MD0621A
V.24/V.28 (RS-232C)
Interface Unit
Operation Manual

Fourth Edition

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

JUN.
2004

ANRITSU CORPORATION

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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. 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.

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

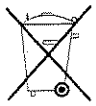
The following safety symbols are used inside or on the equipment near operation locations to provide information about safety items and operation precautions. Insure that you clearly understand the meanings of the symbols and take the necessary precautions BEFORE using the equipment.

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.

MD0621A V.24/V28 (RS-232) Interface Unit
Operation Manual

November 1990 (First Edition)
March 2003 (Fourth Edition)

For Safety

Repair

WARNING ⚠

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. 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.

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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.

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TABLE OF CONTENTS

SECTION 1
GENERAL

1.1 Introduction

This manual describes handling and operation of the MD0621A V.24/V.28 (RS-232C) Interface Unit (hereinafter referred to as the V.24/V.28 Unit), an MD6420A Data Transmission Analyzer interface unit.

It covers the parts that are unique to the V.24/V.28 Unit and the various measurements that can be made by inserting it into a slot in the rear of the MD6420A. When measurements are in progress, refer to the MD6420A Data Transmission Analyzer operation manual.

This manual consists of the following Sections:

SECTION 1 General

SECTION 2 Operation

SECTION 3 Application

SECTION 4 Simple Operation Checks

SECTION 5 Remote Control

SECTION 6 Principles of Operation

It also contains the following appendixes:

Appendix A EL-Display Menu Reference

Appendix B Remote-Control Commands Reference

Appendix C Remote-Control Response Data Reference

1.2 Features

The MD0621A V.24/V.28 Unit is an interface unit that is inserted into a slot on the rear of the MD6420A Data Transmission Analyzer.

It is used to make a variety of measurements on V.24/V.28 interfaces to ensure conformity with CCITT V.24/V.28.

(1) Measurement functions

- When inserted into the MD6420A:

  Error measurements

  Voltage measurements

  Frequency measurements

  Line interval measurements

  Transmission delay time measurements

  Pattern data sending and word trace

- When added with an extension unit:

  Function for long-term error-measurement-data collection and analysis (error analysis unit: MD0633A)

  Measurement of digital levels (ANALOG unit: MD0627A)

  Measurement of distortion (Distortion unit: MD0630A)

(2) Features

- Function testing and transmission quality evaluation of V.24/V.28 (RS-232C) interface modem and terminal devices
- Measurement of transmission and reception in start-stop and asynchronous timing modes
- Detection of bit and parity errors in error-measurement

1.3 Composition

(1) Standard composition

The standard composition of the MD0621A is shown in Table 1-1.

Table 1-1 Standard Composition

No.	Item	Name	Qty.	Remarks
1	Unit	MD0621A V.24/V.28 (RS-232C) Interface Unit	1	Inserted into the MD6420A
2	Supplied accessories	Operation manual	1	

(2) Optional accessories

The optional accessories (sold separately) are listed in Table 1-2.

Table 1-2 Optional Accessories

Order No.	Name	Remarks
J0387	Double-ended 25-pin connector cable	2 m
J0388	25-pin DCE-DTE conversion connector	Used for DTE connection

1.4 Specifications

1.4.1 Operating conditions

- Operating temperature : 0° to 40℃
  - * Check to be sure that condensation has not occurred on the EL display
- Storage temperature : −25° to 70℃
- Operating humidity : 20% to 90%
- Storage humidity : 20% to 90%

1.4.2 Send clock

(1) Internal clock (Synchronous-ST1, Asynchronous-ASYNC, Start/Stop-ST/SP)

Data signal speed : • 50 kb/s to 20 kb/s (5 b/s step VARIABLE)

Accuracy : • Self oscillation : ±5ppm

• Slave oscillation : External input 8 bit/s, or 64 k + 8 kbit/s

(2) External clock (Synchronous-ST2, RT, External oscillator)

Data signal speed • 50 b/s to 20 kb/s

1.4.3 Receive clock

(1) Internal clock (Asynchronous-ASYNC, Start/Stop-ST/SP)

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

Accuracy • ≦ ±20 ppm

(2) External clock (Synchronous-RT)

- 50 b/s to 20 kb/s

1.4.4 Send pattern

(1) Controlling the send pattern with the CS (Clear to Send) signal

- The desired pattern can only be output when CS is ON.

(2) CONT LINE send

- ER, RS, NS can be set to ON/OFF/OPEN

The other send pattern functions conform to the specifications for the MD6420A main frame.

1.4.5 Error insertion

(1) Type of errors:

- Bit

The other error insertion functions conform to the specifications for the MD6420A main frame.

1.4.6 START/STOP Synchronization

- START/STOP bit length : START bit : 1 bit
  STOP bit : 1, 1.5, 2 bit
- Data length : 5, 6, 7, 8 bit
- Parity : NONE, ODD (odd parity)
  EVEN (even parity)

  * Note that a parity bit of 1 may indicate either ODD or EVEN parity.

1.4.7 Error measurement

(1) Detection error

- Bit error, parity error

(2) Alarm counting and time measurement

- Measurement of number and time at which pattern sync-loss errors occur
- Clock-slip counting
- Measurement of time of power failure
- Measurement of time of pattern sync-loss (second)

The other error measurement functions conform to the specifications for the MD6420A main frame.

1.4.8 Pattern trace function

The pattern trace functions conform to the specifications for the MD6420A main frame.

1.4.9 DC voltage measurement

- Measurement signal

  The DC voltage of the SD, RD, ST1, ST2, RT, ER, DR, RS, CS, CD, CI, TI, NS and can be measured.

The other DC voltage measurement functions conform to the specifications for the MD6420A main frame.

1.4.10 Frequency measurement and count

- Measurement signal

  The frequency of the SD, RD, ST1, ST2, RT, ER, DR, RS, CS, CD, CI, TI, NS and external input signal can be measured.

The other frequency measurement and count functions conform to the specifications for the MD6420A main frame.

1.4.11 Time measurement

- Measurement signal

  Transition times between SD, RD, ST1, ST2, RT, ER, DR, RS, CS, CD, CI, TI, NS, and external input signals can be measured.

1.4.12 Signal line monitoring

- Measurement signal

  The status of SD, RD, ST1, ST2, RT, ER, DR, RS, CS, CD, CI, TI, and NS can be monitored.

  Receive data can be monitored in 8 bit units

- Lighting conditions

Data	1	:	Green
	0	:	Off
Timing	ON	:	Green
	OFF	:	Off
Control line	ON	:	Green
	OFF	:	Off

- Monitor output

  The voltages of the SD, RD, ST1, ST2, RT, ER, DR, RS, CS, CD, CI, TI and NS can also be monitored via the monitor terminals

1.4.13 Dimensions, weight and power consumption

Dimensions : • 145H × 30W × 230 Dmm

Weight : • < 0.6kg

Power consumption : • < 12 VA

1.5 Ordering Information

Model	Name	Remarks
MD0621A	V.24 (RS-232C) Interface Unit	
	– Standard supplied accessory – MD0621A operation manual	
	– Optional accessories –	
J0387	Cable with 25P connectors at both ends 2 m	
J0388	25 P DCE-DTE converting connector	Used for DTE mode

SECTION 2
OPERATION

2.1 Precautions before Use

This unit has been thoroughly tested and inspected at the factory. On delivery, inspect the box for damage before opening it.

After opening the box, inspect the unit and verify the type and number of accessories.

If the unit has been damaged during shipment, please contact Anritsu.

- Operating environment

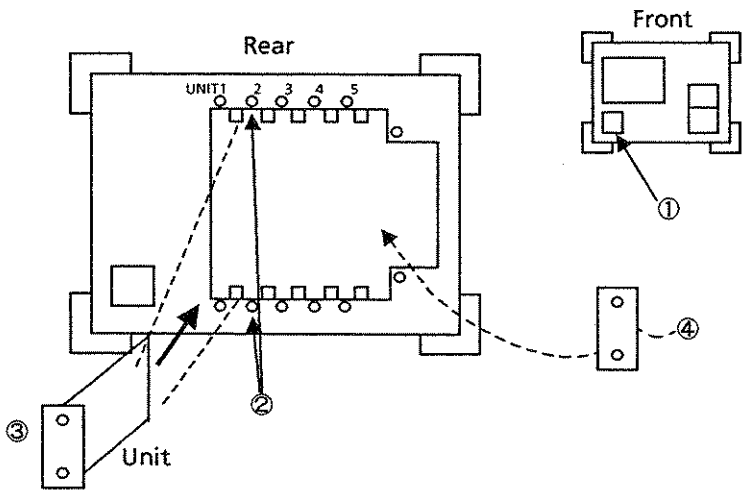
The MD0621A is used by inserting it into a slot on the rear of the MD6420A. It operates normally at an ambient temperature of 0° to 40℃. However, do not use it where:

1. Vibration is severe.
2. It is damp.
3. It is dusty.
4. There is exposure to direct sunlight.

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

- This unit is designed to be used only with the MD6420A Data Transmission Analyzer. Never use it with other equipment since it may be damaged.
- Although the shape of this unit is compatible with the rear panel slots of the MD6401A Data Transmission Analyzer, it cannot be used with the MD6401A.

2.2 Inserting and Removing Unit



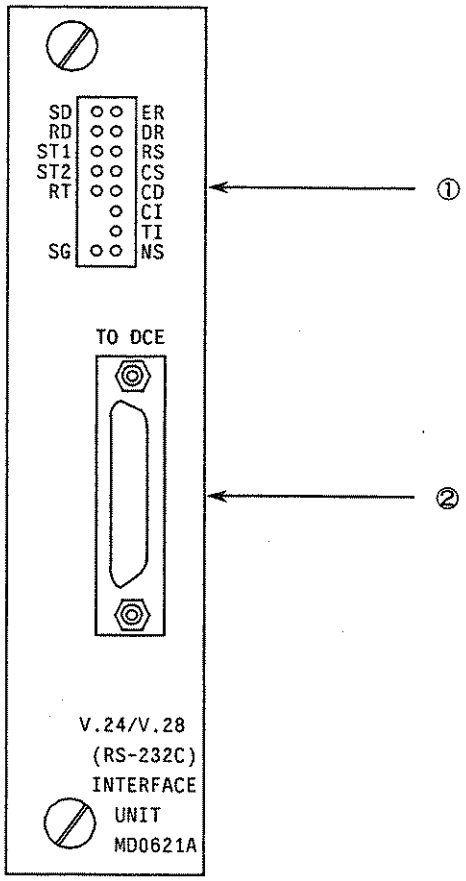
① Before inserting or removing this unit, turn the front-panel POWER switch OFF.

② This unit can be inserted into any position, from UNIT1 to UNIT5.

③ To insert the unit, align the edges of the unit PC board along the top and bottom guide rails and push it in UNIT1 it is firmly seated, then tighten the screws at the top and bottom. If the unit is not inserted and fastened properly, it may not operate correctly.

④ Cover empty slots with blank panels.

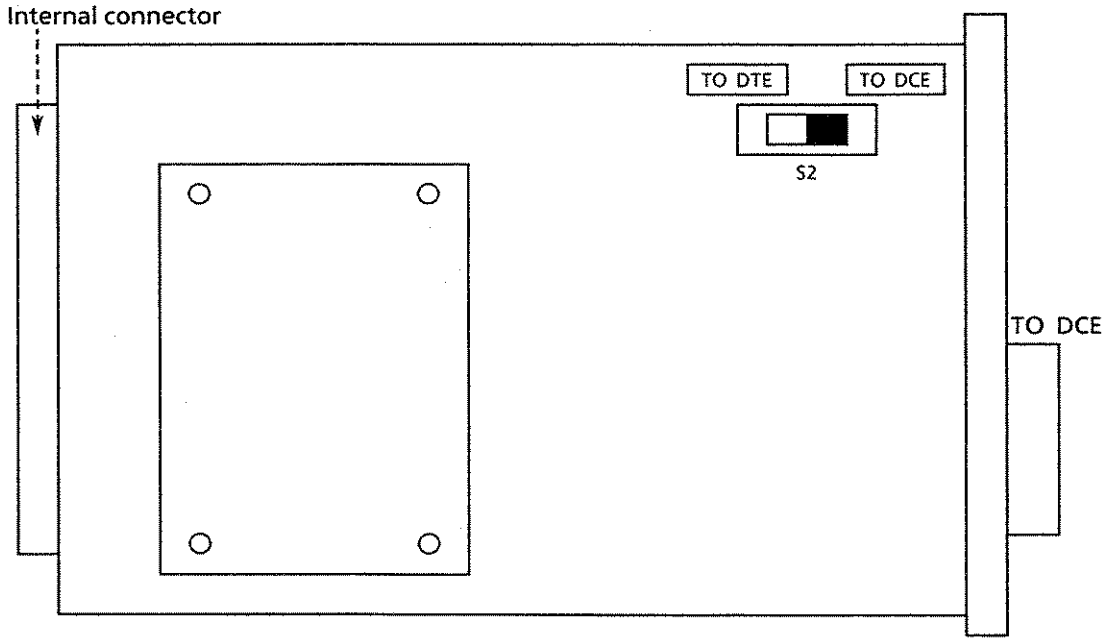
2.3 Description of Unit Panel



No.	Name	Explanation
①	SD, RD, ST1, ST2, RT, ER, DR, RS, CS, CD, CI, TI, NS SG	Check terminal. Send data can be monitored via the check terminals. Signal G.
②	TO DCE	25-pin connector when using the MD6420A as a dummy terminal to connect it to the DCE. When using the MD6420A as a dummy circuit to connect to a DTE device, connect the 25-pin DCE-DTE conversion connector to the MD6420A before connecting it to the DTE connector.

2.4 Setting the Internal Switch

The internal switch and the internal terminal are located as shown below:



Internal Switch Mounting

DTE/DCE Change-Over Switch

S2 is a toggle switch for selecting either the DTE or DCE port for measurement. S2 is set to the DCE port position at shipment.

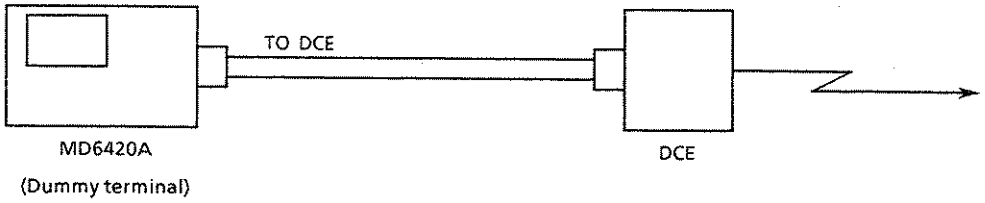
TO DCE ..... For measurements of the DCE port

TO DTE ..... For measurements of the DTE port (Required DTE-DCE conversion connector. Refer to table 1-2.)

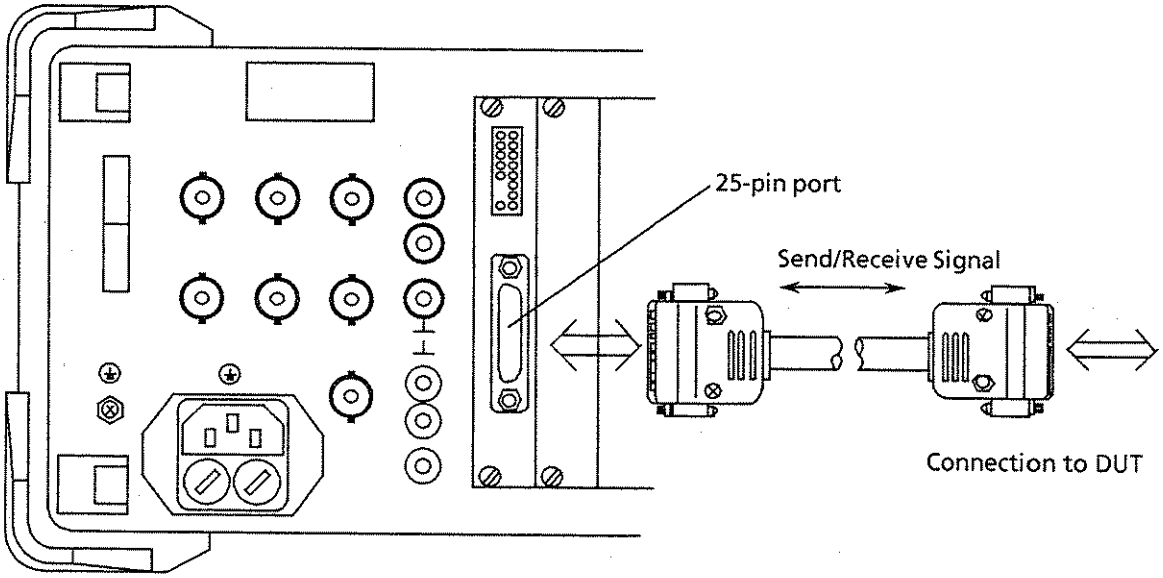
2.5 Connecting to the Device Under Test (DUT)

2.5.1 Connecting to the DCE

When the MD6420A is used as a dummy terminal, the 25-pin TO DCE port on the V.24/V.28 Unit panel is connected to the DCE line.

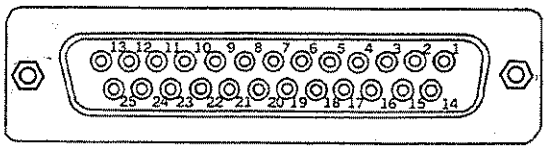


Connect as shown below:



- As described in paragraph 2.4, set S2 to the "TO DCE" side and fasten the "TO DCE" connector to the cable connector with the top and bottom screws
- In this configuration, this unit can simultaneously send and receive.
- The send signal can be synchronized to oscillate with either the internal clock or the 8 kHz receive signal.

The table on the next page shows the signals input to and output by the 25-pin TO DCE port of this unit.



V.24 TO DCE Port 25-Pin Connections

Pin No.	Circuit No. (CCITT)	Circuit name (MD0621A)	Circuit name (RS-232C)	Direction MD6420A DCE	Explanation
1	101	FG	AA		Protective ground
2	103	SD	BA	→	Send data
3	104	RD	BB	←	Receive data
4	105	RS	CA	→	Send request
5	106	CS	CS	←	Send enabled
6	107	DR	CC	←	Data set ready
7	102	SG	AB		Signal ground
8	109	CD	CF	←	Carrier for data channel detected
9	(N)				
10	(N)				
11	126 (N)	NS		→	Send frequency selected
12	122 (N)				
13	121 (I)				
14	118 (I)				
15	114 (I)	ST2	DB	←	Send timing (DCE)
16	119 (I)				
17	115 (I)	RT	DD	←	Receive timing (DCE)
18	141 (N)				
19	120 (I)				
20	108 1/2	ER	CD	→	Data terminal ready
21	140 (N)				
22	125	CI	CE	←	Requested result
23	111 (N)				
24	113 (N)	ST1	DA	→	Send timing (DTE)
25	142	TI		←	Test display

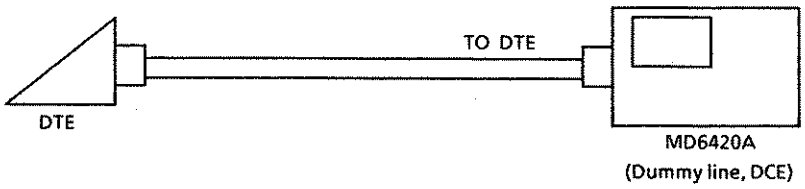
(I) Pin used in international communications protocols

(II) Pin used in domestic (i.e. Japanese) communications protocols

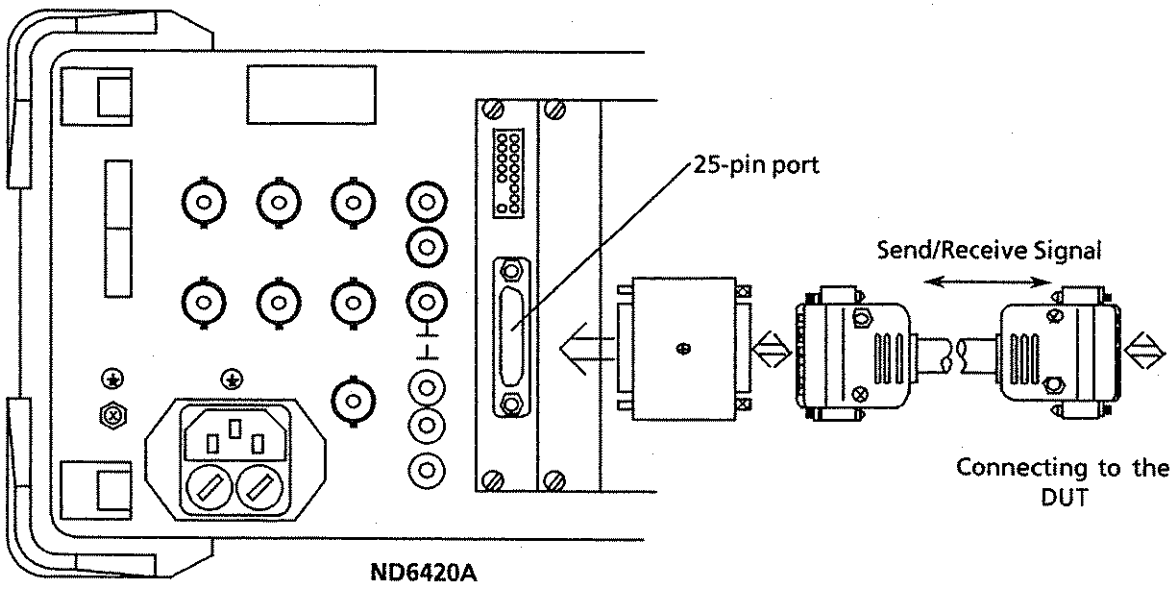
Note: The equivalent of an SN75188N and SN75189N are used as the driver and receiver, respectively.

2.5.2 Connecting to the DTE

When the MD6420A is used as a dummy line (DCE) , the 25-pin TO DTE port on the V.24/V.28 Unit panel is connected to a terminal.



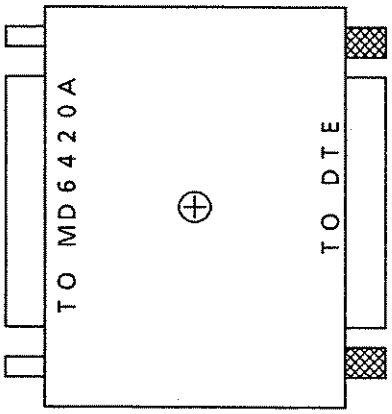
Connect as shown below.

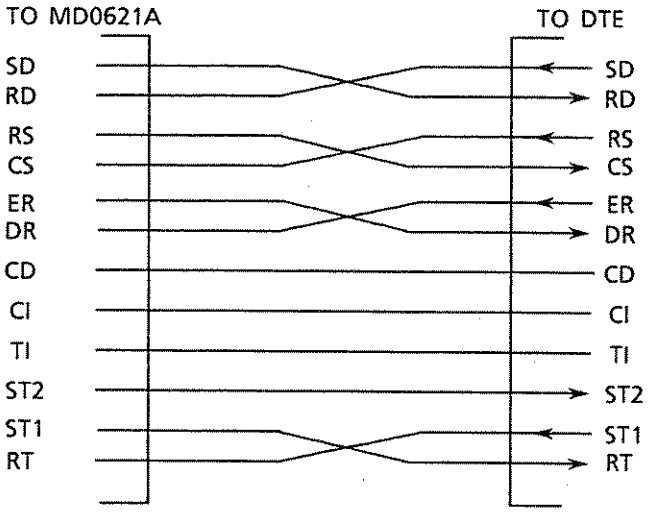


- As described in paragraph 2.4, set S2 to the "TO DTE" port position and fasten the "TO DCE" connector to the conversion connector with the top and bottom screws before connecting it to the cable connector.
- In this configuration, this unit can perform both sending and receiving.
- The send signal can be synchronized to oscillate with either the internal clock or the 8 kHz receive signal.

