MD6420A
Data Transmission Analyzer
Operation Manual

Vol.1
(Operation)

Fourth Edition

Read this manual before using the equipment.
Keep this manual with the equipment.

Measuring Instruments Division
Measurement Group

ANRITSU CORPORATION

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2001

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Safety Symbols

To prevent the risk of personal injury or loss related to equipment malfunction, Anritsu Corporation uses the following safety symbols to indicate safety-related information. Insure that you clearly understand the meanings of the symbols BEFORE using the equipment.

Symbols used in manual

DANGER This indicates a very dangerous procedure that could result in serious injury or death if not performed properly.

WARNING This indicates a hazardous procedure that could result in serious injury or death if not performed properly.

CAUTION This indicates a hazardous procedure or danger that could result in light-to-severe injury, or loss related to equipment malfunction, if proper precautions are not taken.

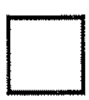
Safety Symbols Used on Equipment and in Manual

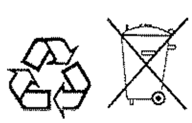
(Some or all of the following five symbols may not be used on all Anritsu equipment. In addition, there may be other labels attached to products which are not shown in the diagrams in this manual.)
The following safety symbols are used inside or on the equipment near operation locations to provide information about safety items and operation precautions. Insure that you clearly understand the meanings of the symbols and take the necessary precautions BEFORE using the equipment.


This indicates a prohibited operation. The prohibited operation is indicated symbolically in or near the barred circle.


This indicates an obligatory safety precaution. The obligatory operation is indicated symbolically in or near the circle.


This indicates warning or caution. The contents are indicated symbolically in or near the triangle.


This indicates a note. The contents are described in the box.


These indicate that the marked part should be recycled.

MD6420A Data Transmission Analyzer
Operation Manual Vol.1 (Operation)

August 1990 (First Edition)
August 1995 (Fourth Edition)

Printed in japan

For Safety

WARNING

1. Always refer to the operation manual when working near locations at which the alert mark shown on the left is attached. If the operation, etc., is performed without heeding the advice in the operation manual, there is a risk of personal injury. In addition, the equipment performance may be reduced.
   Moreover, this alert mark is sometimes used with other marks and descriptions indicating other dangers.

2. When supplying power to this equipment, connect the accessory 3-pin power cord to a 3-pin grounded power outlet. If a grounded 3-pin outlet is not available, before supplying power to the equipment, use a conversion adapter and ground the green wire, or connect the frame ground on the rear panel of the equipment to ground. If power is supplied without grounding the equipment, there is a risk of receiving a severe or fatal electric shock.

Repair

WARNING ⚠

3. This equipment cannot be repaired by the user. DO NOT attempt to open the cabinet or to disassemble internal parts. Only Anritsu-trained service personnel or staff from your sales representative with a knowledge of electrical fire and shock hazards should service this equipment. There are high-voltage parts in this equipment presenting a risk of severe injury or fatal electric shock to untrained personnel. In addition, there is a risk of damage to precision parts.

Falling Over

4. This equipment should be used in the correct position. If the cabinet is turned on its side, etc., it will be unstable and may be damaged if it falls over as a result of receiving a slight mechanical shock.

For Safety

CAUTION

Changing Fuse

CAUTION ⚠

1. Before changing the fuses, ALWAYS remove the power cord from the poweroutlet and replace the blown fuses. Always use new fuses of the type and rating specified on the fuse marking on the rear panel of the cabinet.

   T5A250V or T3.15A250V indicates a time-lag fuse.

   There is risk of receiving a fatal electric shock if the fuses are replaced with the power cord connected.

Cleaning

2. Keep the power supply and cooling fan free of dust.
   - Clean the power inlet regularly. If dust accumulates around the power pins, there is a risk of fire.
   - Keep the cooling fan clean so that the ventilation holes are not obstructed. If the ventilation is obstructed, the cabinet may overheat and catch fire.

Equipment Certificate

Anritsu Corporation certifies that this equipment was tested before shipment using calibrated measuring instruments with direct traceability to public testing organizations recognized by national research laboratories including the Electrotechnical Laboratory, the National Research Laboratory and the Communication Research laboratory, and was found to meet the published specifications.

Anritsu Warranty

Anritsu Corporation will repair this equipment free-of-charge if a malfunction occurs within 1 year after shipment due to a manufacturing fault, provided that this warranty is rendered void under any or all of the following conditions.

- The fault is outside the scope of the warranty conditions described in the operation manual.
- The fault is due to misoperation, misuse, or unauthorized modification or repair of the equipment by the customer.
- The fault is due to severe usage clearly exceeding normal usage.
- The fault is due to improper or insufficient maintenance by the customer.
- The fault is due to natural disaster including fire, flooding and earthquake, etc.
- The fault is due to use of non-specified peripheral equipment, peripheral parts, consumables, etc.
- The fault is due to use of a non-specified power supply or in a non-specified installation location.

In addition, this warranty is valid only for the original equipment purchaser. It is not transferable if the equipment is resold.

Anritsu Corporation will not accept liability for equipment faults due to unforeseen and unusual circumstances, nor for faults due to mishandling by the customer.

Anritsu Corporation Contact

If this equipment develops a fault, contact the head office of Anritsu Corporation at the address in the operation manual, or your nearest sales or service office listed on the following pages.

MEMORY BACK-UP BATTERY REPLACEMENT

The power for memory back-up is supplied by a Poly-carbomonofluoride Lithium Battery. This battery should only be replaced by a battery of the same type; since replacement can only be made by Anritsu, contact the nearest Anritsu representative when replacement is required.

At the end of it's life, the battery should be recycled or disposed properly.

Note: The battery life is about 7 years. Early battery replacement is recommended.

Note 1:

1. The instrument is operable on a voltage of 85 to 132 Vac or 170 to 250 Vac by changing the connections on the power supply circuit.

   The voltage and current ratings are indicated on the rear panel when the instrument is shipped from the factory.

   To operate on the other voltage, change the connections on the power supply circuit. The plate on the rear panel indicating the voltage and current ratings should be changed to the appropriate one. Order the plate from ANRITSU CORPORATION if needed.

2. In this manual, the power supply voltage and current ratings are represented by **Vac and ***A, respectively.

3. The relationship between power supply voltage and current ratings is shown below.

**Vac	***A
85 to 132 V	5 A
170 to 250 V	3.15 A

Note 2:

Trademarks

IBM is the registered trademark of International Business Machines Corporation.

IBM PC and PC DOS are trademarks of International Business Machines Corporation.

Microsoft QuickBASIC is a trademark of Microsoft Corporation.

GPIB-PC is a trademark of National Instruments Corporation.

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Power Line Fuse Protection

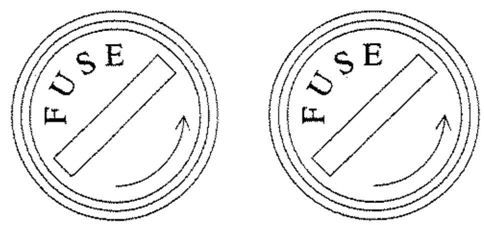
For safety, Anritsu products have either one or two fuses in the AC power lines as requested by the customer when ordering.

Single fuse: A fuse is inserted in one of the AC power lines.

Double fuse: A fuse is inserted in each of the AC power lines.

Example: An example of the double fuse is shown below:

Fuse Holders



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SECTION 1
GENERAL

1.1 Operation Manual Composition

The MD6420A operation manual is divided into VOLUME 1 and VOLUME 2. VOLUME 1 contains the information necessary to operate and make measurements with the MD6420A.

VOLUME 2 explains the menus and remote control commands in detail. Refer to it as required. Both volumes are for the MD6420A main frame. For detailed information regarding the plug-in units, refer to the manual for each unit.
VOLUME 1 and VOLUME 2 consist of the following sections:

VOLUME 1 (OPERATION)

SECTION 1	GENERAL
SECTION 2	OPERATION
SECTION 3	MEASUREMENT
SECTION 4	APPLICATION
SECTION 5	REMOTE CONTROL
SECTION 6	PRINCIPLE OF OPERATION
SECTION 7	SIMPLE OPERATION CHECKS
SECTION 8	STORAGE AND TRANSPORTATION
APPENDIX A	ABBREVIATIONS
APPENDIX B	TABLE OF DATA CODES

VOLUME 2 (REFERENCE)

SECTION 1	REMOTE CONTROL COMMANDS REFERENCE
SECTION 2	RESPONSE DATA REFERENCE
SECTION 3	MENU REFERENCE
APPENDIX A	ABBREVIATIONS

1.2 What is the MD6420A?

The MD6420A Data Transmission Analyzer is a measuring instrument for evaluation, maintenance, and construction of lines and terminal equipment. It can be used with a wide range of interfaces, from low-speed modems to high-speed digital lines, via different plug-in units.

(1) Measurement functions

- Error measurement
- DC voltage measurement
- Frequency measurement
- Line interval measurement
- Transmission delay measurement
- Pattern data transmission and word tracing
- Long-term collection and analysis of error measurement data (MD0633A Error Analyzer Unit)
- Distortion measurement (MD0630A Distortion Measure Unit)
- Analog level and frequency measurement (MD0627A Analog Unit)
- Digital level measurement (MD0630B CODEC Unit)
- Jitter generation/detection (MD0632A/B/C Jitter Unit)

(2) Features

- Can measure a variety of devices from low-speed modems to high-speed digital lines
  Can be configured to a variety of communications protocols via CCITT V, X, G, and I series plug-in units.
- Can perform measurements between signals from different interfaces
  When different interfaces are used for sending and receiving, measurements can be performed between these different interfaces. Up to five plug-in units can be installed.
- Simultaneous error measurement of various error parameters
  The error count (bit error, parity error, CRC error, and code error, etc.) error rate, block error count, block error rate, background error count, background bit error rate (BBER), US, AT, %AT, %US, SES, %SES, DM, %DM, ES %ES, EFS, %EFS, clock slip count, synchronization loss count, and alarm generation times (signal loss, AIS, etc.) can be measured simultaneously.
- Up to 28 different measurement items can be displayed on a single screen
- Data will not be lost if a power failure occurs during measurement
  If an AC power failure occurs during error measurements, all data obtained prior to the failure is recalled from memory and measurement is automatically continued when power is resupplied.
- Convenient one-touch recall of measurement settings
  The settings for a measurement can be stored in memory, then recalled with the push of a key, if subsequent measurements require the same settings.
  The BEFORE POWER-OFF function key allows one-touch recall of the screen used immediately before power-off.

- Storage and statistical analysis of error measurement data
  When the MD0633A Error Analyze Unit is used, the error measurement data can be saved. The results of stored data analyses can be displayed as a histogram.
- Optional selection of print items
  The measurement conditions and measured results can be printed on the built-in printer.
  During error measurement, print-out is automatically performed whenever an error/alarm occurs and at the end of measurement.
  The items to be printed can be selected.

1.3 Composition

1.3.1 Standard composition

The standard composition of the MD6420A Data Transmission Analyzer is shown in Table 1-1.

Table 1-1 Standard Composition

Item	Model Number / Order Number	Name	Qty.	Remarks
Instrument	MD6420A	Data Transmission Analyzer	1	
Accessories	J0017	Power cord	1	
	F0013	Fuse, 5 A	2	T5A250 V (only for 85 to 132 V ac)
	F0012	Fuse, 3.15 A	2	T3.15A 250 V (only for 170 to 250 V ac)
	Z0031A	Printer paper	2 rolls	
	B0301	Protective cover	1	
	W0618AE	Operation manual	1	Volumes 1 and 2

1.3.2 Options

The options of the MD6420A Data Transmission Analyzer is shown in Table 1-2.

Table 1-2 Options

Model Number	Name	Remarks
MD6420A-01	Send-Pattern Sync. Signal Output	Video signal output becomes disabled.
MD6420A-02	32 kByte memory size for word pattern	Word pattern length 2 to 32768 bytes.
Z0174	Service kit for MD6420A	

1.4 Plug-In Units

1.4.1 Selection guide

Various terminals and lines can be measured with the MD6420A by inserting plug-in units into the slots on the rear (interface unit/extension unit slots: 5, remote control unit slots: 1).

Interface units

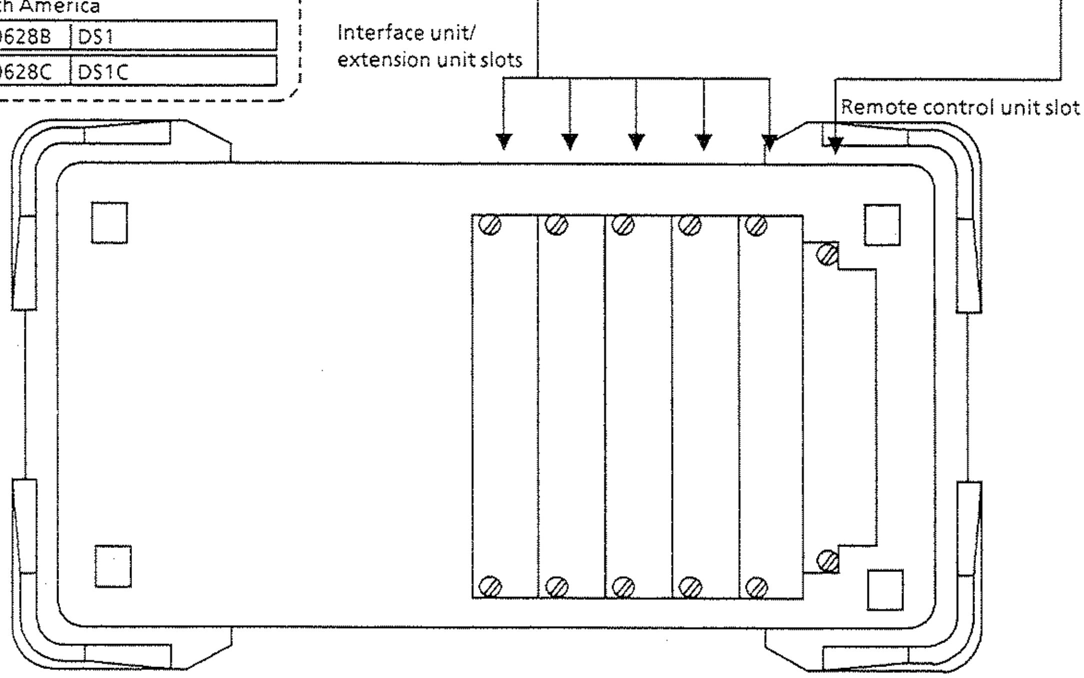
●V / X Series interface	
MD0621A	V.24/V.28(RS-232C)
MD0621B	V.35
MD0621C	V.36(RS-449)
MD0621D	X.20(RS-423) / X.21(RS-422)
●G.703 Interface	
MD0622B	G.703 / G.704 1.544Mb/s Bipolar
MD0622D	G.703 / G.704 6.312Mb/s Bipolar
MD0622E	G.703 64kb/s
MD0623A/A1	G.703 / G.704 2.048Mb/s Bipolar
MD0623B	G.703 / G.741 8.448Mb/s Bipolar
●I.430	
MD0625A	I.430 192 kb/s
●I.431 interface	
MD0625B	I.431 1.544 Mb/s
MD0625C	I.431 2.048 Mb/s
●TTL Interface	
MD0626A	TTL
●North America	
MD0628B	DS1
MD0628C	DS1C

Extension units

●Analog interface	
MD0627A	Analog
●Measurement extension	
MD0630A	Distortion Measure
MD0630B	CODEC
MD0610D/D1	Word Memory
●Error analysis	
MD0633A	Error Analyze

Remote control units

MD0620A	GP-IB
MD0620B	RS-232C



The interface units and extension units can be combined as shown below.

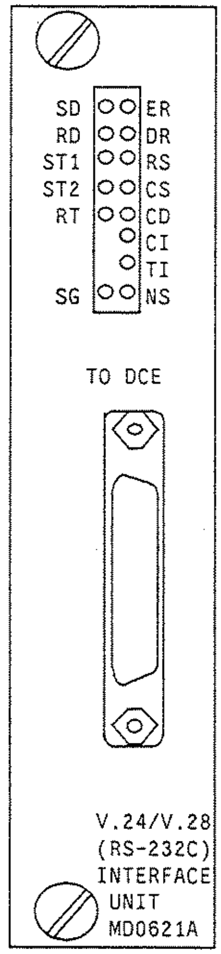
Interface units — Unit name \ Extension units — Model Number	MD0627A Analog	MD0630A Distortion Measure	MD0630B CODEC	MD0633A Error Analyze	MD0610D /D1 Word Memory	MD0632A 64 kb/s Jitter	MD0632B 1.544 Mb/s Jitter	MD0632C 2.048 Mb/s Jitter
MD0621A V.24 / V.28 (RS-232C)	○	○		○	○			
MD0621B V.35	○	○		○	○			
MD0621C V.36 (RS-449)	○	○		○	○			
MD0621D X.20 (RS-423) /X.21 (RS-422)	○	○		○	○			
MD0622B G.703 / G.704 1.544Mb/s Bipolar	○ *		○	○	○			
MD0622D G.703 / G.704 6.312Mb/s Bipolar	○ *			○	○			
MD0622E G.703 64kb/s	○ *		○	○	○			
MD623A/A1 G.703 / G.704 2.048Mb/s Bipolar	○ *		○	○	○			
MD0623B G.703 / G.741 8.448Mb/s Bipolar	○ *			○	○			
MD0625A I.430 192 kb/s	○ *		○	○	○			
MD0625B I.431 1.544 Mb/s	○ *		○	○	○		○	
MD0625C/C1 I.431 2.048 Mb/s	○ *		○	○	○			○
MD0626A TTL	○ *	○		○	○			
MD0628B DS1	○ *		○	○	○		○	
MD0628C DS1C	○ *			○	○			

* : In these combination, no analog-digital mode measurements can be done on the ANALOG screen.

1.4.2 Interface Units

V. 24/V. 28 (RS-232C)

MD0621A



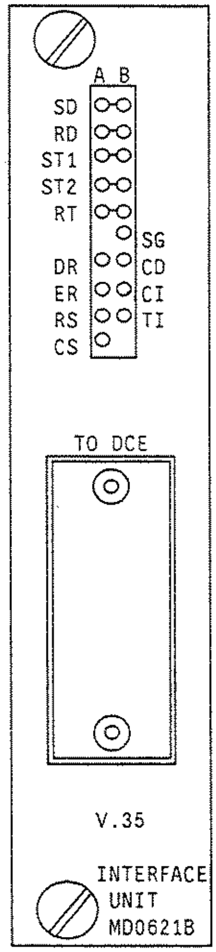
Measurement object	:	Interfaces conforming to CCITT V.24/V.28 (RS-232C modem, etc.)
Synchronization	:	Start-stop, asynchronous, synchronous (ST1, ST2, RT)
Data bit rate	:	• Start-stop, asynchronous, synchronous (ST1) 50 b/s to 20 kb/s (conforms to the MD6420A spec.) • Synchronous (ST2, RT) 50 b/s to 20 kb/s

Measurement items (conforms to the MD6420A spec.) :

Error (bit, parity), DC voltage

V. 35

MD0621B



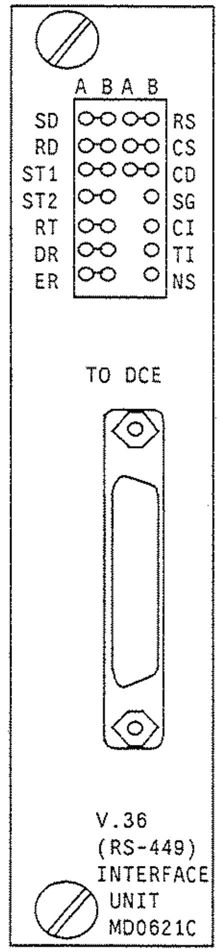
Measurement object	:	Interfaces conforming to CCITTV.35
Synchronization	:	Synchronous (ST1, ST2, RT)
Data bit rate	:	ST1; 50 b/s to 8.192 Mb/s (conforms to the MD6420A spec.) ST2; 50 b/s to 10 Mb/s RT; 50 b/s to 9 Mb/s

Measurement items (conforms to the MD6420A spec.) :

Error (bit), DC voltage

V. 36

MD0621C



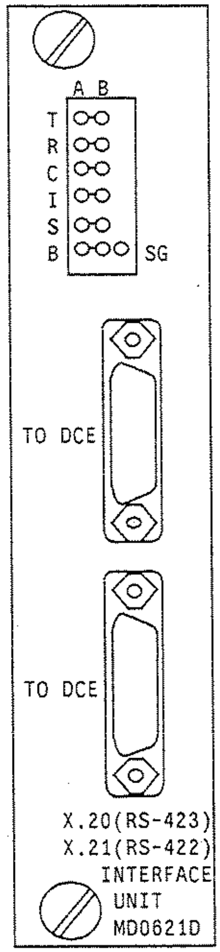
Measurement object	:	Interfaces conforming to CCITT V.36 (RS-449, V.10/V.11 modems, etc.)
Synchronization	:	Synchronous (ST1, ST2, RT)
Data bit rate	:	ST1; 50 b/s to 8.192 Mb/s (conforms to the MD6420A spec.) ST2; 50 b/s to 10 Mb/s RT; 50 b/s to 9 Mb/s

Measurement items (conforms to the MD6420A spec.) :

Error (bit), DC voltage

X. 20/X. 21

MD0621D



Measurement object : Interfaces conforming to CCITT X.20/X.21 (RS-423 [V.10], RS-422[V.11] modems, etc.)

Synchronization : Start-stop, asynchronous, synchronous (ST1, ST2, RT)

Data bit rate :
- Start-stop, asynchronous
  50 b/s to 20 kb/s (conforms to the MD6420A spec.)
- Synchronous
  ST1; 50b/s to 8.192 Mb/s (conforms to the MD6420A spec.)
  S/ST2; 50b/s to 9 Mb/s

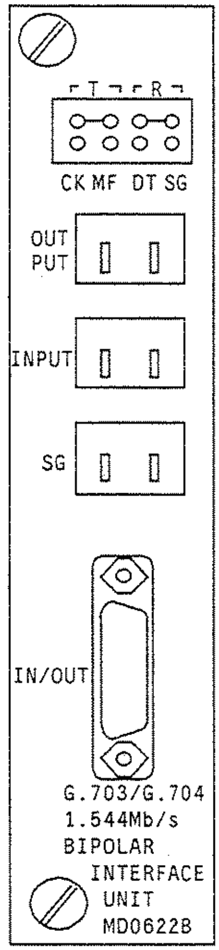
Measurement items (conforms to the MD6420A spec.) :

Error (bit, parity), DC voltage

G. 703/G. 704

1.544 Mb/s Bipolar

MD0622B



Measurement object	:	1.544 Mb/s interfaces conforming to CCITT G.703/G.704 (DS1, ESF, D4 frame, etc.)
Transmission rate:	:	1.544 Mb/s (clock: self oscillation or slave oscillation)
Code rule	:	AMI, B8ZS, B6ZS, HDB3
Input/output impedance	:	100 Ω balance
Frame	:	CCITT G.704/G.734, X.50, no frame
Data bit rate (kb/s)	:	56, 64×N (N: 1 to 24), 2.4, 4.8, 9.6, 48

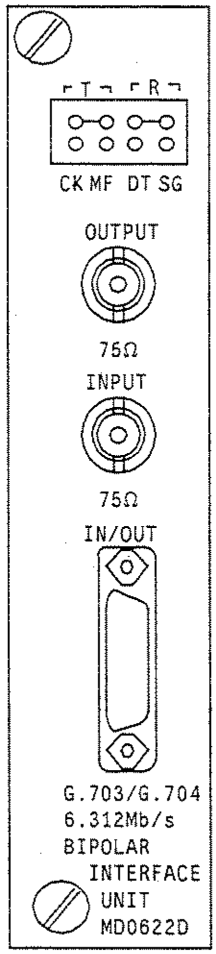
Measurement items (conforms to the MD6420A spec.) :

Error (bit, G.704 CRC-6 code, parity, frame mismatch)

G. 703/G. 704

6.312 Mb/s Bipolar

MD0622D



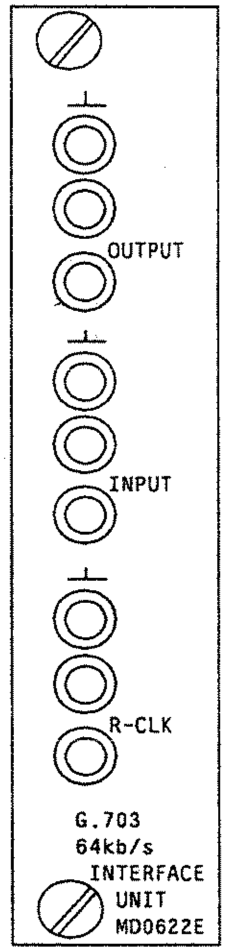
Measurement object	:	6.312 Mb/s interfaces conforming to CCITT G.703/G.704
Transmission rate:	:	6.312 Mb/s (clock: self oscillation or slave oscillation)
Code rule	:	AMI, B8ZS, B6ZS, HDB3
Input/output impedance	:	110 Ω balance/75 Ω unbalance
Frame	:	CCITT G.704, no frame
Data bit rate (kb/s)	:	56, 64×N (N: 1 to 98)

Measurement items (conforms to the MD6420A spec.) :

Error (bit, G.704 CRC-5 code, frame mismatch)

G. 703 64 kb/s

MD0622E



Measurement object	:	64 kb/s interfaces conforming to CCITT G.703 (codirectional, contradirectional, centralized clock)
Transmission rate:	:	64 kb/s (clock: self oscillation or slave oscillation)
Code rule	:	AMI

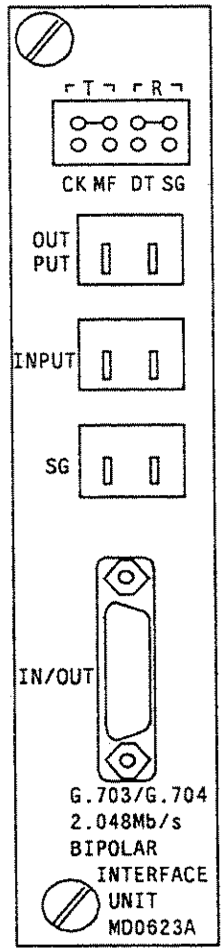
Measurement items (conforms to the MD6420A spec.) :

Error (bit, code)

G. 703/G. 704

2.048 Mb/s Bipolar

MD0623A/AI



Measurement object	:	2.048 Mb/s interfaces conforming to CCITT G.703/G.704
Transmission rate:	:	2.048 Mb/s (clock: self oscillation or slave oscillation)
Code rule	:	AMI, B8ZS, B6ZS, HDB3
Frame	:	CCITT G.704, X.50, no frame
Data bit rate (kb/s)	:	56, 64×N (N: 1 to 31), 2.4, 4.8, 9.6, 48

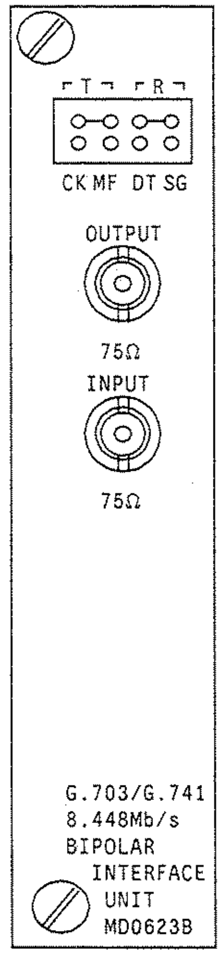
Measurement items (conforms to the MD6420A spec.) :

Error (bit, G.704 CRC-4, code, frame mismatch)

G. 703/G. 741

8.448 Mb/s Bipolar

MD0623B



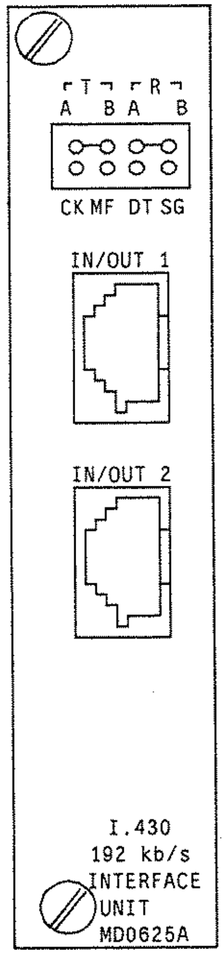
Measurement object	:	8.448 Mb/s interfaces conforming to CCITT G.703/G.741 synchronous system
Transmission rate	:	8.448 Mb/s (clock: self oscillation or slave oscillation)
Code rule	:	AMI, B8ZS, B6ZS, HDB3
Input/output impedance	:	75 Ω unbalance
Frame	:	CCITT G.741 synchronous system, X.50, no frame
Data bit rate (kb/s)	:	56, 64×N (N: 1 to 120)

Measurement items (conforms to the MD6420A spec.) :

Error (bit, code, frame mismatch)

I.430 192 kb/s

MD0625A



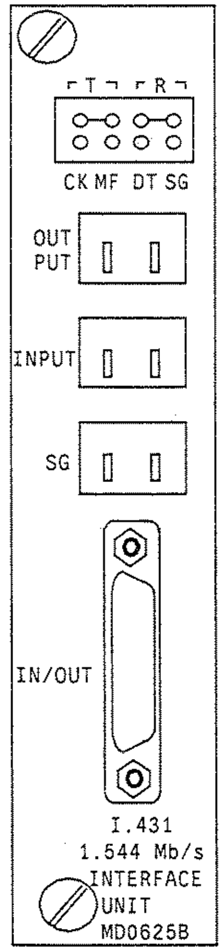
Measurement object	:	192 kb/s interface conforming to CCITT I.430. ISDN 2B + D interface and I 192 kb/s private line interface
Transmission rate:	:	192 kb/s (clock: self oscillation or slave oscillation)
Code rule	:	100% AMI
Frame	:	Conforms to CCITT I.430, X.50 (Multiframe supported)
Measurement mode	:	TE mode, NT mode and R monitor
Data bit rate	:	64 kb/s (B1, B2), 128 kb/s (2B), 144 kb/s (2B + D), 16kb/s (D) 56 kb/s, 8 kb/s, 16 kb/s, 32 kb/s, 2.4 kb/s, 4.8 kb/s, 9.6 kb/s 48 kb/s (X.50)

CODEC compression/expansion rules (MD0630B unnecessary) :
a-low, μ-low Outgoing/incoming-call procedure
CCITT 0.921/0.931 C NTT

I.431 1.544 Mb/s

Interface Unit

MD0625B



Measurement object	:	I.431 1.544 Mb/s layer 1 interface of ISDN primary hierarchy of Japan and North America (I interface)
Transmission rate:	:	1.544 Mb/s (clock: self oscillation or slave oscillation)
Code rule	:	AMI, B8ZS
Imput/output impedance	:	100 Ω balanced, HIGH
Frame	:	CCITT I.431 24B, 23B + D, X.50, no frame
Data bit rate (kb/s)	:	56, 64×N (N: 1 to 24, selectable discontinuous multiframe), 8, 16, 32, 2.4, 4.8, 9.6, 48

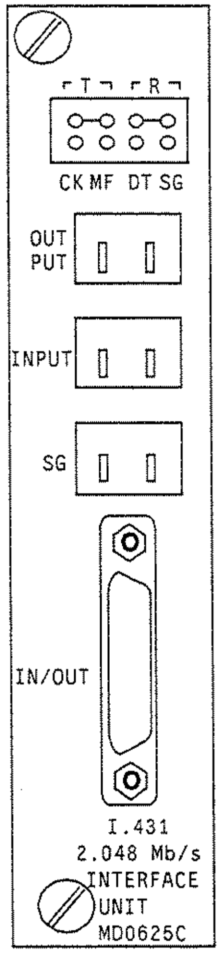
Measurement items (conforms to the MD6420A spec.) :

Error (bit, code, CRC-6, frame mismatch, open one bit at 56 kb/s)

I.431 2.048 Mb/s

Interface Unit

MD0625C/C1



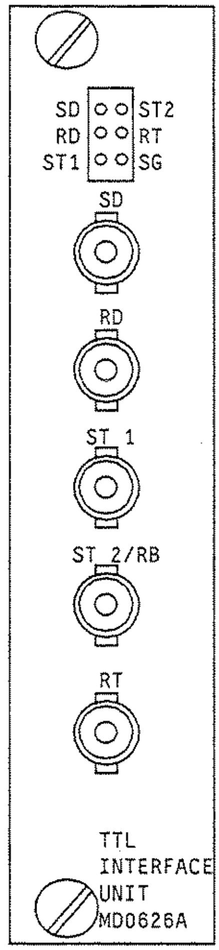
Measurement object	:	I.431 2.048 Mb/s layer 1 interface of ISDN primary hierarchy of CEPT system (I interface)
Transmission rate:	:	2.048 Mb/s (clock: self oscillation or slave oscillation)
Code rule	:	AMI, HDB3
Imput/output impedance	:	120 Ω balanced (MD0625C)/75 Ω unbalanced (MD0625C1), HIGH
Frame	:	CCITT I.431 31B, 30B + D, X.50, no frame
Data bit rate (kb/s)	:	56, 64×N (N: 1 to 31, selectable discontinuous multiframe), 8, 16, 32, 1544, 2.4, 4.8, 9.6, 48

Measurement items (conforms to the MD6420A spec.) :

Error (bit, code, CRC-4, frame mismatch, E bit, open one bit at 56 kb/s)

TTL

MD0626A



Measurement object : TTL Level input/output interface

Synchronization : Start-stop, asynchronous, synchronous (ST1, ST2, RT)

Data bit rate :
- Start-stop, asynchronous
  50 b/s to 20 kb/s (conforms to the MD6420A spec.)
- Synchronous
  ST1; 50 b/s to 8.192 Mb/s (conforms to the MD6420A spec.)
  ST2; 50 b/s to 10 Mb/s
  RT; 50 b/s to 9 Mb/s

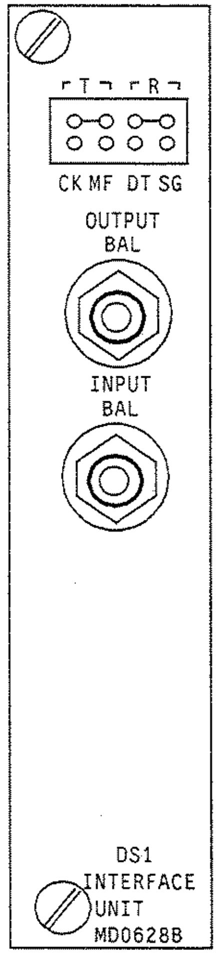
Measurement items (conforms to the MD6420A spec.) :

Error (bit, parity)

DS1

Interface Unit

MD0628B



Measurement object	:	DS1 (T1) interface of North America
Transmission rate:	:	1.544 Mb/s (clock: self oscillation or slave oscillation)
Code rule	:	AMI, H8ZS
Imput/output impedance	:	100 Ω balanced, HIGH
Imput/output connector	:	Weco-310
Frame	:	ESF, SF (D4), Ft, no frame
Data bit rate (kb/s)	:	56, 64 × N (N: 1 to 24)

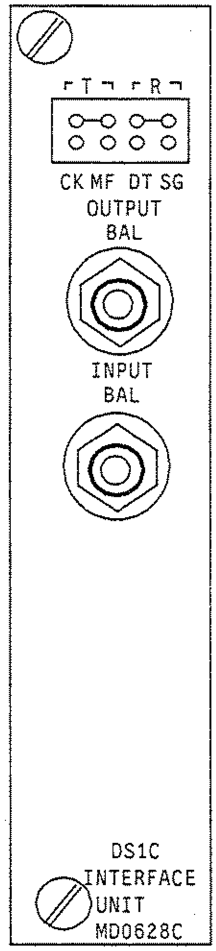
Measurement items (conforms to the MD6420A spec.) :

Error (bit code, CRC-6, frame mismatch, open one bit at 56 kb/s), alarm/signaling generation and monitoring, AIS, Yellow Alarm, signaling bit (A to D)

DS1C

Interface Unit

MD0628C



Measurement object	:	DS1C interface of North America
Transmission rate:	:	3.152 Mb/s (clock: self oscillation or slave oscillation)
Code rule	:	AMI, H8ZS
Imput/output impedance	:	100 Ω balanced, HIGH
Imput/output connector	:	Weco-310
Frame	:	DS1C, no frame
Data bit rate (Mb/s)	:	1.544, 3.088

Measurement items (conforms to the MD6420A spec.) :

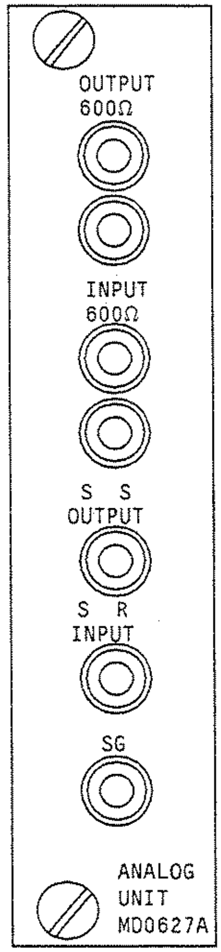
Error (bit, code, frame, multiframe)

Stuff monitoring and control: C bit monitoring, ON/OFF

1.4.3 Extension Units

Analog

MD0627A

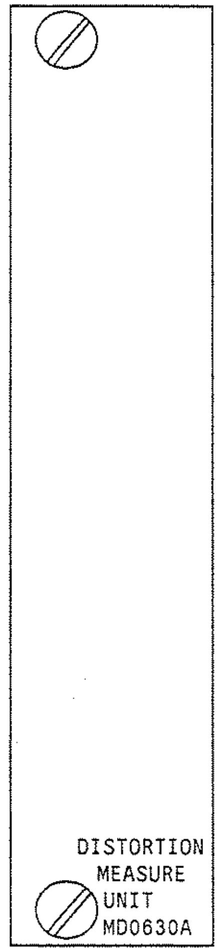


When this unit is used with the interface units, sending/receiving and level measurement of 600 Ω analog interfaces can be performed.

Sending	Frequency :	50 Hz to 10 kHz in 5 Hz steps
	Output level :	−40 to 0 dBm in 0.1 dB steps
Receiving	Frequency :	50 Hz to 10 kHz
	Input level :	−60 to +10 dBm

Distortion Measure

MD0630A



When this unit is used with MD0621A/B/C/D, MD0626A interface units, the bias distortion, single-point distortion and start-stop distortion can be measured.

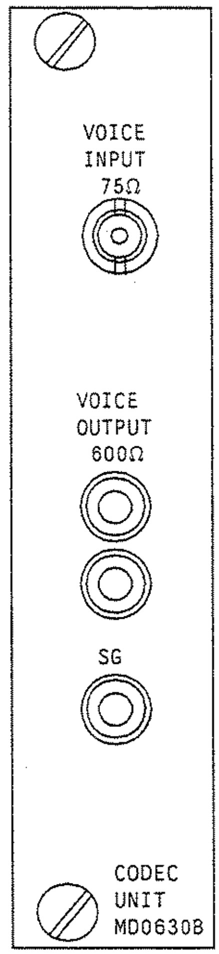
Single-point distortion (≦ 64 kb/s)
    Measurement range : −49 to +49% (resolution: 1%)

Bias distortion (≦ 64 kb/s)
    Measurement pattern : 1:1, 4:1, 1:4
    Measurement range : −400 to +400% (resolution: 1%)

Start-stop distortion (≦ 19.2 kb/s)
    Measurement range : −49 to +49% (resolution: 1%)

CODEC

MD0630B

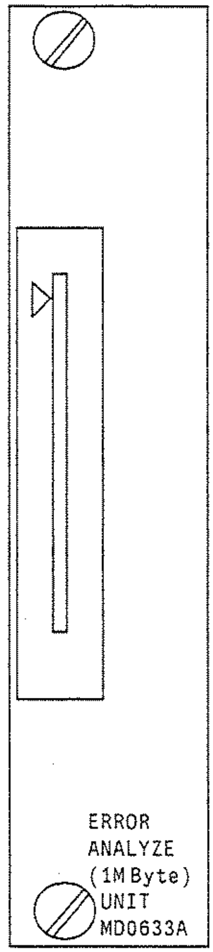


When this unit is used with the MD0622B/E or MD0633A/A1 interface units, the 64 kb/s PCM signal digital level can be measured and signal coding/decoding can be performed for a specified time slot.

Transmission rate	:	64 kb/s to 2.048 Mb/s
CODEC rule	:	μ-low, A-low (conforms to CCITT G.711)
Code to specified time slot	:	Sine-wave (100 Hz to 3.9 kHz, −40 to +3 dBm), voice, external analog input
Decode from specified time slot	:	Voice monitor, external analog output

Error Analyze

MD0633A

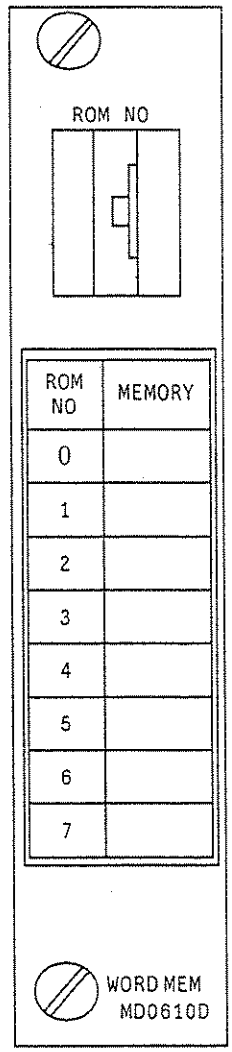


The measured error data and the alarm generation status can be stored in a built-in memory (backed up by battery). These results can be displayed as hitograms.

Data may be collected	:	As a specified time interval According to the conditions for the error data When a measurement period is completed Depending on the alarm conditions (FSL, SGL, PSL, etc.)
Method of display analysis	:	Histogram Histogram + alarm Trace Distribution of errors rates relative to time intervals Distribution of errors relative to time of occurrence Threshold distribution (The above items can also be printed out)

Word Memory

MD0610D/D1

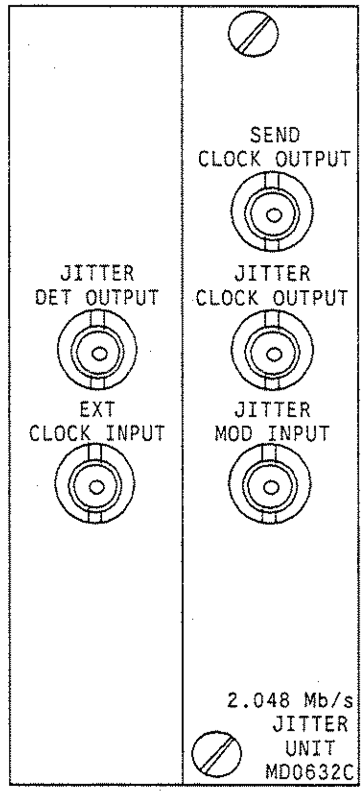


ROM NO	MEMORY
0	
1	
2	
3	
4	
5	
6	
7	

The MD0610D provides the word pattern ROM and EEPROM for pattern generation. It can accommodate up to eight 8 k byte ROMs and EEPROMs.

However, the MD0610D1 can accommodate 32 k×8 bit ROMs and EEPROMs.

64 kb/s, 1.544 Mb/s,
2.048 Mb/s Jitter Unit
MD0632A/B/C



The MD0632A/B/C are used in combination with the interface units (64 kb/s, 1.544 Mb/s, 2.048 Mb/s) to generate and analyze jitters (CCITT O.171).

Model		MD0632A	MD0632B	MD0632C
Data bit rate		64 kb/s	1.544 Mb/s	2.048 Mb/s
Jitter generation	Modulation frequency	2 Hz to 20 kHz	2 Hz to 50 kHz	2 Hz to 100 kHz
	Modulation amplitude	0.1 to 5.0 UIp-p	0.1 to 10.0 UIp-p	0.1 to 10.0 UIp-p
Jitter detection	Amplitude measurement	0 to 5.1 UIp-p	0 to 10.2 UIp-p	0 to 10.2 UIp-p
	Hit count threshold setting	0.1 to 2.5 UIp-p	0.1 to 5.0 UIp-p	0.1 to 5.0 UIp-p

Modulation mode : Sine wave, external

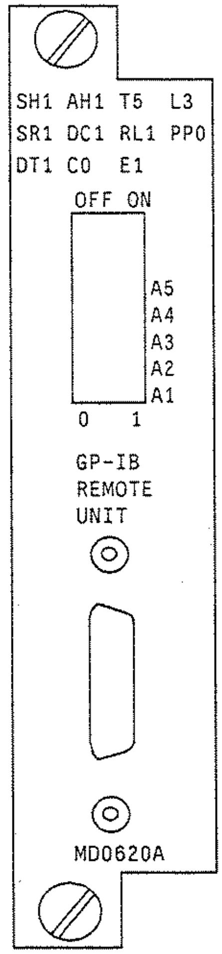
Auto sweep : Frequency, amplitude (four arbitrary points can be programmed)

Measurement items : Jitter amplitude, jitter gain, hit count, hit second count, maximum jitter amplitude

1.4.4 Remote Control Units

GP-IB

MD0620A

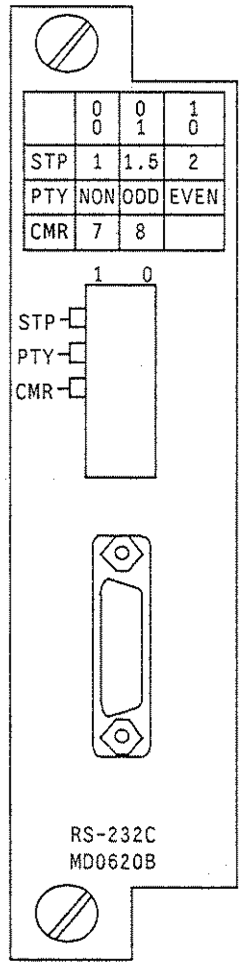


GP-IB interface unit conforming to IEEE 488.2

When this unit is inserted into the main frame and a controller (Packet V or other personal computer) is connected to it, the MD6420A can be controlled remotely. In addition, when the conversion connector (sold separately) is used, the IEC-IB specified by IEC-625 can be interfaced.

RS-232C

MD0620B



	00	01	10
STP	1	1.5	2
PTY	ROM	COE	EVEN
CMR	7	8	

Serial Interface unit conforming to EIA RS-232C

When a controller (Packet V or other personal computer) is connected to this interface, the MD6420A can be remotely controlled.

Transmission rate : 1200 b/s

Synchronization mode : Start-stop synchronization

Data bit length : 7,8 bits

Parity : None, odd, even

Stop bit length : 1, 1.5, 2 bits

Transmission procedure : None

1.4.5 Unit combination example

The MD6420A can be combined with many plug-in units to perform a variety of measurement.

Table 1-2 Unit Combination Example

Measurement items	Unit combination
Modem	MD0621A/B/C/D , MD0627A , MD0630A
TDM (U.S.A.)	MD0621A/B/C/D , MD0622B , MD0622E
CEPT TDM	MD0621A/B/C/D , MD0623A/A1 , MD0622E
Digital wireless communications	MD0626A
0-1MUX, 1-2MUX (Japan)	MD0622E , MD0622B , MD0622D
PCM 64 kb/s voice monitor call	MD0622B / MD0623A/A1 , MD0630B

1.5 Options, Optional Accessories, and Peripheral Devices (Sold Separately)

The optional accessories and Peripheral Devices are shown in Table 1-3.

Table 1-3 Optional Accessories and Peripheral Devices

Model Number/ Order Number	Name	Remarks
B0291B	Carrying case	With casters
B0251F	Shoulder bag	
B0302	Rack mount kit	
B0253	Unit housing case	Accommodates 10 units
A0006	Headset	
B0254A	Blank panel	For interface unit
B0254B	Blank panel	For remote control unit
J0386	Probe for external input	BNC-P · IC clip
J0135	Balanced cord, 2m	I-214APS — M-1PS
J0126B	Balanced cord, 2m	M-3912 — M-3912
J0050B	Balanced cord, 2m	M-214S Shielded cord M-214S
J0127B	Coaxial cable, 1m	BNC-P RG-58A/U BNC-P
J0106	Coaxial cable, 2m	3CV-P2 — M-1P
UA455A	Video protter	With connection cord
Z0047	Printer paper	For UA455A, 5 rolls/set

The options of the MD6420A are shown in Table 1-4.

Table 1-4 Options

Model Number	Name	Remarks
MD6420A-01	Send-Pattern Sync. Signal Output	Video signal output becomes disabled.
MD6420A-02	32 kByte memory size for word pattern	Word pattern length 2 to 32768 bytes.
Z0174	Service kit for MD6420A	

1.6 Specifications

1.6.1 Operating conditions

- Operating temperature range 0 to 40°C
- Operating humidity range 20% to 90%

Note: Make sure that there is no condensation on the EL display.

- Storage temperature range −25 to 70°C
- Storage humidity range 20% to 90%

1.6.2 Send clock signal

(1) Internal clock (synchronous-ST1, asynchronous-ASYNC, start/stop-ST/SP)

Bit rate

- 50 b/s to 20 kb/s in 5 b/s steps
- 20 kb/s to 400 kb/s in 100 b/s steps
- 512 kb/s, 576 kb/s, 672 kb/s, 768 kb/s, 1024 kb/s, 1152 kb/s, 1344 kb/s, 1536 kb/s, 1920 kb/s, 2048 kb/s, 4096 kb/s, and 8192 kb/s

Note: For ASYNC and ST/SP, bit rate is 50 b/s to 20 kb/s in 5 b/s steps

Accuracy

- Self oscillation ±5 ppm
- Slave oscillation Subject to 8 kb/s, 64 k + 8 kb/s external input, or receive data. Slave oscillation range is ±100 ppm or more

(2) External clock (synchronous-ST2, RT, S, or external oscillator)

Bit rate

- 50 b/s to 10 Mb/s

Note: Sending clock rate depends on interface unit.

1.6.3 Receive clock signal

(1) Internal clock (asynchronous-ASYNC, start/stop-ST/SP)

Bit rate

- 50, 75, 100, 110, 150, 200, 256, 300, 400, 500, 512, 600, 768, 800, 1000, 1200, 1600, 1800, 2000, 2400, 2560, 3000, 3600, 4800, 7200, 9600, 14400, and 19200 b/s

Accuracy

- Within ±20 ppm

(2) External clock (synchronous-RT, S)

Bit rate

- 50 b/s to 9 Mb/s

1.6.4 Send pattern

(1) Fixed pattern

- A, Z, 1:1, 3:1, 7:1, 1:7
- Programmable pattern
  Repetition of 8-bit pattern, 0000 0000 to 1111 1111

Note: For ST/SP: 5 to 8 bits depending on data length

For 2.048M bipolar Spare Bit: 5 bits

(2) Pseudorandom pattern

- 2^n-1 bits repetition (n: 6, 7, 9, 11, 15, 19, 20, 23)
  CCITT positive/negative logic (normal/inverted)
  CCITT reverse.
  Zero suppression pattern (maximum number of consecutive zeros: 14 or 7)

(3) Word pattern

- User pattern
  8 bits× word length (2 to 8192)*
  START, ST address of the send pattern can be set
  (Manually input or read from MD0610D Word Memory Unit)
  * Option 02: 2 to 32768
- FOX pattern
  EBCDIC (8 bits), ASCII (7 bits), EBCD (6 bits)
  Baudot (5 bits)
- Trace pattern
  Traced pattern can be sent after being copied in an internal memory for transmission

1.6.5 Error insertion

(1) Kinds of errors

- Bit
- Bit + code (depends on interface unit)

Note: When CRC or parity bits are used, errors are inserted after the CRC or parity bits are added.

(2) Insertion method

- Channel errors (inserted in send pattern data part)
  One bit error is inserted whenever key is pressed or once every one-second period.
- Cyclic error (inserted throughout send signal)
  Error rate: 2.5×10^{-1} to 1.7×10^{-7}
  ($N \times 10^{-n}$: N = 1.0, 1.1, 1.3, 1.5, 1.7, 2.0, 2.5, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0)

1.6.6 Start/stop synchronization (V.24/V.28, X.20/X.21, TTL unit)

• Start/stop bit length	Start bit: 1 bit Stop bit: 1, 1.5, 2 bits
• Data length	5, 6, 7, 8 bits
• Parity	none, odd even

Note: The number of 1s in a data byte, including the parity bit, is made an odd (odd parity) or even (even parity).

1.6.7 Error measurement

(1) Detection errors

- Any error from among bit error, code error,parity error, CRC error, and frame mismatch error can be selected for measurement.
  (The selectable error depends on the interface unit.)

(2) Error measurement items

- Error count, error rate
- Block error count, block error rate
- BBE (Background Bit Error)
- BBER (Background Bit Error Ratio)

(3) Error performance

- US (Unavailable Seconds), %US
- AT (Available Time), %AT
- SES (Severely Errored Seconds), %SES
- DM (Degraded Minutes), %DM
- ES (Errored Seconds), %ES
- EFS (Errored Free Seconds), %EFS

(4) Alarm generation count and time measurement

- Pattern sync loss count
- Clock slip count
- Clock slip generation time (second)
- AC power failure time (second)
- Pattern sync loss time (second)
- AIS generation time (second)
- Frame sync loss time (second)
- X.50 frame sync loss time (second)
- Input signal loss time (second)
(Measurement items differ depending on the interface unit.)

(5) Measurement elapsed time

- Elapsed time from start of measurement
0 to 999 hrs 59 mins 59 s
- Cyclic measurement elapsed time
0 to 999 hrs 59 mins 59 s

(6) Data Block length

- 2^n bits (n=5 to 16)
- 10^m bits (m=1 to 6)

(7) Measurement time

- Single measurement
10^n bits (n=2 to 9), 2500 bits
1s to 999 hrs 59 mins 59 s
- Repetitive measurement
1s to 999 hrs 59 mins 59 s
- Manual (max. 1 year)

(8) Bit error measurement pattern

- Fixed pattern, pseudorandom pattern

(9) Pattern sync loss detection conditions

- Pseudorandom pattern
  Detection of m or more errored bits with an n-bit interval is defined as sync loss.
- m/n can be set as follows:
  10/100, 20/100, 25/100, 100/300, 100/1000, 200/1000, 250/1000, 1000/3000, 1000/10000, 2000/10000, 2500/10000, 10000/30000, 10000/100000, 20000/100000, 25000/100000, 100000/300000, AUTO (See paragraph 6.1.5.)

1.6.8 Pattern trace

(1) Number of trace bytes

- Max. 32 k bytes

(2) Trace start conditions

- 1 byte sync code trigger
  0000 0000 to 1111 1111
  When sync code is received for 2 or more consecutive bytes, trace starts from 2nd byte.
- Manual triggering

(3) Trace stop conditions

- Manual
- Detection of stop code
  Trace is stopped when the specified code is detected.
  0000 0000 to 1111 1111 can be specified.
  Any bit can be specified as "Don't care."
- Detection of stop NOT code
  Trace is stopped when any code other than the specified code is detected.
  0000 0000 to 1111 1111 can be specified.
  Any bit can be specified as "Don't care."
- Signal lines ON/OFF
  Trace is stopped when the level of a signal from the interface unit changes.
- Number of trace bytes
  Trace is stopped when 10 to 32764 bytes have been received.
- External signal ON/OFF
  Trace is stopped when the rising edge or falling edge of an external input signal (TTL).

(4) Number of delay trace bytes after trace stop trigger is detected.

- 10 to 8000 bytes

(5) Display of traced data

- Displayed along with trace stop time in HEX, JIS8, ASCII, EBCDIC or EBCDIK, EBCD, baudot.

Notes:

1. JIS8 and EBCDIK can be selected for display only when the internal DIP switch is set appropriately.
2. When the number of traced bytes (not including the number of delayed bytes) is ≦10, the trace data is not displayed.

(6) Trace data bit shifting

- Trace data may be shifted and redisplayed.
  Number of bits to be shifted:
  +4, +3, +2, 0, −1, −2, −3

(7) Trace-data reverse display

- Trace data LSB/MSB is reversed and displayed.

(8) Trace-data inverse display

- Trace data 1, 0 is inverted and displayed.

1.6.9 DC voltage measurement

Measurement range	• −30 to +30V
Accuracy	• ±5% of max value of each range ±1 digit
Range	• Autoranging from 1. to 3. below 1. 0.01 to 1.99 V 2. 2.0 to 19.9 V 3. 20.0 to 30.0 V
Measurement interval	• Approx. 1 measurement/s
Display digits	• 3 digits

Note: Can be measured with MD0621A/B/C/D

1.6.10 Frequency measurement and counting

Measurement signal	• LINE from each interface • External input signal (TTL, rising edge counted)
Measurement range	• DC to 10 MHz
Accuracy	• ±5 ppm 1 count
Display range	• Significant digits: Decimal, 7 digits 0 to 10000.00 kHz (100 ms gate time) 0 to 1000000 Hz (1s gate time) 0 to 100000.0 Hz (10s gate time) 0 to 1000000 (MANUAL)

1.6.11 Time measurement

Measurement items	• Time between signal level transitions The measurement start and stop conditions can be set. The measurement signal can be selected from among the internal line and external signals. The ON → OFF (1 → 0, High → Low) or OFF → ON (0 → 1, Low → High) edge can be defined as the transition point. • Transmission delay time
Measurement range	• 0 to 10 s in 10 μs steps, displayed as a decimal 7 digit number
Accuracy	• ±5 ppm 1 count

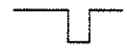
1.6.12 Mounting signal lines

• The state of each signal line and alarm signal is indicated by the monitor LEDs. Receive data is displayed in 8-bit units.

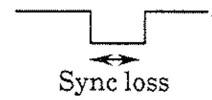
1,	ON :	Signal line ...	Green LED lights
		Alarm	Red LED lights
0,	OFF :	LED goes off	

1.6.13 Output signals

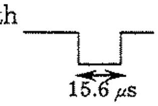
(1) Error output signal (ERROR OUTPUT)

- Outputs TTL level error pulse
  (Half with of receive clock signal, negative logic)
  ()

(2) Pattern sync loss signal (SYNC LOSS OUTPUT)

- Outputs TTL level pattern sync loss signal
  (Sync loss is indicated by TTL low)
  ()

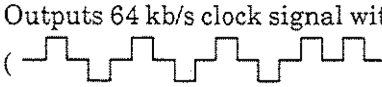
(3) Clock signal (8k/R-CLK CLOCK OUTPUT)

- Outputs TTL level receive gate clock or 8 kHz send clock (selectable by internal switch)
  Receive clock ... Gate clock ()
  8 kHz clock .... TTL low level pulse with 64 kHz clock width
  ()

(4) Receive data output signal (RECEIVE DATA OUTPUT)

- Outputs TTL level receive burst data signal.
  ()

(5) 64k + 8k clock signal (64k + 8k CLOCK OUTPUT)

- Outputs 64 kb/s clock signal with 8 kb/s violation.
  ()

Clock speed	• 64 kb/s with 8 kb/s violation
Code	• AMI, RZ
Impedance	• 120 Ω (balanced)
Level	• 1.0Vo-p ±10%

(6) Video output signal (VIDEO OUTPUT)

- Outputs display image as (composite video signal)

Vertical	• 16.666 ms ±100 ppm
Horizontal	• 63.61 μs ±100 ppm
Level	• 1 $V_{p\text{-}p}$ ±10%

1.6.14 Input signals

(1) External clock input signal (EXT1 8k/S-CLK)

- External clock input. 50 Hz to 10 MHz TTL or 0 dBm ±1 dBm sine wave
- 8 kHz TTL signal used for synchronizing oscillations between the master and slave.

(2) 64k + 8k clock input signal (EXT2 64k + 8k)

- 64 k + 8 k clock signal used for synchronizing oscillations between the master and slave.

Clock speed
- 64 kb/s with 8 kb/s violation

Code
- AMI, RZ

Impedance
- 110 Ω (balanced)

Input level
- 0.6 to 1.1 $V_{0\text{-}p}$

(3) External pulse input signal (EXTERNAL INPUT)

- TTL level external trigger for frequency measurement, time measurement, and word trace.

1.6.15 Printed output

(1) Printing error measurements

Printing at start of measurement
- Prints the measurement conditions at the start of measurement. Prints the time of which error count is started.

Interval printing
- When the print interval and items to be printed are specified, the specified items are printed during measurement.

  Printing interval
  - 1 s, 10 s, 30 s, 1 min, 2 mins, 5 mins, 10 mins, undefined

  Printable items
  - Error count, block error, and alarm information (alarm information for each unit ... input loss, pattern sync loss, etc.)

  Print contents
  - For errors, the generation time and count are printed.
    For alarms, the generation time and generated alarm are printed.
    At alarm recovery, the time and type of alarm are printed.

At end of interval
- For repeat measurements, the specified items, measurement interval start time and end time are printed at the end of each interval.

During measurement
- When the PRINT OUT function key is pressed during measurements, the cumulative measured result from the start of measurement to the time the key was pressed is printed.

At end of measurement
- At the end of measurement, the specified item, end time and elapsed measurement time are printed.

While measurement stopped
- If the PRINT OUT function key is pressed while measurement is stopped, the most recent measured results are printed.

Printing control function
- When error/alarm data is printed out at 10 consecutive intervals, interval print output is not executed even if error/alarm printing conditions are generated at succeeding intervals.
  If the print conditions are not generated at 10 consecutive intervals, printing recovers.

(2) Printing at other measurements
- Information of each screen and measured results can be printed manually.

1.6.16 Saving measurement conditions

- Ten measurement conditions can be saved into and recalled from the battery backed-up memory via the front panel keys.

1.6.17 Built-in timer

- Year, month, day, hour, minute, second (backed-up by battery)

1.6.18 Display

- EL (Electroluminescent) display, 320×240 dots

1.6.19 Audio speaker alarm

- Alarm beeps when error is detected.
- Voice monitored (MD0627A or MD0630B is required)
- Audio volume can be adjusted with volume control.

1.6.20 Voice transmission

- Voice input to the headset is sent. (MD0627 A or MD0630B is required)

1.6.21 Power requirements

Voltage	• 85 to 132 V/170 to 250 V ac (internally switchable)
Frequency	• 47.5 to 63 Hz
Power consumption	• ≦180 VA (including 6 plug-in units)

1.6.22 Dimensions and weight

Dimensions	• 177H×319W×450D mm
Weight	• ≦10.5 kg (not including plug-in units)

SECTION 2
OPERATION

2.1 Precautions before Use

The MD6420A Data Transmission analyzer is inspected thoroughly before shipment. When it is received, first inspect the box for damage and unpack the instrument. After unpacking, inspect the outside of the instrument and verify the number and type of accessories.

If the instrument has been damaged during shipment, contact Anritsu or your nearest representative.

- Operating environment

This instrument operates normally at ambient temperatures of 0° to 40℃. However, do not use it:

1. Where vibrations are severe
2. Where the humidity is high
3. Where it is dusty
4. Where it will be in direct sunlight.

To ensure that the instrument operates normally for a long time, it should be used at room temperature in addition to the above conditions.

WARNING

This instrument operates on the voltage range indicated on the rear panel (85 to 132 Vac or 170 to 250 Vac, 47.5 to 63 Hz). Always check that the power line voltage is within the indicated voltage range before connecting the instrument to the power line. Also check that the instrument POWER switch is set to OFF before connecting the power cord. Always ground the frame ground terminal (⏚).

2.2 Assembly and Connection

(1) Protective cover installation and removal

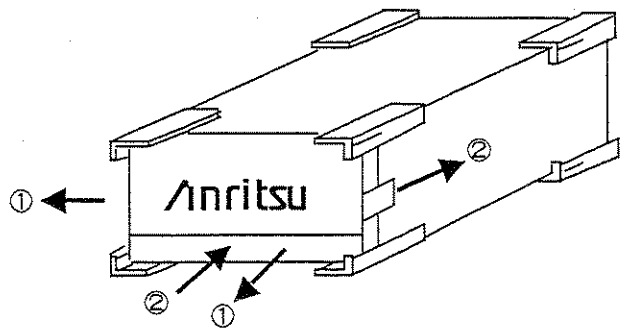


Fig. 2-1 Protective Cover Installation and Removal

- Remove the protective cover by pulling out the plastic tabs on the sides of the protective cover in the horizontal direction.
- Install the protective cover by pushing on the protective cover until the plastic tabs latch with a click.

(2) Power cord connection

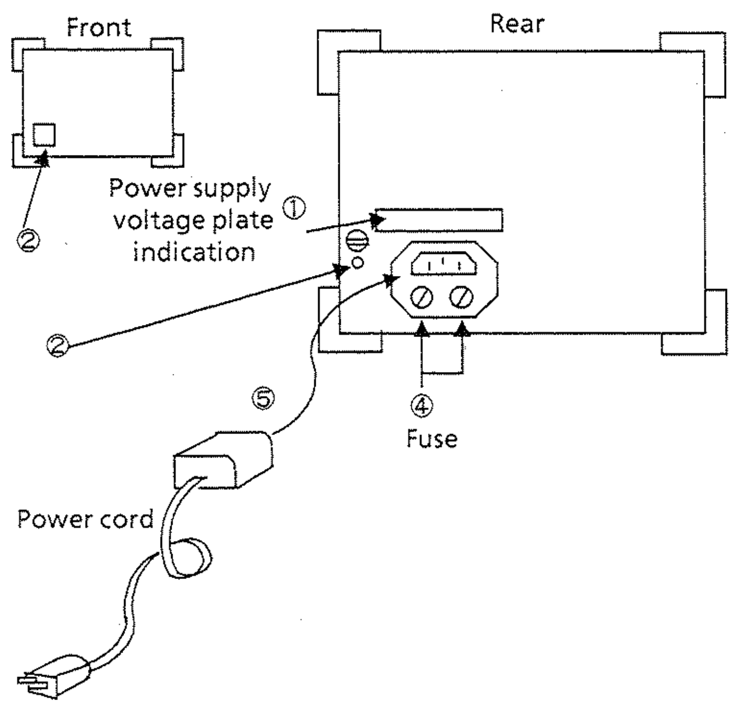


Fig.2-2 Power Cord Connection

Step	Procedure
1	Check that the ac line voltage is within the MD6420A ac input voltage, indicated on the rear panel.
2	Ground the rear panel ⏚ terminal.
3	Varity that the front-panel POWER switch is OFF.
4	Check that fuses of the specified type and capacity are installed. 85 to 132 V → 5 A (T5A 250V) 170 to 250 V → 3.15 A (T3.15A 250V)
5	Connect the power cord to the ac inlet on the rear panel.

WARNING

Ground the rear panel ⏚ terminal.

CAUTION

Check that fuses of the specified type and capacity are installed.

2.3 Inserting and Removing Unit

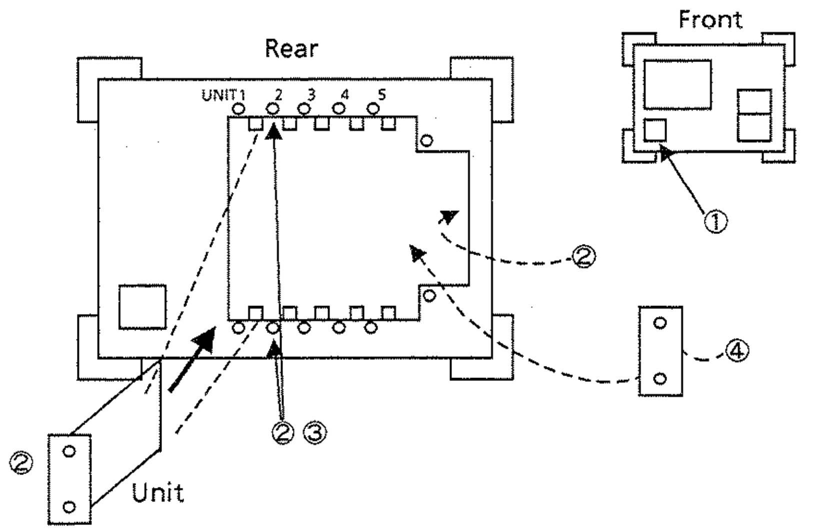


Fig.2-3 Inserting and Removing Plug in Units

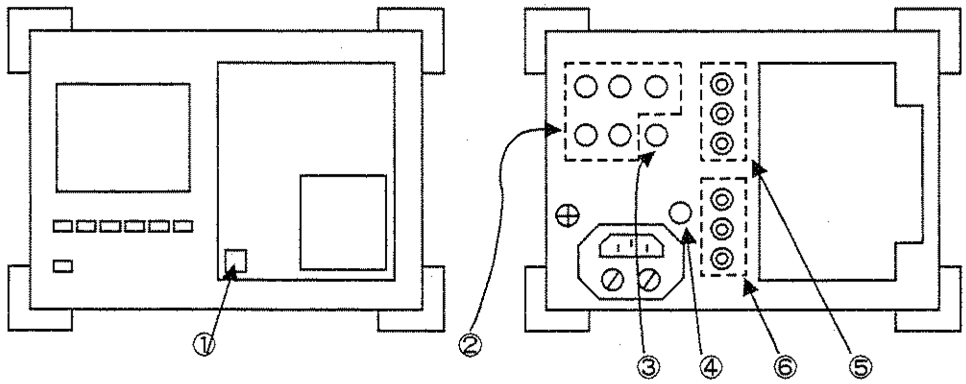
Step	Procedure
1	Turn the front-panel POWER switch OFF. Slots UNIT1 to UNIT5 are used for interface and extension units; the right most slot is used for a remote control unit (MD0620A or MD0620B).
2	When inserting a unit, align the edge of the PC board of the unit with the top and bottom guide rails and push the unit in until it is firmly seated, then tighten the screws on the top and bottom. A unit that is inserted improperly will operate incorrectly.
3	When removing a unit, loosen the screws at the top and bottom, then pull it out.
4	Cover empty slots with a blank panel against dust and other accidents. (Even if without a blank panel, the MD6420A operates normally.)

CAUTION

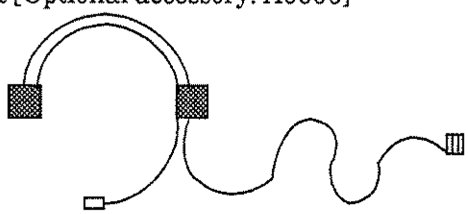
1. Check the front-panel POWER switch OFF.
2. A unit that is inserted improperly will not operate correctly.
3. Cover the empty slots with a blank panel.

2.4 Cables and Peripheral Devices Connection

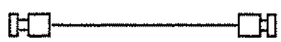
The following cables and peripheral devices can be connected to the MD6420A Data Transmission Analyzer.



① Headset [Optional accessory: A0006]

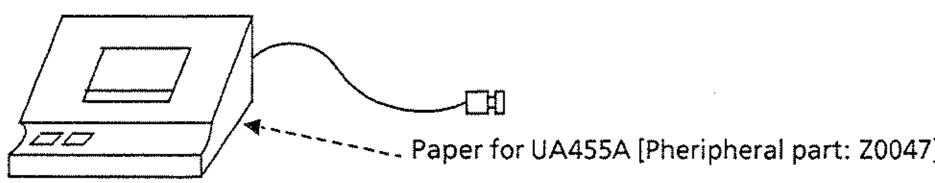


② Coaxial cable [Optional accessory: J0127B]

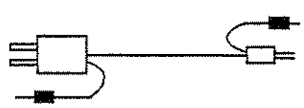


③ Probe for external input [Optional accessory: J0386]

④ Video plotter [Peripheral device: UA455A]



⑤ Balanced cord (I-214APS ~ M-1PS) [Optional accessory: J0135]



⑥ Balanced cord (M-3912 ~ M-3912) [Optional accessory: J0126B]

Fig.2-4 Cables and Peripherals Connection

Note: The cable connecting position is as shown above. Confirm the cable connecting position.

2.5 Explanation of Front Panel

The MD6420A front-panel layout and controls are described below.

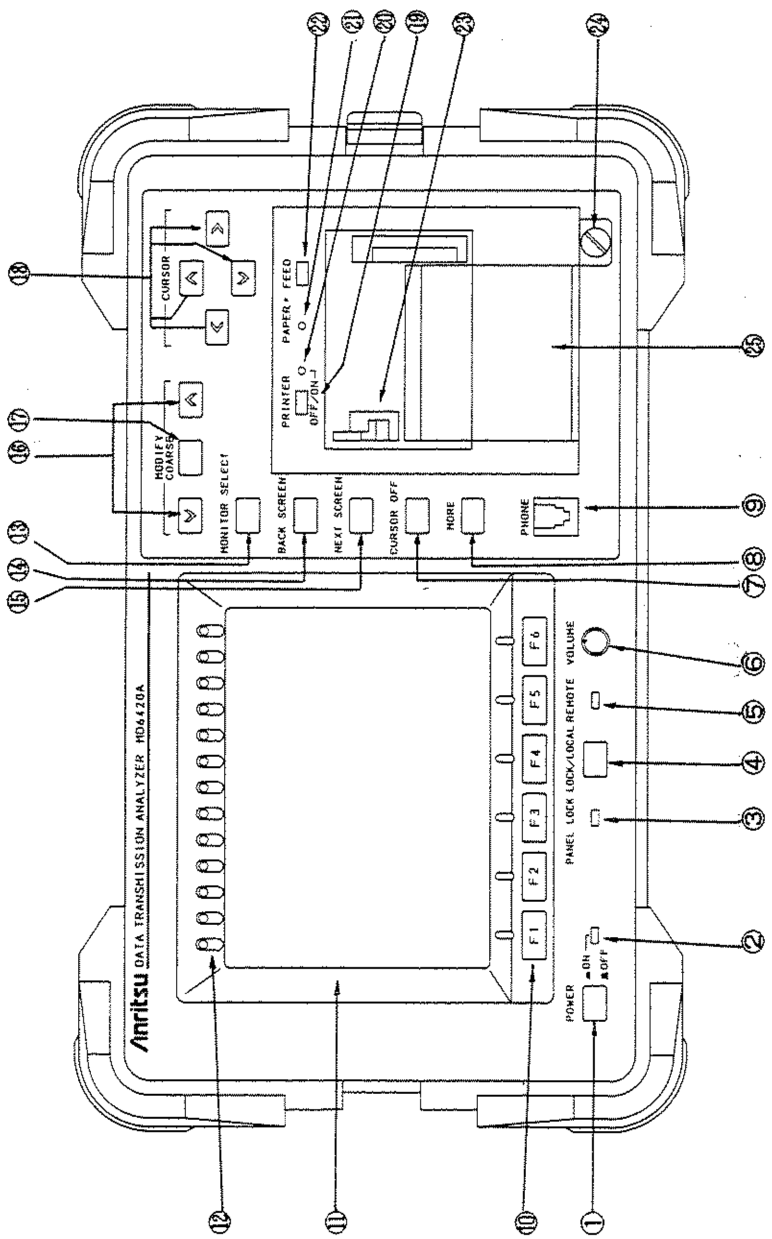


Fig. 2-5 Front Panel

Table 2-1 Explanation of Controls (Front Panel)

No.	Label	Name	Explanation
①	POWER	Power switch	AC power ON/OFF switch
②	(POWER) ON	Power ON LED	Lit when AC power is ON
③	PANEL LOCK	Panel lock LED	Lit when panel keys are locked
④	LOCK/LOCAL	Panel lock/local key	Key that locks panel keys and switches from remote to local mode of operation
⑤	REMOTE	Remote LED	Lit when MD6420A is controlled remotely by GP-IB or RS-232C
⑥	VOLUME	Speaker/buzzer volume	Speaker and buzzer volume control knob
⑦	CURSOR OFF	Cursor off key	Turns off cursor displayed on EL screen
⑧	MORE	More key	Displays next menu on EL screen
⑨	PHONE	Headset connector	Connector for talk test headset
⑩	F1~F6	Function keys (F keys)	Keys for setting a variety of parameters, as indicated by the labels on the EL screen
⑪		EL screen	EL screen upon which settings are performed and measured results are displayed
⑫		Monitor LEDs	Indicate control line, alarm signal, and data transmission states The control line and data status is displayed in green and the alarm signal status is displayed in red.
⑬	MONITOR SELECT	Monitor LED switching key	Sets item to be displayed on monitor LEDs
⑭	BACK SCREEN	Back screen key	Returns to screen whose rank is one back in the menu hierarchy.
⑮	NEXT SCREEN	Next screen key	Calls screen rank is one forward in the menu hierarchy
⑯	MODIFY ⍗ ⍐	Data modify keys (up/down)	Increment/decrement value of selected item as indicated by cursor
⑰	MODIFY COARSE	Data modify key (coarse)	The data is incremented or decremented in coarse steps by pressing this key simultaneously with the MODIFY ⍗ or ⍐ key.

