MT9080 Series
ACCESS Master
Operation Manual

Fifth Edition

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

ANRITSU CORPORATION

Document No.: M-W2462AE-5.0

Safety Symbols

To prevent the risk of personal injury or loss related to equipment malfunction, Anritsu Corporation uses the following safety symbols to indicate safety-related information. Insure that you clearly understand the meanings of the symbols BEFORE using the equipment. Some or all of the following five symbols may not be used on all Anritsu equipment. In addition, there may be other labels attached to products which are not shown in the diagrams in this manual.

Symbols used in manual

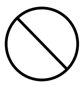
DANGER ⚠ This indicates a very dangerous procedure that could result in serious injury or death if not performed properly.

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

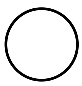
CAUTION ⚠ This indicates a hazardous procedure or danger that could result in light-to-severe injury, or loss related to equipment malfunction, if proper precautions are not taken.

Safety Symbols Used on Equipment and in Manual

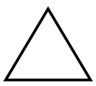
The following safety symbols are used inside or on the equipment near operation locations to provide information about safety items and operation precautions. Insure that you clearly understand the meanings of the symbols and take the necessary precautions BEFORE using the equipment.



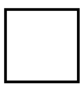
This indicates a prohibited operation. The prohibited operation is indicated symbolically in or near the barred circle.



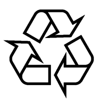
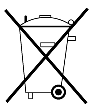
This indicates an obligatory safety precaution. The obligatory operation is indicated symbolically in or near the circle.



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



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

These indicate that the marked part should be recycled.

MT9080 Series
ACCESS Master
Operation Manual

1 September 2004 (First Edition)
7 April 2005 (Fifth Edition)

For Safety

DANGER

NEVER touch parts where the label shown on the left is attached. Such parts have high voltages of at least 1 kV and there is a risk of receiving a fatal electric shock.

WARNING

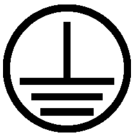
1. ALWAYS refer to the operation manual when working near locations at which the alert mark shown on the left is attached. If the operation, etc., is performed without heeding the advice in the operation manual, there is a risk of personal injury. In addition, the equipment performance may be reduced.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

2. Measurement Categories
   This instrument is designed for Measurement category I (CAT I). Don’t use this instrument at the locations of measurement categories from CAT II to CAT IV.
   In order to secure the safety of the user making measurements, IEC 61010 clarifies the range of use of instruments by classifying the location of measurement into measurement categories from I to IV.
   The category outline is as follows:
   Measurement category I (CAT I):
   Secondary circuits of a device connected to an outlet via a power transformer etc.
   Measurement category II (CAT II):
   Primary circuits of a device with a power cord (portable tools, home appliance etc.) connected to an outlet.
   Measurement category III (CAT III):
   Primary circuits of a device (fixed equipment) to which power is directly supplied from the power distribution panel, and circuits from the distribution panel to outlets.
   Measurement category IV (CAT IV):
   All building service-line entrance circuits through the integrating wattmeter and primary circuit breaker (power distribution panel).

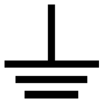
For Safety

WARNING ⚠

3. Laser radiation warning
   - NEVER look directly into the cable connector on the equipment nor into the end of a cable connected to the equipment. If laser radiation enters the eye, there is a risk of injury.
   - The Laser Safety label is attached to the equipment for safety use as indicated in "Laser Safety" on a following page.



or



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

Repair

WARNING ⚠

5. This equipment cannot be repaired by the operator. DO NOT attempt to remove the equipment covers or unit covers or to disassemble internal components. Only qualified service technicians with a knowledge of electrical fire and shock hazards should service this equipment. There are high-voltage parts in this equipment presenting a risk of severe injury or fatal electric shock to untrained personnel. In addition, there is a risk of damage to precision components.

Calibration

6. The performance-guarantee seal verifies the integrity of the equipment. To ensure the continued integrity of the equipment, only Anritsu service personnel, or service personnel of an Anritsu sales representative, should break this seal to repair or calibrate the equipment. If the performance-guarantee seal is broken by you or a third party, the performance of the equipment cannot be guaranteed.

Falling Over

7. This equipment should be used in the correct position. If the cabinet is turned on its side, etc., it will be unstable and may be damaged if it falls over as a result of receiving a slight mechanical shock.
   And also DO NOT use this equipment in the position where the power switch operation is difficult.

Replacing Battery

8. When replacing the battery, use the specified battery and insert it with the correct polarity. If the wrong battery is used, or if the battery is inserted with reversed polarity, there is a risk of explosion causing severe injury or death.

For Safety

WARNING ⚠

Battery Fluid

9. DO NOT short the battery terminals and never attempt to disassemble it or dispose of it in a fire. If the battery is damaged by any of these actions, the battery fluid may leak.
   This fluid is poisonous.
   DO NOT touch it, ingest it, or get in your eyes. If it is accidentally ingested, spit it out immediately, rinse your mouth with water and seek medical help. If it enters your eyes accidentally, do not rub your eyes, irrigate them with clean running water and seek medical help. If the liquid gets on your skin or clothes, wash it off carefully and thoroughly.

LCD

10. This instrument uses a Liquid Crystal Display (LCD); DO NOT subject the instrument to excessive force or drop it. If the LCD is subjected to strong mechanical shock, it may break and liquid may leak.
    This liquid is very caustic and poisonous.
    DO NOT touch it, ingest it, or get in your eyes. If it is ingested accidentally, spit it out immediately, rinse your mouth with water and seek medical help. If it enters your eyes accidentally, do not rub your eyes, irrigate them with clean running water and seek medical help. If the liquid gets on your skin or clothes, wash it off carefully and thoroughly.

For Safety

WARNING ⚠

Laser Safety

The laser safety is assured by correct operation of the warning means of the laser output. Before using the optical output, if it is not possible to check the optical emission using the warning means of the laser output at power-on or when the optical output switch is set to on, the laser output may be faulty. Do not use the equipment and call our service department or representative to request repair.

The laser in this equipment is classified as Class 1 and 1M according to the IEC 60825-1 specifications, or as Class I and II according to the 21 CFR 1040.10 specifications (Refer to "Table 1".)

Classes are indicated on the label attached near the laser-radiations (Refer to "Laser Radiation markings".)

Do not view laser light from Class 1M and II laser products directly with optical instruments, because the laser radiation might harm your eyes.

Table 1

Light source type	Specifications	
	IEC 60825-1	21 CFR 1040.10
OTDR light source	Class 1	Class I
Visible light source	Class 1M	Class II

For Safety

Class 1 and 1M indicate the danger degree of the laser radiation specified below according to IEC 60825-1.

Class 1: Lasers that are safe under reasonably foreseeable conditions of operation, including the use of optical instruments for intrabeam viewing.

Class 1M: Lasers emitting in the wavelength range from 302.5 to 4000 nm which are safe under reasonably foreseeable conditions of operation, but may be hazardous if the user employs optics within the beam. Two conditions apply:

a) for diverging beams, if the user places optical components within 100 mm from the source to concentrate (collimate) the beam; or

b) for collimated beams with a diameter more than certain diameter.

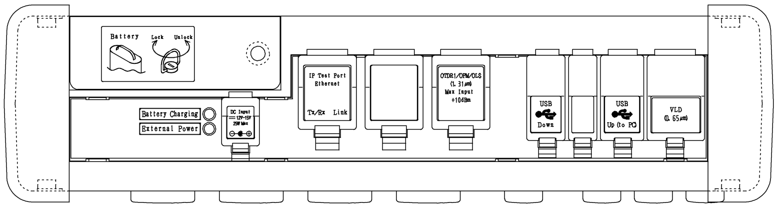
And, Class I, IIa and II indicates the degree of danger of the laser radiation outlined below as defined by 21 CFR 1040.10.

Class I: Class I labels of laser radiation are not considered to be hazardous.

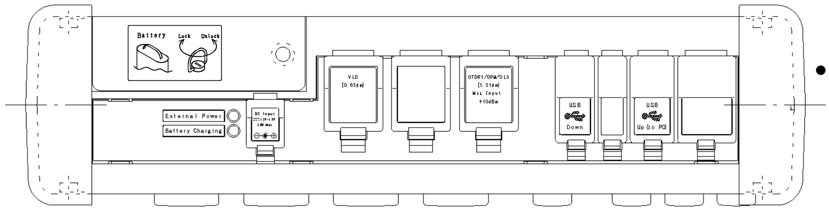
Class IIa: Class IIa labels of laser radiation are not considered to be hazardous if viewed for any period of time less than or equal to 1×10^3 seconds but are considered to be a chronic viewing hazard for any period of time greater than 1×10^3 seconds. The wavelength range of laser radiating is in 400 to 710 nm.

Class II: Class II labels of laser radiation are considered to be a chronic viewing hazard. The wavelength range of laser radiating is in 400 to 710 nm.

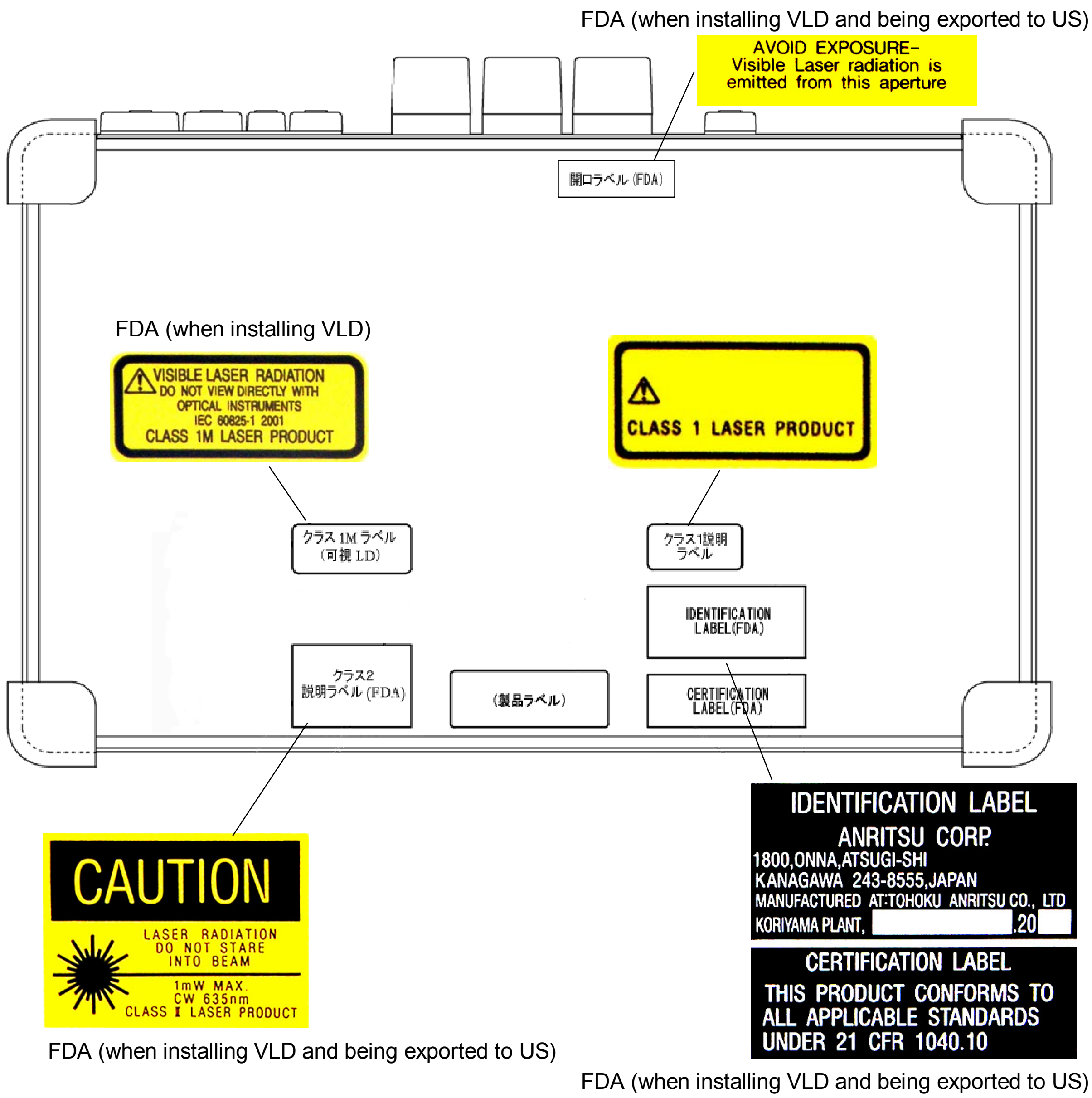
Laser Radiation Markings



- For hardware version 2 or later
  The hardware version can be checked after performing a self test. Refer to Section 8.4 "Self Test Function" for details.



- For hardware version prior to 2



For Safety

CAUTION ⚠

Replacing Memory Back-up Battery

This equipment uses a Poly-carbomonofluoride lithium battery to back-up the memory. This battery must be replaced by a service engineer when it has reached the end of its useful life; contact the Anritsu sales section or your nearest representative.

Note: The battery used in this equipment has a maximum useful life of 7 years. It should be replaced before this period has elapsed.

External Storage Media

This equipment uses a USB memory as external storage media for storing data and programs.

If this media is mishandled or becomes faulty, important data may be lost. To prevent this chance occurrence, all important data and programs should be backed-up.

<u>Anritsu will not be held responsible for lost data.</u>

Pay careful attention to the following points.

- Never remove the USB memory from the ACCESS master, while it is being accessed.
- Memory card may be damaged by static electric charges.

Life Time of Parts

This instrument uses parts with operating time or power-On time life span. These parts must be replaced at the customer's expense even if within the guaranteed period described in Warranty in the beginning of this manual. Pay attention to the life-span of parts used in continuous long-time operation.

Equipment Certificate

Anritsu Corporation certifies that this equipment was tested before shipment using calibrated measuring instruments with direct traceability to public testing organizations recognized by national research laboratories including the National Institute of Advanced Industrial Science and Technology, and the National Institute of Information and Communications Technology, and was found to meet the published specifications.

Anritsu Warranty

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

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

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

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

Anritsu Corporation Contact

In the event that this equipment malfunctions, contact an Anritsu Service and Sales office. Contact information can be found on the last page of the printed version of this manual, and is available in a separate file on the CD version.

Notes On Export Management

This product and its manuals may require an Export License/Approval by the Government of the product's country of origin for re-export from your country.

Before re-exporting the product or manuals, please contact us to confirm whether they are export-controlled items or not.

When you dispose of export-controlled items, the products/manuals are needed to be broken/shredded so as not to be unlawfully used for military purpose.

Trademark and Registered Trademark

Windows® is a registered trademark of Microsoft Corporation in the United States and/or other countries.

Ethereal is a registered trademark of Ethereal Inc. in the United States and/or other countries.

Disposing of Product

This product that you have purchased contains a rechargeable battery. The battery is recyclable. At the end of its useful life, under various state and local laws, it may be illegal to dispose of this battery into the municipal waste stream. Check with your local solid waste officials for details in your area for recycling options or proper disposal.

CE Conformity marking

Anritsu affixes the CE Conformity marking on the following product (s) in accordance with the Council Directive 93/68/EEC to indicate that they conform to the EMC and LVD directive of the European Union (EU).

CE marking

1. Product Model

Model: MT9080A/B/C/D/E/F ACCESS Master
MT9081A/A1/B/B1/C/C1/D/D1/E/E1/F/F1 ACCESS Master

2. Applied Directive

EMC: Council Directive 89/336/EEC
LVD: Council Directive 73/23/EEC

3. Applied Standards

- EMC: Emission: EN61326: 1997 / A2: 2001 (Class A)
  Immunity: EN61326: 1997 / A2: 2001 (Annex A)

	Performance Criteria*
IEC 61000-4-2 (ESD)	B
IEC 61000-4-3 (EMF)	A
IEC 61000-4-4 (Burst)	B
IEC 61000-4-5 (Surge)	B
IEC 61000-4-6 (CRF)	A
IEC 61000-4-11 (V dip/short)	B

*: Performance Criteria
A: During testing normal performance within the specification limits
B: During testing, temporary degradation, or loss of function or performance which is self-recovering

Harmonic current emissions:
EN61000-3-2: 2000 (Class A equipment)
: No limits apply for this equipment with an active input power under 75 W.

- LVD: EN61010-1: 2001 (Pollution Degree 2)

C-tick Conformity marking

Anritsu affixes the C-tick marking on the following product (s) in accordance with the regulation to indicate that they conform to the EMC framework of Australia/New Zealand.

C-tick marking

N274

1. Product Model

Model: MT9080A/B/C/D/E/F ACCESS Master
MT9081A/A1/B/B1/C/C1/D/D1/E/E1/F/F1 ACCESS Master

2. Applied Standards

EMC: Emission:
AS/NZS 2064.1 / 2 (ISM, Group 1, Class A equipment)

About This Manual

The operation manuals for the MT9080 Series ACCESS Master (hereafter, also referred to as MT9080 Series or this equipment) are comprised of the operation manual for the MT9080 Series ACCESS Master main frame and that for the IP network connectivity check function. This operation manual describes the operation, calibration and maintenance of the MT9080 Series. To understand characteristic functions of the MT9080 Series, thoroughly read Section 1 "Overview."

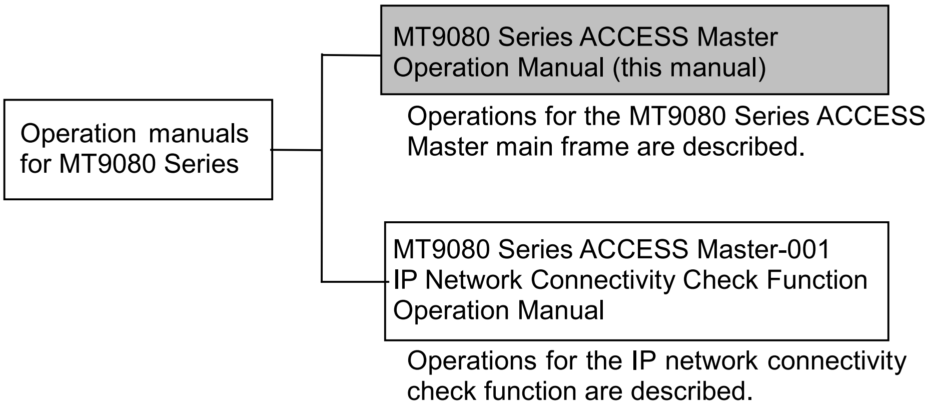


Table of Contents

Section 1 Overview

This section describes an overview of the MT9080 Series. It describes the characteristics of the MT9080 Series and the basic operation flow.

The items displayed in the [ ] in this section indicate panel keys.

When the appellation “MT9080 Series” appears in this manual, it encompasses both the MT9080x and the MT9081x. When the appellation “MT9080x” or “MT9081x” appear, the descriptions pertain uniquely to each respective unit.

1.1 Functions of MT9080 Series ACCESS Master

The MT9080 Series ACCESS Master is provided with the functions that are required to perform diagnosis of optical fibers fault on optical fiber lines, specifically FTTH lines.

Table 1.1-1 MT9080 Series ACCESS Master functions

	Function	Characteristics	Usage
<1>	Optical Pulse Testing (OTDR: Optical Time Domain Reflectometer)	Wavelength: 1.31/1.55/1.65 μm SM (The wavelength varies depending on the model.) Fresnel event dead zone: 1 m Fault Locate and Trace Analysis modes	Breaking point, splice loss, fiber loss, and distance measurement
<2>	Optical Power Meter (OPM: Optical Power Meter)	Measurement range: –50 to –5 dBm, Accuracy of measurement: ±6.5%	Communication light power level measurement
<3>	Fiber Identification Light Source (OLS: Optical Light Source)	Optical output: > –8 dBm Modulation frequency: CW (Note1)/ 270 Hz/1 kHz/2 kHz, Wavelength: 1.31/1.55/1.65 μm (The wavelength varies depending on the model.)	Optical light source for fiber identification equipment (ID tester)
<4>	Visible Light Source (VLD: Visible Laser Diode) (Option 02) (Note2)	Wavelength: 650 nm Optical output: > –3 dBm	Visual reference for fiber identification of optical fiber by bending. Detection of breaking profile in OTDR dead zone.
<5>	IP Network Connectivity Check Function (IP) (Option 001) (Note2)	10/100Base-T/1000BASE-T (Option 011) Connectivity check (PPPoE, DHCP) Connection test (Ping, trace route) Download throughput measurement Throughput measurement Counter measurement	Check of connection to the IP network (PPPoE session establishment, etc.) Download throughput speed evaluation

Notes:

1. CW can be selected only by the MT9081x.
2. When using an MT9080 Series unit with the hardware version 2 or later, both the visible light source function and IP network connectivity check function can be installed together. Refer to Section 8.4 “Self Test Function” for checking the hardware version.

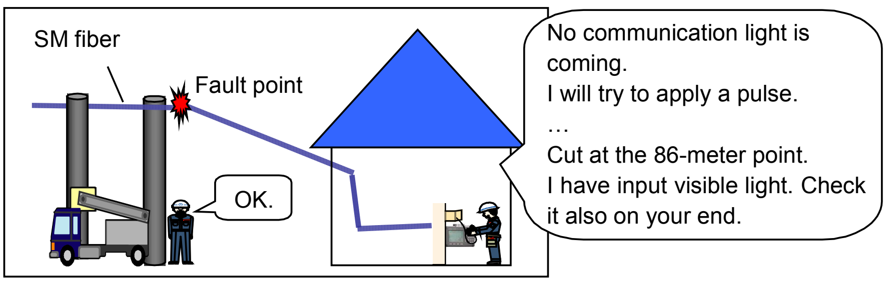


Fig. 1.1-1 Example of using MT9080 Series ACCESS Master

<1> Optical Pulse Testing (OTDR)

Capable of measuring the connection loss, fiber loss, and distance of an optical fiber line. You can find the fault position of a breakage. This function works in two modes: Fault Locate and Trace Analysis. In both modes, the function automatically detects event positions such as splice points with loss exceeding the preset threshold or return loss, and lists the data in an event table. In the Fault Locate mode, possible fault points of the detected events are also listed at the upper right corner of the screen as shown in Fig. 1.1-2.

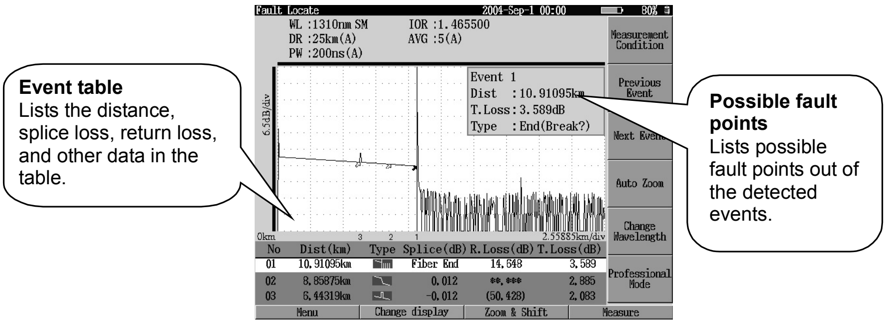


Fig. 1.1-2 OTDR screen

Note:

Although an event including a possible fault point is detected automatically, the measured result is not guaranteed. The automatic detection function has its limits, and may cause erroneous detection or detection failure. The user should make the final decision for the measured results by observing the waveform.

<2> Optical Power Meter (OPM)

Capable of measuring the optical power level. By measuring the communication light power level in the customer's system, you can easily decide whether the fault point is on the optical fiber or network.

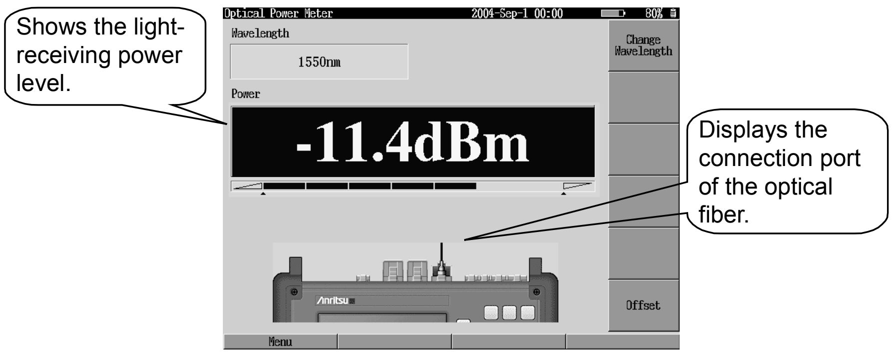


Fig. 1.1-3 Optical Power Meter screen

<3> Optical Light Source (OLS) for Fiber identification

Available as the light source for fiber identification equipment (ID tester). CW light or modulation light of 270 Hz/1 kHz/2 kHz is output. (CW light is available for the MT9081x only.)

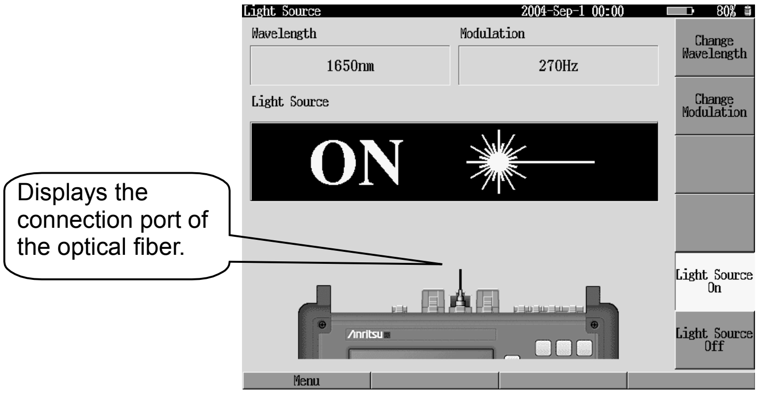


Fig. 1.1-4 Light Source screen

<4> Visible Light Source (VLD)

Works as the visible light source by means of a red laser diode. Available for visual fiber identification by visual means, fiber identification by bending, detection of breaking points within the OTDR dead zone, and other purposes.

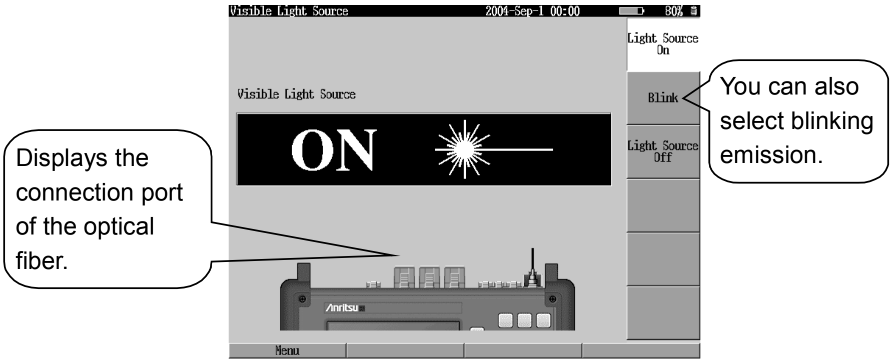


Fig. 1.1-5 Visible Light Source screen

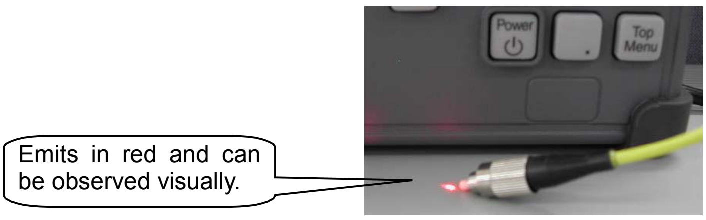


Fig. 1.1-6 Visible light

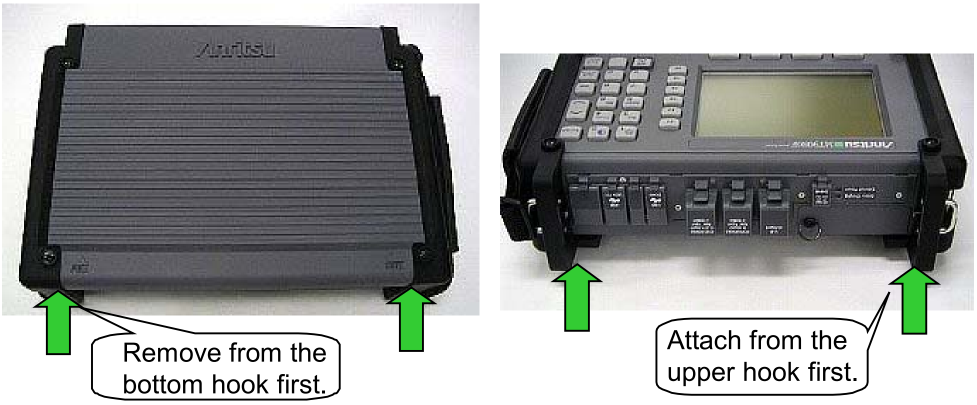
<5> IP Network Connectivity Check Function

PPPoE connection check, Ping test, trace route test, download throughput measurement, throughput measurement, and counter measurement are available by connecting to an Ethernet interface (10/100/1000Base-T) such as ONU. Refer to the MT9080 Series ACCESS Master IP Network Connectivity Check Function Operation Manual for details.

1.2 Quick Operations Guide

1.2.1 Names and functions of each part

(1) Protective cover (Option 10: When the protector is installed)



(a) Removal **(b) Attachment**

Fig. 1.2.1-1 Attaching/removing the protective cover

(2) Front panel (When the Option 10: protector is installed)

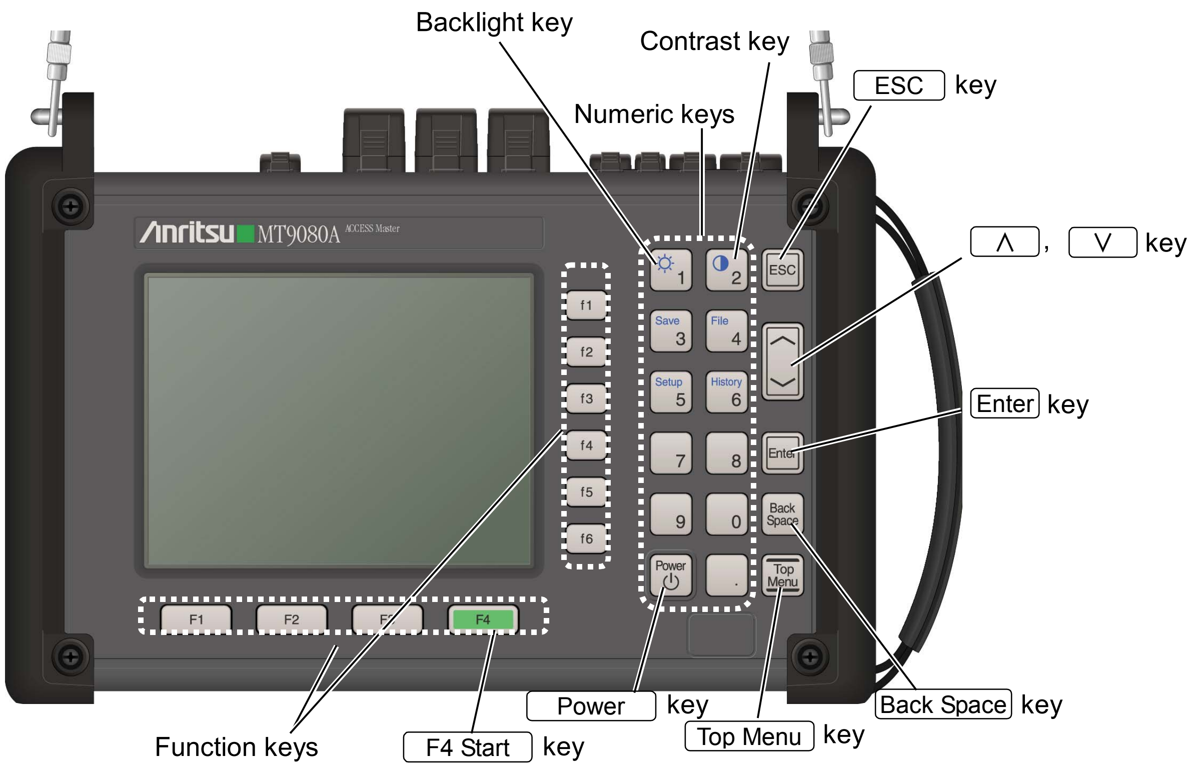


Fig. 1.2.1-2 Front panel

(3) Top view

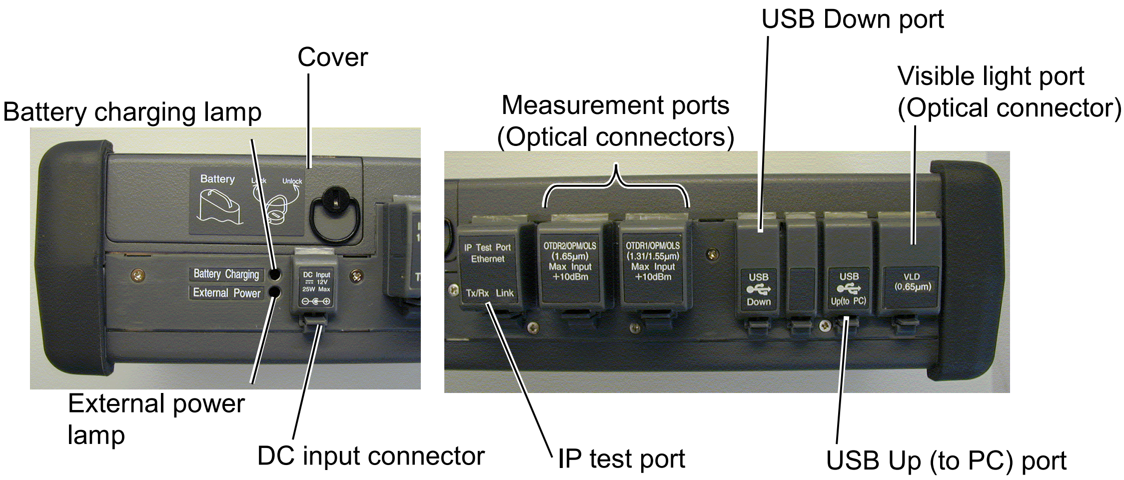


Fig. 1.2.1-3 Top view

Note:

For an MT9080 Series unit with the hardware version prior to 2, note that the visible light port is located where the IP test port is in Fig. 1.2.1-3. Refer to Section 8.4 "Self Test Function" for checking the hardware version.