When the DCE-DTE conversion connector is connected to the TO DCE connector of the unit, the 25-pin connector is connected as follows:

- Connections for the conversion connector are shown below:





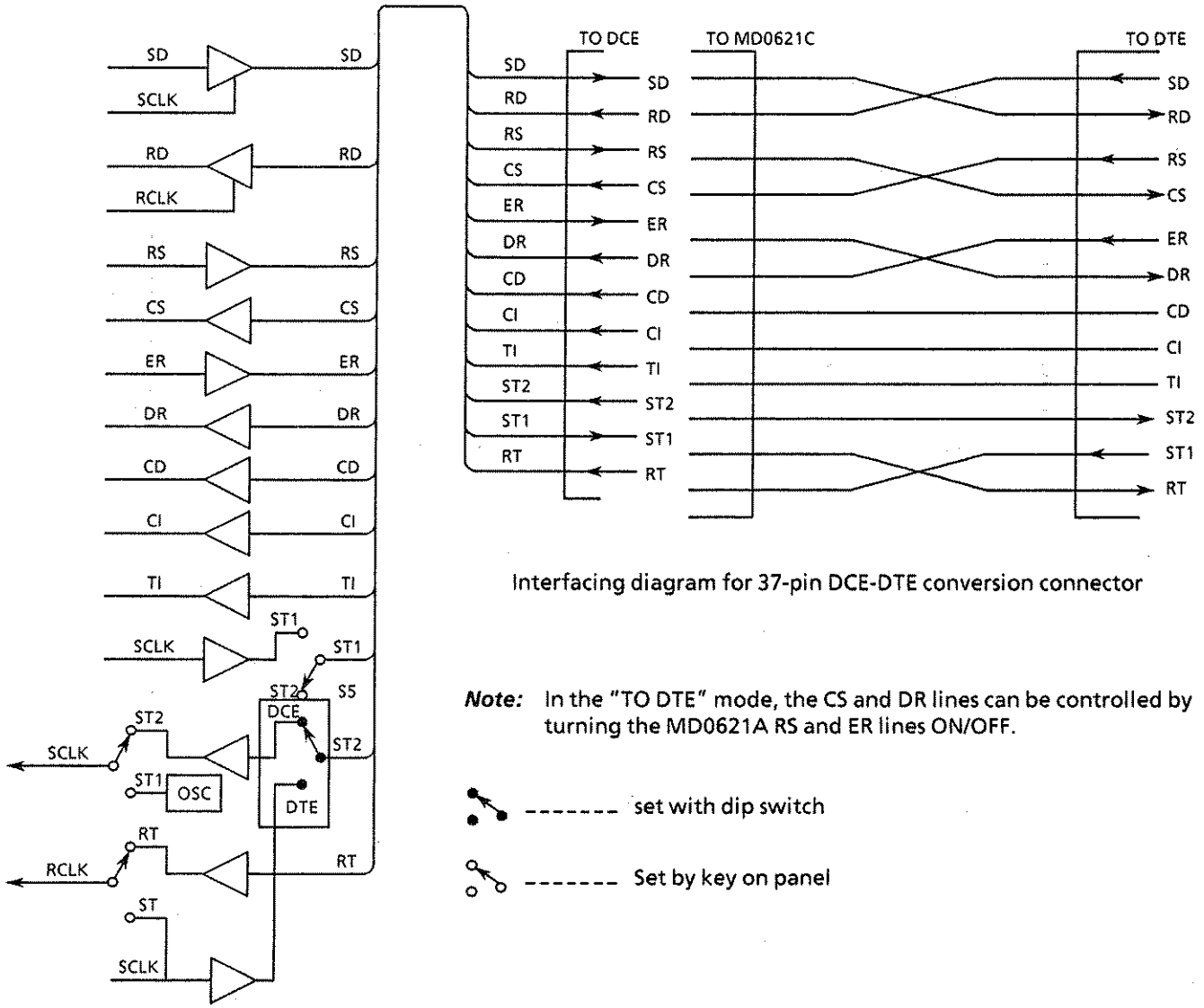
Interfacing Diagram for 25-pin DCE-DTE Conversion Connector

MD0621A DCE/DTE connection

The MD0621A DCE/DTE is connected.

The following signal conventions apply to the MD0621A send interface in the DTE send mode:

Port connection	DTE send mode	Send timing signal	Receive timing signal
TO DCE	ST1	ST1	RT
	ST2	ST2	RT
TO DTE	ST1	ST1	RT
	ST2	ST1	ST



Interfacing diagram for 37-pin DCE-DTE conversion connector

Note: In the "TO DTE" mode, the CS and DR lines can be controlled by turning the MD0621A RS and ER lines ON/OFF.

------- set with dip switch

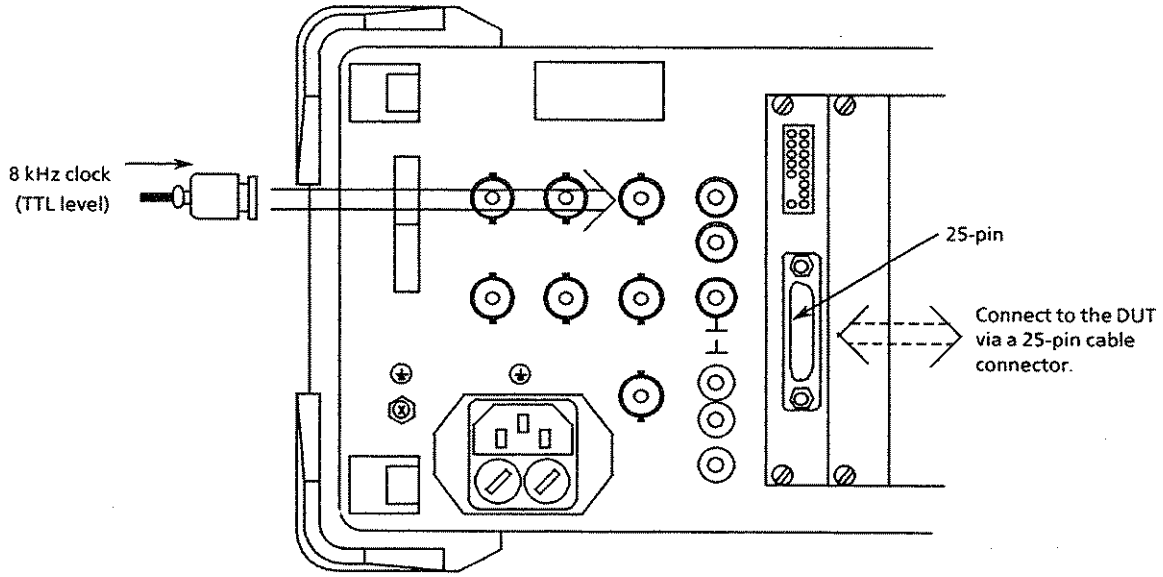
------- Set by key on panel

Fig. 2-1 MD0621A DCE/DTE Connection

2.6 Using an External Clock Source for the Send-Signal

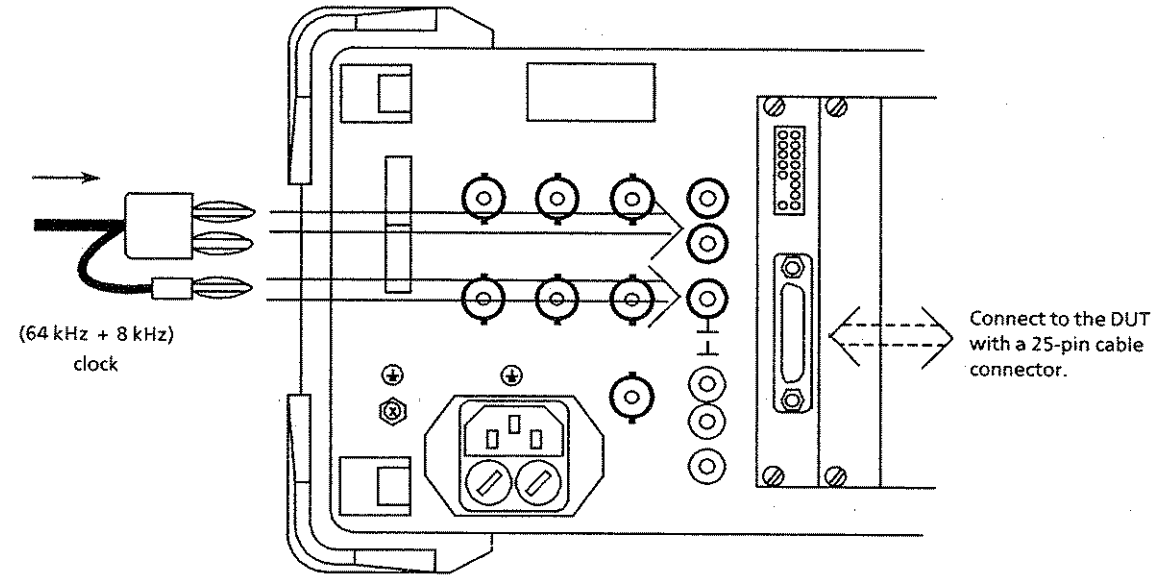
An External clock can be used instead of the MD6420A internal clock source as the send clock source.

1. Slave synchronization to an external 8 kHz clock (The specified-bit-rate is generated by an internal clock source.)



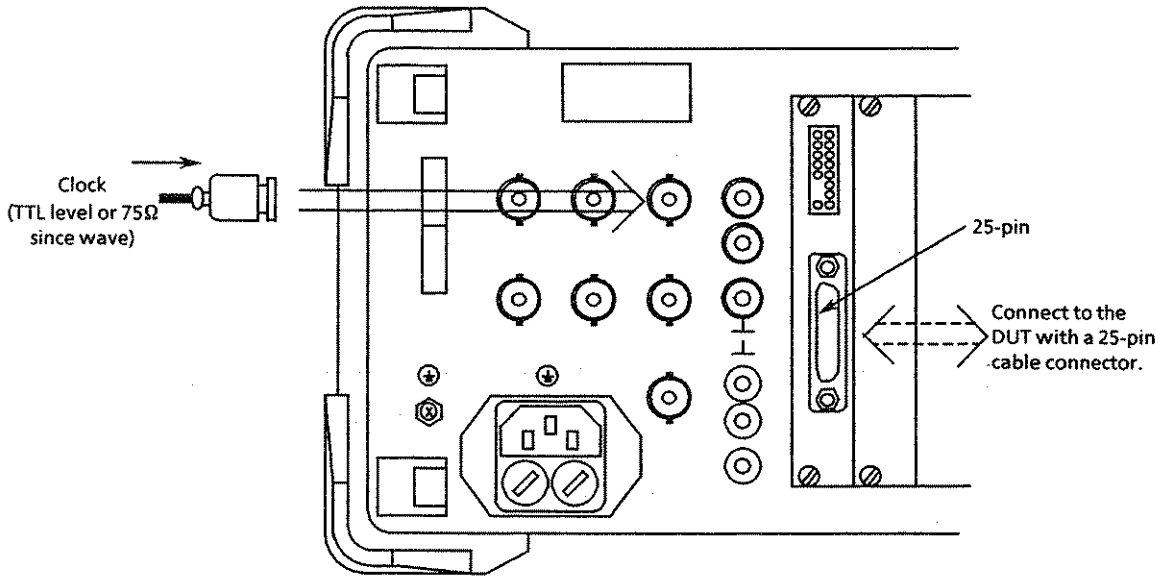
- Connect the 8 kHz signal source to the rear-panel EXT1 connector via a coaxial cable.

2. Slave synchronization to an external (64 kHz + 8 kHz) clock source. (The specified-bit-rate is generated by an internal clock source.)



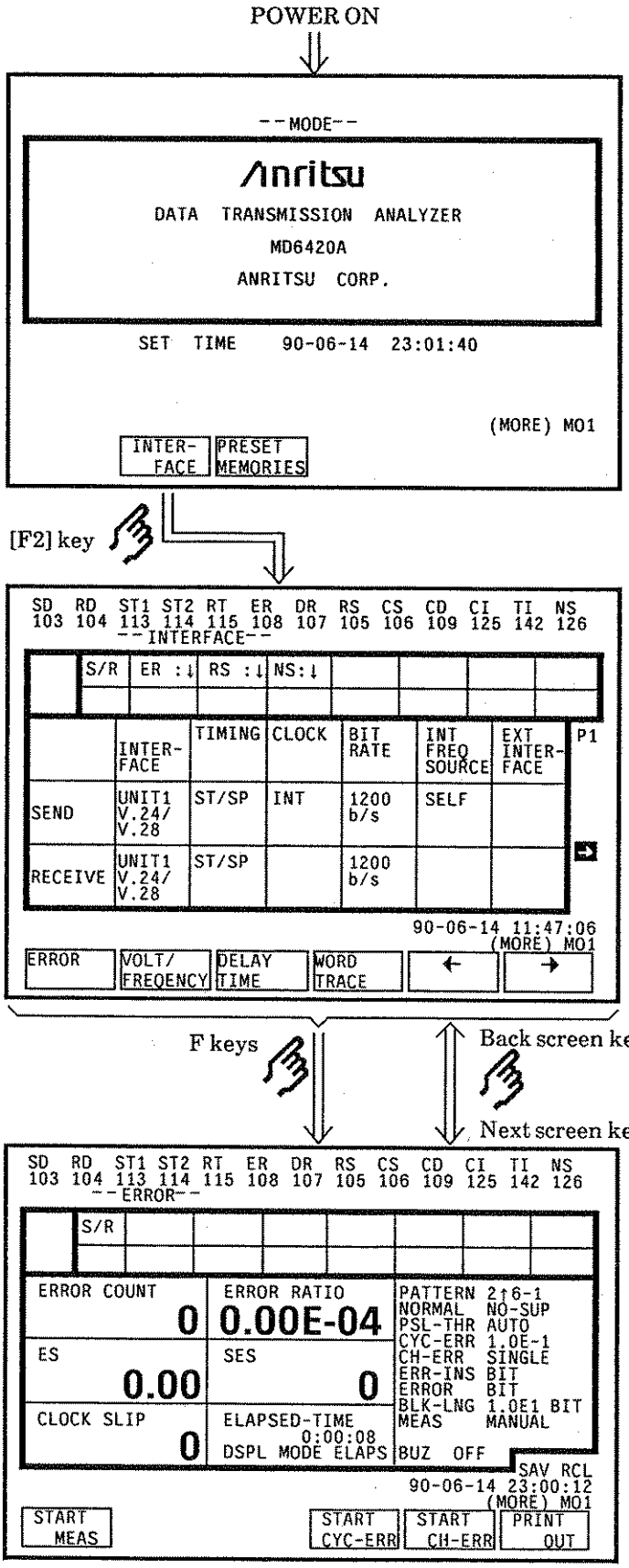
- Connect the 64 kHz + 8 kHz signal source to the rear-panel EXT 2 connector via a coaxial cable.

3. External clock source for send signal



2.7 Outline of Measurement Operation

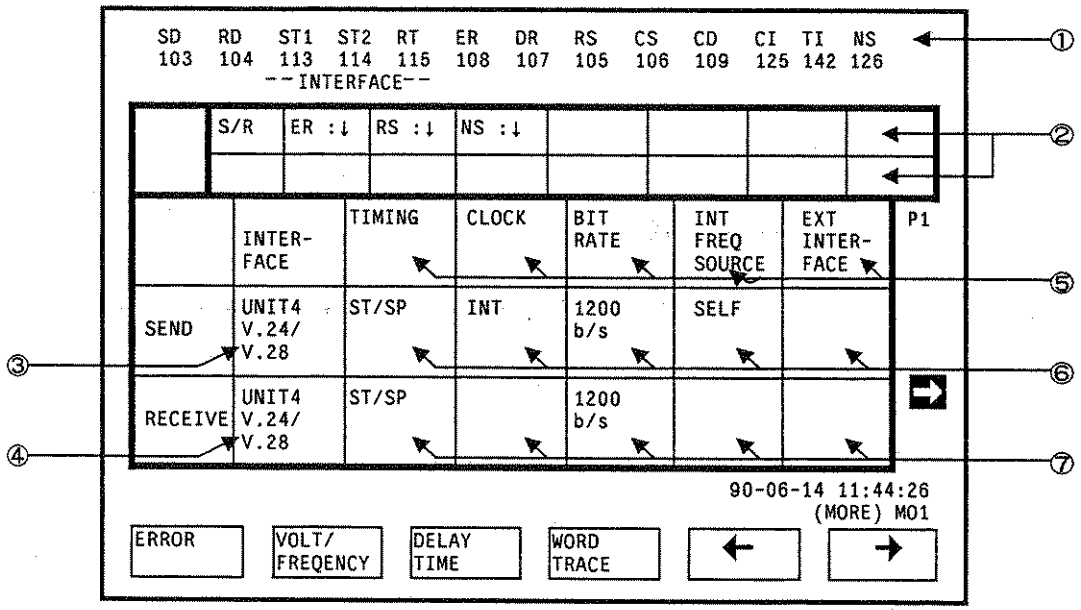
Before beginning measurements, first set the send and receive interface conditions for the DUT via the INTERFACE screen. Then set the appropriate measurement conditions on the measurement screens and initiate measurement.



- Press [F2] to display the INTERFACE screen.
- Using the CURSOR, MODIFY, and F (soft) keys, set the send and receive interface conditions for the DUT.
- After the cursor goes off, press the appropriate F key to display the desired measurement screen.
- The V.24/V.28 Unit can be used as either the send or receive interface unit 9 or as both.
- Using the CURSOR, MODIFY, and F (soft) keys to set the send signal conditions, measurement conditions, etc.
- After the cursor goes off, select measurement start/stop, etc.
- For an operational description of the ERROR and other measurement screens, refer to the MD6420A operation manual.

2.8 INTERFACE Screen Composition

The composition of the INTERFACE screen is shown below:

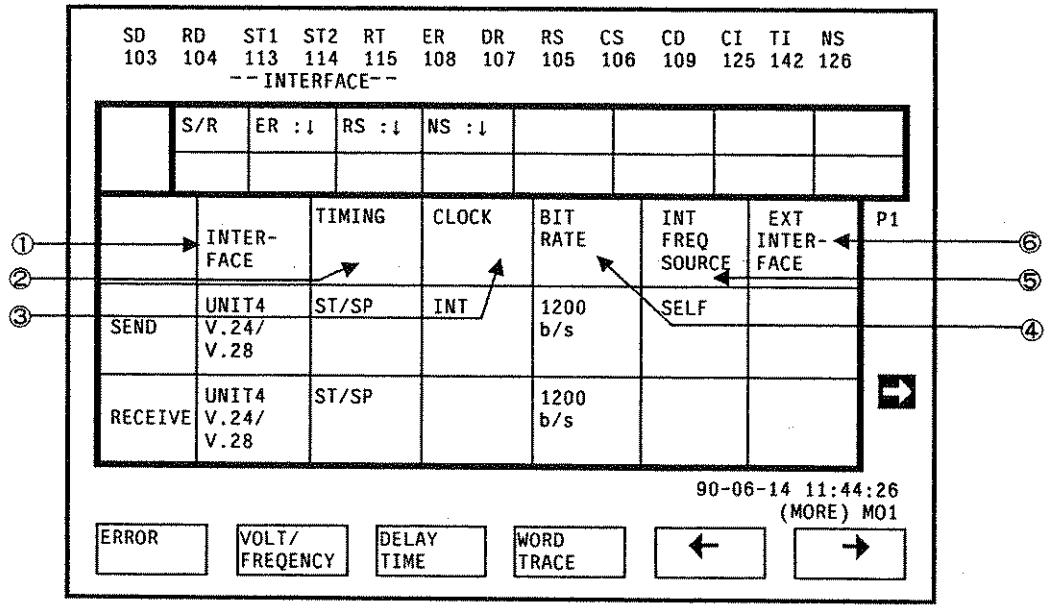


NO	Label	Item	Explanation	Setting	
①		Name of signal being monitored by LED	Displays names and connection circuit numbers corresponding to signal lines and alarm signals being monitored by LEDs.	×	
②	S/R , SND , RCV	Signal line and alarm signal setting	Displays signal line and the alarm signal setting	○	
③	SEND INTERFACE	Send interface unit setting	Displays number and name of unit selected as send interface	○	
④	RECEIVE INTERFACE	Receive interface unit setting	Displays number and name of unit selected as receive interface	○	
⑤		Interface setting item name	Displays send/receive interface setting item names The settings depend on the selected unit.	×	
⑥		Send interface settings	The send interface setting depend on the type of send interface being used.	○	
⑦		Receive interface settings	The receive interface settings depend on the type of receive interface being used	○	

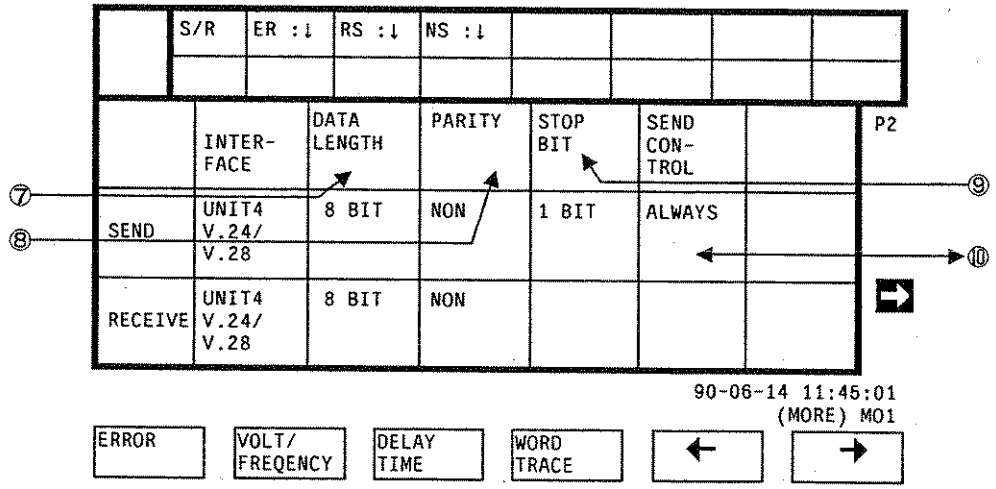
2.9 V.24/V.28 Unit Interface Conditions

The V.24/V.28 Unit interface conditions can be set on the INTERFACE screen as shown below:

(1) Page 1



(2) Page 2



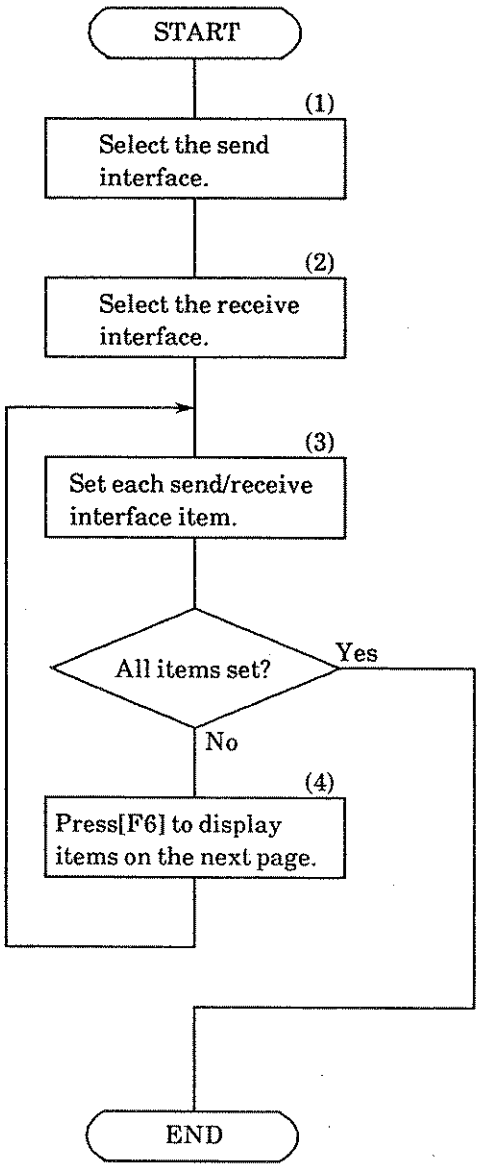
Note: These display examples assume that both the send and receive sides of the V.24/V.28 Unit are being used. The display location of each item and the number of pages differ with the type of interface unit.

No.	Label	Name	Send	Receive	Explanation
①	INTER-FACE	Interface unit	○	○	Send/receive interface unit No. and name
②	TIMING	Send/receive signal timing	○	○	Send and receive signal timing.
③	CLOCK	Type of send clock signal	○		Send clock signal source
④	BIT RATE	Bit rate	○	○	Clock bit rate when TIMING is ASYNC, ST/SP or ST1
⑤	INT FREQ SOURCE	Type of internal-clock slave signal for send signal	○		Type of slave clock signal when CLOCK ③ is set to INT
⑥	EXT INTER-FACE	Type of external-clock input interface for send signal	○		Type of external-clock input interface when CLOCK ③ is set to EXT
⑦	DATA LENGTH	Data length	○	○	Data length (number of bits/datum) when TIMING ② is ST/SP
⑧	PARITY	Parity	○	○	Parity when TIMING ② is ST/SP
⑨	STOP BIT	Type of stop-bit	○		Type of stop-bit when TIMING ② is ST/SP
⑩	SEND CON-TROL	Type of send-signal control	○		

- Subsequent items are set in accordance with the previously-set items.
- The cursor skips over the display areas of items that cannot be set.

2.10 Setting Interface Conditions

1. Basic setting procedure



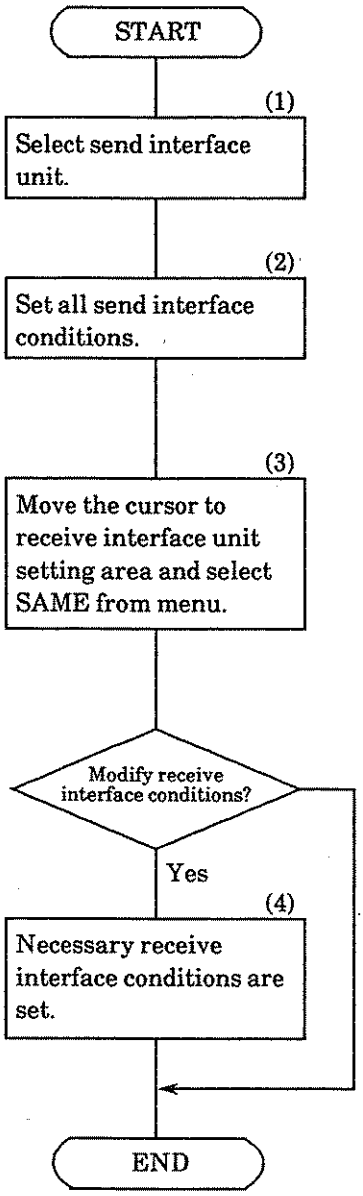
(1) When the CURSOR key is pressed once in the cursor-off state, the cursor is displayed in the send interface setting area. Select the unit corresponding to the required send interface from the menu via the F (soft) keys.