Table 2-1 Explanation of Controls (Front Panel) (Cont'd)

No.	Label	Name	Explanation
⑱	CURSOR [《] [》] [∨] [∧]	Cursor keys (left, right, up, down)	Move cursor on EL display
⑲	PRINTER OFF/ON	Printer ON/OFF key	Turns printer on and off
⑳	PRINTER ON	Printer ON LED	Lit when printer is on
㉑	PAPER	Out-of-paper LED	Lit when no paper is in printer
㉒	FEED	Feed key	Feeds printer paper
㉓		Head-up lever	Raises printer head. Used when changing paper
㉔		Printer lock screw	Printer lock screw Used when changing paper
㉕		Built-in printer	Prints measured results, etc.

2.6 Explanation of Rear Panel

The MD6420A rear-panel layout and controls are described below.

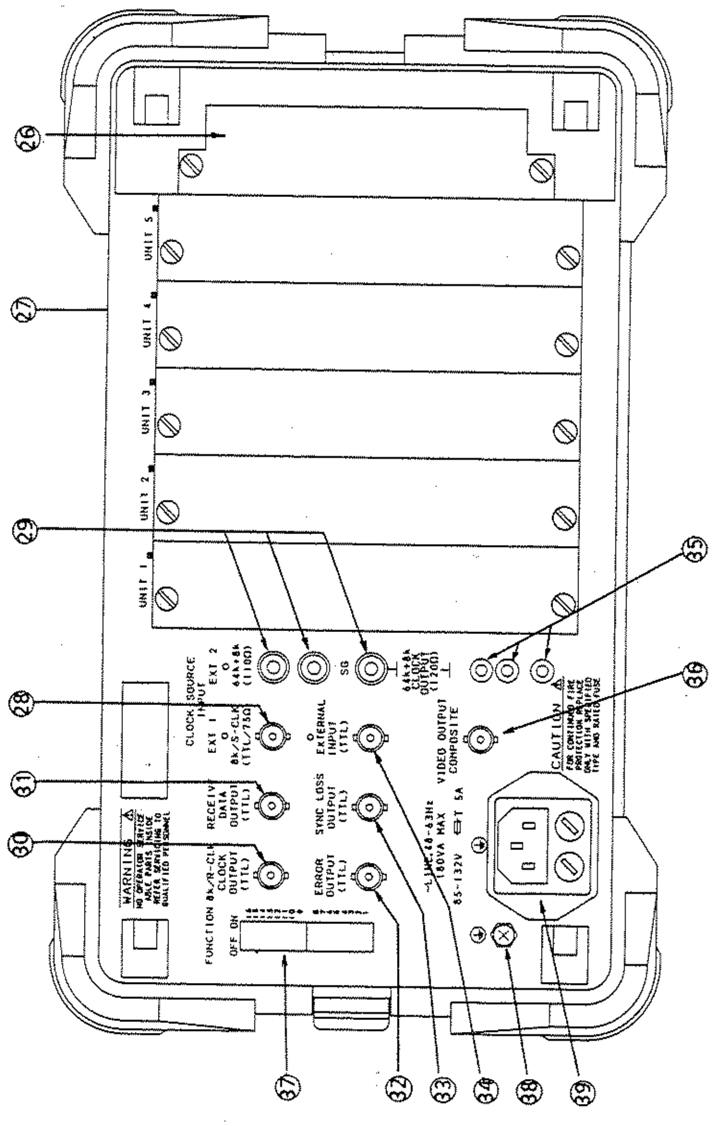


Fig. 2-6 Rear Panel

Table 2-2 Explanation of Controls (Rear Panel)

No.	Label	Name	Explanation
㉖		Remote control unit slot	Slot for GP-IB or RS-232C remote control unit
㉗	UNIT1 – UNIT5	Unit slots	Slots for interface and extension plug-in units
㉘	EXT1 8k /S – CLK (TTL / 75Ω)	EXT1 clock input connector	·Input connector for 8 kHz (TTL) signal when CLOCK is set to INT and INT FREQ SOURCE is set to EXT1 8k on the INTERFACE screen ·Input connector for external clock (TTL or 75 Ω) signal when CLOCK is set to EXT at INTERFACE screen
㉙	EXT2 64k + 8k(110Ω)	EXT2 clock input connector	Connector for 64k + 8k signal when CLOCK is set to INT and INT FREQ SOURCE is set to EXT2 64k + 8k on the INTERFACE screen
㉚	8k / R – CLK CLOCK OUTPUT (TTL)	8kHz clock output connector	Output connector for 8 kHz clock signal syncronized to the receive gate clock or the internal clock for transmitting
㉛	RECEIVE DATA OUTPUT(TTL)	Receive data output connector	Receive data output connector
㉜	ERROR OUTPUT (TTL)	Error output connector	Connector for outputting half clock width error signal when an error is detected
㉝	SYNC LOSS OUTPUT (TTL)	SYNC LOSS output connector	Output connector for SYNC LOSS signal. Signal is TTL low when pattern sync loss occurs.
㉞	EXTERNAL INPUT (TTL)	EXT input connector	Signal input connector when EXT is selected at VOLT/FREQUENCY, DELAY TIME or WORD TRACE screens
㉟	64k + 8k CLOCK OUTPUT(120Ω)	64 k + 8 k clock output connector	64 k + 8 k clock signal output connector
㊱	VIDEO OUTPUT COMPOSITE	Video output connector	Video signal (NTSC) output connector
㊲	FUNCTION	Function setting DIP switches	DIP switches used to set measurement conditions, etc.
㊳	⏚	Frame ground	Frame ground terminal
㊴		AC inlet	AC inlet with fuse holders

2.7 The EL Display Screen

An example of an EL display screen is explained below.

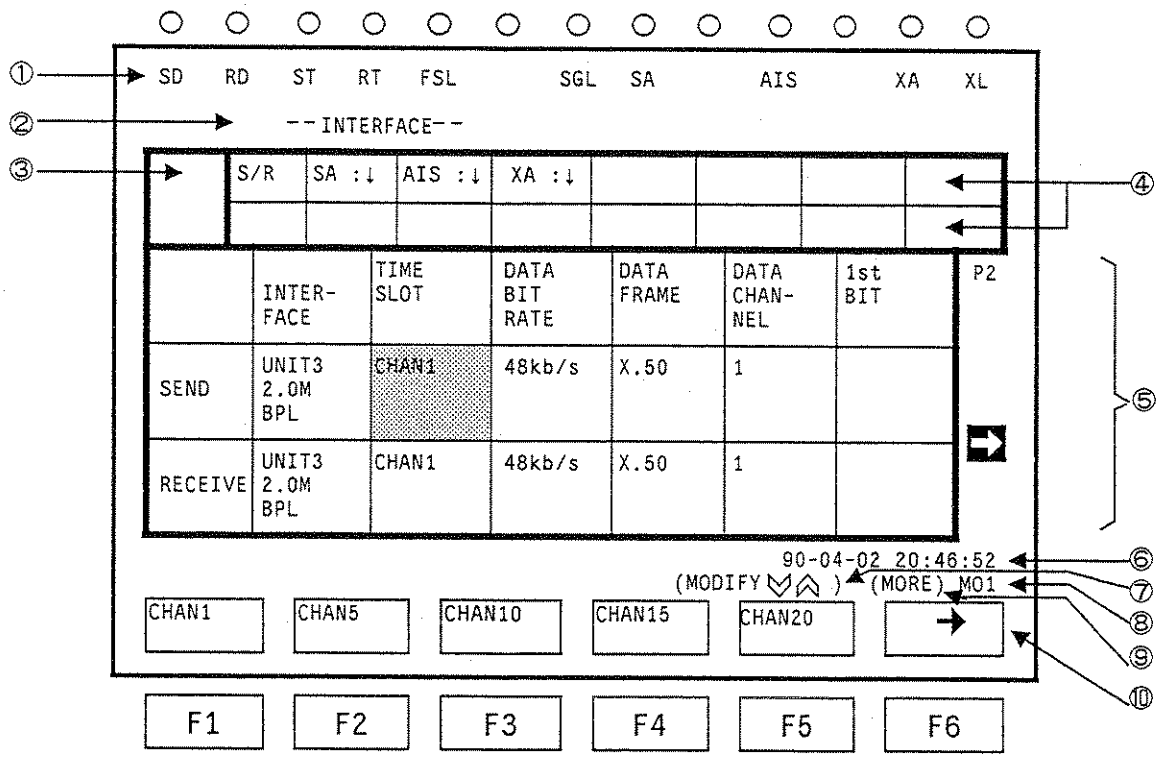


Fig. 2-7 Screen Structure

Table 2-3 Explanation of Screen

No.	Name	Explanation
①	Name of signal being monitored by adjacent LED.	Displays signal line and alarm signal names and connection circuit number corresponding to each monitor LED.
②	Screen title	Displays name of screen
③	Status display	Displays status of the MD6420A
④	Signal and alarm settings	Displays the current signal and alarm settings. The cursor can be moved to this area to change the settings.
⑤	Individual display areas	Individual displays for each screen
⑥	Current time display	Displays current time
⑦	Data modify message	Displays a message that indicates settings can be modified via the MODIFY ⩔, ⩓ key

Table 2-3 Explanation of Screen (Cont'd)

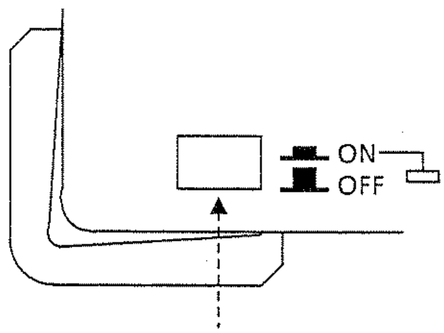
No.	Name	Explanation
⑧	Menu page number	Displays page No. of function key menu switched to when MORE key is pressed
⑨	More message	Displays message that shows menu can be switched by MORE key.
⑩	Function key label menu	Displays setting items corresponding to function keys

2.8 Power-on and Setting the Time

The MD6420A has an internal clock. The date and time can be added to the data, as required.

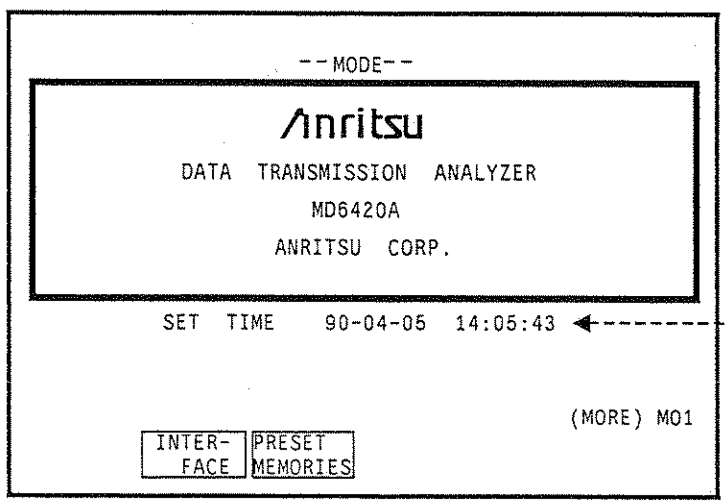
The time is extremely important in data transmission line maintenance and other work. Therefore, always verify that the time is correct. The internal clock operates even when the power switch is off. The time is set when the power is turned on for the first time. Thereafter, resetting is unnecessary.

Step	Procedure
1	After checking that the front-panel POWER switch is set to OFF, connect the power cord to the power outlet.



Verify that the POWER switch is set to OFF.

Step	Procedure
2	Turn on the power by pressing the POWER switch. The MODE screen shown below is displayed. Check the MD6420A time on this screen.



Current time display
Updated every second

90 – 04 – 05 14 : 05 : 43
Year Month Day Hour Minute Second
(Last 2 digits of the Gregorian calender year)

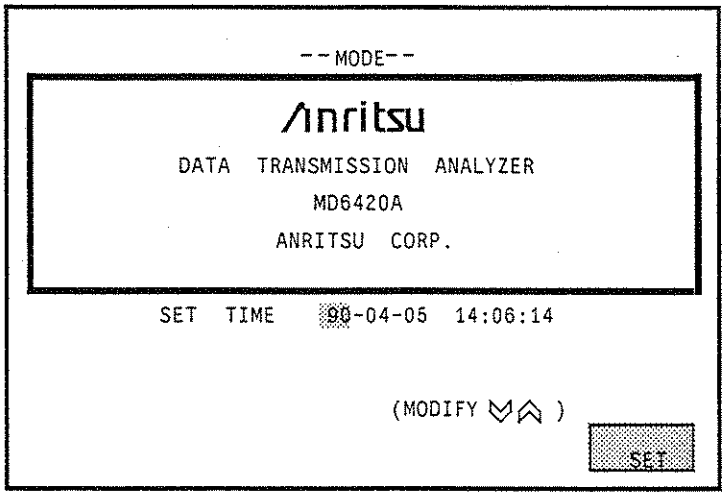
If the date and time are incorrect, they can be reset on this screen.

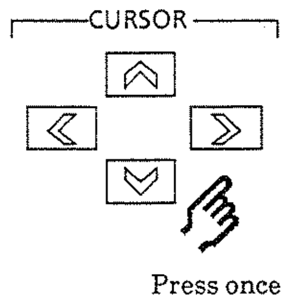
(Continued)

Step	Procedure

Setting the time

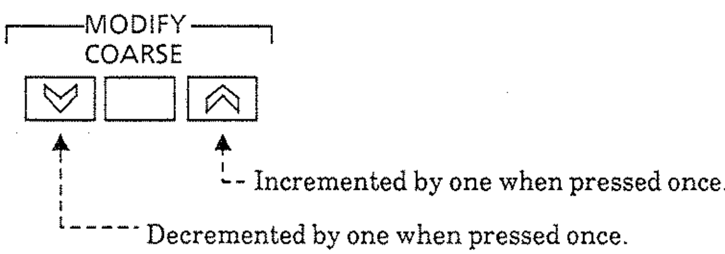
3 Press the CURSOR right key ⊵ once.



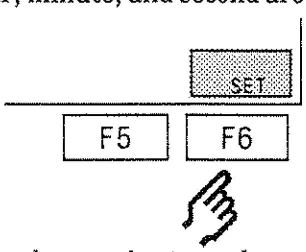


Year digits are reverse displayed (cursor)

4 Set the year using the MODIFY keys.



5 If the day, hour, minute, and second are correct, press [F6].

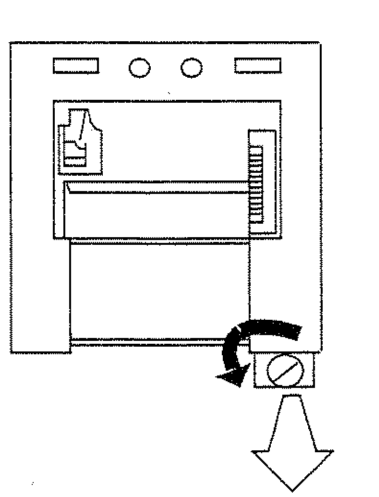
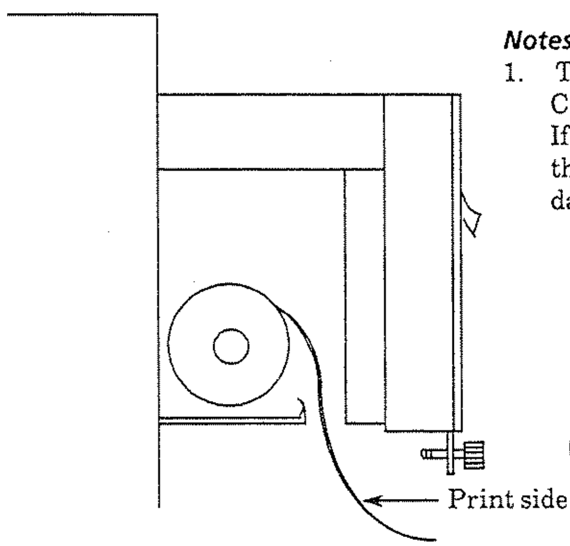
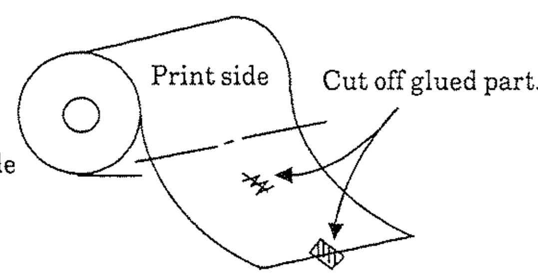


To set the day, hour, minute, and second, move the cursor to the pertinent position, and press the CURSOR keys in the same sequence as step 3 then set the value with the MODIFY keys. After setting all desired values, press the F6 key.

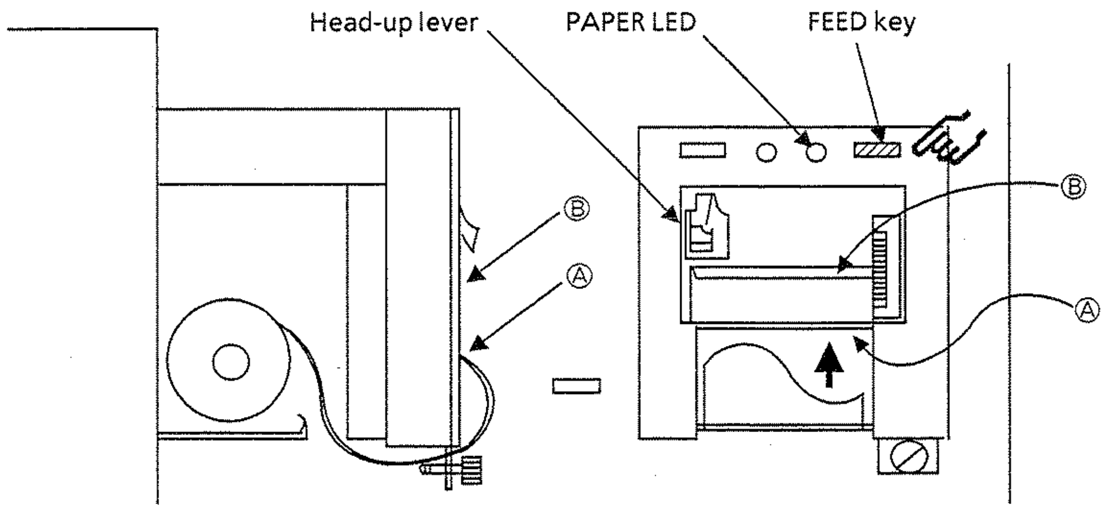
6 Press [CURSOR OFF].
The MODE screen from step2 is redisplayed.

2.9 Loading Printer Paper

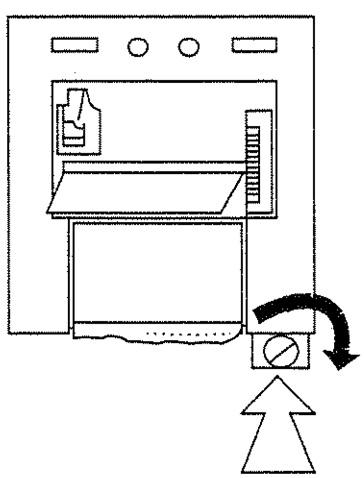
- Only load the printer paper while the power is on.

Step	Procedure
1	Turn the printer lock screw counterclockwise to loosen it. Pull out the printer. 
2	Load the printer paper (roll paper) as shown below.  *Notes:* 1. The end of a new roll of paper is glued. Cut off this part before loading the paper. If the paper is loaded without cutting off the glued part jamming or printer head damage will occur.  2. The print side is on the outside of the roll.

Step	Procedure
3	Lower the head-up lever and insert the paper through paper insertion slot Ⓐ as shown in the figure below. The paper can be inserted about 5 cm.



Step	Procedure
4	Press [FEED] until the paper appears at Ⓑ as shown in the figure above. At this time, verify that the PAPER LED is not lit. If the PAPER LED is lit, the paper is not loaded correctly. Reload the paper.
5	Press [PRINTER OFF/ON] several times. The printer ON LED should go on and off each time the printer is turned on and off. If the ON LED remains off, verify that (a) the head-up lever is lowered (b) the PAPER LED is not lit.
6	After loading the paper correctly, push the printer into the main frame and lock it by turning the printer lock screw clockwise.

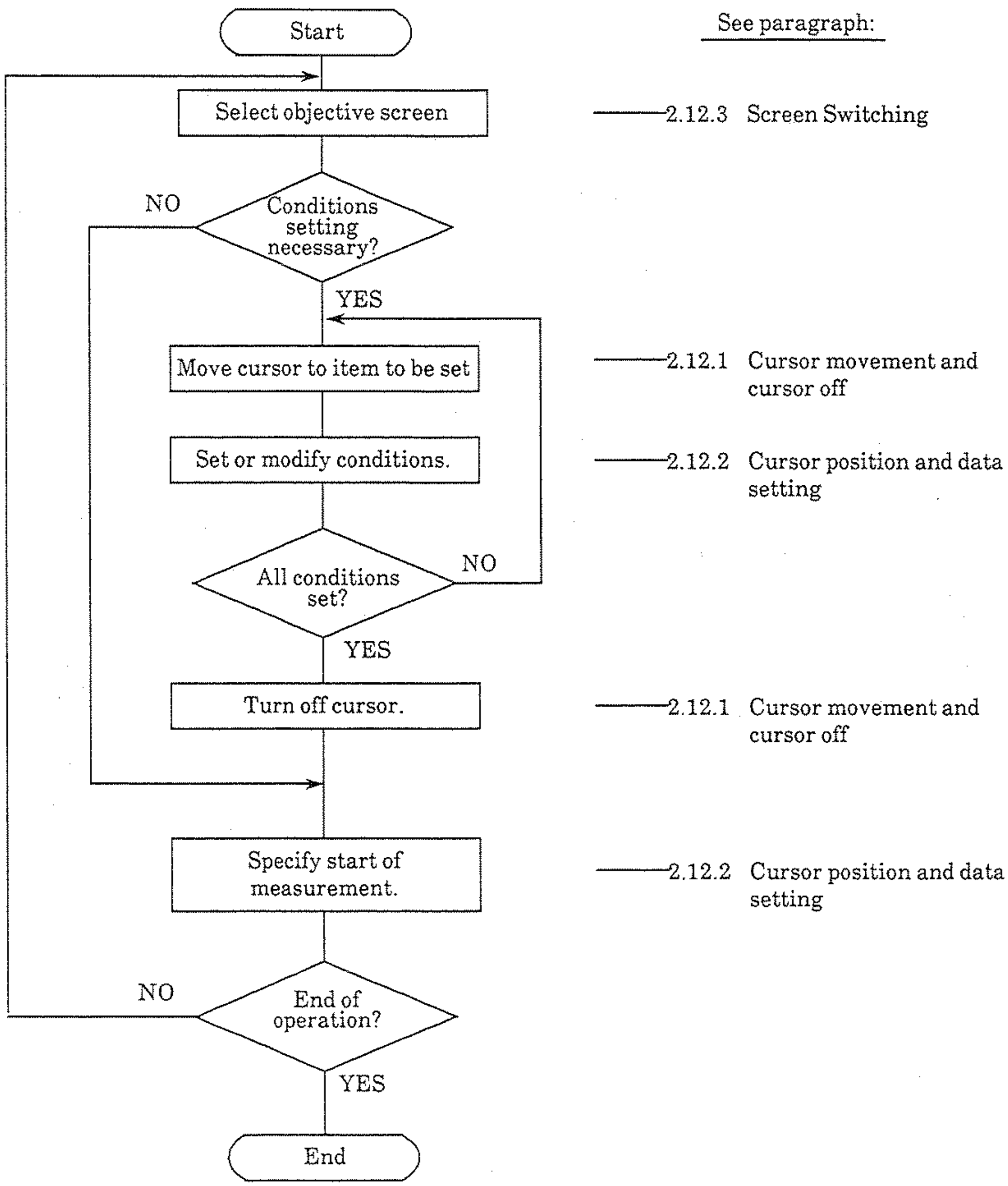


Notes:

1. The print side is on the outside of the roll. Check the print side.
2. When the PAPER LED is lit, print out is stopped.

2.10 Overview of Screen Operations

The MD6420A front panel measurement operations are shown below.



2.11 Screen Hierarchy

The operator sets the measurement conditions and performs measurements via the menu displayed on the EL screens and the CURSOR keys, function (F) keys, and MODIFY keys.

The hierarchy of screens is shown in Fig. 2-8.

- Rank 1

  MODE screen --- This screen is displayed when the MD6420A power is turned on.

- Rank 2

  PRESET MEMORIES screen --- This screen displays a table of the contents previously stored in memory via the SAVE function.

  TABLE OF UNITS screen --- This screen lists the units inserted in the unit slots and remote control unit slot.

  INTERFACE screen --- This screen is used to view and modify the current interface settings.

- Rank 3

  Basic measurement function screens

Screens	
ERROR screen VOLT/FREQUENCY screen DELAY TIME screen WORD TRACE screen	These screens are used to set the conditions for each measurement and view the measured results.

  Extended function screens --- These are the screens for the extended functions added by inserting extension units. The extended function screen depends on the inserted extension unit.

- Rank 4

  Auxiliary screens when rank-3 screen overflows

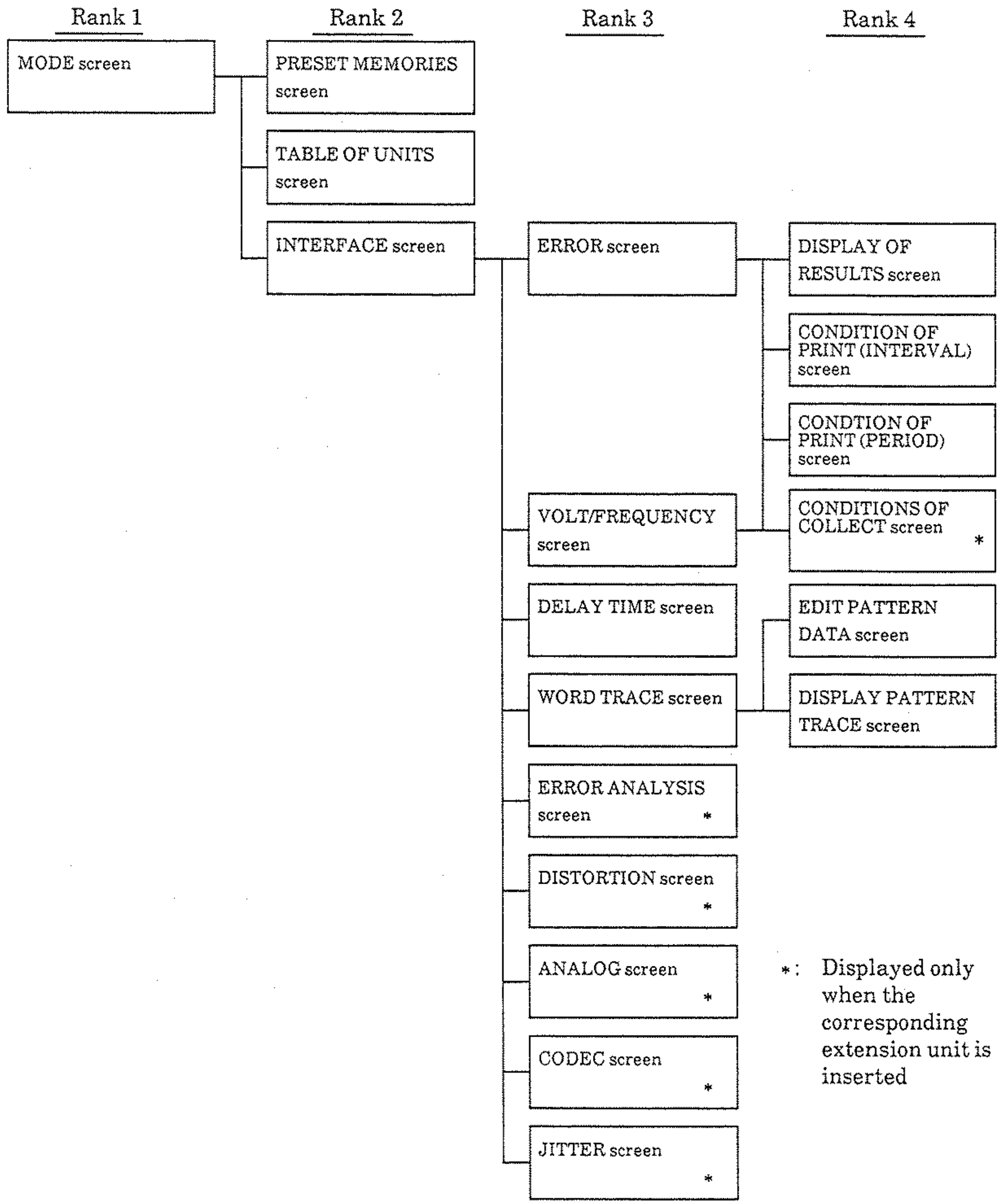
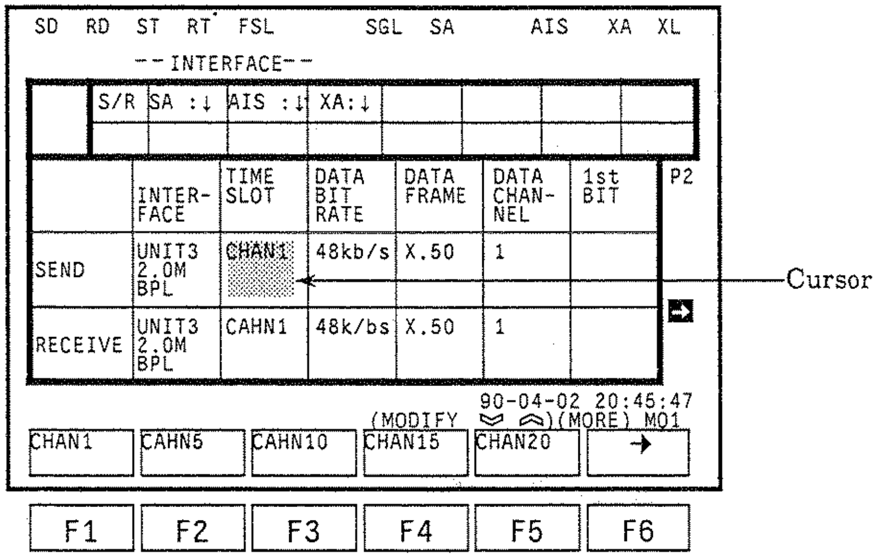


Fig.2-8 Screen Hierarchy

2.12 Basic Screen Operation

2.12.1 Cursor movement and cursor off

- Definition of a cursor:
  The reverse-displayed portion of the EL display used to select or modify a setting.

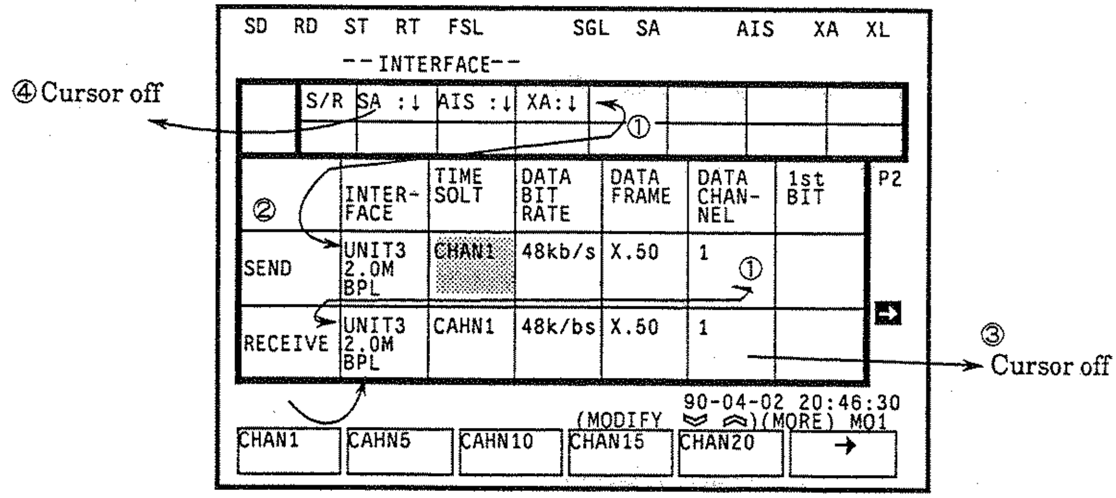


The value of any item selected with the cursor can be set and modified with the function and MODIFY keys.

- Cursor movement
  The cursor can be moved with the CURSOR keys (left, right, up, down). Settable items are generally arranged from left to right and top to bottom. The cursor is moved to the next settable item, when the CURSOR right key ⊵ is pressed.
  The cursor can be moved up, down, left, and right by pressing the appropriate CURSOR key.

- Cursor off
  Switching to a screen of lower rank or starting measurement can only be performed at a screen at which the cursor is not displayed. When the cursor is displayed, it is turned off by pressing the CURSOR OFF key.

- Cursor call
  If a CURSOR key ⊴, ⊵, ⩓, or ⩔ is pressed while the cursor is turned OFF, the cursor moves according the following cursor movement rules.



- Cursor movement rules

① If the CURSOR left $\boxed{<}$ or right $\boxed{>}$ key is pressed when the cursor is at the beginning or end of a line, the cursor is moved to the end of the preceding line or the beginning of the next line, respectively.

② When the CURSOR up $\boxed{\wedge}$ or down $\boxed{\vee}$ key is pressed when the cursor is at the top or bottom of a line, the cursor wraps around to the bottom or top line, respectively.

③ If the CURSOR right key $\boxed{>}$ is pressed when the cursor is in the bottom-right corner, the cursor is turned off.

④ If the CURSOR left key $\boxed{<}$ is pressed when the cursor is at the top-left corner, the cursor is turned off.

⑤ If the CURSOR left key $\boxed{<}$ is pressed when the cursor is not displayed, the cursor appears in the bottom-righ corner.

⑥ If the CURSOR right key $\boxed{>}$ is pressed when the cursor is not displayed, the cursor appears in the first settable display item on the top row.

2.12.2 Cursor position and data setting

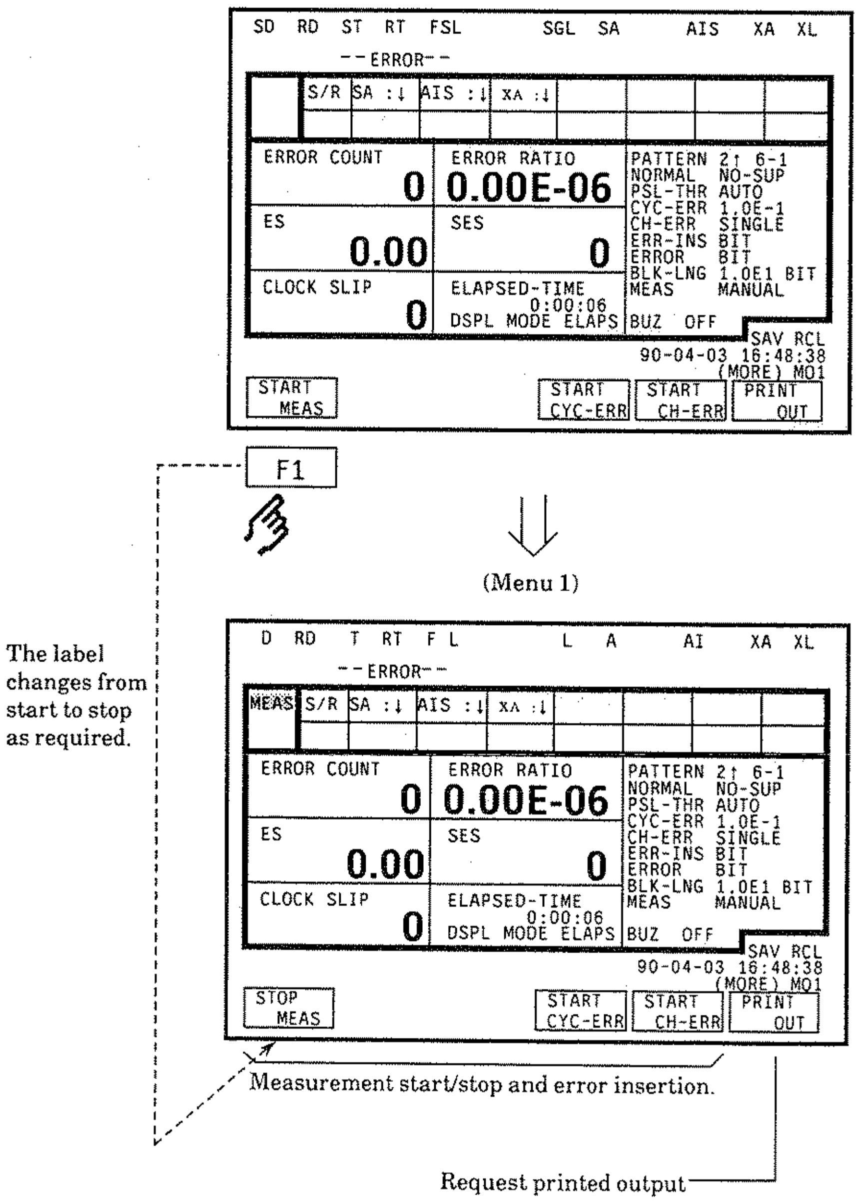
- When the cursor is not displayed

  When the cursor is not displayed, the following operations can be performed at each screen via the function keys.

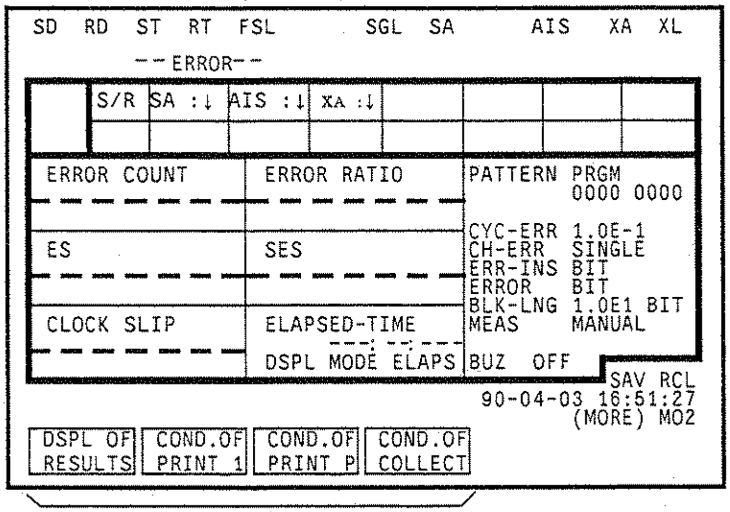
  - Start/stop measurement, etc.
  - Switch to screen of lower rank
  - Request printed output
  - Select signal line and alarm signal

Sample ERROR screens are shown below.

In this example, three menus can be viewed via the MORE key.

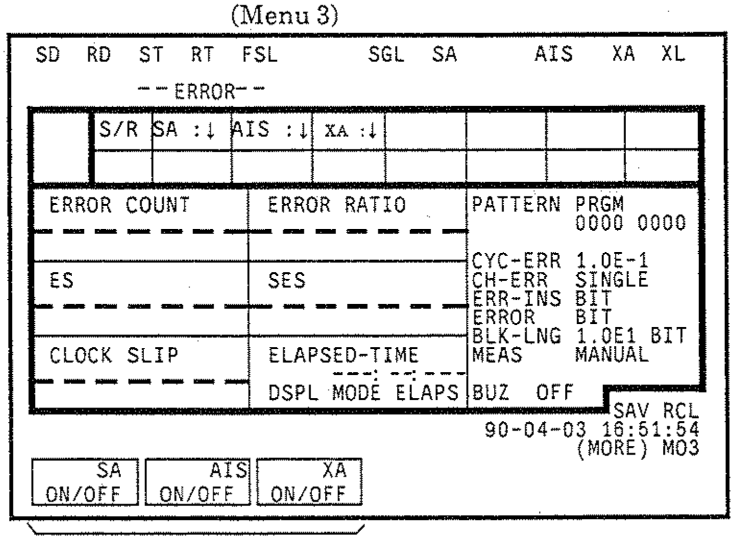


(Menu 2)



Select screen of lower rank

(Menu 3)

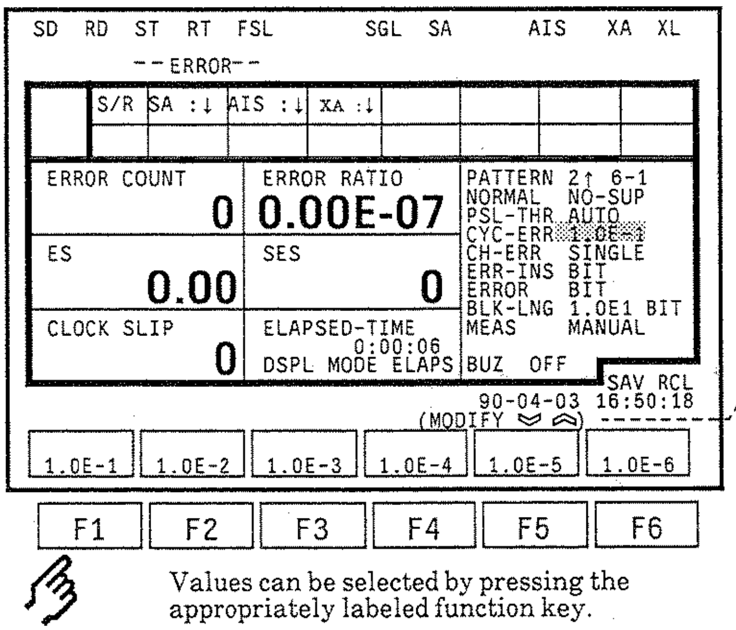


Turn signal line and alarm signal ON/OFF

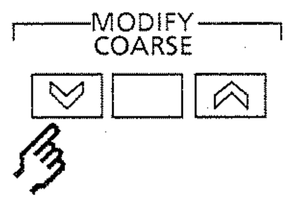
- When the cursor is displayed

  When the cursor is displayed, the selected item can be set or modified according to the following three operations:

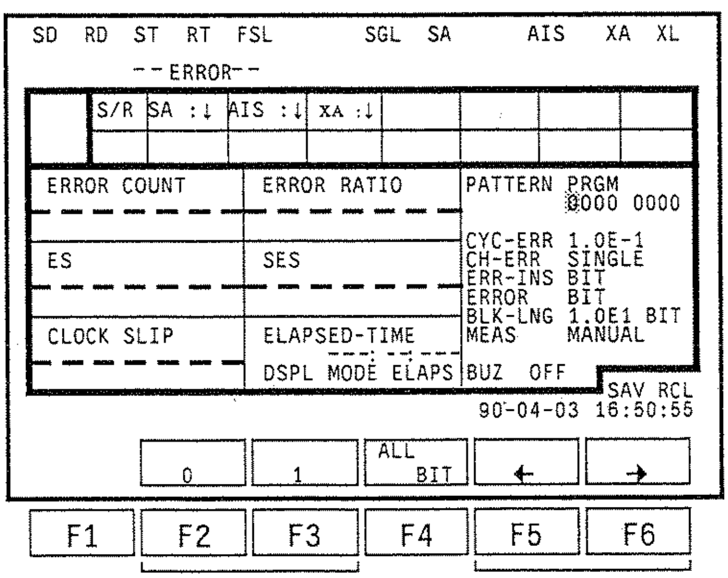
  - Select values via the function keys
  - Incrementing/decrement set value via the MODIFY keys.
  - Set all bit values to 0/1 via a function key



Values can be selected by pressing the appropriately labeled function key.



When the data modify message "(MODIFY [▽] [△])", is displayed, the set value can be incremented/decremented with the MODIFY keys.
When [COARSE] and [△] or [▽] are pressed simultaneously, the set value is incremented/decremented in coarse steps.



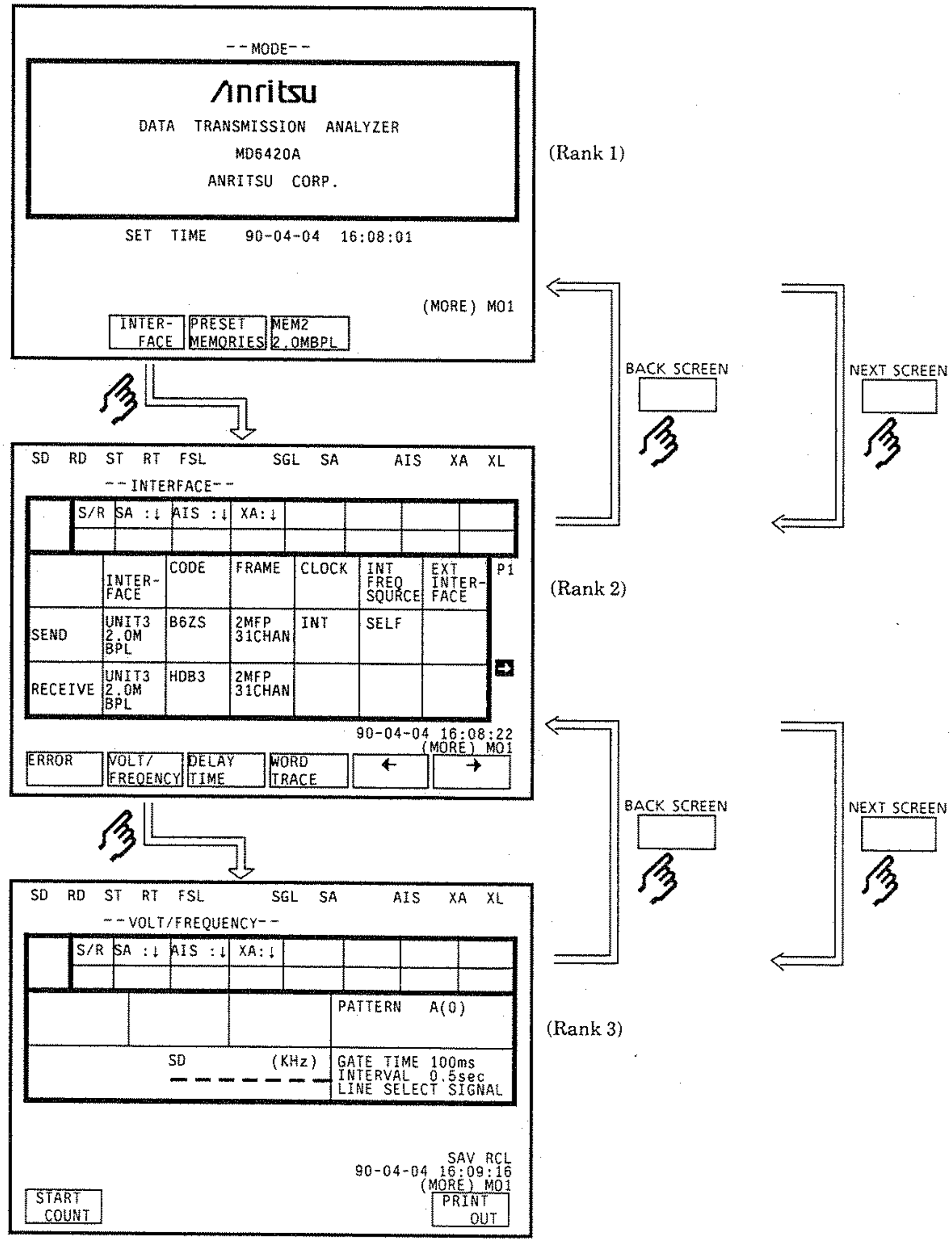
Sets the bit designated by the cursor to 0 or 1. After setting, the cursor moves 1 bit to the right. If F4 (ALL BIT) and F2 or F3 are pressed simultaneously, all bits are set to 0 or 1.

Moves the cursor to the left and right 1 bit at a time.

2.12.3 Screen selection

To switch to a screen of lower rank, press a function key on the cursor-off screen.

To switch to the screen of next higher rank, press the BACK SCREEN key. After the BACK SCREEN has been recalled, the previous lower ranking screen can be displayed by pressing the NEXT SCREEN key.



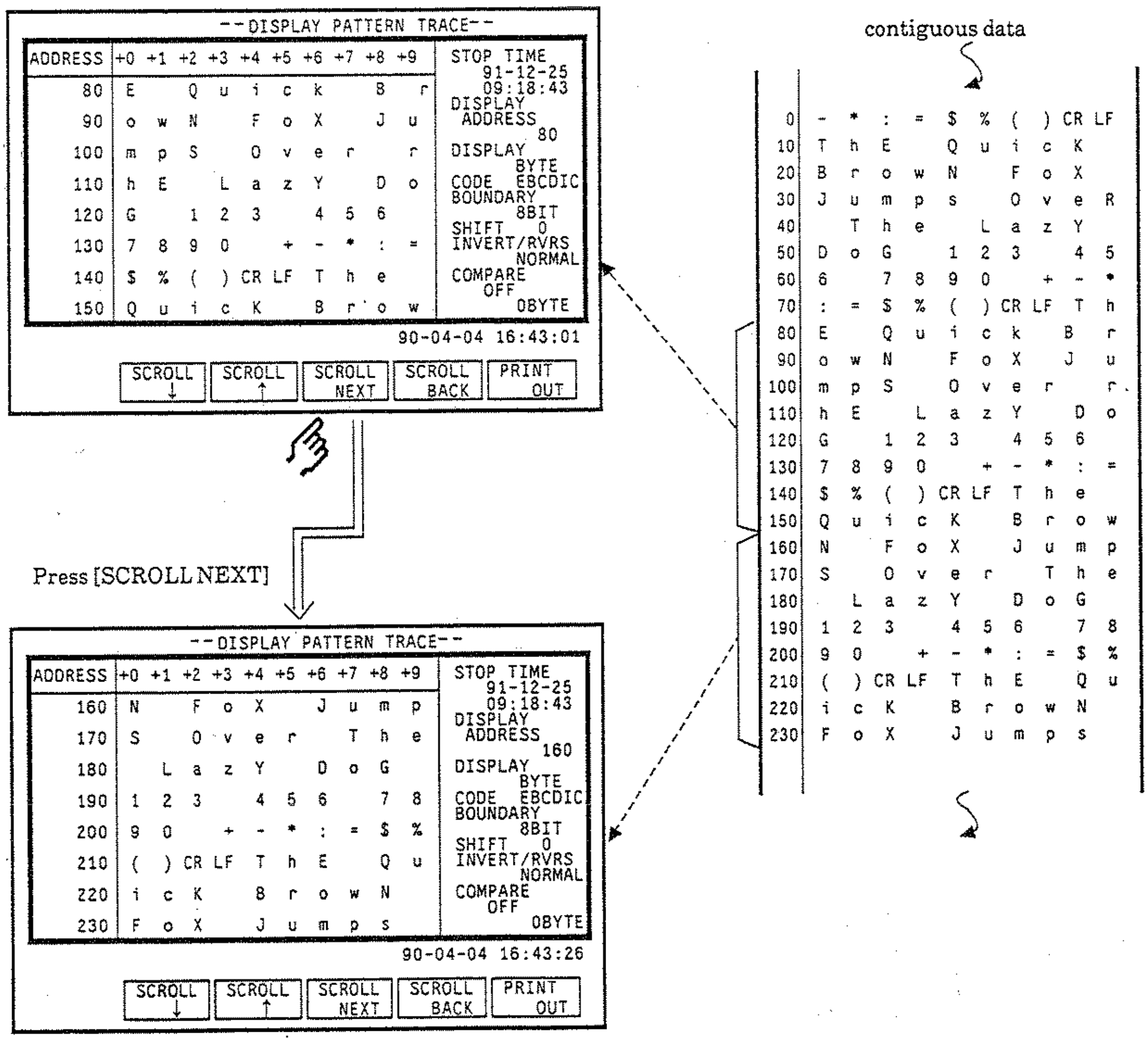
2.12.4 Scrolling display

The following screens can be scrolled vertically and horizontally:

- INTERFACE screen
- DISPLAY PATTERN TRACE screen
- ERROR ANALYSIS (HISTOGRAM) screen
- ERROR ANALYSIS (HISTOGRAM + ALARM) screen

Scrolling is performed by pressing the appropriately labeled function keys.

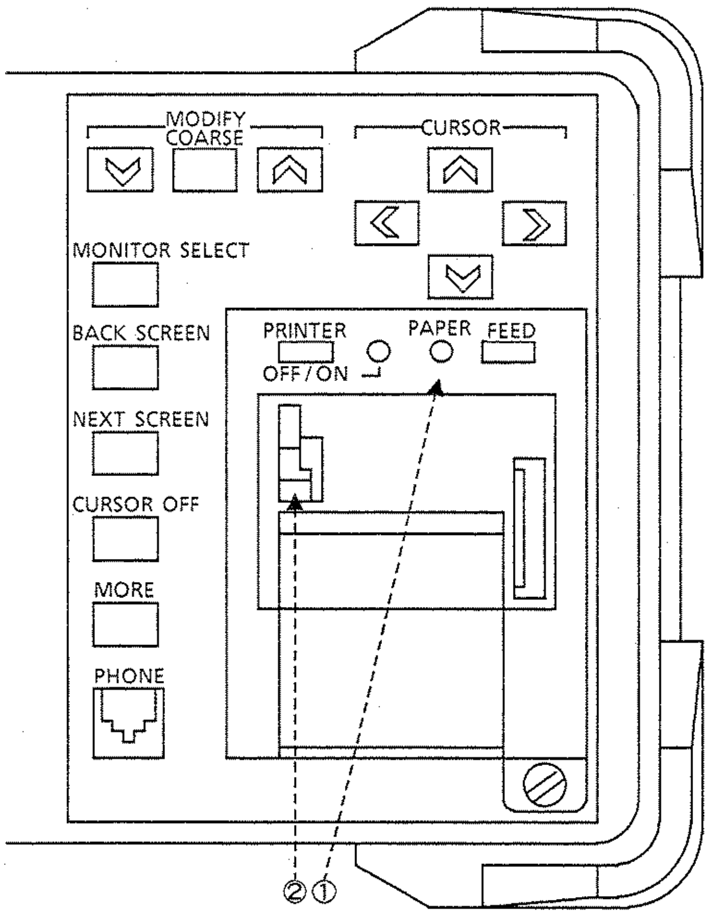
When scrolling, the preceding or following contiguous data are displayed, as is appropriate..



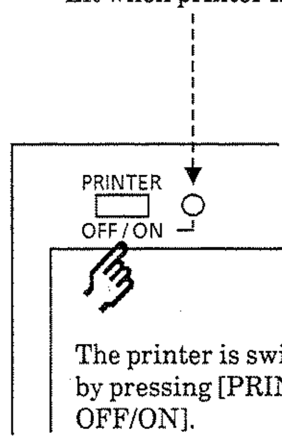
For example, when the F3 (SCROLL ↑) key is pressed, display data are scrolled from higher (ADDRESS 80-150) to lower (ADDRESS 70-140) address locations.

2.13 Printer ON/OFF

The measured results, setting conditions, etc. of any screen can be printed out on the built-in printer when the printer is turned on.



Printer ON LED
Lit when printer is on



The printer is switched off/on by pressing [PRINTER OFF/ON].

- If the printer function cannot be turned on, check the following:

  ① Is the out-of-paper LED (PAPER LED) Lit?

  If it is lit, there is no paper or the paper is not loaded properly. Load the paper properly.

  ② Is the head-up lever lowered?

  When it is up, the printing head is raised. If it is up, press [PRINTER OFF/ON] again after lowering the lever.

Notes: If either of the following cases is occurred, printer does not operate:

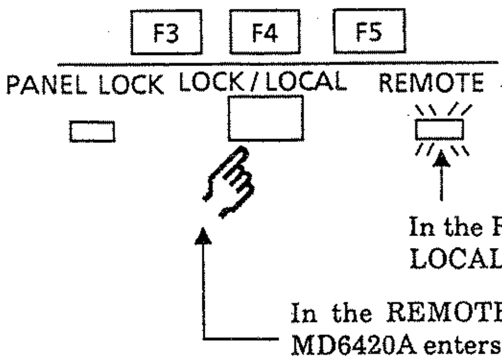
1. The out-of-paper LED (PAPER LED) is lit.
2. The head-up lever is lowered.

2.14 Remote/Local and Panel Lock Operations

When the power is turned on, the MD6420A is normally operated manually from the front panel.

This state is called the LOCAL state.

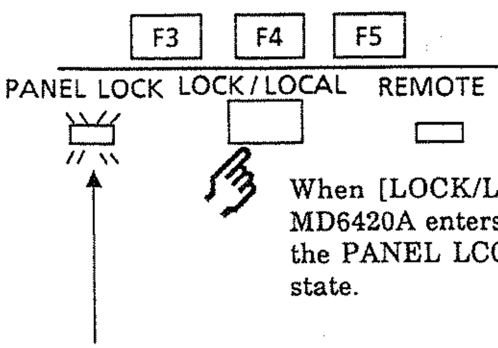
When a remote control unit is inserted, and connected to a controller (Packet V, IBM PC), via GP-IB or RS-232C, the MD6420A can be controlled by the controller. This state is called the REMOTE state.



In the REMOTE state, the REMOTE LED is lit. In the LOCAL state, the REMOTE LED is off.

In the REMOTE state, when [LOCK/LOCAL] is pressed, the MD6420A enters the LOCAL state and the REMOTE LED goes off.

To prevent measurement from being stopped by erroneous operations the front-panel can be disabled. This is called the PANEL LOCK state. Panel operation can be locked by pressing the LOCK/LOCAL key from the LOCAL state. When this key is pressed in the PANEL LOCK state, the MD6420A returns to the LOCAL state.



When [LOCK/LOCAL] is pressed in the LOCAL state, the MD6420A enters the PANEL LOCK state. When it is pressed in the PANEL LCOK state, the MD6420A returns to the LOCAL state.

While the front PANEL is locked, the PANEL LOCK LED is lit.

2.15 Switching Monitor LED Display

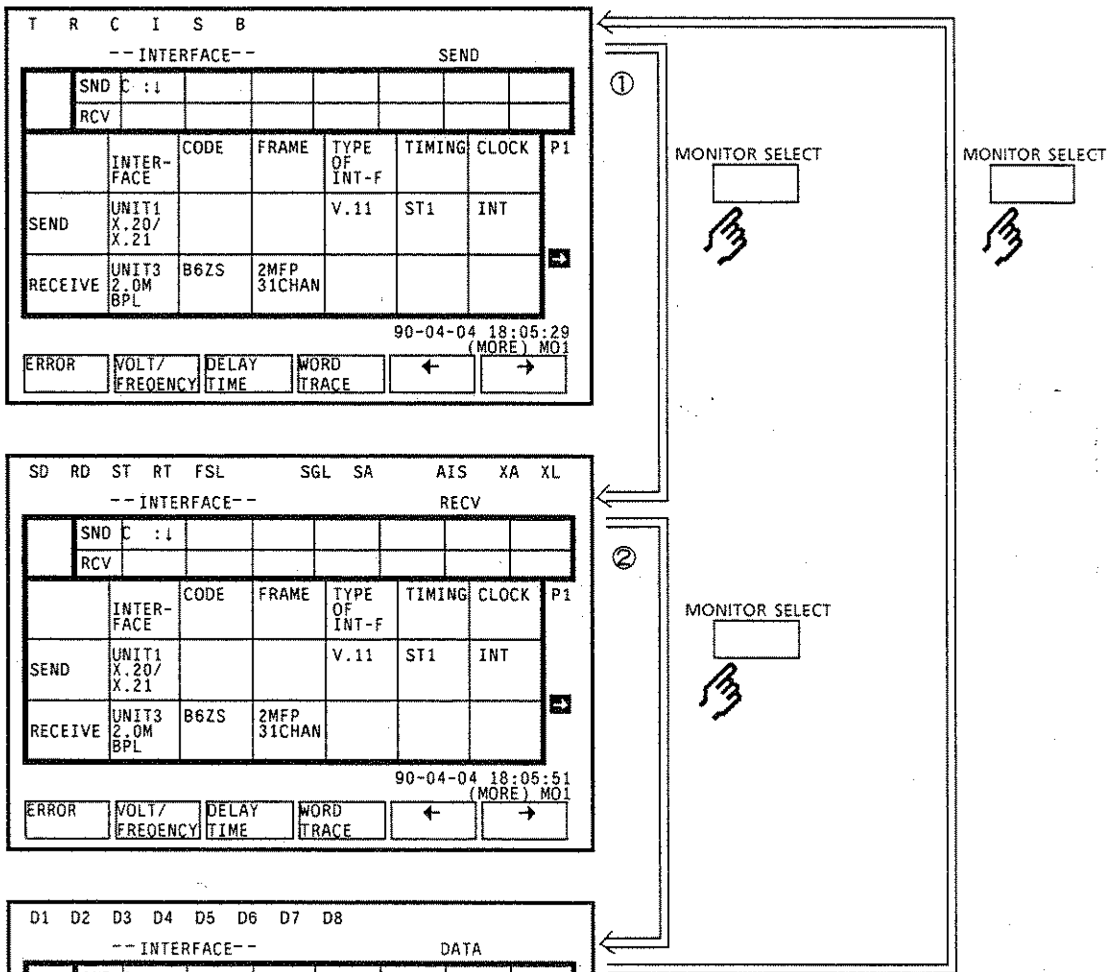
The signal line and alarm signal, and data status can be monitored via the 13 monitor LEDs above the EL screen. The contents displayed by these LEDs are:

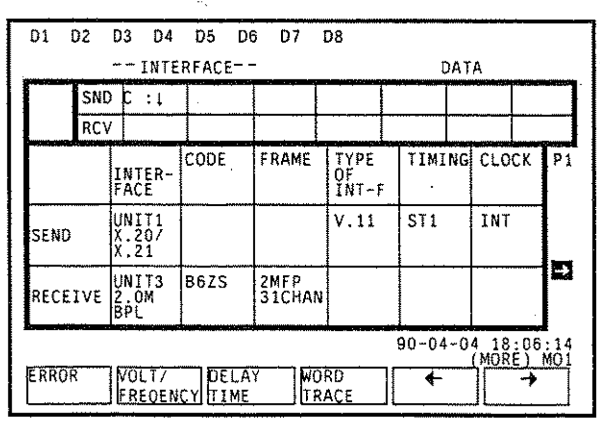
① Sending side signal line and alarm signal (SEND)

② Receiving side signal line and alarm signal (RECV)

③ Receive data (DATA)

The names of the signals and alarms being monitored are displayed at the top of the EL display. These can be selected in order ① (SEND) -> ② (RECV) -> ③ (DATA) -> ① --- via the MONITOR SELECT key.





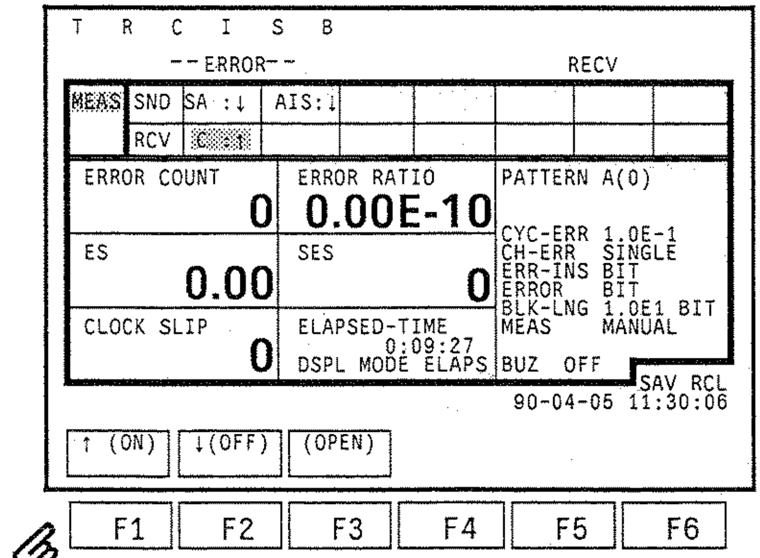
Note:
It may be possible to display only subsets of ①, ②, and ③, depending on the measurement and measurement conditions.

2.16 Setting Signal Line and Alarm Signal

The DUT interface signal line and send alarm signal can be set or reset via the INTERFACE screen and each measurement screen.

(1) Moving cursor to the signal line and alarm signal to be set

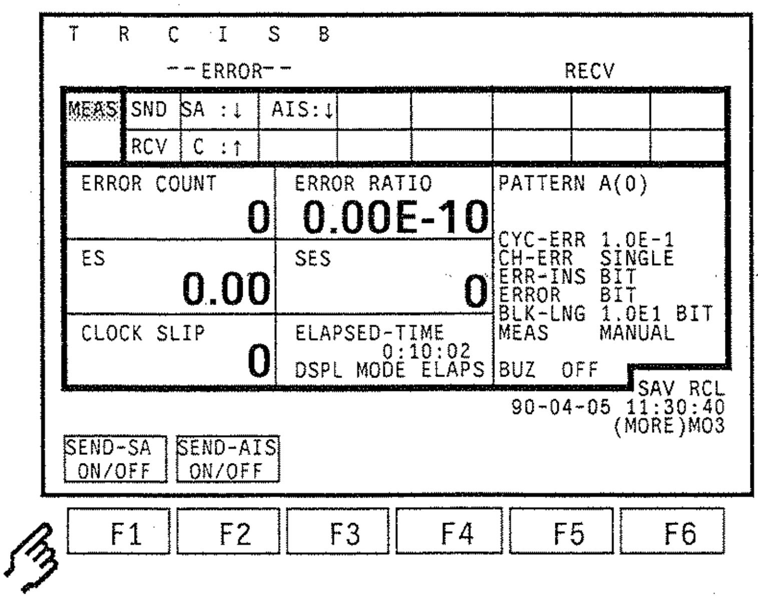
Move the cursor to the signal line or alarm signal to be set via the CURSOR keys. Set or modify the line or signal by pressing the function keys.



Press the appropriately labeled function key.

(2) Turning the signal line or alarm signal ON/OFF at cursor-off screen

The function key for turning signal line or alarm signal ON/OFF is displayed after the first page of each cursor off screen. Press the MORE key to display additional page of menus. Turn the signal line or alarm signal ON/OFF with the appropriate function key.



Note:
When the current setting state is OPEN or THROUGH ("x" is displayed), no label is displayed for that signal line and alarm signal. After setting the signal line and alarm signal ON or OFF as described in (1), perform step (2).

SECTION 3
MEASUREMENT

3.1 Measurement Preparations

Before beginning measurement, perform the following measurement preparations and checks.

(1) Verify that the MD6420A power is off.

(2) Insert the interface unit corresponding to the DUT into one of the slots on the rear of the MD6420A. (See paragraph 2.3.)

(3) Connect the DUT to the interface unit connector on the rear of the MD6420A with the connecting cable. (For a detailed description, refer to the operation manual of the appropriate interface unit.)

(4) When receiving a slave clock for the send signal output from the DUT, connect the slave clock source of the DUT to the slave clock input connector on the rear panel of the MD6420A via a connecting cable. (See paragraph 3.2.)

(5) When receiving the send signal clock source directly from outside, connect the external clock source to the clock input connector on the rear panel of the MD6420A via a connecting cable. (See paragraph 3.2.)

(6) Verify the settings of the MD6420A rear-panel FUNCTION switches are appropriate for that measurement. (See paragraph 3.3.)

(7) Turn on the MD6420A power. After the MODE screen is displayed, check the time. If the time is incorrect, set it. (See paragraph 2.8.)

3.2 Connecting Devices to MD6420A Rear-Panel Connectors

There are input and output connectors for each measurement on the rear panel of the MD6420A.

Connect these connectors as follows:

(1) When the clock source is set to INT or EXT1 8k on the interface menu, connect the 8 kb/s clock source to the EXT1 connector ① with a coaxial cable.

(2) When the clock source is set to INT or EXT2 64k + 8k on the interface menu, connect the 64k + 8kb/s clock source to the EXT2 connector ② with a balanced cord.

(3) When the clock source is set to EXT on the interface menu, connect the clock source to the EXT1 connector ① with a coaxial cable.

(4) When the trigger signal is set to [EXT] or [EXTERNAL] on the frequency, interval, and word trace measurement menus, connect the external signal line to the EXTERNAL INPUT connector ③ with a coaxial cable.

(5) When the receive clock or send 8 kb/s clock is to be output, connect the 8k/R-CLK CLOCK OUTPUT connector ④ to the external device with a coaxial cable

(6) When the received data are to be output, connect the RECEIVE DATA OUTPUT connector ⑤ to the external device with a coaxial cable

(7) When the error detection signal for an error measurement is to be output, connect the ERROR OUTPUT connector ⑥ to the external device with a coaxial cable. The error detection signal is output during error measurements.

(8) When the pattern sync loss signal is to be output, connect the sync LOSS OUTPUT connector to the external device with a coaxial cable.
The pattern sync loss signal is output during error measurements.

(9) When the 64k + 8 kbs clock signal is to be output, connect the 64k +8k CLOCK OUTPUT connector ⑧ to the external device with a balanced cord.

(10) When the NTSC video signal (contents of EL display screen) is to be output, connect the VIDEO OUTPUT COMPOSITE connector ⑨ to the external device (video plotter, etc.) with a coaxial cable.
If connected to an ordinary television monitor, the display will overflow the top and left sides of the screen by few lines and columns, respectively.

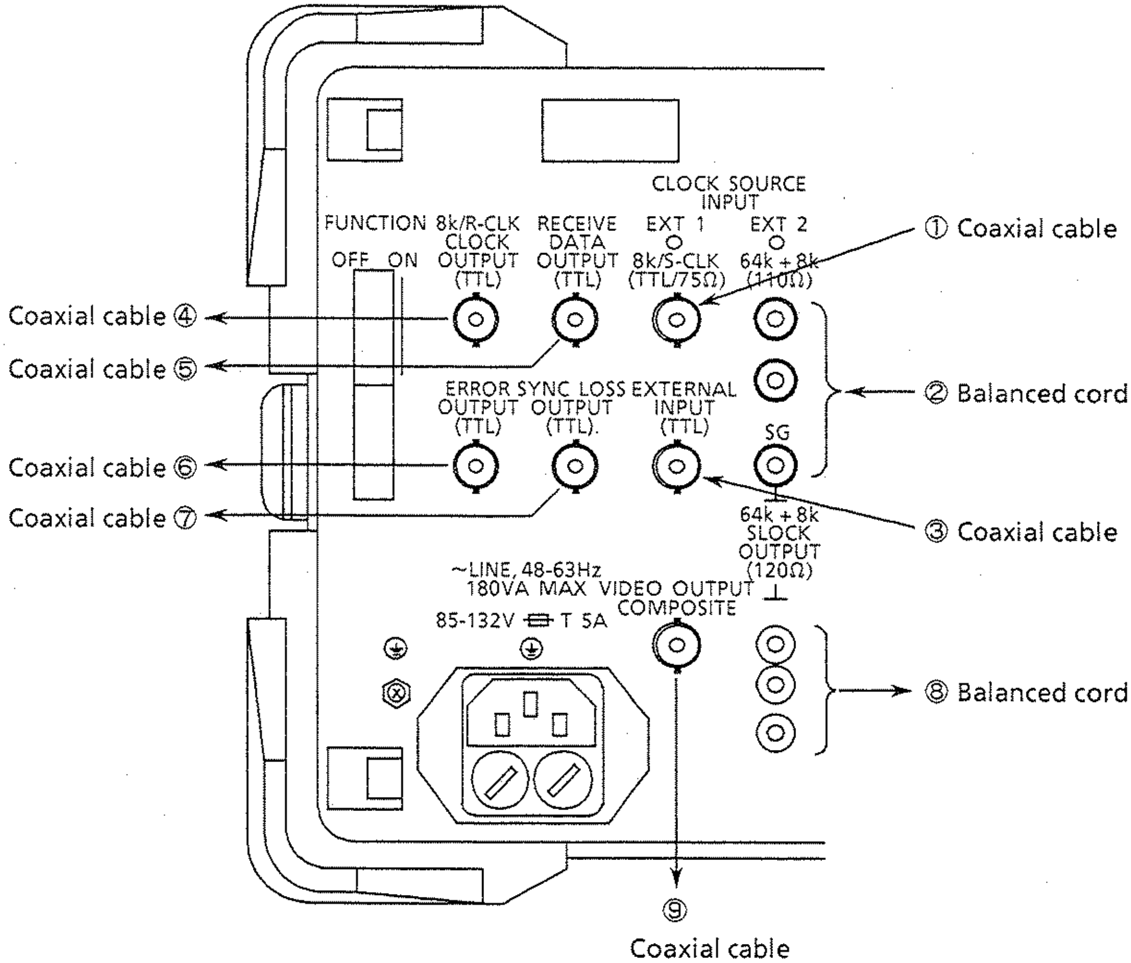
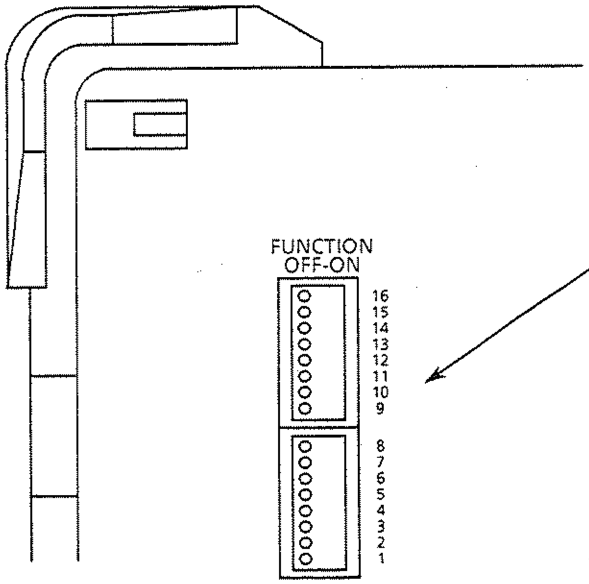


Fig. 3-1 Rear-Panel Connectors

3.3 Setting the Rear-Panel FUNCTION Switches

The error measurement parameters are specified by setting the FUNCTION switches (1 to 16) on the rear panel.

