ADVANTEST®

ADVANTEST CORPORATION

INSTRUCTION MANUAL

TQ8450

Optical Fiber Reflect Meter

MANUAL NUMBER 8450 EF 811

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Printed in Japan

PREFACE

Thank you for purchasing the ADVANTEST Optical Fiber Reflect Meter TQ8450.

Before using TQ8450 (hereinafter called this unit), please read this manual thoroughly.

This manual is written for users who have some knowledge of and experience in operation of optical measuring instruments. If you are using unit for the first time, read this manual from the beginning. Since basic knowledge of programming is required to use the GPIB, refer to the programming guides and controller instruction manuals as required.

Observe the following caution when using this unit:

CAUTION

The optical output connector outputs optical pulses. These optical pulses are not strong enough to damage eyes; however, never look at them directly.

TQ8450
OPTICAL FIBER REFLECT METER
INSTRUCTION MANUAL

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1. INTRODUCTION

This chapter explains how to use this manual, the outline of this unit, procedures for setting up this unit, and preparation for measurement. Do not forget to read this manual before starting measurement.

1.1 STRUCTURE OF THIS MANUAL

This manual is written for users who have some knowledge of and experience in measurements with optical measuring instruments. The chapters in this manual are described independently of each other so that a user at a certain level only has to read necessary chapters. If you are using this unit for the first time, read this manual from the beginning. Since basic knowledge of programming is required to use the GPIB. Since basic knowledge of programming is required to use the GPIB, refer to the programming guides and controller instruction manuals as required.

1. Introduction ----- Overview of TQ8450
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1.2 OVERVIEW OF TQ8450

The TQ8450 optical fiber reflect meter is used to detect the faulty point (break point), optical fiber loss, and connection loss when laying or maintaining an optical fiber cable.

By connecting a plug-in unit, various wavelengths can be measured. Moreover, this unit is light and compact and it incorporates a thermal printer, in consideration of the field use.

Features

- Wide dynamic range (back-scattered light)
  Use of plug-in unit Q84506 permits high-sensitivity measurement of a pulse width of 5 μs at 24 dB.
- Expansible plug-in unit
  Three different plug-in units are available for measuring various wavelengths.

Mainframe	TQ8450		
Plug-in unit	Q84505	Q84506	Q84501
Wavelength	0.85 ±0.02μm	1.31 ±0.02μm	1.31 ±0.02μm
Fiber to be measured	Multi Mode	Multi Mode	Single Mode

Mainframe	TQ8450		
Plug-in unit	Q84502	Q84521	
Wavelength	1.55 ±0.03μm	1.31 ±0.02μm	1.55 ±0.03μm
Fiber to be measured	Single Mode	Single Mode	

- Highly stable
  The laser beam source temperature is controlled to assure output of stable light and waveform thus enabling measurement with high reproducibility.
- Light masks
  Three light masks can be set on the screen to mask large Fresnel reflections. Thus, saturation of the light sensor is prevented and linearity is enhanced.
- Read resolution up to a minimum of 1 m
- 0.0001-step setting of optical fiber refractive group index
  Because the optical fiber cable refractive index may be set in steps of 0.0001 between 1.4000 and 1.6000, distances can be measured with high precision.
- Loss read resolution of 0.01 dB
  Uses of an average mode permits measurement at an improved S/N ratio.

- Built-in thermal printer
  The measurement conditions and results displayed on the CRT can be copied without any external output unit.
- GPIB provided as standard bus
  Use of an external controller permits full remote control.
- Portable
  The lightweight (about 14 kg) compact body is suitable for outdoor use.

1.3 BEFORE USING THIS UNIT

1.3.1 Checking External View and Accessories

When you receive the TQ8450, check whether it has suffered any external damage or scratching during transportation.

Next, check standard accessories for quantity and specifications in accordance with Table 1-1.

If there is any external damage or missing part, or the unit does not operate as specified, contact your nearest dealer or the ADVANTEST CE Headquarters Front Desk (in Yokohama CE center).

Their addresses and telephone numbers are listed at the end of this manual.

Table 1-1 TQ8450 Standard Accessories Supplied

	Article name		Standard	Quantity	Remarks
1	Power cable (2-pin, with adapter)		MP-43	1	
2	Power fuse	90 VAC to 132 VAC type	MDX-2A	2	
		198 VAC to 250 VAC type	MDX-1A	2	
3	Recording paper		A09052	3	Nakagawa Seisakusho
4	Instruction Manual		J8450	1	

1.3.2 Power Requirement, Grounding, and Fuse

(1) Power requirement
The supply voltage is 90 VAC to 126 VAC and the frequency is 48 Hz to 66 Hz. Before using this unit, make sure that the specified fuse is inserted. This unit is designed in due consideration of AC power supply line noise; however, try to use it at a place where the noise level is as low as possible. If the noise level is high, use a noise suppressing filter.

(2) Power cable
The power cable plug has three pins. The central round pin is used for grounding when the plug is inserted in a 3-phase receptacle. If the plug cannot be inserted in the 3-phase receptacle, use the attached adapter A09034 (KPR-18) and connect either the ground wire of this adapter (Figure 1-1 (a)) or the ground cable on the rear panel of this unit to the terminal ground.

The attached adapter conforms to the Electric Equipment Regulations. Width A and B of the two blades of this adapter (A09034 (KPR-18)) are different as shown below (Figure 1-1 (b)). When inserting it in the receptacle, check the plug and receptacle directions.
When the A09034 (KPR-18) cannot be inserted into the receptacle, use the optionally available adapter KPR-13.

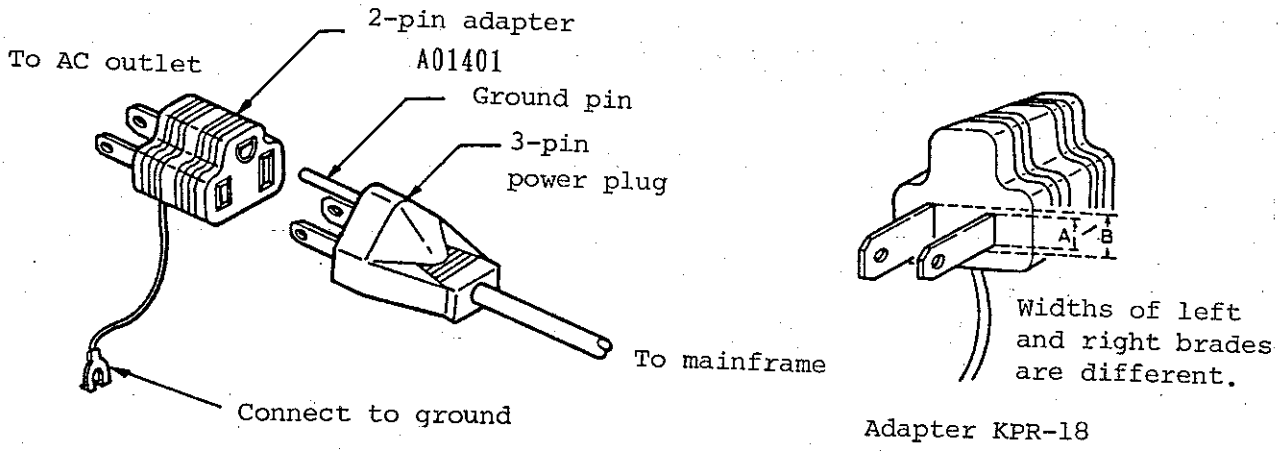
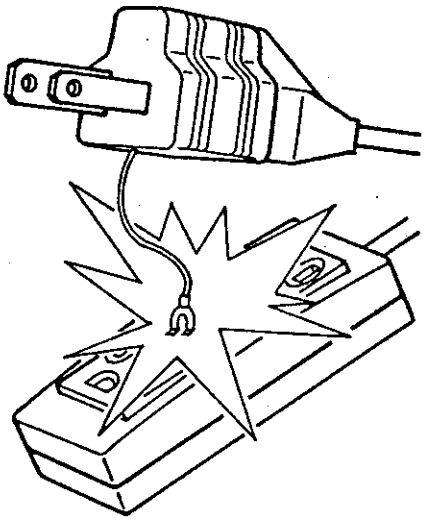


Figure 1-1 Power Cable Plug and Adapters

CAUTION

When connecting the ground wire of the adapter plug, never touch it with the hot line (AC line). It is touched by mistake, this unit and/or other units may be damaged.



(3) Grounding (Power supply line looping by CM
When this unit is connected to peripheral equipment such as a desktop computer, pay attention to the common mode noise (CMV) generated by improper grounding of the power source. Do not use a power source which is not grounded properly.
When a ground line which is not grounded is used, a loop is formed as shown in Figure 1-2, that is, an AV voltage (CMV) of about 50 V is applied between terminals a1 and a2 and between terminals b1 and b2. If signal terminals a1 and a2 are connected with the circuit between terminals b1 and b2 open, the input/output circuit elements in circuits 1 and 2 may be destroyed or deteriorated. To prevent this, the power line must be grounded without fail.
If the power plug is inserted or removed to turn on or off this unit, a similar CMV is generated instantaneously. Use the POWER switch to turn on/off this unit.
If you are obliged to use a power supply line that is not grounded, connect ground terminals GND1 and GND2 and signal cable, insert the power plug in the receptacle, then set the POWER switch to ON.

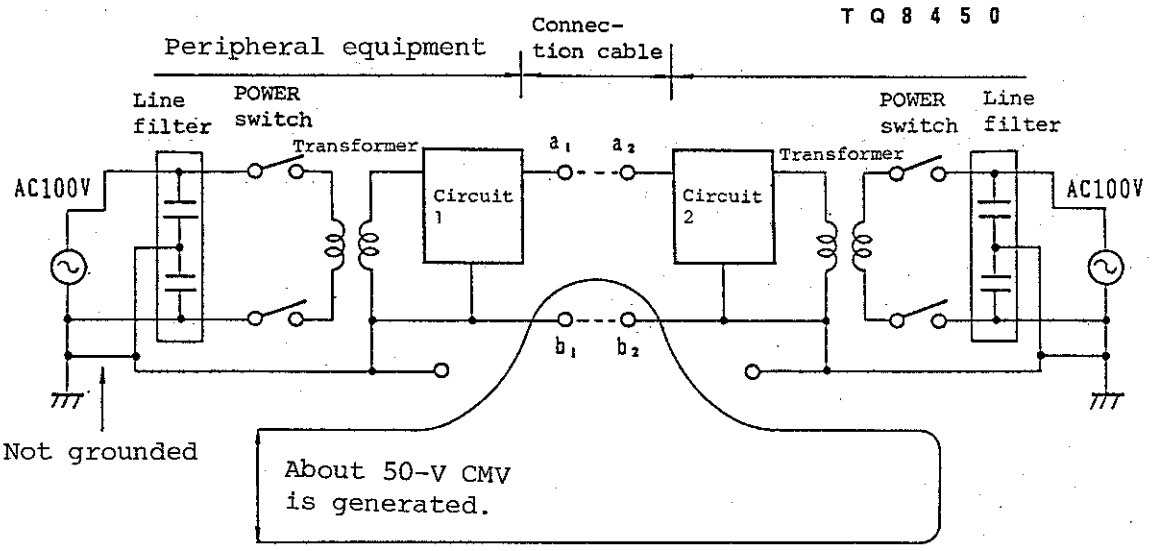


Figure 1-2 Power Supply Line Looping by CMV

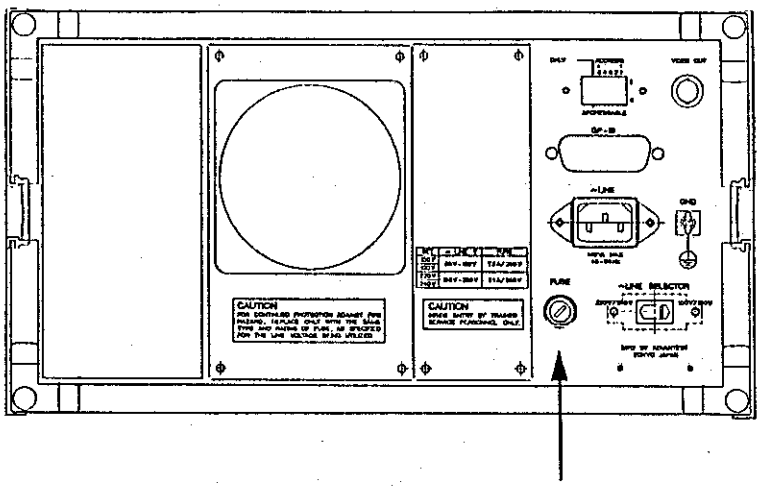
(4) Fuse

Before replacing a fuse, disconnect the power cable from the AC line connector. The power fuse is inserted in the fuse holder on the rear panel.

Check the rating of the fuse before replacement.

Fuse Specifications

90 VAC to 132 VAC	—— (MDX-2A)
198 VAC to 250 VAC	—— (MDX-1A)



Fuse holder

To remove the fuse holder, turn it counterclockwise with a Phillips screwdriver

Figure 1-3 Fuse Holder

1.3.3 Operating Conditions and Notes

(1) Ambient temperature
To operate this unit as designed, the ambient temperature must be 0°C to +40°C and the relative humidity must be 85% or less.

(2) Installation place
Do not install this unit in a place exposed to dust, vibration, direct sunlight, or corrosive gas, or place it on a trunk and so forth from which it might fall.

(3) Protection of eyes again laser beam
This unit uses a laser diode as a light source. Pay attention not to expose the eyes to the laser beam directly.
Before connecting the fiber cable, check that the LED of the ON key in the OPTICAL OUTPUT section is off.

(4) High tension circuit
A very high voltage is supplied to the CRT. Do not disassemble this unit when it is powered.

(5) Cooling and ventilation
This unit has a cooling fan to prevent abnormal temperature rises in it. Since this fan sucks in air, give attention to the ventilation around this unit. Do not place any obstruction close to the rear panel of this unit. Do not use this unit with its side up. Check the air filter for blocking and clean it weekly.

(6) Storage
The storage temperature is -20°C to +60°C. If this unit is not used for a long period, wrap it with a vinyl cover and put in a corrugated cardboard box. Store it in a place not exposed to dew condensation and direct sunlight.

(7) Dew condensation
This unit incorporates a lens. Pay attention to dew condensation caused by sudden temperature changes. If the surface of this unit is dewed, dry it well before use.

(8) Warm-up
Warm this unit up for more than 30 minutes for high accuracy.

1.4 PLUG-IN UNIT

One of the following three plug-in units is used as a light source of this unit.

Table 1-2 illustrates the plug-in units and the corresponding wavelengths.

Table 1-2 Plug-in Unit

Mainframe	TQ8450		
Plug-in unit	Q84505	Q84506	Q84501
Wavelength	0.85 ±0.02μm	1.31 ±0.02μm	1.31 ±0.02μm
Optical fiber cable to be measured	Multi Mode	Multi Mode	Single Mode

Mainframe	TQ8450		
Plug-in unit	Q84502	Q84521	
Wavelength	1.55 ±0.03μm	1.31 ±0.02μm	1.55 ±0.03μm
Optical fiber cable to be measured	Single Mode	Single Mode	

1.4.1 Assembling and Disassembling Plug-in Unit

CAUTION

Before assembling or disassembling any plug-in unit, turn off this unit without fail.

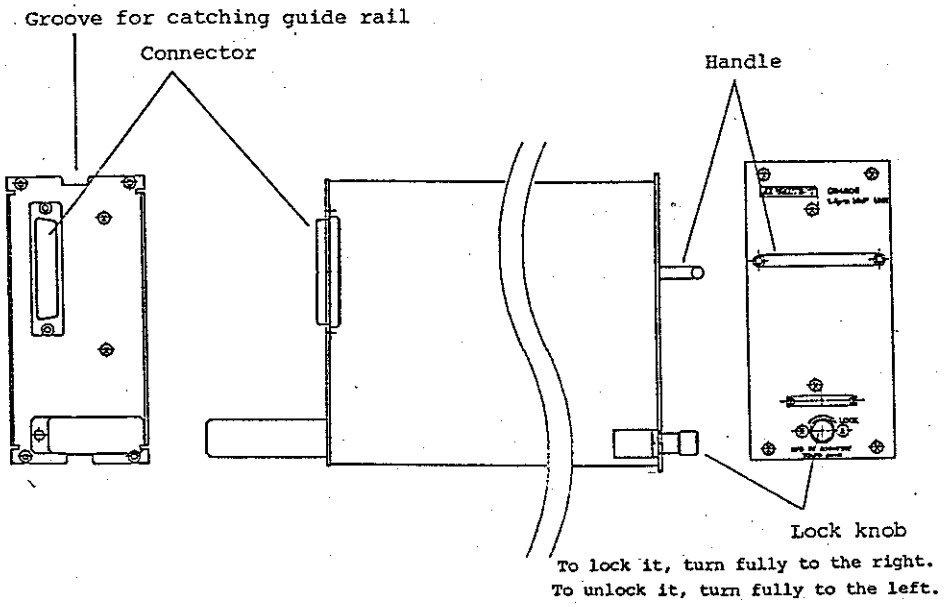


Figure 1-4 Plug-in Unit

① Insert the plug-in unit slowly into the opening of the rear panel of TQ8450 so that its upper and lower grooves catch the guide rails inside the opening.

② Push the plug-in unit so that its front connector is connected securely, and so that the laser output connector shutter projecting on the front panel can be opened and closed freely without touching the front panel.

③ Turn the lock knob fully to the right for locking.

④ Pull the handle to check that the plug-in unit is locked.

- To remove the plug-in unit, turn the lock knob counterclockwise and pull the handle.

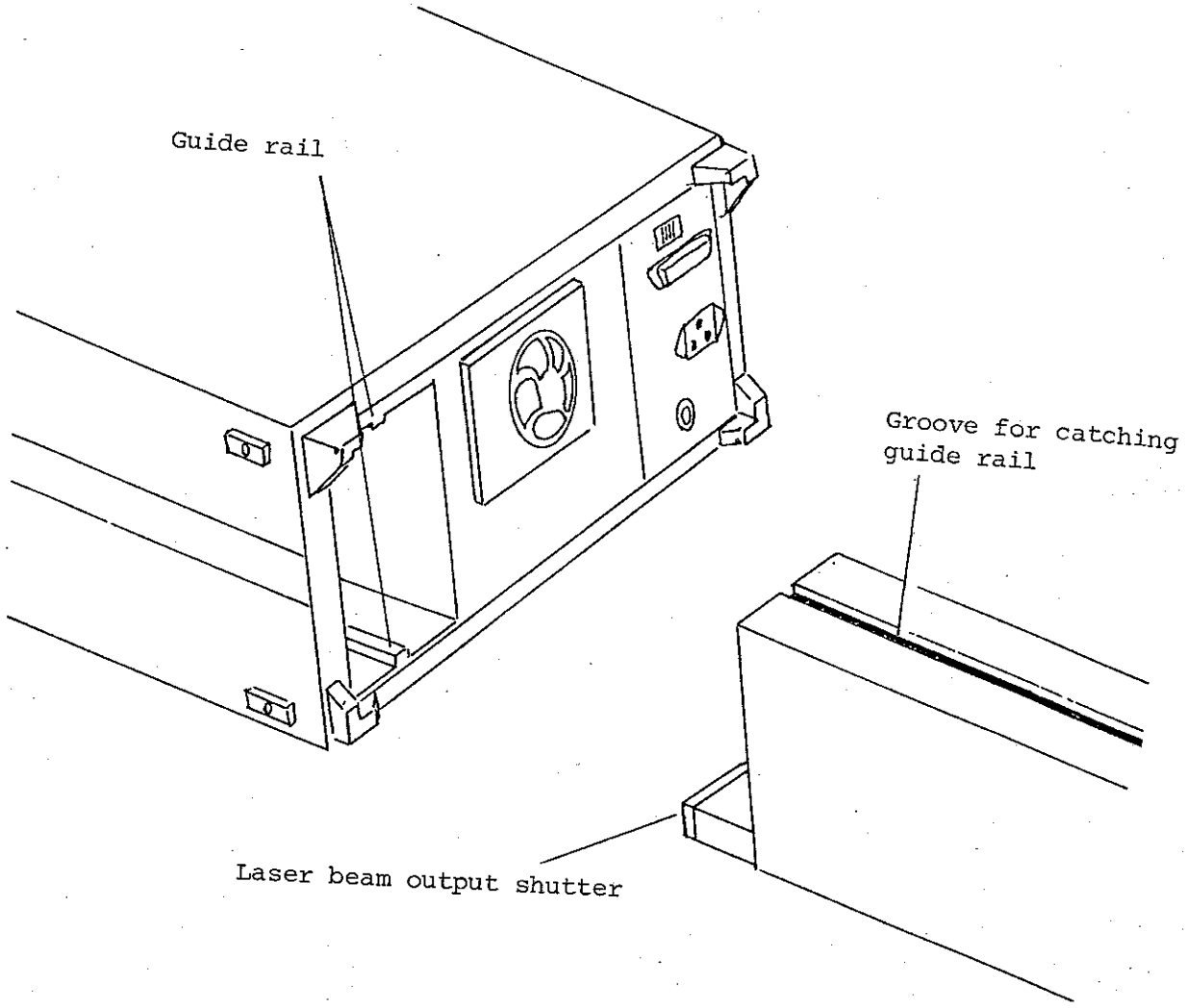


Figure 1-5 Assembling and Disassembling a Plug-in Unit

1.5 LOADING RECORDING PAPER

① Open the sliding cover of TQ8450 by pulling it backward.

② Pull the paper holder upward. It may not be removed easily because it is fixed with strings on both ends.

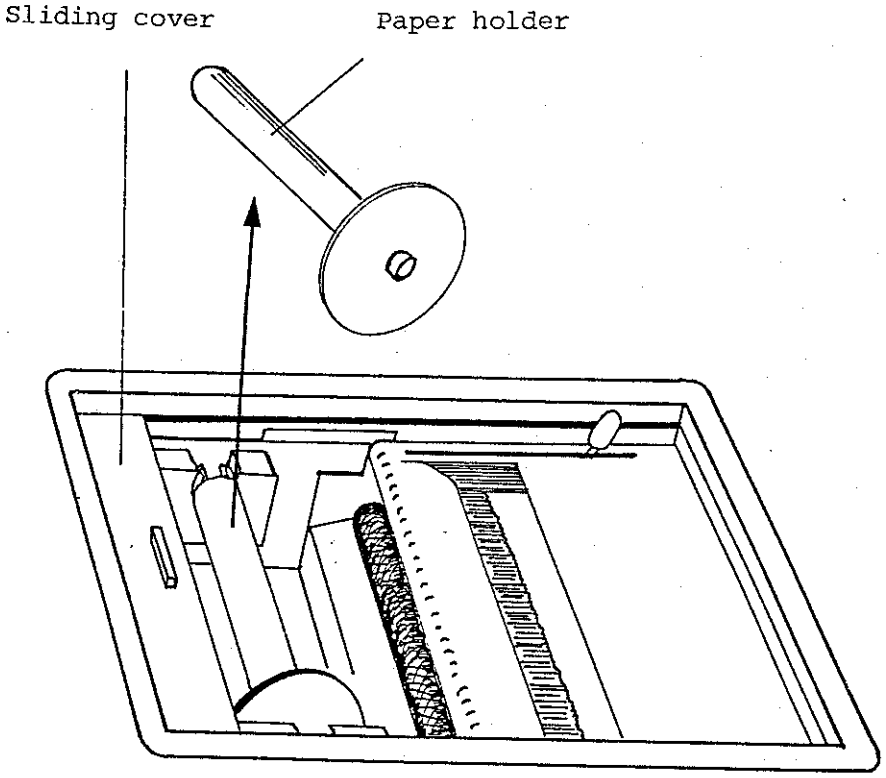
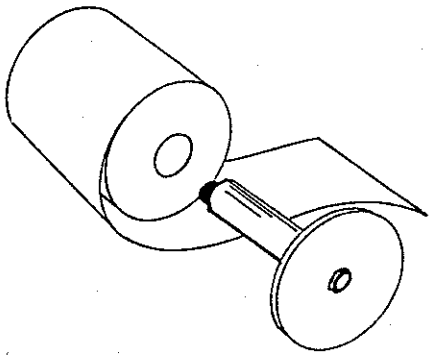


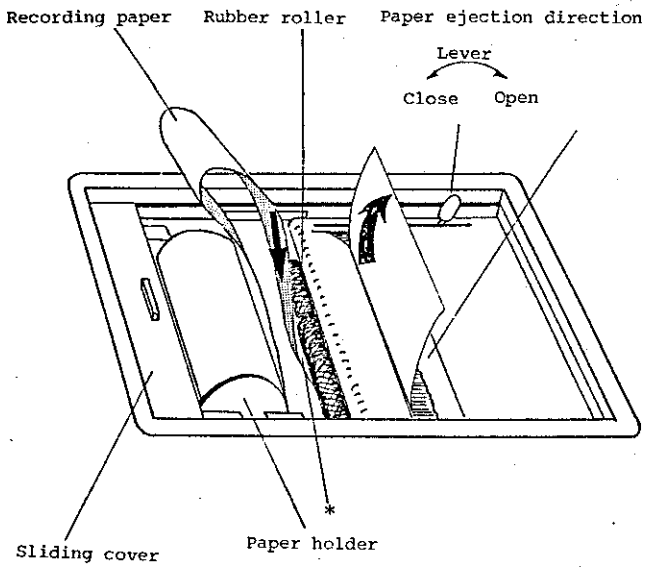
Figure 1-6 Loading Recording Paper (1)

③ Unwrap the recording paper, peel off the adhered paper end, and insert the paper holder into the roll hole as shown below.



④ Set the paper holder at the original position and pull the paper friction ON/OFF lever toward the front panel to release it.

⑤ Insert the paper end into the lower part of the rubber roller until it projects from the paper cutter. Set the paper friction lever to the original position.



Note: If it is difficult to insert the end into the lower part of the rubber roller, cut its end with the scissors laterally or lightly push the portion marked with * toward the controller with your finger.

Figure 1-7 Loading Recording Paper (2)

⑥ Return the paper friction lever to the original position. Open the sliding cover halfway so that the recording paper holder is hidden. If it is opened fully, the printed paper may be taken up by the recording paper holder.

CAUTION

When operating the printer, close the sliding cover halfway so that the recording paper is not taken up by the holder.

2. PANEL

2.1 GENERAL

This chapter outlines the function of keys and switches on the panel. See Figures 2-1 and 2-2 at the end of this chapter.

When a key is pressed, a short electronic sound (peep) is issued. If an illegal key is pressed, a low sound (beep) is issued. The LED on the key top indicates that the function of this key has been selected. There are two types of keys: a key that selects one of the preset values every time it is pressed (released) and a rotary key that can change the setting continuously. For the key with no LED on its top, the setting may be changed on the CRT screen.

The setting is cancelled when another key is pressed.

2.2 FRONT PANEL

① POWER switch
This is a toggle switch. TQ8450 is powered on and off every time this switch is pressed.

REMOTE Section

② REMOTE LED
LOCAL key
The REMOTE LED goes on when this unit is controlled by an external unit.
If the LOCAL key is pressed, panel key inputs are made effective when this unit is controlled by the GPIB.

PRINTER Section

③ PRINT key
When the PRINT key is pressed, all information displayed on the CRT screen is output by the built-in printer. If this key is pressed during printing, printing stops.

④ FEED key
When this key is pressed, the recording paper is fed about 2 cm.

⑤ INTENSITY control
This control is used to adjust the CRT brightness.

Caution: Using the CRT display for a long period with this control fully turned to the right will burn it.

VIEW Section

⑥ MONITOR key
This key is used for ordinary measurement. Averaging is performed with this function. (2^8 times Measurement time = About 0.7 ms)

⑦ AVERAGE key: Averaging is performed in the state set by the monitor key. (2^{16} times max. Measurement time = About 60 s (in the 64 km range))

⑧ PAUSE key
Averaging is terminated temporarily to display the current averaging result. Pressing this key will restart averaging.

DISTANCE Section

⑨ RANGE key
This key sets a measurement range. Every time this key is pressed in the ORIGIN mode, the following ranges are set cyclically.

→128 km → 64 km → 32 km → 16 km → 8 km → 4 km→

If this key is pressed in the EXPAND mode, the ORIGIN mode is selected.

⑩ ORIGIN/EXPAND key
ORIGIN or EXPAND modes are selected alternately every time this key is pressed. The current setting can be checked by observing the LED.
When the AVERAGE mode is selected, the STORE EXPAND state is set automatically.
When this unit is powered, the ORIGIN mode is selected automatically.

⑪ START key

In the ORIGIN mode	:	The marker is moved to the starting point. In this case, the marker may be adjusted to the corresponding span. When the EXPAND mode is selected, this marker indicates the starting point.
In the EXPAND mode	:	The starting point is moved.
In the STORE EXPAND mode	:	The starting point is moved.

⑫ SPAN key

In the ORIGIN mode	:	The marker is moved to the stop point. When the EXPAND mode is selected, this marker indicates the stop point.
In the EXPAND mode	:	The span is changed. In the STORE EXPAND mode: The span is changed.

⑬ GAIN key
When the back-scattered light level is too low or high, the gain is changed. (This key is effective only in the monitor mode.)
Every time this key is pressed, the gain changes as follows:

→0 dB ↔ 3 dB ↔ 6 dB ↔ 9 dB←

VERTICAL Section

⑭ SCALE key
Every time this key is pressed, the vertical-axis scale is selected as follows:

→4 dB/DIV ↔ 2 dB/DIV ↔ 1 dB/DIV ↔ 0.5 dB/DIV←

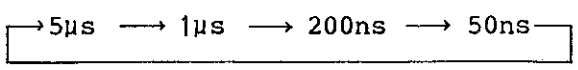
The vertical axis consists of 8 divisions.

⑮ POSITION key
The reference level is changed to move the waveform up or down.

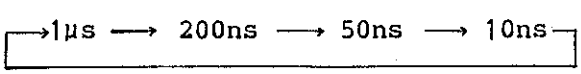
PULSE Section

⑯ PULSE key
Every time this key is pressed, the pulse width of the laser beam radiated from the OPTICAL OUTPUT connector is cyclically selected as follows (This key is effective only in the monitor mode.):

o For Q84502, Q84506 and Q84521



o For Q84505



⑰ MASK ON/OFF
Up to three masks are set on the screen or they are cancelled. To set the mask, move marker MO to the desired position and press the MASK ON key. (This key is effective only in the monitor mode.)
To delete the set mask(s), press the MASK OFF key.

⑱ INDEX key
This key is used to set the refractive index of the fiber cable to be measured. The refractive index can be set in steps of 0.0001 steps between 1.4000 and 1.6000 by turning the control knob.
Turning the knob clockwise (counterclockwise) will increase (decrease) the refractive index.
Press the ENTER or INDEX KEY to complete this function.

⑲ LABEL key
Desired digits and/or characters may be entered at the top of the screen. Select digits and/or characters with the knob, then press the ENTER key. Pressing the LABEL key again will cancel the LABEL mode. In the LABEL mode, the following keys can be used for cursor movement and character deletion.

MASK ON : Moves the cursor to the left.
MASK OFF: Moves the cursor to the right.
INDEX : Deletes the character preceding the current cursor position.

⑳ ENTER key
The data set with the INDEX and LABEL keys is input.

MARKER Section

(21) M0, M1, and M2 keys
The marker corresponding to the pressed key is displayed. The marker can be moved with the knob.

(22) CLR key
All markers are cleared.

(23) Data knob
This knob is used to move a marker, input a label, or change data in the selected mode.

(24) SPLICE key
Either LOSS or SPLICE mode is selected for LSA (Least Square Approximation). When the LED is off, the LOSS mode is selected.

OPTICAL OUTPUT Section

(25) READY LED
This LED goes on (operation enabled) when the internal temperature of the laser diode reaches the specified value.

(26) λ key
This key is used to select the laser beam wavelength of the optional unit.
If this key is pressed when Q84521 is used, the wavelength can be switched from 1.31 μm to 1.55 μm via the front panel.
(This key is effective only in the monitor mode.)

(27) ON key
This is a laser diode ON/OFF key. This key is effective when the READY LED is on.

(28) OPTICAL OUTPUT connector
There is a fiber cable connecting connector in the protective lid.

2.3 REAR PANEL

See Figure 2-3 at the end of this chapter.

① VIDEO OUT connector
This is a BNC connector used to output a hard copy of the CRT screen by connecting an external video plotter.

② FUSE holder
To remove the FUSE holder, turn it counterclockwise with a standard screwdriver. Check the fuse rating without fail.

③ GND terminal

④ GPIB address switch

⑤ GPIB connector

⑥ ∿ LINE connector
Power connector

⑦ Fan
This is a cooling fan. Because it sucks in air, be careful not to place any obstruction behind this unit.
The fan case can be pulled out for cleaning the internal filter.
Remove the case once a week to clean the filter.

2.4 CRT DISPLAY

The CRT screen displays the following setting conditions in addition to the measurement result.

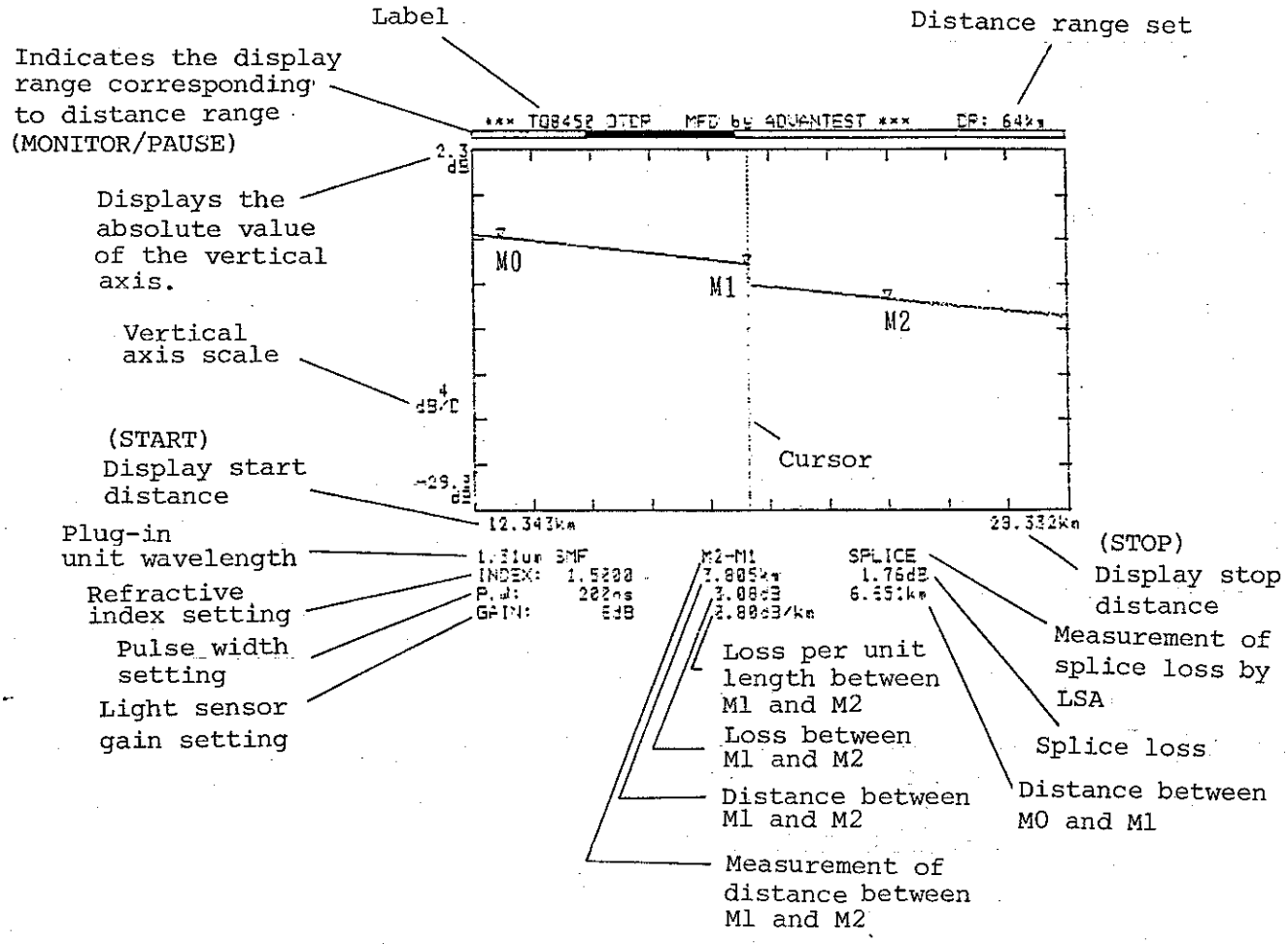


Figure 2-1 SPLICE Setting

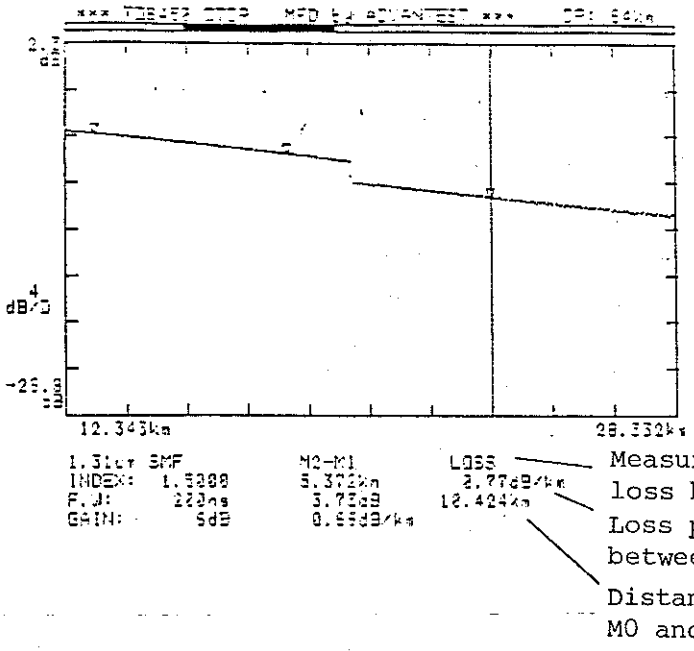


Figure 2-2 LOSS Setting

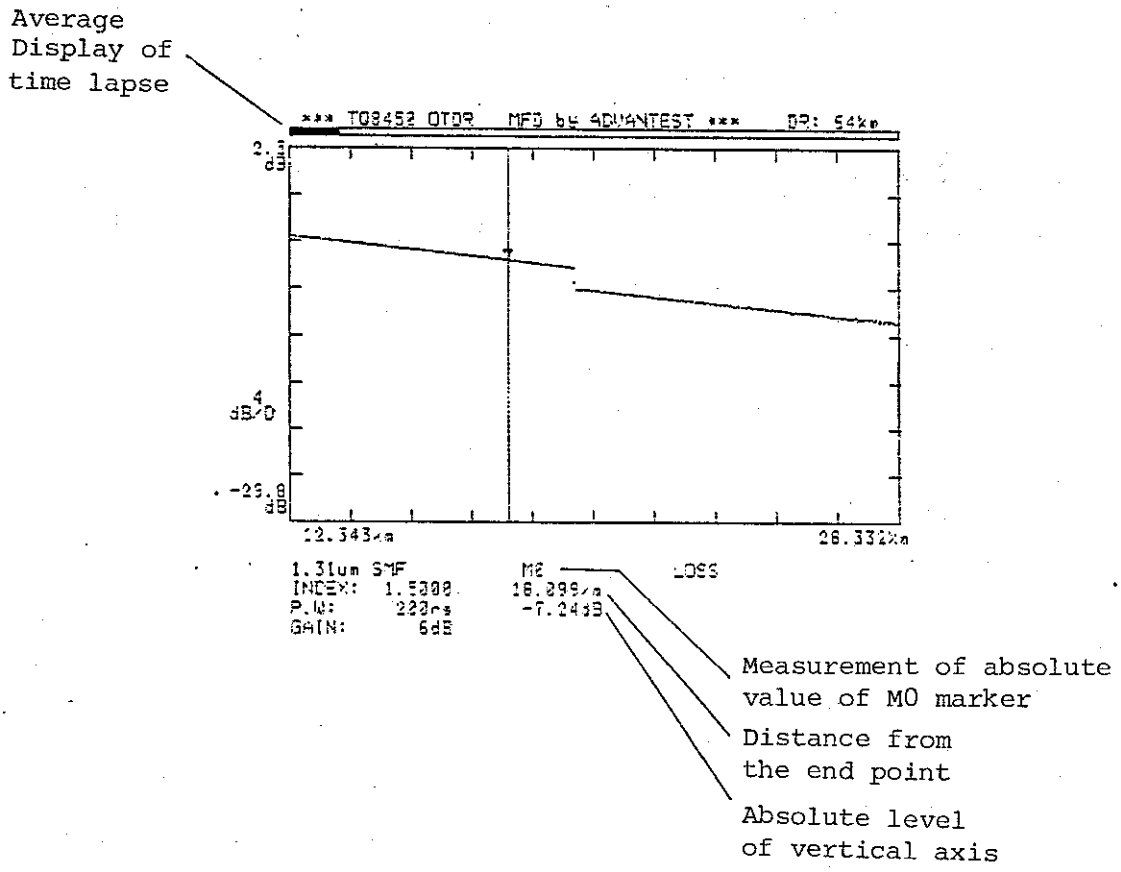


Figure 2-3 Averaging Mode

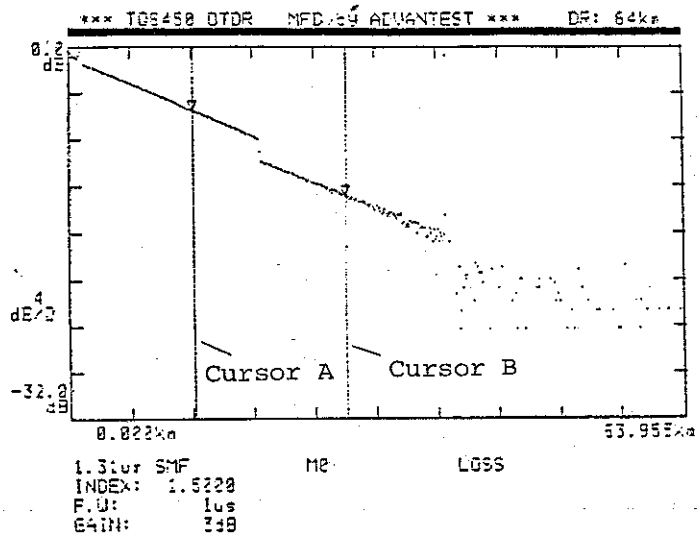


Figure 2-4 LABEL Mode

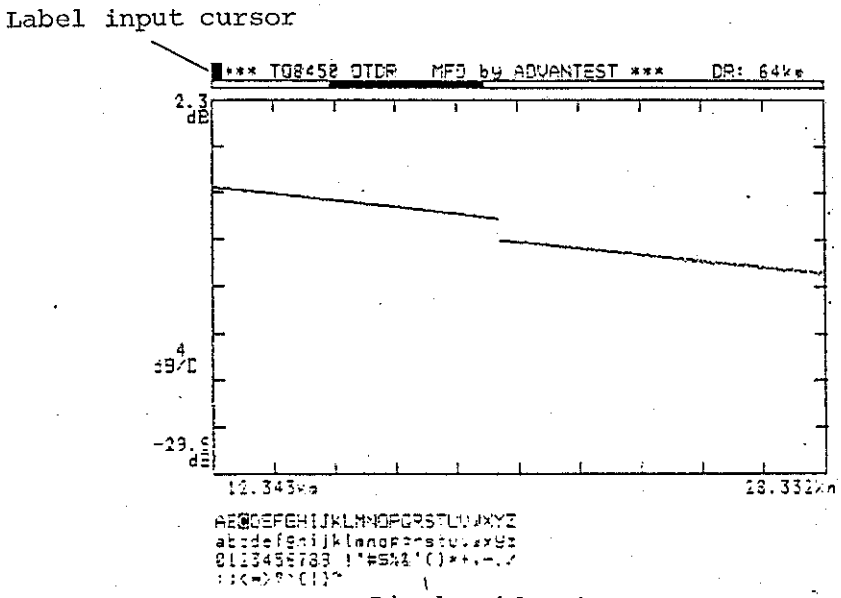


Figure 2-5 Display in ORIGIN Mode

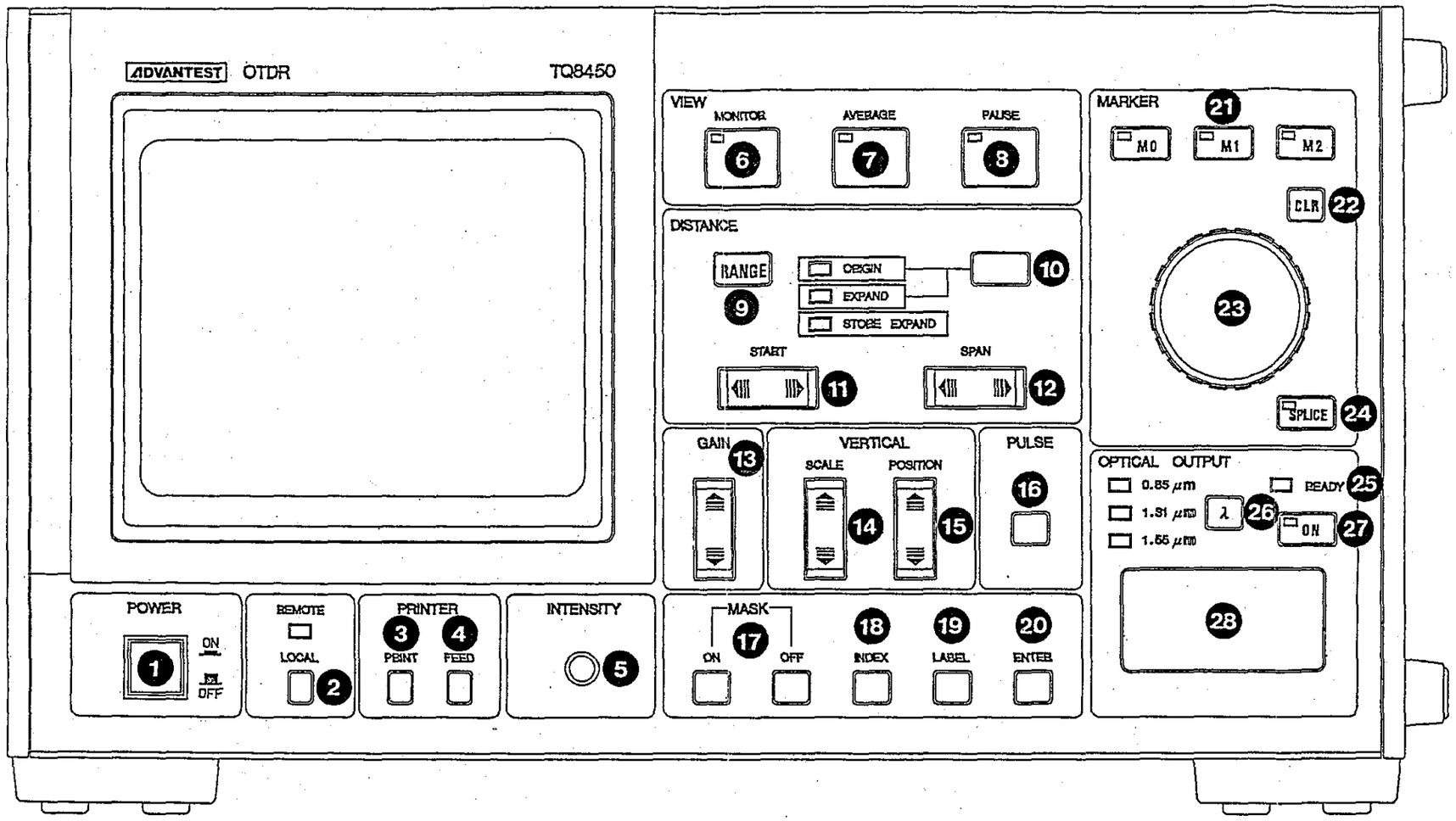


Figure 2-2 Front Panel

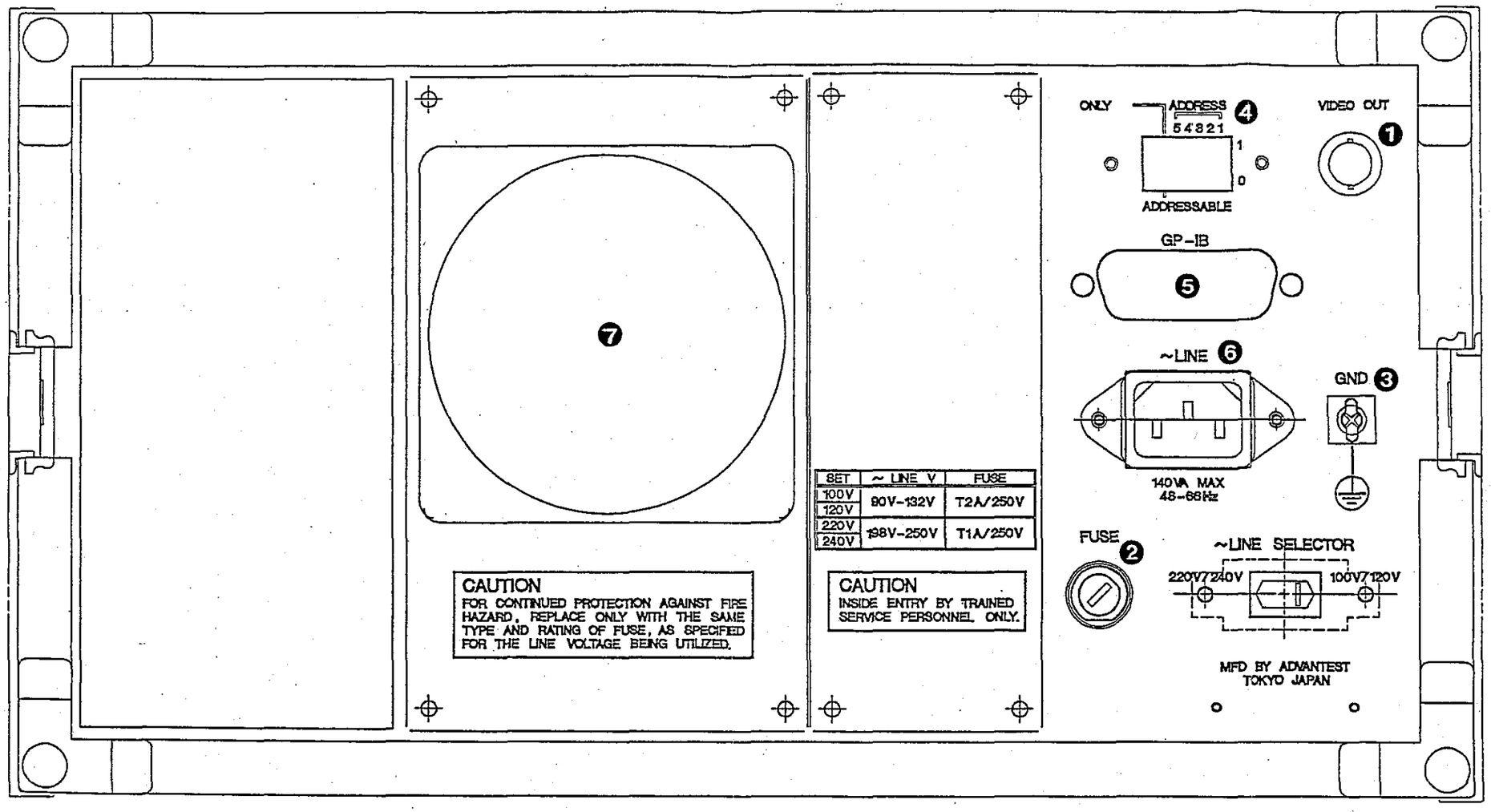
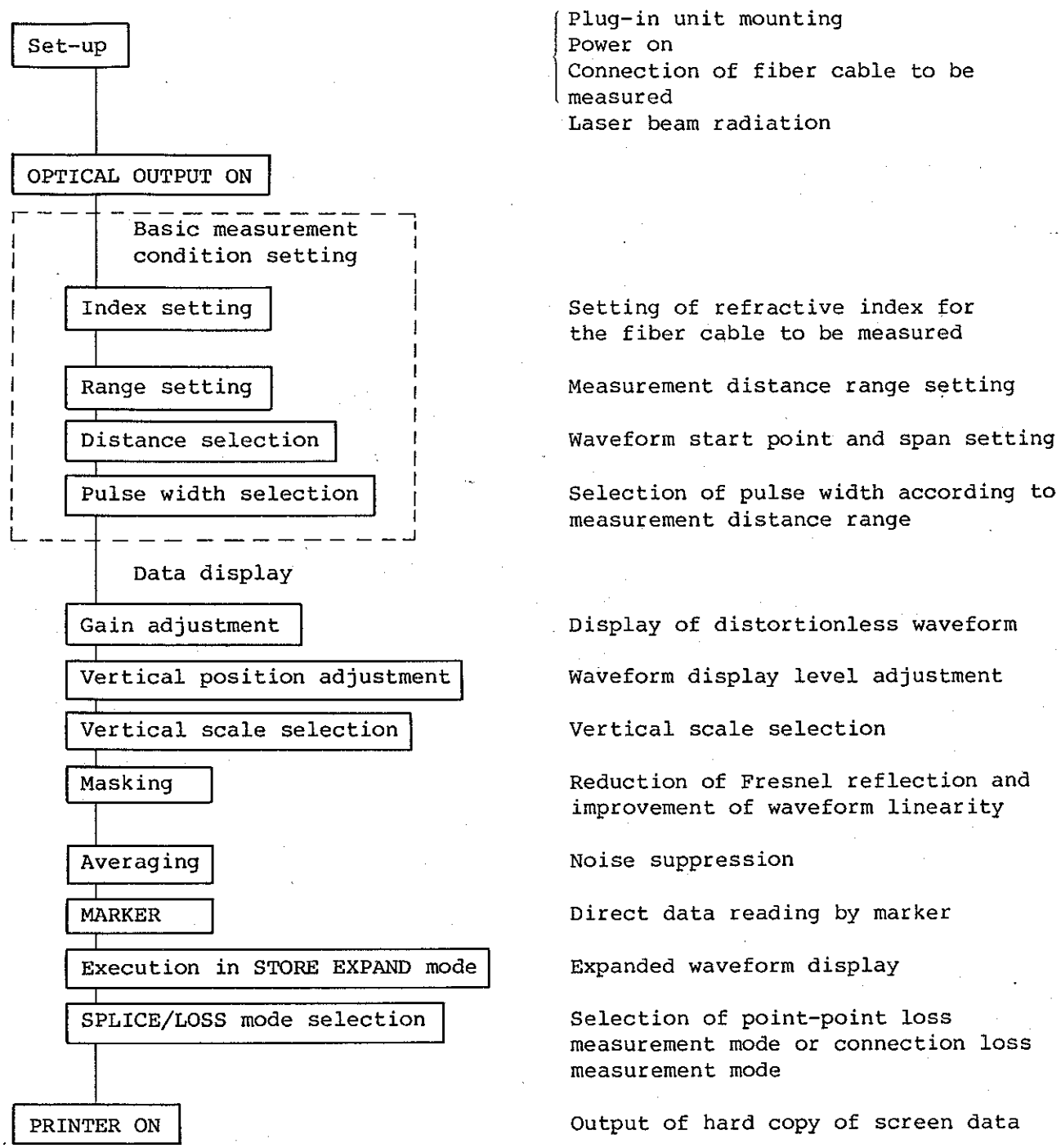


Figure 2-3 Rear Panel

3. OPERATION

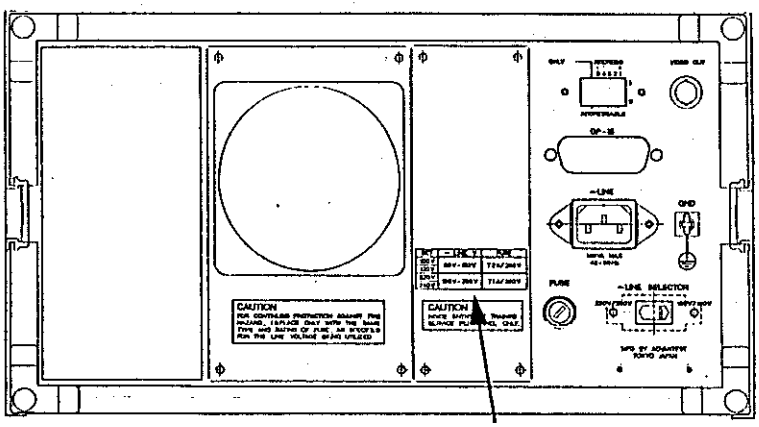
3.1 OUTLINE OF OPERATION PROCEDURE

The basic operation procedure is as follows:



3.2 SET-UP

(1) Checking supply voltage and fuse
Check whether the fuse rating matches the supply voltage.