(4) Stand (When the Option 10: protector is installed)

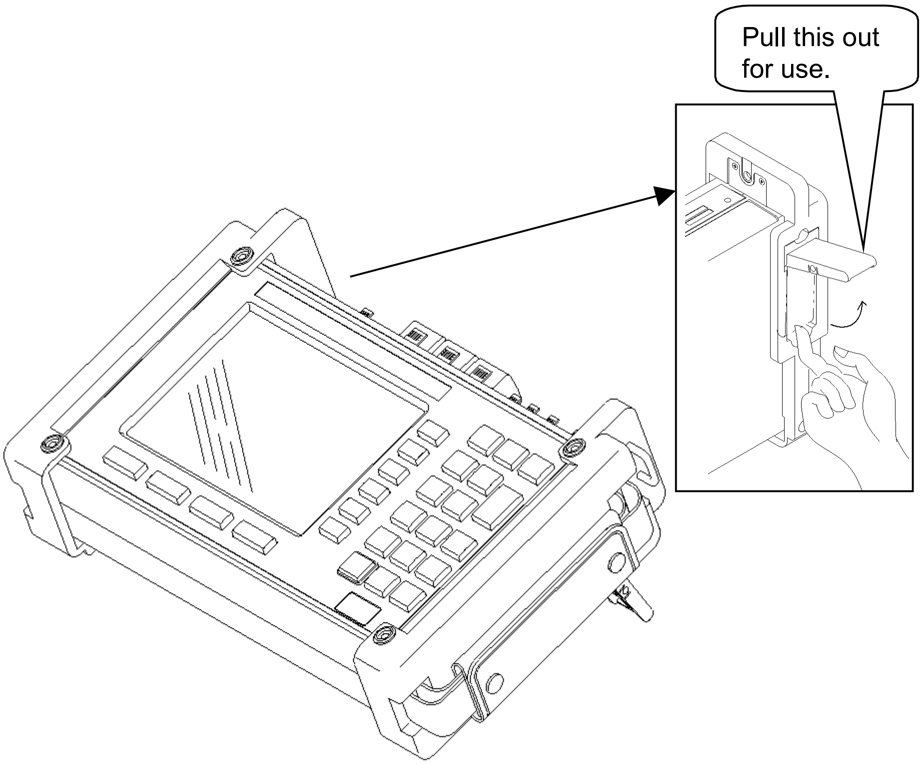
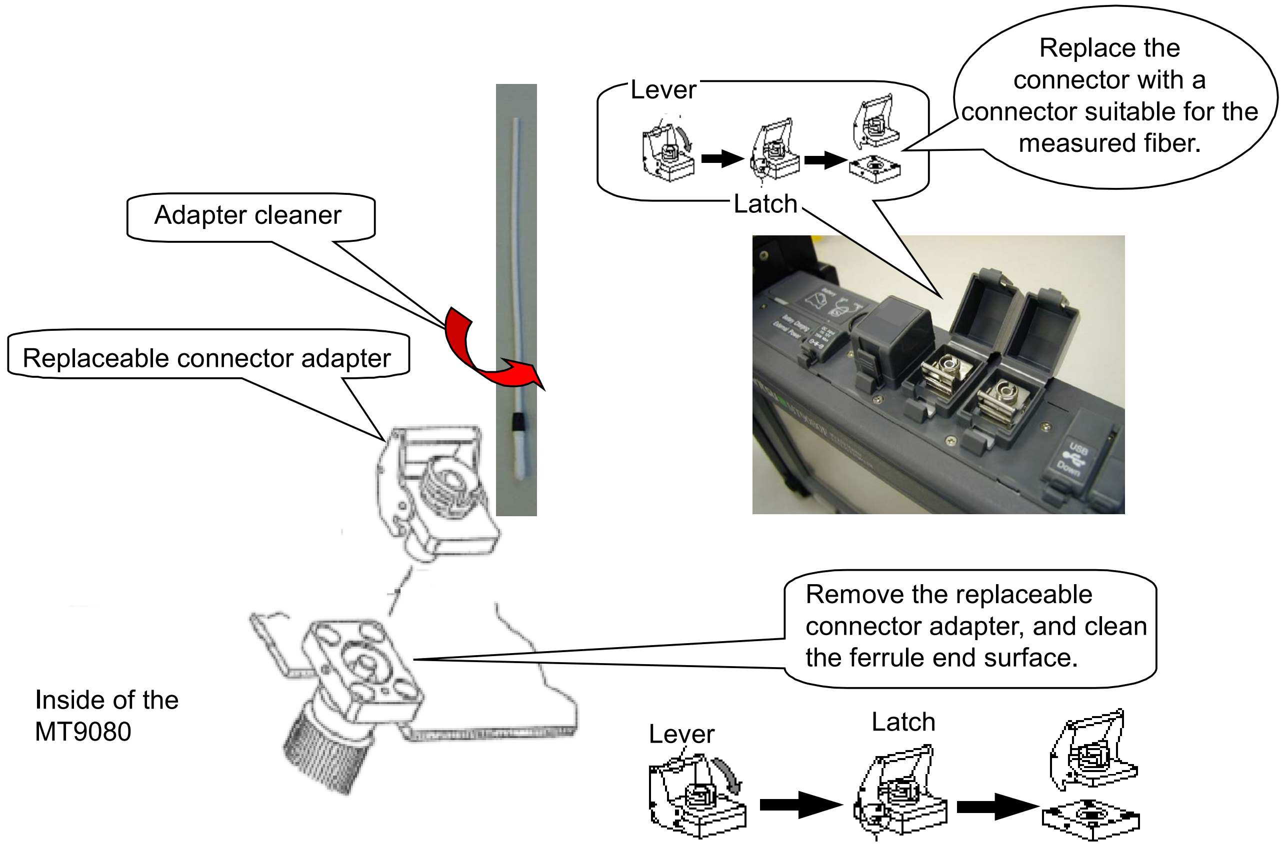


Fig. 1.2.1-4 Stand

1.2.2 Checking and cleaning optical connectors

(1) Checking the types of optical connectors and replacing/cleaning them

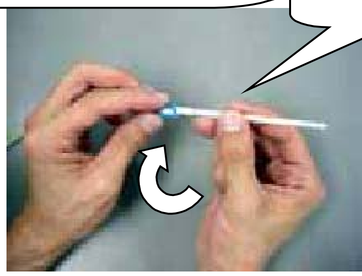


(2) Cleaning the end surface of the measured optical fiber

With the ferrule end surface pressed against the right slot of the ferrule cleaner, turn it clockwise and counterclockwise to slide it. Turn the optical connector 90 degrees each way and clean it in the same manner in the left slot of the ferrule cleaner.

Cleaning the ferrule end surface

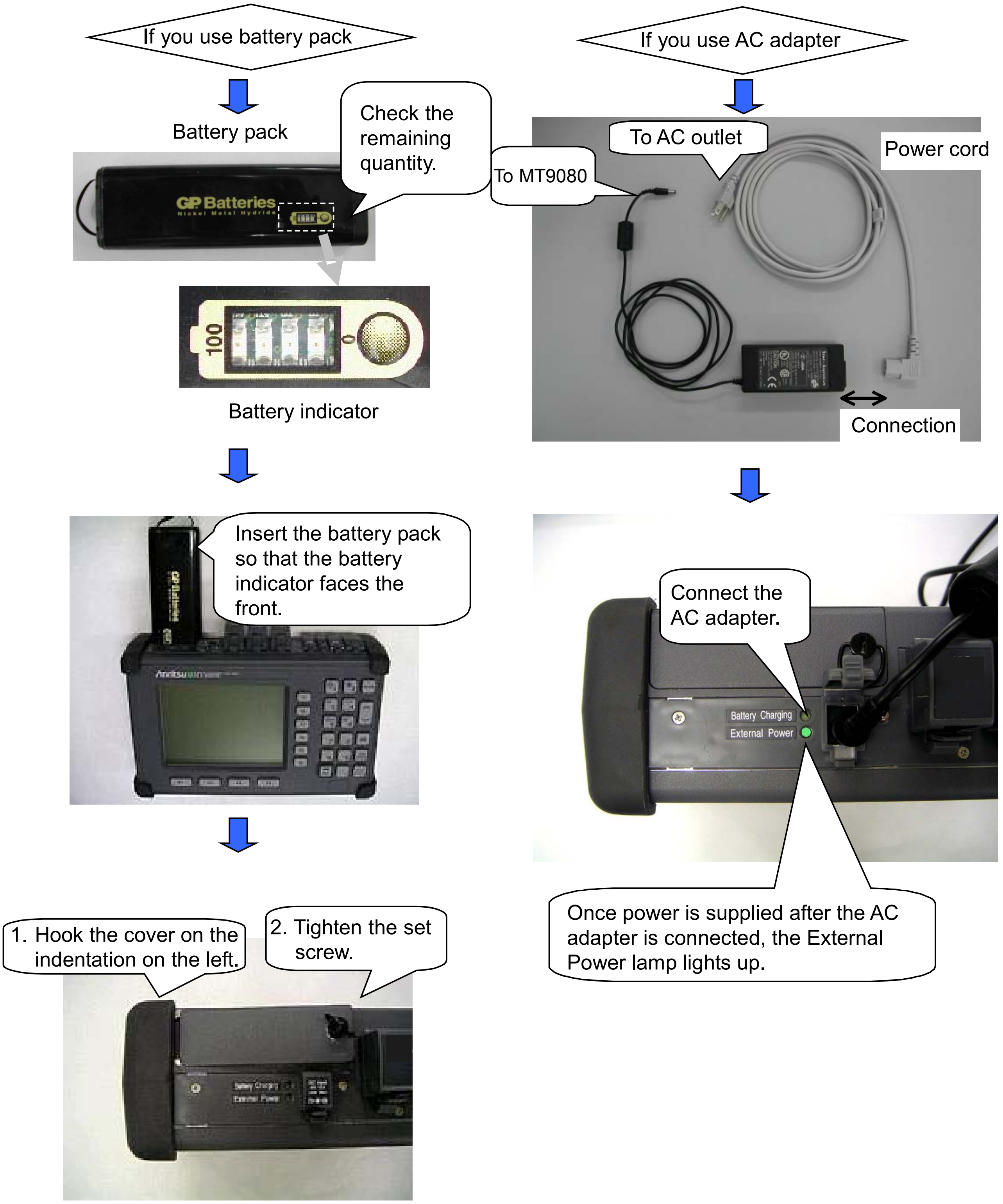
Adapter cleaner



Cleaning the side of the ferrule

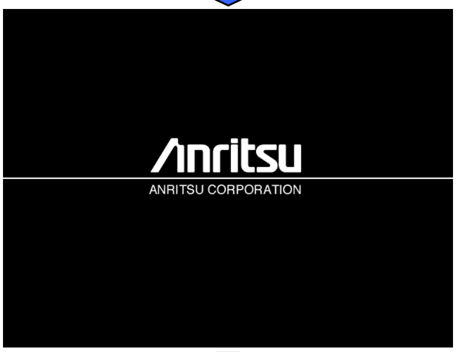
Light passes through an optical fiber portion of approximately 10 microns in diameter. Even if the optical connector has slight dirt on its surface, measurement may not be accurate because of loss or reflection. Be sure to clean the optical connector before measurement.

1.2.3 Connecting battery pack and AC adapter

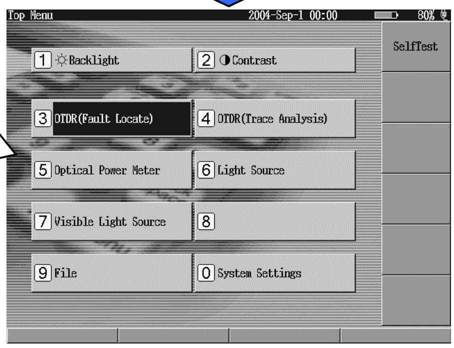


1.2.4 Turning on power and adjusting backlight and contrast

Press the [Power] key.

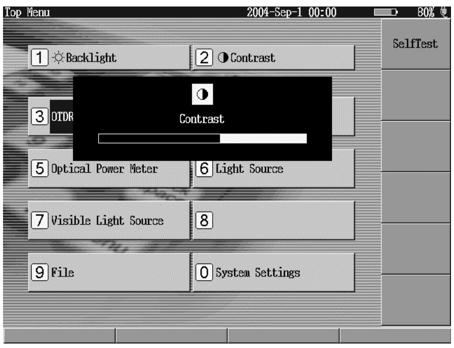


The power goes on and the MT9080 starts. This screen is shown during the startup process. Although the image may disappear several times during the process, this is not a fault of the equipment.



When the MT9080 starts up normally, this screen appears. It is called the Top Menu. You can select and execute various functions of the MT9080 Series via the Top Menu.

Backlight key
Each time you press this key, the backlight brightens, darkens, and goes out in that order.

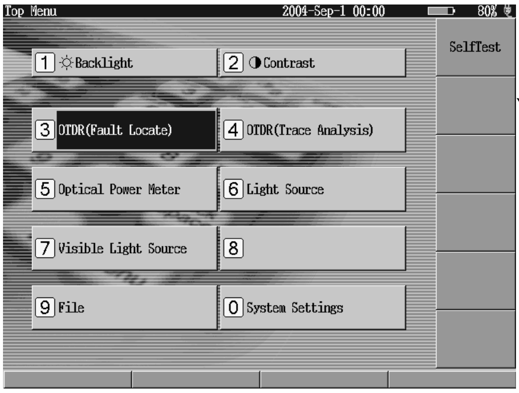


Contrast key
Pressing this key opens the Contrast window on the screen (see the figure on the left).
Use the [∧] [∨] key to adjust the contrast. Use the [Enter] key to finalize the adjustment.

Note:

Contrast adjustment is impossible for the MT9080 Series units that are equipped with the color LCD panel.

1.2.5 Top Menu and measurement function selection



Top Menu
After the power is turned on, or when you press the Top Menu key, this screen appears.

Table 1.2.5-1 Top Menu and measurement function selection keys

Objective	Function	Key operations	Remarks
To detect the fault point position in the optical fiber	OTDR (Fault Locate)	Save 3, File 4, Setup 5, History 6, 7, 8, 9, 0 Or press the ∧ and ∨ keys to select the item and press the Enter key for finalization.	
To make detailed measurement of the splice points of the optical fiber and fiber loss, etc.	OTDR (Trace Analysis)		
To measure the optical power level of the communication light	Optical Power Meter		
To use the equipment as the light source for fiber identification equipment (ID tester)	Light Source		
To check the connection of the PPPoE or DHCP To execute a Ping or trace route test To perform download throughput measurement To perform throughput measurement	IP Test (Connectivity)		Option
To measure the number of Ether frames, IP packets, and/or error frames	IP Test (Counter)		Option
To use the equipment as a visual fault locator	Visible Light Source		Option
To set date & time or power saving for the MT9080 Series	System Settings		
To read a previously measured and saved optical pulse test file	File		

OTDR (Fault Locate)	Refer to Section 1.2.6 “Measuring fault point position of optical fiber”.
OTDR (Trace Analysis)	Refer to Section 1.2.7 “Measuring distance, splice loss, and transmission loss of optical fiber”.
Optical Power Meter	Refer to Section 1.2.8 “Measuring optical power level”.
Light Source	Refer to Section 1.2.9 “Using optical light source for fiber identification”.
Visible Light Source	Refer to Section 1.2.10 “Using visible light source”.
IP Test (Connectivity)	Refer to the MT9080 Series ACCESS Master IP Network Connectivity Check Function Operation Manual.
IP Test (Counter)	Refer to the MT9080 Series ACCESS Master IP Network Connectivity Check Function Operation Manual.

The menu item display in the Top Menu and the numeric key display shown in Table 1.2.5-1 vary depending on the installed option types.
When both the IP Network Connectivity Check Function and Visible Light Source options are installed, for example, the [File] menu is not displayed in the Top Menu. In this event, select a menu item from the shortcut menu displayed by pressing F1 (Menu) when the OTDR (Fault Locate/Trace Analysis) or IP Test (Connectivity/Counter) screen is displayed, or press the shortcut key 

on the operation panel to display the file operation screen.

1.2.6 Measuring fault points of optical fiber – OTDR (Fault Locate)

(1) Full auto measurement

This function automatically measures the fault points of the optical fiber. Event positions such as splice points with loss exceeding the preset threshold or return loss are detected and listed in an event table. In addition, possible fault points of the detected events are listed. For the distance rage, pulse width, and average settings, the MT9080 Series determines and set the optimal values automatically.

1. Preparation

<1> Turn on the power. (If the power is already on, press the [Top Menu] key.)

<2> Select [OTDR (Fault Locate)] in the [Top Menu] screen. (Press the [3] key.)

2. Setting up measurement conditions and connecting optical fiber to be measured

<1> Check that [Auto] is set for Setting Mode. If the setting mode is [Manual], use the [∧], [∨] key to select the setting mode, and then press the [Enter] key to open the selection window. Use the [∧] key to select [Auto], and then finalize the setting using the [Enter] key.

<2> Check that [Auto Search] is set for Event. If it is [Fixed], change it in the same manner as Step <1>.

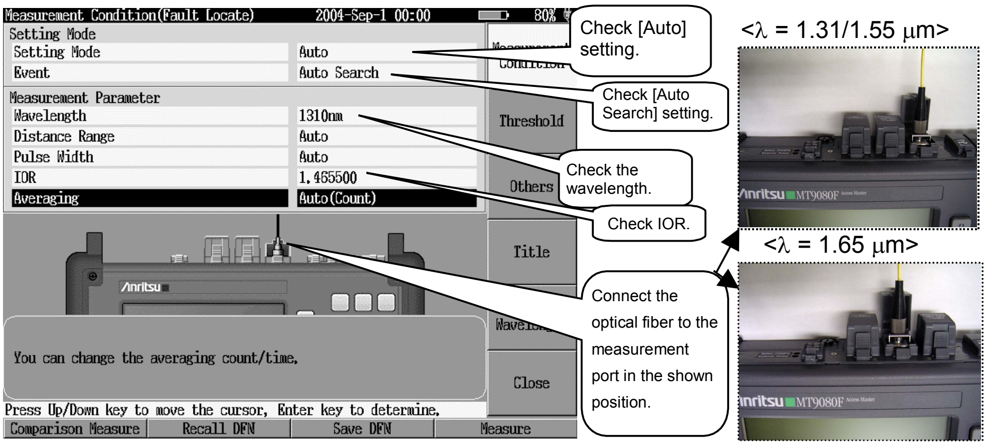
<3> Set and check the measurement wavelength.

<4> Check IOR (Index of Refraction).
By factory default, the IOR values are 1.4655 (1.31 μm), 1.4661 (1.55 μm), and 1.4665 (1.65 μm).

<5> Connect the fiber to be measured to the measurement port currently being displayed on the screen.

Note:

Be sure to clean the end surface of the optical connector before connection.



3. Setting threshold

The threshold is the value at which the MT9080 Series automatically detects event positions, such as splice or break points, from the measurement waveform.

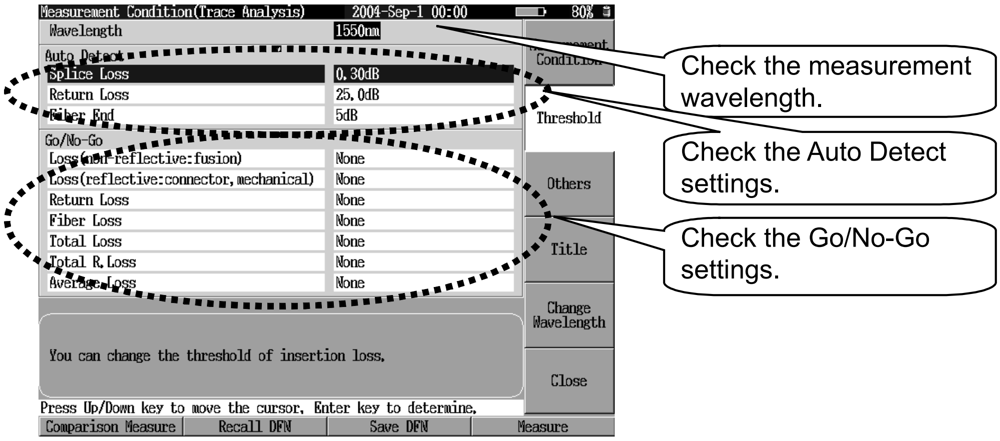
Auto Detect: Automatically detects the splice points, etc., exceeding this value, and lists them in an event table.

Go/No-Go: If an event listed in the above event table exceeds the threshold, the measured results will be highlighted.

<1> Press [f2] (Threshold) on the Measurement Condition screen.

<2> Set [Auto Detect]. To set it, use the [∧], [∨] and [Enter] keys. (Numeric keys can also be used.)
You can set different thresholds for different wavelengths. Press [f5] (Change Wavelength) to set/check values for each of the wavelengths.
<Setting example: Factory default (initial setting)>
Splice Loss: 0.30 dB
Return Loss: 25.0 dB
Fiber End: 5 dB

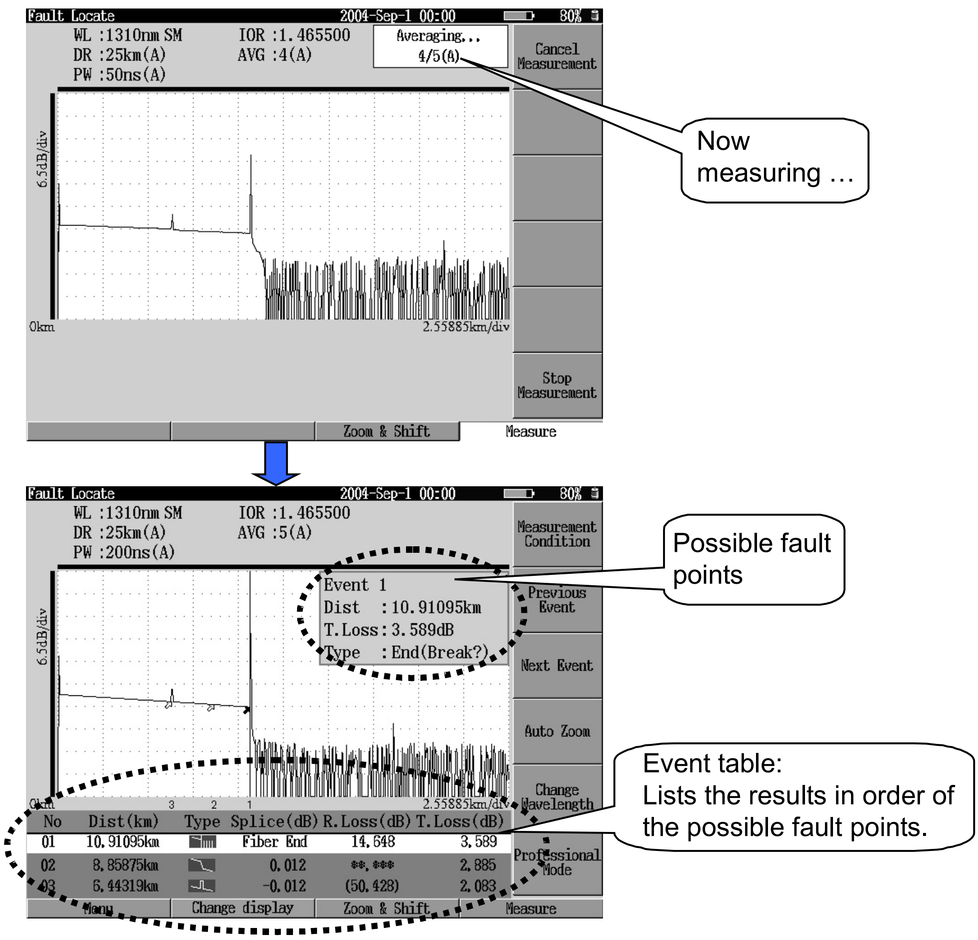
<3> Set Go/No-Go.
You may skip this setting. All of the settings are [None] by factory default.



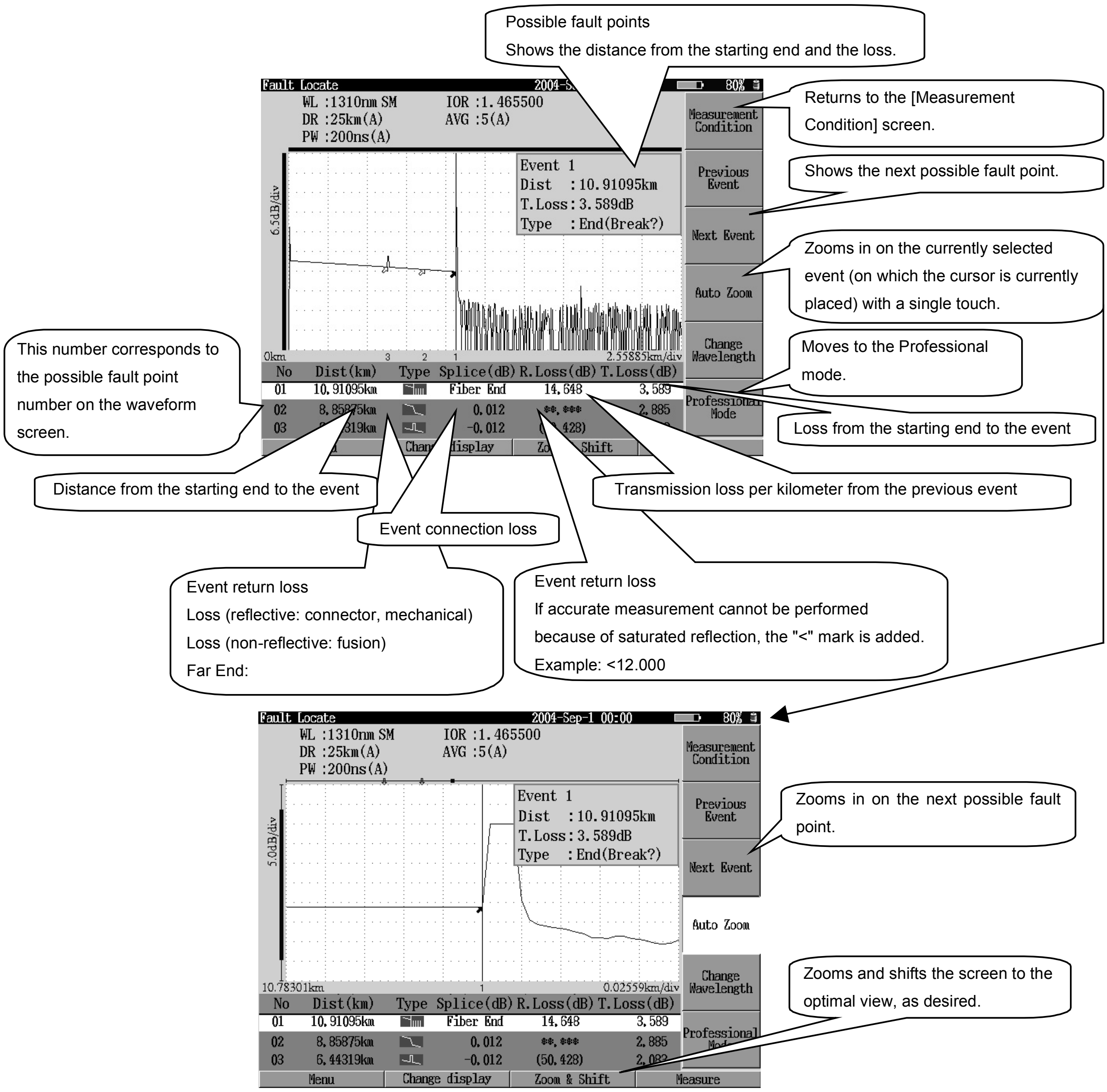
4. Measurement

<1> Press F4 (Start).

The MT9080 Series automatically sets the optimal distance range, pulse width, and averaging time (count) and performs the measurement. Once measurement finishes, the event table and possible fault points are shown.



5. Interpreting measured results shown on Fault Locate screen



Note:

Although an event including a possible fault point is detected automatically, its measured results are not guaranteed. The automatically detection function has its limits, and may cause erroneous detection or detection failure. The user should make the final decision for the measured results by observing the waveform.

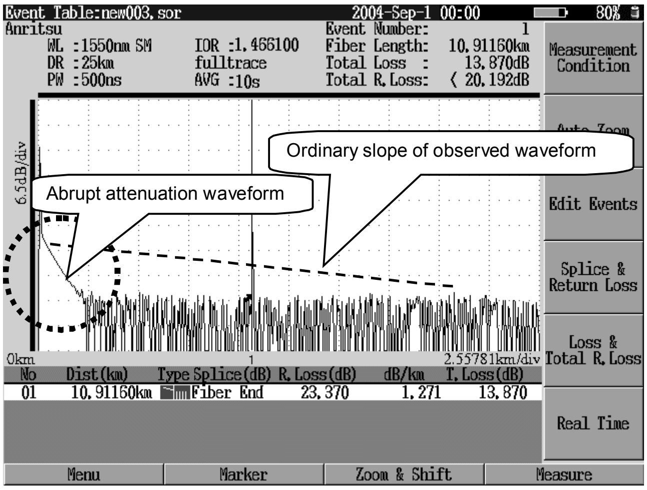
To edit an event, set a marker on the waveform to measure the loss, or make real-time (preview) measurement, change the mode to OTDR (Trace Analysis) before measurement.

6. Example where no accurate measurement has been performed

<Example 1> Symptom: Disabled measurement (abrupt attenuation is displayed from the measuring port).

Cause <1> The optical connector is not connected properly.

Cause <2> A breakage was found at the near end of the optical fiber.

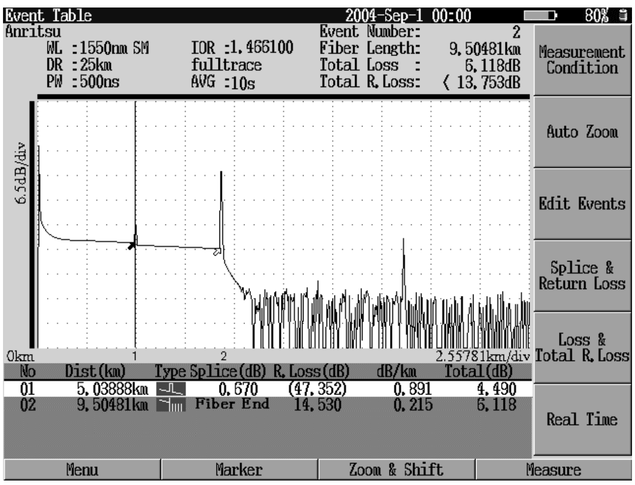


<Example 2> Symptom: The waveform at the near end is drawn in a trailing skirt.

Cause <1> An optical connector with a return loss of 30 dB or less is being used.

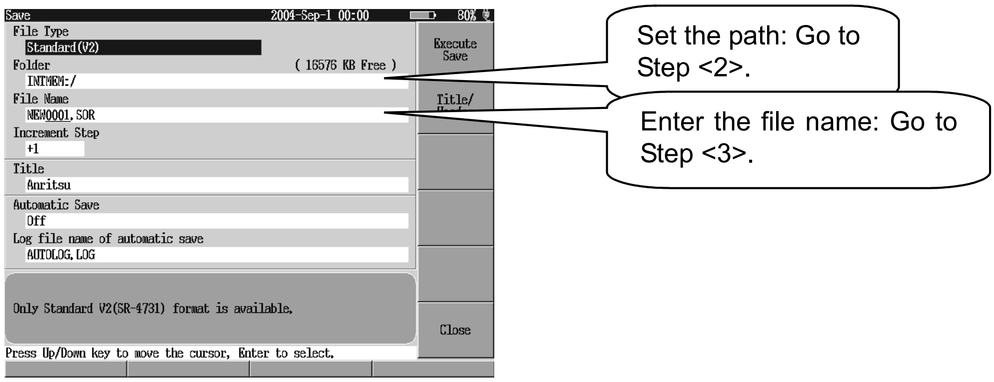
Cause <2> The optical connector has dust on its surface.

Cause <3> A breakage was found at the near end of the optical fiber.



7. Saving measured results

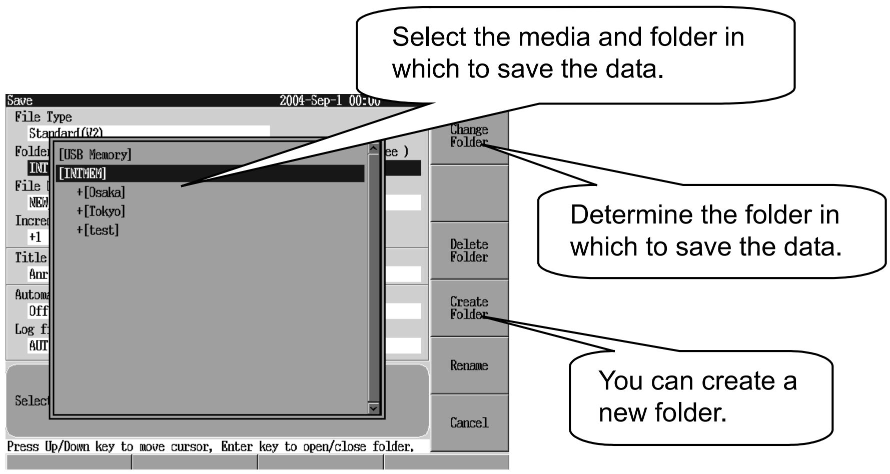
<1> Press the Save key or press F1 (Menu) to display the shortcut menu, use the ∧ and ∨ keys to select [Save File], and press the Enter key. The Save screen opens.



Use the ∧ and ∨ keys to select the item to be set or changed, before pressing the Enter key.

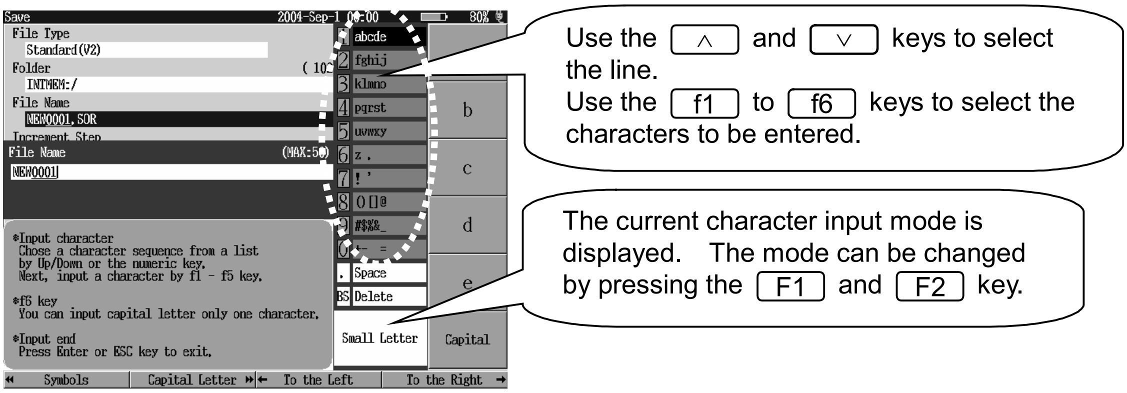
<2> Define the folder.

Folder is a location (directory) in which files are saved. Use the ∧, ∨ and Enter keys to select the storage media (internal memory or USB memory) in which to save the waveform data. Then, press f1 (Change Folder) to determine it.

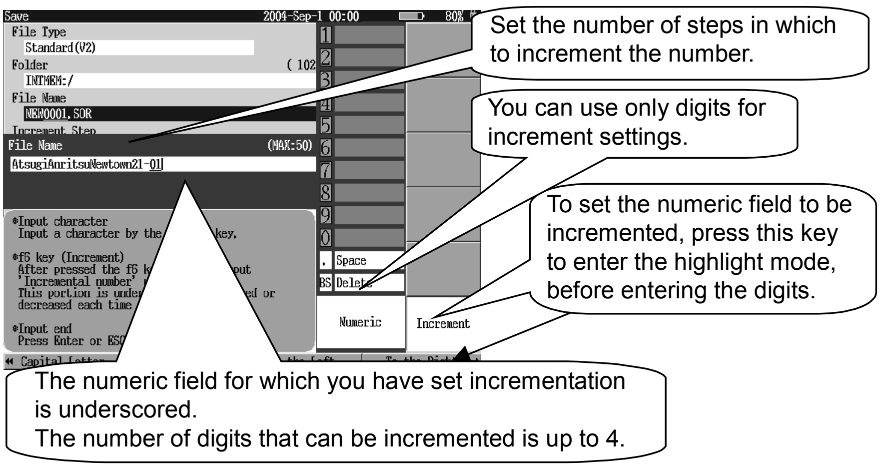


<3> Enter the file name.

The character input mode (character types: numbers, capital or small letters, symbols) can be changed using the F1 and F2 keys. Use the ∧, ∨ and f1 to f6 keys to select the character input mode.