Although these switches can be set and modified, when the MD6420A power is on, they will not become active settings until the power is turned off and then on again.



Check the switch settings and reset or modify them as required.

Note: When the switch setting is modified, turn off the POWER switch and then on again.

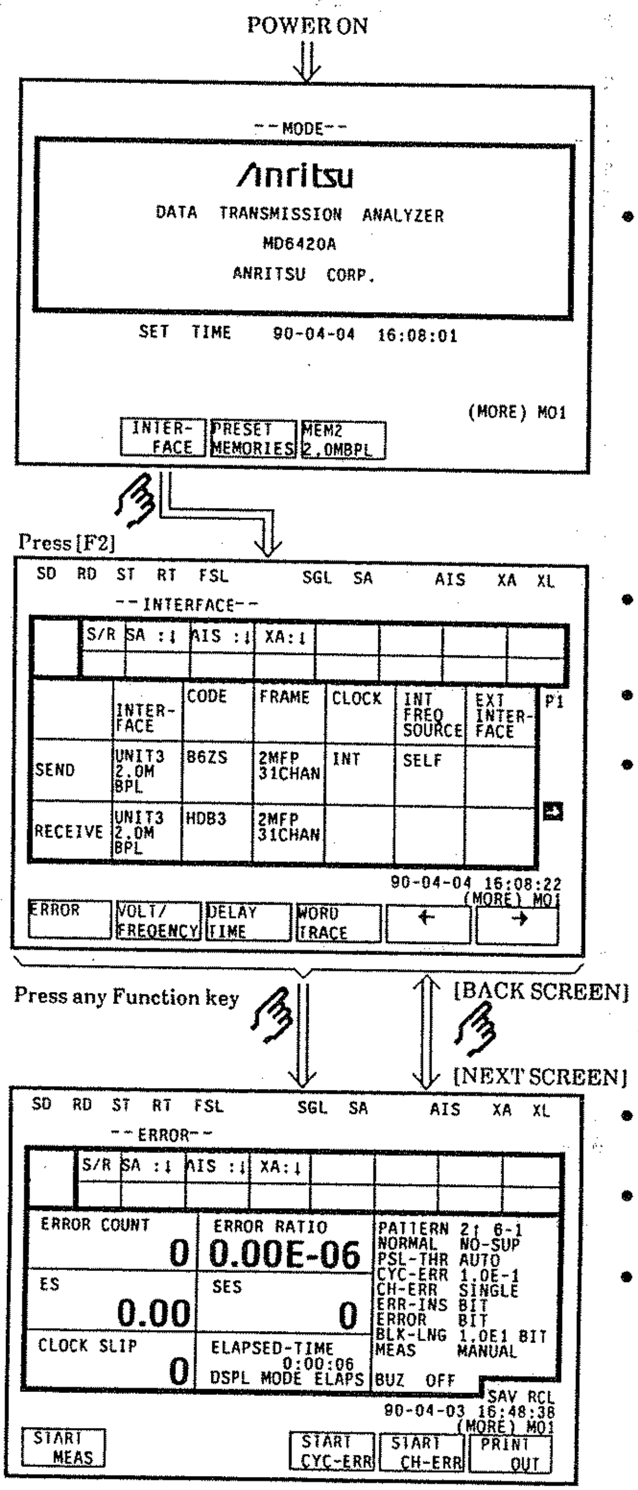
Fig. 3-2 Rear-panel FUNCTION Switches

Table 3-1 Explanation of Rear-Panel FUNCTION Switches

No.	Item	Settings
16 ~ 5	(Not used)	
4	Determines processing for bit error count during clock slip (error measurement)	OFF : Include bit errors generated by clock slip in the error count ON : Do not include bit errors (generated within 80 bits around clock slip detection) in the error count
3	Determines processing for bit errors which occur during pattern sync loss (error measurement)	OFF : Include bit errors generated during pattern sync loss in the error count ON : Do not include bit errors generated during pattern sync loss in the error count
2	SES and DM threshold value (error measurement)	OFF : Makes 1- second error ratio more than 10^{-3} SES and 1-minute error ratio more than 10^{-6} DM ON : Makes 1- second error ratio more than 10^{-4} SES and 1-minute error ratio more than 10^{-8} DM
1	DM calculation interval (error measurement)	OFF : 1 minute ON : 10 minutes

3.4 Overview of Measurement Operations

Before beginning measurements, set the sending and receiving interface conditions for the DUT on the INTERFACE screen, then set the measurement conditions for each measurement screen.



- Select INTERFACE screen by pressing [F2].

- Use the CURSOR, MODIFY, and function keys to set the sending and receiving interface conditions for the DUT.
- Turn the cursor off, then press the appropriate function key to select the desired measurement screens.
- If [BACK SCREEN] is pressed while error measurements are in progress, the INTERFACE screen will be displayed, but setting and modification will be disabled.

  Conversely, if [BACK SCREEN] is pressed when some other type of measurement is in progress, the INTERFACE screen will be displayed and measurement will be suspended.

- Use the CURSOR, MODIFY, and function keys to set the send signal conditions, measurement condition, etc.
- Turn the cursor off, then specify measurement start/stop, etc.
- Set or modify the signal line and alarm signal as required.

3.5 Setting Interface Conditions

3.5.1 INTERFACE screen

The INTERFACE screen is shown below.

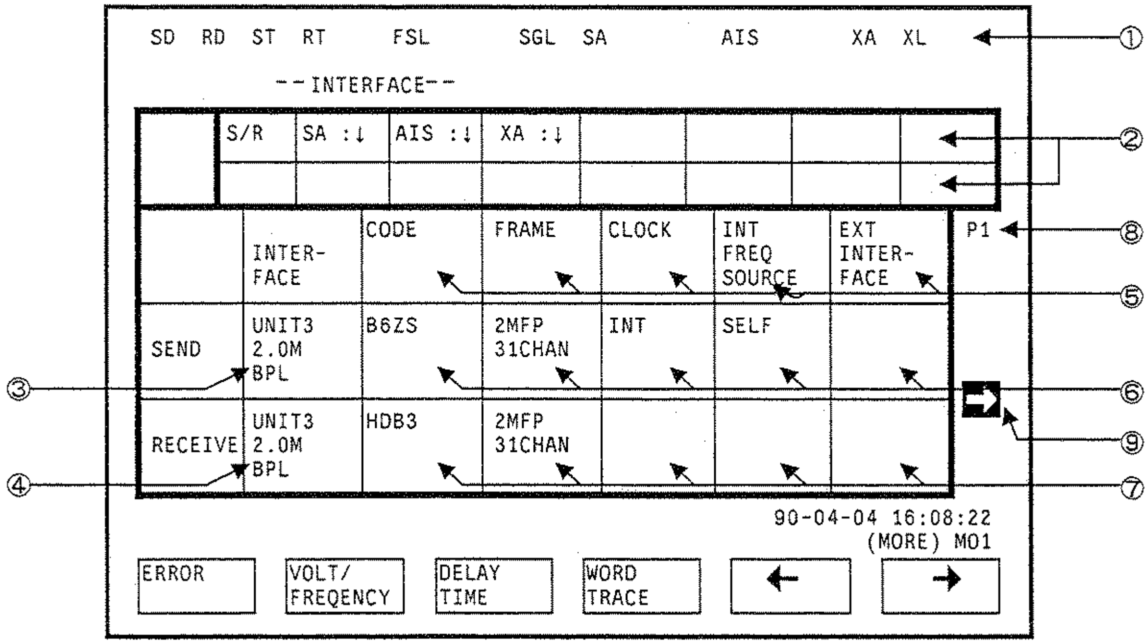


Fig. 3-3 INTERFACE Screen

Table 3-2 Explanation of INTERFACE Screen

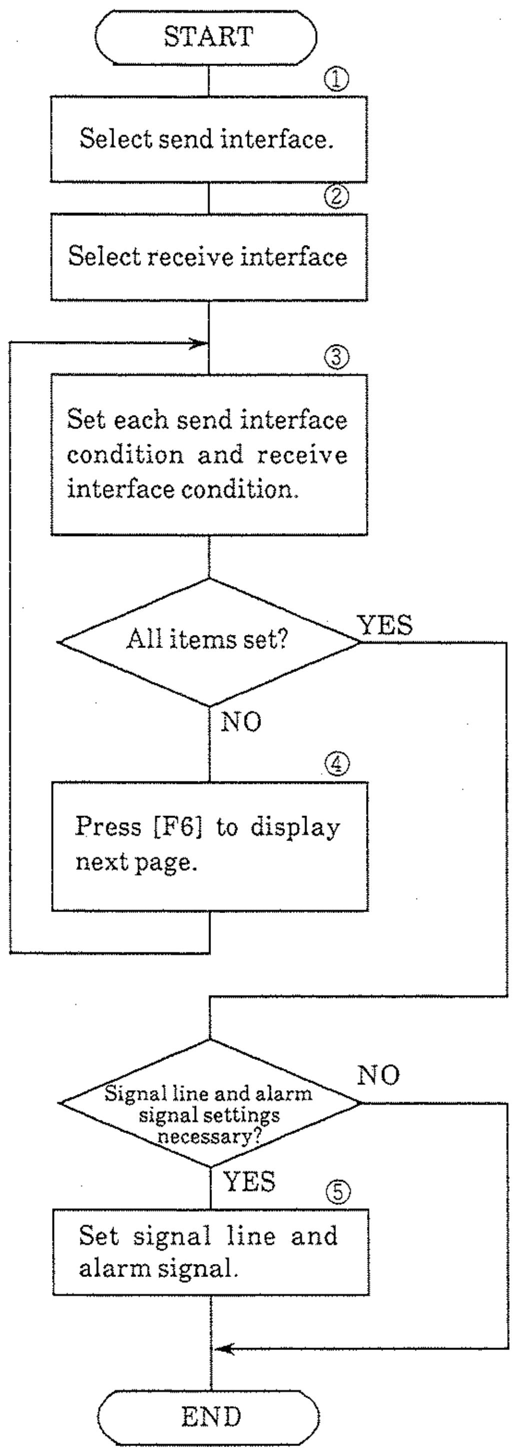
No.	Label	Name	Explanation	Setting	Setting during measure-ment
①		Monitor LED signal names	Displays name and connection circuit number of signal line or alarm signal represented by monitor LEDs	×	×
②	S/R , SND , RCV	Signal and alarm settings	Displays signal and alarm settings	○	×
③	SEND INTER FACE	Select send interface unit	Displays No. and name of selected send interface unit	○	×
④	RECEIVE INTER FACE	Select Receive interface unit	Displays No. and name of selected receive interface unit	○	×
⑤		Selectable interface conditions	Displays names of send and receive interface conditions which may be set. The names depend on the unit selected.	×	×
⑥		Send interface conditions	Displays setting for each send interface condition	○	×
⑦		Receive interface conditions	Displays setting for each receive interface condition	○	×
⑧	P1	Screen page number	Indicates screen page number as P1, P2.	×	×
⑨	➡	Next page symbol	Indicates that next page exists	×	×

○ : Enable

× : Disable

3.5.2 Setting interface conditions

(1) General Procedure



① When the CURSOR right key [>] is pressed once in the cursor-off state, the cursor is displayed at the send interface setting area. Select the unit connected to the send interface with the function keys.

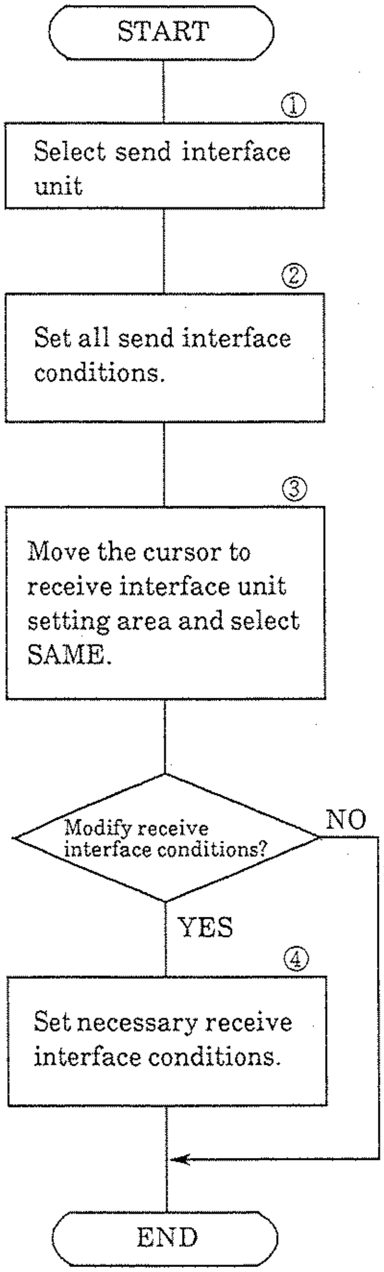
② Afterwards, if the CURSOR down key [V] is pressed, the cursor moves to receive interface setting area. Select the receive interface with the function keys as previously described.

③ Use the CURSOR, MODIFY, and function keys to set or modify each interface condition as required.
The setting procedure and items to be set depend on the interface unit. For more information, refer to the interface unit operation manual.

④ If [→] is displayed above [F6], press [F6] to display the next page. If it is not displayed, press [CURSOR OFF], then press [F6].

⑤ Use the CURSOR up, down, and left keys to move the cursor to the appropriate signal line and alarm signal setting area, then press the function key.
If only the CURSOR right key is pressed, the cursor is not displayed on the setting screen; therefore, use the CURSOR up, down, and left keys.

(2) Simple setting procedure when send and receive interface conditions are the same



① Select send interface unit as described in paragraph 3.5.2 (1) ①.

② Use the CURSOR, MODIFY, and function keys to set or modify all send interface conditions.

③ Move the cursor to the receive interface unit setting area and press[MORE]. When the second page menu appears, SAME is displayed at [F1]. Press [F1]. The receive interface conditions are set according to those of the send interface.

④ Set the conditions as described in paragraph 3.5.2 (2) ② above.

3.6 Error Measurement

3.6.1 Overview

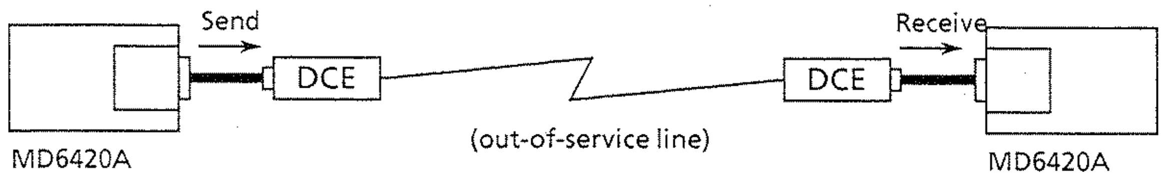
To measure error, set the measurement condition, measured results to be displayed, and print condition via the following screens.

- MODE screen
  - INTERFACE screen
    - ERROR screen
      - DISPLAY OF RESULTS screen
      - CONDITION OF PRINT (INTERVAL) screen
      - CONDITION OF PRINT (PERIOD) screen
      - CONDITION OF COLLECT screen *
    - ERROR ANALYSIS (TABLE OF COLLECTED DATA) screen *
      - ERROR ANALYSIS (DATA BLOCK DIVISION) screen *
      - ERROR ANALYSIS (HISTOGRAM) screen *
      - ERROR ANALYSIS (HISTOGRAM + ALARM) screen *
      - ERROR ANALYSIS (TRACE) screen *
      - ERROR ANALYSIS (TIME BETWEEN ERRORS) screen *
      - ERROR ANALYSIS (TIME TO RECOVER FROM ERROR) screen *
      - ERROR ANALYSIS (DENSITY) screen *

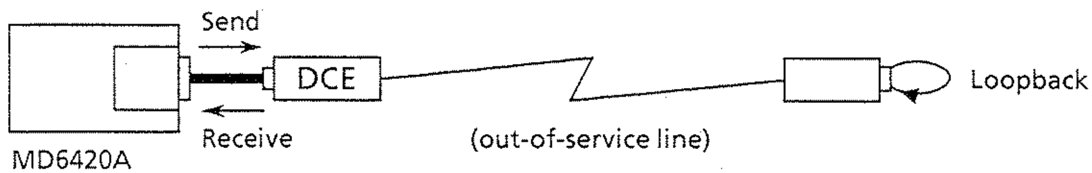
* : Screens that can be used when MD0633A Error Analyze Unit is installed.

Many types of error measurement can be performed, depending on the purpose. Examples are shown below.

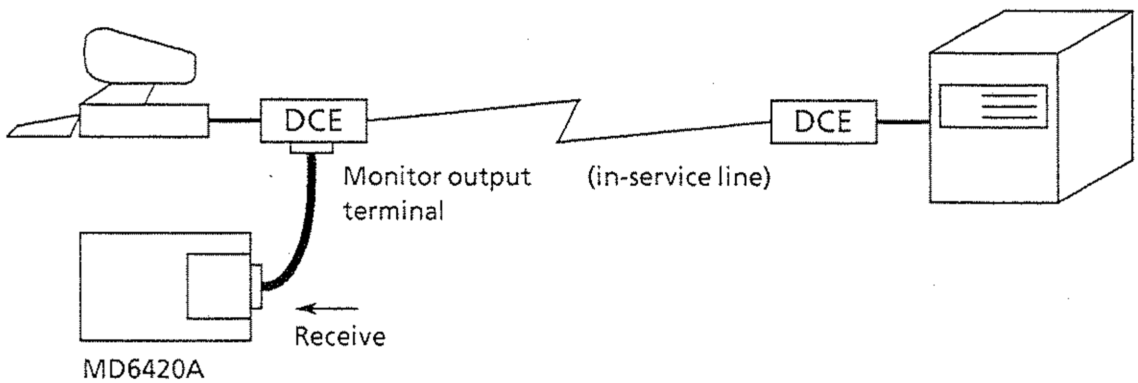
(1) End-to-end measurement



(2) Loopback measurement



(3) Monitor measurement



The following operations are described in this manual.

(1) Basic error measurement operation
This operation measures errors and prints the measured results for both long and short term.

(2) Operation to insert errored data into the send data
This operation inserts error data into error measurement send data. The same operation may be used for end-to-end and loopback measurements.
This operation can be performed whether or not a measurement is in progress.

(3) Operation for long-term measurements, the printing of measured results whether an error occurs and alarm generation/reset.

(4) Operation for repeat measurement mode and printing measured results periodically.

(5) Operation for long-term error measurements and histogram analysis of time at which error occurred.

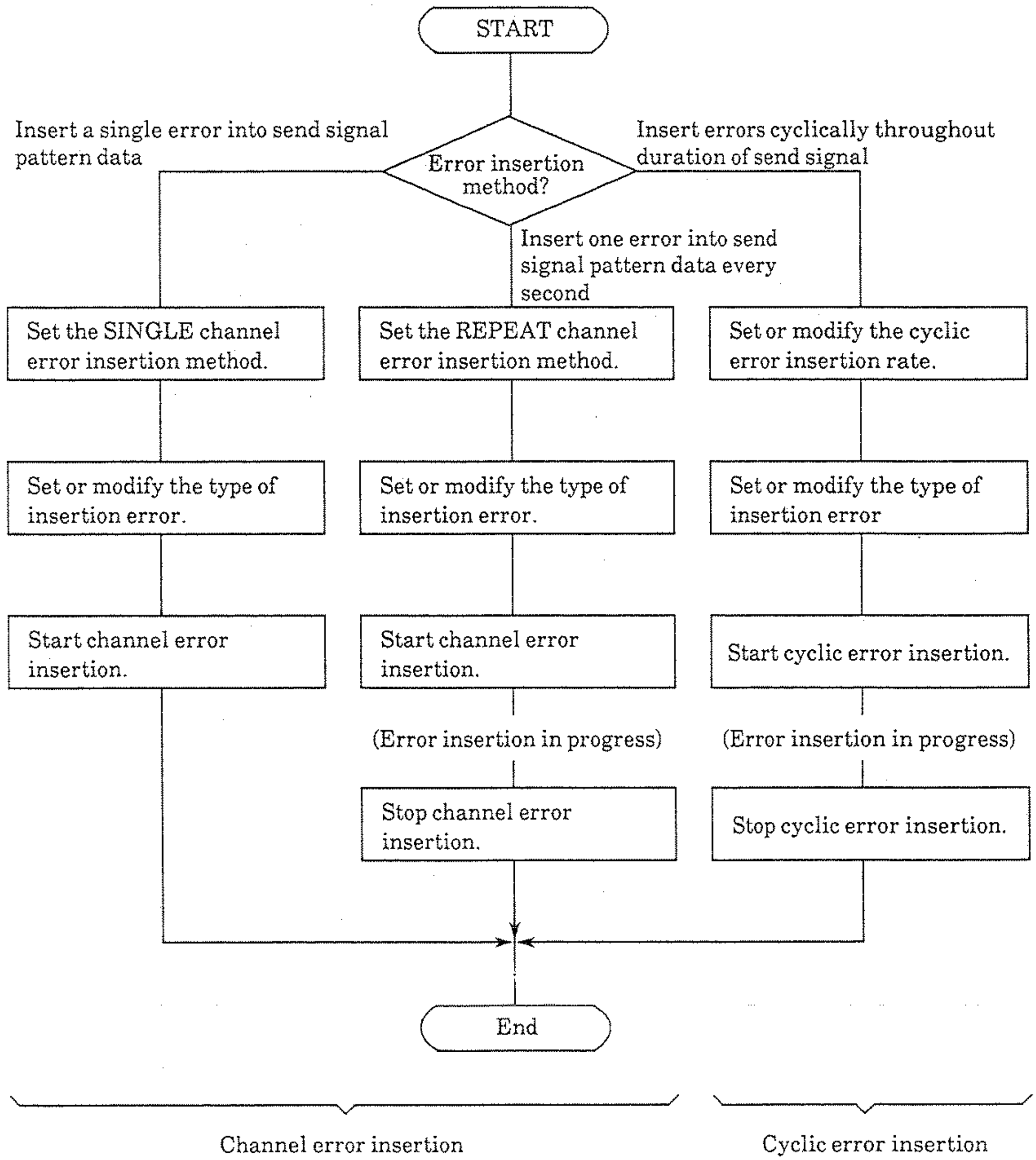
(6) Operation for long-term error measurements in repeat measurement mode and performing histogram, error distribution procedure, and other types statistical analyses.

3.6.2 General error measurement

START	
Prepare for measurement.	Insert the interface unit, connect the MD6420A to the DUT, and check the settings of the rear-panel FUNCTION switches.
Set the POWER switch to ON.	
Select the INTERFACE screen.	Press [F1] on the cursor-off MODE screen page 1 (M01) menu. For other screens, press [BACK SCREEN] once to redisplay the INTERFACE screen.
Set or modify the interface settings.	
Switch to the ERROR screen.	Press[F1] on the cursor-off INTERFACE screen page 1 (M01) menu.
Set or change the error measurement conditions.	
Start error measurement.	
Monitor results during measurement via the ERROR or DISPLAY OF RESULTS screen.	
Wait for the end of measurement, or stop measurement.	In the BIT measurement and TIME measurement, measurement ends automatically. In other measurement or to abort measurement, end measurement manually by pressing the STOP MEAS function key.
Turn on the printer and print the measured results.	Press [PRINTER OFF/ON]. The PRINTER ON LED lights. Then, press [F6] on the cursor-off ERROR screen page1 (M01) menu.
END	

3.6.3 Operation when inserting errored data into send data

This operation is performed from the ERROR screen. It can be specified whether measurement is in progress or not. Error insertion can also be started/stopped from the DISPLAY OF RESULTS screen.



- Cyclic error insertion and channel error insertion can be performed simultaneously.

3.6.4 Operation for long-term measurements and printing measured results whenever an error occurs and an alarm is generated/reset

For this operation, the printing conditions setting (interval) operation is added to the basic error measurement operation.

START	
Prepare for measurement. Set the interface conditions and select the ERROR screen.	
Set or modify the error measurement conditions.	Set the measurement to MANUAL, TIME or REPEAT
Select to CONDITION OF PRINT (INTERVAL) screen.	Press [F2] key of the cursor-off ERROR screen page 2 (M02) menu.
Set or modify the printing conditions.	The printing conditions can be set or modified whether or not measurement is in progress.
Return to the ERROR screen.	Press [BACK SCREEN].
Turn on the printer.	Press [PRINTER OFF/ON]. The PRINTER ON LED lights.
Start error measurement.	
Monitor intermediate measurement results via the ERROR or DISPLAY OF RESULTS screen.	
Wait for the end of measurement or stop measurement.	
Print the measured results.	
END	

3.6.5 Operation when making measurements in repeat measurement mode and printing measured results periodically

For this operation, the printing conditions setting (periodic) operation is added to the basic error measurement operation.

START	
Prepare for measurement. Set the interface conditions and switch to the ERROR screen.	
Set or modify the error measurement conditions.	Select the REPEAT measurement.
Switch to the CONDITION OF PRINT (PERIOD) screen.	Press [F3] on the cursor-off ERROR screen page 2 (M02) menu.
Set or modify the printing conditions.	The printing conditions can be set or modified whether or not a measurement is in progress.
Return to the ERROR screen.	Press [BACK SCREEN].
Turn on the printer.	Press [PRINTER OFF/ON]. The PRINTER ON LED lights.
Start error measurement.	
Monitor the intermediate measurement results and the periodic measured results for via the ERROR or DISPLAY OF RESULTS screen.	
Stop measurement.	Only the measured results specified by the CONDITION OF PRINT (PERIOD) screen are printed when measurement is stopped. To print all the data items, press [F6] on the cursor-off ERROR screen page 1 (M01) menu.
Print the measured results.	***Note:*** The INTERVAL printing and PERIOD printing can be performed simultaneously.
END	

3.6.6 Operation for long-term measurements and histogram analysis of error generation conditions relative to time

For this operation, the analysis data collection conditions setting and the analysis start operations are added to the basic error measurement operation.

START	
Prepare for measurement. Set the interface conditions and switch to the ERROR screen.	
Set or modify the error measurement conditions.	When performing error analysis, select the MANUAL, TIME, or REPEAT measurement.
Switch to the CONDITION OF COLLECT screen.	Press [F4] of the cursor-off ERROR screen page 1 (M01) menu.
Set or modify the collection conditions.	
Return to the ERROR screen.	Press [BACK SCREEN].
Start collection of data for analysis.	
Start error measurement.	
Wait for the end of measurement, or stop measurement.	
Return to the INTERFACE screen.	Press [BACK SCREEN].
Perform histogram, generation time distribution, and other analyses.	Press the ERROR ANALYSIS function key of the cursor-off INTERFACE screen page 2 (M02) menu. Then, select the area into which data is to be collected and the method of analysis. Refer to the MD0633A Error Analyze Unit operation manual for details.
END	

3.6.7 Operation for long-term error measurements in repeat measurement mode and histogram, error distribution, and other statistical analyses

For this operation, the analysis data collection conditions setting and analysis start operations are added to the basic error measurement operation. (The operating procedure is described in paragraph 3.6.6, however the conditions that may be set differ.)

START	
Prepare for measurement. Set the interface conditions and switch to the ERROR screen.	
Set or modify the error measurement conditions.	Set the measurement to REPEAT.
Switch to the CONDITION OF COLLECT screen.	Press [F4] of the cursor-off ERROR screen page 2 (M02) menu.
Set or modify the collection conditions.	
Return to the ERROR screen.	Press [BACK SCREEN].
Start collection of data for analysis.	
Start error measurement.	
Wait for the end of measurement, or stop measurement.	
Return to the INTERFACE screen.	Press [BACK SCREEN].
Perform histogram, generation time distribution, threshold value, etc. analyses via the appropriate ERROR ANALYSIS screen.	Press the ERROR ANALYSIS function key of the cursor-off INTERFACE screen page 2 (M02) menu. Then, select the area into which data will be collected and the method of analysis. Refer to the MD0633A Error Analyze Unit operation manual
END	

3.6.8 ERROR screen structure

The structure of the ERROR screen is shown below. The error measurement conditions are set via this screen.

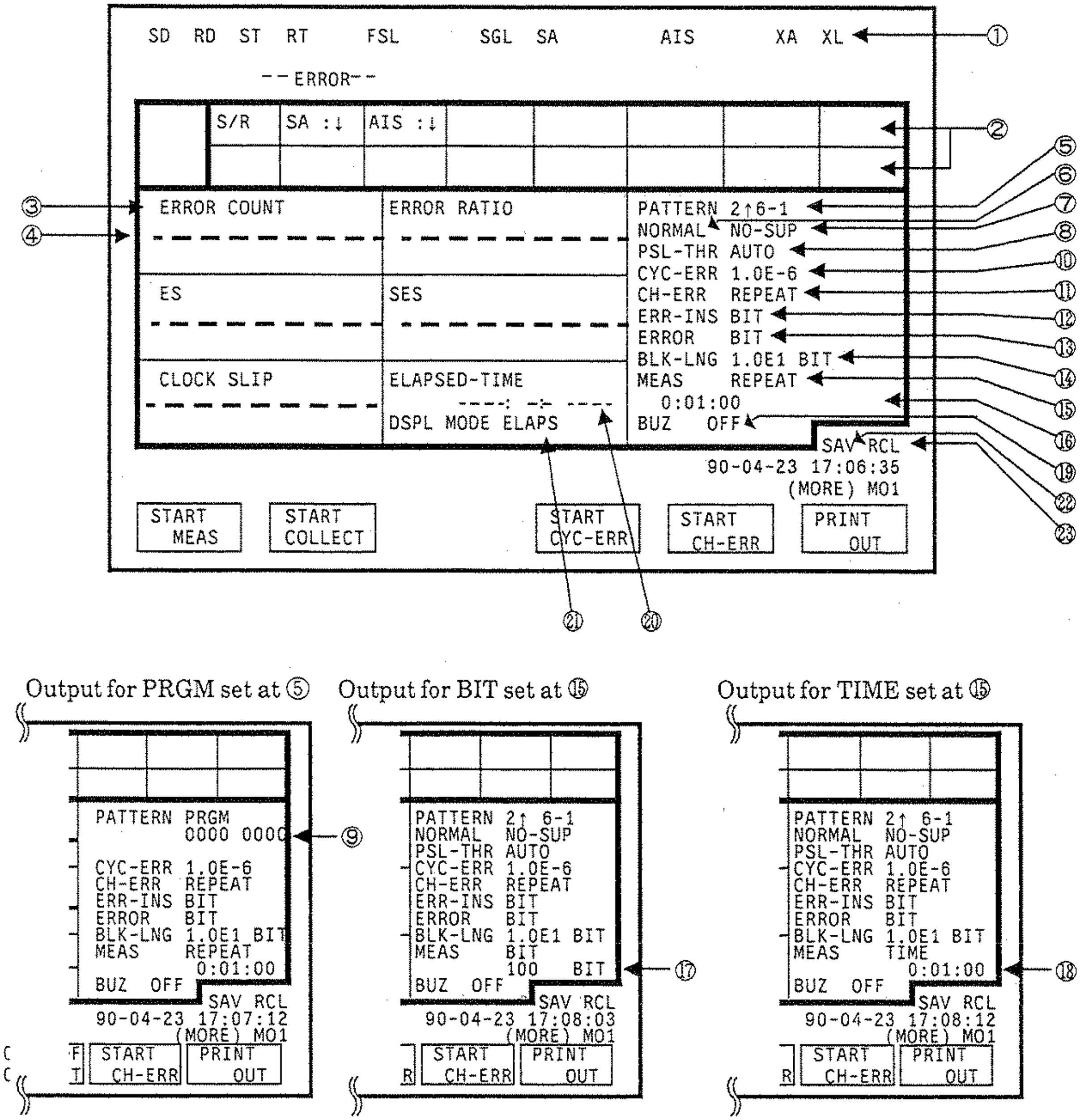


Fig. 3-4 ERROR Screen Structure

Table 3-3 Explanation of ERROR Screen

No.	Label	Name	Explanation	Setting	Setting during measure-ment
①		Monitor LED signal names	Displays name and connection circuit number of signal line and alarm signal represented by monitor LEDs	×	×
②	S/R, SND, RCV	Signal line and alarm signal settings	Displays signal line and alarm signal settings	○	○
③		Measured result item	Displays item name of results to be displayed at ④	○	○
④		Measured results	Displays measured results	×	×
⑤	PATTERN	Name of send and receive pattern	Displays name of send and bit error detection patterns used during error measurement	○	×
⑥		Type of send and receive patterns	Displays normal/invert and normal/reverse classification of pattern when pseudorandom pattern (2 ↑ n-1) is selected at ⑤	○	×
⑦		Suppress continuous zeros in send and receive pattern	Displays continuous 0s suppression method when pseudorandom pattern (2 ↑ n-1) is selected at ⑤	○	×
⑧	PSL-THR	Pseudorandom pattern sync loss detection threshold value	Displays pattern sync loss detection threshold value when pseudorandom pattern (2 ↑ n-1) is selected at ⑤	○	×
⑨		Programmable pattern	Displays 8-bit pattern when programmable pattern is selected at ⑤	○	×
⑩	CYC-ERR	Cyclic error insertion rate	Displays cyclic error insertion rate	○	○

○ : Enable
× : Disble

Table 3-3 Explanation of ERROR Screen (Cont'd)

No.	Label	Name	Explanation	Setting	Setting during measurement
⑪	CH-ERR	Channel error insertion method	Displays channel error insertion method	○	○
⑫	ERR-INS	Insertion error type	Displays type of error inserted as cyclic error/channel error	○	○
⑬	ERROR	Error item to be detected	Displays error to be detected	○	×
⑭	BLK-LNG	Block length	Displays bit length of one block when block errors are to be detected	○	×
⑮	MEAS	Measurement mode	Displays error measurement mode	○	×
⑯		Measurement interval	Displays measurement interval when REPEAT mode is selected at ⑮	○	×
⑰		Number of bits	Displays number of bits when BIT mode is selected at ⑮	○	×
⑱		Measurement time	Displays measurement time when TIME mode selected at ⑮	○	×
⑲	BUZ	Buzzer ON/OFF state	Displays whether or not buzzer sounds at error detection	○	○
⑳	ELAPSED-TIME	Elapsed time	Displays error measurement elapsed time or time from measurement start to measurement end	×	×
㉑	DSPL MODE	Results display mode	Displays display mode setting for ④ and ⑳	○	○
㉒	SAV	Preset memory save command label	Command label to save current interface conditions settings (including printing conditions) to preset memory	○	○
㉓	RCL	Preset memory recall command label	Command label to recall interface conditions and printing conditions saved in preset memory	○	○

3.6.9 DISPLAY OF RESULTS screen structure

The structure of the DISPLAY OF RESULTS screen is shown below. All error measured results are monitored at this screen.

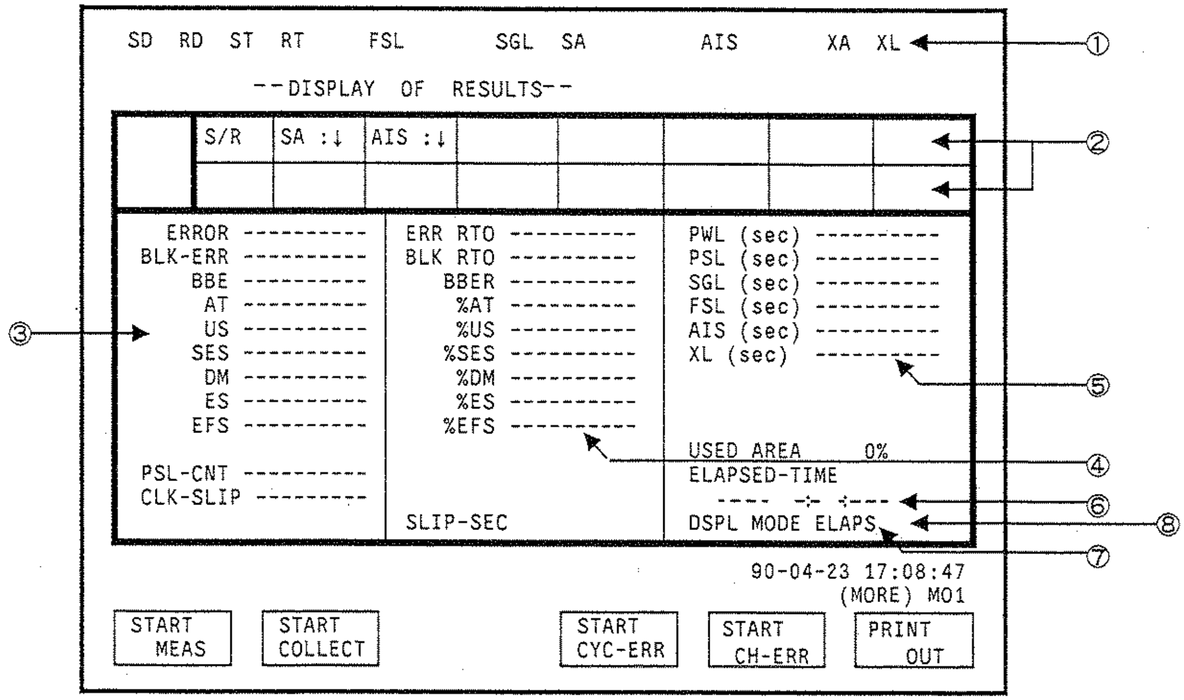


Fig. 3-5 DISPLAY OF RESULTS Screen Structure

Table 3-4 Explanation of DISPLAY OF RESULTS Screen

No.	Label	Name	Explanation	Setting	Setting during measurement
①		Monitor LED signal names	Displays name and connection circuit number of signal line and alarm signal represented by monitor LEDs	×	×
②	S/R, SND, RCV	Signal line and alarm signal setting	Displays signal line and alarm signal settings	○	○

Table 3-4 Explanation of DISPLAY OF RESULTS Screen (Cont'd)

No.	Label	Name	Explanation	Setting	Setting during measurement
③		Measured result display 1	Displays each item of measured result data or intermediate result data	×	×
	ERROR	Units Error count			
	BLK-ERR	Block error count Blocks			
	BBE	Background error count			
	AT	AT (Available time) seconds			
	US	US (Unabail Seconds) seconds			
	SES	SES (Severely Errored Seconds) seconds			
	DM	DM (Degraded Minutes) minutes			
	ES	ES (Errored Seconds) seconds			
	EFS	EFS (Errored Free Seconds) seconds			
	PSL-CNT	Pattern sync loss count			
	CLK-SLIP	Clock slip generation count			
④		Measured result display 2		×	×
	ERR RTO	Error ratio			
	BLK RTO	Block error ratio			
	BBER	Background error ratio			
	%AT	AT ratio (%)			
	%US	US ratio (%)			
	%SES	SES ratio (%)			
	%DM	DM ratio (%)			
	%ES	ES ratio (%)			
	%EFS	EFS ratio (%)			
	SLIP-SEC	Clock slip generation time seconds			
⑤		Measured result display 3	Displays each item of measured result data or intermediate result data "PWL (sec)" and "PSL (sec)" are displayed for all the interface units. Other items may not be displayed with the interface unit.	×	×
	PWL (sec)	Power loss time			
	PSL (sec)	Pattern sync loss time			
	SGL (sec)	Signal loss time			
	FSL (sec)	Frame sync loss time			
	AIS (sec)	AIS alarm generation time			
	XL (sec)	X.50 frame sync loss time			

Table 3-4 Explanation of DISPLAY OF RESULTS Screen (Cont'd)

No.	Label	Name	Explanation	Setting	Setting during measurement
⑥	ELAPSED-TIME	Elapsed time	Displays error measurement elapsed time or time from measurement start to measurement end	×	×
⑦	DSPL MODE	Result display mode	Displays display mode setting for ③, ④, ⑤, and ⑥.	○	○
⑧	USED AREA	Occupancy rate of error analysis data collection area	Displays occupancy rate of data collection area during error analysis data collection in %	×	×

○ : Enable
× : Disble

3.6.10 CONDITION OF PRINT (INTERVAL) screen structure

The structure of the CONDITION OF PRINT (INTERVAL) screen is shown below.

The printing conditions for interval printing (printing at error occurrence and alarm generation/reset) are set at this screen.

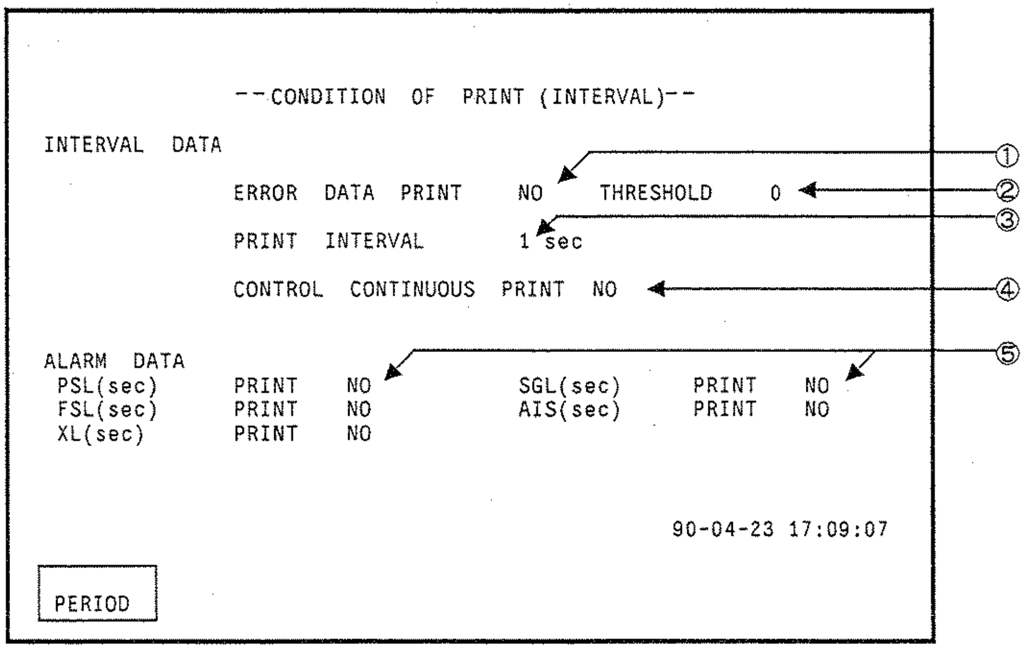


Fig. 3-6 CONDITION OF PRINT (INTERVAL) Screen Structure

Table 3-5 Explanation of CONDITION OF PRINT (INTERVAL) Screen

No.	Label	Name	Explanation	Setting	Setting during measurement
①	ERROR DATA PRINT	Interval data printing at error generation	Displays whether or not interval data is to be printed at error generation	○	○
②	THRESHOLD	Error generation judgment threshold value	Displays threshold value (error count) setting for interval printing. When error count > threshold value, interval printing is performed.	○	○
③	PRINT INTERVAL	Printing interval	Displays printing interval setting for error/alarm interval printing	○	○

Table 3-5 Explanation of CONDITION OF PRINT (INTERVAL) Screen (Cont'd)

No.	Label	Name	Explanation	Setting	Setting during measurement
④	CONTROL CONTINUOUS PRINT	Continuous printing control	Displays whether or not printing stopped (continuous printing control) when error/alarm interval printing continued from 10 times or more.	○	○
⑤	ALARM DATA PSL (sec) PRINT SGL (sec) PRINT FSL (sec) PRINT AIS (sec) PRINT XL (sec) PRINT	Interval data printing at alarm status change	Displays whether or not interval printing performed when alarm status (generation/reset) changed. "PSL" is displayed for all the interface units, but the other items may not be displayed with the interface unit.	○	○

○ : Enable

3.6.11 CONDITION OF PRINT (PERIOD) screen structure

The structure of the CONDITION OF PRINT (PERIOD) screen is shown below.

The printing items for REPEAT measurement end printing and other measurement stop and end printing are set at this screen.

Optional printing is performed by pressing [F6] (PRINT OUT) during measurement or at the end of measurement and prints all the items regardless of the settings at this screen.

```
                 --CONDITION  OF  PRINT (PERIOD)--

 PERIODIC / TOTAL  DATA
                                                                      ①
  ERROR  DATA   PRINT    NO         BLOCK  DATA   PRINT    NO
  BBER   DATA   PRINT    NO         AT     %AT    PRINT    NO
  US  %US       PRINT    NO         SES    %SES   PRINT    NO
  DM  %DM       PRINT    NO         ES     %ES    PRINT    NO
  EFS %EFS      PRINT    NO         PSL    COUNT  PRINT    NO
  CLK-SLIP      PRINT    NO         SLIP-SEC      PRINT    NO


 ALARM  DATA                                                          ②
  PWL(sec)      PRINT    NO         PSL(sec)      PRINT    NO
  SGL(sec)      PRINT    NO         FSL(sec)      PRINT    NO
  AIS(sec)      PRINT    NO         XL(sec)       PRINT    NO

                                          90-04-23 17:09:22
 INTERVAL
```

Fig. 3-7 CONDITION OF PRINT (PERIOD) Screen Structure

Table 3-6 Explanation of CONDITION OF PRINT (PERIOD) Screen

No.	Label	Name	Explanation	Setting	Setting during measurement
①	ERROR DATA PRINT BLOCK DATA PRINT BBER DATA PRINT AT %AT PRINT US %US PRINT SES %SES PRINT DM %DM PRINT ES %ES PRINT EFS %EFS PRINT PSL CONUT PRINT CLK-SLIP PRINT SLIP-SEC PRINT	Error data/error performance data printing setting	Displays whether or not each item printed	○	○
②	ALARM DATA PSL (sec) PRINT SGL (sec) PRINT FSL (sec) PRINT AIS (sec) PRINT XL (sec) PRINT	Alarm data printing setting	Displays whether or not each item printed	○	○

○ : Enable

× : Disable

3.6.12 CONDITION OF COLLECT screen structure

The structure of the CONDITION OF COLLECT screen is shown below. The data collection area and collection conditions for error analysis are set at this screen.

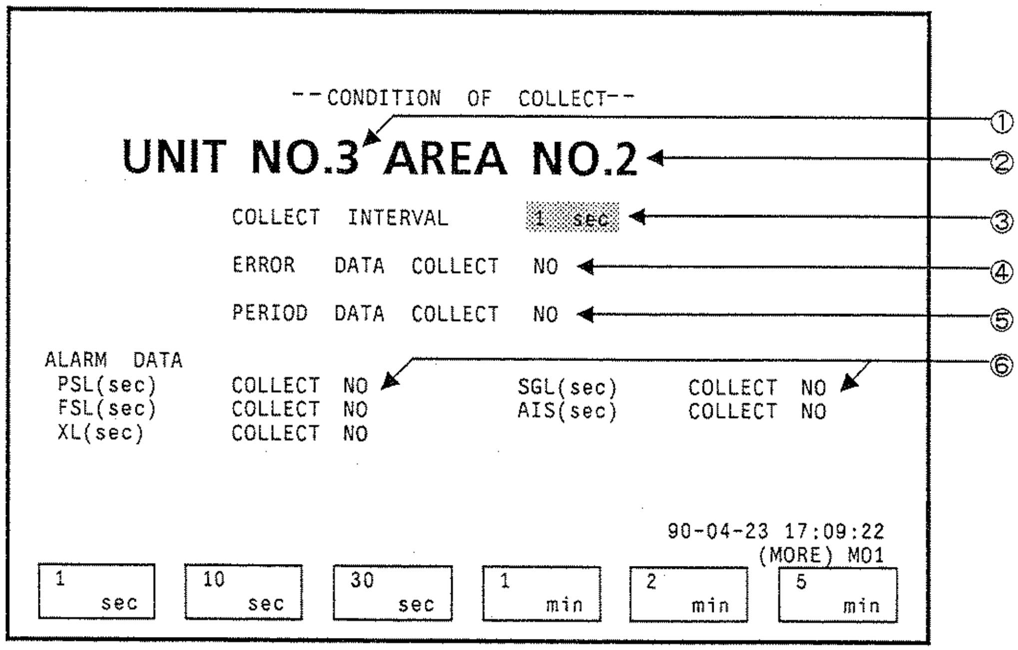


Fig. 3-8 CONDITION OF COLLECT Screen Structure

Table 3-7 Explanation of CONDITION OF COLLECT Screen

No.	Label	Name	Explanation	Setting	Setting during measure-ment
①	UNIT NO.	Data collection unit No.	Displays data collection area No. setting	○	×
②	AREA NO.	Data collection area No.	Displays data collection area No. setting During data collection, the current collection area No. is displayed. When data is not being collected, the usable area No. is displayed at the current vacant area.	○	×
③	COLLECT INTERVAL	Interval data collection interval	Displays interval data (error/alarm) collection interval setting	○	×

Table 3-7 Explanation of CONDITION OF COLLECT Screen (Cont'd)

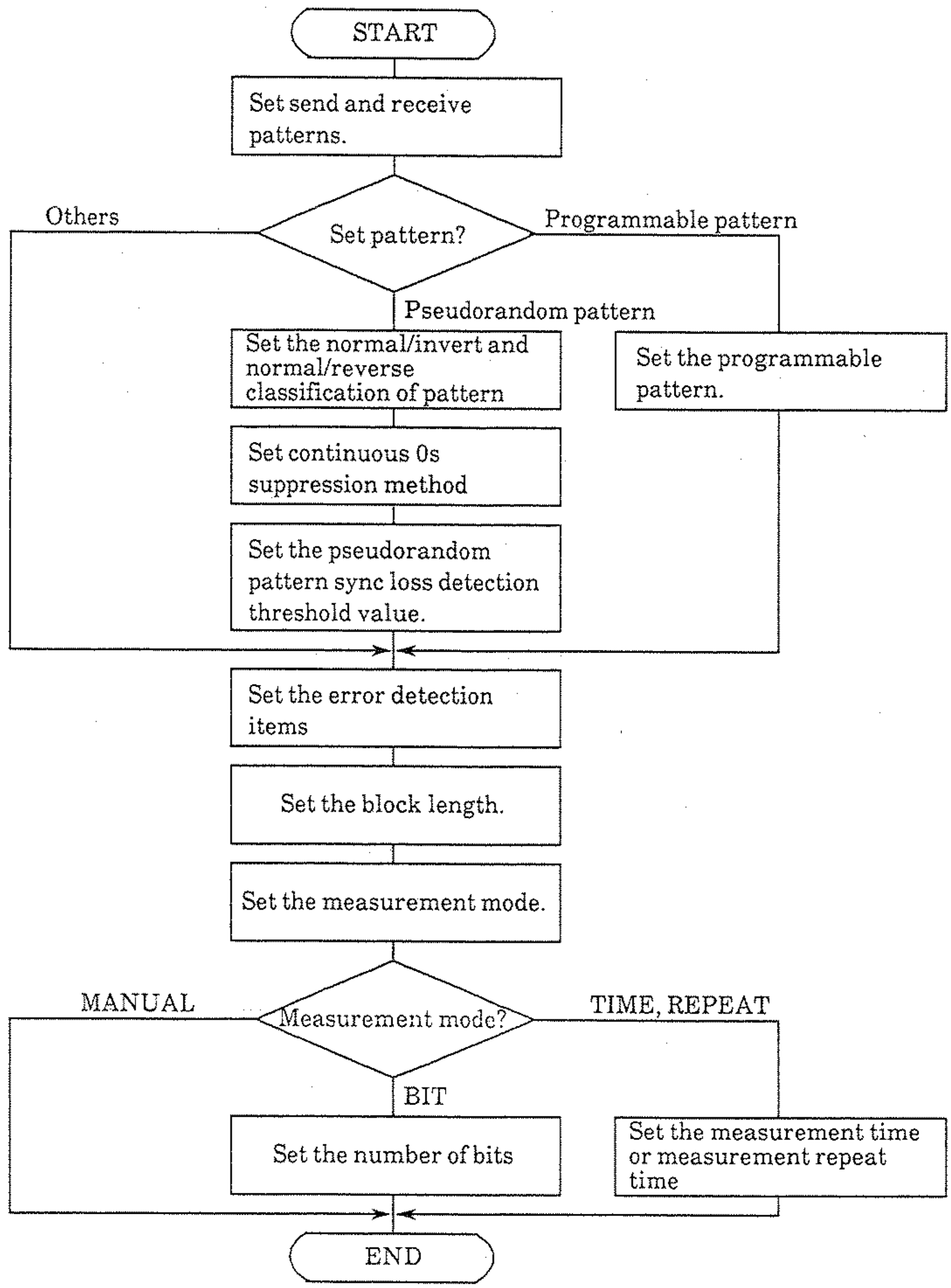
No.	Label	Name	Explanation	Setting	Setting during measure-ment
④	ERROR DATA COLLECT	Interval error data collection setting	Displays whether or not interval error data collection performed Interval error data is the data for histogram analysis, histogram + alarm analysis, continuous error generation time analysis, and error generation time interval analysis.	○	×
⑤	PERIOD DATA COLLECT	Periodic data (REPEAT measurement result) collection setting	Displays whether or not periodic data collection performed Periodic data is the data for threshold value distribution analysis.	○	×
⑥	ALARM DATA PSL(sec) COLLECT SGL(sec) COLLECT FSL(sec) COLLECT AIS (sec) COLLECT XL (sec) COLLECT	Interval alarm data collection setting	Displays whether or not interval alarm data collection performed Interval alarm data is the data for histogram + alarm analysis, and continuous alarm generation time, and alarm generation time interval analysis.	○	×

○ : Enable
× : Disable

3.6.13 Setting error measurement conditions

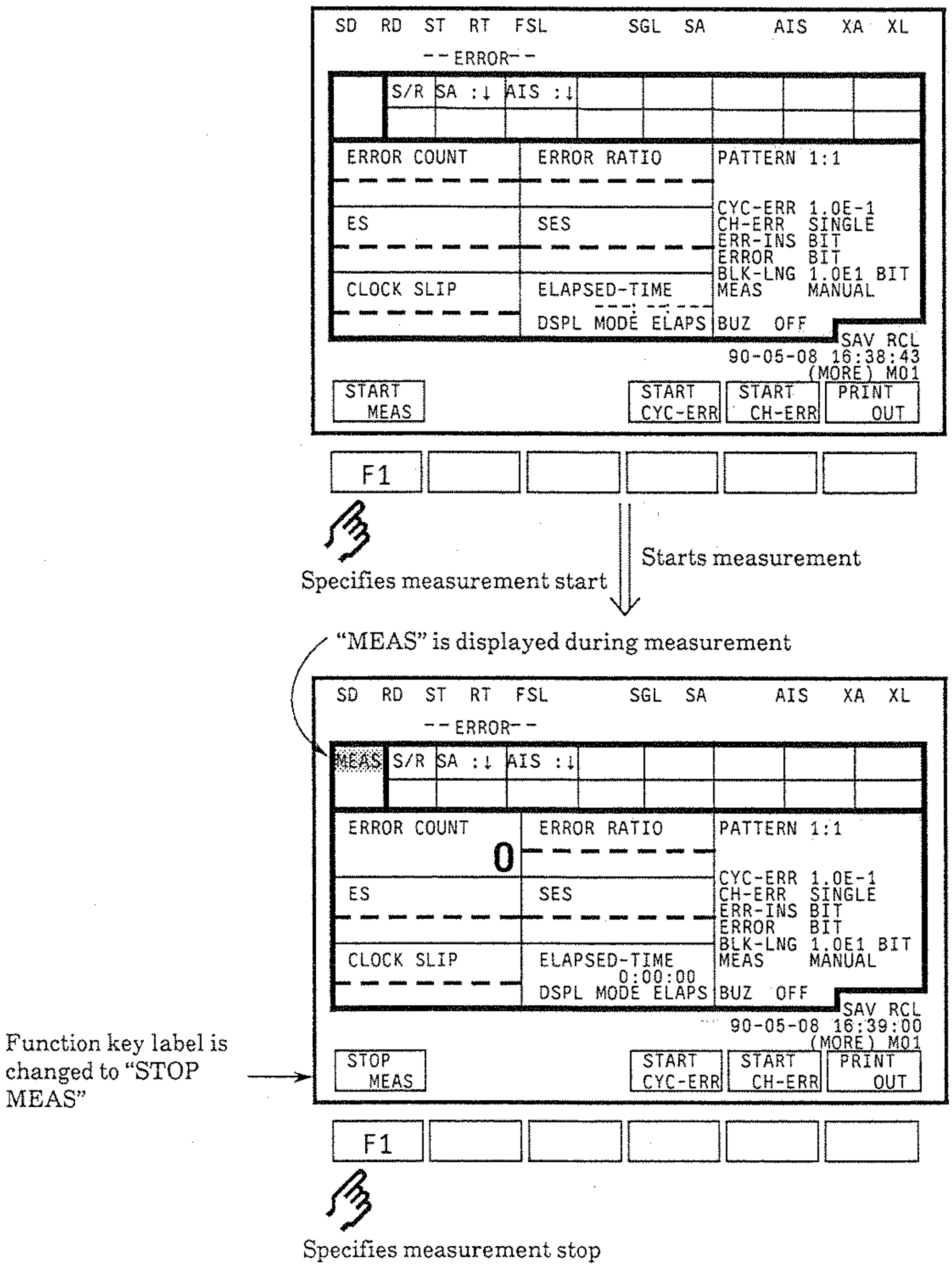
Error measurement condition setting is performed at the ERROR screen. Setting is performed sequentially from the top of the display. Items that are not set retain their current value.

Error measurement conditions setting procedure

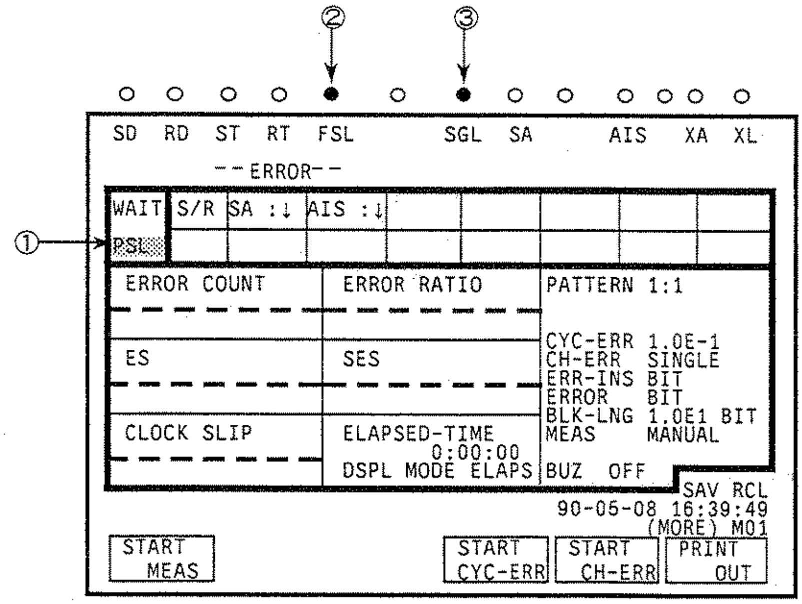


3.6.14 Start/stop error measurements

Error measurement is started and stopped from the cursor-off ERROR or DISPLAY OF RESULTS screen.



- When measurement start is specified, the following conditions are assessed and when all the conditions are satisfied, the instrument enters the measurement state. If any condition is not satisfied, the instrument waits ("WAIT" is displayed) and measurement does not start. Check the connections to the DUT and the interface and measurement conditions.



Conditions

① Pattern sync loss not generated?

② Frame sync loss not generated?

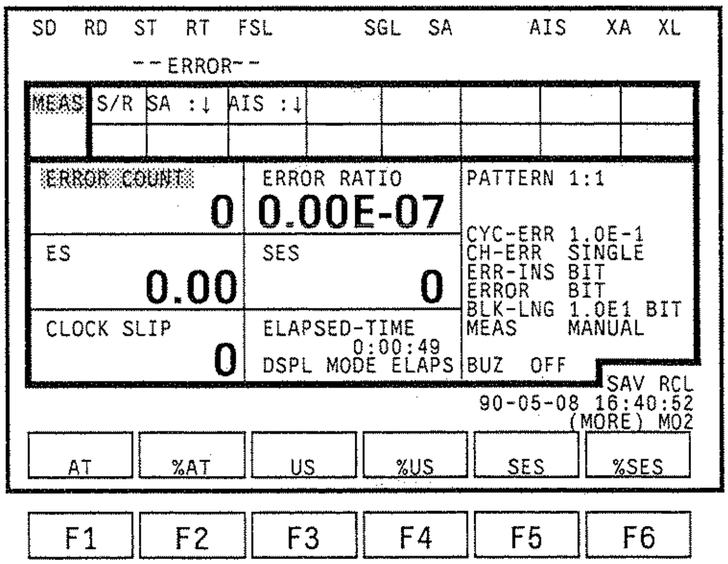
③ Signal loss not generated?

- BIT measurement and TIME measurement end automatically after the specified measurement time. To stop measurement on halfway press [F1] (STOP MEAS).
- At MANUAL measurement and REPEAT measurement, stop measurement by pressing [F1] (STOP MEAS).

3.6.15 Reading measured results

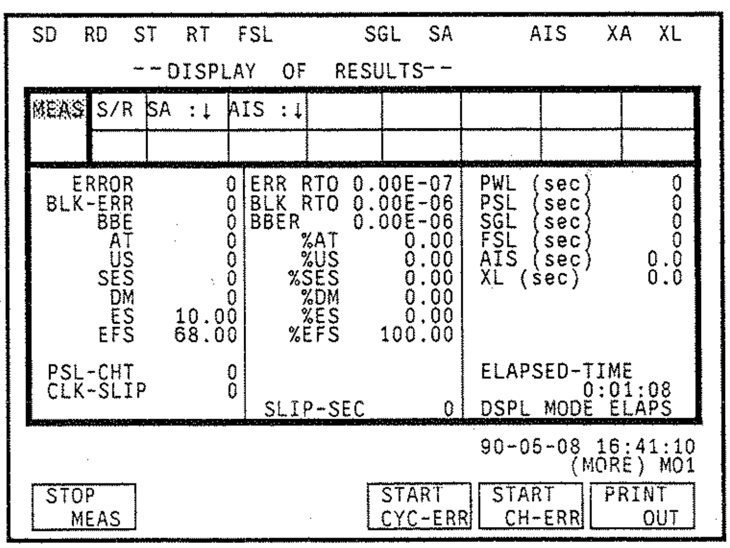
The intermediate measured result or measured result at measurement end or stop is monitored at the ERROR screen and DISPLAY OF RESULTS screen.

- ERROR Screen



- Five items selected by function keys can be monitored simultaneously. (Expanded character display)
- ERROR COUNT and BLK-ERR COUNT are displayed every time when the error occurs. Other items are displayed every second.

- DISPLAY OF RESULTS screen



- Error performance (21 items), PSL-CNT, CLK-SLIP, and alarm generation time (max. 7 items) can be monitored simultaneously.
- All the items are displayed every second.

- Display mode

At the REPEAT mode, there are two display modes (DSPL MODE): "ELAPS" and "PERIOD". The measured result differs with the display mode.

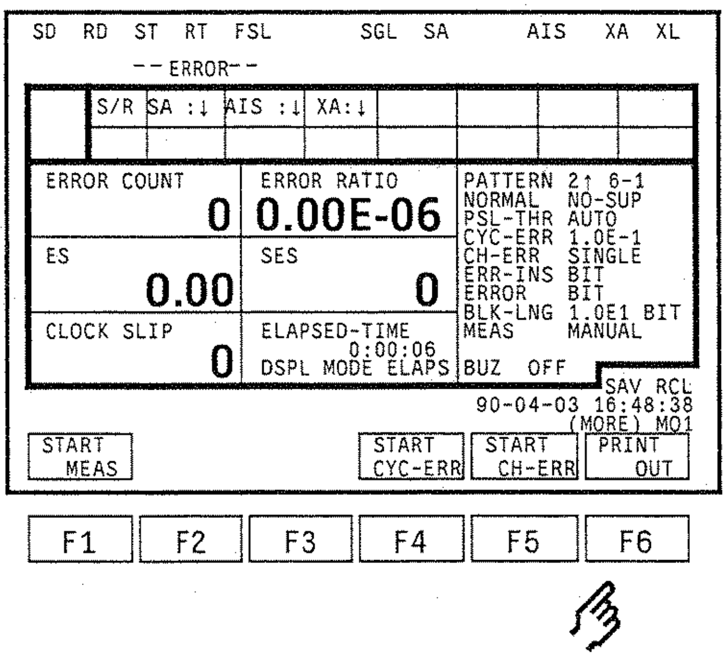
Elapse display (ELAPS) :	Display total measured result from measurement start. Displays results every second (or every time when error occurs)
Repeat measured results display (PERIOD) :	Displays measured results of one period just before the current period. " - - - " is displayed up to the end of one period from the start of measurement and the display is updated at the end of each period.

At the end of measurement, the results of the last period are displayed.

At the MANUAL, BIT, or TIME mode, only the ELAPS display can be used.

3.6.16 Printing measured results

To print the measured results during or after measurement press [PRINT OUT] on the ERROR screen.



Press function key F6 (PRINT OUT)

Depending on the display mode (DSPL MODE), the intermediate results, final results, or REPEAT measurement results will be printed.

(1) Example of printing after measurement stop/end.

REPEAT measurement results

```
==      ERROR      ==
91-12-24    19:30:21
INTF.RECV I431_1.5
PATTERN  2↑6-1‾NRML
          NO-SUP
PSL-THR   AUTO
MEAS ERR  BIT
BLK-LENG  1.0E1 BIT
MEAS REPT    0:01:00

<< PERIOD COUNT >>
 91-12-24    19:28:42
~91-12-24    19:29:42
ERR        0 0.00E-07
BLK        0 0.00E-06
BBE        0 0.00E-07
AT        60   100.00
US         0     0.00
SES        0     0.00
DM         0     0.00
ES      0.00     0.00
EFS    60.00   100.00
PSL-CNT             0
CLK-SLIP            0
SLIP-SEC            0
PWL(sec)            0
PSL(sec)            0
SGL(sec)            0
FSL(sec)            0
AIS(sec)          0.0
RAI(sec)          0.0
XL (sec)          0.0
```

Final results

```
==      ERROR      ==
91-12-24    19:28:26
INTF.RECV I431_1.5
PATTERN  2↑6-1‾NRML
          NO-SUP
PSL-THR   AUTO
MEAS ERR  BIT
BLK-LENG  1.0E1 BIT
MEAS REPT    0:01:00

<< TOTAL COUNT >>
 91-12-24    19:24:52
~91-12-24    19:28:02
 TOTAL-TM     0:03:10
ERR     2270 1.87E-04
BLK     2051 1.69E-03
BBE        1 8.31E-08
AT       190   100.00
US         0     0.00
SES        2     1.05
DM         0     0.00
ES      3.00     1.58
EFS   187.00    98.42
PSL-CNT             1
CLK-SLIP            0
SLIP-SEC            0
PWL(sec)            0
PSL(sec)            2
SGL(sec)            0
FSL(sec)            2
AIS(sec)          0.0
XL (sec)          0.0
```

(2) Example of printing during measurement

REPEAT measurement results

```
<< PERIOD COUNT >>
 91-12-24    19:28:42
~91-12-24    19:29:42
ERR        0 0.00E-07
BLK        0 0.00E-06
BBE        0 0.00E-07
AT        60   100.00
US         0     0.00
SES        0     0.00
DM         0     0.00
ES      0.00     0.00
EFS    60.00   100.00
PSL-CNT             0
CLK-SLIP            0
SLIP-SEC            0
PWL(sec)            0
PSL(sec)            0
SGL(sec)            0
FSL(sec)            0
AIS(sec)          0.0
RAI(sec)          0.0
XL (sec)          0.0
```

Cumulative measurement results from start of measurement

```
<< ELAPSED COUNT >>
 91-12-24    19:28:42
~91-12-24    19:30:01
ERR        0 0.00E-07
BLK        0 0.00E-06
BBE        0 0.00E-07
AT        79   100.00
US         0     0.00
SES        0     0.00
DM         0     0.00
ES      0.00     0.00
EFS    79.00   100.00
PSL-CNT             1
CLK-SLIP            0
SLIP-SEC            0
PWL(sec)            0
PSL(sec)            0
SGL(sec)            0
FSL(sec)            0
AIS(sec)          0.0
RAI(sec)          0.0
XL (sec)          0.0
```

3.6.17 Setting error measurement printing conditions

To print all measurement items, press [PRINT OUT]. During error measurement, results may also be printed at specific intervals or periodically as follows.

Interval printing : When an error is detected or when the alarm status (generated/result) changes, the time and measured results are printed.

Periodic printing : When the measurement mode is REPEAT, the measured results are printed at the end of each repeat measurement. In all measurement modes, the measured results are also printed at measurement stop/end.

For these two kinds of printing, the printing conditions can be set so that only the required data is printed.

(1) Periodic printing conditions

Specify the items to be printed on the CONDITION OF PRINT (PERIOD) screen.

(2) Interval printing conditions

Set the interval error detection conditions and interval alarm detection conditions on the CONDITION OF PRINT (INTERVAL) screen.

Setting procedure

START

Set the error detection interval.

Enable/disable continuous printing

Enable/disable interval printing on error generation.

Set the error generation threshold value.

Enable/disable interval printing in response to changes in alarm status.

END

Printing examples are shown below.

(1) Periodic printing

Printing conditions : ERROR-DATA, US, SES, ES, EFS, PSL-CNT, PSL (sec), FSL (sec), AIS (sec) XL (sec) --- "YES"

Others --- "NO"

REPEAT measurement result printing

```
<<  PERIOD COUNT  >>
 90-05-09    09:36:58
~90-05-09    09:37:08
ERR         1 1.56E-06
US          0     0.00
SES         0     0.00
ES       1.00    10.00
EFS      9.00    90.00
PSL-CNT              0
CLK-SLIP             0
PSL(sec)             0
FSL(sec)             0
AIS(sec)           0.0
XL(sec)            0.0
```

Results printed when measurement is completed

```
<<  TOTAL   COUNT   >>
 90-05-09    09:36:48
~90-05-09    09:37:45
 TOTAL-TM     0:00:57
ERR      8207 2.25E-03
US          0     0.00
SES         3     5.26
ES       8.00    14.04
EFS     49.00    85.96
PSL-CNT              3
CLK-SLIP             0
PSL(sec)             3
FSL(sec)             3
AIS(sec)           0.0
XL(sec)            0.0
```

(2) Interval printing

Printing conditions :

Interval	--- 1 second
Continuous printing control	--- NO (no control)
Interval error data	--- YES
Threshold value	--- 5 (Print if more than 5 errors occur)
Interval alarm data	
PSL (sec)	--- YES
FSL (sec)	--- YES

```
 90-05-09   09:37:29
E      3091      2315
A  PSL(sec) FSL(sec)
 90-05-09   09:37:30
R PSL(sec)  FSL(sec)
 90-05-09   09:37:36
E      2673      1574
A  PSL(sec) FSL(sec)
 90-05-09   09:37:37
R  PSL(sec) FSL(sec)
```

Detected error (The number on the left is the number of errors and the number on the right is the number of block errors.)

PSL (sec), FSL (sec) alarm generation

PSL (sec), FSL (sec) alarm reset

3.6.18 Setting error analysis data collection conditions

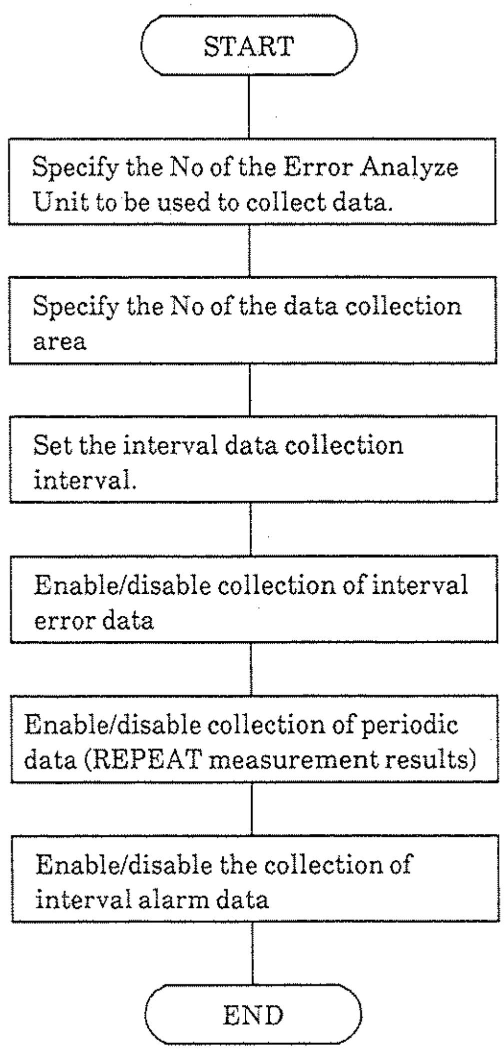
To collect error analysis data,

(1) the MD0633A Error Analyze Unit must be inserted

(2) there must be area available in the Error Analyze Unit.

Specify the data to be collected and other collection conditions on the CONDITION OF COLLECT screen, then start collection.

Collection conditions setting procedure



The following data must be collected to perform the appropriate analyses.

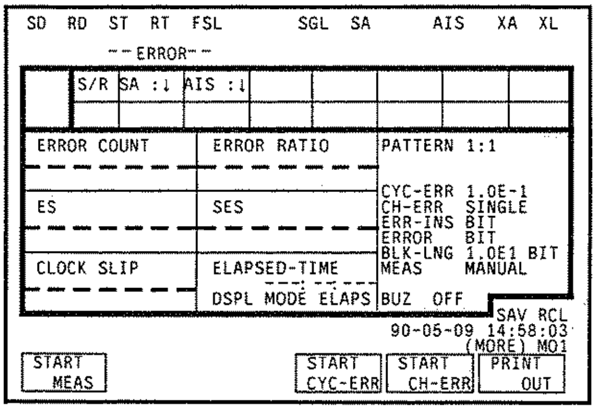
Analysis / Required data	Histogram	Histogram + alarm	Trace	Time between errors	Time to recover from error	Density
Interval error data	○	○	△	△	△	
Interval alarm data		○	△	△	△	
Periodic data			△			○

○ : Necessary

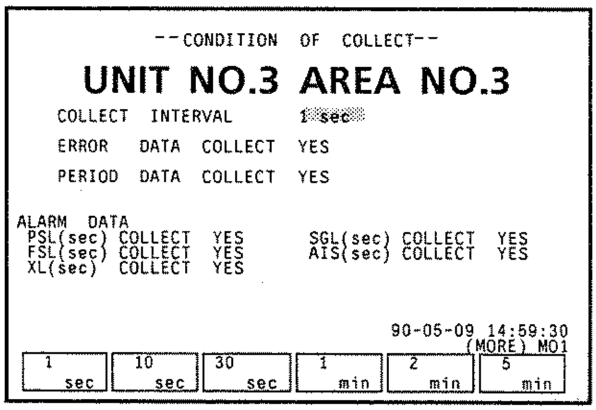
△ : When collected, the data can be analyzed.