SET	- LINE V	FUSE
100 V	90 V to 132 V	T2 A/250 V
120 V		
220 V	198 V to 250 V	T1 A/250 V
240 V		

(2) Mounting a plug-in unit
Use a proper plug-in unit.

- See Section 1.6 for details on plug-in unit mounting.

(3) Power on
When this unit is powered off, the preceding settings are saved by the built-in lithium battery. The lithium battery is capable of storing the conditions for about 10 years.
When the POWER switch is set to ON, all LEDs flash; then the previous panel settings are reproduced.
However, the following settings are not saved:

① VIEW ---→ MONITOR
② SPLICE ---→ LOSS
③ (LASER)ON ---→ OFF (Setting after power-on operation)

(4) Initialization
When the POWER switch is set to ON, all LEDs flash, then go off. Press the LOCAL key and CLR key sequentially for initialization.
When the GPIB is used for initialization, send a Z command to this unit.

Initialization

SPAN ----------	64 km
GAIN ----------	3 dB
Pulse width ----------	1 µs
INDEX ----------	1.5000
VIEW ----------	MONITOR
SPLICE ----------	LOSS
(LASER)ON ----------	OFF

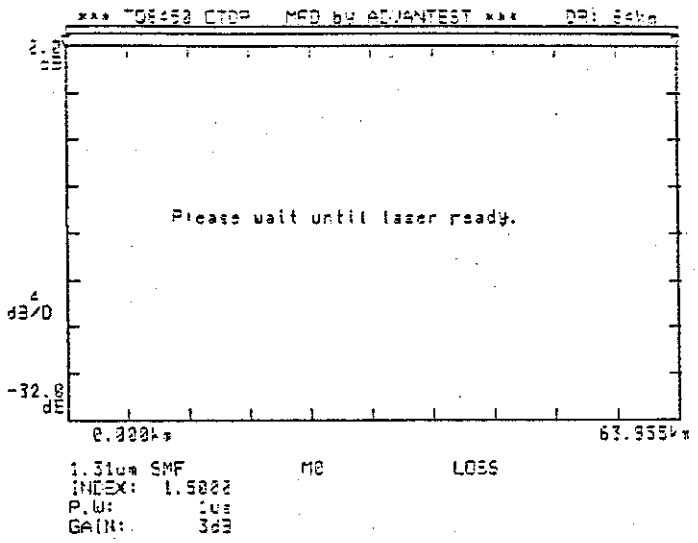


Figure 3-1 Initial Screen

(5) Connection of fiber cable to be measured
Connect the optical fiber cable to be measured to the OPTICAL OUTPUT connector. This connector is an FC type. To tighten the connector, turn it clockwise. To loosen the connector, turn it counterclockwise.

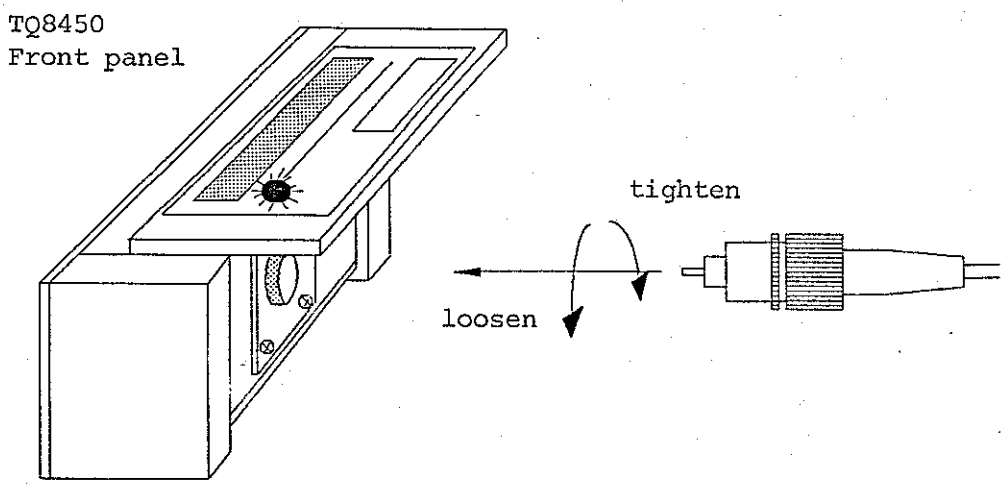


Figure 3-2 Connecting Optical Fiber Cable

Check that the input fiber end is clean. If it is dirty, clean it with alcohol.

CAUTION

Before opening the protective lid, check that the ON LED is off.
Be careful not to expose your eyes to the laser diode beam directly.

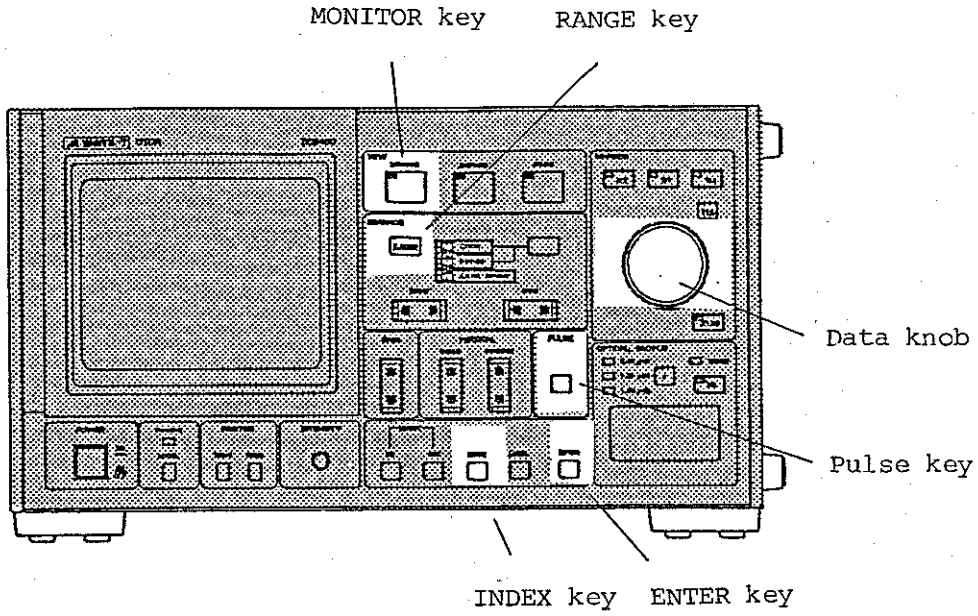
(6) Radiating beam

READY
OPTICAL OUTPUT
ON

When the OPTICAL OUTPUT key is pressed (its LED goes on), the laser diode radiates a beam. When the internal temperature of the laser diode reaches the specified value, the READY LED goes on to indicate that this unit is ready for operation.
When the READY LED is off, the laser does not emit a beam if the OPTICAL OUTPUT key is pressed.

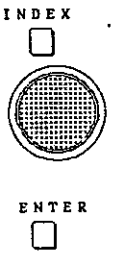
3.3 SETTING BASIC MEASUREMENT CONDITIONS (RANGE, INDEX, AND PULSE)

Set measurement conditions according to the length of the fiber cable to be measured and core refractive index.



3.3.1 Setting the Index

This unit measures the time T (s) of the optical pulse that passes through the optical fiber cable and calculates the distance according to the refractive index N. The value of N differs between fiber cables.



Press the INDEX key to select the refractive index change mode. When the INDEX key is pressed, a void character string "INDEX" is displayed to indicate that setting is enabled. Set the value with the data knob. The setting range is 1.4000 to 1.6000 and the setting resolution is 0.0001. The value set with the data knob is entered by pressing the ENTER key.

3.3.2 Selecting the Range

RANGE

Set the measurement distance range. Every time the RANGE key is pressed, the following values are set cyclically:

→ 128km ⟶ 64km ⟶ 32km ⟶ 16km ⟶ 8km ⟶ 4km →

The set range must be longer than the length of the cable to be measured.
The set value is displayed in the upper right field (DR: Distance Range) on the screen.

3.3.3 Setting the Pulse Width

PULSE

Set the pulse width according to the measurement distance resolution.
Every time this key is pressed, the setting value changes cyclically as follows. The set value is displayed at the bottom of the screen.

o For Q84501, Q84502, Q84506 and Q84521

→ 5μs ⟶ 1μs ⟶ 200ns ⟶ 50ns →

o For Q84505

→ 1μs ⟶ 200ns ⟶ 50ns ⟶ 10ns →

Pulse widths of 5μs and 1μs are generally for long- and middle-distance range. These pluse widths can obtain clear waveforms comparing with other pulse widths. Pulse widths of 200ns, 50ns and 10ns are effective for high-resolution measurement.

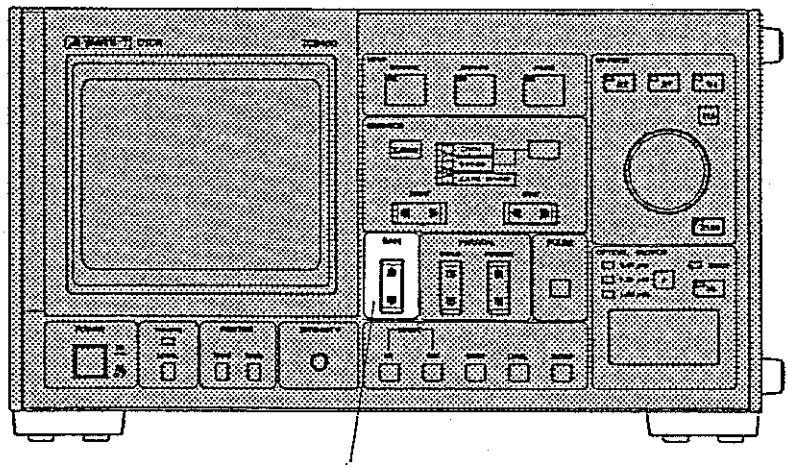
3.3.4 Switching Laser Beam Wavelengths

When the Q84521 plug-in unit is used, either 1.31 μm (SM) or 1.55 μm (SM) may be selected by pressing the λ key. The selected wavelength is displayed by the corresponding LED.

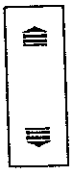
The λ key is not effective when another plug-in unit is used. If used, the corresponding LED goes on.

3.3.5 Setting the Gain

If the back-scattering level is too high or low, change the gain for optimum display. If the Fresnel reflection or back-scattering waveform is too high or low, the amplifier in this unit is saturated and consequently the measurement accuracy is impaired.



Gain



Press this key to set the gain. Every time this key is pressed, the gain changes as follows:

0 dB ⟷ 3 dB ⟷ 6 dB ⟷ 9 dB

The set value is displayed under the screen.

CAUTION

The back-scattering level changes with the pulse width. If the pulse width is changed during measurement, the gain must be readjusted.

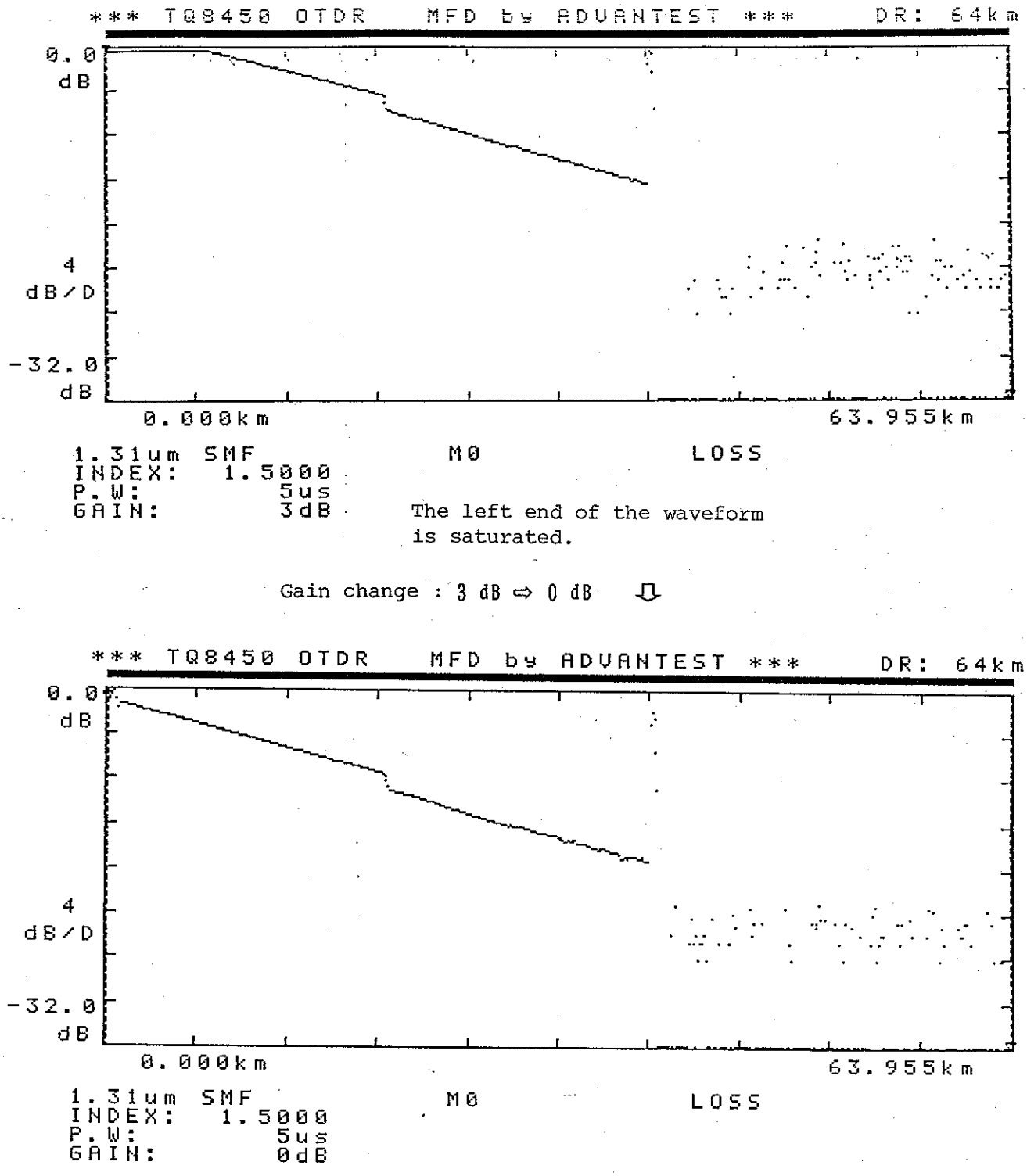


Figure 3-3 Changing a Gain

3.3.6 Label

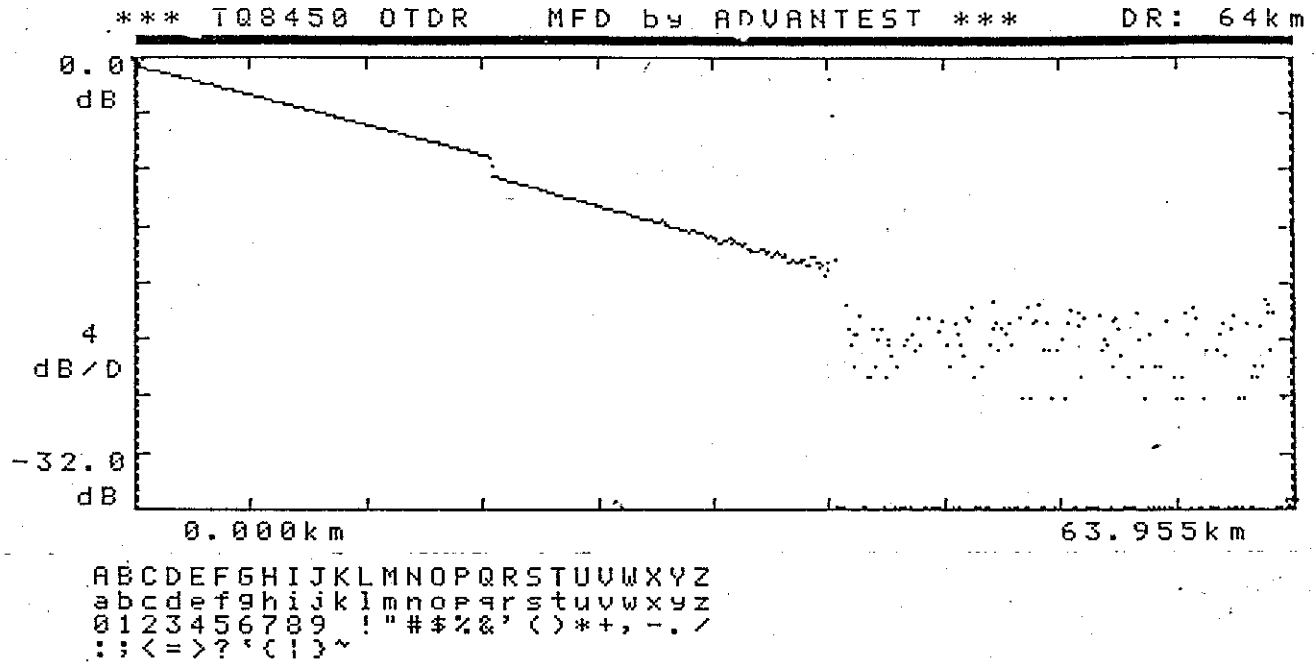


Figure 3-4 Initial Screen

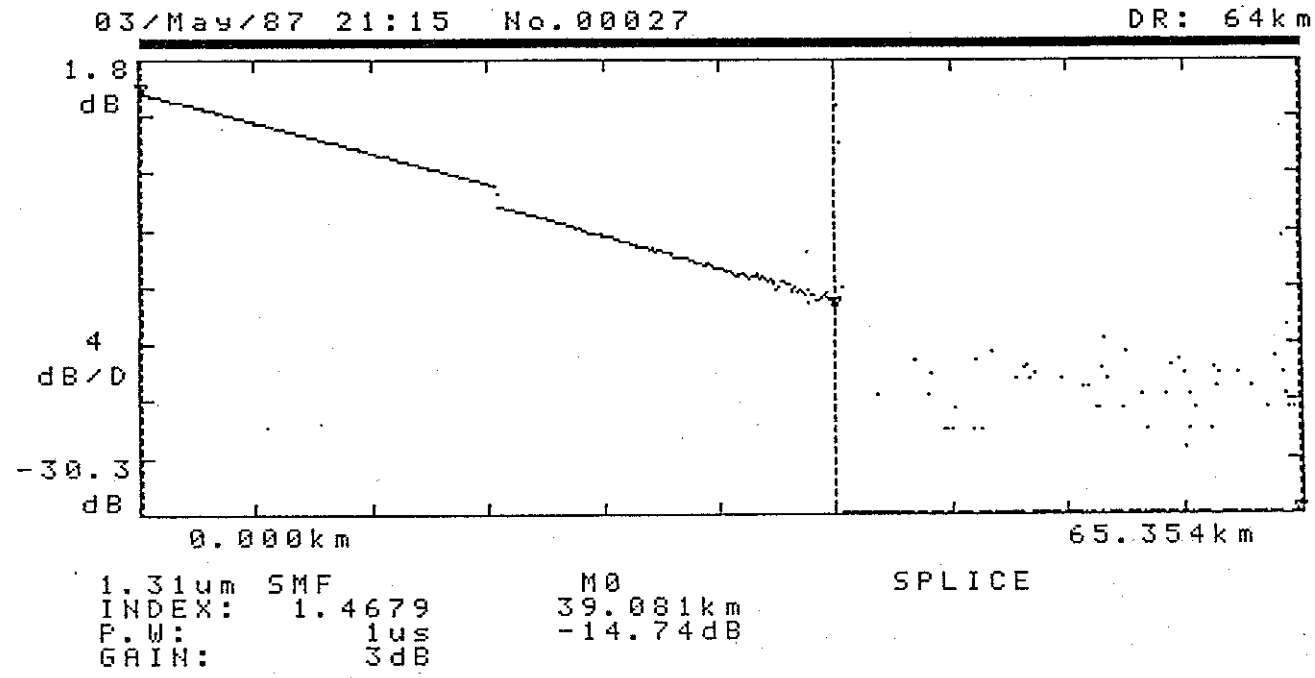


Figure 3-5 Label Input Example

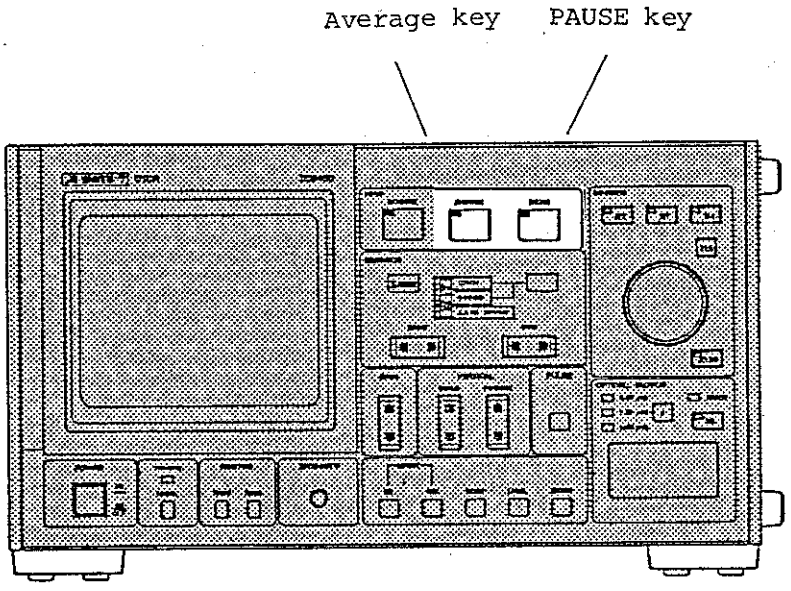
Desired characters may be entered in the top line; that is, up to 41 characters may be entered to indicate the date; time, title, and so forth.

When the LABEL key is pressed, the character menu shown in Figure 3-4 is displayed at the bottom of the screen. Turn the knob to move the cursor to the character to be set, then press the ENTER key; the selected character will be displayed from the left end of the top line. To cancel the LABEL mode, press the LABEL key again. The following keys are used for cursor movement and character deletion.

MASK ON : Moves the cursor to the left.
MASK OFF: Moves the cursor to the right.
INDEX : Deletes the character preceding the cursor position.

3.3.7 Averaging

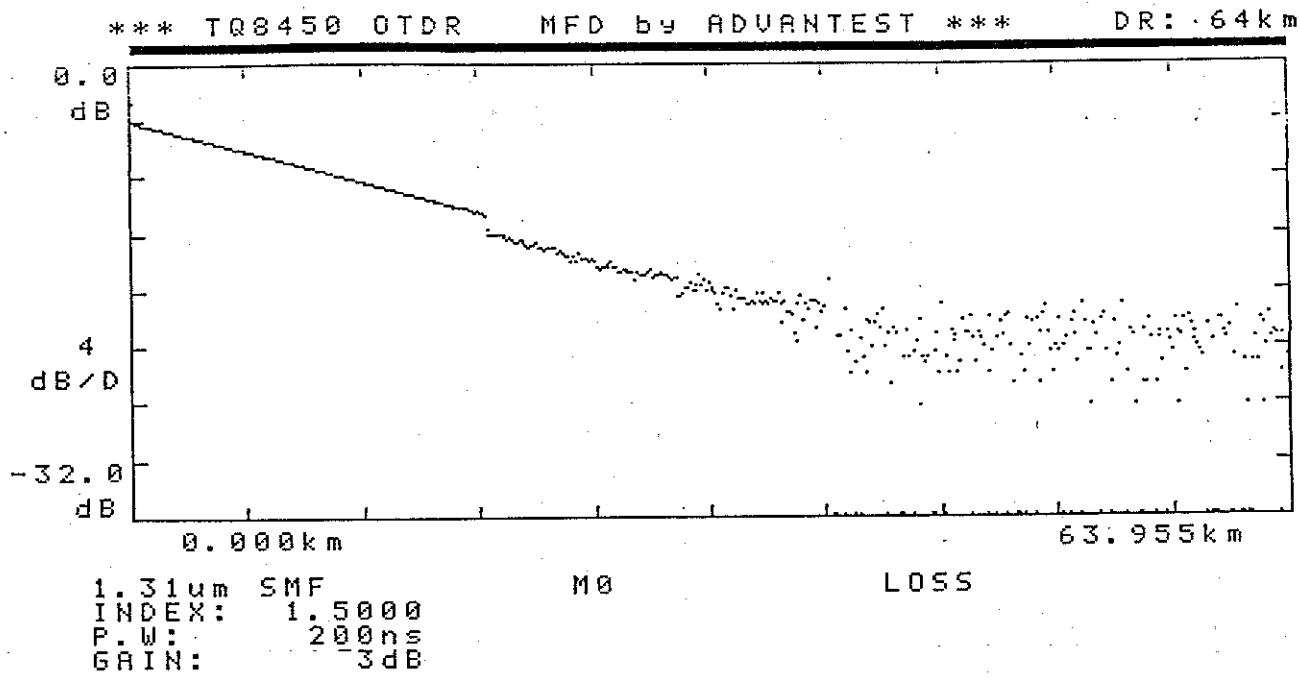
The measurement by the MONITOR key function in the VIEW section has been described. Averaging is performed 2^8 times with the MONITOR key function; however, selecting an AVERAGE function permits measurement over a longer distance.



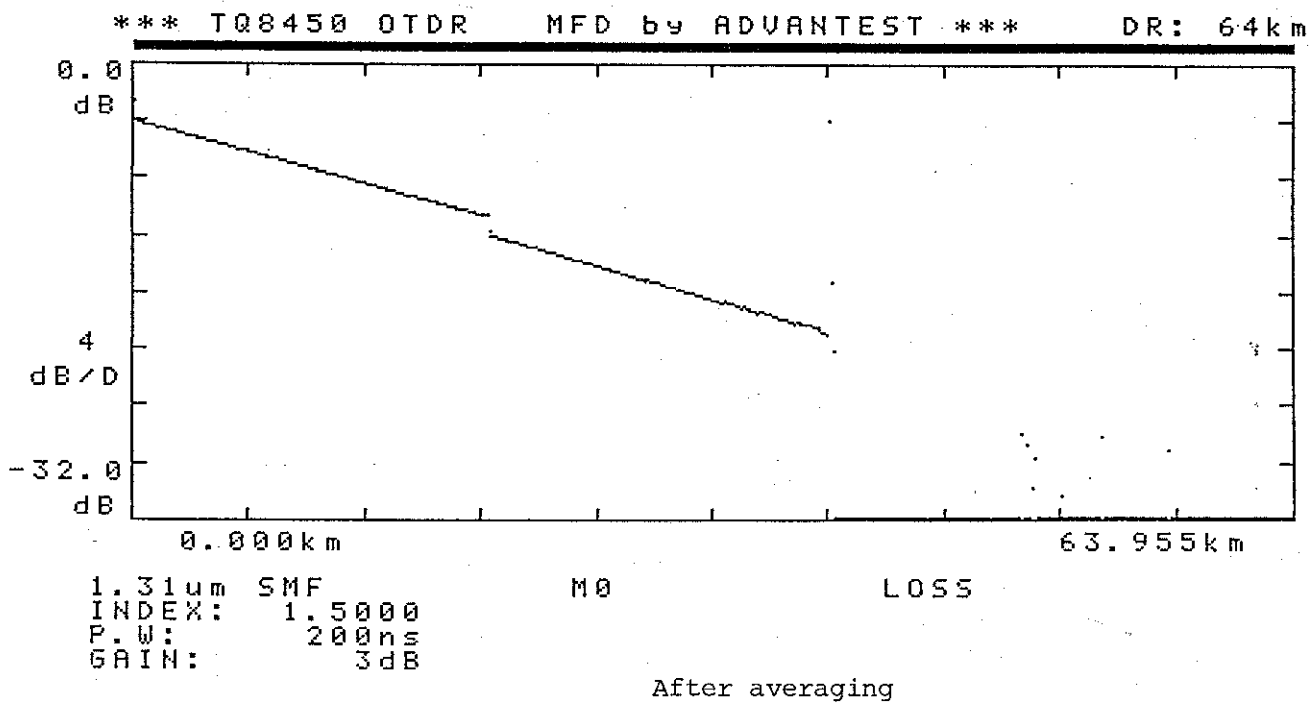
(1) Setting the averaging

When this key is pressed, averaging is performed (up to 2^{16} times). Averaging is repeated up to 2^{16} times or until the PAUSE key is pressed.

Press this key to terminate averaging forcibly. Averaging is restarted when this key is pressed again. When the averaging count reaches 2^{16}, the PAUSE mode is automatically set.
During averaging, the horizontal frame (band) on the screen indicates the averaging lapse time. As averaging proceeds, this frame is shaded from the left end. If this frame is shaded up to the right end, 2^{16} times of averaging has been completed.
During averaging, the displayed waveform changes when the averaging count reaches 2^n (9 to 16). Therefore, the display interval is prolonged as averaging progress.

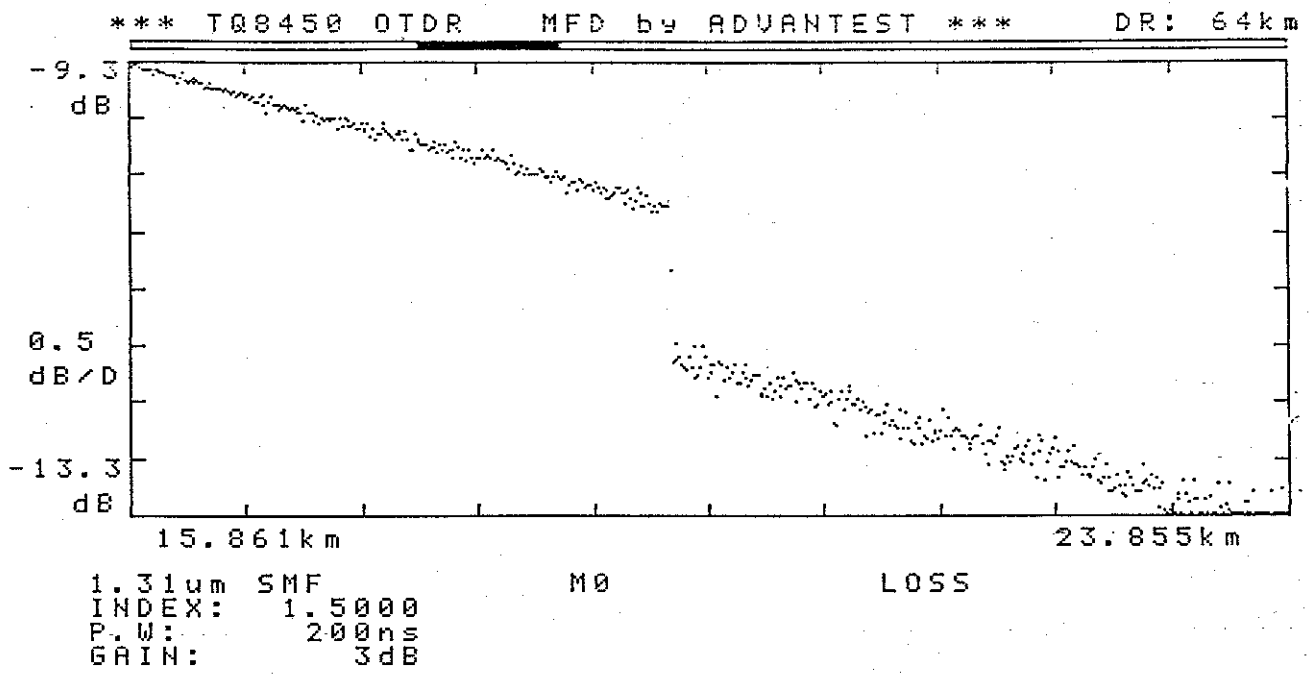


Before averaging

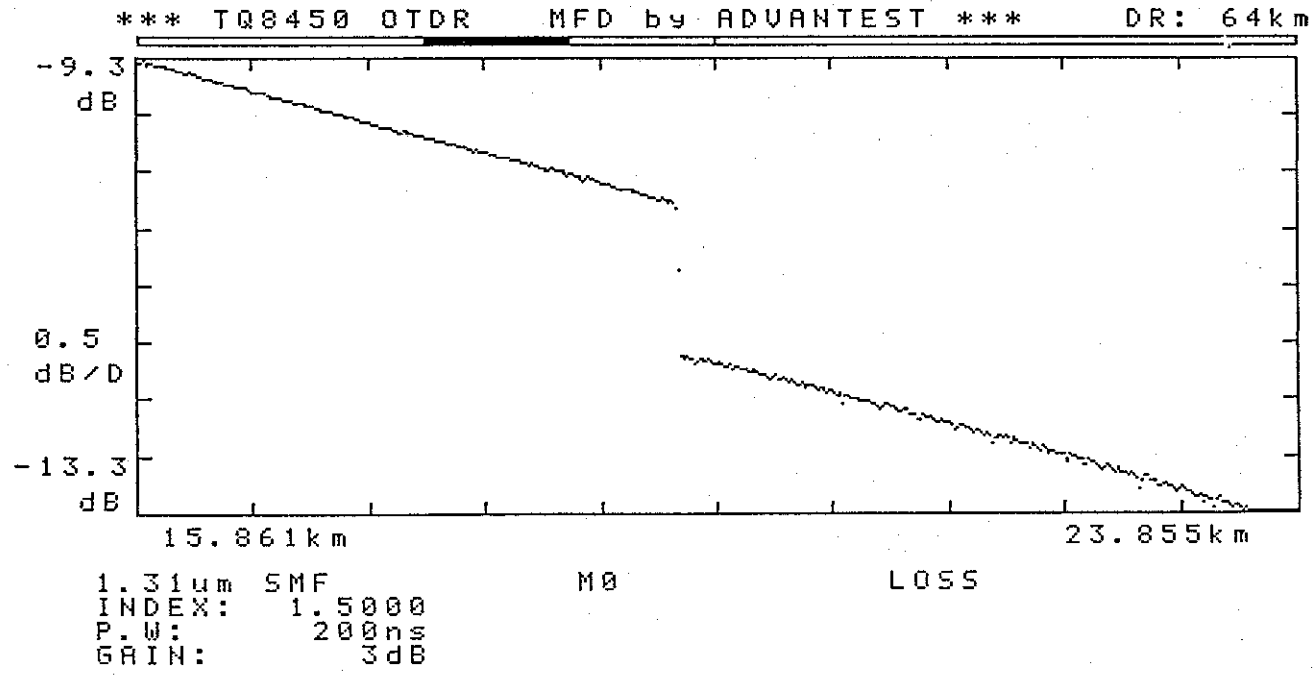


After averaging

Figure 3-6a Averaging (1)



Before averaging

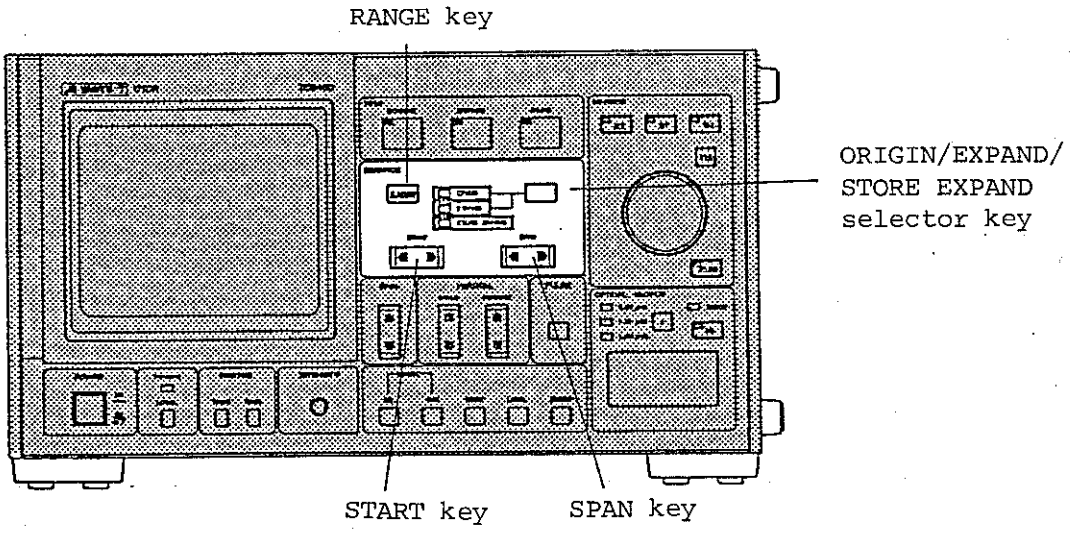


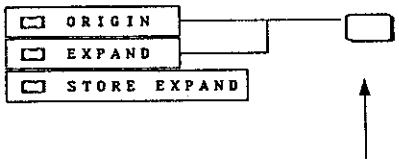
After averaging

Figure 3-6b Averaging (2)

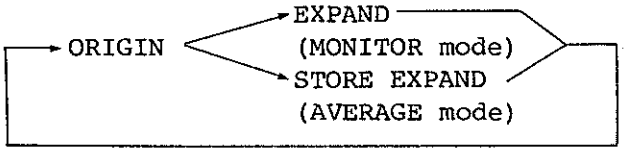
3.3.8 Setting a Distance

Set the start point and span of the waveform to be displayed in the measurement range set by the [RANGE] key.





Every time this key is pressed, modes are switched as follows:



Switching between EXPAND and STORE EXPAND is made automatically.

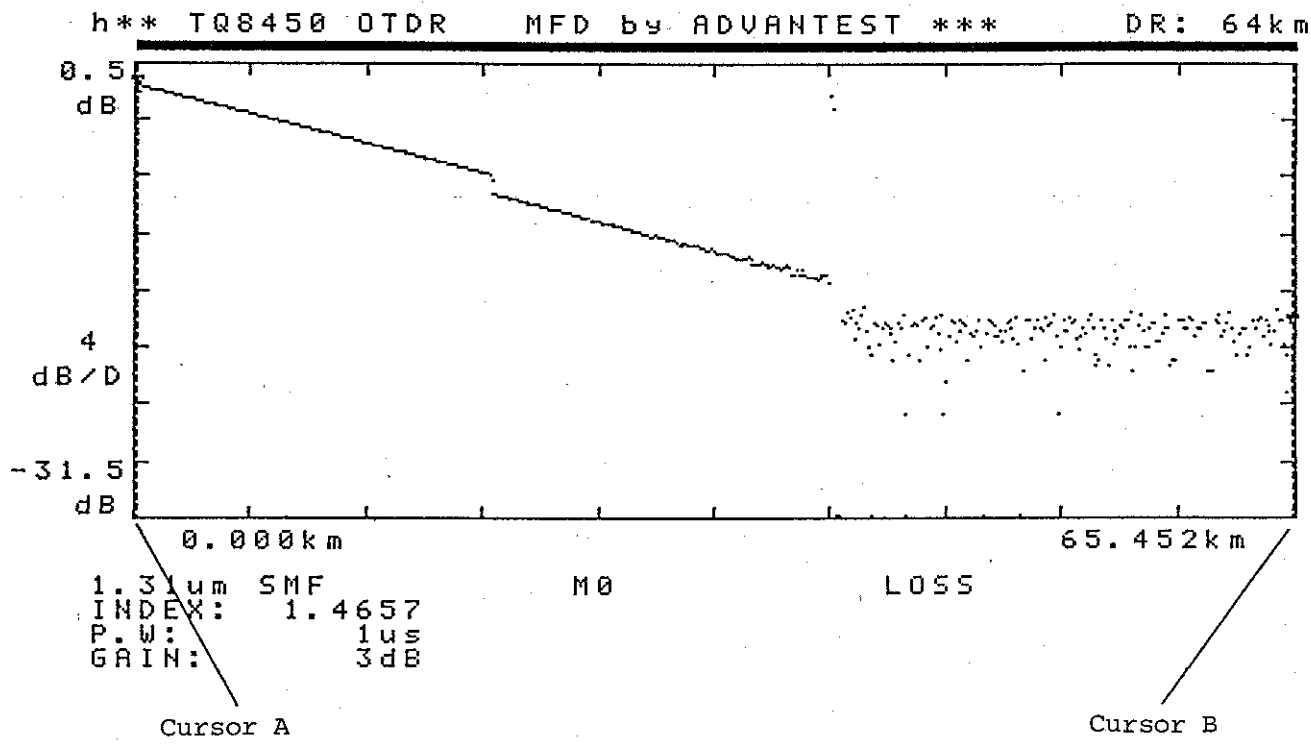
ORIGIN : The distance from the origin (0 m point of fiber cable) to the point selected in the RANGE mode is defined as the measurement range.
When this unit is powered, two vertical cursors A and B are displayed at the left and right ends of the screen in the ORIGIN mode.
These cursors can be moved along settable points using the START and SPAN keys. See Table 3-1 for settable points.

EXPAND : An expanded waveform is displayed in the MONITOR mode. In the ORIGIN mode, the distance between two points indicated by cursors A and B is defined as the display range.

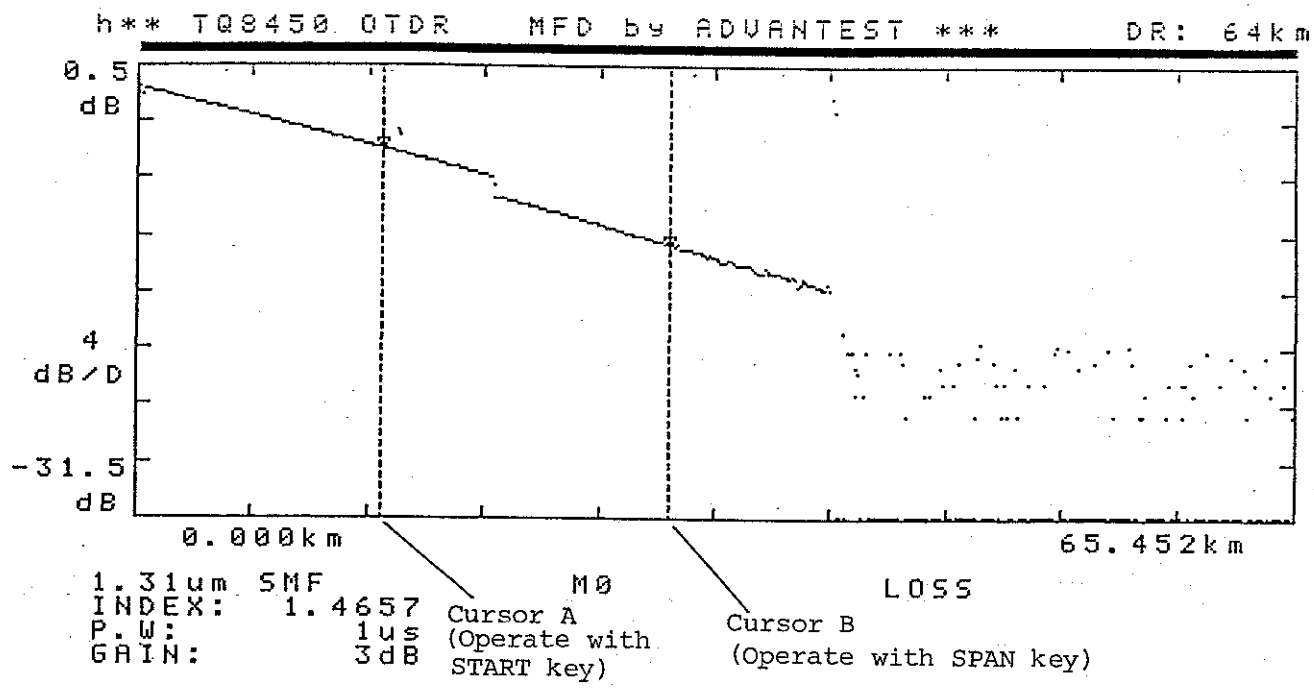
STORE EXPAND: An expanded waveform is displayed in the AVERAGE mode. Switching between EXPAND and STORE EXPAND is automatically made according to the mode selected in the VIEW section.

- Setting START and SPAN
  (1) ORIGIN mode
  When the DISPLAY key is pressed, the ORIGIN mode is selected and cursors A and B are displayed at both ends of the screen. Using START and SPAN keys, move two cursors at both ends of the waveform to be expanded.
  When the ORIGIN/EXPAND selector key is pressed, the waveform between cursors A and B is expanded and displayed on the screen.

① ORIGIN

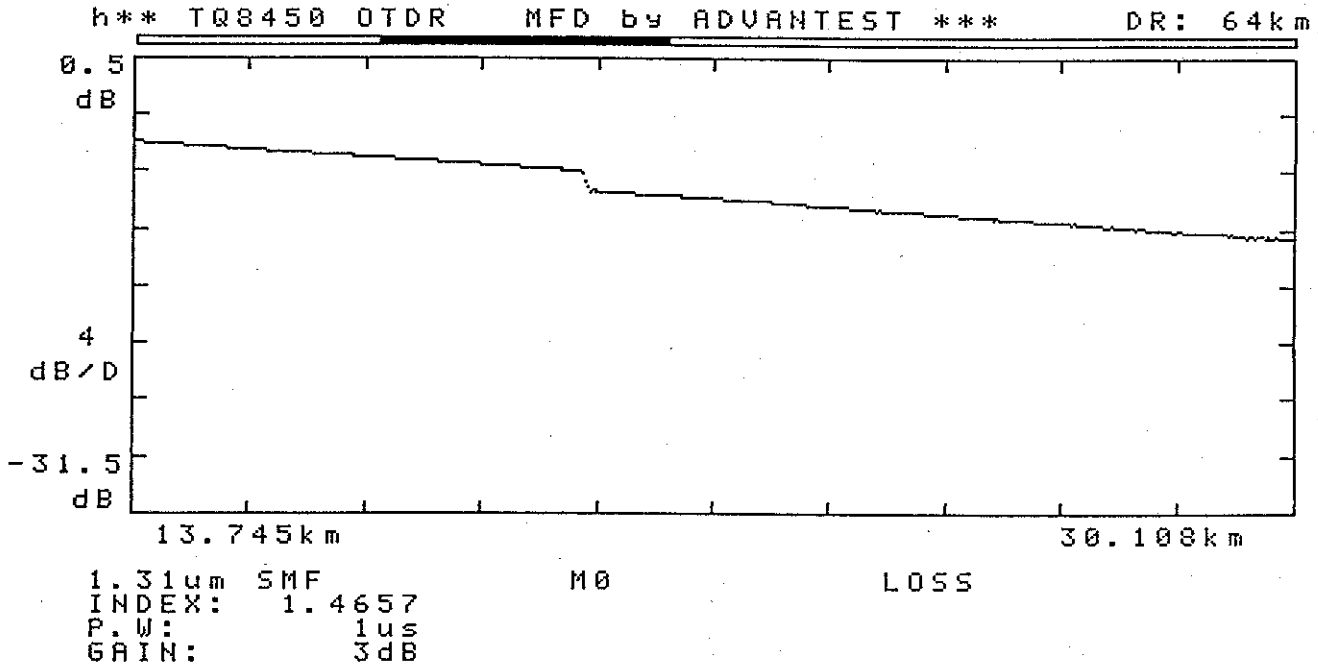


② ORIGIN



Set cursors A and B with START and SPAN keys.

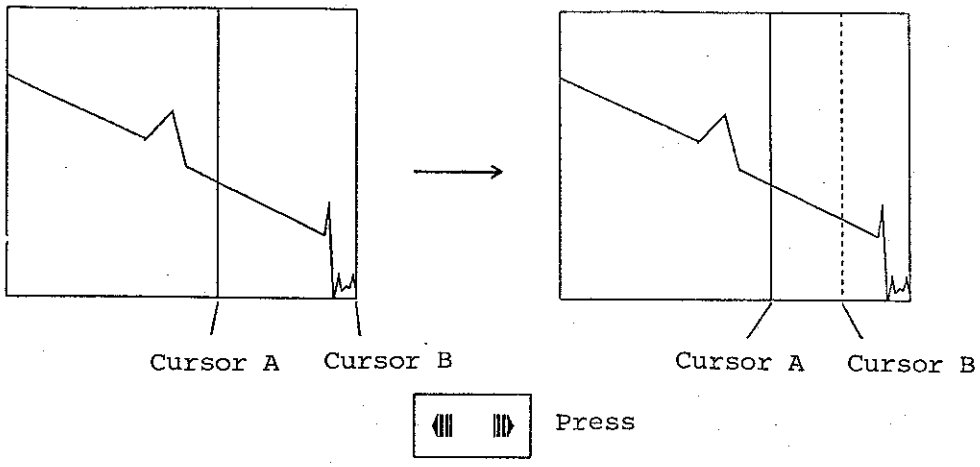
③ ORIGIN
EXPAND



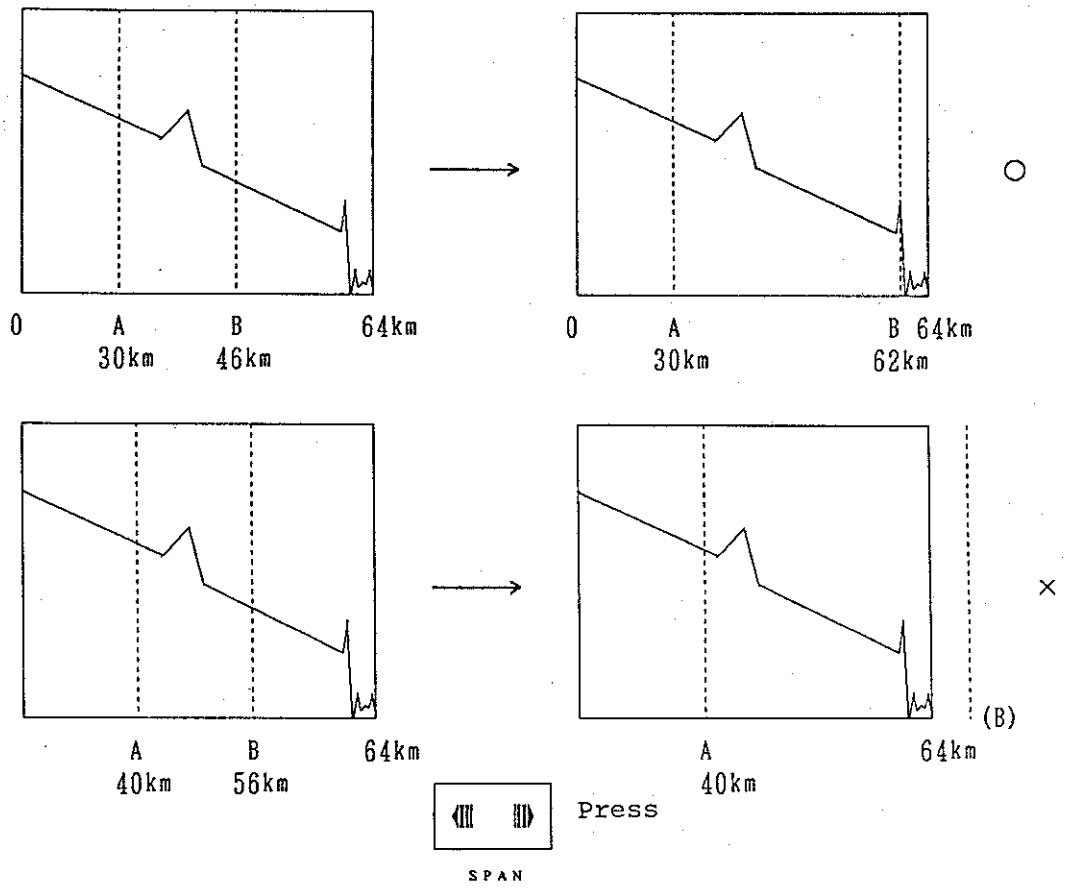
Expansion of waveform between sursors A and B

When the RANGE key is pressed once (if pressed one more time, the distance range changes) or the ORIGIN/EXPAND key is pressed, state ② above is set again.

Note: When an attempt is made to move cursor B above the stop position by pressing the START key, the span is reduced to 1/2 automatically.



When the span is expanded, the stop position depending on the span to be expanded must not exceed the stop position set on the screen.

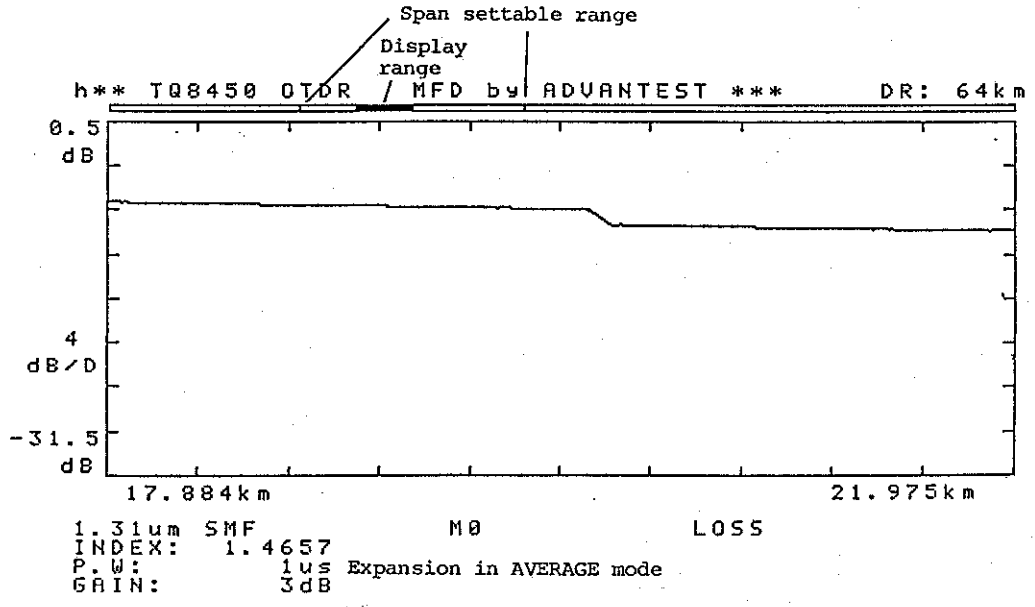


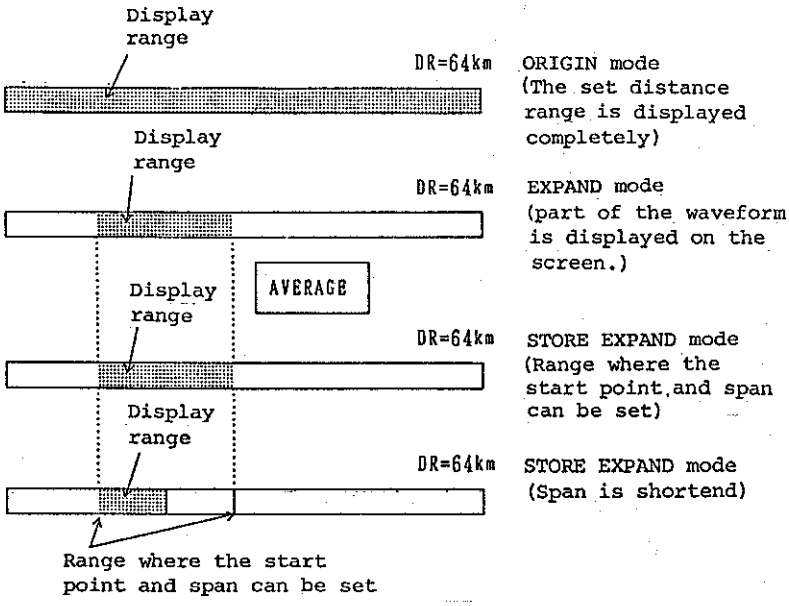
(2) EXPAND mode
In the EXPAND mode, the start point and span of the expanded waveform are set. Spans set by the SPAN key and steps set by the START key are listed below.

Span (km)	Step (m/point)
128	256
64	128
32	64
16	32
8	16
4	8
2	4
1	2
0.5	1

A span exceeding the set distance cannot be set.