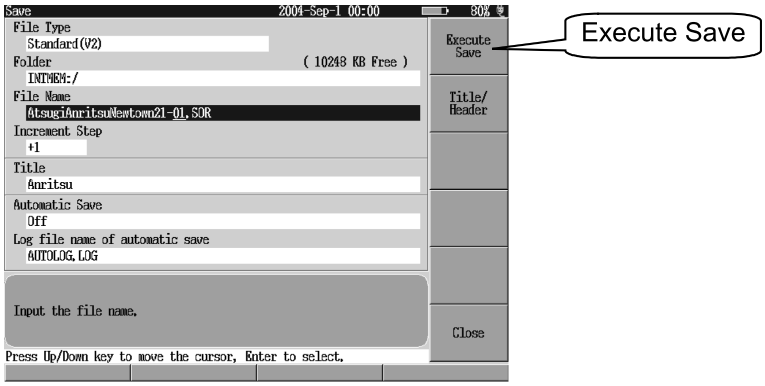


Using numbers for part of a file name, you can set up a feature that increments that number each time the file is saved. For example, suppose that you want to make measurements for 32 core optical fibers, and save the files under the file names "Atsugi Anritsu New Town 21-01" to "Atsugi Anritsu New Town 21-32", respectively. By setting the incrementing feature for the portion of the "01" field of the first file, it is incremented to 01, 02, 03, and so on each time you save a new file. The incrementation step can also be set.



<4> Save

Confirm the contents of the screen and press f1 (Execute Save).



(2) Manual setting measurement

This function automatically measures the fault points of the optical fiber in the same way as [Auto] setting measurement.

The difference from [Auto] setting measurement is that the user can set the distance range, pulse width, and averaging settings manually.

<1> Setting the distance range: Set this to a value longer than that of the optical fiber to be measured.

<2> Setting the pulse width: The valid range of the pulse width varies depending on the distance range.
Pulses with a smaller width are higher in spatial resolution and useful for short distance measurement. Pulses with a larger width are useful for long distance measurement, though the spatial resolution is poor.

<3> Setting the averaging: When you set a larger value for the averaging, the measurement takes longer though the signal-to-noise (S/N) ratio (amount of noise on the waveform) improves.

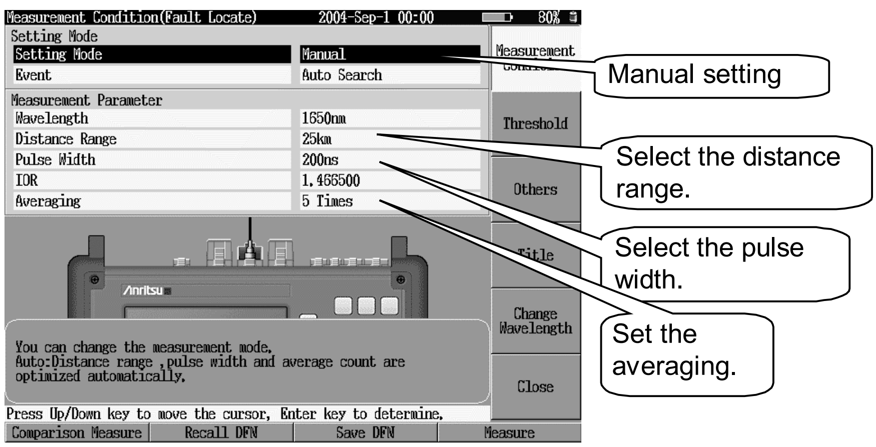


Fig. 1.2.6-1 Manual setting

1.2.7 Measuring distance, splice loss, and fiber loss of optical fiber – OTDR (Trace Analysis)

The following table summarizes the main differences between the Fault Locate and Trace Analysis modes.

Table 1.2.7-1 Fault Locate and Trace Analysis modes

Function	Fault Locate mode	Trace Analysis mode
Display Possible Fault Points	Available	Not available
Event Table	Available	Available
Event Edit	Not available	Available
Real-time Sweep	Not available	Available
Manual Measurement [Splice & Return Loss] [Loss & Total R. Loss]	Not available	Available
Set Measurement Conditions Individually	Partially available	Available

<Operation Procedure>

1. Turn on the power. (If the power is already on, press the Top Menu key.)
2. Select [OTDR (Trace Analysis)] in the [Top Menu] screen. (Press the 4 key.)
3. The [Event Table], [Splice & Return Loss] or [Loss & Total R. Loss] screen appears.
   (This depends on the screen associated with the previously selected mode.)

   Event Table: Automatically measures the distance, splice loss, fiber loss, and other attributes of the optical fiber. Event positions such as splice points with splice loss exceeding the preset threshold or return loss are detected, and listed in an event table.

   Splice & Return Loss: Allows the user to set a marker (on the waveform), which can be used to measure the splice or return loss of the splice point or other items.

   Loss & Total R. Loss: Allows the user to set a marker (on the waveform), which can be used to measure the loss or return loss between two points.

(1) Event table

1. Interpreting the measured results

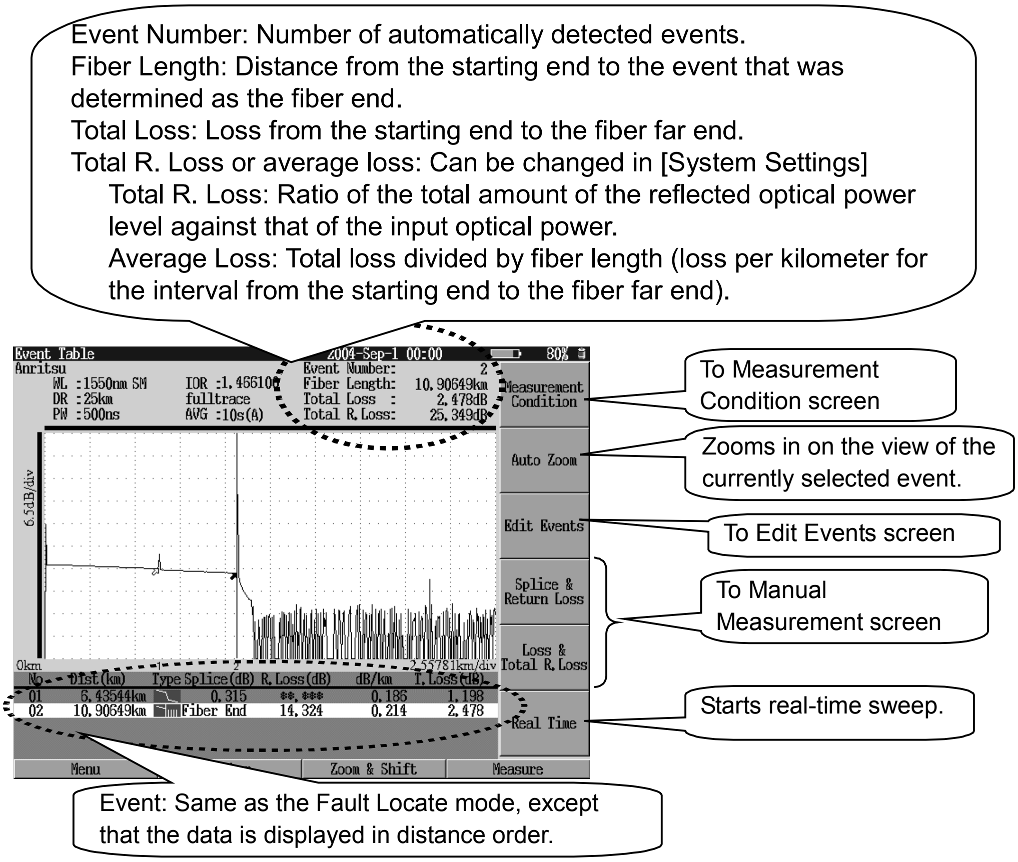


Fig. 1.2.7-1 Event Table screen

2. Measurement Condition

The Trace Analysis mode allows you to set detailed measurement parameters.

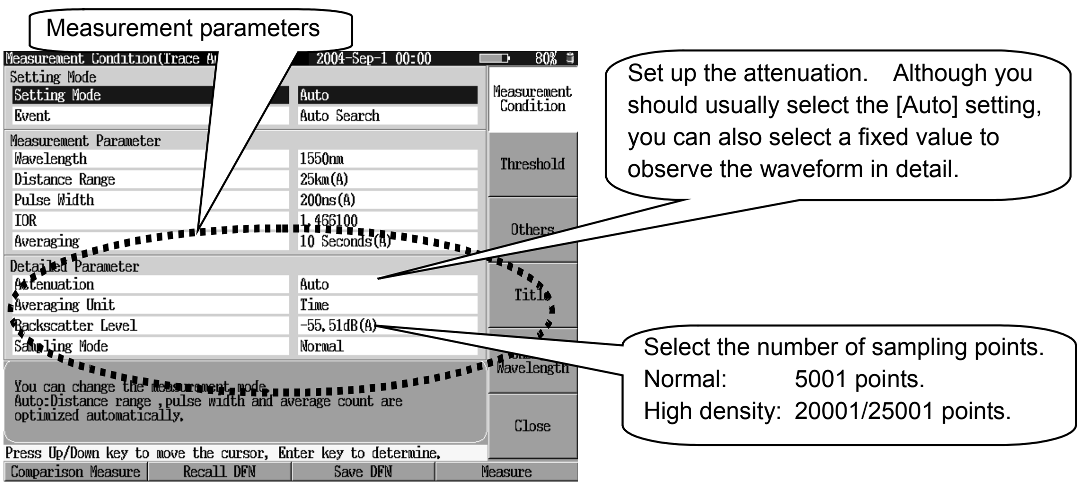


Fig. 1.2.7-2 Measurement Condition (Trace Analysis) screen

3. Edit Events

For example, when the MT9080 Series failed to detect splice points or caused erroneous detection, you can edit (e.g., add, move, or delete) the event table while checking the waveform.

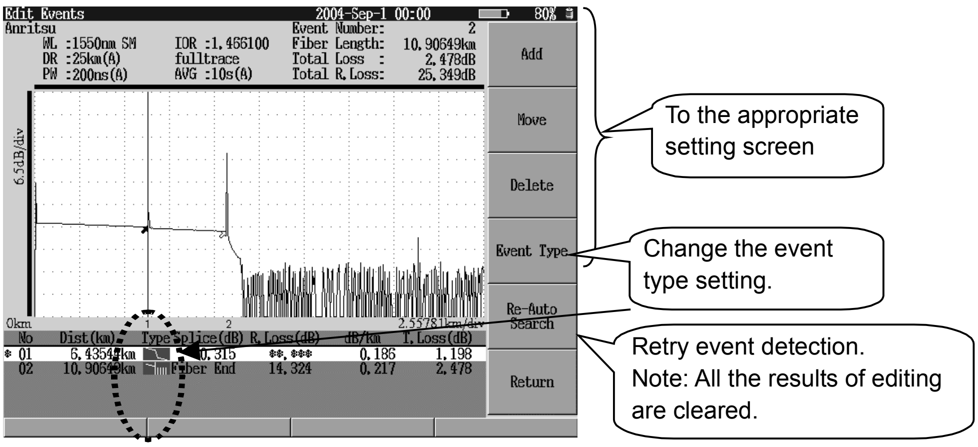


Fig. 1.2.7-3 Edit Events screen

4. Fix Events

After completion of event editing, you can fix the positions of the detected events. If measurement works in the [Fixed] condition, the position is detected as an event even if no threshold has been exceeded. This function is useful if splice points are located in the same position on all the optical fibers, like multi-core fibers. (Set [Event] to [Fixed] on the Measurement Condition screen.)

<Operation Procedure (example)>

1. When measurement is made for the first core: Set [Auto Search].
2. Modify the measured results using the Edit Events function. (For example, deleting erroneously detected splice points, or adding those not detected.)
3. Set [Event] to [Fixed].
4. Make measurements for the second and subsequent cores of the optical fiber.

(2) Manual measurement ([Splice & Return Loss] and [Loss & Total R. Loss])

By pressing [f4] [Splice & Return Loss] or [f5] [Loss & Total R. Loss] on the Event Table or Auto Zoom screen, you can set a marker in any position on the waveform and perform various measurements manually.

Splice & Return Loss:	Allows the user to set a six-point marker, which can be used to measure the splice or return loss of the splice point or other items.
Loss and Total R. Loss:	Allows the user to set a two-point marker, which can be used to measure the loss (or distance) and return loss between two points.

1. Splice and Return Loss

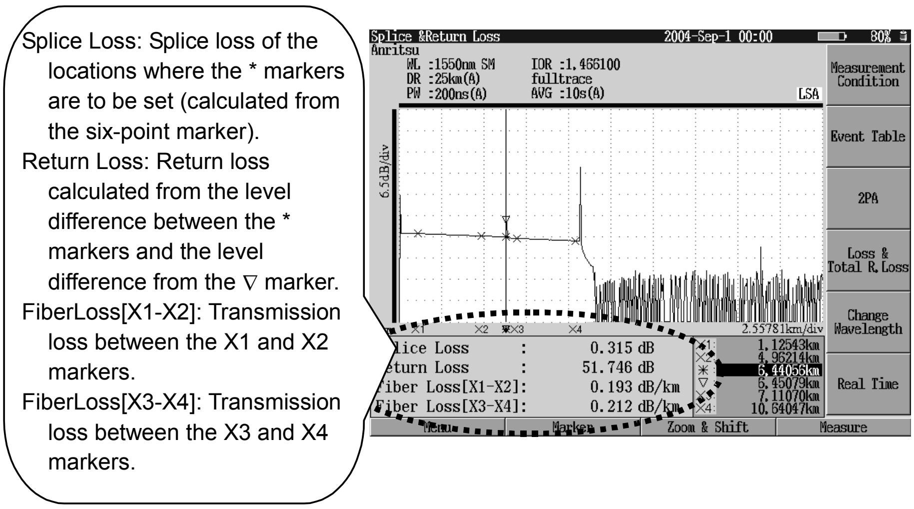


Fig. 1.2.7-4 Splice & Return Loss screen

<Marker Moving/Setting Procedure>

1. Press [F2] (Marker).
2. Press [f3] (Next Marker) to place the cursor on the desired marker position.
3. Move the marker using the [∧] and [∨] keys.

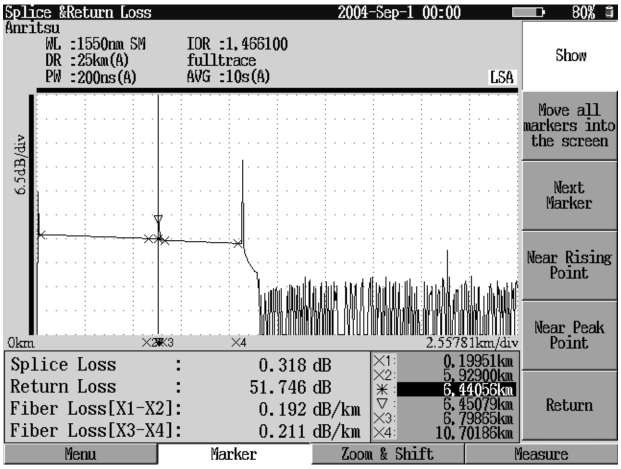


Fig. 1.2.7-5 Moving/setting marker screen

<Setting Procedure for Six Markers>

1. Set the * marker at the point where the event occurred.
2. Set the X1 and X2 markers to the left of the event point. (Determining the slope of the loss located in front of the event)
3. Set the X3 and X4 markers to the right of the event point. (Determining the slope of the loss located behind the event)
4. If Fresnel reflection occurs, set the ∇ marker at the peak.

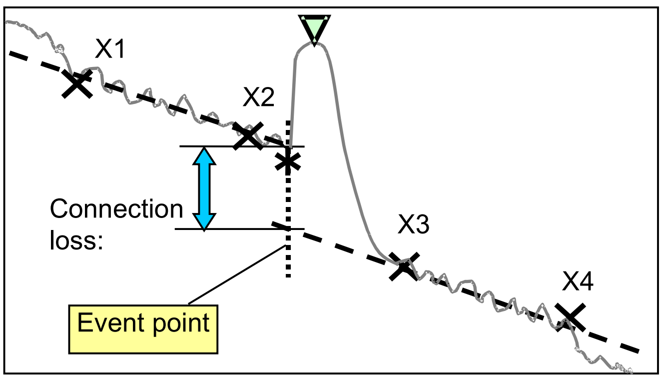


Fig. 1.2.7-6 Setting a marker in Splice & Return Loss

2. Loss & Total R. Loss

Dist: Distance between the X and * markers.
Loss: Loss between the X and * markers.
FiberLoss: Transmission loss between the X and * markers. Loss divided by time.
TORL: Return loss calculated from the integral value of the withstanding voltage between the X and * markers.

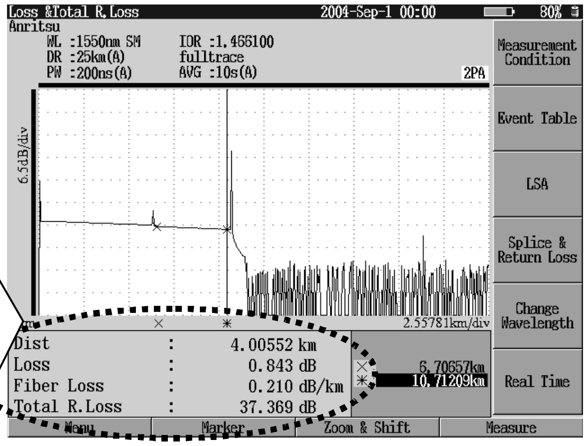


Fig. 1.2.7-7 Loss & Total R. Loss screen

1.2.8 Measuring optical power level (Optical Power Meter)

<Operation Procedure>

1. Select [Optical Power Meter] in the Top Menu screen and press the [Enter] key. (Or, press the [5] key.)
2. Press [f1] (Change Wavelength) to select the measurement wavelength.

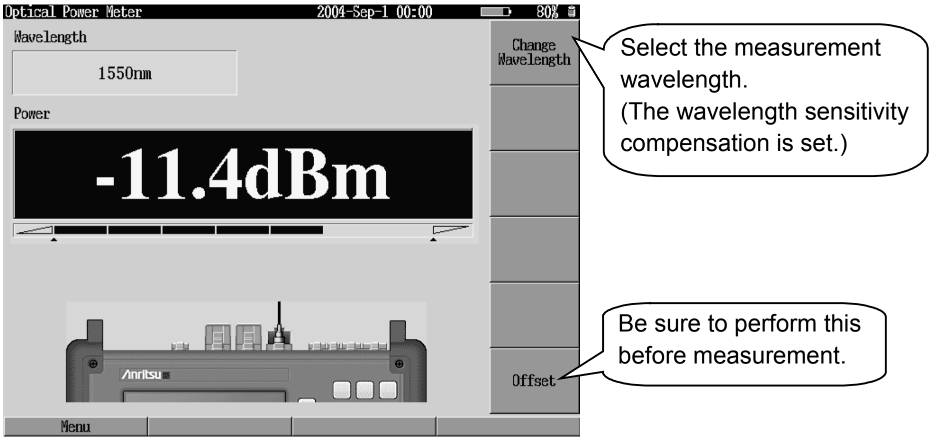


Fig. 1.2.8-1 Optical Power Meter screen

3. Press [f6] (Offset).

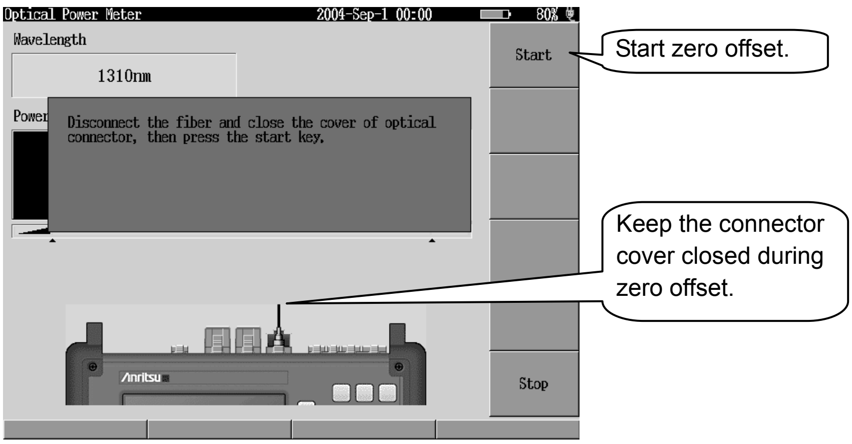
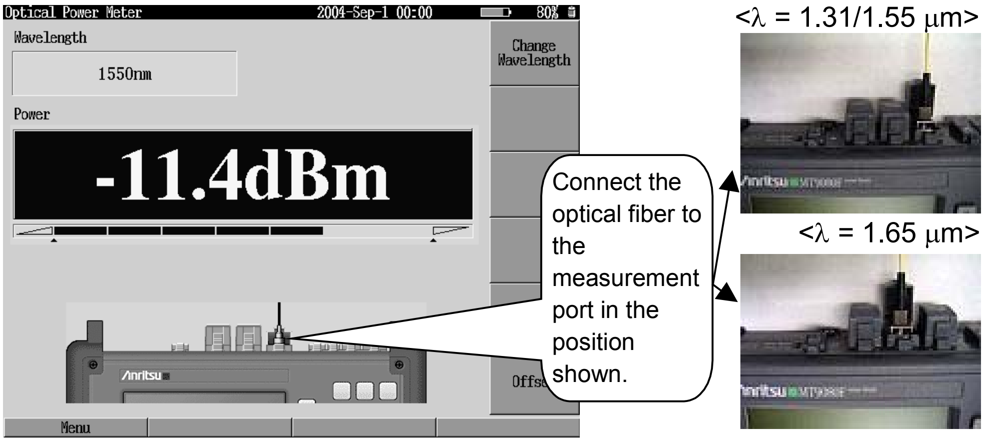


Fig. 1.2.8-2 Zero offset message

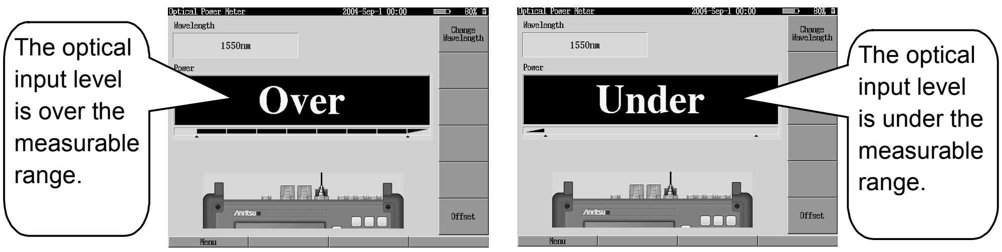
4. Close the connector cover of the measurement port and press [f1] (Start).

5. Connect the optical fiber to be measured to the measurement port shown on the screen.



(a) (b) MT9080F

Fig. 1.2.8-3 Optical Power Meter screen and measurement port connection



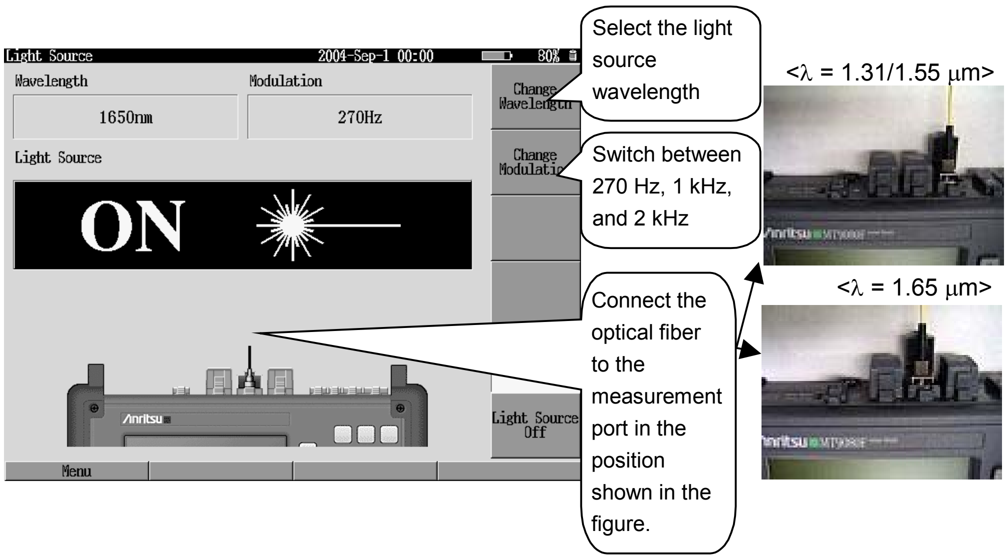
(a) (b)

Fig. 1.2.8-4 Measured results screen displayed when optical input level is outside measurable range

1.2.9 Using optical light source for fiber identification

<Operation Procedure>

1. Select [Light Source] in the Top Menu screen and press the Enter key. (Or, press the 6 key.)
2. Press f1 (Change Wavelength) to select the wavelength to be used for measurement.
3. Press f2 (Change Modulation) to select the modulation frequency. CW can also be selected for the MT9081x.
4. Press f5 (Light Source On) to turn on the light source.
5. Press f6 (Light Source Off) to turn off the light source.



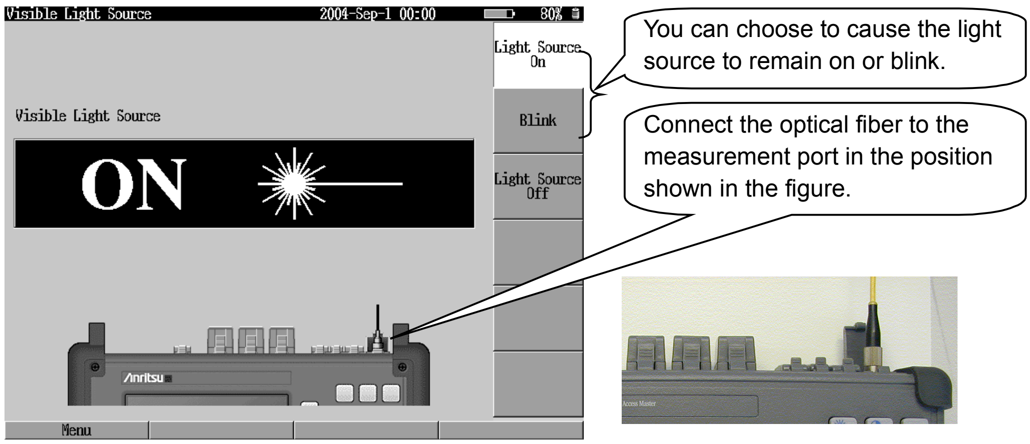
(a) (b)

Fig. 1.2.9-1 Light Source screen and measurement port connection

1.2.10 Using visible light source (option)

<Operation Procedure>

1. Select [Visible Light Source] in the Top Menu screen and press the Enter key. (Or, press the 7 key.)
2. Press f1 (Light Source On) to turn on the light source.
3. Press f2 (Blink) to cause the light source to blink.
4. Press f3 (Light Source Off) to turn off the light source.



(a) (b)

Fig. 1.2.10-1 Visible Light Source screen and measurement port

Notes:

1. The equipped position of the visible light port varies depending on the hardware version of the MT9080 Series (Fig. 1.2.10-1 shows the ports for the unit with the hardware version 2 or later). Refer to Section 8.4 "Self Test Function" for checking the hardware version.

2. Connect the optical fiber to the measurement port in the position shown in the figure.

1.2.11 Using IP Network Connectivity Check Function (option)

Refer to the MT9080 Series ACCESS Master IP Network Connectivity Check Function Operation Manual for the operation procedure.

Section 2 Before Use

This section describes information you require before using the MT9080 Series. In particular, it details how to use the battery pack. The section also describes how to set up the peripheral equipment.

The items displayed in the ☐ in this section indicate panel keys.

2.1 Components

2.1.1 Standard components

The table below lists the standard components of the MT9080 Series ACCESS Master. After unpacking, check that all the components listed in the packing list are in the package. If you find any missing or broken components, swiftly contact Anritsu or our sales dealer.

Table 2.1.1-1 Standard configuration

Item	Product name	Qty.	Model or ordering No.	Remarks
Body	ACCESS Master	1	MT9080A/B/C/D/E/F MT9081A/B/C/D/E/F/ A1/B1/C1/D1/E1/F1	
Accessories	Packing list Battery pack Operation manual AC adapter Power cord	1 1 1 1 1	 DR15SBA W2487AE SA165A-1250V-3	Stored in accessory box CD-ROM version

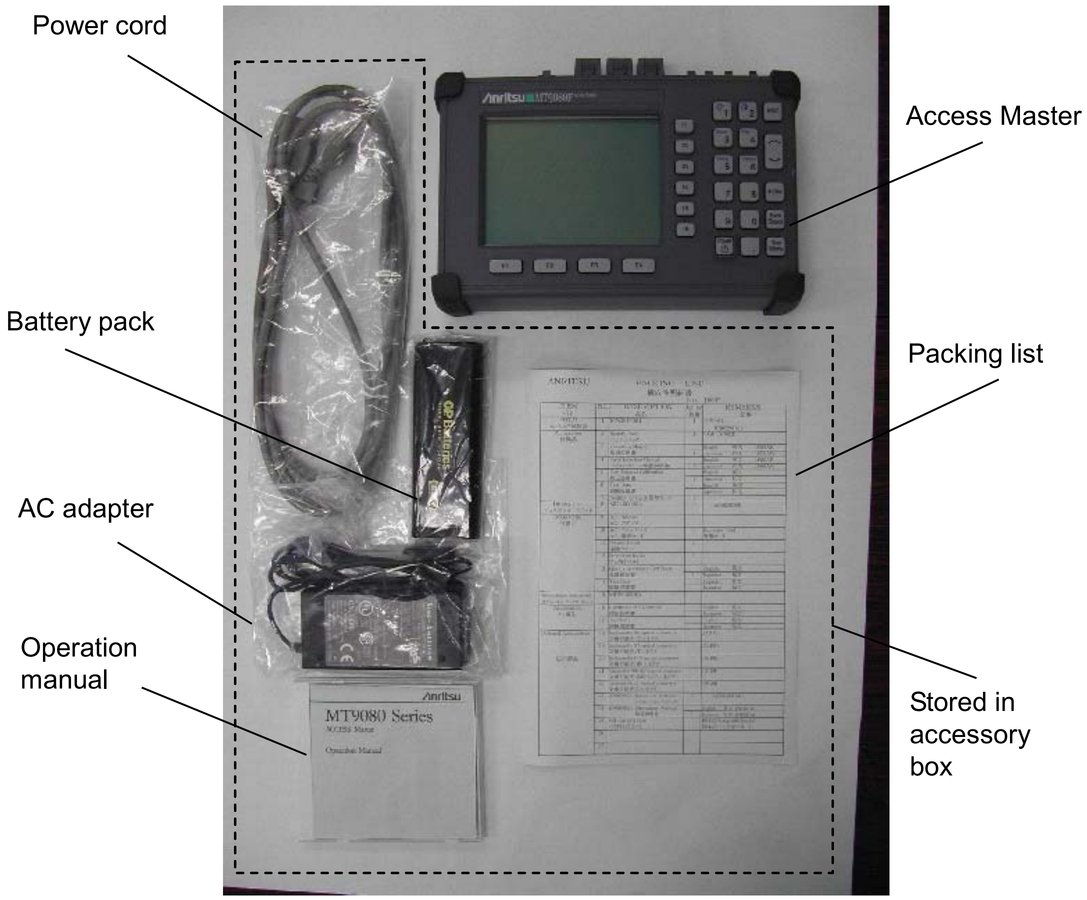


Fig. 2.1.1-1 ACCESS Master and accessories

2.1.2 Options

The options below are available for the MT9080 Series. You can select the desired options. Note that when you need to install an option in the MT9080 Series, the unit may need to be delivered to an Anritsu factory. For the standards, refer to Appendix A “Specifications”.

Visible Light Source (Option No. 02 or 002)

Allows you to get visual information about faults in the optical fiber.
To install this option, the MT9080 Series needs to be delivered to an Anritsu factory.

IP Network Connectivity Check function (Option No. 001)

Allows you to check connectivity with the network. To install this option, the MT9080 Series needs to be delivered to an Anritsu factory.
In addition, the 1000BASE-T functions become available by installing the 1000BASE-T Interface Addition option (Option No. 011).

Note:

When using an MT9080 Series unit with the hardware version 2 or later, both the visible light source function and IP network connectivity check function can be installed together. Refer to Section 8.4 “Self Test Function” for checking the hardware version.

Optical connectors (Option No. 33, 37 to 40, 43, or 033, 037 to 040, 043)

These designate the following measurement ports of the MT9080 Series:
-33: LC, -37: FC, -38: ST, -39: DIN, -40: SC, -43: HMS-10/A
-033: LC, -037: FC, -038: ST, -039: DIN, -040: SC, -043: HMS-10/A
All the connectors are PC connectors.

Key character displays (Option No. 08, 09, or 008, 009)

These designate the language in which characters are represented on the key panel.
-08: Japanese; -09: English
-008: Japanese; -009: English

Protector (Option No. 10 or 010)

Useful for outdoor use. Provides a protective cover on the front panel and a shoulder cover.

Note:

Options with two-digit option number are for the MT9080 and options with three-digit option number are for the MT9081, except for Option 001 that is common to both the MT9080 and the MT9081.

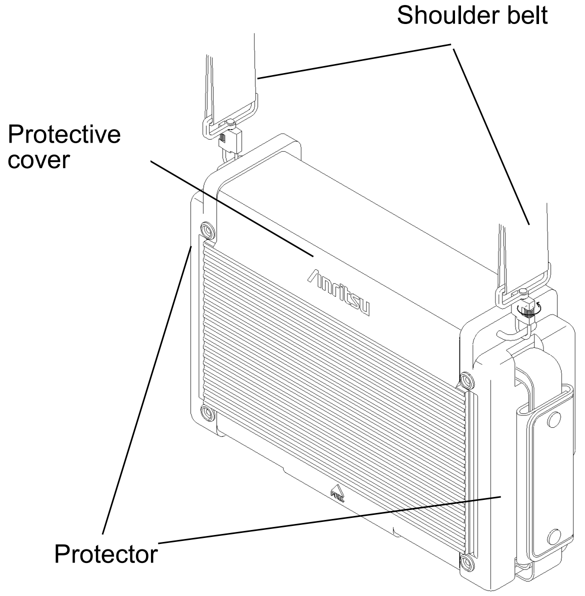


Fig. 2.1.2-1 Protector installation drawing

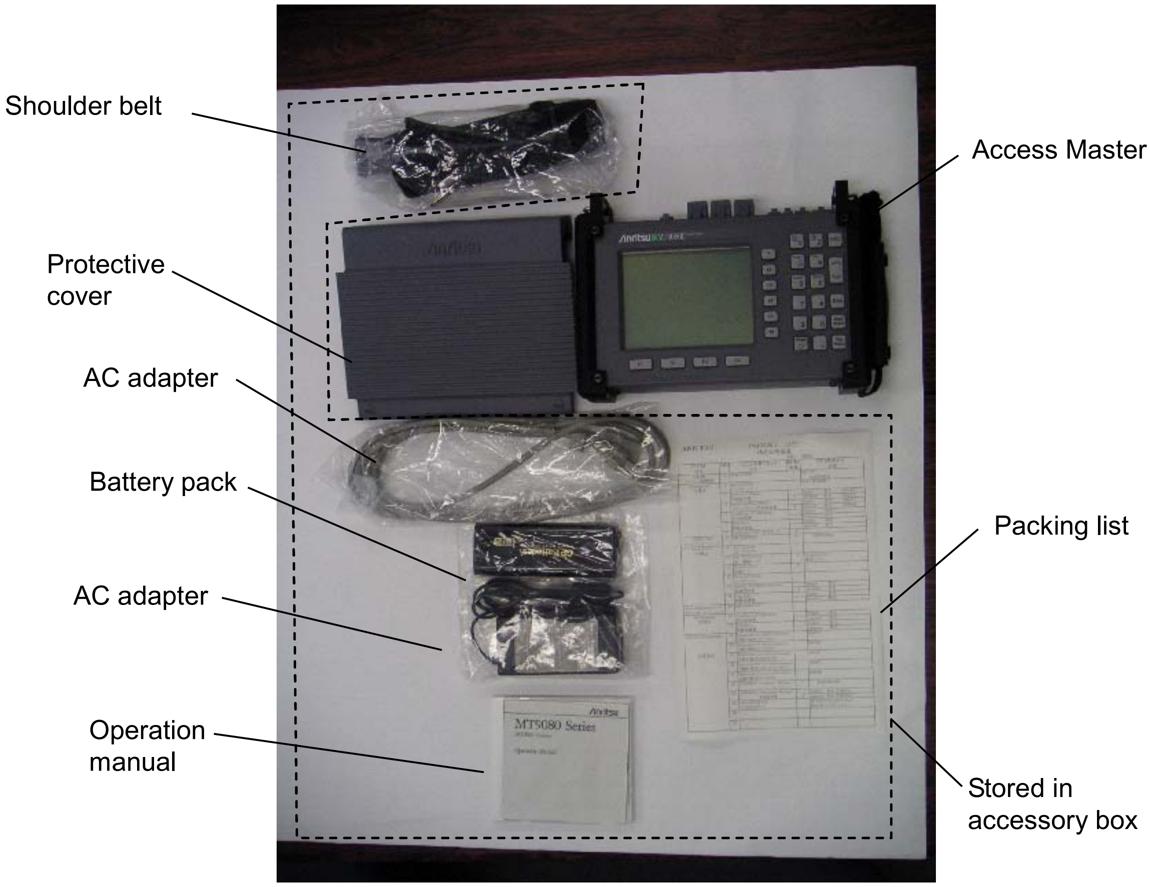


Fig. 2.1.2-2 ACCESS Master and accessories (including optional protector)

2.2 Power Supply Connection

Connecting the AC adapter

The AC adapter used must be the one supplied with the MT9080 Series. Use of another adapter may damage the MT9080 Series or battery pack. When using the AC adapter, connect it as shown below and plug the power plug into the AC outlet.