3.6.19 Starting/stopping collection of error analysis data

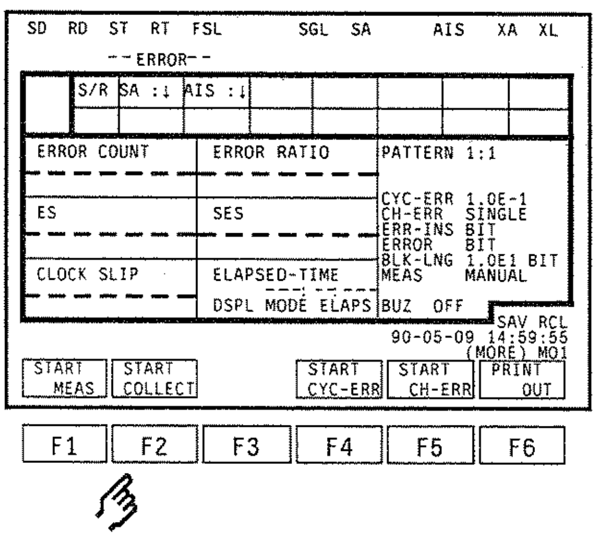
The collection of Error analysis data is started and stopped via the ERROR screen or DISPLAY OF RESULT screen. The area in which data is to be saved is set on the CONDITION OF COLLECT screen before beginning data collection.



- When the Error Analyze Unit is not installed, when no collection areas are available, or when a collection area is not specified, the [START COLLECT] label is not displayed on the ERROR screen.
  Verify that the Error Analyze Unit is inserted and select the CONDITION OF COLLECT screen by pressing [F4] of the cursor-off ERROR screen page 2 (M02) menu.

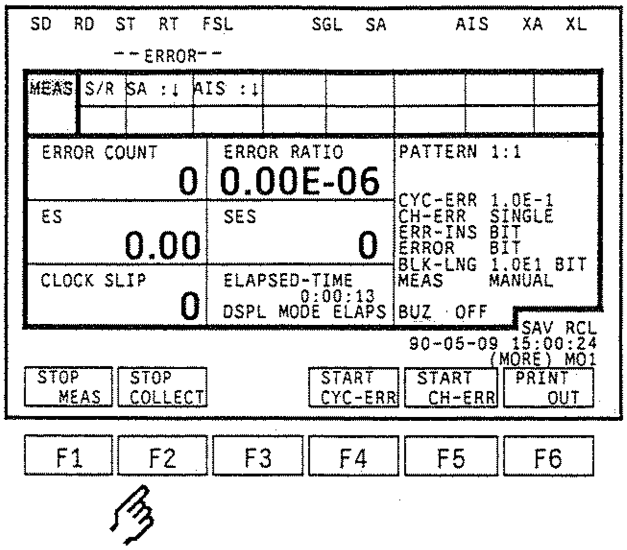


- When the CONDITION OF COLLECT screen is displayed, the number of the lowest available area (vacant area) is set.
  To change the area number, move the cursor to the AREA NO. display and set the desired area number with the function keys.
- Press [BACK SCREEN] to return to the ERROR screen.



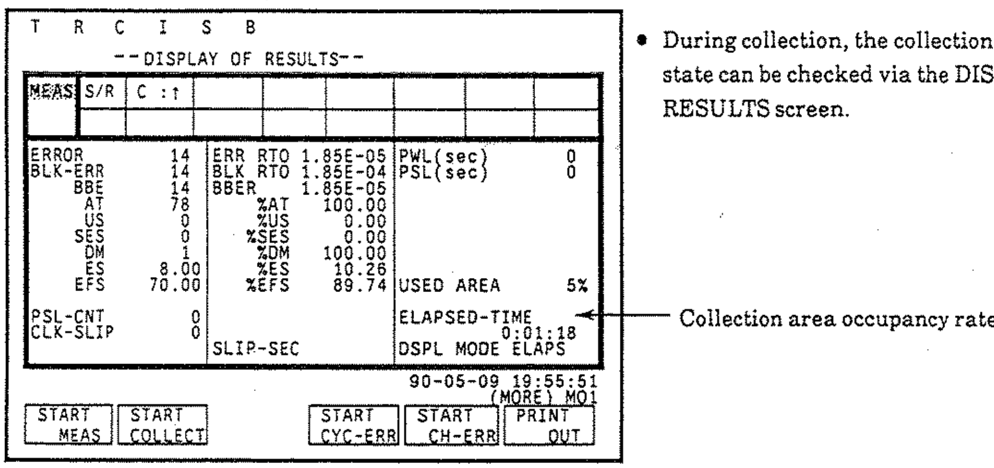
Press [F2] then [F1] or [F1] then [F2].

- Verify that [START COLLECT] is displayed at [F2].
  Start data collection by pressing [F2] then [F1] or [F1] then [F2].

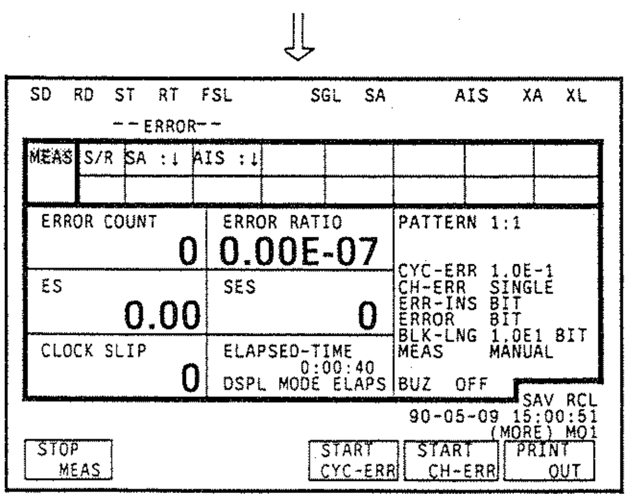


- When [F2] (START COLLECT) is pressed, the [F2] label changes to [STOP COLLECT].
  To stop collection, press [F2].

To discontinue data collection, press [F2].



- During collection, the collection area occupancy state can be checked via the DISPLAY OF RESULTS screen.



- When data collection is discontinued or when the collection area becomes full, data collection is aborted and the [F2] label goes off.

3.7 Voltage Measurement

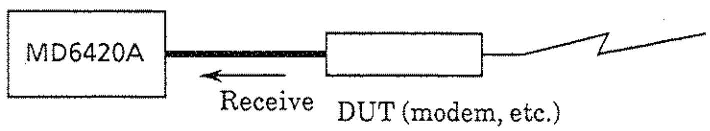
3.7.1 Overview

Voltage measurement is performed via the VOLT/FREQUENCY screen. Voltage measurements can be performed via the following interfaces:

MD0621A	V.24/V.28 (RS-232C)	Interface Unit
MD0621A	V.35	Interface Unit
MD0621C	V.36 (RS-499)	Interface Unit
MD0621D	X.20 (RS-423)/X.21 (RS-422)	Interface Unit

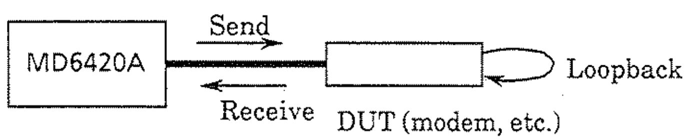
Measurement setup

(1) Interface line voltage measurement on signal received from DUT



Measure the voltage after setting the receive interface unit as required for the DUT via the INTERFACE screen.

(2) Measure the voltage of the line by looping back the fixed-pattern data.



Measure the voltage after setting the send interface unit and receive interface unit as required for the DUT via the INTERFACE screen.

3.7.2 Voltage measurement screen structure

The voltage measurement portion of the VOLT/FREQUENCY screen is shown below.

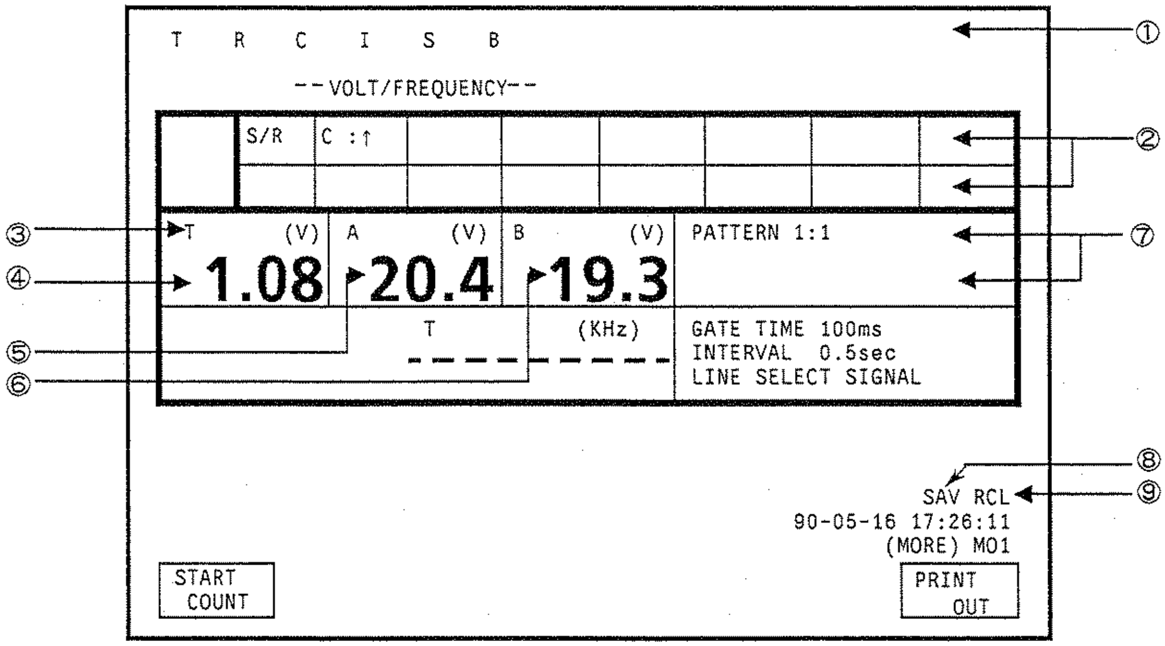


Fig. 3-9 Voltage Measurement Screen Structure

Table 3-8 Explanation of Voltage Measurement Screen

No.	Label	Name	Explanation	Setting	Setting during measurement
①		Monitor LED signal names	Displays name and connection circuit number of signal lines and alarm signal represented by the monitor LEDs	×	×
②	SR/, SND, RCV	Signal line and alarm signal settings	Displays signal line and alarm signal settings	○	○
③		Name of signal whose voltage is to be measured	Displays name of receive interface unit signal line to be measured	○	○
④		Measured voltage	Periodically displays measured voltage value	×	×

Table 3-8 Explanation of Voltage Measurement Screen (Cont'd)

No.	Label	Name	Explanation	Setting	Setting during measurement
⑤	A	Measured voltage of balanced line A	Displays measured A line voltage when interface line is a balanced line	×	×
⑥	B	Measured voltage of balanced line B	Displays measured B line voltage when interface line is a balanced line	×	×
⑦	PATTERN	Send pattern setting	Displays current send pattern This is the same as ⑤, ⑥, ⑦, and ⑨ of the ERROR screen (paragraph 3.6.8).	○	○
⑧	SAV	Preset memory save command label	Command label to save current interface and measurement conditions to preset memory (including frequency measurement conditions)	○	○
⑨	RCL	Preset memory recall command label	Command label to recall current interface and measurement conditions saved in preset memory	○	○

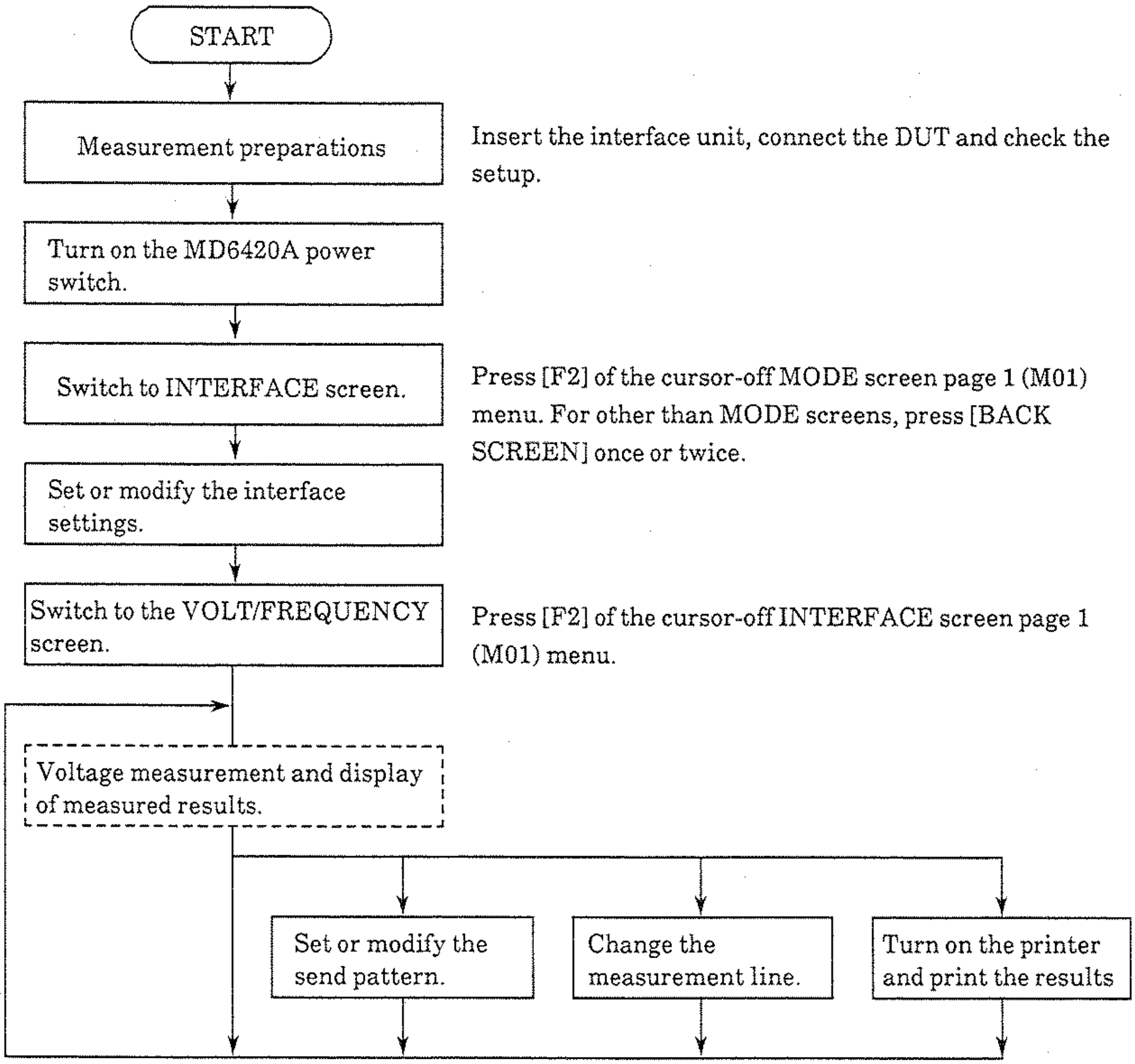
○ : Enable
× : Disable

3.7.3 Voltage measurement procedure

When the VOLT/FREQUENCY screen is selected, voltage measurements start immediately and the measured value is displayed every 500 ms.

To change the measurement line or send pattern, move the cursor to the required item and change it.

After a condition has been changed, measurements are performed under these new conditions and results are displayed every 500 ms.



Press [PRINTER OFF/ON]; the PRINTER ON LED lights. Press [F6] of the cursor-off ERROR screen page 1 (M01) menu.

3.8 Frequency Measurement

3.8.1 Overview

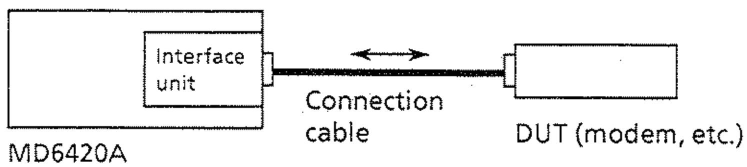
Frequency is measured via the VOLT/FREQUENCY screen.

The frequency and number of rising edges of pulses can be counted for the following signals.

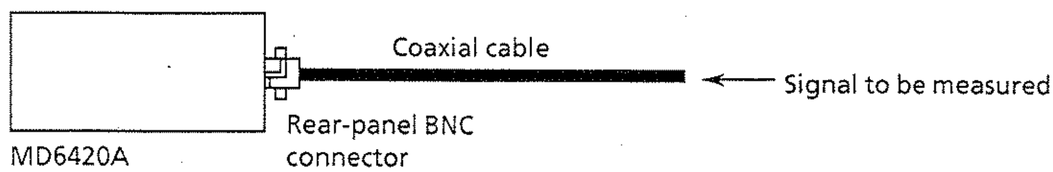
- Frequency and number of rising edges for the receive unit send clock line, receive data line, and other signal lines (interface lines) frequency or rising edge count.
- Number of rising edges for the Receive unit alarm signal (alarm displayed via monitor LEDs)
- Number of rising edges for the external signal (TTL level) input from rear panel

Measurement setup

(1) Counting the frequency or number of rising edges on signal lines and alarms



(2) Counting number of rising edges on external signal (TTL level)



3.8.2 Frequency measurement screen structure

The frequency measurement part of the VOLT/FREQUENCY screen is shown below.

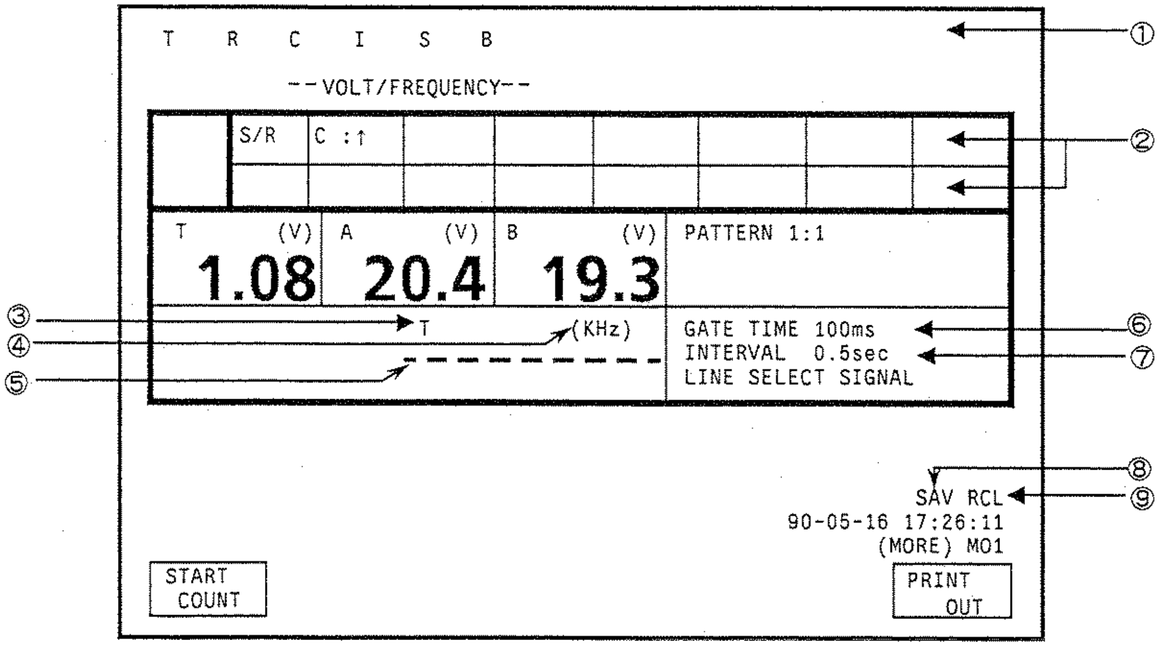


Fig. 3-10 Frequency Measurement Screen Structure

Table 3-9 Explanation of Frequency Measurement Screen

No.	Label	Name	Explanation	Setting	Setting during measurement
①		Monitor LED signal names	Displays name and connection circuit number of signal lines and alarm signals represented by the monitor LEDs	×	×
②	S/R, SND, RCV	Signal line and alarm signal settings	Displays signal line and alarm signal settings	○	○
③		Signal to be measured	Displays name of signal line to be measured	○	○
④		Units	Displays units of measured frequency result	×	×

Table 3-9 Explanation of Frequency Measurement Screen (Cont'd)

No.	Label	Name	Explanation	Setting	Setting during measure-ment
⑤		Measured Frequency	Displays measured frequency	×	×
⑥	GATE TIME	Frequency measurement time	Displays time over which the frequency was measured	○	×
⑦	INTERVAL	Frequency measurement repetition interval	Displays frequency measurement repetition interval	○	×
⑧	SAV	Preset memory save command label	Command label to save current interface conditions and frequency measurement conditions (including voltage measurement conditions) to preset memory	○	○
⑨	RCL	Preset memory recall command label	Command label to recall the interface conditions and measurement conditions saved in preset memory	○	○

○ : Enable
× : Disable

3.8.3 Frequency measurement procedure

START

1. **Measurement preparations** — Insert the interface unit, connect the DUT and check the setup.
2. **Turn on the MD6420A power switch.**
3. **Switch to INTERFACE screen.** — Press [F2] of the cursor-off MODE screen page 1 (M01) menu. For screens other than the MODE screen, press [BACK SCREEN] once or twice.
4. **Set or modify the interface conditions.**
5. **Switch to the VOLT/FREQUENCY screen.** — Press [F2] of the cursor-off INTERFACE screen page 1 (M01) menu.
6. **Set or modify the frequency measurement conditions** — Set the signal line to be measured, measurement time, and measurement interval
7. **Start frequency measurement.** — Press [F1] of the cursor-off VOLT/FREQUENCY screen page 1 (M01) menu.
8. **Monitor the measured result.** (optional)
   - Change the signal line to be measured.
   - Turn on the printer and print the results.
   - (repeat measurement)
9. **Wait for the end of measurement, or stop measurement.** — When a frequency-measurement repeat interval mode is MANUAL, measurement ends automatically. In the other modes or to stop measurement in halfway, press [STOP COUNT].
10. **Turn on the printer and print the measured result** — Press [PRINTER OFF/ON]. The PRINTER ON LED lights. Then press [F6] of the cursor-off VOLT/FREQUENCY screen page 1 (M01) menu.

END

3.9 Line Interval Measurement

3.9.1 Overview

Line interval measurement is performed via the DELAY TIME screen. The time between level transitions in the following signals can be measured.

- Measurement start and stop points

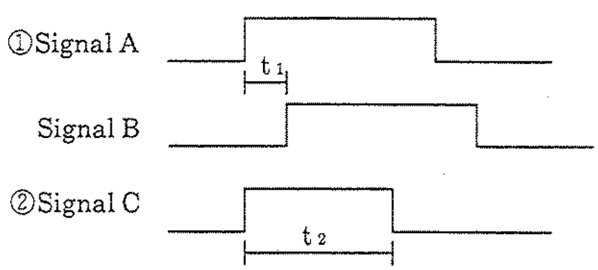
(1) Rising (OFF→ON, 0→1) or falling edge (ON→OFF, 1→0) of the line and alarm signals of the receive or send interface units.

(2) Rising or falling edges of external signal (TTL level) input to the real panel

- Valid combinations of measurement signals

  The interval between the transitions of any two arbitrary signals can be measured provided that the signals originate from the same interface unit.

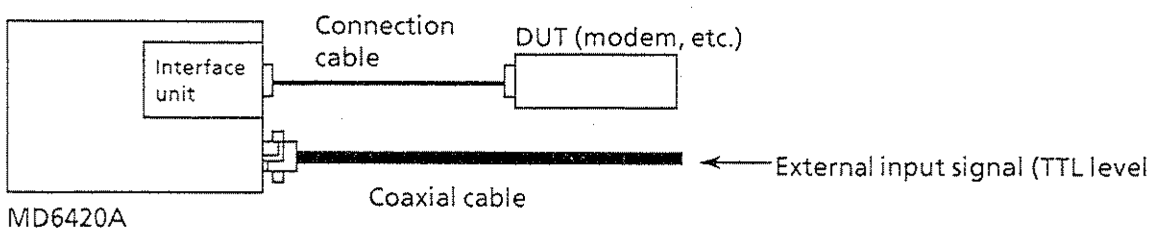
- Combination examples



The delay time (t1) between the rising edges of A and B is measured by assigning the rising edge of signal A as the start point and the rising edge signal B as the stop point.

The signal C ON time (t2) is measured by assigning the rising edge of C as the start point and the falling edge of C as the stop point.

Measurement Setup



3.9.2 Line interval measurement screen structure

The line interval is measured by setting LINE INTERVAL measurement mode on the DELAY TIME screen

The structure of the DELAY TIME screen at this time is shown below.

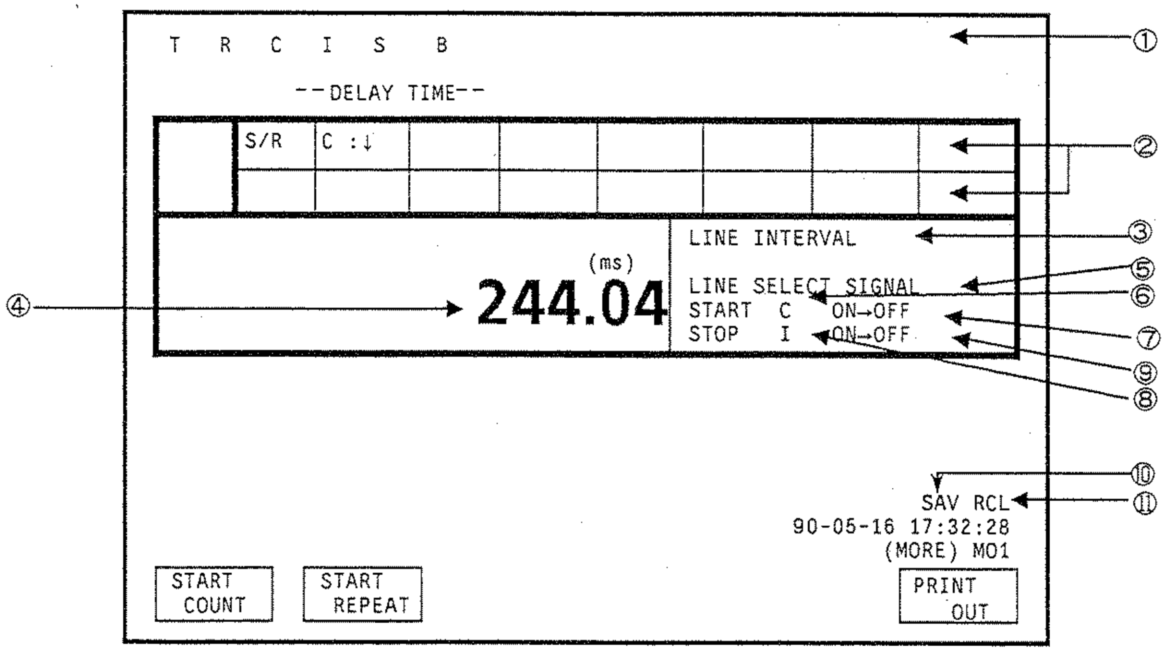


Fig. 3-11 Line Interval Measurement Screen Structure

Table 3-10 Explanation of Line Interval Measurement Screen

No.	Label	Name	Explanation	Setting	Setting during measurement
①		Monitor LED signal names	Displays name and connection circuit number of signal lines and alarm signals represented by monitor LEDs	×	×
②	S/R, SND, RCV	Signal line and alarm settings	Displays signal line and alarm signal settings	○	○
③		Measurement mode	Displays current measurement mode For line interval measurements, select LINE INTERVAL.	○	×
④		Measured value	Displays measured line interval value	×	×
⑤	LINE SELECT	Signal line selection	Displays sending/receiving signal line selection When the same unit sends and receives signals "SIGNAL" is displayed	○	×
⑥	START	Measurement start trigger signal name	Displays name of signal whose transition starts measurement.	○	×
⑦		Specified transition	Displays high to low or low to high as measurement start trigger	○	×
⑧	STOP	Measurement stop trigger signal name	Displays name of signal whose transition stops measurement	○	×
⑨		Specified transition	Displays high to low or low to high as measurement stop trigger.	○	
⑩	SAV	Preset memory save command label	Command label to save current interface and line interval measurement conditions to preset memory	○	○
⑪	RCL	Preset memory recall command label	Command label to recall current interface and measurement conditions saved in preset memory	○	○

○ : Enable

× : Disable

3.9.3 Line interval measurement procedure

START	
Measurement preparations	Insert the interface unit, connect the DUT and check the setup.
Turn on the MD6420A power switch.	
Switch to the INTERFACE screen.	Press [F2] of the cursor-off MODE screen page 1 (M01) menu. For screens other than MODE screen, press [BACK SCREEN] once or twice.
Set or modify the interface conditions.	
Switch to the DELAY TIME screen.	Press [F3] of the cursor-off INTERFACE screen page 1 (M01) menu.
Set the measurement mode to LINE INTERVAL.	When the cursor $\boxed{\geq}$ key is pressed once in the cursor-off state, the cursor is displayed at the measurement mode area. Select line interval measurement by pressing [F1].
Set or modify the line interval measurement conditions.	Set or modify the measurement start trigger/stop trigger conditions.
Start line interval measurement.	For signal measurement, press [F1] (START COUNT) For repeat measurement, press [F2] (START REPEAT)
Check the measured value	
Wait for the end of measurement, or PRESS (STOP MEAS) stop measurement.	For single measurement, measurement ends automatically. For repeat measurement, manually end measurement.
Turn on the printer and print the measured results	Press [PRINTER OFF/ON]. The PRINTER ON LED lights. Then press [F6] of the cursor-off DELAY TIME screen page 1 (M01) menu.
END	

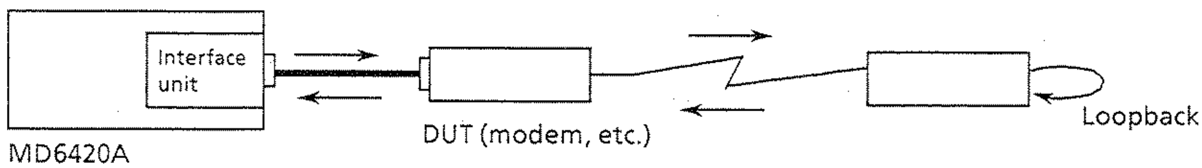
3.10 Transmission Delay Time Measurement

3.10.1 Overview

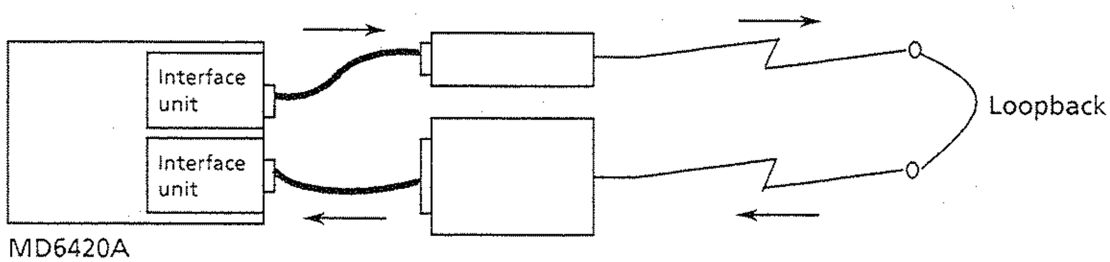
The transmission delay time is measured via the DELAY TIME screen

Measurement setup

(1) When same interface unit is used for send and receive



(2) Different interface units are used (whether they are the same or different types)



A special measurement pattern is sent from the MD6420A and looped back. Then the time at which it is received is measured.

3.10.2 Transmission delay time measurement screen structure

The transmission delay time is measured by setting the measurement mode on the DELAY TIME screen to TRANSMIT DELAY. The structure of the DELAY TIME screen at this time is shown below.

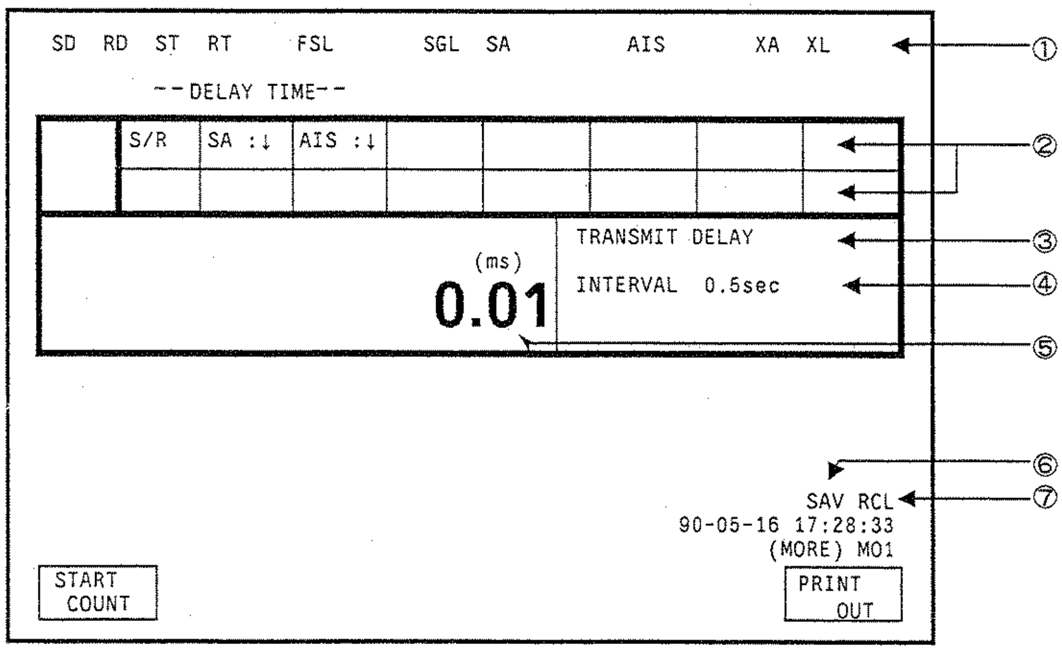


Fig. 3-12 Transmission Delay Time Measurement Screen Structure

Table 3-11 Explanation of Transmission Delay Time Screen

No.	Label	Name	Explanation	Setting	Setting during measurement
①		Monitor LED signal names	Displays name and connection circuit number of signal lines and alarm represented by monitor LEDs	×	×
②	S/R , SND , RCV	Signal line and alarm signal settings	Displays signal line and alarm signal settings	○	○
③		Measurement mode	Displays current measurement mode For the transmission delay time measurements, select TRANSMIT DELAY.	○	×

Table 3-11 Explanation of Transmission Delay Time Screen (Cont'd)

No.	Label	Name	Explanation	Setting	Setting during measurement
④	INTERVAL	Measurement interval	Displays measurement interval	○	×
⑤		Measured value	Displays measured transmission delay time.	×	×
⑥	SAV	Preset memory save command label	Command label to save current interface conditions and transmission delay time measurement conditions to preset memory	○	○
⑦	RCL	Preset memory recall command label	Command label to recall interface conditions and measurement conditions saved in preset memory	○	○

○ : Enable

× : Disable

3.10.3 Transmission delay time measurement procedure

START	
Measurement preparations	Insert the interface unit, connect the DUT and check the setup.
Turn on the MD6420A power switch.	
Switch to INTERFACE screen.	Press [F2] of the cursor-off MODE screen page 1 (M01) menu. For screens other than MODE screen, press [BACK SCREEN] once or twice.
Set or modify the interface conditions.	
Switch to the DELAY TIME screen.	Press [F3] of the cursor-off INTERFACE screen page 1 (M01) menu.
Set the measurement mode to TRANSMIT DELAY.	When the cursor (≥) key is pressed once in the cursor-off state, the cursor is displayed at the measurement mode area. Select the TRANSMIT DELAY mode by pressing [F2].
Set or modify the transmission delay time measurement conditions.	Set or modify the measurement interval.
Start transmission delay time measurement (repeat measurement).	Press [F1] (START COUNT)
Monitor the measured value.	
Stop measurement.	Press [PRINTER OFF/ON]. The PRINTER ON LED lights. Press [F6] of the cursor-off DELAY TIME screen page 1 (M01) menu.
Turn on the printer and print the measured results	
END	

3.11 Word Pattern Data Send and Word Trace

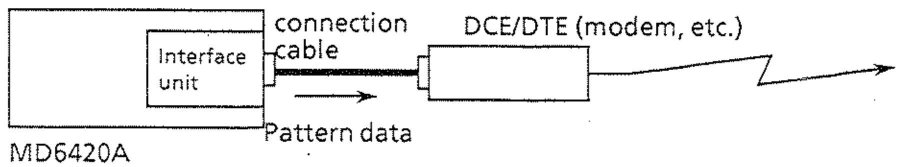
3.11.1 Overview

Word pattern data send and word trace operations are performed via the WORD TRACE and DISPLAY PATTERN TRACE screens.

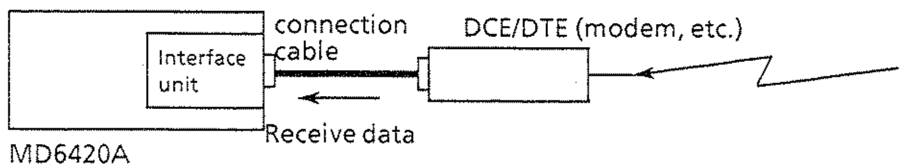
Word pattern data send and word trace can be performed separately or together.

Measurement Setup

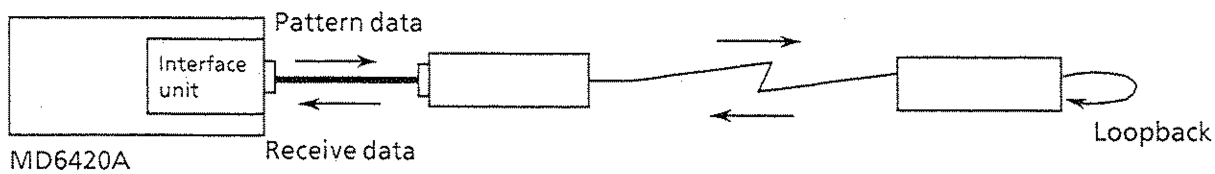
(1) Word pattern data send



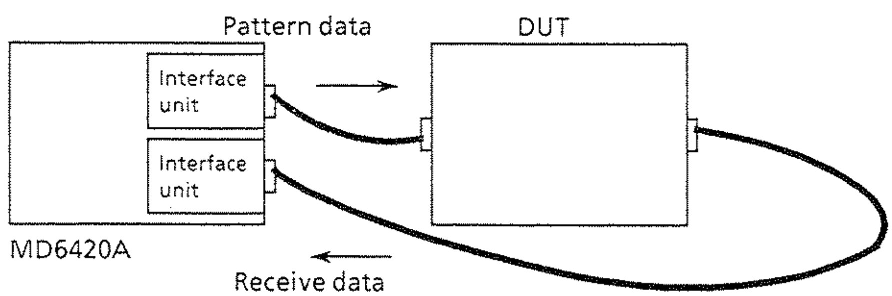
(2) Word trace



(3) Send and receive continuity loopback



(4) Continuity test of terminal equipment (TDM, PBX, etc.)



3.11.2 WORD TRACE screen structure

The WORD TRACE screen is shown below. Word pattern and trace are performed via this screen.

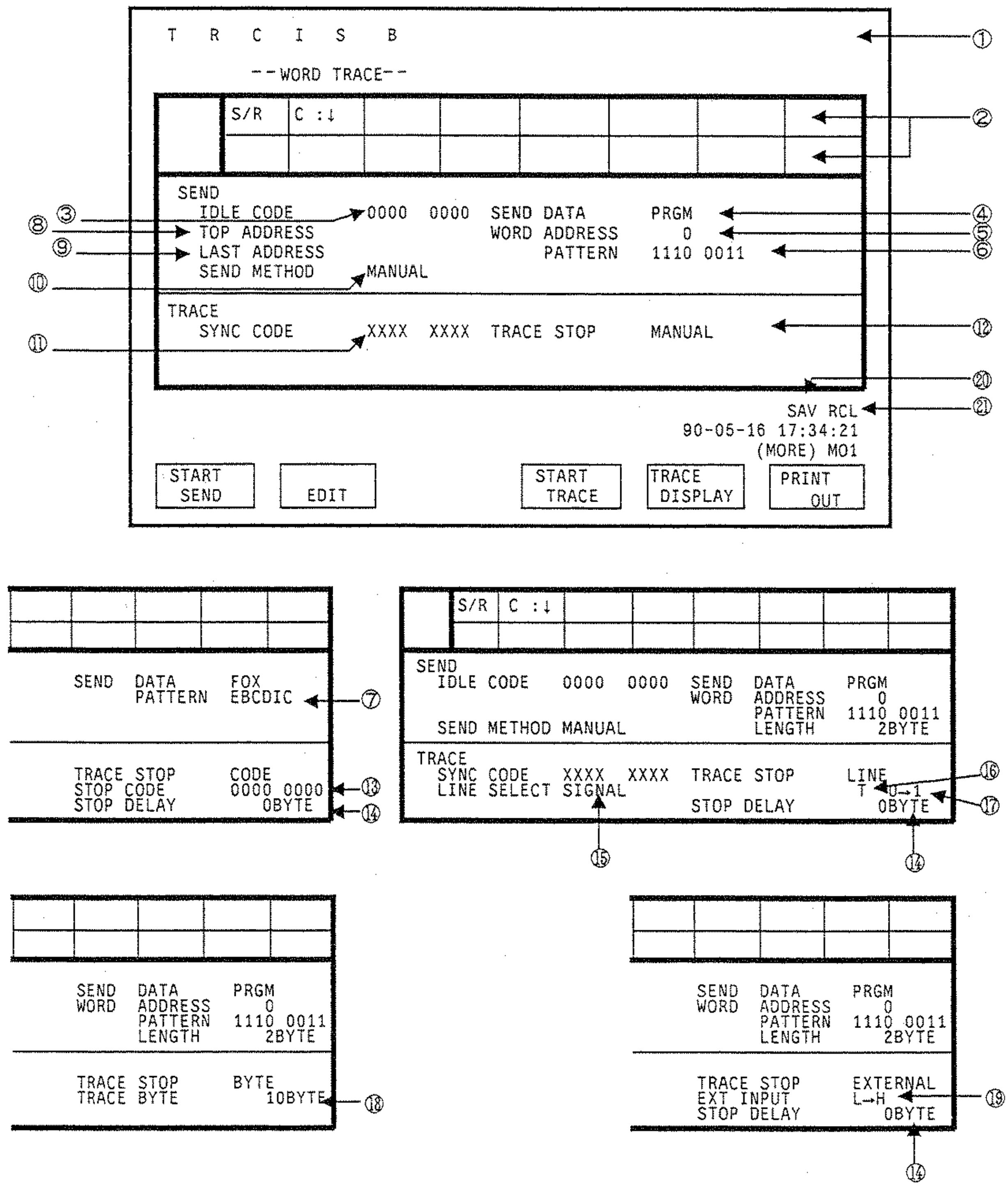


Fig. 3-13 WORD TRACE Screen Structure

Table 3-12 Explanation of WORD TRACE Screen

No.	Label	Name	Explanation	Setting	Setting during measurement
①		Monitor LED signal names	Displays name and connection circuit number of signal lines and alarm signals represented by monitor LEDs	×	×
②	S/R , SND , RCV	Signal line and alarm signal settings	Displays signal line and alarm signal settings	○	○
③	IDLE CODE	Send idle code	Displays send pattern (idle code) when word pattern data not being sent	○	×
④	SEND DATA	Send pattern data type	Displays type of send word pattern data	○	×
⑤	WORD ADDRESS	Word pattern address	Displays address of send word pattern	○	×
⑥	PATTERN	Pattern data	Displays send word pattern	○	×
⑦	PATTERN	FOX pattern code	Displays send code when FOX pattern is sent	×	×
⑧	TOP ADDRESS	Word pattern send data top address	Displays top address of word pattern send data	○	×
⑨	LAST ADDRESS	Word pattern send data last address	Displays last address of word pattern send data	○	×
⑩	SEND METHOD	Method of pattern sending	Displays word pattern send method	○	×
⑪	SYNC CODE	Trace start sync code	Displays sync code for trace start trigger	○	×
⑫	TRACE STOP	Trace stop method	Displays trace stop method	○	×
⑬	STOP CODE	Trace stop condition code	Displays condition code when trace stop method is CODE or NOT CODE	○	×

Table 3-12 Explanation of WORD TRACE Screen (Cont'd)

No.	Label	Name	Explanation	Setting	Setting during measurement
⑭	STOP DELAY	Number of bytes traced after trace stop trigger	Displays number of bytes traced after stop condition (trigger) is executed	○	×
⑮	LINE SELECT	Signal line type	Displays signal line type for trace stop trigger when stop method is LINE	○	×
⑯		Signal line name	Displays signal line name for trace stop trigger when stop method is LINE	○	×
⑰		Specified transition	Displays whether a high-to-low or low-to-high transition is used as the trace stop trigger in LINE mode.	○	×
⑱	TRACE BYTE	Trace length	Displays trace length used as stop trigger when stop method is BYTE	○	×
⑲	EXT INPUT	Specified transition of external input trigger	Displays whether a high-to-low or low-to-high transition is used as the trace stop trigger in EXTERNAL mode.	○	×
⑳	SAV	Preset memory save command label	Command label to save current interface conditions and word trace conditions to preset memory	○	○
㉑	RCL	Preset memory recall command label	Command label to recall interface conditions and measurement conditions saved in preset memory	○	○

○ : Enable
× : Disable

3.11.3 EDIT PATTERN DATA screen structure

The EDIT PATTERN DATA screen is shown below. The data send word pattern is set or modified via this screen.

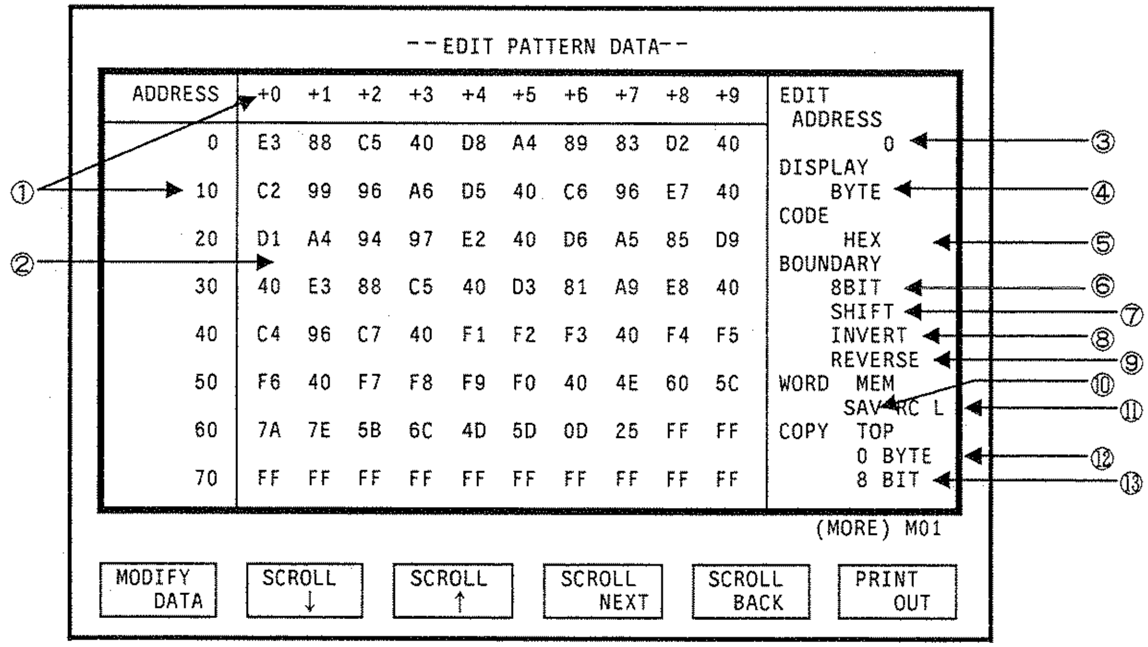


Fig. 3-14 EDIT PATTERN DATA Screen Structure

Table 3-13 Explanation of EDIT PATTERN DATA Screen

No.	Label	Name	Explanation	Setting
①	ADDRESS	Display edit address	Displays the displayed data address	×
②		Word pattern data	Displays the word pattern setting data	○
③	EDIT ADDRESS	Edit top address	Displays top address of the displayed data	○
④	DISPLAY	Display mode	Indicates the display mode of displayed data	○
⑤	CODE	Display code	Indicates the display code of displayed data	○
⑥	BOUNDARY	Boundary display indication	Displays the bit boundary indication contents of displayed data	○

Table 3-13 Explanation of EDIT PATTERN DATA Screen (Cont'd)

No.	Label	Name	Explanation	Setting
⑦	SHIFT	Shift processing indication label	Performs shift processing indication from here	○
⑧	INVERT	Inverse processing indication label	Performs inverse processing indication from here	○
⑨	REVERSE	Reverse processing indication label	Performs reverse processing indication from here	○
⑩	WORD MEM SAV	Word memory saving indication label	Performs saving processing indication to the word memory from here	○
⑪	WORD MEM RCL	Word memory reading indication label	Performs reading processing indication from the word memory	○
⑫	COPY TOP BYTE	Copy top byte address	Displays the specified top byte address for copying from trace data	○
⑬	COPY TOP BIT	Copy top bit position	Displays the top bit position for copying from trace data	○

3.11.4 DISPLAY PATTERN TRACE screen structure

The DISPLAY PATTERN TRACE screen is shown below. The word-trace receive data is checked via this screen.

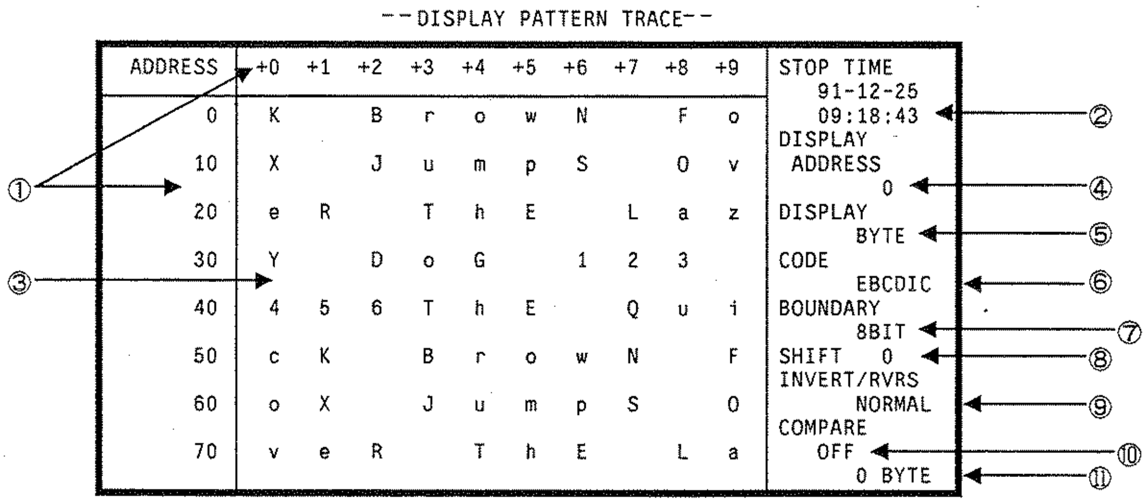


Fig. 3-15 EDIT PATTERN DATA screen structure

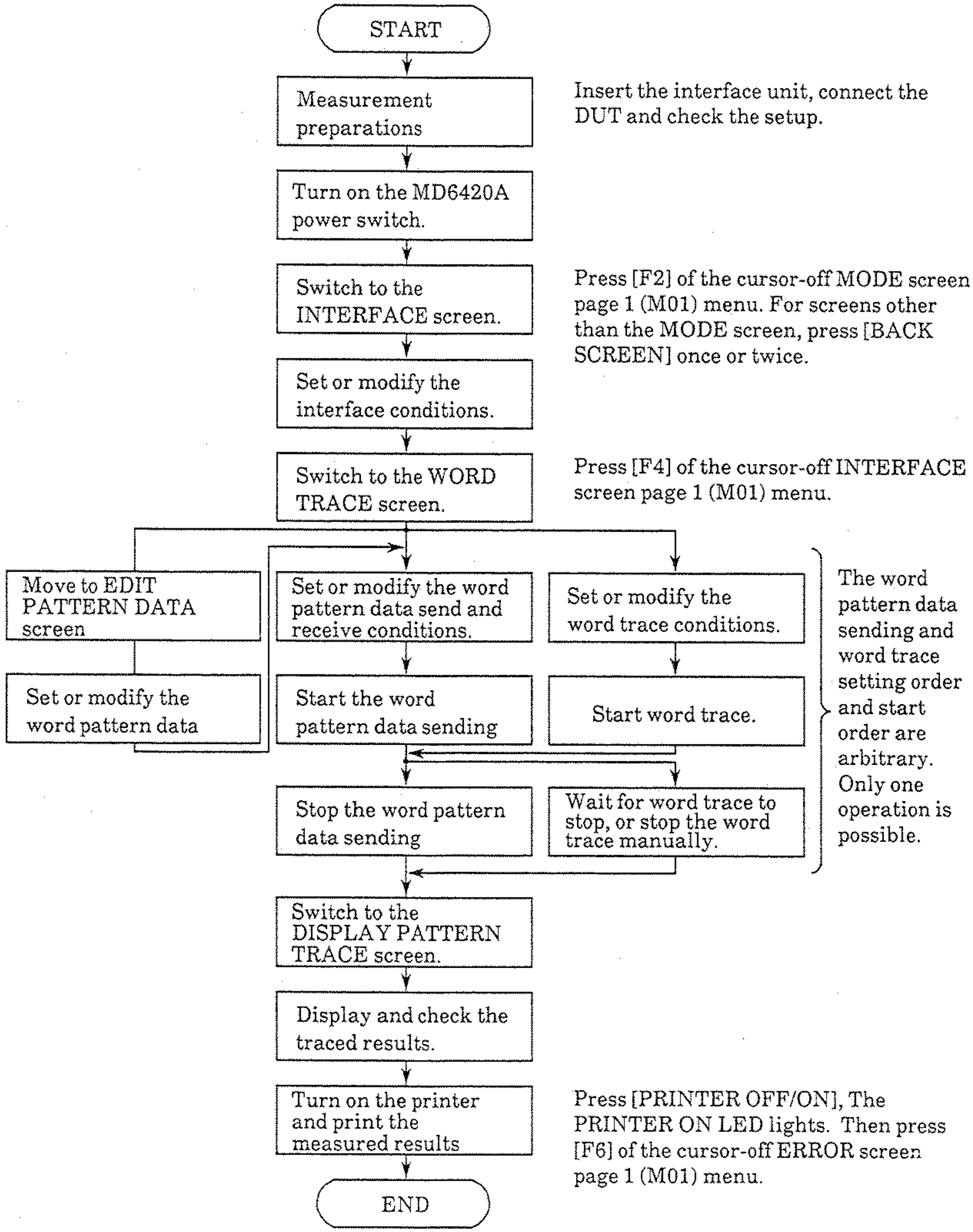
Table 3-14 Explanation of EDIT PATTERN DATA Screen

No.	Label	Name	Explanation	Setting
①	ADDRESS	Data address	Displays address of traced data	×
②	STOP TIME	Trace stop time	Displays time when trace stopped	×
③		Trace data	Displays traced data. When it is not within the display range, "**" is displayed.	×
④	DISPLAY ADDRESS	Top of display data address	Displays address at trace data at top of screen	○
⑤	DISPLAY	Display mode	Indicates the display mode for displayed data	○
⑥	CODE	Type of code	Displays code used for displaying traced data	○
⑦	BOUNDARY	Number of boundary bits	Displays number of boundary bits	○
⑧	SHIFT	Number of shifted bits	Displays number of shifted bits (The traced data is shifted forward or backward by the specified number of bits and redisplayed)	○

Table 3-14 TExplanation of EDIT PATTERN DATA Screen (Cont'd)

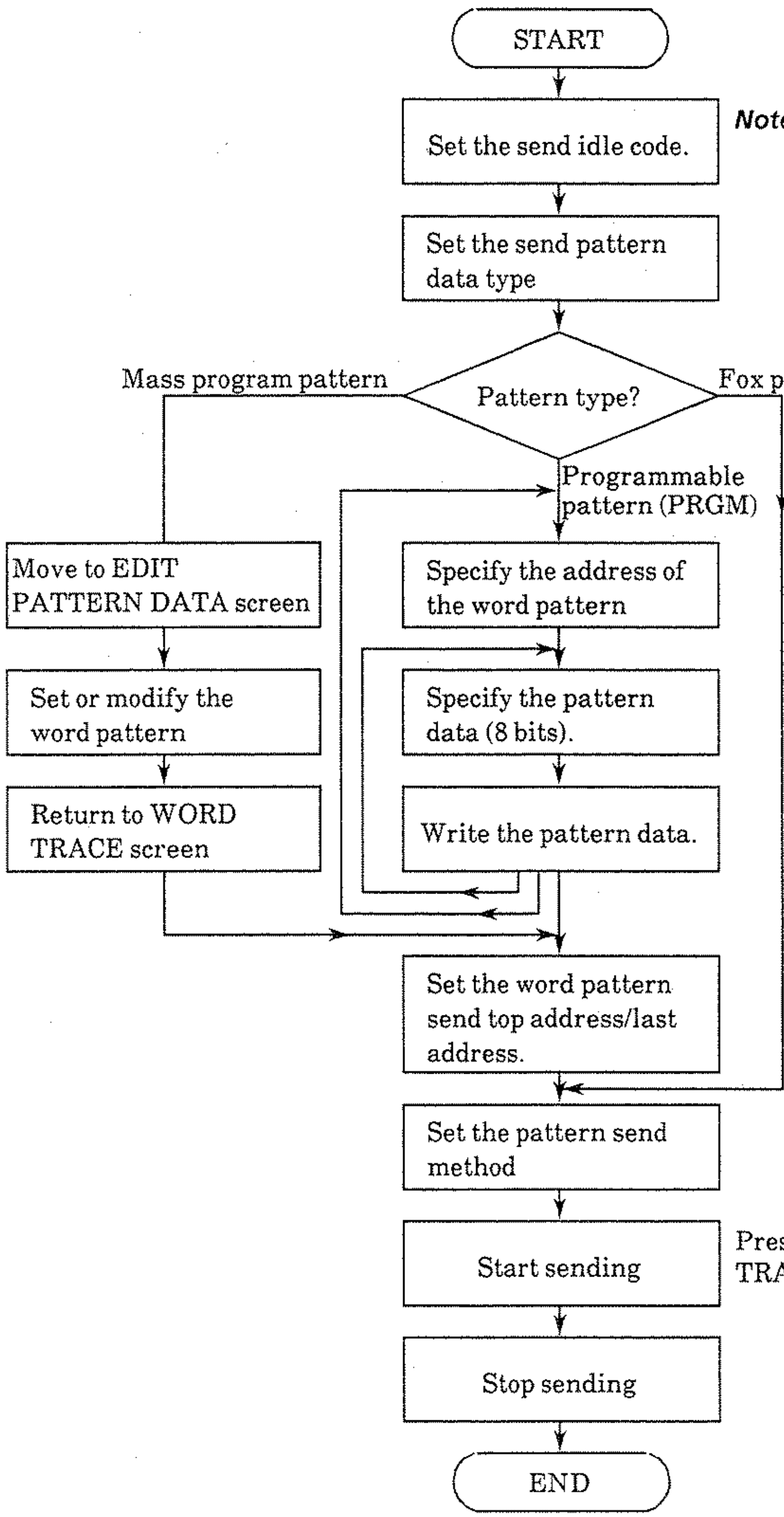
No.	Label	Name	Explanation	Setting
⑨	INVERT/RVRS	Inverse/Reverse processing	Displays inverse/reverse processing indication contents.	○
⑩	COMPARE	Comparison processing	Displays indication of comparison processing of displayed data and send data	○
⑪	COMPARE	Comparison data top address	Displays the send data top address for the comparison display	○

3.11.5 Word pattern send and word trace procedure



3.11.6 Word trace data send conditions setting and send procedure

Set or modify the word pattern send conditions and start sending data as follows.



Note: While sending ("SEND" is displayed), word pattern data is sent, but when not sending, the idle code is sent.

Specify 0 or 1 for each bit. To specify the same data as before, press [F6] (RECALL).

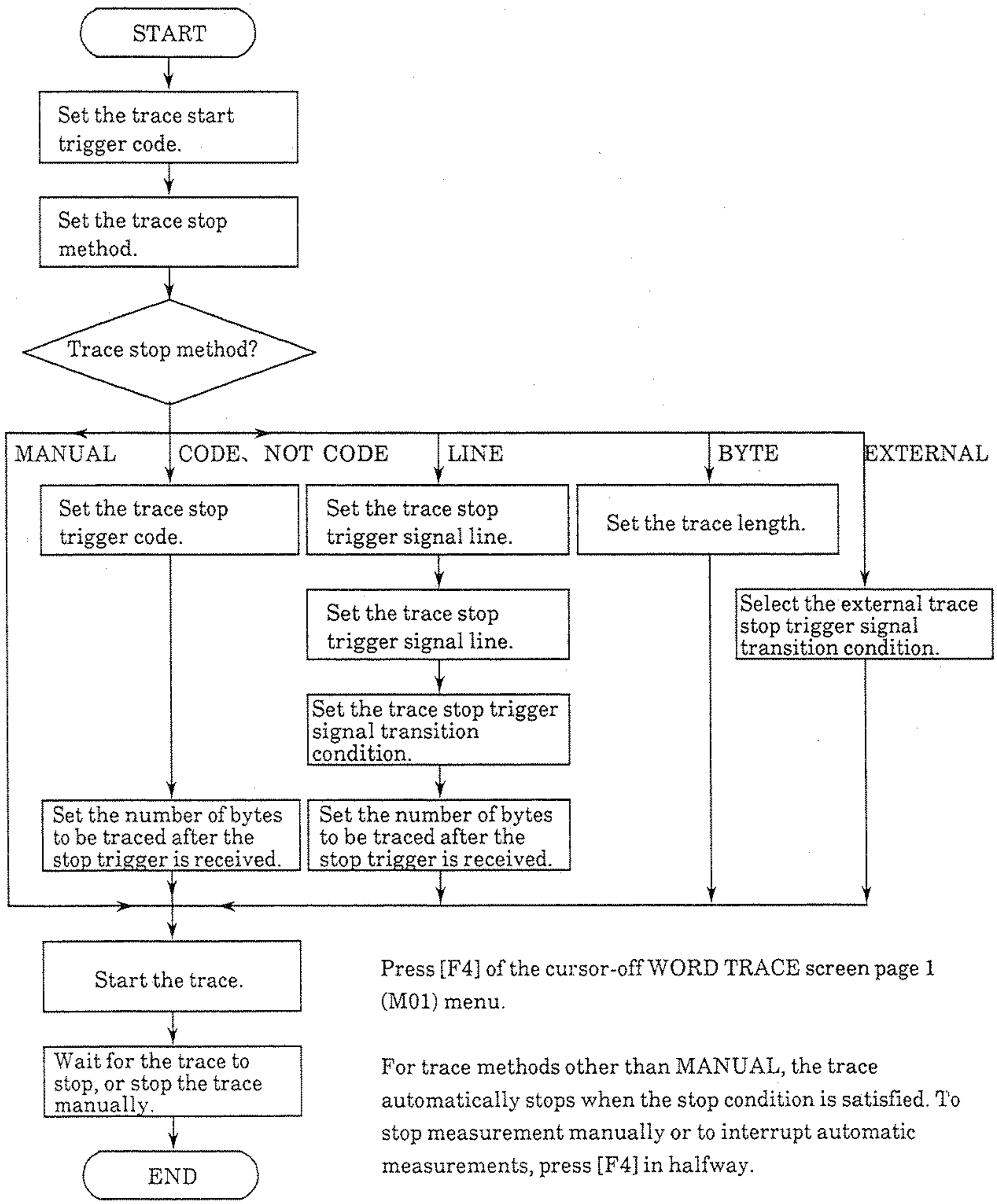
Press [F1] (ENTER) while the cursor is displayed at the word pattern send data field. Pattern data is written and the setting address and setting data change to the next data.

The above operation is the pattern send data setting method on WORD TRACE screen. It is convenient to use EDIT PATTERN DATA screen for setting or modifying the mass data. Refer to paragraph 3.11.8 for operation on EDIT PATTERN DATA screen.

Press [F1] of the cursor-off WORD TRACE screen page 1 (M01) menu.

3.11.7 Word trace conditions setting and trace procedure

Set or modify the word trace conditions and initiate trace as follows:



Press [F4] of the cursor-off WORD TRACE screen page 1 (M01) menu.

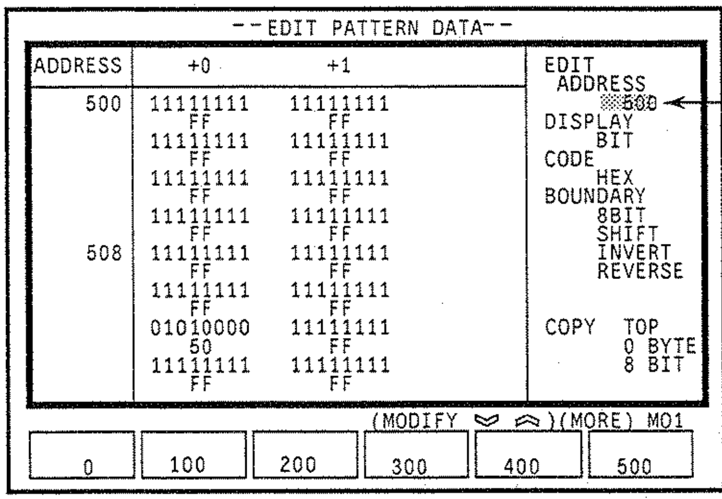
For trace methods other than MANUAL, the trace automatically stops when the stop condition is satisfied. To stop measurement manually or to interrupt automatic measurements, press [F4] in halfway.

3.11.8 Pattern setting on EDIT PATTERN DATA screen

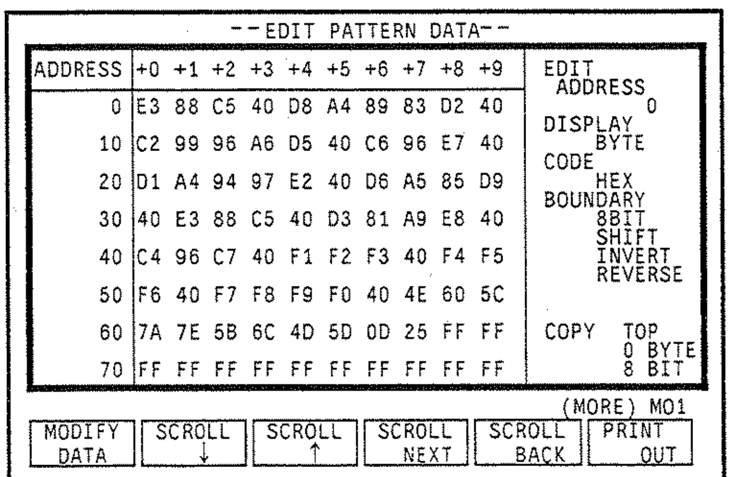
The send data for sending the pattern can be set or modified on WORD TRACE screen and EDIT PATTERN DATA screen. It is convenient to use EDIT PATTERN DATA screen for setting mass data. The following shows on operation to set the pattern on EDIT PATTERN DATA screen.

(1) Specifying the display address of pattern data and displaying the pattern data.

The pattern data setting area is 8192 bytes(option 02:32768bytes). Displays the data with specifying an address.



Move the cursor to the display top address column and specify the address.



Search can be done by scrolling from the cursor off menu.

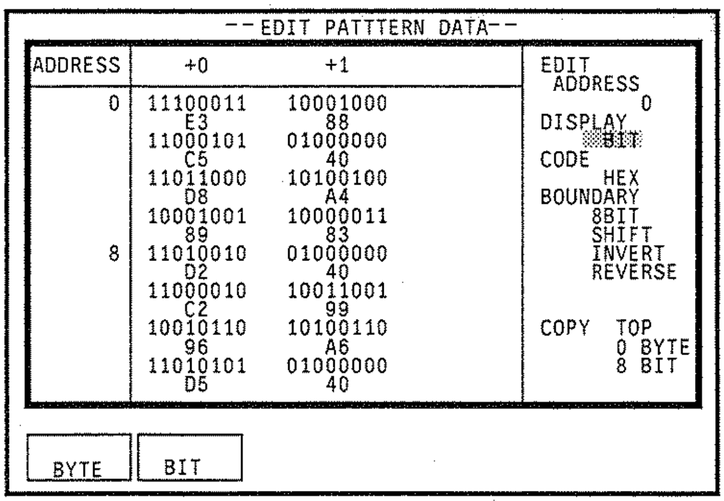
Scrolls in one page unit.

Press this key for modifying data

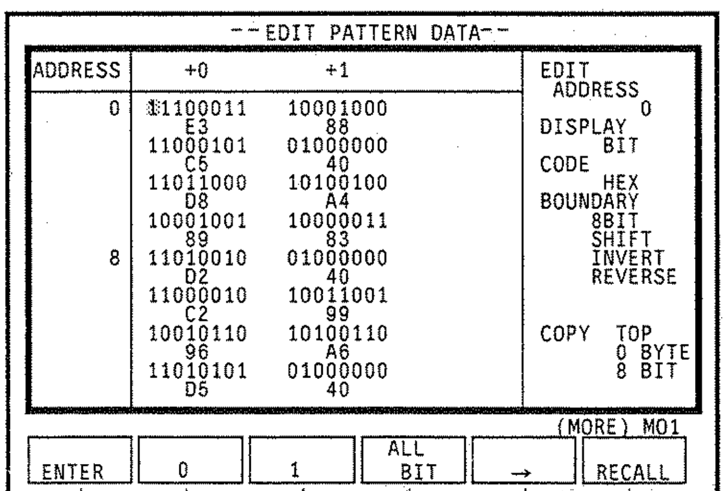
Scrolls in one line unit.

(2) Displaying/setting by bit data

Data is displayed in binary format when the display mode (DISPLAY) is set to "BIT".



When [F1] (MODIFY) key is pressed on the cursor OFF menu after pressing the [CURSOR OFF] key once, the cursor is displayed in top data which has been displayed. Data can be set in every bit here.



- RECALL: Recalls the data previously entered.
- →: Moves the setting cursor to the right by one bit.
- ALL BIT: All "0" or all "1" data can be set pressing [F2] (0) key or [F3] (1) key simultaneously.
- 1: Sets "1" on the setting cursor position and moves the cursor to the right.
- 0: Sets "0" on the setting cursor position and moves the cursor to the right.
- ENTER: Press for ascertaining the set bit pattern. When pressed, the setting cursor is moved to top bit of the next data field.

(3) Displaying/setting by byte data.

Data is displayed in byte format when the displayed mode (DISPLAY) is set to "BYTE".

When [F1] (MODIFY) key is pressed on the cursor OFF menu after pressing [CURSOR OFF] key once, the cursor is displayed in top data which has been displayed.

Data can be set in byte unit.

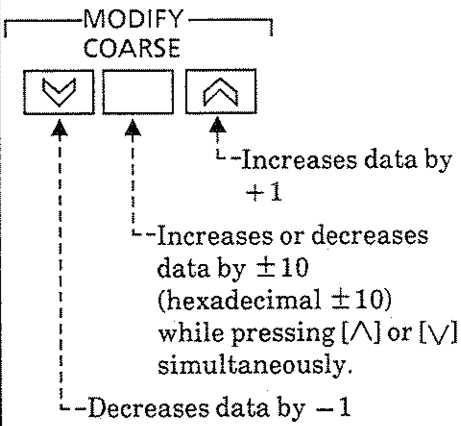
--EDIT PATTERN DATA--

ADDRESS	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9
0	E3	88	C5	40	D8	A4	89	83	D2	40
10	C2	99	96	A6	D5	40	C6	96	E7	40
20	D1	A4	94	97	E2	40	D6	A5	85	D9
30	40	E3	88	C5	40	D3	81	A9	E8	40
40	C4	96	C7	40	F1	F2	F3	40	F4	F5
50	F6	40	F7	F8	F9	F0	40	4E	60	5C
60	7A	7E	5B	6C	4D	5D	0D	25	FF	FF
70	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF

EDIT
ADDRESS
0
DISPLAY
BYTE
CODE
HEX
BOUNDARY
8BIT
SHIFT
INVERT
REVERSE
COPY TOP
0 BYTE
8 BIT

(MODIFY ⩔ ⩓)(MORE) M01

ENTER RECALL



Ascertain the data by pressing [F1] (ENTER) key after setting byte data.

(4) Specifying the display code

--EDIT PATTERN DATA--

ADDRESS	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9
0	T	h	E		Q	u	i	c	K	
10	B	r	o	w	N		F	o	X	
20	J	u	m	p	S		0	v	e	R
30		T	h	E		L	a	z	Y	
40	D	o	G		1	2	3		4	5
50	6		7	8	9	0		+	-	*
60	:	=	$	%	(	)	CR	LF		
70										

EDIT
ADDRESS
0
DISPLAY
BYTE
CODE
EBCDIC
BOUNDARY
8BIT
SHIFT
INVERT
REVERSE
COPY TOP
0 BYTE
8 BIT

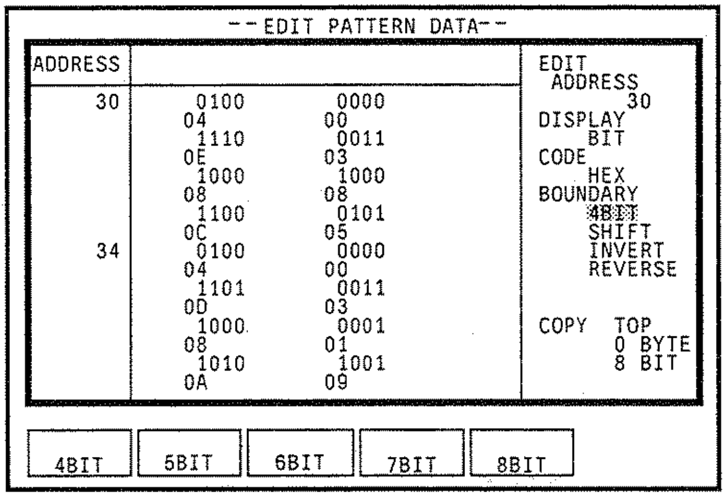
(MORE) M01

HEX ASCII EBCDIC EBCDIK JIS8 EBCD

Specify the display code after moving the cursor to the display code column (CODE).

This specification can be used for both the BYTE and BIT display modes.

(5) Specifying the displayed data boundary (bit boundary)

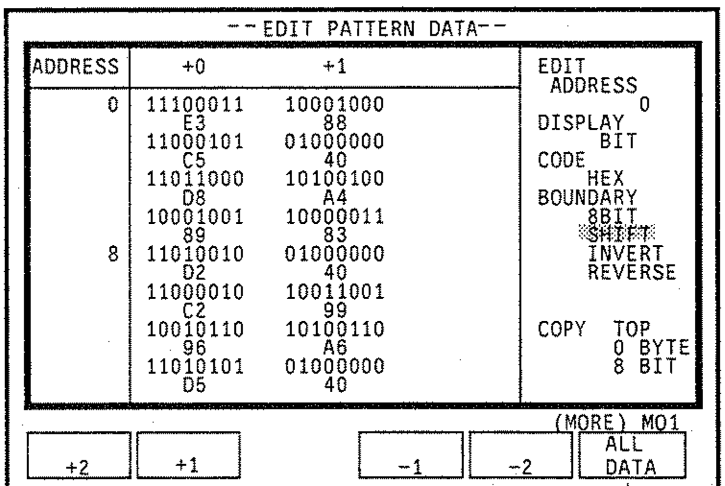


Specify a bit boundary after moving the cursor to the display boundary column (BOUNDARY).