(3) STORE EXPAND
The START key function is the same as that of the EXPAND mode; however, the settable range is specified. As a rule, the span within the range specified in the EXPAND mode may be set. If the span is 8 km or less, it can be expanded up to 16 km. In the STORE EXPAND mode, the usable range is indicated by the horizontal band at the top of the screen.





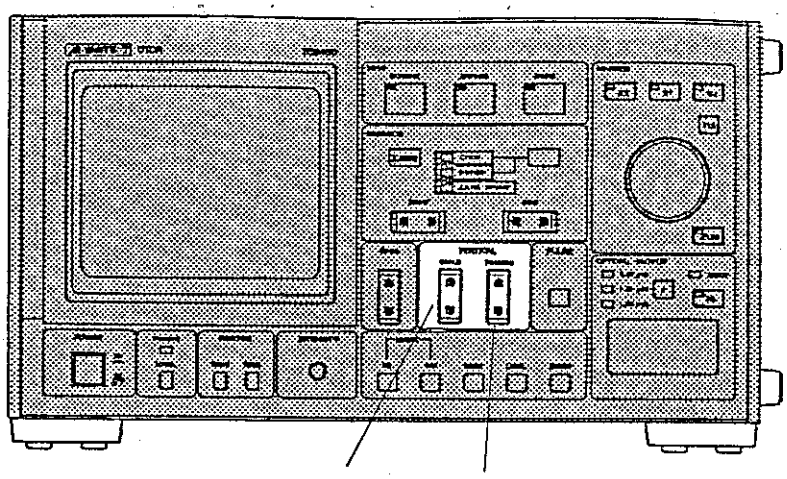
Reading the horizontal band at the top

The following table lists the spans that can be set in the STORE EXPAND mode for the spans set in the EXPAND mode:

STORE EXPAND SPAN (km) / EXPAND SPAN (km)	128	64	32	16	8	4	2	1	0.5
128	o	o	o	o	o	o	-	-	-
64	-	o	o	o	o	o	o	-	-
32	-	-	o	o	o	o	o	o	-
16	-	-	-	o	o	o	o	o	o
8	-	-	-	o	o	o	o	o	o
4	-	-	-	o	o	o	o	o	o
2	-	-	-	o	o	o	o	o	o
1	-	-	-	o	o	o	o	o	o
0.5	-	-	-	o	o	o	o	o	o

o: Setting enabled
-: Setting disabled

3.3.9 Setting in VERTICAL Section



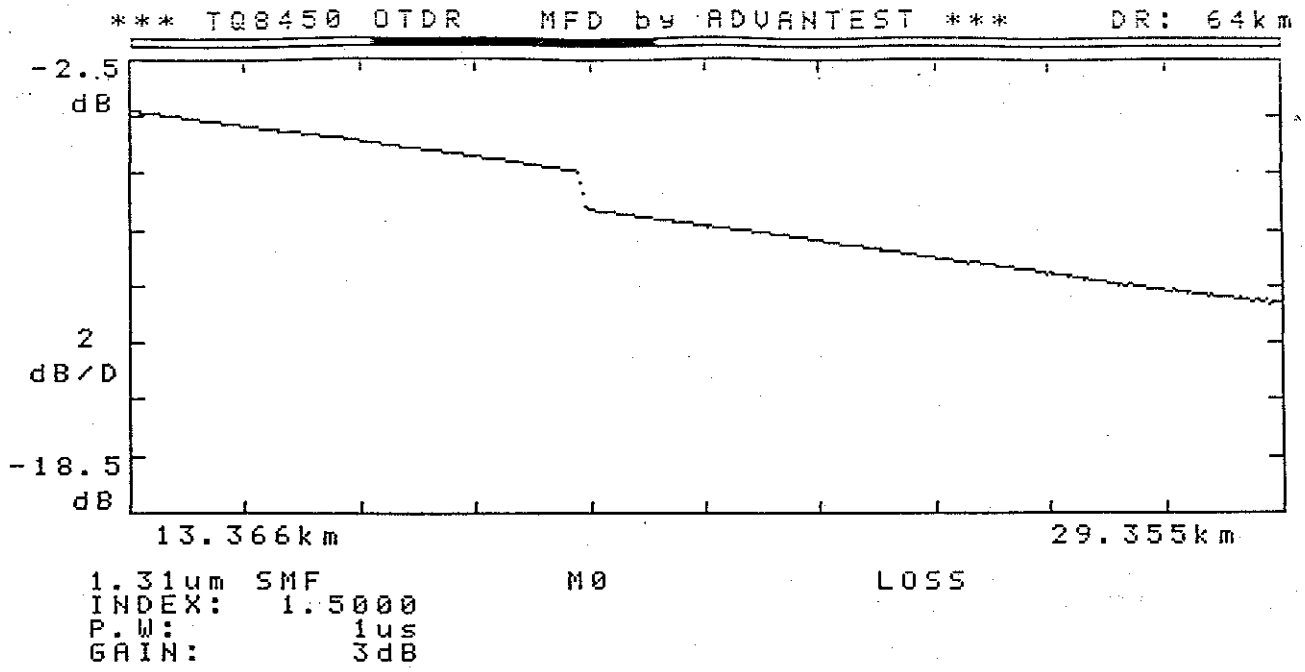
SCALE key POSITION key

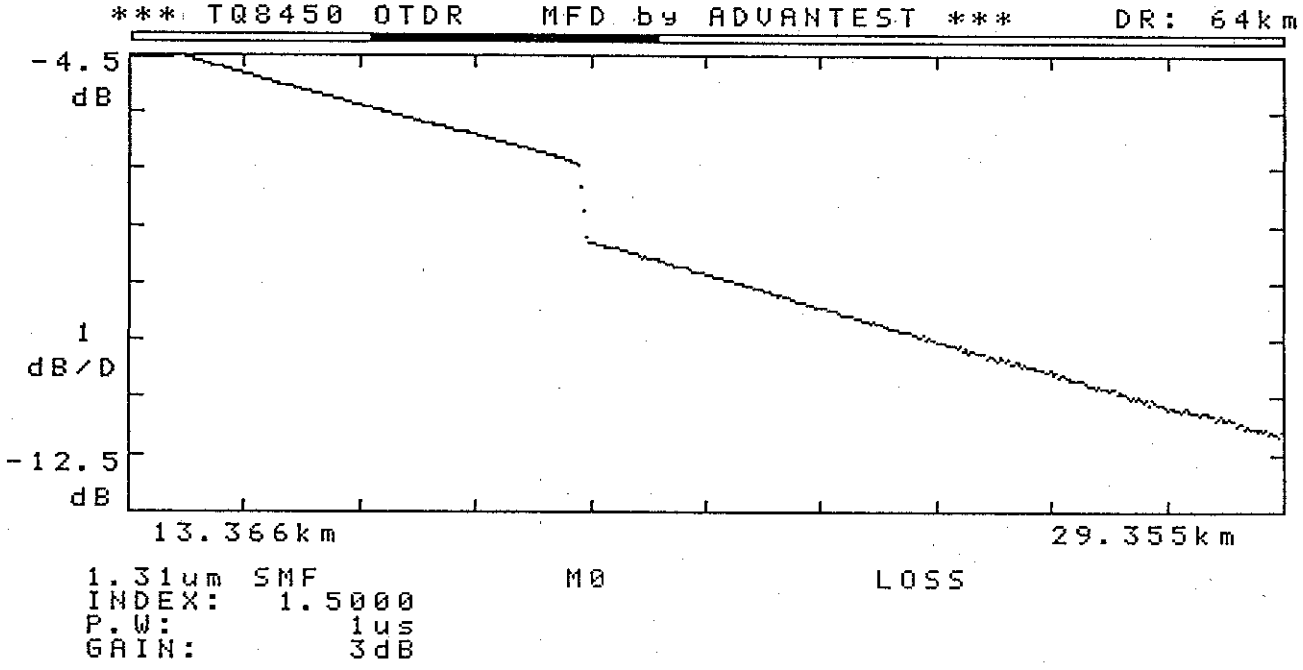
(1) Setting the SCALE

Every time this key is pressed, the vertical axis scale is changed as follows:

4 dB/DIV.⟷ 2 dB/DIV.⟷ 1 dB/DIV.⟷ 0.5 dB/DIV.

Select the fiber cable loss according to the splice loss condition. The vertical axis always consists of eight divisions.
Scaling is changed with reference to the second graduation from the top.
When M0 marker is displayed, POSITION is changed to align M0 marker position with the second graduation from the top of the vertical axis.

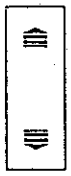




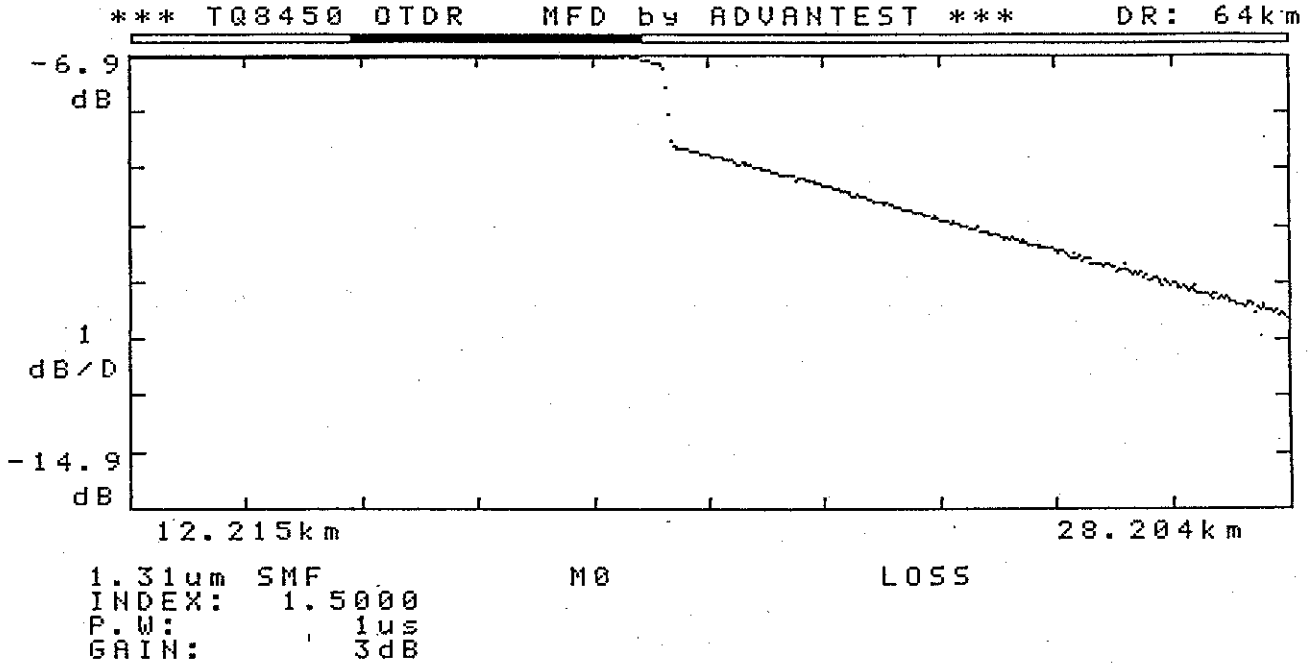
Expansion from 2 dB/div. to 1 dB/div.

(2) Setting the position

POSITION



The reference level can be changed and the waveform can be moved up and down with this key.



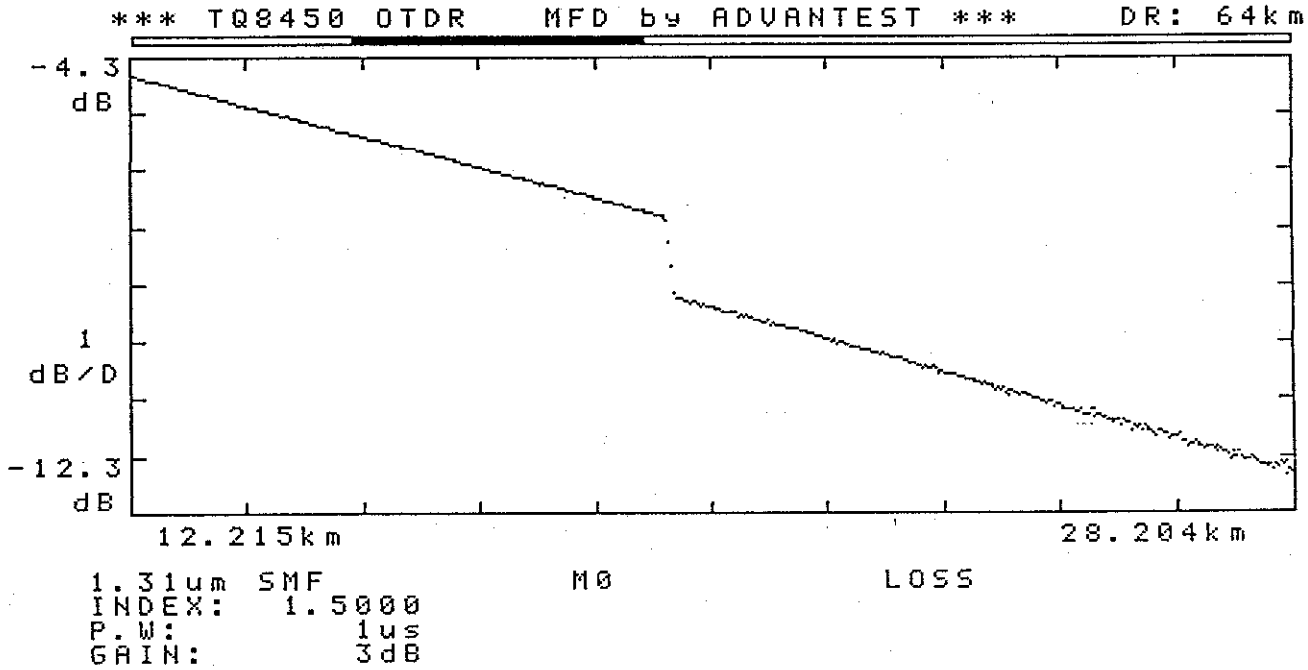
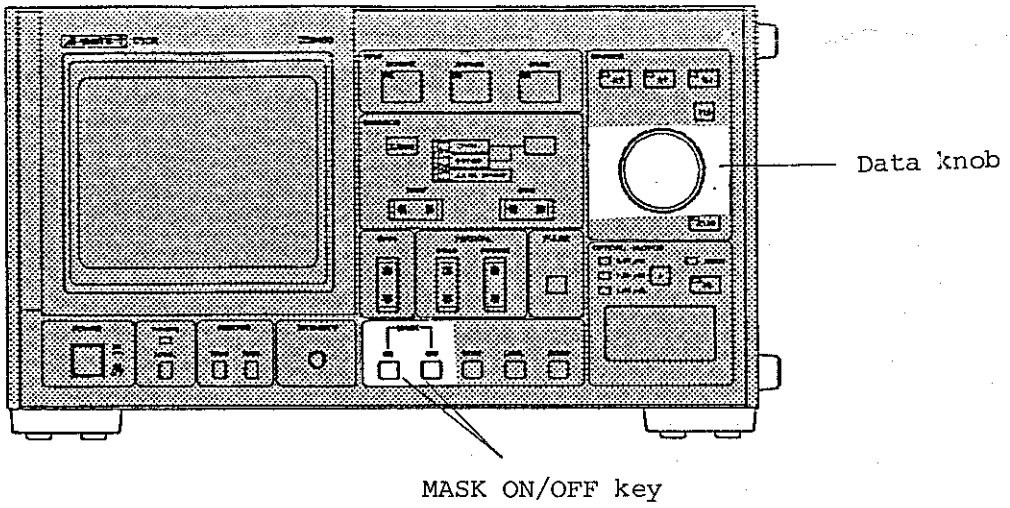
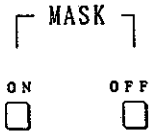


Figure 3-7 Changing Position

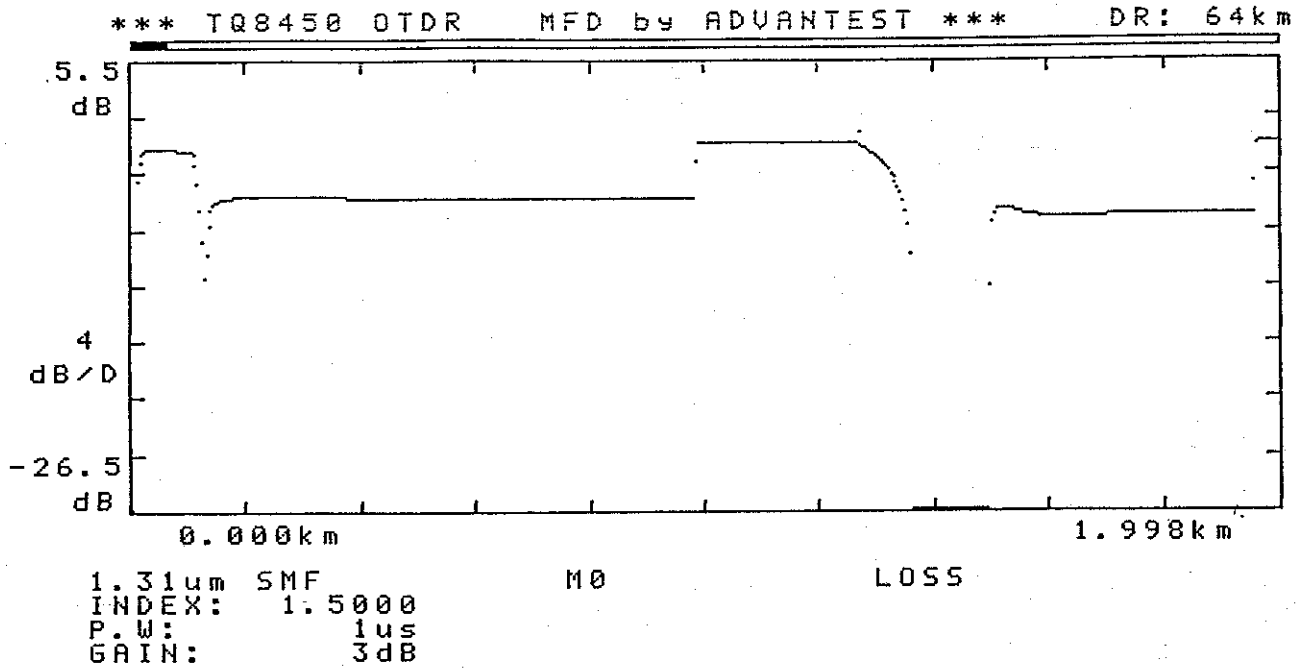
3.3.10 Mask Function



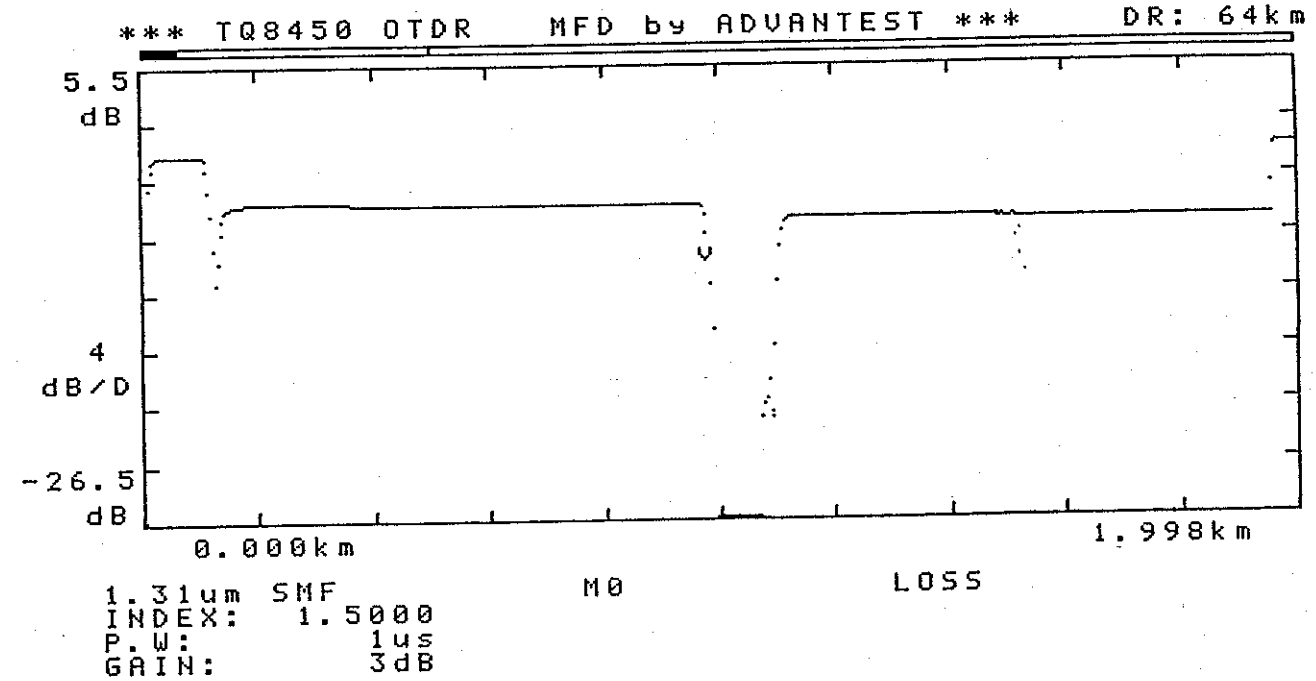


If the Fresnel reflection level is too high, the waveform is distorted and the measurement result becomes inaccurate. The mask function is used to reduce Fresnel reflection to improve linearity of the displayed waveform. Up to three masks may be set.

Move the M0 marker to the mask position. When the MASK ON key is pressed, the mask is set and "V" is displayed at the mask position. By repeating this procedure, up to three mask points may be set. After setting three mask points, move the M0 marker and press the MASK ON key. The initially set mask point is unmasked and the mask is set on the M0 marker.
To clear a mask, press the MASK OFF key. Every time the MASK OFF key is pressed, masks are cleared from the one closest to the M0 marker. Do not forget to display the M0 marker before using the MASK OFF key.



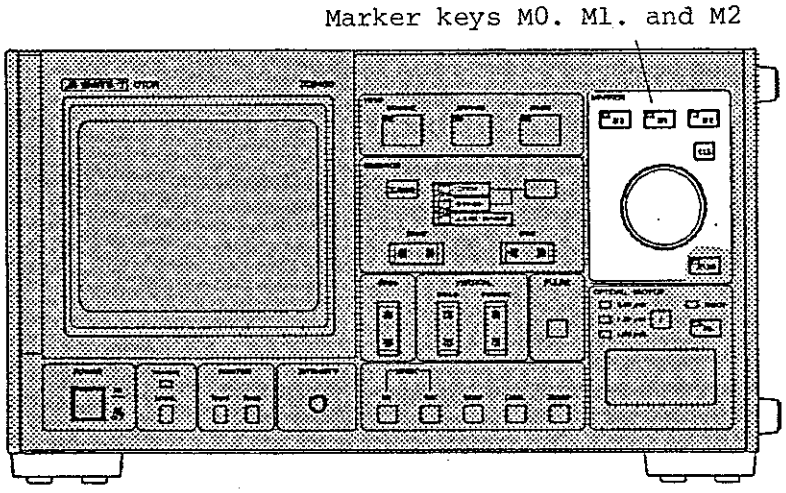
Fresnel reflection at connection point



Setting a mask at the position
where Fresnel reflection occurs

3.3.11 Marker Function

Up to three markers may be displayed. The obtained waveform can be read digitally.

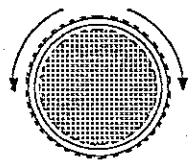


MARKER

M0 M1 M2

Up to three markers can be displayed. The break point position and splice loss can be obtained by using M0, M1, and M2 keys.
Use the data knob to move a marker. When the marker key corresponding to the marker to be moved is pressed, a vertical cursor appears on this marker. Turn the knob to move this cursor. The LEDs of M0, M1, and M2 keys are used to indicate the marker currently displayed on the screen. (The marker corresponding to the LED which is lit is displayed on the screen.)
Symbols of M0, M1, and M2 markers are all the same. When three markers are displayed, they are called M0, M1, and M2 from the left. When two markers are displayed, they are called M1 and M2 from the left; that is, M2 must not be moved to the left of M1.

Marker moves to the left.



Marker moves to the right

CLR

All markers are cleared.

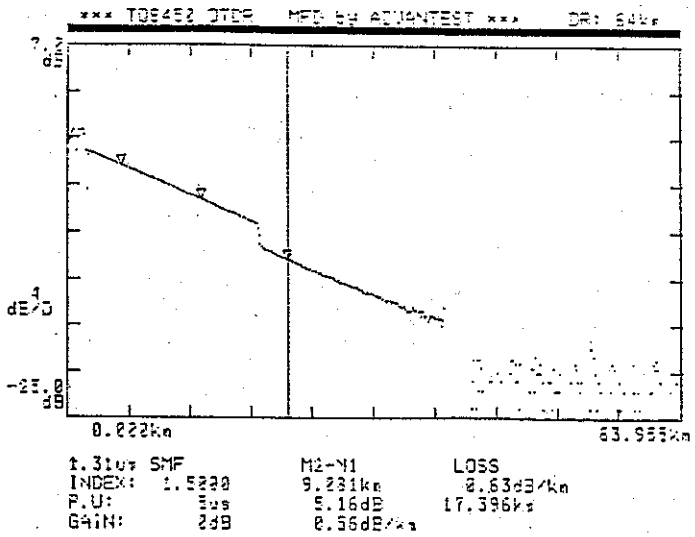
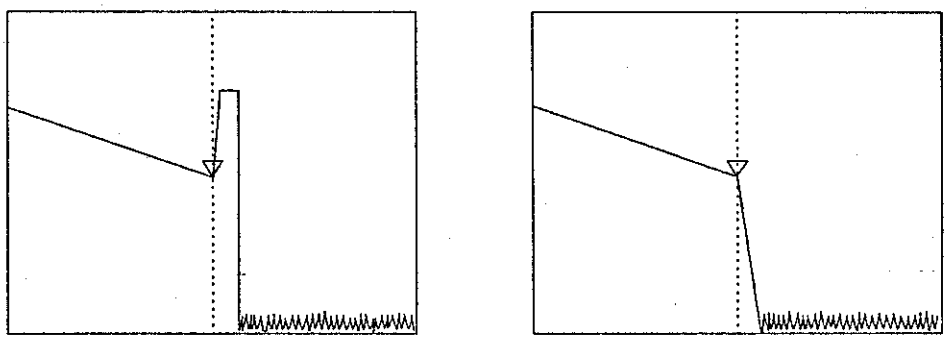


Figure 3-8 Marker

3.3.12 Examples of Measurement by Marker Function

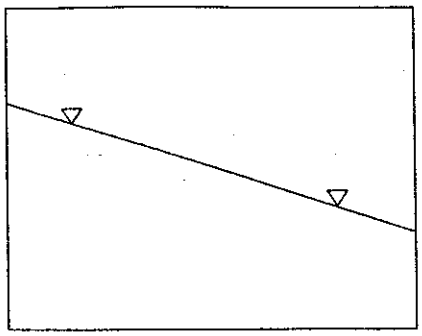
(1) Measuring the break point position
Using the M0 marker, obtain the absolute distance from light radiation end to break point.

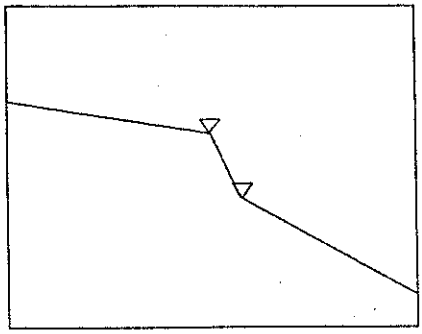
- Example of measurement
Set the marker on the left of the Fresnel reflection. If Fresnel reflection is not detected, set the marker to the position preceding the back-scattering change point.



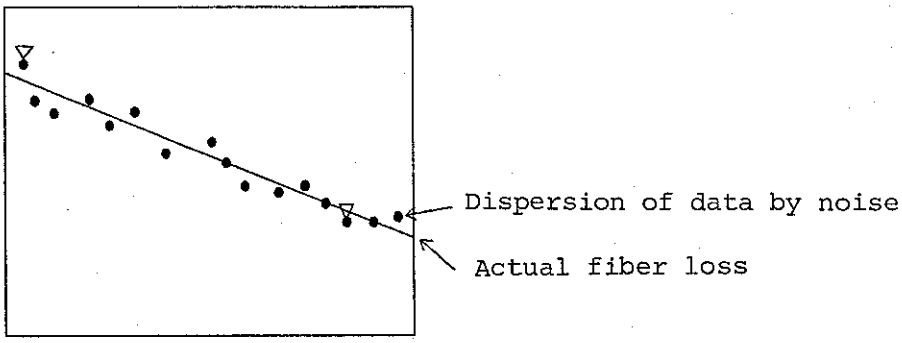
The measurement result is displayed under M0 at the bottom of the screen.

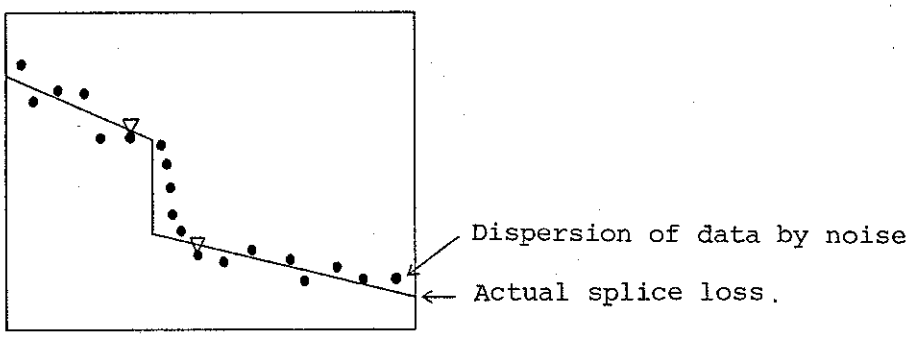
(2) Example of measurement of fiber loss and splice loss
Using M1 and M2 markers, measure the relative loss and distance between two points on the fiber cable to be measured. When measuring the fiber loss, set the markers at two desired points on the fiber cable. When measuring the splice loss, set the marker at the beginning and end of splice change.

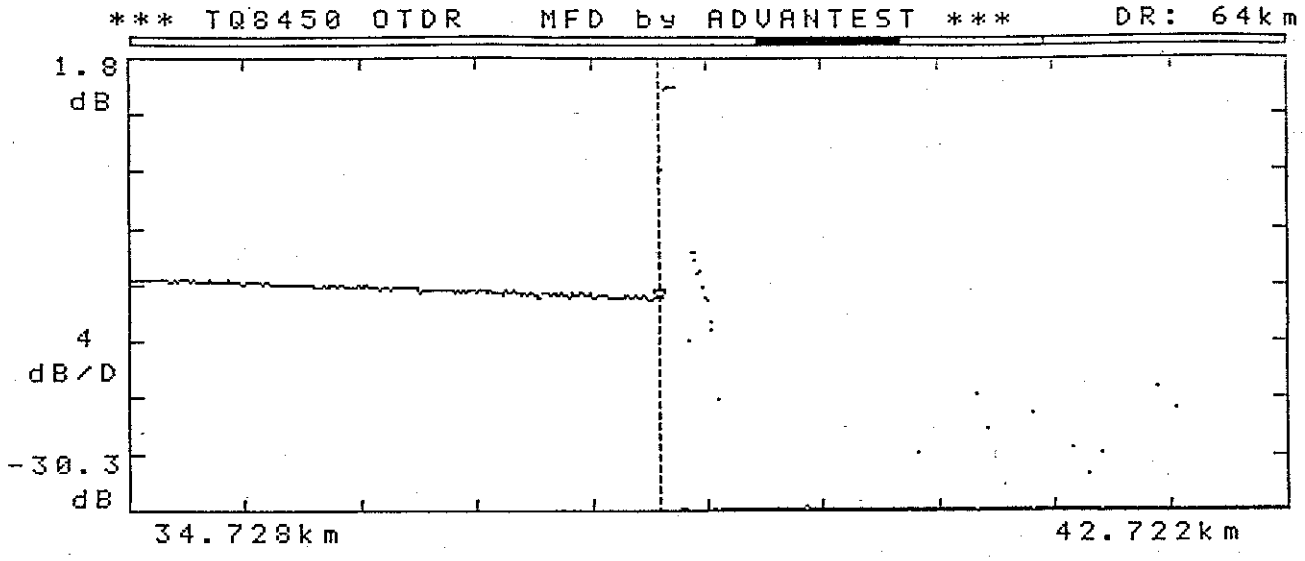




The result of measurement by this method disperses and involves a large error when the noise level is high.
When measuring the splice loss, splice points may get blunted because of pulse widths and light sensor amplifier frequency characteristics and consequently the obtained result becomes inaccurate. To obtain an accurate value, the three markers and the LSA method.
(See the explanation on the SPLICE/LOSS mode.)







1.31um SMF
INDEX: 1.5000
P.W: 1us
GAIN: 3dB

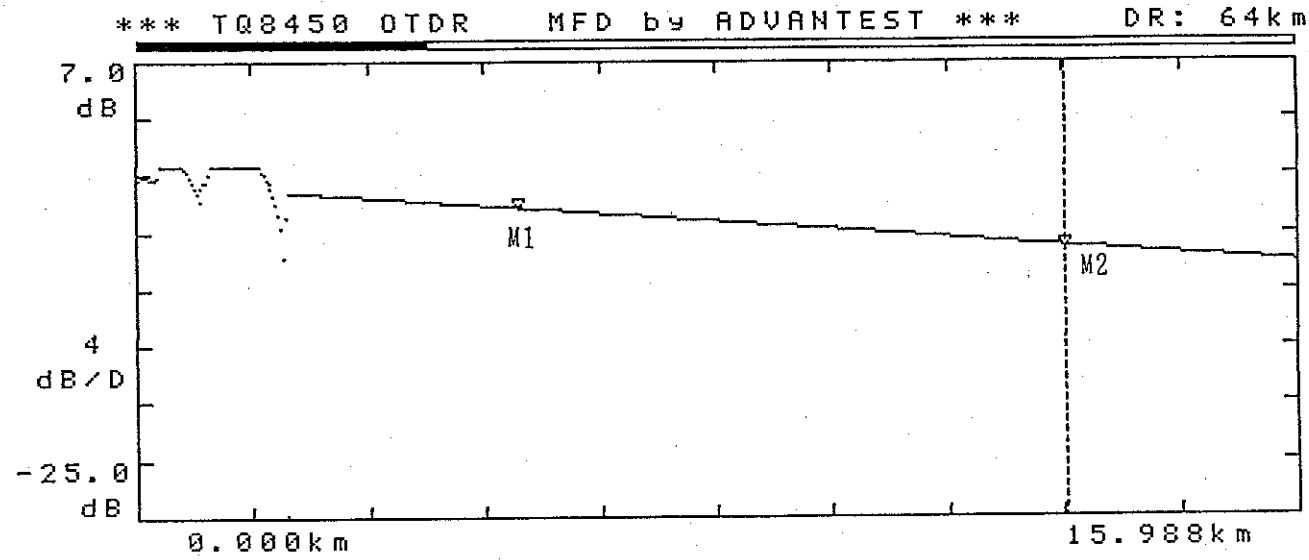
M0
38.373km
-15.18dB

SPLICE

Distance between light radiation end and M0

Absolute value on vertical axis

Example of measurement of break point position



1.31um SMF
INDEX: 1.5000
P.W: 5us
GAIN: 0dB

M2-M1
7.546km
2.65dB
0.35dB/km

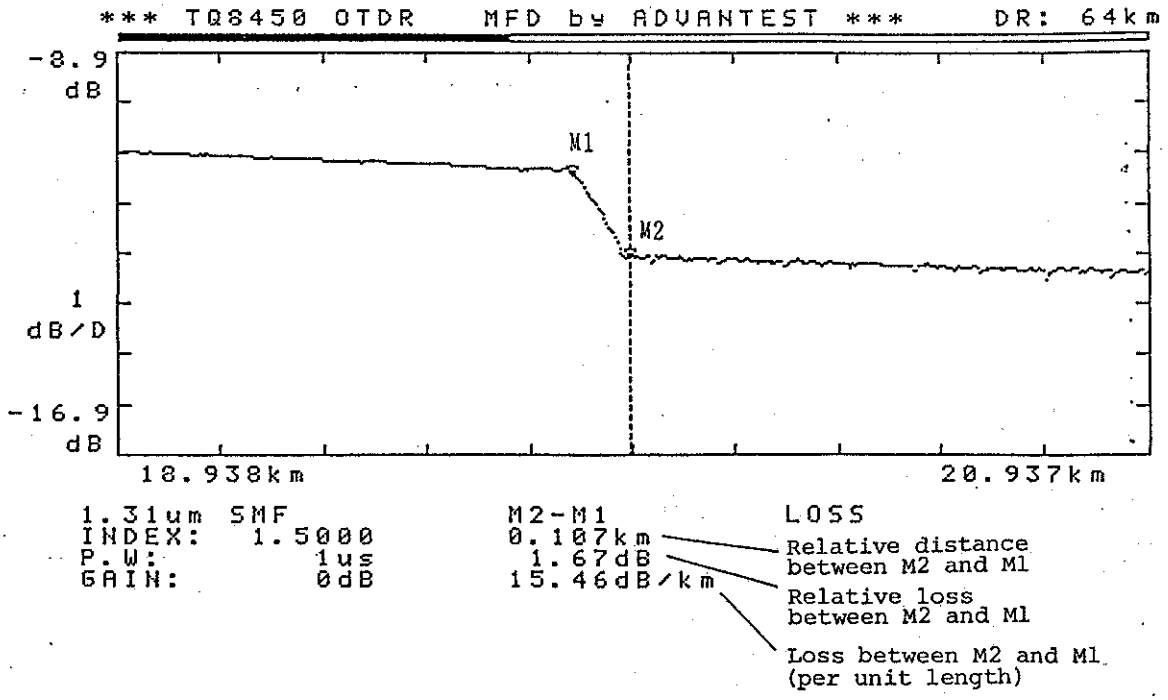
LOSS

Relative distance between M2 and M1

Relative loss between M2 and M1

Loss between M2 and M1 (per unit length)

Measurement of fiber loss with two markers



Measurement of splice loss with two markers

Display changes according to indicated markers and SPLICE/LOSS mode.

- When only one marker is displayed;

  This marker's distance and level value.

- When two markers are displayed;

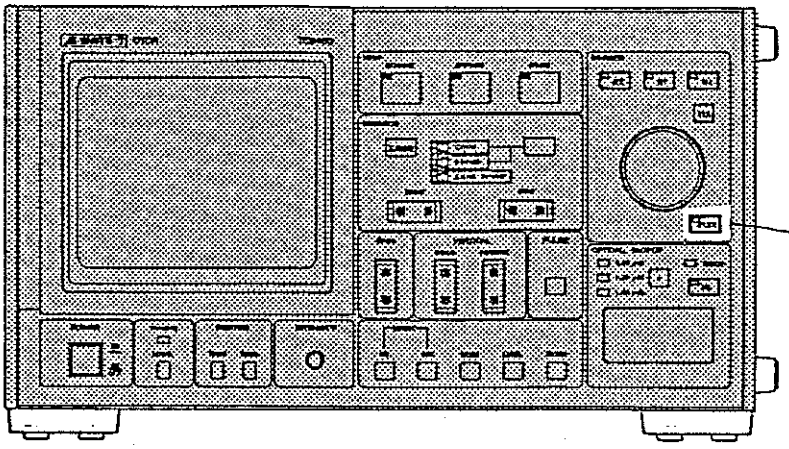
  Relative distance and loss between two markers.

- When three markers are displayed;

  In LOSS mode ..... Relative distance and loss between M1 and M2.
  In SPLICE mode ... Distance and level values of M1.

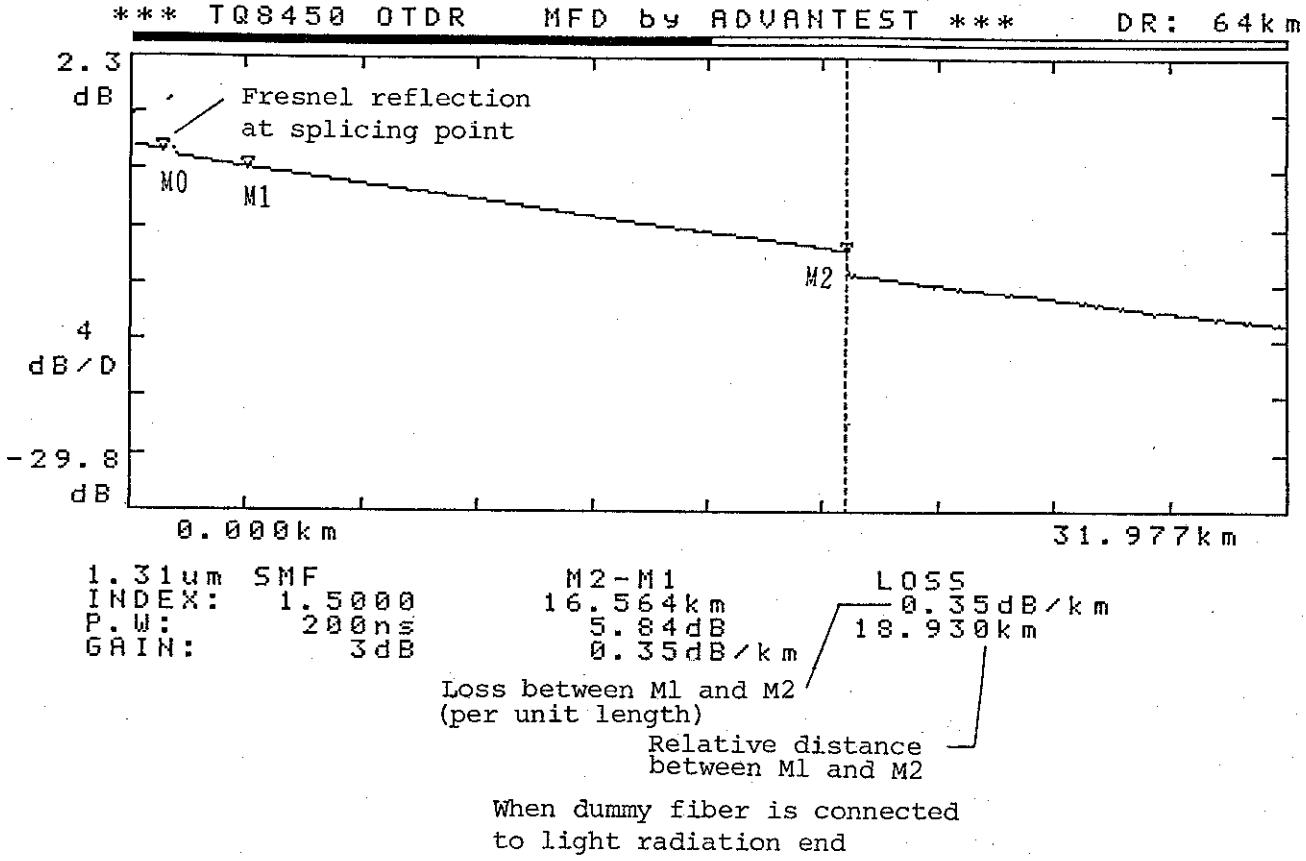
3.3.13 SPLICE/LOSS Mode Selection

The SPLICE mode is used to obtain the splice loss of the fiber cable to be measured. The LOSS mode is used to obtain the fiber loss by the LSA (Least Square Approximation) method.

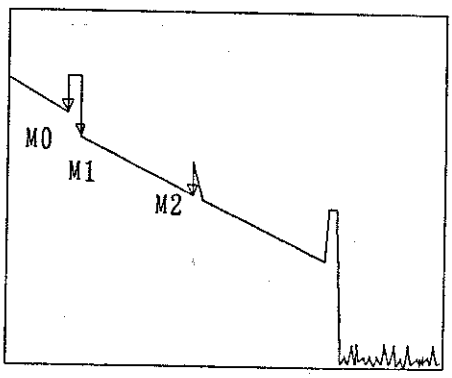


LED off: Ordinary mode for measuring loss between two points
LED on : Mode for measuring splice or fiber loss

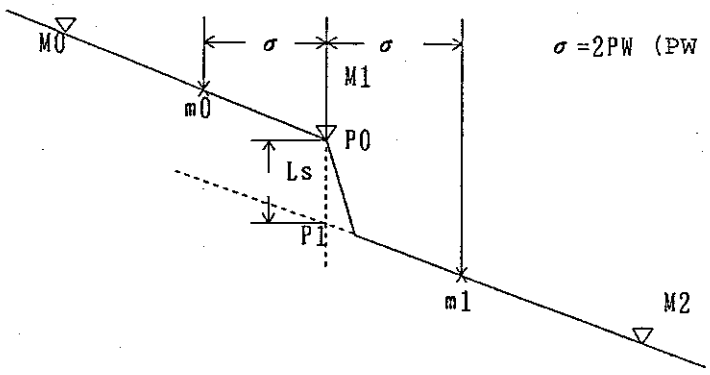
(1) Measurement in LOSS mode (by LSA method)
Set two markers M1 and M2 on the fiber cable to be measured, obtain the approximate value with the LSA method, and display the loss. When the M0 marker is used, the distance of the fiber cable to be measured can be obtained by connecting a dummy fiber cable to the light radiation end.



Set two markers M1 and M2 so that Fresnel reflection is not detected between them. (A linear approximation error occurs.)

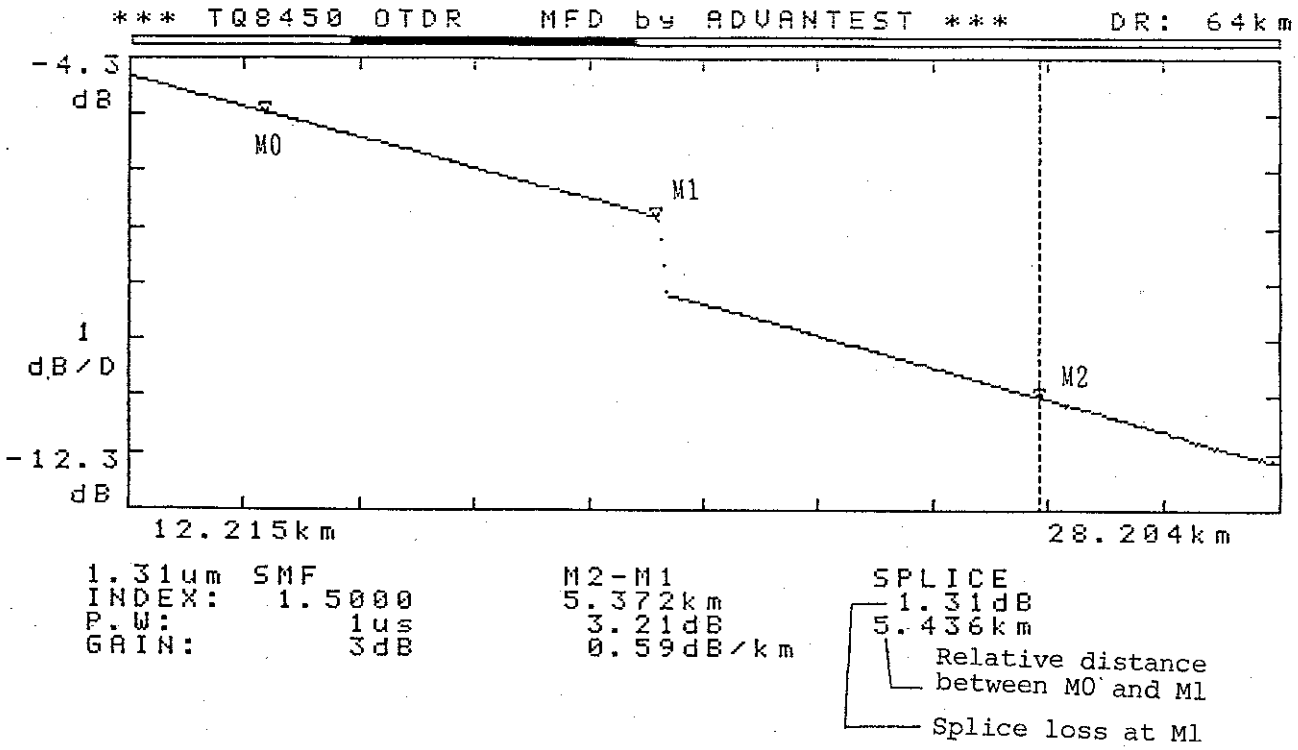


(2) Setting in SPLICE mode
Using three markers M0, M1, and M2 obtain the fiber splice error.



σ =2PW (PW = Pulse width setting)

Set M1 at the splice change point and set M0 and M2 at desired points on the left and right fiber cables connected at the splice point. When these markers are set, points m0 and m1 are generated at a distance of σ from M1 respectively so that arithmetic operation can be performed by the LSA method. (Points m1 and m0 are not displayed on the screen.) When intersection point P1 is obtained according to the value measured between M0 and m0 and the value measured between m1 and M2, the difference between levels P0 and P1 is the splice loss. The reason for setting m1 and m0 at a distance of σ is that the approximate line obtained near M1 may be erroneous because Fresnel reflection may be caused at M1, or splice points may get blunted because of pulse width or light sensor amplifier frequency characteristic.
When setting the above markers, Fresnel reflection or splice loss must not be detected between M0 and m0 and between M2 and m1 like the LOSS mode.



Measurement in SPLICE LOSS mode

3.3.14 Video Output

A composite video signal is output from the VIDEO OUT terminal. The hardcopy of screen data can be output by connecting a video printer using a cable with BNC connectors. Before taking a hard copy, press the PAUSE key to make the waveform still.

3.3.15 Direct Plot through GPIB

Measurement results can be automatically plotted by plotter when an applicable plotter is connected to the GPIB connector of this unit (TQ8450).

(1) Plotter connecting

Only digital plotter of R9833 (produced by ADVANTEST Corp.) or HP7470A, HP7475A (produced by Hewlett Packard Corp.) can be connected with this unit. In these plotters, ISO A4 (210mm x 297mm) and ANSI A (8 1/2" x 11") size paper can be used in lateral lines.

To connect this unit and each plotter, connect 24 pin GPIB connector on the rear panel of main unit and 24 pin GPIB connector on the rear panel of each plotter with GPIB standard bus cable.

(2) GPIB Address Switch Setting

Set talker only by setting talker only bit of address switch on the main-unit rear panel to 1 (See Figure 3-9.).
And set the GPIB address switch of the plotter (currently connected with the amin unit) to 31 (See Figure 3-10.).

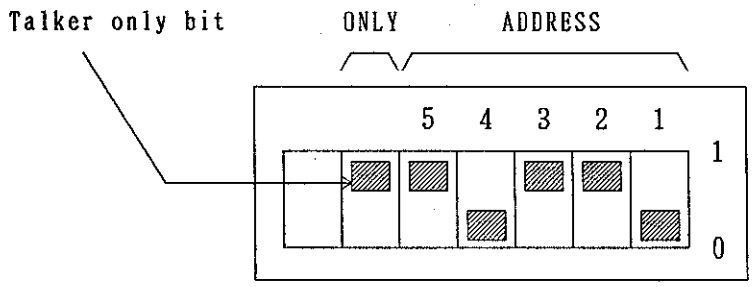


Figure 3-9 GPIB Address Switch of TQ8450

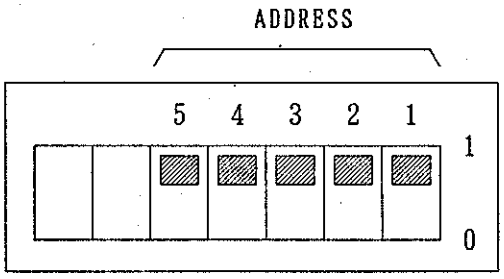


Figure 3-10 GPIB Address Switch of Plotter

(3) Operation

Depress LOCAL key and then PRINT key to automatically plot the measurement results by plotter. If only PRINT key is depressed, the measurement results is printed out onto the main unit built-in printer.

(4) Plot

In the automatic plotting by plotter, plotter pen number of 2 is used for drawing waveform while plotter pen number of 1 is used for the other. Waveform is output with solid line. Plotting example is shown in Figure 3-11.

