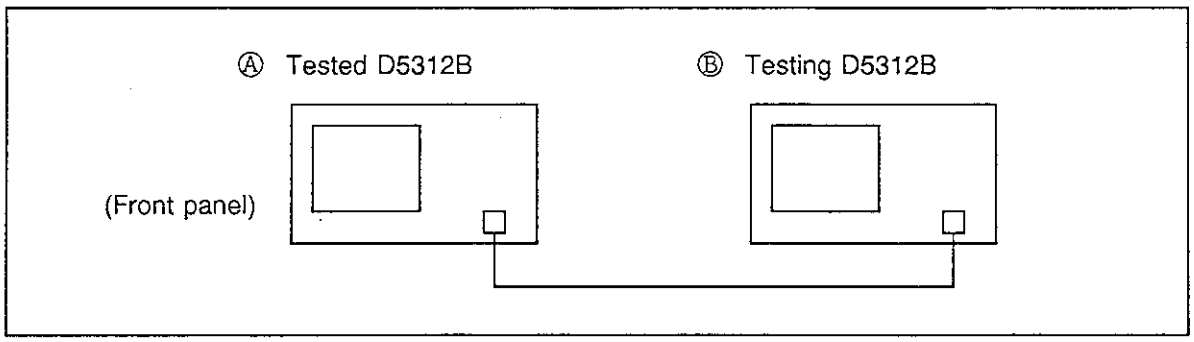


Figure 10-21 Setup of Error Bit Test

- Equipment and cables

  - D5312B's whose calibration and operation have been tested
  - Modular cable (attached to the D5312B)

- Procedure

(1) Press the TE and SINGLE keys in this sequence on the tested D5312B (Ⓐ of Figure 10-21), select the "Error bit" option on the SETUP screen, press the SUB key to call the Measurement Condition screen, and set the parameters as shown in Figure 10-22.

Terminate		[100Ω]
Phantom Power		[OFF]
Test Pattern		[PRBS]
B1	[YES]	[PN7]
B2	[YES]	[PN7]
B1 + B2	[NO]	
D	[YES]	[PN7]
Measurement Time		[Cont]
Amplitude		[0.0dB]
Jitter Amplitude		[0%]
Frequency		[1kHz]
D-Channel		[INT]

Figure 10-22 Setup on UUT Measurement Condition Screen

Terminate		[100Ω]
Power Feed		[Local]
Test Pattern		[PRBS]
B1	[YES]	[PN7]
B2	[YES]	[PN7]
B1 + B2	[NO]	
D	[YES]	[PN7]
Measurement Time		[Cont]
Amplitude		[0.0dB]
Phase		[0%]
Jitter Amplitude		[0%]
Frequency		[1kHz]
D-Channel		[INT]

Figure 10-23 Setup on Measurement Condition Screen of Testing D5312B

(2) Press the NT and SINGLE keys in this sequence on the testing D5312B (Ⓑ of Figure 10-21), select the "Error bit" option on the SETUP screen, press the SUB key to call the Measurement Condition screen, and set the parameters as shown in Figure 10-23.

(3) Press the START key on both the testing and tested D5312B's to start them, and make sure that B1, B2, and D channels of them are error free (*). After error free check, press the START key again on both the D5312B's and the measurement of both D5312B's will stop. (*: No error occurs one minute or more.)

(4) Press the SETUP and SUB keys in this sequence on the testing and tested D5312B's to call the Measurement Condition screen, switch the test pattern of B1, B2 and D channels, and perform Step (3) again. Make sure that each channel and all of PRBS operate normally. If the PRBS pattern is not set common to both the testing and tested D5312B's, the error free cannot be checked.

(5) After PRBS pattern check, check the word pattern. To do so, modify the test parameters of the testing and tested D5312B's on the Measurement Condition screen (shaded area) shown in Figure 10-24.

Test Pattern		[WORD:16bits]
B1	[YES]	[0111 1110 1000 0001]
B2	[YES]	[0111 1110 1000 0001]
B1 + B2	[NO]	
D	[YES]	[0111 1110 1000 0001]

(6) Press the START key on both the testing and tested D5312B's, and the measurement will start. Make sure that no error occurs (error free). Also, make sure that the error indication of the testing D5312B is incremented by 1 each time the ERROR ADDITION key is pressed on the tested D5312B. When it is incremented by 1 bit, the error insertion function is normal.

For the tested D5312B:

Terminate		[100Ω]
Phantom Power		[OFF]
Test Pattern		[WORD:16bits]
B1	[YES]	[0111 1110 1000 0001]
B2	[YES]	[0111 1110 1000 0001]
B1 + B2	[NO]	
D	[YES]	[0111 1110 1000 0001]
Measurement Time		[Cont]
Amplitude		[0.0dB]
Jitter Amplitude		[0%]
Frequency		[1kHz]
D-Channel		[INT]

For the testing D5312B:

Terminate		[100Ω]
Power Feed		[Local]
Test Pattern		[WORD:16bits]
B1	[YES]	[0111 1110 1000 0001]
B2	[YES]	[0111 1110 1000 0001]
B1 + B2	[NO]	
D	[YES]	[0111 1110 1000 0001]
Measurement Time		[Cont]
Amplitude		[0.0dB]
Phase		[0%]
Jitter Amplitude		[0%]
Frequency		[1kHz]
D-Channel		[INT]

Figure 10-24 Parameters Modified on Measurement Condition Screen

10.4.5 Input/Output Impedance

- Description

This test checks the normal operation of the input/output impedance measuring function by the measurement of resistor impedance.

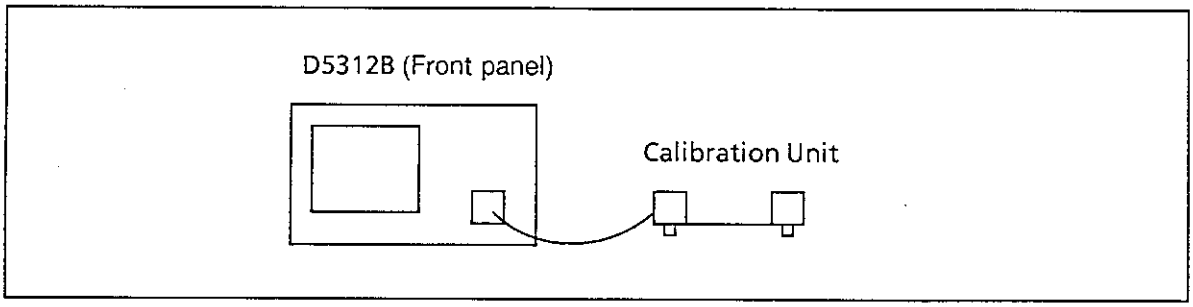


Figure 10-25 Setup of Input/Output Impedance Test

- Equipment and cables

  - Calibration unit
  - Modular cable (a short cable attached to the calibration kit)

- Procedure

(1) Connect a modular cable between the 47Ω modular jack of the calibration unit and the D5312B modular jack.

(2) Press the TE and SINGLE keys in this sequence on the D5312B to call the SETUP screen, and select the "Input Impedance" option.

(3) Press the START key on the D5312B to start measurement, and compare the resulting display with the value defined on Table 10-5. The obtained data is used as the R-line data of the check list. When the measurement is complete, press the START key again to stop the measurement.

(4) Press the NT key on the D5312B to call the SETUP screen of the NT test, and select the "Output Impedance 1" option.

(5) Press the START key on the D5312B to start measurement, and compare the resulting display with the value defined on Table 10-5. The obtained 106kHz data is used as the R-line data of the check list. When the measurement is complete, press the START key again to stop the measurement.

(6) Press the TE key on the D5312B to call the SETUP screen of the TE test, and select the "Output Impedance 1" option.

(7) Press the START key on the D5312B to start measurement, and compare the resulting display with the value defined on Table 10-5. The obtained data is used as the T-line data of the check list. When the measurement is complete, press the START key again to stop the measurement.

(8) Press the NT key on the D5312B to call the SETUP screen of the NT test, and select the "Input Impedance" option.

(9) Press the START key on the D5312B to start measurement, and compare the resulting display with the value defined on Table 10-5. The obtained 106kHz data is used as the T-line data of the check list. When the measurement is complete, press the START key again to stop the measurement.

(10) Connect a modular cable between the 470Ω modular jack of the calibration unit and the D5312B modular jack. Repeat Steps (2) to (9).

(11) Connect a modular cable between the 1kΩ modular jack of the calibration unit and the D5312B modular jack. Repeat Steps (2) to (9).

Table 10-5 Allowance of Input/Output Impedance Test

Resistance measured	Frequency	Allowance
47Ω	2kHz	45.6Ω to 48.4Ω
	20kHz	
	80kHz	
	106kHz	
	1MHz	44.7Ω to 49.4Ω
470Ω	2kHz	455.9Ω to 484.1Ω
	20kHz	
	80kHz	
	106kHz	
	1MHz	446.5Ω to 493.5Ω
1kΩ	2kHz	970.0Ω to 1030.0Ω
	20kHz	
	80kHz	
	106kHz	
	1MHz	950.0Ω to 1050.0Ω

10.4.6 Pulse Amplitude

- Description

This test measures the pulse amplitude through loopback of output pulses of D5312B by itself. Therefore, both the output pulse level and the pulse amplitude measuring function of the D5312B can be checked simultaneously.

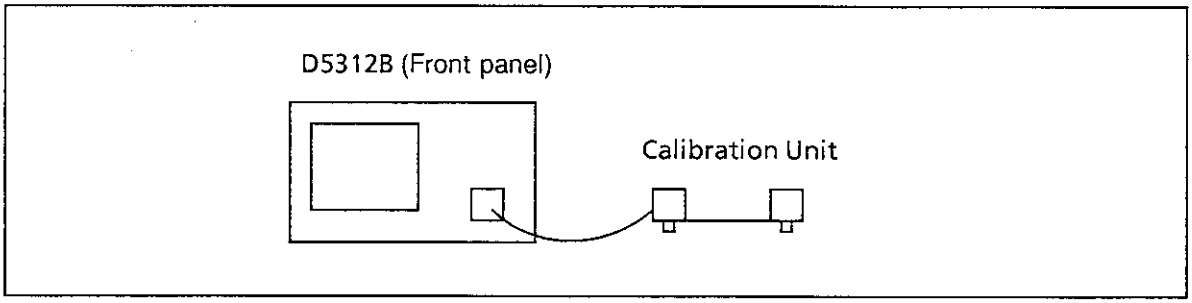


Figure 10-26 Setup of Pulse Amplitude Test

- Equipment and cables

  - Calibration unit
  - Modular cable (a short cable attached to the calibration kit)

- Procedure

(1) Connect a modular cable between the straight loopback modular jack of the calibration unit and the D5312B modular jack.

(2) Press the TE and SINGLE keys in this sequence on the D5312B to call the SETUP screen of the TE test, select the "Pulse Amplitude" option, press the SUB key to call the Measurement Condition screen, and set the following parameters.

Terminate	[100Ω]
Phantom Power	[OFF]
Load Resistance	[50Ω]

Figure 10-27 Setup on Measurement Condition Screen

CAUTION

Always turn the phantom power off during test. If it is not turned off, the internal fuse may blow during test.

(3) Press the START key on the D5312B to start measurement, and compare the resulting display with the value defined on Table 10-6.

Table 10-6 Allowance of Pulse Amplitude Test

bit	Allowance
[F] [L]	635.1mV to 878.3mV

10.4.7 Pulse Width

- Description

  This test checks the pulse width measuring function through loopback of output pulses of D5312B by itself.

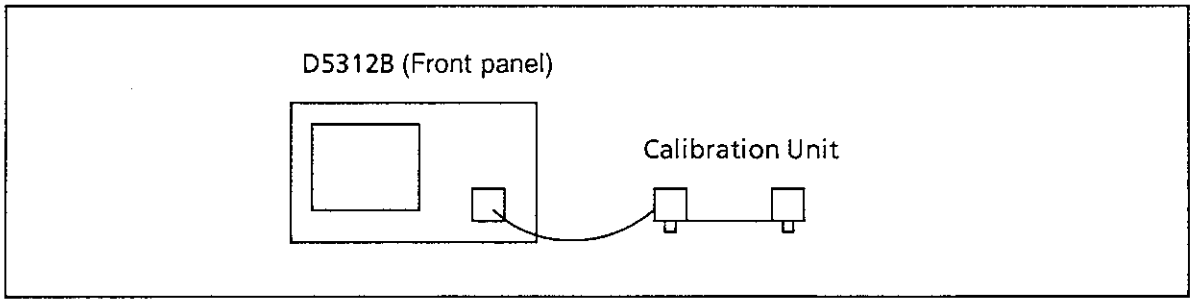


Figure 10-28 Setup of Pulse Width Test

- Equipment and cables

  - Calibration unit
  - Modular cable (a short cable attached to the calibration kit)

- Procedure

(1) Connect a modular cable between the straight loopback modular jack of the calibration unit and the D5312B modular jack.

(2) Press the TE and SINGLE keys in this sequence on the D5312B to call the SETUP screen of the TE test, select the "Pulse Width" option, press the SUB key to call the Measurement Condition screen, and set the following parameters.

Terminate	[100Ω]
Phantom Power	[OFF]

Figure 10-29 Setup on Measurement Condition Screen

CAUTION

Always turn the phantom power off during test. If it is not turned off, the internal fuse may blow during test.

(3) Press the START key on the D5312B to start measurement, and compare the resulting display with the value defined on Table 10-7. When the D5312B is operating normally, the pulse width is the standard pulse width (T) or the two-time larger pulse width (2T).

Note : The positive output pulses of D5312B have not only the standard pulse width (T) (approximately 5.2μs) but also the two-time larger pulse width (2T). Therefore, the resulting display may vary. If it has occurred, press the START key again to stop the measurement and compare the current data with the reference.

Table 10-7 Allowance of Pulse Width Test

Polarity of pulse	Allowance	
	1T width	2T width
[+]	4.7μs to 6.1μs	9.9μs to 11.3μs
[–]	4.7μs to 6.1μs	—

10.4.8 Pulse Polarity

- Description

  This test checks the pulse polarity check function through loopback of output pulses of D5312B by itself.

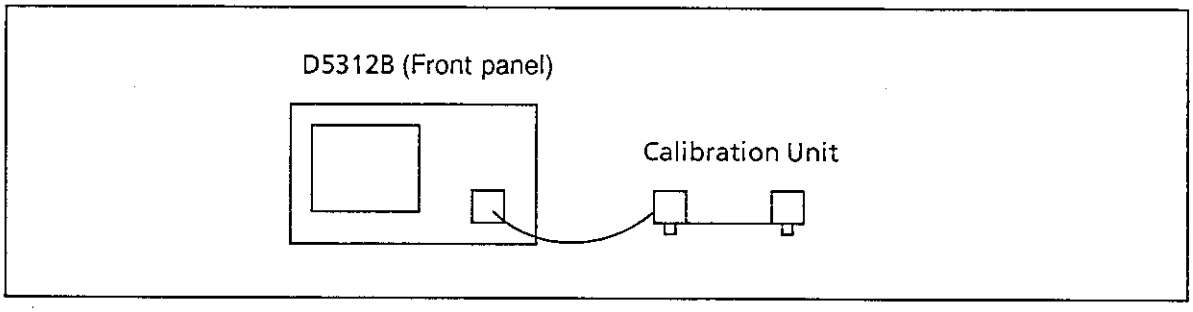


Figure 10-30 Setup of Pulse Polarity Test

- Equipment and cables

  - Calibration unit
  - Modular cable (a short cable attached to the calibration kit)

- Procedure

(1) Connect the short modular cable between the straight loopback modular jack of the calibration unit and the D5312B modular jack.

(2) Press the TE and SINGLE keys in this sequence on the D5312B to call the SETUP screen of the TE test, select the "Pulse Polarity" option, press the SUB key to call the Measurement Condition screen, and set the following parameters.

Terminate	[100Ω]
Phantom Power	[OFF]

Figure 10-31 Setup on Measurement Condition Screen

CAUTION

Always turn the phantom power off during test. If it is not turned off, the internal fuse may blow during test.

(3) Press the START key on the D5312B to start measurement, and make sure that the resulting display is Normal.

(4) Connect the short modular cable between the cross loopback modular jack of the calibration unit and the D5312B modular jack.

(5) If the displayed polarity is Reverse, the pulse polarity check function is normal.