When the boundary is specified at other than 8 bits; data is divided in each specified bits starting from the data top bit (MSB) of the display top address.

This specification can be used for both the BYTE and BIT display modes.

(6) Edit function 1 - shift

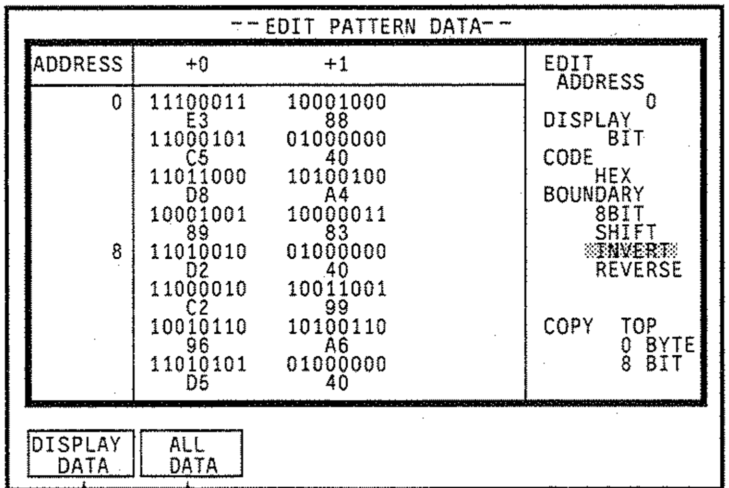


Pattern data can be shifted in the range from −4 to +4 bits after moving the cursor to the shift column (SHIFT).

Shift processing can be done for the displayed data

Shift processing can be done for all the data (8192 or 32768 bytes) by pressing each key from +4 to −4 simultaneously.

(7) Edit function 2 - Inverse



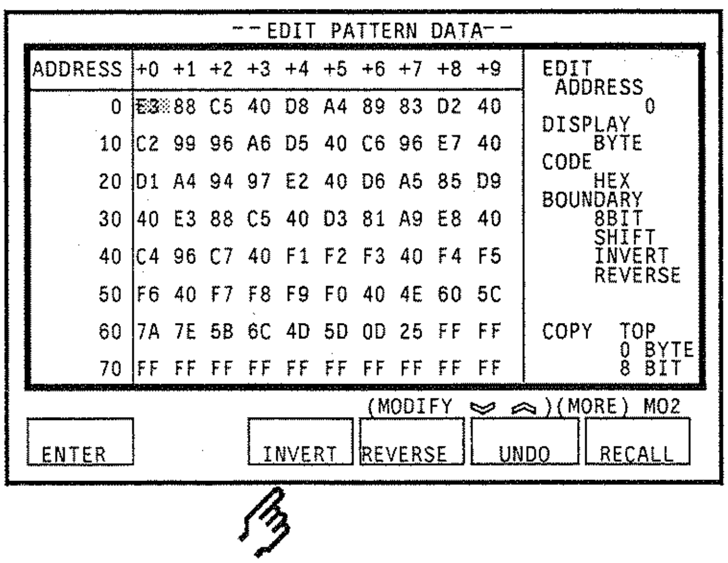
Inverts all the data (8192 or 32768 bytes)

Inverts displaying data

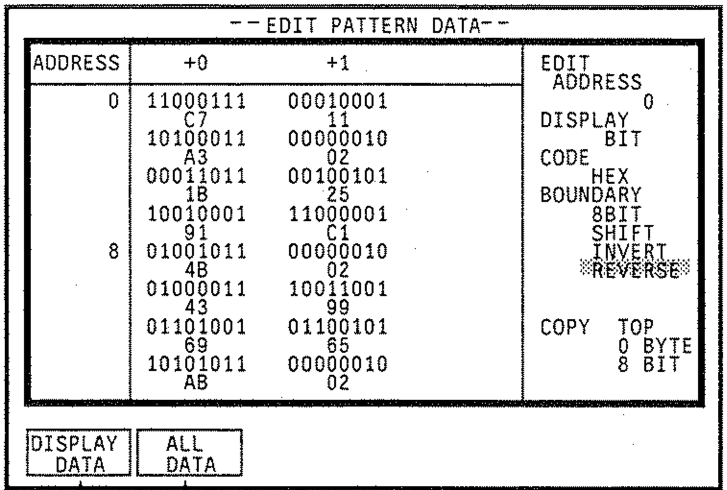
Data inverse (change from 1 to 0 or 0 to 1 in every bits) is performed after moving the cursor to invert column (INVERT).

During setting data in BIT/BYTE display mode, data in the data field (where the setting cursor is currently existed) can be inverted by pressing [F3] (INVERT) key on the menu at more 2nd page (M02).

Ascertain the data by pressing [F1] (ENTER) key after inverting.



(8) Edit function 3 - Reverse



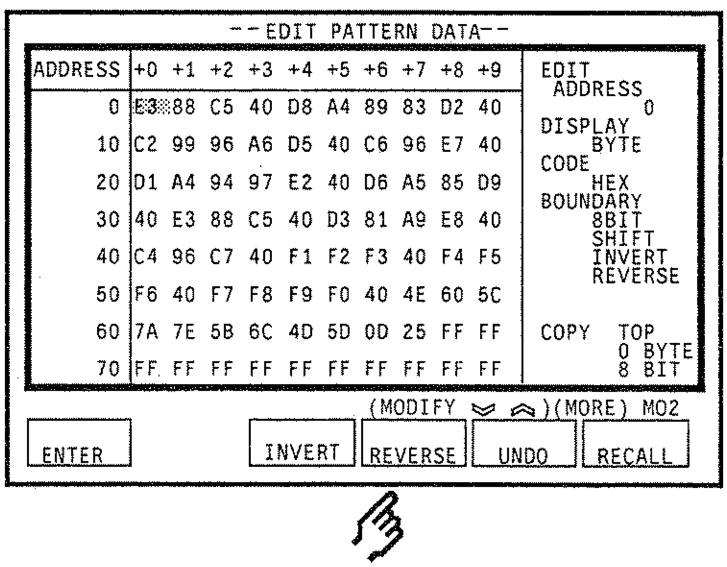
Reverses all the data (8192 or 32768 bytes)

Reverses the displaying data

Data reverse (to reverse the upper bits and the lower bits) is performed after moving the cursor to reverse column (REVERSE).

During setting the data in BIT/BYTE display mode, data in the data field (where the setting cursor is currently existed) can be reversed by pressing [F4] (REVERSE) key on the menu at MORE 2nd page (M02).

Ascertain the data by pressing [F1] (ENTER) key after reversing.



(9) Saving/reading of the pattern data to / from the word memory unit (MD0610D/D1)

Data set on EDIT PATTERN DATA screen can be stored in E^{2}PROM of the word memory unit.

In addition, the data can be read out from E^{2}PROM and PROM of the word memory unit.

-- EDIT PATTERN DATA --

ADDRESS	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9
0	E3	88	C5	40	D8	A4	89	83	D2	40
10	C2	99	96	A6	D5	40	C6	96	E7	40
20	D1	A4	94	97	E2	40	D6	A5	85	D9
30	40	E3	88	C5	40	D3	81	A9	E8	40
40	C4	96	C7	40	F1	F2	F3	40	F4	F5
50	F6	40	F7	F8	F9	F0	40	4E	60	5C
60	7A	7E	5B	6C	4D	5D	0D	25	FF	FF
70	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF

EDIT
ADDRESS 0
DISPLAY BYTE
CODE HEX
BOUNDARY 8BIT
SHIFT
INVERT
REVERSE
WORD MEM SAV RCL
COPY TOP 0 BYTE 8 BIT

(MORE) M01

ROM0 ROM1 ROM2 ROM3 ROM4 ROM5

ROM No. to save the data is specified from [F] key after moving the cursor to the word memory save column(SAV).

Similarly,ROM No. to read out the data is specified from [F] key after moving the cursor to the word memory recall column (RCL).

(10) Copying the trace data (receive data) to the send pattern data

Received data (8192 or 32768 bytes) in the trace memory can be copied to the send pattern data using trace function.

-- EDIT PATTERN DATA --

ADDRESS	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9
0	T	h	E		Q	u	i	c	K	
10	B	r	o	w	N		F	o	X	
20	J	u	m	p	S		O	v	e	R
30		T	h	E		L	a	z	Y	
40	D	o	G		1	2	3		4	5
50	6		7	8	9	0		+	-	*
60	:	=	$	%	(	)	CR	LF		
70										

EDIT
ADDRESS 0
DISPLAY BYTE
CODE EBCDIC
BOUNDARY 8BIT
SHIFT
INVERT
REVERSE
COPY TOP 0 BYTE 8 BIT

(MORE) M02

COPY FROM TRC

Specify top address and top bit of the trace data for copying.

When the traced data is copied as it is, set it at "0 byte/8 bits".

The traced data is transferred to the send pattern data area by pressing this [F] key.

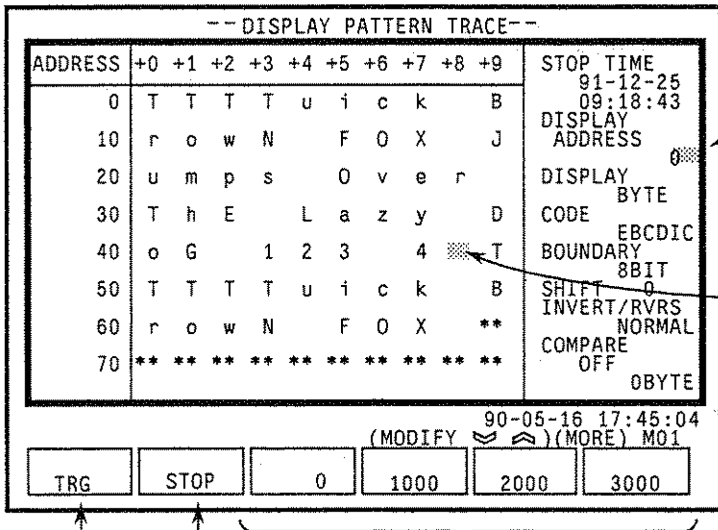
3.11.9 Trace result viewing

The traced word results are viewed via the DISPLAY PATTERN TRACE screen.

(1) Viewing by specifying the display address
Trace data is collected sequentially from address 0. Up to 32767 bytes can be traced.

When the address reaches 32767, it returns to address 0 and data collection is repeated.

Collected data can be viewed by specifying the appropriate address.



Move the cursor to the display start address field and specify the address.

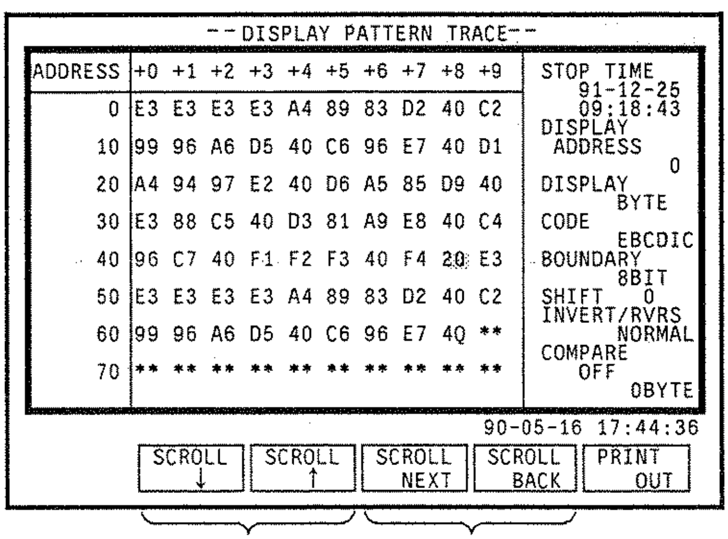
The data that satisfied the stop trigger condition is reverse-displayed.

Specify the address as an absolute value. It can also be set with the MODIFY keys.

Redisplays trace data from the last line at the start line

Redisplays data from the line which satisfied the stop trigger condition at the start line

(2) Viewing by scrolling the screen



The screen can be scrolled when the cursor is off.

Scrolls in line units   Scrolls in page (8 lines) units

(3) Changing the display mode (BIT/BYTE)

The traced data can be viewed by "byte mode display" being displayed with the specified code in every byte, and by "bit mode display" being displayed with 0/1 binary code in every bit.

```
                --DISPLAY PATTERN TRACE--
 ADDRESS |   +0          +1         | STOP TIME
---------|--------------------------|     91-12-25
      43 | 11100011    10001000     |     09:18:43
         |     T           h        | DISPLAY
         | 11000101    01000000     |  ADDRESS
         |     E                    |           43
         | 11011000    10100100     | DISPLAY
         |     Q           u        |       BIT
         | 10001001    10000011     | CODE
         |     i           c        |       EBCDIC
      51 | 11010010    01000000     | BOUNDARY
         |     K                    |       8BIT
         | 11000010    10011001     | SHIFT    0
         |     B           r        | INVERT/RVRS
         | 10010110    10100110     |       NORMAL
         |     o           w        | COMPARE
         | 11010101    01000000     |    OFF
         |     N                    |        0BYTE

 [ BYTE ] [ BIT ]
```

Move the cursor to the display mode column (DISPLAY) and select "BYTE" or "BIT".

(4) Specifying the display code

```
                --DISPLAY PATTERN TRACE--
 ADDRESS |+0 +1 +2 +3 +4 +5 +6 +7 +8 +9 | STOP TIME
---------|------------------------------|     91-12-25
       0 | p  S     O  v  e  r     T  h |     09:18:43
      10 | E     L  a  z  y     D  O  G | DISPLAY
      20 |    1  2  3     4  5  6     7 |  ADDRESS
      30 | 8  9  0     +  -  *  :  =  $ |            0
      40 | %  (  ) CR LF  T  h  E     Q | DISPLAY
      50 | u  i  c  k     B  r  o  w  N |       BYTE
      60 |    F  o  x     J  u  m  p  S | CODE
      70 |    O  v  e  R     T  h  E    |       EBCDIC
         |                              | BOUNDARY
         |                              |       8BIT
         |                              | SHIFT    0
         |                              | INVERT/RVRS
         |                              |       NORMAL
         |                              | COMPARE
         |                              |    OFF
         |                              |        0BYTE
                                  90-05-18 19:54:44
                                          (MORE) M01
 [ HEX ] [ ASCII ] [ EBCDIC ] [ EBCDIK ] [ JIS8 ] [ EBCD ]
```

Move the cursor to the display code field and specify the display code. The displays of EBCDIK and JIS8 depend on internal dip switches.

(5) Specifying boundary (bit boundary) of the display data

```
                 --DISPLAY PATTERN TRACE--
ADDRESS |                               | STOP TIME
        |                               |     91-12-25
      0 | 110100        100100          |     09:18:43
        |   34            24            | DISPLAY
        | 000011        000010          |  ADDRESS
        |   03            02            |            0
        | 100110        011001          | DISPLAY
        |   26            19            |        BIT
        | 011010        100110          | CODE
        |   1A            26            |        HEX
      6 | 110101        010100          | BOUNDARY
        |   35            14            |       6BIT
        | 000011        000110          | SHIFT    0
        |   03            06            | INVERT/RVRS
        | 100101        101110          |       NORMAL
        |   25            2E            | COMPARE
        | 011101        000000          |    OFF
        |   1D            00            |        0BYTE

[ 4BIT ] [ 5BIT ] [ 6BIT ] [ 7BIT ] [ 8BIT ]
```

Move the cursor to the display boundary column (BOUNDARY) and specify the bit boundary.

When boundary is specified at other than 8 bits, data is divided in every specified bits starting from the data top bit (MSB) of the display top address.

This specification can be used for both the BYTE and BIT display modes.

(6) Viewing by shifting data forward and backward bitwise.
When the data is not byte-synchronized, this can be used to display data that would otherwise be difficult to recognize.

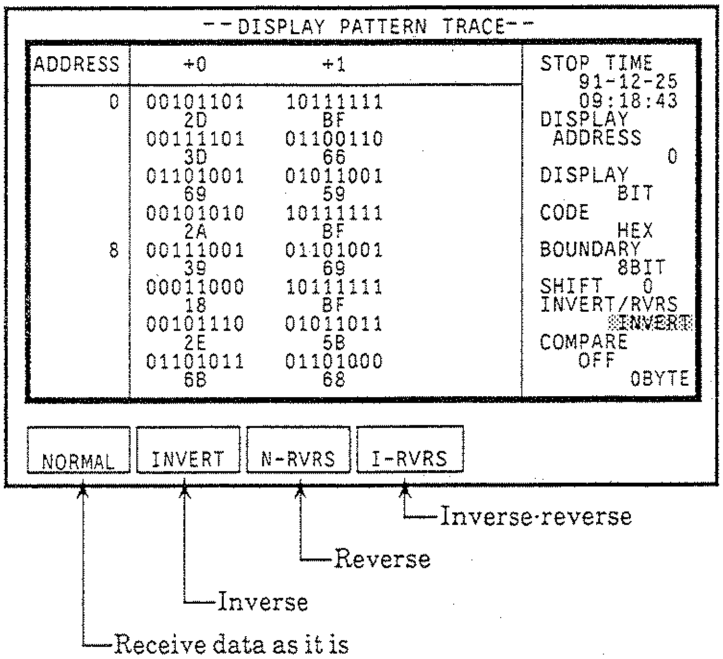
```
                 --DISPLAY PATTERN TRACE--
ADDRESS |+0 +1 +2 +3 +4 +5 +6 +7 +8 +9 | STOP TIME
        |                              |    91-12-25
      0 |97 E2 40 D6 A5 85 D9 40 E3 88 |    09:18:43
        |                              | DISPLAY
     10 |C5 40 D3 81 A9 E8 40 C4 96 C7 |  ADDRESS
        |                              |           0
     20 |40 F1 F2 F3 40 F4 F5 F6 40 F7 | DISPLAY
        |                              |       BYTE
     30 |F8 F9 F0 40 4E 60 5C 7A 7E 5B | CODE
        |                              |       EBCDIC
     40 |6C 4D 5D 0D 25 E3 88 C5 40 D8 | BOUNDARY
        |                              |       8BIT
     50 |A4 89 83 D2 40 C2 99 96 A6 D5 | SHIFT    0
        |                              | INVERT/RVRS
     60 |40 C6 96 E7 40 D1 A4 94 97 E2 |       NORMAL
        |                              | COMPARE
     70 |40 D6 A5 85 D9 40 E3 88 C5 40 |    OFF
        |                              |       0BYTE
                                   90-05-18 19:55:24
                                          (MORE) M01
[ +3 ] [ +2 ] [ +1 ] [ 0 ] [ -1 ] [ -2 ]
```

Move the cursor to the shift display specification field and specify the number of bits to be shifted.

(7) Viewing data by inverse /reverse in every bit

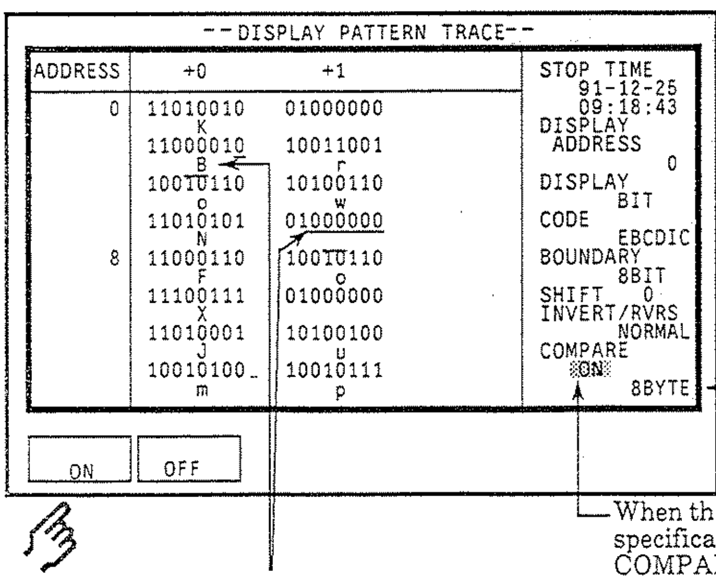
Data can be viewed by inverting the bit from 0 to 1 or 1 to 0 in every bit.

In addition, data can be viewed by reversing the upper bits and the lower bits.



Move the cursor to invert /reverse column (INVERT/RVRS) and specify inverse /reverse.

(8) Comparing with the send data and displaying difference



Specify top byte address of the send data to be compared with.

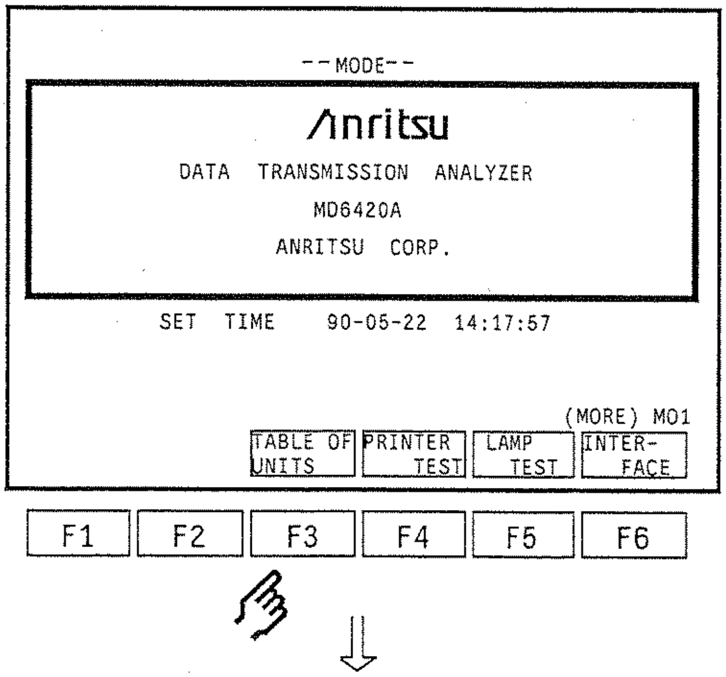
Displays different portions by underlines.

When the cursor is moved to compared specification column (COMPARE) and the COMPARE is specified to "ON", the send data are compared with the display data starting from the specified top address.

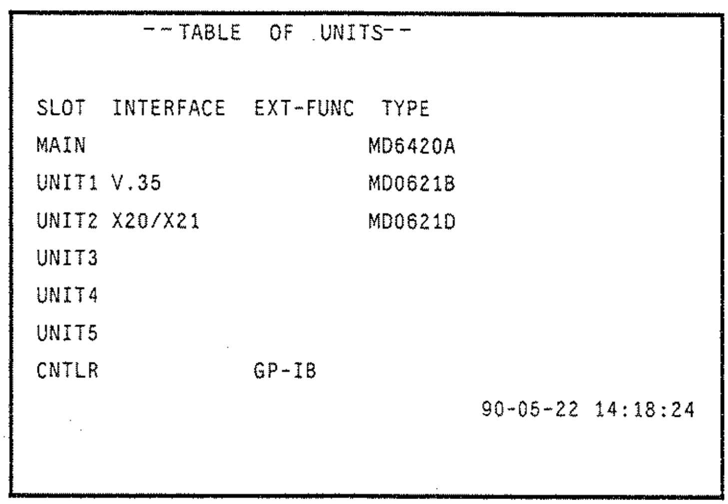
Displays different portions by underlines.

3.12 Checking Unit Insertion State of Rear Slots

The kinds of units inserted in the rear slots can be checked via the TABLE OF UNITS screen.



The menu shown on the left is displayed on page 2 (or subsequently) of the cursor-off MODE screen. Press [F3].



Verify the unit insertion state at the TABLE OF UNITS screen.

3.13 Save/Recall Operation

3.13.1 Overview

The MD6420A has a preset memory to store the interface conditions and measurement conditions. Up to 10 conditions can be saved in this memory.

(1) Preset memory save operations

The interface conditions, measurement conditions (including print conditions and status during measurement), and printer ON/OFF condition can be saved in the preset memory via the following screens.

ERROR
VOLT/FREQUENCY
DELAY TIME
WORD TRACE

DISTORTION
ANALOG
CODEC

(2) Preset memory recall operation

The preset memory settings can be recalled from:

(a) the MODE screen cursor-off menu

(b) the PRESET MEMORIES screen

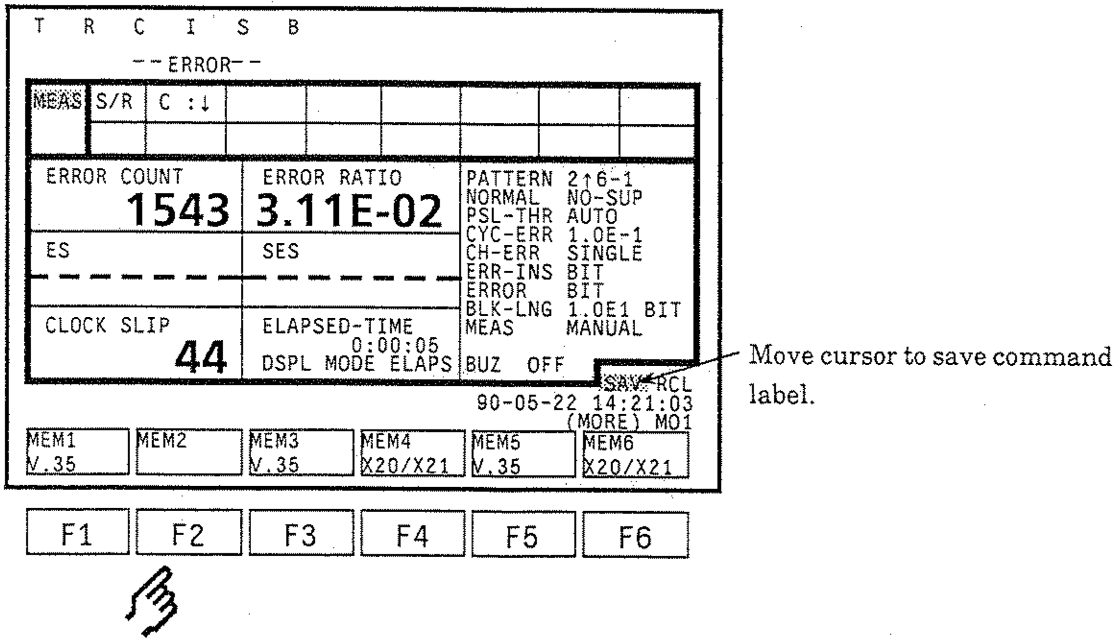
(c) any measurement screens from which the save operation can be performed.

After recall, the saved interface and measurement conditions are set and the display is switched to the appropriate measurement screen. If measurement was performed when the conditions were saved, measurement is restarted automatically.

Routine measurements can be recalled and performed via this one-touch measurement function. Therefore, numerous measurement conditions settings are avoided.

3.13.2 Preset memory save

When the cursor is moved to "SAV" (save command label) on the bottom right corner of each measurement screen, labels from "MEM1" to "MEM10" are displayed. When the function key corresponding to the memory No. in which data are to be saved is pressed, the interface conditions and measurement conditions are saved to that memory and the name of the receive interface unit (abbreviation) is displayed as a label.



Interface conditions, measurement conditions (including print conditions/data collection conditions), status during measurement, and printer ON/OFF status are saved to the specified memory.

The receive interface name (abbreviation) is displayed as a label at the bottom of the screen corresponding to a memory area that has already been saved. When a saved memory location is specified, it is overwritten.

3.13.3 Preset memory recall

There are three methods of recalling saved conditions.

(1) Recall at MODE screen cursor-off menu

```
--MODE--

Anritsu
DATA TRANSMISSION ANALYZER
MD6420A
ANRITSU CORP.

SET TIME    90-05-22  14:19:28

                                        (MORE) M01
 INTER- | PRESET   | MEM1 | MEM2    | MEM3
  FACE  | MEMORIES | V.35 | X20/X21 | V.35

 F1   F2   F3   F4   F5   F6
```

The recallable memory No. labels are displayed on [F4] of page 1 and succeeding function keys (page 2, page 3). Press the relevant function key to recall the conditions.

(2) Recall at PRESET MEMORIES screen

--PRESET MEMORIES--

MEM -NO	SEND	RECV	RE MEAS MODE	CALL	PRESET	TIME
01	V.35	V.35	VOLT/FREQ	Ok	90-05-22	14:13:23
02	X20/X21	X20/X21	ERROR	Ok	90-05-22	14:09:24
03	V.35	V.35	DELAY TIME	Ok	90-05-22	14:13:28
04	X20/X21	X20/X21	DELAY TIME	Ok	90-05-22	14:12:59
05	V.35	V.35	ERROR	Ok	90-05-22	14:13:18
06	X20/X21	X20/X21	COLRT/FREQ	Ok	90-05-22	14:12:54
07	V.35	V.35	ERROR	Ok	90-05-22	14:13:47
08	V.35	V.35	WORD TRACE	Ok	90-05-22	14:13:46
09	V.35	V.35	DELAY TIME	Ok	90-05-22	14:13:31
10	X20/X21	X20/X21	WORD TRACE	Ok	90-05-22	14:13:05

Move the cursor

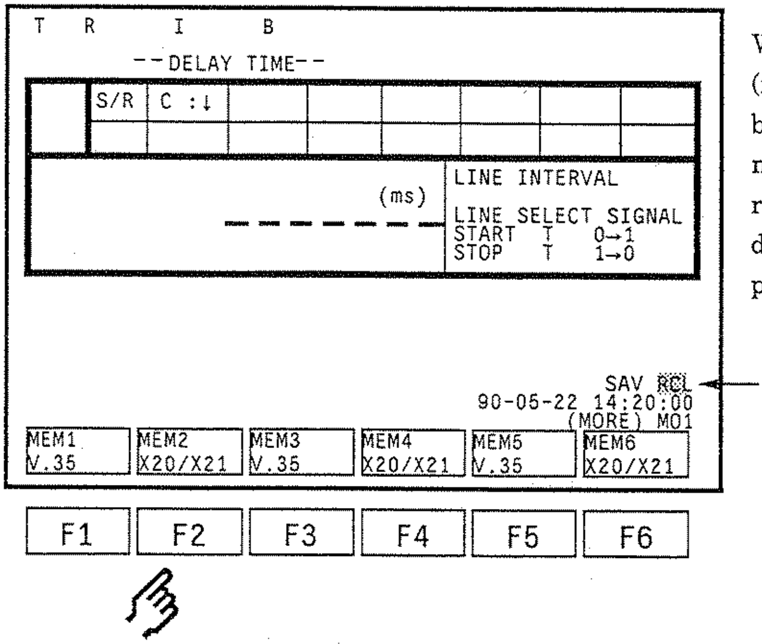
90-05-22 14:15:07

RECALL | INITIA-LIZE

F1 F2 F3 F4 F5 F6

When [F3] of the MODE screen cursor-off menu is pressed, the PRESET MEMORIES screen is displayed. Move the cursor to the memory No. to be recalled and recall the conditions by pressing [F1].

(3) Recall at measurement screen at which save operation was performed

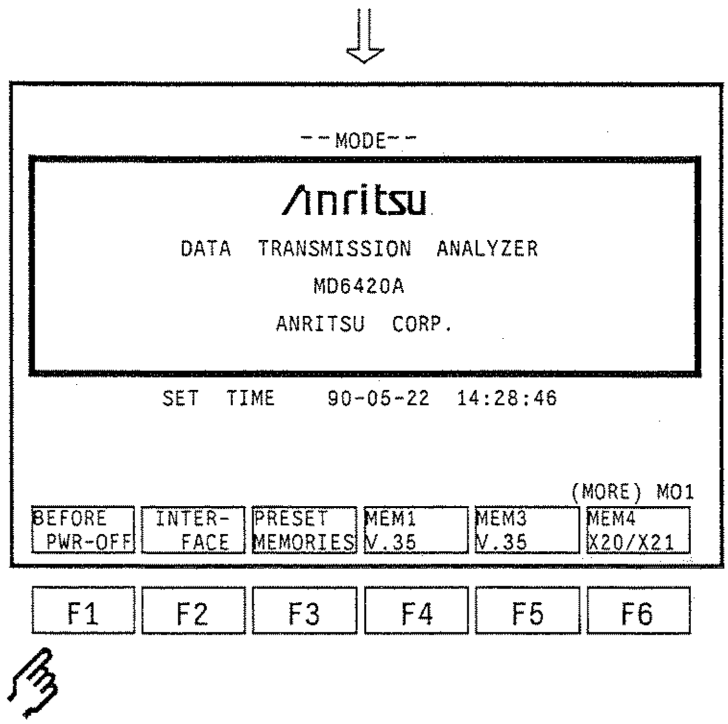


When the cursor is moved to "RCV" (recall command label) in the bottom right corner of the measurement screen, the recallable memory No. labels are displayed. Recall the conditions by pressing the relevant function key.

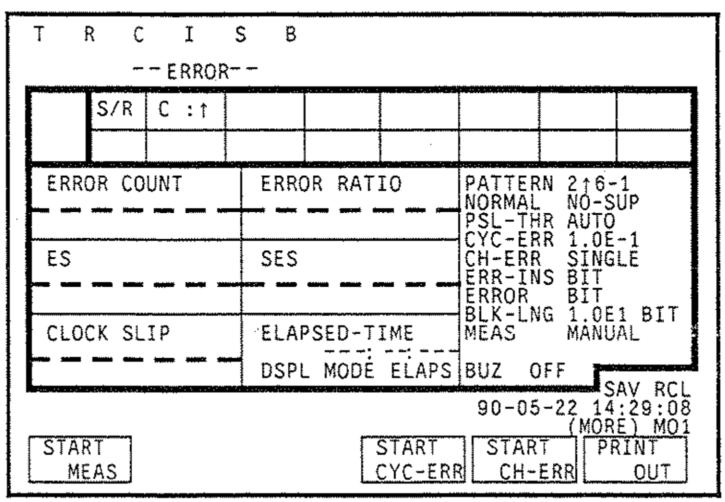
3.14 Before-Power-Off Recall Operation

When the MD6420A power switch is turned on, the label "BEFORE PWR-OFF" is displayed at [F1] of the MODE screen. When [F1] is pressed, the screen used prior to power off is displayed. The interface conditions and measurement conditions set at power-off are also recalled.

Turn power switch ON.



Press [F1].



The screen set at power-off is displayed.

Note: The BEFORE PWR-OFF label is displayed on the first MODE screen only. When the MODE screen was displayed at power-off, the BEFORE PWR-OFF label is not displayed.

3.15 Printing

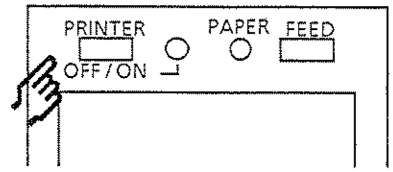
The display contents (measured results, measurement conditions) of each screen can be printed via the built-in printer.

Printing procedure

START

Turn on the printer

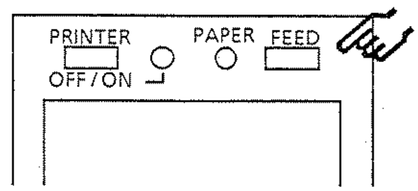
Press the printer [OFF/ON] key



Specify print out.

Press [F6] (PRINT OUT) on the desired screen cursor-off menu.

Print to printer



Tear off the printed result.

Press [FEED] to advance paper.
Tear off the printed result.

END

A printout example is shown below for each screen.

(1) PRESET MEMORIES screen

```
 ==PRESET MEMORIES==
 90-05-24  11:37:59
<MEM1>  RECALL OK
SEND UNIT X20/X21
RECV UNIT X20/X21
MEAS MODE ERROR
  90-05-24  11:37:21
<MEM3>  RECALL OK
SEND UNIT X20/X21
RECV UNIT X20/X21
MEAS MODE VOLT/FREQE
  90-05-24  11:37:27
<MEM5>  RECALL OK
SEND UNIT X20/X21
RECV UNIT 2.0MBPL
MEAS MODE DELAYTIME
  90-05-24  11:37:41
<MEM10> RECALL OK
SEND UNIT 2.0MBPL
RECV UNIT 2.0MBPL
MEAS MODE WORDTRACE
  90-05-24  11:37:53
```

(2) INTERFACE screen

```
== INTERFACE ==
90-05-24  11:38:21
     < SEND >
UNIT2         2.0M BPL
CODE              HDB3
FRAME      16MFP 30CH
CLOCK              INT
INT FREQ          SELF
TIME SLT         CHAN1
BIT RATE        64kb/s
SP BIT           00000
TS16 FRM0         1011
Si BIT              00
    < RECEIVE >
UNIT2         2.0M BPL
CODE              HDB3
FRAME      16MFP 30CH
TIME SLT         CHAN1
BIT RATE        64kb/s
INPT LVL          MAIN
```

(3) ERROR screen

```
==     ERROR      ==
90-05-24   11:21:56
INTF.RECV 64KG.703
PATTERN  2↑6-1 NRML
          NO-SUP
PSL-THR   AUTO
MEAS ERR  BIT
BLK-LENG  1.0E1 BIT
MEAS TIME MANUAL

<< TOTAL  COUNT  >>
 90-05-24   11:19:14
~90-05-24   11:21:50
 TOTAL-TM    0:02:36
ERR        5 5.01E-07
BLK        5 5.01E-06
US         0     0.00
SES        0     0.00
DM         1    33.33
ES     5.00      3.21
EFS  151.00     96.79
PSL-CNT             0
CLK-SLIP            0
PWL(sec)            0
PSL(sec)            0
SGL(sec)            0
AIS(sec)          0.0
RCL(sec)          0.0
BSL(sec)          0.0
```

(4) VOLT/FREQUENCY screen

```
== VOLT / FREQ ==
90-05-24  11:30:06
INTF.RECV X20/X21
PATTERN  2↑6-1 NRML
          NO-SUP
T          2.45kHz
T          -0.06 V
      A      2.1 V
      B      2.1 V
```

(5) VOLT/FREQUENCY screen (line interval)

```
== LINE INTERVAL ==
 90-05-24  11:31:22
 INTF.     X20/X21
START      C   OFF→ON
STOP       I   OFF→ON
               0.00 ms
```

(6) DELAY TIME screen
(transmission delay time)

```
== TRANSMIT DELAY ==
 90-05-24   11:33:33
 INTF.      X20/X21
                0.00 ms
```

(7) WORD TRACE screen

```
 == WORD  TRACE ==
 90-05-24   11:33:53
 INTF.      X20/X21
SEND METHOD MANUAL
IDLE CODE   00000000
WORD LENGTH    2BYTE
SYNC CODE   XXXXXXXX
TRACE STOP  MANUAL
```

(8) EDIT
PATTERN DATA screen

```
== EDIT PATTERN ==
 91-12-25   09:17:41
DISPLAY     BYTE
CODE        EBDCID
BOUNDARY    8BIT
-ADR-
    0 T  h  E     Q
    5 u  i  c  K
   10 B  r  o  w  N
   15    F  o  X
   20 J  u  m  p  S
   25    O  v  e  R
   30    T  h  E
   35 L  a  z  y
   40 D  o  G     1
   45 2  3     4  5
   50 6     7  8  9
   55 0     +  -  *
   60 :  =  $  %  (
   65 ) CR LF
   70
   75
SHIFT       0
INVERT/
 RVRS       NORMAL
COMPARE     OFF
-ADR-
    0 4  5  6     7
    5 8  9  0     +
   10 -  *  :  =  $
   15 %  (  ) CR LF
   20 T  h  E     Q
   25 u  i  c  K
   30 B  r  o  w  N
   35    F  o  X
   40 J  u  m  p  S
   45    O  v  e  R
   50    T  h  E
   55 L  a  z  y
   60 D  o  G     1
   65 2  3     4  5
   70 6     7  8  9
   75 0     +  -  *
```

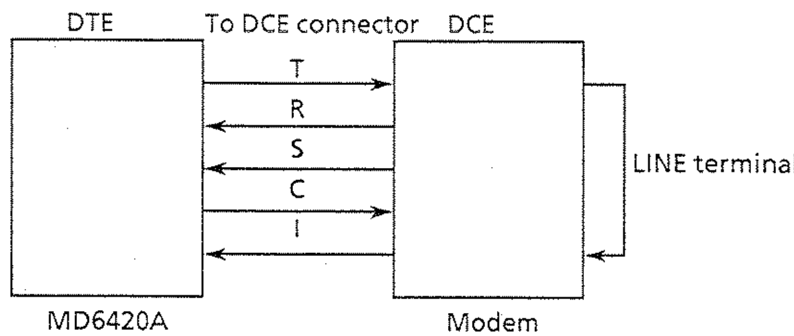
(Blank)

SECTION 4
APPLICATION

4.1 X.21, V.11 Interface Synchronous Data Circuit-Terminating Equipment (DCE) Error Measurement

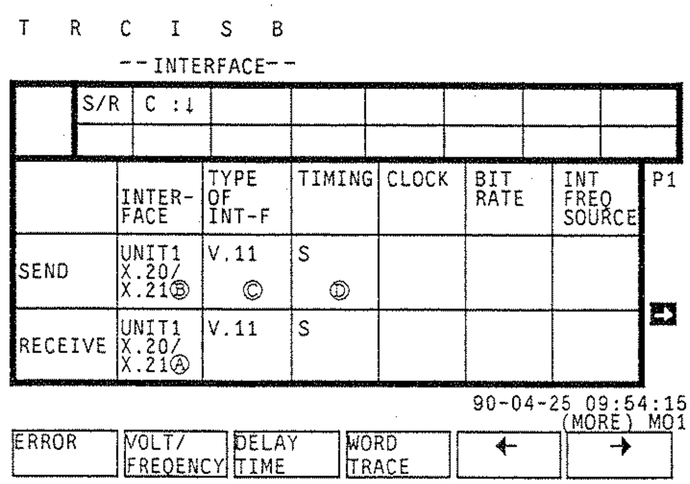
(1) Setup

Insert the MD0621D X.20 (RS-423)/X.21 (RS-422) Interface Unit into the MD6420A. Connect the interface unit to the modem with a 15-pin cable.



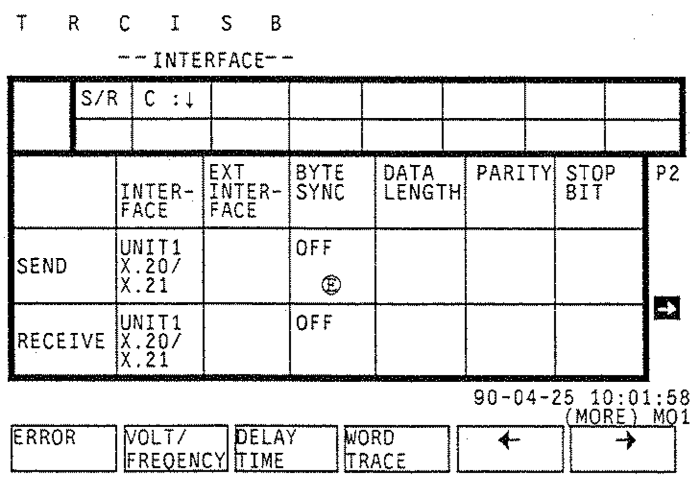
(2) Procedure

Step	Procedure	Screen
1	Turn on the POWER switch.	The MODE screen is displayed.
2	Press [F2].	The INTERFACE screen is displayed.



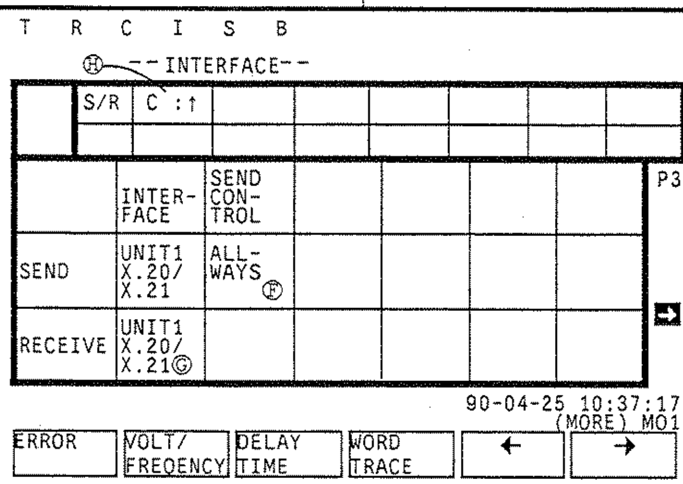
(Continued)

Step	Procedure	Screen
3	Press the CURSOR ⇧ key once.	The cursor is displayed at Ⓐ.
4	Press X.20/X.21 from among [F1] to [F5].	"X.20/X.21" is displayed at RECEIVE INTERFACE (Ⓐ).
5	Press the CURSOR ⇧ key once.	The cursor is displayed at Ⓑ.
6	Press X.20/X.21 from among [F1] to [F5].	"X.20/X.21" is displayed at SEND INTERFACE (Ⓑ).
7	Press the CURSOR ⇨ key once.	The cursor is displayed at Ⓒ.
8	Press [F2].	"V.11" is displayed at SEND TYPE OF INT-F (Ⓒ).
9	Press the CURSOR ⇨ key once.	The cursor is displayed at Ⓓ.
10	Press [F2].	"S" is displayed at SEND TIMING (Ⓓ).
11	Press [F6].	INTERFACE screen page 2 (P2) is displayed and the cursor is displayed at Ⓔ.

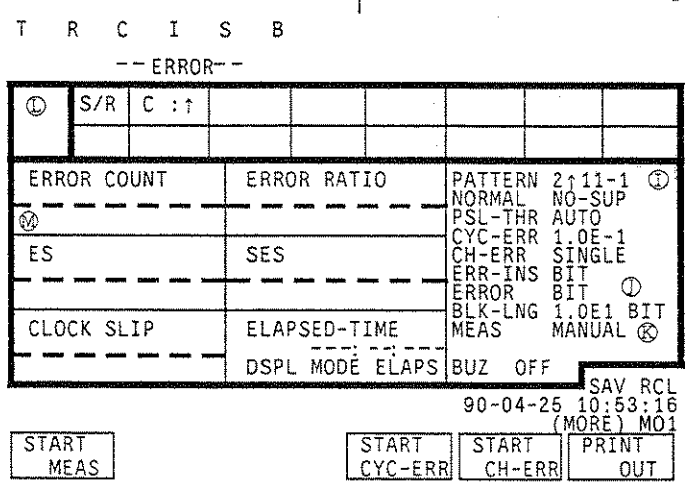


Step	Procedure	Screen
12	Press [F1].	"OFF" is displayed at SEND BYTE SYNC (Ⓔ).
13	Press [F6].	INTERFACE screen page 3 (P3) is displayed and the cursor is displayed at Ⓕ.

(Continued)



Step	Procedure	Screen
14	Press [F1].	"ALL-WAYS" is displayed at SEND SEND CONTROL (Ⓕ).
15	Press the CURSOR ⧐ key once.	The cursor is displayed at Ⓖ.
16	Press [MORE] once.	The next menu is displayed.
17	Press [F1].	The same send and receive interface conditions are set.
18	Press the CURSOR ⧩ key once.	The cursor is displayed at Ⓗ.
19	Press [F1].	"C: ↑ " is displayed at Ⓗ.
20	Press [CURSOR OFF].	The cursor is turned off.
21	Press [F1].	The ERROR screen is displayed.



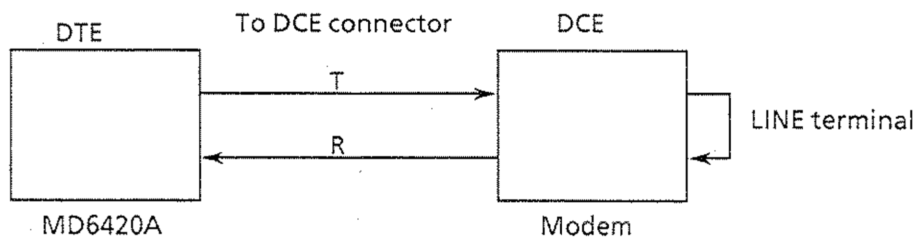
(Continued)

Step	Procedure	Screen
22	Press the CURSOR $\boxed{\triangleright}$ key three times.	The cursor is displayed at Ⓘ.
23	Press [F4].	"2 ↑ 11-1" is displayed at PATTERN (Ⓘ).
24	Press the CURSOR $\boxed{\triangledown}$ key five times.	The cursor is displayed at Ⓙ.
25	Press [F1].	"BIT" is displayed at ERROR (Ⓙ).
26	Press the CURSOR $\boxed{\triangledown}$ key twice.	The cursor is displayed at Ⓚ.
27	Press [F1].	"MANUAL" is displayed at MEAS (Ⓚ).
28	Press [CURSOR OFF].	The cursor is turned off.
29	Press [F1].	Measurements starts. If normal, "MEAS" is displayed at Ⓛ and no errors are counted. (0 is displayed at ERROR COUNT Ⓜ.)

4.2 X.20, V.10 Interface Asynchronous-Modem Error Measurement

(1) Setup

Insert the MD0621D X.20 (RS-423)/X.21 (RS-422) Interface Unit into the MD6420A. Connect the interface unit to the modem with a 15-pin cable.



(2) Procedure

Step	Procedure	Screen
1	Turn on the POWER switch.	The MODE screen is displayed.
2	Press [F2].	The INTERFACE screen is displayed.

T R

--INTERFACE--

S/R

	INTER-FACE	TYPE OF INT-F	TIMING	CLOCK	BIT RATE	INT FREQ SOURCE	P1
SEND	UNIT1 X.20/ X.21Ⓑ	V.10 Ⓒ	ST/SP Ⓓ	INT Ⓔ	2400 b/s Ⓕ	SELF Ⓖ	
RECEIVE	UNIT1 X.20/ X.21Ⓐ	V.10	ST/SP		9600 b/s		

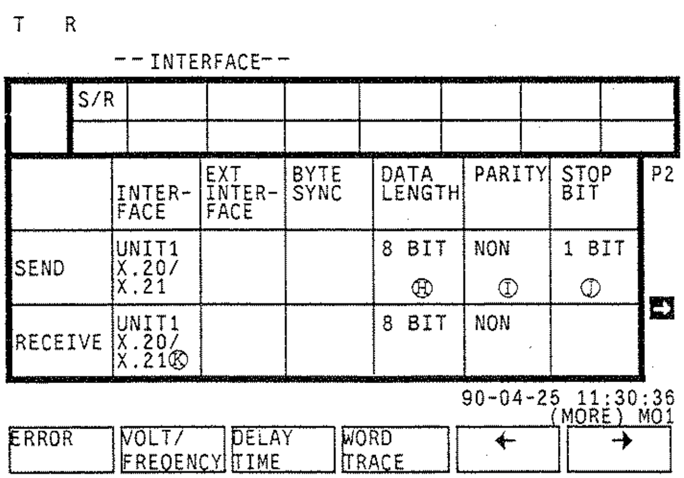
90-04-25 11:21:54
(MORE) M01

ERROR | VOLT/ FREQENCY | DELAY TIME | WORD TRACE | ← | →

Step	Procedure	Screen
3	Press the CURSOR ⋀ key once.	The cursor is displayed at Ⓐ.
4	Press X.20/X.21 from among [F1] to [F5].	"X.20/X.21" is displayed at RECEIVE INTERFACE (Ⓐ).
5	Press the CURSOR ⋀ key once.	The cursor is displayed at Ⓑ.
6	Press X.20/X.21 from among [F1] to [F5].	"X.20/X.21" is displayed at SEND INTERFACE (Ⓑ).
7	Press the CURSOR ≥ key once.	The cursor is displayed at Ⓒ.

(Continued)

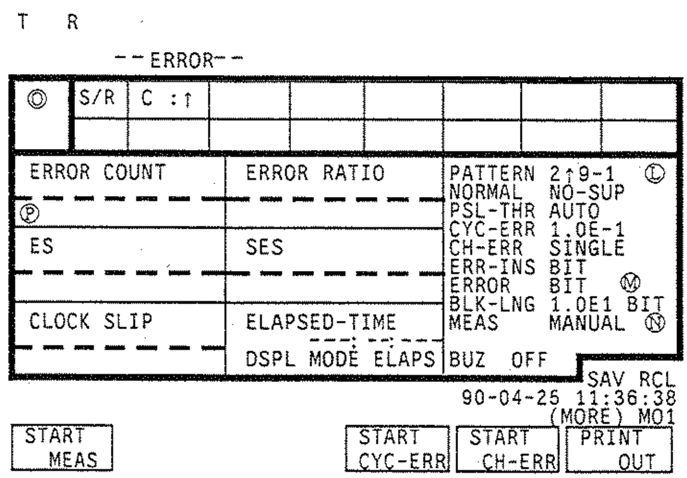
Step	Procedure	Screen
8	Press [F1].	"V.10" is displayed at SEND TYPE OF INT-F (Ⓒ).
9	Press the CURSOR [≥] key once.	The cursor is displayed at Ⓓ.
10	Press [F2].	"ST/SP" is displayed at SEND TIMING (Ⓓ).
11	Press the CURSOR [≥] key once.	The cursor is displayed at Ⓔ.
12	Press [F1].	"INT" is displayed at SEND CLOCK (Ⓔ).
13	Press the CURSOR [≥] key once.	The cursor is displayed at Ⓕ.
14	Press [F2].	"2400b/s" is displayed as SEND BIT RATE (Ⓕ).
15	Press the CURSOR [≥] key once.	The cursor is displayed at Ⓖ.
16	Press [F1].	"SELF" is displayed at SEND INT FREQ SOURCE (Ⓖ).
17	Press [CURSOR OFF].	The cursor is turned off.
18	Press [F6].	INTERFACE screen page 2 (P2) is displayed.



Step	Procedure	Screen
19	Press the CURSOR [≥] key twice.	The cursor is displayed at Ⓗ.
20	Press [F4].	"8BIT" is displayed as SEND DATA LENGTH (Ⓗ).
21	Press the CURSOR [≥] key once.	The cursor is displayed at Ⓘ.

(Continued)

Step	Procedure	Screen
22	Press [F1].	"NON" is displayed at SEND PARITY (Ⓘ).
23	Press the CURSOR ▷ key once.	The cursor is displayed at Ⓙ.
24	Press [F1].	"1BIT" is displayed as SEND STOP BIT (Ⓙ).
25	Press the CURSOR ▷ key once.	The cursor is displayed at Ⓚ.
26	Press [MORE] once.	The next menu is displayed.
27	Press [F1].	The same send and receive interface conditions are set.
28	Press [CURSOR OFF].	The cursor is turned off.
29	Press [F1].	The ERROR screen is displayed.



Step	Procedure	Screen
30	Press the CURSOR ▷ key three times.	The cursor is displayed at Ⓛ.
31	Press [F3].	"2 ↑ 9-1" is displayed at PATTERN (Ⓛ).
32	Press the CURSOR ▽ key five times.	The cursor is displayed at Ⓜ.
33	Press [F1].	"BIT" is displayed at ERROR (Ⓜ).
34	Press the CURSOR ▽ key twice.	The cursor is displayed at Ⓝ.
35	Press [F1].	"MANUAL" is displayed at MEAS (Ⓝ).
36	Press [CURSOR OFF].	The cursor is turned off.

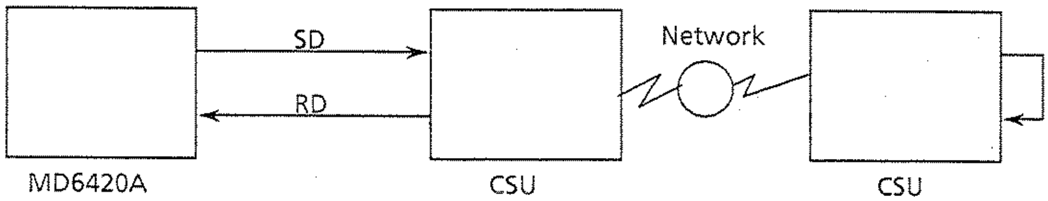
(Continued)

Step	Procedure	Screen
37	Press [F1].	Measurements starts. If normal, "MEAS" is displayed at Ⓞ and no errors are counted. (0 is displayed at ERROR COUNT Ⓟ.)

4.3 G.703, 2.048 Mb/s, G.704 Frame Interface Communication Service Unit (CSU) Error Measurement

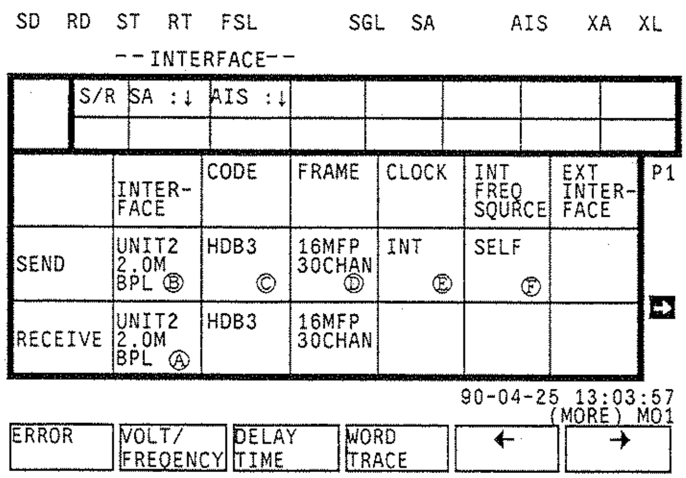
(1) Setup

Insert the MD0623A (or MD0623A1) G.703/G.704 2.048 Mb/s Bipolar Interface Unit into the MD6420A. Connect the interface unit to the CSU with a cable.



(2) Procedure

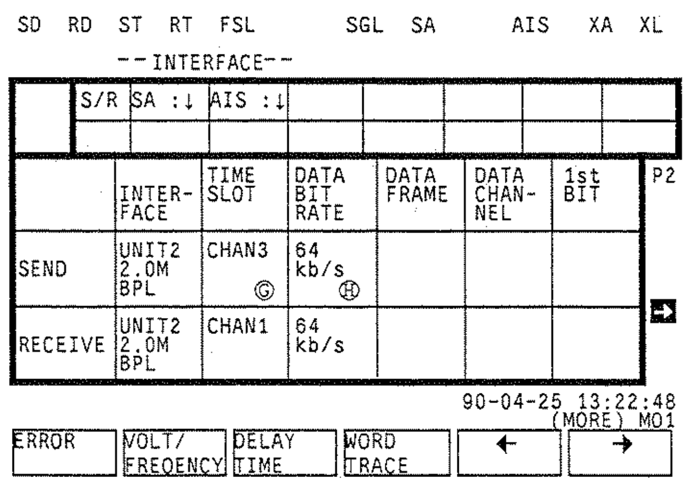
Step	Procedure	Screen
1	Turn on the POWER switch.	The MODE screen is displayed.
2	Press [F2].	The INTERFACE screen is displayed.



Step	Procedure	Screen
3	Press the CURSOR [∧] key once.	The cursor is displayed at Ⓐ.
4	Press 2.0 MBPL from among [F1] to [F5].	"2.0MBPL" is displayed at RECEIVE INTERFACE (Ⓐ).
5	Press the CURSOR [∧] key once.	The cursor is displayed at Ⓑ.
6	Press 2.0 MBPL from among [F1] to [F5].	"2.0MBPL" is displayed at SEND INTERFACE (Ⓑ).
7	Press the CURSOR [>] key once.	The cursor is displayed at Ⓒ.

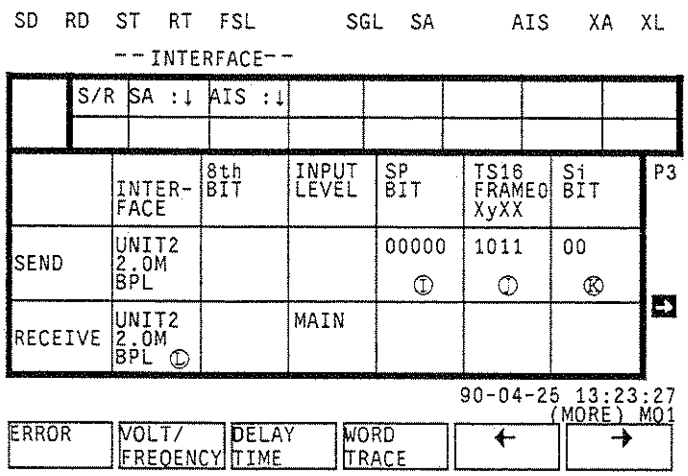
(Continued)

Step	Procedure	Screen
8	Press [F4].	"HDB3" is displayed at SEND CODE (Ⓒ).
9	Press the CURSOR [>] key once.	The cursor is displayed at Ⓓ.
10	Press [F2].	"16MFP 30CHAN" is displayed at SEND FRAME (Ⓓ).
11	Press the CURSOR [>] key once.	The cursor is displayed at Ⓔ.
12	Press [F1].	"INT" is displayed at SEND CLOCK (Ⓔ).
13	Press the CURSOR [>] key once.	The cursor is displayed at Ⓕ.
14	Press [F4].	"RD 8K" is displayed as SEND INT FREQ SOURCE (Ⓕ).
15	Press [CURSOR OFF].	The cursor is turned off.
16	Press [F6].	INTERFACE screen page 2 (P02) is displayed.

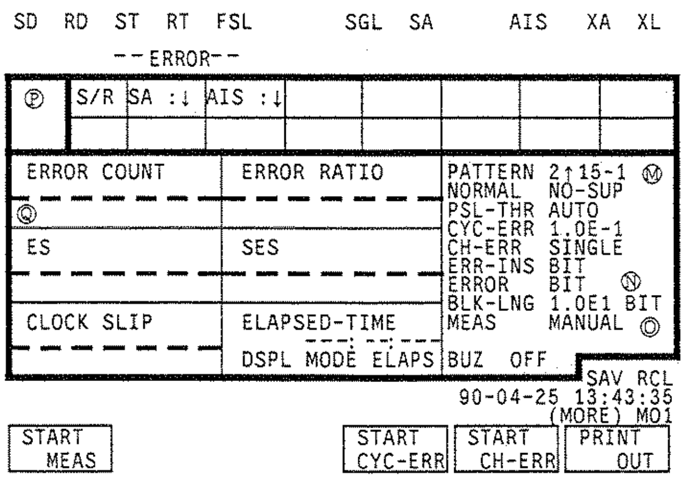


Step	Procedure	Screen
17	Press the CURSOR [>] key twice.	The cursor is displayed at Ⓖ.
18	Press [F1].	"CHAN1" is displayed at SEND TIME SLOT (Ⓖ).
19	Press the MODIFY [∧] key twice.	"CHAN3" is displayed at SEND TIME SLOT (Ⓖ).
20	Press the CURSOR [>] key once.	The cursor is displayed at Ⓗ.
21	Press [F1].	"64k b/s" is displayed at SEND DATA BIT RATE (Ⓗ).

(Continued)

Step	Procedure	Screen
22	Press [F6].	INTERFACE screen page 3 (P03) is displayed. 
23	Press the CURSOR [>] key once.	The cursor is displayed at Ⓘ.
24	Press [F1] five times.	"00000" is displayed at SEND SP BIT (Ⓘ).
25	Press the CURSOR [>] key once.	The cursor is displayed at Ⓙ.
26	Press the function keys in order [F2], [F1], [F2], [F2].	"1011" is displayed at SEND TS16 FRAME0 xyxx Ⓙ.
27	Press the CURSOR [>] key once.	The cursor is displayed at Ⓚ.
28	Press [F1] twice.	"00" is displayed at SEND Si BIT (Ⓚ).
29	Press the CURSOR [>] key once.	The cursor is displayed at Ⓛ.
30	Press [MORE] once.	The next menu is displayed.
31	Press [F1].	The same send and receive interface conditions are set.
32	Press [CURSOR OFF].	The cursor is turned off.
33	Press [F1].	The ERROR screen is displayed.

(Continued)

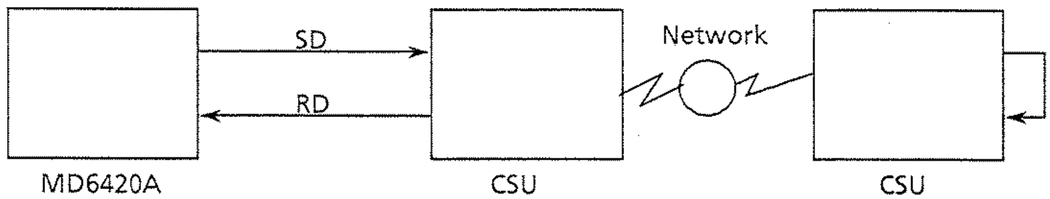


Step	Procedure	Screen
34	Press the CURSOR $\boxed{>}$ key three times.	The cursor is displayed at Ⓜ.
35	Press [F5].	"2 ↑ 15-1" is displayed at PATTERN (Ⓜ).
36	Press the CURSOR $\boxed{\vee}$ key six times.	The cursor is displayed at Ⓝ.
37	Press [F1].	"BIT" is displayed at ERROR (Ⓝ).
38	Press the CURSOR $\boxed{\vee}$ key twice.	The cursor is displayed at Ⓞ.
39	Press [F1].	"MANUAL" is displayed at MEAS (Ⓞ).
40	Press [CURSOR OFF].	The cursor is turned off.
41	Press [F1].	Measurements starts. If normal, "MEAS" is displayed at Ⓟ and errors are not counted. (0 is displayed at ERROR COUNT Ⓠ.)

4.4 G.703, 2.048 Mb/s Unframe Interface CSU Error Measurement

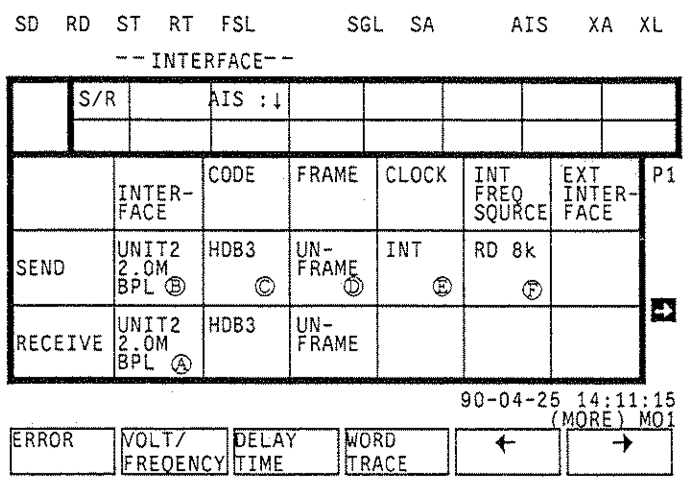
(1) Setup

Insert the MD0623A (or MD0623A1) G.703/G.704 2.048 Mb/s Bipolar Interface Unit into the MD6420A. Connect the interface unit to the CSU with a cable.



(2) Procedure

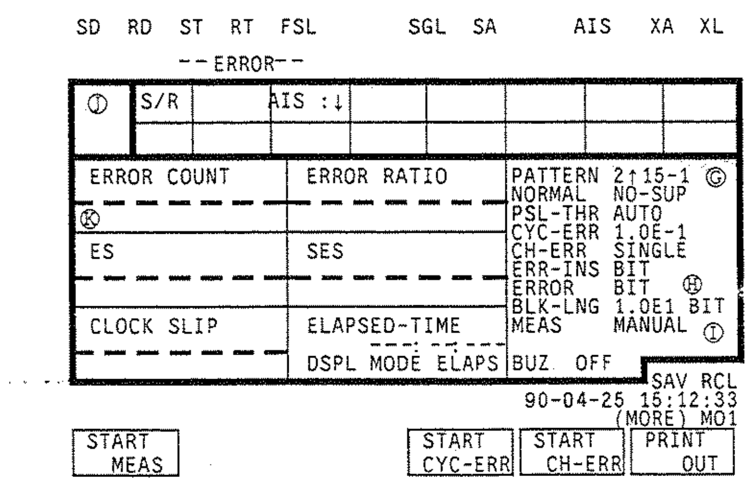
Step	Procedure	Screen
1	Turn on the POWER switch.	The MODE screen is displayed.
2	Press [F2].	The INTERFACE screen is displayed.



Step	Procedure	Screen
3	Press the CURSOR [∧] key once.	The cursor is displayed at Ⓐ.
4	Press 2.0 MBPL from among [F1] to [F5].	"2.0 MBPL" is displayed at RECEIVE INTERFACE (Ⓐ).
5	Press the CURSOR [∧] key once.	The cursor is displayed at Ⓑ.
6	Press 2.0 MBPL from among [F1] to [F5].	"2.0MBPL" is displayed at SEND INTERFACE (Ⓑ).
7	Press the CURSOR [>] key once.	The cursor is displayed at Ⓒ.

(Continued)

Step	Procedure	Screen
8	Press [F4].	"HDB3" is displayed at SEND CODE (C).
9	Press the CURSOR [>] key once.	The cursor is displayed at D.
10	Press [F2].	"UN-FRAME" is displayed at SEND FRAME (D).
11	Press the CURSOR [>] key once.	The cursor is displayed at E.
12	Press [F1].	"INT" is displayed at SEND CLOCK (E).
13	Press the CURSOR [>] key once.	The cursor is displayed at F.
14	Press [F4].	"RD 8K" is displayed as SEND INT FREQ SOURCE (F).
15	Press the CURSOR [>] key once.	The cursor is displayed at A.
16	Press [MORE] once.	The next menu is displayed.
17	Press [F1].	The same send and receive interface conditions are set.
18	Press [CURSOR OFF].	The cursor is turned off.
19	Press [F1].	The ERROR screen is displayed.



Step	Procedure	Screen
20	Press the CURSOR [>] key three times.	The cursor is displayed at G.
21	Press [F5].	"2 ↑ 15-1" is displayed at PATTERN (G).
22	Press the CURSOR [∨] key six times.	The cursor is displayed at H.

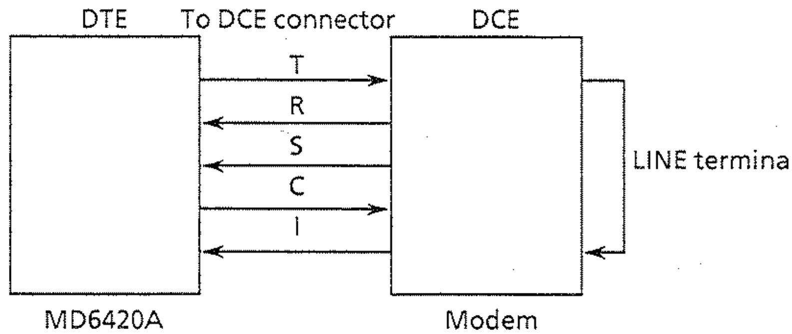
(Continued)

Step	Procedure	Screen
23	Press [F1].	"BIT" is displayed at ERROR (Ⓗ).
24	Press the CURSOR Ⓥ key twice.	The cursor is displayed at Ⓘ.
25	Press [F1].	"MANUAL" is displayed at MEAS (Ⓘ).
26	Press [CURSOR OFF].	The cursor is turned off.
27	Press [F1].	Measurements starts. If normal, "MEAS" is displayed at Ⓙ and no errors are counted. (0 is displayed at ERROR COUNT Ⓚ.)

4.5 X.21, V.11 Interface DCE Voltage Measurement

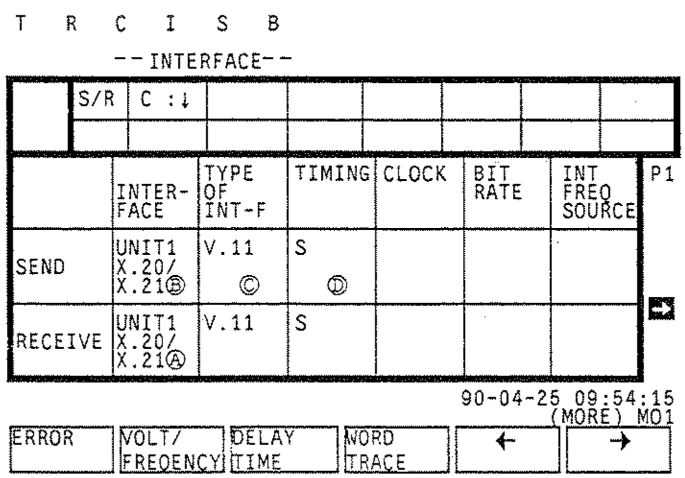
(1) Setup

Insert the MD0621D X.20 (RS-423)/X.21 (RS-422) Interface Unit into the MD6420A. Connect the interface unit to the modem with a 15-pin cable.



(2) Procedure (Measure Voltage by setting R line to All ones.)

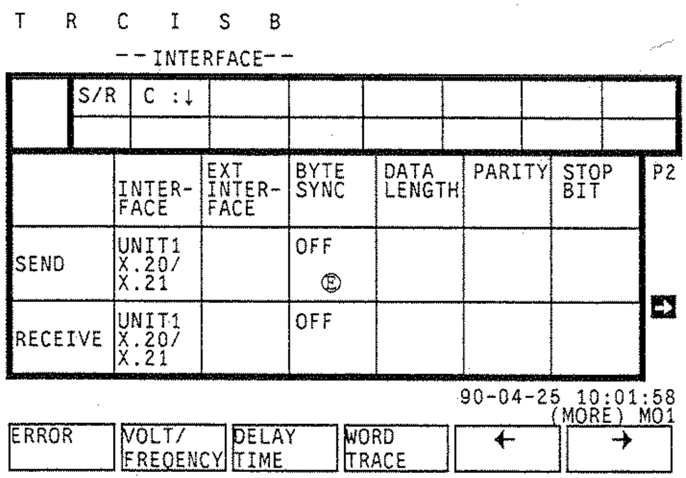
Step	Procedure	Screen
1	Turn on the POWER switch.	The MODE screen is displayed.
2	Press [F2].	The INTERFACE screen is displayed.



Step	Procedure	Screen
3	Press the CURSOR Ⓐ key once.	The cursor is displayed at Ⓐ.
4	Press X.20/X.21 from among [F1] to [F5].	"X.20/X.21" is displayed at RECEIVE INTERFACE (Ⓐ).
5	Press the CURSOR Ⓐ key once.	The cursor is displayed at Ⓑ.

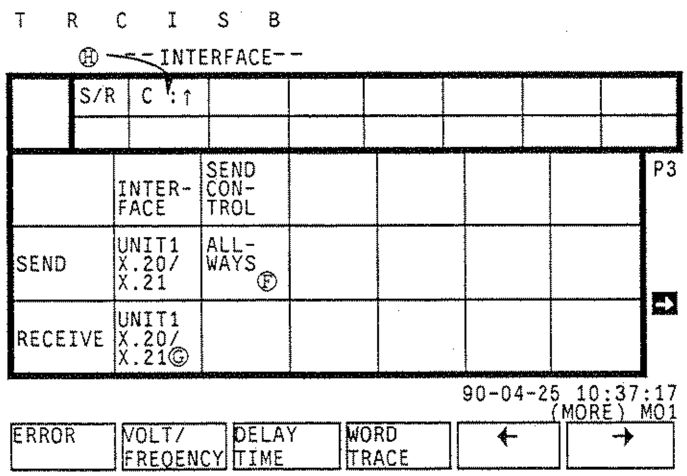
(Continued)

Step	Procedure	Screen
6	Press X.20/X.21 from among [F1] to [F5].	"X.20/X.21" is displayed at SEND INTERFACE (Ⓑ).
7	Press the CURSOR ⊵ key once.	The cursor is displayed at Ⓒ.
8	Press [F2].	"V.11" is displayed at SEND TYPE OF INT-F (Ⓒ).
9	Press the CURSOR ⊵ key once.	The cursor is displayed at Ⓓ.
10	Press [F2].	"S" is displayed at SEND TIMING (Ⓓ).
11	Press [F6].	INTERFACE screen page 2 (P02) is displayed and the cursor is displayed at Ⓔ.