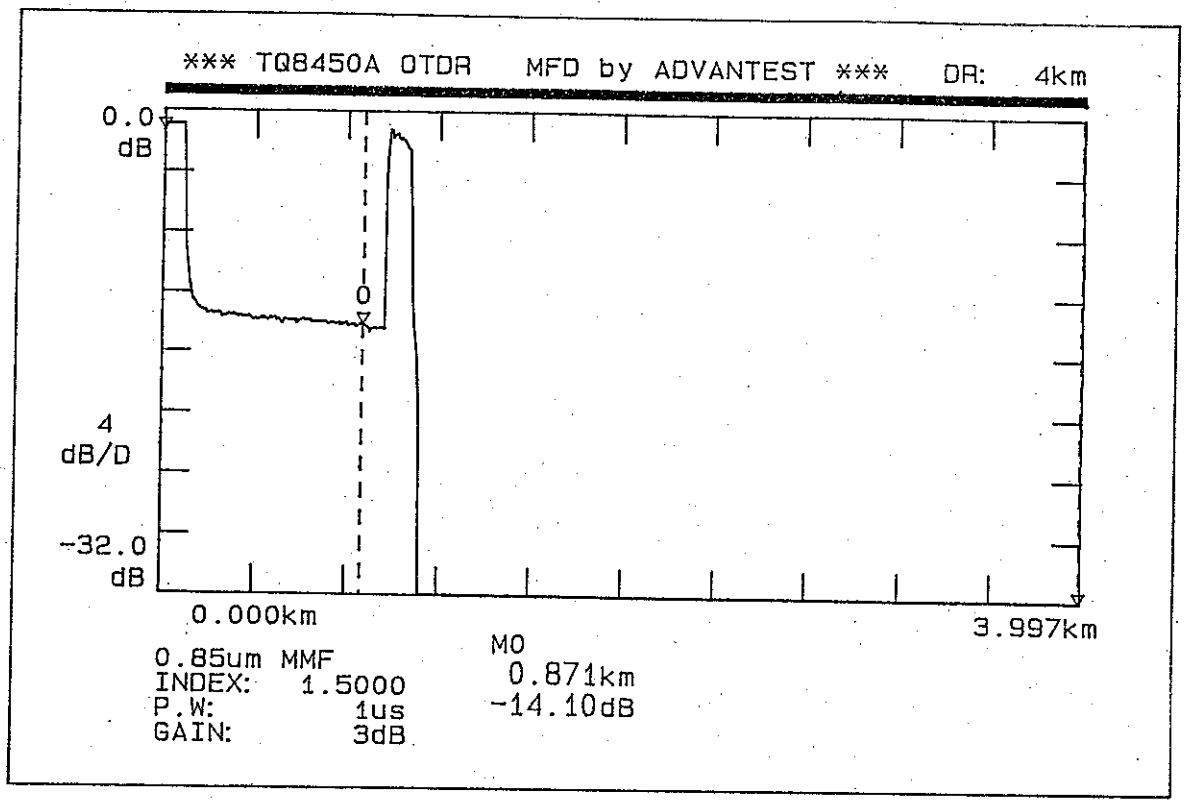
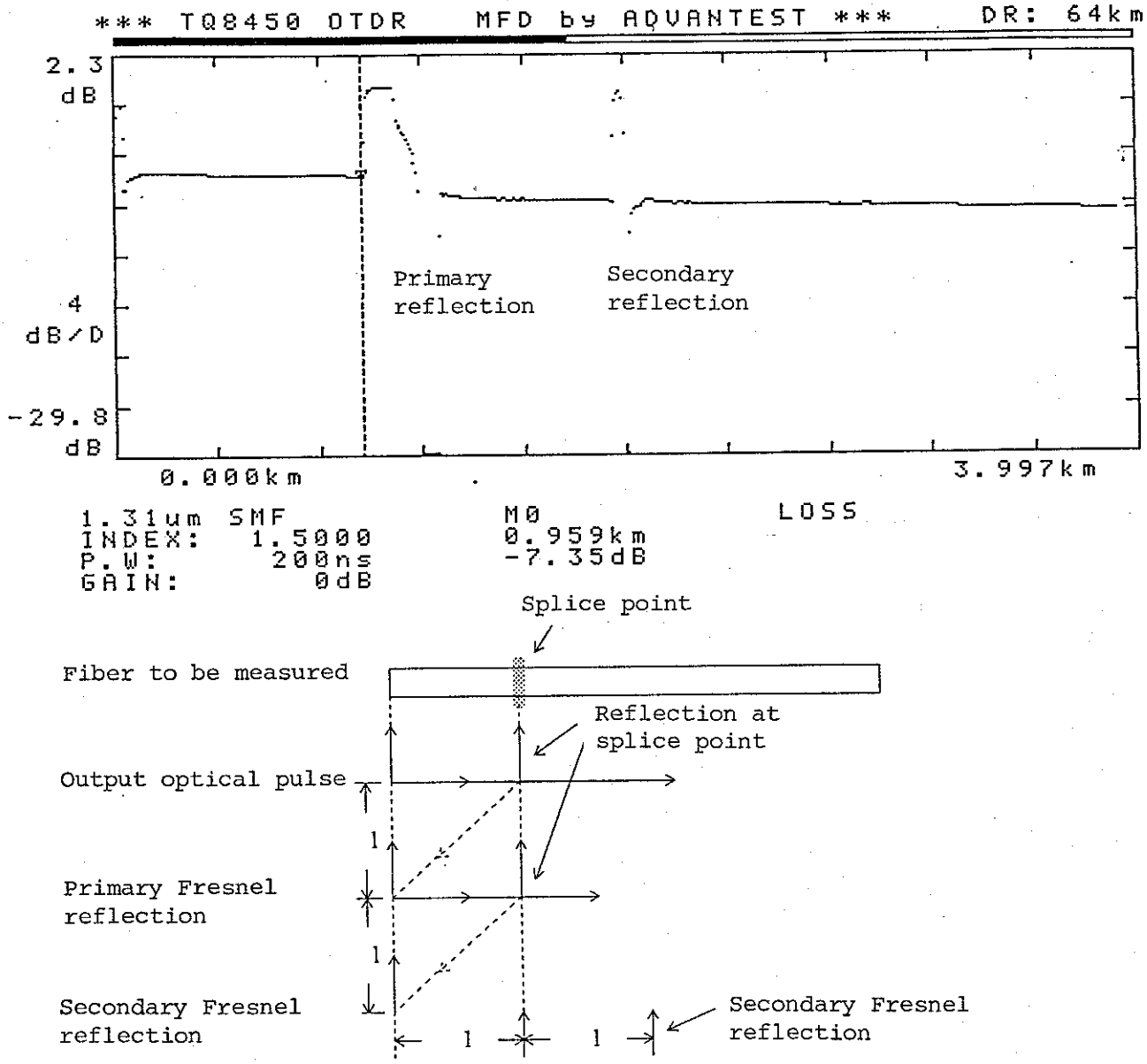


Figure 3-11 Example of Plot Output

4. MULTIREFLECTION

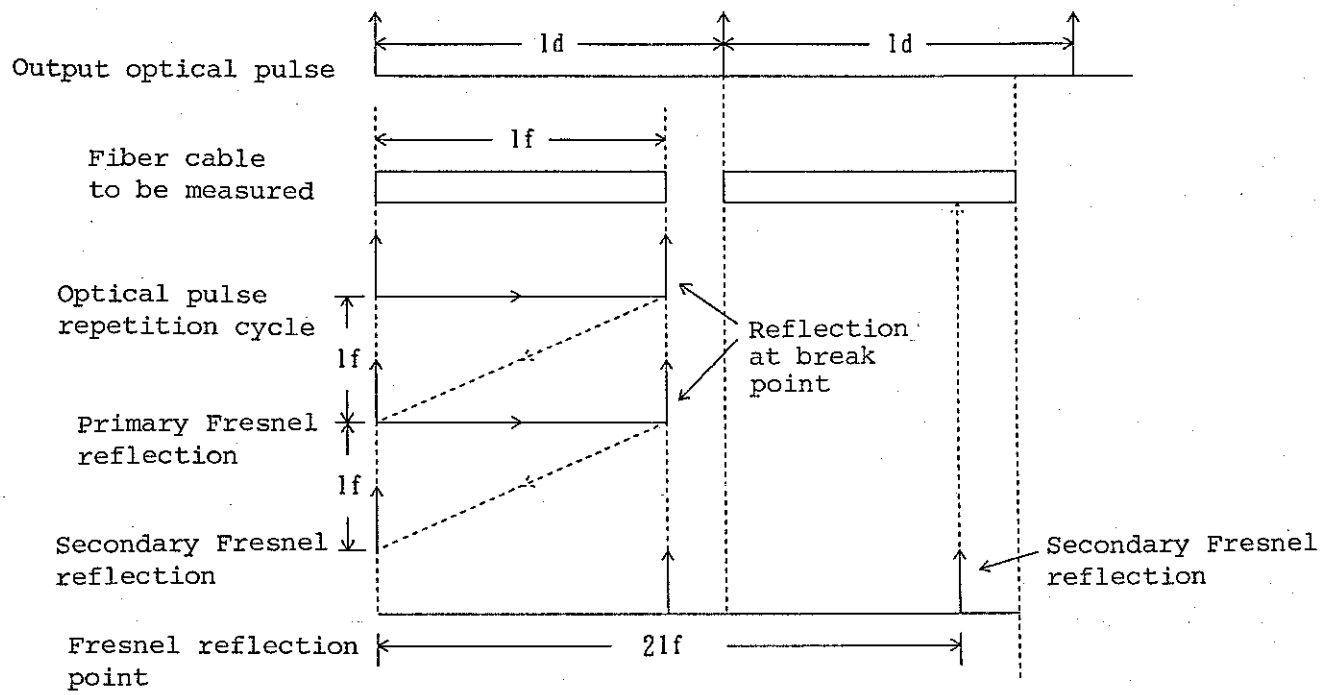
4.1 ABOUT MULTIREFLECTION

The optical pulse emitted from the light radiation end returns from the break point of the fiber cable (to be measured) as Fresnel reflection (primary Fresnel reflection). It is reflected in the splice part of the light radiation end, then it is reflected at the break point as Fresnel reflection (secondary reflection). The repetitive reflection of the output optical pulse within the fiber to be measured is called multireflection. If the multireflection occurs, Fresnel reflection occurs at points other than splice and break points.



If the fiber that is spliced at a distance of 1 from the light radiation end is measured as shown above, secondary Fresnel reflection occurs at 21. Actually, Fresnel reflection occurs more times (tertiary reflection, quaternary reflection, ...) but does not appear because of the extremely low level.

If an optical fiber cable 1/2 as long as the optical pulse repetition cycle is measured, secondary reflection occurs at the following point:



Assume that the optical pulse repetition cycle is 1d, the fiber length is 1f, and 1d is less than 21d; primary Fresnel reflection occurs at the remote end of the fiber and secondary reflection occurs at the remote end of the fiber and secondary reflection occurs at a distance of 21f.

This is at the position of (1f - (1d - 1f)) from the light radiation end of the fiber.

When the distance range is set to 64 km, the output optical pulse repetition cycle becomes approximately 860 µs (equivalent to the fiber length of approximately 86 km). If a 60-km fiber cable is measured in this range, secondary Fresnel reflection occurs at the following point:

60 (km) - (86 (km) - 60 (km)) = 34 (km)

To eliminate multireflection,

1) Adjust the splice point or apply matching oil (optical bond).
2) Increase the distance range if multireflection seems to have occurred. (The distance range must be at least two times as long as the fiber length.)

5. OPERATION PRINCIPLE

5.1 MAINFRAME

Figure 5-1 shows the TQ8450 mainframe.

The signal issued from the 100 MHz crystal oscillated is divided into clock pulses by the clock generator according to the set distance range and span. Using these clock pulses, the timing generator generates timing signals for the ADDER circuit, LD emitting trigger, and mask trigger. The LD emitting trigger signal is sent from the timing generator to the plug-in unit to turn LD on; its beam is input the fiber and the returned optical signal is converted to an electric signal and sent to the mainframe.

The A/D converter converts the signal sent to the mainframe to a digital value. The A/D converter operates according to the block generated by the clock generator. Up to about 16000-point data is converted data to the data (same points) from RAM1, then the result is stored in RAM1 again. This operation is called summation averaging and it is effective for noise suppression. In the MONITOR mode, the averaging count is 256. In the AVERAGING mode, it is 65536.

When summation averaging is finished, CPU1 moves the RAM1 data to RAM2 for log conversion. After log conversion, data is transferred from RAM2 to the bus of the CPU2 (display control) through RAM3. Then, the CRT controller converts this data to the display data and stores it in the video RAM. Moreover, the CRT controller outputs vertical and horizontal synchronizing signals for CRT operation. These signals are input to the CRT driver together with the video RAM data, then displayed on the CRT screen.

On the other hand, the CRT driver generates a composite signal and outputs it through the Video Out terminal.

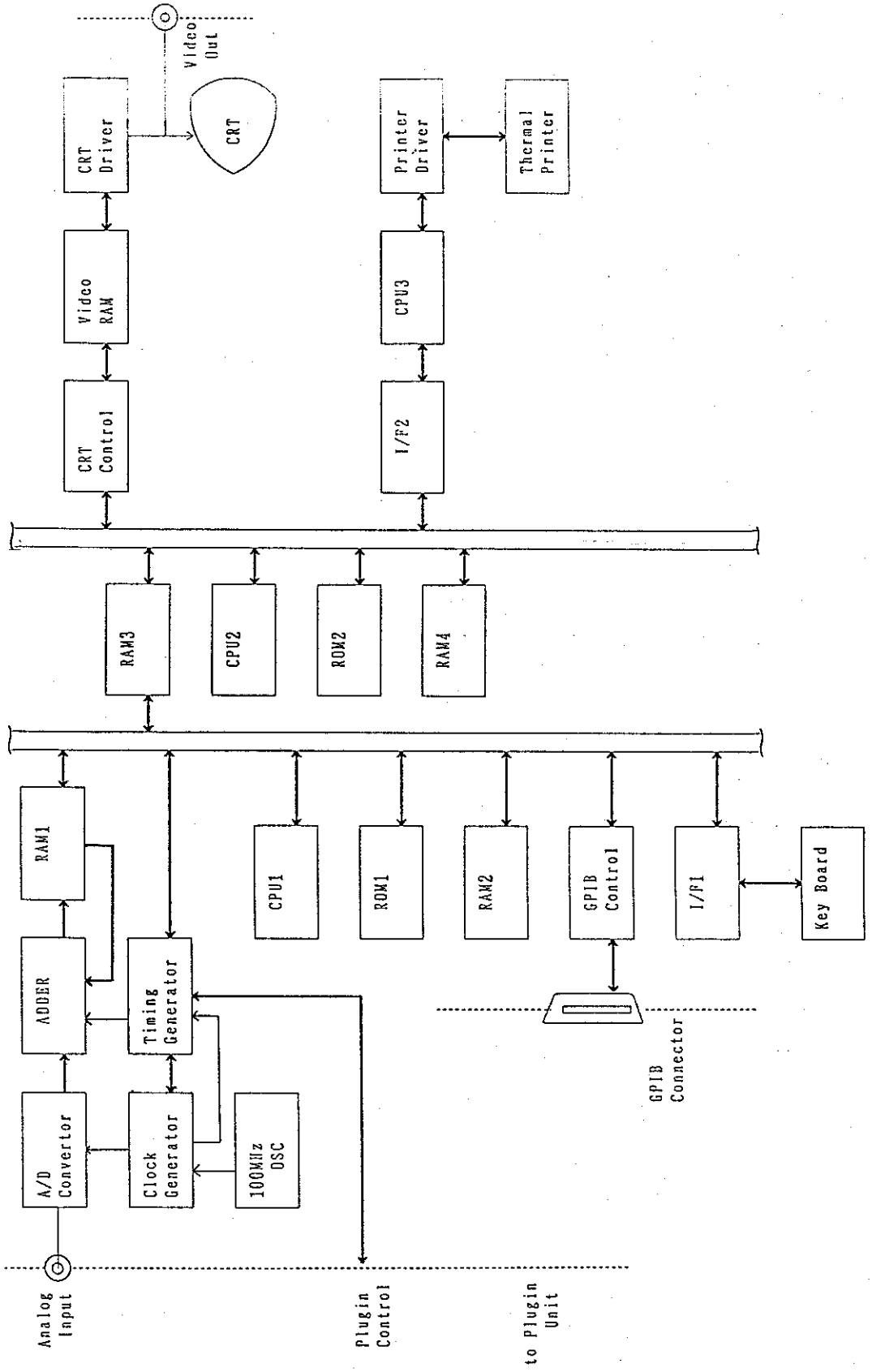


Figure 5-1 Mainblock

5.2 PLUG-IN

Figure 5-2 shows the plug-in block diagram.

In the plug-in unit, the LD pulse generator generates LD pulses (having a preset pulse width) according to the LD trigger signal sent from the mainframe, inputs these pulses to the LD driver to let the LD emit the beam. The LD module (Q84521) is provided with two wavelengths 1.31 μm and 1.55 μm which are switched with the front panel switch.

LD pulses are also input to the mask pulse generator to output a mask signal that operates the A/O driver to close the A/O switch; thus, preventing Fresnel reflection at the light radiation end toward the light receiving side is prevented. Also, linearity deterioration caused by amplifier saturation (because of excess input) is prevented. When a Mask Timing Trigger signal is input from the mask pulse generator, the A/O switch is closed to mask Fresnel reflection at the desired point.

The thermo-controller maintains the LD temperature at 25°C to prevent waveform and output level change caused by LD temperature change. If the LD temperature is abnormal, the thermo-controller issues a signal to the mainframe to let the LD stop radiation.

The LD pulse is input to the fiber cable and the returned light is converted to an electric signal by the APD. The converted signal is amplified by the I-V converter, then sent to the mainframe. Since the level of the light that returns through the test cable depends on the wavelength and pulse width, it is necessary to adjust the amplifier gain and light level. This adjustment can be made by inputting a Gain Control signal from the mainframe.

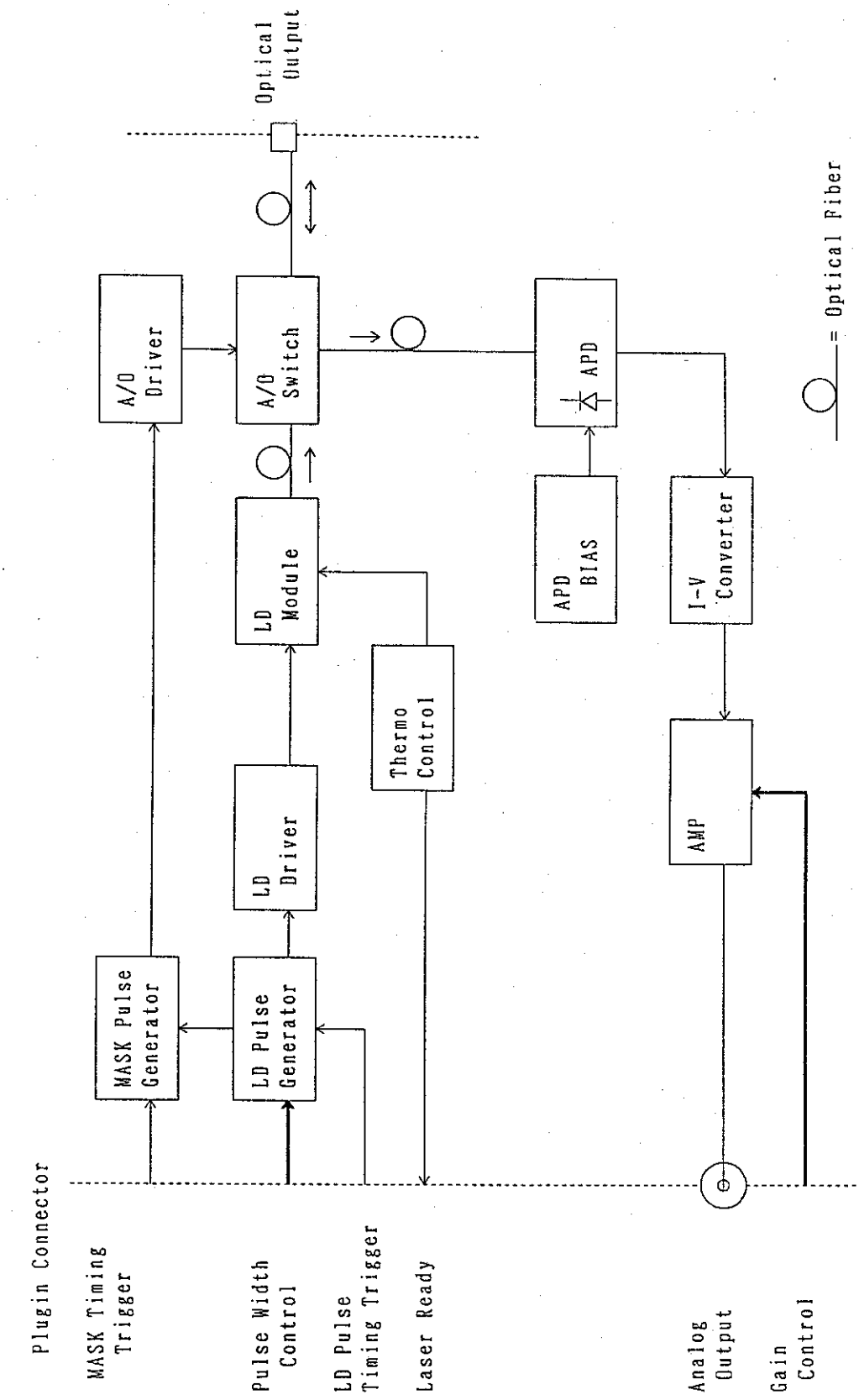


Figure 5-2 Plug-in Unit Block Diagram

6. GPIB (REMOTE CONTROL)

6.1 GENERAL

The TQ8450 optical fiber reflect meter can be operated remotely with the GPIB (General Purpose Interface Bus conforming to IEEE 488-1978) supplied together with the mainframe.

6.1.1 Outline of GPIB

The GPIB is an interface system used to constitute an automatic measurement system by connecting a measurement instrument and peripheral devices with a simple bus cable.

It is more expansible than the existing interface systems and compatible with the systems of other companies electrically, mechanically, and functionally. Various systems, from a simple system using only one bus cable to a system having high-level functions, can be constructed.

In the GPIB system, addresses are assigned to the devices connected to the bus line firstly. Each device can take one or more of three parts, controller, talker, and listener. Only one talker can send data to the bus line and multiple listeners can receive the data.

The controller specifies the address of the talker and listener(s) to transfer data from the talker to listener(s). Moreover, the controller (talker) sets measuring conditions for the listener.

Eight bit-parallel and byte-parallel data lines are used to transfer data between devices (asynchronous two-way data transfer). High-speed and low-speed devices may be mixed as desired because of the asynchronous system.

The data (messages) transferred between devices involves measurement data, measurement conditions (program), and commands expressed with ASCII codes.

Beside data lines, there are three handshake lines for controlling asynchronous data transfer and five control lines for controlling the information flow on the bus.

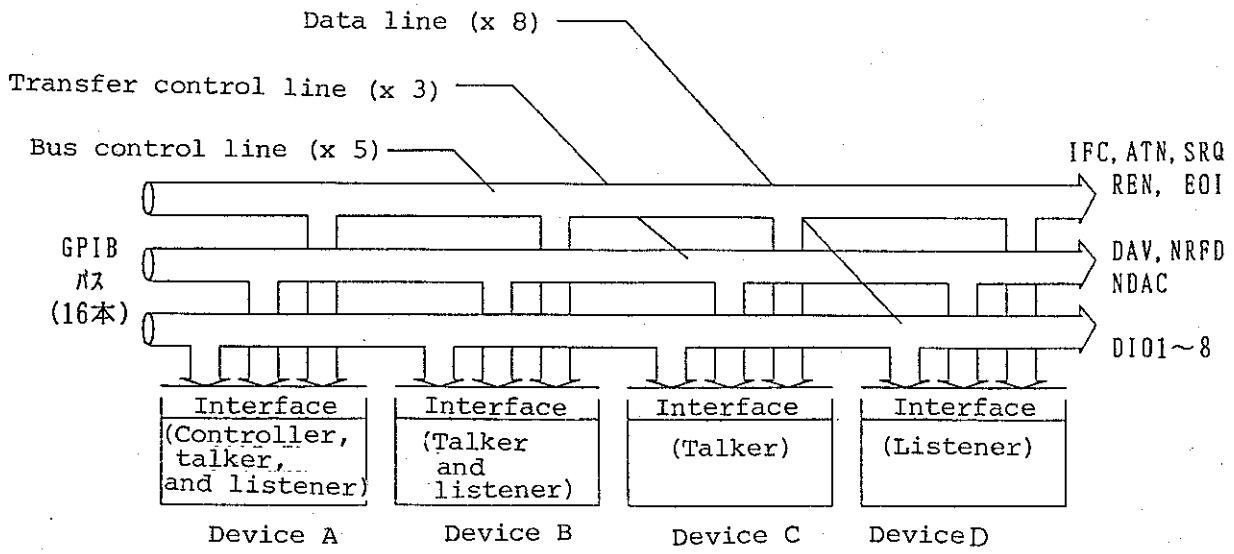


Figure 6-1 GPIB Bus Line

- The handshake line supplies the following signals:
  DAV (Data valid) : Indicates whether the data is valid.
  NRFD (Not Ready for Data): Indicates whether data reception is enabled.
  NDAC (Not Data Accepted) : Indicates whether reception has been completed.
- The control line supplies the following signals:
  ATN (Attention) : Discriminates the signal on the data line between address, command, and other information.
  IFC (Interface Clear) : Clears the interface.
  EOI (End of Identity) : Terminates transfer of data.
  SRQ (Service Request) : Requires the controller to start services.
  REN (Remote Enable) : Controls the device that can be controlled remotely.

6.1.2 GPIB Standard and Specifications of GPIB of this Unit

Standard	:	IEEE488-1978
Code	:	ASCII (or binary codes when the packed format is used)
Logical level	:	Logical "0" (high) --> +2.4 V or more Logical "1" (low) --> +0.4 V or less
Driver specifications	:	Open collector (except EOI and DAV) "Low" output voltage --> +0.4 V or less (48 mA) "High" output voltage --> +2.4 V or more (-5.2 mA)

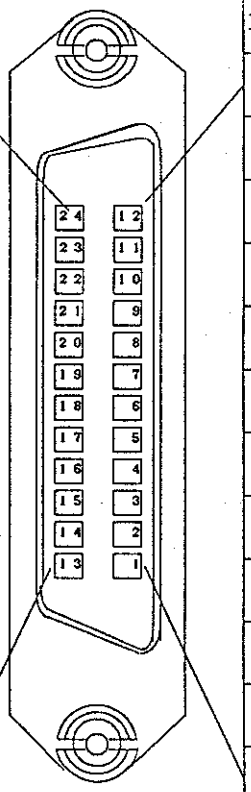
Receiver specifications: +0.6 V or less --> "Low"
+2.0 V or more --> "High"

Address specifications : Thirty-one different talk/listen addresses may be specified with ADDRESS switches.

Cable length : The bus cable length is limited as follows: (Number of devices connected to bus) x (2 m or less) < 20 m

Connector : 24-pin GPIB connector 57-20240-D35A (Anphenol or equivalent)

Signal name	Pin No.
GND. LOGIC	24
GND. (ATN)	23
GND. (SRQ)	22
GND. (IFC)	21
GND. (NDAC	20
GND. (NRFD	19
GND. (DAV)	18
REN	17
DIO 8	16
DIO 7	15
DIO 6	14
DIO 5	13



Pin No.	Signal name
12	SHIELD
11	ATN
10	SRQ
9	IFC
8	NDAC
7	NRFD
6	DAV
5	EOI
4	DIO 4
3	DIO 3
2	DIO 2
1	DIO 1

Figure 6-2 GPIB Connector

Interface functions: (Table 6-1)

Table 6-1 Interface Functions

Code	Function
SH1	Source handshaking function
AH1	Accepter handshaking function
T5	Basic talker functions, serial polling function, talker-only function*, and listener-specified talker cancel function
L4	Basic listener function and talker-specified listener cancel function
SR1	Service request function
RL1	Remote function
PP0	No parallel function
DC0	Device clear function
DT0	No device trigger function
C0	No controller function
E2	Tri-state output

24 12
23 11
22 10
21 9
20 8
19 7
18 6
17 5
16 4
15 3
14 2
13 1

6.1.3 Connecting GPIB System Components

The GPIB system comprises two or more devices. When setting up the GPIB system, give attention to the following points:

(1) Check the devices (controller and peripheral devices) to be connected for preparation and operation with reference to their Instruction Manuals.

(2) The bus cable for connecting the measuring device and the controller must not be longer than is needed. Each bus cable length must be shorter than is specified. The overall bus cable length must be shorter than 20 m.
(Number of devices connected to bus) x (2 m or less) < 20 m

ADVANTEST standard bus cables follow:

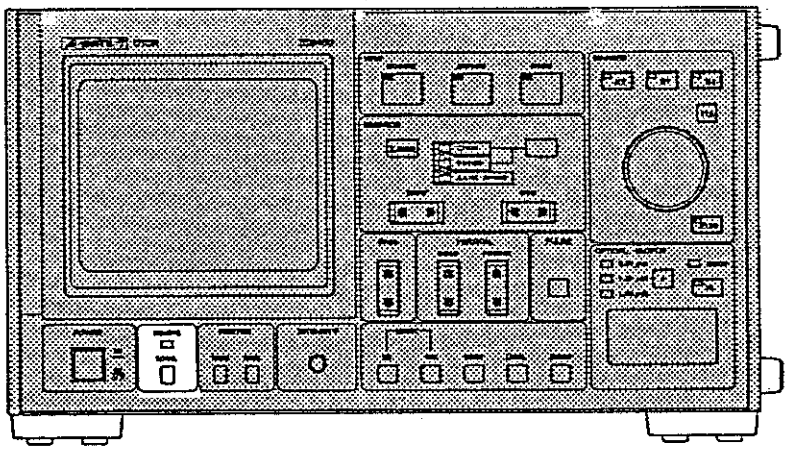
Table 6-2 Standard Bus Cables (Option)

Length	Designation
0.5 m	408JE-1P5
1 m	408JE-101
2 m	408JE-102
4 m	408JE-104

(3) A standard bus cable is provided with piggy-back connectors. Since a connector has both male and female connectors, two connectors may be overlaid. Do not overlay three or more connectors. Do not forget to fasten connectors with the screws.

(4) Turn on the GPIB system components after checking their power requirements, ground condition, and other settings if required. All devices connected to the bus must be powered; otherwise, the whole system operation is not guaranteed.

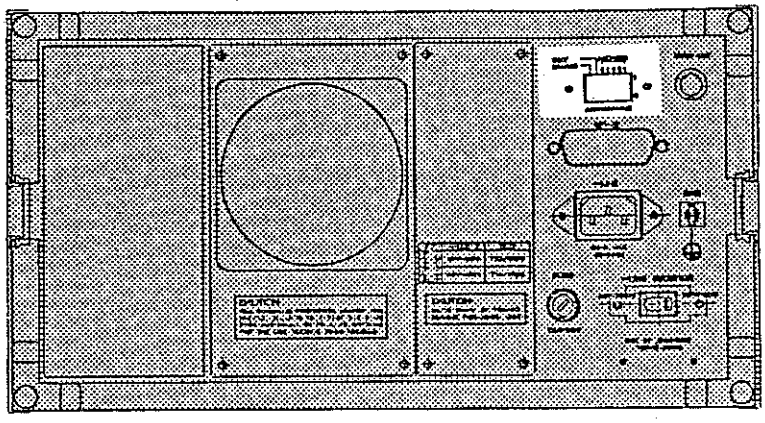
6.1.4 GPIB-related Key, LED, and Switch on Main Frame Panels



① LOCAL key
When TQ8450 is remotely controlled (REMOTE LED on), this key is used to cancel remote control and make panel keys effective. When this unit is powered, the LOCAL mode is set automatically.

② REMOTE LED
This LED lights when TQ8450 is under the external controller. Front panel keys are ineffective.

③ GPIB Address Switch



Address switch bits 1 to 5 are DIP switch keys for setting a talker or listener address on the TQ8450 GPIB.

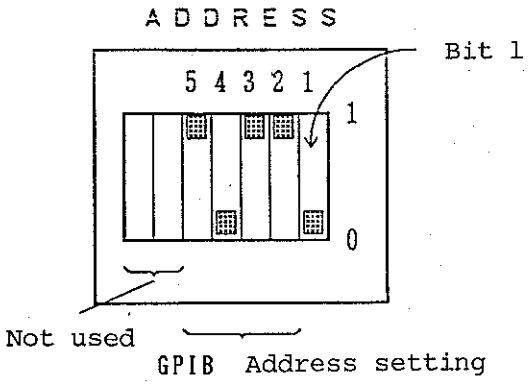


Figure 6-3 GPIB Address Switch

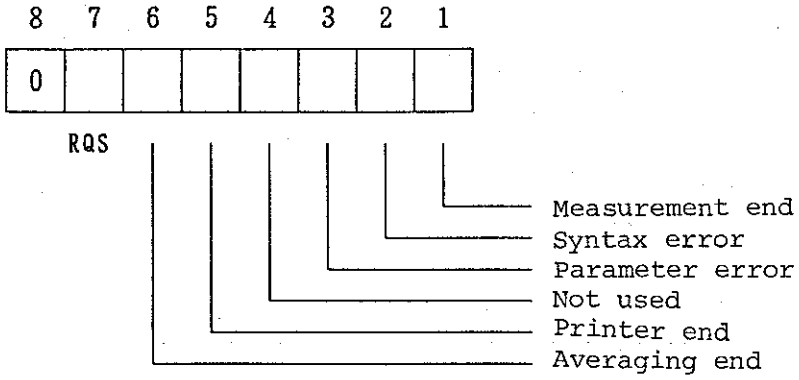
CAUTION

The address code must be set before setting the POWER switch to ON.

6.2 SERVICE REQUEST

This unit issues a service request (SQR) to the controller when the S0 mode is set and 1 is set in each bit of the status byte.

When a service request is issued, the controller performs serial polling to send status byte contents.



6.3 GPIB COMMANDS

Table 6-3 GPIB Commands (1/2)

Command	Parameter	Function	Initial setting
C	None	Same as SDC and DCL (settings do not change)	
Z	None	Initializes all set values	
Sn	n = 0 n = 1	Issues a service request Does not issue a service request	S1
SMKn	None	Masks a service request	ø
DLn	n = 0 n = 1 n = 2	Delimiter mode CR/LF + EOI Delimiter mode LF only Delimiter mode EOI only	DL0
SLn	n = 0 n = 1	String delimiter "," String delimiter LF	
MON	None	Selects the MONITOR mode	
AVE	None	Selects the AVERAGE mode	
PSE	None	Selects the PAUSE mode	
PRT	None	Printer output	
PFD	None	Feeds paper	
PSP	None	Stops printer	
CLR	None	Clears markers	
MKRn	n = 0 n = 1 n = 2	Displays marker 0 Displays marker 1 Displays marker 2	
MSKn	n = 0 n = 1	Mask on Mask off	
LSRn	n = 0 n = 1	LASER OFF LASER ON	
DRn	n = 0 n = 1 n = 2 n = 3 n = 4 n = 5	DISTANCE RANGE 128km DISTANCE RANGE 64km DISTANCE RANGE 32km DISTANCE RANGE 16km DISTANCE RANGE 8km DISTANCE RANGE 4km	

* The maximum number of characters in one command processing line is 80.

Table 6-3 GPIB Commands (2/2)

Command	Parameter	Function	Initial setting
XSTnn	nn = 0 to 128	EXPAND START	
XSPn	nn = 0 to 8	EXPAND SPAN	
SSTnn	nn = 0 to 128	STORE EXPAND START	
SSPn	nn = 0 to 5	STORE EXPAND SPAN	
VPS	nn = -30 to -15	VERTICAL POSITION	
VSLn	n = 0 n = 1 n = 2 n = 3	VERTICAL SCALE 4 dB/DIV VERTICAL SCALE 2 dB/DIV VERTICAL SCALE 1 dB/DIV VERTICAL SCALE 0.5 dB/DIV	
GANn	n = 0 n = 1 n = 2 n = 3	GAIN 0 dB/DIV GAIN 3 dB/DIV GAIN 6 dB/DIV GAIN 9 dB/DIV	
PWn	n = 0 n = 1 n = 2 n = 3	PULSE WIDTH 5 µsec PULSE WIDTH 1 µsec PULSE WIDTH 200 µsec PULSE WIDTH 50 µsec	
IDXnn	nn = 1.4 to 1.5	INDEX	
LSSn	n = 0 n = 1	LOSS SPLICE	
WLn	n = 0 n = 1 n = 2	λ 0.85 µm λ 1.31 µm λ 1.55 µm	
WKAnn	nn = 0 to 500	Moves marker 0	
WKBnn	nn = 0 to 500	Moves marker 1	
MKCnn	nn = 0 to 500	Moves marker 2	
LBLnn	Selects the LABEL mode. nn = Character string enclosed by same special characters		

Table 6-4 Read Commands

Command	Function
RPI	Reads the connected plug-in unit
RGAN	Reads the gain
RVSL	Reads the vertical scale
RVPS	Reads the vertical position
RDR	Reads the distance range
RST	Reads the start point
RSP	Reads the span
RMKR	Reads the marker read-out operation
RLSS	Reads the loss between markers and the distance from splice point
RPW	Reads the pulse width
RLBL	Reads the label
RIDX	Reads the index

Table 6-5 Waveform Data Read Commands and Formats

Command	Function
RDTB	Binary output, 1 byte per data Data is output assuming that the bottom of the screen is 0 and the top of the screen is 255. The data volume is minimum. □□□□□□□□ . . . Delimiter
RDTW	Binary output, 2 bytes per data The upper one byte expresses the integer part and the lower one byte expresses the fractional part. □□□□□□□□ . . . Delimiter
RDTL	Binary output, 4 bytes per data The upper two bytes express the integer part and the lower two bytes express the fractional part. □□□□□□□□ . . . Delimiter
RDTS	ASCII output, 7 bytes per data A comma (,) or LF is output as a delimiter between strings. -XXX. XX, -XXX. XX, . . . Delimiter String delimiter

6.4 PROGRAM EXAMPLE

This section gives an example of programming with the FACOM 9450 and HP200 Series controller.

6.4.1 Example of Programming with FACOM 9450

Read the waveform data (on the screen) in the 2-byte binary format.

```
1000  OPTION BASE 1
1010  OPEN #5:$IBO
1020  EOR #5:'0A'
1030  IFC #5
1040  SDC #5:2
1050  WAIT DELAY 1
1060  CONNECT #5:30=2
1070  OUTPUT #5:"RDYW"&@0D@ ----------- Output data format
1080  CLOSE #5                          1-byte binary:  Output
1090  !!                                                specification
1100  !!                                (Upper byte  :  Integer part)
1110  OPEN 35:IBO,FIXED(1004)           (Lower byte  :  Fractional part)
1120  EOR #5:'0A'
1130  IFC #5
1140  WAIT DELAY 1
1150  CONNECT #5:30=2
1160  DIM A%(1004) ------------------------ Input data:  1004 bytes
1180  GET #5:A%    ---------------------    (including delimiters OD and OA)
1200  FOR I=1 TO 501                   |
1200  PRINT A%(I)                      |--- Data input
1210  NEXT I
1250  CLOSE #5
1260  END
```

6.4.2 Example of Programming with HP200 Series Controller

```
10    !
20    !         Example program 1
30    !
40    !         Measurement setup
50    !
60    INTEGER Tq
70    Tq=701                    ! GPIB address of TQ8450 OTDR
80    !
90    OUTPUT Tq;"MON            ! Monitor mode
100   OUTPUT Tq;"LSR1"          ! turn on laser output
120   OUTPUT Tq;"IDX1.4657"     ! refractive index = 1.4657
130   OUTPUT Tq;"DR2,PW1,GAN1"  ! distance range = 32 km range
140                             ! pulse width    = 1 μm
150                             ! gain           = 3 dB
160   OUTPUT Tq;"XSP5,XST10"    ! span           = 16 km
170                             ! start          = 10 km
190   END
```

```
10    !
20    !         Example program 2
30    !
40    !         Read setup of OTDR
50    !
60    INTEGER Tq
70    DIM Pi$ [40],Dr$[40],St$[40],Sp$[40],Pw$[40],Gain$[40],Index$[40]
80    Tq=701    ! GPIB address of TQ8450 OTDR
90    !
100   OUTPUT Tq;"RPI"            ! read plug in
110   ENTER Tq;pi$
120   OUTPUT Tq;"RIDX"           ! read refractive index
130   ENTER Tq;Index$
140   OUTPUT Tq;"RDR"            ! read distance range
150   ENTER Tq;Dr$
160   OUTPUT Tq;"RST"            ! read start distance on CRT
170   ENTER Tq;St$
180   OUTPUT Tq;"RSP"            ! read distance span on CRT
190   ENTER Tq;Sp$
200   OUTPUT Tq;"RPW"            ! read pulse width
210   ENTER Tq;Pw$
220   OUTPUT Tq;"RGAN"           ! read gain
230   ENTER Tq;Gain$
240   !
250   PRINT "plug in         =",Pi$
260   PRINT refractive index =",Index$
270   PRINT "distance range  =",Dr$
280   PRINT "start           =",St$
290   PRINT "span            =",SP$
300   PRINT "pulse width     =",Pw$
310   PRINT "gain            =",Gain$
320   END
```

```
10    !
20    !         Example program 3
30    !
40    !         Service request
50    !
60    INTEGER Tq,Select_code
70    INTEGER Srqmask
80    Tq=701                        ! GPIB address of TQ8450 OTDR
90    Select_code=Tq DIV 100        ! GPIB select code
100   !
110   Srqmask=IVAL("00011111",2)          ! only average complete
120   OUTPUt Tq;"SMK";Srqmask             ! set mask
130   OUTPUT Tq;"S0"                      ! enable service request
140   ON INTR Select_code GOTO Ave_end
150   ENABLE INTR Select_code;2
160   !
170   OUTPUT Tq;"AVE"             ! start averaging
180   Sleep:GOTO Sleep            ! wait for interruption
190   !
200   Ave_end:BEEP
210     PRINT "average completed."
220   END
```

```
10    !
20    !         Example program 4
30    !
40    !         Read data block by 1 byte format
50    !
60    INTEGER Tq
70    DIM Dbuf$ [503],Y(0:500)
80    Tq=701                         ! GPIB address of TQ8450 OTDR
90    !
100   OUTPUT Tq;"DL0"                ! delimiter CR.LF+EOI
110   OUTPUT Tq;"RDTB"
120   ENTER Tq;Dbuf$                 ! data 501 bytes, delimiter 2 bytes
130   FOR I=0 TO 500
140     Y(I)=NUM(Dbuf$[I+1;1)]       ! format conversion
150   NEXT I
160   END
```

```
10    !
20    !          Example program 5
30    !
40    !          Read data block by 2 bytes format
50    !
60    INTEGER Tq
70    REAL Y(0:500)
80    INTEGER Dbuf(0:501)
90    REAL A
100   Tq=701                      ! GPIB address of TQ8450 OTDR
110   !
120   OUTPUT Tq;"DL0"             ! delimiter CR,LF+EOI
130   OUTPUT Tq;"RDTW"
140   ENTER Tq USING "#,W"Dbuf(*)
150   REDIM Dbut(0:500)
160   A=1/256
170   MAT Y= Dbuf*(A)
180   END
```

```
10    !
20    !          Example program 6
30    !
40    !          Read data block of 4 bytes format
50    !
60    INTEGER Tq
70    REAL Y(0:500)
80    INTEGER Dbuf(0:1002)
90    REAL F,X,Z
100   Tq=701                      ! GPIB address of TQ8450 OTDR
110   !
120   OUTPUT Tq;"DL0"             ! delimiter CR.LF+EOI
130   OUTPUT Tq;"RDTL"
140   ENTER Tq USING "#,W,;Dbuf(*)
150   F=2 ^ (-16)
160   FOR I=0 TO 500
170     X=Dbuf(2*I+1)*F
180     IF X<0 THEN X=1+X
190     Z=Dbuf(2*1)
200     Y(I)=Z+X
210   NEXT I
220   END
```

```
10    !
20    !         Example program 7
30    !
40    !         Read data block by 8 bytes format
50    !
60    INTEGER Tq
70    DIM Dbuf$(0:500) [8],D$[2], Y(0:500)
80    Tq=701                        ! GPIB address of TQ8450 OTDR
90    !
100   OUTPUT Tq;"DL0"               ! delimiter CR,LF+EOI
110   OUTPUT Tq;"RDTS"
120   ENTER Tq;"Dbuf$(*);D$
130   FOR I=0 TO 500
140     Y(I)=VAL(Dbuf$(I))
150   NEXT I
160   END
```

7. SPECIFICATIONS

TQ8450

Model name			TQ8450
Distance range (km)			16, 32, 64, 128
Reading resolution			1 m min.
Horizontal axis	Span (km)	16 km range 32 km range 64 km range 128 km range	0.5, 1, 2, 4, 8, 16 0.5, 1, 2, 4, 8, 16, 32 0.5, 1, 2, 4, 8, 16, 32, 64 0.5, 1, 2, 4, 8, 16, 32, 64, 128
	Accuracy		+3 m +2 x 10^{-5} x Measured value (m) (Excluding the error depending on the group refractive index)
Vertical axis	Scale		0.5/1/2/4 (dB/div) x 8 div.
	Reading resolution		0.01 dB
	Linearity		0 to 5 dB: ±0.3 dB or less 0 to 10 dB: ±0.5 dB or less 0 to 15 dB: ±0.7 dB or less
Averaging	MONITOR mode		2^8 times (Specified time: About 0.7 sec.)
	AVERAGE mode		2^{16} times (Measurement time: About 60 sec. in 64 km range)
Group refractive index setting			The refractive factor of the fiber cable may be set in 0.0001 steps from 1.4000 to 1.6000.
Marker setting			Up to three points may be set.
Mask function			Up to three points may be masked with optical masks.
Memory function			When the power is turned off, the preceding measurement conditions are saved.
CRT			5.5 in.
Interface			GPIB is a standard unit supplied together with mainframe. (As per IEEE488-1978)
Printer			The data displayed on the CRT screen is copied by the built-in thermal printer.
Video output			Output impedance 75 ohm, Composite signal (NTSC system), BNC connector

Operating conditions	Ambient temperature 0°C to +40°C, Relative humidity 85% or less
Storage temperature	Ambient temperature -20°C to +60°C
Power source	90 V AC to 130 V AC, 48 Hz to 66 Hz
Power requirement	140 V AC or less
Outside dimensions	Approximately 330 (W) x 177 (H) x 450 (D) mm
Weight	Approximately 14 kg
Accessories	Power cable (x 1) Fuse (x 2) Instruction Manual (x 1) 3P-2P adapter (x 1) Recording paper roll (x 3)

Q84501/Q84502/Q84505/Q84506/Q84521

Mainframe	TQ8450											
Plug-in unit model name	Q84501				Q84502				Q84505			
Suitable fiber	SMF				SMF				MMF			
Probe Wavelength (μm) pulse	1.31 ±0.02				1.55 ±0.03				0.85 ±0.02			
Pulse width (μs)	0.05	0.2	1	5	0.05	0.2	1	5	0.01	0.05	0.2	1
Dynamic range (single-sided back-scattering)	13	16	20	23	10	13	17	20	11	15	18	22
Mask function	Provided (optical)								Not provided			
Optical connector	FC[1)]											
Laser product classing	21 CFR Class 1											

1) If you use a connector other than FC, contact us.

Mainframe	TQ8450							
Plug-in unit model name	Q84506				Q84521			
Suitable fiber	MMF				SMF			
Probe Wavelength (μm) pulse	1.31 ±0.02				1.31 ±0.02/1.55 ±0.03 Switchable			
Pulse width (μs)	0.05	0.2	1	5	0.05	0.2	1	5
Dynamic range (single-sided back-scattering)	13	17	21	24	12/10	15/13	19/17	22/20
Mask function	Provided (optical)							
Optical connector	FC[1)]							
Laser product classing	21 CFR Class 1							

1) If you use a connector other than FC, contact us.

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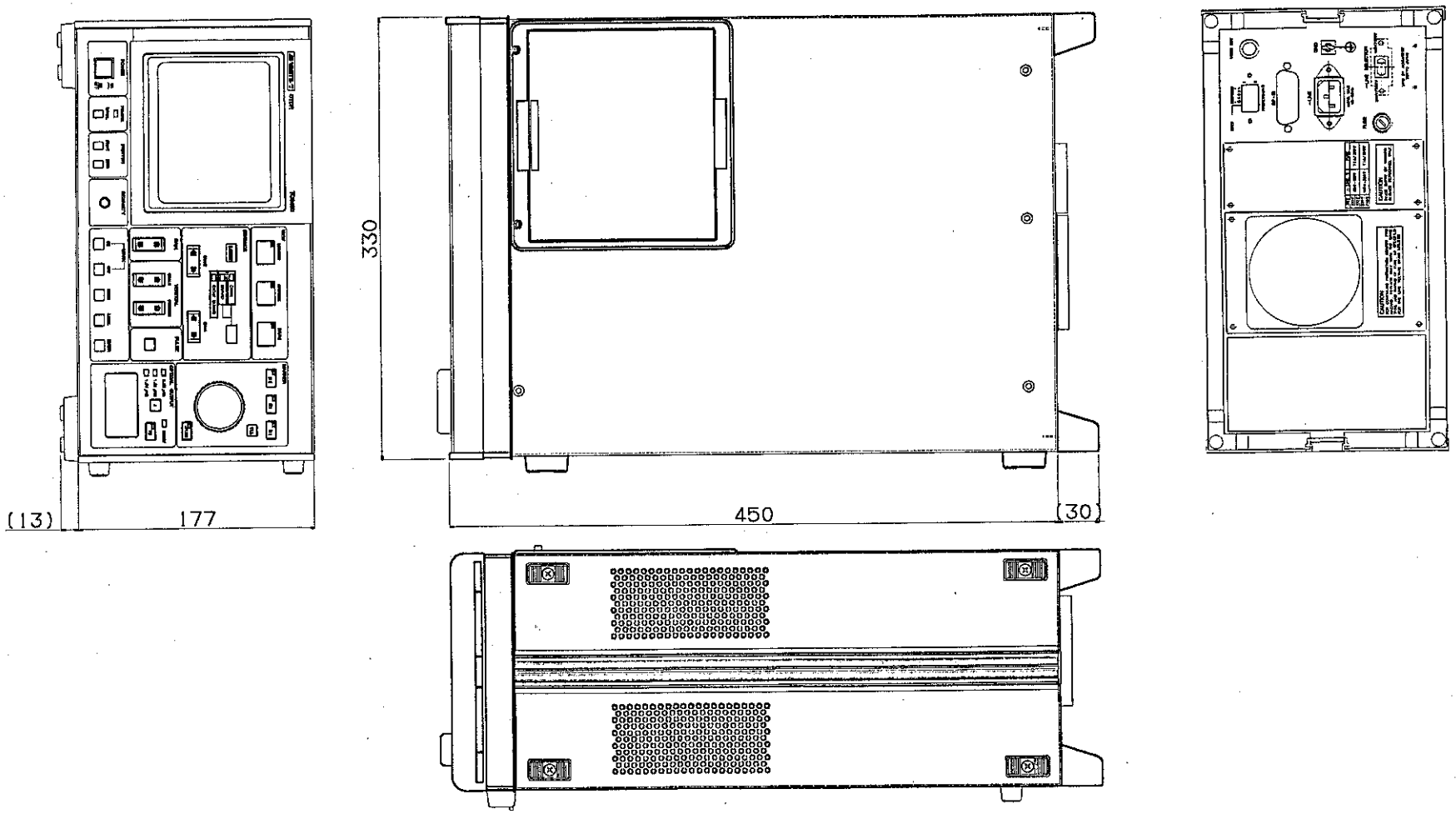
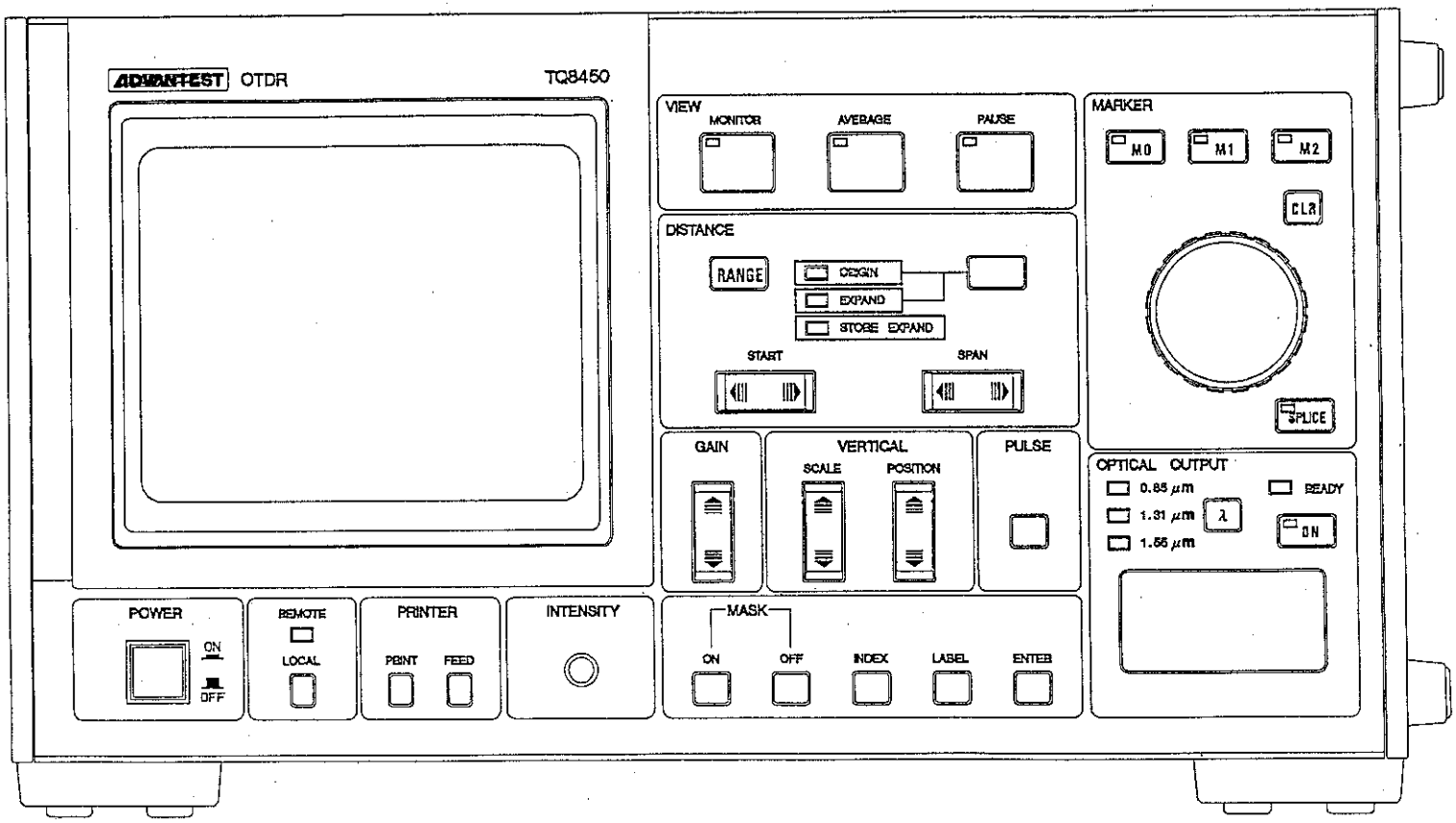


8450EXT1-809-A

EXTERNAL VIEW

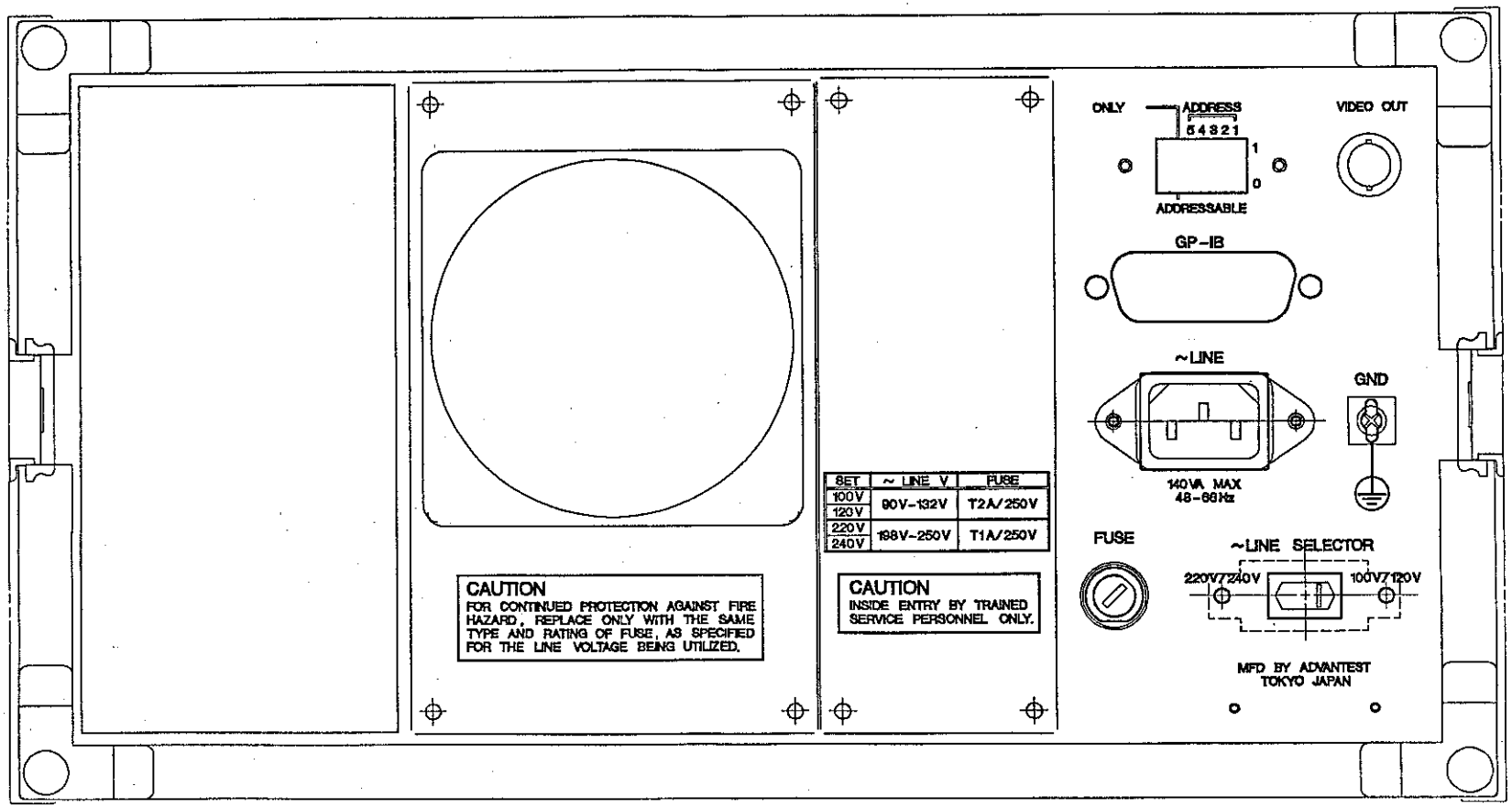
TQ8450



8450EXT2-809-A

FRONT VIEW

TQ8450



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REAR VIEW

TQ8450

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1. EXPLANATION OF OPERATION

1.1 OUTLINE

1.1.1 Principles of Measurement with OTDR

When light enters optical fiber it causes backward scattering of light as shown in Figure 1-1.