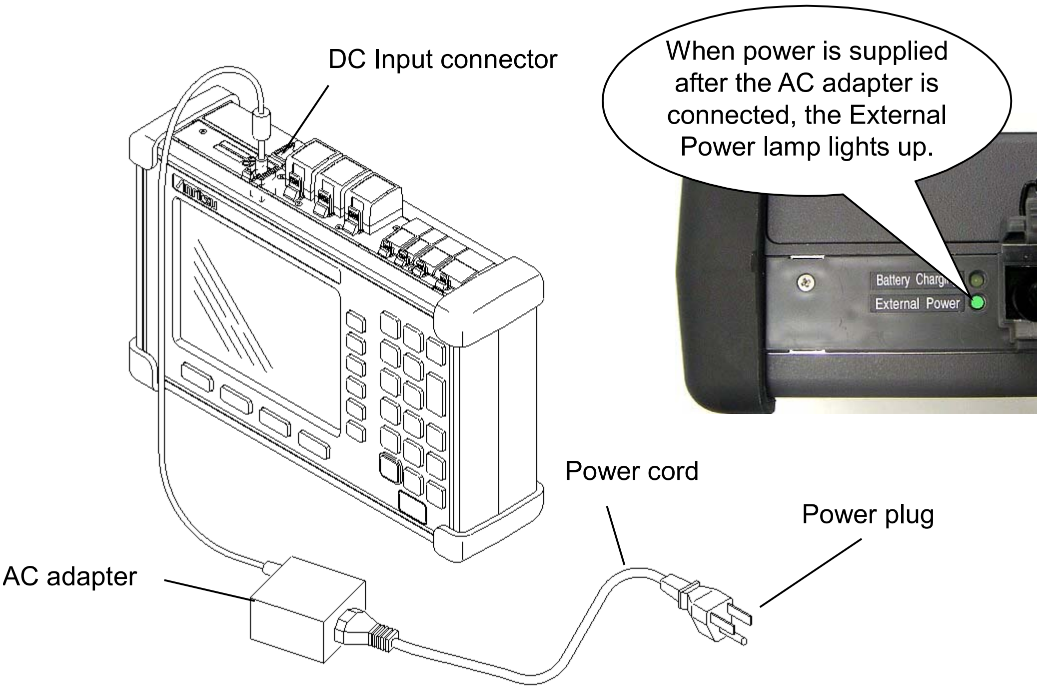


Fig. 2.2-1 AC adapter connection drawing

CAUTION ⚠

The power plug used must be tripolar. If you do not have 3-pole power socket, use a conversion connector to use the socket as a bipolar socket with the ground line securely connected to the ground. If the ground line is not connected to the ground, the MT9080 Series may malfunction or you may receive an electric shock.
In addition, the supplied AC adapter is designed only for use with the ACCESS Master. If you use it for another type of equipment or use another AC adapter for the MT9080 Series, the MT9080 Series may malfunction or cause a fire.

2.3 Battery Pack

2.3.1 Installing battery pack

This section describes how to install the battery pack in or remove it from the MT9080 Series.

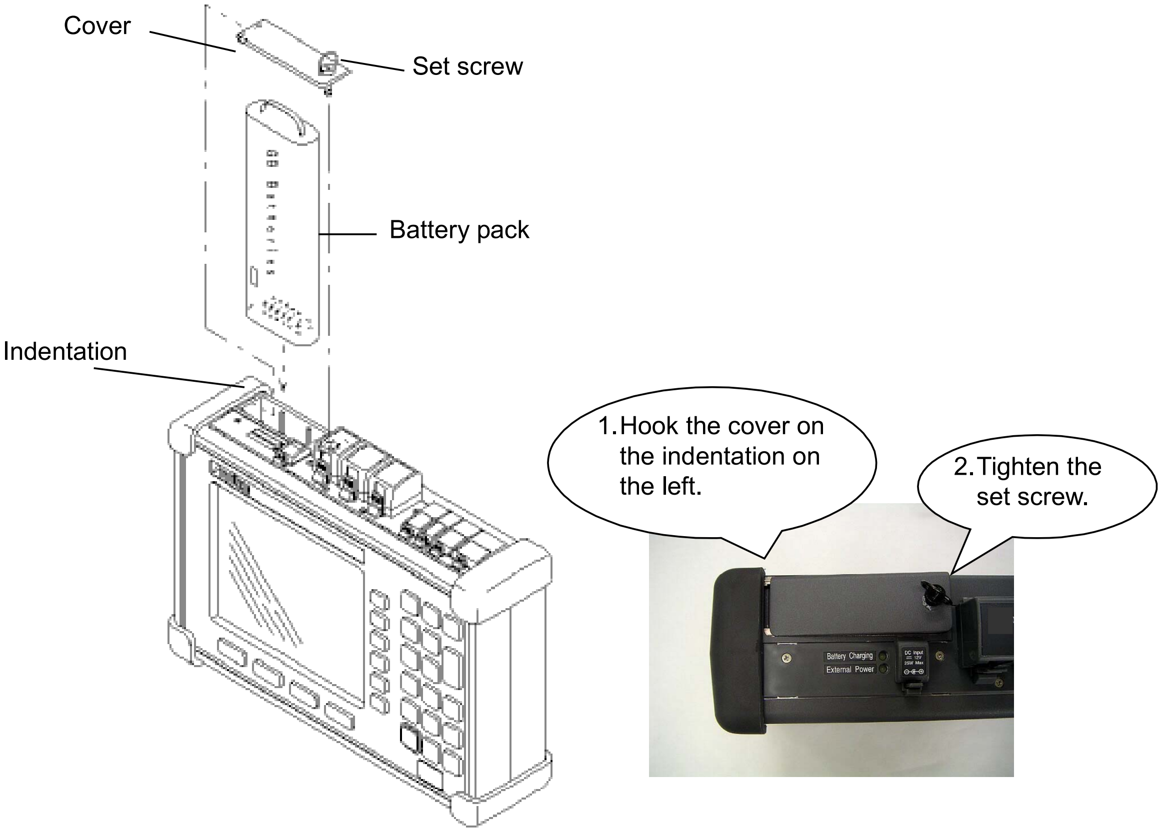


Fig. 2.3.1-1 Battery pack installation drawing

<Battery Pack Installation Procedure>

1. Insert the battery pack into the MT9080 Series. (Place the pack in the direction shown above.)
2. Set the cover in place. Hook the cover on the indentation shown on the left in the above photograph.

CAUTION ⚠

Tighten the cover screws securely. Otherwise, the battery pack may fly out and you may be injured, or the pack may be damaged while you are using the MT9080 Series.

<Battery Pack Removal Procedure>

1. Loosen the cover screws to remove the cover.
2. Pull out the battery pack.

CAUTION

Be sure to keep the power off when removing the battery pack. The battery pack and/or MT9080 Series may be damaged if the power is on while you are removing the pack.

2.3.2 Charging battery pack

When a new battery pack is used, the full performance is obtained only after the full charging/discharging cycle is performed three to five times. Every battery pack for the ACCESS Master has been subjected to the full charging/discharging cycle three or more times in the factory.

Because the battery pack you receive has been fully discharged, recharge it before use.

(1) Charging a battery pack that has been left in the MT9080 Series

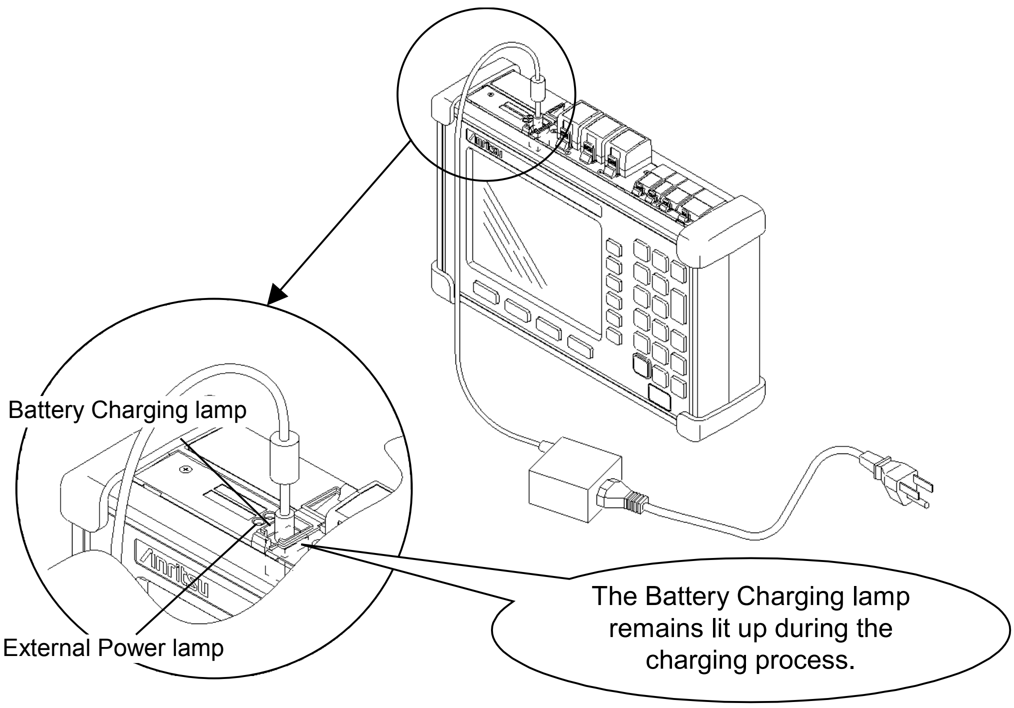


Fig. 2.3.2-1 Charging battery pack

<Battery Pack Charging Procedure>

1. Turn off the power to the MT9080 Series.
2. Connect the supplied AC adapter to the DC Input connector of the MT9080 Series. Plug the power plug into the outlet. Refer to Fig. 2.3.2-1.
3. High-speed charging starts, and the Battery Charging lamp lights up in green.
4. Charging finishes in about three hours. After completion, the Battery Charging lamp goes out.
5. Remove the AC adapter from the MT9080 Series and outlet.

Notes on charging

- To charge the battery pack fully, keep the MT9080 Series at an ambient temperature of 0 to 30°C and keep the power off during the charging process. Even while the battery pack is left installed and used with the power on, charging occurs. In this case, it stops after three hours. Also when charging is attempted at an ambient temperature higher than the specified value, it may stop before the pack is fully charged. This is because the temperature in the battery pack may rise above the upper limit during high-speed charging.
- After completion of high-speed charging, the Battery Charging lamp goes out. However, a trickle charge (a charge by very low current) continues as long as the AC adapter is left connected to the MT9080 Series.
- If the battery pack has been over-discharged, high-speed charging may not start until trickle charging has occurred for several hours. If the Battery Charging lamp does not light up even if you connect the AC adapter, leave it as is for several hours and remove the AC adapter once before reconnecting it.
- The battery pack must not be charged for more than 24 hours. Overcharging the battery pack may shorten its life.

(2) Using the external charger (optional, related product) to charge battery packs

With the optional external charger, up to two battery packs can be charged consecutively. (One battery pack can be charged at a time. When two battery packs are installed, charging of the second battery pack begins immediately after the first one has been charged.)

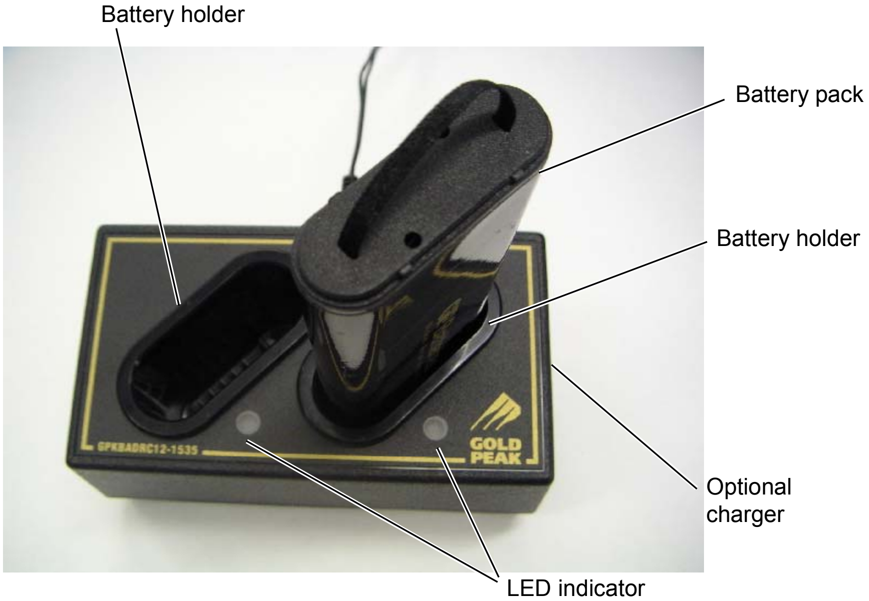


Fig. 2.3.2-2 External charger

<Battery Pack Charging Procedure>

1. Connect the external charger to the AC adapter supplied with the external charger, which differs from the ACCESS Master AC adapter supplied with the MT9080 Series.
2. Remove the battery pack from the MT9080 Series and plug it into the battery holder of the external charger.
3. When normal charging starts, the LED indicator lights up in red.
4. Charging finishes after about two hours. Once charging finishes, the LED indicator turns green.
5. Remove the battery pack from the battery holder of the external charger.

Notes on charging

- Perform charging at an ambient temperature of 0 to 30°C.
- Each battery holder of the external charger is provided with an LED indicator that indicates the current charged condition. As the battery pack is charged, the LED color changes.

Off:	The battery pack is not connected to the battery holder.
Red:	The battery pack is being charged.
Green:	The battery pack has been fully charged.
Yellow:	The battery pack is ready for charging, or the battery pack temperature is not in the specified range, i.e., is above 45°C or under 0°C.
Blinking red:	One of conditions 1) to 3) below: 1) The charging time has exceeded four hours. 2) A short circuit at the electrode has occurred. 3) The battery pack is faulty.

2.3.3 Checking remaining battery quantity

The remaining battery quantity can be checked from either the indicator on the battery pack or the indication on the screen of the MT9080 Series.

Checking the remaining quantity from the battery pack indicator

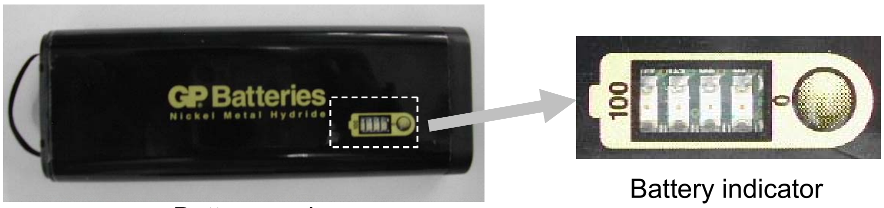
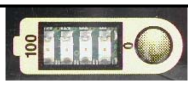
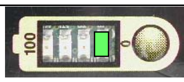
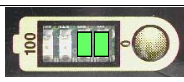
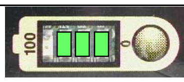
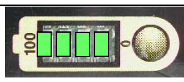


Fig. 2.3.3-1 Remaining battery quantity

Table 2.3.3-1 Battery pack LED indication and remaining quantity

LED state	Remaining battery quantity (guide)
	0 to 5%
	5 to 25% (The LED flashes at 5 to 10%.)
	25 to 50%
	50 to 75%
	75 to 100%

The battery pack has an installed battery indicator (for the remaining quantity indication) that is implemented with four LEDs. When you press the portion "" indicated in Fig. 2.3.3-1 above, the LED(s) light up for about 5 s. You can check the remaining battery quantity from the number of LEDs that light up.

Checking the remaining battery quantity on the MT9080 Series screen

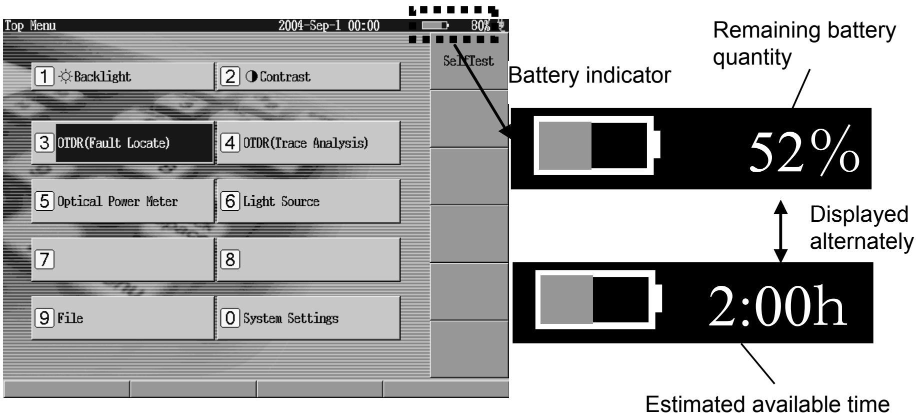
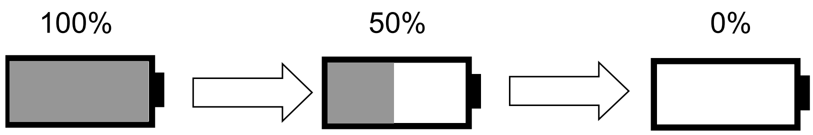


Fig. 2.3.3-2 Checking remaining battery quantity

You can check the remaining battery quantity using the bar-shaped battery indicator located at the upper right corner of the screen (see Fig. 2.3.3-2). If the whole battery indicator is entirely gray, it indicates that the battery has been charged fully (100%). As the battery is discharged, the gray field lessens.



The remaining battery quantity is expressed numerically on the right of the battery indicator. This field alternately displays the remaining battery quantity in percent (%) and the estimated available time (h) forecast from the average power consumption over the previous 1-minute period.

When the remaining battery quantity falls below 10%, the battery indicator flashes.
When the remaining battery quantity falls below 3%, the buzzer sounds and the following message appears: "The battery is running low. Please connect the AC adapter to charge it."
When the remaining battery quantity falls below 1%, the power goes off automatically after the following message appears: "Battery is empty.".

Notes:

1. The remaining battery quantity and estimated available time values cannot be guaranteed. The estimated available time may differ from the actual available time, depending on the battery pack or the condition of the MT9080 Series. Remember that these values should be considered as guides.

2. If you attempt the following when the remaining battery quantity is less than 10%, the following message appears: "Cannot perform it. The battery is running low. Please connect the AC adapter." Use the AC adapter according to the message's instructions in this case. Charging the battery pack starts when you plug in the AC adapter. If the power to the MT9080 Series is left on, the pack will not be charged fully; charging will stop after about three hours.

   - Repairing the internal memory
   - Formatting the internal memory
   - Updating the firmware

For details of the screen display, also refer to Section 3.2 "Screen Details and Panel Key Operations".

2.3.4 Important information about battery pack (including notes)

- When a new battery pack is used, the full performance is obtained only after the full charging/discharging cycle is performed three to five times. Every battery pack for the ACCESS Master has been subjected to the full charging/discharging cycle three times in the factory. If you use a battery pack that has not been charged a sufficient number of times, the charging rate may not reach 100% even after completion of charging.
- The battery pack must not be charged for more than 24 hours. Over-charging the battery pack may shorten its life. (The AC adapter must not be left connected for a long time with the battery pack plugged into the MT9080 Series or external charger.)
- The battery pack is a consumable item, although it can be charged/discharged about 300 to 500 times. If the actual available time shortens suddenly even after the battery pack has been charged, the battery pack's life may have expired. Replace it with a new one in this case.
- Sometimes discharge the battery pack in order to enhance its performance and extend its life.
- If the battery pack is stored at an excessively high (45°C or higher) or low (0°C or lower) temperature, its performance and life will degrade. When the ambient temperature rises, battery pack discharge speeds up.
- A fully charged battery pack will be completely discharged in several months if left as is.
- If the battery pack has been discharged fully, its smart memory capabilities will be lost. In this case, the remaining battery quantity indication and other information may be displayed inaccurately, or the pack may be unable to be charged normally.

CAUTION ⚠

- The battery pack must be charged only with the MT9080 Series or an Anritsu-approved external charger. If you use another charger, the battery pack may malfunction or cause a fire.
- Do not short-circuit the terminals of the battery pack. If you do so, the battery pack may malfunction or cause a fire.
- Do not drop or attempt to disassemble the battery pack. If you do so, the battery pack may malfunction or cause a fire.
- Do not use the battery pack for other than the intended purpose. If you do so, the battery pack may malfunction or cause a fire.
- Be sure to recycle or dispose of the battery pack correctly. Do not discard the battery pack in the garbage or burn it. If you do so, fire or explosion may occur.

2.4 Names and Functions of Each Part

This section shows the names and functions of each part.

2.4.1 Front panel

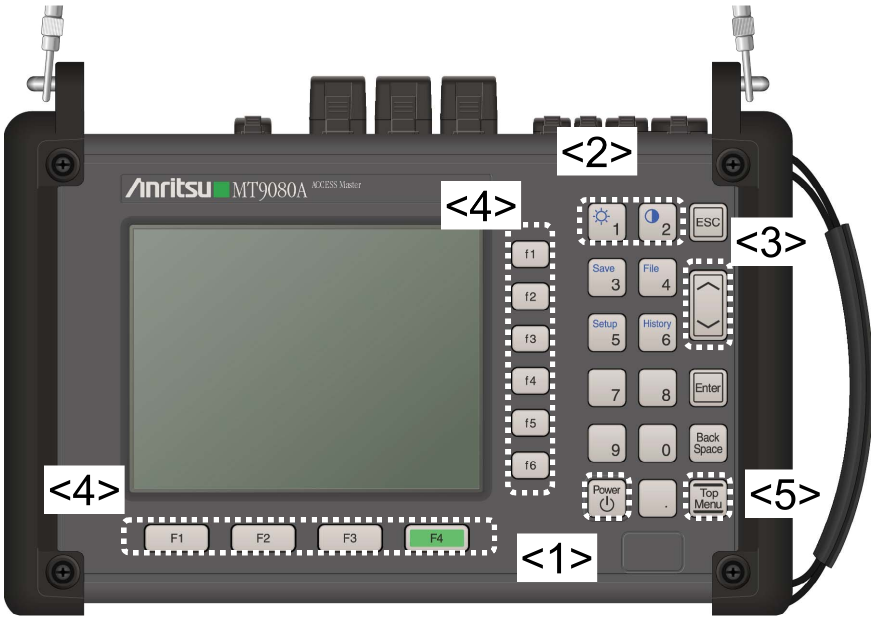


Fig. 2.4.1-1 Front panel

<1> Power key

Used to turn on/off the power.

<2> Backlight and contrast keys

The backlight key is used to adjust the brightness of the backlight, while the contrast key is used to adjust the contrast. Refer to Sections 3.3 "Adjusting Backlight" and 3.4 "Adjusting Contrast".

<3> Arrow key set

A key set containing two key components: Up and Down arrows. These keys are represented by ∧ and ∨ in this manual.

<4> Function keys

These sections contain function keys f1 to f6 and F1 to F4. The functions of the f1 to f6 keys are displayed on the right of the screen. The functions of the F1 to F4 are displayed at the bottom of the screen. Refer to Section 3.2.1 "Top menu".

<5> Top Menu key

The Top Menu is displayed whenever the Top Menu key is pressed. In the Top Menu, the functions of the MT9080 Series are listed in a menu from which the desired menu item can be selected.

2.4.2 Top view

Battery charging lamp
Lights up while the battery pack is being charged.

DC input connector
Used to connect the supplied AC adapter.

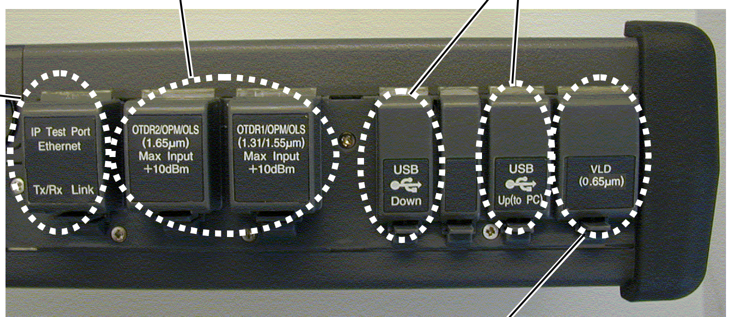
External power lamp
Lights up while the external power is being supplied.

Fig. 2.4.2-1 Top view (left)

Measurement ports
Used to connect an optical fiber.
Refer to Section 2.5 “Connecting Optical Fiber Cable.”

USB joints
Used to connect a USB memory card or a cable.
Refer to Section 2.7 “Connecting Peripheral Devices.”

IP test port
Used to connect an Ethernet cable.
Refer to “MT9080 Series IP Network Connectivity Check Function Operation Manual.”



Visible light port
Used to connect an optical fiber.
Refer to Section 2.5 “Connecting Optical Fiber Cable.”

Fig. 2.4.2-2 Top view (right)

Note:

For an MT9080 Series unit with the hardware version prior to 2, note that the visible light port is located where the IP test port is in Fig. 2.4.2-2. Refer to Section 8.4 “Self Test Function” for checking the hardware version.

2.4.3 Rear panel

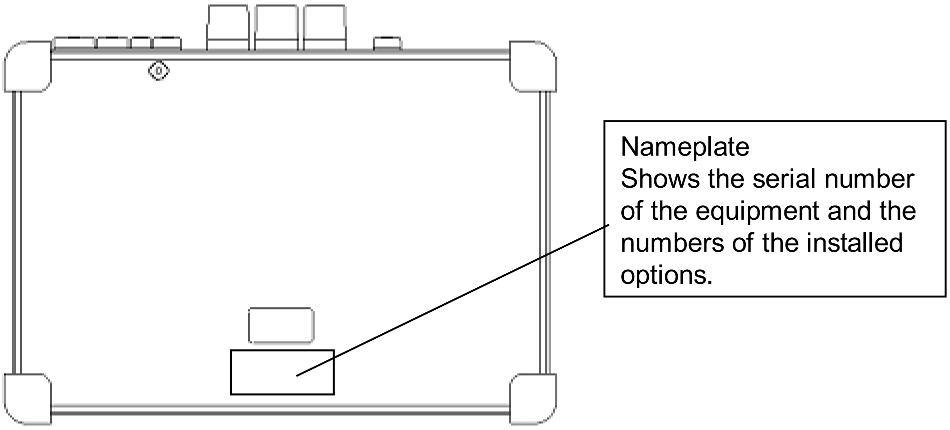


Fig. 2.4.3-1 Rear panel

Stand (Option 10: When the protector is installed)

To tilt the MT9080 Series, pull out the stand as shown below:

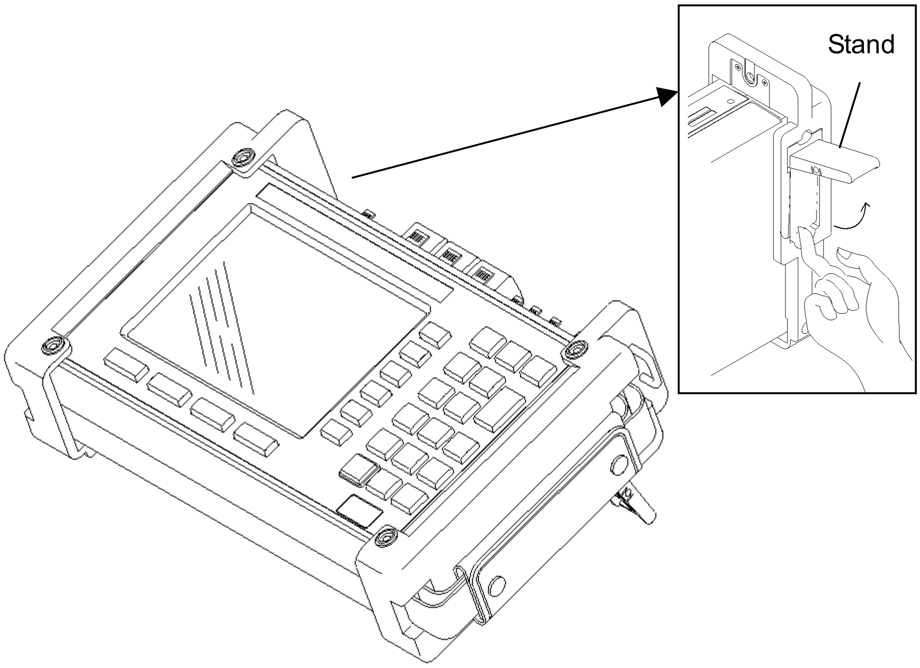


Fig. 2.4.3-2 Using stand

2.5 Connecting Optical Fiber Cables

Measurement ports

Open the measurement port connector cover of the MT9080 Series, and connect the optical fiber to be measured. The measurement port to which the cable should be connected depends on the function to be executed and the wavelength to be measured.

Table 2.5-1 ACCESS Master models and measurement ports

Model name	Measurement ports		
	OTDR, Optical Power Meter, and Optical Light Source		Visible Light Source (option)
	1.31/1.55 μm	1.65 μm	
MT9080A/81A/81A1	<1>	–	<3>
MT9080B/81B/81B1	<1>	–	<3>
MT9080C/81C/81C1	<1>: Optical Power Meter –: OTDR/Optical Light Source	<2>	<3>
MT9080D/81D/81D1	<1>	–	<3>
MT9080E/81E/81E1	<1>	<2>	<3>
MT9080F/81F/81F1	<1>	<2>	<3>

The destination port to which the optical fiber should be connected is shown in a stereogram on the screen. Connect it according to the instructions.

Note:

The equipped position of the visible light port varies depending on the hardware version of the MT9080 Series (Fig. 2.5-1 shows the ports for the unit with hardware version 2 or later). Refer to Section 8.4 “Self Test Function” for checking the hardware version.

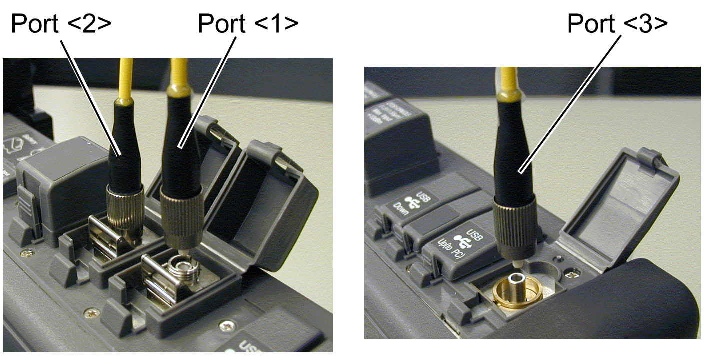


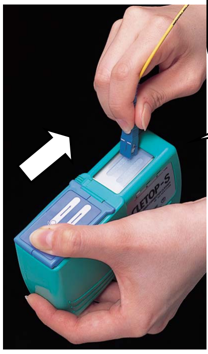
Fig. 2.5-1 Connecting optical fiber

Before connecting the fiber, be sure to clean the connector end surface according to the example shown below.

Cleaning the end surface of the optical fiber

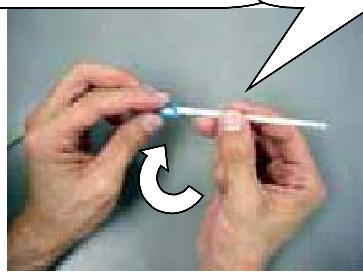
Clean the ferrule end surface using the specialized cleaning tool. Cleaning the side of the ferrule may also be effective in some cases.

With the ferrule end surface pressed against the right slot of the ferrule cleaner, turn it clockwise and counterclockwise to slide it.
Turn the optical connector 90 degrees each way and clean it in the same manner in the left slot of the ferrule cleaner.



Cleaning the ferrule end surface

Adapter cleaner



Cleaning the side of the ferrule

Light passes through an optical fiber portion of approximately 10 microns in diameter.　Even if the optical connector has slight dirt on its surface, measurement may not be accurate because of loss or reflection.　Be sure to clean the optical connector before measurement.

Fig. 2.5-2　Cleaning ferrule

Cleaning the measurement port (optical connector) of the MT9080 Series

Remove the replaceable connector adapter, and clean the ferrule end surface. To remove the dirt from the sleeve in the replaceable connector adapter, use the adapter cleaner.

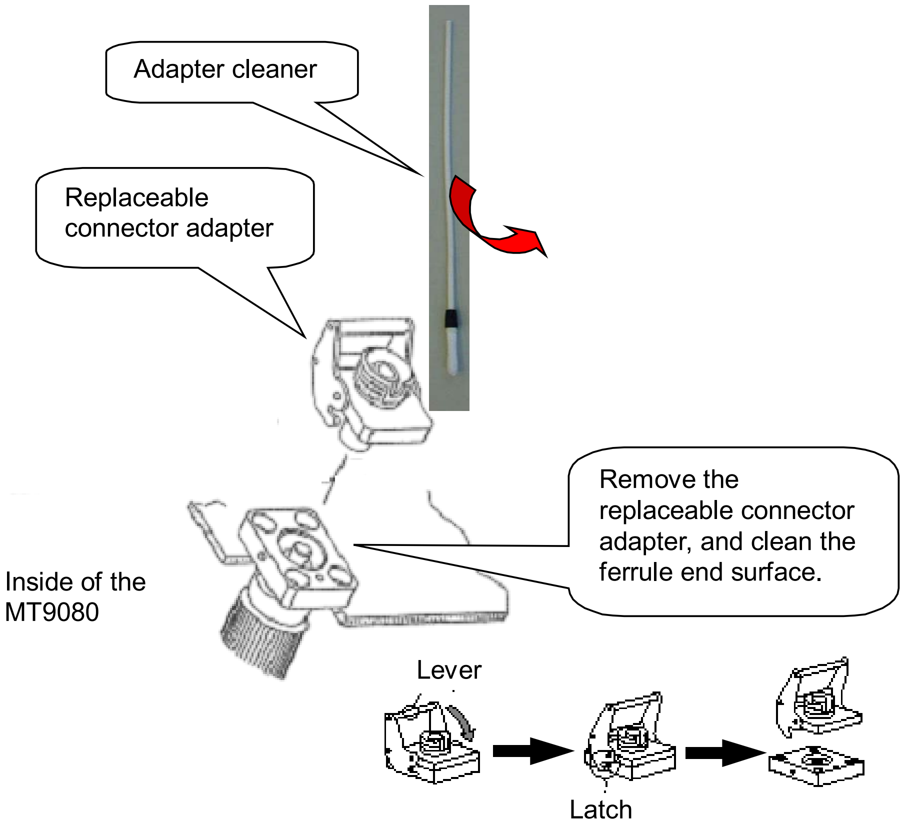


Fig. 2.5-3 Cleaning optical connector

WARNING ⚠

Never look directly into the cable connector on the equipment nor into the end of a cable connected to the equipment. If laser radiation enters the eye, there is a risk of injury.