Table 10-8 Normal Display of Pulse Polarity Test

Connection	Display result
Straight	Normal
Cross	Reverse

10.4.9 Clock Accuracy

- Description

This test checks the accuracy of the clock accuracy measuring function through input of square wave signals from the function generator.

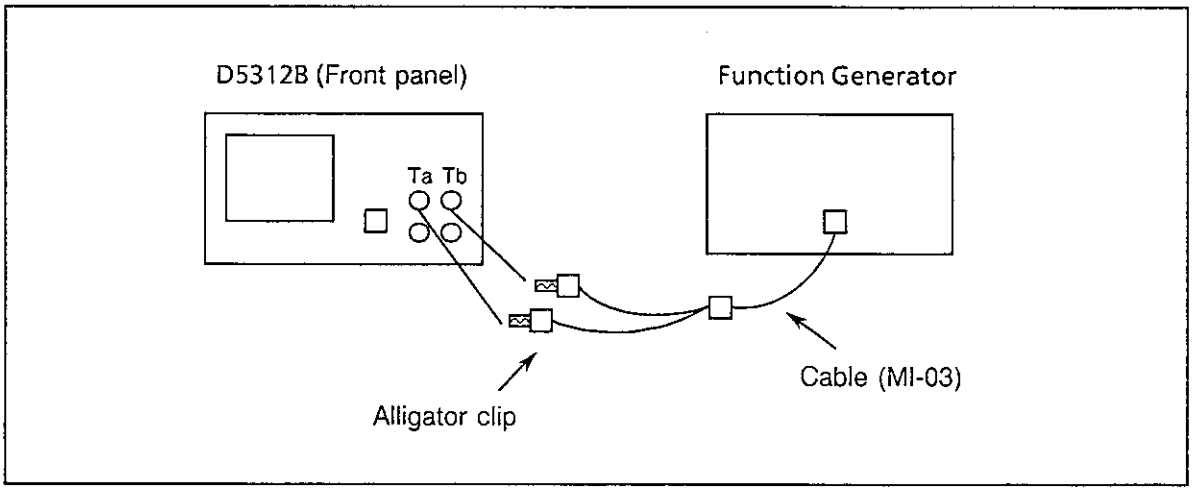


Figure 10-32 Setup of Clock Accuracy Test

- Equipment and cables

  - Function generator (HP3325B and OPT001)
  - BNC to alligator clips cable (MI-03)

- Procedure

(1) Set the function generator to have the 24kHz frequency, square wave, 1.5Vp-p output.

(2) Press the TE and SINGLE keys in this sequence on the D5312B to call the SETUP screen, select the "Clock Accuracy" option, press the SUB key to call the Measurement Condition screen, and set the following parameters.

Terminate	[50Ω]
Phantom Power	[OFF]

Figure 10-33 Setup on Measurement Condition Screen

(3) Connect the MI-03 cable between the function generator and D5312B, and press the START key on the D5312B to display the result. The allowance given on Table 10-9 is guaranteed during D5312B delivery. However, its accuracy may drop ±2 ppm every year. Adjust the Counter Clock when necessary.

Table 10-9 Allowance of Clock Accuracy Test

Allowance during delivery	Aging rate
±10ppm or less	±2ppm/year

10.4.10 Power Receiving

- Description

  This test checks the polarity and voltage of the phantom power supply and tests the power consumption measurement accuracy.

(1) Polarity and open voltage check

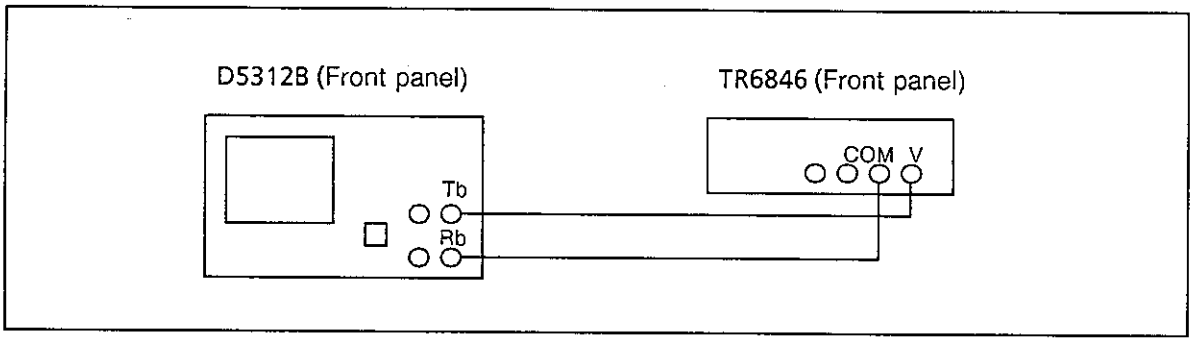


Figure 10-34 Setup of Phantom Voltage Test

- Equipment and cables

  - TR6846 digital voltmeter

- Procedure

① Press the TE and SINGLE keys in this sequence on the D5312B to call the SETUP screen, select the "Clock Accuracy" option on this screen, press the SUB key to call the Measurement Condition screen, and set the following parameters.

Terminate	[50Ω]
Phantom Power	[Normal]

Figure 10-35 Setup on Measurement Condition Screen

② Press the START key on the D5312B to start it, connect cables as shown in Figure 10-34, and measure the voltage between "Tb" and "Rb" of the D5312B.

③ Press the START key again to stop the measurement, press the SETUP key to call the SETUP screen, press the SUB key on this screen to call the Measurement Condition screen, and set the Phantom Power to the Reverse mode.

④ Press the START key on the D5312B to start it, and measure the voltage between "Tb" and "Rb" of the D5312B as shown in Figure 10-34.

Table 10-10 Allowance of Phantom Voltage Test

Phantom power	Voltage allowance between "Tb" and "Rb"
Normal	39.8 to 40.6 Vdc
Reverse	–39.8 to –40.6 Vdc

(2) Power consumption measurement accuracy test

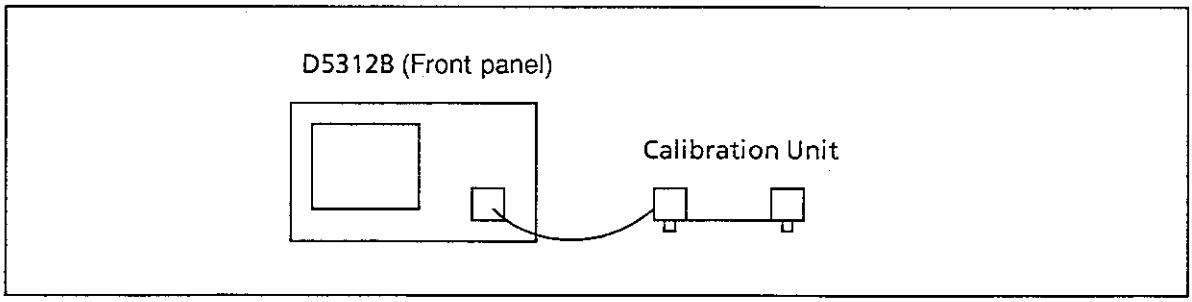


Figure 10-36 Setup of Power Consumption Test

- Equipment and cables

  - Calibration unit
  - Modular cable (a short cable attached to the calibration kit)

- Procedure

① Press the TE and SINGLE keys in this sequence on the D5312B to call the SETUP screen of the TE test, select the "Power Receiving" option, press the SUB key to call the Measurement Condition screen, and set the following parameters.

Phantom Power [Reverse]

Figure 10-37 Setup on Measurement Condition Screen

② Press the START key on the D5312B under no load (that is, when nothing is plugged into the D5312B modular jacks) to start measurement, and compare the resulting display with the allowance given on Table 10-11.

③ Press the START key again on the D5312B to stop the measurement.

④ Connect the short modular cable between the Load modular jack of the calibration unit and the D5312B modular jack.

⑤ Press the START key on the D5312B to start measurement, and compare the resulting display with the allowance given on Table 10-11.

Table 10-11 Allowance of Power Consumption Test

Load	Allowance
No load	0.0 to 1.0 mW
Test load	30.7 to 33.3 mW

10.4.11 Power Feeding

- Description

  This test checks the accuracy of power feeding by applying the reference voltage to the D5312B from the VIG and measuring it.

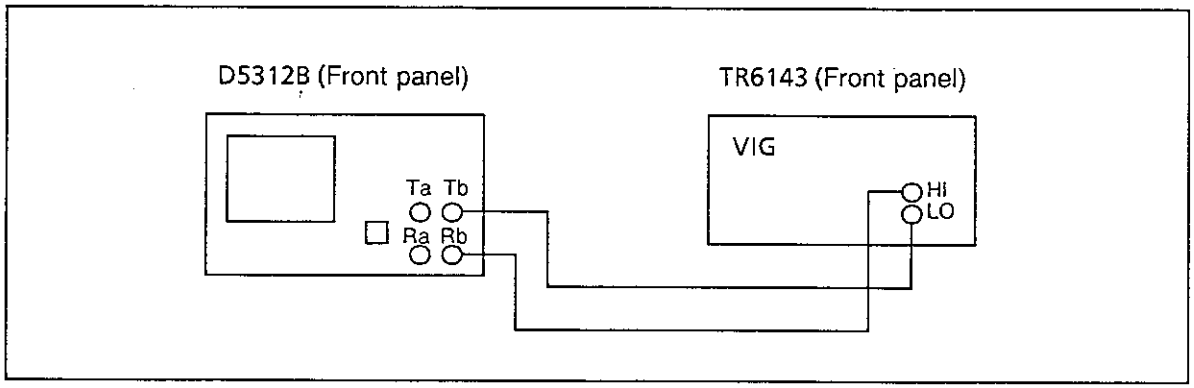


Figure 10-38 Setup of Power Feeding Test

- Equipment and cables

  - TR6143 DC voltage generator

- Procedure

(1) As shown in Figure 10-38, connect a cable between the "HI" terminal of the VIG and the "Rb" terminal of D5312B and a cable between the "LO" terminal of VIG and the "Tb" terminal of D5312B.

CAUTION

Never apply the DC voltage exceeding 0.5 Vdc between terminals "Ta" and "Tb" and between terminals "Ra" and "Rb". If done, the D5312B may seriously be damaged.

(2) Press the NT and SINGLE keys in this sequence on the D5312B to call the SETUP screen, and select the "Power Feeding" option on this screen.

(3) Press the START key on the D5312B to start measurement, apply the voltage defined on Table 10-12 from the VIG, and make sure that the voltage between "Rb" and "Tb" is within the allowance of Table 10-12. (As the D5312B measures the voltage between terminals one after the other, the display of D5312B may not change immediately when the VIG setup voltage is changed.)

Table 10-12 Allowance of Power Feeding Test

Input voltage between "Rb" and "Tb"	Allowance
40.00 Vdc	39.5 to 40.5 Vdc
0.00 Vdc	−0.1 to +0.1 Vdc
−40.00 Vdc	−39.5 to −40.5 Vdc

10.4.12 Output Pulse Amplitude

- Description

  This test checks the accuracy of the output pulse amplitude variation function by measuring the output pulse amplitude of the D5312B on the oscilloscope.

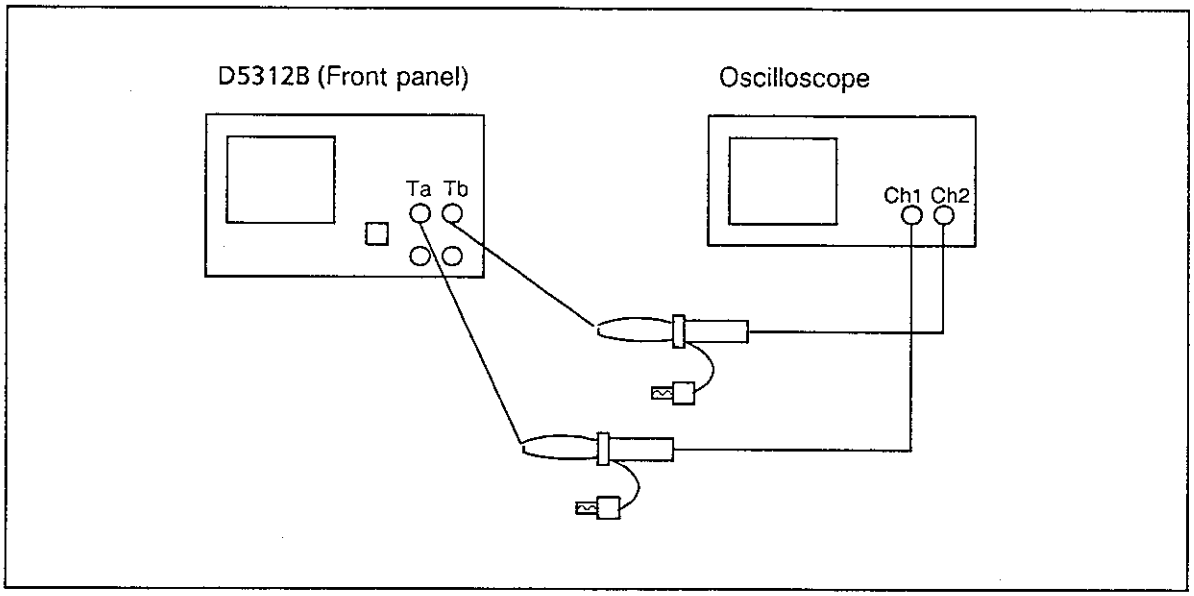


Figure 10-39 Setup of Output Pulse Amplitude Test

- Equipment and cables

  - Oscilloscope: Tek DSA601A + 11A32
  - Two probes: Tek P6134

- Procedure

(1) Connect the oscilloscope to the D5312B as shown in Figure 10-39. The ground leads of these two probes must be connected to the ground terminal on rear panel of D5312B respectively.

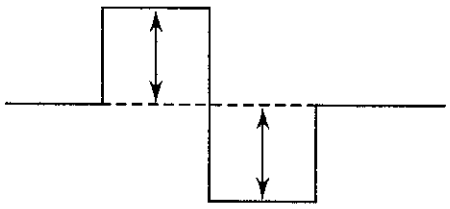
(2) Press the NT and SINGLE keys in this sequence on the D5312B to call the SETUP screen, select the "Data Access" option on this screen, press the SUB key to call the Measurement Condition screen, and set the following parameters.

Terminate		[50Ω]
Power Feed		[Local]
Word Pattern		
B1	[NO]	
B2	[NO]	
D	[NO]	
Q	[NO]	
Loop	[0 bit (s)]	(D 0 bit (s))
Amplitude		[0.0dB]
Phase		[0%]
Jitter	Amplitude	[0%]
	Frequency	[1kHz]

Figure 10-40 Setup on Measurement Condition Screen

(3) Set the display and trigger on the oscilloscope to "Ch1-Ch2".

(4) Press the START key on the D5312B to start waveform output, and measure the signal amplitude on the scope. If it is difficult to measure the amplitude due to the noise contained in the waveforms, add a 20MHz low-pass filter (LPF) to the scope or use the smoothing function of the scope.



Measure the amplitude of both the positive and negative waveforms at their center position.

Figure 10-41 Measurement Position of Output Pulse Amplitude

(5) Press the START key on the D5312B, and the pulse output will stop. Press the SETUP key to call the SETUP screen, and press the SUB key to call the Measurement Condition screen. Then, modify the amplitude setup and measure the following amplitude.

Table 10-13 Allowance of Output Pulse Amplitude Test

Pulse amplitude setup	Allowance	
	Positive pulse	Negative pulse
2dB	841.5 to 1059.4mV	–841.5 to –1059.4mV
0dB	668.4 to 841.5mV	–668.4 to –841.5mV
–4dB	421.8 to 531.0mV	–421.8 to –531.0 mV
–8dB	266.1 to 335.0 mV	–266.1 to –335.0 mV

10.4.13 Echo Check

- Description

  This test checks the normal operation of echo check function.