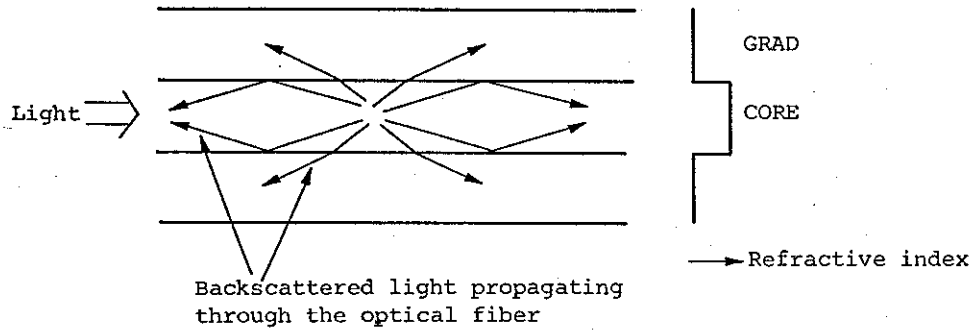

Figure 1-1 Backward Scattering of Light

Light scatters in optical fiber at places where the refractive index of the material is uneven, and back scattered light is the beams of this scattered light returning to the side where they entered. OTDR uses this back scattered light to detect defects in optical fiber. Here Figure 1-2 shows the basic configuration of OTDR.

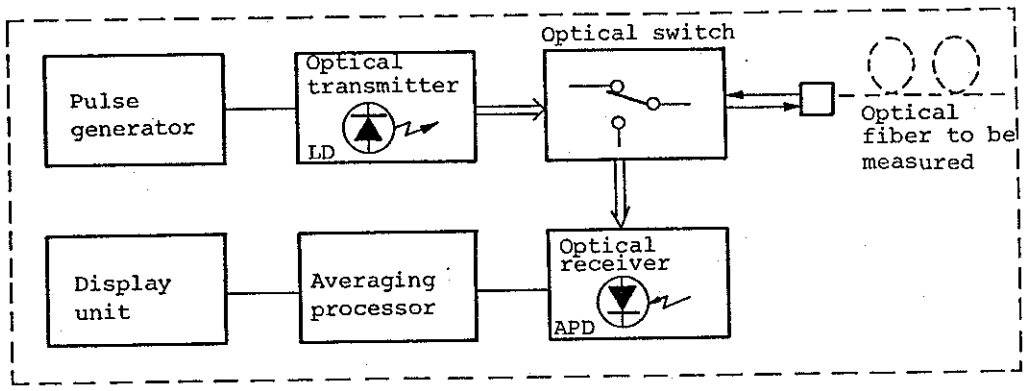

Figure 1-2 Basic Configuration of OTDR

The following explains how OTDR makes measurement (Figure 1-2).

The laser diode is pulse-driven, and the resulting pulse light is input to the optical fiber. Then, the optical switch is switched to the optical receiver and the back scattered light from the optical fiber is presented to the optical receiver.

The light is converted into an electrical signal by APD. The signal is passed through the averaging processor to raise its S/N ratio and output to the CRT for display.

The equipment consists primarily of the main unit and PLUG IN, detailed as follows:

Table 1-1 Board Name and Relationship with Figure 1-2

	Block name in Figure 1-2	Board name
Main unit (TQ8450)	Averaging processor	AD (BLP-014529) ADD (BLP-014530)
	Display unit	CPU_M (BLP-014524) CPU_S (BLD-014525) MOTHER (BLQ-014526)
PLUG IN	Pulse generator	TIMING
	Optical transmitter	LD DRIVER, LD (BLD-014538 / BLD-014540)
	Optical switch	A/O SWITCH
	Optical receiver	APD BIAS, APD BLC-014536 RECEIVER BLK-014535

1.1.2 Performance of OTDR

The distance resolution of OTDR is increased by raising the speed of the AD converter. For example, to obtain a 1m resolution, a 10C MHz sampling clock is generally needed. This equipment, however, uses a 25 MHz sampling frequency; yet, by using a technique known as interleaving, it obtains a high resolution equivalent to that obtained by 100 MHz sampling. If the S/N ratio is improved, measurement can be taken of long-distance fibers. This is accomplished by taking the following three measures:

(1) Increased LD output
The greater the LD output, the greater the level of back scattered light, making it possible to detect back scattered light from far away.

(2) Averaging
An addition averaging procedure is used to improve the S/N ratio. It permits noise components to be suppressed and only the signal component to be taken out.

(3) Improved S/N ratio of receiver
The level of the back scattered light detected by APD is amplified by the receiver board. By increasing the S/N ratio of this board, the performance of OTDR is improved.

1.1.3 Overall Block Diagram

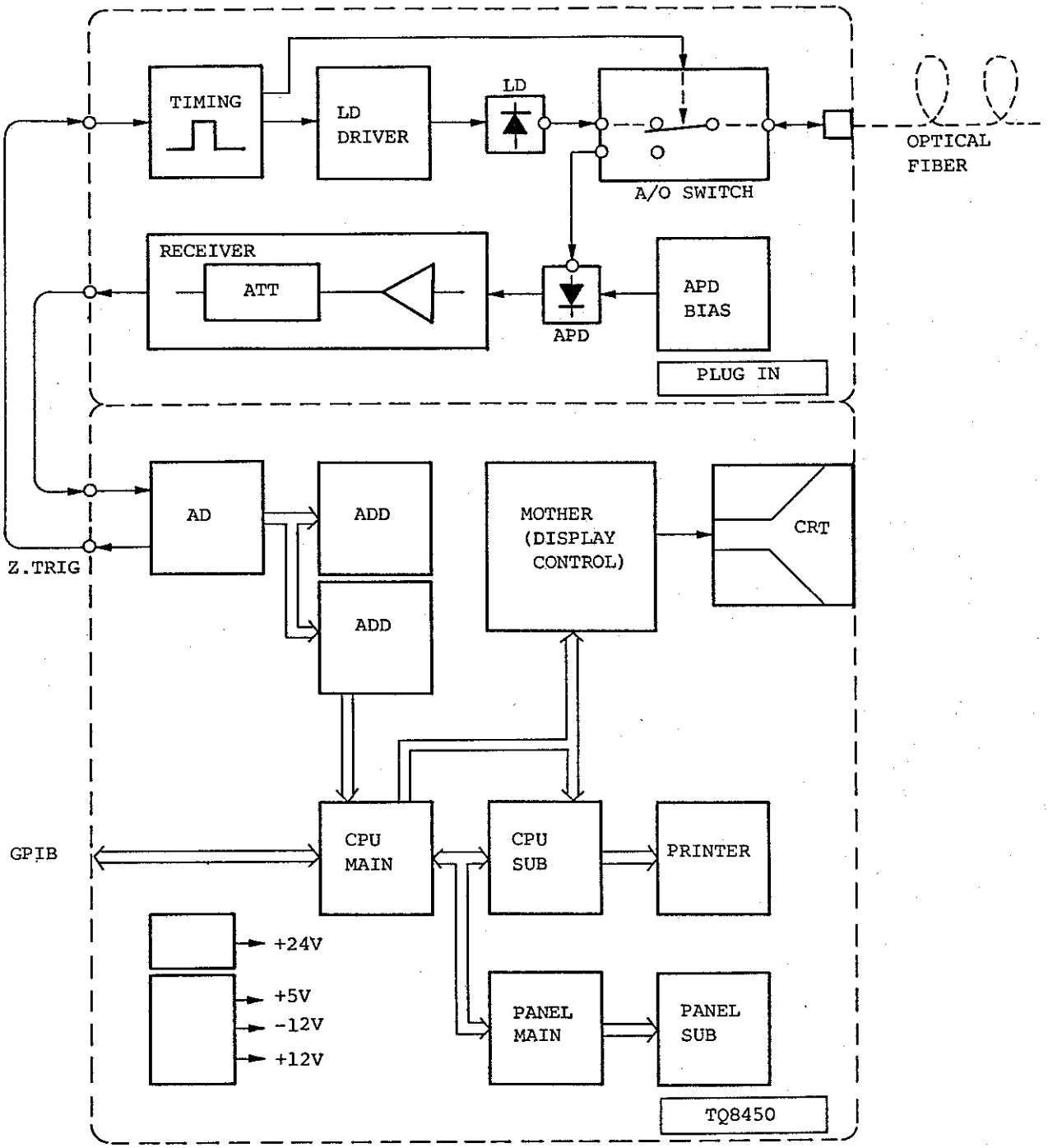

Figure 1-3 Block Diagram

1.2 EXPLANATION OF BLOCK DIAGRAM

The PLUG IN is configured as shown in Table 1-1.

1.2.1 Timing

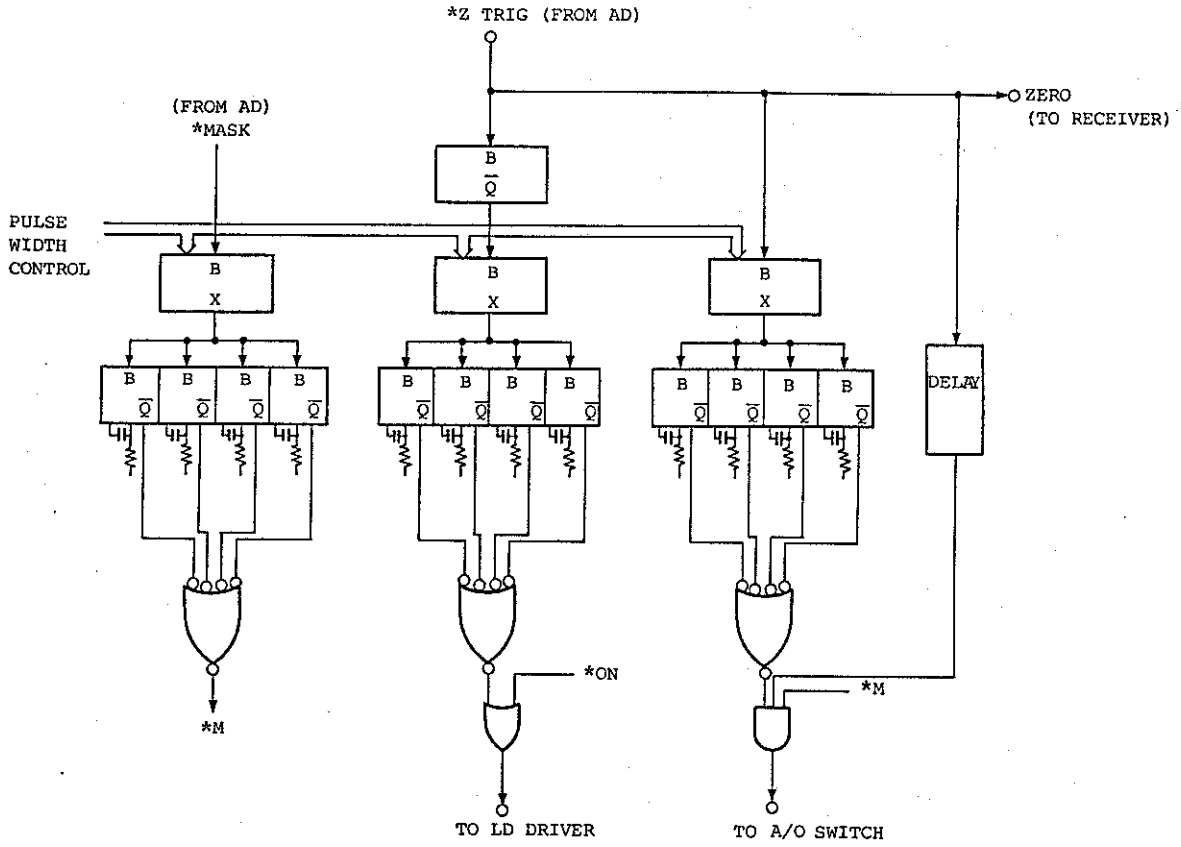

Figure 1-4 Timing Board

The pulse to drive the laser diode is produced using the Z TRIG signal from the AD board (TQ8450). The pulse width TW is determined by the value of the resistor connected from U4 to U10 and the capacity of the capacitor. The pulse signal used to switch the A/O SWITCH is also produced by this board. The A/O SWITCH is initially set to the LD side and, when light emission by LD is finished, switched to the APD side.

1.2.2 LD Driver (BLD-014538, BLD-014540)

By changing the pulse from the Timing Board for LD drive, this device drives the LD. The laser output is determined by the current value, so the output is controlled by changing the current value. R51 is a VR used to adjust the output of laser light. In addition to its function to drive LD, the LD Driver comes equipped with devices to protect the Slow Starter circuit, Ready circuit and LD.

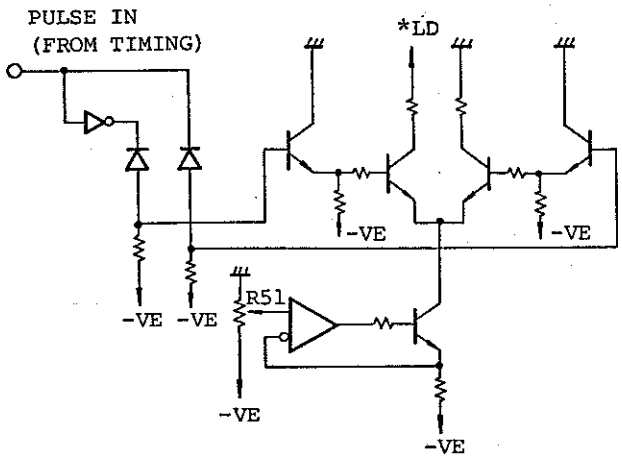

Figure 1-5 LD Driver

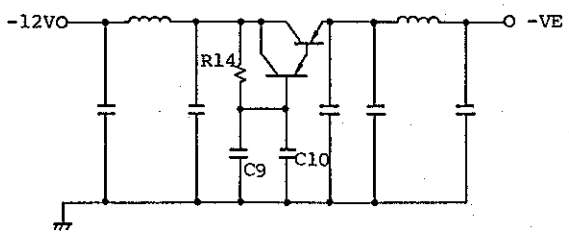

Figure 1-6 Slow Starter Circuit

Figure 1-6 shows the Slow Starter circuit. The moment the power switch is turned on, this circuit is started and gradually raised to the power supply level with a certain time constant. Consequently the overall drive circuit is protected.

The time constant is determined by R14 and C10, and π-type LPF is incorporated in the input and output parts so that low-frequency noise is eliminated by C9.

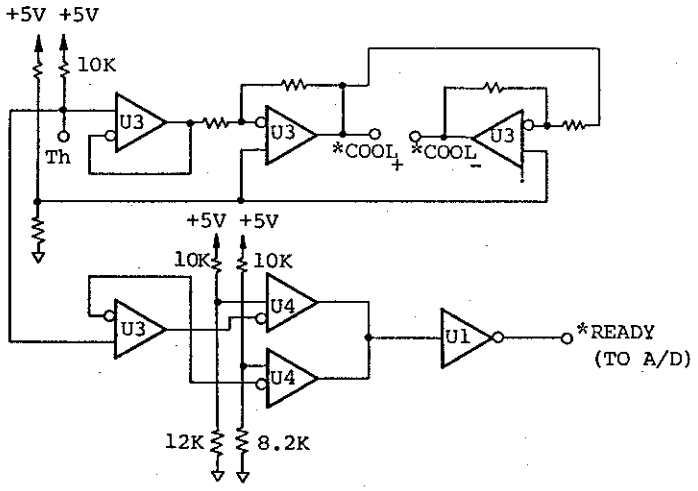

Figure 1-7 Ready Circuit

The Ready Circuit detects the internal temperature of LD with a thermistor and, when the internal temperature of LD is in the range of 20° - 30°C, generates a *READY signal and lights up the READY LED on the front panel. Resistance values against the temperature of the thermistor inside the LD are

30°C	8.2 kΩ
25°C	10 kΩ
20°C	12 kΩ

so the temperature is determined by the comparator in the output part, to generate the *READY signal.

Further, the Peltier effect is utilized to keep the temperature at a constant level. The input voltage of U3 is varied by the influence of the thermistor. Accordingly, by using signals *COOL+ and *COOL-, the temperature is kept constant by expanding the potential difference between the two.

1.2.3 A/O Switch

A kind of optical switch, this switch uses the acoustic optical effect to switch the light between two directions. Figure 1-8 shows its working principle. When an ultrasonic wave is applied to matter, the light input to that matter causes the Bragg diffraction to occur, which in turn polarizes the light. This takes place because the ultrasonic wave forms coarse and dense waves inside the matter. And, because the refractive index varies in the coarse and dense parts, a difference in the optical path results. The A/O Switch operates on the basis of this principle.

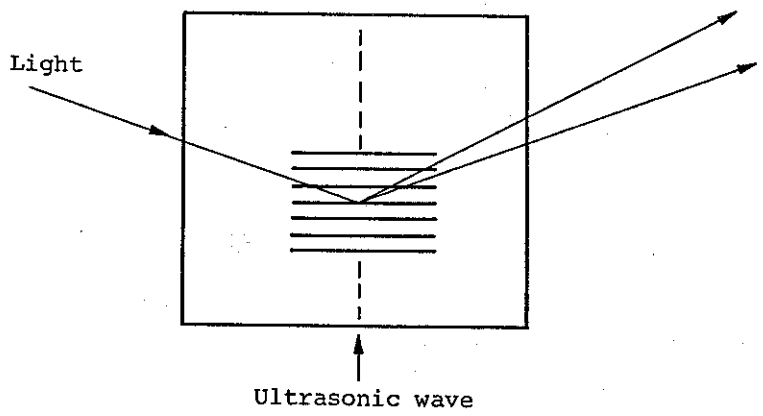

Figure 1-8 Bragg Diffraction

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1.2.4 AD (BLP-014529), ADD (BLP-014530)

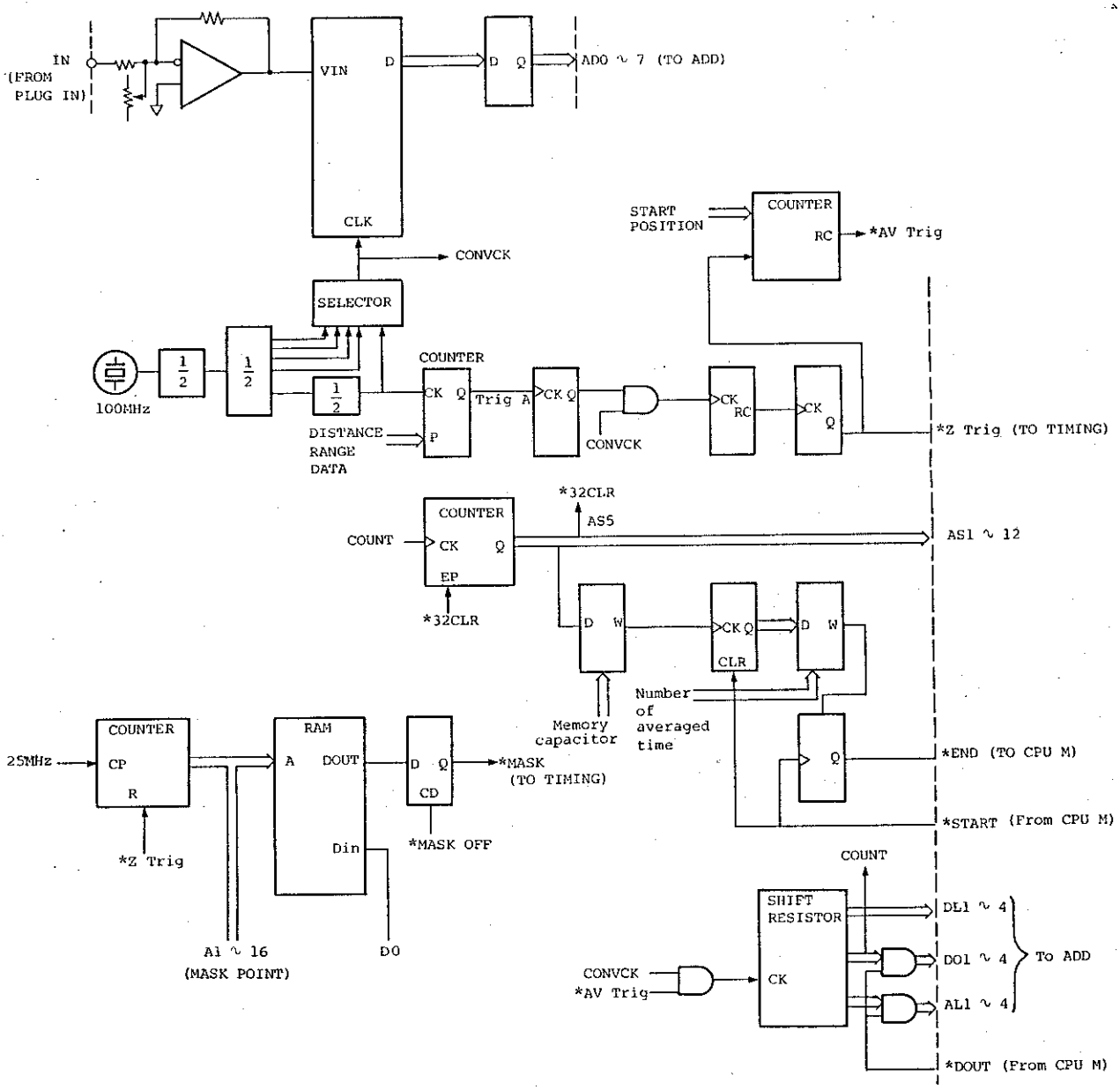


Figure 1-9 AD (BLP-014529)

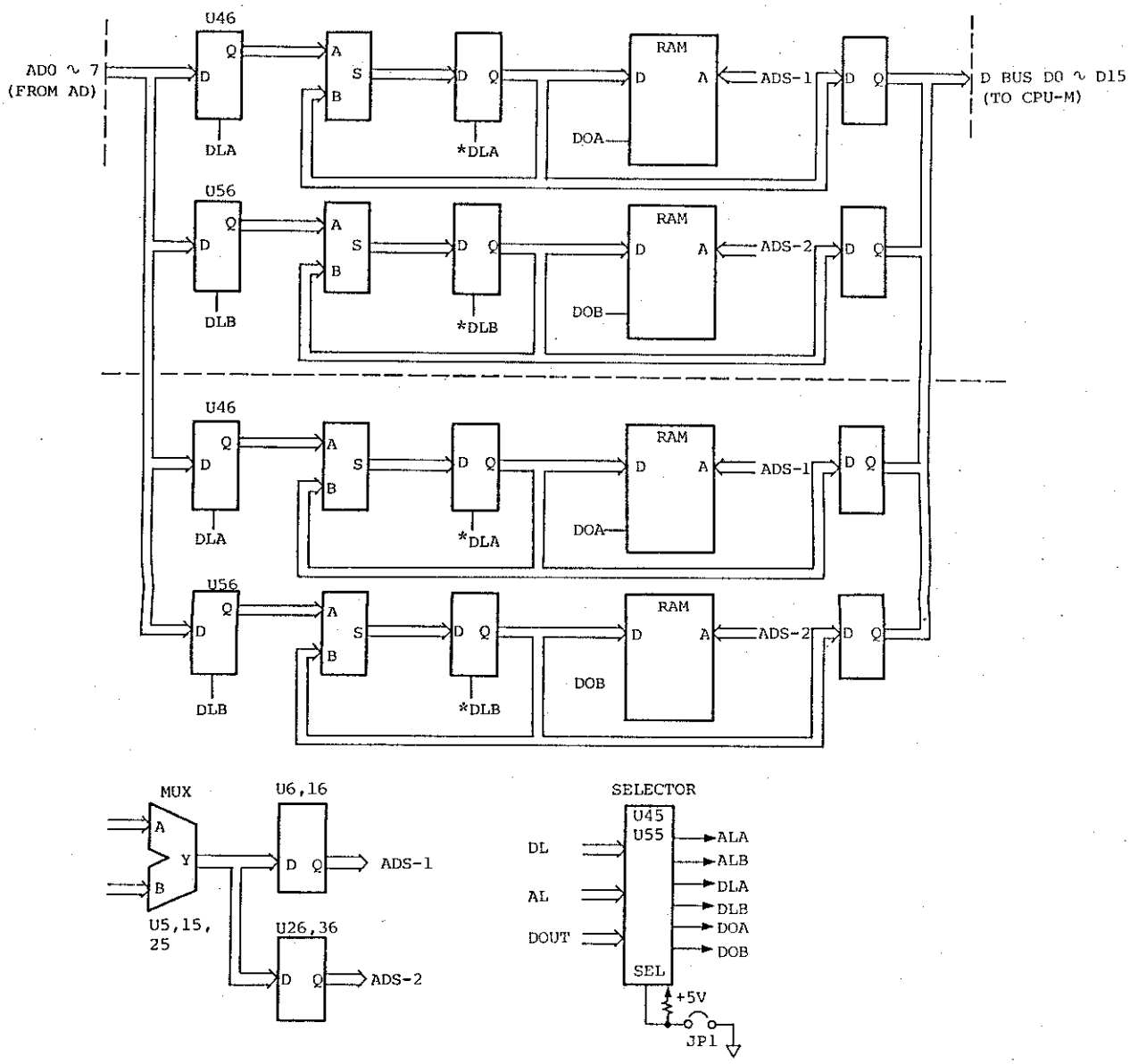


Figure 1-10 ADP (BLP-014530)

The signal from PLUG IN is AD-converted in the AD Board. The digitized signal is then stored in RAM on the ADD Board, from which it is sent to CPU M.

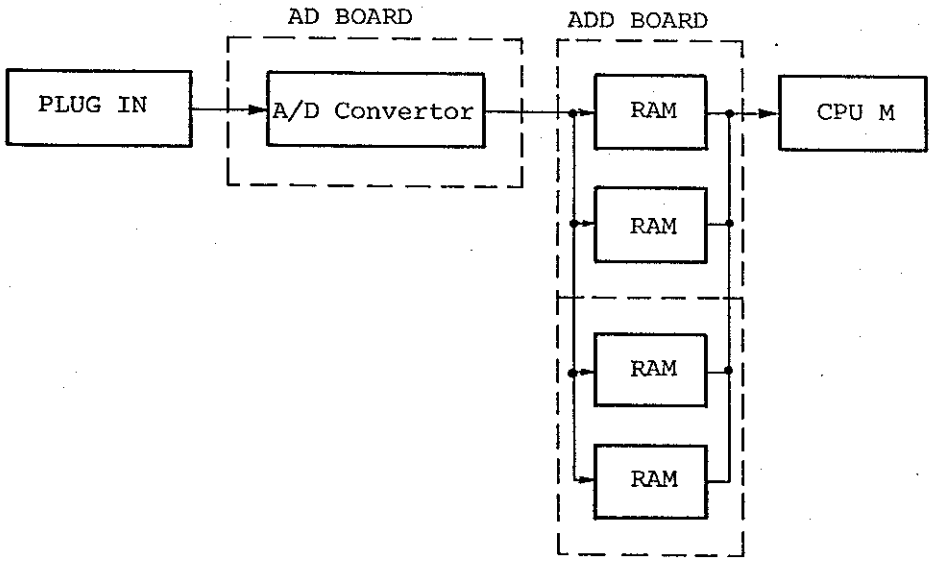


Figure 1-11 Flow of Measurement Data

As shown in Figure 1-11, the RAM on the ADD Board comprises four sections, each of which has 4K bytes capacity, providing a total 16K bytes of space to store data. This RAM area is varied by distance range in such a way that it is used as a 4K, 8K and 16K RAM. For the AD Board, on the other hand, two sampling clocks -- 25 MHz and 12.5 MHz -- are used depending on distance range. This relationship is shown in Table 1-2.

Table 1-2 Internal AD Operation vs. Distance Range

Distance range (km)	Number of data points	SPAN (km)	Sampling block (ns)	CRT reading resolution (m)	Number of interleaved times	Number of over-samplings	Monitor
128	16K	128	80	256		32	0
		64		128		16	
		32		64		8	
		16		32		4	
		8		16		2	
		4		8		1	
	16K	64	40	128		32	0
		32		64		16	0
		16		32		8	
		8		16		4	
		4		8		2	
		2		4		1	
	8K	16	40	32	2	16	0
		8		16		8	0
		4		8		4	
		2		4		2	
		1		2		1	
	4K	4	40	8	4	8	0
		2		4		4	0
		1		2		2	0
		0.5		1		1	0

- Addition averaging
  Data from AD is added by the Adder located in the input part of the ADD Board. There are 256 additions in the Monitor state; when being averaged, averaging by addition is performed 256 x 256 = 65536 times.

- How data is written to ADD RAM and transferred to CPU M

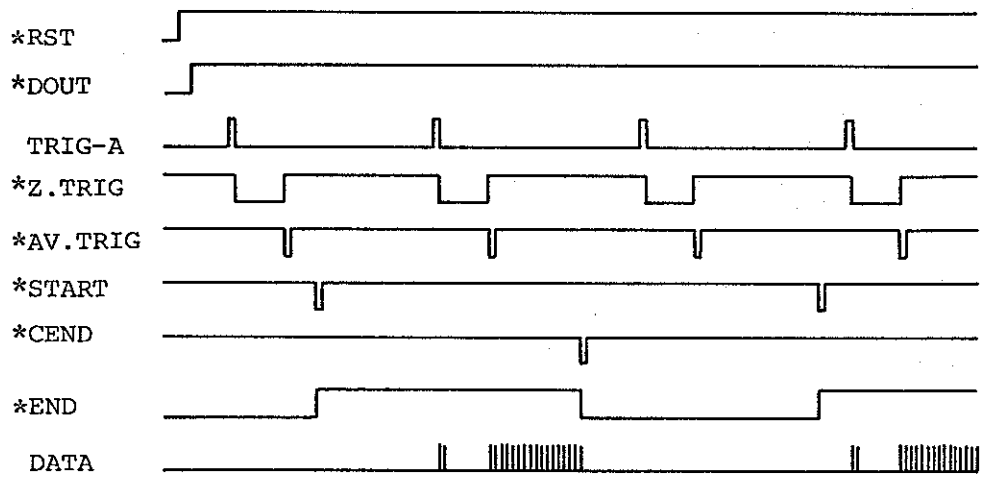


Figure 1-12 Timing Diagram of AD Board

When the *DOUT signal (from CPU M) changes to 'H,' the measurement data is written to ADD RAM. Taking-in of the measurement data is started by the *START signal (from CPU M) and, when the ADD RAM area is filled, *CEND and *END signals are generated to request the *START signal from CPU M. This is repeated 256 times while addition averaging is performed. When this is finished, CPU M lowers the *DOUT signal to "L" and then reads 16 bits each of the high-order and low-order data from ADD RAM (24 bits).

- About the interleave system
  The sampling clock of the equipment during AD conversion is max. 40 ns. For 1m resolution, however, at least 10 ns of sampling clock is required.
  The 40 ns sampling clock is divided into four, each 10 ns out of phase with one another (Figure 1-13).

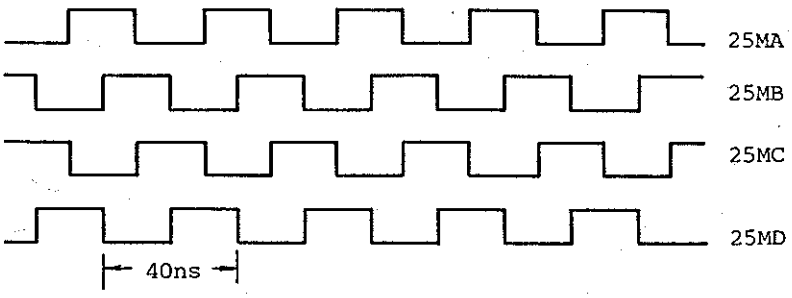


Figure 1-13 Sampling Clock

Using this clock, the data is sampled four times each. As a result, the sampled data is equivalent to what might have been sampled at 100 MHz. Use of ADD RAM varies depending on whether the interleave is used. The interleave is applied when the number of data points is 8K or less. And, depending on the number of interleaved times, the data is stored in the addresses of ADD RAM which are allocated as shown in Table 1-3.

Table 1-3 Allocation of ADD RAM

Number of data points	Addresses of ADD RAM
16K	0 - 4095
8K	0 - 2047
	2048 - 4095
4K	0 - 1023
	1024 - 2047
	2048 - 3071
	3072 - 4095

When the number of data points is 8K, sampling clocks 25MA and 25MC are used.

- Oversampling
  The resolution of the display in the lateral direction is 500 dots, so the display cannot indicate all of the 16K data. For this reason, the 16K of data is divided into 32-point sections, and these are averaged to produce data for display. It should be noted however that the number of oversamplings is determined by SPAN and the number of data points is as shown in Table 1-2.

- Mask
  If there is a large Fresnel reflection from the connecting point of an optical fiber, the light detection circuits (APD and Receiver) will be saturated. For this reason, the A/O Switch is switched to prevent the Fresnel reflection from going to APD. RAM addresses are used to do this, because the Fresnel reflection must be eliminated at some arbitrary point. Data is written to the address corresponding to the marker address, and the data is read by a counter.

1.2.5 CPU_M (BLP-014524)

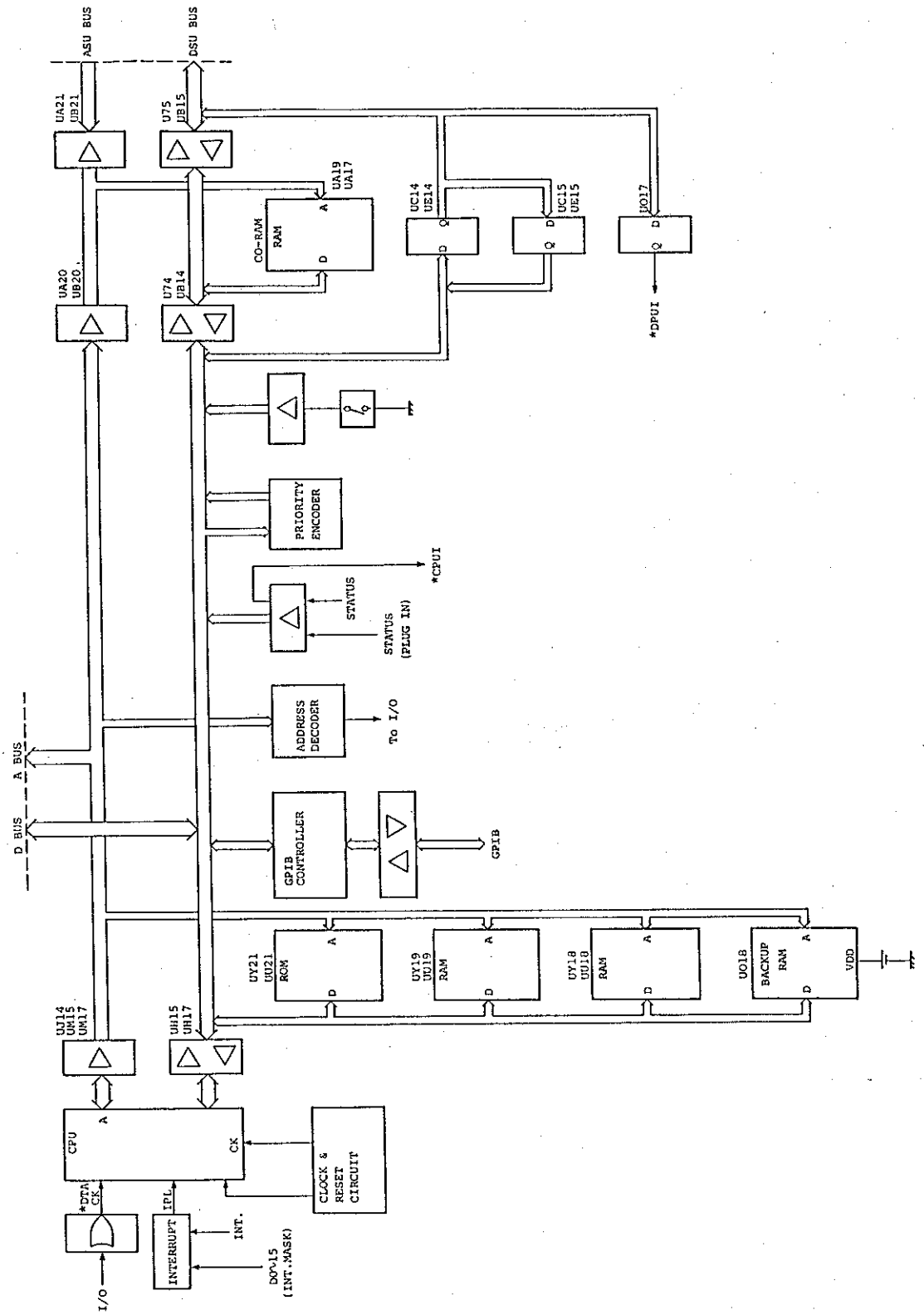
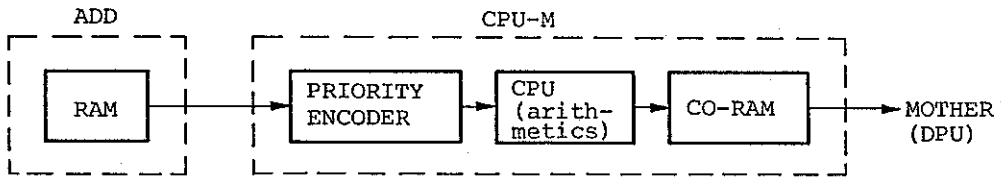


Figure 1-14 CPU-M

By lowering *DOUT to "L", the contents of ADD RAM are read and then stored in CO-RAM, after performing arithmetic processing on them.

- Data flow



For the data from ADD RAM, its MSB position is obtained by the Priority Encoder and sent to CPU. This circuit is used for LOG arithmetic to determine where the high-order digit of the 24-bit data is. After being subjected to LOG arithmetic is the CPU, the data is sent to CO-RAM. This CO-RAM is shared by the CPU mounted on the Mother Board and can also be read from the Mother Board (DPU). Furthermore, to ensure liaison between CPU M and Mother (DPU), they write and read from CO-RAM while reading each other's status. UC14, 15 and UE14, 15 are the latches used to read the respective status. At the same time they use *DPUI and *CPUI interrupts.

● Address map

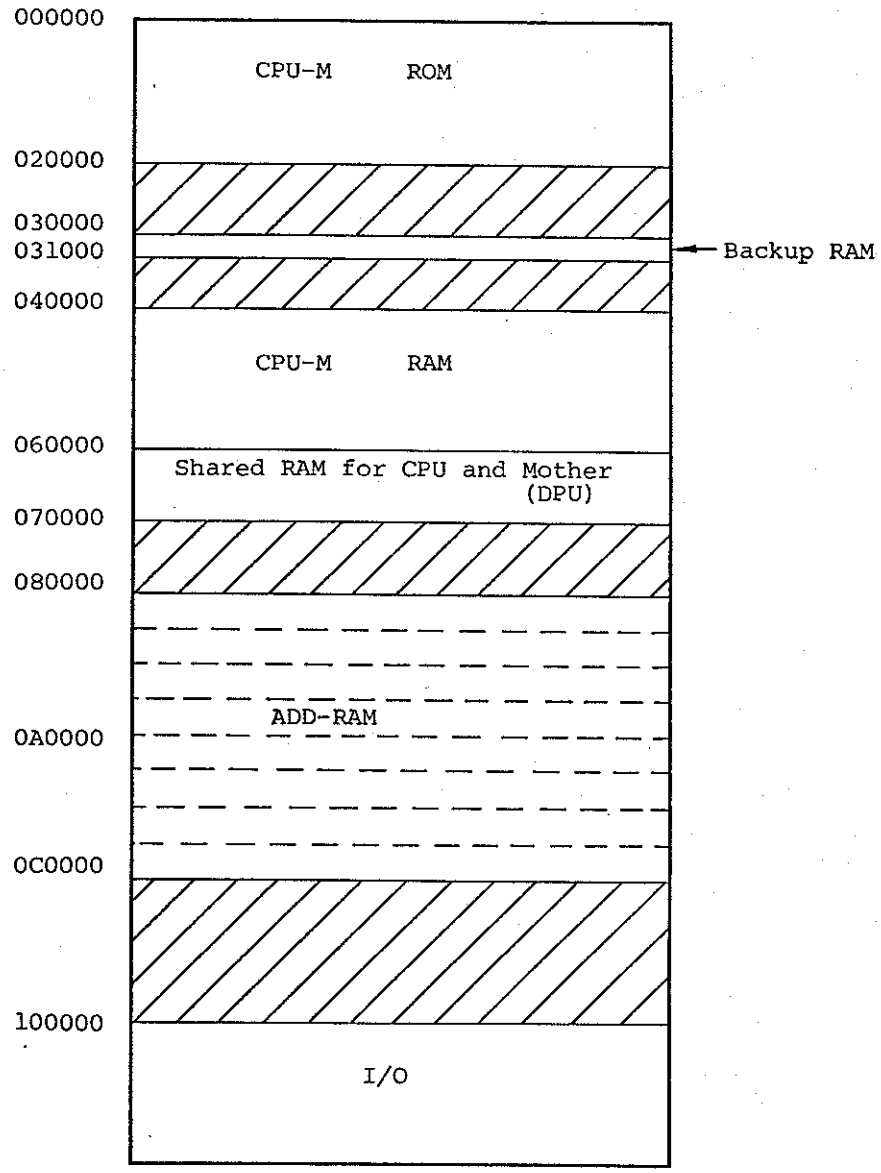


Figure 1-15 Address Map

1.2.6 Mother (BLQ-014526)

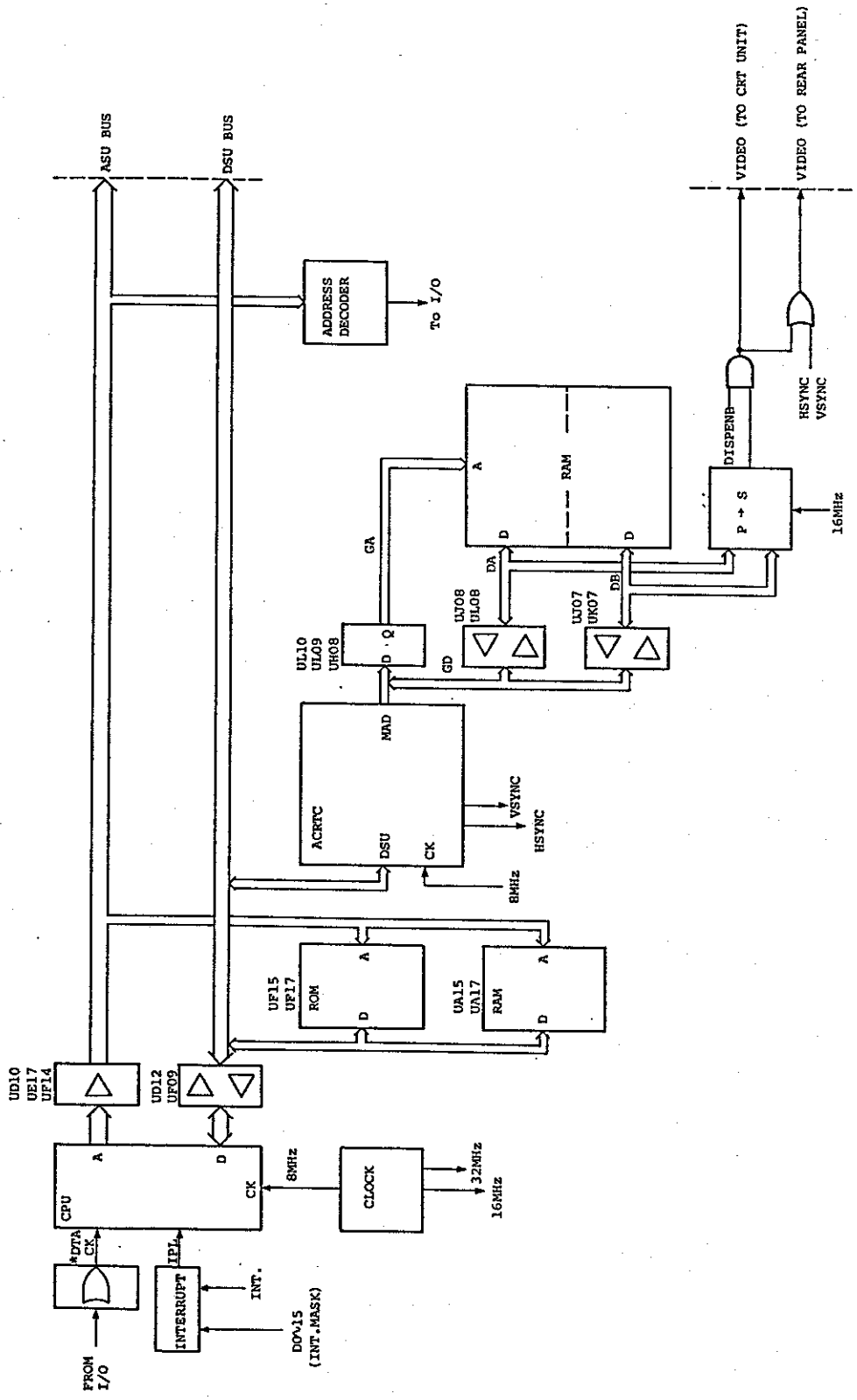


Figure 1-16 Mother

The data read from CO-RAM in CPU M is stored in RAM on the Mother Board via the CPU and ACRTC. After that, the data is converted from parallel to serial and displayed on the CRT. Unlike the conventional CRTC that can handle characters only, ACRTC used here can handle graphics as well. Both characters and graphics are stored in R and then read out. This ACRTC can configure one pixel with four dots, so that gradation can be applied to display.

Character data is contained in ROM, and by reading characters from it the function of a character generator is performed.

- Address map

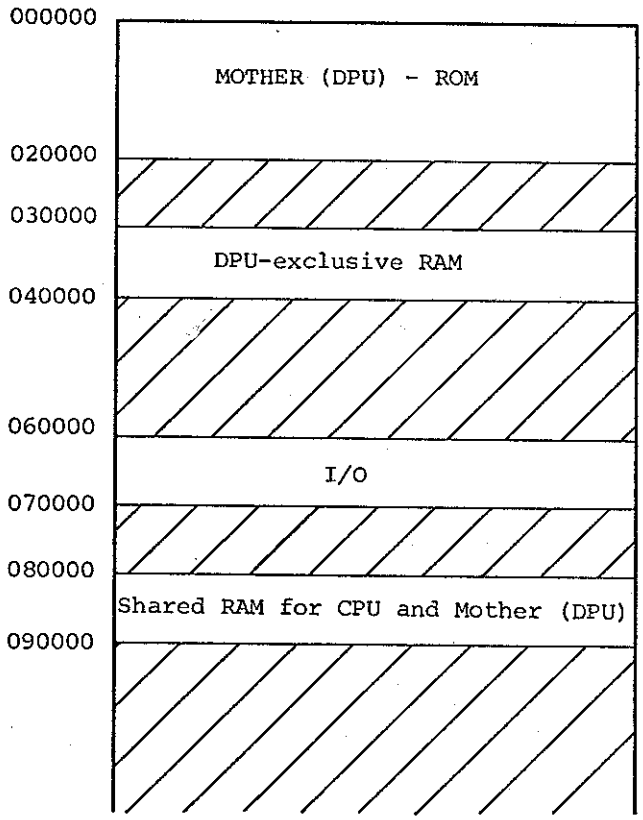


Figure 1-17 Address Map

2. MAINTENANCE DATA

2.1 SELF TEST

Self test is performed for RAM and ROM on CPU M and Mother Board at power-on time. Table 2-1 lists the contents of the test and how the test is done, as well as error display.

Table 2-1 Self Test

Contents of Test	Test Method	Error display
CPU_M RAM TEST	By writing "all high" and "all low" to the Main RAM (UY18, UU18, UY19, UU19) and reading the data, this test checks whether there is any fault in the RAM.	All LEDs on the front panel are lit and the test is stopped.
CPU_M ROM TEST	This test compares the check sum that had been written to ROM with the calculated check sum (UY21, UU21).	All LEDs on the front panel are turned off and the test is stopped.
CPU_M CO-RAM TEST	By writing "all high" and "all low" to the CO-RAM (UA17, UA19) and reading the data, this test checks whether there is any fault in the RAM.	"Common Memory Error" is displayed on the CRT.
CPU_M Backup RAM TEST	Contents of Backup RAM (U018) are temporarily saved to Main RAM and write/read are tested.	"Backup Memory Error" is displayed on the CRT.
CPU_M Backup ROM TEST	When storing data in Backup ROM, this test compares the written sum data with the actual sum data.	"Backup Memory Check Sum Error" is displayed on the CRT.
MOTHER DPU_RAM TEST	By writing "all high" and "all low" to the DPU-RAM (UA15, UA17) and reading the data, this test checks whether there is any fault in the RAM.	"Fail RAM" is displayed on the CRT.
MOTHER DPU ROM TEST	This test compares the check sum that had been written to the ROM with the calculated check sum. (US15, UF17)	"Fail ROM" is displayed on the CRT.
CPU_M STATUS TEST	Status of CPU_M is read by Mother DPU. (UC14, UE14)	When power is turned on, Revision on the CPU side is not shown.

2.2 EPROM LOCATION MAP

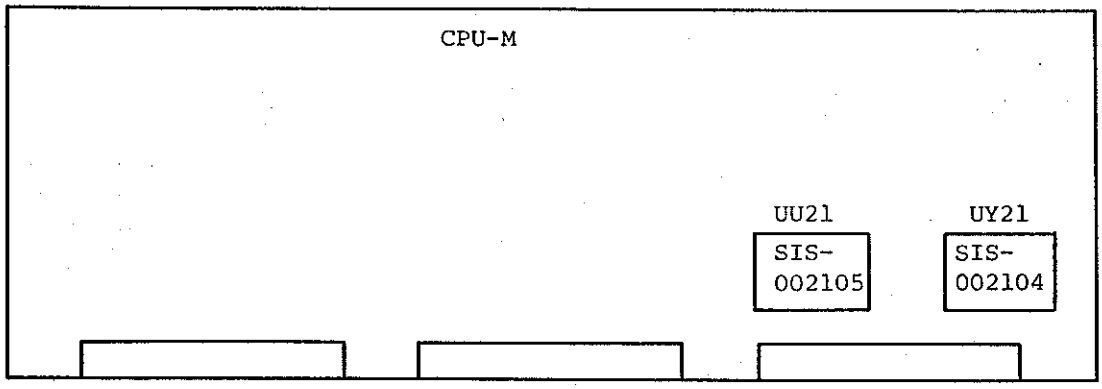


Figure 2-1 EPROM Location Map (1)

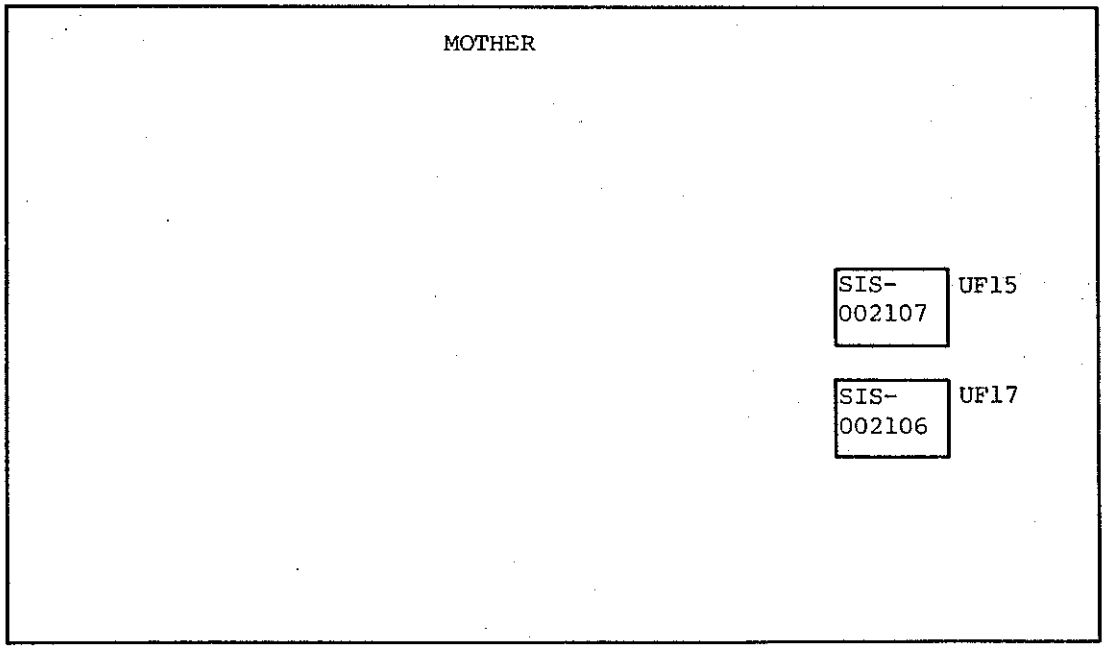


Figure 2-2 EPROM Location Map (2)

2.3 LOCATION DIAGRAM

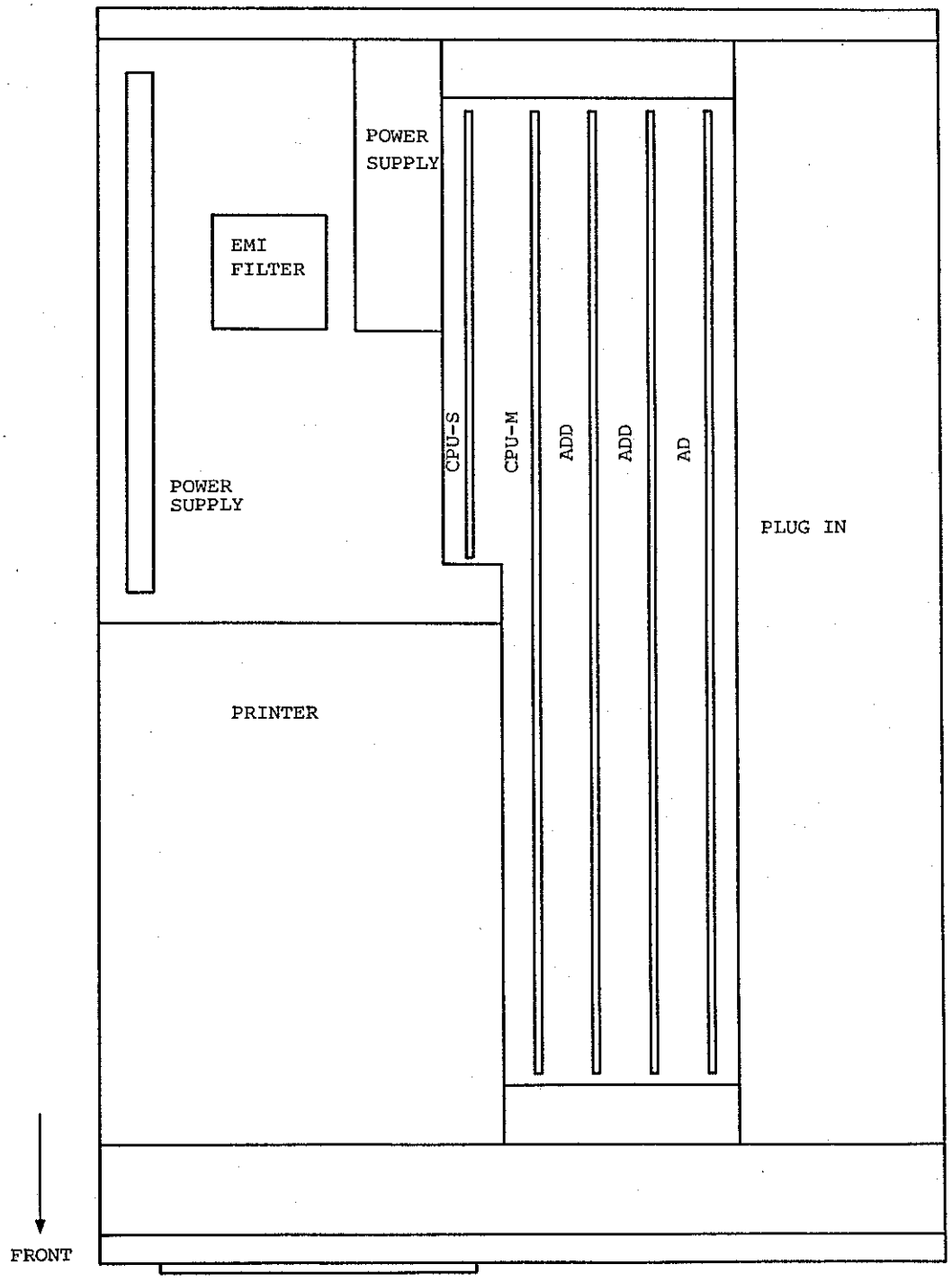


Figure 2-3 Location Diagram (Top View)

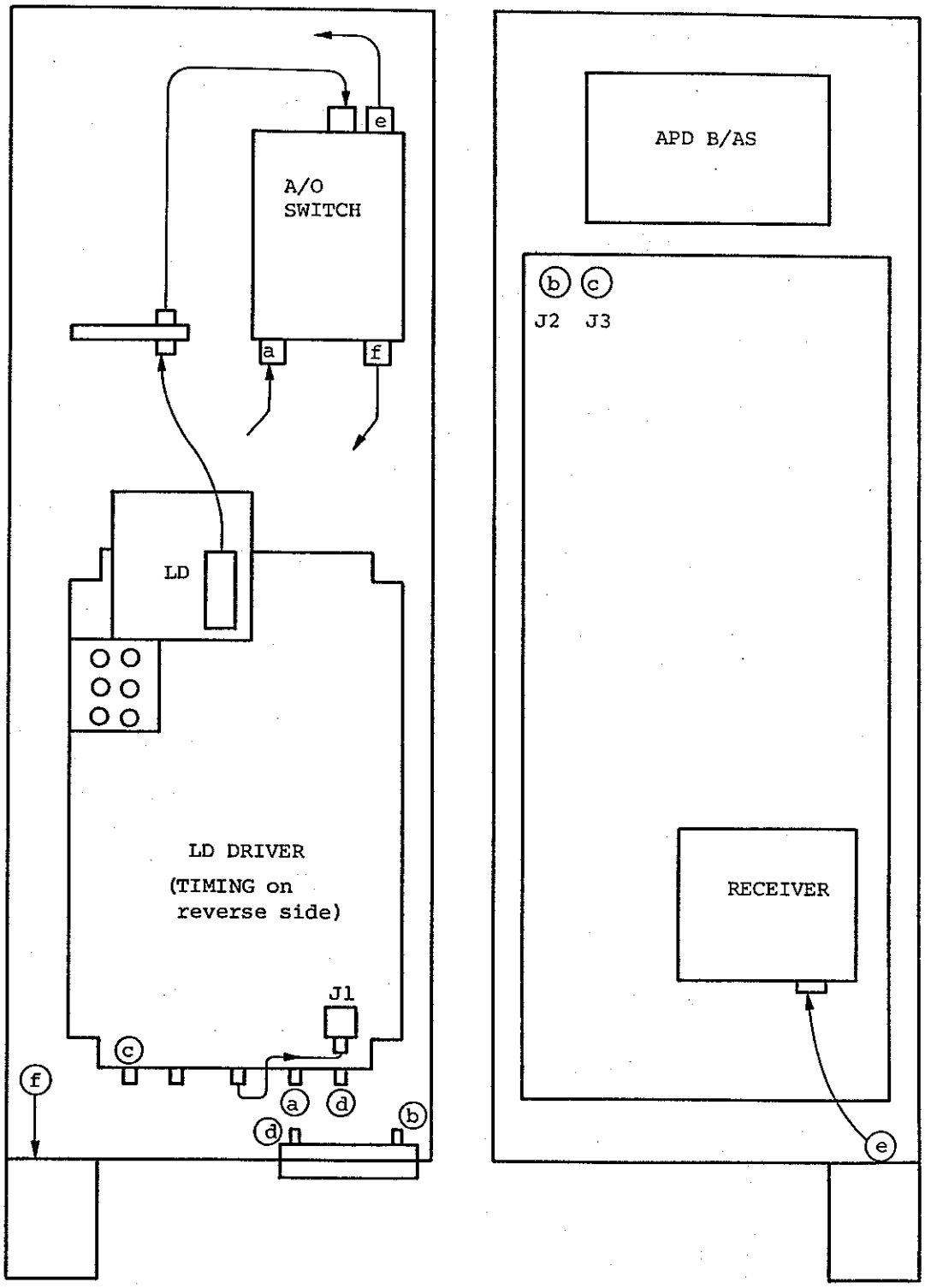
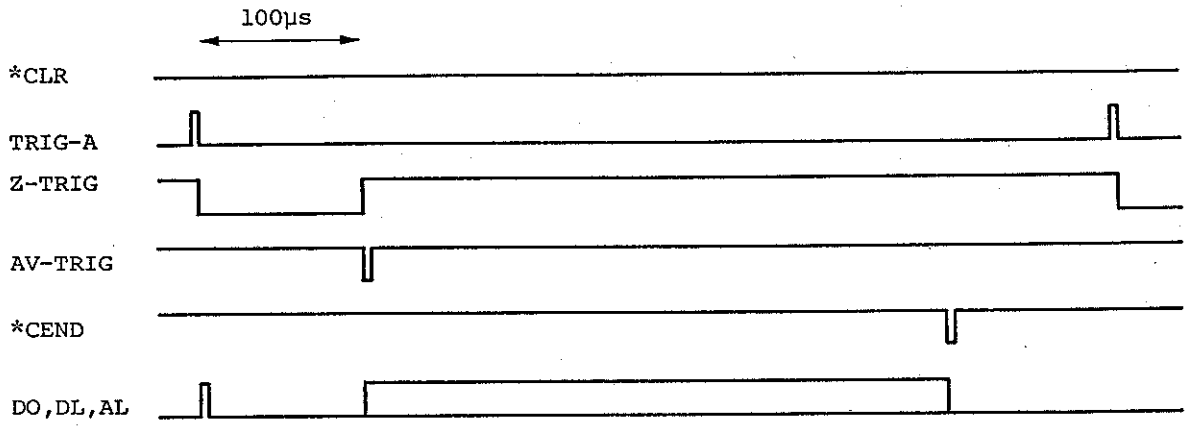


Figure 2-4 Location Diagram (Plug In)

2.4 TIMING OF AD BOARD

The AD Board has short pins (JP5) which are used to diagnose the board when there is a fault. When these pins are detached to open, the AD Board repeats a series of operations. Figure 2-5 shows the timing taken for this.