(2) When the CURSOR key is pressed once while in state (1) above, the cursor is displayed in the receive interface setting area. Select the receive interface unit with the F (soft) keys, as described above.

(3) Operate the CURSOR, MODIFY, and F (soft) keys to set or modify each interface item currently being displayed.

(4) Press the displayed above [F6] on the menu display. If it is not displayed, press[CURSOR OFF] followed by [F6].

2. Simple setting procedure when using the same send/receive conditions



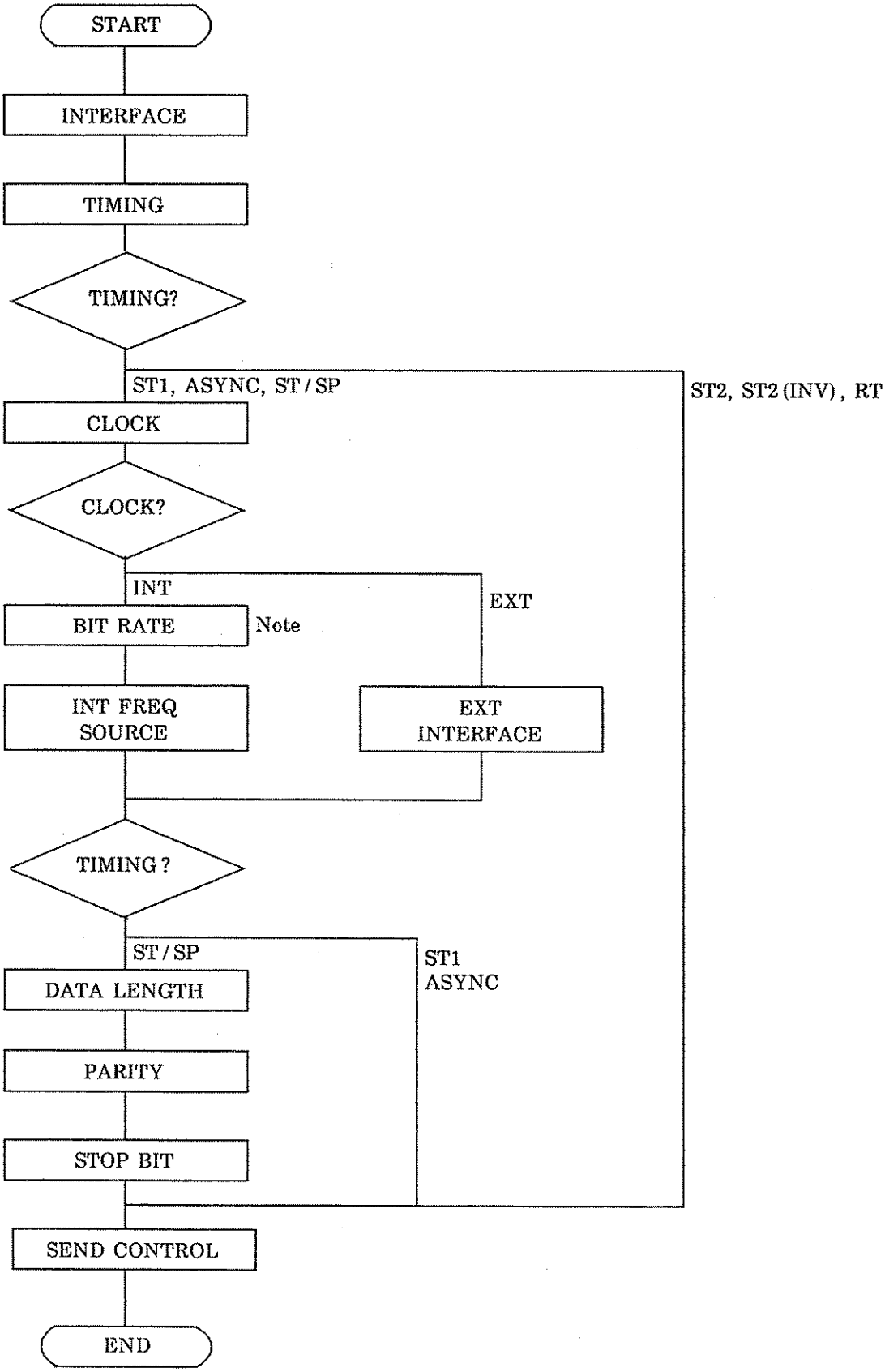
(1) Select the send interface unit as described in step (1) of paragraph 1 above.

(2) Operate the CURSOR, MODIFY, and F (soft) keys to set or modify all the send interface conditions.

(3) Move the cursor to the receive interface unit setting area and press[MORE] to display the next page of the menu. Press [F1] (SAME) to set the receive interface conditions to the same conditions as the send interface conditions.

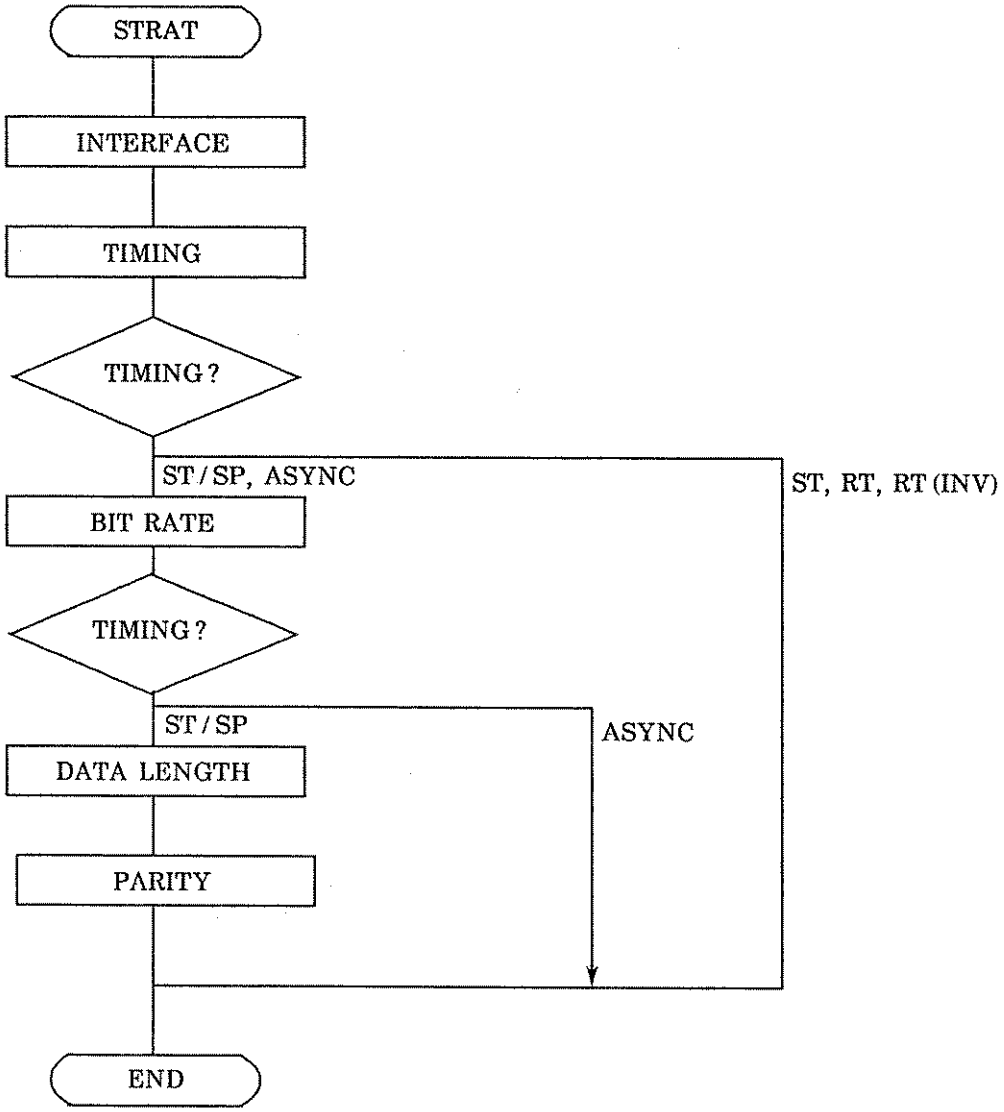
(4) Modify any necessary items as described in step (2) above.

2.11 Operation Procedure for setting V.24/V.28 Unit Send-condition



Note: From 50 to 20,000 b/s can be set in 5 bit/s steps

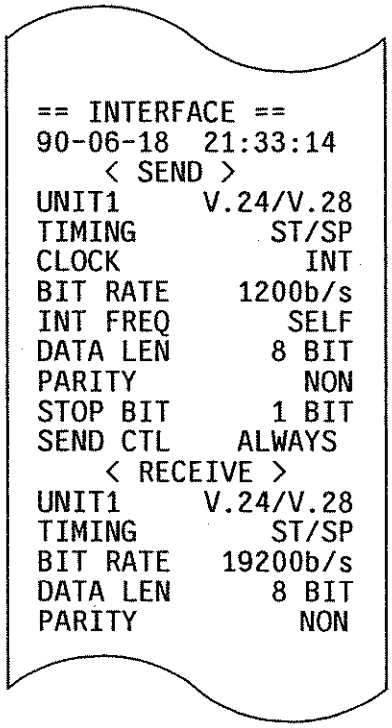
2.12 Operation Procedure for Setting V.24/V.28 Unit Receive-Conditions



2.13 Setting the Print Conditions for Interface Settings

The interface conditions can be printed by pressing [F6] (PRINT OUT) on page 2 of the INTERFACE screen while the cursor is disabled.

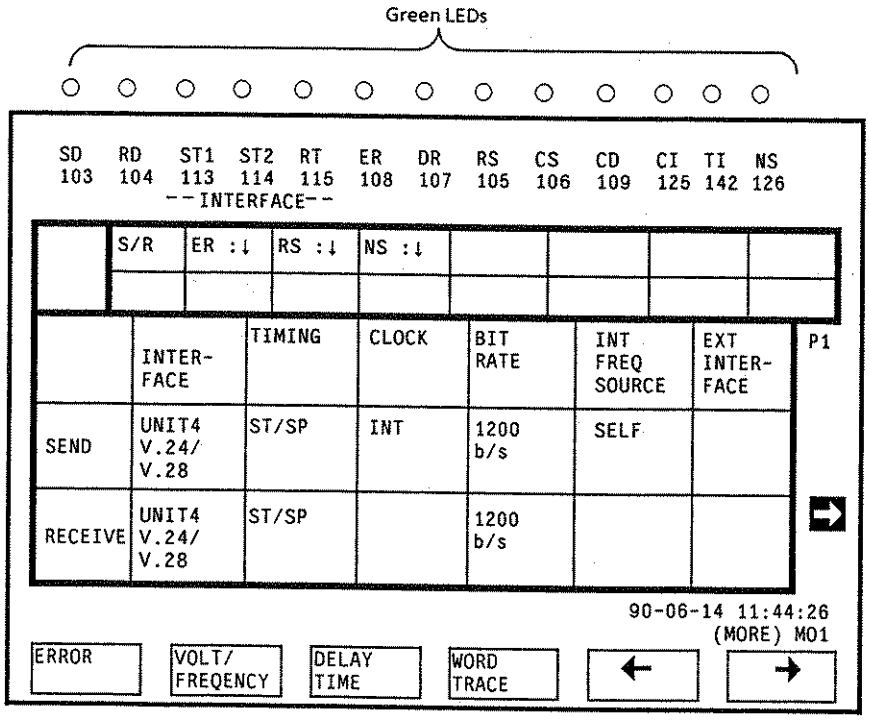
A sample print out (in which the conditions are set in accordance with paragraph 2.9) is shown below.



```
== INTERFACE ==
90-06-18  21:33:14
    < SEND >
UNIT1      V.24/V.28
TIMING         ST/SP
CLOCK             INT
BIT RATE     1200b/s
INT FREQ         SELF
DATA LEN       8 BIT
PARITY           NON
STOP BIT       1 BIT
SEND CTL     ALWAYS
    < RECEIVE >
UNIT1      V.24/V.28
TIMING         ST/SP
BIT RATE    19200b/s
DATA LEN       8 BIT
PARITY           NON
```

2.14 Monitor LED Display

The statuses of the V.24/V.28 interface signal-lines can be monitored by the LEDs on any INTERFACE or measurement screen.



The monitor LEDs indicate the status of the specified signal-line.

① SD [CCITT Circuit No. 103/RS-232C, Circuit name BA/25P Connector pin No.2]

Transmit (Send) data: A signal output from the MD0621A that monitors the transmission of data
1: Lit, 0: Unlit

② RD [CCITT Circuit No. 104/RS-232C, Circuit name BB/25P Connector pin No.3]

Receive data: A signal input to the MD0621A that monitors the reception of data
1: Lit, 0: Unlit

③ ST1 [CCITT Circuit No. 113/RS-232C, Circuit name DA/25P Connector pin No.24]

Transmit (Send) signal element timing: Signal element timing information output to DCE.
ON: Lit, OFF: Unlit

④ ST2 [CCITT Circuit No. 114/RS-232C, Circuit name DB/25P Connector pin No.15]

Transmit (Send) signal element timing: Signal element timing information input from DCE.
ON: Lit, OFF: Unlit

⑤ RT [CCITT Circuit No. 115/RS-232C, Circuit name DD/25P Connector pin No.17]

Receive signal element timing: Signal element timing information input from DCE.
ON: Lit, OFF: Unlit

⑥ ER [CCITT Circuit No. 108/RS-232C, Circuit name CD/25P Connector pin No.20]

Data terminal ready: Monitors status of ER line.
ON: Lit, OFF: Unlit

⑦ DR [CCITT Circuit No. 107/RS-232C, Circuit name CC/25P Connector pin No.6]

Data set ready: Monitors status of DR line.
ON: Lit, OFF: Unlit

⑧ RS [CCITT Circuit No. 105/RS-232C, Circuit name CA/25P Connector pin No.4]

Request to send: Monitors status of RS line.
ON: Lit, OFF: Unlit

⑨ CS [CCITT Circuit No. 106/RS-232C, Circuit name CS/25P Connector pin No.5]

Ready for send: Monitors status of CS line.
ON: Lit, OFF: Unlit

⑩ CD [CCITT Circuit No. 109/RS-232C, Circuit name CF/25P Connector pin No.8]

Data channel received line signal detector: Monitors status of CD line.
ON: Lit, OFF: Unlit

⑪ CI [CCITT Circuit No. 125/RS-232C, Circuit name CE/25P Connector pin No.22]

Calling indicator: Monitors status of CI line.
ON: Lights, OFF: Unlit

⑫ TI [CCITT Circuit No. 142/RC-232C, Circuit name None/25P Connector pin No.25]

Test indicator: Monitors status of TI line.
ON: Lit, OFF: Unlit

⑬ NS [CCITT Circuit No. 126/RS-232C, Circuit name None/25P Connector pin No.11]

Select transmit frequency: Monitors status of NS line.
ON: Lit, OFF: Unlit

2.15 Setting the Signal-Line

The signal-lines of the V.24/V.28 Unit to be monitored can be set via any INTERFACE or measurement screen.

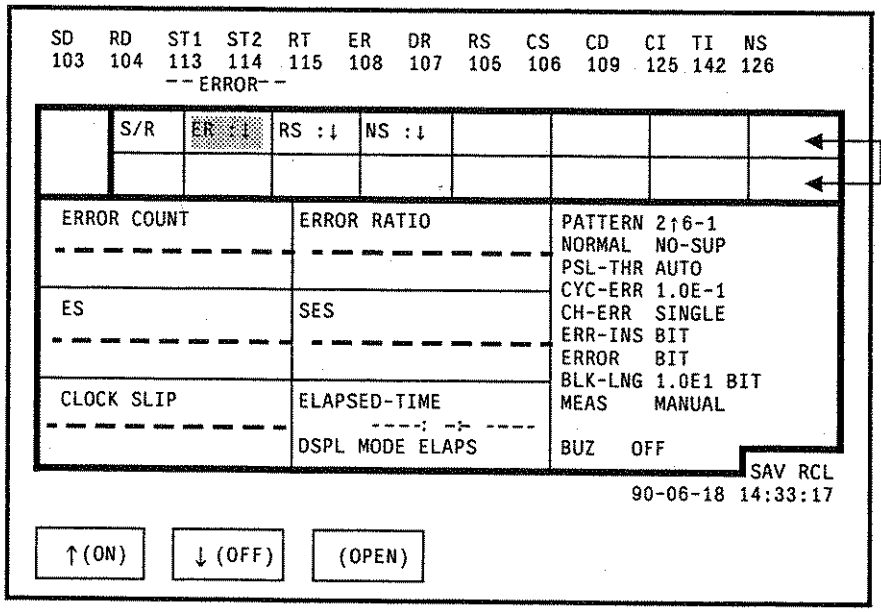
- Setting items

  ER : Data terminal ready

  RS : Request to send

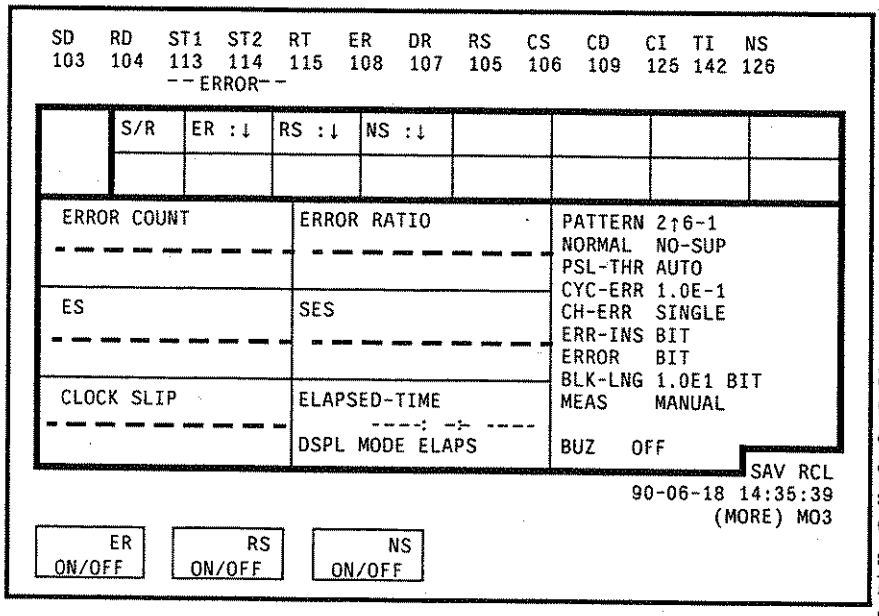
  NS : Select transmit frequency

- Operation for setting (1)



Move the cursor to the signal-line setting area of the screen and specify ON/OFF/ OPEN.

- Operation for setting (2)



Switch each signal ON/OFF via the cursor off menu of page 2 (or 3) of each measurement screen.
ON/OFF can also be selected when the signal line is set to OPEN ([x]).

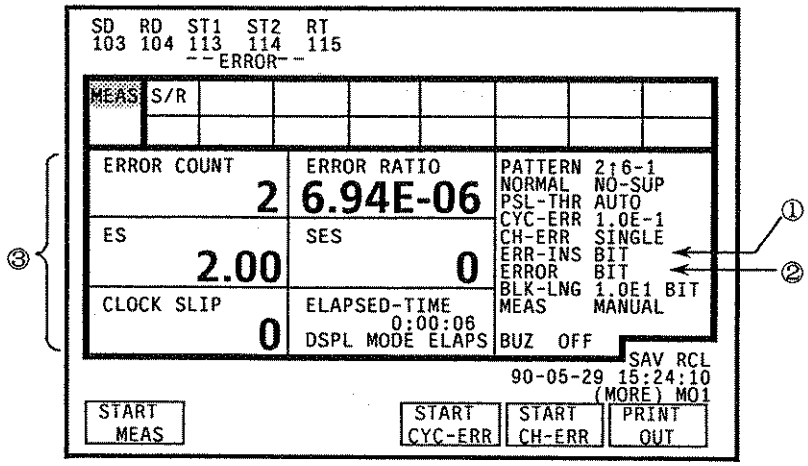
2.16 Measurement Conditions (only Items Unique to V.24/V.28 Unit)

2.16.1 Error measurement

As regards error measurements, the following measurement conditions and items are unique to the V.24/V.28 Unit. Other items referred to as common items.

For a description of the common items and error measurement operations, refer to the MD6420A operation manual.

(1) ERROR screen

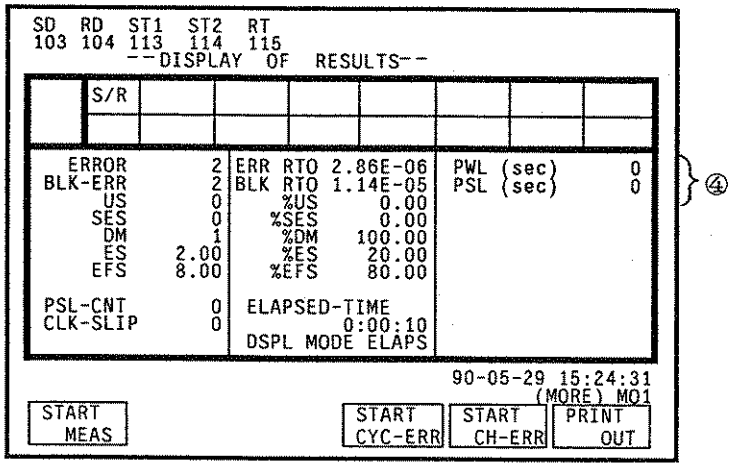


① Types of errors that can be inserted
BIT: Bit error

② Errors that can be detected
BIT : Bit error
PARITY : Parity error (valid for start/stop-sync, parity)

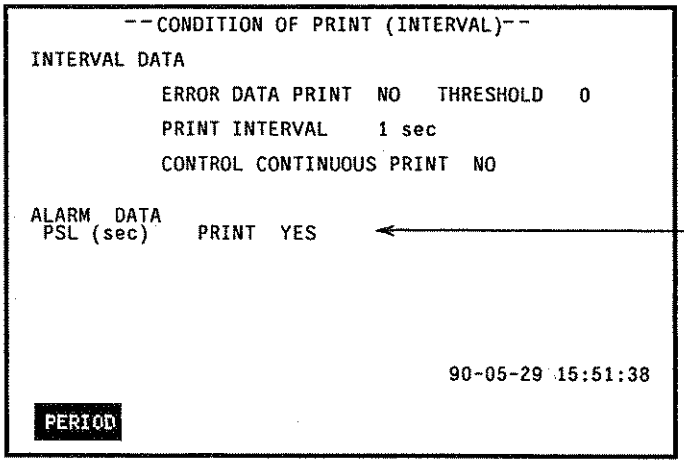
③ Other measurable items
In addition to common items such as ordinary errors, block errors, and error performance, the following alarm items can also be selected for measurement:
PWL (sec): Power-off time
PSL (sec) : Pattern sync-loss time

(2) DISPLAY OF RESULTS screen



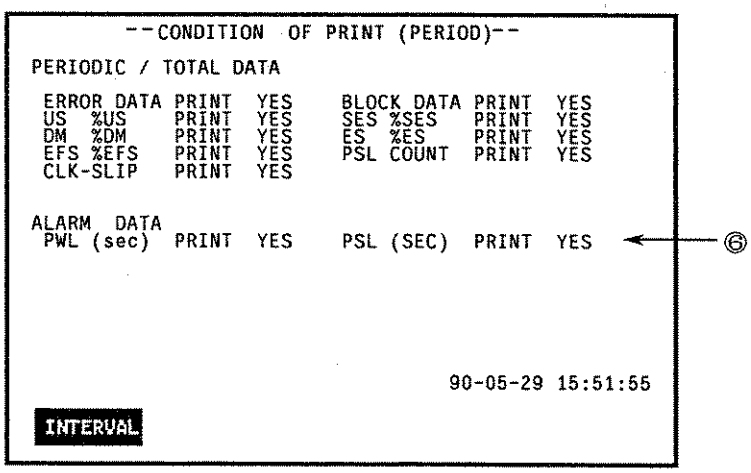
④ Alarm generation times
None except the common items (PWL (sec) and PSL (sec))

(3) CONDITION OF PRINT (INTERVAL) screen



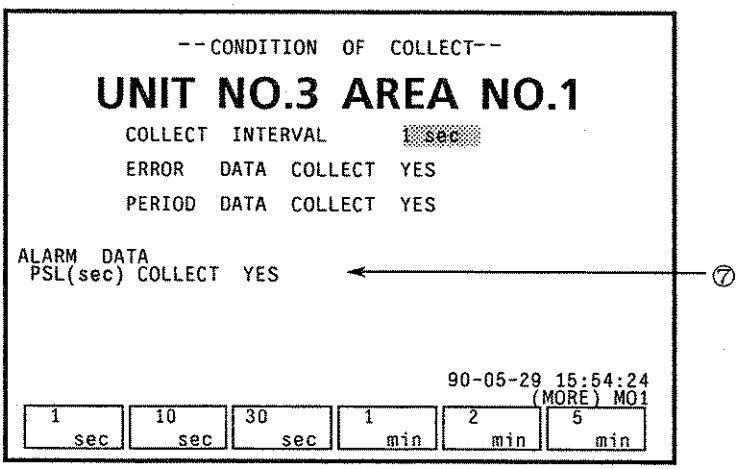
⑤ Interval alarm data
Interval printing for each alarm item can be either enabled or disabled.