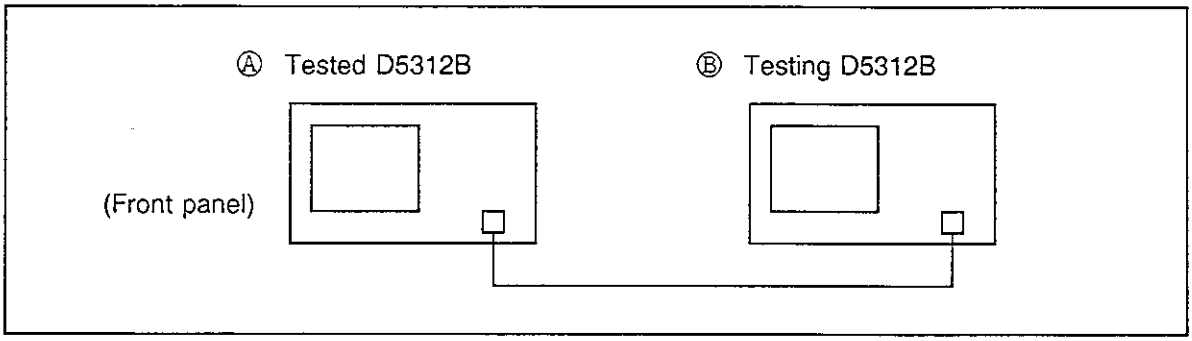


Figure 10-42 Setup of Echo Check Test

- Equipment and cables

  - D5312B's whose calibration and operation have been tested
  - Modular cable (attached to the D5312B)

- Procedure

(1) Press the NT and SINGLE keys in this sequence on the tested D5312B (Ⓐ of Figure 10-42), select the "Echo Check" option on the SETUP screen, press the SUB key to call the Measurement Condition screen, and set the parameters as shown in Figure 10-43.

Terminate	[100Ω]
Power Feed	[Local]
Word Pattern D	[0000]

Figure 10-43 Setup on UUT Measurement Condition Screen

(2) Press the TE and SINGLE keys in this sequence on the testing D5312B (Ⓑ of Figure 10-42), select the "Pulse Amplitude" option on the SETUP screen, press the SUB key to call the Measurement Condition screen, and set the parameters as shown in Figure 10-44.

Terminate	[100Ω]
Phantom Power	[OFF]
Load Resistance	[50Ω]

Figure 10-44 Setup on Measurement Condition Screen of Testing D5312B

(3) Press the START key on both the testing and tested D5312B's to start them, and make sure that their test results are [SAME] and the number of events continues to zero on the tested D5312B.

(4) Press the START key on the tested D5312B to stop measurement. Press the SETUP and SUB keys in this sequence to call the Measurement Condition screen, change "Word Pattern D" to [1111], and press the START key. Make sure that the number of events continues to zero for a while on the tested D5312B.

(5) Press the START key on the testing D5312B to stop measurement. Press the SETUP key, select the "Phase & Jitter" option on the SETUP screen, press the SUB key to call the Measurement Condition screen, and set the parameters as shown in Figure 10-45.

Terminate		[100Ω]
Phantom Power		[OFF]
Test Pattern		[PN19]
Jitter	Amplitude	[0%]
	Frequency	[1kHz]

Figure 10-45 Setup on Measurement Condition Screen of Testing D5312B

(6) Press the START key on the testing D5312B to start measurement. Make sure that their test results are [DIFF] and the number of events increases according to the time on the tested D5312B.

10.4.14 Transmitting of Echo Bit

- Description

  This test verifies that the D channel input data is looped back to the E bits correctly during the TE test.

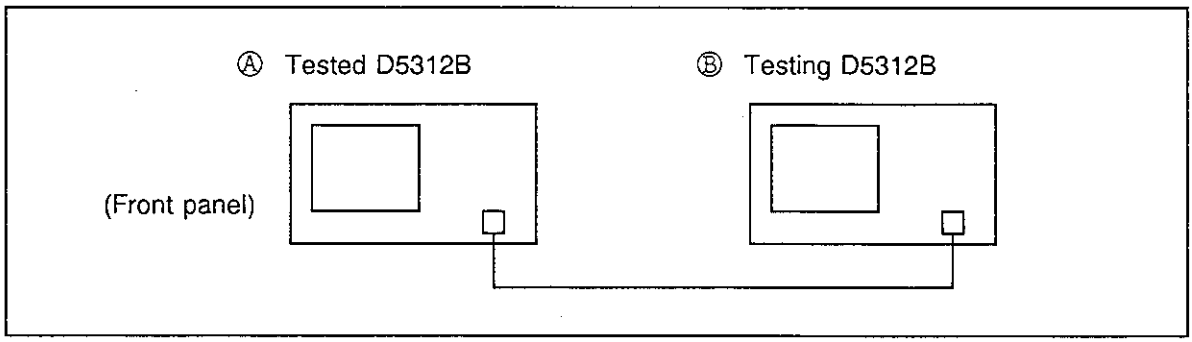


Figure 10-46 Setup of Echo Bit Transmission Test

- Equipment and cables

  - D5312B's whose calibration and operation have been tested
  - Modular cable (attached to the D5312B)

- Procedure

(1) Press the TE and SINGLE keys in this sequence on the tested D5312B (Ⓐ of Figure 10-46), select the "Pulse Amplitude" option on the SETUP screen, press the SUB key to call the Measurement Condition screen, and set the parameters as shown in Figure 10-47.

Terminate	[100Ω]
Phantom Power	[OFF]
Load Resistance	[50Ω]

Figure 10-47 Setup on UUT Measurement Condition Screen

(2) Press the NT and SINGLE keys in this sequence on the testing D5312B (Ⓑ of Figure 10-46), select the "Echo Check" option on the SETUP screen, press the SUB key to call the Measurement Condition screen, and set the parameters as shown in Figure 10-48.

Terminate	[100Ω]
Power Feed	[Local]
Word Pattern D	[0000]

Figure 10-48 Setup on Measurement Condition Screen of Testing D5312B

(3) Press the START key on both the testing and tested D5312B's to start them, and make sure that the number of events continues to zero for a while on the testing D5312B.

(4) Press the START key on the testing D5312B to stop measurement. Press the SETUP and SUB keys in this sequence to call the Measurement Condition screen, change "Word Pattern D" to [1111], and press the START key. Make sure that the number of events continues to zero for a while on the testing D5312B.

10.4.15 Phase Delay of Transmitting Signal

- Description

  This test measures and checks the transmission pulse delay when the D5312B is in the simulated TE mode.

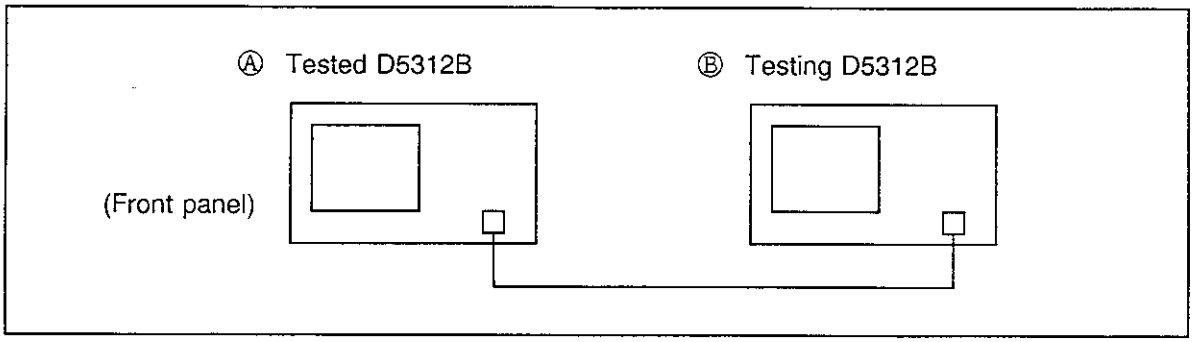


Figure 10-49 Setup of Transmission Signal Phase Delay Test

- Equipment and cables

  - D5312B's whose calibration and operation have been tested
  - Modular cable (attached to the D5312B)

- Procedure

(1) Press the NT and SINGLE keys in this sequence on the tested D5312B (Ⓐ of Figure 10-49), select the "Pulse Polarity" option on the SETUP screen, press the SUB key to call the Measurement Condition screen, and set the parameters as shown in Figure 10-50.

Terminate	[100Ω]
Power Feed	[Local]

Figure 10-50 Setup on UUT Measurement Condition Screen

(2) Press the TE and SINGLE keys in this sequence on the testing D5312B (Ⓑ of Figure 10-49), select the "Phase & Jitter" option on the SETUP screen, press the SUB key to call the Measurement Condition screen, and set the parameters as shown in Figure 10-51.

Terminate		[100Ω]
Phantom Power		[OFF]
Test Pattern		[ALL 1]
Jitter	Amplitude	[0%]
	Frequency	[1kHz]

Figure 10-51 Setup on Measurement Condition Screen of Testing D5312B

(3) Press the START key on both the testing and tested D5312B's to start them, read the resulting mean value on the testing D5312B, and make sure that it is within the phase delay allowance of Table 10-14.

Table 10-14 Allowance of Phase Delay of Transmitting Signal Test

Reference phase delay	Allowance of phase delay
10.42μs	10.16 to 10.68μs (Equivalent to ±0.05 UI)

10.4.16 D-Channel External Input/Output

- Description

This test checks the D-channel external I/O functions through the error test by jumpering the BNC cable between the D-channel external input terminal and D-channel external output terminal of the D5312B. Also, this test checks the normal output of 16kHz D-channel clock by observing the signals of the clock output terminal on the oscilloscope.

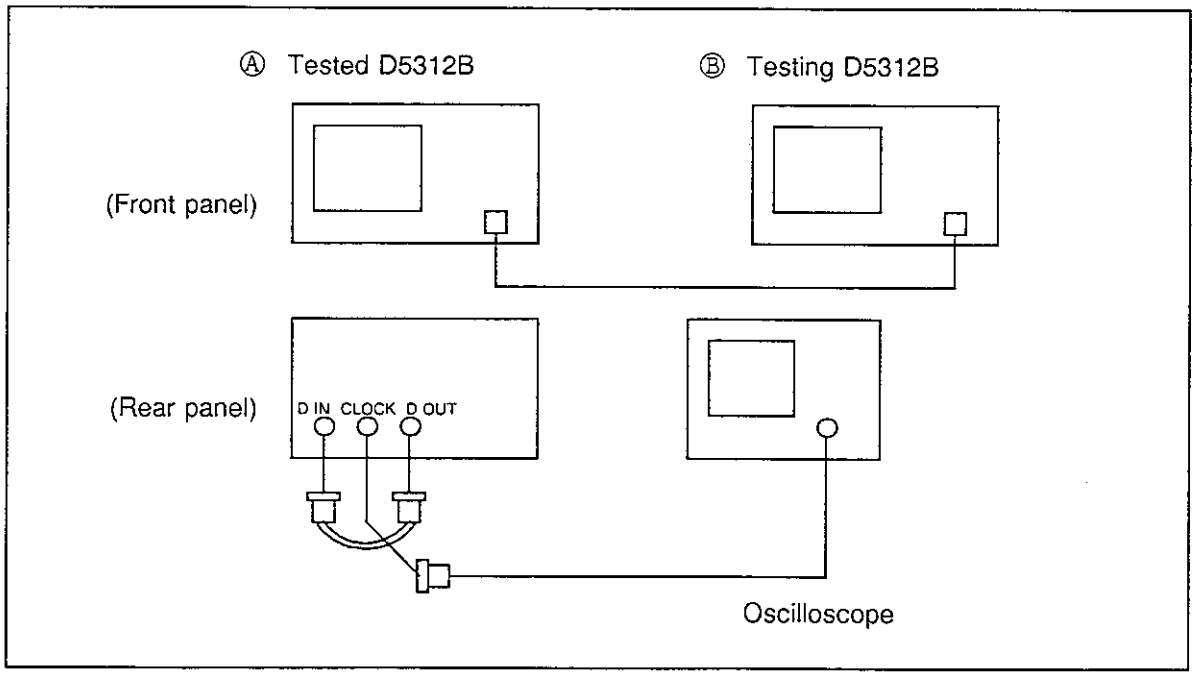


Figure 10-52 Setup of D-Channel External Input/Output Test

- Equipment and cables

  - D5312B's whose calibration and operation have been tested
  - Modular cable (attached to the D5312B)
  - BNC cables, 100cm or less (2 required): MC-06
  - Oscilloscope: Tek DSA601A + 11A32

- Procedure

(1) Connect the BNC cable between terminals "D in" and "D out" on the rear panel of the tested D5312B (Ⓐ of Figure 10-52), and connect another BNC cable between the CLOCK terminal and the oscilloscope. The oscilloscope input must be 1MΩ.

(2) Press the TE and SINGLE keys in this sequence on the tested D5312B, select the "Error bit" option on the SETUP screen, press the SUB key to call the Measurement Condition screen, and set the parameters as shown in Figure 10-53.

Terminate		[100Ω]
Phantom Power		[OFF]
Word Pattern		[Word : 4 bits]
B1	[NO]	
B2	[NO]	
B1 + B2	[NO]	
D	[YES]	[1111]
Measurement Time		[Cont]
Amplitude		[0.0dB]
Jitter Amplitude		[0%]
Frequency		[1kHz]
D-Channel		[EXT]

Figure 10-53 Setup on UUT Measurement Condition Screen

(3) Press the NT and SINGLE keys in this sequence on the testing D5312B (Ⓑ of Figure 10-52), select the "Error bit" option on the SETUP screen, press the SUB key to call the Measurement Condition screen, and set the parameters as shown in Figure 10-54.

Terminate		[100Ω]
Power Feed		[Local]
Test Pattern		[PRBS]
B1	[NO]	
B2	[NO]	
B1 + B2	[NO]	
D	[YES]	[PN7]
Measurement Time		[Cont]
Amplitude		[0.0dB]
Phase		[0%]
Jitter Amplitude		[0%]
Frequency		[1kHz]
D-Channel		[INT]

Figure 10-54 Setup on Measurement Condition Screen of Testing D5312B

(4) Press the START key on both the testing and tested D5312B's to start them, and make sure that the D channel is error free on the testing D5312B. Also, observe the clock output on the oscilloscope and make sure it is 62.5μs (16 kHz) and it is 2.4 Vdc or more at high level and 0.5 Vdc or less at the low level.

10.5 Checklist/Data FORM

File No : Description : ISDN TESTER

UUT MFR : ADVANTEST CO. ID No. :

Model : D5312B Date :

Para. No.	Test Description			Results		
				Min.	Actual	Max.
1	Activation Procedure					
			TE TEST	—		—
			NT TEST	—		—
2	Data Access					
			TE TEST	—		—
			NT TEST	—		—
3	Phase and Jitter					
	Phase Delay 0μs		Mean	−0.10μs		0.10μs
	Max		Max	−0.10μs		0.10μs
	Min		Min	−0.10μs		0.10μs
	Delta		Delta	0.00μs		0.20μs
4	Error bit					
	Error Free	PRBS	PN7	—		—
			PN9	—		—
			PN10	—		—
			PN11	—		—
			PN15	—		—
			PN17	—		—
			PN19	—		—
			PN20	—		—
			PN23	—		—
		Word	16bits	—		—
	Error Addition			—		—

Para. No.	Test Description			Results		
				Min.	Actual	Max.
5	Input/Output Impedance					
	(a) 47Ω	R-Line	2kHz	45.6Ω		48.4Ω
			20kHz	45.6Ω		48.4Ω
			80kHz	45.6Ω		48.4Ω
			106kHz	45.6Ω		48.4Ω
			1MHz	44.7Ω		49.4Ω
	(b) 47Ω	T-Line	2kHz	45.6Ω		48.4Ω
			20kHz	45.6Ω		48.4Ω
			80kHz	45.6Ω		48.4Ω
			106kHz	45.6Ω		48.4Ω
			1MHz	44.7Ω		49.4Ω
	(c) 470Ω	R-Line	2kHz	455.9Ω		484.1Ω
			20kHz	455.9Ω		484.1Ω
			80kHz	455.9Ω		484.1Ω
			106kHz	455.9Ω		484.1Ω
			1MHz	446.5Ω		493.5Ω
	(d) 470Ω	T-Line	2kHz	455.9Ω		484.1Ω
			20kHz	455.9Ω		484.1Ω
			80kHz	455.9Ω		484.1Ω
			106kHz	455.9Ω		484.1Ω
			1MHz	446.5Ω		493.5Ω
	(e) 1kΩ	R-Line	2kHz	970.0Ω		1030.0Ω
			20kHz	970.0Ω		1030.0Ω
			80kHz	970.0Ω		1030.0Ω
			106kHz	970.0Ω		1030.0Ω
			1MHz	950.0Ω		1050.0Ω
	(f) 1kΩ	T-Line	2kHz	970.0Ω		1030.0Ω
			20kHz	970.0Ω		1030.0Ω
			80kHz	970.0Ω		1030.0Ω
			106kHz	970.0Ω		1030.0Ω
			1MHz	950.0Ω		1050.0Ω

Para. No.	Test Description		Results		
			Min.	Actual	Max.
6	Pulse Amplitude				
	Loop Back Measurement	[F]	635.1mV		878.3mV
		[L]	635.1mV		878.3mV
7	Pulse Width				
	Loop Back Measurement	[+]1T Width	4.70μs		6.10μs
		2T Width	9.90μs		11.30μs
		[–] 1T Width	4.70μs		6.10μs
8	Pulse Polarity				
	Confirmation of the display		—		—
9	Clock Accuracy				
	Input : 0ppm Reference signal		–10.0ppm		10.0ppm
10	Power Receiving				
	Phantom Voltage (Tb-Rb)	Normal	39.8V		40.6V
		Reverse	–39.8V		–40.6V
	Power Consumption	No-Load	0.0mW		1.0mW
		50kΩ	30.7mW		33.3mW
11	Power Feeding				
	Input Voltage of Rb-Tb	40.00V	39.5V		40.5V
		0.00V	–0.1V		0.1V
		–40.00V	–39.5V		–40.5V
12	Output Pulse Amplitude				
	Setting of the Amplitude	2dB +Pulse	841.5mV		1059.4mV
		–Pulse	–841.5mV		–1059.4mV
		0dB +Pulse	668.4mV		841.5mV
		–Pulse	–668.4mV		–841.5mV
		–4dB +Pulse	421.8mV		531.0mV
		–Pulse	–421.8mV		–531.0mV
		–8dB +Pulse	266.1mV		335.0mV
		–Pulse	–266.1mV		–335.0mV

Para. No.	Test Description	Results		
		Min.	Actual	Max.
13	Echo Check Confirmation of [SAME], [DIFF]	—		—
14	Transmitting of Echo bits Confirmation by Echo Check	—		—
15	Phase Delay of Transmitting Signal Phase Delay Mean	10.16μs		10.68μs
16	D channel External Input/Output Loop back by Shorting D IN & D OUT CLOCK Output	— —		— —

MEMO

11. ADJUSTMENT

11.1 Introductory Description and UUT Adjustment Requirements

This procedure describes the adjustment of the ISDN tester D5312B.