*DOUT, *RST, *START → "H"

Figure 2-5 Timing Diagram of AD

2.5 TROUBLESHOOTING

2.5.1 Preparation

The equipment and tools necessary for troubleshooting are listed in Table 2-2. The equipment must have equivalent or better performance ratings that those in the table.

Table 2-2 Equipment and Tools Required for Calibration and Adjustment

Equipment	Performance	Recommended Equipment
Digital voltmeter	Range : ±1000V Accuracy : ±1% Input Impedance: 10MΩ	TR6846
Oscilloscope	Frequency Range: DC to 300MHz Input Impedance: 1MΩ	TEKTRONIX 2465
DC Power Supply	Output voltage : ±10V Accuracy : ±0.03%	TR6142
Spectrum Analyzer	Frequency Range: 1 to 120MHz Impedance : 50Ω and 1MΩ	TR4171

Table 2-3 Tools and Jigs Required for Troubleshooting

Product name	Stock number	Remarks
Extender Board	BLP-014531	
Extender Board	BLC-014533	
O/E CONVERTER	(REF. Figure 2-6)	
Cable	MC-36 (2 pcs.)	UM-BNC
Cable		UM-UM
Cable	DCB-SS2624 x 01 - 1	TQ8450-PLUG IN

2.5.2 O/E Converter

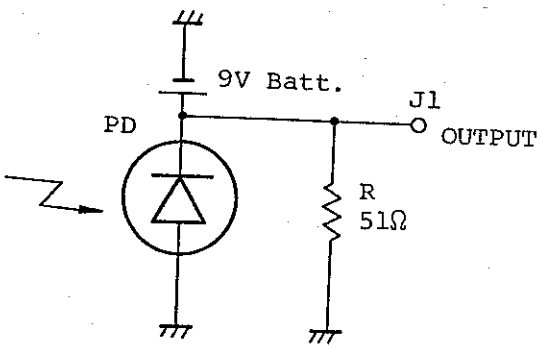
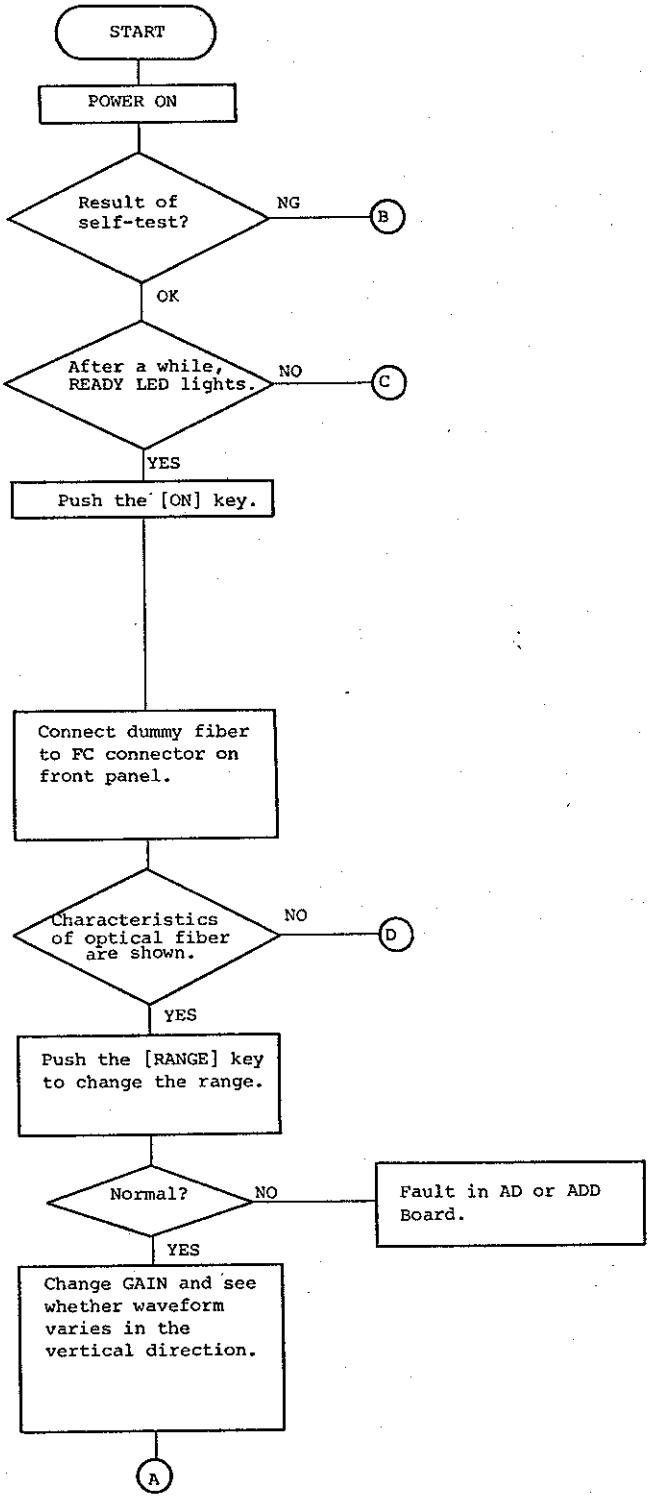


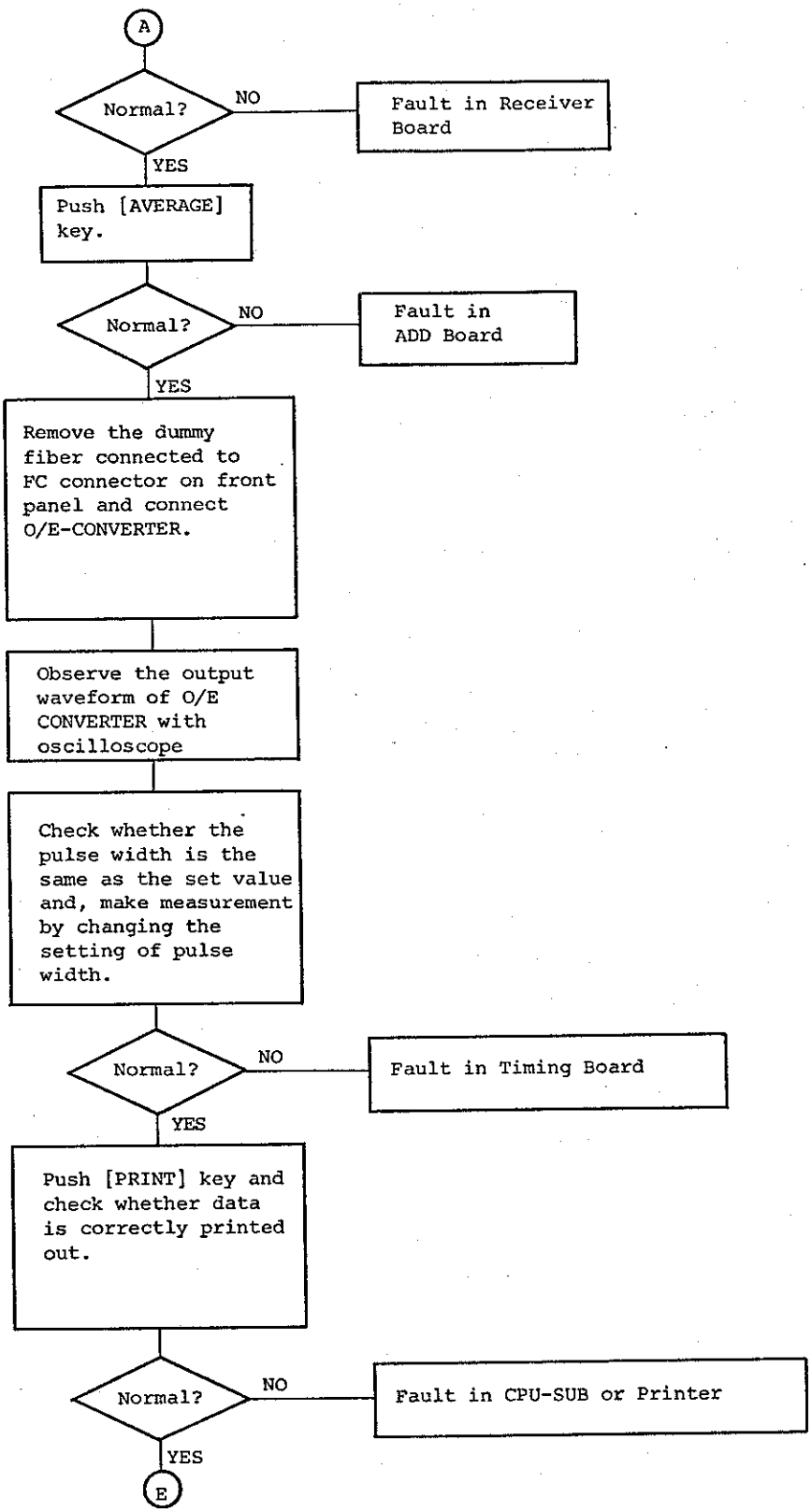
Figure 2-6

-- Parts Configuration --

- J1: JCF-AC001JX01-1
- R1: RCB-AH51-1 (UM CONNECTOR)
- PD: WBL-82018#01 (with FC CONNECTOR)
- 9V Batt.
- Substrate

2.5.3 Troubleshooting




A
Normal?
NO
Fault in Receiver Board
YES
Push [AVERAGE] key.
Normal?
NO
Fault in ADD Board
YES
Remove the dummy fiber connected to FC connector on front panel and connect O/E-CONVERTER.
Observe the output waveform of O/E CONVERTER with oscilloscope
Check whether the pulse width is the same as the set value and, make measurement by changing the setting of pulse width.
Normal?
NO
Fault in Timing Board
YES
Push [PRINT] key and check whether data is correctly printed out.
Normal?
NO
Fault in CPU-SUB or Printer
YES
E

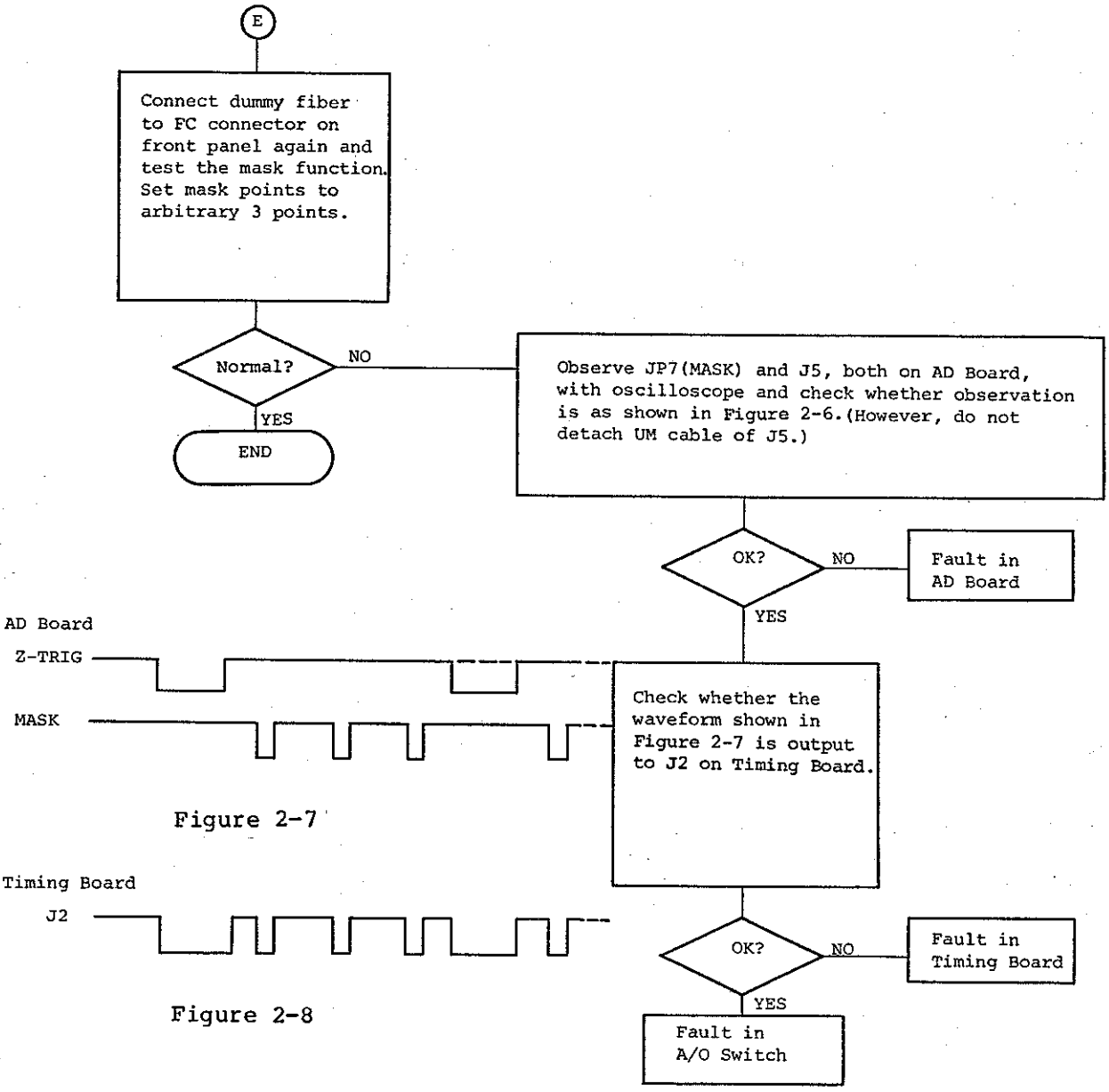
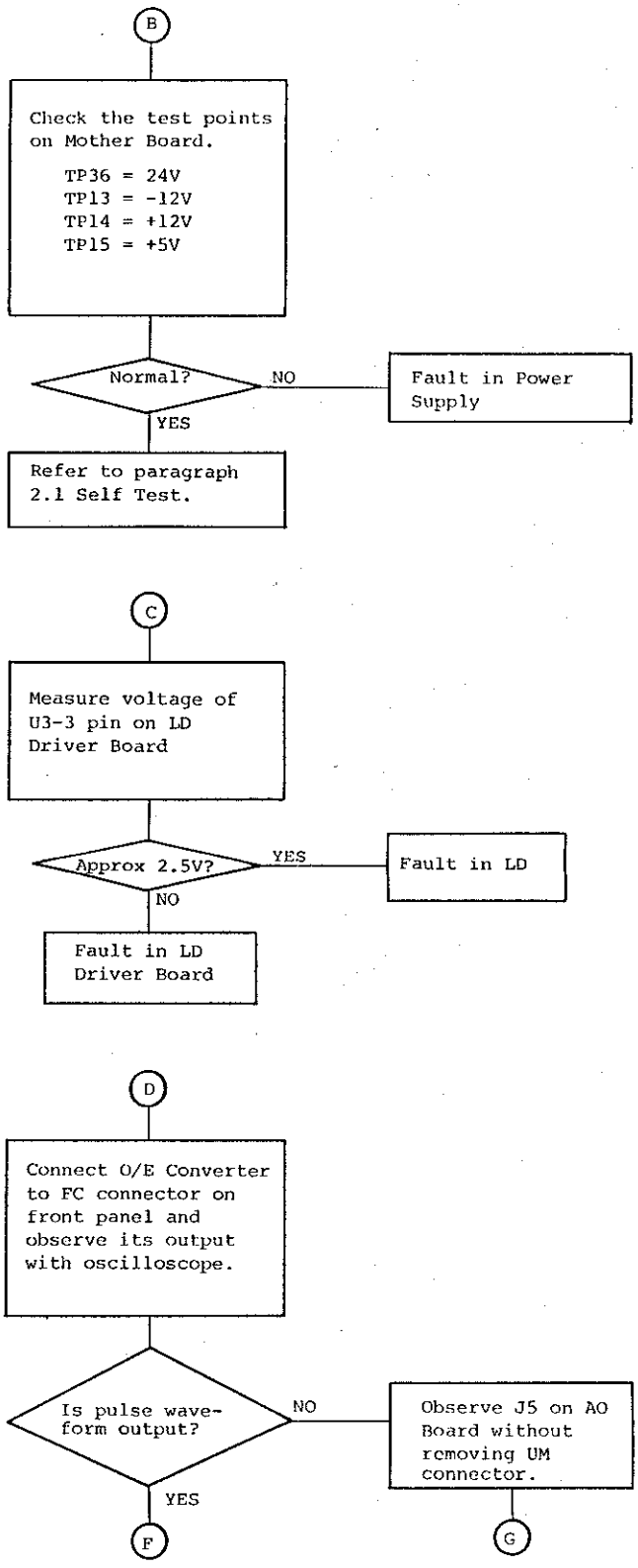
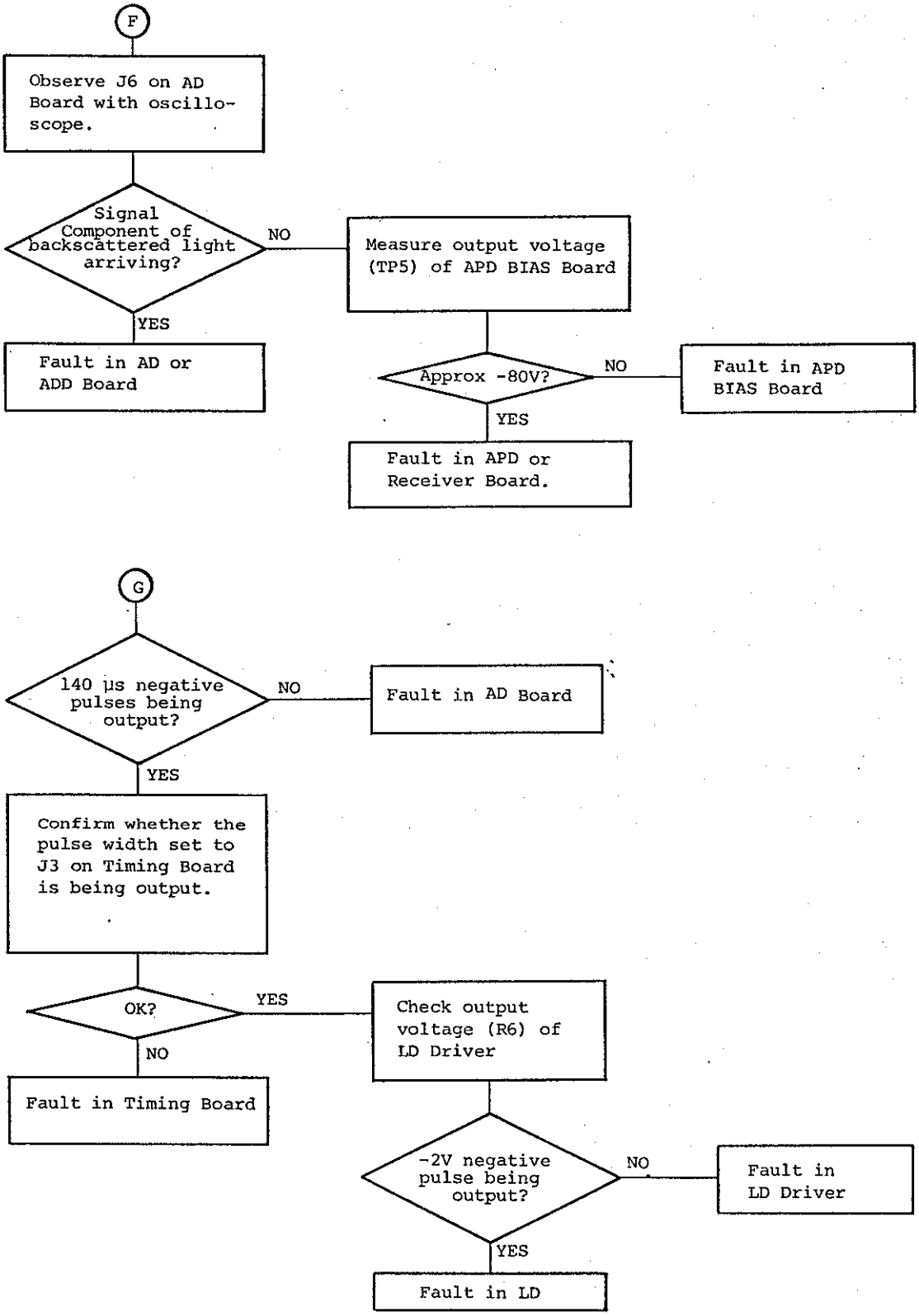


Figure 2-7

Figure 2-8


B
Check the test points on Mother Board.
TP36 = 24V
TP13 = -12V
TP14 = +12V
TP15 = +5V
Normal?
NO
Fault in Power Supply
YES
Refer to paragraph 2.1 Self Test.
C
Measure voltage of U3-3 pin on LD Driver Board
Approx 2.5V?
YES
Fault in LD
NO
Fault in LD Driver Board
D
Connect O/E Converter to FC connector on front panel and observe its output with oscilloscope.
Is pulse wave-form output?
NO
Observe J5 on AO Board without removing UM connector.
YES
F
G


F
Observe J6 on AD Board with oscillo-scope.
Signal Component of backscattered light arriving?
NO
YES
Measure output voltage (TP5) of APD BIAS Board
Fault in AD or ADD Board
Approx -80V?
NO
YES
Fault in APD BIAS Board
Fault in APD or Receiver Board.
G
140 µs negative pulses being output?
NO
YES
Fault in AD Board
Confirm whether the pulse width set to J3 on Timing Board is being output.
OK?
YES
NO
Check output voltage (R6) of LD Driver
Fault in Timing Board
-2V negative pulse being output?
NO
YES
Fault in LD Driver
Fault in LD

3. HOW TO ADJUST

3.1 PREPARATION

Table 3-1 lists the equipment and tools required for calibration and adjustment. Use equipment and tools equivalent or superior in performance to these.

Table 3-1 Equipment and Tools Required for Calibration and Adjustment

Equipment	Performance	Recommended Equipment
Digital voltmeter	Range : ±1000V Accuracy : ±1% Input Impedance: 10mΩ	TR6846
Spectrum Analyzer	Range : 1MHz to 120MHz Input Impedance: 50Ω and 1MΩ	TR4171
DC Power Supply	Output voltage : ±10V Accuracy : ±0.03%	TR6142
Oscilloscope	Frequency Range: DC to 300MHz Input Impedance: 1mΩ	TEKTRONIX 2465
Optical Attenuator	Attenuation : 0 - 60dB 1dB step	o Fujitsu H72M - 2026 - M101 (GI 0.85μm) o Fujitsu H72M - 2026 - M102 (GI 1.3μm)

Table 3-2 Tools and Jigs Required Adjustment

Product name	Stock number	Remarks
Extender Board	BLP-014531	
O/E CONVERTER	(REF. Figure 2-6)	
Cable	MC-36	UM-BNC
Cable		UM-UM
Cable	DCB-SS2624 x 01 - 1	TQ8450-PLUG IN
Dummy Fiber	5km or more	

3.2 EXPLANATION OF ADJUSTMENT PROCEDURE

3.2.1 Adjusting the AD Board

(1) Adjusting the 100 MHz Oscillator
Place the probe on TP25 and observe the 100 MHz signal with a spectrum analyzer. Adjust the trimmer capacitor C4 by turning it right and left until the waveform comes at the center of A and B characteristics as shown in Figure 3-1.

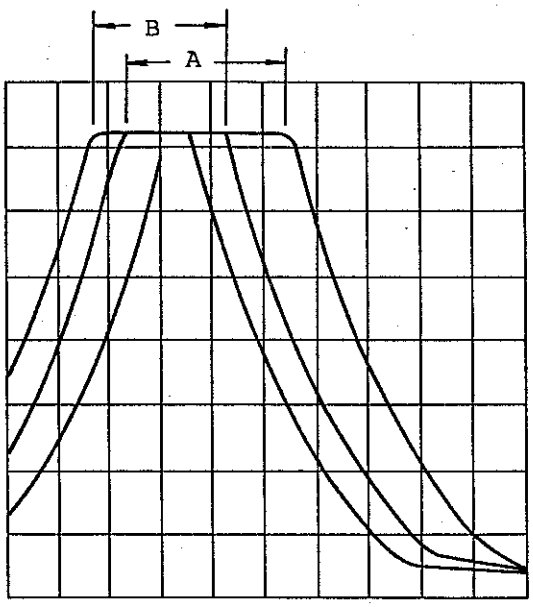
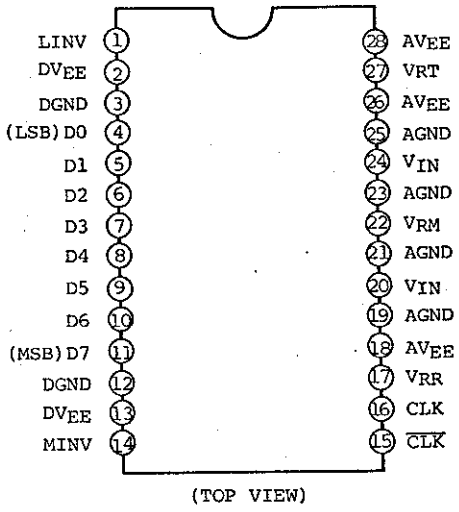


Figure 3-1 Adjustment of the 100 MHz Oscillator

(2) Adjusting the AD Converter

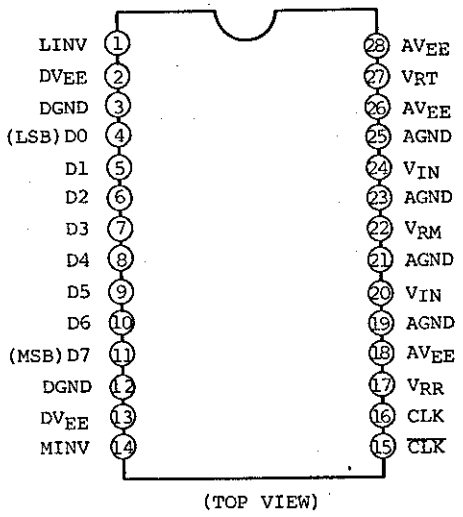
- Apply 7 mV to J6 from the DC Power Supply and adjust VR (R30) until the output of the AD Converter (CXA1016) becomes as shown below.

Output terminal	D_7	D_6	D_5	D_4	D_3	D_2	D_1	D_0
Level	L	L	L	L	L	L	L	H



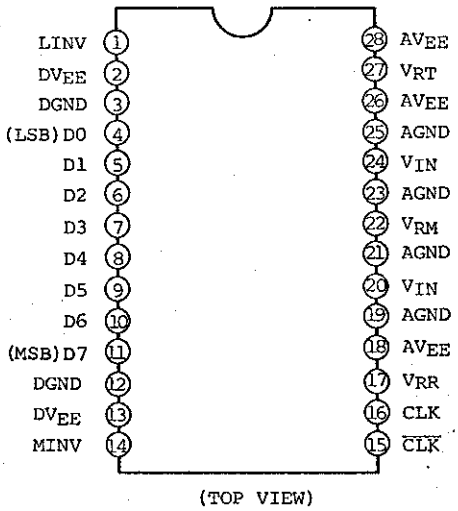
- In the same way, input 1.993V to J6 and adjust VR (R22) until the output of the AD Converter becomes as shown below.

Output terminal	D_7	D_6	D_5	D_4	D_3	D_2	D_1	D_0
Level	H	H	H	H	H	H	H	L



- Input 1.0V to J6 and adjust VR (R36) until the output of the AD Converter becomes as shown below.

Output terminal	D_7	D_6	D_5	D_4	D_3	D_2	D_1	D_0
Level	L	H	H	H	H	H	H	H



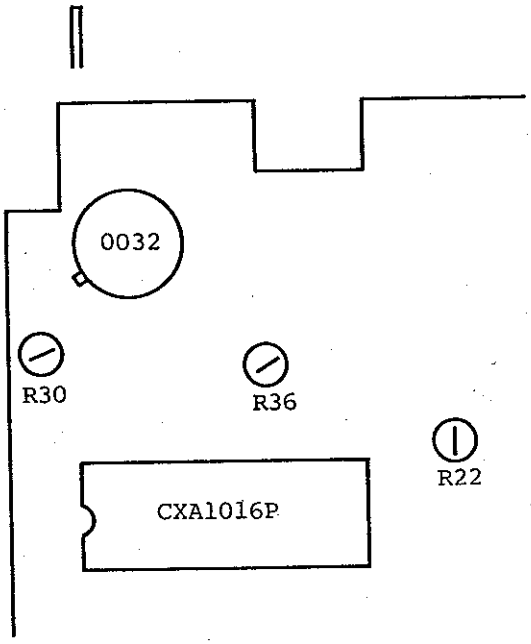


Figure 3-2 AD Board (Top View)

3.2.2 Adjusting the CPU SUB (Adjustment of Printer)

(1) Detach the printer cable from J2 on the CPU SUB Board.

(2) Short pin 2 and pin 3 of J3 with a jumper socket.

(3) Set the digital voltmeter to DCV and connect (-) to TP11 and (+) to TP15.

(4) Adjust the voltage of TP15 with R15 to the voltage that corresponds to the head rank of the printer. (The head rank is described on the printer by the assembly manufacturer.)

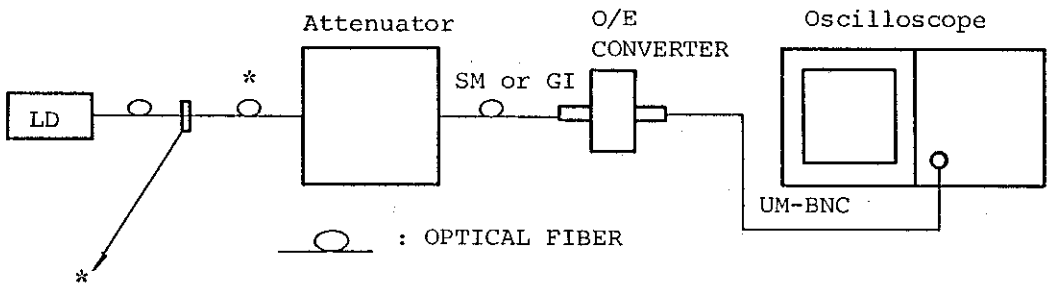
Table 3-3

Head rank	Voltage of TP15 (V)
I	3.50 ± 0.06
II	3.14 ± 0.06
III	2.90 ± 0.06

(5) Pull out the jumper socket form J3 and set it to pin 1 and pin 2.

(6) Connect the printer cable to the CPU SUB board.

3.2.3 Adjusting the LD Power



* An adapter connecting LD and port 1 of AOSW in P1. Remove fiber from AOSW and connect test fiber.

Figure 3-3 Connection Diagram

- Connect equipment as shown in Figure 3-3. For fiber marked by *, use SM for Q84501/521 and GI for Q84506.
- Set the pulse width of TQ8450 to 200 nsec, GAIN to 3 dB and RANGE to 16 km, respectively.
- Turn on LD.
- Adjust power with VR on the LD Driver Board. Table 3-3 shows types of VR used and the rated current.

Table 3-4

P.I.	Rated Current	LD	Peak Power	VR
Q84501	340mA	44SLD	50mW	R51
Q84506	340mA	33LD	55mW	R51
Q84521	280mA	1.31μm 44SLD	50mW	R44
		1.55μm 64SLD	40mW	R40

- For the drive current, measure both ends of R13 on the LD Driver Board with DVM and calculate the value of R13 assuming 6.8 ohms for Q84501/506 and 9 ohms for Q84521.

However, when LD and port 1 of AOSW are connected and the fiber marked by * is connected to the inlet of PI, confirm that the power is

Q84501 ⟶ 8 mW or more
Q84506 ⟶ 8 mW or more
Q84521 ⟶ 6 mW or more (1.31 μm)
⟶ 3 mW or more (1.55 μm)

3.2.4 Adjusting the LD Emission Delay Time

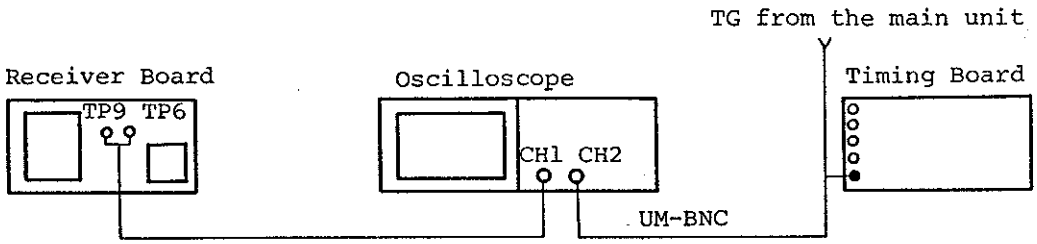


Figure 3-4 Connection Diagram

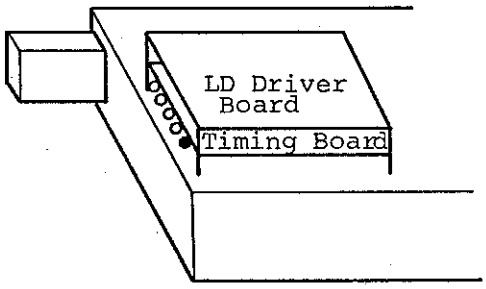


Figure 3-5 Position of Timing Board J1 Connector

- Connect TP6 and TP9 (GND) of the Receiver Board to CH1 and J1 (from TG) of the Timing Board to CH2 for monitoring with oscilloscope.
- Trigger of the oscilloscope should be applied on the rising edge of CH2 (TG).
- Set the pulse width of TQ8450 to 1 μsec and GAIN to 3 dB, respectively.

  *At this time, do not connect the fiber.

- Turn on LD.
- Adjust the delay time from the rising edge of the TG pulse to the rising edge of the Timing pulse with VR (R26) on the Timing Board so that it becomes 880 μsec.

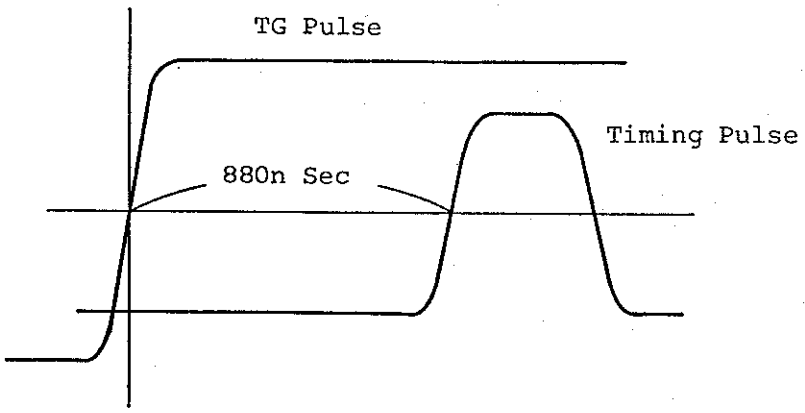


Figure 3-6 Monitor Diagram of Oscilloscope

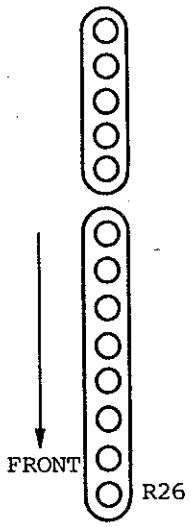


Figure 3-7 Location of VR

3.2.5 Adjusting Timing Board

Connect equipment as shown in Figure 3-8.

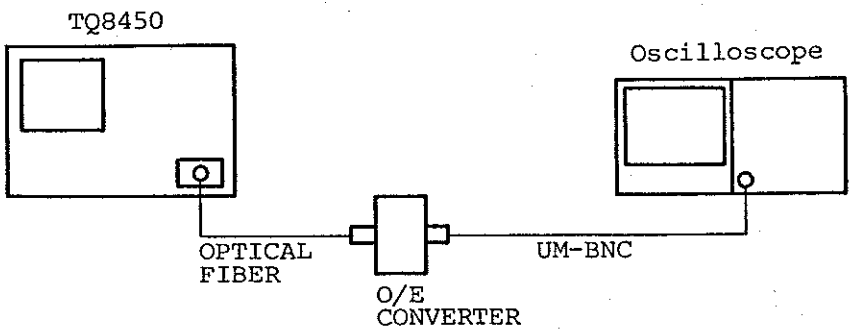


Figure 3-8 Connection Diagram

- Adjustment of pulse width
  Set the pulse width of TQ8450 to 5 μs. Then, observe its pulse waveform with the oscilloscope and adjust it with VR (R23) until the pulse width is made to 5 μs.
  In the same way, set the pulse width and adjust it with VR until it becomes the same as the set value.

Table 3-5 Adjustment of Pulse Width

Pulse width	VR to adjust with
5 μs	R23
1 μs	R20
200 ns	R17
50 ns	R14

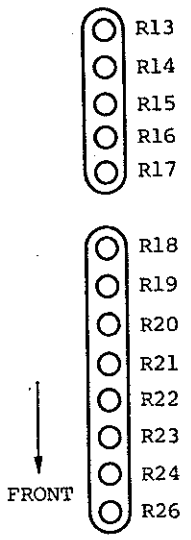


Figure 3-9 Location of VR

- Adjusting the mask
  Connect a dummy fiber to the FC connector on the front panel and display its characteristics.

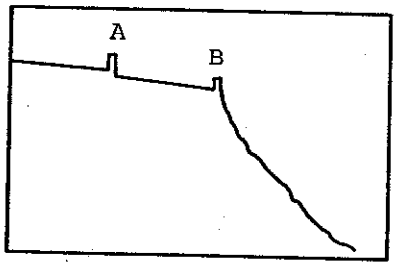


Figure 3-10 Measurement Results

Place the marker on top of point A or point B and then push MASK SW. Do this for each pulse width so that Fresnel reflections such as those at point A and point B are completely masked.

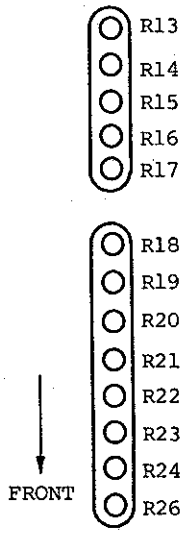


Figure 3-11 Location of VR

Table 3-6 Adjustment of Mask

Pulse width	VR to adjust with
5 µs	R24
1 µs	R21
200 ns	R18
50 ns	R15

- Adjusting the near-edge dead zone

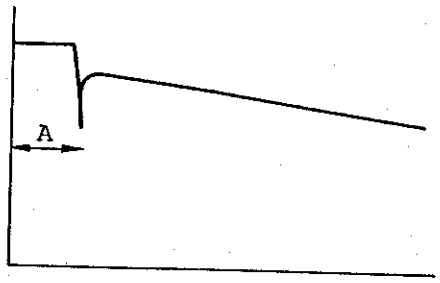


Figure 3-12 Measurement Example

Adjustment with VR until the relationship of distance A shown in Table 3-6 is obtained for each pulse width.

Table 3-7 Adjustment of Near-edge Dead Zone

Pulse width	Dead zone	VR to adjust with
5 µs	less than 600 m	R22
1 µs	less than 200 m	R19
200 ns	less than 120 m	R16
50 ns	less than 100 m	R13

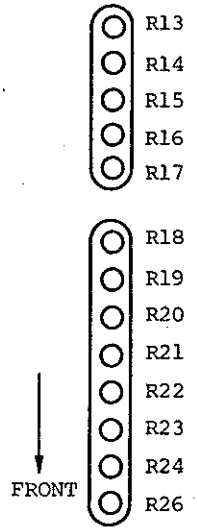


Figure 3-13 Location of VR

3.2.6 Adjusting the Receiver Board

- Adjustment of Receiver's output offset voltage
  Adjust the output offset voltage by changing the gain of the Receiver Board using the GAIN key as shown in Table 3-7.

  *Sequence of adjustment: 9 dB ⟶ 3 dB

Table 3-8 Adjustment of Output Offset Voltage

GAIN	OFFSET VOLTAGE	VR to adjust with	TP
9 dB	500mV ± 50mV	R69	TP13(12MV)
3 dB	250mV ± 30mV	R70	TP14(LMV)

*Common for each type of equipment

3.2.7 Adjusting the APD Bias Board (BLC-014536)

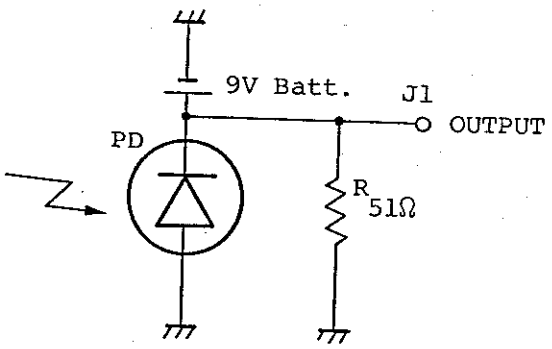
(1) Adjustment of DC-DC converter reference voltage
While monitoring TP3 (+2V) with a digital voltmeter, adjust it to +2.000V with R3.

(2) Adjustment of APD Bias voltage
While monitoring TP5 ($-V_B$) or the through terminal connected to the mounted land of $-V_B$ with a digital voltmeter, adjust it with R19 to the voltage that is indicated in the table affixed to the cover of the I-V Converter shield case of the Receiver Board.

3.2.8 Adjusting the I-V Converter Offset Voltage of the Receiver Board (BLK-014535, X02, X03)

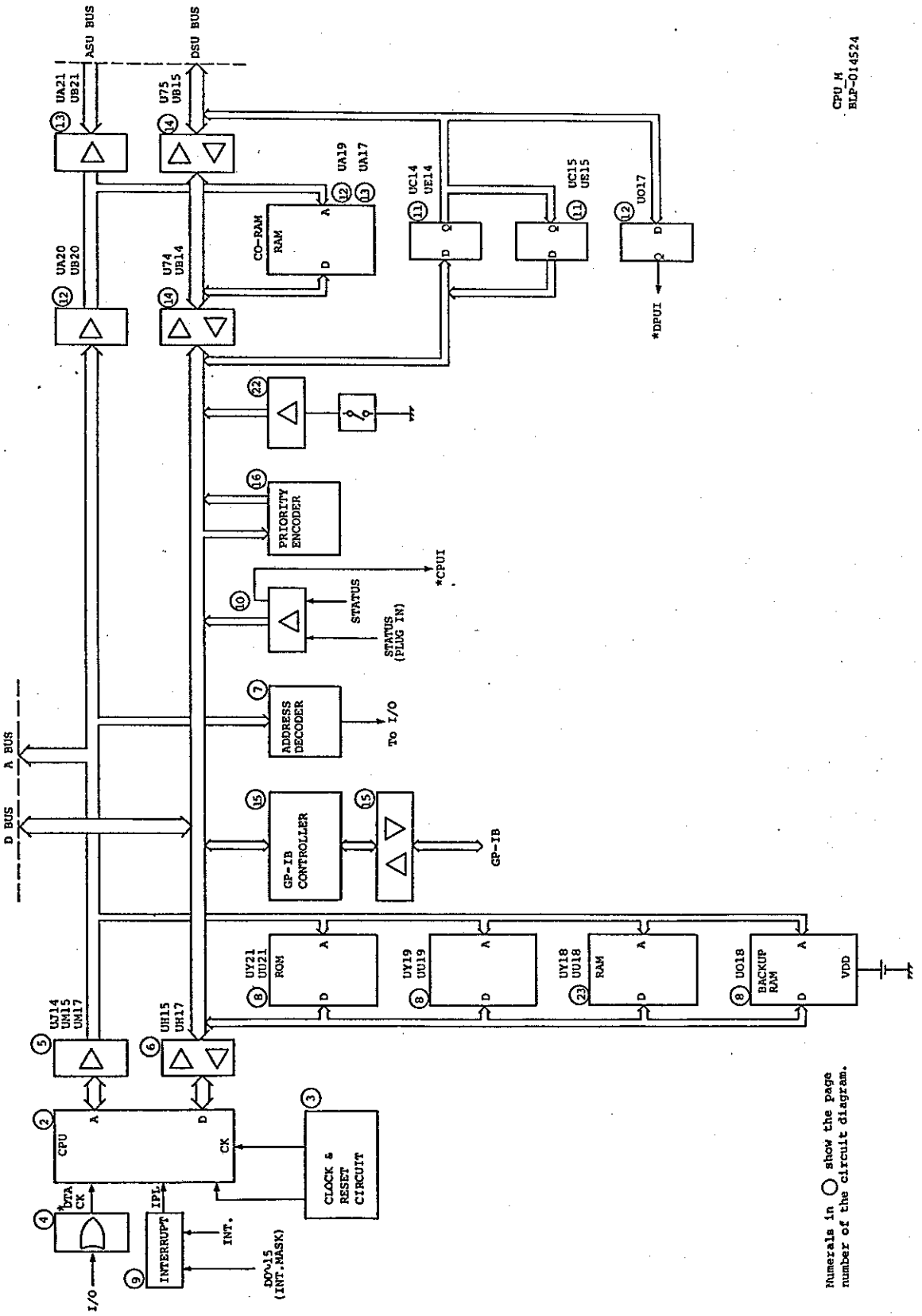
- Remove mini-jumpers from J6 J8 and J7.
- At this time, the voltage of Vcc is approx. -5.2V.
- While monitoring TP4 (BFO) with a digital voltmeter with APD shielded off, adjust the voltage with R54 until it becomes within 0 to +1V.

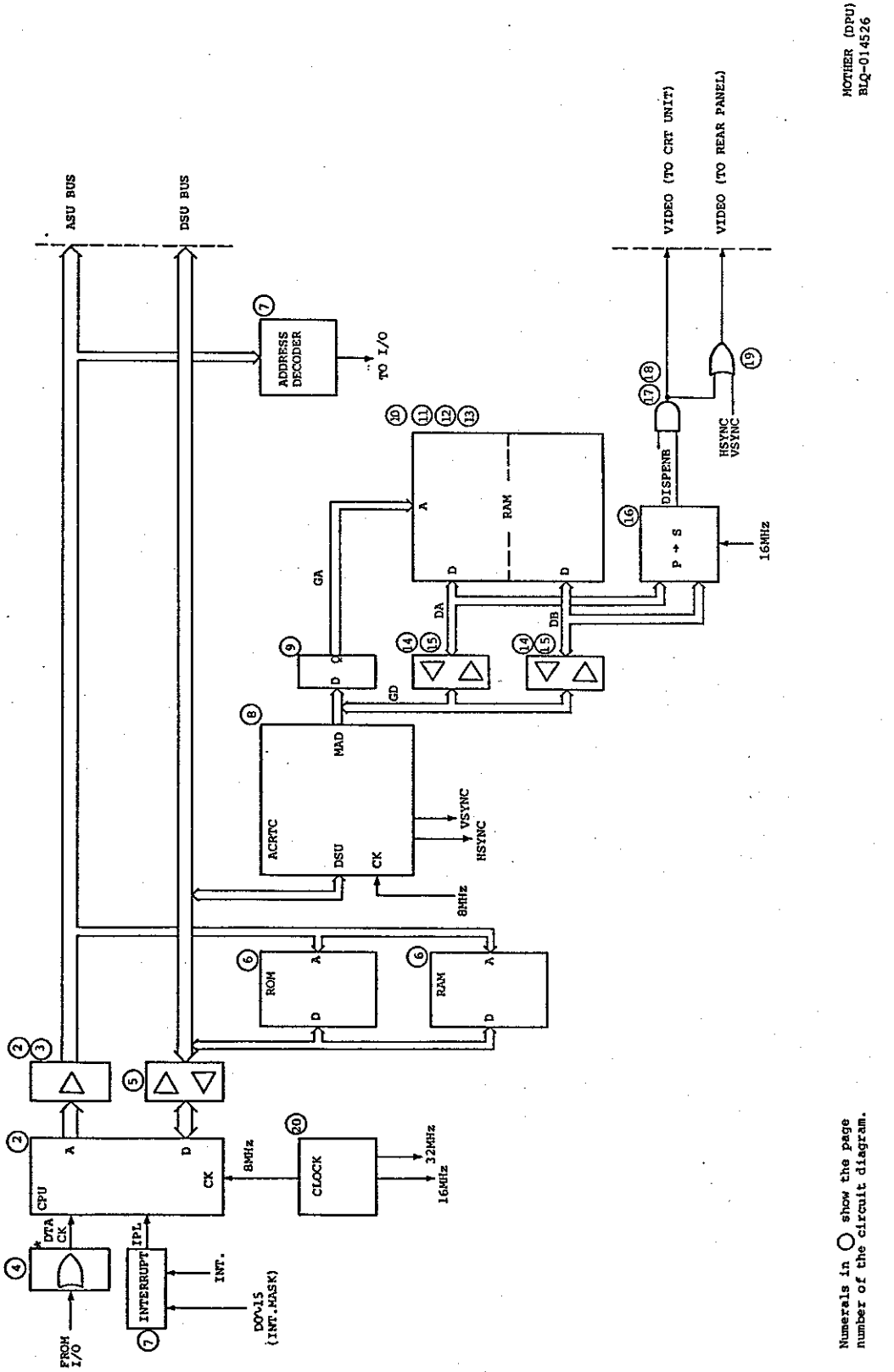
3.2.9 O/E Converter



-- Parts Configuration --

- J1: JCF-AC001JX01-1
- R1: RCB-AH51-1 (UM CONNECTOR)
- PD: WBL-82018#01 (with FC CONNECTOR)
- 9V Batt.
- Substrate


CPU_H
BLP-014524
ASU BUS
DSU BUS
UA21
UB21
U75
UB15
UA19
UA17
UC14
UE14
UC15
US15
UO17
CO-RAM
RAM
UA20
UB20
U74
UB14
*DFUI
PRIORITY
ENCODER
*CPUI
STATUS
STATUS
(PLUG IN)
ADDRESS
DECODER
To I/O
A BUS
D BUS
GP-IB
CONTROLLER
GP-IB
UY21
UU21
ROM
UY19
UU19
UY18
UU18
RAM
UO18
BACKUP
RAM
VDD
UJ14
UM15
UH17
UH15
UH17
CPU
CK
CLOCK &
RESET
CIRCUIT
DTA
CK
IPL
INTERRUPT
INT.
DO^15
(INT.MASK)
I/O
Numerals in ○ show the page
number of the circuit diagram.


MOTHER (DPU)
BLQ-014526
ASU BUS
DSU BUS
VIDEO (TO CRT UNIT)
VIDEO (TO REAR PANEL)
ADDRESS DECODER
TO I/O
RAM
DISPENB
HSYNC
VSYNC
P → S
16MHz
GA
DA
DB
GD
MAD
ACRTC
DSU
CK
VSYNC
HSYNC
8MHz
ROM
RAM
CPU
A
D
CK
8MHz
CLOCK
32MHz
16MHz
DTA CK
IPL
INTERRUPT
INT.
D0~15
(INT.MASK)
FROM I/O
Numerals in ○ show the page number of the circuit diagram.