(4) CONDITION OF PRINT (PERIOD) screen



⑥ Periodic alarm data
Periodic printing of each alarm can either be enabled or disabled.

(5) CONDITION OF COLLECT screen

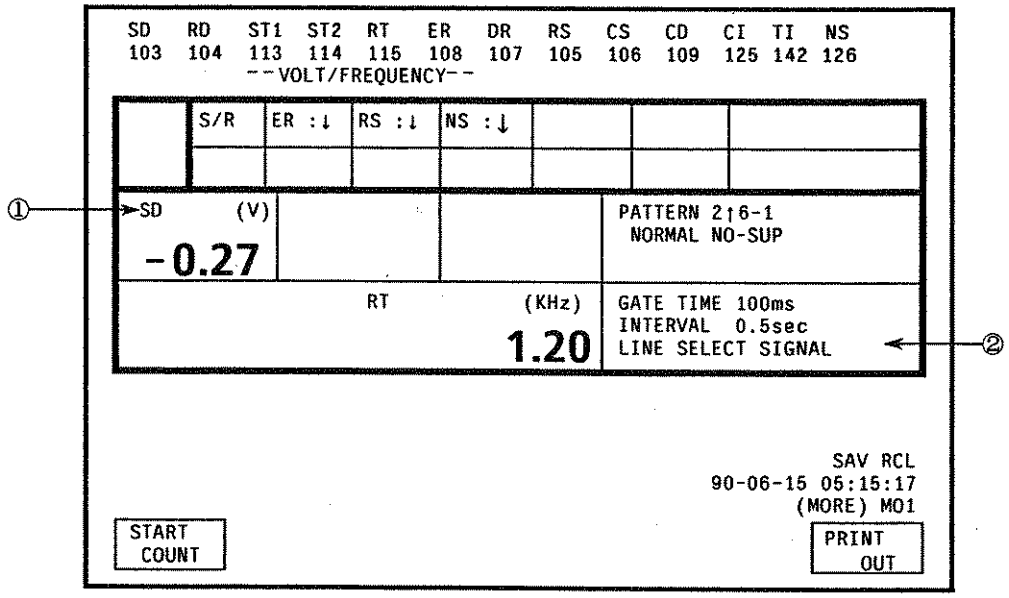


⑦ Interval alarm data collection control
Each interval alarm data item can be selected or deselected for data collection.

2.16.2 Voltage/frequency measurement

The following voltage/frequency measurement items are unique to the V.24/V.28 Unit.

Other items are referred to as common items. For a description of the common items and the voltage/frequency measurement items, refer to the MD6420A operation manual.

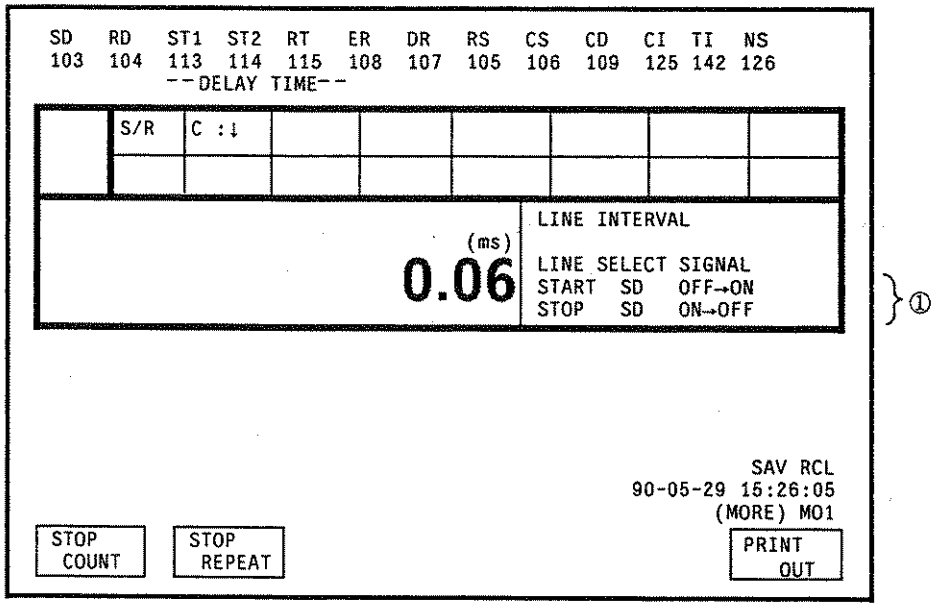


① The voltage of any signal line being monitored by an LED can be selected for measurement.

② The frequency of any signal line being monitored by an LED can be selected for measurement.

2.16.3 Line interval measurement

The following line interval measurement items are unique to the V.24/V.28 Unit. Other items are referred to as common items. For a description of common items and line interval measurement operations, refer to the MD6420A operation manual.

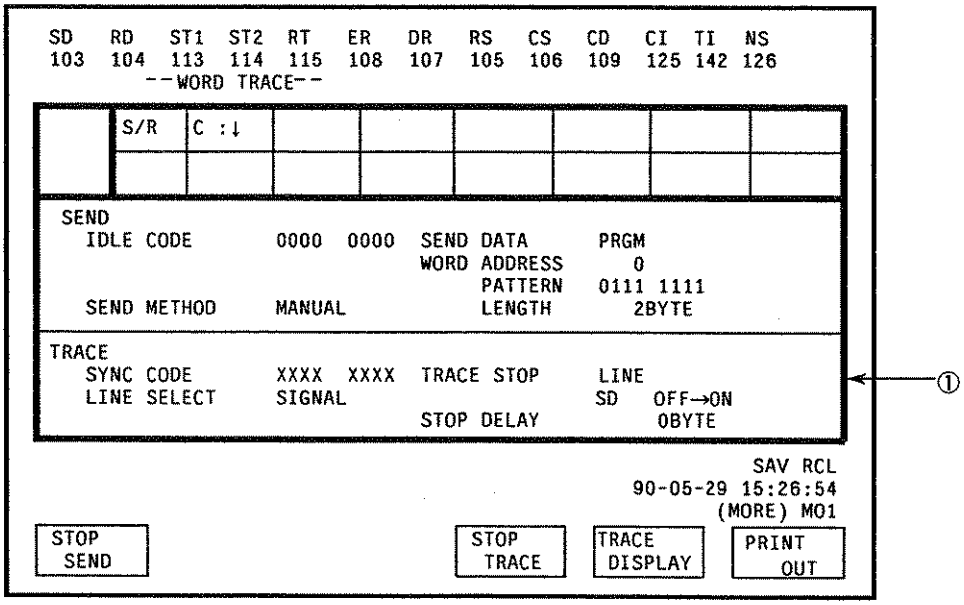


① Any signal line monitored by an LED can be selected as a START/STOP trigger.

2.16.4 Word trace

The following word-trace items are unique to the V.24/V.28 Unit.

The other items are referred to as common items. For a description of the common items and word-trace operations, refer to the MD6420A operation manual.



① When the trace stop condition (TRACE STOP) is LINE, any signal line being monitored by an LED can be selected as the condition signal line.

2.17 Initial Values for Interface and Measurement Settings

Initial values for interface and measurement settings unique to the V.24/V.28 Unit are shown below:

(1) Initialization is performed from the MODE screen

(2) The POWER is turned ON after being turned OFF when the V.24/V.28 Unit was not selected.

(3) The measurement screen displayed at the moment the POWER was turned OFF is not redisplayed when the POWER is turned back ON.

1. Interface settings items

No.	Item		Initial value
①	INTERFACE	Send-interface unit conditions	
②	TIMING	Send-signal generation timing	ST1
③	CLOCK	Type of send-signal clock	INT
④	DATA BIT RATE	Internal-clock frequency (bit rate) of send signal	1200 b / s
⑤	INT FREQ SOURCE	Type of internal-clock slave send signal	SELF
⑥	EXTERNAL INTERFACE	Type of external-clock input interface for sending	TTL
⑦	DATA LENGTH	Send data length	8 BIT
⑧	PARITY	Send-data parity	NON
⑨	STOP BIT	Type of send-data stop bit	1 BIT
⑩	SEND CONTROL	Send control signal	ALWAYS
	INTERFACE	Receive-interface unit	
	TIMING	Receive-signal timing	RT
	DATA BIT RATE	Internal-clock frequency (bit rate) for receive signal	1200 b / s
	DATA LENGTH	Receive data length	8 BIT
	PARITY	Receive-data parity	NON

2. Signal line setting items

No.	Item		Initial value
①	ER		OFF
②	RS		OFF
③	NS		OFF

3. VOLT/FREQ/COUNT measurement

No.	Item		Initial value
①		Voltage-measurement line name	SD
②		Frequency-measurement line name/count-signal name	SD

4. DELAY measurement

No.	Item		Initial value
①		Measurement-start trigger signal	SD
②		Trigger-signal start measurement condition	0 → 1
③		Measurement-stop trigger signal	SD
④		Trigger-signal stop measurement condition	1 → 0

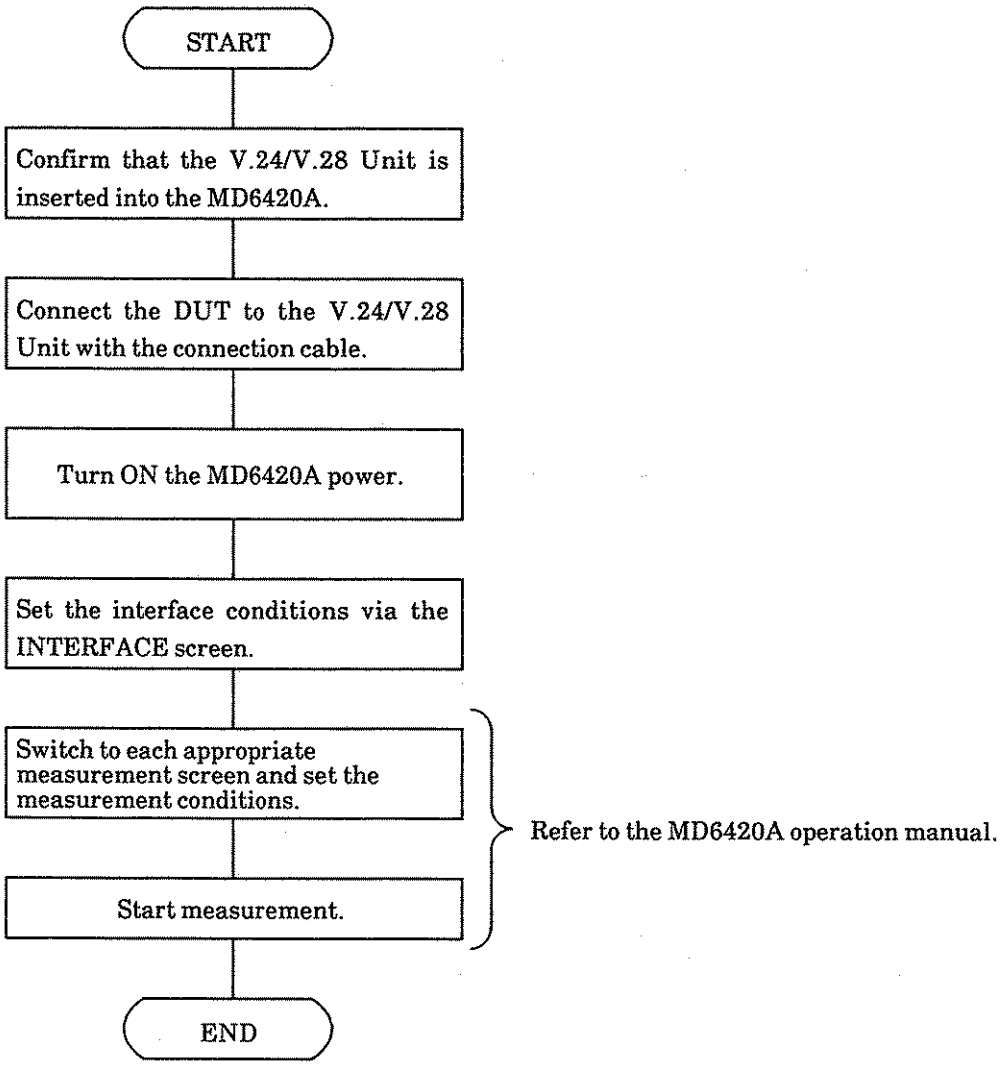
5. WORD TRACE measurement

No.	Item		Initial value
①		Trace-stop trigger line	SD
②		Trigger stop trace condition	0 → 1

SECTION 3
APPLICATION

3.1 Introduction

This section describes the measurement procedure for a device under test (DUT). Measurement is roughly divided into the following steps:

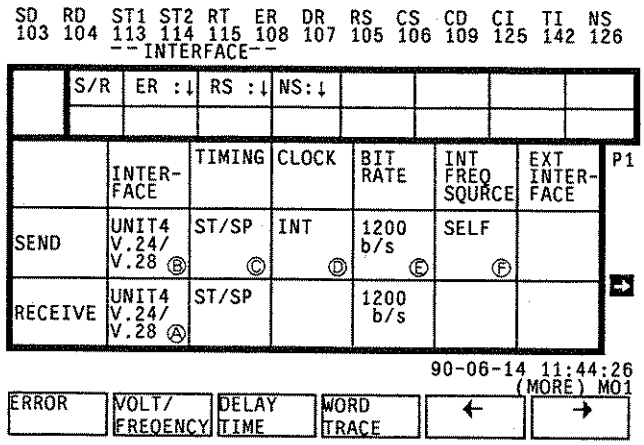


The following procedure is used when setting the interface parameters for ST/SP measurements.

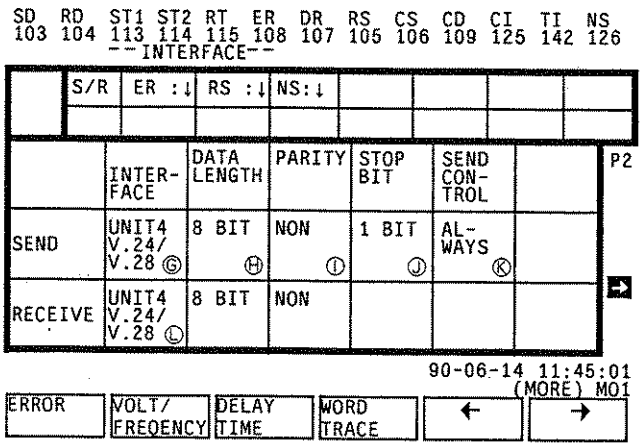
3.2 Setting the Interface-Conditions of Measurements via ST/SP (Start/Stop Sync.) mode

Step	Procedure	Screen
1.	Set [POWER] to ON.	The MODE screen is displayed.
2.	Press [F2].	The INTERFACE screen is displayed.
3.	Move the cursor by pressing [△] once.	The cursor is displayed at Ⓐ in the screen below.
4.	Press [V.24/V.28].	V.24/V.28 is displayed at the receive, INTER-FACE Ⓐ.
5.	Move the cursor by pressing [△] once.	The cursor is displayed at Ⓑ.
6.	Press [V.24/V.28].	V.24/V.28 is displayed at SEND, INTER-FACE Ⓑ.
7.	Move the cursor by pressing [▷] once.	The cursor is displayed at Ⓒ.
8.	Press [F5].	ST/SP is displayed at SEND, TIMING Ⓒ.
9.	Move the cursor by pressing [▷] once.	The cursor is displayed at Ⓓ.
10.	Press [F1].	INT is displayed at SEND, CLOCK Ⓓ.
11.	Move the cursor by pressing [▷] once.	The cursor is displayed at Ⓔ.
12.	Press [F1].	1200 b/s is displayed at SEND, BIT RATE Ⓔ.
13.	Move the cursor by pressing [▷] once.	The cursor is displayed at Ⓕ.
14.	Press [F1].	SELF is displayed at SEND, INT FREQ SOURCE Ⓕ.
15.	Move the cursor by pressing [▷] once.	The cursor is displayed at Ⓐ.
16.	Press [F6] once.	INTERFACE screen P2 is displayed.
17.	Move the cursor by pressing [△] once.	The cursor is displayed at Ⓖ.
18.	Move the cursor by pressing [▷] once.	The cursor is displayed at Ⓗ.
19.	Press [F4].	The message "8 BIT" is displayed at SEND, DATA LENGTH Ⓗ.
20.	Move the cursor by pressing [▷] once.	The cursor is displayed at Ⓘ.
21.	Press [F1].	NON is displayed at SEND, PARITY Ⓘ.
22.	Move the cursor by pressing [▷] once.	The cursor is displayed at Ⓙ.
23.	Press [F3].	The message "2 BIT" is displayed at SEND, STOP BIT Ⓙ.
24.	Move the cursor by pressing [▷] once.	The cursor is displayed at Ⓚ.

Step	Procedure	Screen
25.	Press [F1].	ALWAYS is displayed at SEND, SEND CONTROL Ⓚ.
26.	Move the cursor by pressing ▶ once.	The cursor is displayed at Ⓛ.
27.	Press [MORE] once.	The next page of soft-keys is displayed.
28.	Press [F1].	The same SEND and RECEIVE conditions are set.
29.	Press [CURSOR].	The cursor is turned OFF.
30.	1. Press [F1]. 2. Press [F2]. 3. Press [F3]. 4. Press [F4].	The ERROR screen is displayed. The VOLT/FREQ screen is displayed. The DELAY/TIME screen is displayed. The WORD TRACE screen is displayed.



INTERFACE screen P1



INTERFACE screen P2

The procedures for performing measurements are given in the MD6420A operation manual.

SECTION 4
SIMPLE OPERATION CHECKS

4.1 Introduction

This section describes how to make simple operation checks and verify that operation is correct when the V.24/V.28 Unit is inserted into the MD6420A.

Simple operation checks consist of:

(1) Insertion state check

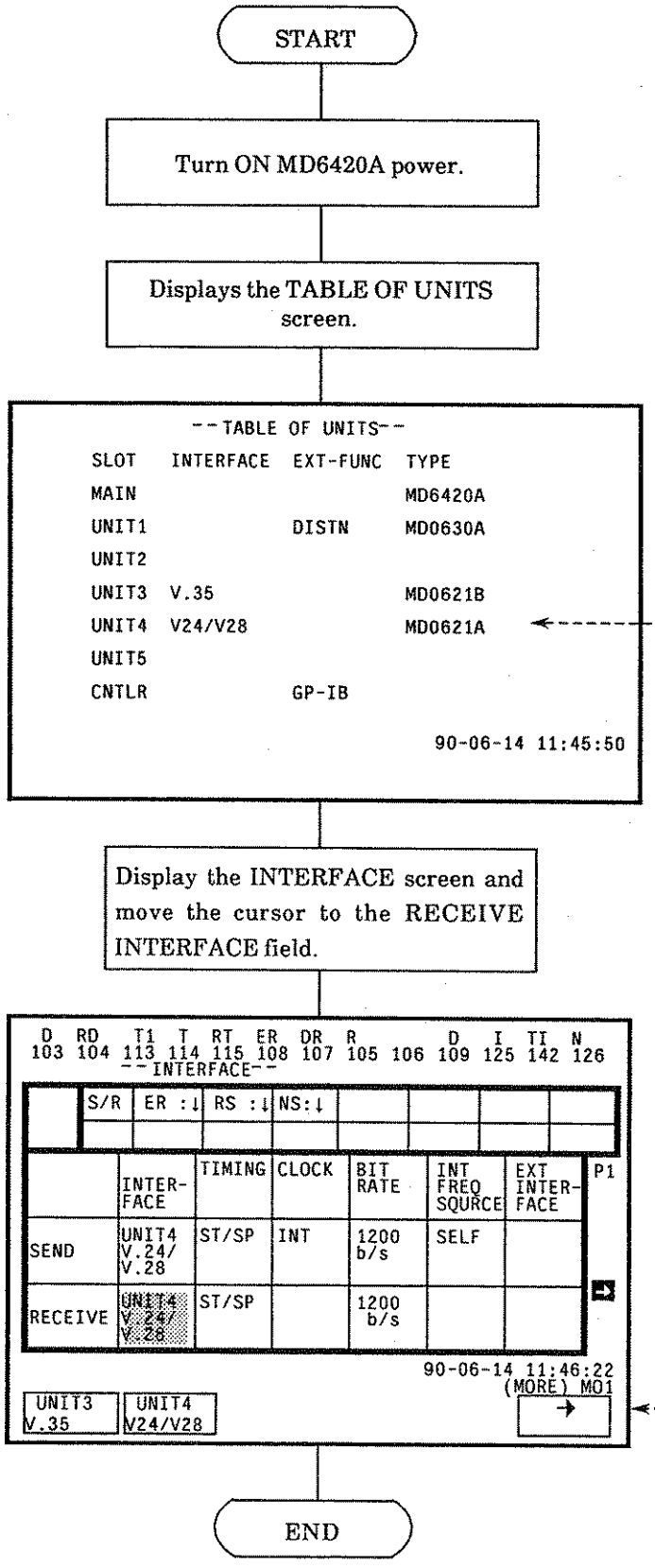
(2) Error-measurement by SELF Loop check

(3) Frequency-measurement by SELF Loop check

4.2 Insertion State Check

After turning the MD6420A power OFF, insert the V.24/V.28 Unit into the MD6420A rear-panel slots and tighten the screws on the top and bottom of the unit.

Turn the MD6420 power ON and verify that the V.24/V.28 Unit is inserted properly, as follows:



The TABLE OF UNITS menu can be displayed on pages 2 to 4 of the MODE screen provided that the cursor is off. Press [F3] on the TABLE OF UNITS screen.

Verify that the V.24/V.28 Unit is displayed for the unit in whose slot the V.24/V.28 Unit has been inserted.

Return to the MODE screen by pressing [BACK SCREEN]. Then press [F2] (INTERFACE).
When the INTERFACE screen is displayed, press the CURSOR△ key to display. The cursor at the RECEIVE INTER-FACE field.

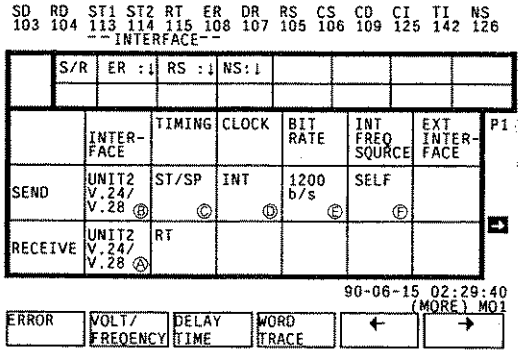
Verify that V.24/V.28 Unit is displayed at the unit No. in whose slot the V.24/V.28 Unit has been inserted.

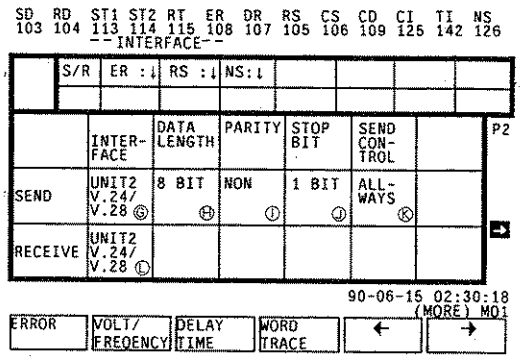
4.3 Confirming Error Measurement by SELF LOOP

Step	Procedure	Screen
1.	Set [POWER] to ON.	The MODE screen is displayed.
2.	Press [F2].	The INTERFACE screen is displayed.
3.	Move the cursor by pressing ⩓ once.	The cursor is displayed at Ⓐ.
4.	Press [V.24/V.28].	V.24/V.28 is displayed at RECEIVE, INTERFACE Ⓐ.
5.	Move the cursor by pressing ⩓ once.	The cursor is displayed at Ⓑ.
6.	Press [V.24/V.28].	V.24/V.28 is displayed at SEND, INTERFACE Ⓑ.
7.	Move the cursor by pressing ⩔ once.	The cursor is displayed at Ⓒ.
8.	Press [F5].	ST/SP is displayed at SEND, TIMING Ⓒ.
9.	Move the cursor by pressing ⩔ once.	The cursor is displayed at Ⓓ.
10.	Press [F1].	INT is displayed at SEND, CLOCK Ⓓ.
11.	Move the cursor by pressing ⩔ once.	The cursor is displayed at Ⓔ.
12.	Press [F1].	2400 b/s is displayed at SEND, BIT RATE Ⓔ.
13.	Move the cursor by pressing ⩔ once.	The cursor is displayed at Ⓕ.
14.	Press [F1].	SELF is displayed at SEND, INT FREQ SOURCE Ⓕ.
15.	Move the cursor by pressing ⩔ once.	The cursor is displayed at Ⓐ.
16.	Press [F6].	The second page of the INTERFACE screen is displayed.
17.	Move the cursor by pressing ⩓ once.	The cursor is displayed at Ⓖ.
18.	Move the cursor by pressing ⩔ once.	The cursor is displayed at Ⓗ.
19.	Press [F4].	8 BIT is displayed at SEND, DATA LENGTH Ⓗ.
20.	Move the cursor by pressing ⩔ once.	The cursor is displayed at Ⓘ.
21.	Press [F1].	NON is displayed at SEND, PARITY Ⓘ.
22.	Move the cursor by pressing ⩔ once.	The cursor is displayed at Ⓙ.
23.	Press [F3].	2 BIT is displayed at SEND, STOP BIT Ⓙ.
24.	Move the cursor by pressing ⩔ once.	The cursor is displayed at Ⓚ.