UUT Environmental range : Temperature : 18 to 28°C
Relative humidity : 85% or less

UUT Warm-up/Stabilization period requirements : 30 minutes

Table 11-1 Adjustment Requirements

Adjustment Parameter/Function	Initial Accuracy of UUT	Adjustment Method
Phantom Power Voltage	Output Voltage without Load : 40.2V Accuracy : ±0.4V	Use a digital voltmeter for adjustment.
Counter Clock	Frequency : 20.000000MHz Accuracy : ±10ppm Aging rate : ±2ppm/year	Use a frequency counter for adjustment.

11.2 Measurement Standards and Support Test Equipment Performance Requirements

The Minimum Use Specifications (MUS) are the calculated minimum performance specifications criteria needed for the Measurement Standards (MS) and support M&TE to be used for comparison measurement required in the Adjustment Procedure (AP) process.

The MUS is developed through uncertainty analysis and is calculated through assignment of a defined and documented uncertainty/accuracy ratio or margin between the specified tolerances of the UUT and the capability (uncertainty specifications) required of the measurement standards system. The MUS is required to assist a measurement specialist in the evaluation of existing or selected alternate measurement standards equipment.

MS and SM&TE environmental range : Temperature : 18 to 28°C
Relative humidity : 30 to 70%

MS and SM&TE warmup/stabilization period requirements : 60 minutes

Table 11-2 Measurement Standards (MS) Performance Requirements

Equipment Generic Name (Quantity)	Minimum Use Specifications (MUS)	Manufacturer/Model /Option Applicable
Digital multimeter	DC voltage resolution : 4digits or more Input Impedance : 10MΩ or more	TR6846
Frequency counter	Measurement range : 20MHz or more Input impedance : Approx. 1MΩ Accuracy : 1ppm or less	TR5823H

Table 11-3 Support Measuring & Test Equipment (M&TE) Performance Requirements

Equipment Generic Name (Quantity)	Minimum Use Specifications (MUS)	Manufacturer/Model /Option Applicable
Probe	Frequency : 20MHz 10:1 Impedance : 10MΩ	P6133 (Tektronix)
Mini Jumper	—	General

11.3 Preliminary Operations

WARNING

Always make sure that the power cord of the ISDN tester is plugged into a three-hole grounded outlet or two-hole outlet with the grounded adapter. You can be fatally shocked if you fail to follow this rule.
Do not touch live circuits when adjusting an instrument.

(1) Always confirm that the POWER switch is OFF before connecting the power cord to the AC line.

11.4 Adjustment Procedure

11.4.1 Phantom Power Voltage

Assembly adjustment

DC-DC board (BLC-017124)

Related performance test

Power Receiving

Description

Adjust the voltage of the phantom power supply.

[Adjustment of Phantom Power Voltage]

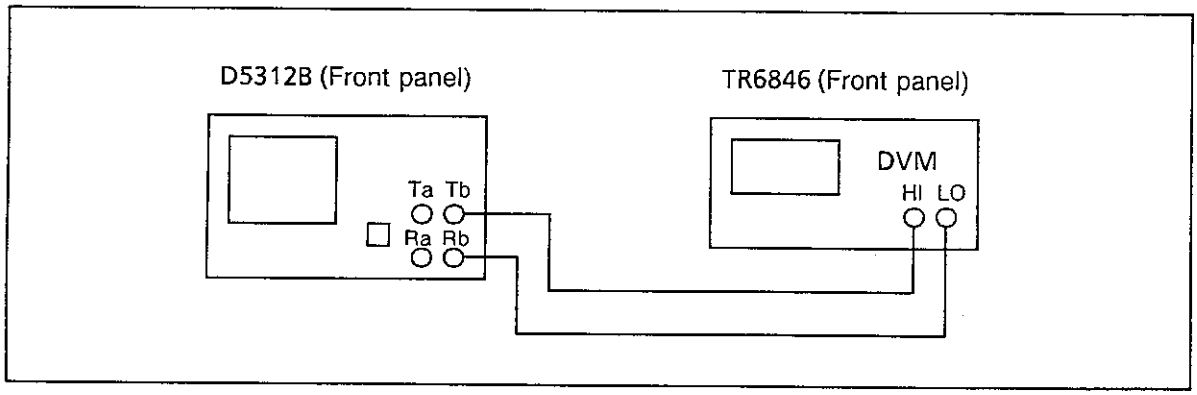


Figure 11-1 Setup for Phantom Power Voltage Adjustment

- Equipment

  Digital multimeter (DMM): TR6846

- Procedure

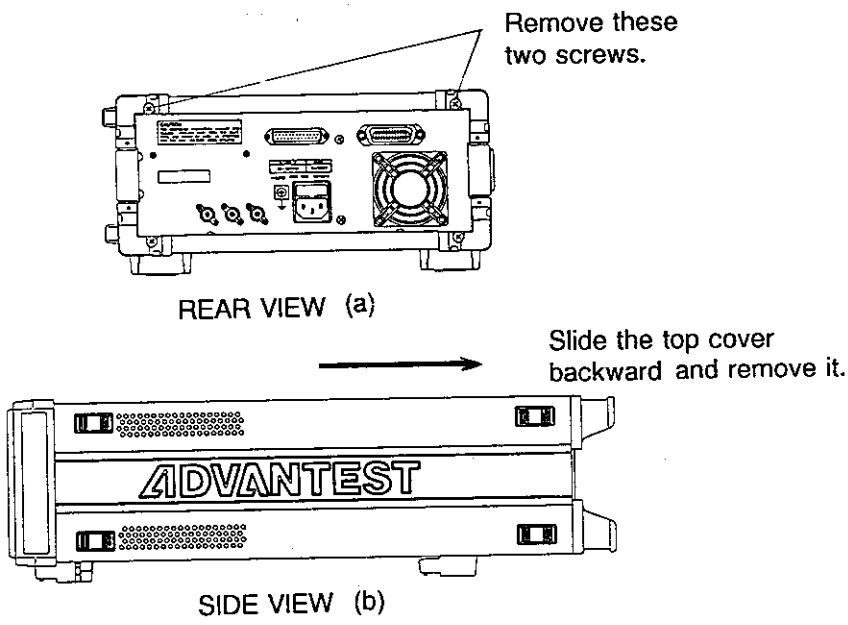


Figure 11-2 Removing the Top Cover

(1) Turn off the D5312B power switch and unplug the power cable from it. Remove the top cover. To do so, remove two set screws from the rear panel, and slide the top cover backward (see Figure 11-2).

(2) Plug the power cable again, turn the D5312B power switch on, and wait more than 15 minutes for warm-up.

(3) Press the TE, SINGLE, and SUB keys in this sequence on the D5312B to call the Measurement Condition screen of the "Activation Procedure", and set the parameters as shown in Figure 11-3.

Terminate	[50Ω]
Phantom Power	[Normal]
Activation	[Answer]

Figure 11-3 Setup on Measurement Condition Screen

(4) Set the digital multimeter (DMM) to the DC voltage measurement mode, contact the DMM probes to the "Tb" positive terminal and "Rb" negative terminal of the D5312B front panel, and press the START key on the D5312B to start it.

(5) Adjust the R15 control on the DC-DC board (BLC-017124) to set the DC voltage within 40.20 ±0.4 Vdc. (See Figure 11-4 for the R15 trimmer position.)

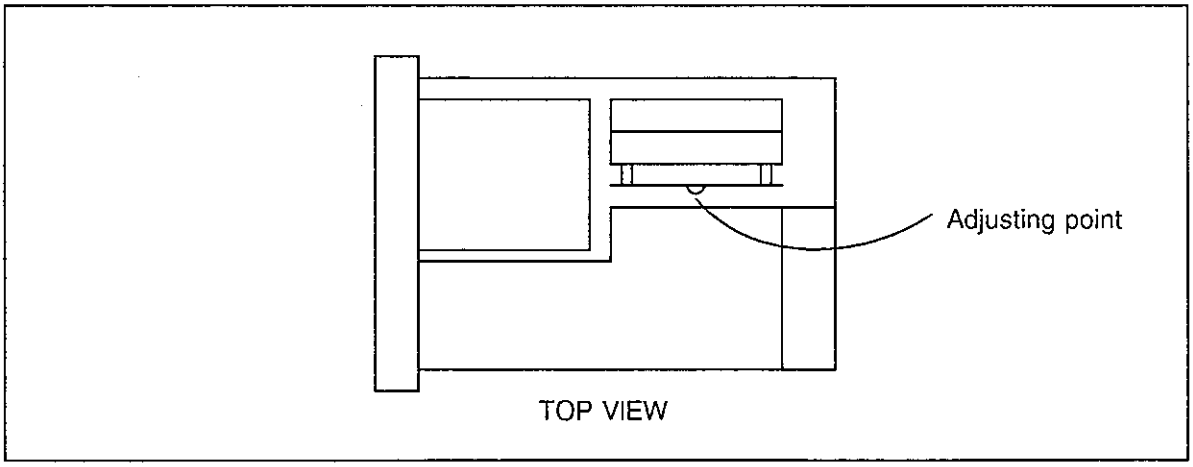


Figure 11-4 Adjusting Point of Phantom Power Voltage

11.4.2 Counter Clock

Assembly adjustment

Digital board (BLK-016512 or BLK-018622)

Related performance tests

Phase and Jitter
Pulse Width
Clock Accuracy

Description

Adjust the 20MHz counter clock.

[Counter Clock Adjustment]

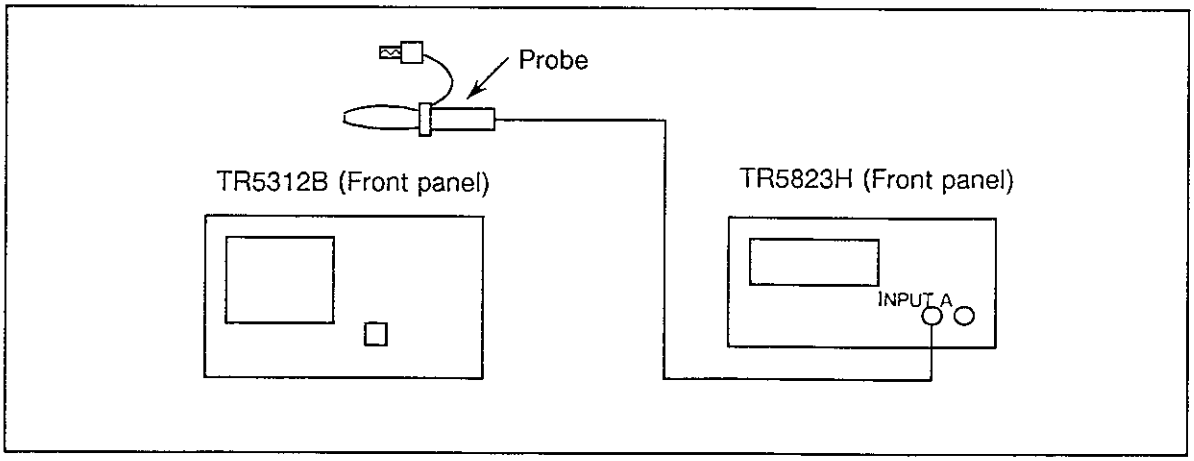


Figure 11-5 Setup for Counter Clock Adjustment

- Equipment

  Frequency counter: TR5823H

  Probe: P6133

- Procedure

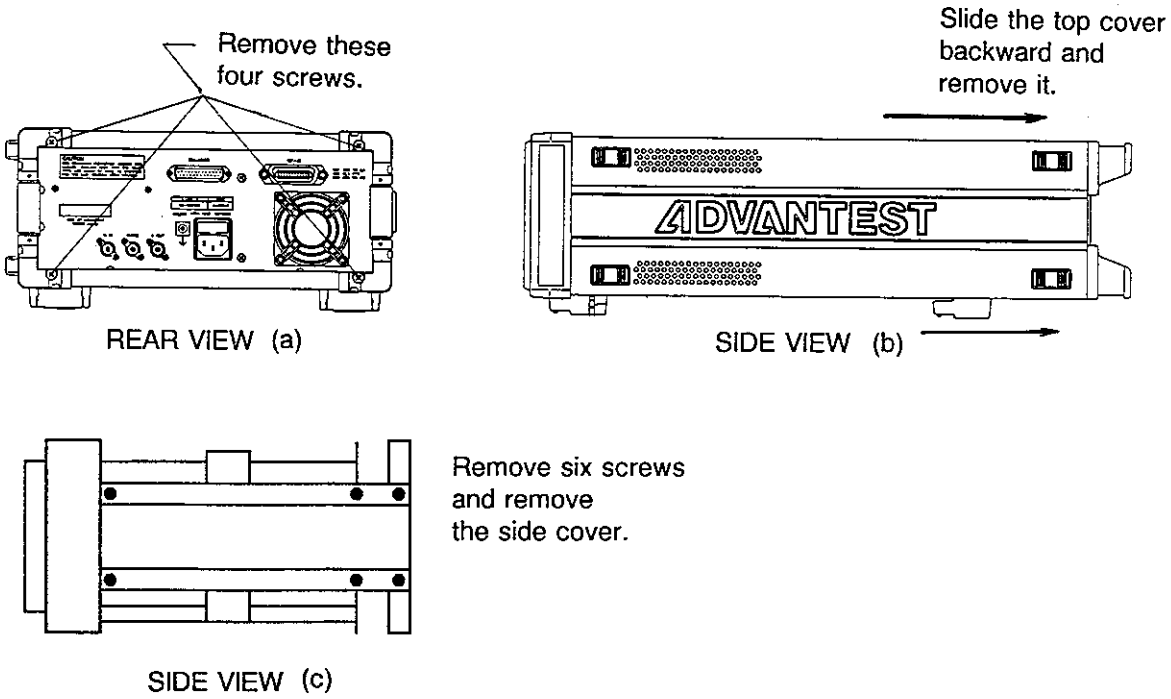


Figure 11-6 Removing the Top, Bottom and Side Covers

(1) Turn off the D5312B power switch and unplug the power cable from it. Remove the top and bottom covers and the left side cover (when viewed from its front). To do so, remove four set screws from the rear panel, and slide the top and bottom covers backward (see Figure 11-6). Then, remove six set screws from the left side cover and remove the side cover.