APPENDIX

PARTS LIST
SCHEMATIC SECTION
MECHANICAL PARTS

LIST OF FIGURES

LIST OF TABLES

TQ8450
MECHANICAL PARTS LIST

Parts No.	ADVANTEST Stock No.	Description
1	MHT-42294A	FOOT
2	MBX-42848A	COVER, Bottom
3	MMX-20403A	FOOT
4	MPX-42287A	COVER, Side
5	MPX-36169A	BELT COVER, 4U Side
6	MEX-11053A	FOOT B, Stack
7	MPX-42289A	BELT COVER, Lower
8	MPX-42288A	BELT COVER, Upper
9	MBX-42845A	COVER, Top
10	MBX-42308A	SHUTTER
11	MPX-42284A	RAIL B, Shutter
12	MPX-42321A	RAIL A, Shutter
13	YEE-001647-1	BALL PRANGER
14	MKT-44846A	BEZEL
15	MPX-42282A	COVER, Side: Rear
16	MMX-35642A	HANDLE
17	MPX-36850A	COVER, Side: Front
18	MKX-32181A	SPACER, Handle
19	MHT-42295A	HANDLE
73	MKC-10422A	Nut

Parts No.	ADVANTEST Stock No.	Description
20	MHT-42296A	SUBFRAME, Lower
21	MCT-35637A	4U SIDE CORNER
22	MHT-42297A	FRAME R, Side
23	MPX-42285B	PI RAIL, Lower
24	MPX-42286B	PI RAIL, Upper
25	MBJ-42325B	PECEPTACLE, Connector
26	MBJ-42847B	PARTITION PLATE
27	MBJ-42314A	GUIDE R, Circuit Board
28	YEE-000151-1	SUPPORT Circuit Board
29	MKN-23339A	HOOK
30	MBE-53201	HOLDER C, Power Supply
31	MBE-44856A	HOLDER, Circuit Board
32	MBE-44812A	CLAMPER, Thermostat
33	MBJ-42318B	HOLDER A, Power Supply
34	MBJ-42846B	CHASSIS
35	MBJ-42850A	SUPPORT, CRT
36	MBJ-42313C	GUIDE F, Circuit Board
37	MHA-42290A	SUPPORT B, Circuit Board
38	MHA-42291A	SUPPORT A, Circuit Board
39	MBA-42307B	COVER A, Circuit Board
40	MPX-44848A	COVER Insulation
41	MBS-42309B001B	PANEL, Front
42	MKT-36061B	KNOB
43	MNS-36062B	PLATE, Knob
44	MMX-20592A	KNOB
45	MNS-12367A	PLATE, Knob
46	MMX-11093A	BEZEL
47	MKC-10421A	SPACER BOLT
48	MBA-42323A	COVER B, Circuit Board
49	MKT-42302A	BEZEL, CRT
50	MPX-22028A	FILTER, CRT
51	MBJ-42324A	SUBPANEL
52	MMX-11094A	CAP, Power Switch
53	MBZ-42316B	HOLDER, CRT
54	MHT-42293B	SUBFRAME, Upper
55	MBZ-42849B	HOLDER, Printer
56	MBT-44810A	CHASSIS, Printer
57	MPX-44849A	GUIDE A, Paper
58	MHJ-42304A	SHAFT
59	MPX-44851A	RING, Stop
60	YEE-001194-1	FINGER CONTACT
61	MBA-44852A	GUIDE B, Paper
62	MBE-42322A	RECEPTACLE, Shaft
63	YEE-000036-1	CLAMPER
64	MBT-44811A	CASE, Printer
65	MPE-42281A	CUTTER, Paper
71	MHT-42303A	4U SIDE CORNER

Parts No.	ADVANTEST Stock No.	Description
66	MBS-42315B001B	PANEL, Rear
67	MBS-44847A001A	COVER, Fan
68	MKZ-15313A	SPACER BOLT
69	MBS-44853A001	COVER, Power Supply
70	YEE-002124	FILTER UNIT
72	YKG-E01084-1	PLATE, Serial Number

Parts No.	ADVANTEST Stock No.	Description
R1	RVR-BL200K	R: VAR CERMET 200kΩ
C1	CCK-AA100U25V	C: FXD ELECT 100μF 25V
CB1	DCB-QS0536-1	Cable
CB2	DCB-RR1210X02	Cable
CB3	DCB-ES2545X01-1	Cable
CB4	DCB-FF1167X08-1	Cable
CB5	DCB-RE2636X03-1	Cable
CB6	DCB-QS0481-1	Cable
CB7	DCB-RR2658X04-1	Cable
CB8	DCB-RR0907X02	Cable
CB9	DCB-RR2659X03-1	Cable
J2	JCD-AE003PX05-2	Connector
J3 thru J6		Not assigned
J7	JCF-AB001JX10	Connector
J8	JCF-AC001PX01	Connector
J9	JCR-AE034JX02	Connector
L1	LCL-T00083A-1	L: FXD Coil
S1	KSL-000713	Switch
S2	KSP-000035-1	Switch
S3	KSA-000691	Switch
F1	DFT-AG2A	Fuse
FH1	DFH-000844	Fuse Holder
FM	DMF-001430-1	Motor
NF	DEE-001427-1	Noise Filter

Parts No.	ADVANTEST Stock No.	Description
CB1	DCB-QS0536-1	Cable
D1	NLD-000204	Light Emitting Diode
S1 thru S3	KSP-000250	Switch

Parts No.	ADVANTEST Stock No.	Description
U1	SIT-74F283	IC: 4-Bit Binary Full Adder
U2	SIT-74F08	IC: Quadruple 2-Input Positive-AND Gate
U3	SIT-74F374	IC: Octal D-Type Flip Flop
U4	SMM-5814A-1	IC:
U5	SIT-74LS157	IC: Quad 2-to 1-Line Data Selector/Multiplexer Low Power
U6	SIT-74F373	IC: Octal D-Type Latch
U7	SIT-74F283	IC: 4-Bit Binary Full Adder
U8	SIT-74F08	IC: Quadruple 2-Input Positive-AND Gate
U9	SIT-74F374	IC: Octal D-Type Flip Flop
U10	SMM-5814A-1	IC:
U11	SIT-74F283	IC: 4-Bit Binary Full Adder
U12	SIT-74F08	IC: Quadruple 2-Input Positive-AND Gate
U13	SIT-74HC244	IC: Octal Buffer/Line Driver/Line Receiver
U14	SMM-5814A-1	IC:
U15	SIT-74LS157	IC: Quad 2-to 1-Line Data Selector/Multiplexer Low Power
U16	SIT-74F373	IC: Octal D-Type Latch
U17	SIT-74F283	IC: 4-Bit Binary Full Adder
U18	SIT-74F08	IC: Quadruple 2-Input Positive-AND Gate
U19	SIT-74HC244	IC: Octal Buffer/Line Driver/Line Receiver
U20	SMM-5814A-1	IC:
U21	SIT-74F283	IC: 4-Bit Binary Full Adder
U22	SIT-74F08	IC: Quadruple 2-Input Positive-AND Gate
U23	SIT-74F374	IC: Octal D-Type Flip Flop
U24	SMM-5814A-1	IC:
U25	SIT-74LS157	IC: Quad 2-to 1-Line Data Selector/Multiplexer Low Power
U26	SIT-74F373	IC: Octal D-Type Latch
U27	SIT-74F283	IC: 4-Bit Binary Full Adder
U28	SIT-74F08	IC: Quadruple 2-Input Positive-AND Gate
U29	SIT-74F374	IC: Octal D-Type Flip Flop
U30	SMM-5814A-1	IC:
U31	SIT-74F283	IC: 4-Bit Binary Full Adder
U32	SIT-74F08	IC: Quadruple 2-Input Positive-AND Gate
U33	SIT-74HC244	IC: Octal Buffer/Line Driver/Line Receiver
U34	SMM-5814A-1	IC:
U35	SIT-74F04	IC: Hex Inverter
U36	SIT-74F373	IC: Octal D-Type Latch
U37	SIT-74F283	IC: 4-Bit Binary Full Adder
U38	SIT-74F08	IC: Quadruple 2-Input Positive-AND Gate
U39	SIT-74HC244	IC: Octal Buffer/Line Driver/Line Receiver
U40	SMM-5814A-1	IC:
U41	SIT-74F283	IC: 4-bit Binary Full Adder
U42	SIT-74F08	IC: Quadruple 2-Input Positive-AND Gate
U43	SIT-74F374	IC: Octal D-Type Flip Flop
U44	SMM-5814A-1	IC:
U45	SIT-74LS157	IC: Quad 2-to 1-Line Data Selector/Multiplexer Low Power
U46	SIT-74F374	IC: Octal D-Type Flip Flop
U47	SIT-74F283	IC: 4-Bit Binary Full Adder
U48	SIT-74F08	IC: Quadruple 2-Input Positive-AND Gate

Parts No.	ADVANTEST Stock No.	Description
U49	SIT-74F374	IC: Octal D-Type Flip Flop
U50	SMM-5814A-1	IC:
U51	SIT-74F283	IC: 4-Bit Binary Full Adder
U52	SIT-74F08	IC: Quadruple 2-Input Positive-AND Gate
U53	SIT-74HC244	IC: Octal Buffer/Line Driver/Line Receiver
U54	SMM-5814A-1	IC:
U55	SIT-74LS157	IC: Quad 2-to 1-Line Data Selector/Multiplexer Low Power
U56	SIT-74F374	IC: Octal D-Type Flip Flop
U57	SIT-74F283	IC: 4-Bit Binary Full Adder
U58	SIT-74F08	IC: Quadruple 2-Input Positive-AND Gate
U59	SIT-74HC244	IC: Octal Buffer/Line Driver/Line Receiver
U60	SMM-5814A-1	IC:
U61	SIT-74LS04	IC: Hex Inverter Hex Inverter Low Power
D1	NLD-000020	Light Emitting Diode
R1	RCB-AG1K	R: FXD CAR 1kΩ ±5% 1/8W
R2	RCB-AG1K	R: FXD CAR 1kΩ ±5% 1/8W
R3 thru R8	RAY-AL22K8	R: FXD COM 22kΩ
C1	CCK-AA100U16V	C: FXD ELECT 100μF 16V
C2	CCA-AA100U16V	C: FXD ELECT 100μF 16V
C3 thru C32	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V
L1	LCL-T00084A	L: FXD Coil
J1 thru J3	JCS-BF048PX01-1	Connector

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Parts No.	ADVANTEST Stock No.	Description
U1	SIM-8279	IC:
U2	SIT-74S373	IC: Octal D-Type Latch
U3	SIM-4051	IC:
U4	SIM-74HC138	IC: 3-to-8 Line Decoder/Multiplexer
U5	SIM-74HC393	IC: Dual 4-Bit Binary Counter
U6	SIM-4093	IC:
U7	SIM-74HC74	IC: Dual D-Type Positive-Edge-Triggered Flip Flop with Preset AND Clear
U8	SIM-74HC4538	IC: Dual monostable multiviblator
U9	SIM-74HC14	IC: Hex Schmitt-Triggered Inverter
U10	SIA-555	IC: Timer
U11	SIM-74HC32	IC: Quadruple 2-Input Positive-OR Gate
Q1	STP-2SA642	Transistor SI PNP
Q2	STP-2SA642	Transistor SI PNP
D1 thru D9	NLD-000204	Light Emitting Diode
D10		Not assigned
D11	NLD-000204	Light Emitting Diode
D12		Not assigned
D13	NLD-000204	Light Emitting Diode
D14	NLD-000111-1	Light Emitting Diode
D15 thru D17	NLD-000204	Light Emitting Diode
R1	RAY-AK100Q4	R: FXD COM 100Ω
R2	RAY-AK100Q4	R: FXD COM 100Ω
R3	RAY-AL22K8	R: FXD COM 22kΩ
R4	RCB-AG10K	R: FXD CAR 10kΩ ±5% 1/8W
R5	RCB-AG10K	R: FXD CAR 10kΩ ±5% 1/8W
R6	RCB-AG15K	R: FXD CAR 15kΩ ±5% 1/8W
R7	RCB-AG15K	R: FXD CAR 15kΩ ±5% 1/8W
R8	RCB-AH220K	R: FXD CAR 220kΩ ±5% 1/4W
R9	RMF-AR39KFK	R: FXD Metal FLM 39kΩ ±1% 1/4W
R10	RMF-AR18KFK	R: FXD Metal FLM 18kΩ ±1% 1/4W
R11	RCB-AG22K	R: FXD CAR 22kΩ ±5% 1/8W
R12	RAY-BGX0010	R: FXD COM
C1 thru C6	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V
C7	CSM-AC6800P50V	C: FXD CER 6800pF +80, -20% 50V
C8	CSM-AFR1U50V	C: FXD CER 0.1μF +80, -20% 50V
C9	CSM-AFR1U50V	C: FXD CER 0.1μF +80, -20% 50V
C10	CCK-AA100U16V	C: CCK ELECT 100μF 16V
S1 thru S6	KSP-000250	Switch
S7	KSS-000848-1	Switch
S8	KSS-000848-1	Switch

Parts No.	ADVANTEST Stock No.	Description
S9	KSP-000250	Switch
S10	KSP-000250	Switch
S11 thru S13	KSS-000848-1	Switch
S14 thru S22	KSP-000250	Switch
S23	KSP-000250	Switch
J1	JCR-AV034PX01	Connector
J2	JCP-AA012PX05-1	Connector

Parts No.	ADVANTEST Stock No.	Description
U1	SIM-6321	IC:
U2	SIM-74HC244	IC: Octal Buffer/Line Driver/Line Receiver
U3	SIM-74HC374	IC: Octal D-Type Flip Flop
U4	SIM-M50734-1	IC:
U5	SIT-75468	IC: Driver
U6	SIM-74HC373	IC: Octal D-Type Latch
U7	SMM-27C64	IC:
U8	SMM-5517	IC: S-RAM
U9	SIM-74HC04	IC: Hex Inverter
U10	SIM-74HC05	IC: Hex Inverter with Open Collector Output
U11	SIM-74HC32	IC: Quadruple 2-Input Positive-OR Gate
U12	SIM-74HC10	IC: Triple 3-Input Positive-NAND Gate
U13	SIM-74HC08	IC: Quadruple 2-Input Positive-AND Gate
Q1	STP-2SA1015	Transistor SI-PNP
D1 thru D7	NLD-000016	Light Emitting Diode
D8 thru D15		Not assigned
R1 thru R4	RAY-AL22K8	R: FXD COM 22kΩ
R5	RAY-AL3R9K8	R: FXD COM 3.9kΩ
R6	RAY-AL10K8	R: FXD COM 10kΩ
R7	RCB-AG1M	R: FXD CAR 1MΩ ±5% 1/8W
R8	RCB-AH10K	R: FXD CAR 10kΩ ±5% 1/4W
R9	RCB-AG3R3K	R: FXD CAR 3.3kΩ ±5% 1/8W
R10	RCB-AG10K	R: FXD CAR 10kΩ ±5% 1/8W
R11	RCB-AG3R3K	R: FXD CAR 3.3kΩ ±5% 1/8W
R12	RCB-AG10K	R: FXD CAR 10kΩ ±5% 1/8W
R13	RCB-AG3R3K	R: FXD CAR 3.3kΩ ±5% 1/8W
R14	RCB-AG220	R: FXD CAR 220Ω ±5% 1/8W
R15	RVR-CD10K	R: VAR CERMET 10kΩ
R16		Not assigned
R17	RCB-AK47	R: FXD CAR 47Ω ±5% 1/2W
C1	CCK-AA100U50V	C: FXD ELECT 100μF 50V
C2	CCK-AA100U50V	C: FXD ELECT 100μF 50V
C3	CCK-AA4R7U50V	C: FXD ELECT 4.7μF 50V
C4 thru C7	CCK-AA1000U35V	C: FXD ELECT 1000μF 35V
C8	CCK-AA100U16V	C: FXD ELECT 100μF 16V
C9	CCK-AA100U16V	C: FXD ELECT 100μF 16V
C10 thru C23	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V
C24	CMC-AB100PR3K	C: FXD DIPPED MICA 100pF ±5% 300V
C25	CMC-AB100PR3K	C: FXD DIPPED MICA 100pF ±5% 300V

Parts No.	ADVANTEST Stock No.	Description
L1	LCL-T00084A	L: FXD Coil
L2	LCL-T00084A	L: FXD Coil
S1	KSA-000788	Switch
S2	KSE-000765	Switch
J1	JCS-BF048PX01	Connector
J2	JCR-AF034PX02	Connector
X1	DXE-001379-1	Crystal

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Parts No.	ADVANTEST Stock No.	Description
U1	SIA-H0032	IC:
U2	SIA-356	IC: Junction FET Input Type Operational Amplifier
U3	SIT-74F32	IC: Quadruple 2-Input Positive-OR Gate
U4	SIT-74F08	IC: Quadruple 2-Input Positive-AND Gate
U5	DDL-AC10	IC:
U6	SIT-74F08	IC: Quadruple 2-Input Positive-AND Gate
U7	SIT-74F74	IC: Dual D-Type Positive-Edge-Triggered Flip Flop with Preset AND Clear
U8	SIT-74LS191	IC: Synchronous up/down Counter Low Power
U9	SIM-74HC32	IC: Quadruple 2-Input Positive-OR Gate
U10	SIT-74F161	IC: Synchronous 4-Bit Counter
U11	SIT-74F04	IC: Hex Inverter
U12	SIT-74LS10	IC: Triple 3-Input Positive-NAND Gate Low Power
U13	SIT-74LS04	IC: Hex Inverter Low Power
U14	SIM-74HC08	IC: Quadruple 2-Input Positive-AND Gate
U15	SIM-74F08	IC: Quadruple 2-Input Positive-AND Gate
U16	SIT-74F74	IC: Dual D-Type Positive-Edge-Triggered Flip Flop with Preset AND Clear
U17	SIT-74F161	IC: Synchronous 4-Bit Counter
U18	SIT-74F161	IC: Synchronous 4-Bit Counter
U19	SIT-74LS191	IC: Synchronous up/down Counter Low Power
U20	SIT-74LS138	IC: 3-to-8 Line Decoder/Multiplexer Low Power
U21	SIT-74LS191	IC: Synchronous up/down Counter Low Power
U22	SIA-CXA1016	IC:
U23	SIC-10H102	IC: Quadruple 2-Input Gate
U24	SIT-74F04	IC: Hex Inverter
U25	SIT-74F241	IC: Octal Buffer/Line Driver/Line Receiver
U26	SIT-74F08	IC: Quadruple 2-Input Positive-AND Gate
U27	SIT-74LS390	IC: Dual Decade Counter Low Power
U28	SIT-74F74	IC: Dual D-Type Positive-Edge-Triggered Flip Flop with Preset AND Clear
U29	SIT-74F161	IC: Synchronous 4-Bit Counter
U30	SIT-74F244	IC: Octal Buffer/Line Driver/Line Receiver
U31	SIM-74HC273	IC: Octal D-Type Flip Flop
U32	SIM-74F191	IC: Synchronous up/down Counter
U33	SIT-74LS74	IC: Dual D-Type Positive-Edge-Triggered Flip Flop with Preset AND Clear Low Power
U34	SIT-74LS04	IC: Hex Inverter Low Power
U35	SIT-74F151	IC: 1-of-8 Data Selector/Multiplexer
U36	SIT-74F74	IC: Dual D-Type Positive-Edge-Triggered
U37	SIT-74F191	IC: Synchronous up/down Counter
U38	SIT-74LS08	IC: Quadruple 2-Input Positive-AND Gate Low Power
U39	SIT-74F161	IC: Synchronous 4-Bit Counter
U40	SIT-74F244	IC: Octal Buffer/Line Driver/Line Receiver
U41	SIM-74HC273	IC: Octal D-Type Flip Flop
U42	SIT-74F191	IC: Synchronous up/down Counter
U43	SIT-74F161	IC: Synchronous 4-Bit Counter
U44	SIC-10176	IC:
U45	SIC-10176	IC:

Parts No.	ADVANTEST Stock No.	Description
U46	SIT-74LS11	IC: Triple 3-Input Positive-AND Gate Low Power
U47	SIT-74F74	IC: Dual D-Type Positive-Edge-Triggered Flip Flop with Preset AND Clear
U48	SIT-74F00	IC: Quadruple 2-Input Positive-NAND Gate
U49	SIT-74LS08	IC: Quadruple 2-Input Positive-AND Gate Low Power
U50	SIT-74LS74	IC: Dual D-Type Positive-Edge-Triggered Flip Flop with Preset AND Clear Low Power
U51	SIM-74HC04	IC: Hex Inverter
U52	SIM-74HC32	IC: Quadruple 2-Input Positive-OR Gate
U53	SMM-81C67	IC:
U54	SIM-74HC273	IC: Octal D-Type Flip Flop
U55	SIT-74LS191	IC: Synchronous up/down Counter Low Power
U56	SIT-74LS74	IC: Dual D-Type Positive-Edge-Triggered Flip Flop with Preset AND Clear Low Power
U57	SIC-10H125	IC:
U58	SIC-10H125	IC:
U59	SIT-74F161	IC: Synchronous 4-Bit Counter
U60	SIT-74F08	IC: Quadruple 2-Input Positive-AND Gate
U61	SIT-74F164	IC: 8-Bit Parallel output serial shift Register
U62	SIT-74LS08	IC: Quadruple 2-Input Positive-AND Gate Low Power
U63	SIT-74LS32	IC: Quadruple 2-Input Positive-OR Gate Low Power
U64	SIT-74LS04	IC: Hex Inverter Low Power
U65	SIM-74HC4040	IC: 12-Stage Binary Counter
U66	SMM-81C67	IC:
U67	SIM-74HC273	IC: Octal D-Type Flip Flop
U68	SIT-74LS191	IC: Synchronous up/down Counter Low Power
U69	SIT-74LS14	IC: Hex Schmitt-Trigger Inverter Low Power
U70	SIT-74F191	IC: Synchronous up/down Counter
U71	SIC-10H131	IC: Dual Type D Master-Slave Flip Flop
U72	SIT-74F74	IC: Dual D-Type Positive-Edge-Triggered Flip Flop with Preset AND Clear
U73	SIC-10H116	IC:
U74	SIT-74F161	IC: Synchronous 4-Bit Counter
U75	SIT-74F08	IC: Quadruple 2-Input Positive-AND Gate
U76	SIT-74LS04	IC: Hex Inverter Low Power
U77	SIT-74F74	IC: Dual D-Type Positive-Edge-Triggered
U78	SIT-74F04	IC: Hex Inverter
U79	SIT-74LS151	IC: 1-of-8 Data Selector/Multiplexer Low Power
U80	SIT-74F161	IC: Synchronous 4-Bit Counter
U81	SIT-74LS00	IC: Quadruple 2-Input Positive-NAND Gate Low Power
U82	SIT-74LS74	IC: Dual D-Type Positive-Edge-Triggered Low Power
U83	SIT-74LS151	IC: 1-of-8 Data Selector/Multiplexer Low Power
U84	SIT-74LS244	IC: Octal Buffer/Line Driver/Line Receiver Low Power
U85	SIM-74HC273	IC: Octal D-Type Flip Flop
U86	SIT-74F191	IC: Synchronous up/down Counter Low Power
U87	SIT-74LS00	IC: Quadruple 2-Input Positive-NAND Gate Low Power
U88	SIC-10H125	IC:
U89	SIC-10H124	IC: Mttl to Meol Translator
U90	SIT-74F161	IC: Synchronous 4-Bit Counter

Parts No.	ADVANTEST Stock No.	Description
U91	SIT-74F32	IC: Quadruple 2-Input Positive-OR Gate
U92	SIT-74F08	IC: Quadruple 2-Input Positive-AND Gate
U93	SIT-74F08	IC: Quadruple 2-Input Positive-AND Gate
U94	SIT-74LS244	IC: Octal Buffer/Line Driver Line Receiver Low Power
U95	SIM-74HC273	IC: Octal D-Type Flip Flop
U96	SIT-74F08	IC: Quadruple 2-Input Positive-AND Gate
Q1	STN-2SC1730	Transistor SI NPN
Q2	STN-2SC1844	Transistor SI NPN
Q3	SIN-2SC1844	Transistor SI NPN
Q4	STP-2SA1015	Transistor SI PNP
D1	SDZ-W067	Zener Diode
D2 thru D4	NLD-000020	Light Emitting Diode
R1	RCB-AG10K	R: FXD CAR 10kΩ ±5% 1/8W
R2	RCB-AG4R7K	R: FXD CAR 4.7kΩ ±5% 1/8W
R3	RCB-AG1K	R: FXD CAR 1kΩ ±5% 1/8W
R4	RCB-AG22	R: FXD CAR 22Ω ±5% 1/8W
R5	RCB-AG470	R: FXD CAR 470Ω ±5% 1/8W
R6	RCB-AH2R2	R: FXD CAR 2.2Ω ±5% 1/4W
R7	RCB-AH10K	R: FXD CAR 10kΩ ±5% 1/8W
R8	RCB-AG6R8K	R: FXD CAR 6.8kΩ ±5% 1/8W
R9	RCB-AG330	R: FXD CAR 330Ω ±5% 1/8W
R10	RCB-AG390	R: FXD CAR 390Ω ±5% 1/8W
R11	RCB-AG10	R: FXD CAR 10Ω ±5% 1/8W
R12	RCB-AG8R2K	R: FXD CAR 8.2kΩ ±5% 1/8W
R13	RCB-AG330	R: FXD CAR 330Ω ±5% 1/8W
R14	RCB-AG68	R: FXD CAR 68Ω ±5% 1/8W
R15	RAY-AL680Q4	R: FXD COM 680Ω
R16	RAY-AL680Q4	R: FXD COM 680Ω
R17	RCB-AG820	R: FXD CAR 820Ω ±5% 1/8W
R18	RCB-AG270	R: FXD CAR 270Ω ±5% 1/8W
R19	RAY-AL22K8	R: FXD COM 22kΩ
R20	RCB-AG4R7K	R: FXD CAR 4.7kΩ ±5% 1/8W
R21	RMF-AC1R5KFJ	R: FXD Metal FLM 1.5kΩ ±1% 1/4W
R22	RVR-CB1K	R: VAR CERMET 1kΩ
R23	RMF-AC2R7KFJ	R: FXD Metal FLM 2.7kΩ ±1% 1/4W
R24	RMF-AC3R9KFJ	R: FXD Metal FLM 3.9kΩ ±1% 1/4W
R25	RMF-AC1KFJ	R: FXD Metal FLM 1kΩ ±1% 1/4W
R26	RCB-AG470	R: FXD CAR 470Ω ±5% 1/8W
R27	RCB-AH220	R: FXD CAR 220Ω ±5% 1/4W
R28	RMF-AC1KFJ	R: FXD Metal FLM 1kΩ ±1% 1/4W
R29	RCB-AG10K	R: FXD CAR 10kΩ ±5% 1/8W
R30	RVR-CB2K	R: VAR CERMET 2kΩ
R31	RCB-AG1R2K	R: FXD CAR 1.2kΩ ±5% 1/8W
R32	RCB-AG270	R: FXD CAR 270Ω ±5% 1/8W
R33	RMF-AC1KFJ	R: FXD Metal FLM 1kΩ ±1% 1/4W
R34	RCB-AH2R2	R: FXD CAR 2.2Ω ±5% 1/4W

Parts No.	ADVANTEST Stock No.	Description
R35	RCB-AH2R2	R: FXD CAR 2.2Ω ±5% 1/4W
R36	RVR-CB1K	R: VAR CERMET 1kΩ
R37	RCB-AG5R1K	R: FXD CAR 5.1kΩ ±5% 1/8W
R38	RCB-AG5R1K	R: FXD CAR 5.1kΩ ±5% 1/8W
R39	RAY-AL330Q4	R: FXD COM 330Ω
R40	RAY-AL330Q4	R: FXD COM 330Ω
R41 thru R44	RAY-AL680Q4	R: FXD COM 680Ω
R45 thru R47	RCB-AG1K	R: FXD CAR 1kΩ ±5% 1/8W
R48	RCB-AG10K	R: FXD CAR 10kΩ ±5% 1/8W
R49	RCB-AH220	R: FXD CAR 220Ω ±5% 1/4W
R50	RCB-AH220	R: FXD CAR 220Ω ±5% 1/4W
R51	RCB-AG10K	R: FXD CAR 10kΩ ±5% 1/8W
R52	RAY-AL10K8	R: FXD COM 10kΩ
R53	RCB-AG10K	R: FXD CAR 10kΩ ±5% 1/8W
R54	RAY-AL10K8	R: FXD COM 10kΩ
R55	RAY-AL10K8	R: FXD COM 10kΩ
R56	RCB-AG10K	R: FXD CAR 10kΩ ±5% 1/8W
C1	CSM-AC4700P50V	C: FXD CER 4700pF +80, -20% 50V
C2	CSM-AC4700P50V	C: FXD CER 4700pF +80, -20% 50V
C3	CMC-AB10PR5K	C: FXD DIPPED MICA 10pF ±5% 500V
C4	CTM-AA20P	C: VAR CER 20pF
C5	CMC-AB12PR5K	C: FXD DIPPED MICA 12pF ±10% 500V
C6	CMC-AB12PR5K	C: FXD DIPPED MICA 12pF ±10% 500V
C7	CMC-AB330PR3K	C: FXD DIPPED MICA 330pF ±5% 300V
C8	CSM-AC47P50V	C: FXD CER 47pF ±10% 50V
C9	CSM-ACR022U50V	C: FXD CER 0.022μF +80, -20% 50V
C10	CSM-ACR022U50V	C: FXD CER 0.022μF +80, -20% 50V
C11	CSM-AC4700P50V	C: FXD CER 4700pF +80, -20% 50V
C12	CSM-ACR022U50V	C: FXD CER 0.022μF +80, -20% 50V
C13		Not assigned
C14	CSM-AFR01U50V	C: FXD CER 0.01μF +80, -20% 50V
C15	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V
C16 thru C18	CSM-AFR01U50V	C: FXD CER 0.01μF +80, -20% 50V
C19	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V
C20	CSM-AFR01U50V	C: FXD CER 0.01μF +80, -20% 50V
C21	CSM-AFR01U50V	C: FXD CER 0.01μF +80, -20% 50V
C22	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V
C23	CCP-BAR01U50V	C: FXD CHIP 0.01μF +80, -20% 50V
C24	CSM-AG1U50V	C: FXD CHIP 1μF +80, -20% 50V
C25	CCK-AA47U16V	C:FXD ELECT 47μF 16V
C26	CCP-BAR01U50V	C: FXD CHIP 0.01μF +80, -20% 50V
C27	CSM-AG1U50V	C: FXD CER 1μF +80, -20% 50V
C28	CCK-AA47U16V	C: FXD ELECT 47μF 16V
C29	CCK-AA100V16V	C: FXD ELECT 100μF 16V

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Parts No.	ADVANTEST Stock No.	Description
C30	CCK-AA100U16V	C: FXD ELECT 100µF 16V
C31	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
C32	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
C33	CCK-AA100U16V	C: FXD ELECT 100µF 16V
C34	CTA-AC1U50V	C: FXD TANTAL 1µ ±20% 50V
C35	CCK-AA100U25V	C: FXD ELECT 100µF 25V
C36	CCK-AA100U25V	C: FXD ELECT 100µF 25V
C37	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
C38	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
C39	CMC-AB10PR5K	C: FXD DIPPED MICA 10pF ±5% 500V
C40	CSM-AFR1U50V	C: FXD CER 0.1µF +80, -20% 50V
C41	CSM-AFR1U50V	C: FXD CER 0.1µF +80, -20% 50V
C42	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
C43	CSM-AFR1U50V	C: FXD CER 0.1µF +80, -20% 50V
C44	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
C45	CSM-AFR1U50V	C: FXD CER 0.1µF +80,; -20% 50V
C46	CSM-AG1U50V	C: FXD CER 1µF +80, -20% 50V
C47	CCP-ABR01U50V	F: FXD CHIP 0.01µF +80, -20% 50V
C48	CSM-AG1U50V	C: FXD CER 1µF +80, -20% 50V
C49	CCP-BAR01U50V	C: FXD CHIP 0.01µF +80, -20% 50V
C50	CSM-AG1U50V	C: FXD CER 1µF +80, -20% 50V
C51	CCP-BAR01U50V	C: FXD CHIP 0.01µF +80, -20% 50V
C52	CSM-AG1U50V	C: FXD CER 0.1µF +80, -20% 50V
C53 thru C100	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
C101	CSM-AFR1U50V	C: FXD CER 0.1µF +80, -20% 50V
C102	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
C103	CSM-AFR1U50V	C: FXD CER 0.1µF +80, -20% 50V
C104 thru C109	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
C110	CSM-AFR1U50V	C: FXD CER 0.1µF +80, -20% 50V
L1	LCL-B00482	L: FXD Coil
L2	LCL-B00362	L: FXD Coil
L3 thru L5	LCL-T00084A	L: FXD Coil
J1 thru J3	JCS-BF048PX01	Connector
J4	JCR-AF020PX02	Connector
J5	JCF-AC001JX01	Connector
J6	JCF-AC001JX01	Connector
X1	DXD-000150	Crystal

Parts No.	ADVANTEST Stock No.	Description
UA13	SIM-74HC32S	IC: Quadruple 2-Input Positive -OR Gate
UA14 thru UA16		Not assigned
UA17	SMM-62256A-1	IC:
UA18		Not assigned
UA19	SMM-62256A-1	IC:
UA20	SIM-74HC244S	IC: Octal Buffer/Line Dirver/Line Receiver
UA21	SIM-74HC244S	IC: Octal Buffer/Line Dirver/Line Receiver
UB14	SIM-74HC245S	IC: Octal Bus Tranceiver
UB15	SIM-74HC245S	IC: Octal Bus Tranceiver
UB16 thru UB19		Not assigned
UB20	SIM-74HC244S	IC: Octal Buffer/Line Driver/Line Receiver
UB21	SIM-74HC244S	IC: Octal Buffer/Line Driver/Line Receiver
UC14	SIM-74HC374S	IC: Octal D-Type Flip Flop
UC15	SIM-74HC374S	IC: Octal D-Type Flip Flop
UD17	SIM-74HC273S	IC: Octal D-Type Flip Flop
UD18	SMM-5517S	IC:
UD19		Not assigned
UD20		Not assigned
UD21	SIM-74HC32S	IC: Quadruple 2-Input Positive-OR Gate
UE14	SIM-74HC374S	IC: Octal D-Type Flip Flop
UE15	SIM-74HC374S	IC: Octal D-Type Flip Flop
UE16		Not assigned
UE17	SIM-74HC273S	IC: Octal D-Type Flip Flop
UE18 thru UE20		Not assigned
UE21	SIM-74HC08S	IC: Quadruple 2-Input Positive-AND Gate
UF15	SIM-74HC32S	IC: Quadruple 2-Input Positive-OR Gate
UF16		Not assigned
UF17		Not assigned
UF18	SIM-74HC04S	IC: Hex Inverter
UF19		Not assigned
UF20		Not assigned
UF21	SIM-74HC32S	IC: Quadruple 2-Input Positive-OR Gate
UG14	SIM-74HC32S	IC: Quadruple 2-Input Positive-OR Gate
UG15	SIM-74HC08S	IC: Quadruple 2-Input Positive-AND Gate
UG16		Not assigned
UG17	SIM-74HC273S	IC: Octal D-Type Flip Flop
UG18	SIM-74HC04S	IC: Hex Inverter
UG19	SIM-74HC08S	IC: Quadruple 2-Input Positive-AND Gate
UG20	SIM-74HC393S	IC: Dual 4-Bit Binary Counter
UG21	SIM-74HC04S	IC: Hex Inverter
UH15	SIM-74HC245S	IC: Octal Bus Tranceiver
UH16		Not assigned
UH17	SIM-74HC245S	IC: Octal Bus Tranceiver
UH18	SIM-74HC244S	IC: Octal Buffer/Line Driver/Line Receiver

Parts No.	ADVANTEST Stock No.	Description
UJ14	SIM-74HC244S	IC: Octal Buffer/Line Driver/Line Receiver
UJ15 thru UJ19		Not assigned
UJ20	SIM-74HC148S	IC: 8-Line-to-3-Line Octal Priority Encoder
UJ21	SIM-74HC32S	IC: Quadruple 2-Input Positive-OR Gate
UK14	SIM-74HC374S	IC: Octal D-Type Flip Flop
UK15		Not assigned
UK16	SIM-68HC000PGC-2	IC:
UK17 thru UK19		Not assigned
UK20	SIM-74HC32S	IC: Quadruple 2-Input Positive-OR Gate
UK21	SIM-74HC273S	IC: Octal D-Type Flip Flop
UL17	SIM-74HC393S	IC: Dual 4-Bit Binary Counter
UL18		Not assigned
UL19		Not assigned
UL20	SIM-74HC08S	IC: Quadruple 2-Input Positive-AND Gate
UL21	SIM-74HC244S	IC: Octal Buffer/Line Driver/Line Receiver
UM13	SIM-74HC05S	IC: Hex Inverter with Open Collector Output
UM14	SIM-74HC27S	IC: Triple 3-Input Positive-NOR Gate
UM15	SIM-74HC244S	IC: Octal Buffer/Line Drive/Line Receiver
UM16		Not assigned
UM17	SIM-74HC244S	IC: Octal Buffer/Line Driver/Line Receiver
UM18	SIM-74HC05S	IC: Hex Inverter with Open Collector Output
UN14	SIM-74HC10S	IC: Triple 3-Input Positive-NAND Gate
UN15 thru U20		Not assigned
UN21	SIM-74HC244S	IC: Octal Buffer/Line Driver/Line Receiver
UP13	SIM-74HC244S	IC: Octal Buffer/Line Driver/Line Receiver
UP14		Not assigned
UP15	SIM-74HC30S	IC: 8-Input Positive-NAND Gate
UP16		Not assigned
UP17	SIM-74HC05S	IC: Hex Inverter with Open Collector Output
UP18	SIM-74HC00S	IC: IC: Quadruple 2-Input Positive-NAND Gate
UP19	SIM-SIM-74HC32S	IC: Quadruple 2-Input Positive-OR Gate
UP20	SIM-74HC30S	IC: 8-Input Positive-NAND Gate
UP21	SIM-74HC138S	IC: 3-to-8 Line Decoder/Multiplexer
UQ14	SIM-74HC32S	IC: Quadruple 2-Input Positive-OR Gate
UQ15	SIM-74HC244S	IC: Octal Buffer/Line Driver/Line Receiver
UQ16		Not assigned
UQ17	SIM-74HC30S	IC: 8-Input Positive-NAND Gate
UQ18	SIM-74HC138S	IC: 3-to-8 Line Decoder/Multiplexer
UQ19	SIM-74HC32S	IC: Quadruple 2-Input Positive-OR Gate
UQ20	SIM-74HC30S	IC: 8-Input Positive-NAND Gate
UR14	SIT-75160	IC: Octal GP-IB Bus Tranceiver
UR15		Not assigned
UR16		Not assigned
UR17	SIM-74HC30S	IC: 8-Input Positive-NAND Gate

Parts No.	ADVANTEST Stock No.	Description
UR18	SIM-74HC138S	IC: 3-to-8 Line Decoder/Multiplexer
UR19		Not assigned
UR20		Not assigned
UR21	SIM-74HC138S	IC: 3-to-8 Line Decoder/Multiplexer
US16	SIM-9914	IC: GP-IB Interface Bus Adaptor
US17		Not assigned
US18	SIM-74HC32S	IC: Quadruple 2-Input Positive-OR Gate
US19	SIM-74HC138S	IC: 3-to-8 Line Decoder/Multiplexer
US20	SIM-74HC32S	IC: Quadruple 2-Input Positive-OR Gate
UT17	SIM-74HC04S	IC: Hex Inverter
UT18		Not assigned
UT19	SIM-74HC32S	IC: Quadruple 2-Input Positive-OR Gate
UU14	SIT-75161	IC: Octal GP-IB Bus Tranceiver
UU15		Not assigned
UU16	SIM-62421	IC:
UU17		Not assigned
UU18	SMM-62256A-1	IC: 256K Bit EPROM
UU19	SMM-62256A-1	IC: 256K Bit EPROM
UU20		Not assigned
UU21	SMM-27C512A	IC:
UW12	SIM-74HC244S	IC: Octal Buffer/Line Driver/Line Receiver
UW13 thru UW15	SIT-74LS348S	IC: 8-Line-to-3-Line Priority Encoder Low Power
UW16	SIM-74HC32S	IC: Quadruple 2-Inpout Positive-OR Gate
UY13	SIM-74HC534	IC: Octal D-Type Flip Flop
UY141	SIM-74HC534	IC: Octal D-Type Flip Flop
UY142	SIM-74HC534	IC: Octal D-Type Flip Flop
UY15	SIM-74HC534	IC: Octal D-Type Flip Flop
UY16	SIM-74LS348S	IC: 8-Line-to-3 Line Priority Encoder Low Power
UY17	DMY-000914-1	IC:
UY18	SMM-62256A-1	IC: 256K Bit EPROM
UY19	SMM-62256A-1	IC: 256K Bit EPROM
UY20		Not assigned
UY21	SMM-27C512A	IC:
UZ16	SIM-74HC240S	IC: Octal Buffer/Line Driver/Line Receiver
U2	DXC-000109	IC:
U3 thru U58		Not assigned
U59	SIM-74HC32S	IC: Quadruple 2-Input Positive-OR Gate
U60 thru U73		Not assigned
U74	SIM-74HC245S	IC: Octal Bus Tranceiver
U75	SIM-74HC245S	IC: Octal Bus Tranceiver
U76 thru U78		Not assigned
U79	DMY-000914-1	IC:

Parts No.	ADVANTEST Stock No.	Description
D100 thru D110	NLD-000016	Light Emitting Diode
D111	SDS-1S953	Diode SI
D112	SDS-1S953	Diode SI
R100	RAY-AL3R9K8	R: FXD COM 3.9kΩ
R101 thru R104	RCB-AG1K	R: FXD CAR 1kΩ
R105 thru R108	RAY-AL22K8	R: FXD COM 22kΩ
R109	RCB-AG22K	R: FXD CAR 22kΩ ±5% 1/8W
R110 thru R117	RAY-AL22K8	R: FXD COM 22kΩ
R118	RCB-AG22K	R: FXD CAR 22kΩ ±5% 1/8W
R119 thru R122	RAY-AL22K8	R: FXD COM 22kΩ
R123	RAY-AL22K4	R: FXD COM 22kΩ
R124	RCB-AG22K	R: FXD CAR 22kΩ ±5% 1/8W
R125	RAY-AL22K8	R: FXD COM 22kΩ
C100 thru C131	CSM-AFR1U50V	C: FXD CER 0.1μF +80, -20% 50V
C132	CTA-AB22U16V	C: FXD ELECT TANTAL 22μF ±20% 16V
C133 thru C143	CSM-AFR1U50V	C: FXD CER 0.1μF +80, -20% 50V
C144	CCK-AA100U16V	C: FXD ELECT 100μF 16V
C145	CCK-AA100U16V	C: FXD ELECT 100μF 16V
C146	CSM-AFR1U50V	C: FXD CER 0.1μF +80, -20% 50V
C147	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF +80, -20% 50V
J1 thru J3	JCS-BF048PX01	Connector
J4	JCR-AF034PX02	Connector
J5	JCR-AF034PX02	Connector
SW1	KSE-000765	Switch
SW2	KSA-000788	Switch
L1	LCL-T00084A	L: FXD Coil

Parts No.	ADVANTEST Stock No.	Description
UA7	SIM-74HC27S	IC: Triple 3-Input Positive-NOR Gate
UA8	SIA-BGS6-1	IC:
UA9	SIM-74HC138S	IC: 3-to-8 Line Decoder/Multiplexer
UA10	SIM-74HC32S	IC: Quadruple 2-Input Positive-OR Gate
UA11		Not assigned
UA12	SIM-74HC10S	IC: Triple 3-Input Positive NAND-Gate
UA13		Not assigned
UA14		Not assigned
UA-15	SIM-62256A-1	IC: 256K Bit EPROM
UA16		Not assigned
UA17	SIM-62256A-1	IC: 256K Bit EPROM
UA18	DMY-000914-1	IC:
UA19		Not assigned
UA20		Not assigned
UA21	DMY-000914-1	IC:
UB8	SIM-74HC138S	IC: 3-to-8 Line Decoder/Multiplexer
UB9		Not assigned
UB10	SIM-74HC32S	IC: Quadruple 2-Input Positive-OR Gate
UB11		Not assigned
UB12	SIM-74HC05S	IC: Hex Inverter with Open Collector Output
UB13		Not assigned
UB14	SIM-74HC273S	IC: Octal D-Type Flip Flop
UC7	SIM-74HC32S	IC: Quadruple 2-Input Positive-OR Gate
UC8	SIM-74HC32S	IC: Quadruple 2-Input Positive-OR Gate
UC9	SIM-74HC04S	IC: Hex Inverter
UC10	SIM-74HC138S	IC: 3-to-8 Line Decoder/Multiplexer
UC11		Not assigned
UC12	SIM-74HC148S	IC: 8-Line-to-3-Line Octal Priority Encoder
UC13		Not assigned
UC14	SIM-74HC244S	IC: Octal Buffer/Line Driver/Line Receiver
UD7	SIM-74HC30S	IC: 8-Input Positive-NAND Gate
UD8	SIM-74HC138S	IC: 3-to-8 Line Decoder/Multiplexer
UD9		Not assigned
UD10	SIM-74HC244S	IC: Octal Buffer/Line Driver/Line Receiver
UD12	SIM-74HC245S	IC: Octal Bus Tranceiver
UE7	SIM-74HC30S	IC: 8-Input Positive-NAND Gate
UE8	SIM-74HC05S	IC: Hex Inverter with Open Collector Output
UE9 thru UE13		Not assigned
UE14	SIM-74HC244S	IC: Octal Buffer/Line Driver/Line Receiver
UF8	SIM-74HC00S	IC: Quadruple 2-Input Positive-NAND Gate
UF9	SIM-74HC245S	IC: Octal Bus Tranceiver
UF10	SIM-68HC000PGC-2	IC:
UF11 thru UF13		Not assigned
UF14	SIM-74HC244S	IC: Octal Buffer/Line Driver/Line Receiver
UF15	SMM-27C512A	IC:

Parts No.	ADVANTEST Stock No.	Description
UF16		Not assigned
UF17	SMM-27C512A	IC:
UG8	SIM-74HC244S	IC: Octal Buffer/Line Driver/Line Receiver
UG9	SIM-74HC374S	IC: Octal D-Type Flip Flop
UG10 thru UG13		Not assigned
UG14	SIT-74F08S	IC: Quadruple 2-Input Positive-AND Gate
UH6	SIT-74LS375S	IC: 4-Bit Bistable Latch Low Power
UH7		Not assigned
UH8	SIT-74F373S	IC: Octal D-Type Flip Flop
UH9		Not assigned
UH10	SIM-63484A	IC:
UH11	SIM-74HC244S	IC: Octal Buffer/Line Driver/Line Receiver
UH12	SIT-74F244S	IC: Octal Buffer/Line Driver/Line Receiver
UH13	SIT-74F10S	IC: Triple 3-Input Positive-NAND Gate
UH14-1	SIT-74F74S	IC: Dual D-Type Positive-Edge-Triggered Flip Flop with Preset AND Clear
UH14-2	SIT-74F10S	IC: Triple 3-Input Positive-NAND Gate
UH15	SIT-74F240S	IC: Octal Buffer/Line Driver/Line Receiver
UJ7	SIT-74F245S	IC: Octal Bus Tranceiver
UJ8	SIT-74F245S	IC: Octal Bus Tranceiver
UJ9 thru UJ14		Not assigned
UJ15	SIT-74F174S	IC: Hex D-Type Flip Flop
UJ16	SIT-74F74S	IC: Dual D-Type Positive-Edge-Triggered Flip Flop with Preset AND Clear
UK7	SIT-74F245S	Ic: Octal Bus Tranceiver
UK8 thru UK10		Not assigned
UK11	SIT-74F04S	IC: Hex Inverter
UK12		Not assigned
UK13	SIT-74F04S	IC: Hex Inverter
UK14	SIT-74F174S	IC: Hex D-Type Flip Flop
UK15		Not assigned
UK16	SIT-74F163	IC: Synchronous 4-Bit Counter
UL8	SIT-74F245S	IC: Octal Bus Tranceiver
UL9	SIT-74F373S	IC: Octal D-Type Latch
UL10	SIT-74F373S	IC: Octal D-Type Latch
UL11	SIT-74F139S	IC: Dual 2-to-4 Line Decoder/Multiplexer
UM71	SMM-81464B-2	IC:
UM72	SMM-81464B-2	IC:
UM8	SMM-81464B-2	IC:
UM9	SMM-81464B-2	IC:
UM10	SIT-74F00S	IC: Quadruple 2-Input Positive-NAND Gate
UM11	SIT-74F138S	IC: Dual 2-to-4 Line Decoder/Multiplexer
UP71	SMM-81464B-2	IC:
UP72	SMM-81464B-2	IC:
UP8	SMM-81464B-2	IC:

Parts No.	ADVANTEST Stock No.	Description
UP-9	SMM-81464B-2	IC:
UP10	SIT-74F299S	IC: 8-Bit Bidirectional universal shift/storage
UP11	SIT-74F299S	IC: 8-Bit Bidirectional universal shift/storage
UP12		Not assigned
UP13	SIM-74HC393S	IC: Dual 4-Bit Binary Counter
UP14	SIM-74HC86S	IC: Quadruple 2-Input Exclusive-OR Gate
UQ10	SIT-74F299S	IC: 8-Bit Bidirectional universal shift/storage
UQ11	SIT-74F299S	IC: 8-Bit Bidirectional universal shift/storage
UQ13	SIM-74HC04S	IC: Hex Inverter
UQ14	SIM-74HC74S	IC: Dual D-Type Positive-Edge-Triggered Flip Flop with Preset AND Clear
UR71	SMM-81464B-2	IC:
UR72	SMM-814648-2	IC:
UR8	SMM-81464B-2	IC:
UR9	SMM-81464B-2	IC:
UR10	SIT-74F10S	IC: Triple 3-Input Positive-NAND Gate
UR11	SIM-74HC32S	IC: Quadruple 2-Input Positive-OR Gate
US10	SIM-74HC20S	IC: Dual 4-Input Positive-NAND Gate
US11	SIM-74HC04S	IC: Hex Inverter
UT71	SMM-81464B-2	IC:
UT72	SMM-81464B-2	IC:
UT8	SMM-81464B-2	IC:
UT9	SMM-81464B-2	IC:
UW8	DMY-000914-1	IC:
UW9	DMY-000914-1	IC:
U44	DXC-000661	IC:
Q100	STN-2SC2026	Transistor SI NPN
Q101	STN-2SC1815	Transistor SI NPN
Q102	STN-2SC2026	Transistor SI NPN
Q103	STN-2SC1815	Transistor SI NPN
Q104	STN-2SC2901-5	Transistor SI NPN
Q105	STN-2SC2901-5	Transistor SI NPN
Q106	STP-2SA675	Transistor SI NPN
Q107 thru Q109	STN-2SC1815	Transistor SI NPN
D100	SDZ-D082	Zener Diode
D101 thru D103	SDS-1S953	Diode SI
D104	NLD-000016	Light Emitting Diode
D105	NLD-000016	Light Emitting Diode
D106	SDZ-W110	Zener Diode
D107	NLD-000016	Light Emitting Diode
D108	NLD-000016	Light Emitting Diode
D109	SDS-1S953	Diode SI
D110	NLD-000016	Light Emitting Diode
D111	NLD-000016	Light Emitting Diode
D112	SDS-1S953	Diode SI

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Parts No.	ADVANTEST Stock No.	Description
D113	NLD-000016	Light Emitting Diode
D114	NLD-000016	Light Emitting Diode
R100	RAY-AL22K8	R: FXD COM 22kΩ
R101	RAY-AL22K8	R: FXD COM 22kΩ
R102	RCB-AG22K	R: FXD CAR 22kΩ ±5% 1/8W
R103	RCB-AG22K	R: FXD CAR 22kΩ ±5% 1/8W
R104	RAY-AL22K8	R: FXD COM 22kΩ
R105	RAY-AL22K4	R: FXD COM 22kΩ
R106	RCB-AG100	R: FXD CAR 100Ω ±5% 1/8W
R107	RCB-AG22K	R: FXD CAR 22kΩ ±5% 1/8W
R108	RCB-AH470	R: FXD CAR 470Ω ±5% 1/4W
R109	RCB-AH3R3K	R: FXD CAR 3.3kΩ ±5% 1/4W
R110	RCB-AG22K	R: FXD CAR 22kΩ ±5% 1/8W
R111 thru R113	RCB-AG100	R: FXD CAR 100Ω ±5% 1/8W
R114	RCB-AH56	R: FXD CAR 56Ω ±5% 1/4W
R115	RCB-AG100	R: FXD CAR 100Ω ±5% 1/8W
R116	RCB-AH470	R: FXD CAR 470Ω ±5% 1/4W
R117	RCB-AH68	R: FXD CAR 68Ω ±5% 1/4W
R118	RCB-AG100	R: FXD CAR 100Ω ±5% 1/8W
R119	RAY-AL22K4	R: FXD COM 22kΩ
R120	RAY-AL22K8	R: FXD COM 22kΩ
R121	RCB-AG22K	R: FXD CAR 22kΩ ±5% 1/8W
R122	RCB-AG22K	R: FXD CAR 22kΩ ±5% 1/8W
R123	RCB-AG100	R: FXD CAR 100Ω ±5% 1/8W
R124	RCB-AH12K	R: FXD CAR 12kΩ ±5% 1/4W
R125	RCB-AH56	R: FXD CAR 56Ω ±5% 1/4W
R126	RCB-AH3R3K	R: FXD CAR 3.3kΩ ±5% 1/4W
R127	RCB-AH220	R: FXD CAR 220Ω ±5% 1/4W
R128	RCB-AH330	R: FXD CAR 330Ω ±5% 1/4W
R129	RCB-AH680	R: FXD CAR 680Ω ±5% 1/4W
R130	RCB-AH100	R: FXD CAR 100Ω ±5% 1/4W
R131	RAY-AL22K8	R: FXD COM 22kΩ
R132	RAY-AL22K8	R: FXD COM 22kΩ
R133	RCB-AG22K	R: FXD CAR 22kΩ ±5% 1/8W
R134	RCB-AG100	R: FXD CAR 100Ω ±5% 1/8W
R135	RCB-AH470	R: FXD CAR 470Ω ±5% 1/4W
R136	RCB-AH10	R: FXD CAR 10Ω ±5% 1/4W
R137	RAY-AL22K8	R: FXD COM 22kΩ
R138	RAY-AL22K8	R: FXD COM 22kΩ
R139	RCB-AG22K	R: FXD CAR 22kΩ ±5% 1/8W
R140	RCB-AG22K	R: FXD CAR 22kΩ ±5% 1/8W
R141	RCB-AG22K	R: FXD CAR 22kΩ ±5% 1/8W
R142	RAY-AL22K8	R: FXD COM 22kΩ
R143	RCB-AH5R6K	R: FXD CAR 5.6kΩ ±5% 1/4W
R144	RCB-AH220	R: FXD CAR 220Ω ±5% 1/4W
R145	RCB-AH150	R: FXD CAR 150Ω ±5% 1/4W