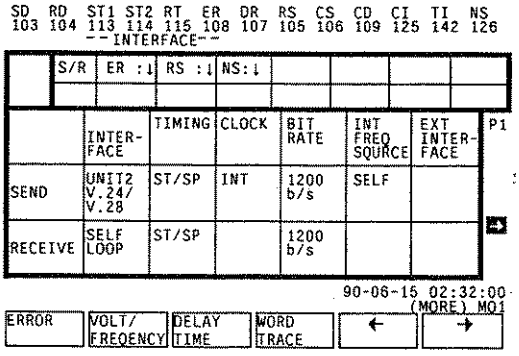
No.	Step Procedure Screen	Screen
25.	Press [F1].	ALWAYS is displayed at SEND, CON-TROL Ⓚ.
26.	Move the cursor by pressing ▷ once.	The cursor is displayed at Ⓛ.
27.	Press [MORE] once.	The next page of the soft-key menu is displayed.
28.	Press [F2].	The same SEND and RECEIVE interface conditions are set and SELF-Loop is displayed at the RECEIVE INTER-FACE Ⓛ.
29.	Press [CURSOR OFF].	The cursor is turned OFF.
30.	Press [F1].	The ERROR screen is displayed.

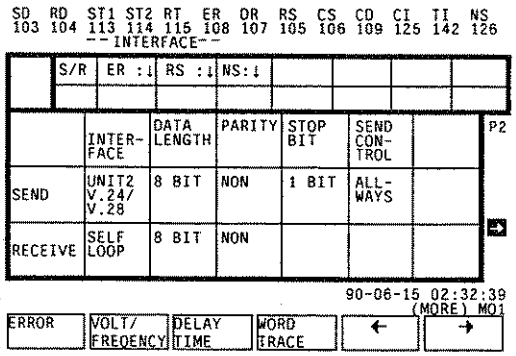
Before setting SELF Loop



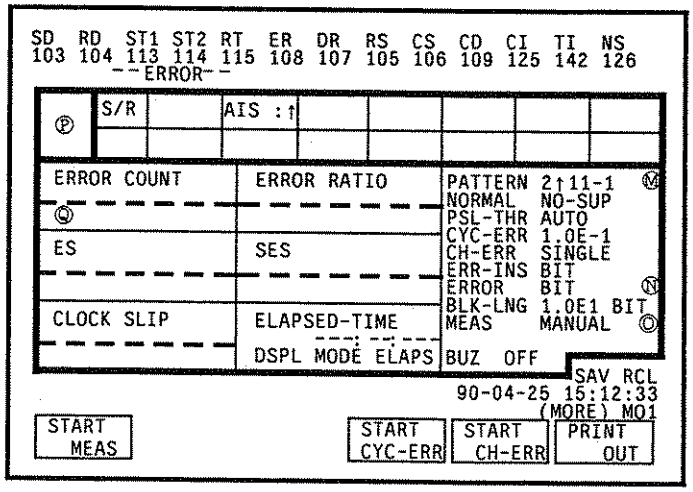


After setting SELF Loop





Step	Procedure	Screen
31.	Move the cursor by pressing ▷ three times.	The cursor is displayed at Ⓜ.
32.	Press [F5].	2↑15-1 is displayed at PATTERN Ⓜ.
33.	Move the cursor by pressing ▽ six times.	The cursor is displayed at Ⓝ.
34.	Press [F1].	BIT is displayed at ERROR Ⓝ.
35.	Move the cursor by pressing ▽ twice.	The cursor is displayed at Ⓞ.
36.	Press [F1].	MANUAL is displayed at MEAS Ⓞ.
37.	Press [CURSOR OFF].	The cursor is turned OFF.
38.	Press [F1].	Measurement starts. Normally, MEAS is displayed at Ⓟ and errors are not counted. (0 is displayed at ERROR COUNT Ⓠ.)
39	Press [F5] once.	"1" is displayed at ERROR COUNT Ⓠ. (The number of errors displayed corresponds to the number of time [F5] is pressed.)



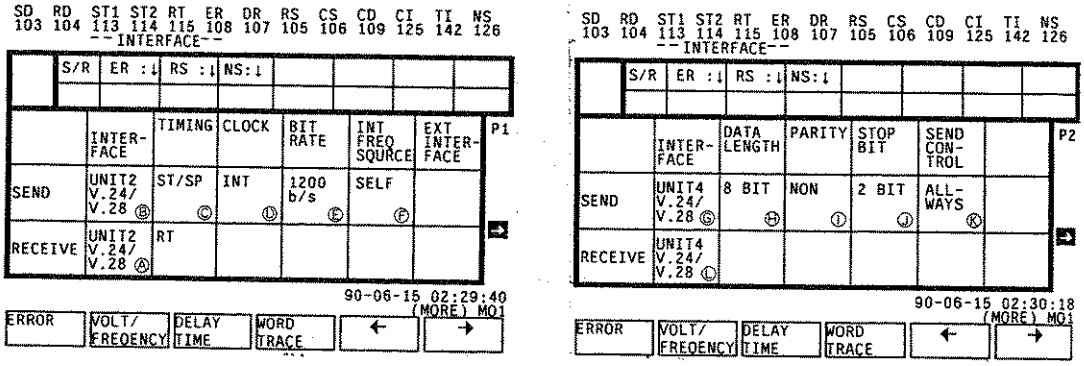
Check method

- When measurement starts correctly as described at Step 38 and 0 is displayed at ERROR COUNT, operation is normal.
- When ERROR COUNT corresponds to the number of times [F5] (START CH-ERR) is pressed at Step 39, operation is normal.

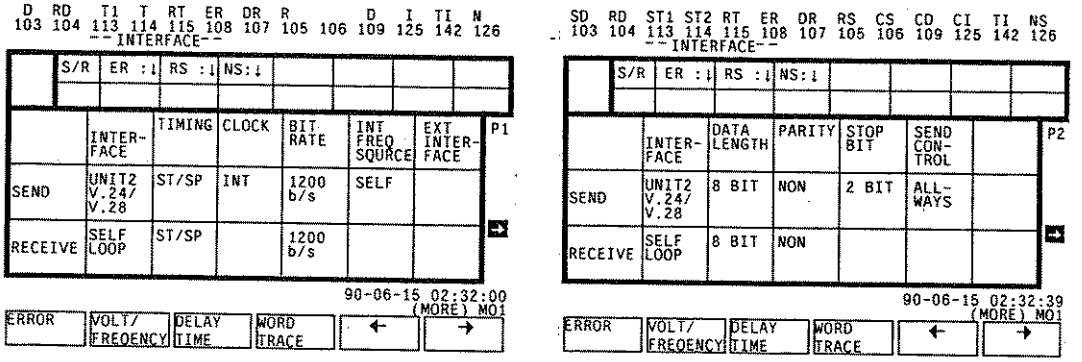
4.4 Confirming Frequency Measurement by SELF LOOP

Step	Procedure	Screen
1.	Set [POWER] to ON.	The MODE screen is displayed.
2.	Press [F2].	The INTERFACE screen P1 is displayed.
3.	Move the cursor by pressing ⩓ once.	The cursor is displayed at Ⓐ in the screen below.
4.	Press [V.24/V.28].	V.24/V.28 is displayed at RECEIVE, INTER-FACE Ⓐ.
5.	Move the cursor by pressing ⩓ once.	The cursor is displayed at Ⓑ.
6.	Press [V.24/V.28].	V.24/V.28 is displayed at SEND, INTER-FACE Ⓑ.
7.	Move the cursor by pressing ⩔ once.	The cursor is displayed at Ⓒ.
8.	Press [F3].	ST1 is displayed at SEND, TIMING Ⓒ.
9.	Move the cursor by pressing ⩔ once.	The cursor is displayed at Ⓓ.
10.	Press [F1].	INT is displayed at SEND, CLOCK Ⓓ.
11.	Move the cursor by pressing ⩔ once.	The cursor is displayed at Ⓔ.
12.	Press [F1].	1200 b/s is displayed at SEND, BIT RATE Ⓔ.
13.	Move the cursor by pressing ⩔ once.	The cursor is displayed at Ⓕ.
14.	Press [F1].	SELF is displayed at SEND, INT FREQ SOURCE Ⓕ.
15.	Move the cursor by pressing ⩔ once.	The cursor is displayed at Ⓐ.
16.	Press [F6].	Interface conditions are displayed on the measurement screen P2.
17.	Move the cursor by pressing ⩔ once.	The cursor is displayed at Ⓚ.
18.	Press [F1].	ALWAYS is displayed at SEND, CON-TROL Ⓚ.
19.	Move the cursor by pressing ⩔ once.	The cursor is displayed at Ⓛ.
20.	Press [MORE] once.	The next page of the soft-key menu is displayed.
21.	Press [F2].	The same send and receive interface conditions are set and SELF-LOOP is displayed at the RECEIVE, INTERFACE Ⓛ.
22.	Press [CURSOR OFF].	The cursor is turned OFF.
23.	Press [F1].	The ERROR screen is displayed.

Step	Procedure	Screen

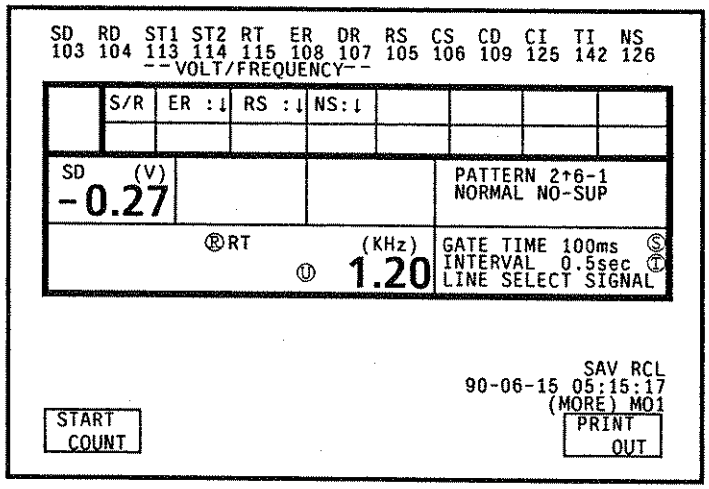


After setting the SELF LOOP mode



24.	Move the cursor by pressing ⩾ three times.	The cursor is displayed at Ⓡ.
25.	Press [F5].	RT is displayed at frequency measurement signal-line Ⓡ.
26.	Move the cursor by pressing ⩾ once.	The cursor is displayed at Ⓢ.
27.	Press [F1].	100 ms is displayed at GAME TIME Ⓢ.
28.	Move the cursor by pressing ⩾ once.	The cursor is displayed at Ⓣ.
29.	Press [F1].	0.5 sec is displayed at INTERVAL Ⓣ.
30.	Press [CURSOR OFF].	The cursor is turned OFF.
31.	Press [F1].	Measurement starts (1.20 (kHz) is displayed at Ⓤ.)

Step	Procedure	Screen

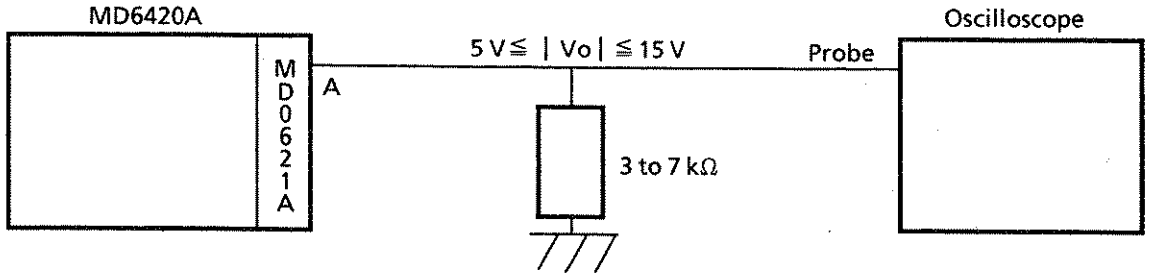


Check method

- When measurements are performed correctly and "1.20 kHz" is displayed at Step 38, operation is normal.

4.5 Check the Output Level

- Connection



Oscilloscope: frequency range > 200 MHz

A: TO DCE 25-Pin Connections Pin: No.2 (SD), No.4 (RS), No.11 (NS), No.20 (ER), No.24 (ST1)

- Setting the interface display

  SEND

INTERFACE	: V.24/V.28
TIMING	: ST1
CLOCK	: INT
BIT RATE	: 1200 b/s
INT FREQ SOURCE	: SELF
SEND CONTROL	: ALWAYS

- Setting the error measurement display

  PATTERN 1:1

- Setting the signal-line

  ER: ON (↑), RS: ON (↑), NS: ON (↑)

- Output level

  As regards the 3 to 7 kΩ unbalanced duty resistor, a voltage drop of more than 5 V but less than 15 V must occur.

SECTION 5
REMOTE CONTROL

5.1 Overview of Remote Control

The MD6420A Data Transmission Analyzer can also be used to perform measurements via a remote controller (Anritsu Packet V, IBM-PC, NEC PC-9801 (Japan), etc.) when either of the following two Remote Control Units are used.

- MD0620A GP-IB Remote Control Unit
- MD0620B RS-232C Remote Control Unit.

The MD6420A can be used to remotely control measurements made by the V.24/V.28 Unit.

This section describes items that are unique to a V.24/V.28 Unit being used for remote-control measurements.

For a description of MD6420A common commands, sample programs, etc., refer to the MD6420A operation manual.

The following are described in each paragraph of this section:

5.2 Control Command Table

(1) INTERFACE screen

(2) ERROR screen

(3) VOLT/FREQUENCY screen

(4) DELAY TIME screen

(5) WORD TRACE screen

5.3 Response Data Table

For a detailed description of each command, see Appendix B. For a detailed description of the response data, see Appendix C.

5.4 Control Command Table

(1) INTERFACE screen-1

Item to be set	Command name	Parameter	Page
Inserted unit No. (send)	SUT	0 to 5	B - 2
Send-interface unit condition	SUN	0 to 14	B - 2
Send-signal generation timing	SMD	0, 3 to 7	B - 3
Type of send-signal clock	SCK	0, 1	B - 5
Frequency of internal send clock	SBR	50 to 20000	B - 5
Type of internal-clock slave send signal	IFS	0 to 3	B - 6
Type of external-clock input send interface	EI	0, 1	B - 6
Send-data length	SDL	5 to 8	B - 7
Send-data parity	SPR	0 to 2	B - 7
Type of send-data stop bit	SSP	0 to 2	B - 8
Send control signal	CT	0, 1	B - 8
No. of inserted unit function (receive)	RUT	0 to 5, 16	B - 9
Receive interface unit conditions	RUN	0 to 14, 255	B - 9
Receive signal generation timing	RMD	0, 3 to 6	B - 10
Frequency of internal receive clock	RBR	50 to 19200	B - 11
Receive-data length	RDL	5 to 8	B - 11
Receive-data parity	RPR	0 to 2	B - 12
Line to be monitored	MSL	0 to 4	B - 12
Signal line to be monitored	SCT	n : 5, 7, 12 m : 0 to 2	B - 13
Send signal line	SCS	n : 5, 7, 12 m : 0 to 2	B - 13
Receive signal line	SCR	n : 5, 7, 12 m : 0 to 2	B - 14

(2) ERROR screen

Setting item	Command name	Parameter	Page
Measured result display selection (Top left side)	DSA	0 to 11, 15 to 20	B - 15
Measured result display selection (Top right side)	DSB	0 to 11, 15 to 20	B - 16
Measured result display selection (Middle left side)	DSC	0 to 11, 15 to 20	B - 17
Measured result display selection (Middle right side)	DSD	0 to 11, 15 to 20	B - 18
Measured result display selection (bottom left side)	DSE	0 to11, 15 to 20	B - 19
Alarm output data format specification	OFA	0, 1	B - 20

(3) VOLT/FREQUENCY screen

Setting item	Command name	Parameter	Page
Voltage measurement line	VM	0 to 12	B - 20
Frequency measurement line	FM	0 to 12	B - 21

(4) DELAY TIME screen

Setting item	Command name	Parameter	Page
Start line	SAL	n : 0 to 12, 13 m : 0, 1	B - 21
Stop line	SOL	n : 0 to 12, 13 m : 0, 1	B - 22

(5) WORD TRACE screen

Setting item	Command name	Parameter	Page
Trace stop line	SL	n : 0 to 12 m : 0, 1	B - 22

5.5 Response Data Table

(1) INTERFACE screen

Setting item	Command name	Parameter	Page
Contests output request	DO?	———	C - 2

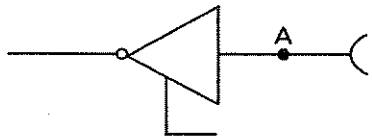
SECTION 6
PRINCIPLES OF OPERATION

6.1 Receiver/Driver

6.1.1 Receiver

Figure 6-1 shows an input-circuit block diagram. The signal lines that use this type of circuit are listed below:

RD, ST2, RT, CS, DR, CD, CI, TI



75189 or equivalent

Fig. 6-1 Input-Circuit Block Diagram

The input conditions conform to CCITT recommendation for V.28 interfaces. When the voltage at point A is less than −3 V, the signal is said to be in the binary "1" state. When the voltage (VA) is greater than +3V, the signal is said to be in the binary "0" state.

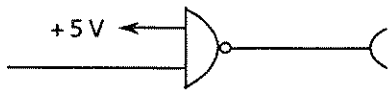
In the control line and timing circuits, when the voltage (VA) is more than +3 V, the signal is said to be "ON". Conversely when less than −3 V, the signal is said to be "OFF".

Table 6-1

	VA < −3 V	VA > −3 V
Data circuit	1	0
Control and timing circuits	OFF	ON

6.1.2 The V.28 driver

Figure 6-2 is the block diagram for the output circuit. The only V.11 signal lines that can be output are SD, ST1, RS, ER and NS.



75188 or equivalent

Fig. 6-2 Output-Circuit Block Diagram

The output conditions conform to CCITT recommendations for V.28 interfaces.

As regards the 3 to 7 kΩ unbalanced duty resistor, a voltage drop of more than 5 V but less than 15 V must occur.

6.2 Connecting Circuits

(1) SD [CCITT Circuit No. 103/RS-232C, Circuit name BA/25P Connector pin No.2]

Direction: Towards DCE

(a) Used to transmit to one or more remote data stations via a data channel,

(b) Used to convert to DCE during maintenance testing via DTE control,

or

(c) Used for programming serial automatic calling routines for DCE or control,

Data signals generated by DTE are converted to DCE by this circuit.

(2) RD [CCITT Circuit No. 104/RS-232C, Circuit name BB/25P Connector pin No.3]

Direction: From DCE

Signal generated by DCE,

(a) Used to respond to data channel tracking signals which are received from remote data stations,

(b) Used to respond to DTE maintenance tests,

Response signal is transferred to DTE iva this circuit. or

(c) Signal generated in response to serial automatic calls to the DCE by a program from the DTE,

Response signal is transferred to DTE via this circuit.

Note: Receive conditions for maintenance test signal are specified by circuit 107.

(3) ST1 [CCITT Circuit No. 113/RS-232C, Circuit name DA/25P Connector pin No.24]

Direction: Toward DCE

The signal from this circuit provides signal element timing information to the DCE. This signal has equal ON and OFF intervals and switches from ON to OFF at the midpoint of each signal as specified for circuit 103.

(4) ST2 [CCITT Circuit No. 114/RS-232C, Circuit name DB/25P Connector pin No.15]

Direction: From DCE

The signal from this circuit provides signal element timing information to the DCE. This signal has equal ON and OFF intervals, and is generated such that OFF to ON switching of Circuit 114 occurs in synchrony with Circuit 103.

(5) RT [CCITT Circuit No. 115/RS-232C, Circuit name DD/25P Connector pin No.17]

Direction: From DCE

The signal from this circuit provides signal element timing information to the DCE. The signal has equal ON and OFF intervals and switches from ON to OFF at the midpoint of each signal element as specified for circuit 104.

(6) ER [CCITT Circuit No. 108/RS-232C, Circuit name CD/25P Connector pin No.20]

Direction: Towards DCE

This signal is used to control signal conversion and switching to a DTE line or device.

The ON state indicates that a DTE line or device is in use and that all DCE signals need to be converted appropriately. The DTE and DCE elements can only be connected after being converted externally.

The DTE ON state for circuit 108/2 is used any time data reception is expected to occur.

The OFF state is entered after all data has been transferred to circuit 103, circuit 118 or any other appropriate circuit. At that moment, DCE signal conversion is disabled.

(7) DR [CCITT Circuit No. 107/RS-232C, Circuit name CC/25P Connector pin No.6]

Direction: From DCE

This signal indicates whether or not DCE conversion is effective. When circuit 142 is OFF or not in use, signal conversion is enabled as indicated by the ON state of circuit 107. This indicates that DCE conversion in preparation for reception of the control signals from the DTE has occurred.

When circuit 142 is ON, the ON state of circuit 107 can be used during maintenance testing to verify that the receive data signal is converted from DCE to DTE. When circuit 106 is ON, the ON state of circuit 107 can be used to verify that sequential self-calling programs or data signals are executed in the DCE mode.

When circuit 106 is OFF, the OFF state of circuit 107 indicates that the:

(a) DCE cannot convert and transfer data

(b) DCE has detected an impasse relative to the circuit network or DCE convertions, or

(c) The DCE has detected on unconnected display located remotely or in the circuit network.

Note: When referring to paragraphs (b) and (c) above within the DCE recommendations, consult the appropriate agencies for user rights and information regarding these functions.

(8) RS [CCITT Circuit No. 105/RS-232C, Circuit name CA/25P Connector pin No.4]

Direction: Towards DCE

This signal controls the sending of data on a DCE channel. In the ON state, data are sent on the channel by the DCE. In the OFF state, data transfers to circuit 103 are completed, after which data transmissions on the channel by the DCE are disabled.

(9) CS [CCITT Circuit No. 106/RS-232C, Circuit name CS/25P Connector pin No.5]

Direction: From DCE

This signal indicates that the DCE is ready to receive data sent on the data channel and can be used during maintenance checks of the DTE control.

The ON state indicates that the DCE is ready to receive data sent by the DTE. The OFF state indicates that the DCE is not ready to receive data send by the DTE.

(10) CD [CCITT Circuit No. 109/RS-232C, Circuit name CF/25P Connector pin No.8]

Direction: From DCE

This signal indicates whether or not the signal received on the data receive channel is within the range specified by the related DCE recommendation.

The ON state indicates that the data signal lines between the DCE and DTE are OK and changing in accordance with the program or serial automatic calling DCE. The OFF state indicates that the receive signal is not in range.

(11) CI [CCITT Circuit No. 125/RS-232C, Circuit name CE/25P Connector pin No.22]

Direction: From DCE

This signal indicates that the DCE has received a non-calling signal.

The ON state indicates that a non-calling signal has been received and vice-versa. The OFF state may also occur during breaks in non-calling signal pulse modulation.

(12) TI [CCITT Circuit No. 142/RS-232C, Circuit name None/25P Connector pin No.25]

Direction: From DCE

This signal indicates whether or not maintenance is in progress.

The ON state indicates that a maintenance test is in progress so that neither the DCE nor the DTE can be used to send data remotely.

(13) NS [CCITT Circuit No. 136/RS-232C, Circuit name None/25P Connector pin No.11]

Direction: Towards DCE

Signals on this circuit are used to control the response times of the DCE receiver.

The ON condition of circuit 136, instructs the DCE receiver to prepare itself to detect rapidly the disappearance of the line signal (e.g., by disabling the response time circuitry associated with

circuit 109). After the received lien signal falls below the threshold of the received line signal detector, the DCE will:

1) turn OFF circuit 109, and

2) prepare itself to detect rapidly the appearance of a new line signal (e.g., by resetting the receiver timing recovery circuitry).

Once turned ON, circuit 136 may be turned OFF after one unit interval and must be turned OFF after circuit 109 is turned OFF. Circuit 136 shall be OFF at all other times.

After the voltage of the receive line signal falls below the threshold value of the receive line signal detector:

(a) Circuit 109 of the DCE is turned OFF.

Circuit 136 is turned OFF again only after 1 unit interval has elapsed (since it was turned ON) and only after circuit 109 has been turned OFF. Otherwise, circuit 136 is always OFF.

6.3 Send Timing

6.3.1 The ST1 mode

When the ST1 sync mode is selected, the ST1 signal is used as the master clock source for the MD6420A.

Figure 6-3 shows the block diagram for ST1 and SD, while Fig. 6-4 illustrates the phase relationship.

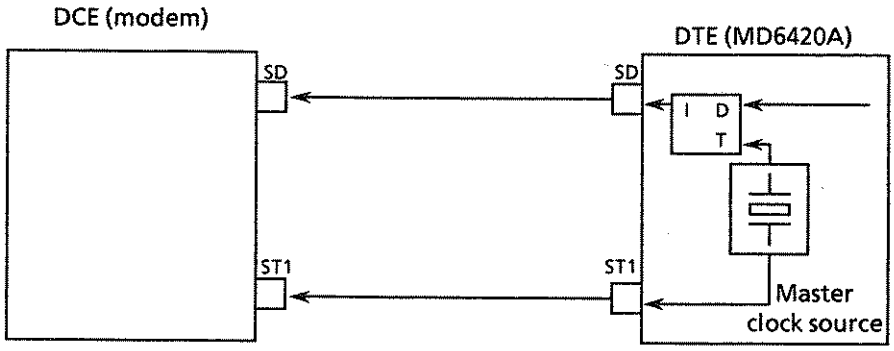


Fig. 6-3 Block-Diagram for ST1 and SD

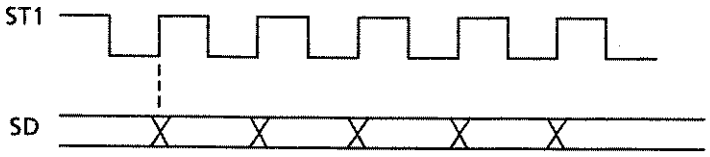


Fig. 6-4 Phase Relationship

6.3.2 The ST2 mode

When the ST2 sync mode is selected, the ST2 clock supplied by the DCE is used as the send timing signal.