(2) Plug all of four cables having connectors from the CPU board (BLK-016951) locating at the top of the horizontally inserted boards. Place a jumper plug between pins 7 and 8 at jumper pin post J10 of the CPU board (see Figure 11-7).

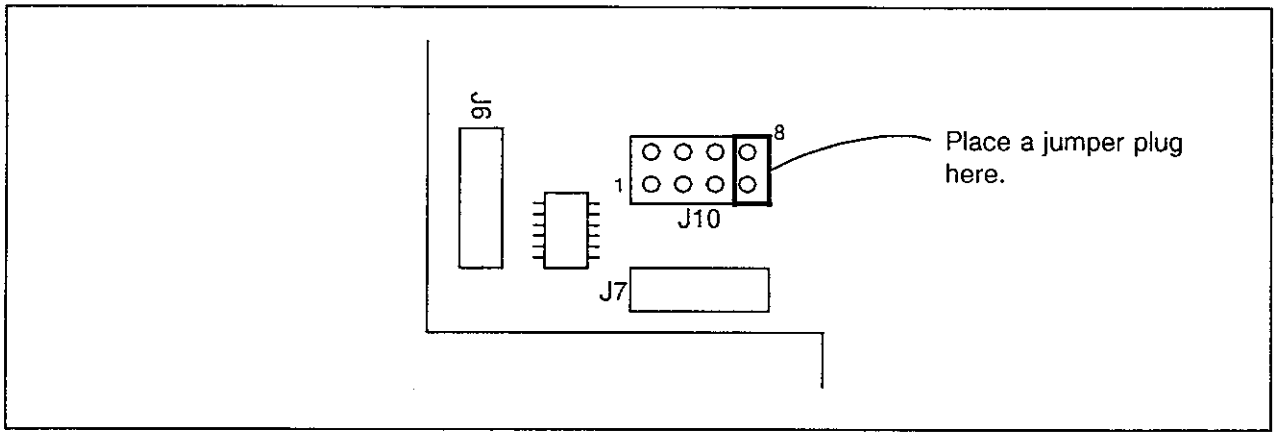


Figure 11-7 Jumper Plug Insertion Position on CPU Board

(3) Replace the top CPU board and the second DIGITAL board which have been inserted horizontally into slots. (Keep the connector cables unplugged from the DIGITAL board.)

(4) Connect the power cable, turn the power switch on, and wait at least 30 minutes for warmup. During warm-up, nothing is displayed on the CRT screen and no data can be entered from the keyboard. You can check the power-on status by observing the fan rotation at the rear panel.

The following adjustment procedure varies depending on the digital board type being used.

(5) <If BLK-016512 is used>

Connect the probe ground (GND) lead to TP8, and contact the probe to pin 18 of IC of UB11. Adjust the trimmer on the IC oscillator of UC12 to have the frequency of 20.000 000 MHz ±4 Hz.

<If BLK-018622 is used>

Connect the probe ground (GND) lead to TP8, and contact the probe to TP12. Adjust the trimmer on the IC oscillator of UD17 to have the frequency of 20.000 000 MHz ±4 Hz.

MEMO

APPENDIX 1 Explanation of Technical Terms

S point/T point

The reference points (S and T) in the user network interface defined in CCITT 1.430.
The user network interface reference is illustrated in Fig. A1-1 and the frame configuration at points S and T, in Fig. A1-2.

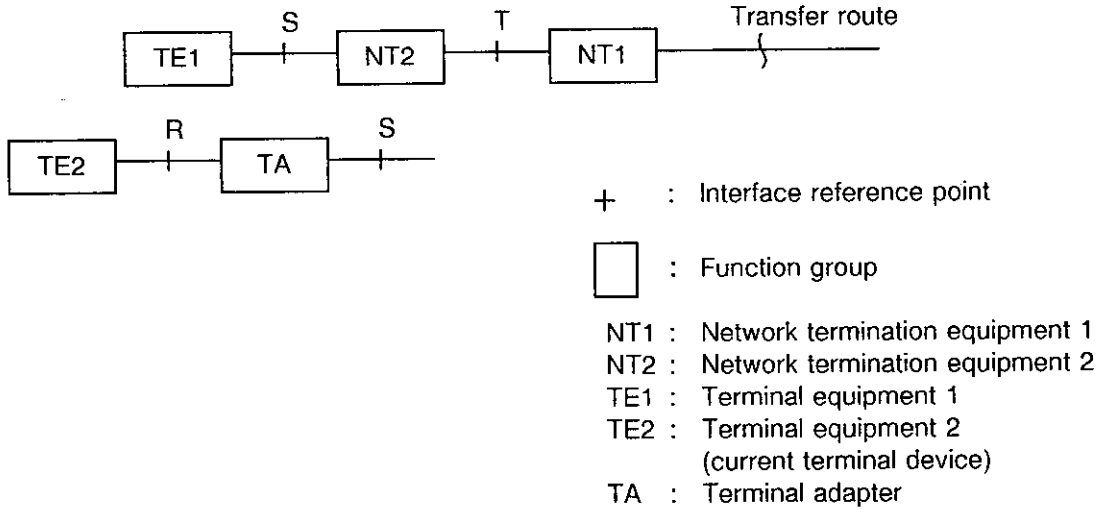


Fig. A1-1 Configuration of the User Network Interface Reference

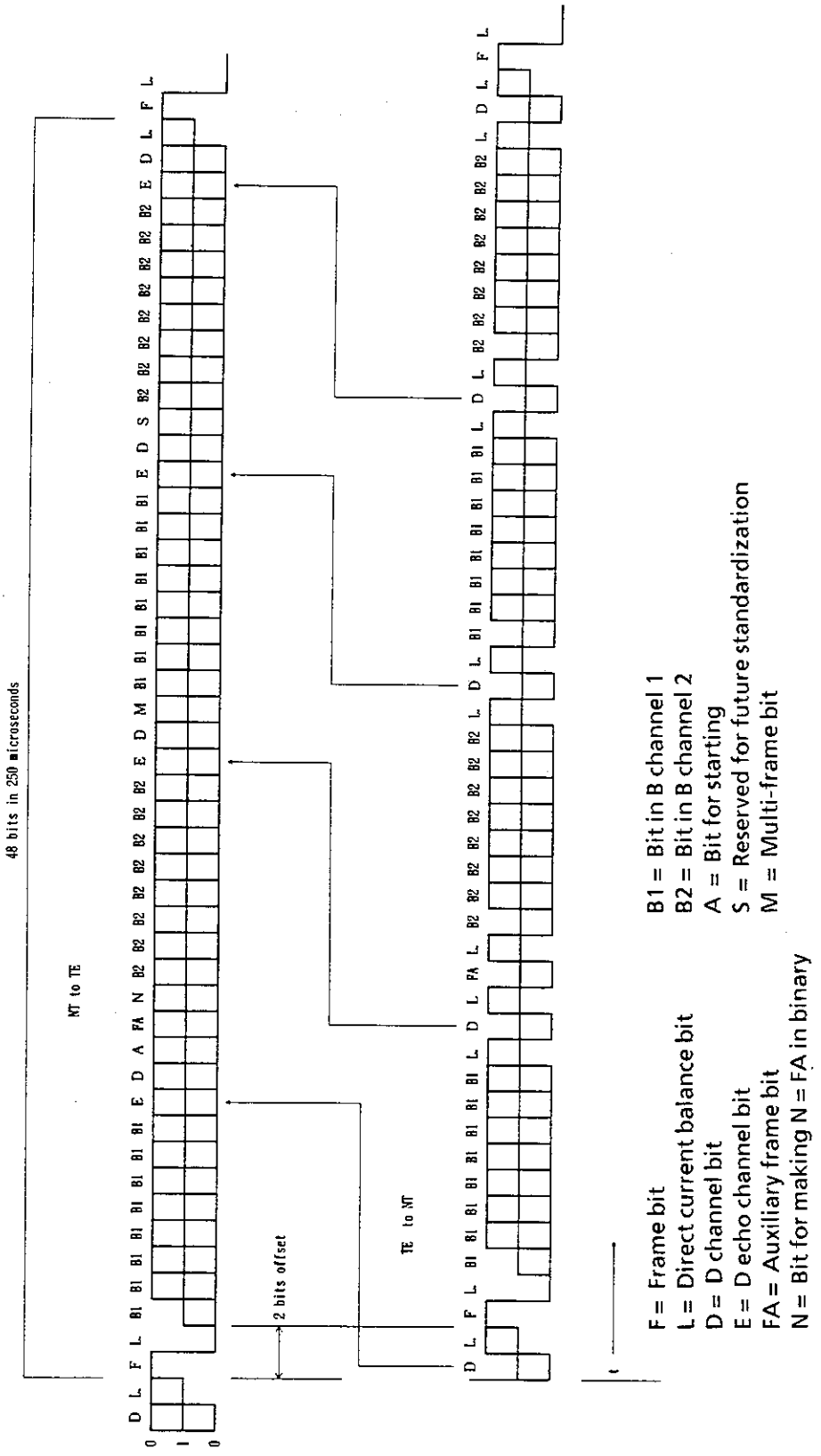
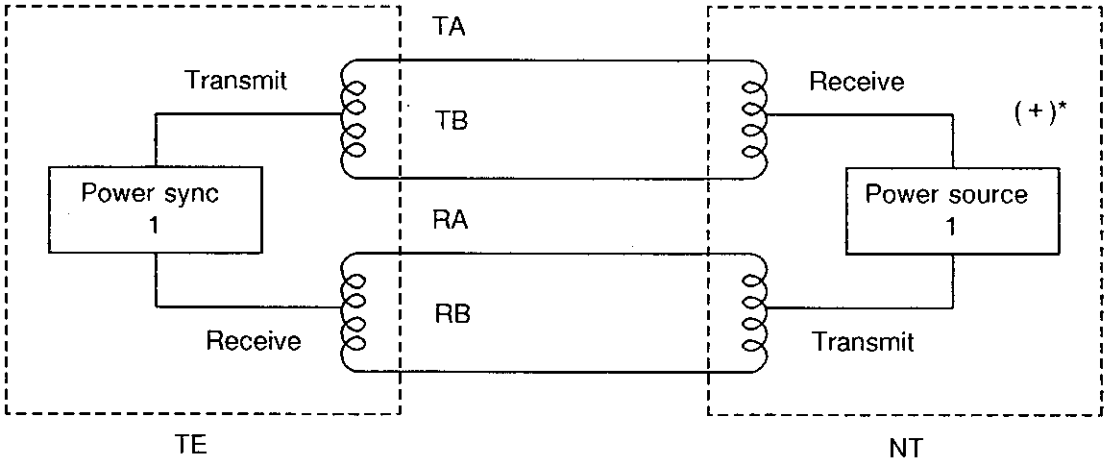


Fig. A1-2 Frame Configuration

Phantom Power Supply

Power source 1/power sync 1 as defined in CCITT 1.430.
Figure A1-3 illustrates the power supply system.



Note: The asterisk (*) represents the power polarity in normal power feed mode. The polarity is reversed in reverse power feed mode.

Fig. A1-3 Phantom Power Supply

T line/R line

T line: Signal from the TE to NT (transmit viewed from the TE)
R line: signal from the NT te TE (receive viewed from the TE)

INFO

The signal states in the T and R lines are identified as follows: INFO 0, 1, 3 for the T line; and INFO 0, 2, 4 for the R line. The INFO signal is defined in Table A1-1, and the INFO signal change upon start processing is briefly illustrated in Fig. A1-4.

Table A1-1 INFO Signal Definition

Signal from NT to TE	Signal from TE to NT
No INFO signal	No INFO signal INFO 1: Continuous signal consisting of positive ZERO, negative ZERO and six ONEs.  Standard bit rate = 192kbits/s
INFO 2: Frame in which the B, D and D echo channel bits are all set to binary ZERO. Bit A is set to binary ZERO. Bits N and L are set according to the sign definition.	
	INFO 3: Synchronized frame in which channels B and D are accompanied by the operation data.
INFO 4: Frame in which the echo of channels B, D and D isaccompanied by the operation data. Bit A is set to binary ONE.	

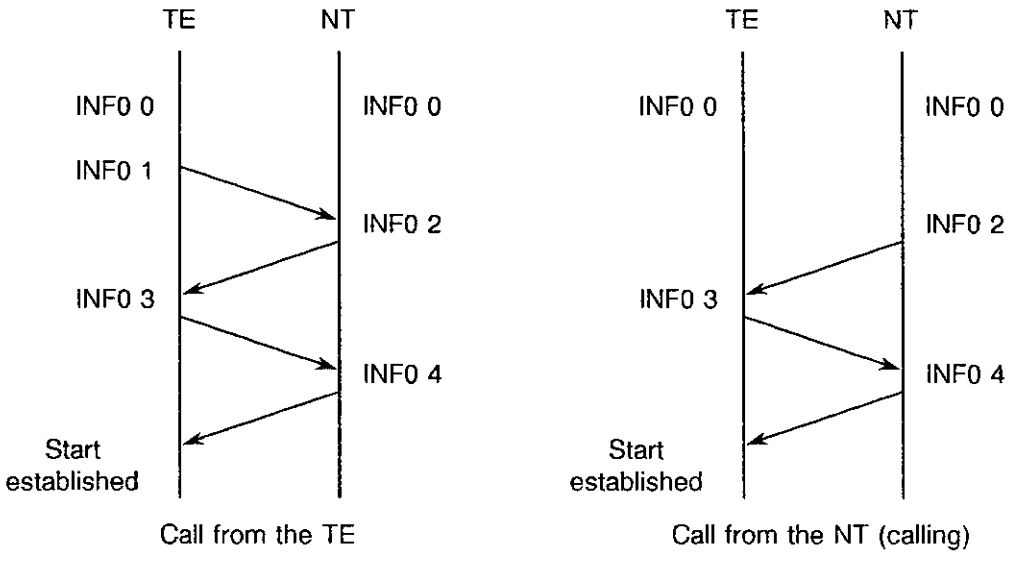


Fig. A1-4 INFO Signal Change upon Start

Q bit/S bit

The multi-frame is synchronized with the R line bits FA and M for identifying Q1 through Q4. The Q bit position identification and the multi-frame configuration are described in Table A1-2. When the S bit is handled as a signal consisting of amulti-frame, the S bits at frame numbers 1, 6, 11 and 16 are assigned as S1, S2, S3 and S4, respectively, and all the other S bits are specified as ZERO.

Table A1-2 Q Bit Position Identification and the Multi Frame Configuration

Frame No.	From NT to TE FA bit position	From TE to NT FA bit position (Notes)	M bit
1	ONE	Q1	ONE
2	ZERO	ZERO	ZERO
3	ZERO	ZERO	ZERO
4	ZERO	ZERO	ZERO
5	ZERO	ZERO	ZERO
6	ONE	Q2	ZERO
7	ZERO	ZERO	ZERO
8	ZERO	ZERO	ZERO
9	ZERO	ZERO	ZERO
10	ZERO	ZERO	ZERO
11	ONE	Q3	ZERO
12	ZERO	ZERO	ZERO
13	ZERO	ZERO	ZERO
14	ZERO	ZERO	ZERO
15	ZERO	ZERO	ZERO
16	ONE	Q4	ZERO
17	ZERO	ZERO	ZERO
18	ZERO	ZERO	ZERO
19	ZERO	ZERO	ZERO
20	ZERO	ZERO	ZERO
1	ONE	Q1	ONE
2	ZERO	ZERO	ZERO
etc.			

Notes:

1. If the TE is not to use the Q bits, they should be set to binary ONE.
2. The multi-frame cannot be identified because the binary ONE is not found at the correct position among the M bits. However, if the Q bit position can be identified, then Q bits 1 through 4 are not clear.

MEMO

APPENDIX 2 Error and Status Messages

If errors occur as a result of the tester internal state or are detected during measurement, the following messages will appear.

Can't change MODE (TEST) on this menu
An attempt was made to modify the test mode while the NT or TE test is in progress. No modification can be made while executing a test. Stop measurement if modification is required.

CAN'T CONTINUE History buffer full
The measurement buffer (memory) has become full (about 63 lines) before start time measurement is completed.

HARDWARE FAILURE (COOLING FAN)
An error was found in the tester cooling fan.
The measurement value may be incorrect. If the tester is kept in used in this state, trouble may occur.
Check the cooling fan on the tester rear panel and contact the service engineer for cleaning or repair.