CAUTION ⚠

The MT9080 Series emits high output optical pulses. Disconnect communications devices, etc. from the target measurement optical fiber during measurement to prevent the optical sensors from being damaged.

2.6 Replacing Optical Connector

To replace the optical connector, do the following: Pull the lever toward you, and check that the latch is unlatched. Then, raise the connector to remove it.

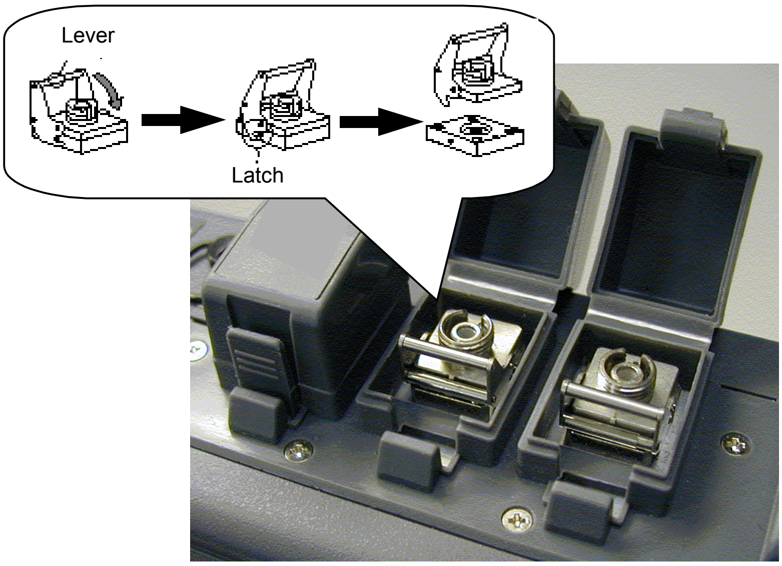


Fig. 2.6-1 Optical connector joints

For reference, the connector types are shown below:

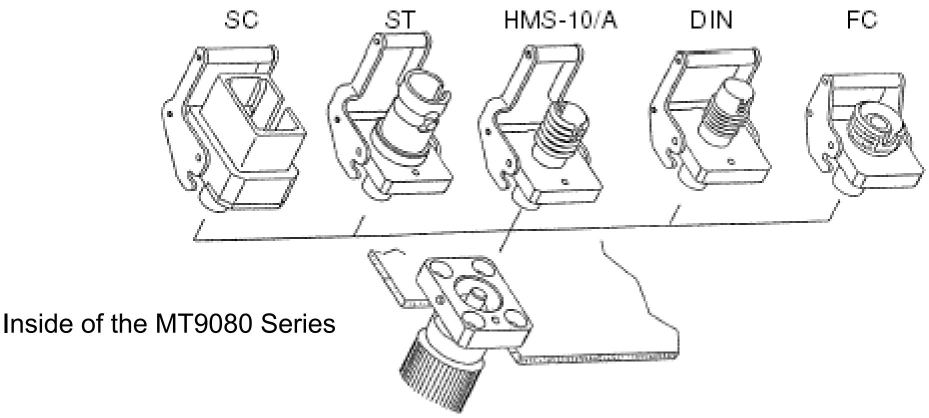


Fig. 2.6-2 Connector types

WARNING ⚠

Never look directly into the cable connector on the equipment nor into the end of a cable connected to the equipment. If laser radiation enters the eye, there is a risk of injury.

CAUTION ⚠

When replacing the optical connector, pay attention so that both the connector and its connection surface are not damaged.

2.7 Connecting Peripheral Devices

The standard configuration of the MT9080 Series includes two USB ports, which allows a USB memory or personal computer to be connected.
For details, refer to Section 9 “Peripheral Interface”.

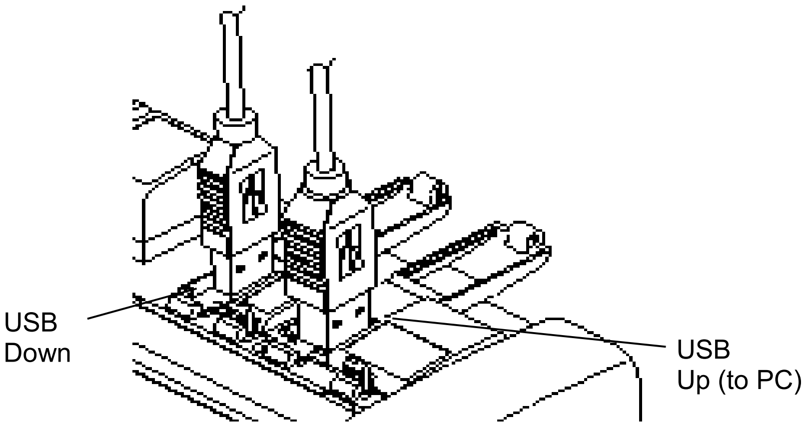


Fig. 2.7-1 Connecting USB cable

2.7.1 USB Up (to PC) port

By connecting the USB Up (to PC) port of the MT9080 Series to a personal computer via a USB cable, you can access the internal memory of the MT9080 Series directly from your computer. While a personal computer is connected to the MT9080 Series, accessing the internal memory from the MT9080 Series is disabled.

CAUTION ⚠

Before disconnecting the USB cable between the MT9080 Series and the personal computer, be sure to prepare the computer so that the hardware can be removed. Otherwise, the Internal memory may be damaged.

2.7.2 USB Down port

This port is used to connect with a USB memory or a printer.

(1) USB memory
Use a USB memory conforming to USB 1.1. Some of the commercially available USB memory may be unavailable for this port. For the validated USB memory, see the "Validated USB Memory" section in the attachment.

CAUTION ⚠

A mark during access is displayed on screen when recalling, saving, copying or deleting folders and/or files. Do not remove USB memory while accessing it. USB memory or files may be damaged.

(2) USB printer conversion cable
Use a USB printer conversion cable conforming to USB 1.1. Some of the commercially available USB printer conversion cables may be unavailable for this port. For the validated USB printer conversion cables, see the "Validated USB Printer Conversion Cables" section in the attachment.

2.8 Basic Notes on Use

Connector cover

A connector cover is installed on each of the connectors to prevent dust. Do not remove these connector covers except when connecting a cable to the connectors.

Condensation

Condensation may occur on the inside surface of the MT9080 Series when the MT9080 Series is carried into a room (high temperature) from an outdoor location (low temperature), etc. If this occurs, dry the MT9080 Series thoroughly before turning on the power to it.

Temperature range

Use the MT9080 Series within the operating temperature range (0 to +40°C) and storage temperature range (–20 to +60°C). If the MT9080 Series is placed in a car or other enclosed space for a long time, the ambient temperature may exceed the specified range, resulting in malfunction of the MT9080 Series.

Safety

Do not use any AC adapter or battery pack other than the one supplied. Otherwise, the MT9080 Series may be damaged due to nonconformity with the specifications.

Laser

Never look directly into the cable connector on the equipment nor into the end of a cable connected to the equipment. If laser radiation enters the eye, there is a risk of injury.

In addition, the MT9080 Series outputs high-power optical pulses. To prevent damage to the photoreceiving circuit of the communication device connected to the optical fiber to be measured, remove the communication device from the optical fiber before measurement. Anritsu will take no responsibility for damage to the communication or any other device.

Maintenance

Anritsu recommends that the MT9080 Series be inspected once a year at the Anritsu Customer Service Center (a fee will be charged).

For other notes on use, read the safety-related information in this manual thoroughly before use.

Section 3 General Operations and Presettings for Measurement

This section describes operations and settings related to turning on/off the power and those of the MT9080 Series as a whole.

The items displayed in the [ ] in this section indicate panel keys.

3.1 Turning On Power

This section assumes that the battery has already been charged or the AC adapter is already connected properly.

For how to charge the battery pack or connect the AC adapter, refer to the following sections:

Charging the battery:	Section 2.3.2 “Charging battery pack”
Connecting the AC adapter:	Section 2.2 “Power Supply Connection”

When the Power key is pressed, the screen shown in Fig. 3.1-1 is displayed. However, if the power is turned off by the Auto Power Off function (refer to Section 3.5.3 “Power saving settings”) when one of the following measurement function screens is displayed, the appropriate measurement function screen may be displayed instead.

- OTDR (Fault Locate)
  The period immediately after you select [OTDR (Fault Locate)] in the Top Menu or via F1 (Menu) until f6 (Close) is pressed on the [Measurement Condition] screen is excluded.
- OTDR (Trace Analysis)
- Optical Power Meter
- Light Source (optical light source for fiber identification)
- Visible Light Source
- IP Test (Connectivity)
- IP Test (Counter)

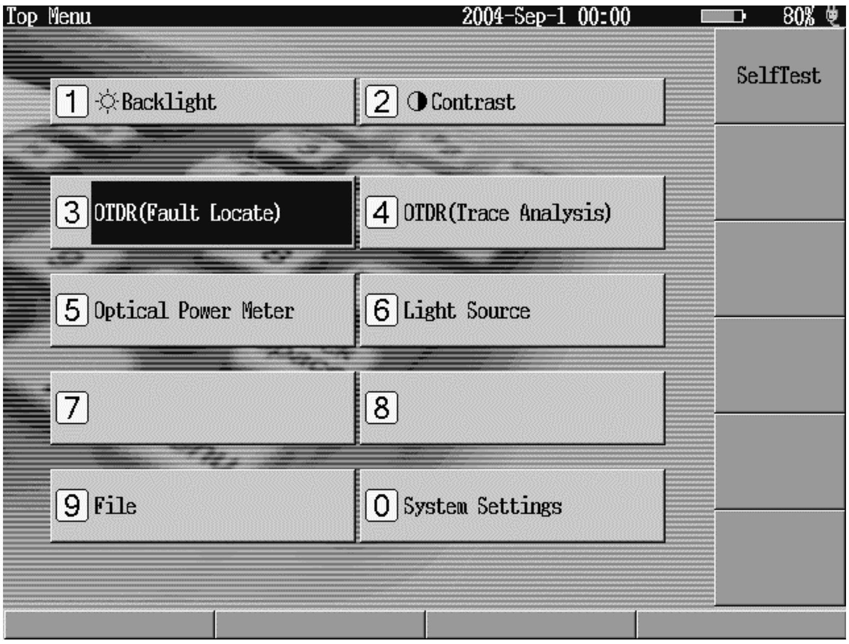


Fig. 3.1-1 Initial screen (Top Menu)

If the screen shown in Fig. 3.1-1 is not displayed when the power is turned on, the MT9080 Series may have failed. If this occurs, turn off the power and contact Anritsu or our sales dealer.

The menu item display in the Top Menu varies depending on the installed option types.
When both the IP Network Connectivity Check Function and Visible Light Source options are installed, for example, the [File] menu is not displayed in the Top Menu. In this event, select a menu item from the shortcut menu displayed by pressing F1 (Menu) when the OTDR (Fault Locate/Trace Analysis) or IP Test (Connectivity/Counter) screen is displayed, or press the shortcut key 

on the operation panel to display the file operation screen.

3.2 Screen Details and Panel Key Operations

This section describes the Top Menu screen layout, and describes how to operate the panel keys.

3.2.1 Top menu

This section describes the functions and the basic operations of the screens of the MT9080 Series. When the MT9080 Series is turned on, the screen shown in Fig. 3.2.1-1 is displayed.

To move to the desired function, select a function using the ∧ and ∨ keys, and press the Enter key, or press the numeric key that is displayed adjacent to the function.

Except in the following cases, pressing the Top Menu key displays the Top Menu screen.

- When the backlight is off by means of the Auto Backlight Off function (refer to Section 3.5.3 “Power saving settings”).
- When a warning or caution message has been displayed

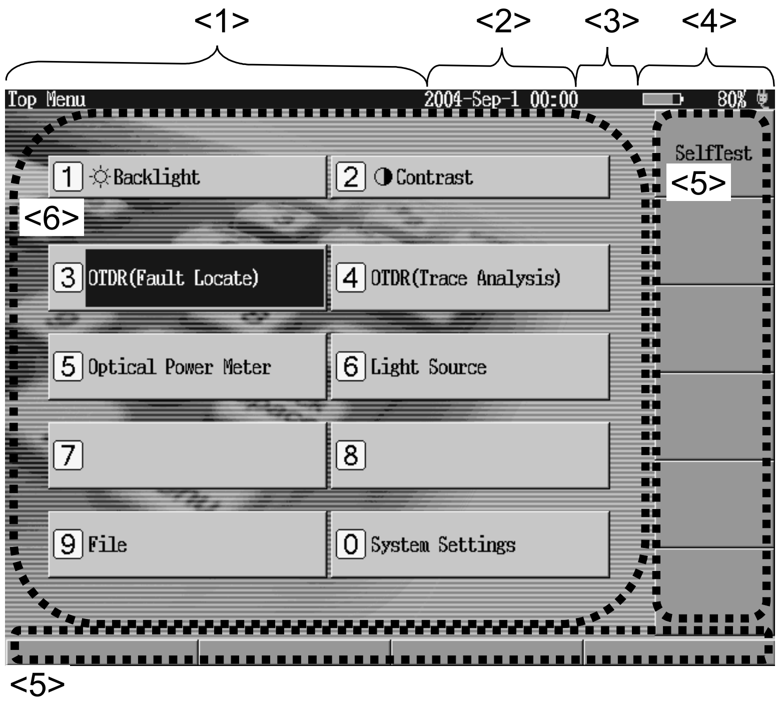


Fig. 3.2.1-1 Top Menu

The menu item display in the Top Menu varies depending on the installed option types.
When both the IP Network Connectivity Check Function and Visible Light Source options are installed, for example, the [File] menu is not displayed in the Top Menu. In this event, select a menu item from the shortcut menu displayed by pressing [F1] (Menu) when the OTDR (Fault Locate/Trace Analysis) or IP Test (Connectivity/Counter) screen is displayed, or press the shortcut key 

on the operation panel to display the file operation screen.

Descriptions of the areas:

<1> Screen title area

Displays the screen title or the name of the file that has been recalled. For the setting procedure, refer to Section 3.5.2 “Display settings”.

<2> Date/time area

Displays the current date and time.
The format (year-month-day, month-day-year, or day-month-year) follows the system setting. For the setting procedure, refer to Section 3.5.1 “General settings”.

<3> Status area:

Displays an icon that indicates that file access or laser emission is in progress or the result of a connection check is NG.

- File access in progress: 
- Laser emission in progress: 
- Connection check result NG: 

<4> Battery status area:

Displays the battery indicator, remaining battery quantity, or driving power (external power or battery pack) icon.
For the remaining battery quantity, the ratio to the fully charged quantity (“%”) and the estimated available time (“h”) are displayed alternately, except that a “%” is always displayed when the value is indicated in the description below (“About the remaining battery quantity indication”):
When the remaining battery quantity goes below 30%, recharging the battery pack is recommended.

- Battery indicator: 
- Remaining battery quantity (%): 

- Remaining battery quantity (h): 

(e.g., Estimated available time: 2 hours and 2 minutes)
- Driving power (external power): 
- Driving power (battery pack): 

About the remaining battery quantity indication

- Remaining battery quantity is less than 10%:
  The battery indicator flashes.
- Remaining battery quantity is less than 3%:
  The following message appears "The battery is running low. Please connect the AC adapter to charge it.", and the buzzer sounds. Pressing any key causes the message to disappear, stopping the buzzer.

  The buzzer sounds independently of the buzzer setting in the system settings.
  Note that the following operations will be interrupted in this event:

  - Settings of measurement conditions, etc.: The setup window will be closed.
  - Copy and deletion of files.: Interrupted halfway.
- Remaining battery quantity is less than 1%:
  The following message appears: "Battery is empty.", and the power goes off automatically.
  At this time, measurement is canceled if it is in progress. The settings and the on-screen waveforms are saved in memory, and will be read at the next startup with the screen at shut down displayed.
- When a battery pack temperature failure warning occurs:
  When the battery pack is in use, the following message appears: "The battery issued a temperature warning. Please connect the AC adapter. The instrument is shutting down after a minute automatically." After the lapse of 1 minute, the power goes off automatically. At the end of the process, or at the next startup, the same occurs as when "Remaining battery quantity is less than 1%".
  By switching to external power, the MT9080 Series can be used; however, charging will remain stopped until the battery pack temperature drops to normal.

Note:

Even if the remaining battery quantity is 1% or more, the power may be turned off, depending on the characteristics or conditions of the battery pack. Note that the remaining battery quantity is indicated for guidance purposes only.

<5> Function key area:

Lists the assignments of the function keys associated with the functions required according to the screen and the operational status. Primarily used to select or confirm a function.

<6> Function selection area:

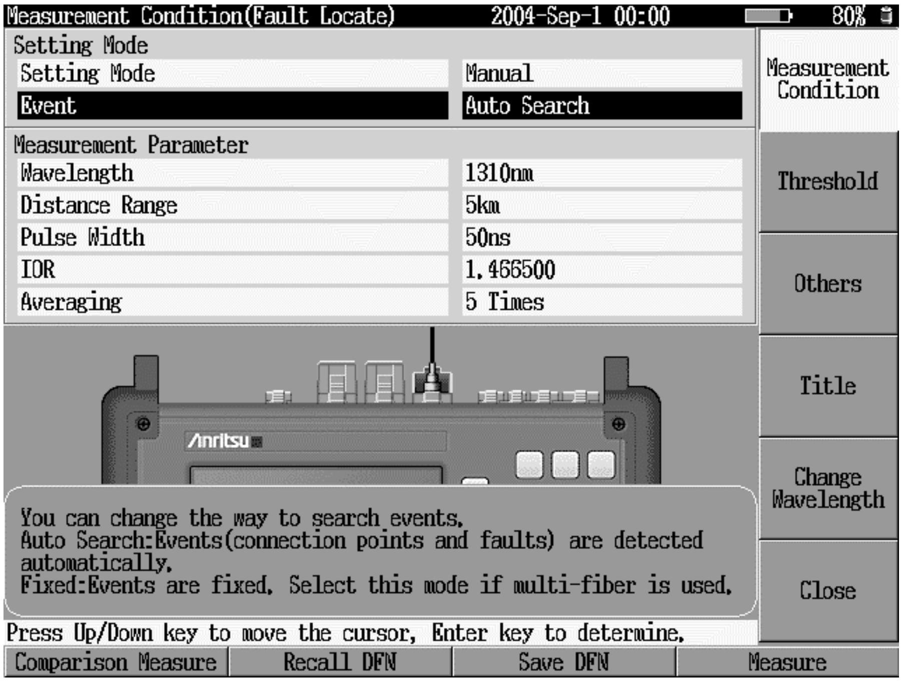
Allows you to select a menu item from this area and move to the appropriate function.

A few items may be added to this area, depending on the options installed.

3.2.2 Setting procedure

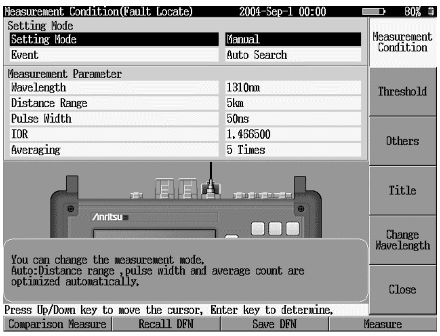
This section describes how to change the settings.

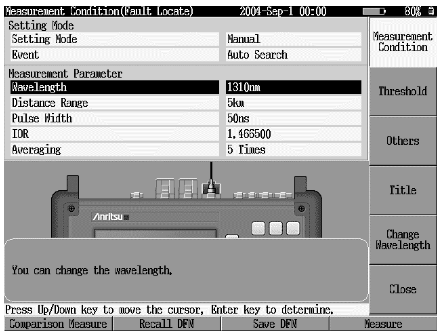
- Selecting the setting item:
  Pressing the [∧] key moves the cursor to the upper, or previous item.
  Pressing the [∨] key moves it to the lower, or next item.



Press the [∧] key once.

Press the [∨] key once.

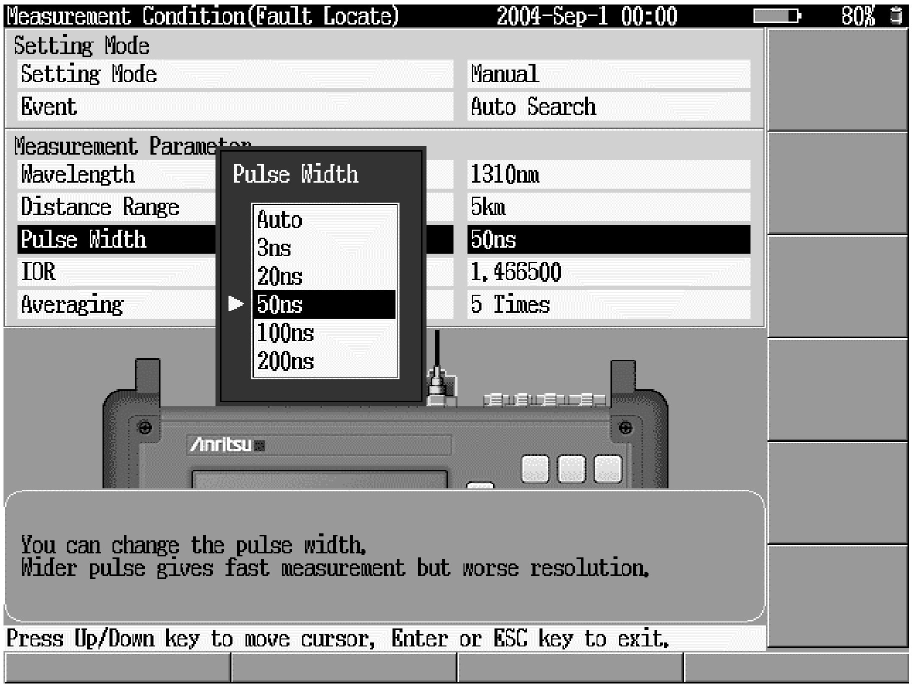




Move the cursor to the item to be changed, and press the [Enter] key to select the item. Once the setting item is selected, a window opens that allows you to change the setting.

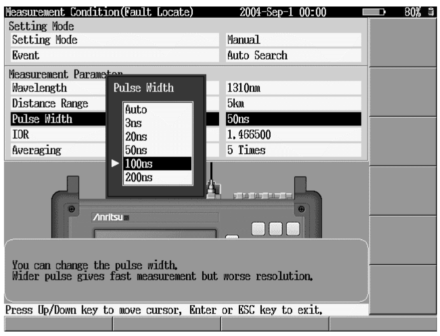
- Canceling the selection:
  Pressing the [ESC] key cancels your setting item selection.

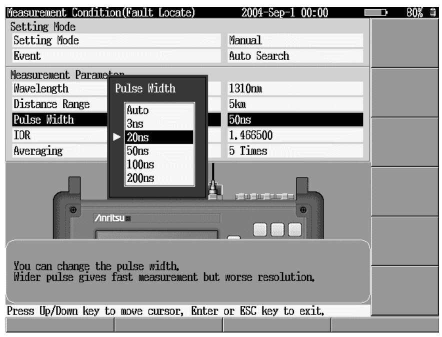
- Selecting the setting value:
  A window for selecting the setting value is displayed when the setting item is selected. Select the setting value using the [∧] and [∨] keys.



Press the [∧] key once.

Press the [∨] key once.

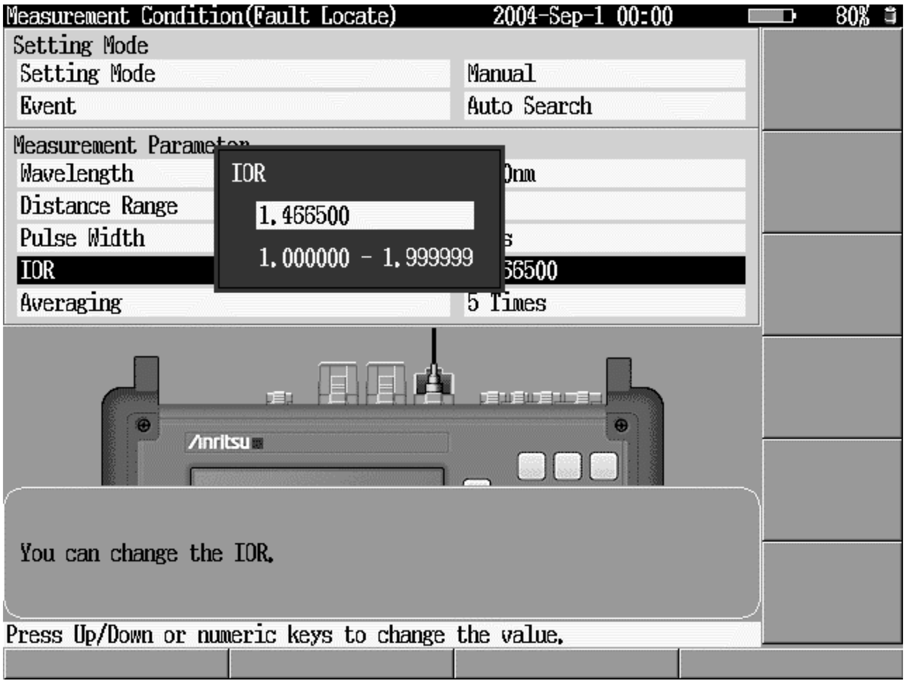




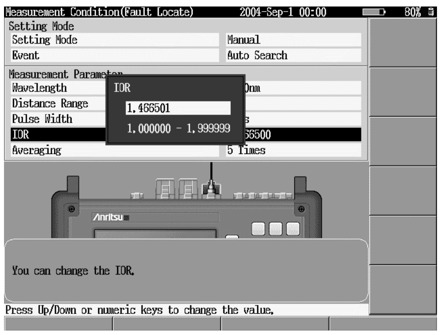
Move the cursor to the new value, and press the [Enter] key to select that value.

- Entering a numeric value:

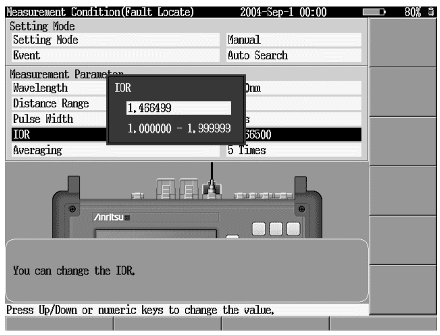
  A window for entering a numeric value is displayed when the setting item is selected. Enter the setting value using the [∧] and [∨] keys or numeric keys.



Press the [∧] key once.

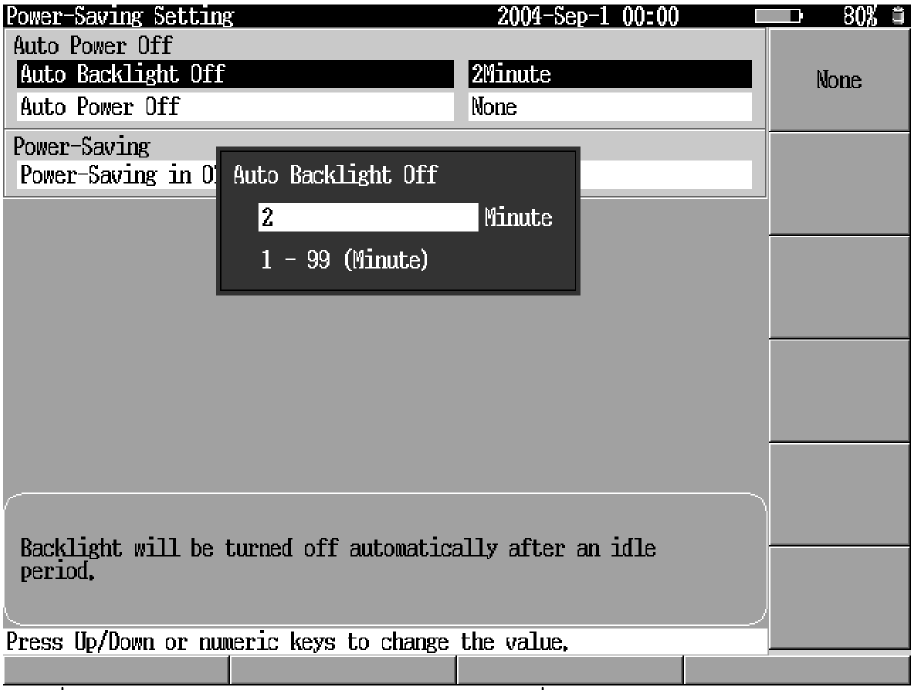


Press the [∨] key once.



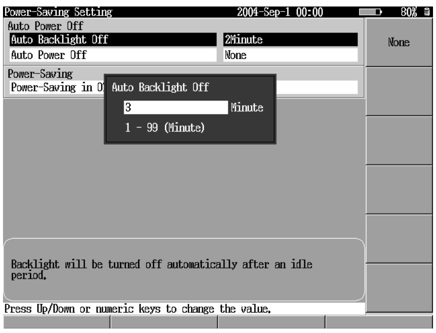
Press the [Enter] key to change the setting.

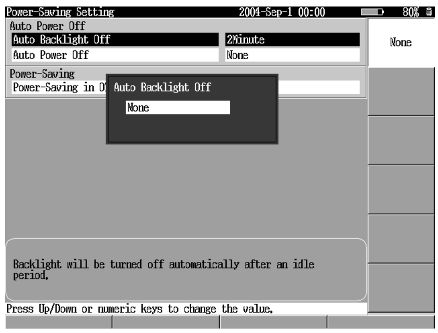
- Entering a numeric value and using the function keys:
  A window for entering the setting value is displayed when the setting item is selected. Enter the setting value using the [∧] and [∨] keys, numeric keys, or function keys.



Press the [∧] key once.

Press the [f1] key once.





Pressing the [f1] key sets this to "None".
Pressing the [0] or [∨] key does not set this to "None".
Press the [Enter] key to change the setting.

3.2.3 Character entry procedure

Text characters can be entered for some setting items. When a setting item for which characters can be input is selected, the screen shown in Fig. 3.2.3-1 is displayed.

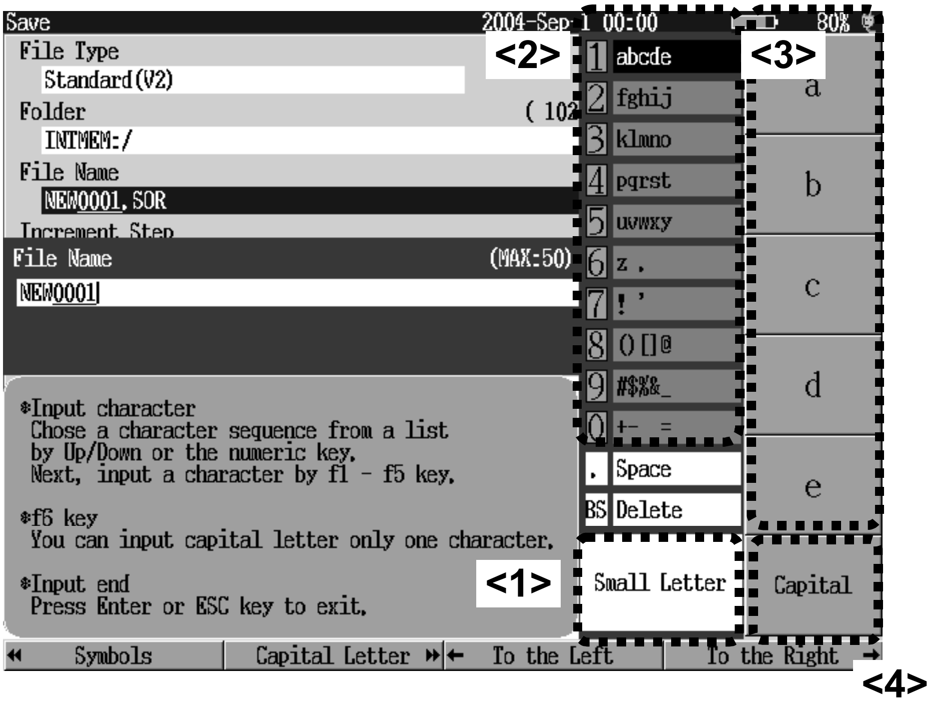


Fig. 3.2.3-1 Character entry screen

- Moving to the character entry position:
  If a character has already been set, press F3 (To the Left) and F4 (To the Right) to move the cursor to the position in which to enter the character.

- Deleting a character you entered:
  To delete a character you entered, move the cursor to the right of the desired character and press the Back Space key.

- Selecting the character input mode (type of characters to enter):
  The currently selected character input mode is displayed in Area <1>.
  Press the F1 and F2 keys to set the character input mode:

  Character types: Capital letter, Small letter, Numeric, Symbols...

- Entering characters:
  When the character input mode is selected, select a character group from Area <2> using the ∧ and ∨ keys and numeric keys. Then, enter one of the characters in Area <3> by pressing one of the f1 to f5 keys.

- Temporarily switching case between capital and small:
  The capital or small letters in the character group in Area <2>, can be switched between the capital and small per character by pressing the f6 key in Area <4>.

- Entering a number used for auto incrementation:
  Each time the result from measurement is saved in a file, you can update the set values of several setting items.
  When the character type is set to number, f6 (Increment) appears. After pressing this key, you can set a numeric string of up to four digits for the auto incrementation value. The auto incrementation value is underlined.
  Refer to Section 8.2 "Automatic Increment Function" for details of the automatic increment function.

Note the following when entering characters:

- The maximum character string length that can be entered is fifty 1-byte characters. However, depending on the setting item, the maximum number of characters may be limited. So, confirm the maximum value displayed on the screen.

- The file name length may be up to fifty 1-byte characters, excluding the extension. The extension cannot be changed.

- When changing a folder or file name with a length of fifty-one 1-byte characters, one or more characters can be deleted but no characters can be added. After the string length becomes less than fifty 1-byte characters, characters can be added.