Step	Procedure	Screen
12	Press [F1].	"OFF" is displayed at SEND BYTE SYNC (Ⓔ).
13	Press [F6].	INTERFACE screen page 3 (P03) is displayed and the cursor is displayed at Ⓕ.

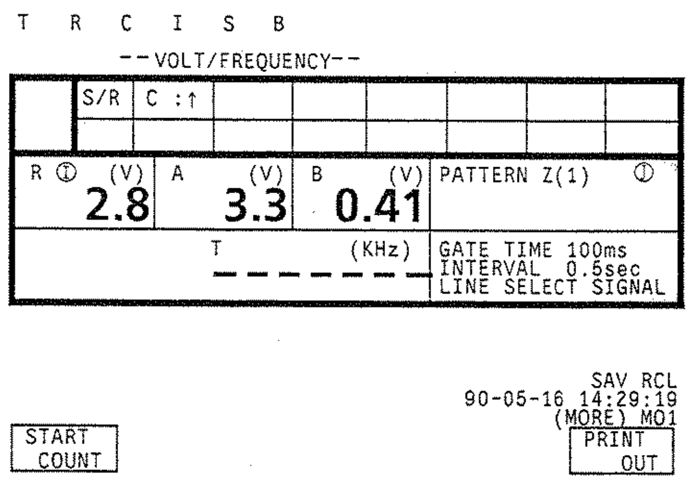
(Continued)



Step	Procedure	Screen
14	Press [F1].	"ALL-WAYS" is displayed at SEND CONTROL (Ⓕ).
15	Press the CURSOR ▷ key once.	The cursor is displayed at Ⓖ.
16	Press [MORE] once.	The next menu is displayed.
17	Press [F1].	The same send and receive interface conditions are set.
18	Press the CURSOR ▽ key once.	The cursor is displayed at Ⓗ.
19	Press [F1].	"C: ↑" is displayed at Ⓗ.
20	Press [CURSOR OFF].	The cursor is turned off.
21	Press [F1].	The VOLT/FREQUENCY screen is displayed. (When this screen is selected, voltage measurement starts automatically.)

(Continued)

Step	Procedure	Screen

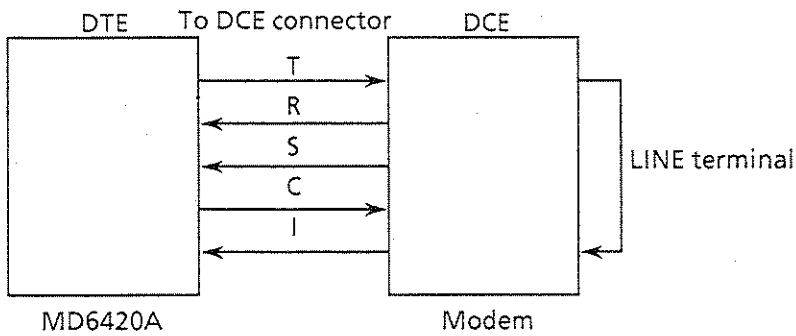


Step	Procedure	Screen
22	Press the CURSOR ⧐ key once.	The cursor is displayed at Ⓘ.
23	Press [F2].	"R" is displayed at the voltage measurement signal line (Ⓘ).
24	Press the CURSOR ⧐ key once.	The cursor is displayed at Ⓙ.
25	Press [MORE] once.	The next menu is displayed .
26	Press [F5].	"Z (1)" is displayed at PATTERN (Ⓙ).

4.6 X.21, V.11 Interface Synchronous-DCE Frequency Measurement

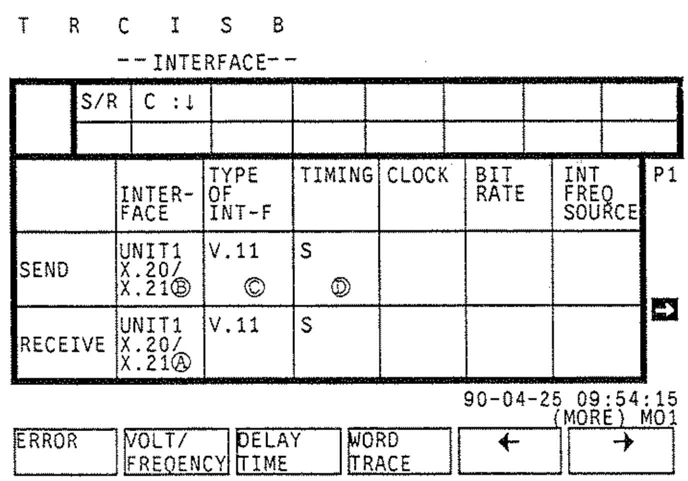
(1) Setup

Insert the MD0621D X.20 (RS-423)/X.21 (RS-422) Interface Unit into the MD6420A. Connect the interface unit to the modem with a 15-pin cable.



(2) Procedure (signal line (S) frequency measurement)

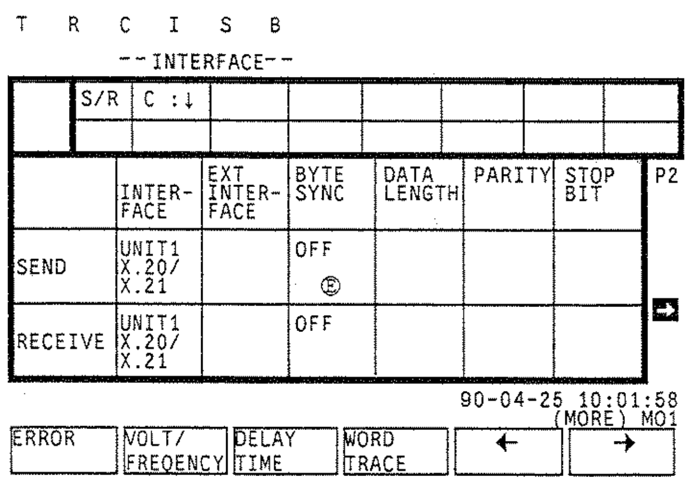
Step	Procedure	Screen
1	Turn on the POWER switch.	The MODE screen is displayed.
2	Press [F2].	The INTERFACE screen is displayed.



Step	Procedure	Screen
3	Press the CURSOR △ key once.	The cursor is displayed at Ⓐ.
4	Press X.20/X.21 from among [F1] to [F5].	"X.20/X.21" is displayed at RECEIVE INTERFACE (Ⓐ).
5.	Press the CURSOR △ key once.	The cursor is displayed at Ⓑ.

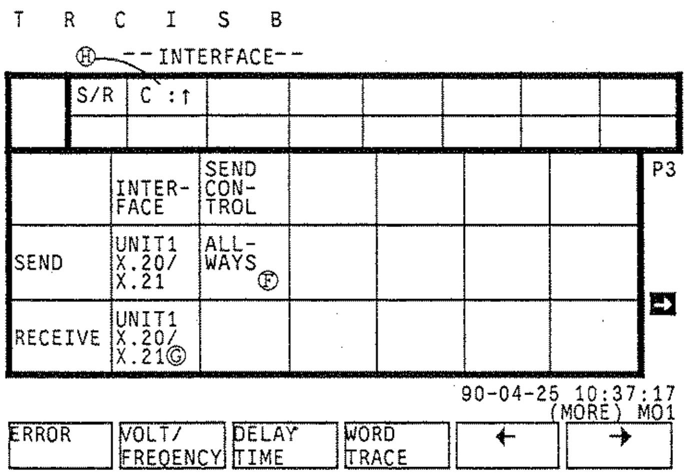
(Continued)

Step	Procedure	Screen
6	Press X.20/X.21 from among [F1] to [F5].	"X.20/X.21" is displayed at SEND INTERFACE (Ⓑ).
7	Press the CURSOR ⊵ key once.	The cursor is displayed at Ⓒ.
8	Press [F2].	"V.11" is displayed at SEND TYPE OF INT-F (Ⓒ).
9	Press the CURSOR ⊵ key once.	The cursor is displayed at Ⓓ.
10	Press [F2].	"S" is displayed at SEND TIMING (Ⓓ).
11	Press [F6].	INTERFACE screen page 2 (P02) is displayed and the cursor is displayed at Ⓔ.



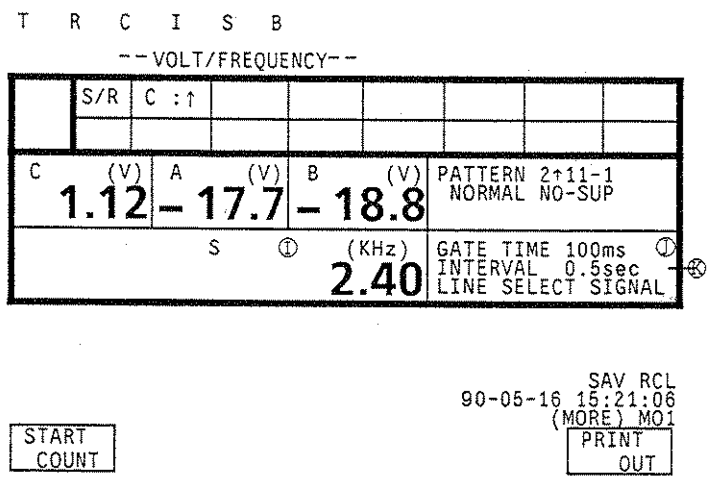
Step	Procedure	Screen
12	Press [F1].	"OFF" is displayed at SEND BYTE SYNC (Ⓔ).
13	Press [F6].	INTERFACE screen page 3 (P03) is displayed and the cursor is displayed at Ⓕ.

(Continued)



Step	Procedure	Screen
14	Press [F1].	"ALL-WAYS" is displayed at SEND CONTROL (Ⓕ).
15	Press the CURSOR ⩾ key once.	The cursor is displayed at Ⓖ.
16	Press [MORE] once.	The next menu is displayed.
17	Press [F1].	The same send and receive interface conditions are set.
18	Press the CURSOR ⩔ key once.	The cursor is displayed at Ⓗ.
19	Press [F1].	"C: ↑ " is displayed at Ⓗ.
20	Press [CURSOR OFF].	The cursor is turned off.
21	Press [F1].	The VOLT/FREQUENCY screen is displayed. (When this screen is selected, frequency measurement starts automatically.)

(Continued)

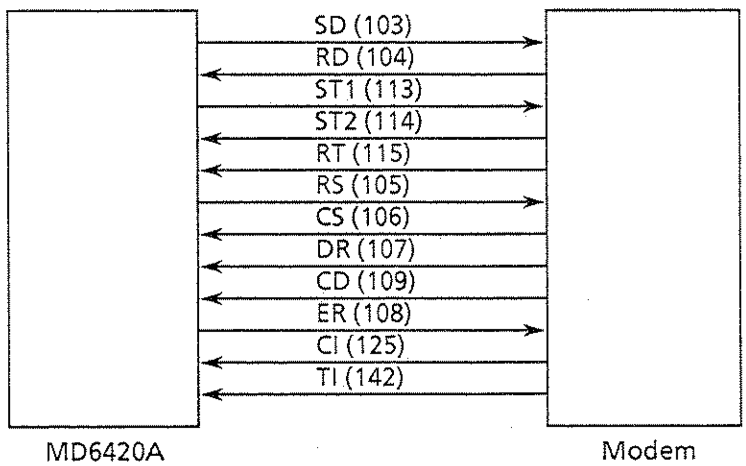


Step	Procedure	Screen
22	Press the CURSOR ⊵ key three times.	The cursor is displayed at Ⓘ.
23	Press [F5].	"S" is displayed at the frequency measurement signal line field (Ⓘ).
24	Press the CURSOR ⊵ key once.	The cursor is displayed at Ⓙ.
25	Press [F1].	"100 ms" is displayed at GATE TIME (Ⓙ).
26	Press the CURSOR ⊵ key once.	The cursor is displayed at Ⓚ.
27	Press [F1].	"0.5 sec" is displayed at INTERVAL (Ⓚ).
28	Press [CURSOR OFF].	The cursor is turned off.
29	Press [F1].	Measurements starts.

4.7 V.35 Interface Modem Delay Time Measurement

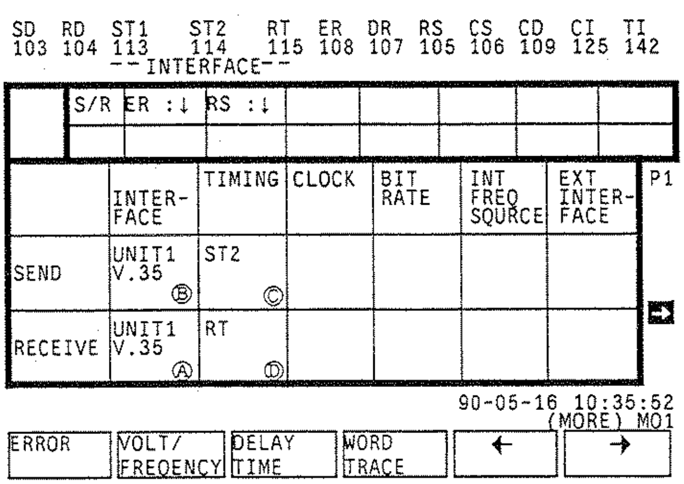
(1) Setup

Insert the MD0621B V.35 Interface Unit into the MD6420A. Connect the interface unit to the modem with a 34-pin cable.



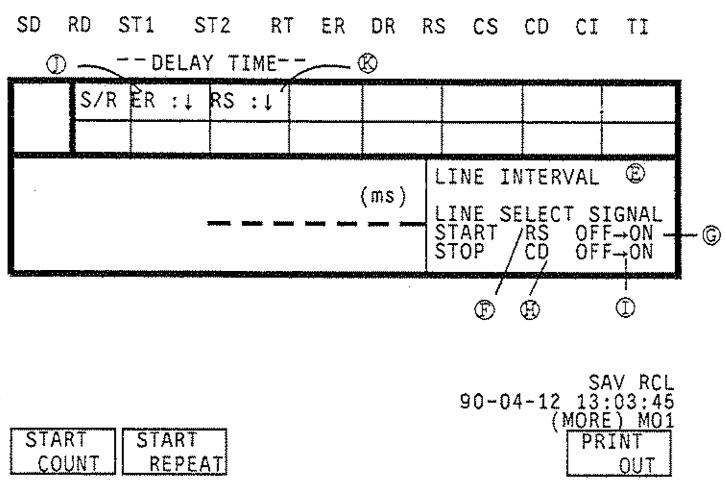
(2) Procedure

Step	Procedure	Screen
1	Turn on the POWER switch.	The MODE screen is displayed.
2	Press [F2].	The INTERFACE screen is displayed.



(Continued)

Step	Procedure	Screen
3	Press the CURSOR $\boxed{\wedge}$ key once.	The cursor is displayed at Ⓐ.
4	Press V.35 from among [F1] to [F5].	"V.35" is displayed at RECEIVE INTERFACE (Ⓐ).
5	Press the CURSOR $\boxed{\wedge}$ key once.	The cursor is displayed at Ⓑ.
6	Press V.35 from among [F1] to [F5].	"V.35" is displayed at SEND INTERFACE (Ⓑ).
7	Press the CURSOR $\boxed{>}$ key once.	The cursor is displayed at Ⓒ.
8	Press [F2].	"ST2" is displayed at SEND TIMING (Ⓒ).
9	Press the CURSOR $\boxed{\vee}$ key once.	The cursor is displayed at Ⓓ.
10	Press [F2].	"RT" is displayed at SEND TIMING (Ⓓ).
11	Press [CURSOR OFF].	The cursor is turned off.
12	Press [F3].	The DELAY TIME screen is displayed.



Step	Procedure	Screen
13	Press the CURSOR $\boxed{>}$ key once.	The cursor is displayed at Ⓔ.
14	Press [F1].	"LINE INTERVAL" is displayed at (Ⓔ).
15	Press the CURSOR $\boxed{>}$ key once.	The cursor is displayed at Ⓕ.
16	Press [MORE] once.	The next menu is displayed.
17	Press [F2].	"RS" is displayed at Ⓕ.

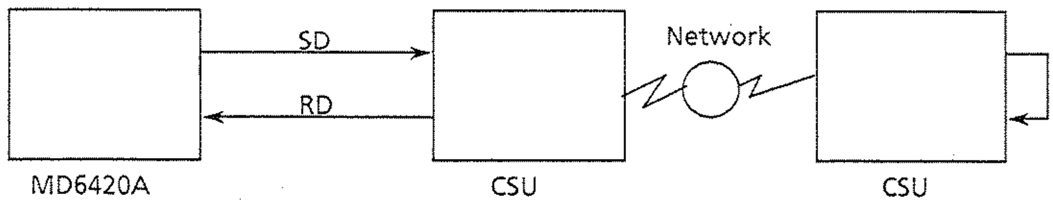
(Continued)

Step	Procedure	Screen
18	Press the CURSOR [>] key once.	The cursor is displayed at Ⓖ.
19	Press [F1].	"OFF→ON" is displayed at (Ⓖ).
20	Press the CURSOR [>] key once.	The cursor is displayed at Ⓗ.
21	Press [MORE] once.	The next menu is displayed.
22	Press [F4].	"CD" is displayed at Ⓗ.
23	Press the CURSOR [>] key once.	The cursor is displayed at Ⓘ.
24	Press [F1].	"OFF→ON" is displayed at (Ⓘ).
25	Press [CURSOR OFF].	The cursor is turned off.
26	Press [F1].	The MD6420A enters the WAIT state.
27	Press the CURSOR [∨] key once.	The cursor is displayed at Ⓙ.
28	Press [F1].	"ER: ↑ " is displayed at Ⓙ.
29	Press the CURSOR [>] key once.	The cursor is displayed at Ⓚ.
30	Press [F1].	"RS: ↑ " is displayed at Ⓚ. (Counting starts here.) When the CD LED lights, measurement stops automatically.

4.8 G.703, 2.048 Mb/s, G.704 Frame Interface CSU FOX Pattern Send/Receive Test

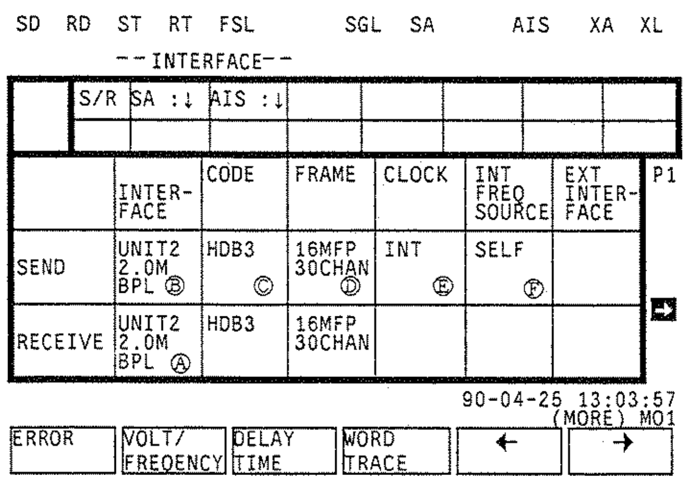
(1) Setup

Insert the MD0623A (or MD0623A1) G.703/G.704 2.048 Mb/s Bipolar Interface Unit into the MD6420A. Connect the interface unit to the CSU with a cable.



(2) Procedure

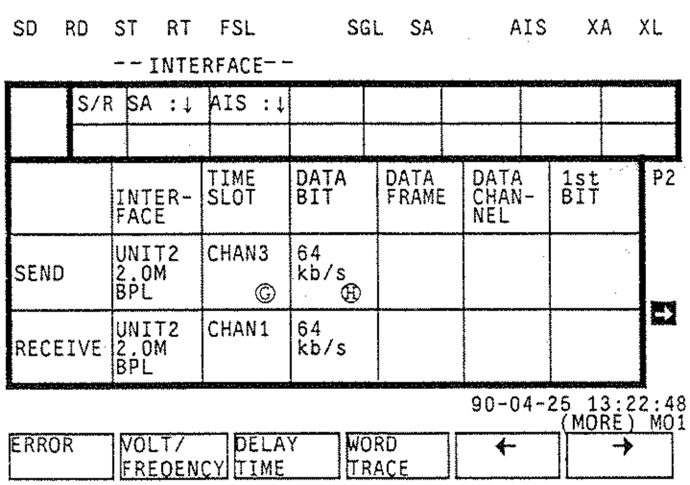
Step	Procedure	Screen
1	Turn on the POWER switch.	The MODE screen is displayed.
2	Press [F2].	The INTERFACE screen is displayed.



Step	Procedure	Screen
3	Press the CURSOR ⩓ key once.	The cursor is displayed at Ⓐ.
4	Press 2.0MBPL from among [F1] to [F5].	"2.0MBPL" is displayed at SEND INTERFACE (Ⓐ).
5	Press the CURSOR ⩓ key once.	The cursor is displayed at Ⓑ.
6	Press 2.0MBPL from among [F1] to [F5].	"2.0MBPL" is displayed at SEND INTERFACE (Ⓑ).
7	Press the CURSOR ⩥ key once.	The cursor is displayed at Ⓒ.

(Continued)

Step	Procedure	Screen
8	Press [F4].	"HDB3" is displayed at SEND CODE (Ⓒ).
9	Press the CURSOR [>] key once.	The cursor is displayed at Ⓒ.
10	Press [F2].	"16MFP 30CHAN" is displayed at SEND FRAME (Ⓓ).
11	Press the CURSOR [>] key once.	The cursor is displayed at Ⓔ.
12	Press [F1].	"INT" is displayed at SEND CLOCK (Ⓔ).
13	Press the CURSOR [>] key once.	The cursor is displayed at Ⓕ.
14	Press [F4].	"RD 8K" is displayed at SEND INT FREQ SOURCE (Ⓕ).
15	Press [CURSOR OFF].	The cursor is turned off.
16	Press [F6].	INTERFACE screen page 2 (P02) is displayed.



Step	Procedure	Screen
17	Press the CURSOR [>] key twice.	The cursor is displayed at Ⓖ.
18	Press [F1].	"CHAN1" is displayed at SEND TIME SLOT (Ⓖ).
19	Press the MODIFY [∧] key twice.	"CHAN3" is displayed at SEND TIME SLOT (Ⓖ).
20	Press the CURSOR [>] key once.	The cursor is displayed at Ⓗ.

(Continued)

Step	Procedure	Screen
21	Press [F1].	"64 kb/s" is displayed at SEND DATA BIT RATE (Ⓗ).
22	Press [F6].	INTERFACE screen page 3 (P03) is displayed.

SD RD ST RT FSL SGL SA AIS XA XL

-- INTERFACE--

	S/R	SA :↓	AIS :↓				

	INTER-FACE	8th BIT	INPUT LEVEL	SP BIT	TS16 FRAME0 XyXX	Si BIT
SEND	UNIT2 2.0M BPL			00000 Ⓘ	1011 Ⓙ	00 Ⓚ
RECEIVE	UNIT2 2.0M BPL Ⓛ		MAIN			

P3

90-04-25 13:23:27

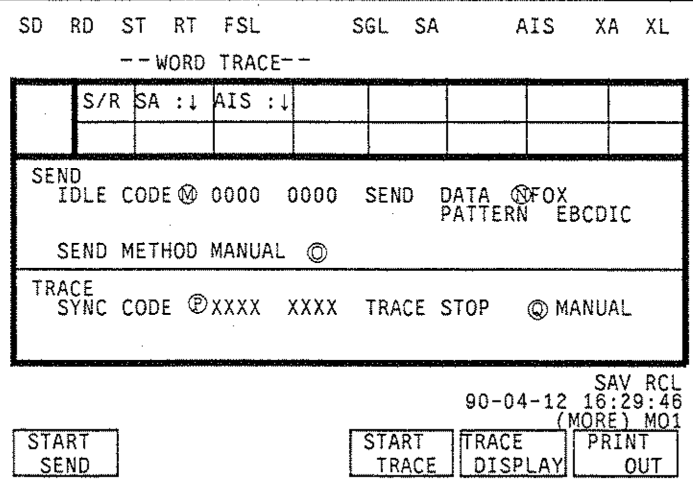
(MORE) M01

ERROR	VOLT/ FREQENCY	DELAY TIME	WORD TRACE	←	→

Step	Procedure	Screen
23	Press the CURSOR ⊵ key once.	The cursor is displayed at Ⓘ.
24	Press [F1] five times.	"00000" is displayed at SEND SP BIT (Ⓘ).
25	Press the CURSOR ⊵ key once.	The cursor is displayed at Ⓙ.
26	Press the keys [F2], [F1], [F2], [F2] in order.	"1011" is displayed at SEND TS16 FRAME0 xyxx Ⓙ.
27	Press the CURSOR ⊵ key once.	The cursor is displayed at Ⓚ.
28	Press [F1] twice.	"00" is displayed at SEND Si BIT (Ⓚ).
29	Press the CURSOR ⊵ key once.	The cursor is displayed at Ⓛ.
30	Press [MORE] once.	The next menu is displayed.
31	Press [F1].	The same send and receive interface conditions are set.
32	Press [CURSOR OFF].	The cursor is turned off.
33	Press [F4].	The WORD TRACE screen is displayed.

(Continued)

Step	Procedure	Screen



34	Press the CURSOR $\boxed{\geq}$ key once.	The cursor is displayed at Ⓜ.
35	Press [F2] while pressing and holding [F4].	All 0s are displayed at IDLE CODE (Ⓜ).
36	Press the CURSOR $\boxed{\geq}$ key once.	The cursor is displayed at Ⓝ.
37	Press [F1].	"FOX" is displayed at SEND DATA (Ⓝ).
38	Press the CURSOR $\boxed{\geq}$ key once.	The cursor is displayed at Ⓞ.
39	Press [F1].	"MANUAL" is displayed at SEND METHOD (Ⓞ).
40	Press the CURSOR $\boxed{\geq}$ key once.	The cursor is displayed at Ⓟ.
41	Press [F1].	"xxxx xxxx" is displayed at SYNC CODE (Ⓟ).
42	Press the CURSOR $\boxed{\geq}$ key once.	The cursor is displayed at Ⓠ.
43	Press [F1].	"MANUAL" is displayed at TRACE STOP (Ⓠ).
44	Press [CURSOR OFF].	The cursor is turned off.
45	Press [F1].	The pattern is sent.
46	Press [F4].	Trace starts.
47	Press [F4].	Trace stops (The time between steps 46 and 47 is the trace time.)
48	Press [F1].	Pattern sending stops.

(Continued)

Step	Procedure	Screen
49	Press [F5].	The DISPLAY PATTERN TRACE screen is displayed.

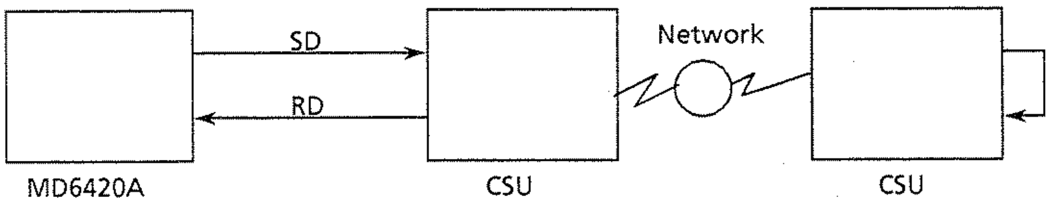
```
                  --DISPLAY PATTERN TRACE--
ADDRESS |+0 +1 +2 +3 +4 +5 +6 +7 +8 +9 | STOP TIME
      0 | T  H  E        L  a  z  y     D |   91-12-25
     10 | o  G     1  2  3     4  5  6 |   09:18:43
     20 |    7  8  9  0     +  -  *  : | DISPLAY
     30 | =  $  %  (  )  CR LF T  h  E |  ADDRESSⓇ
     40 |    Q  u  i  c  k     B  r  o |          0
     50 | w  N     F  o  x     J  u  m | DISPLAY
     60 | p  S     O  v  e  R     T  h |      BYTEⓈ
     70 | E     L  a  z  y     D  o  G | CODE
                                          ⓉEBCDIC
                                        BOUNDARY
                                             8BIT
                                        SHIFT   0
                                        INVERT/RVRS
                                           NORMAL
                                        COMPARE OFF
                                            0BYTE
                                    90-04-12 15:50:18

 [SCROLL ↓] [SCROLL ↑] [SCROLL NEXT] [SCROLL BACK] [PRINT OUT]
```

Step	Procedure	Screen
50	Press the CURSOR [>] key once.	The cursor is displayed at Ⓡ.
51	Press [F1].	"0" is displayed at DISPLAY ADDRESS (Ⓡ).
52	Press the CURSOR [>] key once.	The cursor is displayed at Ⓢ.
53	Press [F1].	"BYTE" is displayed at DISPLAY (Ⓢ).
54	Press the CURSOR [>] key once.	The cursor is displayed at Ⓣ.
55	Press [F3].	"EBCDIC" is displayed at CODE Ⓣ. (The FOX pattern data is sent and the looped-back data is displayed.)

4.9 G.703, 2.048 Mb/s, G.704 Frame Interface CSU User Pattern Send/Receive Test

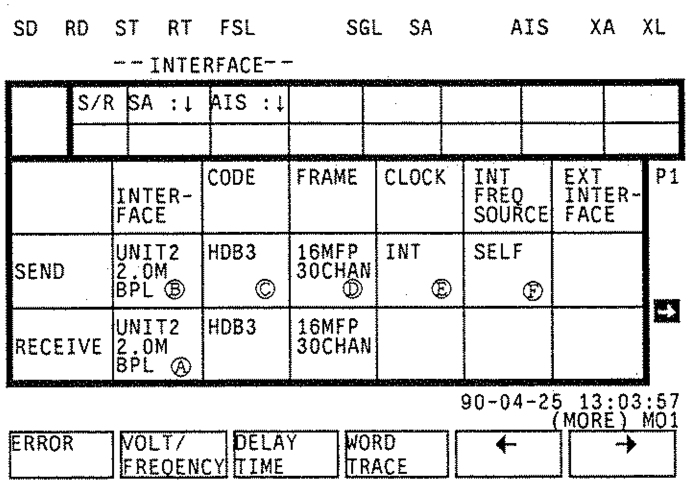
(1) Setup

Insert the MD0623A (or MD0623A1) G.703/G.704 2.048 Mb/s Bipolar Interface Unit into the MD6420A. Connect the interface unit to the CSU with a cable.



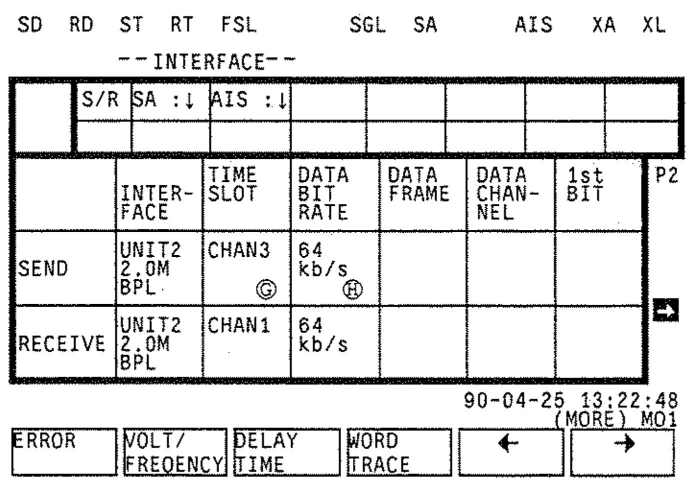
(2) Procedure

Step	Procedure	Screen
1	Turn on the POWER switch.	The MODE screen is displayed.
2	Press [F2].	The INTERFACE screen is displayed.



Step	Procedure	Screen
3	Press the CURSOR [∧] key once.	The cursor is displayed at Ⓐ.
4	Press 2.0MBPL from among [F1] to [F5].	"2.0MBPL" is displayed at RECEIVE INTERFACE (Ⓐ).
5	Press the CURSOR [∧] key once.	The cursor is displayed at Ⓑ.
6	Press 2.0MBPL from among [F1] to [F5].	"2.0MBPL" is displayed at SEND INTERFACE (Ⓑ).
7	Press the CURSOR [>] key once.	The cursor is displayed at Ⓒ.

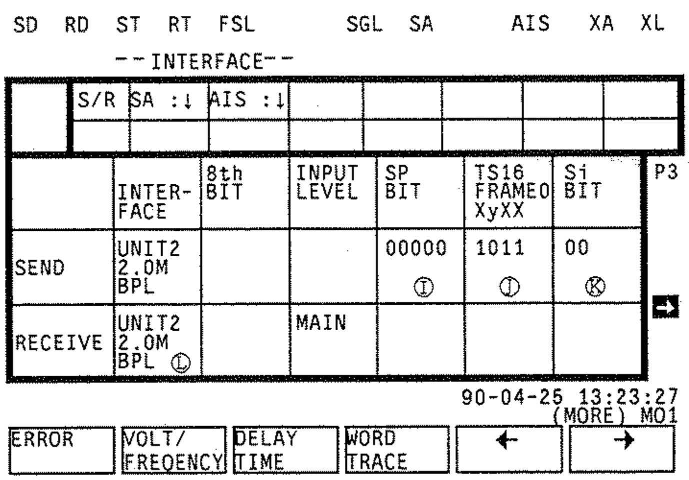
Step	Procedure	Screen
8	Press [F4].	"HDB3" is displayed at SEND CODE (Ⓒ).
9	Press the CURSOR [>] key once.	The cursor is displayed at Ⓓ.
10	Press [F2].	"16MFP 30CHAN" is displayed at SEND FRAME (Ⓓ).
11	Press the CURSOR [>] key once.	The cursor is displayed at Ⓔ.
12	Press [F1].	"INT" is displayed at SEND CLOCK (Ⓔ).
13	Press the CURSOR [>] key once.	The cursor is displayed at Ⓕ.
14	Press [F4].	"RD 8K" is displayed at SEND INT FREQ SOURCE (Ⓕ).
15	Press [CURSOR OFF].	The cursor is turned off.
16	Press [F6].	INTERFACE screen page 2 (P02) is displayed.



Step	Procedure	Screen
17	Press the CURSOR [>] key twice.	The cursor is displayed at Ⓖ.
18	Press [F1].	"CHAN1" is displayed at SEND TIME SLOT (Ⓖ).
19	Press the MODIFY [∧] key twice.	"CHAN3" is displayed at SEND TIME SLOT (Ⓖ).
20	Press the CURSOR [>] key once.	The cursor is displayed at Ⓗ.

(Continued)

Step	Procedure	Screen
21	Press [F1].	"64 kb/s" is displayed at SEND DATA BIT RATE (Ⓗ).
22	Press [F6].	INTERFACE screen page 3 (P03) is displayed.



Step	Procedure	Screen
23	Press the CURSOR [≥] key once.	The cursor is displayed at Ⓘ.
24	Press [F1] five times.	"00000" is displayed at SEND SP BIT (Ⓘ).
25	Press the CURSOR [≥] key once.	The cursor is displayed at Ⓙ.
26	Press the keys [F2], [F1], [F2], [F2] in order.	"1011" is displayed at SEND TS16 FRAME0 xyxx Ⓙ.
27	Press the CURSOR [≥] key once.	The cursor is displayed at Ⓚ.
28	Press [F1] twice.	"00" is displayed at SEND Si BIT (Ⓚ).
29	Press the CURSOR [≥] key once.	The cursor is displayed at Ⓛ.
30	Press [MORE] once.	The next menu is displayed.
31	Press [F1].	The same send and receive interface conditions are set.
32	Press [CURSOR OFF].	The cursor is turned off.
33	Press [F4].	The WORD TRACE screen is displayed.

(Continued)

Step	Procedure	Screen

```
SD  RD  ST  RT  FSL      SGL  SA      AIS   XA  XL
          --WORD TRACE--
+----+-----+------+------+-----+-----+-----+-----+
|    | S/R | SA :↓| AIS :↓|    |     |     |     |
|    |     |      |      |     |     |     |     |
+----+-----+------+------+-----+-----+-----+-----+
| SEND                                            |
|   IDLE CODE Ⓜ 0000  0000  SEND  DATA  Ⓝ PRGM    |
|   TOP ADDRESS    Ⓡ   0  WORD  ADDRESS Ⓞ25       |
|   LAST ADDRESS   Ⓢ  25        PATTERNⓅ0101 1010 |
|   SEND METHOD MANUAL Ⓠ                          |
+-------------------------------------------------+
| TRACE                                           |
|   SYNC CODE Ⓣ XXXX  XXXX  TRACE STOP  Ⓤ MANUAL  |
+-------------------------------------------------+
                                       SAV RCL
                              90-04-13 12:48:53
                                      (MORE) M01
[START]                     [START] [TRACE  ] [PRINT]
[ SEND]                     [TRACE] [DISPLAY] [  OUT]
```

Step	Procedure	Screen
34	Press the CURSOR ▷ key once.	The cursor is displayed at Ⓜ.
35	Press [F2] while pressing and holding [F4].	All 0s are displayed at IDLE CODE (Ⓜ).
36	Press the CURSOR ▷ key once.	The cursor is displayed at Ⓝ.
37	Press [F2].	"PRGM" is displayed at SEND DATA (Ⓝ).
38	Press the CURSOR ▽ key once.	The cursor is displayed at Ⓞ.
39	Press [F2].	"0" is displayed at WORD ADDRESS (Ⓞ).
40	Press the CURSOR ▽ key once.	The cursor is displayed at Ⓟ.
41	Input the ASCII code for "A" (0100 0001) with [F2] and [F3].	"0100 0001" is displayed at PATTERN (Ⓟ).
42	Press [F1].	"A" in ASCII code is input at address 0 and "1" is displayed at WORD ADDRESS Ⓞ.
43	Repeat steps 41 and 42 and input ASCII code for "A" to "Z".	
44	Press the CURSOR ▷ key once.	The cursor is displayed at Ⓠ.
45	Press [F1].	"MANUAL" is displayed at SEND METHOD (Ⓠ)
46	Press the CURSOR ▽ key twice.	The cursor is displayed at Ⓡ.
47	Press [F1].	"0" is displayed at TOP ADDRESS (Ⓡ).

(Continued)

Step	Procedure	Screen
48	Press the CURSOR ∨ key once.	The cursor is displayed at Ⓢ.
49	Press [F1].	"50" is displayed at LAST ADDRESS (Ⓢ).
50	Press the MODIFY ∨ key three times while pressing [COARSE].	"20" is displayed at LAST ADDRESS (Ⓢ).
51	Press the MODIFY ∧ key five times.	"25" is displayed at LAST ADDRESS (Ⓢ).
52	Press the CURSOR ∨ key twice.	The cursor is displayed at Ⓣ.
53	Press [F1].	"xxxx xxxx" is displayed at SYNC CODE (Ⓣ).
54	Press the CURSOR > key once.	The cursor is displayed at Ⓤ.
55	Press [F1].	"MANUAL" is displayed at TRACE STOP (Ⓤ).
56	Press [CURSOR OFF].	The cursor is turned off.
57	Press [F1].	A pattern is sent.
58	Press [F4].	Trace starts.
59	Press [F4].	Trace stops (The time between steps 56 and 57 is the trace time.)
60	Press [F1].	Pattern sending stops.
61	Press [F5].	The DISPLAY PATTERN TRACE screen is displayed.

--DISPLAY PATTERN TRACE--

ADDRESS	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9
0	A	B	C	D	E	F	G	H	I	J
10	K	L	M	N	O	P	Q	R	S	T
20	U	V	W	X	Y	Z	A	B	C	D
30	E	F	G	H	I	J	K	L	M	N
40	O	P	Q	R	S	T	U	V	W	X
50	Y	Z	A	B	C	D	E	F	G	H
60	I	J	K	L	M	N	O	P	Q	R
70	S	T	U	V	W	X	Y	Z	A	B

STOP TIME
91-12-25
09:18:43
DISPLAY
ADDRESSⓋ
0
DISPLAY
ⓌBYTE
CODE
ⓍASCII
BOUNDARY
8BIT
SHIFT 0
INVERT/RVRS
NORMAL
COMPARE OFF
0BYTE

90-04-13 11:50:22

SCROLL ↓	SCROLL ↑	SCROLL NEXT	SCROLL BACK	PRINT OUT

(Continued)

Step	Procedure	Screen
62	Press the CURSOR [≥] key once.	The cursor is displayed at Ⓥ.
63	Press [F1].	"0" is displayed at DISPLAY ADDRESS (Ⓥ).
64	Press the CURSOR [≥] key once.	The cursor is displayed at Ⓦ.
65	Press [F1].	"BYTE" is displayed at DISPLAY (Ⓦ).
66	Press the CURSOR [≥] key once.	The cursor is displayed at Ⓧ.
67	Press [F2].	"ASCII" is displayed at CODE (Ⓧ).

(Blank)

SECTION 5
REMOTE CONTROL

5.1 General

The MD6420A Data Transmission Analyzer can be remotely controlled via the remote control unit.

The functions for remotely controlling the MD6420A are common to the following remote control units.

(1) MD0620A GP-IB Unit

(2) MD0620B RS-232C Unit

This section explains how to use the MD6420A when it is connecting a GP-IB or RS-232C interface via the MD0620A or MD0620B.

5.2 RS-232C Serial Interface

The MD6420A can be remotely controlled by EIA-RS232C or CCITT-V24 serial signals from the MD0620B RS-232C Unit.

The MD6420A can be remotely controlled by a control program when it is connected to a controller (usually a Anritsu Packet V, IBM-PC, or other personal computer) with an RS-232C cable. The measured results can be read from the MD6420A to the controller. The MD6420A serial interface specifications are shown in Table 5-1.

Table 5-1 MD6420A Serial Interface Specifications

Item	Specification
Transmission rate	1200 b/s
Signal level	Conforms to CCITT V.28
Synchronization	Start-stop synchronization
Data bit length	Select 7 or 8 bits
Parity	Select none, even, or odd
Stop bit length	Select 1, 1.5 or 2 bits
Transmission protocol	No protocol

5.2.1 Installing and removing the MD0620B RS-232C unit

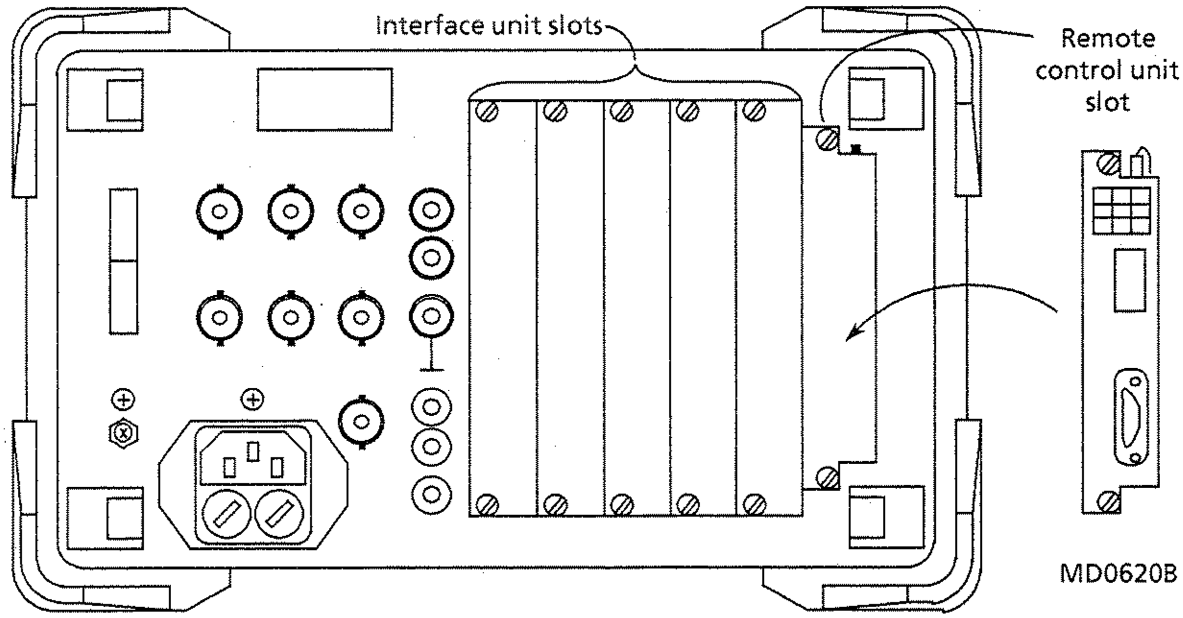


Fig. 5-1 MD6420A Rear View

Installation procedure

Step	Procedure
1	Turn off the MD6420A POWER switch.
2	Loosen the screws at the top and bottom of a blank panel on the remote control unit slot (or GP-IB unit) and remove the blank panel (or GP-IB unit).
3	Insert the RS-232C unit along the top and bottom guide rails and push in the unit so that it is firmly seated.
4	Tighten the top and bottom screws firmly.

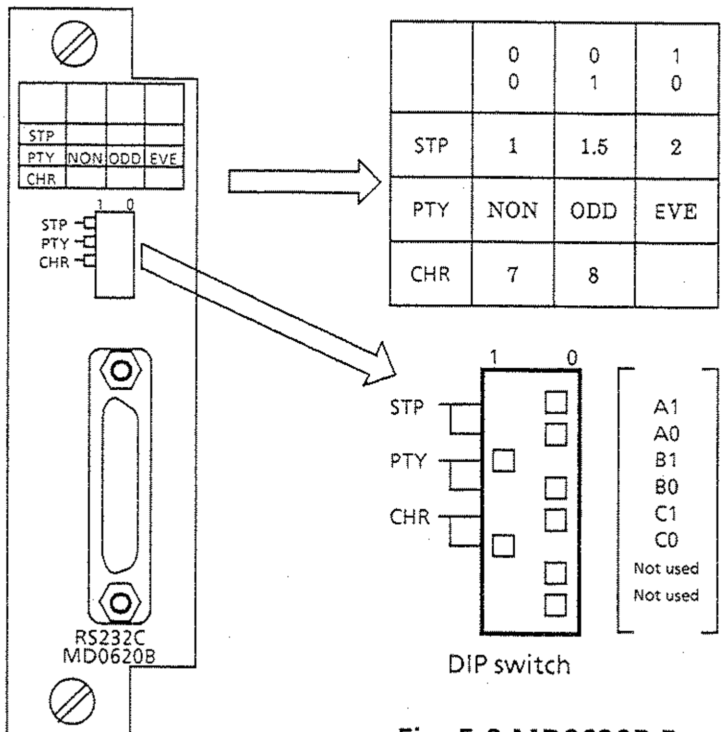
Removal procedure

Step	Procedure
1	Turn off the MD6420A POWER switch
2	Loosen the screws at the top and bottom of the RS-232C unit.
3	Pull the unit out by holding the screws.
4	Install a blank panel or GP-IB unit.

Notes: 1. Before inserting or removing a unit, turn off the POWER switch.
2. Tighten the unit screws on the top and bottom.

5.2.2 Setting the MD0620B RS-232C Unit

The data bit length, parity, and stop bit length of this unit can be set via the DIP switches on the unit.



Stop bit length (bit)

A1 A0	0 0	0 1	1 0	1 1
STP	1	1.5	2	

Parity bit

B1 B0	0 0	0 1	1 0	1 1
PTY	None	Odd	Even	

Data bit length (bit)

C1 C0	0 0	0 1	1 0	1 1
CHR	7	8	7	8

Fig. 5-2 MD0620B Rear Panel

(Setting example)
The settings in Fig. 5-2 are for 1 stop bit, even parity, and 8 bits (data bit length).

The signal lines are shown below.

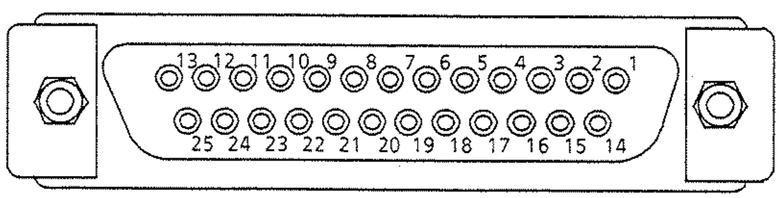


Fig. 5-3 RS-232C Interface Connector Pin Arrangement

Table 5-2 Signal Lines

Signal name	Pin No.	Explanation
SD	2	Send data
RD	3	Receive data
RS	4	ON when data is being sent
ER	20	Always ON
DR	6	Not used

5.2.3 Connecting the RS-232C cable

The RS-232C cable can be connected as shown in Fig. 5-4.

Connection procedure

Step	Procedure
1	Turn off the MD6420A POWER switch.
2	Connect the RS-232C cable to the RS-232C unit.
3	Fasten the cable plug by tightening the screws at the top and bottom.

Notes:

1. Before connecting a cable, turn off the POWER switch.
2. Tighten the unit screws on the top and bottom.

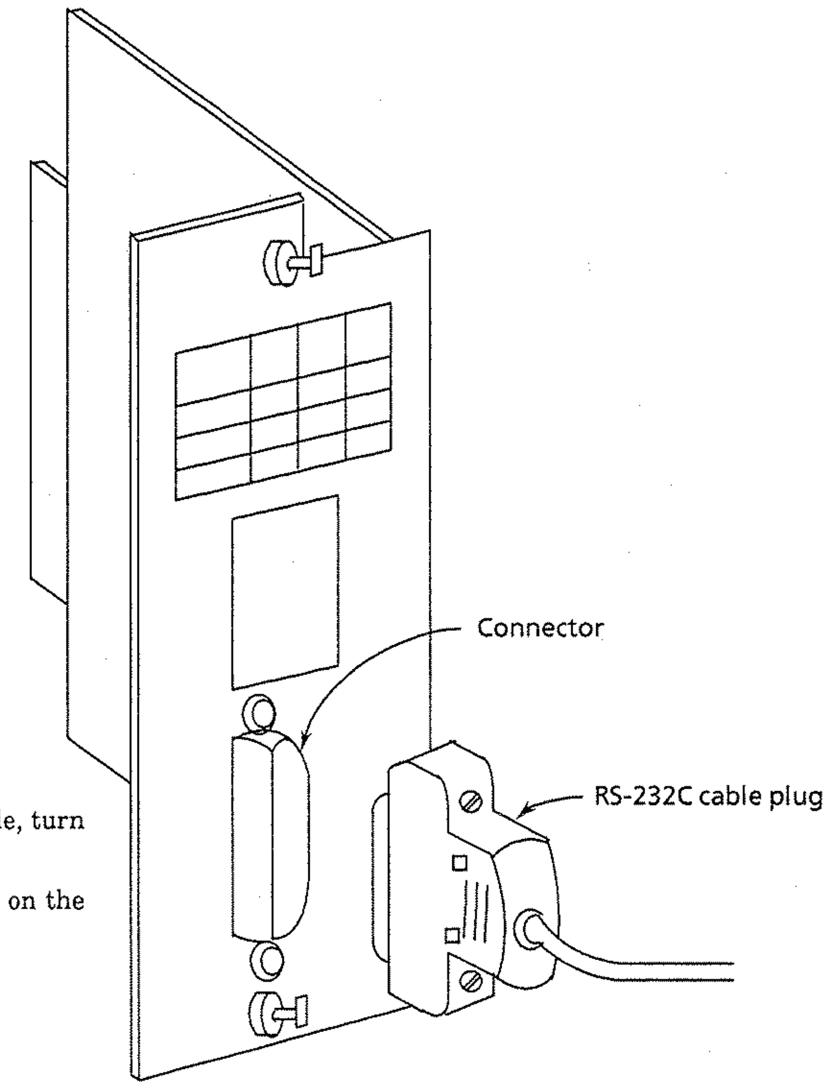


Fig. 5-4 Connection

5.3 GP-IB Interface (IEEE 488.2)

The MD6420A can be interfaced with an IEEE 488 GP-IB via the MD0620A GP-IB Unit. It can also be interfaced to the IE625 by means of a conversion connector (sold separately).

The MD6420A can be remotely controlled by a control program when it is connected to a controller (usually packet V Series, IBM-PC, etc.) with a GP-IB cable.

When interfaced, measured results can be read from the MD6420A by the controller. The MD6420A GP-IB interface functions are shown in Table 5-3.

Table 5-3 GP-IB Interface Functions

Symbol	Interface function
SH1	All source handshake functions provided
AH1	All accept handshake functions provided
T5	Basic talker functions provided Serial polling function provided
L3	Basic listener functions provided
SR1	All service request functions provided
RL1	All remote/local functions provided
PP0	Parallel polling function not provided
DC1	Device clear function provided
DT1	Device trigger function provided
C0	Control function not provided

5.3.1 Setting the GP-IB address

When a number of devices such as a printer are connected via the same GP-IB bus cable, a unique address must be assigned to each device.

The address switch to set the MD6420A address is on the rear of the MD0620A GP-IB Unit.

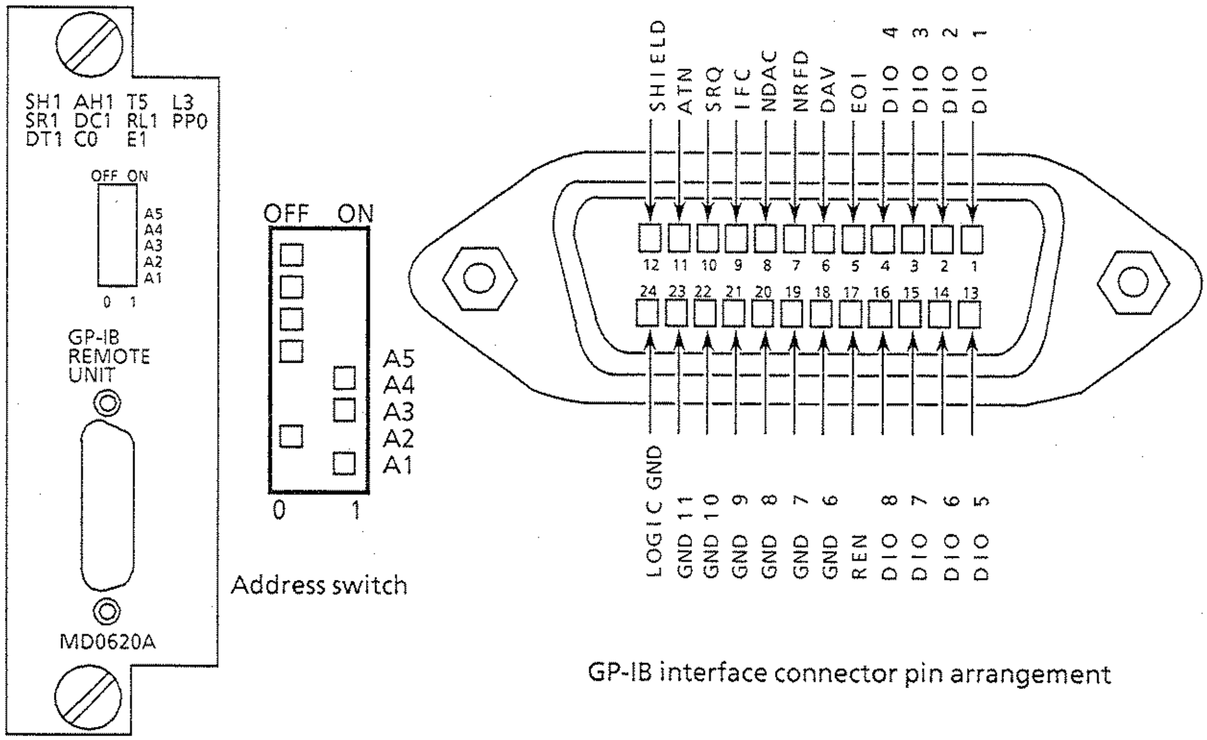


Fig. 5-5 MD0620A Rear Panel

The binary value of the address is set on switches A1 to A5. Bit values are shown in Table 5-4.

For example, to set the address to 13, 13 = 8 + 4 + 1 and switches “A1”, “A3”, and “A1” are set to 1 and switches “A5” and “A2” are set to 0 (Fig. 5-5). Since switches other than A1 to A5 have no significance, they can be either ON or OFF.

Table 5-4 Setting Address Switches

Switch bit name	"1" side	"0" side
A1	1	0
A2	2	0
A3	4	0
A4	8	0
A5	16	0

Note:
When switches A1 to A5 are all set to “1” (31), the address is 0.

5.3.2 Installing and removing MD0620A GP-IB unit

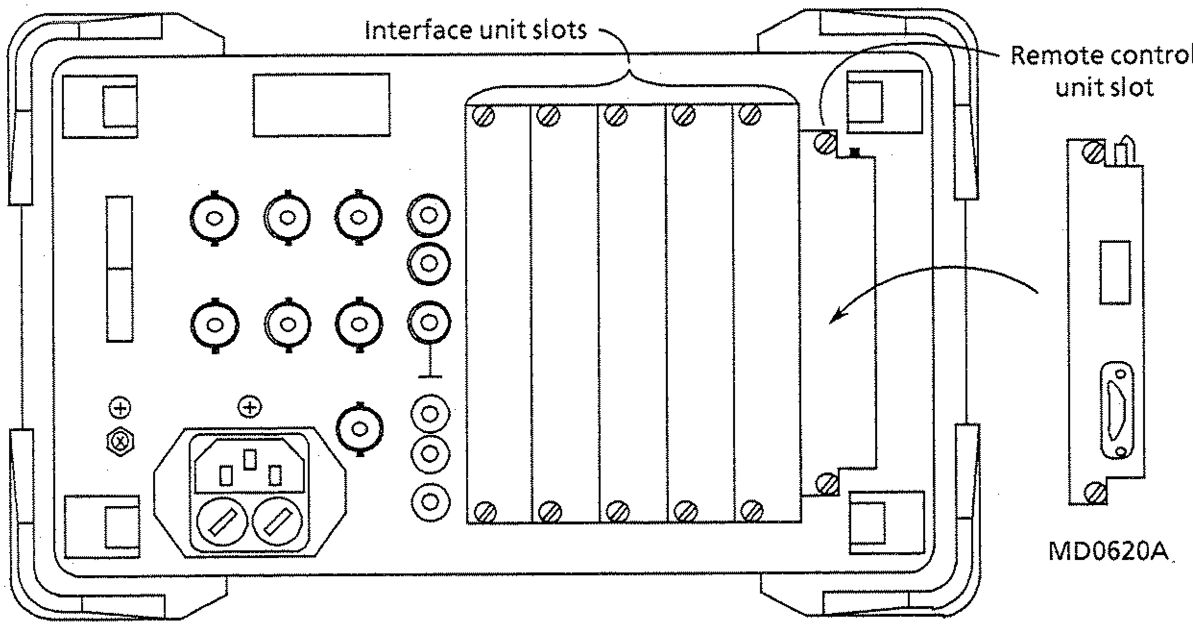


Fig.5-6 MD6420A Rear View

Installation procedure

Step	Procedure
1	Turn off the MD6420A POWER switch
2	Loosen the screws at the top and bottom of the blank panel or (RS-232C unit) and remove it.
3	Insert the RS-232C unit along the top and bottom guide rails and push it in until the unit is firmly seated.
4	Tighten the top and bottom screws firmly.

Removal procedure

Step	Procedure
1	Turn off the MD6420A POWER switch
2	Loosen the screws at the top and bottom of the GP-IB unit.
3	Hold the screws and pull out the unit.
4	Install a blank panel or RS-232C unit.

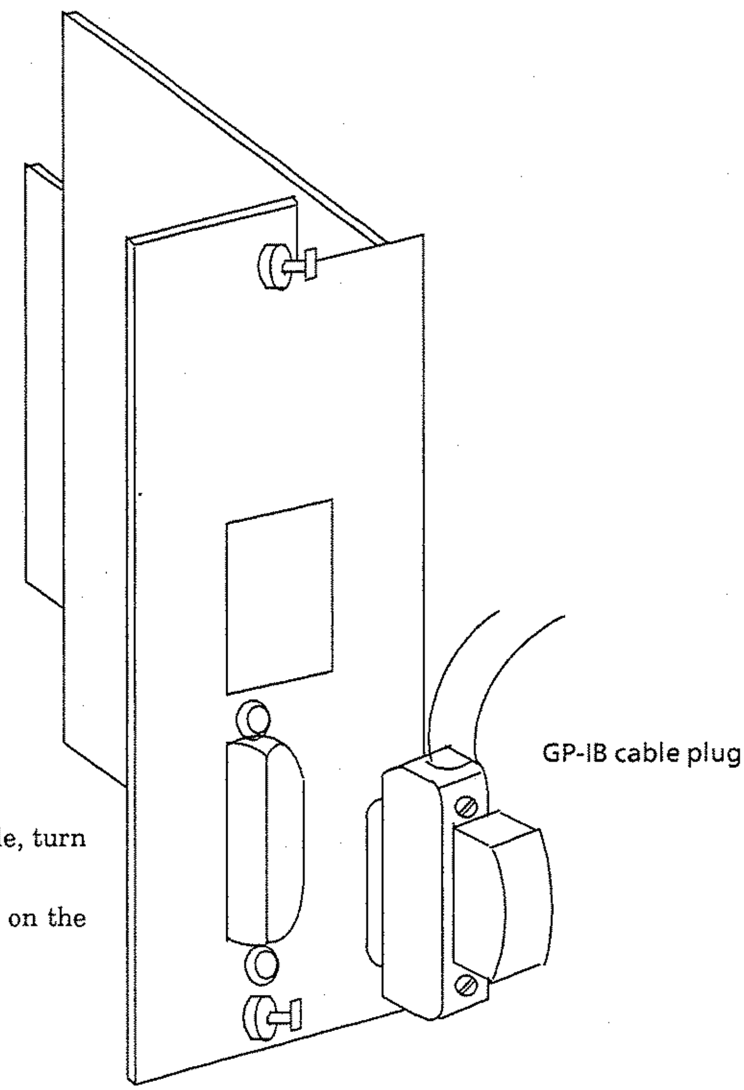
Notes: 1. Before inserting or removing a unit, turn off the POWER switch.
2. Tighten the unit screws on the top and bottom.

5.3.3 Connecting the GP-IB cable

The GP-IB cable connection procedure is shown in below.

Connection procedure

Step	Procedure
1	Turn off the MD6420A POWER switch.
2	Connect the GP-IB cable to the GP-IB interface unit.
3	Tighten the screws at the top and bottom of the GP-IB cable plug.



Notes:

1. Before connecting a cable, turn off the POWER switch.
2. Tighten the unit screws on the top and bottom.

Fig. 5-7 Connecting GP-IB Cable

5.3.4 Overview of IEEE 488.2 standard

The MD6420A status register structure conforms to IEEE 488.2. This structure is shown in Fig. 5-8.

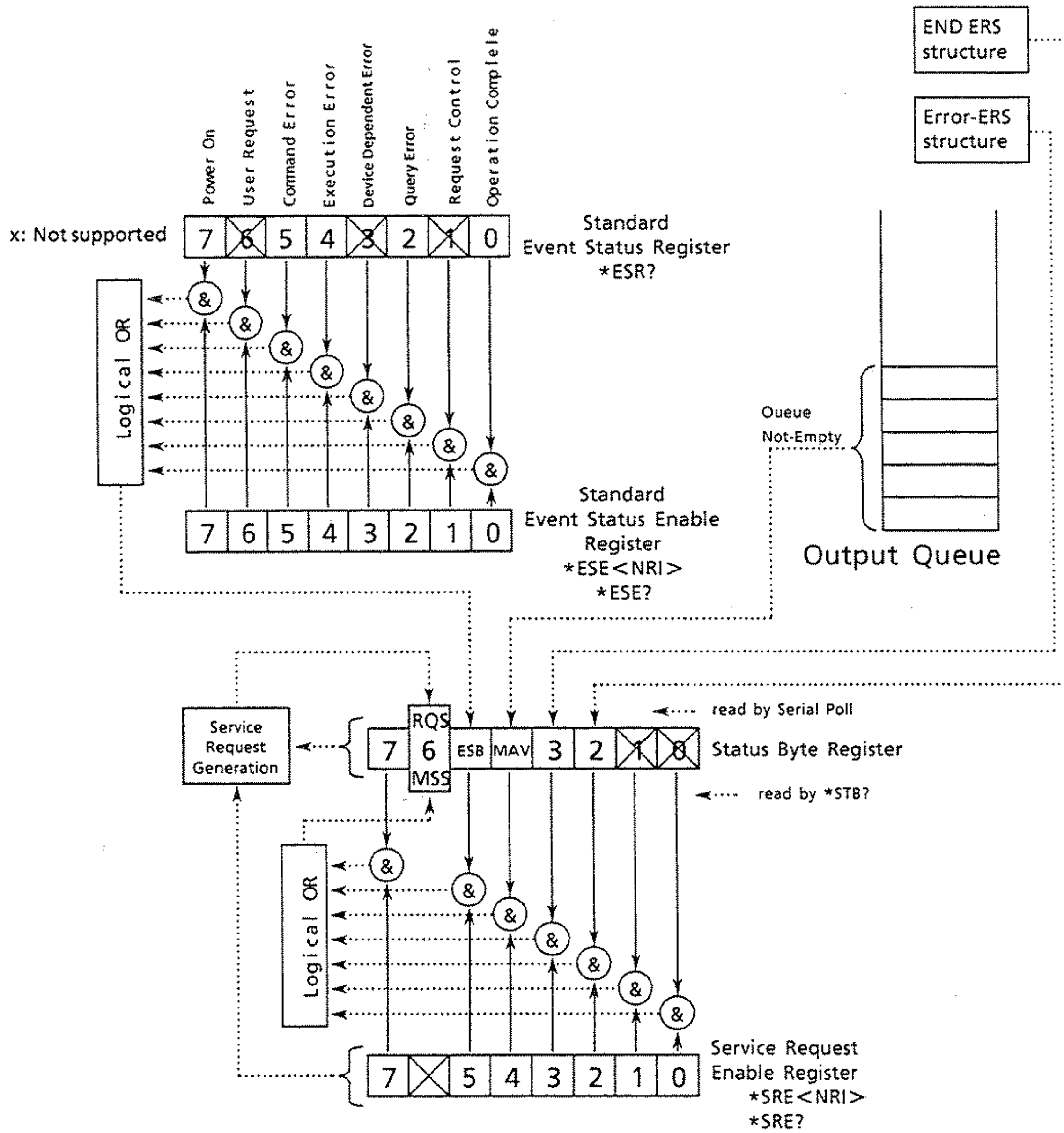


Fig. 5-8 Status Register Structure

The MD6420A registers shown in Table 5-5 are expansion event status registers.

Table 5-5 Expansion Event Status Register

Expansion ERS A	error-ERS : ERS related to device error
Expansion ERS B	END-ERS : Indicates end of measurement, interval, and other processing timing functions

Expansion event register details are shown in Figs. 5-9 and 5-10.

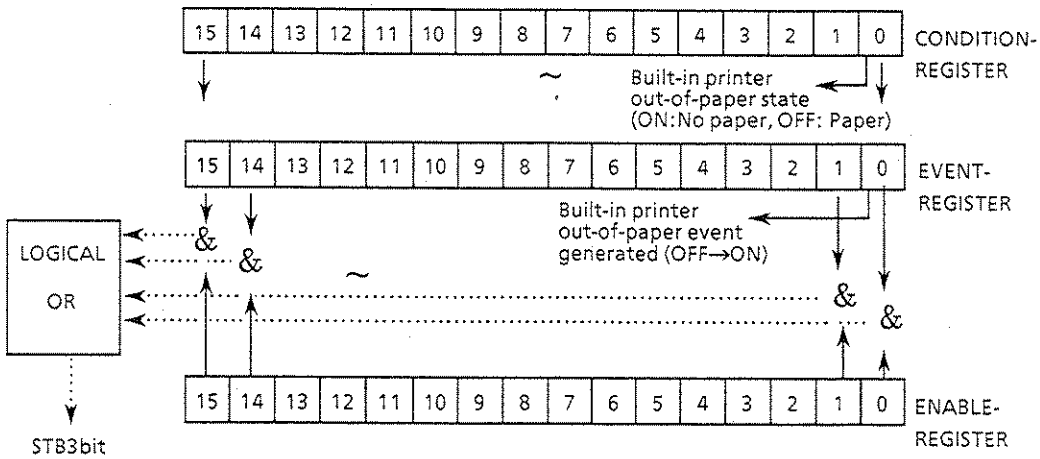


Fig. 5-9 Expansion Status Register Structure: error-ERS

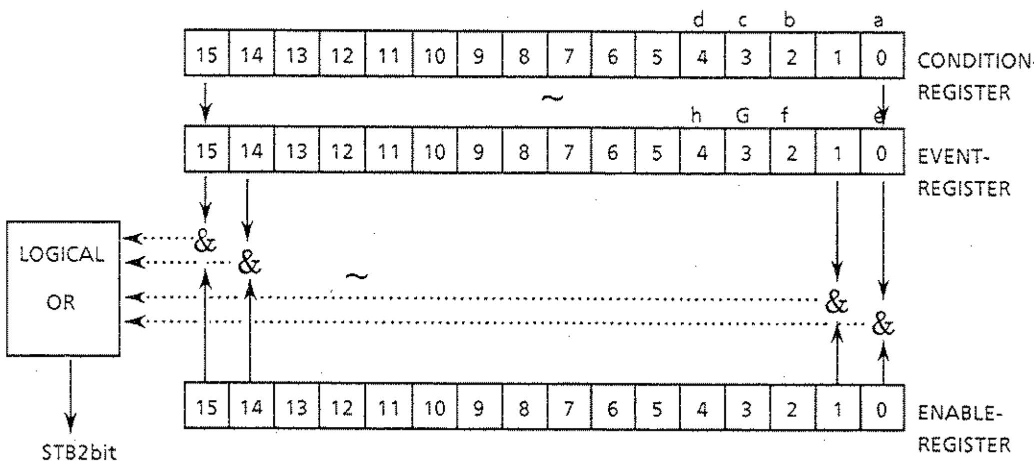


Fig. 5-10 Expansion Status Register Structure: END-ERS

CONDITION-REGISTER

- a : Measuring state (ON: Measurement in progress, OFF: Measurement not in progress)
- b : Automatic output data other than interval monitor data present/absent (ON: Present, OFF: Absent)
- c : Interval monitor data present/absent (ON: present OFF: absent)
- d : Error analysis (ON: Analyzing, OFF: No)

EVENT-REGISTER

- e : End of Measurement (ON→OFF)

  Note: End of timing differs depending on the measurement mode.
- f : Automatically output data other than interval monitor data (OFF→ON)
- g : Output interval monitor data (OFF→ON)
- h : End analysis (ON→OFF)

5.3.5 State at power-on

(1) When the MD6420A power is turned on, the contents of the status registers are as follows:

Table 5-6 Status Registers at Power-On

Register	State	
SRE	ESB and MAV are enabled	(00110000)
STB	All OFF(disable)	(00000000)
ESR	Power is ON	(10000000)
ESE	All OFF (disable)	(00000000)
ESAR	All OFF (disable)	(00000000)
ESAE	All OFF (disable)	(00000000)
ESAC	All OFF (disable)	(00000000)
ESBR	All OFF (disable)	(00000000)
ESBE	All OFF (disable)	(00000000)
ESBC	All OFF (disable)	(00000000)

(2) The contents of the input buffer are cleared.

(3) The INTERFACE Screen and measurement screen settings, displayed at power-off, are held. The settings of the screen other than above are initialized.

(4) The contents of the preset memory are held.

5.3.6 Message exchange option

The specifications for exchanging MD6420A messages are shown in Table 5-7.

Table 5-7 Message Exchange Option

1.	Input buffer size	128 bytes (When received as a multi-command, the command length may be as large as the size of the input buffer or larger.)
2.	Inquiries that return multiple response messages	One response message is returned for each inquiry. When an inquiry command is received as a multi-command, the response messages are arranged in order of request and returned as a single message.
3.	Response generation inquiry at syntax analysis.	Refer to each inquiry command (command with?) in the VOLUME 2 of the MD6420A Operation Manual.
4.	Inquiries that generate a message which responds when read from controller	Refer to each inquiry command (command with?) in the VOLUME 2 of the MD6420A Operation Manual.
5.	Common commands	None
6.	Device-inherent command	None

Notes:

1. Multi-command

   Multiple commands separated by delimiters and sent from the controller as one message.

2. Sequential command

   The MD6420A fetches, decodes, and processes the commands in one message one at a time from the top.

5.4 Program Message and Command Rules

This paragraph explains the structure of the program messages and commands used by the MD6420A. The MD6420A remote controller syntax uses some of the conventions described in Section 5 of IEEE 488.2.

(1) Program message

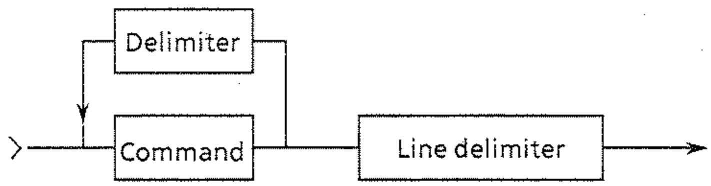


Fig. 5-11 Program Message Structure

(2) Command

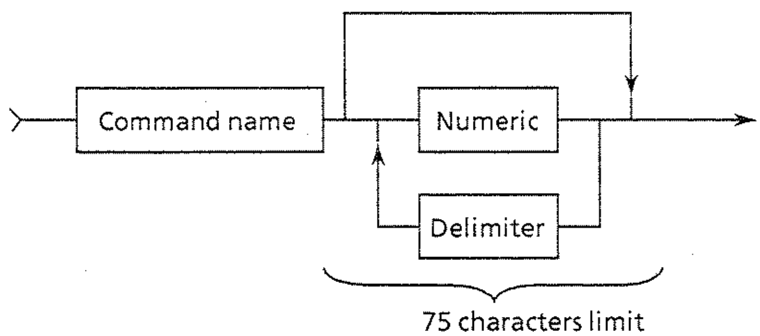


Fig. 5-12 Command Message Structure

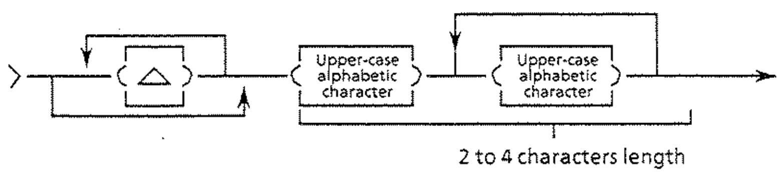


Fig. 5-13 Command Name Structure

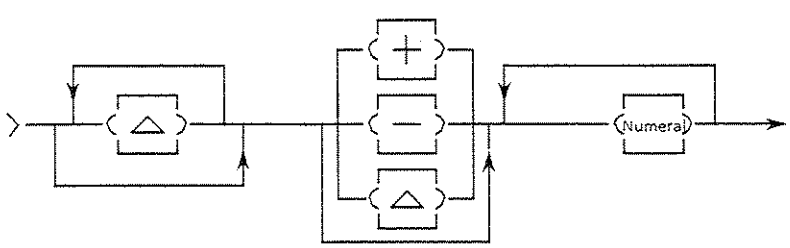


Fig. 5-14 Numeric Format

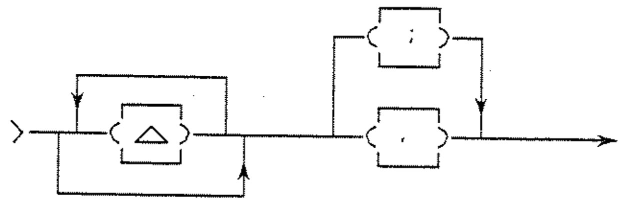


Fig. 5-15 Delimiter Structure

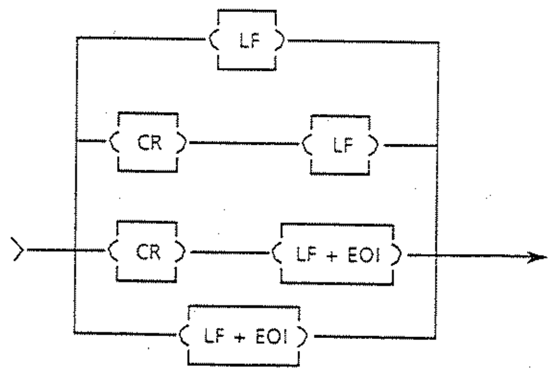


Fig. 5-16 Line Delimiter Structure

Notes:

1. △: One space
2. Numeral: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9.
3. Zero suppress can be used for numeric expression in Fig. 5-12.