Figure 6-5 shows the block diagram for ST2 and SD, while Fig. 6-6 illustrates the phase relationship.

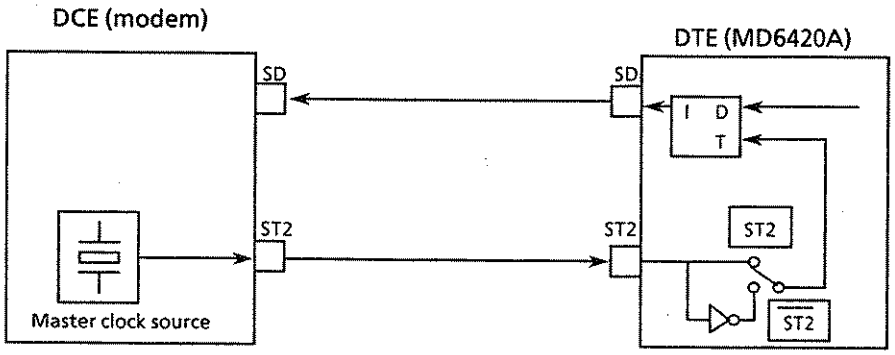


Fig. 6-5 Relationship Between ST2 and SD

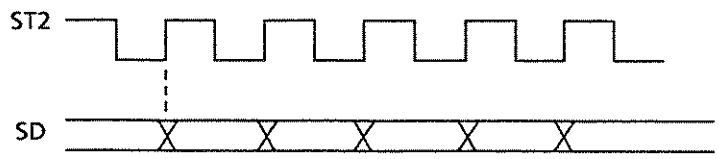


Fig. 6-6 Phase Relationship

6.3.3 The $\overline{ST2}$ mode

When the ST2 mode is set, the inverted ST2 clock is used as the send timing signal.

Figure 6-5 again shows the block diagram for $\overline{ST2}$ and SD while Fig. 6-7 illustrates the phase relationship.

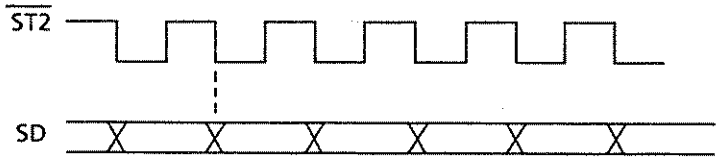


Fig. 6-7 Phase Relationship

6.3.4 The ASYNC mode

When the asynchronous mode is set, the MD6420A internal clock is used for both send and receive timing.

Figure 6-8 shows the block diagram for SD, RD and the master clock source.

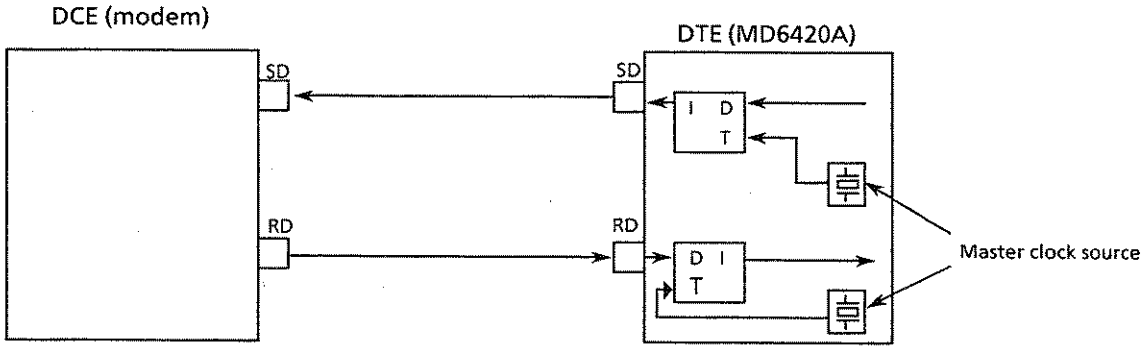


Fig. 6-8 SD, RD and the Master Clock Source Block Diagram

6.3.5 The ST/SP mode

When the start/stop mode is set, the MD6420A internal clock is used as both the send and receive clock.

Figure 6-9 shows the block diagram for SD, RD and the master clock source.

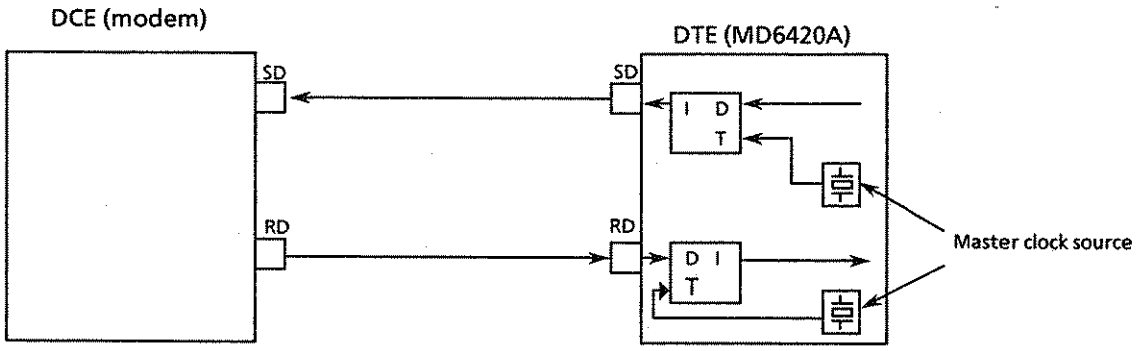


Fig. 6-9 SD, RD and the Master Clock Source Block Diagram

6.3.6 The RT mode

When the RT synchronous mode is used, the RT (receive timing) clock supplied by the DCE is used as the send timing signal.

Figure 6-10 shows the block diagram for RT and SD while Fig. 6-11 shows the phase relationship.

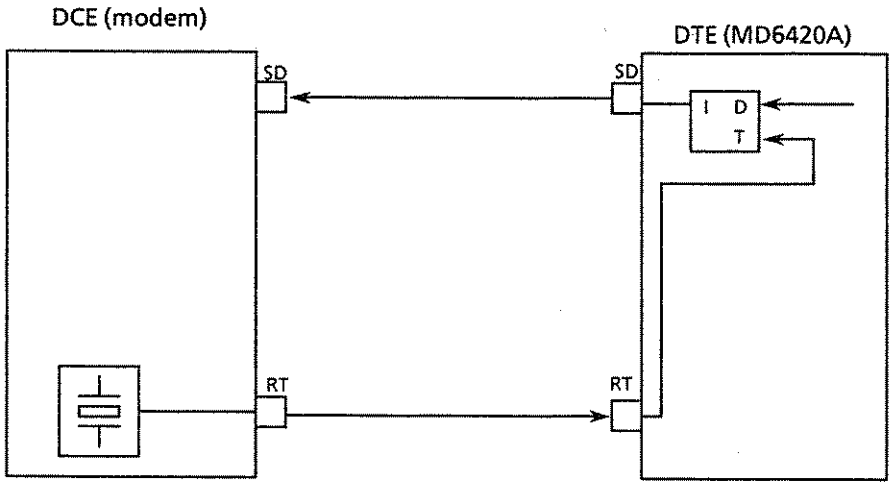


Fig. 6-10

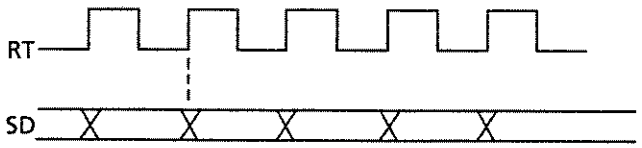


Fig. 6-11

6.4 Receive Timing

6.4.1 The RT mode

When the RT synchronous mode is selected, the RT clock supplied by the DCE is used as the receive timing signal.

Figure 6-12 shows the block diagram for RT and RD while Fig. 6-13 shows the phase relationship.

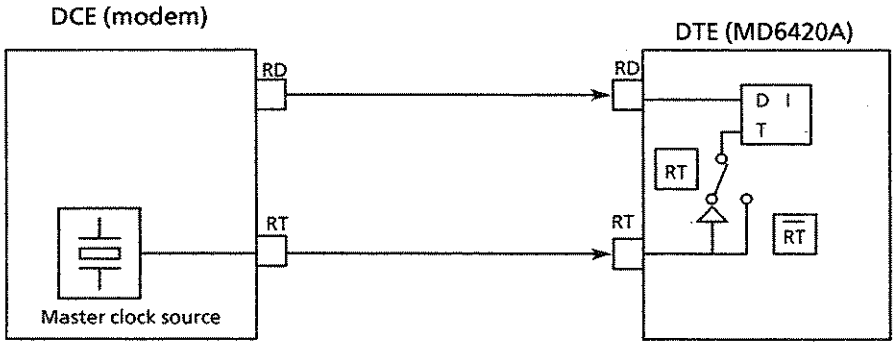
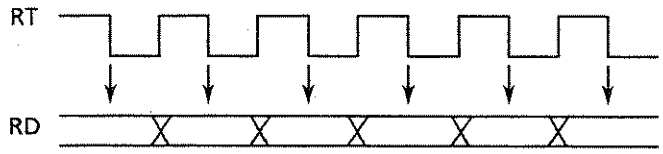


Fig. 6-12 RT and RD Block Diagram



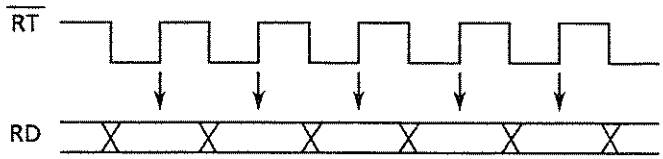
(RD is sampled at those time intervals indicated by the ↓ mark)

Fig. 6-13 Phase Relationship Between RT and RD

6.4.2 The $\overline{RT}$ mode

When the $\overline{RT}$ synchronous mode is set, the inverted $\overline{RT}$ clock is used as the receive timing signal.

Figure 6-12 shows the block diagram for $\overline{RT}$ and RD while Fig. 6-14 shows the phase relationship.



(RD is sampled at those time intervals indicated by the ↓ mark)

Fig. 6-14

6.4.3 The ST mode

When the ST synchronous mode is set, the MD6420A internal clock is used as both the receive and send timing signal.

Figure 6-15 shows the block diagram for ST1, SD, and RD. Figure 6-16 shows the block diagram for ST2, SD, and RD. Figure 6-17 shows the phase relationship between ST, SD, and RD.

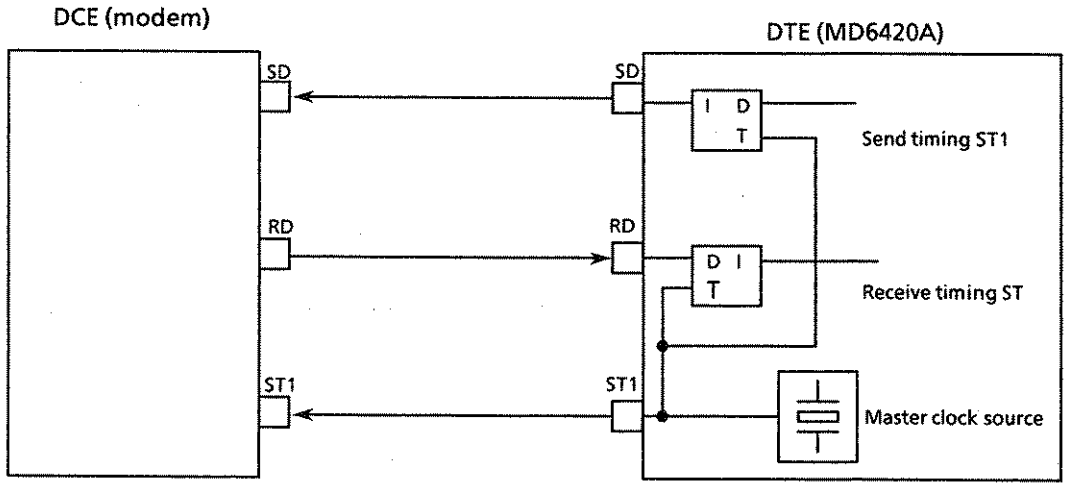


Fig. 6-15 SD and RD Block Diagram

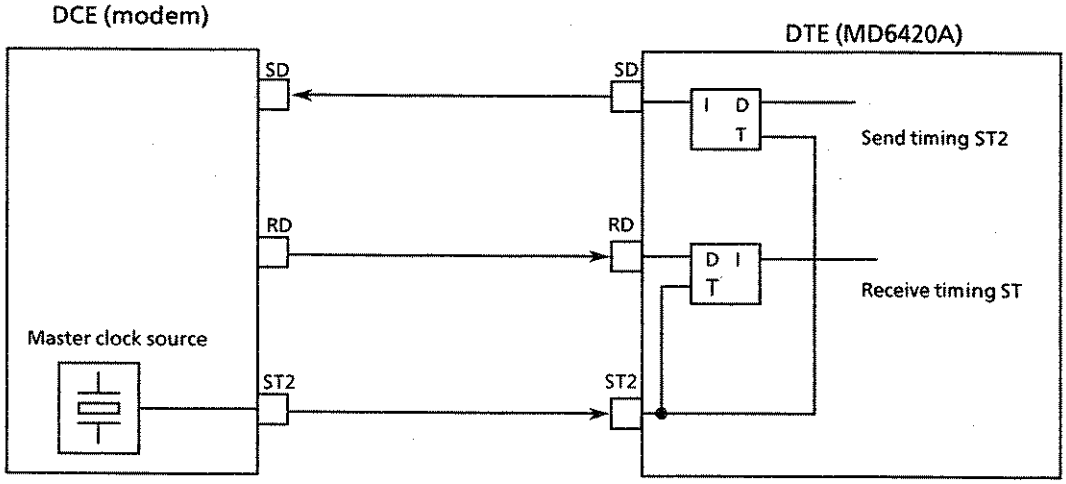
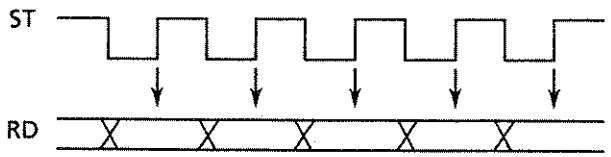


Fig. 6-16 ST2 and SD, RD Block Diagram



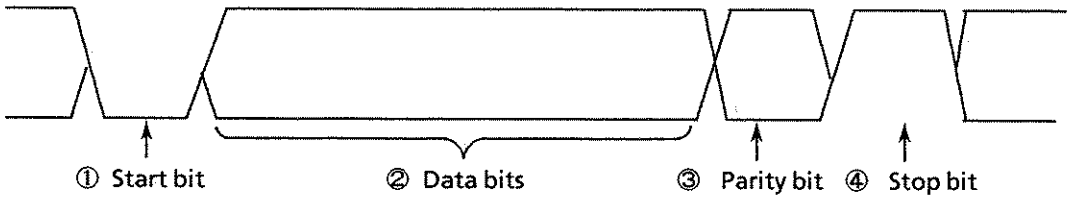
(RD is sampled at the time intervals indicated by the ↓ mark)

Fig. 6-17 Phase Relationship Between ST, SD and RD

6.5 Start/Stop Synchronization

In the synchronous start/stop mode, synchronization is established by inserting date between the start and stop bits.

The figure below shows the format of the bit pattern.



① Start bit

A single 0 bit is inserted at the beginning of each data transmission to indicate the start of data transmission.

② Data bit

A bit length of 5 to 8 bits can be set as the length of the data code.

The codes below correspond to the data bit lengths.

5-bit length ..... Baudot code

6-bit length ..... EBCD code

7-bit length ..... ASCII code

8-bit length ..... EBCDIC code

③ Parity bit

Bit for detecting errors. It can be set to ODD or EVEN polarity or it can be disabled.

④ Stop bit

This bit is added to the end of each transmitted byte. The number of added bits can be set to 1, 1.5 or 2 bits.

6.6 Send Control

This paragraph describes the relationship between signal lines RS and CS when CS-ON is set via the SEND CONTROL interface setting.

The MD6420A RS is a signal line used to request data transfers to the modem. When the RS signal is received, the modem sends the carrier signal to the circuit to which the MD6420A is connected. After the carrier signal output by the modem has stabilized, CS is turned ON.

After CS has been turned ON, the pattern to be measured is sent by the MD6420A to the measuring instrument.

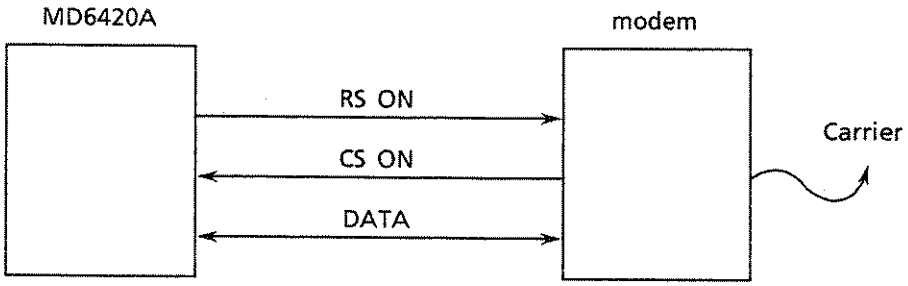


Fig. 6-18 RS and CS ON State

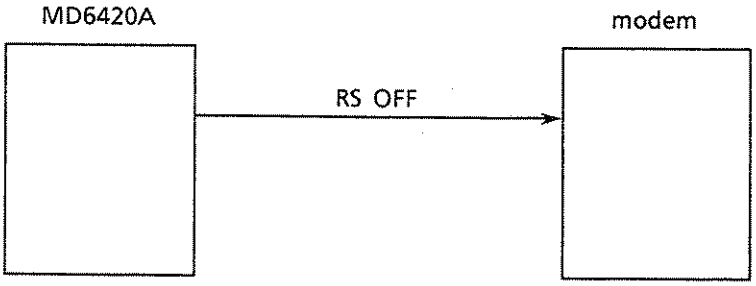


Fig. 6-19 RS OFF State

Note: In the CS-ON mode, the CS signal line of the send unit (V.36 in this case) can be measured. (the CS line of the send unit enters a state in which it can be monitored by an LED.)

6.7 Self Loop Mode

In this mode, output data are looped back as input so that instrument self-checking can be performed.

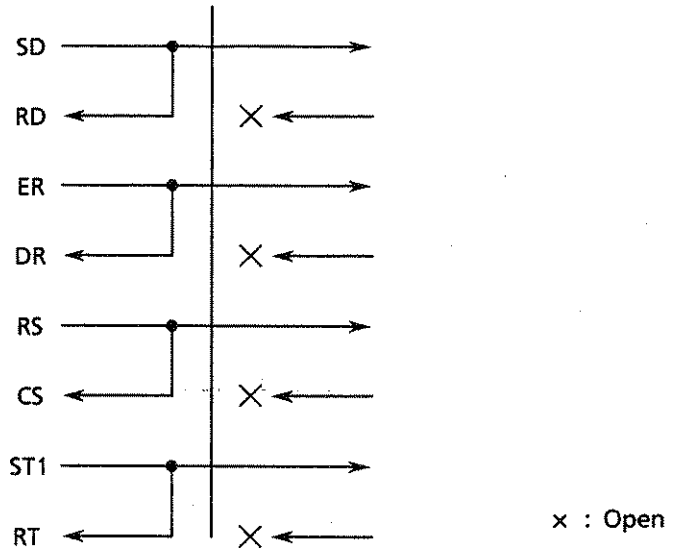
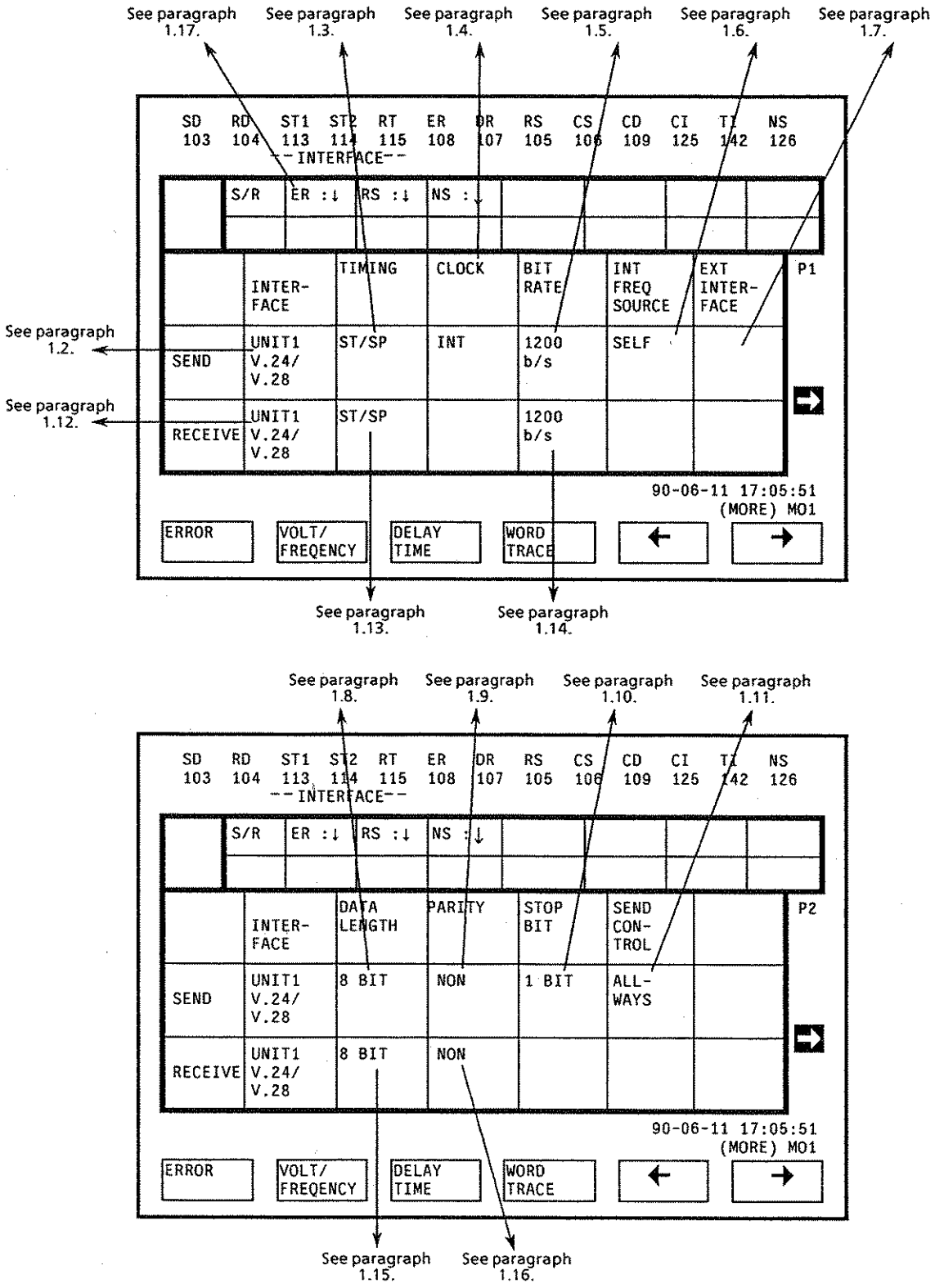


Fig. 6-20 Connections in the Self-Loop Mode

APPENDIX A
MENU REFERENCE
V.24/V.28 INTERFACE UNIT

- If nocursor is displayed ⟶ See paragraph 1.1.



Note: When the send and receive interface units differ, the cursor position changes.

1.1 Menu for function selection

Cursor position	Cursor not displayed	Label	None
Outline	Function selection menu on INTERFACE screen		

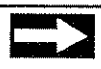
Function key labels and explanations:

ERROR	° When pressed, the ERROR screen is fetched. Error measurement is performed via the ERROR screen.
VOLT/ FREQENC	° When pressed, the VOLT/FREQUENCY screen is fetched. The voltage and frequency of each signal line on the receive side are measured via the VOLT/FREQUENCY screen.
DELAY TIME	° When pressed, the DELAY TIME screen is fetched. The time difference between transitions in the levels of 2 signal lines or the transmission delay time can be measured via the DELAY TIME screen.
WORD TRACE	° When pressed, the WORD TRACE screen is fetched. The send pattern is set and receive data are traced via the WORD TRACE screen.
	° When pressed, the screen scrolls to the left (previous page).
	° When pressed, the screen scrolls to the right (next page).
PRINT OUT	° When pressed, the INTERFACE screen settings are printed.

1.2 Menu for setting the send interface unit conditions

Cursor position	Sets send interface unit conditions	Label	INTER - FACE (SEND)
Outline	Sets the send interface unit conditions		

Function key labels and explanations:

UNIT 1 XXXXXXX	° When pressed, the send interface unit is set to the interface unit inserted in slot 1.
UNIT 2 XXXXXXX	° When pressed, the send interface unit is set to the interface unit inserted in slot 2.
UNIT 3 XXXXXXX	° When pressed, the send interface unit is set to the interface unit inserted in slot 3.
UNIT 4 XXXXXXX	° When pressed, the send interface unit is set to the interface unit inserted in slot 4.
UNIT 5 XXXXXXX	° When pressed, the send interface unit is set to the interface unit inserted in slot 5.
	° When pressed, the screen scrolls to the right (next page).