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Parts No.	ADVANTEST Stock No.	Description
R146	RCB-AH510	R: FXD CAR 510Ω ±5% 1/4W
R147	RCB-AH390	R: FXD CAR 390Ω ±5% 1/4W
R148	RCB-AH1K	R: FXD CAR 1kΩ ±5% 1/4W
R149	RAY-AL3R9K8	R: FXD COM 3.9kΩ
R150	RCB-AH510	R: FXD CAR 510Ω ±5% 1/4W
R151	RCB-AH10K	R: FXD CAR 10kΩ ±5% 1/4W
R152	RCB-AH330	R: FXD CAR 330Ω ±5% 1/4W
R153	RCB-AH270	R: FXD CAR 270Ω ±5% 1/4W
R154	RCB-AH510	R: FXD CAR 510Ω ±5% 1/4W
R155	RCB-AH150	R: FXD CAR 150Ω ±5% 1/4W
R156	RCB-AH510	R: FXD CAR 510Ω ±5% 1/4W
R157	RCB-AH1R2K	R: FXD CAR 1.2kΩ ±5% 1/4W
C100 thru C117	CSM-AFR1U50V	C: FXD CER 0.1μF +80, -20% 50V
C118	CCK-AR330U16V	C: FXD ELECT 330μF 16V
C119 thru C124	CSM-AFR1U50V	C: FXD CER 0.1μF +80, -20% 50V
C125	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V
C126 thru C129	CSM-AFR1U50V	C: FXD CER 0.1μF +80, -20% 50V
C130	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V
C131	CSM-ACR022U50V	C: FXD CER 0.022μF +80, -20% 50V
C132	CCK-AR100U10V-1	C: FXD ELECT 100μF 10V
C133	CSM-AFR1U50V	C: FXD CER 0.1μF +80, -20% 50V
C134	CCK-AR100U10V-1	C: FXD ELECT 100μF 10V
C135 thru C137	CSM-AFR1U50V	C: FXD CER 0.1μF +80, -20% 50V
C138	CCK-AR100U10V-1	C: FXD ELECT 100μF 10V
C139	CSM-AFR1U50V	C: FXD CER 0.1μF +80, -20% 50V
C140	CSM-AC470P50V	C: FXD CER 470pF ±10% 50V
C141	CCK-AR100U35V-1	C: FXD ELECT 100μF 35V
C142	CSM-AGR1U50V	C: FXD CER 0.1μF +80, -20% 50V
C143	CSM-AC10P50V	C: FXD CER 10pF ±10% 50V
C144 thru C146	CSM-AFR1U50V	C: FXD CER 0.1μF +80, -20% 50V
C147	CCK-AR100U35V-1	C: FXD ELECT 100μF 35V
C148	CSM-AFR1U50V	C: FXD CER 0.1μF +80, -20% 50V
C149	CSM-AGR1U50V	C: FXD CER 0.1μF +80, -20% 50V
C150	CSM-AC10P50V	C: FXD CER 10pF ±10% 50V
C151	CSM-AGR1U50V	C: FXD CER 0.1μF +80, -20% 50V
C152	CCK-AR100U35V-1	C: FXD ELECT 100μF 35V
C153	CSM-AFR1U50V	C: FXD CER 0.1μF +80, -20% 50V
C154	CSM-AC10P50V	C: FXD CER 10pF ±10% 50V
C155	CSM-AGR1U50V	C: FXD CER 0.1μF +80, -20% 50V
C156	CSM-AFR1U50V	C: FXD CER 0.1μF +80, -20% 50V
C157	CSM-AFR1U50V	C: FXD CER 0.1μF +80, -20% 50V

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Parts No.	ADVANTEST Stock No.	Description
C158	CSM-AC10P50V	C: FXD CER 10pF ±10% 50V
C159 thru C161	CSM-AFR1U50V	C: FXD CER 0.1µF +80, -20% 50V
J1 thru J13	JCS-BF048JX01	Connector
J14	YEE-000874-1	Connector
J15	YEE-000874-1	Connector
J16	JCP-AA012PX05	Connector
J17	JCF-AC001JX01	Connector
J18	JCP-AA003PX06-1	Connector
SW1	KSE-000765	Switch
S100	KSE-000689	Switch

Parts No.	ADVANTEST Stock No.	Description
CB1	DCB-ES2544X01A-1	Cable
CB2	DCB-FF0093X01A-1	Cable
CB3	DCB-FF0093X03A-1	Cable
CB4	DCB-FF0093X03A-1	Cable
J1	JCH-AD001JX01-1	Connector
J2	JCH-AD001JX01-1	Connector
SW1	QBL-000032-1	Switch

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Parts No.	ADVANTEST Stock No.	Description
U1	SIT-74F00	IC: Quadruple 2-Input Positive-NAND Gate
U2	SIA-LT1001CN8	IC:
U3	SIA-TL084	IC: JFET Input Operational Amplifier
U4	SIA-324	IC: Quadruple Operational Amplifier
U5	SQD-FU44SLD-1	IC:
Q1	STN-2SC641	Transistor SI NPN
Q2	STN-2SC1253	Transistor SI NPN
Q3	STN-2SC1253	Transistor SI NPN
Q4	STN-2SC641	Transistor SI NPN
Q5	STN-2SC510	Transistor SI NPN
Q6	STP-2SA965	Transistor SI PNP
Q7	STP-2SA965	Transistor SI PNP
Q8	STN-2SC1815	Transistor SI NPN
Q9	STN-2SC1815	Transistor SI NPN
Q10	STN-2SC1173	Transistor SI NPN
Q12	STP-2SA1015	Transistor SI PNP
Q13	STP-2SA1015	Transistor SI PNP
Q14	STP-2SA473	Transistor SI PNP
Q15	STP-2SA473	Transistor SI PNP
Q16	STN-2SC1253	Transistor SI NPN
Q17	STN-2SC1253	Transistor SI NPN
Q18		Not assigned
Q19	STP-2SA965	Transistor SI PNP
D1	SDZ-W081	Diode SI
D2	SDZ-W081	Diode SI
D3 thru D10	SDS-1S953	Diode SI
D11	SDS-1SS97	Diode SI
R1	RMF-AR4R7KFK	R: FXD Metal FLM 4.7kΩ ±1% 1/4W
R2	RMF-AR4R7KFK	R: FXD Metal FLM 4.7kΩ ±1% 1/4W
R3	RMF-AR100QFK	R: FXD Metal FLM 100Ω ±1% 1/4W
R4	RMF-AR470QFK	R: FXD Metal FLM 470Ω ±1% 1/4W
R5	RMF-AR220QFK	R: FXD Metal FLM 220Ω ±1% 1/4W
R6	RMF-AR10QFK	R: FXD Metal FLM 10Ω ±1% 1/4W
R7	RMF-AS51QFK	R: FXD Metal FLM 51Ω ±1% 1/2W
R8	RMF-AR220QFK	R: FXD Metal FLM 220Ω ±1% 1/4W
R9	RMF-AR470QFK	R: FXD Metal FLM 470Ω ±1% 1/4W
R10	RMF-AR100QFK	R: FXD Metal FLM 100Ω ±1% 1/4W
R11	RMF-AR1KFK	R: FXD Metal FLM 1kΩ ±1% 1/4W
R12	RWR-AE6R8QK	R: VAR WW 6.8Ω
R13		Not assigned
R14 thru R17	RMF-AR10KFK	R: FXD Metal FLM 10kΩ ±1% 1/4W

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Parts No.	ADVANTEST Stock No.	Description
R18	RMF-AR4R7KFK	R: FXD Metal FLM 4.7kΩ ±1% 1/4W
R19	RMF-AR47KFK	R: FXD Metal FLM 47kΩ ±1% 1/4W
R20	RMF-AR680QFK	R: FXD Metal FLM 680Ω ±1% 1/4W
R21	RMF-AR680QFK	R: FXD Metal FLM 680Ω ±1% 1/4W
R22	RMF-AR220QFK	R: FXD Metal FLM 220Ω ±1% 1/4W
R23 thru R26	RWR-AE1QK-1	R: VAR WW 1Ω
R27	RMF-AR220QFK	R: FXD Metal FLM 220Ω ±1% 1/4W
R28	RMF-AR680QFK	R: FXD Metal FLM 680Ω ±1% 1/4W
R29	RMF-AR680QFK	R: FXD Metal FLM 680Ω ±1% 1/4W
R30 thru R33	RMF-AR10KFK	R: FXD Metal FLM 10kΩ ±1% 1/4W
R34	RMF-AR8R2KFK	R: FXD Metal FLM 8.2kΩ ±1% 1/4W
R35	RMF-AR12KFK	R: FXD Metal FLM 12kΩ ±1% 1/4W
R36	RMF-AR1KFK	R: FXD Metal FLM 1kΩ ±1% 1/4W
R37 thru R46		Not assigned
R47 thru R49	RMF-AR10KFK	R: FXD Metal FLM 10kΩ ±1% 1/4W
R50	RMF-AR33KFK	R: FXD Metal FLM 33kΩ ±1% 1/4W
R51	RVR-BE10K	R: VAR CERMET 10kΩ
R52 thru R54	RMF-AS51QFK	R: FXD Metal FLM 51Ω ±1% 1/2W
C1	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
C2	CSM-AGR01U50V	C: FXD CER 0.01µF ±80, -20% 50V
C3	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
C4	CSM-AGR01U50V	C: FXD CER 0.01µF ±80, -20% 50V
C5	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
C6	CSM-AGR01U50V	C: FXD CER 0.01µF +80, -20% 50V
C7	CSM-ACR1U50V	C: FXD CER 0.1µF +80, -20% 50V
C8	CSM-ACR1U50V	C: FXD CER 0.1µF +80, -20% 50V
C9	CCK-AR47U35V	C: FXD ELECT 47µF 35V
C10	CSM-AGR047U50V	C: FXD CER 0.047µF +80, -20% 50V
C11	CCK-AR47U35V	C: FXD ELECT 47µF 35V
C12	CSM-ACR1U50V	C: FXD CER 0.1µF +80, -20% 50V
C13	CSM-ACR1U50V	C: FXD CER 0.1µF +80, -20% 50V
C14	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
C15	CSM-AGR01U50V	C: FXD CER 0.01µF +80, -20% 50V
C16	CCK-AR10U25V	C: FXD ELECT 10µF 25V
C17 thru C19	CSM-ACR1U50V	C: FXD CER 0.1µF +80, -20% 50V
C20	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
C21	CSM-AGR01U50V	C: FXD CER 0.01µF +80, -20% 50V
L1	LCL-T00084A	L: FXD Coil
L2	LCL-T00084A	L: FXD Coil

Parts No.	ADVANTEST Stock No.	Description
J1	JCF-AC001JX01-3	Connector
J2		Not assigned
J3	JCP-AA012PX07-1	Connector

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Parts No.	ADVANTEST Stock No.	Description
U1	SIA-TL494	IC:
U2	SIA-324	IC: Quadruple Operational Amplifier
Q1	SFM-2N6660	FET Junction N-Channel
D1	SDZ-W061	C: Zener Diode
D2	SDZ-W130	C: Zener Diode
D3	SDP-ES1F	C: Diode SI
R1	RMF-AR1R8KFK	R: FXD Metal FLM 1.8kΩ ±1% 1/4W
R2	RMF-AR18KFK	R: FXD Metal FLM 18kΩ ±1% 1/4W
R3	RVR-DF1K	R: VAR CERMET 1kΩ
R4	RMF-AR4R3KFK	R: FXD Metal FLM 4.3kΩ ±1% 1/4W
R5	RMF-AR18KFK	R: FXD Metal FLM 18kΩ ±1% 1/4W
R6	RMF-AR560QFK	R: FXD Metal FLM 560Ω ±1% 1/4W
R7	RMF-AR2R4KFK	R: FXD Metal FLM 2.4kΩ ±1% 1/4W
R8	RMF-AR270KFK	R: FXD Metal FLM 270kΩ ±1% 1/4W
R9	RMF-AR24KFK	R: FXD Metal FLM 24kΩ ±1% 1/4W
R10	RMF-AR56QFK	R: FXD Metal FLM 56Ω ±1% 1/4W
R11	RMF-AR24KFK	R: FXD Metal FLM 24kΩ ±1% 1/4W
R12	RMF-AR20KFK	R: FXD Metal FLM 20kΩ ±1% 1/4W
R13	RMF-AR4R7KFK	R: FXD Metal FLM 4.7kΩ ±1% 1/4W
R14	RMF-AR1R8KFK	R: FXD Metal FLM 1.8kΩ ±1% 1/4W
R15	RMF-AR470QFK	R: FXD Metal FLM 470Ω ±1% 1/4W
R16	RMF-AR47KFK	R: FXD Metal FLM 47kΩ ±1% 1/4W
R17	RMF-AR47KFK	R: FXD Metal FLM 47kΩ ±1% 1/4W
R18	RMF-AR150KFK	R: FXD Metal FLM 150kΩ ±1% 1/4W
R19	RVR-DF2K	R: VAR CERMET 2kΩ
R20	RMF-AR30KFK	R: FXD Metal FLM 30kΩ ±1% 1/4W
R21	RMF-AR100QFK	R: FXD Metal FLM 100Ω ±1% 1/4W
R22	RCB-AF15K	R: FXD CAR 15kΩ ±5% 1W
R23	RCB-AK10	R: FXD CAR 10Ω ±5% 1/2W
C1	CSM-AGR47U50V	C: FXD CER 0.47μF +80, -20% 50V
C2	CCK-AR220U25V	C: FXD ELECT 220μF 25V
C3	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V
C4	CSM-AGR47U50V	C: FXD CER 0.47μF +80, -20% 50V
C5	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V
C6	CSM-AGR01U50V	C: FXD CER 0.01μF +80, -20% 50V
C7	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V
C8	CMC-AC1000PR3K	C: FXD DIPPED MICA 1000pF ±5% 300V
C9	CCK-AR47U10V	C: FXD ELECT 47μF 10V
C10	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V
C11	CMC-AB2PR5K	C: FXD DIPPED MICA 2pF ±0.5% 500V
C12	CSM-AGR01U50V	C: FXD CER 0.01μF +80, -20% 50V
C13	CCK-AA100U160V	C: FXD ELECT 100μF 160V
C14	CSM-ACR01UR5K	C: FXD CER 0.01μF +80, -20% 500V
C15	CSM-AGR1U50V	C: FXD CER 0.1μF +80, -20% 50V
L1	LCL-C00908-1	L: FXD Coil

Parts No.	ADVANTEST Stock No.	Description
U1 thru U3	SIM-4051-1	IC: Single 8-Channel Multiplexer/Demultiplexer
U4 thru U10	SIT-74LS123	IC: Dual Retriggerable Monostable Multivibrator with Clear Low Power
U11	SIT-74LS21	IC: Dual 4-Input Positive-AND Gate Low Power
U12	SIT-74LS21	IC: Dual 4-Input Positive-AND Gate Low Power
U13	SIT-74F32	IC: Quadruple 2-Input Positive-OR Gate
U14	SIT-74LS11	IC: Triple 3-Input Positive-AND Gate Low Power
U15	SIT-74LS14	IC: Hex Schmitt-Trigger Inveter Low Power
R1 thru R7	RMF-AC330QFJ-4	R: FXD Metal FLM 330Ω ±1% 1/4W
R8	RMF-AC1KFJ-4	R: FXD Metal FLM 1kΩ ±1% 1/4W
R9	RMF-AC1KFJ-4	R: FXD Metal FLM 1kΩ ±1% 1/4W
R10	RMF-AC330QFJ-4	R: FXD Metal FLM 330Ω ±1% 1/4W
R11	RMF-AC18KFJ-4	R: FXD Metal FLM 18kΩ ±1% 1/4W
R12	RMF-AC18KFJ-4	R: FXD Metal FLM 18kΩ ±1% 1/4W
R13 thru R16	RVR-CD5K-1	R: VAR CERMET 5kΩ
R17	RVR-CD2K-1	R: VAR CERMET 2kΩ
R18	RVR-CD5K-1	R: VAR CERMET 5kΩ
R19 thru R21	RVR-CD10K-1	R: VAR CERMET 10kΩ
R22	RVR-CD50K-1	R: VAR CERMET 50kΩ
R23	RVR-CD20K-1	R: VAR CERMET 20kΩ
R24	RVR-CD20K-1	R: VAR CERMET 20kΩ
R25	RMF-AC2R7KFJ-4	R: FXD Metal FLM 2.7kΩ ±1% 1/4W
R26	RVR-CD2K	R: VAR CERMET 2kΩ
R27 thru R29	RMF-AC3R3KFJ-4	R: FXD Metal FLM 3.3kΩ ±1% 1/4W
R30 thru R32	RCB-AG3R3K	R: FXD CAR 3.3kΩ ±5% 1/8W
R33 thru R44	RCB-AG10K	R: FXD CAR 10kΩ ±5% 1/8W
C1	CMC-AB200PR3K	C: FXD DIPPED MICA 200pF 5% 300V
C2	CMC-AB51PR3K	C: FXD DIPPED MICA 51pF 5% 300V
C3 thru C6	CMC-AB200PR3K	C: FXD DIPPED MICA 200pF ±5% 300V
C7 thru C13	CMC-AC360PR5K	C: FXD DIPPED MICA 36pF ±5% 500V
C14	CSM-AGR01U50V	C: FXD CER 0.01μF +80, -20% 50V
C15	CCK-AR10U25V	C: FXD ELECT 10μF 25V
C16 thru C26	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V

Parts No.	ADVANTEST Stock No.	Description
L1	LCL-T00084A	L: FXD Coil
J1 thru J4	JCF-AC001JX01-1	Connector
J5	JCP-AA012PX07-1	Connector
J6	JCP-AC001JX01-1	Connector

Parts No.	ADVANTEST Stock No.	Description
U1	SIA-H0033-1	IC:
U2	SIA-H0032-1	IC:
U3	SIA-H0032-1	IC:
U4	SEC-H11F1-1	IC:
U5	SIA-OPA111	IC:
U6	SIA-411-1	IC:
U7	SIA-1515G-1	IC:
U8	SIA-7812L	IC: Series Volrage Regulator
U9	SIA-75468	IC: Driver
U10		Not assigned
U11		Not assigned
U13	SIA-411-1	IC:
U14	SIA-7810M	IC:
U15	SIA-7905U	IC: Voltage Regulator
Q1	STP-2SA603	Transistor SI PNP
Q2	SFN-U309	FET Junction N-Channel
Q3	STP-2SA1206	Transistor SI PNP
Q4	STP-2SA1206	Transistor SI PNP
Q5	STN-2SC2026	Transistor SI NPN
Q6	STP-2SA1206	Transistor SI PNP
Q7	STN-2SC2026	Transistor SI NPN
Q8	STP-2SA1206	Transistor SI PNP
Q9	STP-3SA1224	Transistor SI PNP
Q10	STN-2SC1815	Transistor SI NPN
D2	SDS-1SS286-2	Diode SI
D3	SDS-1SS286-2	Diode SI
D4 thru D7	SDS-1S953	Diode SI
D8 thru D15	SDS-1SS286-2	Diode SI
D16	SDZ-H3-5	Zener Diode
D17	SDZ-W050-5	Zener Diode
R1	RMF-AR24KFK	R: FXD Metal FLM 24kΩ ±1% 1/4W
R2	RMF-AR51QFK	R: FXD Metal FLM 51Ω ±1% 1/4W
R3	RMF-AR300QFK	R: FXD Metal FLM 300Ω ±1% 1/4W
R4	RMF-AR220QFK	R: FXD Metal FLM 220Ω ±1% 1/4W
R5	RMF-AR51QFK	R: FXD Metal FLM 51Ω ±1% 1/4W
R6	RMF-AR560QFK	R: FXD Metal FLM 560Ω ±1% 1/4W
R7	RMF-AR100KFK	R: FXD Metal FLM 100kΩ ±1% 1/4W
R8	RMF-AR220QFK	R: FXD Metal FLM 220Ω ±1% 1/4W
R9	RMF-AR390KFK	R: FXD Metal FLM 390kΩ ±1% 1/4W
R10	RMF-AR220QFK	R: FXD Metal FLM 220Ω ±1% 1/4W
R11	RMF-AR3R3KFK	R: FXD Metal FLM 3.3kΩ ±1% 1/4W
R12	RMF-AR1R2KFK	R: FXD Metal FLM 1.2kΩ ±1% 1/4W
R13	RMF-AR2R2KFK	R: FXD Metal FLM 2.2kΩ ±1% 1/4W
R14	RMF-AR3R9KFK	R: FXD Metal FLM 3.9kΩ ±1% 1/4W

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Parts No.	ADVANTEST Stock No.	Description
R15	RMF-AR910QFK	R: FXD Metal FLM 910Ω ±1% 1/4W
R16	RMF-AR100QFK	R: FXD Metal FLM 100Ω ±1% 1/4W
R17	RMF-AR100QFK	R: FXD Metal FLM 100Ω ±1% 1/4W
R18	RMF-AR68QFK	R: FXD Metal FLM 68Ω ±1% 1/4W
R19	RMF-AR15KFK	R: FXD Metal FLM 15kΩ ±1% 1/4W
R20	RMF-AR15KFK	R: FXD Metal FLM 15kΩ ±1% 1/4W
R21	RMF-AR560QFK	R: FXD Metal FLM 560Ω ±1% 1/4W
R22	RMF-AR4R7KFK	R: FXD Metal FLM 4.7kΩ ±1% 1/4W
R23	RMF-AR1R2KFK	R: FXD Metal FLM 1.2kΩ ±1% 1/4W
R24	RMF-AR15KFK	R: FXD Metal FLM 15kΩ ±1% 1/4W
R25	RMF-AR15KFK	R: FXD Metal FLM 15kΩ ±1% 1/4W
R26	RMF-AR390QFK	R: FXD Metal FLM 390Ω ±1% 1/4W
R27		Not assigned
R28	RMF-AR220QFK	R: FXD Metal FLM 220Ω ±1% 1/4W
R29 thru R31		Not assigned
R32	RMF-AR560QFK	R: FXD Metal FLM 560Ω ±1% 1/4W
R33	RMF-AR10KFK	R: FXD Metal FLM 10kΩ ±1% 1/4W
R34	RMF-AR500QFK	R: FXD Metal FLM 500Ω ±1% 1/4W
R35	RMF-AR51QFK	R: FXD Metal FLM 51Ω ±1% 1/4W
R36	RMF-AR1KFK	R: FXD Metal FLM 1kΩ ±1% 1/4W
R37	RMF-AR12KFK	R: FXD Metal FLM 12kΩ ±1% 1/4W
R38	RMF-AR1MFK	R: FXD Metal FLM 1MΩ ±1% 1/4W
R39	RMF-AR1MFK	R: FXD Metal FLM 1MΩ ±1% 1/4W
R40 thru R44		Not assigned
R45	RMF-AR33KFK	R: FXD Metal FLM 33kΩ ±1% 1/4W
R46	RMF-AR12KFK	R: FXD Metal FLM 12kΩ ±1% 1/4W
R47	RMF-AR5KFK	R: FXD Metal FLM 5kΩ ±1% 1/4W
R48	RMF-AR120QFK	R: FXD Metal FLM 120Ω ±1% 1/4W
R49	RMF-AR270QFK	R: FXD Metal FLM 270Ω ±1% 1/4W
R50	RMF-AR2R2KFK	R: FXD Metal FLM 2.2kΩ ±1% 1/4W
R51	RMF-AR220QFK	R: FXD Metal FLM 220Ω ±1% 1/4W
R52	RMF-AR51QFK	R: FXD Metal FLM 51Ω ±1% 1/4W
R53	RMF-AR100QFK	R: FXD Metal FLM 100Ω ±1% 1/4W
R54	RVR-DF200	R: VAR CERMET 200Ω
R55	RMF-AR150QFK	R: FXD Metal FLM 150Ω ±1% 1/4W
R56	RMF-AR1R5KFK	R: FXD Metal FLM 1.5kΩ ±1% 1/4W
R57	RMF-AR51QFK	R: FXD Metal FLM 51Ω ±1% 1/4W
R58	RMF-AR1R5KFK	R: FXD Metal FLM 1.5kΩ ±1% 1/4W
R59	RMF-AR51QFK	R: FXD Metal FLM 51Ω ±1% 1/4W
R60	RMF-AR1R5KFK	R: FXD Metal FLM 1.5kΩ ±1% 1/4W
R61	RMF-AR1R5KFK	R: FXD Metal FLM 1.5kΩ ±1% 1/4W
R62	RMF-AR2R2KFK	R: FXD Metal FLM 2.2kΩ ±1% 1/4W
R63	RMF-AR4R7KFK	R: FXD Metal FLM 4.7kΩ ±1% 1/4W
R64	RMF-AR120QFK	R: FXD Metal FLM 120Ω ±1% 1/4W
R65	RMF-AR120QFK	R: FXD Metal FLM 120Ω ±1% 1/4W

Parts No.	ADVANTEST Stock No.	Description
R66	RMF-AR1R2KFK	R: FXD Metal FLM 1.2kΩ ±1% 1/4W
R67	RMF-AR560KFK	R: FXD Metal FLM 560kΩ ±1% 1/4W
R68	RMF-AR2KFK	R: FXD Metal FLM 2kΩ ±1% 1/4W
R69	RVR-DF20K	R: VAR CERMET 20kΩ
R70	RVR-DF50	R: VAR CERMET 50Ω
R71	RMF-AR1R5KFK	R: FXD Metal FLM 1.5kΩ ±1% 1/4W
C1 thru C4	CSM-AG1U50V	C: FXD CER 1μF +80, -20% 50V
C5 thru C7	CSM-AGR47U50V	C: FXD CER 0.47μF +80, -20% 50V
C8	CSM-AG1U50V	C: FXD CER 1μF +80, -20% 50V
C9	CCK-AR100U25V	C: FXD ELECT 100μF 25V
C10	CSM-AC4700P50V	C: FXD CER 4700pF +80, -20% 50V
C11	CMC-AB10PR5K	C: FXD DIPPED MICA 10pF ±5% 500V
C12	CSM-AG1U50V	C: FXD CER 1μF +80, -20% 50V
C13	CCK-AR100U16V	C: FXD ELECT 100μF 16V
C14	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V
C15 thru C17	CSM-AGR1U50V	C: FXD CER 0.1μF +80, -20% 50V
C18	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V
C19	CSM-AGR1U50V	C: FXD CER 0.1μF +80, -20% 50V
C20	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V
C21	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V
C22	CMC-AB15PR5K	C: FXD DIPPED MICA 15pF ±5% 500V
C23 thru C26	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V
C27	CMC-AB5PR5K	C: FXD DIPPED MICA 5pF ±0.5% 500V
C28 thru C32	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V
C33	CFM-AHR1U100V	C: FXD Mylar 0.1μF 100V
C34 thru C37	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V
C38	CCK-AR100U25V	C: FXD ELECT 100μF 25V
C39	CSM-AG1U50V	C: FXD CER 1μF +80, -20% 50V
C40	CSM-AG1U50V	C: FXD CER 1μF +80, -20% 50V
C41	CCK-AR47U25V	C: FXD ELECT 47μF 25V
C42	CSM-AG1U50V	C: FXD CER 1μF +80, -20% 50V
C43	CCK-AR47U25V	C: FXD ELECT 47μF 25V
C44	CCK-AR47U25V	C: FXD ELECT 47μF 25V
C45	CSM-AG1U50V	C: FXD CER 1μF +80, -20% 50V
C46	CCK-AR47U25V	C: FXD ELECT 47μF 25V
C47	CSM-AG1U50V	C: FXD CER 1μF +80, -20% 50V
C48	CSM-AGR47U50V	C: FXD CER 0.47μF +80, -20% 50V
C49	CSM-AGR47U50V	C: FXD CER 0.47μF +80, -20% 50V
C50	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V

Parts No.	ADVANTEST Stock No.	Description
C51	CSM-AG1U50V	C: FXD CER 1µF +80, -20% 50V
C52	CSM-AG1U50V	C: FXD CER 1µF +80, -20% 50V
C53	CCK-AR47U25V	C: FXD ELECT 47µF 25V
C54	CSM-AG1U50V	C: FXD CER 1µF +80, -20% 50V
C55	CSM-AGR1U50V	C: FXD CER 0.1µF +80, -20% 50V
C56	CCK-AR47U25V	C: FXD ELECT 47µF 25V
C57 thru C60	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
C61	CFM-AH1U100V-1	C: FXD Mylar 1µF 100V
C62	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
C63	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
C64	CMC-AB15PR5K	C: FXD DIPPED MICA 15pF ±10% 500V
C65	CMC-AB10PR5K	C: FXD DIPPED MICA 10pF ±5% 500V
C66 thru C68	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
C69	CSM-AC2200P50V	C: FXD CER 2200pF +80, -20% 50V
C70	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
K1 thru K3	KRL-000441	Relay
K4	KRL-000688	Relay
L1	LCL-T00084A	L: FXD Coil
L2	LCL-C00907-1	L: FXD Coil
L3	LCL-C00907-1	L: FXD Coil
L4	LCL-T00084A	L: FXD Coil
L5	LCL-T00084A	L: FXD Coil
J1	JCP-AA024PX06-1	Connector
J2	JCF-AC001JX04-1	Connector
J3	JCF-AC001JX04-1	Connector
J4	JCP-AA003PX06-1	Connector
J5	JCF-AC001JX04-1	Connector
J6 thru J8	JCP-AA002PX02-1	Connector

Parts No.	ADVANTEST Stock No.	Description
CB1	DCB-ES2544X01A-1	Cable
CB2	DCB-FF0093X01A-1	Cable
CB3	DCB-FF0093X03A-1	Cable
CB4	DCB-FF0093X03A-1	Cable
J1	JCH-AD001JX01-1	Connector
J2	JCH-AD001JX01-1	Connector
SW1	QBL-000033-1	Switch

Parts No.	ADVANTEST Stock No.	Description
U1	SIA-H0033-1	IC:
U2	SIA-H0032-1	IC:
U3	SIA-H0032-1	IC:
U4	SEC-H11F1-1	IC:
U5	SIA-OPA111	IC:
U6	SIA-411-1	IC:
U7	SIA-1515G-1	IC:
U8	SIA-7812L	IC: Series Voltage Regulator
U9	SIT-75468	IC: Driver
U10 thru U12		Not assigned
U13	SIA-411-1	IC:
U14	SIA-7810M	IC:
U15	SIA-7905U	IC: Voltage Regulator
Q1	STP-2SA603	Transistor SI PNP
Q2	SFN-U309	FET Junction N-Channel
Q3	STP-2SA1206	Transistor SI PNP
Q4	STP-2SA1206	Transistor SI PNP
Q5	STN-2SC2026	Transistor SI NPN
Q6	STP-2SA1206	Transistor SI PNP
Q7	STN-2SC2026	Transistor SI NPN
Q8	STP-2SA1206	Transistor SI PNP
Q9	STP-2SA1224	Transistor SI PNP
Q10	STN-2SC1815	Transistor SI NPN
D2	SDS-1SS286-2	Diode SI
D3	SDS-1SS286-2	Diode SI
D4 thru D7	SDS-1S953	Diode SI
D8 thru D15	SDS-1SS286-2	Diode SI
D16	SDZ-H3-5	Zener Diode
D17	SDZ-W050-5	Zener Diode
R1	RMF-AR24KFK	R: FXD Metal FLM 24kΩ ±1% 1/4W
R2	RMF-AR51QFK	R: FXD Metal FLM 51Ω ±1% 1/4W
R3	RMF-AR300QFK	R: FXD Metal FLM 300Ω ±1% 1/4W
R4	RMF-AR220QFK	R: FXD Metal FLM 220Ω ±1% 1/4W
R5	RMF-AR51QFK	R: FXD Metal FLM 51Ω ±1% 1/4W
R6	RMF-AR560QFK	R: FXD Metal FLM 560Ω ±1% 1/4W
R7	RMF-AR100KFK	R: FXD Metal FLM 100kΩ ±1% 1/4W
R8	RMF-AR220QFK	R: FXD Metal FLM 220Ω ±1% 1/4W
R9	RMF-AR62KFK	R: FXD Metal FLM 62kΩ ±1% 1/4W
R10	RMF-AR220QFK	R: FXD Metal FLM 220Ω ±1% 1/4W
R11	RMF-AR3R3KFK	R: FXD Metal FLM 3.3kΩ ±1% 1/4W
R12	RMF-AR1R2KFK	R: FXD Metal FLM 1.2kΩ ±1% 1/4W
R13	RMF-AR2R2KFK	R: FXD Metal FLM 2.2kΩ ±1% 1/4W
R14	RMF-AR3R9KFK	R: FXD Metal FLM 3.9kΩ ±1% 1/4W

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Parts No.	ADVANTEST Stock No.	Description
R15	RMF-AR910QFK	R: FXD Metal FLM 910Ω ±1% 1/4W
R16	RMF-AR100QFK	R: FXD Metal FLM 100Ω ±1% 1/4W
R17	RMF-AR100QFK	R: FXD Metal FLM 100Ω ±1% 1/4W
R18	RMF-AR51QFK	R: FXD Metal FLM 51Ω ±1% 1/4W
R19	RMF-AR15KFK	R: FXD Metal FLM 15kΩ ±1% 1/4W
R20	RMF-AR15KFK	R: FXD Metal FLM 15kΩ ±1% 1/4W
R21	RMF-AR560QFK	R: FXD Metal FLM 560Ω ±1% 1/4W
R22	RMF-AR4R7KFK	R: FXD Metal FLM 4.7kΩ ±1% 1/4W
R23	RMF-AR1R2KFK	R: FXD Metal FLM 1.2kΩ ±1% 1/4W
R24	RMF-AR15KFK	R: FXD Metal FLM 15kΩ ±1% 1/4W
R25	RMF-AR15KFK	R: FXD Metal FLM 15kΩ ±1% 1/4W
R26	RMF-AR220QFK	R: FXD Metal FLM 220Ω ±1% 1/4W
R27		Not assigned
R28	RMF-AR120QFK	R: FXD Metal FLM 120Ω ±1% 1/4W
R29 thru R31		Not assigned
R32	RMF-AR300QFK	R: FXD Metal FLM 300Ω ±1% 1/4W
R33	RMF-AR10KFK	R: FXD Metal FLM 10kΩ ±1% 1/4W
R34	RMF-AR500QFK	R: FXD Metal FLM 500Ω ±1% 1/4W
R35	RMF-AR51QFK	R: FXD Metal FLM 51Ω ±1% 1/4W
R36	RMF-AR1KFK	R: FXD Metal FLM 1kΩ ±1% 1/4W
R37	RMF-AR12KFK	R: FXD Metal FLM 12kΩ ±1% 1/4W
R38	RMF-AR1MFK	R: FXD Metal FLM 1MΩ ±1% 1/4W
R39	RMF-AR1MFK	R: FXD Metal FLM 1MΩ ±1% 1/4W
R40 thru R44		Not assigned
R45	RMF-AR33KFK	R: FXD Metal FLM 33kΩ ±1% 1/4W
R46	RMF-AR12KFK	R: FXD Metal FLM 12kΩ ±1% 1/4W
R47	RMF-AR5KFK	R: FXD Metal FLM 5kΩ ±1% 1/4W
R48	RMF-AR120QFK	R: FXD Metal FLM 120Ω ±1% 1/4W
R49	RMF-AR270QFK	R: FXD Metal FLM 270Ω ±1% 1/4W
R50	RMF-AR2R2KFK	R: FXD Metal FLM 2.2kΩ ±1% 1/4W
R51	RMF-AR220QFK	R: FXD Metal FLM 220Ω ±1% 1/4W
R52	RMF-AR51QFK	R: FXD Metal FLM 51Ω ±1% 1/4W
R53	RMF-AR100QFK	R: FXD Metal FLM 100Ω ±1% 1/4W
R54	RVR-DF200	R: VAR CERMET 200Ω
R55	RMF-AR150QFK	R: FXD Metal FLM 150Ω ±1% 1/4W
R56	RMF-AR1R5KFK	R: FXD Metal FLM 1.5kΩ ±1% 1/4W
R57	RMF-AR51QFK	R: FXD Metal FLM 51Ω ±1% 1/4W
R58	RMF-AR1R5KFK	R: FXD Metal FLM 1.5kΩ ±1% 1/4W
R59	RMF-AR51QFK	R: FXD Metal FLM 51Ω ±1% 1/4W
R60	RMF-AR1R5KFK	R: FXD Metal FLM 1.5kΩ ±1% 1/4W
R61	RMF-AR1R5KFK	R: FXD Metal FLM 1.5kΩ ±1% 1/4W
R62	RMF-AR2R2KFK	R: FXD Metal FLM 2.2kΩ ±1% 1/4W
R63	RMF-AR4R7KFK	R: FXD Metal FLM 4.7kΩ ±1% 1/4W
R64	RMF-AR120QFK	R: FXD Metal FLM 120Ω ±1% 1/4W

Parts No.	ADVANTEST Stock No.	Description
R65	RMF-AR120QFK	R: FXD Metal FLM 120Ω ±1% 1/4W
R66	RMF-AR1R2KFK	R: FXD Metal FLM 1.2kΩ ±1% 1/4W
R67	RMF-AR560KFK	R: FXD Metal FLM 560kΩ ±1% 1/4W
R68	RMF-AR2KFK	R: FXD Metal FLM 2kΩ ±1% 1/4W
R69	RVR-DF20K	R: VAR CERMET 20kΩ
R70	RVR-DF50	R: VAR CERMET 50Ω
R71	RMF-AR1R5KFK	R: FXD Metal FLM 1.5kΩ ±1% 1/4W
C1 thru C4	CSM-AG1U50V	C: FXD CER 1μF +80, -20% 50V
C5 thru C7	CSM-AGR47U50V	C: FXD CER 0.47μF +80, -20% 50V
C8	CSM-AG1U50V	C: FXD CER 1μF +80, -20% 50V
C9	CCK-AR100U25V	C: FXD ELECT 100μF 25V
C10	CSM-AC4700P50V	C: FXD CER 4700pF +80, -20% 50V
C11	CMC-AB10PR5K	C: FXD DIPPED MICA 10pF ±5% 500V
C12	CSM-AG1U50V	C: FXD CER 1μF +80, -20% 50V
C13	CCK-AR100U16V	C: FXD ELECT 100μF 16V
C14	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V
C15 thru C17	CSM-AGR1U50V	C: FXD CER 0.1μF +80, -20% 50V
C18	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V
C19	CSM-AGR1U50V	C: FXD CER 0.1μF +80, -20% 50V
C20	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V
C21	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V
C22	CMC-AB15PR5K	C: FXD DIPPED MICA 15pF ±5% 500V
C23 thru C26	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V
C27	CMC-AB5PR5K	C: FXD DIPPED MICA 5pF ±0.5% 500V
C28 thru C32	CTA-AC1U50	C: FXD ELECT TANTAL 1μF ±20% 50V
C33	CFM-AHR1U100V	C:FXD Mylar 0.1μF 100V
C34 thru C37	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V
C38	CCK-AR100U25V	C: FXD ELECT 100μF 25V
C39 thru C40	CSM-AG1U50V	C: FXD CER 1μF +80, -20% 50V
C41	CCK-AR47U25V	C: FXD ELECT 47μF 25V
C42	CSM-AG1U50V	C: FXD CER 1μF +80, -20% 50V
C43	CCK-AR47U25V	C: FXD ELECT 47μF 25V
C44	CCK-AR47U25V	C: FXD ELECT 47μF 25V
C45	CSM-AG1U50V	C: FXD CER 1μF +80, -20% 50V
C46	CCK-AR47U25V	C: FXD ELECT 47μF 25V
C47 thru C49	CSM-AG1U50V	C: FXD CER 1μF +80, -20% 50V

Parts No.	ADVANTEST Stock No.	Description
C50	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
C51	CSM-AG1U50V	C: FXD CER 1µF +80, -20% 50V
C52	CSM-AG1U50V	C: FXD CER 1µF +80, -20% 50V
C53	CCK-AR47U25V	C: FXD ELECT 47µF 25V
C54	CSM-AG1U50V	C: FXD CER 1µF +80, -20% 50V
C55	CSM-AGR1U50V	C: FXD CER 0.1µF +80, -20% 50V
C56	CCK-AR47U25V	C: FXD ELECT 47µF 25V
C57 thru C60	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
C61	CFM-AH1U100V-1	C: FXD Mylar 1µF 100V
C62	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
C63	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
C64	CMC-AB15PR5K	C: FXD DIPPED MICA 15pF ±5% 500V
C65	CMC-AB10PR5K	C: FXD DIPPED MICA 10pF ±5% 500V
C66 thru C68	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
C69	CSM-AC2200P50V	C: FXD CER 2200pF +80, -20% 50V
C70	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
L1	LCL-T00084A	L: FXD Coil
L2	LCL-C00907-1	L: FXD Coil
L3	LCL-C00907-1	L: FXD Coil
L4	LCL-T00084A	L: FXD Coil
L5	LCL-T00084A	L: FXD Coil
K1 thru K3	KRL-000441	Relay
K4	KRL-000688	Relay
J1	JCP-AA024PX06-1	Connector
J2	JCF-AC001JX04-1	Connector
J3	JCF-AC001JX04-1	Connector
J4	JCP-AA003PX06-1	Connector
J5	JCF-AC001JX04-1	Connector
J6 thru J8	JCP-AA002PX02-1	Connector

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Parts No.	ADVANTEST Stock No.	Description
U1	SIT-74F00	IC: Quadruple 2-Input Positive-NAND Gate
U2	SIA-LT1001CN8	IC:
U3	SIA-TL084	IC: JFET-Input Operational Amplifier
U4	SIA-324	IC: Quadruple Operational Amplifier
U5	SQD-FU33LD-1	IC:
Q1	STN-2SC641	Transistor SI NPN
Q2	STN-2SC1253	Transistor SI NPN
Q3	STN-2SC1253	Transistor SI NPN
Q4	STN-2SC641	Transistor SI NPN
Q5	STN-2SC510	Transistor SI NPN
Q6	STP-2SA965	Transistor SI PNP
Q7	STP-2SA965	Transistor SI PNP
Q8	STN-2SC1815	Transistor SI NPN
Q9	STN-2SC1815	Transistor SI NPN
Q10	STN-2SC1173	Transistor SI NPN
Q11	STN-2SC1173	Transistor SI NPN
Q12	STP-2SA1015	Transistor SI PNP
Q13	STP-2SA1015	Transistor SI PNP
Q14	STP-2SA473	Transistor SI PNP
Q15	STP-2SA473	Transistor SI PNP
Q16	STN-2SC1253	Transistor SI NPN
Q17	STN-2SC1253	Transistor SI NPN
Q18		Not assigned
Q19	STP-2SA965	Transistor SI PNP
D1	SDZ-W081	Zener Diode
D2	SDZ-W081	Zener Diode
D3 thru D10	SDS-1S953	Diode SI
D11	SDS-1SS97	Diode SI
R1	RMF-AR4R7KFK	R: FXD Metal FLM 4.7kΩ ±1% 1/4W
R2	RMF-AR4R7KFK	R: FXD Metal FLM 4.7kΩ ±1% 1/4W
R3	RMF-AR100QFK	R: FXD Metal FLM 100Ω ±1% 1/4W
R4	RMF-AR470QFK	R: FXD Metal FLM 470Ω ±1% 1/4W
R5	RMF-AR220QFK	R: FXD Metal FLM 220Ω ±1% 1/4W
R6	RMF-AR10QFK	R: FXD Metal FLM 10Ω ±1% 1/4W
R7	RMF-AR51QFK	R: FXD Metal FLM 51Ω ±1% 1/4W
R8	RMF-AR220QFK	R: FXD Metal FLM 220Ω ±1% 1/4W
R9	RMF-AR470QFK	R: FXD Metal FLM 470Ω ±1% 1/4W
R10	RMF-AR100QFK	R: FXD Metal FLM 100Ω ±1% 1/4W
R11	RMF-AR1KFK	R: FXD Metal FLM 1kΩ ±1% 1/4W
R12	RMF-AR6R8QK	R: VAR WW 6.8Ω
R13		Not assigned
R14 thru R17	RMF-AR10KFK	R: FXD Metal FLM 10kΩ ±1% 1/4W
R18	RMF-AR4R7KFK	R: FXD Metal FLM 4.7kΩ ±1% 1/4W
R19	RMF-AR47KFK	R: FXD Metal FLM 47kΩ ±1% 1/4W

Parts No.	ADVANTEST Stock No.	Description
R20	RMF-AR680QFK	R: FXD Metal FLM 680Ω ±1% 1/4W
R21	RMF-AR680QFK	R: FXD Metal FLM 680Ω ±1% 1/4W
R22	RMF-AR220QFK	R: FXD Metal FLM 220Ω ±1% 1/4W
R23 thru R26	RWR-AE1QK-1	R: VAR WW 1Ω
R27	RMF-AR220QFK	R: FXD Metal FLM 220Ω ±1% 1/4W
R28	RMF-AR680QFK	R: FXD Metal FLM 680Ω ±1% 1/4W
R29	RMF-AR680QFK	R: FXD Metal FLM 680Ω ±1% 1/4W
R30 thru R33	RMF-AR10KFK	R: FXD Metal FLM 10kΩ ±1% 1/4W
R34	RMF-AR8R2KFK	R: FXD Metal FLM 8.2kΩ ±1% 1/4W
R35	RMF-AR12KFK	R: FXD Metal FLM 12kΩ ±1% 1/4W
R36	RMF-AR1KFK	R: FXD Metal FLM 1kΩ ±1% 1/4W
R37 thru R46		Not assigned
R47 thru R49	RMF-AR10KFK	R: FXD Metal FLM 10kΩ ±1% 1/4W
R50	RMF-AR33KFK	R: FXD Metal FLM 33kΩ ±1% 1/4W
R51	RVR-BE10K	R: VAR CERMET 10kΩ
R52 thru R54	RMF-AS51QFK	R: FXD Metal FLM 51Ω ±1% 1/4W
C1	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V
C2	CSM-AGR01U50V	C: FXD CER 0.01μF +80, -20% 50V
C3	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V
C4	CSM-AGR01U50V	C: FXD CER 0.01μF +80, -20% 50V
C5	CTA-AC1U50V	C: FXD FXD ELECT TANTAL 1μF ±20% 50V
C6	CSM-AGR01U50V	C: FXD CER 0.01μF +80, -20% 50V
C7	CSM-ACR1U50V	C: FXD CER 0.1μF +80, -20% 50V
C8	CSM-ACR1U50V	C: FXD CER 0.1μF +80, -20% 50V
C9	CCK-AR47U35V	C: FXD ELECT 47μF 35V
C10	CSM-AGR047U50V	C: FXD CER 0.047μF +80, -20% 50V
C11	CCK-AR47U35V	C: FXD ELECT 47μF 35V
C12	CSM-ACR1U50V	C: FXD CER 0.1μF +80, -20% 50V
C13	CSM-ACR1U50V	C: FXD CER 0.1μF +80, -20% 50V
C14	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V
C15	CSM-AGR01U50V	C: FXD CER 0.01μF +80, -20% 50V
C16	CCK-AR10U25V	C: FXD ELECT 10μF 25V
C17 thru C19	CSM-ACR1U50V	C: FXD CER 0.1μF +80, -20% 50V
C20	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V
C21	CSM-AGR01U50V	C: FXD CER 0.01μF +80, -20% 50V
L1	LCL-T00084A	L: FXD Coil
L2	LCL-T00084A	L: FXD Coil
J1	JCF-AC001JX01-3	Connector

Parts No.	ADVANTEST Stock No.	Description
J2		Not assigned
J3	JCP-AA012PX07-1	Connector

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Parts No.	ADVANTEST Stock No.	Description
CB1	DCB-ES2544X01A-1	Cable
CB2	DCB-FF0093X01A-1	Cable
CB3	DCB-FF0093X03A-1	Cable
CB4	DCB-FF0093X03A-1	Cable
CB5	DCB-FF1167X13-1	Cable
J1 thru J3	JCH-AD001JX01-1	Connector
SW1	QBL-000034-1	Switch

Parts No.	ADVANTEST Stock No.	Description
U1	SIT-74F00	IC: Quadruple 2-Input Positive-NAND Gate
U2	SIA-LT1001CN8	IC:
U3	SIA-TL084	IC: JFET Input Operational Amplifier
U4	SIA-324	IC: Quadruple Operational Amplifier
U5	SIT-74LS04	IC: Hex Inverter Low Power
U6	SIA-DG201-1	IC:
U7	SQD-FU44SLD-1	IC:
U8	SQD-FU64SLD-1	IC:
Q1	STN-2SC641	Transistor SI NPN
Q2	STN-2SC1253	Transistor SI NPN
Q3	STN-2SC1253	Transistor SI NPN
Q4	STN-2SC641	Transistor SI NPN
Q5	STN-2SC1253	Transistor SI NPN
Q6	STP-2SA965	Transistor SI PNP
Q7	STP-2SA965	Transistor SI PNP
Q8	STN-2SC1815	Transistor SI NPN
Q9	STN-2SC1815	Transistor SI NPN
Q10	STN-2SC1173	Transistor SI NPN
Q11	STN-2SC1173	Transistor SI NPN
Q12	STP-2SA1015	Transistor SI PNP
Q13	STP-2SA1015	Transistor SI PNP
Q14	STP-2SA473	Transistor SI PNP
Q15	STP-2SA473	Transistor SI PNP
Q16	STN-2SC1815	Transistor SI NPN
Q17	STN-2SC1815	Transistor SI NPN
D1	SDZ-W081	Zener Diode
D2	SDZ-W081	Zener Diode
D3 thru D10	SDS-1S953	Diode SI
D11	SDS-1SS97	Diode SI
D12	SDS-1SS97	Diode SI
D13	SDS-1S953	Diode SI
D14	SDS-1S953	Diode SI
R1	RMF-AR4R7KFK	R: FXD Metal FLM 4.7kΩ ±1% 1/4W
R2	RMF-AR4R7KFK	R: FXD Metal FLM 4.7kΩ ±1% 1/4W
R3	RMF-AR100QFK	R: FXD Metal FLM 100Ω ±1% 1/4W
R4	RMF-AR470QFK	R: FXD Metal FLM 470Ω ±1% 1/4W
R5	RMF-AR220QFK	R: FXD Metal FLM 220Ω ±1% 1/4W
R6	RMF-AR10QFK	R: FXD Metal FLM 10Ω ±1% 1/4W
R7	RMF-AS36QFK-1	R: FXD Metal FLM 36Ω ±1% 1/4W
R8	RMF-AR220QFK	R: FXD Metal FLM 220Ω ±1% 1/4W
R9	RMF-AR470QFK	R: FXD Metal FLM 470Ω ±1% 1/4W
R10	RMF-AR100QFK	R: FXD Metal FLM 100Ω ±1% 1/4W
R11	RMF-AR1KFK	R: FXD Metal FLM 1kΩ ±1% 1/4W
R12	RMF-AJ18QJM-1	R: FXD Metal FLM 18Ω ±1% 1/4W
R13	RMF-AJ18QJM-1	R: FXD Metal FLM 18Ω ±1% 1/4W

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Parts No.	ADVANTEST Stock No.	Description
R14 thru R17	RMF-AR10KFK	R: FXD Metal FLM 10kΩ ±1% 1/4W
R18	RMF-AR4R7KFK	R: FXD Metal FLM 4.7kΩ ±1% 1/4W
R19	RMF-AR47KFK	R: FXD Metal FLM 47kΩ ±1% 1/4W
R20	RMF-AR680QFK	R: FXD Metal FLM 680Ω ±1% 1/4W
R21	RMF-AR680QFK	R: FXD Metal FLM 680Ω ±1% 1/4W
R22	RMF-AR220QFK	R: FXD Metal FLM 220Ω ±1% 1/4W
R23 thru R26	RWR-AE1QK-1	R: VAR WW 1Ω
R27	RMF-AR220QFK	R: FXD Metal FLM 220Ω ±1% 1/4W
R28	RMF-AR680QFK	R: FXD Metal FLM 680Ω ±1% 1/4W
R29	RMF-AR680QFK	R: FXD Metal FLM 680Ω ±1% 1/4W
R30 thru R33	RMF-AR10KFK	R: FXD Metal FLM 10kΩ ±1% 1/4W
R34	RMF-AR8R2KFK	R: FXD Metal FLM 8.2kΩ ±1% 1/4W
R35	RMF-AR12KFK	R: FXD Metal FLM 12kΩ ±1% 1/4W
R36	RMF-AR1KFK	R: FXD Metal FLM 1kΩ ±1% 1/4W
R37	RMF-AR1KFK	R: FXD Metal FLM 1kΩ ±1% 1/4W
R38	RMF-AR220QFK	R: FXD Metal FLM 220Ω ±1% 1/4W
R39	RMF-AR33KFK	R: FXD Metal FLM 33kΩ ±1% 1/4W
R40	RVR-BE10K	R: VAR CERMET 10kΩ
R41	RMF-AR200KFK	R: FXD Metal FLM 200kΩ ±1% 1/4W
R42	RMF-AR200KFK	R: FXD Metal FLM 200kΩ ±1% 1/4W
R43	RMF-AR33KFK	R: FXD Metal FLM 33kΩ ±1% 1/4W
R44	RVR-BE10K	R: VAR CERMET 10kΩ
R45	RMF-AR10MJM	R: FXD Metal FLM 10MΩ ±1% 1/4W
R47 thru R49	RMF-AR10KFK	R: FXD Metal FLM 10kΩ ±1% 1/4W
R50	RMF-AR220QFK	R: FXD Metal FLM 220Ω ±1% 1/4W
R51	RMF-AR36QFK-1	R: FXD Metal FLM 36Ω ±1% 1/4W
R52	RMF-AR36QFK-1	R: FXD Metal FLM 36Ω ±1% 1/4W
C1	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V
C2	CSM-AGR01U50V	C: FXD CER 0.01μF +80, -20% 50V
C3	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V
C4	CSM-AGR01U50V	C: FXD CER 0.01μF +80, -20% 50V
C5	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V
C6	CSM-AGR01U50V	C: FXD CER 0.01μF +80, -20% 50V
C7	CSM-ACR1U50V	C: FXD CER 0.1μF +80, -20% 50V
C8	CSM-ACR1U50V	C: FXD CER 0.1μF +80, -20% 50V
C9	CSM-AGR047U50V	C: FXD CER 0.047μF +80, -20% 50V
C10	CCK-AR47U50V	C: FXD ELECT 47μF 50V
C11	CCK-AR47U50V	C: FXD ELECT 47μF 50V
C12	CSM-ACR1U50V	C: FXD CER 0.1μF +80, -20% 50V
C13	CSM-ACR1U50V	C: FXD CER 0.1μF +80, -20% 50V
C14	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V
C15	CSM-AGR01U50V	C: FXD CER 0.01μF +80, -20% 50V

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Parts No.	ADVANTEST Stock No.	Description
C16	CCK-AR10U25V	C: FXD ELECT 10µF 25V
C17 thru C19	CSM-ACR1U50V	C: FXD CER 0.1µF +80, -20% 50V
C20	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
C21	CSM-AGR01U50V	C: FXD CER 0.01µF +80, -20% 50V
C22	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
C23	CSM-AGR01U50V	C: FXD CER 0.01µF +80, -20% 50V
C24	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
C25	CSM-AGR01U50V	C: FXD CER 0.01µF +80, -20% 50V
C26	CSM-AG1U50V-2	C: FXD CER 0.1µF +80, -20% 50V
C27	CSM-AG1U50V-2	C: FXD CER 0.1µF +80, -20% 50V
L1	LCL-T00084A	L: FXD Coil
L2	LCL-T00084A	L: FXD Coil
K1	KRL-000441-1	Relay
K2	KRL-000291-1	Relay
J1	JCF-AC001JX01-3	Connector
J2		Not assigned
J3	JCP-AA012PX07-1	Connector

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   (b) any improper or inadequate handling, carriage or storage of the Product by the Purchaser or any third party (other than Advantest or its agents);

   (c) use of the Product under operating conditions or environments different than those specified in the Operation Manual or recommended by Advantest, including, without limitation, (i) instances where the Product has been subjected to physical stress or electrical voltage exceeding the permissible range and (ii) instances where the corrosion of electrical circuits or other deterioration was accelerated by exposure to corrosive gases or dusty environments;

   (d) use of the Product in connection with software, interfaces, products or parts other than software, interfaces, products or parts supplied or recommended by Advantest;

   (e) incorporation in the Product of any parts or components (i) provided by Purchaser or (ii) provided by a third party at the request or direction of Purchaser or due to specifications or designs supplied by Purchaser (including, without limitation, any degradation in performance of such parts or components);

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   (h) any negligent act or omission of the Purchaser or any third party other than Advantest.

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

6. **THE REMEDY SET FORTH HEREIN SHALL BE THE SOLE AND EXCLUSIVE REMEDY OF THE PURCHASER FOR BREACH OF WARRANTY WITH RESPECT TO THE PRODUCT.**

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

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

CUSTOMER SERVICE DESCRIPTION

In order to maintain safe and trouble-free operation of the Product and to prevent the incurrence of unnecessary costs and expenses, Advantest recommends a regular preventive maintenance program under its maintenance agreement.

Advantest's maintenance agreement provides the Purchaser on-site and off-site maintenance, parts, maintenance machinery, regular inspections, and telephone support and will last a maximum of ten years from the date the delivery of the Product. For specific details of the services provided under the maintenance agreement, please contact the nearest Advantest office listed at the end of this Operation Manual or Advantest 's sales representatives.

Some of the components and parts of this Product have a limited operating life (such as, electrical and mechanical parts, fan motors, unit power supply, etc.). Accordingly, these components and parts will have to be replaced on a periodic basis. If the operating life of a component or part has expired and such component or part has not been replaced, there is a possibility that the Product will not perform properly. Additionally, if the operating life of a component or part has expired and continued use of such component or part damages the Product, the Product may not be repairable. Please contact the nearest Advantest office listed at the end of this Operation Manual or Advantest's sales representatives to determine the operating life of a specific component or part, as the operating life may vary depending on various factors such as operating condition and usage environment.

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