(Example.)

decimal
- SST000000
- SST0

binary
- SST001010
- SST1010

5.5 Commands Table

5.5.1 Overview of commands

The kinds of remote control commands used with the MD6420A are shown in Table 5-8.

Table 5-8 Overview of Commands

Kind of command	Explanation
IEEE 488.2 common commands	Common commands used to synchronize with the command sequence controllers described in IEEE 488.2 (not usable with RS-232C)
MD6420A common commands	General MD6420A commands (Can be used from all the screens)
Screen switching commands	Screen switching commands (Can be used from all the screens)
Commands in screen	Effective for each screen and used during measurement processing and settings 1. MODE screen 2. PRESET MEMORIES screen 3. TABLE OF UNITS screen 4. INTERFACE screen (Refer to each interface unit operation manual) 5. ERROR screens: DISPLAY OF RESULTS screen; CONDITION OF PRINT (INTERVAL) screen; CONDITION OF PRINT (PERIOD) screen; CONDITION OF COLLECT screen 6. VOLT/FREQUENCY screen 7. DELAY TIME screen 8. WORD TRACE screen 9. EDIT PATTERN DATA screen 10. DISPLAY PATTERN TRACE screen 11. ERROR ANALYSIS screens 12. DISTORTION screen*

Table 5-8 Overview of Commands (Cont.)

Kind of command	Explanation
Commands in screen	13. ANALOG screen* 14. CODEC screen* 15. JITTER screen* *: Screens with * are effective only when the appropriate extension unit is used.

IEEE 488.2 common commands, MD6420A common commands, and screen swithching commands can be used when any screen is displayed. While, commands in the screen can be used in a state displaying respective for its screen. When commands in the screen are used, it is necessary to move the screen to an appropriate screen in advance using the screen switching commands.

5.5.2 Table of remote control commands

The construction of the remote control commands table is shown below. This table gives a simple introduction to the commands. For a detailed description, refer to VOLUME 2 (REFERENCE) of the MD6420A Operation Manual.

Function	Command name	Parameter	Page (VOLUME 2)
Printer output ON/OFF ①	PRT ②	0 : OFF 1 : ON ③	1-14 ④
END-ERS enable register set	ESAE	0 to 65535	1-15

① Command function

② Command name

③ Parameter ranges and types

For a detailed description, refer to VOLUME 2 (REFERENCE).

④ Refer to this page in VOLUME 2 (REFERENCE) for a more detailed description of the command. Commands without a page entry are valid for the MD6401A as well. Processing is not performed even if these commands are used. (However, an error is not recognized.)

There is an alphabetic index at the end of command reference of VOLUME 2. The contents of the commands can be looked up from the command name.

IEEE 488.2 Common Commands (GP-IB only)

Function	Command name	Parameter	Page (VOLUME 2)
Status structure clear	*CLS	————	1-3
ESE register setting	*ESE	0 to 255	1-4
ESE register request	*ESE ?	————	1-4
ESR register request	*ESR ?	————	1-5
SRE register setting	*SRE	0 to 63 , 128 to 191	1-6
SRE register request	*SRE ?	————	1-6
STB register request	*STB ?	————	1-7
Device ID request	*IDN ?	————	1-8
Device reset	*RST	————	1-8
Device test & status request	*TST ?	————	1-9
Preset memory SAVE	*SAV	1 to 10	1-9
Preset memory RECALL	*RCL	1 to 10	1-10
Operation complete message	*OPC	————	1-11
Operation complete request	*OPC ?	————	1-12
Waiting	*WAI	————	1-10

MD6420A Common Commands

Function	Command name	Parameter	Page (VOLUME 2)
Printer ON/OFF	PRT	0 : OFF 1 : ON	1-14
END-ERS enable register setting	ESAE	0 to 65535	1-15
END-ERS enable register request	ESAE ?	————	1-15
END-ERS register request	ESAR ?	————	1-16
END-CONDITION register request	ESAC ?	————	1-16
error-ERS enable register setting	ESBE	0 to 65535	1-17
error-ERS enable register request	ESBE ?	————	1-17
error-ERS register request	ESBR ?	————	1-18
error-CONDITION register request	ESBC ?	————	1-18
Interval monitor printout data buffer clear	DIC	————	1-19
Automatic output data buffer clear	DAC	————	1-19
Terminater specification of response data	TRM	0, 1	1-19

Screen Switching Commands

Function	Command name	Parameter	Page (VOLUME 2)
MODE screen (at power-on)	MD	————	1-21
Clock source setting screen (used interchangeably with the MD6401A)	CS	————	———
ERROR ANALYSIS screen	AL	————	1-21
TABLE OF UNITS screen	UV	————	1-21
PRESET MEMORIES screen	PL	————	1-22
INTERFACE screen	IF	————	1-22
ERROR screen	ED	————	1-22
VOLT/FREQUENCY screen	VF	————	1-23
DELAY TIME screen	DL	————	1-23
WORD TRACE screen	WT	————	1-23
EDIT PATTERN DATA screen	WE	————	1-24
DISPLAY PATTERN TRACE screen	TD	————	1-24
Return to last screen	BP	————	1-24
Switch to next screen	NP	————	1-25

MODE screen

Function	Command name	Parameter	Page (VOLUME 2)
Time setting	TM	00 to 99, 01 to 12, 01 to 31 00 to 23, 00 to 59, 00 to 59	1-27
Lamp test execution	LTS	————	1-27
Printer test execution	PTS	————	1-27
MD6420A initialization (INITIALIZE)	INI	————	1-28

PRESET MEMORIES screen

Function	Command name	Parameter	Page (VOLUME 2)
Output request	DO ?	————	1-35
Preset memory clear	PRI	1 to 10	1-35

TABLE OF UNITS screen

Function	Command name	Parameter	Page (VOLUME 2)
Output request	DO ?	————	1-37

ERROR screen - 1

Function	Command name	Parameter	Page (VOLUME 2)
Monitor line selection	MSL	0 to 4	1-39
Control line setting	SCT	0 to 12 , 0 to 2	1-39
Start error measurement	SA	————	1-40
Stop error measurement	SO	————	1-40
Start cyclic error insertion	EA	————	1-40
Stop cyclic error insertion	EO	————	1-41
Start channel error insertion	EI	————	1-41
Stop channel error insertion	EIO	————	1-41
Cyclic error rate setting	EC	10 to 90 , 1 to 7	1-42
Channel error insertion mode setting	EIM	0 or 1	1-43
Channel error insertion code setting	EIC	0 or 1	1-43
Start collection of error analysis data	CSA	————	1-44
Stop collection of error analysis data	CSO	————	1-44
Display mode switching	DMS	0 or 1	1-46
Error detection item setting	ME	0 to 13	1-46
Select measured results to be displayed (top left side)	DSA	0 to 34	1-45
Select measured results to be displayed (top right side)	DSB	0 to 34	1-45
Select measured results to be displayed (center left side)	DSC	0 to 34	1-45
Select measured results to be displayed (center right side)	DSD	0 to 34	1-45
Select measured results to be displayed (bottom right side)	DSE	0 to 34	1-45
Measurement mode setting (MANUAL)	MM	————	1-46
Measurement mode/time setting (BIT length)	MB	2 to 10	1-47
Measurement mode/time setting (TIME)	MT	0 to 999, 0 to 59, 0 to 59	1-47

ERROR screen - 2

Function	Command name	Parameter	Page (VOLUME 2)
Measurement mode/time setting (REPEAT)	MRT	0 to 999, 0 to 59, 0 to 59	1-47
Pseudorandom pattern period setting	PN	6 to 23	1-48
Pseudorandom pattern (invert) period setting	PNI	6 to 23	1-49
Pseudorandom pattern normal/invert, normal/reverse setting	INV	0 to 3	1-49
Pseudorandom pattern zero suppression specification	ZSP	0 to 2	1-50
Programmable pattern (binary) setting	PR or PRB	00000000 to 11111111	1-50
Programmable pattern (decimal) setting	PRD	0 to 255	1-51
Fixed pattern (A code pattern: all 0s) setting	PA	————	1-51
Fixed pattern (Z code pattern: all 1s) setting	PZ	————	1-51
Fixed pattern (code, a:b pattern) setting	PC	0 to 6	1-52
Pseudorandom pattern sync loss detection condition setting	SYND	0 to 16	1-53
Pseudorandom pattern sync loss detection condition setting	SYN	m 10 to 100000 n 100 to 300000	1-52
Block length setting	BL	0 to 17	1-53
Buzzer ON/OFF specification	BZ	0 or 1	1-54
Output format specification (error performance data)	OFP	0 to 18	1-55
Output format specification (alarm data)	OFA	0 to 13	1-56
Automatic output data output request (interval data)	DRI ?	————	1-56
Data output request (PERIODIC error performance data)	DRP ?	————	1-57
Data output request (PERIODIC alarm data)	DRA ?	————	1-57
Data output request (error performance data)	DOP ?	————	1-58
Data output request (alarm data)	DOA ?	————	1-58
DISPLAY OF RESULTS screen	DPR	————	1-60
CONDITION OF PRINT (INTERVAL) screen	PIC	————	1-59

ERROR screen - 3

Function	Command name	Parameter	Page (VOLUME 2)
CONDITION OF PRINT (PERIOD) screen	PPC	————	1-59
CONDITION OF COLLECT screen	CC	————	1-59
Switching interval output timing	IOT	0 to 1	1-54

CONDITION OF PRINT (INTERVAL) screen

Function	Command name	Parameter	Page (VOLUME 2)
Error data printing control	IDP	0 or 1	1-67
Interval time for printing setting	IPT	0 to 6	1-67
Save printing function for interval printing setting.	ICP	0 or 1	1-68
Alarm data printing control	IAP	0 to 12 , 0 or 1	1-68
Threshold value for interval output (error count) setting	IES	0 to 999	1-68

CONDITION OF PRINT (PERIOD) screen

Function	Command name	Parameter	Page (VOLUME 2)
Error data printing control	EDP	0 or 1	1-69
Block data printing control	BDP	0 or 1	1-69
BBE, BBER data printing control	BBP	0 to 1	1-69
AT, %AT data printing control	ATP	0 to 1	1-73
ES, %ES data printing control	ESP	0 or 1	1-70
US, %US data printing control	USP	0 or 1	1-70
SES, %SES data printing control	SEP	0 or 1	1-70
DM, %DM data printing control	DMP	0 or 1	1-71
EFS, %EFS data printing control	EFP	0 or 1	1-71
PSL count data printing control	PCP	0 or 1	1-71
Clock slip data printing control	CSP	0 or 1	1-72
SLIP-SEC data printing control	SSP	0 to 1	1-73
Distortion data printing control	DDP	0 to 1	1-72
Alarm data printing control	PAP	0 to 12, 0 or 1	1-72

DISPLAY OF RESULTS screen

Function	Command name	Parameter	Page (VOLUME 2)
Monitor line selection	MSL	0 to 4	1-60
Control line setting	SCT	0 to 12 , 0 to 2	1-60
Start error measurement	SA	————	1-61
Stop error measurement	SO	————	1-61
Start cyclic error insertion	EA	————	1-61
Stop cyclic error insertion	EO	————	1-62
Start channel error insertion	EI	————	1-62
Stop channel error insertion	EIO	————	1-62
Start collection of error analysis data	CSA	————	1-63
Stop collection of error analysis data	CSO	————	1-63
Display mode switching	DMS	————	1-63
Alarm result display switching	ARC	0 or 1	1-64
Request for output of automatic output data (interval data)	DRI ?	————	1-64
Data output request (PERIODIC error performance data)	DRP ?	————	1-64
Data output request (PERIODIC alarm data)	DRA ?	————	1-65
Data output request (error performance data)	DOP ?	————	1-65
Data output request (alarm data)	DOA ?	————	1-66

CONDITION OF COLLECT screen

Function	Command name	Parameter	Page (VOLUME 2)
Error analysis unit No. setting	CUN	1 to 5	1-74
Collection area No. setting	CAN	1 to 8	1-74
Error data collection control	CED	0 or 1	1-74
Collection interval time setting	CIT	0 to 6	1-75
Periodic collection control	CPD	0 or 1	1-75
Alarm data collection control	CAD	0 to 12, 0 or 1	1-75

VOLT/FREQUENCY screen

Function	Command name	Parameter	Page (VOLUME 2)
Start count	SA	————	1-87
Stop count	SO	————	1-87
Voltage measurement line setting	VM	0 to 12	1-86
Frequency measurement line setting	FM	0 to 13	1-79
Gate time setting	GT	0 to 3	1-80
Interval time setting	IT	0 to 3	1-80
Measured data output request	DO ?	————	1-88
Monitor line setting	MSL	1, 2, 4	1-85
Monitoring signal line setting	SCT	0 to 12, 0 to 2	1-86
Send side signal line, alarmline setting	SCS	0 to 12, 0 to 2	1-79
Pseudorandom pattern period setting	PN	6 to 23	1-77
Pseudorandom pattern (invert) period setting	PNI	6 to 23	1-81
Pseudorandom pattern normal/invert, normal/reverse setting	INV	0 to 3	1-78
Pseudorandom zero suppression specification	ZSP	0 to 2	1-78
Programmable pattern (binary) setting	PR or PRB	00000000 to 11111111	1-50
Programmable pattern (decimal) setting	PRD	0 to 255	1-83
Fixed pattern (A code pattern: all 0s) setting	PA	————	1-84
Fixed pattern (Z code pattern: all 1s) setting	PZ	————	1-84
Fixed pattern (code, a:b pattern) setting	PC	0 to 6	1-85

DELAY TIME screen

Function	Command name	Parameter	Page (VOLUME 2)
Start measurement	SA	————	1-95
Stop measurement	SO	————	1-96
Start repeat measurement	RSA	————	1-94
Stop repeat measurement	RSO	————	1-95
Measurement mode setting	DM	0 or 1	1-90
Start trigger line setting	SAL	0 to 13, 0 or 1	1-91
Stop trigger line setting	SOL	0 to 13, 0 or 1	1-92
Interval time setting	IT	0 to 3	1-94
Start/stop signal line setting	LSL	0, 1, 3, 4	1-90
Measured data output request	DO ?	————	1-96
Monitor line setting	MSL	0 to 4	1-93
Monitoring signal line setting	SCT	0 to 12 , 0 to 2	1-93

WORD TRACE Screen - 1

Function	Command name	Parameter	Page (VOLUME 2)
Start send	SA	————	1-98
Stop send	SO	————	1-98
Send method setting	SS	0 to 1	1-98
Idle code (Binary) setting	IPB or IP	00000000 to 11111111	1-99
Idle code (Decimal) setting	IPD	0 to 255	1-99
Word pattern address setting	WPA	0 to 8191	1-100
Word pattern (Binary) setting	WPB or WP	00000000 to 11111111	1-100
Word pattern (Decimal) setting	WPD	0 to 255	1-101
Word pattern Fox code setting	WPF	————	1-101
Copy word pattern from the MD0610D	WPM	0 to 7	1-102
Set word-pattern send-data top address	WTD	0 to 32766	1-102
Set word-pattern send-data last address	WL	1 to 32767	1-103
No SYNC code	SYCX	————	1-103
SYNC code (Binary) setting	SYCB or SYC	00000000 to 11111111	1-103
SYNC code (Decimal) setting	SYCD	0 to 255	1-104
Start trace	TA	————	1-104
Stop trace	TO	————	1-104
Set trace stop conditions manually	SM	————	1-105
Trace stop code (Binary) setting	SCB or SC	0 or 1, 00000000 to 11111111	1-105
Trace stop code (Decimal) setting	SCD	0 or 1, 0 to 255	1-106
Trace stop line setting	SL	0 to 12, 0 or 1	1-107
Trace stop byte setting	SB	0 to 32764	1-108
Trace stop external trigger condition setting	SE	0 or 1	1-108
Trace delay byte setting	SD	0 to 8000	1-108

WORD TRACE Screen - 2

Function	Command name	Parameter	Page (VOLUME 2)
Select line trigger signal	LSL	0 or 1	1-109
Set data output request	DO ?	————	1-109
Trace end data output request	DRQ ?	————	1-110
Monitor line selection	MSL	0 to 4	1-111
Monitoring signal line setting	SCT	0 to 12 , 0 to 2	1-111

EDIT PATTERN DATA screen

Function	Command name	Parameter	Page (VOLUME 2)
Edit address specification	WPA	0 to 32767	1-113
Display mode specification	DSP	0 to 1	1-113
Display character code specification	CD	0 to 6	1-114
Display boundary specification	BDR	4 to 8	1-114
Edit function-Shift execution command	SH	0 to 7, 0 to 1	1-115
Edit function-Inverse execution command	INV	0 to 1	1-116
Edit function-Reverse execution command	REV	0 to 1	1-116
Save command to word memory unit	MSV	0 to 7	1-116
Read-out command from word memory unit	MRC	0 to 7	1-117
Trace-data copy command	CPY	0 to 32767, 1 to 8	1-117

DISPLAY PATTERN TRACE screen

Function	Command name	Parameter	Page (VOLUME 2)
Trace display code specification	CD	0 to 4	1-119
Display address specification	DA	0 to 32760	1-119
Number of bits to be shifted setting	SH	0 to 7	1-120
Trace data output request (address setting)	DO ?	0 to 32768	1-120
Display mode setting	DSP	0 to 1	1-122
Display boundary specification	BDR	4 to 8	1-122
Inverse/reverse display specification	INV	0 to 3	1-121
Comparison processing with send data specification	CMP	0 to 1, 0 to 32767	1-121

MD6401A interchangeable commands

Function	Command name	Parameter	Page (VOLUME 2)
Reset abnormally set bits	RAL	——	——
Print output destination	OUT	——	——
INTERFACE screen <A>	IFA	——	——
INTERFACE screen <B>	IFB	——	——
INTERFACE screen A/B switching	CIF	——	——

Note: MD6401A interchangeable commands do not perform any processing.

5.6 Response Message Rules

This paragraph describes the format of MD6420A output data. The response messages partially conform to Section 8 (Fig. 8-1 to Fig. 8-3) of IEEE 488.2. For more information, refer to IEEE std 488.2.

5.6.1 Response message structure

The response message structure is shown in Figs. 5-17, 5-18, and 5-19.

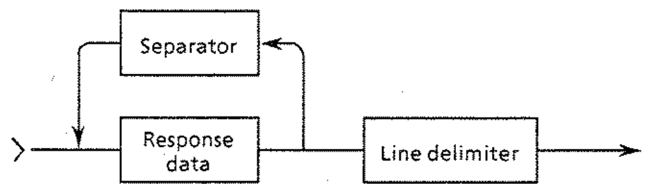


Fig. 5-17 Response Message Structure

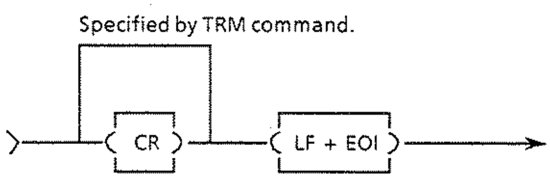


Fig. 5-18 Line Delimiter Structure

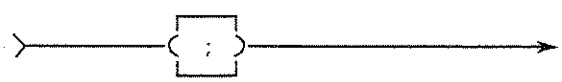


Fig. 5-19 Separator Structure

5.7 Table of MD6420A Responses to Data Request Commands

The response of the MD6420A to data request commands is summarized in Table 5-10 to 5-13. For a more detailed explanation, refer to response data reference of VOLUME 2.

(1) IEEE 488.2 common commands (Invalid for RS-232C interface)

Table 5-10 IEEE 488.2 Common Commands

Output	Command name
ESE register status	* ESE ?
ESR register status	* ESR ?
SRE register status	* SRE ?
STB register status	* STB ?
Device ID status	* IDN ?
Device test & status table	* TST ?
OPERATION COMPLETE status	* OPC ?

(2) MD6420A common commands

Table 5-11 MD6420A common commands

Output	Command name
END-ERS enable register status	ESAE ?
END-ERS register status	ESAR ?
END-CONDITION register status	ESAC ?
error-ERS enable register status	ESBE ?
error-ERS register status	ESBR ?
error-CONDITION register status	ESBC ?

(3) Response to Do? command

Table 5-12 Response to Do? command

Preset memory table
Unit version
INTERFACE screen settings
Volt/frequency measurement results
WORD TRACE screen settings
DISPLAY PATTERN TRACE screen trace data
Delay time measurement results

(4) Other response data

Table 5-13 Other Response Data

Output	Command name
Error measurement interval data	DRI ?
Error measurement periodic data, error performance data	DRP ?
Error measurement periodic data, alarm data	DRA ?
Error measurement error performance data (output in order of specification)	DOP ?
Error measurement alarm data (output in order of specification)	DOA ?
WORD TRACE screen end of trace data	DRQ ?

5.8 Sample Program

5.8.1 GP-IB sample program

This paragraph describes a sample program that performs remote measurement with the MD6420A via GP-IB interface. This sample program runs on the following controller.

Table 5-14 Controller

Controller	IBM-PC or any IBM-PC compatible machines
OS	PC-DOS (IBM), GPIB-PC (National Instrument)
Language used	Quick BASIC

(1) Program execution procedure

To execute the sample program, prepare the MD6420A and controller as follows:

- Set the MD6420A GP-IB address to "0". (See paragraph 5.3.1)
- IBCONF setting

① <Board Characteristics>

Board: GPIB0 (Board is referred to as "GPIB0")

Primary GPIB Address	10
Secondary GPIB Address	NONE
Timeout setting	T30S
EOS byte	OAH
Terminal Read on EOS	yes
Set EO1 with EOS on write	yes
Type of compare on EOS	7-bit
Set EOI w/last byte of write	yes
GPIB-PC Model	PC2A
Board is System Contoroller	yes
Local Lockout on all devices	no
Disable Auto Serial Polling	yes
High-speed timing	no
Interrupt jumper setting	7
Base I/O Address	02E1H
DMA channel	NONE
Internal clock Freq (in MHZ)	6

② <Device Characteristics>

Device: DEV1 (Device name is referred to as "DEV1".)

Primary GPIB Address	0
Secondary GPIB Address	NONE
Timeout setting	T30S
EOS byte	OAH
Terminal Read on EOS	yes
Set EO1 with EOS on write	yes
Type of compare on EOS	7-bit
Set EOI w/last byte of write	yes

③ Device Map for Board GPIB0

Connect the Board (GPIB0) to the Device (DEV1)

- Connect the MD6420A to the IBM-PC with a GP-IB cable.

(2) Sample program specifications

The sample program performs error measurement when frame setting was performed by the MD0623A/A1.

① Setup

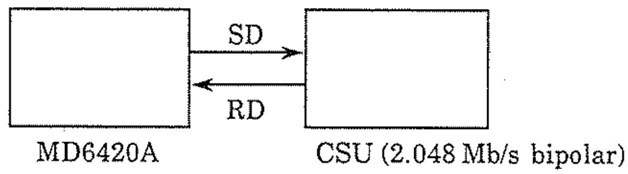
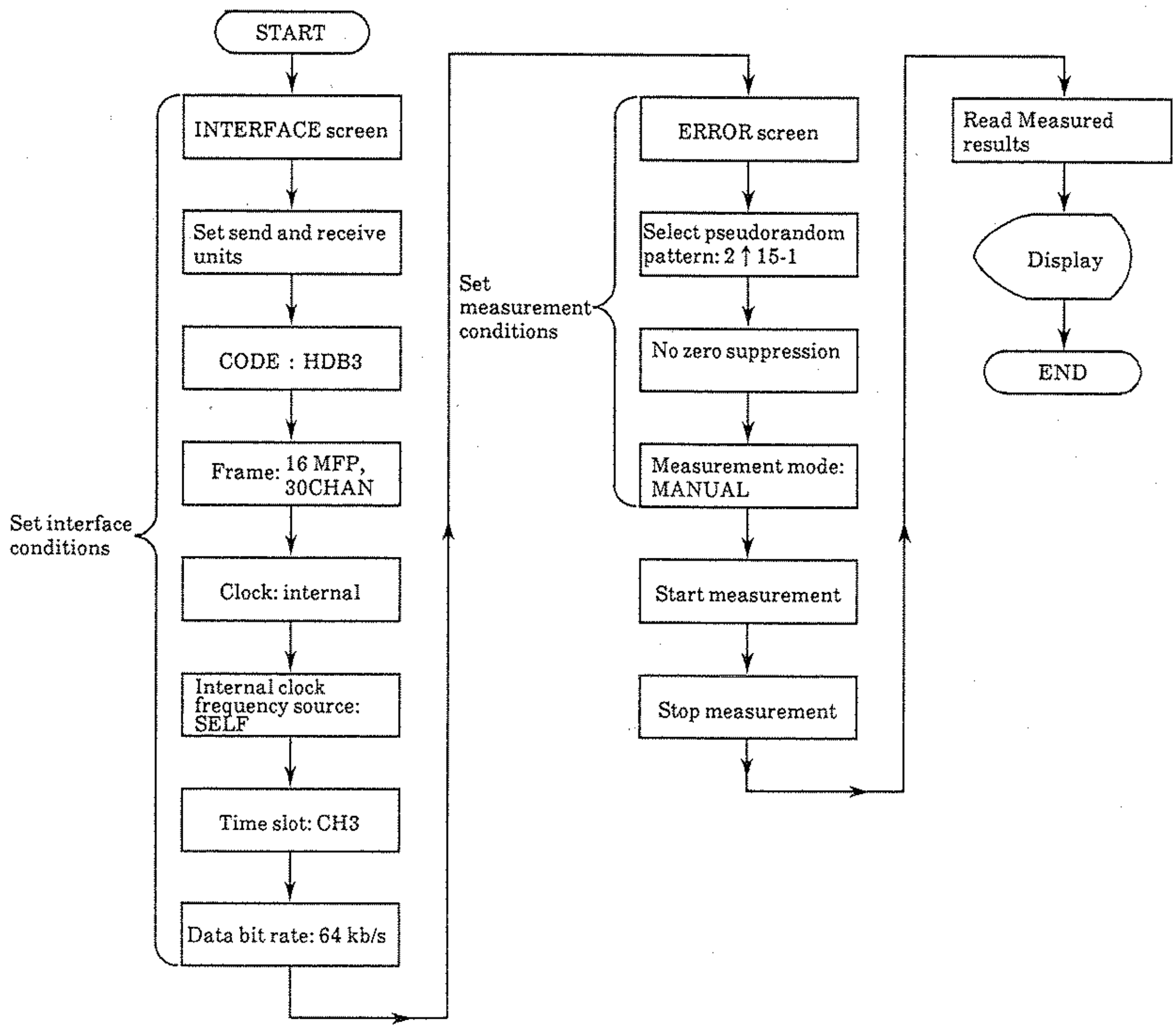


Fig.5-20 Setup

Insert the MD0623A/A1 unit into the MD6420A and connect the MD6420A to the CSU (2.048 Mb/s bipolar) with a cable.

② Measurement procedure



(3) Explanation of common parts of sample program

① Common shared IBSTA%, IBERR, and IBCNT are defined at the beginning of the program to set GP-IB control.

② *1 Set 500 ms wait time after interface is cleared

After clearing the interface but before executing the next command, a unit time of approximately 500 ms is provided for the MD6420A to receive and execute interface clear from the IBM-PC (controller)and to stabilize.

③ *2 Trap

When a GP-IB command is sent by the IBM-PC (controller) to the MD6420A or when data is read from the MD6420A, command execution is checked. If an error occurs, the error contents are displayed and the program stops.

Correct execution of the IBFIND (device definition), IBSIC (interface clear), and IBRSP (serial polling) commands is also verified.

④ wrtcmd: `----- write command -----

wrt$=wrt$+chr$(13)+chr$(10)

Appends CR, LF to end of data stored in variable wrt$ and reassigns it to the same variable CALL IBWRT (DTA%, wrt$) sends data stored in variable wrt$ to the MD6420A.

⑤ DATRD1, 2 - Read measuring data

DAT1$ = SPACE$ (255)

DAT2$ = SPACE$ (255)

Initializes variables DAT1$ and DAT2$ that will be used to read data from the MD6420A to spaces

255 of SPACE$ (255) is the number of characters of read data + 2 characters (CR, LF portion).

CALL IBRD (DTA%, DAT1$ or DAT2$) reads data from the MD6420A and stores it in variable rd$.

(4) Sample program execution result

```
        ************* MD6420A RESULTS OF MEASURING *************

             ERROR       275        ERROR RATIO 1.43E-03
       BLOCK-ERROR       275  BLOCK-ERROR RATIO 1.43E-02
                US         0               %US      0.00
               SES         2              %SES     66.67
                DM         1               %DM    100.00
                ES      3.00               %ES    100.00
               EFS      0.00              %EFS      0.00
                PRBS pattern sybc loss count           0
                            Clock slip count           0
      --------------------------------------------------------------
                  Power loss time(sec)        0
       PRBS  Pattern sync loss time(sec)      0
                 Signal loss time(sec)        0
             Frame sync loss time(sec)        0
        Alarm indicator signal time(sec)    0.0
          X.50 Frame sync loss time(sec)    0.0
*


Press any key to continue
```

(5) Sample program listing

```
DECLARE SUB WAITTIME (TM#)
'***************************************************************************
'*                                                                         *
'*                    MD6420A SAMPLE PROGRAM                               *
'*            (2.048M BPL UNIT ----- ERROR MEASURING)                      *
'*                      90.06.12    by ANRITSU Corp.                       *
'*                                           File name SAMPLE.BAS          *
'***************************************************************************
'
DEFDBL A-Z
'--------------------------------------------------------------------------'
'                             MAIN ROUTINE                                 '
'--------------------------------------------------------------------------'
'
COMMON SHARED IBSTA%, IBERR%, IBCNT%     ' Setup GPIB_PC functions
GOSUB GPINIT                             ' Setup GPIB interface
'
CLS
'wrt$ = "*RST": GOSUB wrtcmd             ' Status structure clear
'--------------------------------------------------------------------------'
'                 INTERFACE CONDITION & MEASURING SET                      '
'--------------------------------------------------------------------------'
'DO
wrt$ = "IF,SUT1,RUT1,SCD2,RCD2,SFM3,RFM3,SCK0,IFS0,STS1,3,RTS1,3,SDB64000,RDB64000"
: GOSUB wrtcmd

wrt$ = "ED,MM,EC17,3,ME0,PN6,ZSP0": GOSUB wrtcmd 'Change measure

wrt$ = "OFP0,1,2,3,4,5,6,7,8,9,10,11,15,16,17,18,OFA0,1,2,3,4,5"
: GOSUB wrtcmd  ' Data format set

wrt$ = "*SRE4,*ESE0,ESBE0,ESAE4": GOSUB wrtcmd    ' GPIB first set

wrt$ = "DPR,DIC,DAC,*CLS,*OPC": GOSUB wrtcmd      ' Clear register and data buffer
    CALL IBRD(DTA%, DAT)                          ' Read command
    IF IBSTA% < 0 THEN GOTO TRAP                  ' Trap

'
'--------------------------------------------------------------------------'
'                             MEASURING                                    '
'--------------------------------------------------------------------------'
'
```

```
wrt$ = "SA,EA": GOSUB wrtcmd                    ' Start measuring and insert error
CALL WAITTIME(2)                                ' Waiting for 2sec
     '
     '          <<< Read measuring data >>>
     '
wrt$ = "DOA?": GOSUB wrtcmd                     ' Alarm data request
DAT2$ = SPACE$(255): GOSUB DATRD2               ' Read alarm data

wrt$ = "DOP?": GOSUB wrtcmd                     ' Paformance data request
DAT1$ = SPACE$(255): GOSUB DATRD1               ' Read paformance data

GOSUB PRINT1                                    ' Display measuring data

     '
     '          <<< Stop measuring and read data >>>
     '
wrt$ = "EO": GOSUB wrtcmd                       ' Stop error insert
wrt$ = "SO": GOSUB wrtcmd                       ' Stop measuring
     '
J = 1                                           ' Check the measuring stop
WHILE J
    MASK% = &H5000
    CALL IBWAIT(GPIB0%, MASK%): PRINT "*"

    IF IBSTA% <> 4000 THEN                      ' Status check
        CALL IBRSP(DTA%, SRP%)
        IF (SRP% AND 4) <> 0 THEN J = 0
    END IF
WEND
     '
     '          <<< Read periodic paformance data >>>
     '
wrt$ = "DRA?": GOSUB wrtcmd                     ' Request periodic alarm data
DAT2$ = SPACE$(255): GOSUB DATRD2               ' Read periodic alarm data
wrt$ = "DRP?": GOSUB wrtcmd                     ' Request periodic paformance data
DAT1$ = SPACE$(255): GOSUB DATRD1               ' Read periodic paformance data
     '
GOSUB PRINT2                                    ' Display measuring data
     '
'LOOP
END
'
```

```
'-----------------------------------------------------------------------'
'                            SUB RUTINES                                '
'-----------------------------------------------------------------------'
'
GPINIT: ' =============== Setup GPIB interface ================
    '
    CALL IBFIND("GPIB0", GPIB0%)                          ' Open device (GPIB0)
    IF GPIB0% < 0 THEN GOTO TRAP                          ' System error
    '
    CALL IBFIND("DEV1", DTA%)                             ' Open device (PPG)
    IF DTA% < 0 THEN GOTO TRAP                            ' System error
    '
    CALL IBSIC(GPIB0%)                                    ' Interface clear
    IF IBSTA% < 0 THEN GOTO TRAP                          ' System error
    '
    TIM = 1
    GOSUB WAIDLY
    '
    CALL IBCLR(DTA%)                                      ' Device clear
    '
    RETURN
    '
wrtcmd: '================= Write command ====================
        '
    wrt$ = wrt$ + CHR$(13) + CHR$(10)
    CALL IBWRT(DTA%, wrt$)                                ' Write command
    IF IBSTA% < 0 THEN GOTO TRAP                          ' Trap
    '
    RETURN
        '
WAIDLY: '=================== Wait delay ===================
        '
    STM = TIMER                                           ' Set the delay time
    ETM = TIMER
    WHILE ETM - STM < TIM
        ETM = TIMER
        IF ETM < STEM THEN ETM = ETM + 86400
    WEND
    '
    RETURN
        '
DATRD1: '================== Read data1 ==================
```

```
    '
    CALL IBRD(DTA%, DAT1$)                              ' Read command
    IF IBSTA% < 0 THEN GOTO TRAP                        ' Trap
    '
    RETURN
    '
DATRD2: '================== Read data2 ==================
    '
    CALL IBRD(DTA%, DAT2$)                              ' Read command
    IF IBSTA% < 0 THEN GOTO TRAP                        ' Trap
    '
    RETURN
    '
PRINT1: '============= Printing error data1 ============
    LOCATE 5, 9
    PRINT " ************* MD6420A RESULTS OF MEASURING ************* "
    LOCATE 7, 14
    PRINT "      ERROR" + " " + MID$(DAT1$, 52, 8) + "  " + "      ERROR RATIO" + " " + MID$(DAT1$, 63, 8)
    LOCATE 8, 14
    PRINT "BLOCK-ERROR" + " " + MID$(DAT1$, 74, 8) + "  " + "BLOCK-ERROR RATIO" + " " + MID$(DAT1$, 85, 8)
    LOCATE 9, 14
    PRINT "         US" + " " + MID$(DAT1$, 162, 8) + "  " + "              %US" + " " + MID$(DAT1$, 173, 8)
    LOCATE 10, 14
    PRINT "        SES" + " " + MID$(DAT1$, 140, 8) + "  " + "             %SES" + " " + MID$(DAT1$, 151, 8)
    LOCATE 11, 14
    PRINT "         DM" + " " + "--------" + "  " + "              %DM" + " " + "--------"
    LOCATE 12, 14
    PRINT "         ES" + " " + MID$(DAT1$, 96, 8) + "  " + "              %ES" + " " + MID$(DAT1$, 107, 8)
    LOCATE 13, 14
    PRINT "        EFS" + " " + MID$(DAT1$, 184, 8) + "  " + "             %EFS" + " " + MID$(DAT1$, 195, 8)
    LOCATE 14, 14
    PRINT "           PRBS pattern sybc loss count" + " " + MID$(DAT1$, 217, 8)
    LOCATE 15, 14
    PRINT "                       Clock slip count" + " " + MID$(DAT1$, 206, 8)
    '
    LOCATE 16, 9
    PRINT "-------------------------------------------------------------"
    '
    LOCATE 17, 14
    PRINT "               Power loss time(sec)" + " " + MID$(DAT2$, 52, 8)
    LOCATE 18, 14
```

```
    PRINT "PRBS  Pattern sync loss time(sec)" + " " + MID$(DAT2$, 63, 8)
    LOCATE 19, 14
    PRINT "            Signal loss time(sec)" + " " + MID$(DAT2$, 74, 8)
    LOCATE 20, 14
    PRINT "        Frame sync loss time(sec)" + " " + MID$(DAT2$, 85, 8)
    LOCATE 21, 14
    PRINT " Alarm indicator signal time(sec)" + " " + MID$(DAT2$, 96, 8)
    LOCATE 22, 14
    PRINT "   X.50 Frame sync loss time(sec)" + " " + MID$(DAT2$, 107, 8)
    '
    RETURN
    '
PRINT2: '========== Printing error data2 ==========
    LOCATE 5, 9
    PRINT " ************* MD6420A RESULTS OF MEASURING ************* "
    LOCATE 7, 14
    PRINT "     ERROR" + " " + MID$(DAT1$, 52, 8) + "  " + "      ERROR RATIO" + " " + MID$(DAT1$, 63, 8)
    LOCATE 8, 14
    PRINT "BLOCK-ERROR" + " " + MID$(DAT1$, 74, 8) + "  " + "BLOCK-ERROR RATIO" + " " + MID$(DAT1$, 85, 8)
    LOCATE 9, 14
    PRINT "        US" + " " + MID$(DAT1$, 162, 8) + "  " + "              %US" + " " + MID$(DAT1$, 173, 8)
    LOCATE 10, 14
    PRINT "       SES" + " " + MID$(DAT1$, 140, 8) + "  " + "             %SES" + " " + MID$(DAT1$, 151, 8)
    LOCATE 11, 14
    PRINT "        DM" + " " + MID$(DAT1$, 118, 8) + "  " + "              %DM" + " " + MID$(DAT1$, 129, 8)
    LOCATE 12, 14
    PRINT "        ES" + " " + MID$(DAT1$, 96, 8) + "  " + "              %ES" + " " + MID$(DAT1$, 107, 8)
    LOCATE 13, 14
    PRINT "       EFS" + " " + MID$(DAT1$, 184, 8) + "  " + "             %EFS" + " " + MID$(DAT1$, 195, 8)
    LOCATE 14, 14
    PRINT "          PRBS pattern sybc loss count" + " " + MID$(DAT1$, 217, 8)
    LOCATE 15, 14
    PRINT "                      Clock slip count" + " " + MID$(DAT1$, 206, 8)
    '
    LOCATE 16, 9
    PRINT "---------------------------------------------------------------------"
    '
    LOCATE 17, 14
    PRINT "             Power loss time(sec)" + " " + MID$(DAT2$, 52, 8)
    LOCATE 18, 14
    PRINT "PRBS  Pattern sync loss time(sec)" + " " + MID$(DAT2$, 63, 8)
    LOCATE 19, 14
```

```
    PRINT "              Signal loss time(sec)" + " " + MID$(DAT2$, 74, 8)
    LOCATE 20, 14
    PRINT "          Frame sync loss time(sec)" + " " + MID$(DAT2$, 85, 8)
    LOCATE 21, 14
    PRINT " Alarm indicator signal time(sec)" + " " + MID$(DAT2$, 96, 8)
    LOCATE 22, 14
    PRINT "    X.50 Frame sync loss time(sec)" + " " + MID$(DAT2$, 107, 8)
    '

    RETURN
    '
TRAP:   '========== System trap ==========
    '
    PRINT "IBERR%:" + STR$(IBERR%)                   ' Find the error code
    STOP

    DEFDBL A-Z

DEFDBL A-Z
    SUB WAITTIME (TM)
    t = TIMER
    '
REPEATER:
    V = TIMER
    IF V - t < TM THEN GOTO REPEATER
    END SUB
```

5.8.2 RS-232C sample program

This program describes a sample program that performs remote measurement with the MD6420A via RS-232C interface. This sample program runs on the following controller.

Table 5-15 Controller

Controller	PC-9800 Series personal computer (NEC, Japan)
Language used	N-88 BASIC

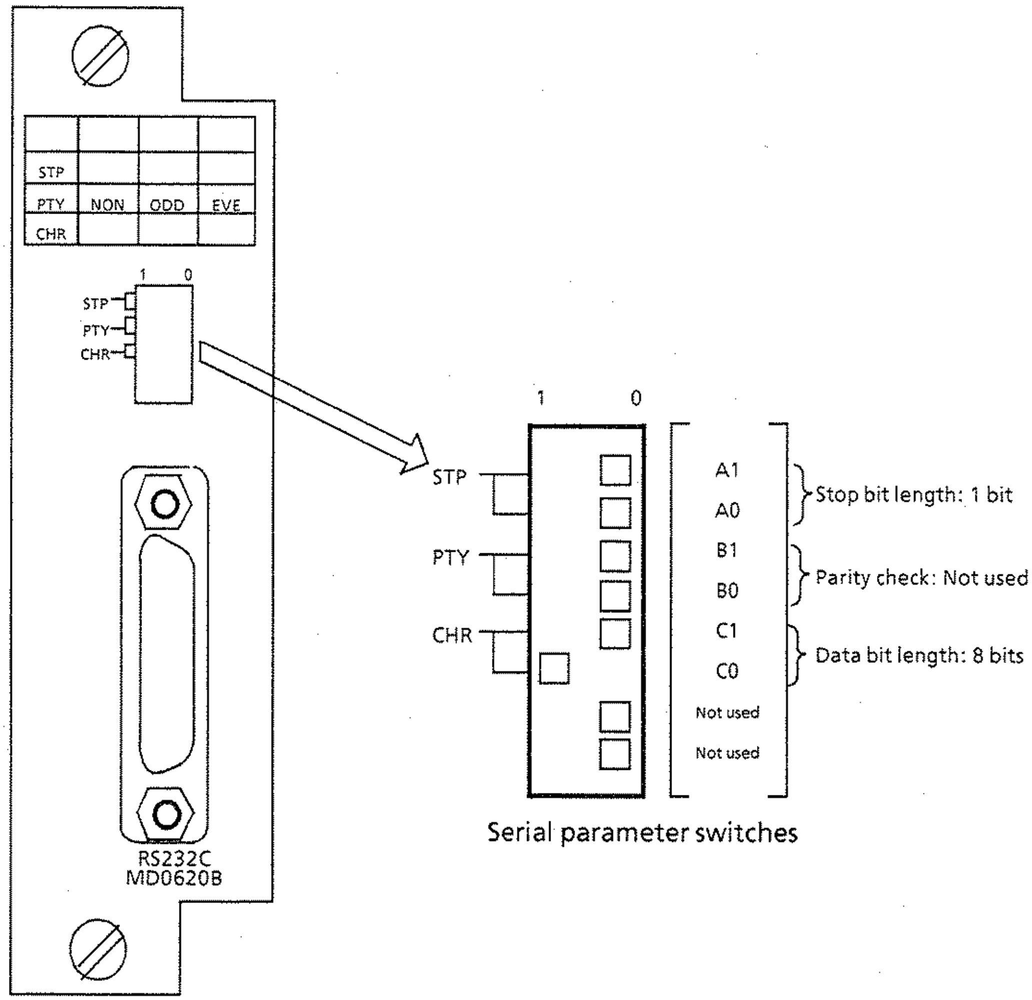
(1) Program execution procedure

To execute the sample program, prepare the controller and the MD6420A as follows:

- Start-up the RS-232C setup utility and set the followings on the controller. (See the N-88 Basic operation manual for the usage of the setup utility.)

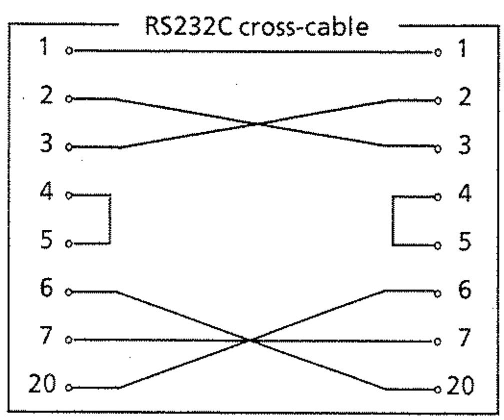
① Band rate : 1200
② Data bit length : 8 bits
③ Stop bit length : 1 bit
④ Parity check : not used
⑤ X parameter : Effective
⑥ S parameter : Effective
⑦ Operation at reception of DEL code: BS/DEL

- Set the MD0620B (RS232C Remote Control Unit) as follows before power-on of the MD6420A.



Serial parameter switches

- Connect the MD6420A to the controller with a RS-232C cross-cable. The internal connection of the cable is shown below.



(2) Sample program specifications

The sample program performs error measurement when frame setting was performed by the MD0623A/A1.

① Setup

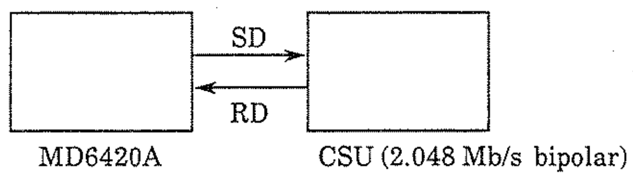
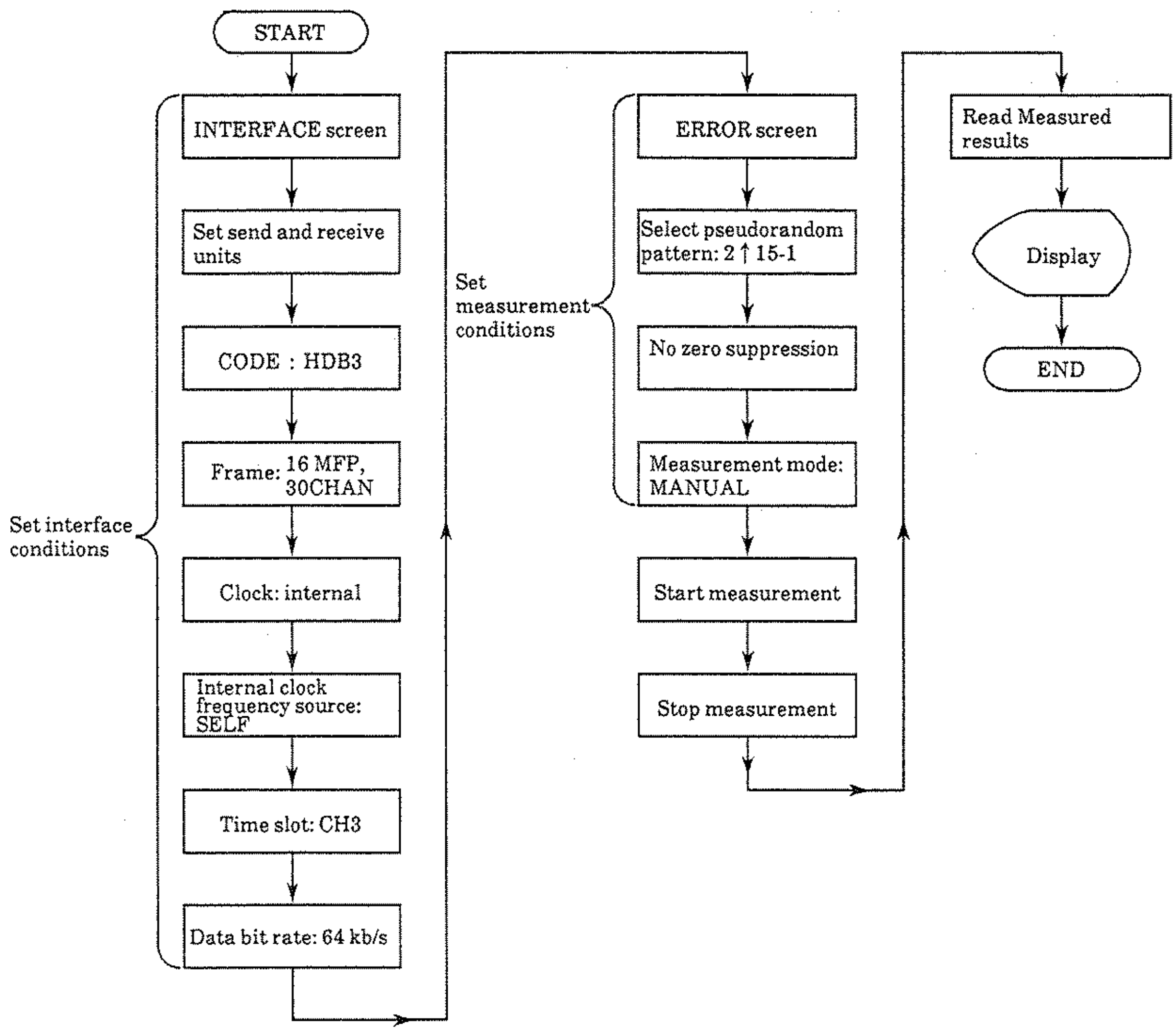


Fig.5-21 Setup

Insert the MD0623A/A1 unit into the MD6420A and connect the MD6420A to the CSU (2.048 Mb/s bipolar) with a cable.

② Measurement procedure



(3) Explanation of common parts of sample program

① OPEN "COM: N81×N" AS#1 are defined at the beginning of the program to set RS-232C control.

② Set appropriate wait time after any command is executed, if necessary.

After executing screen-changing/initializing/measurement-stopping/data-requesting command but before executing the next command from the controller, a unit time of approximately 500 to 1500 ms is provided for the MD6420A to receive and execute these commands and to be stabilized.

Note: On the PC9801 N-88 BASIC, the maximum number of characters to be read by a LINE INPUT # statement (including CR LF code) is 255.

However, that of the response data of the MD6420A (excluding CR LF code) is 255.

So, the number of characters to be read by any data request command (DRA?, DRP?, DOA?, DOP?) may exceed the max. number of the PC9801. If so, use the OFA or OFP command to change the format of the response data, so that the number of characters to be read (including CR LF code) becomes less than 255. See the VOLUME 2 (REFERENCE) for the response data.

(4) Sample program execution result

```
        ***** MD6420A RESULTS OF MEASURING *****   Data during measurement
                                      Current data (Current data)

          ERROR        109          ERROR RATIO  1.70E-03
    BLOCK ERROR        109   BLOCK-ERROR RATIO  1.70E-02
             US   99999999                  %US  99999999
            SES   99999999                 %SES  99999999
             DM   --------                  %DM  --------
             ES   99999999                  %ES  99999999
            EFS   99999999                 %EFS  99999999
           PRBS pattern sync loss count                 0
                       Clock slip count                 0
-------------------------------------------------------------
                  Power loss time (sec)          99999999
      PRBS pattern sync loss time (sec)          99999999
                 Signal loss time (sec)          99999999
             Frame sync loss time (sec)          99999999
       Alarm indication signal time (sec)        99999999
        X.50 Frame sync loss time (sec)          99999999


        ***** MD6420A RESULTS OF MEASURING *****   Data at measurement end
                                          End data (End data)

          ERROR        452          ERROR RATIO  1.41-E03
    BLOCK ERROR        452   BLOCK-ERROR RATIO  1.41-E02
             US          0                  %US      0.00
            SES          4                 %SES     80.00
             DM          1                  %DM    100.00
             ES       5.00                  %ES    100.00
            EFS       0.00                 %EFS      0.00
           PRBS pattern sync loss count                 0
                       Clock slip count                 0
-------------------------------------------------------------
                  Power loss time (sec)                 0
      PRBS pattern sync loss time (sec)                 0
                 Signal loss time (sec)                 0
             Frame sync loss time (sec)                 0
       Alarm indication signal time (sec)             0.0
        X.50 Frame sync loss time (sec)               0.0
```

(5) Sample program listing

```
20 '*************************************************
30 '*              MD6420A SAMPLE PROGRAM            *
40 '*                                                *
50 '*          2M-BPL UNIT ERROR MEASURING           *
60 '*          for PC9801n (N-88BASIC)               *
70 '*          1991/02/25   by ANRITSU Corp.         *
80 '*************************************************
90 '
100 '-------------------------------------------------
110 '       RS-232C LINE OPEN (CONDITION SET)
120 '-------------------------------------------------
130 '                          ! parity-non data-8bit
140 OPEN "COM:N81XN" AS#1 '    ! stop bit-1
150 '                          ! X-parameter S-parameter
160 '-------------------------------------------------
170 '     INTERFACE CONDITION & MEASURING SET
180 '-------------------------------------------------
190 'FOR I=1 TO 100            ! LOOP COUNTER
200 '
210 PRINT #1,"TRM1,MD,INI,IF,SUT1,RUT1,SCD2,RCD2,SFM3,RFM3,SCK0,IFS0,STS1,3,RTS1,3,SDB64000,RDB64000"
220 '                          ! I/F condition set
230 LINE INPUT WAIT 10,Z$'     ! Waitingfor 1sec
240 '
250 PRINT #1,"ED,MM,EC17,3,ME0,PN6,ZSP0,OFP0,1,2,3,4,5,6,7,8,9,10,11,15,16,17,18,OFA0,1,2,3,4,5"
260 '                          ! Measuring condition set
270 LINE INPUT WAIT 10,Z$'     ! WAITING FOR 1SEC
280 '
290 PRINT #1,"DPR,DIC,DAC,SA,EA"
300 '                          ! Change display & data buffer clear
310 '                          ! & start measuring & insert error
320 '
330 LINE INPUT WAIT 20,Z$'     ! Waiting for 2sec
340 '
350 PRINT #1,"DOA?" '          ! Alarm data  request
360 LINE INPUT #1,A$'          ! Read alarm data
370 '
380 PRINT #1,"DOP?" '          ! Performance data request
390 LINE INPUT #1,B$'          ! Read paformance data
400 GOSUB *PRINT1   '          ! Print results of current data
410 '
420 PRINT #1,"EO,SO"'          ! Stop error insert & measuring
430 LINE INPUT WAIT 15,Z$'     ! Waiting for 1.5sec
440 '
450 PRINT #1,"DRA?" '          ! Periodic alarm data request
460 LINE INPUT #1,C$'          ! Read periodic alarm data
```

```
470 '
480 LINE INPUT WAIT 5,Z$'   ! Waiting for 0.5sec
490 '
500 PRINT #1,"DRP?" '       ! Periodic performance data request
510 LINE INPUT #1,D$'       ! Read periodic paformance data
520 GOSUB *PRINT2   '       ! Print resurts of end data
530 '
540 'NEXT I                 ! Loop end
550 END
560 '---------------------------------------------------
570 '     Printing error data1
580 '---------------------------------------------------
590 *PRINT1
600 CLS 3
610 'LOCATE 10,1
620 'PRINT "LOOP COUNT=";I
630 LOCATE 13,2
640 PRINT "********** MD6420A RESULTS OF MEASURING ***********"
650 LOCATE 14,3
660 PRINT "                                     Current data "
670 '
680 LOCATE 13,5
690 PRINT "      ERROR ";MID$(B$,52,8);"        ERROR RATIO ";MID$(B$,63,8)
700 LOCATE 13,6
710 PRINT "BLOCK ERROR ";MID$(B$,74,8);"  BLOCK-ERROR RATIO ";MID$(B$,85,8)
720 LOCATE 13,7
730 PRINT "         US ";MID$(B$,162,8);"              %US ";MID$(B$,173,8)
740 LOCATE 13,8
750 PRINT "        SES ";MID$(B$,140,8);"             %SES ";MID$(B$,151,8)
760 LOCATE 13,9
770 PRINT "         DM ";"--------";"              %DM --------"
780 LOCATE 13,10
790 PRINT "         ES ";MID$(B$,96,8);"              %ES ";MID$(B$,107,8)
800 LOCATE 13,11
810 PRINT "        EFS ";MID$(B$,184,8);"             %EFS ";MID$(B$,195,8)
820 LOCATE 14,12
830 PRINT "     PRBS pattern sync loss count     ";MID$(B$,217,8)
840 LOCATE 14,13
850 PRINT "                 Clock slip count     ";MID$(B$,206,8)
860 LOCATE 13,14
870 PRINT "-----------------------------------------------------"
880 '
890 LOCATE 13,15
900 PRINT "          Power loss time(sec)        ";MID$(A$,52,8)
910 LOCATE 13,16
920 PRINT " PRBS pattern sync loss time(sec)      ";MID$(A$,63,8)
```

```
930 LOCATE 13,17
940 PRINT "            Signal loss time(sec)        ";MID$(A$,74,8)
950 LOCATE 13,18
960 PRINT "        Frame sync loss time(sec)        ";MID$(A$,85,8)
970 LOCATE 13,19
980 PRINT "Alarm indication signal time(sec)        ";MID$(A$,96,8)
990 LOCATE 13,20
1000 PRINT "    X.50 Frame sync loss time(sec)        ";MID$(A$,107,8)
1010 '
1020 RETURN
1030 '
1040 '-----------------------------------------------
1050 '          PRINTING ERROR DATA2
1060 '-----------------------------------------------
1070 '
1080 *PRINT2
1090 '
1100 LOCATE 14,3
1110 PRINT "                                                  End data "
1120 '
1130 LOCATE 13,5
1140 PRINT "      ERROR ";MID$(D$,52,8);"        ERROR RATIO ";MID$(D$,63,8)
1150 LOCATE 13,6
1160 PRINT "BLOCK ERROR ";MID$(D$,74,8);"  BLOCK-ERROR RATIO ";MID$(D$,85,8)
1170 LOCATE 13,7
1180 PRINT "         US ";MID$(D$,162,8);"                %US ";MID$(D$,173,8)
1190 LOCATE 13,8
1200 PRINT "        SES ";MID$(D$,140,8);"               %SES ";MID$(D$,151,8)
1210 LOCATE 13,9
1220 PRINT "         DM ";MID$(D$,118,8);"                %DM ";MID$(D$,129,8)
1230 LOCATE 13,10
1240 PRINT "         ES ";MID$(D$,96,8);"                %ES ";MID$(D$,107,8)
1250 LOCATE 13,11
1260 PRINT "        EFS ";MID$(D$,184,8);"               %EFS ";MID$(D$,195,8)
1270 LOCATE 14,12
1280 PRINT "    PRBS pattern sync loss count       ";MID$(D$,217,8)
1290 LOCATE 14,13
1300 PRINT "                Clock slip count       ";MID$(D$,206,8)
1310 LOCATE 13,14
1320 PRINT "-----------------------------------------------"
1330 '
1340 LOCATE 13,15
1350 PRINT "            Power loss time(sec)        ";MID$(C$,52,8)
1360 LOCATE 13,16
1370 PRINT " PRBS pattern sync loss time(sec)        ";MID$(C$,63,8)
1380 LOCATE 13,17
```

```
1390 PRINT "                Signal loss time(sec)          ";MID$(C$,74,8)
1400 LOCATE 13,18
1410 PRINT "            Frame sync loss time(sec)          ";MID$(C$,85,8)
1420 LOCATE 13,19
1430 PRINT "Alarm indication signal time(sec)              ";MID$(C$,96,8)
1440 LOCATE 13,20
1450 PRINT "    X.50 Frame sync loss time(sec)             ";MID$(C$,107,8)
1460 '
1470 RETURN
1480 '
1490 '==================== END OF PROGRAM ====================
```

SECTION 6
PRINCIPLES OF OPERATION

6.1 Error Measurement

6.1.1 Pseudorandom pattern

- The MD6420A has a pseudorandom pattern generation circuit that conforms to CCITT (NORMAL) and its reverse (REVERSE). The pseudorandom pattern can also be inverted. Further, zero-suppression processing (which the maximum number of consecutive 0s is: 14 or 7) can also be set.

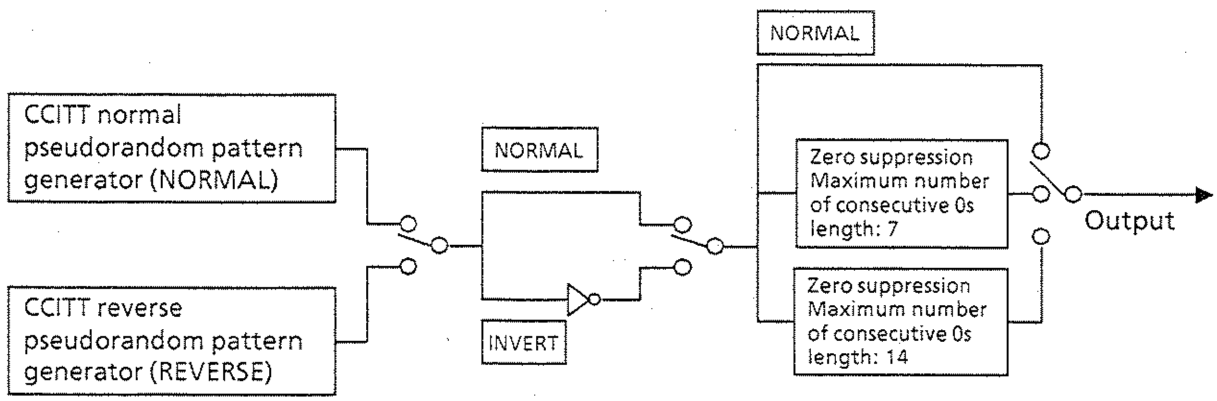
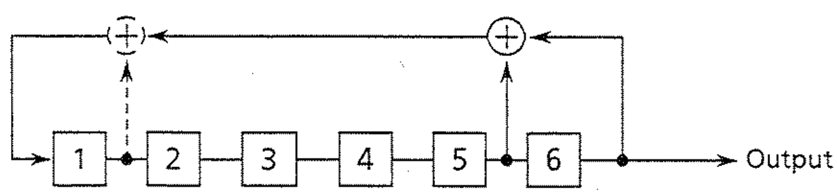


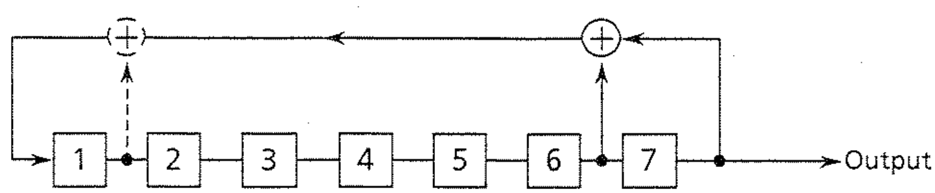
Fig. 6-1 MD6420A Pseudorandom Pattern Generation Block Diagram

The block diagram for the pseudorandom pattern generator is shown below. (The broken lines in the figure represent the CCITT reverse circuit.)

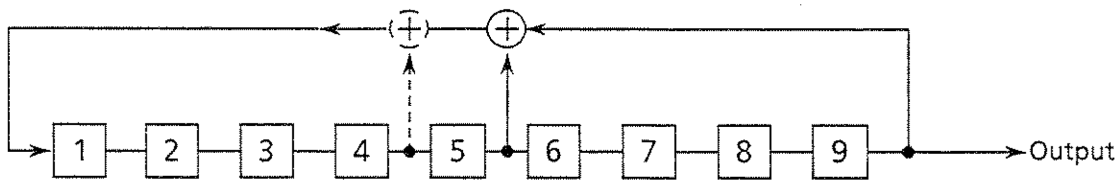
(1) 2^6-1 (63 patterns), $1 + X^5 + X^6$



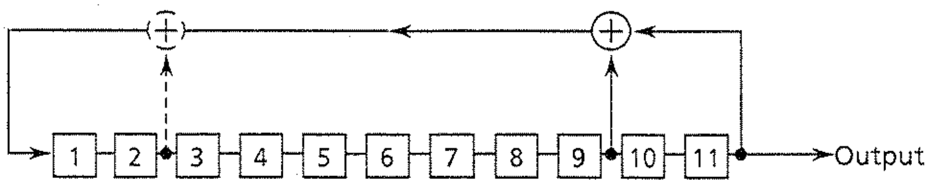
(2) $2^7 - 1, 1 + X^6 + X^7$ (conforms to CCITT V.29)



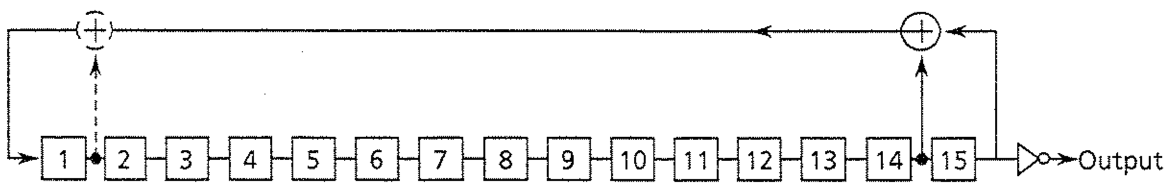
(3) $2^9 - 1$ (511 pattern), $1 + X^5 + X^9$ (conforms to CCITT V.52)



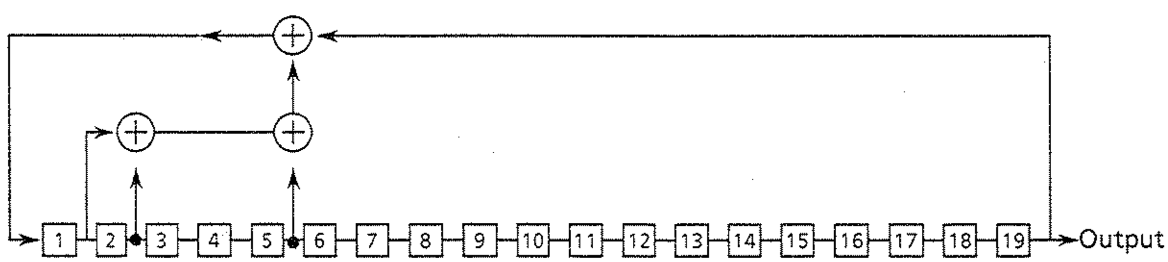
(4) $2^{11} - 1$ (2047 pattern), $1 + X^9 + X^{11}$ (conforms to CCITT O.152)



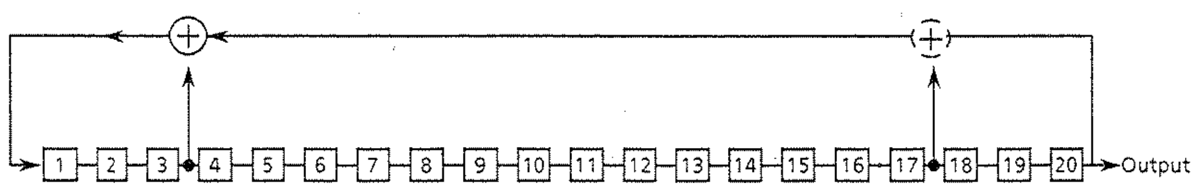
(5) $2^{15} - 1$, $1 + X^{14} + X^{15}$ (conforms to CCITT O.151)



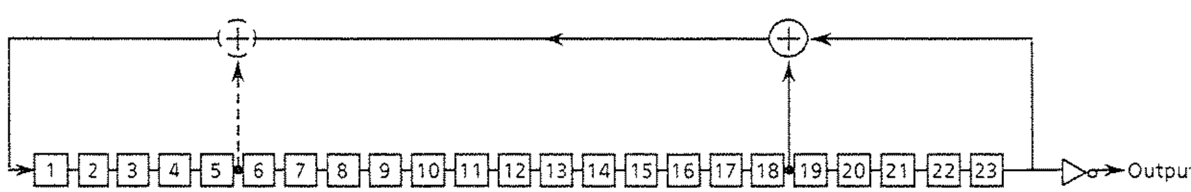
(6) $2^{19} - 1$, $1 + X + X^2 + X^5 + X^{19}$ (conforms to CCITT I.430)



(7) $2^{20} - 1$, $1 + X^3 + X^{20}$ (conforms to CCITT V.57)



(8) $2^{23} - 1$, $1 + X^{18} + X^{23}$ (conforms to CCITT O.151)



6.1.2 Zero-suppression

Paragraphs 1.1.3 (maximum consecutive 0s length: 7) and 2.5 (maximum consecutive 0s length: 14) of CCITT G.703 specify the maximum number of consecutive zeros that can be input into any device. The MD6420A can generate pseudorandom patterns whose consecutive zeros have been suppressed in accordance with paragraph 2.3 of CCITT O.151 specification.

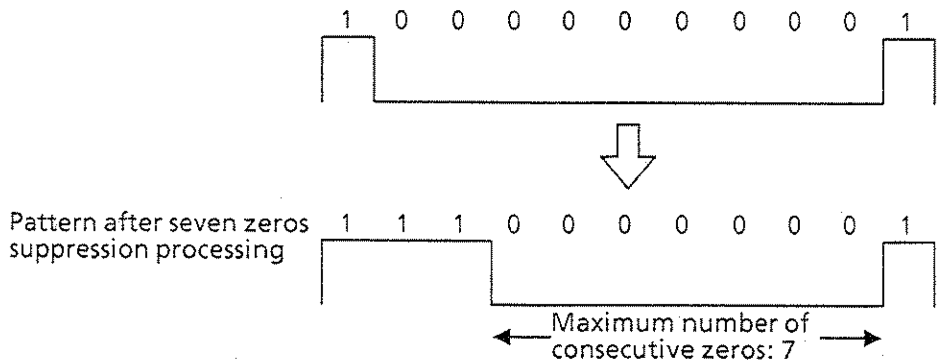


Fig. 6-2 Seven Zeros Suppression Processing Pattern

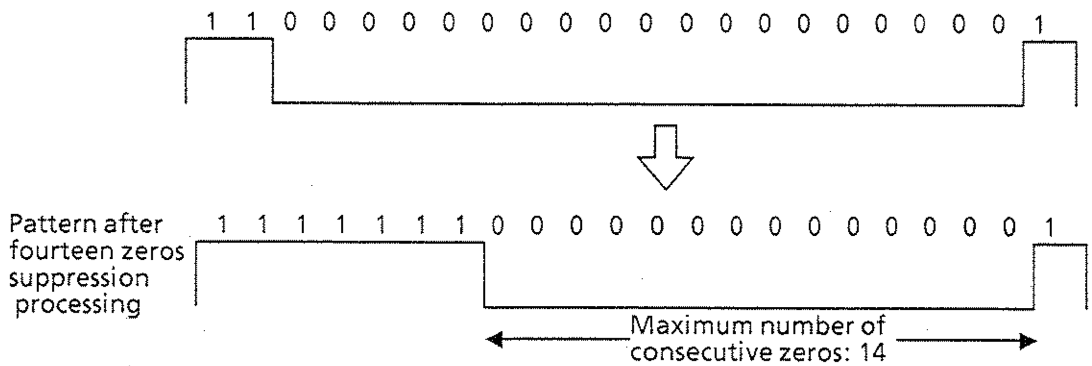


Fig. 6-3 Fourteen Zeros Suppression Processing Pattern

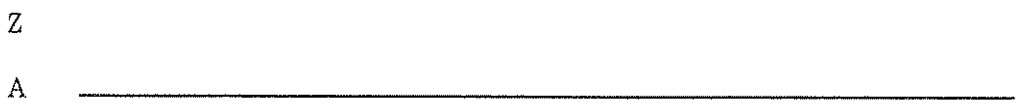
Remarks: Fourteen zeros suppression is necessary when connected to a DS1 (1.544 Mb/s) device in the USA. A pseudorandom pattern (2^{20}-1, CCITT reverse) with fourteen zeros suppression is used to evaluate this device. (This pattern is called a QRSS pattern.)

6.1.3 Fixed pattern

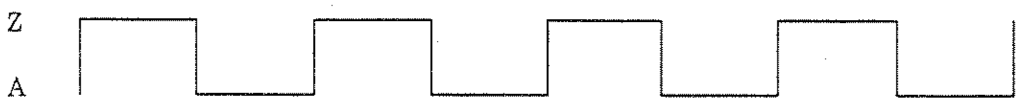
The MD6420A can generate All 0s, All 1s, 1:1, 1:3, 3:1, 1:7, and 7:1 fixed patterns in accordance with CCITT V.52.

(1) Z : All 1s

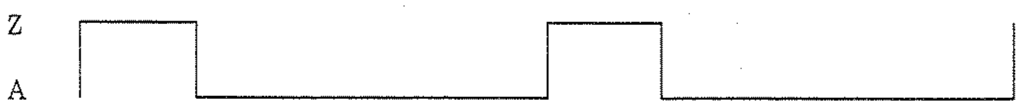
(2) Z : All 0s



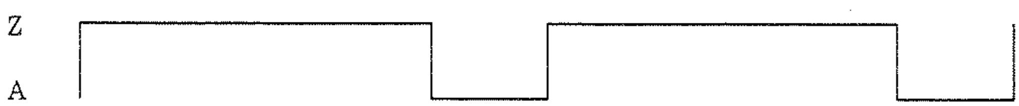
(3) 1 : 1 Repetition of 10



(4) 1 : 3 Repetition of 1000



(5) 3 : 1 Repetition of 1110



(6) 1 : 7 Repetition of 10000000

(7) 7 : 1 Repetition of 11111110

6.1.4 Pseudorandom pattern sync establishment conditions

The MD6420A synchronizes pseudorandom pattern by reading.