ILLEGAL STATE Restart measurement
No measurement can be executed since the I-interface bus has not entered the measurement state even after waiting for the specified time.
The possible cause is in the tester connecting cable or the system to be measured. Remove the cause and restart measurement.

Waiting for power
No phantom power supply can be detected from the object to be tested in the NT test.

Invalid key
This key is disabled on the current menu screen.

NO ITEM!! Please select at least one item
Measurement was started without selecting test item.
Select the necessary item(s) and restart measurement.

No SUB menu

The current menu screen contains no submenu.

Select test NT or TE

Select the object to be tested for the NT or TE test.

Waiting for Activation

A call is to be requested from the test object during activation time measurement. Start measurement at the test object.

APPENDIX 3 IEEE 488.2-1987

Outline

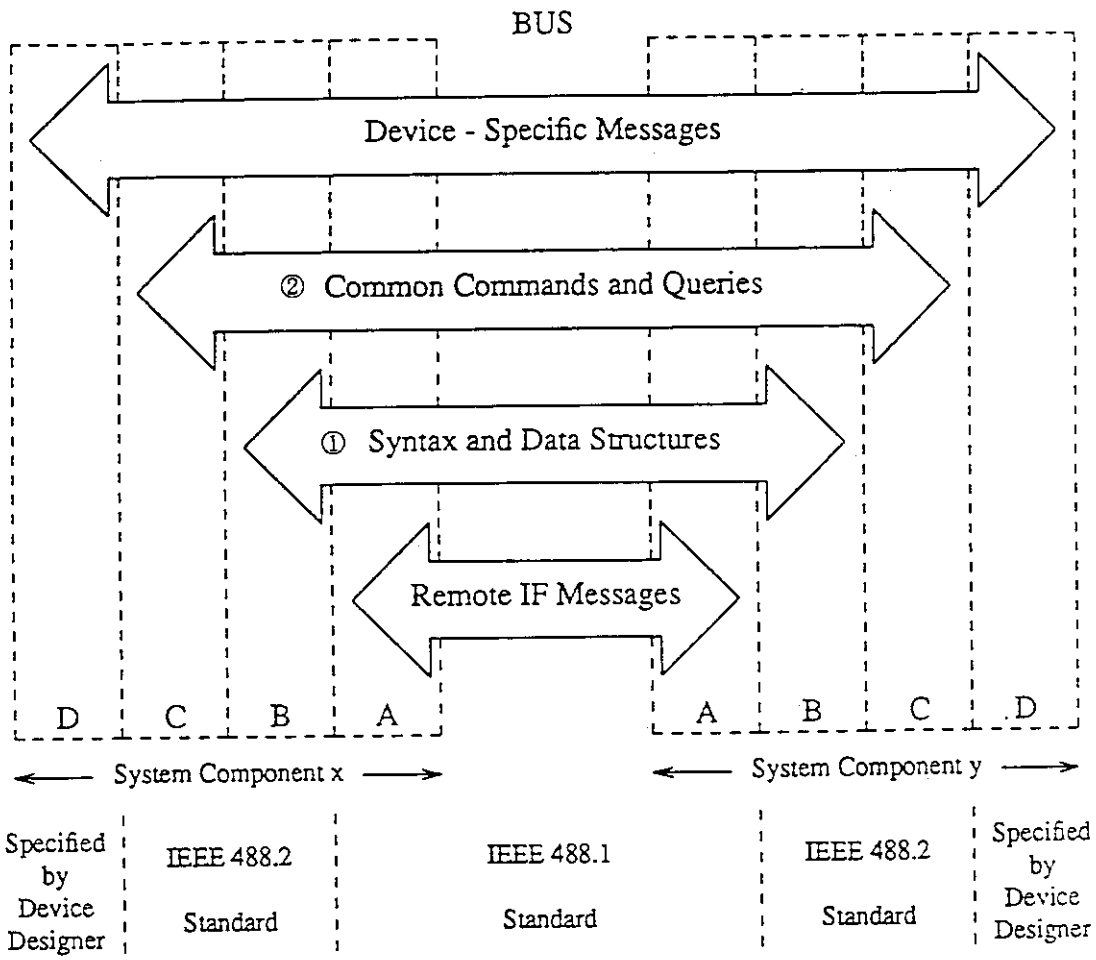
The interface condition for data transfer is defined as the measurement device standard interface bus in IEEE 488.1 and the "lower node protocol" is standardized.
IEEE 488.1 does not define the "upper node protocol" in terms of data content or format. Since some problems exist in "upper node protocol" compatibility between devices, this point is specified in IEEE 488.2.
The IEEE 488.2 specifications are outlined below.
Among the items defined by the IEEE 488.2 Specifications, the following are explained below: message format, data format, status byte, event, common commands and query.
For detailed explanation, see "IEEE 488.2-1987 Specifications".

Features

The following IEEE 488.2 features are added to the upper protocol of IEEE 488.1.

(1) Original.

(2) The IEEE 488.1 "device dependent message" is up to the device designer.
Divided into three layers, each defined as follows:
① Syntax and data structure
② Common command and query from the controller
③ Device-dependent section



These layers are expressed as follows:
Layer D: Device function
Layer C: Shared system function
Layer B: Message communication function
Layer A: Interface function (IF)

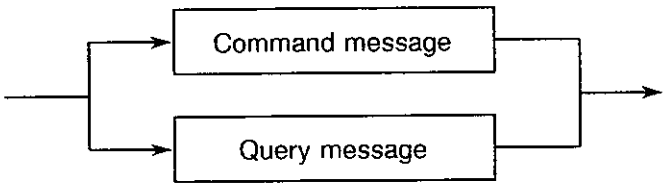
Fig. A3-1 Functional Protocol Layers of IEEE 488.1/IEEE 488.2

Message Format

According to IEEE 488.2, the device message is handled as a program message and classified as a response message. The device message is used from the controller to the device for condition setting, measurement start and others. The response message is sent from the device to the controller in reply to the device setting state and measurement results.
Each message consists of a message body, a separator and a header.

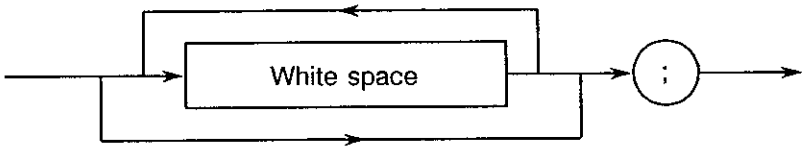
(1) Program message format

Two types of program massages are used: Command and Query messages. They can be connected using a message separator.



(2) Command program separator

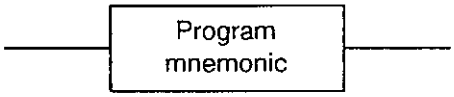
The program message separator is used to separate the multiple commands from one another.



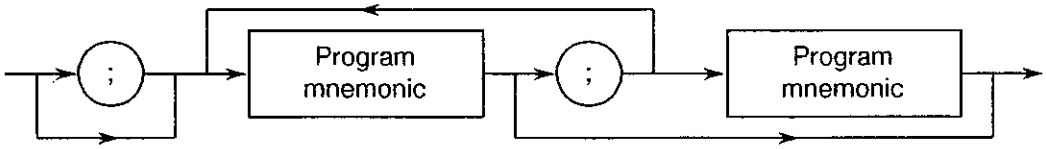
(3) Command program header

The command header represents the command meaning and three types of headers are defined: simple command program header, compound command program header and common command program header.

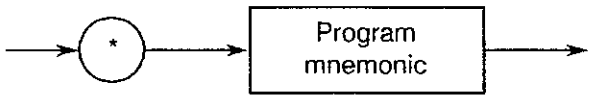
① Simple command program header



② Complex compound program header

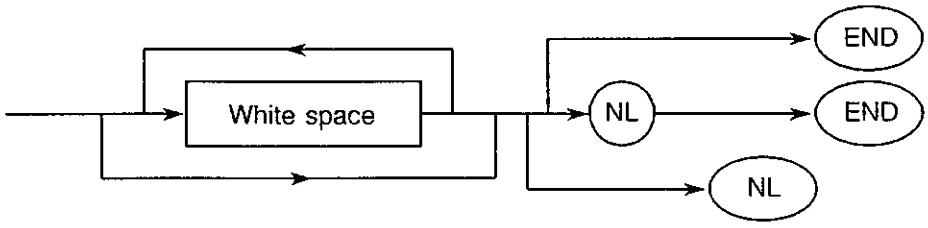


③ Common command program header



(4) Terminator

This is terminated with NL or END to indicate the breakpoint of a message equivalent to a line or record.

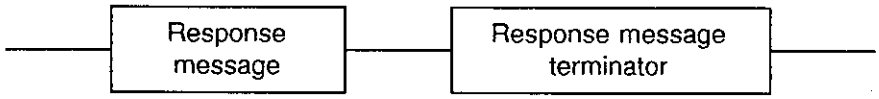


NL: New Line

Response Message Format

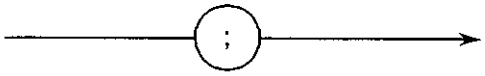
Each message output from the device consists of a response message and a terminator. The response message consists of a response message unit and a separator. The response message unit consists of a header indicating the message type and quality, a data section indicating the sign or numeric value and a separator to indicate the data section breakpoint.

(1) Response message



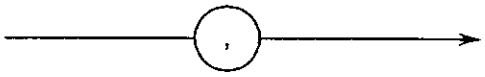
(2) Response message separator

The response message separator is used to indicate the breakpoint of the compound message.



(3) Data separator

A comma "," is used as a separator when sending multiple data items in one message.



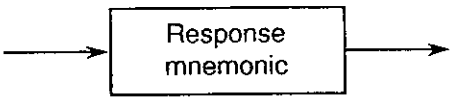
(4) Header separator

The "__" mark is used between the response data and the response header.

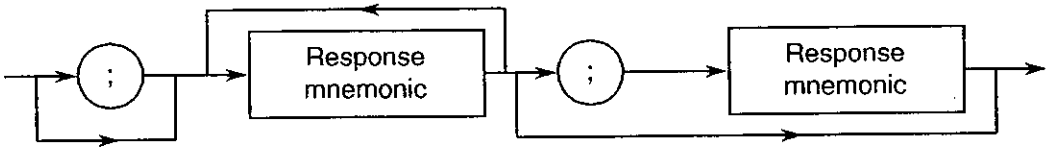
(5) Response header

A response message consists of a response header and a data section. Three types of response headers are defined: simple response header, compound response header and common response header.

- Simple response header



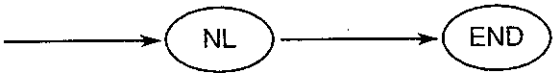
- Compound response header



- Common response header

(6) Terminator

"NL" is used as the terminator between lines or records.



Data Format

The data format defined in IEEE 488.2 can be divided into program and response data. Program data is sent from the controller to the device controlled by the controller. Response data is sent to report the measurement results to the controller.

The following data formats can be handled in IEEE 488.2. Among the data formats given below, those other than the Standard type are defined so that they can be selected as optional by the device designer.

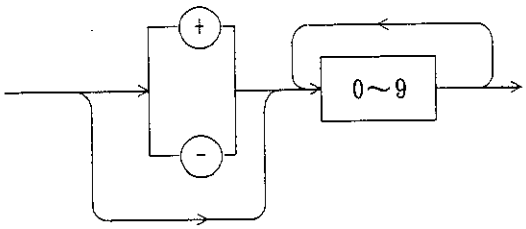
(1) Transmitter response data format

①	Character	TEST	Optional
②	Numeric: NR1 (integer type)	+123	Standard
③	Numeric: NR2 (fixed point)	-1.23	Optional
④	Numeric: NR3 (floating point)	-12.3E+5	Standard
⑤	Numeric: Hexadecimal	#H01FE	Optional
⑥	Numeric: Octal	#Q3077	Optional
⑦	Numeric: Binary	#B0101	Optional
⑧	Character string	"ADVAN"	Optional
⑨	Specified block length	#13 <DAB> <DAB> <DAB>	Optional
⑩	Indefinite block length	#0 <DAB> <DAB> NL EOI	Optional
⑪	Any ASCII	<ASCII> <ASCII> NL EOI	Standard

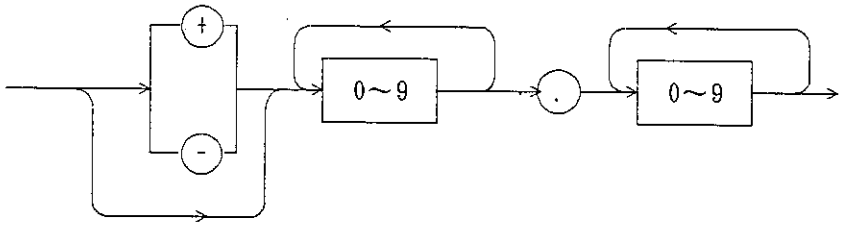
(2) Receiver program data format

The NRf format is defined at the receiver side so that all data formats NR1 through NR3 can be accepted.

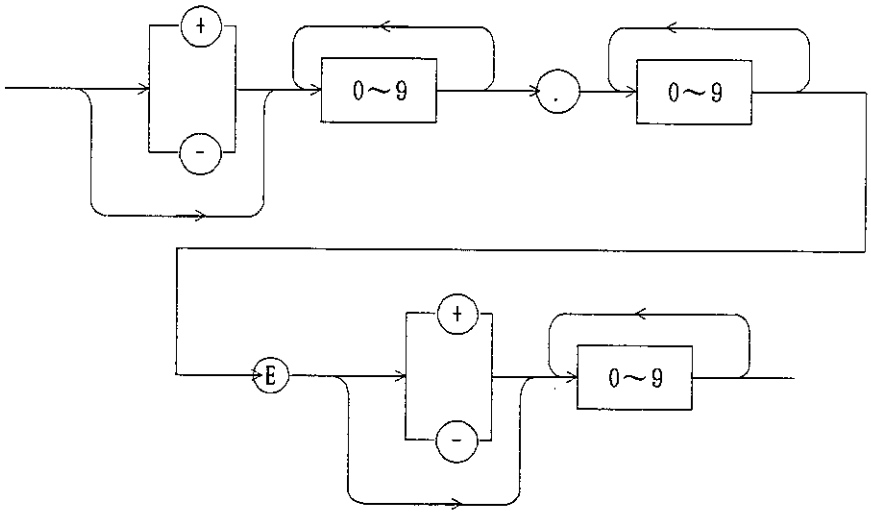
① NR1 format



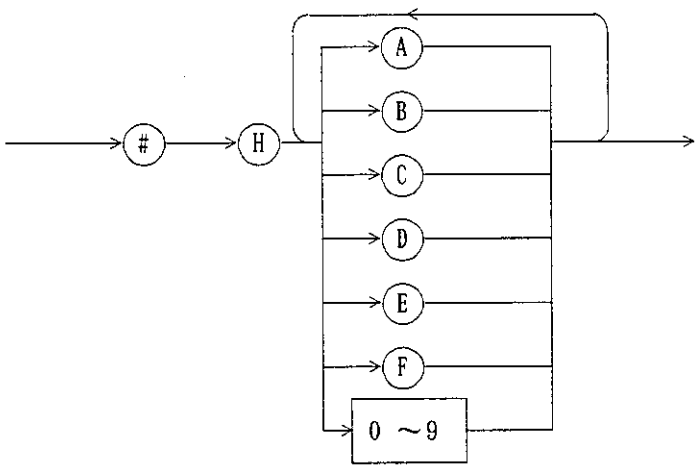
② NR2 format



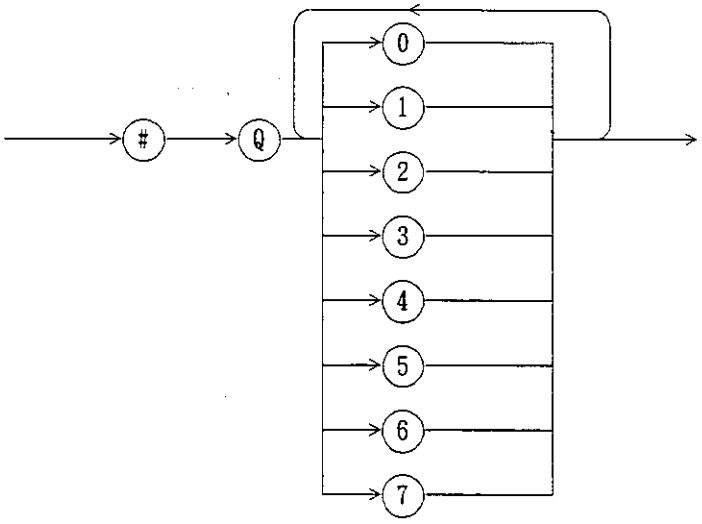
③ NR3 format



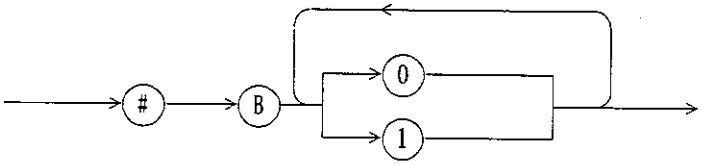
④ HEX format



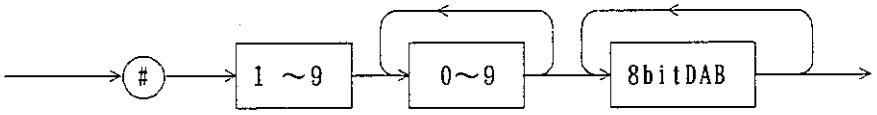
⑤ OCT format



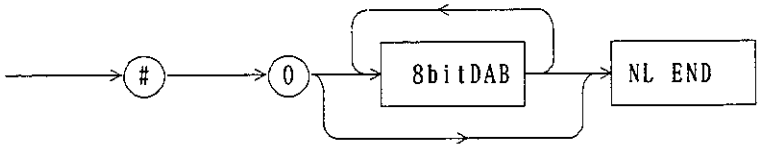
⑥ BIN format



⑦ Specified length format



⑧ Indefinite length format



Status Byte and Event

The IEEE 488.1 specifications define the service request (SR) function as an interrupt method for making service requests to the active controller of the device and a one-byte message is transmitted as the status byte.
Assuming a common status byte model, IEEE 488.2 defines its operation as:

(1) Each bit contained in the status byte represents the logical sum of the corresponding event and status.