3.3 Adjusting Backlight

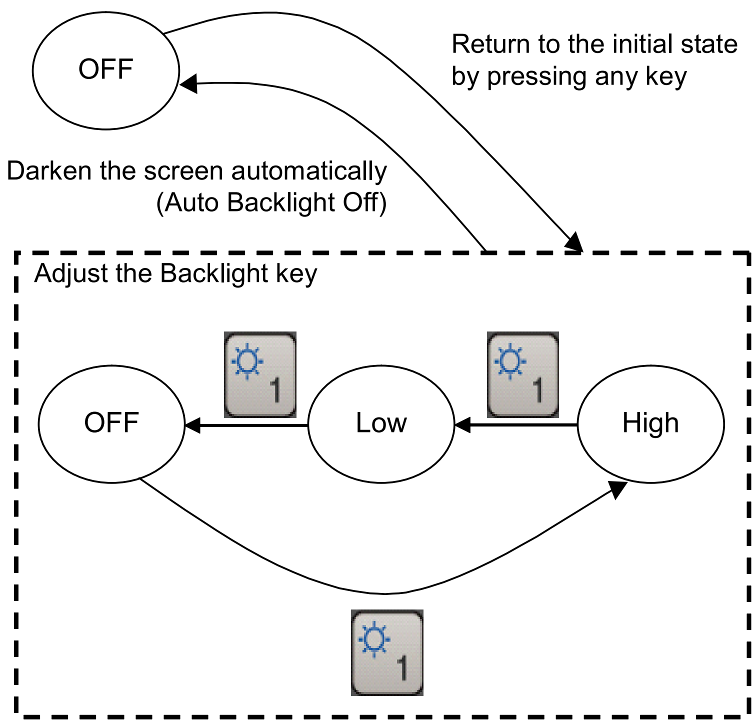
Pressing the 1 key switches the brightness of the backlight in the following order:

High → Low → OFF → High...

In the following cases, you cannot adjust the backlight because the Backlight key is used for another application or is disabled.

- Access to the internal memory or USB memory is in progress.
- You have selected a setting item and are entering a character or making a setting.
- You have opened a shortcut menu by pressing the F1 key.
- A warning or caution message has been displayed.
- The backlight has been turned off via [Auto Backlight Off] in the system settings.

When the backlight is left off via the Auto Backlight Off function, you can return to the initially set conditions by pressing any key.

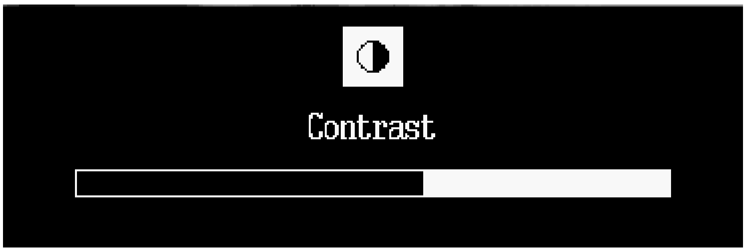


3.4 Adjusting Contrast

When [2] (Contrast key) is pressed, a contrast adjustment screen that allows adjusting the screen contrast is displayed. Note, however, that the contrast can be adjusted only for the MT9080 Series units that are equipped with the monochrome LCD panel.

In the following cases, you cannot adjust the contrast because the Contrast key is used for another application or is disabled.

- When access to the internal memory or USB memory is in progress.
- When you have selected a setting item, and are entering characters or making a setting.
- When you have opened a shortcut menu by pressing the [F1] key.
- When a warning or caution message has been displayed
- When the backlight has been turned off via [Auto Backlight Off] in the system settings.



Pressing the [∧] key increases the contrast, while pressing the [∨] key decreases it.

Pressing any key other than the [∧], [∨] and [Power] keys finalizes the contrast setting.

3.5 System Settings

This section describes the settings related to the MT9080 Series as a whole.

The settings below are saved in the memory of the MT9080 Series immediately after the settings are finalized. All the other settings are retained temporarily. Immediately before the power is turned off, they are saved in the memory of the MT9080 Series. The saved settings will be read at the next startup.

- "Date" in general setting
- "Time" in general setting
- "Time Difference from UTC" in general setting
- "Language" in general setting

3.5.1 General settings

Select [System Settings] on the screen shown in Fig. 3.2.1-1 by using the [∧] and [∨] keys and then press the [Enter] key, or press the [0] key to display the screen shown in Fig. 3.5.1-1 below.

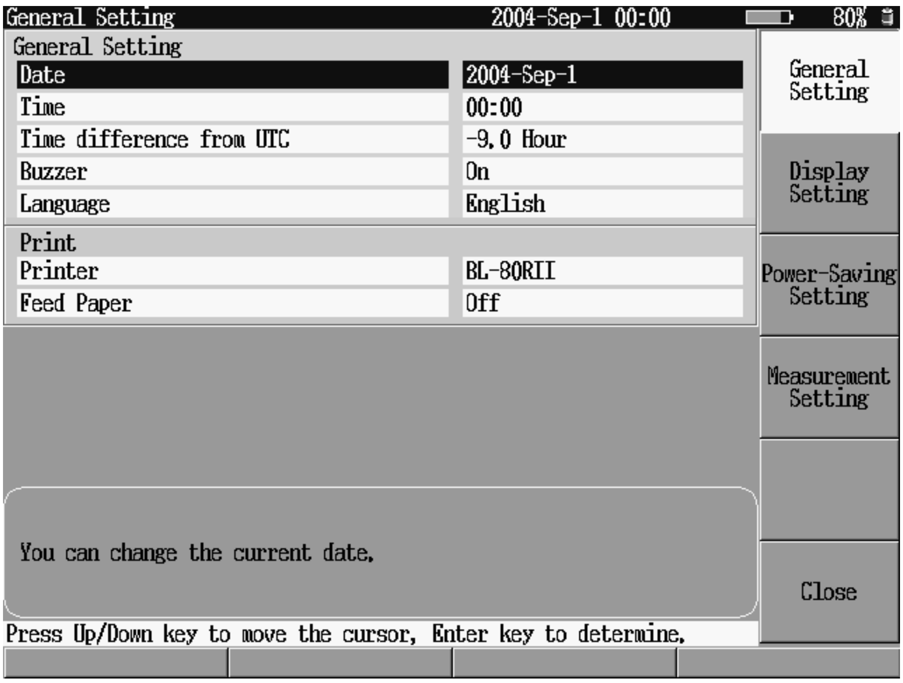


Fig. 3.5.1-1 General Setting screen

The cursor can be moved to the desired setting item by using the [∧] and [∨] keys.

Setting selection and character entry can be operated by selecting the setting item and pressing the [Enter] key. To cancel the selection of the setting item, press the [ESC] key.
Refer to Section 3.2.3 “Character entry procedure” for how to enter characters.

Pressing [f6] (End of Setting) returns the screen to that shown in Fig. 3.2.1-1.

Date

Sets the date.

Year: 2000 to 2036
Month: 1 to 12 (Only the [∧] and [∨] keys are available.)
Day: 1 to 31 (The setting range varies depending on whether the year is a leap year or not, or with the month.)

Time

Sets the time.

Hours: 0 to 23
Minutes: 0 to 59

Time difference from UTC

Sets the time difference from the standard time. For example, set this to “-9.0 hours” in Japan.

Use this if you want to obtain the universal time when you are saving the measured results in a file without this setting affecting the date/time.

The time difference setting range is as follows:

Time difference: –12.0 to +12.0 (hours)

Buzzer

Sets the buzzer sound that is generated in response to a key stroke.

Off: The buzzer does not sound when a key is pressed.
On: The buzzer sounds when a key is pressed.

Language

Switches the language of the on-screen characters.

Japanese: Specifies that characters are displayed in Japanese.
English: Specifies that characters are displayed in English.

Printer

Selects a printer to be used for printing.

Only BL-80RII is currently supported.

Feed Paper

Specifies whether to feed the printer paper to the cutter automatically after a screen image is printed out.

On: The printer paper is automatically fed forward to the cutter after printout.

Off: The printer paper is not fed forward to the cutter after printout, but is automatically fed a little so that the printed image is not overlapped by the next one.

Note:

The printer paper is also fed according to this setting when printing is cancelled.

If an error (out of paper, excluded) occurs during printing, the printer paper is fed according to this setting when printing out next time. Note, however, that the printer paper is not fed for the next printout if the MT9080 Series was turned off after an error occurrence.

3.5.2 Display settings

Press [f2] (Display Setting) on the screen shown in Fig. 3.5.1-1 to display the screen shown in Fig. 3.5.2-1.

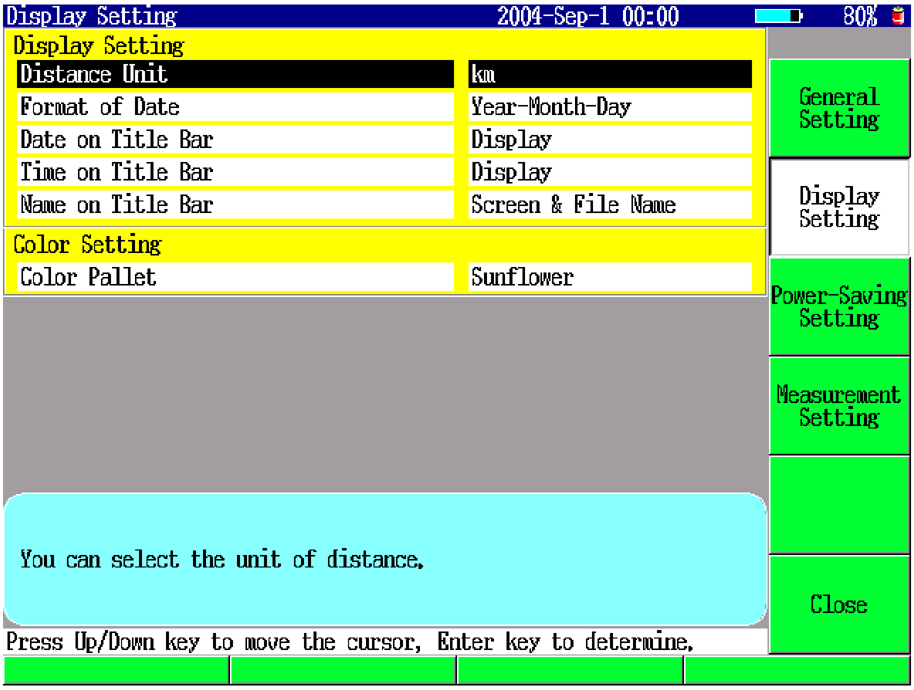


Fig. 3.5.2-1 Display Setting screen

(1) Display Setting

Distance Unit

Sets the unit of distance displayed on the MT9080 Series screens.

Unit of distance: km, m, kf, ft, or mi

Format of Date

Sets the format of the date.

Day-Month-Year: Example: 1-9-2004
Month-Day-Year: Example: 9-1-2004
Year-Month-Day: Example: 2004-9-1

Date on Title Bar

Sets whether the date is displayed or hidden.

Hide: Hides the date in the date/time area.
Display: Shows the date in the date/time area.

Time on Title Bar

Sets whether the time is displayed or hidden.

Hide: Hides the time in the date/time area.
Display: Shows the time in the date/time area.

Name on Title Bar

Sets whether the screen and/or file name is shown.

The file name is shown when the saved file is read.

File Name Only: Shows only the file name in the screen name area.

Screen & File Name: Shows both the screen and file names in the screen name area.

(2) Color Setting

Color Pallet

Sets the color layout for the MT9080 Series screens. This setting is possible for the MT9080 Series units that are equipped with the color LCD panel.

3.5.3 Power saving settings

Press f3 (Power-Saving Setting) on the screen shown in Fig. 3.5.1-1 to display the screen shown in Fig. 3.5.3-1.

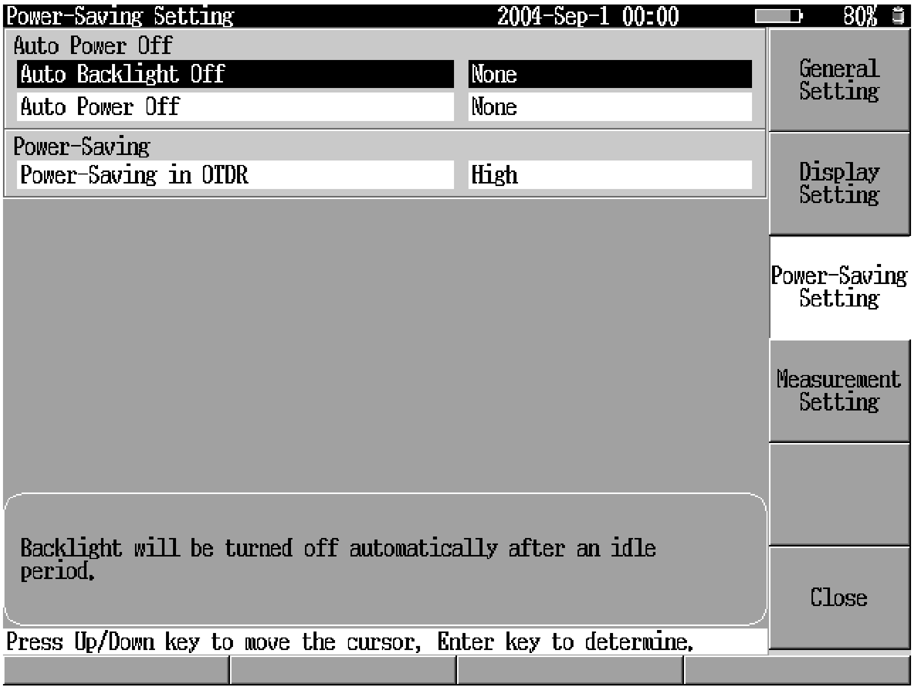


Fig. 3.5.3-1 Power-Saving Setting screen

(1) Auto Power Off

Auto Backlight Off

If no key is pressed for a predetermined time, the backlight can be turned off automatically. The elapsed time for this Auto Backlight Off function can be set in this field.
When the backlight is left off via the Auto Backlight Off function, the initially set conditions are restored by pressing any key.

Elapsed time: 1 to 99 (minutes)
None (Press the f1 key.)

Auto Power Off

If no key is pressed for the predetermined time, the power can be turned off automatically. The elapsed time for this Auto Backlight Off function can be set in this field.

Elapsed time: 1 to 99 (minutes)
None (Press the f1 key.)

In the following cases, the Auto Backlight Off function is disabled, and the timer of the Auto Backlight Off function is restarted at the end of operation:

- Optical pulse testing is in progress.
- Real-time measurement is in progress.
- Auto search is in progress.
- Continuous light emission is in progress.
- Optical power level measurement is in progress.
- Fiber identification light source is on.
- The visible light source is on or flashing.
- Measurement using the IP test function is in progress.
- File access (save, read, copy, delete, etc.) is in progress.
- Self diagnosis is in progress, or the internal memory is being repaired or formatted.
- The firmware is being updated.
- Currently connected with a personal computer.

When the power is turned off by the Auto Backlight Off function, the initial screen will be displayed at the next startup.

(2) Power-Saving

Power-Saving in OTDR

When pulse measurement is completed and successive pulse measurement is not performed for a certain period, the internal devices enter the standby status to save the power (power-saving status). The condition for switching to the power-saving status can be set in this field.

High: (recommended)	Switches to the power-saving status when successive pulse measurement is not performed within approx. 10 seconds after pulse measurement is completed.
Low:	Switches to the power-saving status when successive pulse measurement is not performed within approx. 180 seconds after pulse measurement is completed.
None:	Does not switch to the power-saving status after pulse measurement is completed.

When starting an optical pulse test from the power-saving status, it takes about one second to start measurement because the internal devices needs setup time.

When a screen other than the optical pulse test screen is displayed (Top Menu screen, etc.), unused devices are in the standby status so as to save the power regardless of this setting.

3.5.4 Measurement settings

Press f4 (Measurement Setting) on the screen shown in Fig. 3.5.1-1 to display the screen shown in Fig. 3.5.4-1.

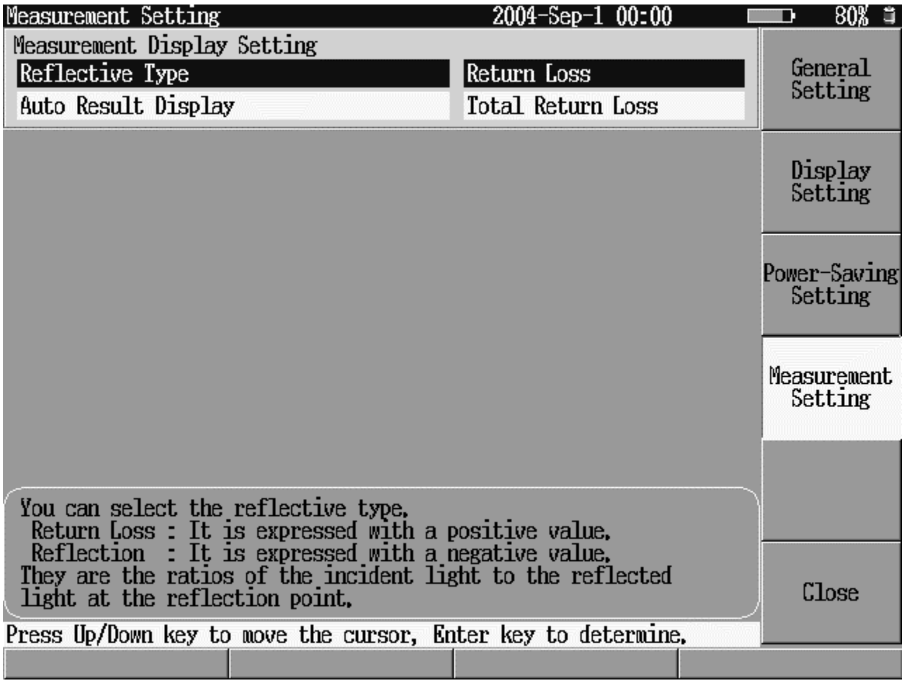


Fig. 3.5.4-1 Measurement Setting screen

Reflective Type

Sets whether the return loss or level difference (amount of reflection) is shown as the result of reflection measurement.

Return Loss: Ratio of the incident light to the reflected light at the reflection point.

Reflection: This is the negative value of Return Loss.

Auto Result Display

Sets whether the total return loss or average loss is shown as the result of event auto detection in OTDR (Trace Analysis).

Average Loss: Average loss up to the fiber end
(Average loss = Total loss / Optical fiber length)

Total Return Loss: The superposition of the reflections in the whole measurement area, i.e., the ratio of the sum of the reflected optical power levels to the incident optical power level.

3.6 Turning Off Power

Pressing the Power key causes the system settings to be saved and the following message to be displayed, except when the backlight is left off by the Auto Backlight Off function:

Press the Power key again to turn off the instrument. Press other keys to cancel.

When the Power key is pressed again at this time, the power to the MT9080 Series is turned off.

To cancel the turn-off process, press any key other than Power.

Under every condition, pressing the Power key for a long time forcibly turns off the power. Note that no message appears and the system settings are not saved at this time.

3.7 Printing Screen Image

Select a printer to be used for printing in the system settings in advance (refer to Section 3.5.1 "General settings" for printer setting).

Also, connect a printer and the MT9080 Series and turn on the printer (refer to Section 9.3 "Printer" for connecting a printer).

Note:

Screen image printout is impossible for some screens such as the top menu and the screen image saving screen.
A screen image cannot be printed out under some conditions (e.g., during optical pulse test measurement).

3.7.1 Executing printing

Pressing [7] (Print) displays the message shown below.

You can output a screen dump to a printer or an image file. Please select output form by function key.

At this time;

Pressing [f1] (Printer) starts printing.

Pressing [f2] (File) displays the screen image saving screen, from which a screen image can be saved in a file. Refer to Section 3.8 "Saving Screen Image to File" for details.

Pressing [f6] (Cancel) cancels screen image output and the status before [7] (Print) was pressed is restored.

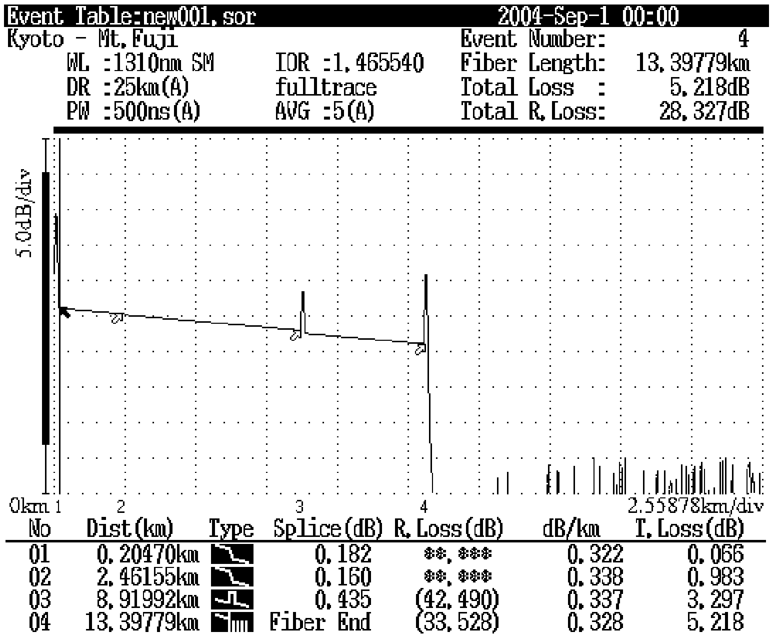


Fig. 3.7.1-1 Screen image printout example

3.7.2 Canceling printing

The message shown below is displayed when printing is started.

Please wait for a while. Printing...

If [f1] (Quit Printing) is pressed while this message is displayed (i.e., during printing), printing is cancelled and the screen before [7] (Print) was pressed is displayed again.

3.7.3 Error messages displayed when starting printing

An error message is displayed if printing is started but the printer is not prepared properly for printing.

Error messages, potential causes, and response methods are shown in Table 3.7.3-1 below.

Table 3.7.3-1 Error messages and their causes, response methods

No.	Error message : Potential causes → Response method
1	Please check the printer. The printer may be not turn on or the cable is not correctly connected. : The printer is not turned on, or the USB printer conversion cable is not connected to the printer securely. → Securely connect the USB printer conversion cable to the printer, and then turn on the printer. → Some USB printer conversion cables require you to remove the USB connector from the MT9080 Series and then connect it again for normal operation. If no problem is found with the connection between the USB printer conversion cable and the printer, remove and re-connect the USB connector.
2	The printer cable is not connected. : The USB connector of the USB printer conversion cable is not connected to the MT9080 Series. → Connect the USB connector of the USB printer conversion cable to the USB Down port on the MT9080 Series.
3	Please check the printer. The printer is offline. : The SELECT button on the printer has not been pressed. → Press the SELECT button on the printer, and check that the SELECT LED lights up green.
4	Paper out. Please replenish it with paper. : The printer paper has run out. → Set a new printer paper roll in the printer.
5	Please check the printer. The printer is not ready. : The printer head-up lever is raised, or other failures occur on the printer. → Pull down the printer head-up lever, and press the SELECT button on the printer. When using the BL-80RII, check if the LED is blinking. (The printer may be broken if the LED is blinking.)

Note:

If an error occurs during printing, check the printer status and eliminate the cause of the error before starting printing.

If the printer status is normal, once remove the USB printer conversion cable USB connector from the MT9080 Series and then connect it again.

3.8 Saving Screen Image to File

When f2 (File) is pressed when the message shown in Section 3.7.1 is displayed, the screen image saving screen is displayed.

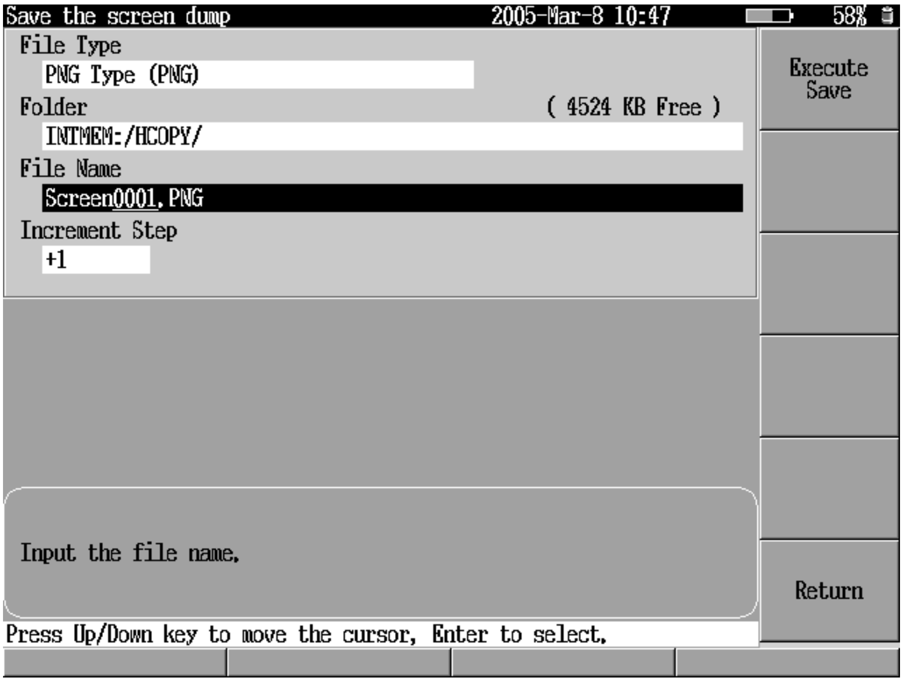


Fig. 3.8-1 Screen image saving screen (Save the screen dump)

Note:

Screen image printout is impossible for some screens such as the top menu and the screen image saving screen.

A screen image cannot be printed out under some conditions (e.g., during optical pulse test measurement).

3.8.1 Save settings

This section describes the settings for saving a screen image to a file.

The cursor can be moved to the desired setting item by using the ∧ and ∨ keys.

Setting selection and character entry can be operated by selecting the setting item and pressing the Enter key. To cancel the selection of the setting item, press the ESC key.

Refer to Section 3.2.3 “Character entry procedure” for how to enter characters.

File Type

Selects a file type (format) in which the screen image is saved. The MT9080 Series supports three file formats for saving a screen image: BITMAP, JPEG, and PNG.

BITMAP type (BMP):

A screen image file is saved in the bitmap format, which is generally used in Windows®. A screen image file in this format can be used by almost all applications, but its size is comparatively large about 300 Kbytes.
Screen images are recorded as they look.
The extension of a BITMAP-formatted file is "BMP."

JPEG type (JPG):

A screen image file is saved in the JPEG format, which is commonly used in Windows®, websites, and digital cameras. A screen image in this format can be used by almost all applications, but the image may be degraded and details may be unrefined since its size is comparatively small about 50 to 100 Kbytes.
The extension of a JPEG-formatted file is "JPG."

PNG type (PNG):

A screen image file is saved in the PNG format, which is commonly used on websites. Although a screen image in this format cannot be used by some old applications, its size is significantly small about 5 to 15 Kbytes.
Screen images are recorded as they look, and the details are still refined.
The extension of a PNG-formatted file is "PNG."

Folder

Set the folder in which the created file is to be saved. The folder selection dialog box is displayed by pressing Enter key when the cursor is in the entry area for Folder. Select the destination folder by pressing ∧ or ∨ key and then press f1 (Change Folder). Refer to Section 8.1.3 "Changing folder" for details.

File Name

Set the name of the file to be saved.

The file name can be input up to 50 characters (excluding the extension).

The automatic increment function is enabled when an underline is displayed for the file name numerical part. The value set in Increment Step is added each time screen image saving is completed, and the next file name is updated. Refer to Section 8.2 “Automatic Increment Function” for details of the automatic increment function.

Capital and small characters are not differentiated for file name alphabets (non-case sensitive). Be careful of file overwriting.

Increment Step

Set an additional value for the automatic increment function when screen image saving, within the following setting range:

Increment Step: –10 to +10

The numerical keys, [f1] (switching +/–), and the [∧] and [∨] keys can be used for setting Increment Step.

Refer to Section 3.2.2 “Setting procedure” for how to set.

3.8.2 Executing save

Press [f1] (Execute Save) on the screen image saving screen shown in Fig. 3.8-1 to save the screen displayed prior to the screen image saving screen in a file according to the specified settings. Then the status before [7] (Print) was pressed is restored.

When a file with the same name already exists in the save destination, the following message is displayed:

File exists already.

Press [f1] (Yes) to allow saving, and press [f2] (No) to cancel.

3.8.3 Error message

Refer to Section 8.1.7 “Error message” for error messages.

Section 4 Optical Pulse Test – OTDR (Fault Locate)

This section outlines the operating procedure by showing examples of OTDR (Fault Locate).

The items displayed in the [ ] in this section indicate panel keys.

4.1 Optical Pulse Test - OTDR (Fault Locate)

Splice points with splice loss or return loss exceeding the preset threshold are detected, and listed in an event table. In addition, possible fault points of the detected events are listed.

4.2 Setting Measurement Conditions

In the Top Menu (Fig. 3.2.1-1), select “OTDR (Fault Locate)” using the ∧ and ∨ keys and press the Enter key, or press 3 (OTDR (Fault Locate)) to display the Measurement Condition (Fault Locate) screen. The Measurement Condition screen is used to set or make changes to the measurement conditions. Even if a setting screen other than the Measurement Condition (Fault Locate) screen (e.g., screens for setting threshold, additional functions, etc.) is displayed, the Measurement Condition (Fault Locate) screen can be simply displayed by pressing f1 (Measurement Condition). This screen can also be displayed by pressing 5 (Setup) when the measurement screen is displayed.

Since the MT9080 Series saves measurement conditions for each wavelength, when the wavelength is changed, the measurement conditions according to the set wavelength will be set.
When the MT9080 Series is turned off, the currently set measurement conditions are stored in the internal memory. They are recalled from the memory when the power is turned on next time.

The measurement conditions can be simply saved by pressing F3 (Save DFN). And if the measurement conditions are changed, the conditions before change can be simply restored and applied by pressing F2 (Recall DFN).

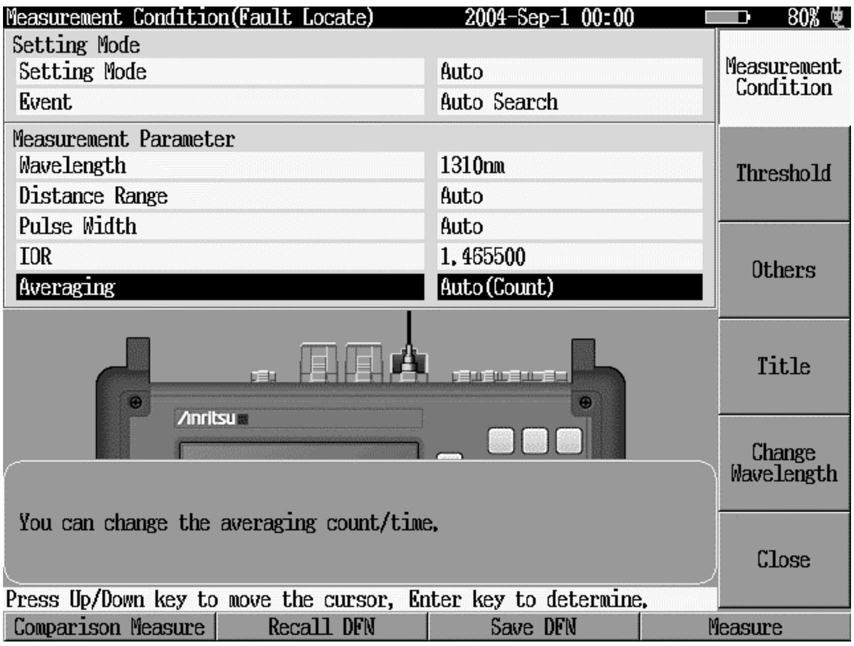


Fig. 4.2-1 Measurement Condition (Fault Locate): Measurement Condition screen

The following subsections detail the parameters on the Measurement Condition screen. The factory shipment settings are summarized in Appendix F "Settings at Factory Shipment".

4.2.1 Measurement conditions

(1) Setting Mode

<1> Setting Mode

Switch the setting mode (Auto/Manual).

Auto: Automatically sets all parameters of Distance Range, Pulse Width, and Averaging. When measurement is complete, event detection is executed automatically.

Manual: Measurement is performed under the measurement conditions currently set. When measurement is complete, event detection is executed automatically.

<[Setting Mode: Auto] Setting Procedure>

1. Move the cursor to [Setting Mode] by using the [∧] and [∨] keys.
2. Press the [Enter] key to open a window that contains the selections.

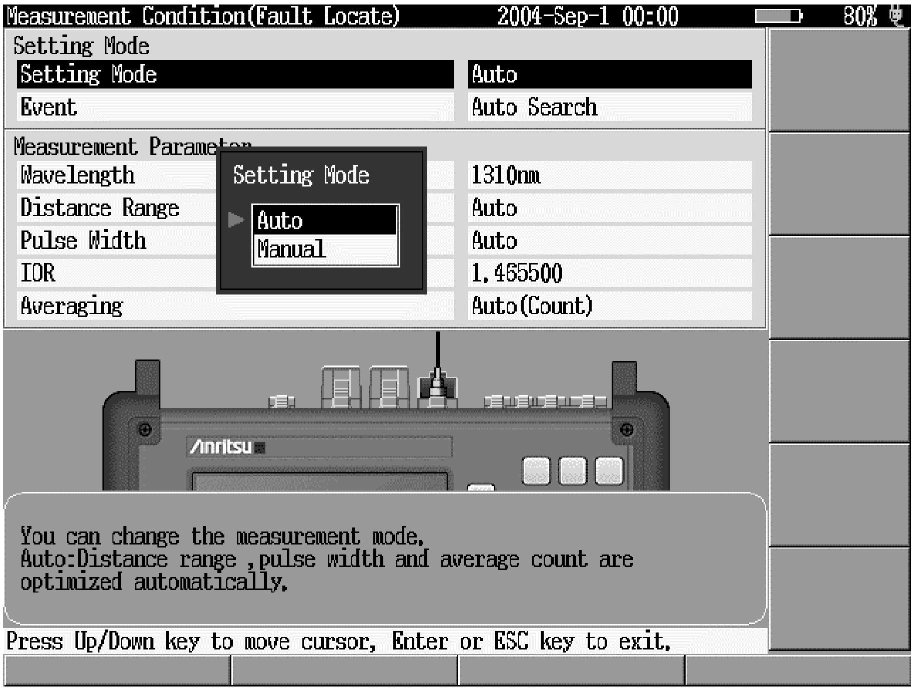


Fig. 4.2.1-1 Setting Mode screen

3. In the window, move the cursor to [Auto] by using the [∧] and [∨] keys.
4. Press the [Enter] key to determine the selection. The window closes, and the Measurement Condition screen is displayed again.

Even if [Setting Mode] has been set to [Auto], the setting mode switches to [Manual] if the settings of the [Distance Range], [Pulse Width], or [Averaging] are changed to one other than [Auto].

Note:

When [Event] is set to [Fixed] (see <2> Event below), [Setting Mode] is automatically set to [Manual] and [Auto] cannot be set.

<2> Event

Switch whether to detect events when creating an event table (Auto Search or Fixed).

Auto Search: Event points such as splice and fault points are detected automatically.

Fixed: Detected event points are fixed, with auto event detection off. Useful when the splice points (events) are placed in the same positions for every optical fiber, like in multi-core optical fiber cases.

Note that [Event] will be automatically set to [Auto Search] when [Setting Mode] is set to [Auto].

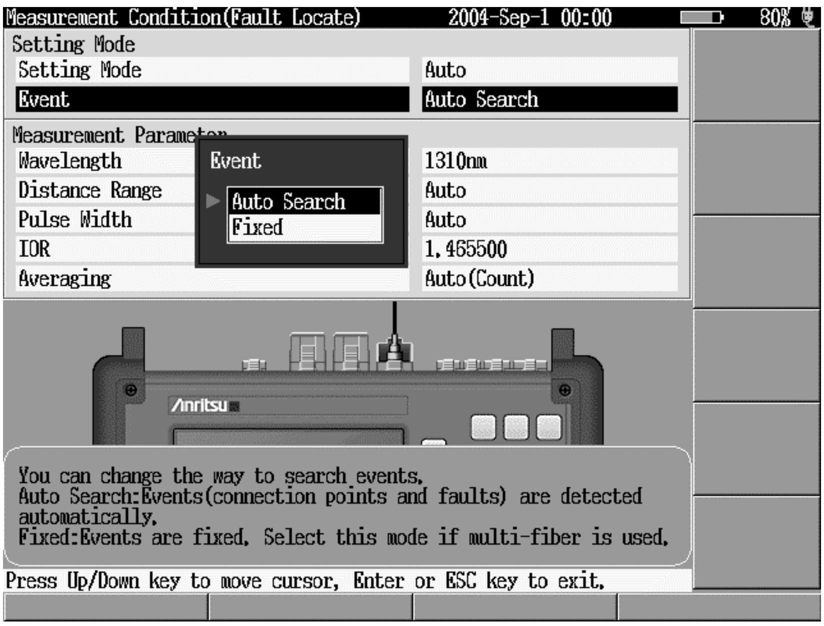


Fig. 4.2.1-2 Event screen

(2) Measurement Parameter

<1> Wavelength

Switch the measurement wavelength.