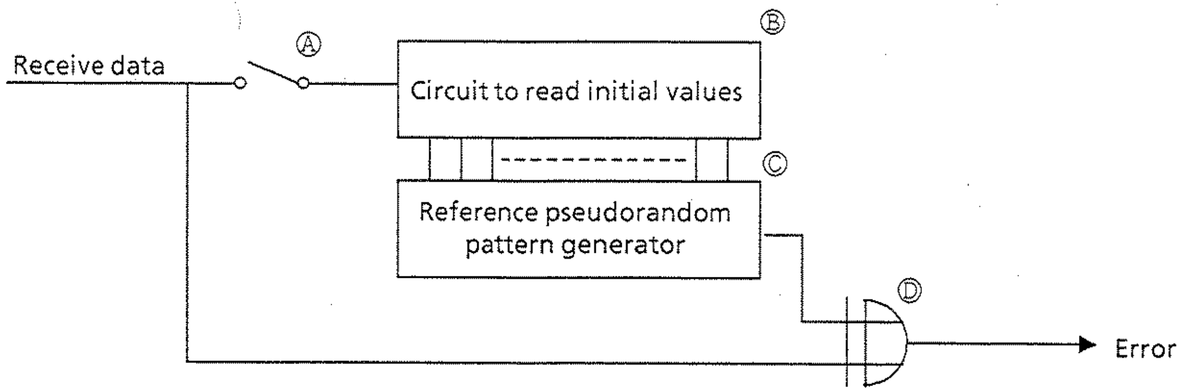


Fig. 6-4 Pseudorandom Pattern Synchronization Circuit Block Diagram

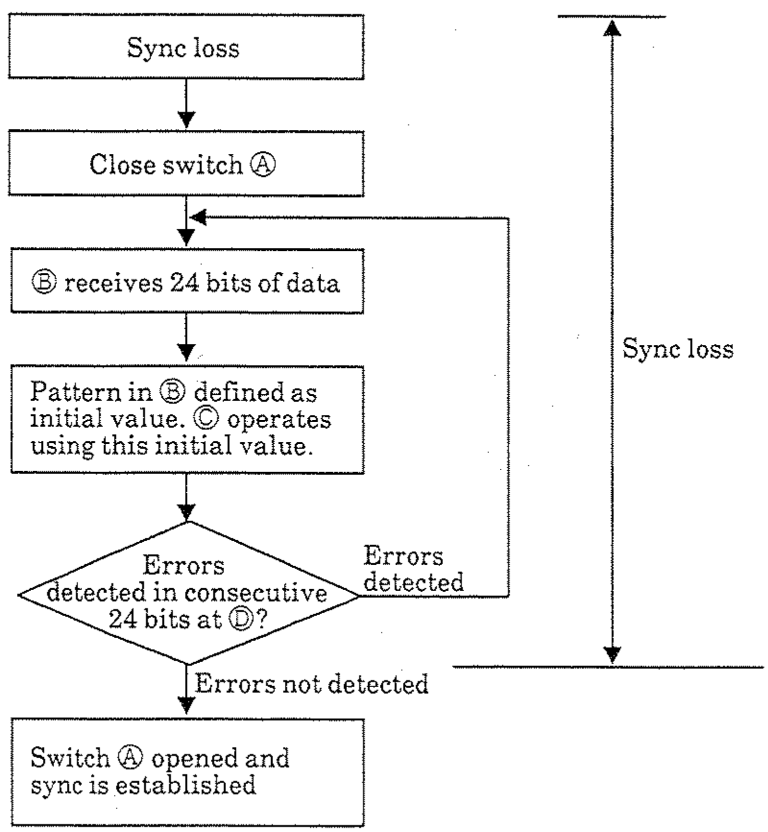


Fig. 6-5 Pseudorandom Pattern Sync Establishment Flowchart

6.1.5 Pseudorandom pattern sync loss detection conditions

- If there are n or more bit errors in the m bits of the receive clock, pseudorandom pattern synchronization is lost. (Sync loss is said to occur when n bit errors are counted. The error bit count is cleared when the receive clock has counted m bits.)

  During sync loss, both bit counters stop. After synchronization is established, counting starts from 0.

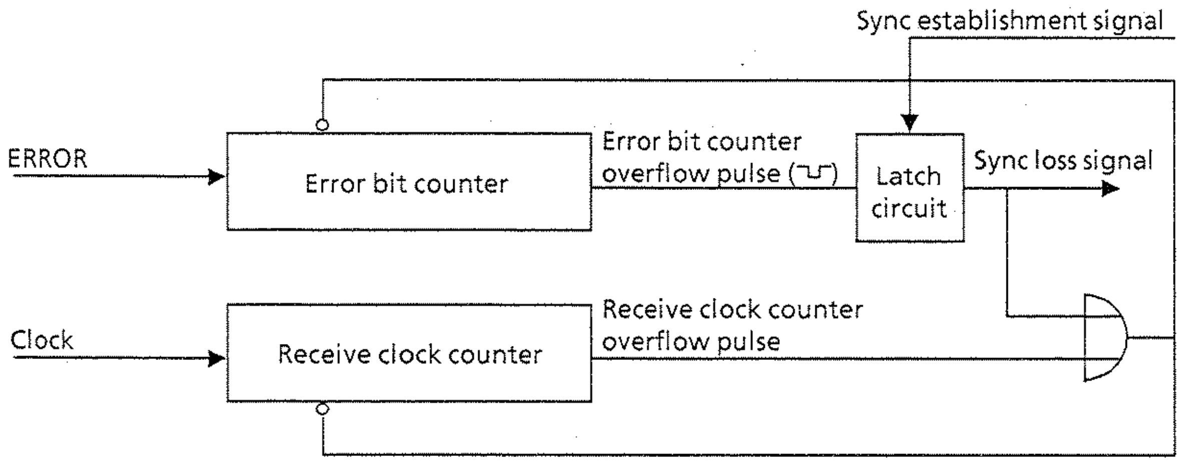


Fig. 6-6 Sync Loss Detection Circuit Block Diagram

In the MD6420A, 16 values of n/m, between 10/100 and 100000/300000, can be set.

The n/m setting in the AUTO mode is shown below.

(1) For interface units whose data bit rate can be set to 64 kbit/s × N.

$m=512\times N,\ n=200\times N$

$$\frac{200\times N}{512\times N}$$

N is specified as follows according to the bit rate.

N=1 (Bit rate: 2.4 to 80kb/s)
N=2 (Bit rate: 128 to 192kb/s)
N=4 (Bit rate: 256 to 384kb/s)
N=8 (Bit rate: 448 to 768kb/s)
N=16 (Bit rate: 832 to 1544kb/s)
N=32 (Bit rate: 1600 to 3072kb/s)
N=64 (Bit rate: 3136 to 8448kb/s)

(2) Other units

$$\frac{200}{512}$$

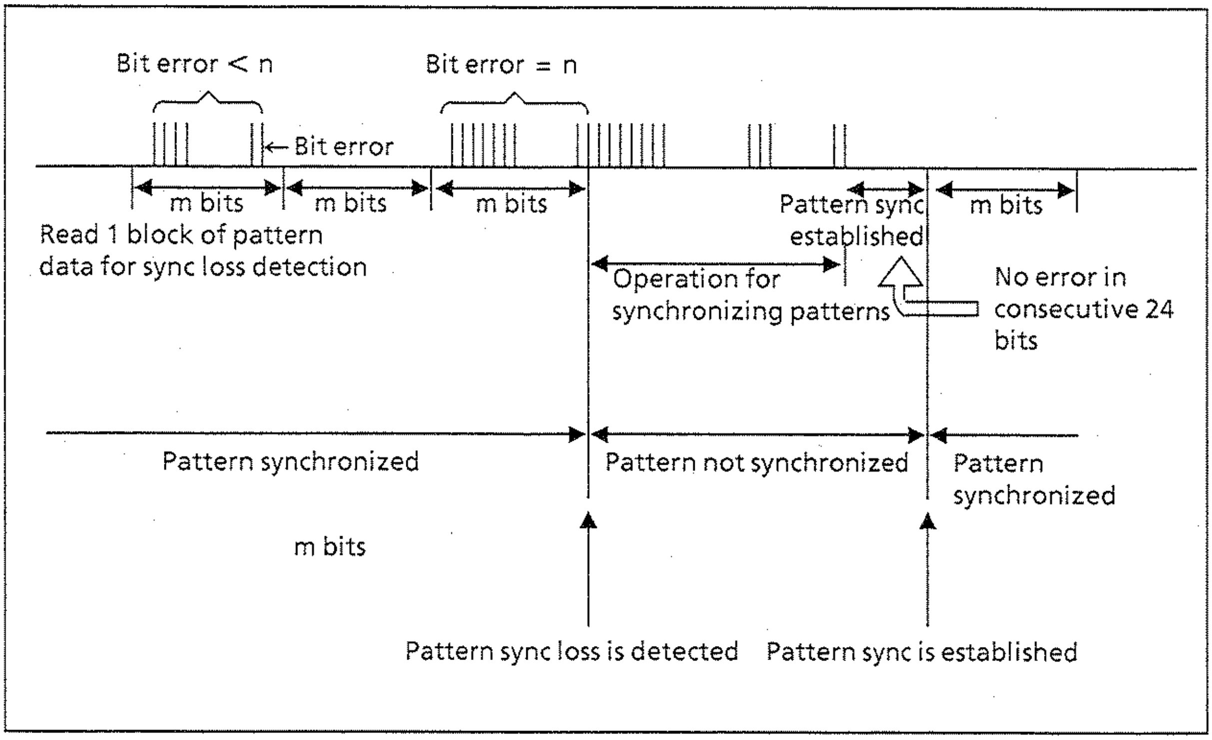


Fig. 6-7 Pattern Sync and Sync Loss State

6.1.6 Error performance (CCITT G.821)

- The MD6420A performs error performance processing in accordance with CCITT G.821. (However, when the measurement time is determined by bit length, error performance processing can not performed.)

(1) Definition of available/unavailable time (sec)

When the state shown below lasts for 10 seconds or longer, the unavailable time is recorded for as long as this state lasts.
(the sum of the seconds that are unavailable is defined as Sunvailable.) When the state shown below has not occurred for 10 seconds or longer after the start of an unavailable time period, available time is recorded for the duration of this state. (The sum of these available seconds is defined as Savailable.)

Unavailable assessment condition

Condition 1: 1 second error rate exceeds SES threshold
Condition 2: Frame sync loss or pattern sync loss is generated 1 or more times within 1 second period (G.821 ANNEX-D)

Note: The SES threshold is 10^{-3} (10^{-4} can also be set via FUNCTION switch).

(2) AT, %AT (Avail able Time)

The total duration of available seconds at paragraph (1) above is defined as AT. The ratio of available time to total time is defined as %AT.

$$\%AT = \frac{AT}{Stotal} \times 100$$

Stotal = Savailable + Sunavailable
(measurement time)

(3) US, %US (Unavailable Seconds)

The total duration of unavailable seconds at (1) is defined as US. The ratio of unavailable to total time is defined as %US.

$$\%US = \frac{US}{Stotal} \times 100$$

Stotal = Savailable + Sunavailable
(measurement time)

(4) SES, %SES (Severely Errored Seconds)

The total number of seconds for which the conditions shown below are satisfied in the savailable intervals are defined as SES. Its ratio is defined as %SES.

SES assessment conditions

Condition 1: 1-second error rate exceeds SES threshold
Condition 2: Frame sync loss is generated 1 or more times in 1 second (G.821 ANNEX-D)

$$\%SES = \frac{SES}{Savailable} \times 100$$

Note: SES threshold is 10^{-3} (10^{-4} can also be set via the FUNCTION switch).

(5) DM, %DM (Degraded Minutes)

Sixty or 600 consecutive available intervals, excluding the SES intervals, are grouped. The 1-minute or 10-minute error rate within this group is computed. The total of groups whose error rate exceeds the DM threshold is made DM. The proportion of DM in the available time is made %DM. Here, the last group with less than 60 or 600 intervals is processed as one group.

DM = total of groups that exceed DM threshold

$$\text{Mavailable} = \frac{\text{Savailable}}{60 \text{ or } 600} \quad \text{(decimal part truncated)}$$

$$\%\text{DM} = \frac{\text{DM}}{\text{Mavailable}} \times 100$$

Notes: 1. The DM threshold is 10^{-6} (10^{-8} can also be set via the FUNCTION switch).

2. When the receive data bit rate is 64 kb/s, the DM threshold at 60-interval grouping is defined as the occurrence of 5 or more bit errors. (Error rate = 1.3×10^{-6})
Four bit error (Error rate = 1.04×10^{-6}) are not defined as a DM (G.821 Table 1 Note 4).

However, it is effective when an interface that can set the receive bit rate at the MD6420A is used.

(6) ES, $ES (Errored Seconds)

When the error count in the available second is one or more, the number of errors is converted to a bit rate 64 kb/s and ES is found.

$$\text{ES} = \text{Sum of} \left(\frac{n}{N}\right)$$

$\left(\frac{n}{N}\right)$: ES in 1 second ES=1 for $n \geqq N$

n : Error count in 1-second interval
N : Receive bit rate divided by 64 kb/s (decimal part truncated)

$$\%\text{ES} = \frac{\text{ES}}{\text{Savailable}} \times 100$$

This ES is calculated when an interface that can set the receive bit rate at the MD6420A is used. For other interfaces, the seconds at which there were one or more errors is made ES.

(7) EFS, %EFS (Errored Free Seconds)

The sum of error-free second in the available second is made EFS.

EFS = Savailable − ES
%EFS = 100 − %ES

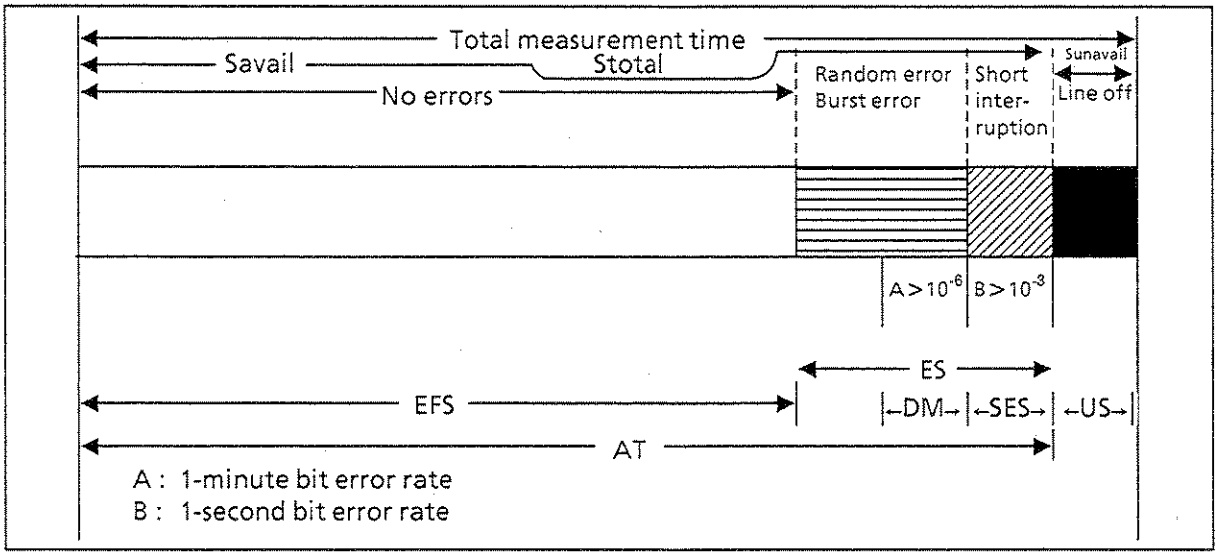
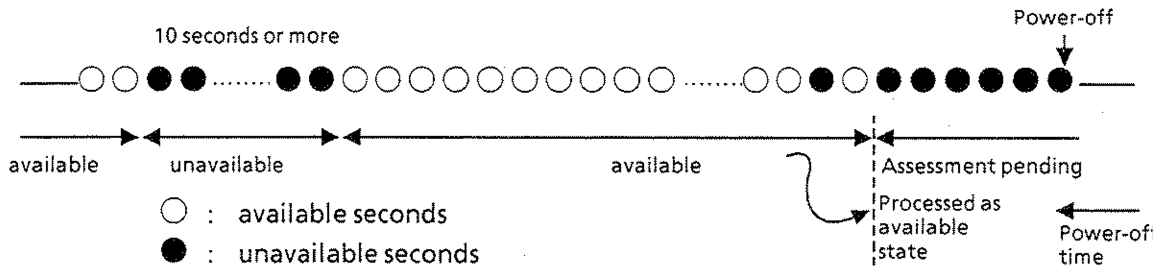


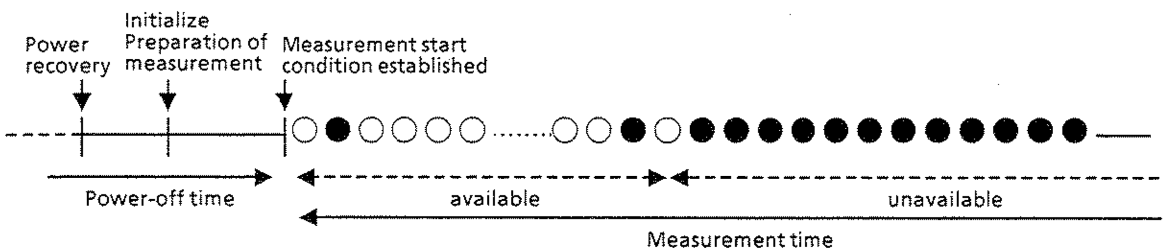
Fig. 6-8 Error Performance Relationship

6.1.7 Measured data backed-up upon power failure

When MD6420A AC power is interrupted during error measurement, the data up to that point is protected and measurement is continued after the power is recovered. The data up to the 1-second measured result data immediately before the power interruption is made valid data and the subsequent data is treated as the power-off time.
Available/unavailable assessment pending data is processed as if the state before it is continued.



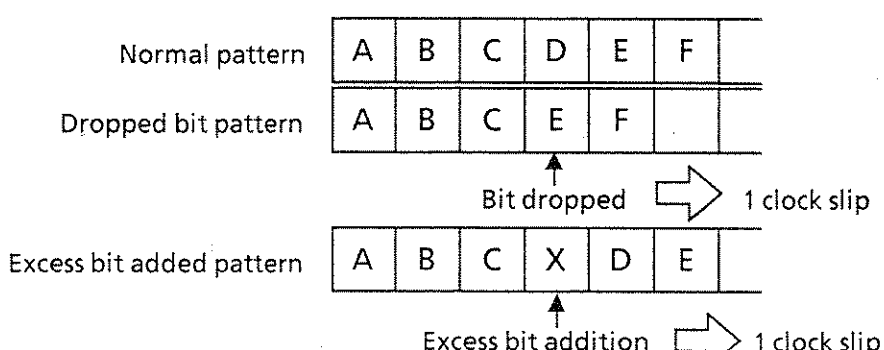
The period up to the time when the measurement start condition is established after power recovery, is made the measurement start time and the period up to that time, is made the power-off time.



This processing is not performed when error measurement mode is BIT.
When the power is recovered after power is turned off by the POWER switch, the measurement data is protected, but measurement is not continued.

6.1.8 Clock slip

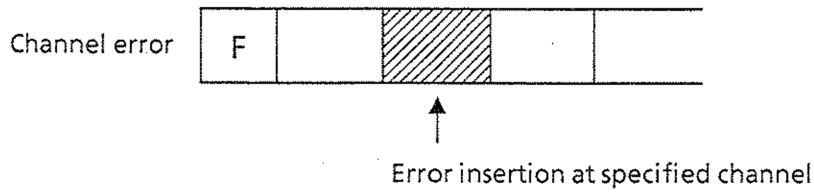
At bit error measurement using pseudorandom pattern, a dropped bit or an excess bit are detected as clock slip.



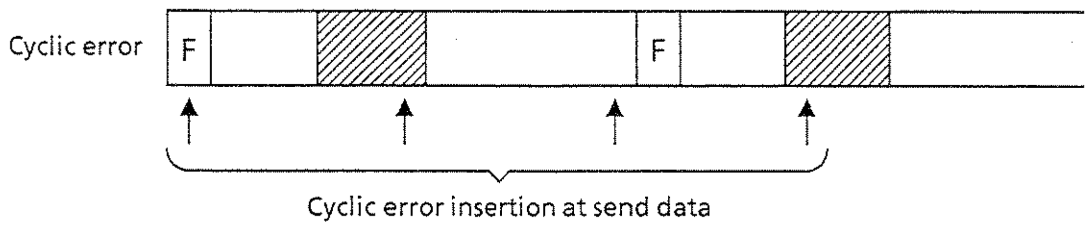
In addition, seconds (in which the clock slip was generated 1 or more times in 1 second interval) counts as a clock slip second.

6.1.9 Error insertion

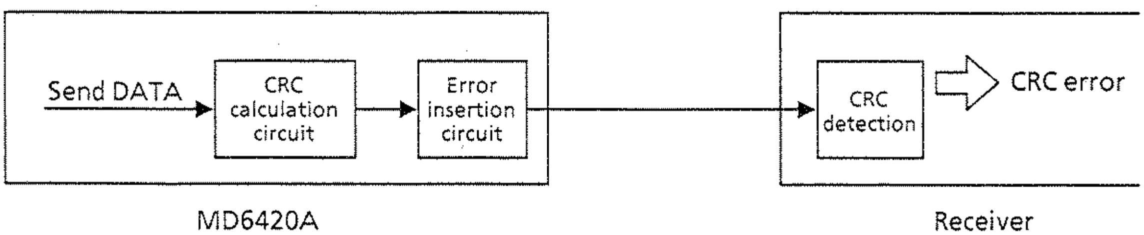
(1) Channel error/cyclic error
Channel error inserts an error at the specified channel



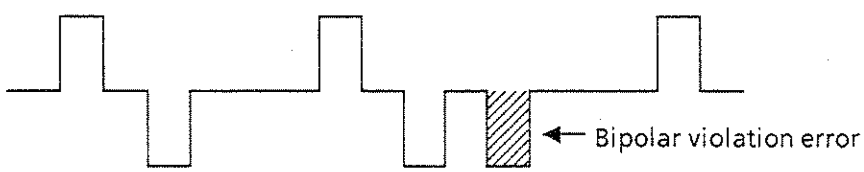
Cyclic error insert errors uniformly into the send data. Therefore, an error may also be inserted at the frame bit.



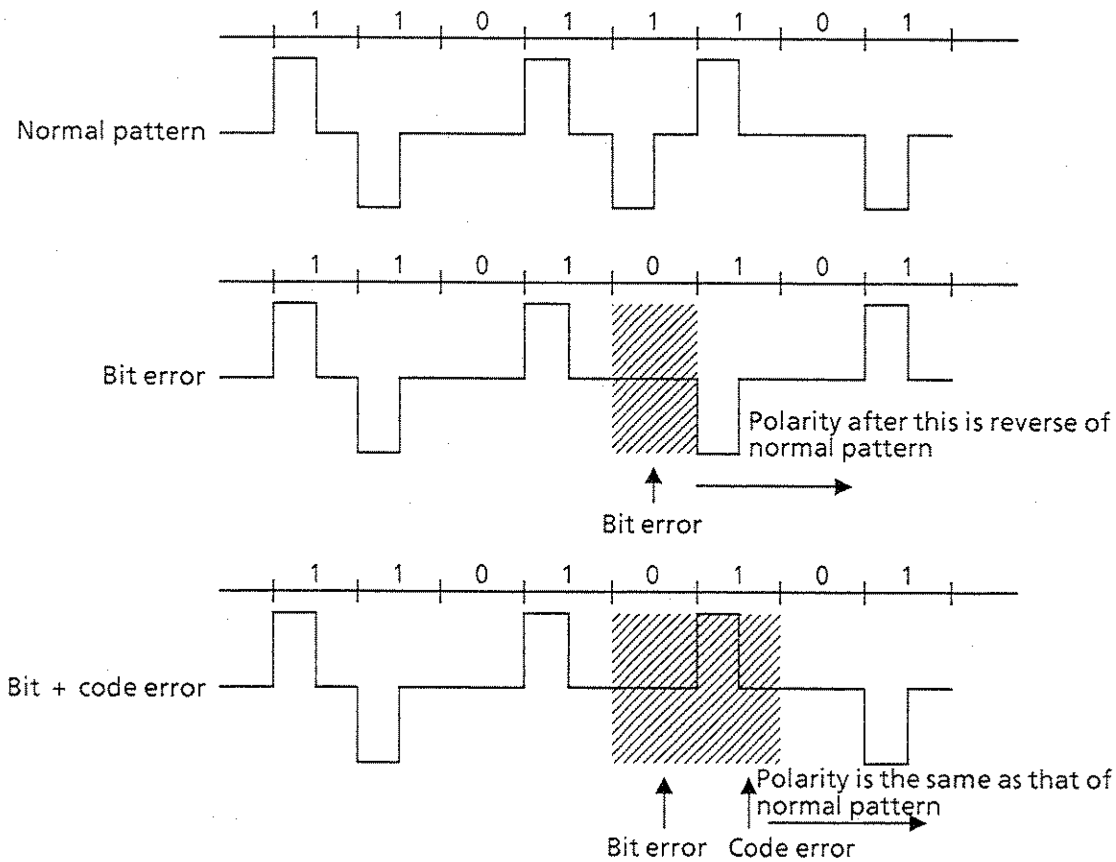
(2) Error insertion circuit
Errors are inserted into the data after CRC and parity calculation. Therefore, at the receiving side, they are also detected as CRC errors and parity errors, as well as bit errors.

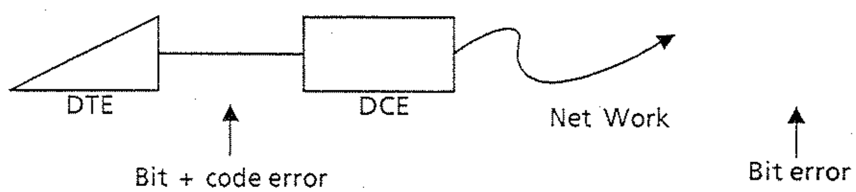


(3) Code error/bit error/code + bit error
When an code error is inserted, a bipolar violation error is recognized.



The difference in the output pattern when the output signal is a bipolar pattern and a bit error or bit + code error is inserted is shown below.





Bit + code error is considered to occur when an error is generated between the DTE and DCE, and a bit error is considered to occur when an error is generated at the network.

6.1.10 Fixed pattern synchronization

With the MD6420A, 8-bit fixed pattern synchronization is established by the following method:

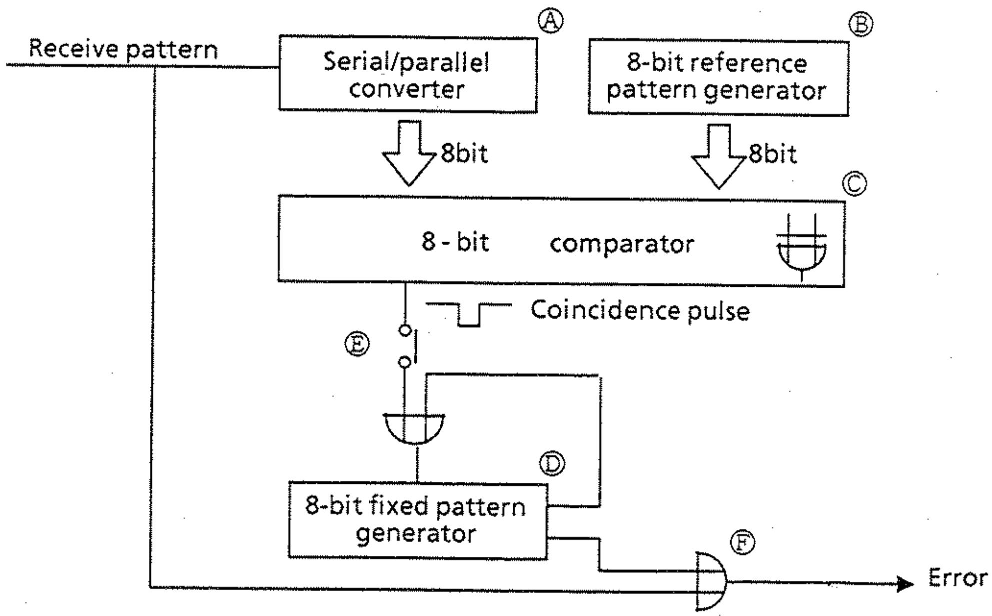


Fig. 6-9 Fixed Pattern Synchronization Circuit Block Diagram

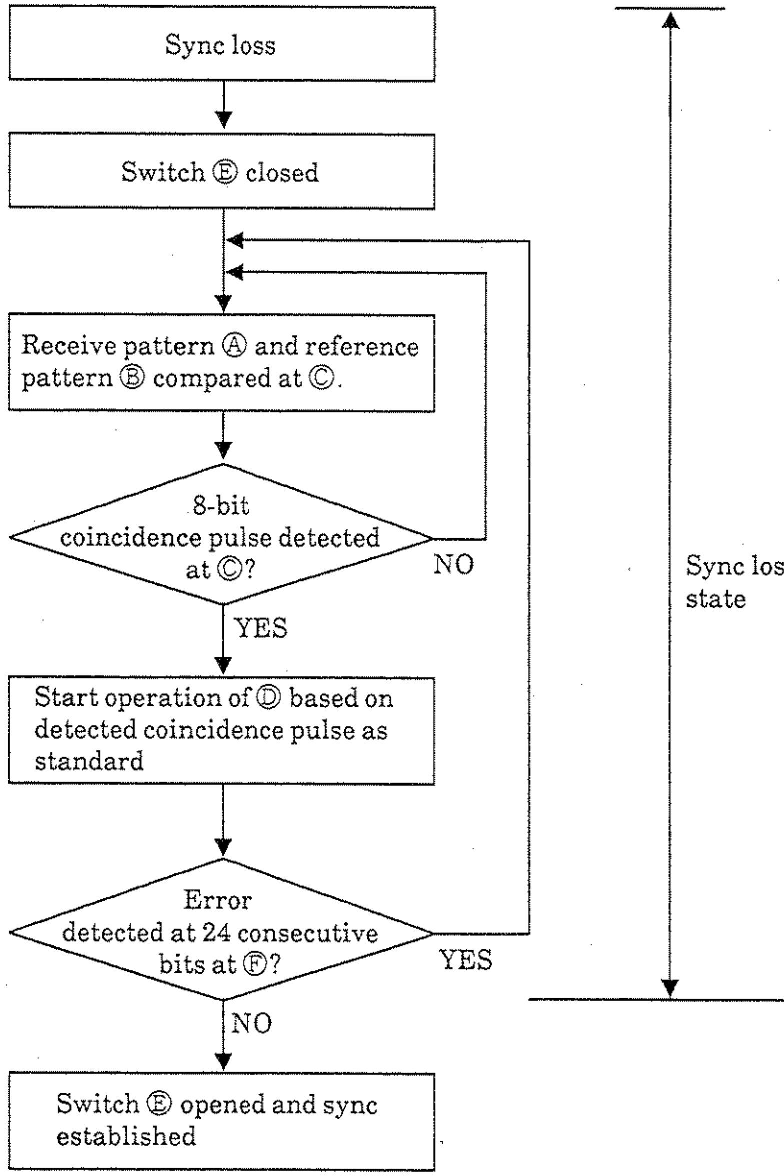


Fig. 6-10 Fixed Pattern Synchronization Flowchart

6.1.11 BBE and BBER

Caluculation for the bit error ratio is as follows:

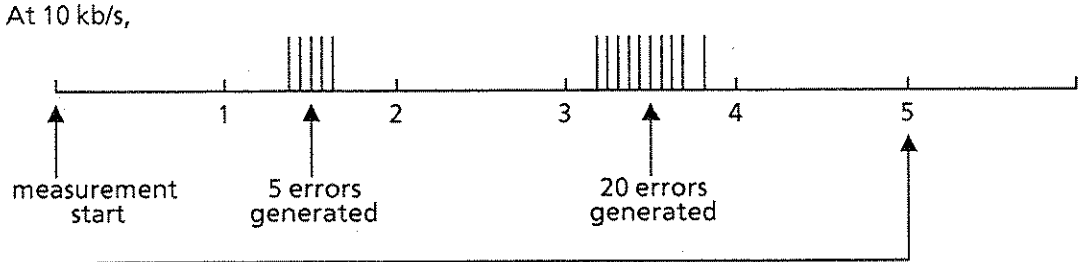
$$\text{Bit error ratio} = \frac{\text{Number of errors}}{\text{Number of received clocks}}$$

BEER= Background Bit Error Ratio is the caluculated value of the bit error ratio excluding the seconds that were US and SES.

BBE= Background Bit Error is numbers of errors excluding the errors that were generated in seconds that are SES and US.

Example:

At 10 kb/s,



measurement results after 5 seconds

Number of errors $= 5 + 20 = 25$

Error ratio $= \dfrac{25}{5 \times 10^4} = 5 \times 10^{-4}$

BBE $= 5$

BBER $= \dfrac{5}{4 \times 10^4} = 1.25 \times 10^{-4}$

6.2 Voltage Measurement

The voltage of each interface signal line can be measured by using the MD6420A with the MD0621A/B/C/D.

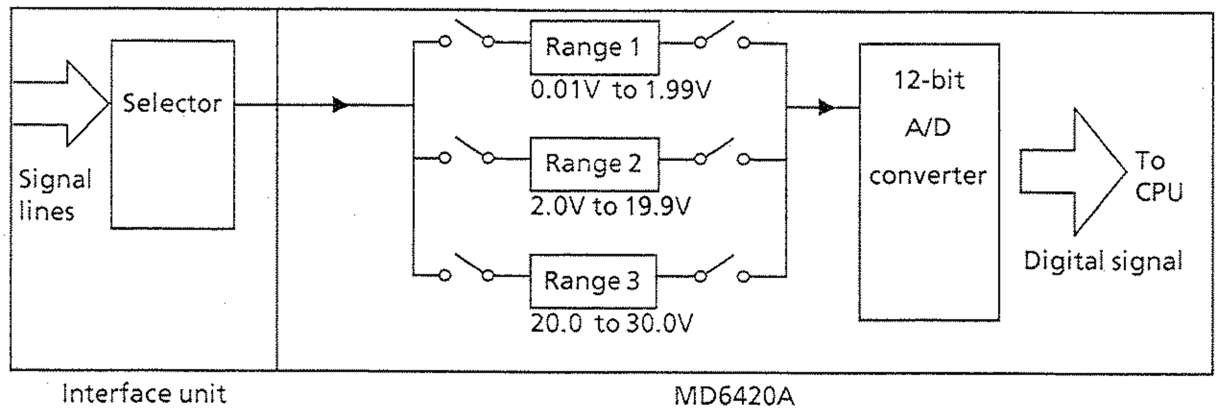


Fig. 6-11 Voltage Measurement Block Diagram

The MD6420A switches the three ranges automatically and performs dc voltage measurement by using a 12-bit A/D converter.

DC voltage measurement is performed once every seconds.

6.3 Transmission Delay Time Measurement

The MD6420A performs transmission delay time measurement in the line loopback mode. Sending pattern is an All 1s pattern. When measurement start is specified, an 8-bit 0 pattern is sent and and is made the measurement start trigger ①. At the receiving side, the 8-bit 0 pattern is detected and is made the measurement stop trigger ②.

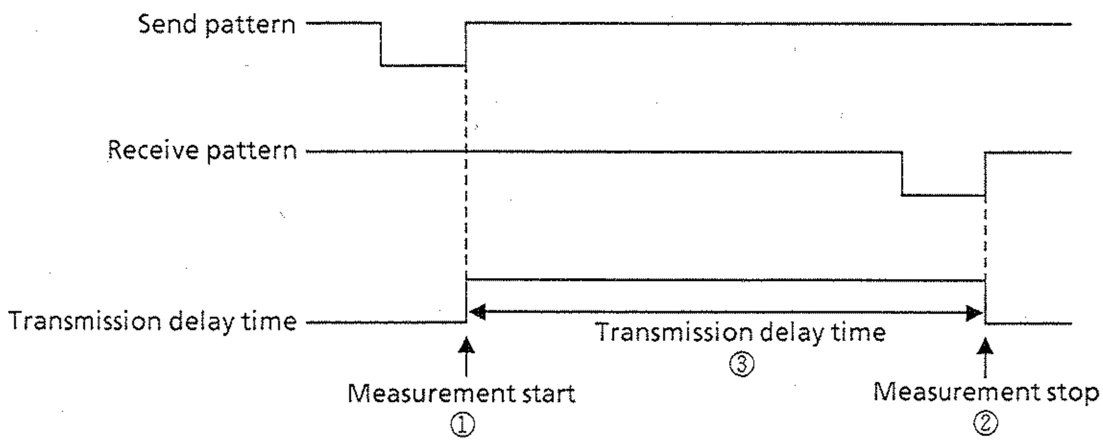


Fig. 6-12 Transmission Delay Time Measurement Timing Chart

③ of Fig. 6-12 is the round-trip transmission delay time.

6.4 Word Pattern Generation and Tracing

6.4.1 Setting and sending the word pattern

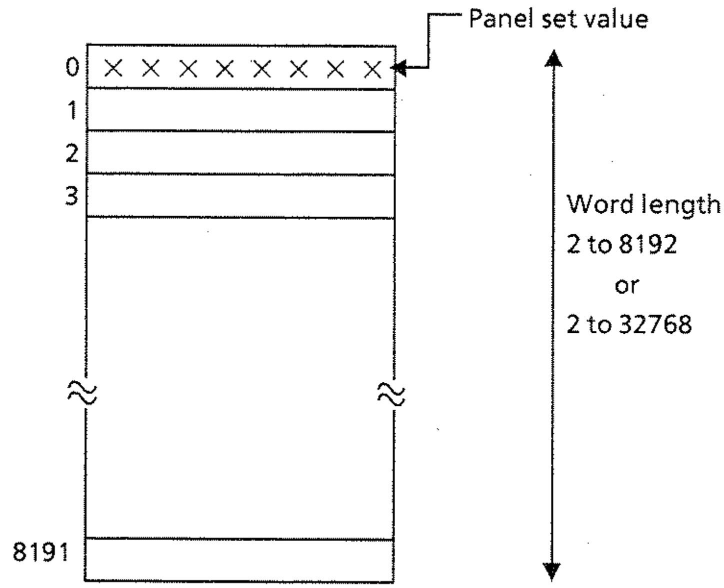


Fig. 6-13 Internal Memory for Word Pattern Generation

The word patterns set at the WORD TRACE screen are stored in the MD6420A internal memory as shown in Fig. 6-13. When the word pattern send is specified, patterns are sent sequentially from start address to the stop address. (Set value is backed-up by battery.)

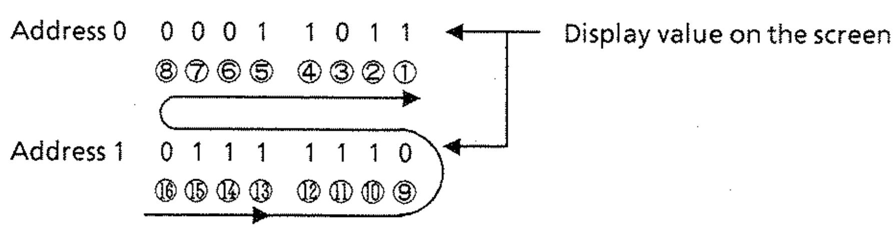
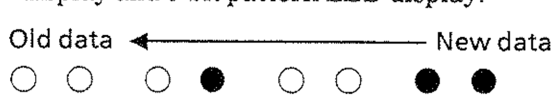


Fig. 6-14 Word Pattern Sending Order

Outputting the idle pattern and word pattern is performed starting from the LSB of the value displayed on the screen. For example, the word pattern is transmitted from the LSB bit of each address in order as shown in Fig. 6-14. (In the order from ① to ⑯.)
Further, the received bit is displayed in the order from D1 bit in the MD6420A 8-bit pattern LED display.
Therefore, on the WORD TRACE screen, the displays have inverted relation between the send-pattern screen display and 8-bit pattern LED display.



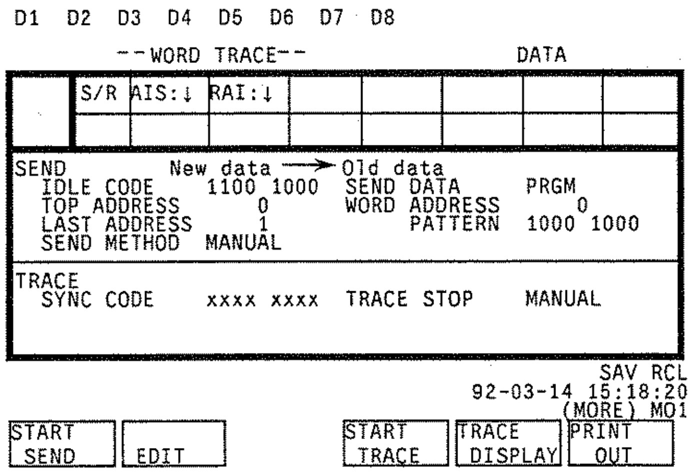


Fig. 6-15 8-Bit Pattern LED and Send-Pattern Set Value on WORD TRACE screen

6.4.2 FOX pattern

ADDRESS	
0	T
1	h
2	E
3	
4	Q

Fig. 6-14 Internal Word Pattern Memory at FOX Pattern Setting

When set to send a FOX pattern, the FOX pattern is stored in the word pattern generation memory. The old pattern in the internal memory is overwritten by the newly-set pattern and is lost.

The FOX patterns are shown below.

(1) EBCDIC, ASCII

ThE Quick BrowN Fox JumpS OveR
ThE LazY DoG 123 456 7890 +-*:=
$%()CRLF

(2) EBCD

THE QUICK BROWN FOX JUMPS OVER
THE LAZY DOG =<; :%' >*()△CRLF

(3) Baudot

THE QUICK BROWN FOX JUMPS OVER
THE LAZY DOG CRLF

6.4.3 Word memory board-save/load

The ROM contents of the MD0610D/D1 can be loaded in an internal memory for the word pattern by using the MD0610D/D1. In addition, the internal memory contents are also loaded in the RAM of the MD0610D/D1.
Eight ROMs or EEPROMs (RAM) can be mounted on the word memory board.
On WORD TRACE screen, ROM contents (of the set number with a switch on the word-memory-board panel within eight ROMs) are loaded in the internal memory.
On EDIT PATTERN DATA screen, ROM number to be saved or loaded within the eight ROMs or EEPROMs (RAM) can be selected.

(1) Loading from the MD0610D/D1

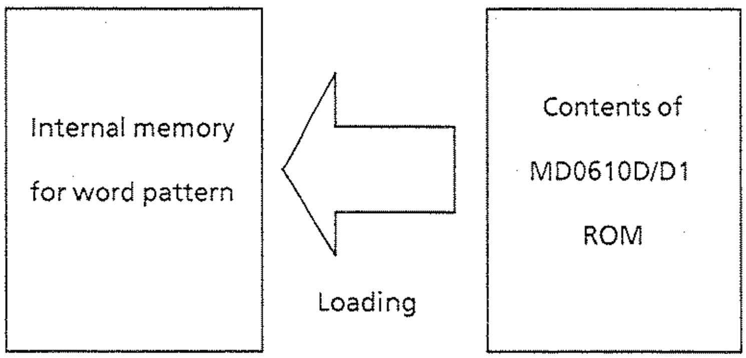


Table 6-1 describes the loading method in accordance with capacities of the main-frame internal memory and the word-memory-unit memory.

Table 6-1 Loading Method in Combination with Main Frame and Word Memory Unit

		Main-Frame internal memory capacity	
		8 k Bytes (Standard)	32 k Bytes (Option:02)
Word Memory Unit	MD0610D for 8 k Bytes	8 k ← 8 k Loaded as it is	32 k Bytes: 8 k, 8 k, 8 k, 8 k ← 8 k The same value loaded in every 8 k Bytes
	MD0610D1 for 32 k Bytes	8 k ← 32 k (8 k) Only 8 k Bytes in top is loaded	32 k ← 32 k Loaded as it is

Loading time is as follows:

8 k Bytes: Approximately 4 seconds

32 k Bytes: Approximately 12 seconds

Table 6-2 Saving Method in Combination with Main Frame and Word Memory Unit

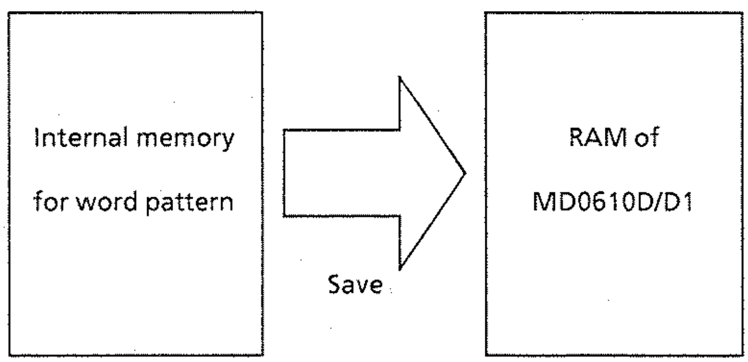
		Main-Frame internal memory capacity	
		8 k Bytes (Standard)	32 k Bytes (Option:02)
Word Memory Unit	MD0610D for 8 k Bytes	8 k → 8 k Saved as it is	32 k → 8 k Last 8 k Bytes 8 k is saved
	MD0610D1 for 32 k Bytes	8 k → 32 k (8 k) 8 k Bytes saved in top	32 k → 32 k Saved as it is

Saving time is as follows:

8 k Bytes: Approximately 6 seconds

32 k Bytes: Approximately 24 seconds

(2) Saving to the MD0610D/D1

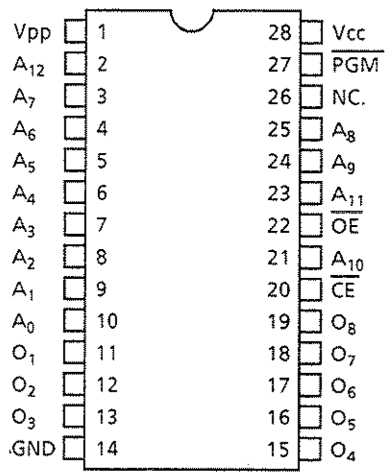


When EEPROM (RAM) is mounted on the MD0610D/D1, the contents of the main-frame internal memory can be saved.
When EEPROM is used, the saved contents are maintained even if the power is turned OFF. (The saved contents can not be maintained when the power is turned OFF at SRAM use.)
Table 6-2 describes the saving method in accordance with capacities of main-frame internal memory and the word-memory-unit memory.

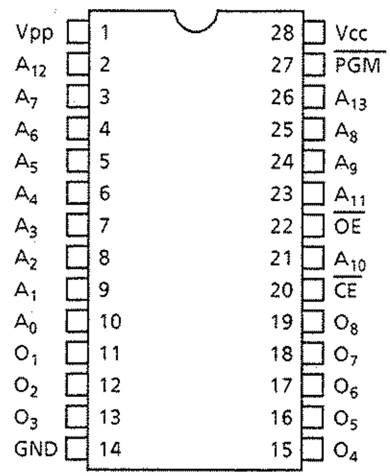
(3) Devices recommended for use

- Use ROMs EEPROMs and RAMs with access times faster than 150ms
- The pin allocations for ROMs, EEPROMs and RAMs are as follows:

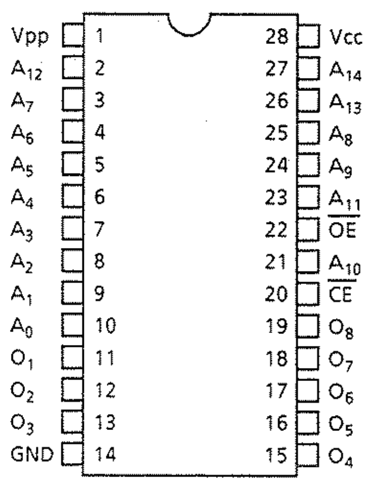
ROM



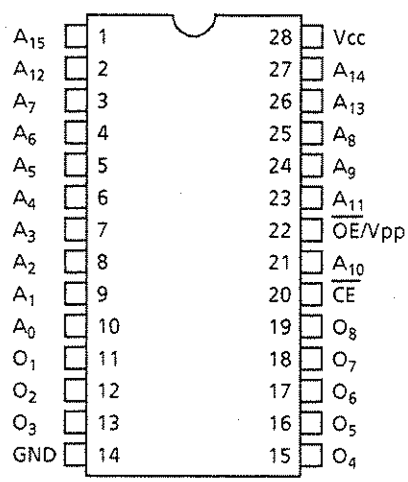
8 k Bytes



16 k Bytes

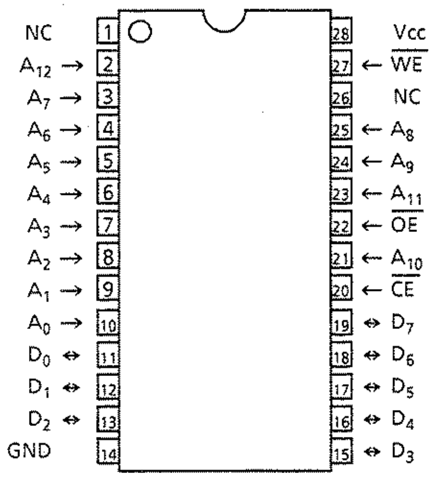


32 k Bytes

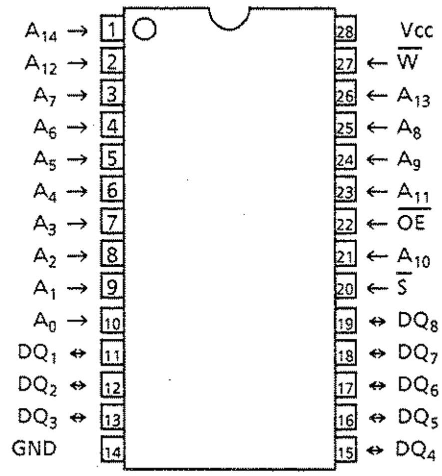


64 k Bytes

EEPROM or SRAM



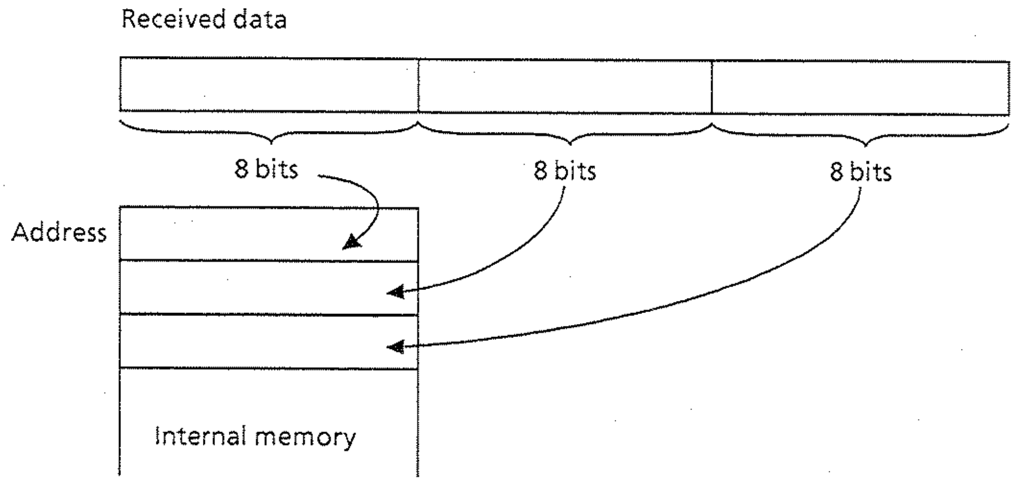
8 k Bytes



32 k Bytes

6.4.4 Bit shifting

Bit shift function of the MD6420A is explained in this paragraph.



For the MD6420A, the received data are stored in an internal memory after dividing them in 8-bit units.

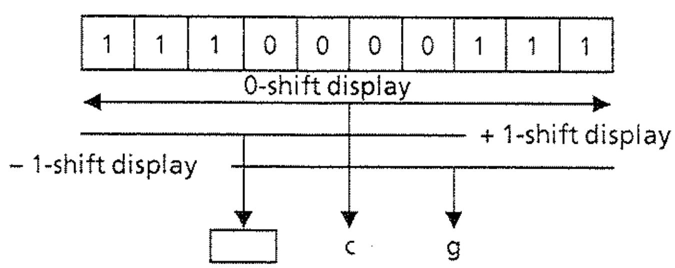
At this time, if the received data has the 8-bit length of start-stop synchronization or time slot of interface with the frame; the detection of 8-bit boundary, namely BYTE SYNC, is possible.

Therefore, the data can be stored in the internal memory in every 8 bits.

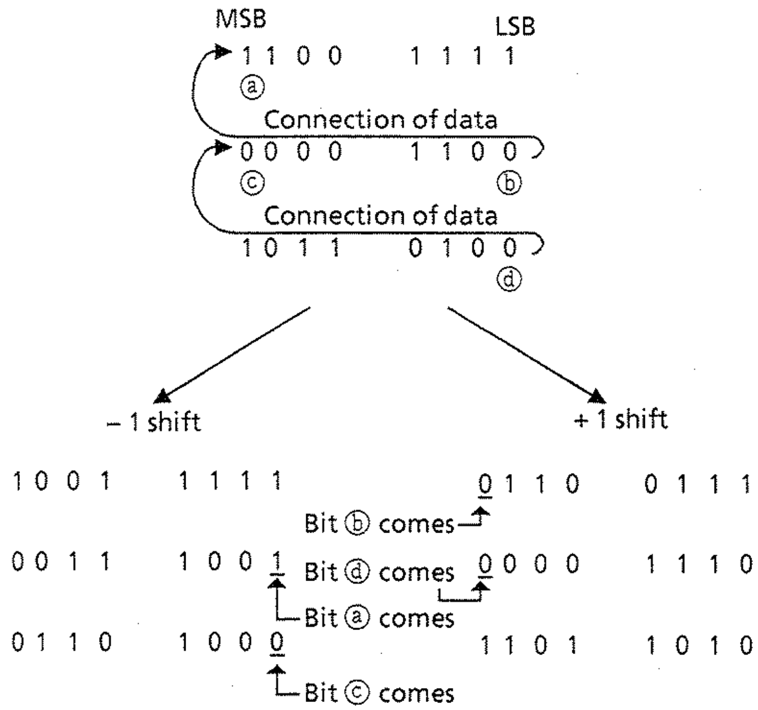
However, a received data (in which Byte SYNC can not be detected) is stored in the internal memory after dividing them with an arbitrary 8 bits by the MD6420A.

At this time, if the traced data are indicated on the display, the display shows generating bit shift.

In case like this, the bit-shift function of the MD6420A can find a correct 8-bit boundary by shifting the 8-bit boundary to be displayed in front and back directions.



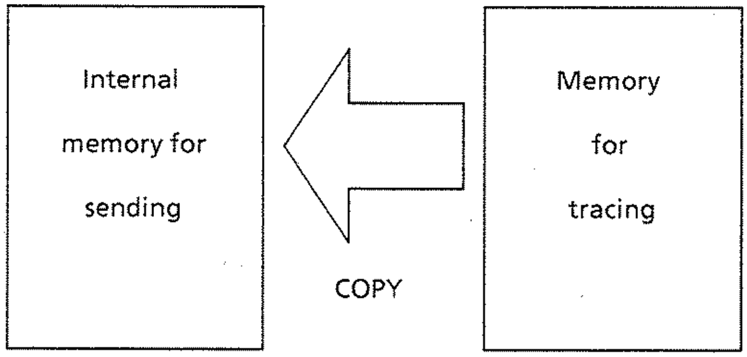
In WORD TRACE screen, new data and old data will be on the MSB side and LSB side, respectively. Therefore, the bit ⓑ has been received after ⓐ as shown below:



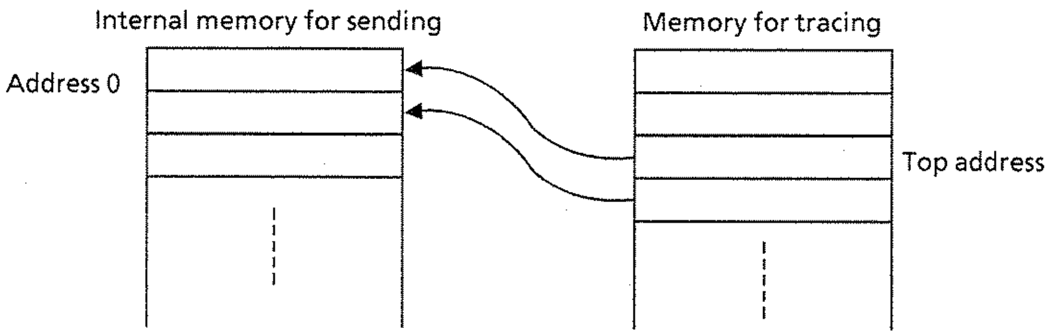
Further, the bit-shift rule on EDIT PATTERN DATA screen for sending is the same.

6.4.5 Trace pattern Copying

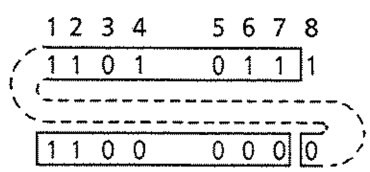
The MD6420A can copy the traced pattern in a send internal memory.



Top address and the bit to be copied are specified for copying.



Data are copied in address 0 of the internal memory for sending from the specified top address in order.

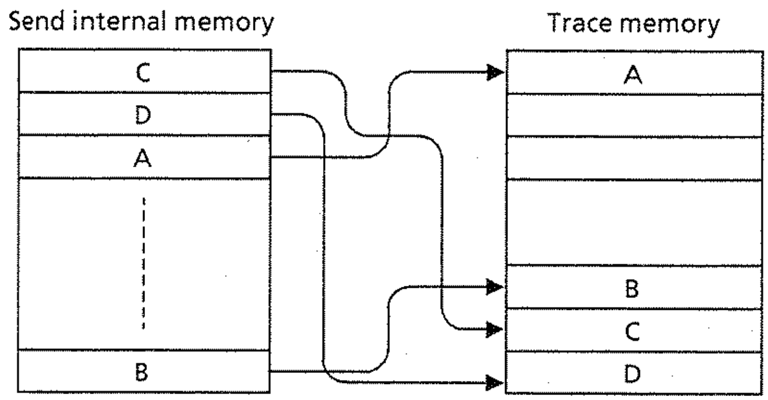


In addition, top bit can be set in the range from 1 to 8. For example, when BIT 7 is specified as shown above, 7 to 1 bits of each address and 8th bit on the next address can be copied as one data.

Further, the trace pattern for copying is the pattern before editing of bit shift, reverse etc.

6.4.6 Comparison of the send pattern with trace pattern

The MD6420A can compare the send internal memory pattern with the traced pattern.



The trace-memory 0-address contents and the set send-internal-memory top-address contents are compared, and then both addresses are incremented to compare both contents.

When the send-internal-memory address has come to the last address, then it returns to the top address for comparison.

SECTION 7
SIMPLE OPERATION CHECK

7.1 General

Since operation cannot be checked with the MD6420A Data Transmission Analyzer alone, when making simple operation checks, insert the interface unit.

This section describes the MD6420A LED, EL, and printer tests. Perform this check every 6 month.

The detailed operation check method is described in the operation manual of each unit.

7.2 Check Procedure

Step	Procedure	Result
1	Turn on the power switch.	The MODE screen is displayed.
2	Press [MORE]. (Press until the function key label (PRINTER TEST) is displayed at F4 and (LAMP TEST) is displayed at F5.)	PRINTER TEST is displayed at F4 and LAMP TEST is displayed at F5.
3	Set the PRINTER switch to ON.	The PRINTER ON LED lights.
4	Press [F4].	The following characters are printed on the printer paper and whether or not printer operation is normal can be checked.

```
 !"#$%&'()*+,-./0123
456789:;<=>?@ABCDEFG
HIJKLMNOPQRSTUVWXYZ[
¥]↑_`abcdefghijk lmno
pqrstuvwxyz{¦}~ αβγδ
εζηθικλμνξοπρστυφχψω
Ω√→←↑÷Σ≈ 。「」、・ヲァィゥェォ
ャュョッーアイウエオカキクケコサシスセソ
タチツテトナニヌネノハヒフヘホマミムメモ
ヤユヨラリルレロワン゛゜上下≤≥
```

5	Press [F5].	The 13 LEDs at the top of the front panel go red → green → off and normal operation can be checked. Also, the REMOTE LED and PANEL LOCK LED go on → off and normal operation can be checked. Whether or not EL display operation is normal can also be checked by returning to MODE screen after the entire screen lights.

SECTION 8
STORAGE AND TRANSPORTATION

8.1 Daily Maintenance

The daily maintenance of the MD6420A is described below:

Item	Measures
Dirty appearance	Wipe it with a neutral detergent, etc.
Dusts	Open the cover, and blow out any dust with compressed air, etc. (Shield your face from dust and loose particles)
Loosening screws	Tighten the screw with a screwdriver.

8.2 Storage

8.2.1 Storing precaution

When storing the MD6420A for a long period of time, observe the following precautions.

1. Remove any dust on the MD6420A prior to storage.
2. Avoid storing it in locations subject to:

   Temperatures of +70℃ or higher
   Temperatures of -25℃ or lower
   Humidities of 75% or more and 20% or less

3. Do not store the MD6420A in dusty places or in places where the MD6420A will be exposed to direct sun light.
4. Do not store the MD6420A in any location where there is a possibility of condensation or rusting.

8.2.2 Recommended storage conditions

When the MD6420A is stored for a long time, it should be stored where:

- Temperature: 5° to 30℃
- Humidity: 40% to 75%
- The variation of temperature and humidity is minimal.

8.3 Transportation

When transporting the MD6420A, observe the following precautions:

1. Package the MD6420A inside a cardboard box and cushion the apparatus with shock-absorbing materials in order to minimize shock and vibration. Before placing the instrument into the box, put it inside of a plastic bag in order to protect against moisture.
2. During transportation, make certain that the environmental conditions described in paragraph 8.2.1 are also met.

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APPENDIX A
ABBREVIATIONS

1.5M BPL	1.544Mb/s Bipolar G. 703 Interface
1 : 1 (m : n)	Repeating pattern of 10 (repeating pattern of m ones (1s) followed by n zeros (0s)
12MFP (G.704)	12 multiframe pattern (G.704)
16MFP 30CHAN	16 multiframe pattern 30 channel
16MFP 31CHAN	16 multiframe pattern 31 channel
2.0M BPL	2.048Mb/s Bipolar G.703 Interface
2 ↑ 6-1 (2 ↑ n-1)	PRBS 2^6-1 bit pattern (2^n-1)
24MFP (G.704)	24 multiframe pattern (G.704)
24MFP (NTT)	24 multiframe pattern (NTT)
2MFP 30CHAN	2 multiframe pattern 30 channel
2MFP 31CHAN	2 multiframe pattern 31 channel
A (0)	All zero pattern
AIS	alarm indicator signal
AIS (sec)	AIS (alarm indicator signal) secondo
AMI	Alternate mark inversion
ASYNC	Asyncronous
ATT	Available time
B	Byte timming
B6ZS	Bipolar with six - zero substitution
B8ZS	Bipolar with eight - zero substitution
BBE	Background bit error
BBER	Background bit error ratio
BEFORE PWR - OFF	Before power off
BLK RTO	Block error ratio
BLK - ERR	Block Error
BLK - LNG	Block Length
BSL	Byte sync loss

BUZ	Buzzer
BV (NTT)	Bipolar violation (NTT)
BYTE SYNC	Byte syncronization
C	Contorol
C - ON	C - line on
CENTRA CLOCK	Centralized clock
CH - ERR	Channel error
CLK - SLIP	Clock slip count
CODIR	Codirectional
COND	Condition
CONTRA - DIR	Contradirectional
CRC	CRC (cyclic redandancy check) code
CYC - ERR	Cyclic error
DCE	Digital Circuit-terminating Equipment
D1 ~ D8	Data 1 ~ 8
DL - BIT	Data link Bit
DM	Degraded Minutes
DSPL	Display
DSPL MODE	Display mode
DTE	Digital Terminal Equipment
EFS	Error free seconds
ELAPS	Elapsed results
ERR RTO	Error ratio
ERR - INS	Error insert
ES	Errored seconds
EXT INPUT	External input
EXT	External
EXT	External clock
EXT INTERFACE	External clock interface
EXT1 8k	External clock 8 kHz

EXT2 64k+8k	External clock 64 kHz + 8 kHz
F-NG	Frame bit no good
FOX	Fox pattern
FREQ	Frequency
FREQE	Frequency
FSL	Frame sync loss
FSL (sec)	Frame sync loss sesconds
H→L (L→H)	High → Low (Low → High)
HDB3	High density bipolar with three zero substitution
I	Indication
I-RVRS	Invert reverse
INT	Internal clock
INT FREQ SOURCE	Internal frequency source
MEAS	Measure / Measurement
MEM1 ~ MEM10	Preset Memory No. 1 ~ No. 10
N-RVRS	Normal reverse
No-sup	No suppress
PERIOD	Periodic resulto
PRBS	Pusedo random bit sequence
PRGM	Program pattern
PRINT-I	Print (interval)
PRINT-P	Print (periodic)
PSL count	PRBS pattern sync loss count
PSL (sec)	PRBS pattern sync loss seconds
PSL CNT	PRBS pattern sync loss count
PSL-THR	PRBS pattern sync loss threshold
PWL (sec)	Power loss seconds

R	Receive
R - clock	Receive clock
RCL	Recall
RCL	Receive clock loss
RD	Receive data
RD 8k	Receive data - 8k
RECV	Receive
RT	Receive timming
S	Signal element timming
SA	Send alarm
SAV	Save
SD	Send data
SES	Severely Errored Seconds
SFP (G.734 - 1)	Short frame pattern (G.734 - 1)
SFP (G.734 - 2)	Short frame pattern (G.734 - 2)
SGL	Signal loss
SGL (sec)	Signal loss seconds
SLIP-SEC	Clock slip seconds
SP BIT	Spare Bit
ST	Send timming
ST / SP	Start / stop
T	Transmit
THROU	Through
TS16 FRAME0. xyxx	Time slot 16 channel frame 0 xyxx pattern
TYPE OF - INT - F	Type of interface
US	Unavailable seconds
XA	X. 50 send alarm
XL	X. 50 frame sync loss
XL (sec)	X. 50 frame sync loss seconds

Z (1)	all '1' pattern
ZERO - 14	14 zero - suppress
ZERO - 7	7 zero - suppress

(Blank)

APPENDIX B
TABLE OF DATA CODES

Table B-1 ASCII

HIGH / LOW	0	1	2	3	4	5	6	7
0	NU	DL	△	0	@	P	`	p
1	SH	D1	!	1	A	Q	a	q
2	SX	D2	"	2	B	R	b	r
3	EX	D3	#	3	C	S	c	s
4	ET	D4	$	4	D	T	d	t
5	EQ	NK	%	5	E	U	e	u
6	AK	SY	&	6	F	V	f	v
7	BL	EB	'	7	G	W	g	w
8	BS	CN	(	8	H	X	h	x
9	HT	EM	)	9	I	Y	i	y
A	LF	CB	*	:	J	Z	j	z
B	VT	EC	+	;	K	[	k	{
C	FF	FS	,	<	L	\	l	¦
D	CR	GS	–	=	M	]	m	}
E	SO	RS	.	>	N	∧	n	~
F	SI	US	/	?	O	_	o	///

CONTROL CHARACTERS

NU NUII Character
SH Start of Header
SX Start of Text
EX End of Text
ET End of Transmission
EQ Enquiry
AK Acknowledge
BL Bell
BS Backspace
HT Horizontal Tab
LF Line Feed
VT Vertical Tab
FF Form Feed
CR Carraige Return
SO Shift Out
SI Shift I n
DL Data Link Escape
D1 Device Control 1
D2 Device Control 2
D3 Device Control 3
D4 Device Control 4
NK Negative Acknowledge
SY Synchronous Idle
EB End Transmission Block
CN Cancel
EM End of Medium
SB Substitute
EC Escape
FS File Separator
GS Group Separator
RS Record Separator
US Unit Separator
/// Delete

Table B-2 EBCDIC

HIGH / LOW	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	NU	DL	DS	3– –0	△	&	-						{	}	\	0
1	SH	D1	SS	3– –1			/		a	j	~		A	J		1
2	SX	D2	FS	SY					b	k	s		B	K	S	2
3	EX	D3	2– –3	3– –3					c	l	t		C	L	T	3
4	PF	RE	BP	PN					d	m	u		D	M	U	4
5	HT	NL	LF	RS					e	n	v		E	N	V	5
6	LC	BS	EB	UC					f	o	w		F	O	W	6
7	///	IL	EC	ET					g	p	x		G	P	X	7
8	0– –8	CN	2– –8	3– –8					h	q	y		H	Q	Y	8
9	0– –9	EM	2– –9	3– –9				`	i	r	z		I	R	Z	9
A	MM	CC	SM	3– –A	¢	!	¦	:								
B	VT	1– –B	2– –B	3– –B	.	$	,	#								
C	FF	IF	2– –C	D4	<	*	%	@								
D	CR	IG	EQ	NK	(	)	_	'								
E	SO	IR	AK	3– –E	+	;	>	=								
F	SI	IU	BL	SB	|	¬	?	"								

CONTROL CHARACTERS

NU	NUII Character
SH	Start of Header
SX	Start of Text
EX	End of Text
PF	Punch off
HT	Horizontal Tab
LC	Lower Case
///	Delete
MM	Start Manual Message
VT	Vertical Tab
FF	Form Feed
CR	Carraiqe Return
SO	Shift Out
SI	Shift I n
DL	Data Link Escape
D1	Device Control 1
D2	Device Control 2
D3	Device Control 3
RE	Restore
NL	New Line
BS	Back Space
IL	Idle
CN	Cancel
EM	End of Medium
CC	Cursor Control
IF	Info Field Sep.
IG	Info. Group Sep.
IR	Info. Record Sep.
US	Info. Unit Sep.
DS	Digit Select
SS	Start of Significance
FS	File Separator
BP	By Pass
LF	Line Feed
EB	End Transmission Block
EC	Escape
SM	Set Made
EQ	Enquire
AK	Acknowledge
BL	Bell
SY	Synchronous Idle
PN	Punch On
RS	Reader Stop
UC	Upper Case
ET	End of Transmission
D4	Device Control 4
NA	Negative Acknowledge
SB	Substitute

Note: Undefined code is displayed with ◆ mark.

Table B-3 EBCDIK

HIGH / LOW	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	$\mathrm{N_U}$	$\mathrm{D_L}$			△	&	-			ｿ					$	0
1	$\mathrm{S_H}$	$\mathrm{D_1}$			｡	ｪ	/		ｱ	ﾀ			A	J		1
2	$\mathrm{S_X}$	$\mathrm{D_2}$			｢	ｫ			ｲ	ﾁ	ﾍ		B	K	S	2
3	$\mathrm{E_X}$	$\mathrm{D_3}$			｣	ｬ			ｳ	ﾂ	ﾎ		C	L	T	3
4	$\mathrm{P_F}$				､	ｭ			ｴ	ﾃ	ﾏ		D	M	U	4
5	$\mathrm{H_T}$	$\mathrm{N_L}$	$\mathrm{I_F}$		･	ｮ			ｵ	ﾄ	ﾐ		E	N	V	5
6	$\mathrm{L_C}$	$\mathrm{B_S}$	$\mathrm{E_B}$		ｦ	ｯ			ｶ	ﾅ	ﾑ		F	O	W	6
7	///		$\mathrm{E_C}$	$\mathrm{E_T}$	ｧ				ｷ	ﾆ	ﾒ		G	P	X	7
8		$\mathrm{C_N}$			ｨ	ｰ			ｸ	ﾇ	ﾓ		H	Q	Y	8
9		$\mathrm{E_M}$			ｩ				ｹ	ﾈ	ﾔ		I	R	Z	9
A					~	!		:	ｺ	ﾉ	ﾕ	ﾚ				
B	$\mathrm{V_T}$				.	¥	,	#				ﾛ				
C	$\mathrm{F_F}$	$\mathrm{F_S}$		$\mathrm{D_4}$	<	*	%	@	ｻ		ﾖ	ﾜ				
D	$\mathrm{C_R}$	$\mathrm{G_S}$	$\mathrm{E_Q}$	$\mathrm{N_K}$	(	)	_	'	ｼ	ﾊ	ﾗ	ﾝ				
E	$\mathrm{S_O}$	$\mathrm{R_S}$	$\mathrm{A_K}$		+	;	>	=	ｽ	ﾋ	ﾘ	ﾞ				
F	$\mathrm{S_I}$	$\mathrm{U_S}$	$\mathrm{B_L}$	$\mathrm{S_B}$	|	¬	?	▮	ｾ	ﾌ	ﾙ	ﾟ				

Note: Undefined code is displayed with ◆ mark.

Table B-4 JIS 8 bit

HIGH / LOW	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	N_U	D_L	△	0	@	P	`	p			△	-	タ	ミ		
1	S_H	D_1	!	1	A	Q	a	q			。	ア	チ	ム		
2	S_X	D_2	▮	2	B	R	b	r			「	イ	ツ	メ		
3	E_X	D_3	#	3	C	S	c	s			」	ウ	テ	モ		
4	E_T	D_4	$	4	D	T	d	t			、	エ	ト	ヤ		
5	E_Q	N_K	%	5	E	U	e	u			・	オ	ナ	ユ		
6	A_K	S_Y	&	6	F	V	f	v			ヲ	カ	ニ	ヨ		
7	B_L	E_B	’	7	G	W	g	w			ァ	キ	ヌ	ラ		
8	B_S	C_N	(	8	H	X	h	x			ィ	ク	ネ	リ		
9	H_T	E_M	)	9	I	Y	i	y			ゥ	ケ	ノ	ル		
A	L_F	S_B	*	:	J	Z	j	z			ェ	コ	ハ	レ		
B	V_T	E_C	+	;	K	[	k	{			ォ	サ	ヒ	ロ		
C	F_F	F_S	,	<	L	\	l	¦			ャ	シ	フ	ワ		
D	C_R	G_S	–	=	M	]	m	}			ュ	ス	ヘ	ン		
E	S_O	R_S	.	>	N	↑	n	~			ョ	セ	ホ	゛		
F	S_I	U_S	/	?	O	←	o	////			ッ	ソ	マ	゜		////

Note: Undefined code is displayed with ◆ mark.

Table B-5 EBCD

HIGH / LOW	LC				UC			
	0	1	2	3	0	1	2	3
0	△	2	1	3	△	<	=	;
1	–	k	j	l	–	K	J	L
2	@	s	/	t	0– –2	S	?	T
3	&	b	a	c	+	B	A	C
4	8	0	9	#	*	)	(	"
5	q	VT	r	$	Q	VT	R	!
6	y	FF	z	,	Y	FF	Z	,
7	h	1– –7	i	.	H	1– –7	I	.
8	4	6	5	7	:	'	%	>
9	m	o	n	p	M	O	N	P
A	u	w	v	x	U	W	V	X
B	d	f	e	g	D	F	E	G
C	0– –C	UC	RS	ET	0– –C	UC	RS	ET
D	0– –D	BS	CR	B– –D	0– –D	BS	CR	3– –D
E	0– –E	EB	LF	EC	0– –E	EB	LF	EC
F	0– –F	LC	HT	///	0– –F	LC	HT	///

Note: Undefined code is displayed with ◆ mark.

Table B-6 Baudot

HIGH / LOW	SHIFT IN		SHIFT OUT	
	0	1	0	1
0	B_K	T	B_K	5
1	E	Z	3	▮
2	L_F	L	L_F	)
3	A	W	–	2
4	△	H	△	#
5	S	Y	B_L	6
6	I	P	8	0
7	U	Q	7	1
8	C_R	O	C_R	9
9	D	B	$	?
A	R	G	4	&
B	J	F_G	'	F_G
C	N	M	,	.
D	F	X	!	/
E	C	V	:	;
F	K	L_T	(	L_T

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