(2) Each bit in the status byte represents multiple events which can be masked using the enable status.

(3) The DI07 bit MSS (master summary status) is the logical sum of the other bits. Before the logical sum is executed, the bits are masked using the SRER (service request enable register).

(4) The MSS generates rsv, which in turn drives the RQS, and serial polling is executed. The RSQ is cleared by serial polling but not the MSS.

(5) Other than the ESB(event summary bit) and the MAV(message available) are defined by users.

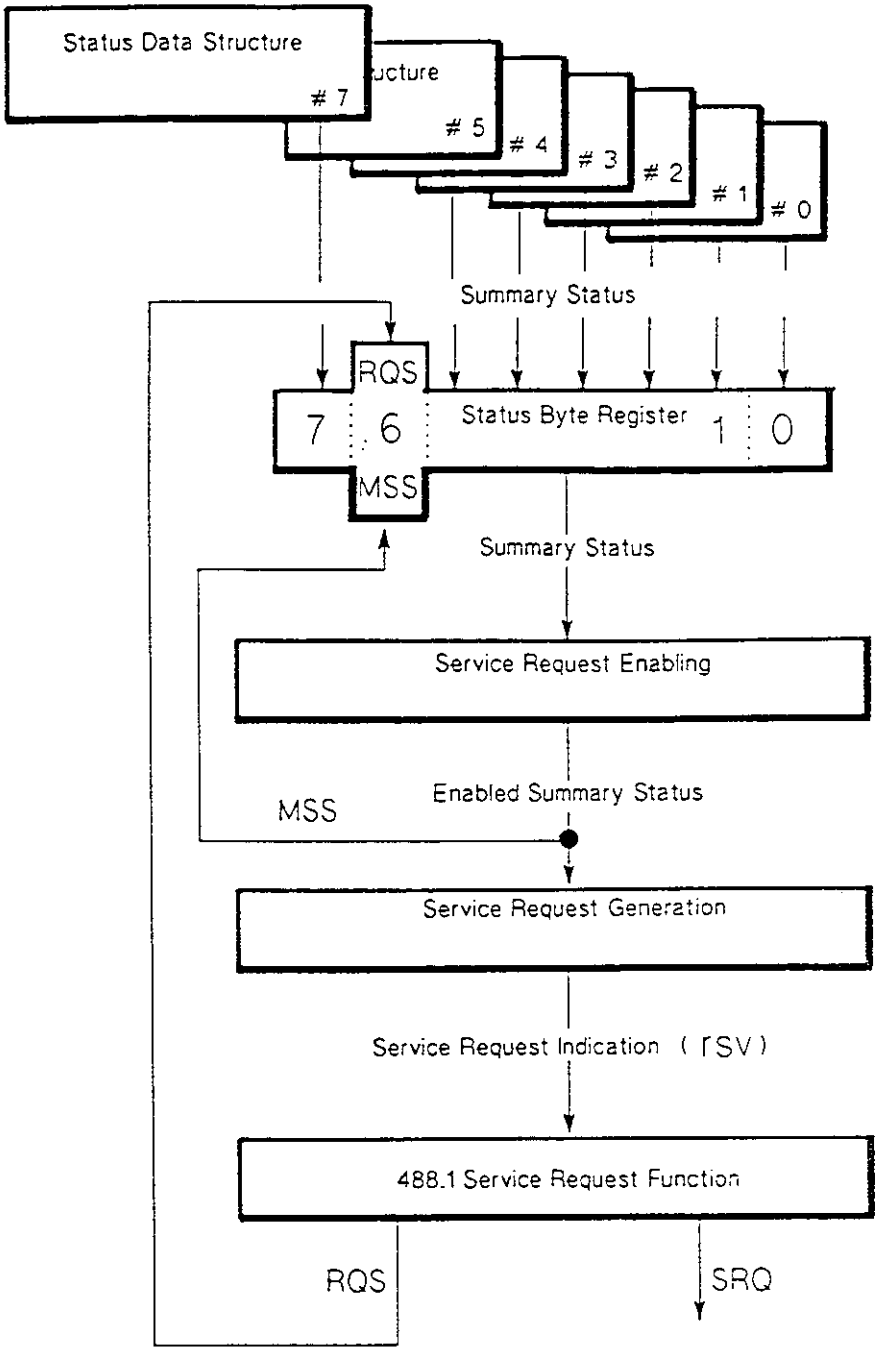


Fig. A3-2 Status Configuration

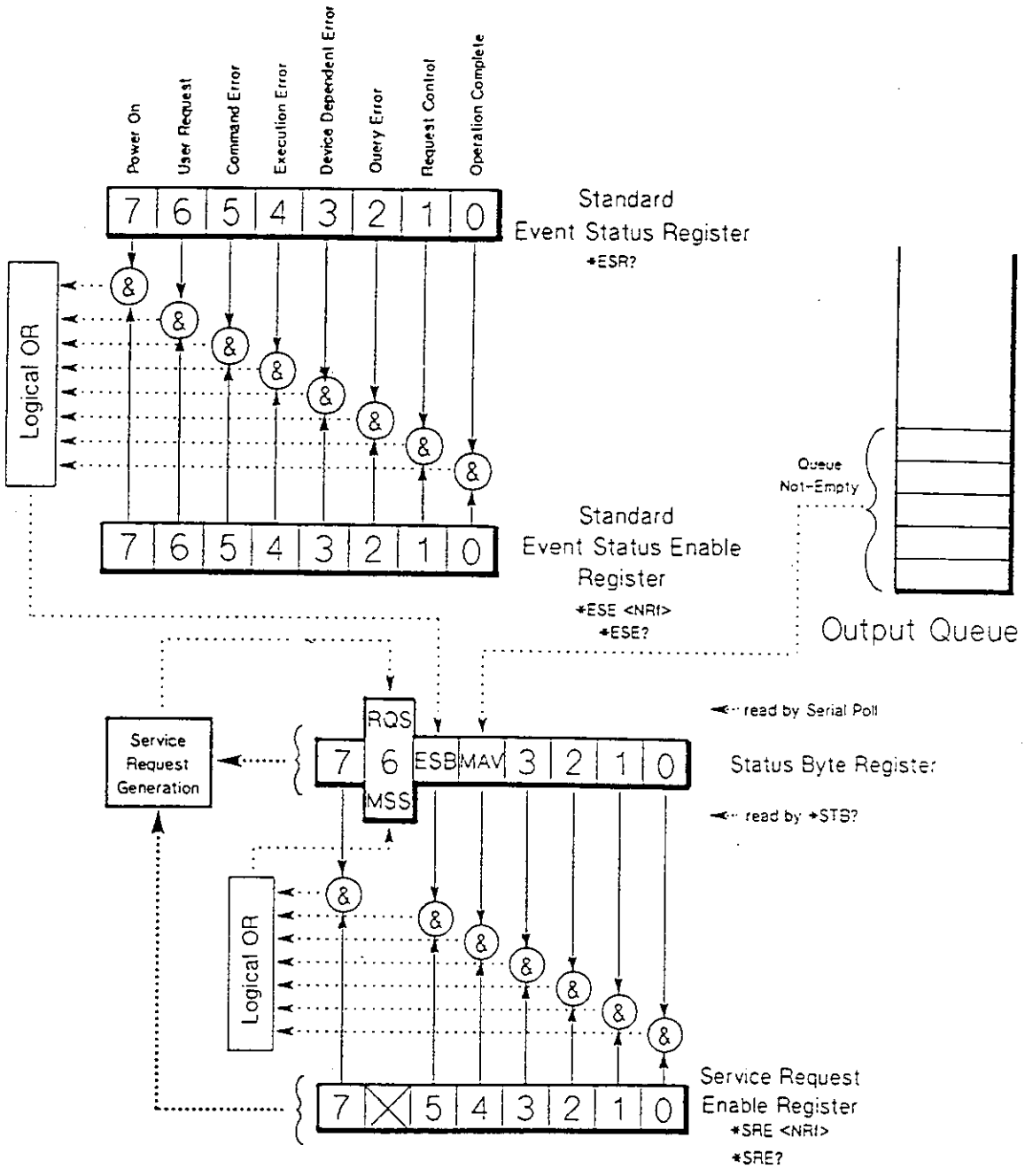


Fig. A3-3 Standard Status Data Configuration

Event Register

According to IEEE 488.2, multiple event registers can be contained in accordance with the device internal change. The contents of each event register is read out by the query and output to the status byte.

Beside these registers, a standard event register (SESR) is contained in each device.

Standard status register

The event status register defined in IEEE 488.2, where each bit is defined as shown in Table A3-1, and the logical sum of each bit are output to the status byte ESB.

Table A3-1 Event Status Register

Bit No.	Description
Bit 7 PON	Power Turn ON Again Power supply may be turned off after this register is read out.
Bit 6 URQ	User Request The local function containing the device has been activated by the user and reported to the controller.
Bit 5 CME	Command Error An error was found in the program data received and analyzed by the device. ① Syntax error : Syntax error not defined in IEEE 488.2. ② Semantic error : A header which cannot be processed or acommand which is not supported was received. ③ GET : The GET command was executed as a normal command.
bit 4 EXE	Execution Error An error was found in the command currently executed. ① Range error : The program data received was found to be outside the setting range. ② Mode error : A command which cannot be used in the current mode was issued.
Bit 3 DDE	Device Dependent Error The command specified could not be executed correctly for internal reasons other than command, query or execution errors.
Bit 2 QYE	Query Error An error was detected by the output queue controller. ① No queue was found : Read was attempted when not transmit data was contained in the output queue. ② Data lost : The data in the queue was lost.
Bit 1 RQC	Request Control A request was made to be active controller.
Bit 0 OPC	Operation Complete All processings completed and the next command can be accepted.

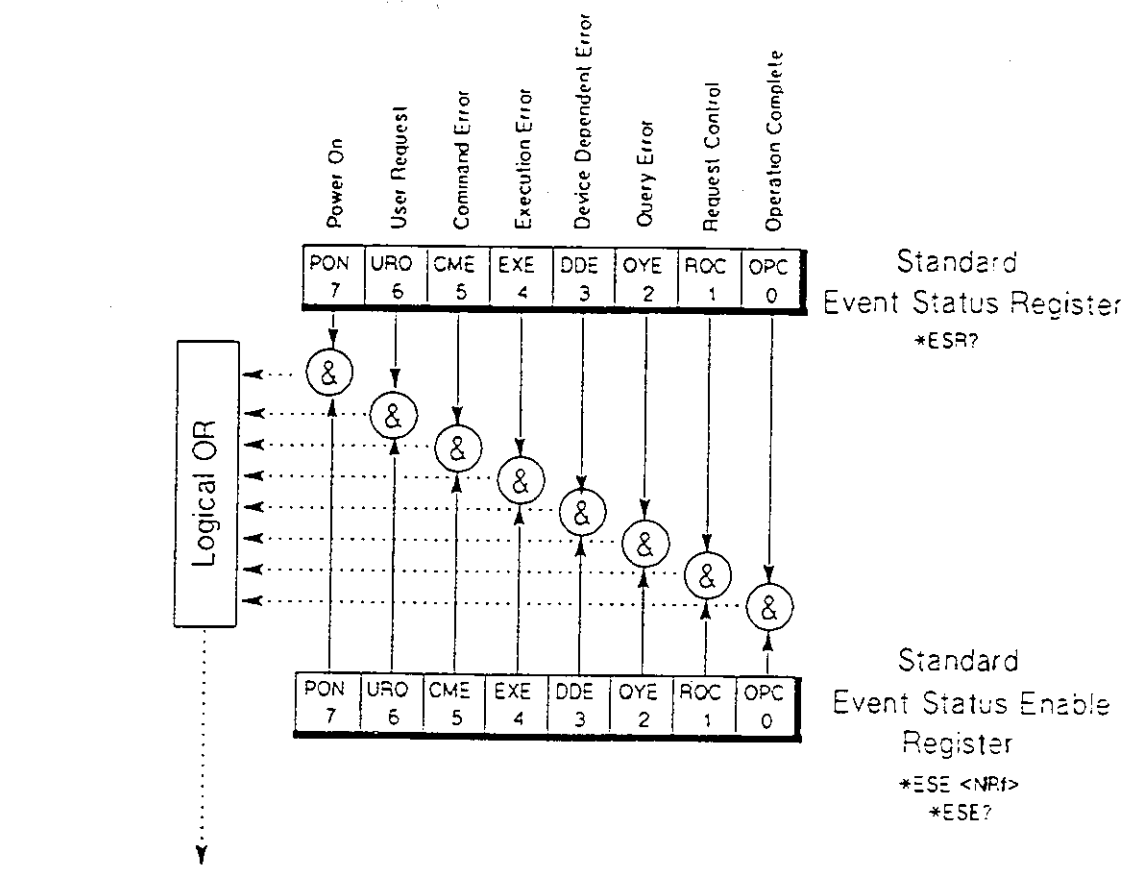


Fig. A3-4 Standard Event Status Register Model

Common Command and Query

The IEEE 488.2 specifications define the commands which are not device dependent as common commands used for device initialization and querying self-test results.
In the common commands, an asterisk "*" is added at the beginning of the header. In the query command, a question mark "?" can be added at the end of the commands.
The IEEE 488.2 specifications define the commands given in Table A3-2.