One wavelength can be selected from the loaded wavelengths as the measurement wavelength.

Refer to Appendix A “Specifications” for selectable wavelengths.

<Wavelength Setting Procedure>

1. Move the cursor to [Wavelength] by using the ∧ and ∨ keys.
2. Press the Enter key to open a window that contains the selections. Note that no window will be opened if there is only one selectable wavelength.

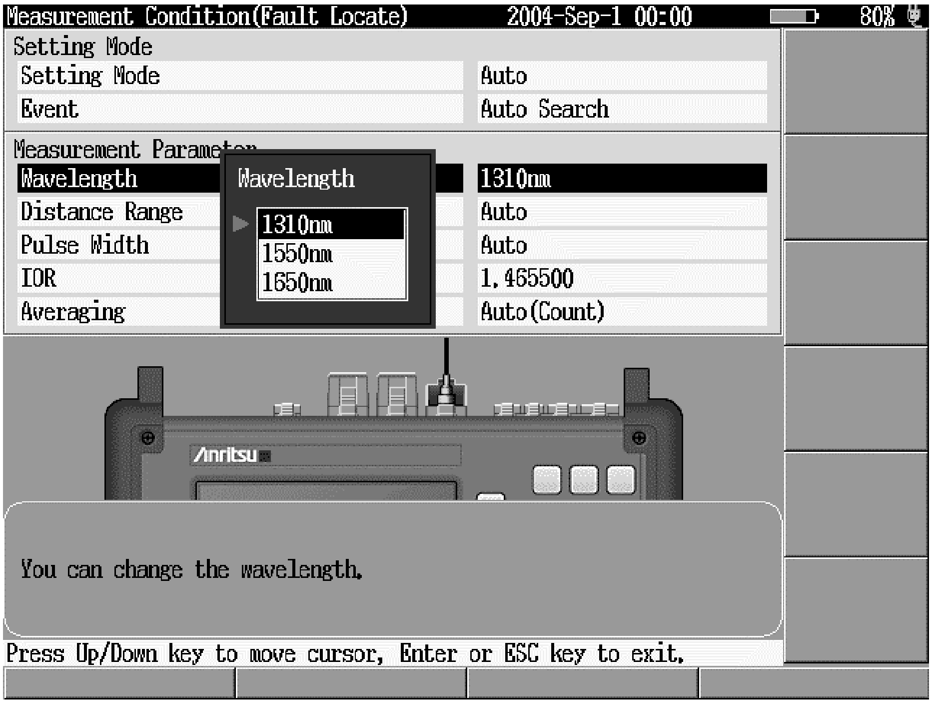


Fig. 4.2.1-3 Wavelength screen

3. In the window, move the cursor to the desired wavelength by using the ∧ and ∨ keys.
4. Press the Enter key to determine the selection. The window closes, and the Measurement Condition screen is displayed again. When the ESC key is pressed after setting a wavelength in the [Wavelength] window, the window is closed ignoring the change of wavelength. (The wavelength before the window was opened remains effective.)

The wavelength is changed as follows each time f5 (Change Wavelength) on the Measurement Condition (Fault Locate) screen is pressed. Refer to Appendix A "Specifications" for selectable wavelengths.

For MT9080F: 1310 nm → 1550 nm → 1650 nm → 1310 nm...

Note:

> f5 (Change Wavelength) is not displayed when there is only one wavelength.

The wavelength settings are identical for both OTDR (Fault Locate) and OTDR (Trace Analysis). The settings made in the Measurement Condition (Fault Locate) screen will be reflected in the Measurement Condition (Trace Analysis) screen.

Note:

> Indication of warm-up operation and out of operating temperature range status:
>
> Certain units may require a warm-up operation.
>
> If F4 (Start) or f6 (Real Time) is pressed during a warm-up operation, a message is displayed (see Fig. 4.2.1-4 below) and a waiting status is entered. The waiting time is about 30 to 120 seconds, though it varies depending on the ambient temperature. Measurement is automatically resumed as soon as it becomes possible. If f1 (Cancel Measurement) is pressed during the waiting status, measurement is cancelled and the window is closed.
>
> If an attempt is made to start measurement at a temperature that is out of the operating temperature range, a message "Out of the operating temperature range. Cannot use this function now." is displayed and measurement cannot be started.

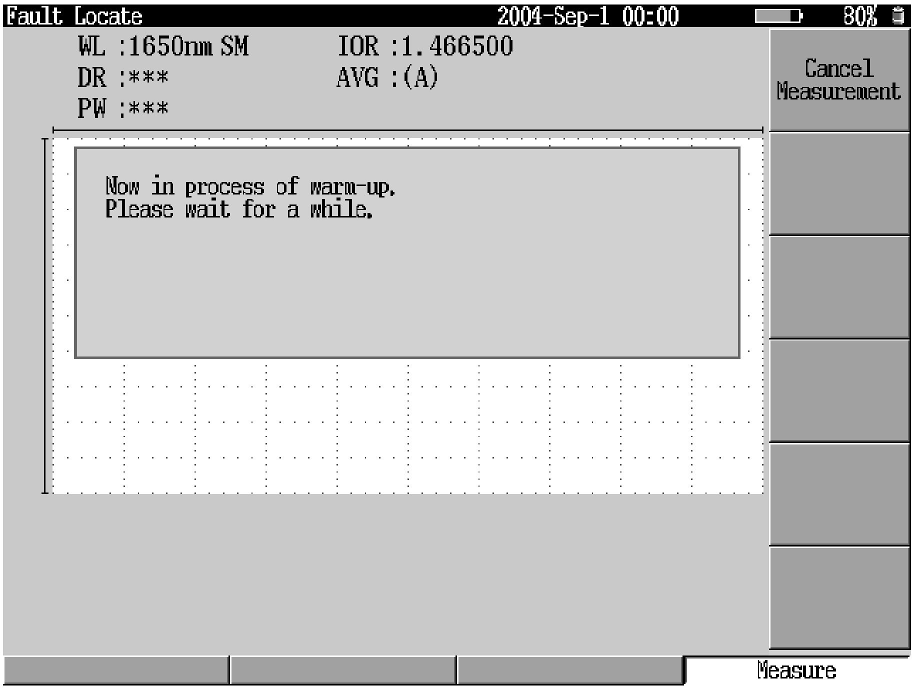


Fig. 4.2.1-4 Message during warm-up operation

Conditions whereas the unit needs to be warmed up:

Model name:	MT9081C/E/F/C1/E1/F1
Wavelength:	When 1650 nm is selected
Message appearance:	After startup or immediately after IP test end

<2> Distance Range

Switch the distance range. Note that if [Event] is set to [Fixed], the selections do not contain [Auto] and [Auto (less than 5 km)], which these cannot be selected. Refer to Appendix A “Specifications” for settable distance range.

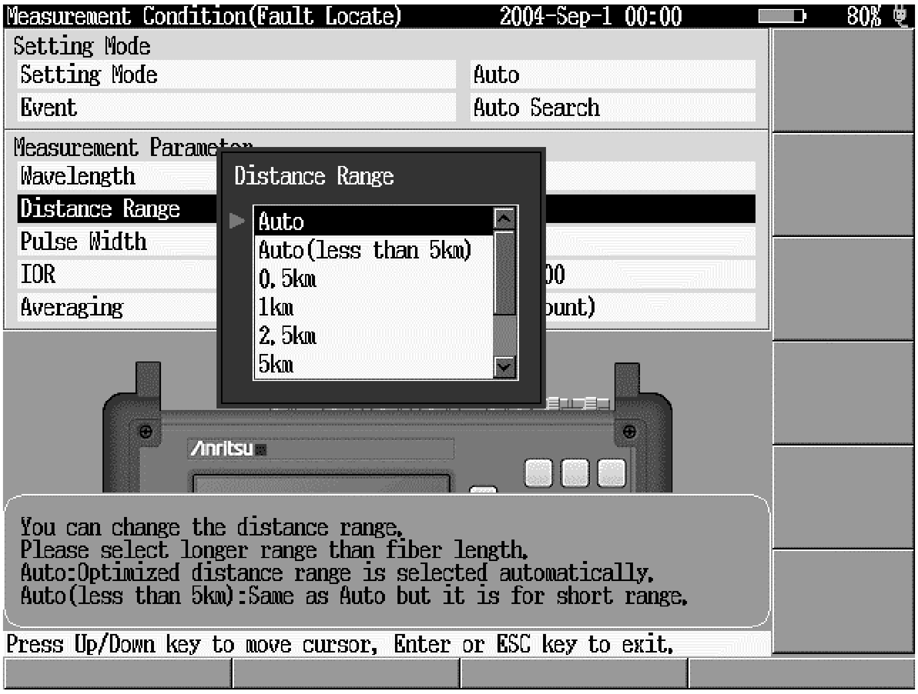


Fig. 4.2.1-5 Distance Range screen

When [Distance Range] is set to [Auto] and the Enter key is pressed, the optimal distance range is automatically selected for measurement.
If the whole length of the optical fiber is known, select a value that is slightly longer than that value. If a value (length) considerably longer is set, measurement will take longer. And if you a value (length) shorter than the actual length of the optical fiber is set, measurement will not be performed correctly.

The distance range settings are identical for both OTDR (Fault Locate) and OTDR (Trace Analysis). The settings made in the Measurement Condition (Fault Locate) screen will be reflected in the Measurement Condition (Trace Analysis) screen.

If the sampling mode is set to high density, [0.5 km] cannot be set for [Distance Range]. Refer to (3) Detailed Measurement Parameters in Section 5.2.1 for details of the sampling mode setting.

<3> Pulse Width

Switch the pulse width. Refer to Appendix A "Specifications" for settable pulse width.

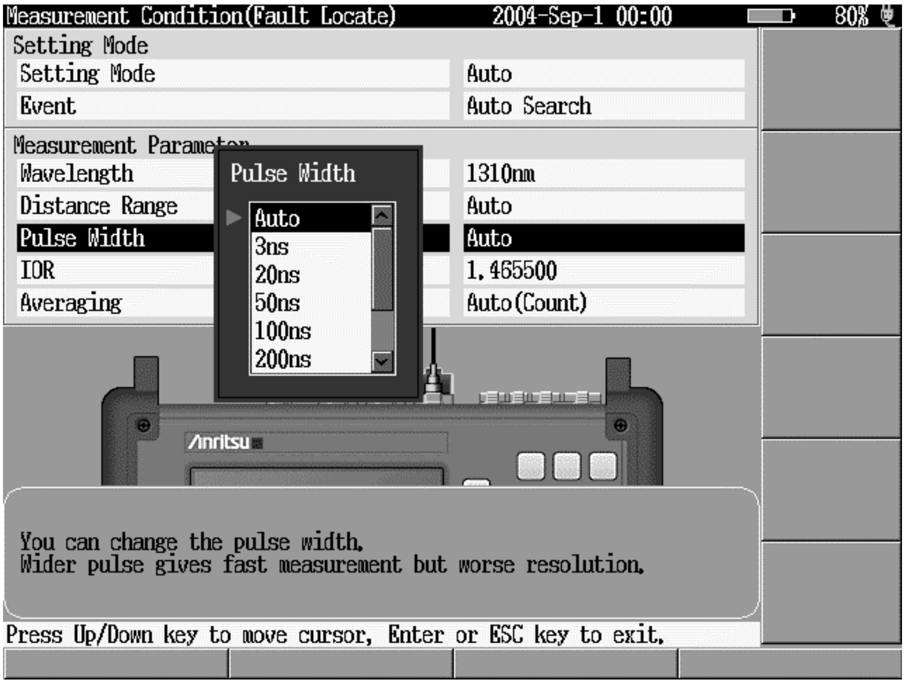


Fig. 4.2.1-6 Pulse Width screen

When [Pulse Width] is set to [Auto] and the Enter key is pressed, the optimal pulse width is automatically selected for measurement. The maximum pulse width that can be set varies depending on the distance range. To set a proper value, see Table 4.2.1-1 below. The shorter the pulse width, the higher the distance resolution, and therefore, the more accurate the measurement. In this event however, the power becomes smaller and the amount of noise generated increases as the light goes further for a long optical fiber.

Note:

If [Setting Mode] is set to [Auto], the distance range and pulse width will be set to [Auto].

The pulse width settings are identical for both OTDR (Fault Locate) and OTDR (Trace Analysis). The settings made in the Measurement Condition (Fault Locate) screen will be reflected in the Measurement Condition (Trace Analysis) screen.

Table 4.2.1-1 Relationship between pulse width and distance range

MT9080A/B/C/D/E/F

Distance range (km)	Pulse width (ns)							
	3	20	50	100	200	500	1000	2000
0.5	✓	✓	✓	✓				
1	✓	✓	✓	✓				
2.5	✓	✓	✓	✓				
5	✓	✓	✓	✓	✓			
10	✓	✓	✓	✓	✓			
25	✓	✓	✓	✓	✓	✓	✓	
50	✓	✓	✓	✓	✓	✓	✓	✓

MT9081A/B/C/D/E/F/A1/B1/C1/D1/E1/F1

Distance range (km)	Pulse width (ns)											
	3	10	20	50	100	200	500	1000	2000	4000	10000	20000
0.5	✓	✓	✓	✓	✓							
1	✓	✓	✓	✓	✓							
2.5	✓	✓	✓	✓	✓							
5	✓	✓	✓	✓	✓	✓						
10	✓	✓	✓	✓	✓	✓						
25	✓	✓	✓	✓	✓	✓	✓	✓				
50	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
100	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
200	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

<<Remarks>>

When setting the pulse width, note the following:

Table 4.2.1-2 lists the distances equivalent to various pulse widths. Table 4.2.1-3 lists the sampling resolutions that are determined by the distance range and sampling mode settings (refer to (3) Detailed Measurement Parameters in Section 5.2.1).

Notes:

1. The sampling mode of OTDR (Fault Locate) is fixed to “Normal”.
2. The waveform that was measured while [Sampling Mode] is set to [High Density] in the OTDR (Fault Locate) screen can also be viewed on the OTDR (Trace Analysis) screen. At this time, high density waveform data is used for automatic event detection in OTDR (Fault Locate).

Table 4.2.1-2 Distances equivalent to pulse widths

Pulse width (ns)	Distance (m)
3	0.3
10	1
20	2
50	5
100	10
200	20
500	50
1000	100
2000	200
4000	400
10000	1000
20000	2000

Table 4.2.1-3 Relationship between distance range, sampling mode, and sampling resolution

Distance range (km)	Sampling mode	
	Normal (m)	High density (m)
0.5	0.1	–
1	0.2	0.05
2.5	0.5	0.1
5	1	0.2
10	2	0.5
25	5	1
50	10	2
100	20	5
200	40	10

Therefore, if you select a pulse width equivalent to a smaller distance than the sampling resolution, the peak of the returned waveform cannot be sampled, and the proper waveform may be unable to be shown. In such a case, it is necessary to select a large pulse width, change the sampling mode to high density, or change the distance range.

Example:

When the distance range is [50 km], the sampling mode is [Normal], and the pulse width is [20 ns], a 2 m pulse waveform will be hidden in a 10 m pulse because the distance equivalent to the pulse width is 2 m. When the pulse width is changed to 200 ns, the equivalent distance will be 20 m, which is larger than the sampling resolution. The pulse waveform will therefore be able to be sampled and shown properly.

<4> IOR (index of refraction)

Set an index of refraction from 1.000000 to 1.999999.

Enter the value that is recommended by the manufacturer of the optical fiber to be connected.

Reference: When an ordinary SMF (single mode fiber) is used, the reference initial value is as follows:

1310 nm: 1.465500
1550 nm: 1.466100
1650 nm: 1.466500

When the IOR value is changed on the IOR setting dialog box, the selected marker position or selected event distance display values are changed automatically.

<Index of Refraction (IOR) Setting Procedure>

1. Move the cursor to [IOR] by using the ∧ and ∨ keys.
2. Press the Enter key to open a window to set the value.

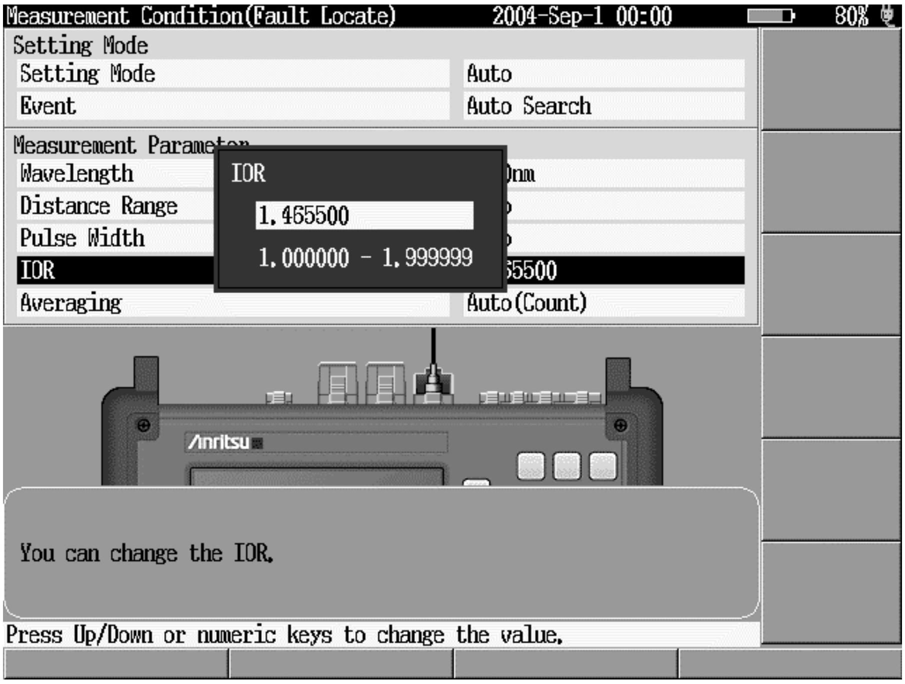


Fig. 4.2.1-7 IOR screen

3. Change the value by using the ∧ and ∨ keys, or by typing the value with the numeric keys.

4. Press the Enter key to determine the selection. The window closes, and the Measurement Condition screen is displayed again.
   In this example, the reference initial value 1.465500, at a waveform of 1310 m is used as is.
   When the ESC key is pressed after setting the IOR in the [IOR] window, the window is closed ignoring the change of IOR. (The IOR before the window was opened remains effective.)

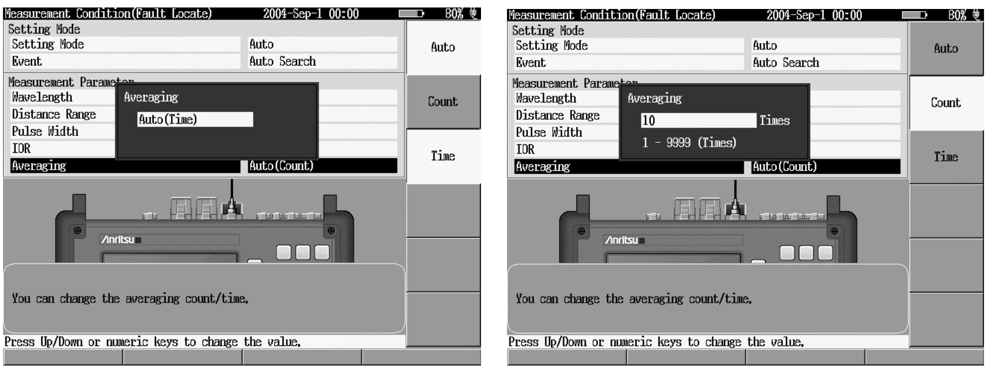
The IOR settings are identical for both OTDR (Fault Locate) and OTDR (Trace Analysis). The settings made in the Measurement Condition (Fault Locate) screen will be reflected in the Measurement Condition (Trace Analysis).

<5> Averaging

Set the averaging count or time (Auto, 1 to 9999 (times or seconds)).
The averaging unit (Count/Time) can also be changed. Note that the actual elapsed time is displayed for the measured result when “Time” is set for the averaging unit. In this event, the time displayed for the measured result may be different from the setting value.

<Averaging Setting Procedure>

1. Move the cursor to [Averaging] by using the ∧ and ∨ keys.
2. Press the Enter key to open a window to set the value.
   To change the averaging unit (Count/Time), press f2 (count) or f3 (second).



(a) (b)

Fig. 4.2.1-8 Averaging screen

3. Change the value by using the ∧ and ∨ keys, or by typing the value with the numeric keys. Pressing f1 (Auto) selects [Auto]. Refer to Fig. (b) above.

4. Press the Enter key to determine the selection. The window closes and the Measurement Condition screen is displayed again.
   When the ESC key is pressed after setting a value in the [Averaging] window, the window is closed ignoring the change. (The value before the window was opened remains effective.)

The averaging settings are identical for both OTDR (Fault Locate) and OTDR (Trace Analysis). The settings made in the Measurement Condition (Fault Locate) screen will be reflected in the Measurement Condition (Trace Analysis) screen.

4.2.2 Threshold

When f2 (Threshold) is pressed, the screen for setting threshold values is displayed.

Set the thresholds at which event points such as splice or break points are detected automatically. Splice points with splice loss or return loss exceeding the preset threshold are detected, and listed in an event table. In addition, you can also set the connection and transmission loss warning levels. Any event exceeding the warning level is highlighted in the event table.

The threshold settings are identical for both OTDR (Fault Locate) and OTDR (Trace Analysis). The settings made in the Measurement Condition (Fault Locate) screen will be reflected in the Measurement Condition (Trace Analysis) screen.

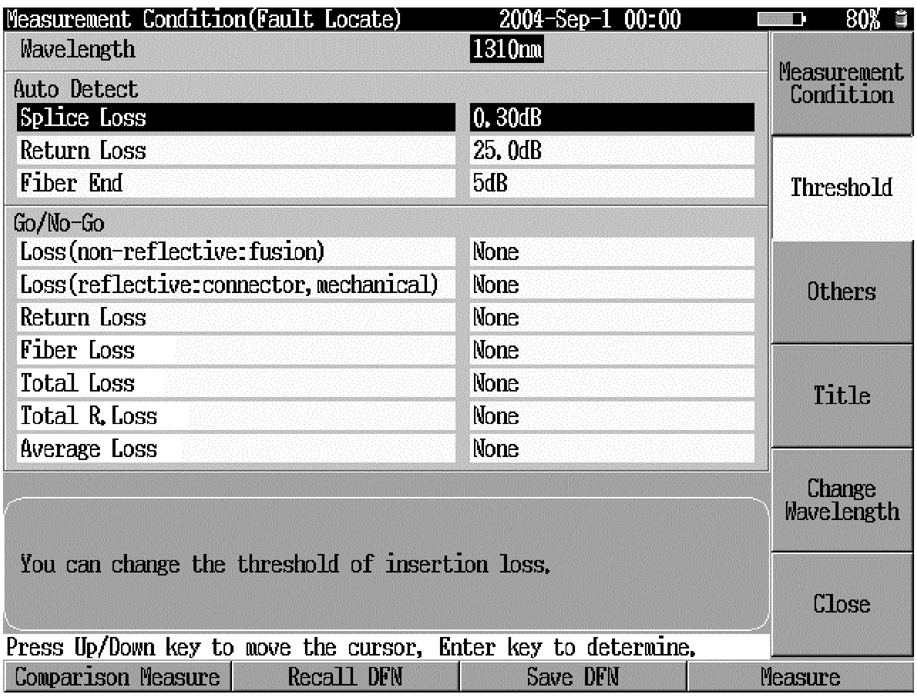


Fig. 4.2.2-1 Measurement Condition (Fault Locate): Threshold screen

(1) Wavelength

The measurement wavelength set in the Measurement Condition screen is displayed. To switch the wavelength, refer to (2) Measurement parameters in Section 4.2.1.
The wavelength is changed as follows each time [f5] (Change Wavelength) is pressed. Refer to Appendix A “Specifications” for selectable wavelengths.

For MT9080F: 1310 nm → 1550 nm → 1650 nm → 1310 nm...

Note:

[f5] (Change Wavelength) is not displayed when there is only one selectable wavelength.

(2) Auto Detect

<Setting Procedure for Each Item>

1. Move the cursor to the filed to be changed by using the [∧] and [∨] keys.
2. Press the [Enter] key to open a window to set the value.
3. Change the value by using the [∧] and [∨] keys, or by typing the value with the numeric keys.
4. Press the [Enter] key to determine the selection. The window closes, and Measurement Condition screen is displayed again.

<1> Splice Loss

Each point exhibiting a splice loss exceeding the preset value is defined as an event point.
The setting range is from 0.01 to 9.99 dB, in 0.01 dB steps.
The factory default setting is 0.30 dB.

<2> Return Loss

Each point exhibiting a return loss exceeding the preset value is defined as an event point.
The setting range is from 20.0 to 60.0 dB, in 0.1 dB steps.
The factory default setting is 25.0 dB.

<3> Fiber End

The cable exhibiting a return loss exceeding the preset value is defined as the far end.

The setting range is from 1 to 99 dB, in 1 dB steps.

Once an event point is detected as the fiber end, the MT9080 Series does not attempt to detect any further event points. If you want the equipment to detect event points further than the event it has determined as the fiber end, set 99 dB in this field. The fiber far end is then not detected.

The factory default setting is 5 dB.

(3) Go/No-Go (event pass/fail judgment)

Set the threshold value for event pass/fail judgment (Go/No-Go). The function that evaluates the measured result and displays a warning is set.

Sets a threshold value used for warning display for each item. When [None] is selected, the warning display does not work for the corresponding item.

When the [∧] or [∨] key is pressed while a parameter set to [None] is selected, the previous setting value stored in the memory is displayed. Then the value can be incremented/decremented by using the [∧] and [∨] keys.

<Setting Procedure for Items to Be Evaluated>

1. Move the cursor to the field to be changed by using the [∧] and [∨] keys.
2. Press the [Enter] key to open a window to set the value.
3. Change the value by using the [∧] and [∨] keys, or by typing the value with the numeric keys. Pressing [f1] (None) selects [None].
4. Press the [Enter] key to determine the selection. The window closes, and Measurement Condition screen is displayed again.

The items to be evaluated and the setting ranges for these items are summarized below:

<1> Loss (non-reflective: fusion)

The object is an event that does not accompany any returns of fused connection, etc.
The setting range is from 0.10 to 9.99 dB, in 0.01 dB steps.

<2> Loss (reflective: connector, mechanical)

The object is an event that accompanies returns of connector connection, mechanical splice, etc.
The setting range is from 0.10 to 9.99 dB, in 0.01 dB steps.

<3> Return Loss

The object is the return loss in the event table.
The setting range is from 10.0 to 50.0 dB, in 0.1 dB steps.
This parameter is not displayed when [Reflective Type] is set to [Reflection] in Section 3.5.4 “Measurement settings”.

<4> Level Difference (amount of reflection)

The object is the level difference (amount of reflection) in the event table.
The setting range is from 1.0 to 20.0 dB, in 0.1 dB steps.
This parameter is not displayed when [Reflective Type] is set to [Return Loss] in Section 3.5.4 “Measurement settings”.

<5> Fiber Loss

The object is the fiber loss (dB/km) in the event table. The event table of OTDR (Fault Locate) does not contain the fiber loss.
The setting range is from 0.01 to 9.99 dB/km, in 0.01 dB steps.

<6> Total

The object is the total loss of the searched results.
The setting range is from 0.1 to 60.0 dB, in 0.1 dB steps.

<7> TORL (Total Return Loss)

The object is the total return loss of the searched results. The searched results of OTDR (Fault Locate) do not contain the total return loss.
The setting range is from 10.0 to 50.0 dB, in 0.1 dB steps.
This parameter is not displayed on the measured results screen when [Auto Result Display] is set to [Average Loss] in Section 3.5.4 “Measurement settings”.

<8> Average

The object is the average loss of the searched results. The searched results of OTDR (Fault Locate) do not contain the average loss.
The setting range is from 0.01 to 9.99 dB/km, in 0.01 dB steps.
This parameter is not displayed on the measured results screen when [Auto Result Display] is set to [Total Return Loss] in Section 3.5.4 “Measurement settings”.

4.2.3 Additional functions

When [f3] (Others) is pressed, the screen for setting additional function is displayed.

In this screen, the conditions of the additional functions can be set.

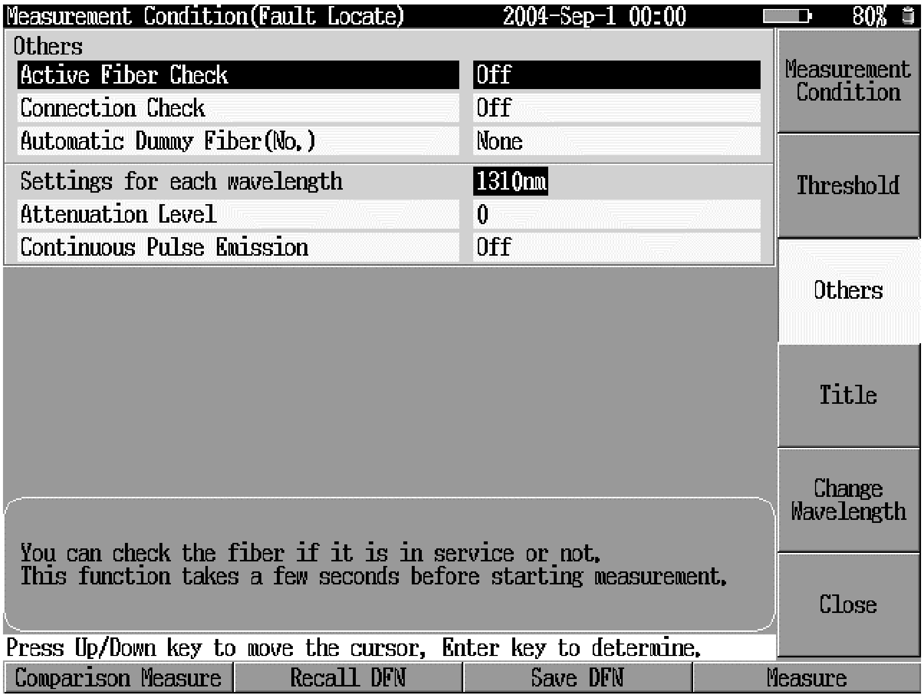


Fig. 4.2.3-1 Measurement Condition (Fault Locate): Others screen

(1) Others

<1> Active Fiber Check

Set whether to check the existence of communication light (another optical signal) in the optical fiber before measurement.

On: Checks the communication light.
Off: Does not check the communication light.

If the check detects communication light, a message appears and measurement is cancelled (refer to Fig. 4.2.3-2 below). Press any key to close the error message.

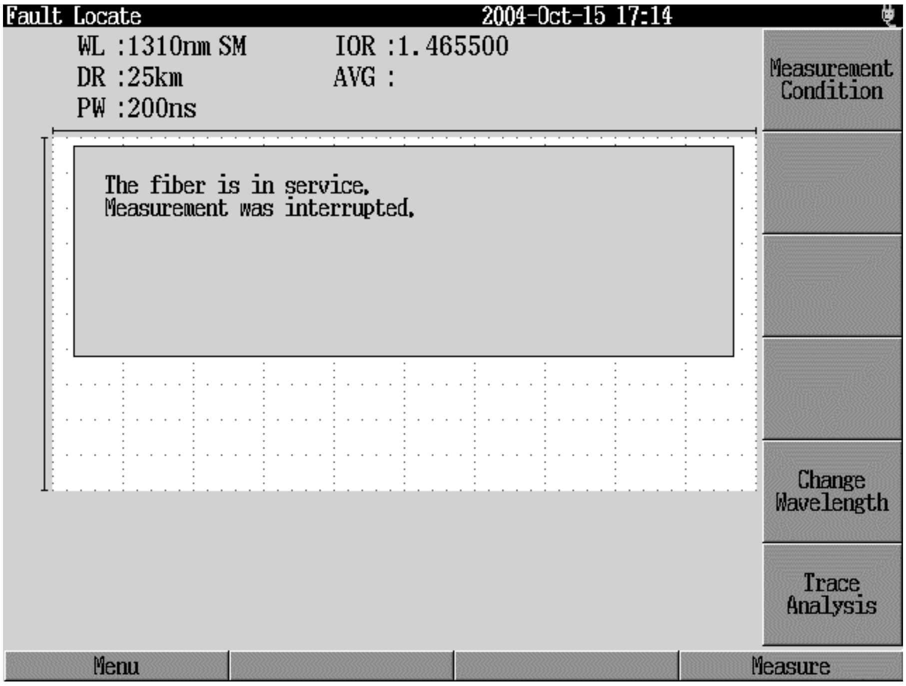


Fig. 4.2.3-2 Communication light check error message

The active fiber check settings are identical for both OTDR (Fault Locate) and OTDR (Trace Analysis). The settings made in the Measurement Condition (Fault Locate) screen will be reflected in the Measurement Condition (Trace Analysis) screen.

<2> Connection Check

Set whether to check the optical fiber connection status before measurement.

On: Checks the connection.

Off: Does not check the connection.

If this check detects a failure related to the connection state, the  mark is displayed on the upper right corner of the screen and a message appears (refer to Fig. 4.2.3-3 below). Press any key to close the error message.

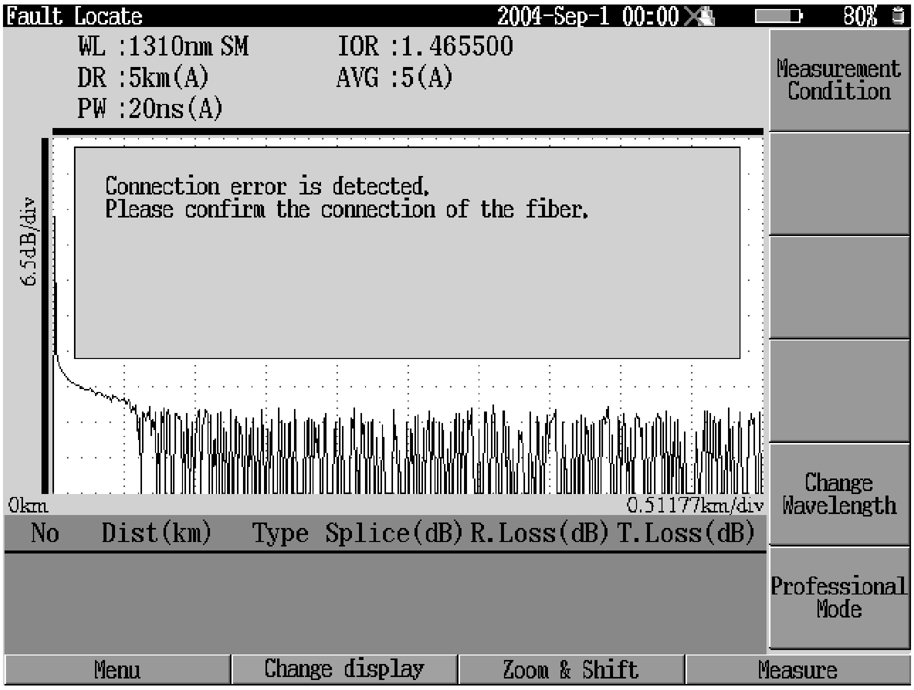


Fig. 4.2.3-3 Connection check error message

The connection check settings are identical for both OTDR (Fault Locate) and OTDR (Trace Analysis). The settings made in the Measurement Condition (Fault Locate) screen will be reflected in the Measurement Condition (Trace Analysis) screen.