1.3 Menu for setting generation timing of the send signal

Cursor position	Sets send signal generation timing	Label	TIMING (SEND)
Outline	Sets send signal generation timing		

Function key labels and explanations:

ASYNC	° When pressed, the send signal is generated asynchronously.
ST/SP	° When pressed, the send signal is generated in accordance with ST/SP (Start/Stop).
ST1	° When pressed, the send signal is generated in accordance with the internal clock.
ST2	° When pressed, the send signal is generated in accordance with the ST2 signal.
ST2 (INV)	° When pressed, the send signal is generated in accordance with the inverted ST2 signal.
RT	° When pressed, the send signal is generated in accordance with the RT signal.
	° When pressed, the screen scrolls to the right (next page).

1.4 Menu for type of send signal clock setting

Cursor position	Sets send signal clock	Label	CLOCK (SEND)
Outline	Enables/disables generation of send signal by clock.		

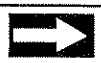
Function key labels and explanations:

INT	° When pressed, the internal clock provides the send clock signal
EXT	° When pressed, the external input clock provides the send clock signal. (Clock input from EXT1 connector)
	° When pressed, the screen scrolls to the right (next page).

1.5 Menu for send internal clock frequency setting

Cursor position	Sets send internal clock frequency	Label	BIT RATE (SEND)
Outline	Sets send internal clock frequency		

Function key labels and explanations:

1200 b/s	° When pressed, the send internal clock frequency is set to the 1200 b/s.
2400 b/s	° When pressed, the send internal clock frequency is set to the 2400 b/s.
4800 b/s	° When pressed, the send internal clock frequency is set to the 4800 b/s.
9600 b/s	° When pressed, the send internal clock frequency is set to the 9600 b/s.
14400 b/s	° When pressed, the send internal clock frequency is set to the 14400 b/s.
19200 b/s	° When pressed, the send internal clock frequency is set to the 19200 b/s.
	° When pressed, the screen scrolls to the right (next page).

◎ Clock frequencies of 50 to 20000 b/s can be set via the DATA MODIFIER key.

1.6 Menu for setting the send internal-clock slave signal

Cursor position	Sets send internal-clock slave signal	Label	INT FREQ SOURCE (SEND)
Outline	Sets the internal clock slave signal		

Function key level and explanations:

SELF	° When pressed, the send internal-clock slave signal is set for internal self oscillation.
EXT1 8k	° When pressed, the send internal-clock slave signal is set to the 8k clock input from EXT1 connector.
EXT2 64 k + 8	° When pressed, the send internal-clock slave signal is set to the 64k + 8k clock input from EXT2 connector.
RD 8k	° When pressed, the send internal-clock slave signal is set to received-signal.
	° When pressed, the screen scrolls to the right (next page).

1.7 Menu for setting the send external-clock input interface

Cursor position	Sets send external-clock input interface	Label	EXT INTER-FACE (SEND)
Outline	Sets the signal convention for send signals input from the EXT1 connector.		

Function key label and explanations:

TTL	° When pressed, the send external-clock input interface uses a TTL signal convention.
75 Ω	° When pressed, the send external-clock input interface uses a since wave (75 Ω) signal convention.
	° When pressed, the screen scrolls to the right (next page).

1.8 Menu for send data length setting

Cursor position	Sets send data length	Label	DATA LENGTH (SEND)
Outline	Sets send data length		

Function key labels and explanations:

5 BIT	° When pressed, the length of the send data byte is set to 5 bits.
6 BIT	° When pressed, the length of the send data byte is set to 6 bits.
7 BIT	° When pressed, the length of the send data byte is set to 7 bits.
8 BIT	° When pressed, the length of the send data byte is set to 8 bits.
	° When pressed, the screen scrolls to the right (next page).

1.9 Menu for setting the parity of the send short-frame pattern

Cursor position	Sets send short-frame pattern parity	Label	PARITY (SEND)
Outline	Sets send short-frame pattern parity		

Function key labels and explanations:

NON	° When pressed, the send short-frame pattern does not use a parity bit.
ODD	° When pressed, the send short-frame pattern parity is set to odd parity.
EVEN	° When pressed, the send short-frame pattern parity is set to even parity.
	° When pressed, the screen scrolls to the right (next page).

1.10 Menu for setting the send data stop bit

Cursor position	Sets type of send data stop bit	Label	STOP BIT (SEND)
Outline	Sets type of send data stop bit		

Function key labels and explanations:

1 BIT	° When pressed, 1 data stop bit is used.
1.5 BIT	° When pressed, 1.5 data stop bits are used.
2 BIT	° When pressed, 2 data stop bits are used.
	° When pressed, the screen scrolls to the right (next page).

1.11 Menu for controlling the send signal

Cursor position	Sets sending of the send signal	Label	SEND CONTROL (SEND)
Outline	Controls sending of the send signal		

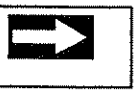
Function key labels and explanations:

ALLWAYS	° When pressed, the send signal is continuously sent.
C-ON	° When pressed, the send signal is sent only when the C signal is ON.
	° When pressed, the screen scrolls to the right (next page).

1.12 Menu for setting the receive interface unit condition

Cursor position	Sets receive interface unit	Label	INTER-FACE (RECEIVE)
Outline	Sets the receive interface unit condition		

Function key labels and explanations:

UNIT 1 XXXXXXX	° When pressed, the receive interface unit is set to the interface unit inserted in slot 1.
UNIT 2 XXXXXXX	° When pressed, the receive interface unit is set to the interface unit inserted in slot 2.
UNIT 3 XXXXXXX	° When pressed, the receive interface unit is set to the interface unit inserted in slot 3.
UNIT 4 XXXXXXX	° When pressed, the receive interface unit is set to the interface unit inserted in slot 4.
UNIT 5 XXXXXXX	° When pressed, the receive interface unit is set to the interface unit inserted in slot 5.
SAME	° When pressed, the same receive and send interface conditions are set.
SELF LOOP	° When pressed, the receive interface unit is set to the SELF LOOP mode.
	° When pressed, the screen scrolls to the right (next page).

1.13 Menu for setting generation timing of the receive signal

Cursor position	Sets receive signal generation timing	Label	TIMING (RECEIVE)
Outline	Sets receive signal generation timing		

Function key labels and explanations:

ASYNC	° When pressed, the receive signal is generated asynchronously.
ST/SP	° When pressed, the receive signal is generated in accordance with ST/SP (Start/Stop).
ST	° When pressed, the receive signal is generated in accordance with the internal clock.
RT	° When pressed, the receive signal is generated in accordance with the RT signal.
RT (INV)	° When pressed, the receive signal is generated in accordance with the inverted RT signal.
	° When pressed, the screen scrolls to the right (next page).

1.14 Menu for setting the receive internal clock frequency

Cursor position	Sets receive internal clock frequency	Label	BIT RATE (RECEIVE)
Outline	Sets receive internal clock frequency		

Function key labels and explanations:

1200 b/s	° When pressed, the receive internal clock frequency is set to 1200 b/s.
2400 b/s	° When pressed, the receive internal clock frequency is set to 2400 b/s.
4800 b/s	° When pressed, the receive internal clock frequency is set to 4800 b/s.
9600 b/s	° When pressed, the receive internal clock frequency is set to 9600 b/s.
14400 b/s	° When pressed, the receive internal clock frequency is set to 14400 b/s.
19200 b/s	° When pressed, the receive internal clock frequency is set to 19200 b/s.
	° When pressed, the screen scrolls to the right (next page).

◎ Clock frequencies of 50 to 19200 b/s can be set via the DATA MODIFIER key.

1.15 Menu for setting the byte length of the receive data

Cursor position	Sets receive data length	Label	DATA LENGTH (RECEIVE)
Outline	Sets the receive data length		

Function key labels and explanations:

5 BIT	° When pressed, the length of the receive data byte is set to 5 bits.
6 BIT	° When pressed, the length of the receive data byte is set to 6 bits.
7 BIT	° When pressed, the length of the receive data byte is set to 7 bits.
8 BIT	° When pressed, the length of the receive data byte is set to 8 bits.
	° When pressed, the screen scrolls to the right (next page).

1.16 Menu for setting the parity of the receive short-frame pattern

Cursor position	Sets receive short-frame pattern parity	Label	PARITY (RECEIVE)
Outline	Sets the receive short-frame pattern parity		

Function key labels and explanations:

NON	° When pressed, the receive short-frame pattern parity does not use a parity bit.
ODD	° When pressed, the receive short-frame pattern parity is set to odd parity.
EVEN	° When pressed, the receive short-frame pattern parity is set to even parity.
	° When pressed, the screen scrolls to the right (next page).

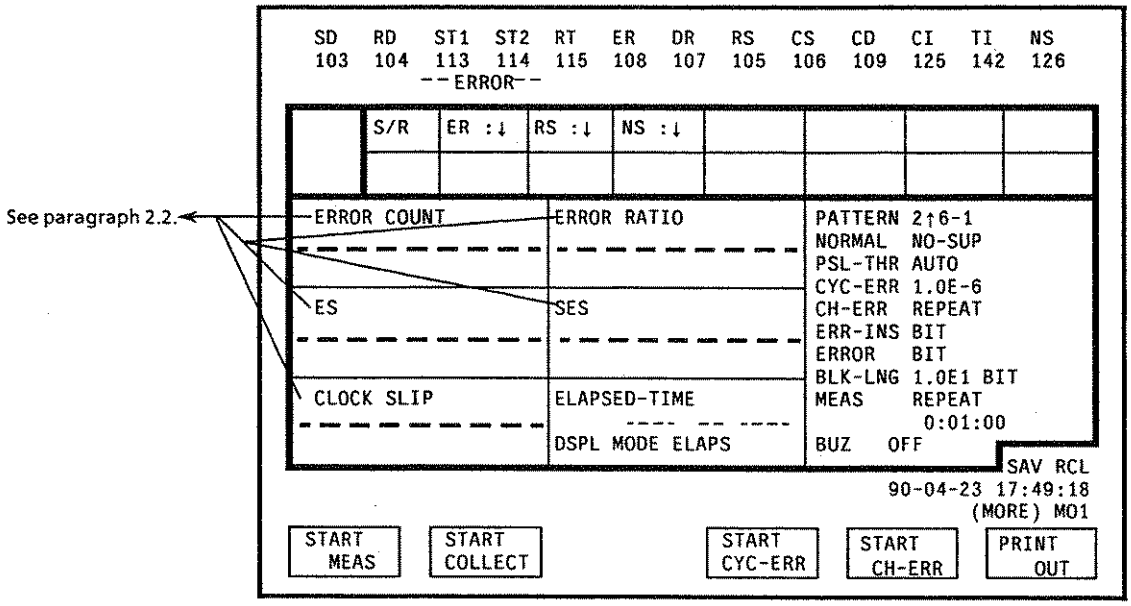
1.17 Menu for setting the signal-line

Cursor position	Sets signal-line contents	Label	EACH SIGNAL LINE
Outline	Sets/resets the signal-line		

Function key labels and explanations:

↑ (ON)	° When pressed, the signal-line is set to ON.
↓ (OFF)	° When pressed, the signal-line is set to OFF.
(OPEN)	° When pressed, the signal-line is set to OPEN.

- If no cursor is displayed ⟶ See paragraph 2.1.



2.1 Menu for function selection

Cursor position	Cursor off	Label	None
Outline	Menu for selecting ERROR screen functions		

Function key labels and explanations:

- The menu displayed on page 3 (MO3) is shown below:

SEND-ER ON/OFF	° The send signal line (ER) ON/OFF key is displayed when the send and receive interfaces are different. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
RECV-ER ON/OFF	° The receive signal line (AIS) ON/OFF key is displayed when the send and receive interfaces are different. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
ER ON/OFF	° The signal line (ER) ON/OFF menu is displayed when the send and receive interfaces are the same. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
SEND-RS ON/OFF	° The send signal line (RS) ON/OFF key is displayed when the send and receive interfaces are different. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
RECV-RS ON/OFF	° The receive signal line (RS) ON/OFF key is displayed when the send and receive interfaces are different. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
RS ON/OFF	° The send signal line (RS) ON/OFF key is displayed when the send and receive interfaces are the same. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
SEND-NS ON/OFF	° The send signal line (NS) ON/OFF key is displayed when the send and receive interfaces are different. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
RECV-NS ON/OFF	° The receive signal line (NS) ON/OFF key is displayed when the send and receive interfaces are different. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
NS ON/OFF	° The signal line (NS) ON/OFF menu is displayed when the send and receive interfaces are the same. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.

2.2 Menu for selecting measured-results to be displayed

Cursor position	Sets measured-results item	Label	None
Outline	Sets the measured-results to be displayed		

Function key labels and explanations:

- The menu displayed on page 4 (MO4) is shown below:

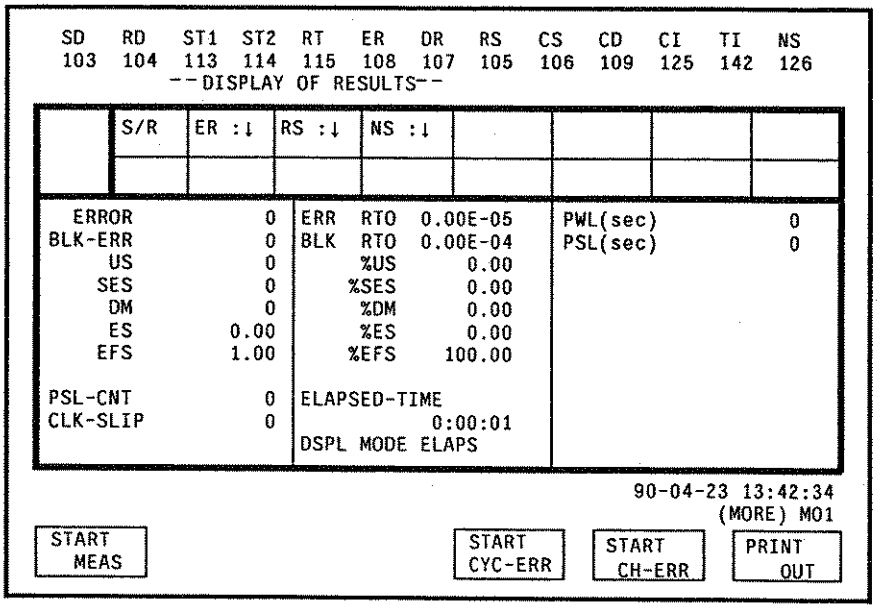
PWL(sec)

- When pressed, the PWL (sec) measured-result is displayed.

PSL(sec)

- When pressed, the PSL (sec) measured-result is displayed.

- If no cursor is displayed ⟶ See paragraph 3.1.



3.1 Menu for function selection

Cursor position	Cursor off	Label	None
Outline	Menu for selecting display items for DISPLAY OF RESULTS screen		

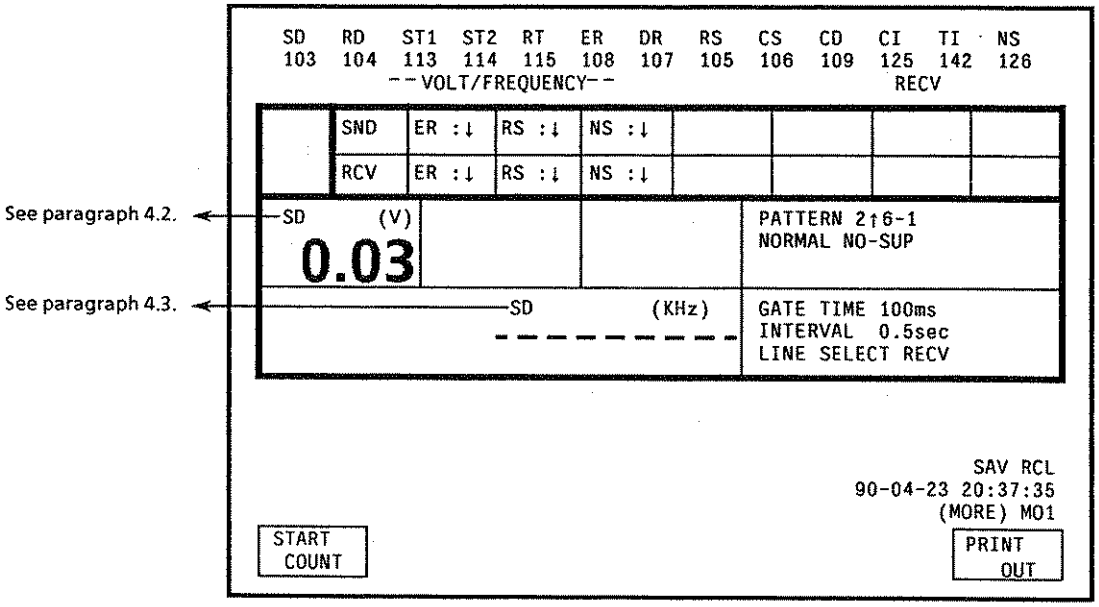
Function key labels and explanations:

- The menu displayed on page 2 (MO2) is shown below:

SEND-ER ON/OFF	° The send signal line (ER) ON/OFF key is displayed when the send and receive interfaces are different. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
RECV-ER ON/OFF	° The receive signal line (ER) ON/OFF key is displayed when the send and receive interfaces are different. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
ER ON/OFF	° The signal line (SA) ON/OFF menu is displayed when the send and receive interfaces are the same. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
SEND-RS ON/OFF	° The send signal line (RS) ON/OFF key is displayed when the send and receive interfaces are different. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
RECV-RS ON/OFF	° The receive signal line (RS) ON/OFF key is displayed when the send and receive interfaces are different. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
RS ON/OFF	° The signal line (RS) ON/OFF key is displayed when the send and receive interfaces are the same. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
SEND-NS ON/OFF	° The send signal line (NS) ON/OFF key is displayed when the send and receive interfaces are different. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
RECV-NS ON/OFF	° The receive signal line (NS) ON/OFF key is displayed when the send and receive interfaces are different. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
NS ON/OFF	° The signal line (NS) ON/OFF key is displayed when the send and receive interfaces are the same. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.

4 VOLT/FREQUENCY Screen

- If no Cursor is displayed ——→ See paragraph 4.1.



4.1 Menu for function selection

Cursor position	Cursor off	Label	None
Outline	VOLT/FREQUENCY screen functions selection menu		

Function key labels and explanations:

- The menu displayed on page 2 (MO2) is shown below:

SEND-ER ON/OFF	° The send signal line (ER) ON/OFF key is displayed when the send and receive interfaces are different. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
RECV-ER ON/OFF	° The receive signal line (ER) ON/OFF key is displayed when the send and receive interfaces are different. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
ER ON/OFF	° The signal line (ER) ON/OFF key is displayed when the send and receive interfaces are the same. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
SEND-RS ON/OFF	° The send signal line (RS) ON/OFF key is displayed when the send and receive interfaces are different. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
RECV-RS ON/OFF	° The receive signal line (RS) ON/OFF key is displayed when the send and receive interfaces are different. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
RS ON/OFF	° The signal line (RS) ON/OFF key is displayed when the send and receive interfaces are the same. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
SEND-NS ON/OFF	° The send signal line (NS) ON/OFF key is displayed when the send and receive interfaces are different. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
RECV-NS ON/OFF	° The receive signal line (NS) ON/OFF key is displayed when the send and receive interfaces are different. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
NS ON/OFF	° The signal line (NS) ON/OFF key is displayed when the send and receive interfaces are the same. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.

4.2 Menu for selecting signal-Line for voltage measurement

Cursor position	Selects voltage-measurement signal line	Label	None
Outline	Selects the voltage-measurement signal line		

Function key labels and explanations:

SD	° SD is selected as the voltage-measurement signal line.
RD	° RD is selected as the voltage-measurement signal line.
ST1	° ST1 is selected as the voltage-measurement signal line.
ST2	° ST2 is selected as the voltage-measurement signal line.
RT	° RT is selected as the voltage-measurement signal line.
ER	° ER is selected as the voltage-measurement signal line.
DR	° DR is selected as the voltage-measurement signal line.
RS	° RS is selected as the voltage-measurement signal line.
CS	° CS is selected as the voltage-measurement signal line.
CD	° CD is selected as the voltage-measurement signal line.
CI	° CI is selected as the voltage-measurement signal line.
TI	° TI is selected as the voltage-measurement signal line.
NS	° NS is selected as the voltage-measurement signal line.

4.3 Menu for selecting the signal-line for frequency measurement

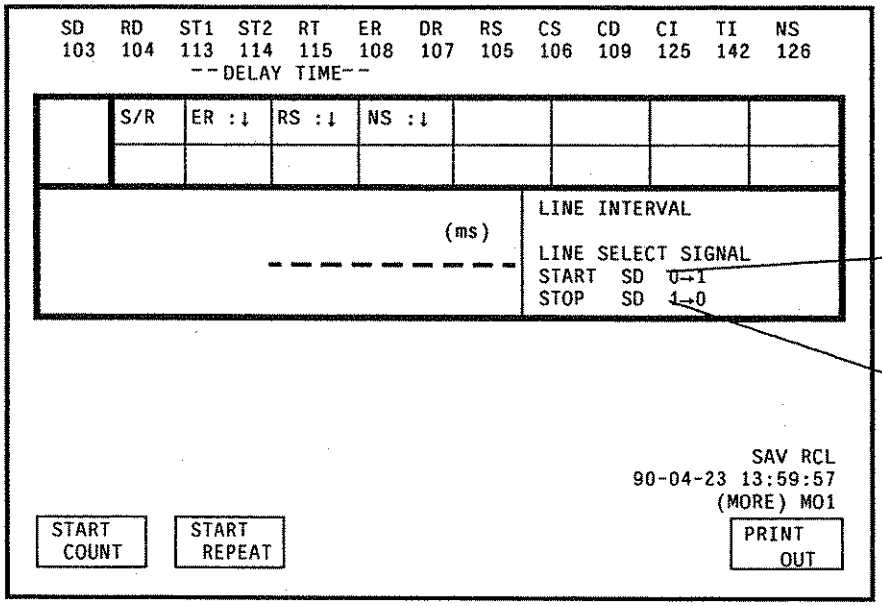
Cursor position	Selects frequency-measurement signal line	Label	None
Outline	Selects the frequency-measurement signal line		

Function key labels and explanations:

SD	° SD is selected as the frequency-measurement signal line.
RD	° RD is selected as the frequency-measurement signal line.
ST1	° ST1 is selected as the frequency-measurement signal line.
ST2	° ST2 is selected as the frequency-measurement signal line.
RT	° RT is selected as the frequency-measurement signal line.
ER	° ER is selected as the frequency-measurement signal line.
DR	° DR is selected as the frequency-measurement signal line.
RS	° RS is selected as the frequency-measurement signal line.
CS	° CS is selected as the frequency-measurement signal line.
CD	° CD is selected as the frequency-measurement signal line.
CI	° CI is selected as the frequency-measurement signal line.
TI	° TI is selected as the frequency-measurement signal line.
NS	° NS is selected as the frequency-measurement signal line.

5 DELAY TIME Screen

- If no cursor is displayed ⟶ See paragraph 5.1.



See paragraph 5.2.

See paragraph 5.3.

5.1 Menu for function selection

Cursor position	Cursor off	Label	None
Outline	DELAY TIME screen functions selection menu		

Function key labels and explanations:

- The menu displayed on page 2 (MO2) is shown below:

SEND-ER ON/OFF	° The send signal line (ER) ON/OFF key is displayed when the send and receive interfaces are different. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
RECV-ER ON/OFF	° The receive signal line (ER) ON/OFF key is displayed when the send and receive interfaces are different. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
ER ON/OFF	° The signal line (ER) ON/OFF key is displayed when the send and receive interfaces are the same. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
SEND-RS ON/OFF	° The send signal line (RS) ON/OFF key is displayed when the send and receive interfaces are different. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
RECV-RS ON/OFF	° The receive signal line (RS) ON/OFF key is displayed when the send and receive interfaces are different. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
RS ON/OFF	° The signal line (RS) ON/OFF menu is displayed when the send and receive interfaces are the same. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
SEND-NS ON/OFF	° The send signal line (NS) ON/OFF key is displayed when the send and receive interfaces are different. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
RECV-NS ON/OFF	° The receive signal line (NS) ON/OFF key is displayed when the send and receive interfaces are different. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
NS ON/OFF	° The signal line (NS) ON/OFF menu is displayed when the send and receive interfaces are the same. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.

5.2 Menu for identifying the signal line to be used as the start trigger in line-transition delay measurements

Cursor position	Selects the signal line to be used as the start-trigger when measuring the time difference between signal transitions.	Label	START
Outline	Selects the signal line to be used as the start-trigger when measuring the time difference between signal transitions.		