Table A3-2 Command Definition (1/3)

Automatically set commands		
*ADD	The device address is reset.	△
*DLF	The listener function is inhibited.	△
System data commands and queries		
*IDN?	Query on the device ID (maker, model name and other)	○
*OPT?	Query on optional equipment for the device	△
*PUD	Writing of protected user data	△
*PUD?	Query on protected user data	△
*RDT	Writing of resource (function) description data	△
*RDT?	Query on resource (function) description data	△
Internal operation commands and queries		
*CAL?	Query on the results of automatical calibration	△
*LRN?	Query on the command sequence for the current devicesetting	△
*RST	Device initialization	○
*TST?	Query on the self-test results	○
Synchronized commands and queries		
*OPC	After all processings currently being executed are complete, the LSB (bit 0) of the SESR is set.	○
*OPC?	After all processings currently being executed are complete, ASCII "1" if sent back.	○
*WAI	After all processings currently being executed are complete, the command following *WAI is executed.	○

○: Standard
△: Optional

Table A3-2 Command Definition (2/3)

Macro commands and queries		
*DMC	Macro definition	△
*EMC	Macro expansion allowed	△
*EMC?	Query on macro expansion	△
*GMC?	Query on the macro definition contents	△
*LMC	Query on all macro definitions	△
*PMC	Canceling of all macro definitions	△
Parallel poll commands and queries (PP1 standard)		
*IST	The ist local message is read without executing parallel polling	○
*PRE	Writing to the parallel poll enable register	○
*PRE?	Reading from the parallel poll enable register	○
Status event control commands and queries		
*CLS	Clearing the status byte and related queue	○
*ESE	Writing to the standard event status enable register	○
*ESE?	Reading from the standard event status enable register	○
*ESR?	Reading from the standard event status register and clearing it	○
*PSC	Controlling the clear flag when the status register power is turned on	△
*PSC?	Reading the clear flag when the status register power is turned on	△
*SRE	Writing to the service request enable register	○
*SRE?	Reading from the service request enable register	○
*STB?	Reading the status byte and the MSS bit without executing serial polling	○

○: Standard
△: Optional

Table A3-2 Command Definition (3/3)

Device trigger commands and queries (DT1 standard or optional)		
*DDT	Setting the command to be executed when GET is received	○
*DDT?	Query on the command to be executed when GET is received	○
*TRG	Same as GET	△
Controller command (Controller standard)		
*PCB	Setting the device address to which control is to be passed before TCT is sent	○
Setting saving commands		
*RCL	Resetting the device state	△
*SAV	Saving the current device state	△

○: Standard
△: Optional

MEMO

ALPAHBETICAL INDEX

P

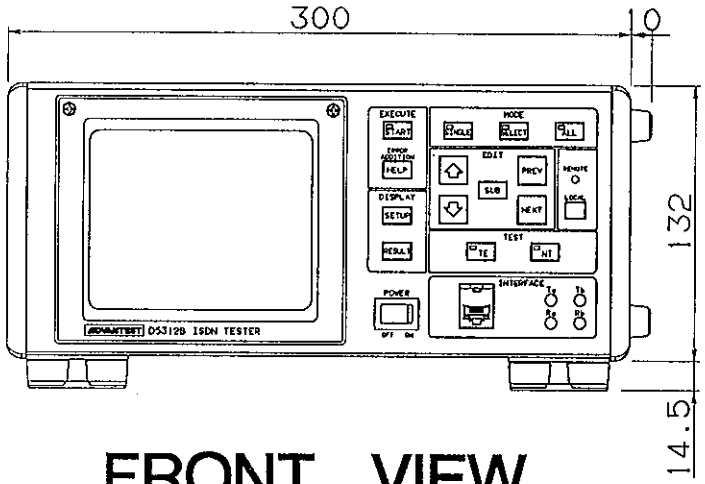
Q

R

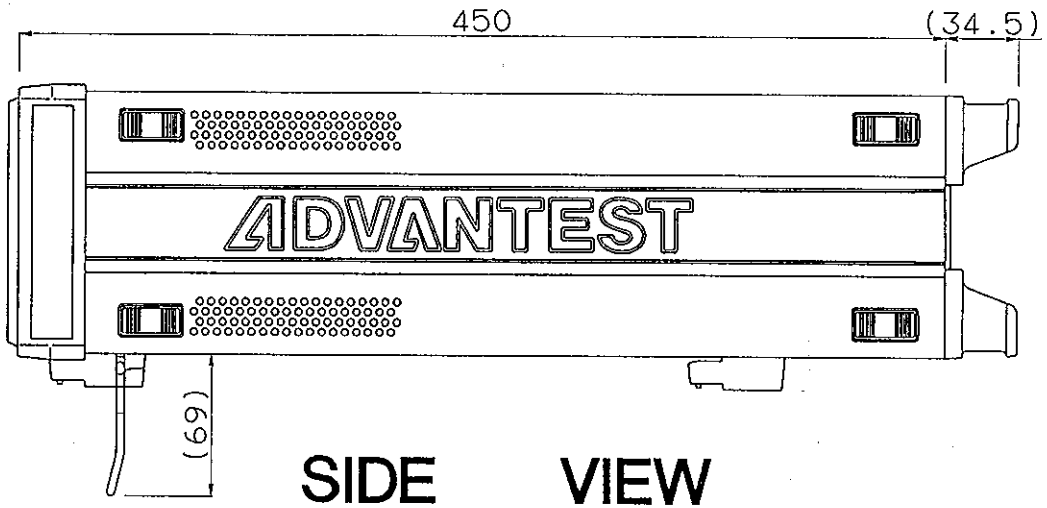
S

T

U

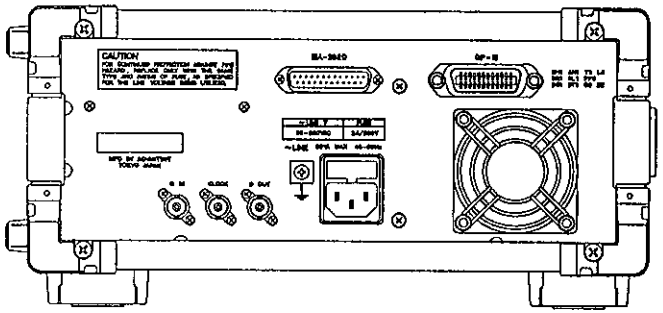


FRONT VIEW



SIDE VIEW

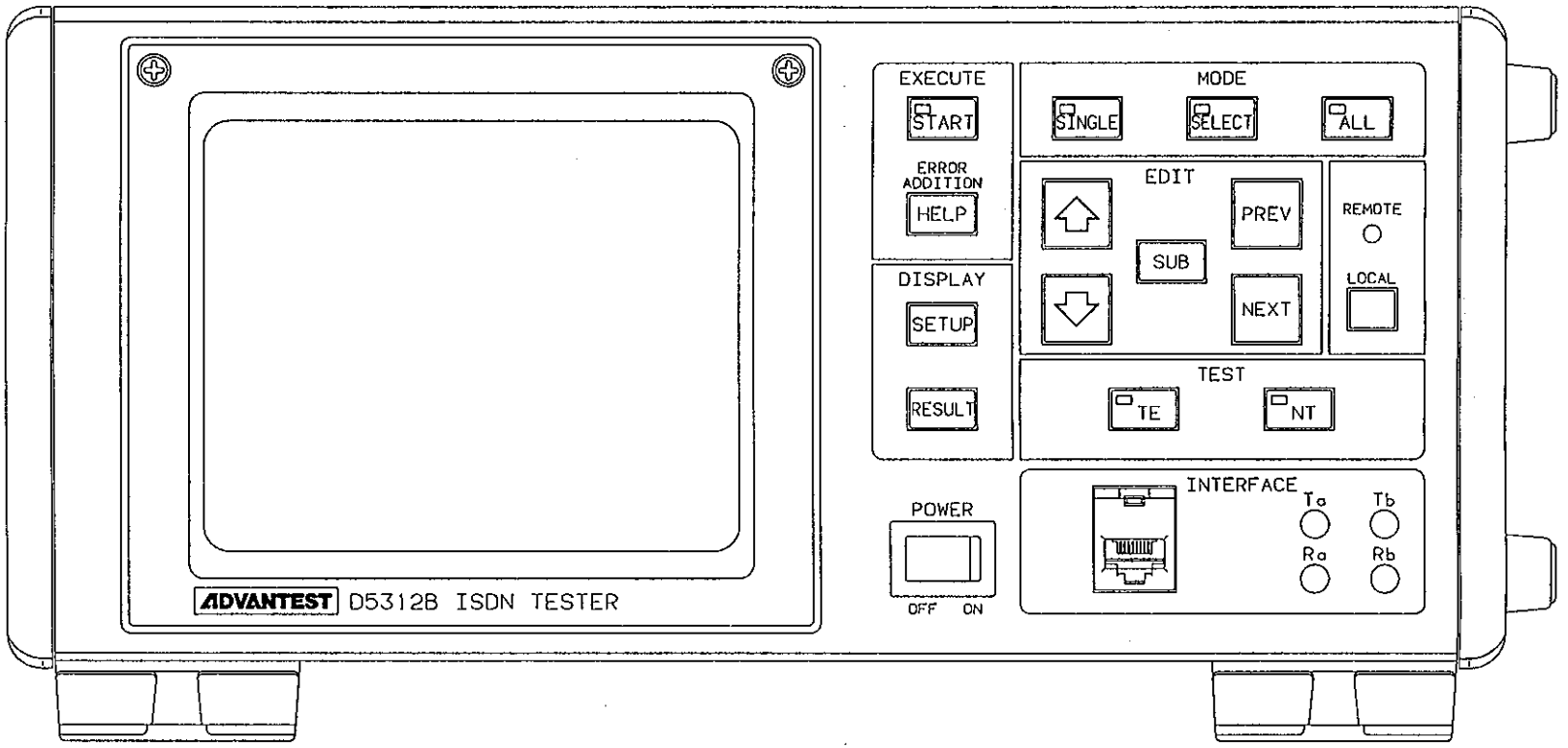
Unit; mm



REAR VIEW

D5312BEXT1-9107-C

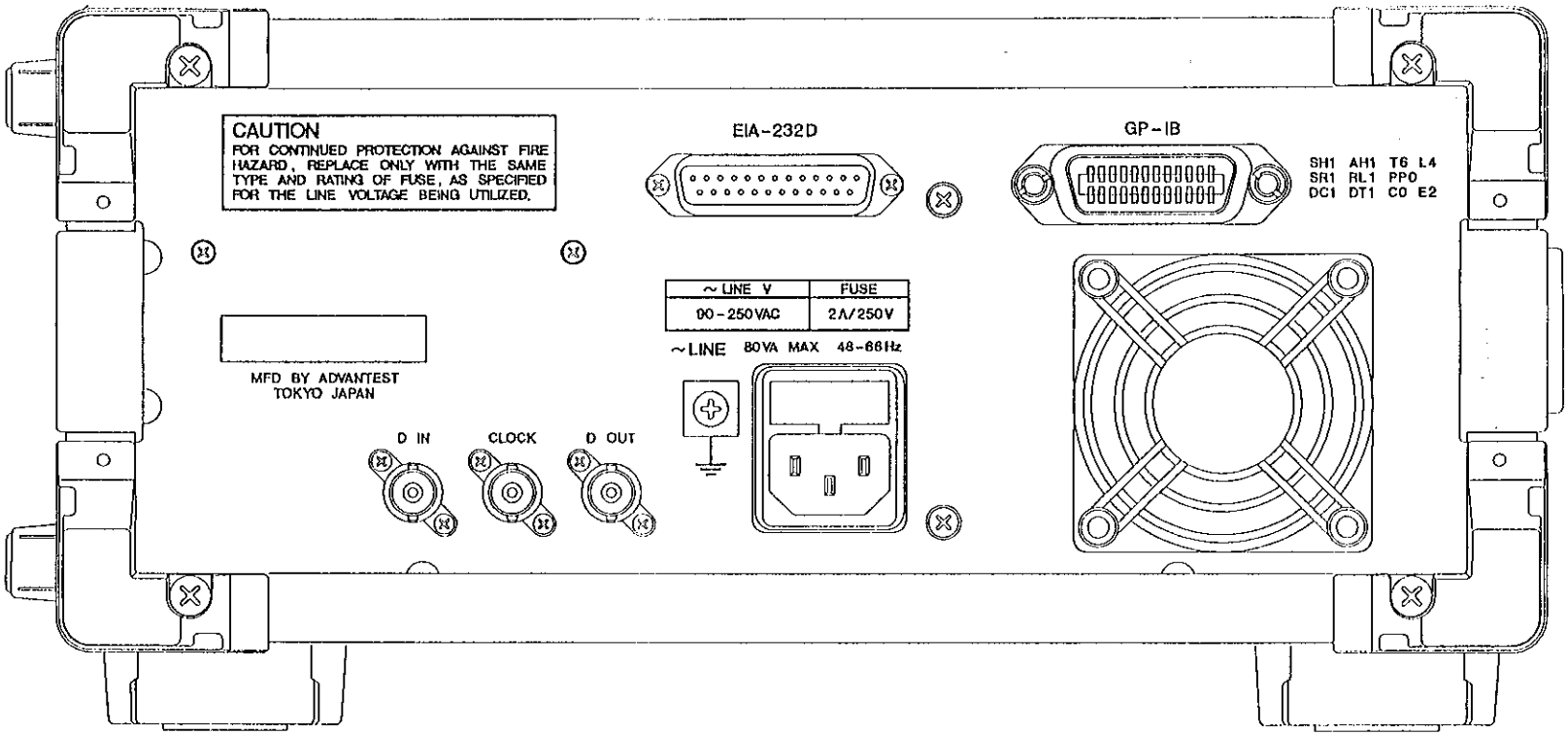
D5312B
EXTERNAL VIEW



D5312B

FRONT VIEW

D5312BEXT2-9107-C



D5312BEXT3-9101-A

D5312B
REAR VIEW

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   (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;

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   (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

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5. **EXCEPT TO THE EXTENT EXPRESSLY PROVIDED HEREIN, ADVANTEST HEREBY EXPRESSLY DISCLAIMS, AND THE PURCHASER HEREBY WAIVES, ALL WARRANTIES, WHETHER EXPRESS OR IMPLIED, STATUTORY OR OTHERWISE, INCLUDING, WITHOUT LIMITATION, (A) ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE AND (B) ANY WARRANTY OR REPRESENTATION AS TO THE VALIDITY, SCOPE, EFFECTIVENESS OR USEFULNESS OF ANY TECHNOLOGY OR ANY INVENTION.**

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.**

7. **ADVANTEST WILL NOT HAVE ANY LIABILITY TO THE PURCHASER FOR ANY INDIRECT, INCIDENTAL, SPECIAL, CONSEQUENTIAL OR PUNITIVE DAMAGES, INCLUDING, WITHOUT LIMITATION, LOSS OF ANTICIPATED PROFITS OR REVENUES, IN ANY AND ALL CIRCUMSTANCES, EVEN IF ADVANTEST HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES AND WHETHER ARISING OUT OF BREACH OF CONTRACT, WARRANTY, TORT (INCLUDING, WITHOUT LIMITATION, NEGLIGENCE), STRICT LIABILITY, INDEMNITY, CONTRIBUTION OR OTHERWISE. TORT (INCLUDING, WITHOUT LIMITATION, NEGLIGENCE), STRICT LIABILITY, INDEMNITY, CONTRIBUTION OR OTHERWISE.**

8. **OTHER THAN THE REMEDY FOR THE BREACH OF WARRANTY SET FORTH HEREIN, ADVANTEST SHALL NOT BE LIABLE FOR, AND HEREBY DISCLAIMS TO THE FULLEST EXTENT PERMITTED BY LAW ANY LIABILITY FOR, DAMAGES FOR PRODUCT FAILURE OR DEFECT, WHETHER ARISING OUT OF BREACH OF CONTRACT, TORT (INCLUDING, WITHOUT LIMITATION, NEGLEGENCE), STRICT LIABILITY, INDEMNITY, CONTRIBUTION OR OTHERWISE.**

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.

SALES & SUPPORT OFFICES

Advantest Korea Co., Ltd.
22BF, Kyobo KangNam Tower,
1303-22, Seocho-Dong, Seocho-Ku, Seoul #137-070, Korea
Phone: +82-2-532-7071
Fax: +82-2-532-7132

Advantest (Suzhou) Co., Ltd.
Shanghai Branch Office:
Bldg. 6D, NO.1188 Gumei Road, Shanghai, China 201102 P.R.C.
Phone: +86-21-6485-2725
Fax: +86-21-6485-2726

Shanghai Branch Office:
406/F, Ying Building, Quantum Plaza, No. 23 Zhi Chun Road,
Hai Dian District, Beijing,
China 100083
Phone: +86-10-8235-3377
Fax: +86-10-8235-6717

Advantest (Singapore) Pte. Ltd.
438A Alexandra Road, #08-03/06
Alexandra Technopark Singapore 119967
Phone: +65-6274-3100
Fax: +65-6274-4055

Advantest America, Inc.
3201 Scott Boulevard, Suite, Santa Clara, CA 95054, U.S.A
Phone: +1-408-988-7700
Fax: +1-408-987-0691

ROHDE & SCHWARZ Europe GmbH
Mühldorfstraße 15 D-81671 München, Germany
(P.O.B. 80 14 60 D-81614 München, Germany)
Phone: +49-89-4129-13711
Fax: +49-89-4129-13723

ADVANTEST®

http://www.advantest.co.jp

ADVANTEST CORPORATION
Shin-Marunouchi Center Building, 1-6-2 Marunouchi, Chiyoda-ku, Tokyo 100-0005, Japan
Phone: +81-3-3214-7500