Function key labels and explanations:

SD	° When pressed, SD is selected as the signal line to be used as the start-trigger when measuring the time difference between signal transitions.
RD	° When pressed, RD is selected as the signal line to be used as the start-trigger when measuring the time difference between signal transitions.
ST1	° When pressed, ST1 is selected as the signal line to be used as the start-trigger when measuring the time difference between signal transitions.
ST2	° When pressed, ST2 is selected as the signal line to be used as the start-trigger when measuring the time difference between signal transitions.
RT	° When pressed, RT is selected as the signal line to be used as the start-trigger when measuring the time difference between signal transitions.
ER	° When pressed, ER is selected as the signal line to be used as the start-trigger when measuring the time difference between signal transitions.
DR	° When pressed, DR is selected as the signal line to be used as the start-trigger when measuring the time difference between signal transitions.
RS	° When pressed, RS is selected as the signal line to be used as the start-trigger when measuring the time difference between signal transitions.
CS	° When pressed, CS is selected as the signal line to be used as the start-trigger when measuring the time difference between signal transitions.
CD	° When pressed, CD is selected as the signal line to be used as the start-trigger when measuring the time difference between signal transitions.
CI	° When pressed, CI is selected as the signal line to be used as the start-trigger when measuring the time difference between signal transitions.
TI	° When pressed, TI is selected as the signal line to be used as the start-trigger when measuring the time difference between signal transitions.
NS	° When pressed, NS is selected as the signal line to be used as the start-trigger when measuring the time difference between signal transitions.

5.3 Menu for identifying the signal line to be used as the stop trigger in line transition delay measurements

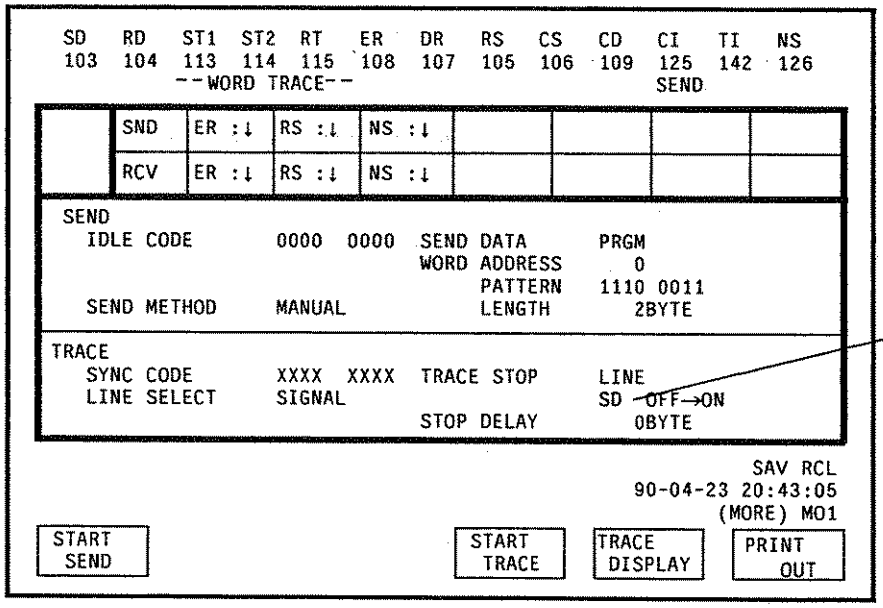
Cursor position	Selects the signal line to be used as the stop trigger in signal line transition measurements	Label	STOP
Outline	Selects the signal line to be used as the stop trigger when measuring the time difference between signal transitions.		

Function key labels and explanations:

SD	° When pressed, SD is selected as the signal line to be used as the stop trigger when measuring the time difference between signal transitions.
RD	° When pressed, RD is selected as the signal line to be used as the stop trigger when measuring the time difference between signal transitions.
ST1	° When pressed, ST1 is selected as the signal line to be used as the stop trigger when measuring the time difference between signal transitions.
ST2	° When pressed, ST2 is selected as the signal line to be used as the stop trigger when measuring the time difference between signal transitions.
RT	° When pressed, RT is selected as the signal line to be used as the stop trigger when measuring the time difference between signal transitions.
ER	° When pressed, ER is selected as the signal line to be used as the stop trigger when measuring the time difference between signal transitions.
DR	° When pressed, DR is selected as the signal line to be used as the stop trigger when measuring the time difference between signal transitions.
RS	° When pressed, RS is selected as the signal line to be used as the stop trigger when measuring the time difference between signal transitions.
CS	° When pressed, CS is selected as the signal line to be used as the stop trigger when measuring the time difference between signal transitions.
CD	° When pressed, CD is selected as the signal line to be used as the stop trigger when measuring the time difference between signal transitions.
CI	° When pressed, CI is selected as the signal line to be used as the stop trigger when measuring the time difference between signal transitions.
TI	° When pressed, TI is selected as the signal line to be used as the stop trigger when measuring the time difference between signal transitions.
NS	° When pressed, NS is selected as the signal line to be used as the stop trigger when measuring the time difference between signal transitions.

6 WORD TRACE Screen

- If no cursor is displayed ⟶ See paragraph 6.1.



See paragraph 6.2

6.1 Menu for function selection

Cursor position	Cursor off	Label	None
Outline	WORD TRACE screen functions selection menu		

Function key labels and explanations:

- The menu displayed on page 2 (MO2) is shown below:

SEND-ER ON/OFF	° When pressed, the send signal line (ER) ON/OFF menu is displayed when the send and receive interfaces are different. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
RECV-ER ON/OFF	° When pressed, the receive signal line (ER) ON/OFF menu is displayed when the send and receive interfaces are different. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
ER ON/OFF	° When pressed, the signal line (ER) ON/OFF menu is displayed when the send and receive interfaces are the same. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
SEND-RS ON/OFF	° When pressed, the send signal line (RS) ON/OFF menu is displayed when the send and receive interfaces are different. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
RECV-RS ON/OFF	° When pressed, the receive signal line (RS) ON/OFF menu is displayed when the send and receive interfaces are different. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
RS ON/OFF	° When pressed, the signal line (RS) ON/OFF menu is displayed when the send and receive interfaces are the same. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
SEND-NS ON/OFF	° When pressed, the send signal line (NS) ON/OFF menu is displayed when the send and receive interfaces are different. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
RECV-NS ON/OFF	° When pressed, the receive signal line (NS) ON/OFF menu is displayed when the send and receive interfaces are different. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.
NS ON/OFF	° When pressed, the signal line (NS) ON/OFF menu is displayed when the send and receive interfaces are the same. This key is toggled. When it is pressed, if it is ON, it is turned OFF and if it is OFF, it is turned ON.

6.2 Menu for setting the signal line to be used as the trace-stop trigger

Cursor position	Sets TRACE STOP to LINE and moves to next item.	Label	None
Outline	Sets the trace stop trigger signal line		

Function key label and explanations:

SD	° When pressed, SD is set as the trace-stop trigger signal line
RD	° When pressed, RD is set as the trace-stop trigger signal line
ST1	° When pressed, ST1 is set as the trace-stop trigger signal line
ST2	° When pressed, ST2 is set as the trace-stop trigger signal line
RT	° When pressed, RT is set as the trace-stop trigger signal line
ER	° When pressed, ER is set as the trace-stop trigger signal line
DR	° When pressed, DR is set as the trace-stop trigger signal line
RS	° When pressed, RS is set as the trace-stop trigger signal line
CS	° When pressed, CS is set as the trace-stop trigger signal line
CD	° When pressed, CD is set as the trace-stop trigger signal line
CI	° When pressed, CI is set as the trace-stop trigger signal line
TI	° When pressed, TI is set as the trace-stop trigger signal line
NS	° When pressed, NS is set as the trace-stop trigger signal line

APPENDIX B
COMMAND DEFERENCE
EXTERNAL CONTROLLER

SUT	INTERFACE screen	

Sets insert unit No. (send)

Format	SUT n	Parameter range	0 to 5

< Details >

Switches the send insert unit.

n :	Unir No.
0	THROUGH
1	Unit No. 1
2	Unit No. 2
3	Unit No. 3
4	Unit No. 4
5	Unit No. 5

SUN	INTERFACE screen	

Sets send interface unit conditions

Format	SUN n	Parameter range	0 to 14

< Details >

Specifies the send interface unit.

When the type of interface unit is specified, the slot No. in which this interface unit is inserted will be read automatically.

SMD	INTERFACE screen	

Sets send signal generation timing

Format	SMD n	Parometer Range	0, 3, 4, 5, 6, 7

<Details>

Selects the method to be used to generate the send signal.

n :	Signal generation timing method
0	ST1
3	ST2
4	ST2 (INV)
5	ASYNC
6	ST/SP
7	RT

Note: Set the send and receive timing parameters for DCE/DTE connections in the following order:

	DTE send	Send timing	Receive timing
TO DCE	ST1	ST1	RT
	ST2	ST2	RT
TO DTE	ST1	ST1	RT
	ST2	ST1	ST

SCK	INTERFACE screen	

Sets the type of send signal clock

Format	SCK n	Parameter range	0 to 1

< Details >

Switches the send signal clock.

n :	Clock
0	INTERNAL
1	EXTERNAL

Note: This can be set only when the send signal is generated in the ASYNC, ST/SP on ST1 modes.

SBR	INTERFACE screen	

Sets the send frequency for the internal clock

Format	SBR n	Parameter range	50 to 20000

< Details >

Sets the send frequency for the internal clock.

- The frequency can be set from 50 to 20000 Hz.

Note: This can be used to set only the send frequency of the INTERNAL clock.

IFS	INTERFACE screen	

Sets the source to which the internal-clock send signal is to be slave-synchronized

Format	IFS n	Parameter range	0 to 3

< Details >

Switches the frequency source used for slave synchronization.

n :	Frequency source
0	SELF
1	EXT1 8k
2	EXT2 64k + 8k
3	RD 8k

Note: This can be set only when an INTERNAL send signal clock is used.

EI	INTERFACE screen	

Sets the type of send external-clock input interface

Format	EI n	Parameter range	0, 1

< Details >

Switches the type of send external-clock input interface.

n :	Type of external-clock input signal
0	TTL
1	75 Ω

Note: This can be set only when an EXTERNAL send signal clock is used.

SDL	INTERFACE screen	

Sets length of send data byte

Format	SDL n	Parameter range	5 to 8

< Details >

Sets the length of the send data byte.

n :	
5	5BIT
6	6BIT
7	7BIT
8	8BIT

Note: This can be set only when ST/SP is used to generate the send signal.

SPR	INTERFACE screen	

Sets send short-frame pattern parity

Format	SPR n	Parameter range	0 to 2

< Details >

Switches the send short-frame pattern parity.

n :	Parity
0	NON
1	ODD
2	EVEN

Note: This can be set only when the send signal is generated by the ST/SP signal.

SSP	INTERFACE screen	

Sets the number of send data stop bits

Format	SSP n	Parameter range	0 to 2

< Details >

Sets the number of send data stop bits.

n :	Number of stop bits
0	1BIT
1	1.5BIT
2	2BIT

Note: This can be set only when the send signal is generated by ST/SP signal.

CT	INTERFACE screen	

Controls the send signal

Format	CT n	Parameter range	0, 1

< Details >

Selects the conditions under which the send signal is sent.

n :	Send control mode
0	ALWAYS
1	CS-ON only

RUT	INTERFACE screen	

Specifies the unit No. to be used for receiving

Format	RUT n	Parameter range	0 to 5, 16

< Details >

Selects the unit to be used for receiving

n	0	:	Slot number into which the unit to be used for receiving is inserted
	1	:	Unit No.1
	2	:	Unit No.2
	3	:	Unit No.3
	4	:	Unit No.4
	5	:	Unit No.5
	16	:	SELP LOOP

RUN	INTERFACE screen	

Sets receive interface unit conditions

Format	RUT n	Parameter range	0 to 14, 255

< Details >

Specifies the receive interface unit.

When the No. of the interface unit is specified, the slot No. is read automatically.

RMD	INTERFACE screen	

Sets generation timing for the receive signal

Format	RMD n	Parometer Range	0, 3, 4, 5, 6

<Details>

Selects the method or signal to be used to generate the receive signal.

n	:	Signal generation timing
0		ST
3		RT
4		RT (INV)
5		ASYNC
6		ST/SP

RBR	INTERFACE screen	

Sets the receive frequency of the internal clock

Format	RBR n	Parameter range	50 to 19200

< Details >

The receive frequency.

- n can be set from 50 to 20000 Hz.

Note: • This can be set to set the frequency of the receive signal only when the ST/SP mode is used.

- The receive frequency of the internal clock can be set to any one of the following values.

No.	Item	No.	Item
	50 b/s 75 b/s 100 b/s 110 b/s 150 b/s 200 b/s 256 b/s 300 b/s 400 b/s 500 b/s 512 b/s 600 b/s 768 b/s 800 b/s		1000 b/s 1200 b/s 1600 b/s 1800 b/s 2000 b/s 2400 b/s 2560 b/s 3000 b/s 3600 b/s 4800 b/s 7200 b/s 9600 b/s 14400 b/s 19200 b/s

RDL	INTERFACE screen	

Sets the receive data length

Format	RDL n	Parameter range	5 to 8

< Details >

Sets the length of the receive data byte.

n :	Length of receive data byte
5	5BIT
6	6BIT
7	7BIT
8	8BIT

Note: This can only be used to set the length of the receive data byte only when the ST/SP mode is used.

RPR	INTERFACE screen	

Sets the parity of the receive data slave signal

Format	RPR n	Parameter range	0 to 2

< Details >

Sets the parity of the receive data slave signal.

n :	Parity
0	NON
1	ODD
2	EVEN

Note: This can only be used to set the parity of the receive signal when ST/SP mode is used.

MSL	INTERFACE screen	

Selects the line to be monitored

Format	MSL n	Parameter range	0 to 4

< Details >

Displays the status of the signal lines.

n :	Status
0	Send signal status
1	Receive signal status
2	Receive data status
3	Send alarm status
4	Receive alarm status

SCT	INTERFACE screen	

Sets the signal line to be monitored

Format	SCT n, m	Parameter range	n: 5, 7, 12 m: 0, 1, 2

< Details >

Switches the status of the control signal while monitoring is in progress.

n : Signal line No.

m : 0 OFF, 1 ON, 2 OPEN

※ The contents of the signal line are shown below:

Contents \ Parameter	5	7	12
V.24 / V.28	ER	RS	NS

Note: When the send interface condition is THROUGH, m: 2 (THROUGH) can be set for SA and XA only.

SCS	INTERFACE screen	

Sets the send signal line

Format	SCS n, m	Parameter range	n: 5, 7, 12 m: 0, 1, 2

< Details >

Swithes the status of the send control signal.

n : Signal line No.

m : 0 OFF, 1 ON, 2 OPEN

※ The allowable values for the signal line are shown below:

Contents \ Parameter	5	7	12
V.24 / V.28	ER	RS	NS

SCR	INTERFACE screen	

Sets the receive signal line

Format	SCR n, m	Parameter range	n: 5, 7, 12 m: 0, 1, 2

< Details >

Swithes the status of the receive control signal.

n : Signal line No.

m : 0 OFF, 1 ON, 2 OPEN

※ The allowable values of the signal line are shown below:

Contents \ Parameter	5	7	12
V.24 / V.28	ER	RS	NS

DSA	ERROR screen	

Selects measured result to be displayed in the top-left corner

Format	DSA n	Parameter range	0 to 11, 15 to 24

<Details>

Specifies the area in which ERROR-screen results are displayed.

n : Specifies item for each display field

Command	DSA	DSB	DSC	DSD	DSE
Display position	Top left side	Top right side	Middle left side	Middle right side	Bottom left side

: Displayed contents

	0	1	2	3	4	5	6
Display contents	ERROR COUNT	ERROR RATIO	BLK-ERR COUNT	BLK-ERR RATIO	ES	%ES	DM

	7	8	9	10	11	12	13
Display contents	% DM	SES	% SES	US	% US		

	14	15	16	17	18	19	20
Display contents		EFS	% EFS	CLOCK SLIP	PSC COUNT	PWL (sec)	PSL (sec)

	21	22	23	24	25	26	27
Display contents							

	28	29	30	31	32	33	34
Display contents							

DSB	ERROR screen	

Selects result to be displayed on top right side

Format	DSB n	Parameter range	0 to 11, 15 to 20

<Details>

Specifies the results to be displayed on the ERROR-screen.

n : Specifies the item to be displayed in each field.

Command	DSA	DSB	DSC	DSD	DSE
Display position	Top left side	Top right side	Middle left side	Middle right side	Bottom left side

: Display contents

	0	1	2	3	4	5	6
Display contents	ERROR COUNT	ERROR RATIO	BLK-ERR COUNT	BLK-ERR RATIO	ES	%ES	DM

	7	8	9	10	11	12	13
Display contents	% DM	SES	% SES	US	% US		

	14	15	16	17	18	19	20
Display contents		EFS	% EFS	CLOCK SLIP	PSC COUNT	PWL (sec)	PSL (sec)

	21	22	23	24	25	26	27
Display contents							

	28	29	30	31	32	33	34
Display contents							

DSC	ERROR screen	

Selects measured result to be displayed at middle left side

Format	DSC n	Parameter range	0 to 11, 15 to 20

<Details>

Specifies the results to be displayed on the ERROR-screen.

n : Specifies item to be displayed in each field.

Command	DSA	DSB	DSC	DSD	DSE
Display position	Top left side	Top right side	Middle left side	Middle right side	Bottom left side

: Display contents

	0	1	2	3	4	5	6
Display contents	ERROR COUNT	ERROR RATIO	BLK-ERR COUNT	BLK-ERR RATIO	ES	%ES	DM

	7	8	9	10	11	12	13
Display contents	% DM	SES	% SES	US	% US		

	14	15	16	17	18	19	20
Display contents		EFS	% EFS	CLOCK SLIP	PSC COUNT	PWL (sec)	PSL (sec)

	21	22	23	24	25	26	27
Display contents							

	28	29	30	31	32	33	34
Display contents							

DSD	ERROR screen	

Selects the measured result to be displayed at the middle right

Format	DSD n	Parameter range	0 to 11, 15 to 20

<Details>

Specifies the results to be displayed on the ERROR screen.

n : Specifies items to be displayed in each field.

Command	DSA	DSB	DSC	DSD	DSE
Display position	Top left side	Top right side	Middle left side	Middle right side	Bottom left side

: Diplay contents

	0	1	2	3	4	5	6
Diplay contents	ERROR COUNT	ERROR RATIO	BLK-ERR COUNT	BLK-ERR RATIO	ES	%ES	DM

	7	8	9	10	11	12	13
Diplay contents	% DM	SES	% SES	US	% US		

	14	15	16	17	18	19	20
Diplay contents		EFS	% EFS	CLOCK SLIP	PSC COUNT	PWL (sec)	PSL (sec)

	21	22	23	24	25	26	27
Diplay contents							

	28	29	30	31	32	33	34
Diplay contents							

DSE	ERROR screen	

Selects measured result to be displayed at bottom-left.

Format	DSE n	Parameter range	0 to 11, 15 to 20

<Details>

Specifies the results to be displayed on the ERROR screen.

n : Specifies the item to be displayed in each display field.

Command	DSA	DSB	DSC	DSD	DSE
Display position	Top left side	Top right side	Middle left side	Middle right side	Bottom left side

: Display contents

	0	1	2	3	4	5	6
Display contents	ERROR COUNT	ERROR RATIO	BLK-ERR COUNT	BLK-ERR RATIO	ES	%ES	DM

	7	8	9	10	11	12	13
Display contents	% DM	SES	% SES	US	% US		

	14	15	16	17	18	19	20
Display contents		EFS	% EFS	CLOCK SLIP	PSC COUNT	PWL (sec)	PSL (sec)

	21	22	23	24	25	26	27
Display contents							

	28	29	30	31	32	33	34
Display contents							

OFA	ERROR screen	

Specifies alarm output data format

Format	OFA n, n, n.. (Total 19)	Parameter range	0, 1

< Details >

Specifies the format of the alarm output data (output data, data sequence).

- Up to 14 parameters can be specified.
- The data items and sequence output in response to the DOA? and DRA? commands are formatted in accordance with this command,
- n : Output contents

n	0	1
Alarm	PWL	PSL

VM	VOLT/FREQUENCY screen	

Selects the line whose voltage is to be measured

Format	VM n	Parameter range	0 to 12

< Details >

Selects the line whose voltage is to be measured.

n : Line to be measured

n	0	1	2	3	4	5	6	7	8	9	10	11	12
Signal	SD	RD	ST1	ST2	RT	ER	DR	RS	CS	CD	CI	TI	NS

FM	VOLT/FREQUENCY screen	

Selects the line for frequency measurement

Format	FM n	Parameter range	0 to 12

< Details >

Selects the line whose frequency is to be measured.

n : Line to be measured

n	0	1	2	3	4	5	6	7	8	9	10	11	12
Signal	SD	RD	ST1	ST2	RT	ER	DR	RS	CS	CD	CI	TI	NS

SAL	DELAY TIME screen	

Sets start signal line and trigger condition

Format	SAL n, m	Parameter range	n: 0 to 12, 13 m: 0, 1

< Details >

Sets the start signal line and trigger condition.

The START LINE and trigger condition can only be set when the measurement mode is LINE INTERVAL.

n : Signal line No.

m : 0= 1→0, ON→OFF, H→L

1= 0→1, OFF→ON, L→H

n	0	1	2	3	4	5	6	7	8	9	10	11	12
Signal	SD	RD	ST1	ST2	RT	ER	DR	RS	CS	CD	CI	TI	NS

SOL	DELAY TIME screen	

Sets the stop signal line and trigger condition

Format	SOL n, m	Parameter range	n: 0 to 12, 13 m: 0, 1

< Details >

Sets the STOP LINE and trigger condition.

The STOP LINE and trigger condition can only be set when the measurement mode is LINE INTERVAL.

n : Signal line No.

m : 0= 1→0, ON→OFF, H→L

1= 0→1, OFF→ON, L→H

n	0	1	2	3	4	5	6	7	8	9	10	11	12
Signal	SD	RD	ST1	ST2	RT	ER	DR	RS	CS	CD	CI	TI	NS

SL	WORD TRACE screen	

Sets the trace-stop-condition signal line

Format	SL n, m	Parameter range	n: 0 to 12 m: 0, 1

< Details >

Sets the trace-stop-trigger signal line and trigger condition simultaneously.

n : Signal line No.

m : 0= 1→0, ON→OFF

1= 0→1, OFF→ON

n	0	1	2	3	4	5	6	7	8	9	10	11	12
Signal	SD	RD	ST1	ST2	RT	ER	DR	RS	CS	CD	CI	TI	NS

Note: When the signal line is SD or RD, m is 0/1. Otherwise, it is OFF/ON.

APPENDIX C
RESPONSE DATA REFERENCE
V.24/V.28 INTERFACE UNIT

Screen	INTERFACE screen		
Command name	DO ?	Explanation	Requests data output

Output format and explanations:

I F 0△ 90, 03, 19, 17, 47, 40, 3, △1, △△1, 6, 0, △1200, 0, 9, 8, 0, 2, 0, △△△
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
△△△

△△△△△△△△△△△△△△, 1, △1, △△1, 6, △1200, 8, 0, △△△△△△△△△△△△△△
22 23 24 25 26 27 28 29
△△△

△△△△△△△△△△△

No.	Output	Column	Number of columns	Range	Remarks
1	Screen symbol	1,2	2	Constant (No range)	
2	Data type	3	1	Constant (No range)	
3 to 5	Year, month, and day of data output	5 to 12	8	00,01,01 to 99,12,31	
6 to 8	Hours, minutes, and seconds at which data were output	14 to 21	8	00,00,00 to 23,59,59	
9	Send interface slot No.	23	1	1 to 5	
10	Send interface unit ID	25,26	2	Constant (No range)	
11	Send interface	28 to 30	3	Constant (No range)	
12	Send timing generation method	32	1	ST1 : 0 ST2 : 3 ST2 (INV) : 4 ASYNC :5 ST/SP : 6 RT : 7	
13	Send signal clock	34	1	INT : 0 EXT : 1	Invalid : 9
14	Sent bit rate	36 to 40	5	50 b/s : △△△50 to 20000 b/s : 20000	Invalid : 99999
15	Send internal clock	42	1	SELF : 0 EXT1 8 k : 1 EXT2 64 k + 8 k : 2 RD 8 k : 3	Invalid : 9
16	Send external clock	44	1	TTL : 0 75 Ω : 1	Invalid : 9
17	Length of send data byte	46	1	5 bit : 5 6 bit : 6 7 bit : 7 8 bit : 8	Invalid : 9
18	Send parity	48	1	NON : 0 ODD : 1 EVEN : 2	Invalid : 9
19	Send stop bit	50	1	1 bit : 0 1.5 bit : 1 2 bit : 2	Invalid : 9
20	Send control	52	1	ALWAYS : 0 CS-ON : 1	
21	100 bytes of free memory space remaining	54 to 122	68	68 bytes of free memory space remaining	
22	Send interface slot No.	124	1	1 to 5	
23	Send interface unit ID	126,127	2	Constant (No range)	

No.	Output	Column	Number of columns	Range	Remarks
24	Receive interface	129 to 131	3	V.24/V.28 : △△1 SELF LOOP : 255	
25	Receive timing	133	1	ST:0 RT:3 RT(INV):4 ASYNC:5 ST/SP:6	
26	Receive bit rate	135 to 139	5	50 b/s : △△△50 19200 b/s : 19200	Invalid : 9
27	Length of receive data byte	141	1	5 bit:5 6 bit:6 7 bit:7 8 bit:8	Invalid : 9
28	Receive parity	143	1	NON:0 ODD:1 EVEN:2	Invalid : 9
29	Remaining of 100 bytes of free memory space remaining	145 to 223	78	8 bytes of free memory space remaining	

Head office address was changed

Head office address on the back cover was changed. Please substitute it as the following address.

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22 September 2003

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