<3> Automatic Dummy Fiber (No.)

After completion of measurement, the distance to the specified event number is regarded as a dummy fiber, and a relative distance is set referencing this position as 0 m.

1(st) to 9(th): Sets the automatic dummy fiber.
None: Does not set the automatic dummy fiber.

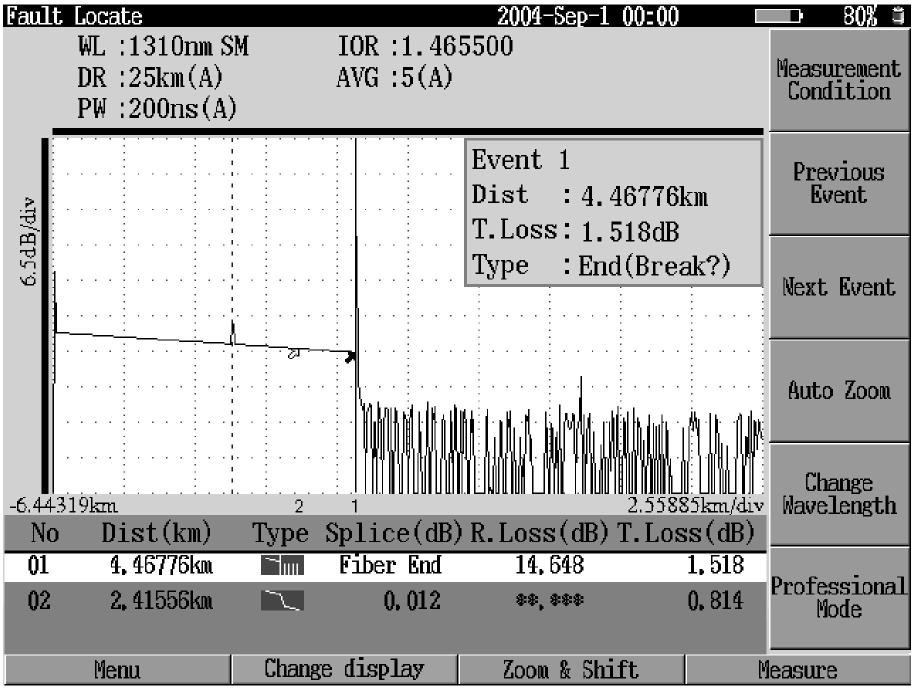


Fig. 4.2.3-4 Example of setting the automatic dummy fiber

The automatic dummy fiber settings are identical for both OTDR (Fault Locate) and OTDR (Trace Analysis). The settings made in the Measurement Condition (Fault Locate) screen will be reflected in the Measurement Condition (Trace Analysis) screen.

<4> Attenuation Level

When an optical pulse test is performed, the peak level of the optical power being output from the MT9080 Series is about +17 dBm. For this reason, if an optical pulse test is executed with the measured optical fiber connected to the communication device, the device may be damaged. If you have no choice but to execute an optical pulse test in this configuration, the output optical level of the MT9080 Series can be attenuated.

0: Attenuation off (attenuation level indicator is not displayed)
Setting value display: [1] to [15]

When the level attenuation function is enabled, the optical pulse attenuation level indicator is displayed at the lower left corner of the screen according to the setting value (refer to Fig. 4.2.3-5 “OTDR optical attenuation level indicator”). As the value increases, the optical power level decreases.

The level setting value is provided for each wavelength; when the wavelength is switched, the level setting set for that wavelength is displayed.

Note that the setting value is displayed for guidance purposes, and does not indicate an absolute value of the optical power level.

To attenuate the optical output level, connect the MT9080 Series to an optical power meter, enables continuous pulse luminescence (see <5> Continuous Pulse Luminescence in this section), and adjust the attenuation level.

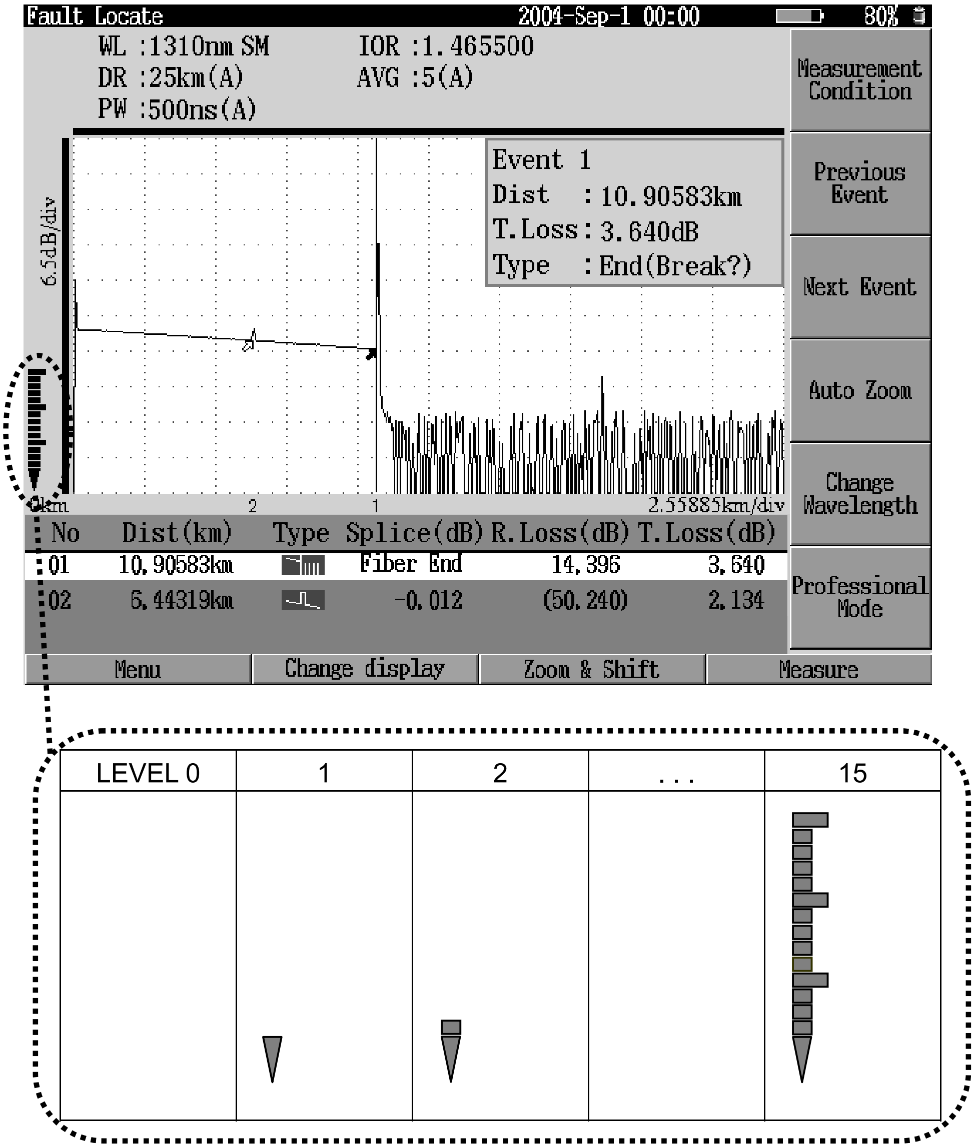


Fig. 4.2.3-5 OTDR optical attenuation level indicator

CAUTION ⚠

- **For this function, it is recommended that the test not be performed with the communication device connected to the optical fiber. Unless you have no choice but to perform testing in this configuration, keep the communication device removed from the optical fiber during testing.**
- **When the optical level has been attenuated, not all the standard values are guaranteed. If you need to measure the loss exactly, you should not use this function.**
- **If you increase the level setting value (attenuation value), light may not be emitted over several grades. Before using this function, measure the optical power level and check that the level is appropriate before starting the optical pulse test.**

<5> Continuous Pulse Luminescence

This function emits pulsed light continuously. This is used to perform a performance test or adjust the OTDR attenuation optical level, but is not used for optical fiber measurement.

On: Emits pulsed light continuously.
Off: Does not emit pulsed light continuously.

When the Enter key in this field, the On/Off selection window opens.

When [On] is selected, the following window is displayed and continuous pulse luminescence starts.

Note:

The continuous pulse luminescence function cannot be set to On when the distance range or pulse width is set automatically. Be sure to set them manually in the Measurement Condition screen so as to enable the continuous pulse luminescence function.

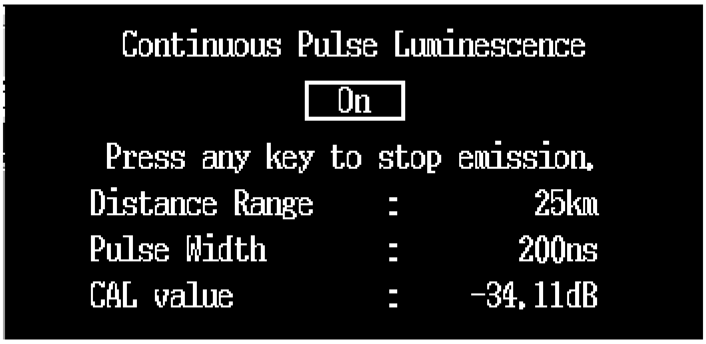


Fig. 4.2.3-6 Display example of Continuous Pulse Luminescence dialog box

The window lists the following parameters:

- Distance Range (only in km)
- Pulse Width
- CAL Value
  CAL value = 10*log (pulse width/repetition period T)
  * T (repetition period) is the value for each distance range.

The average power is usually measured by measuring the optical output of the MT9080 Series using the optical power meter. By setting the CAL value for the optical power meter, it is possible to display the measured results converted to the peak power. For the measuring instruments such as the optical power meter used for measurement, refer to Section 10.1.1 “Optical output and wavelength of OTDR.”

When any key is pressed while this window is displayed, the window is closed with continuous pulse luminescence off.

The [Distance Range] and [Pulse Width] values shown in the window are those set in the Measurement Condition screen. When the [Distance Range] or [Pulse Width] is set to [Auto], however, the continuous pulse luminescence function cannot be set to [On].

Note:

When a warm-up operation is performed for the unit under the specific conditions (refer to Section 4.2.1 “Measurement conditions”) and the continuous pulse luminescence is disabled, a message is displayed indicating that the warm-up operation is under execution (see Fig. 4.2.1-4 and 4.2.3-7 below). The window is closed by pressing any key.

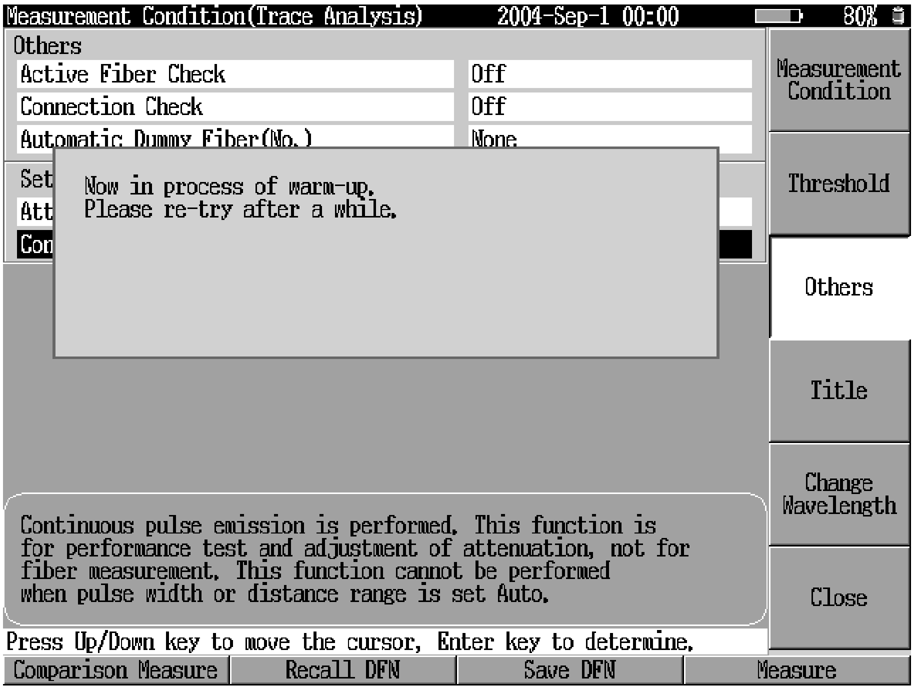


Fig. 4.2.3-7 Message during warm-up operation

4.2.4　Title

When [f4] (Title) is pressed, the screen for entering a title is displayed. In this screen, management comments to be saved in a file can be entered.

The title entered in this screen is also displayed at the top of the OTDR (Trace Analysis): Measured Result screen.

The title and header settings are identical for both OTDR (Fault Locate) and OTDR (Trace Analysis).　The settings made in the Measurement Condition (Fault Locate) screen will be reflected in the Measurement Condition (Trace Analysis) screen.

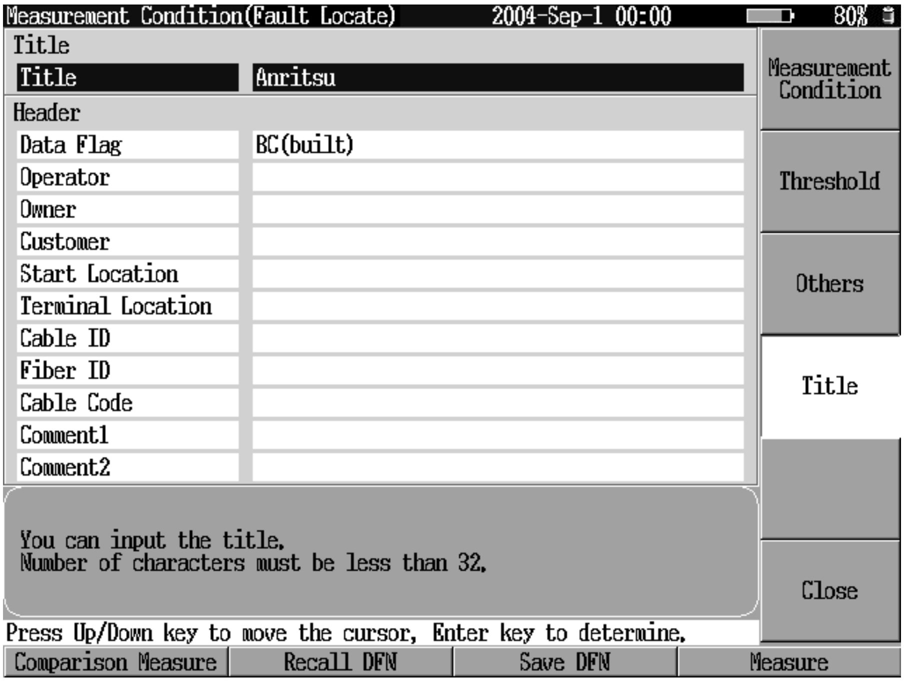


Fig. 4.2.4-1　Measurement Condition (Fault Locate): Title screen

(1)　Title

<1> Title

A title can be attached to the measured waveform.　The set title is saved in a file.

For OTDR (Trace Analysis), the title entered in this screen can be displayed at the top of the measured results screen in which the trace waveform will be displayed.　A title can be entered up to 32 characters.

<Procedure for Entering Title>

1. Move the cursor to [Title] by using the [∧] and [∨] keys.
2. Press the [Enter] key to open the character entry screen. For character entry details, refer to Section 3.2.3 "Character entry procedure".

(2) Header

The set header is saved in a file. A header can be entered up to 42 characters.

<1>	Data Flag:	You can select one of the following as the data flag: BC (Built): Building fiber RC (Recover): Recovering fiber OT (Others): Others
<2>	Operator:	Enter the operator name, operator department name, operator team name, and other information related to the operator.
<3>	Owner:	Enter the owner name, management department name, company name, and other information related to the owner.
<4>	Customer:	Enter the customer name and other information related to the customer.
<5>	Start Location:	Set the measurement start location name and other information related to the measurement start location.
<6>	Terminal Location:	Set the measurement terminal location name and other information related to the measurement terminal location.
<7>	Cable ID:	Set the cable ID.
<8>	Fiber ID:	Set the fiber ID.
<9>	Cable Code:	Set the cable code.
<10>	Comment1:	Enter the comment.
<11>	Comment2:	Enter the comment.

<Procedure for Entering Header (except data flag)>

1. Move the cursor to the header to be set by using the [∧] and [∨] keys.
2. Press the [Enter] key to open the character entry screen. For character entry details, refer to Section 3.2.3 "Character entry procedure".

4.2.5 Saving and recalling measurement conditions

The MT9080 Series can save and recall four types of measurement conditions in the internal memory. This function is useful when performing measurement under the same conditions with that of the previous measurement, and when changing the measurement conditions and then restoring them later.

(1) Saving measurement conditions

When [F3] (Save DFN) is pressed on the Measurement Condition (Fault Locate) screen, [f2] (User defined 1) to [f5] (User defined 4) are shown as locations where measurement conditions can be saved, as shown in the figure below. Out of the [f2] to [f5] keys, press the one associated with the desired saving location.

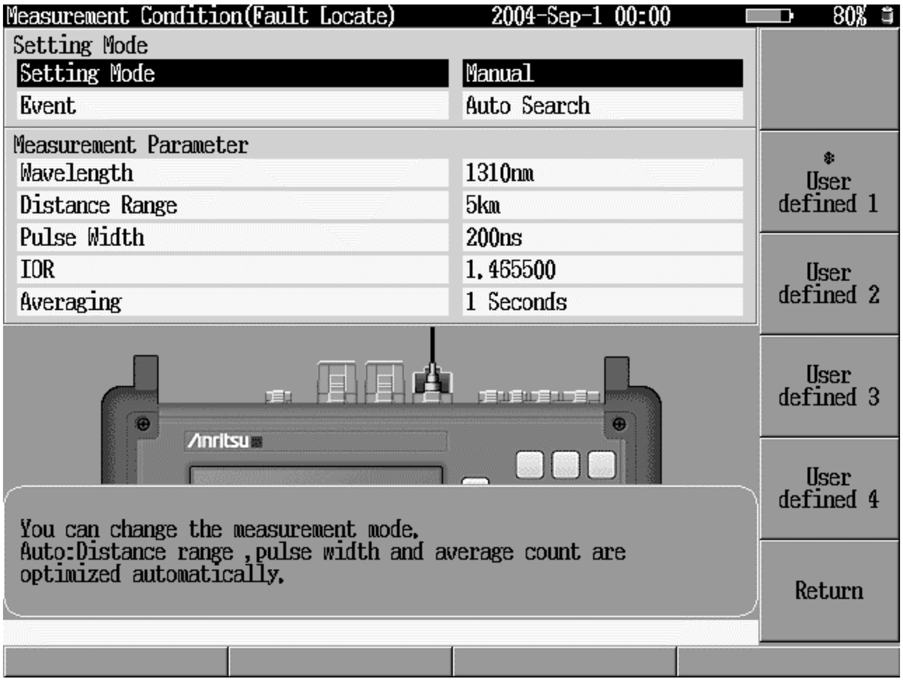


Fig. 4.2.5-1 Measurement condition saving screen

When measurement conditions are saved, an asterisk (*) mark is attached to that location. If you attempt to save data in a location indicated by an * mark, the confirmation message appears (Fig. 4.2.5-2), asking whether to allow overwriting of the measurement conditions. Press [f1] (Yes) to allow overwriting, and press [f2] (No) to cancel.

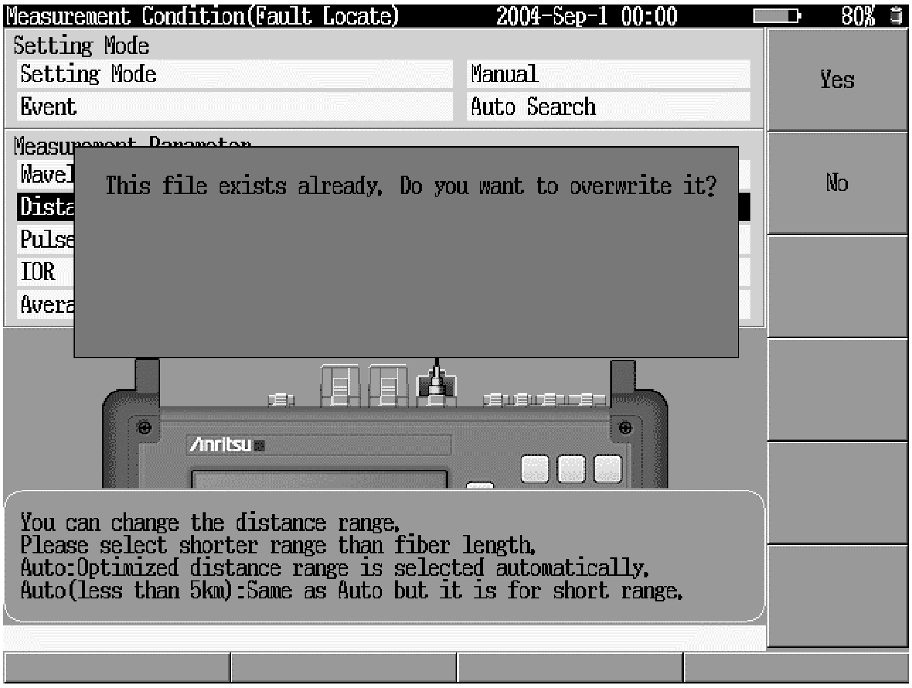


Fig. 4.2.5-2 Confirmation message for overwriting measurement conditions

(2) Recalling measurement conditions

When F2 (Recall DFN) is pressed on the Measurement Condition (Fault Locate) screen, [User defined 1] to [User defined 4] are shown on the f2 to f5 keys associated with the locations that contain the measurement conditions (see the figure below). Nothing is displayed on the key (i.e., left blank) for which no measurement condition is saved. Fig. 4.2.5-3 shows an example where measurement conditions are saved in [User defined 1] only.

Pressing the key associated with the measurement condition to be recalled changes the measurement condition currently set to the one that was recalled.

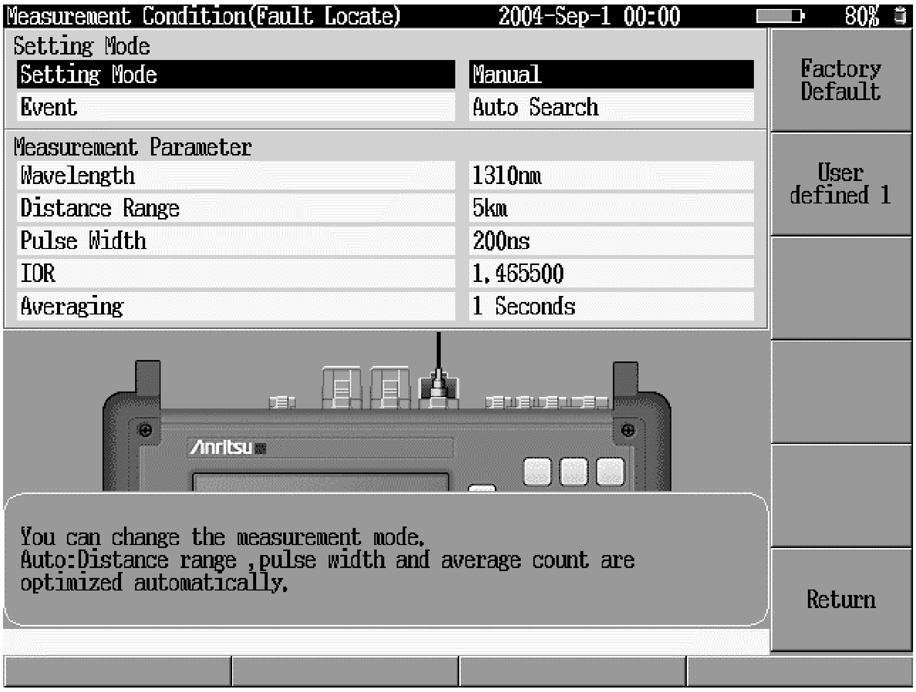


Fig. 4.2.5-3 Measurement conditions recalling screen

(3) Restoring the measurement conditions to the factory default settings

To restore the measurement conditions to the factory default settings, press F2 (Recall DFN) on the Measurement Condition (Fault Locate) screen, and then press f1 (Factory Default).
Refer to Appendix F “Settings at Factory Shipment” for details of the factory shipment settings.

4.3 Performing Measurement

Measurement is performed under the conditions set in Section 4.2 "Setting Measurement Conditions". This section assumes that all the settings have already been completed.

First of all, connect the optical fiber to be measured. For how to make the connection, refer to Section 2.5 "Connecting Optical Fiber Cables".

When the connection is complete, press F4 (Start). The MT9080 Series then performs the following operations and shows the Event Table screen.

Start Measurement

↓

Perform Auto Settings
Detects the optimal values of the distance range, pulse width, and averaging.

↓

Waveform Processing and Fault Point Search (Auto Event Detection)
Executes the waveform averaging process and detects the fault points.
Calculates the information related to the fault points, and lists them in the Event Table screen.

CAUTION ⚠

The MT9080 Series emits high output optical pulses. Disconnect communications devices, etc. from the target measurement optical fiber during measurement to prevent the optical sensors from being damaged.

When auto event detection is complete, the measured waveform and event table are displayed in the OTDR (Fault Locate) screen as shown in Fig. 4.3-1 below.

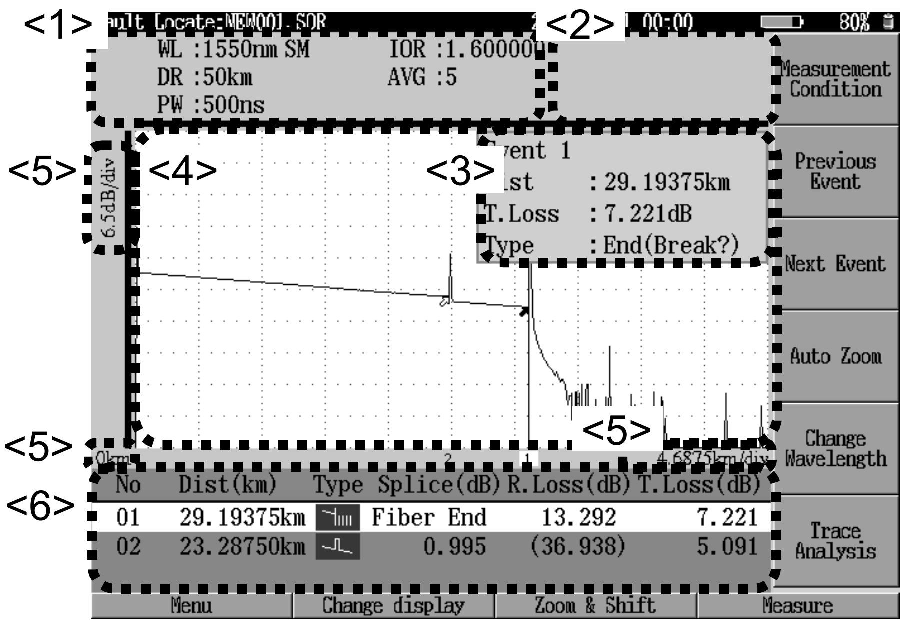


Fig. 4.3-1 OTDR (Fault Locate) screen after auto event detection

When F2 (Change Display) is pressed while the screen shown in Fig. 4.3-1 is displayed, the screen changes as shown in Fig. 4.3-2 below where the possible fault event is emphasized. When measurement is started while this screen is displayed, the screen changes to that shown in Fig. 4.3-1, emphasizing the measuring waveform display. When the measurement is completed, the screen returns to that shown in Fig. 4.3-2, emphasizing the possible fault event.

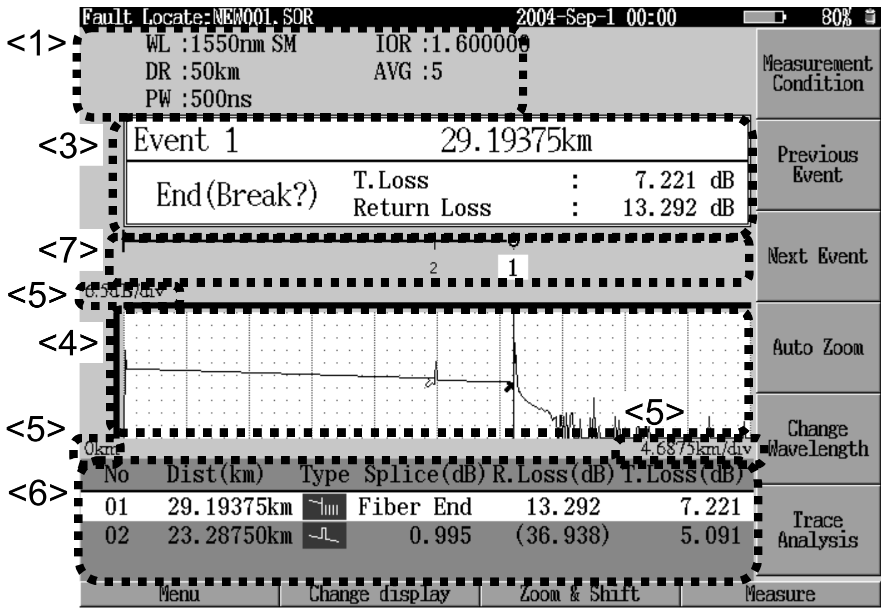


Fig. 4.3-2 OTDR (Fault Locate) screen after auto event detection

The event table screens shown in Fig. 4.3-1 and 4.3-2 contain the following information:

<1> Measurement condition display area (OTDR (Fault Locate))

- WL (Wavelength):
  Shows the wavelength set in the measurement conditions.
- DR (Distance Range):
  Shows the distance range set in the measurement conditions. If you have selected the [Auto] setting, this field shows the value selected by the equipment with the suffix “(A)”.
- PW (Pulse Width):
  Shows the pulse width set in the measurement conditions. If you have selected the [Auto] setting, this field shows the value selected by the equipment with the suffix “(A)”.
- IOR:
  Shows the group index of refraction set in the measurement conditions.
- AVG (Averaging):
  Shows the averaging count (or time) set in the measurement conditions. If selected the [Auto] setting, this field shows the value selected by the equipment with the suffix “(A)”. If measurement is in progress, the actual averaging count (or time) up to now is shown.

<2> Progress of measurement
Shows the progress of the measurement.

- Equipment setup in progress:
  The optimal values for the measurement conditions or settings set to [Auto] are being selected.
- Averaging measurement in progress:
  Shows the actual averaging count (or time) up to now and the averaging count (or time) set. If you have selected averaging for the [Auto] setting, this field shows the value selected by the equipment with the suffix “(A)”.
- Waveform processing in process:
  Auto event detection is being performed after averaging.

<3> Results of auto event detection

The events judged as faults are listed in the event table at the bottom of the measured results screen in order, beginning with the first possible fault. Out of these, this area shows the results of the currently selected events. In case that no possible fault is detected, "No Event" is displayed.

- Event X (Xth Possible Fault Point):
  Number of the event the MT9080 Series presumes as the fault occurrence point.
- Dist (Distance):
  Distance from this equipment to the event that was presumed as a fault point.

  If Relative Distance or Automatic Dummy Fiber is valid, this area shows the distance relative to the relative distance cursor, i.e., Zero Cursor.
- T. Loss: Total loss to that position.
- Type: Event type (refer to Table 5.4.1-1 "Event types").

In the screen where the possible fault event is emphasized, the return loss or level difference (amount of reflection) is also displayed.

- Return Loss: Return loss to that point.
- Reflection: Level difference to that point.

<4> Trace waveform

Shows the waveform in a chart that contains a vertical axis representing the attenuation and a horizontal axis representing the distance. Shows a mark at each fault point.

<5> Scale

The scale along the vertical axis is shown at the upper left of the screen, while that along the horizontal scale is shown at the lower right. The screen display start distance is shown at the lower left of the screen.

<6> Event table display area

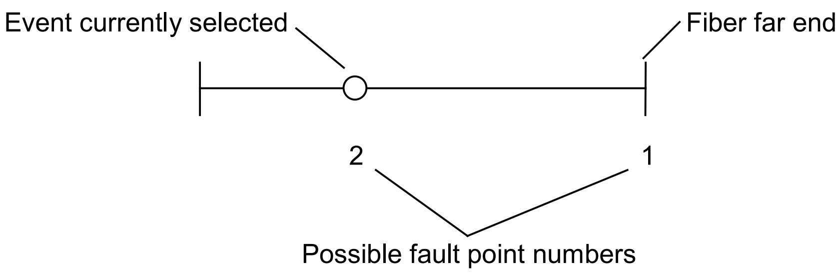
Lists the events that were presumed as faults in sequential order.

In the event table shown in the OTDR (Trace Analysis) screen, the faults are listed in order, beginning with the event nearest to this equipment. Contrarily, in the event table in the OTDR (Fault Locate) screen, the severity of each fault is determined from the threshold of the currently set connection or return loss, and the order of the faults listed is determined based on that. Therefore, the fiber far end or break point is usually listed as the first possible fault, and points with larger splice loss or return are listed as subsequent possible fault.

The selected event point and the information of the event that exceeds the warning level are highlighted.

<7> Fiber schematic diagram

A fiber schematic diagram from 0Km to the fiber far end is displayed. Each event is indicated by a vertical line, and the event currently selected is indicated by a circle.



For each event, the following values are listed:

- No: Number (0 to 99) of each event for which the order was determined based on the severity of the fault.
- Dist: Distance from the MT9080 Series to the event. (Refer to Section 3.5 “System Settings” for selecting the unit of distance.)

  When Relative Distance or Automatic Dummy Fiber is valid, this area shows the distance relative to the relative distance cursor (i.e., zero cursor).
- Type: Event type.
  There are five event types: Reflection, Non-Reflection, Group, and Far-End. Refer to Table 5.4.1-1 “Event types” for details on the event types.
- Splice: Loss at each splice point.
  The Fiber End event type is shown as [Far End].

- R. Loss: Shows the return loss or level difference (amount of reflection). For selecting the item to be shown, refer to Section 3.5.4 "Measurement settings".

  If accurate measurement failed because of saturation, a "<" mark is added before the measured results.
- T. Loss: Total loss from the near end to the event.

Note:

When either the connection or return loss exceeds the event threshold set on the [Set Threshold] screen, the fault is judged as a fault point. Any detected event within the threshold is enclosed within parentheses. If the measured value cannot be obtained, for example, because a fault point is being approximated, it is displayed as "**.*".

Auto event detection is an auxiliary function that facilitates measurement; it does not guarantee the measured values. Because erroneous detection or other problems may occur, make the final pass/fail judgment after reviewing the waveform data.

Selecting an event

After completion of auto event detection, the No. 1 field in the event table is selected with the cursor placed on that field. By moving the cursor, you can select an event existing on the actual trace waveform, read information about each event, and zoom in on or edit the event. To select an event, use the [f2] (Previous Event), [f3] (Next Event), [∧] and [∨] keys. The cursor moves up and down in the order of the events in the table.

If an event is detected on the measured results screen, you can view an enlarged view of the section that contains the cursor, out of the events obtained by the event detection results. To do so, press [f4] (Auto Zoom). To disable this function, press [f4] (Auto Zoom) again.

4.4 Stopping/Canceling Measurement

When F4 (Start) is pressed to start measurement, the OTDR (Fault Locate) in progress screen appears and averaging processing is performed. To stop or cancel measurement during processing, follow the instructions described in this section.

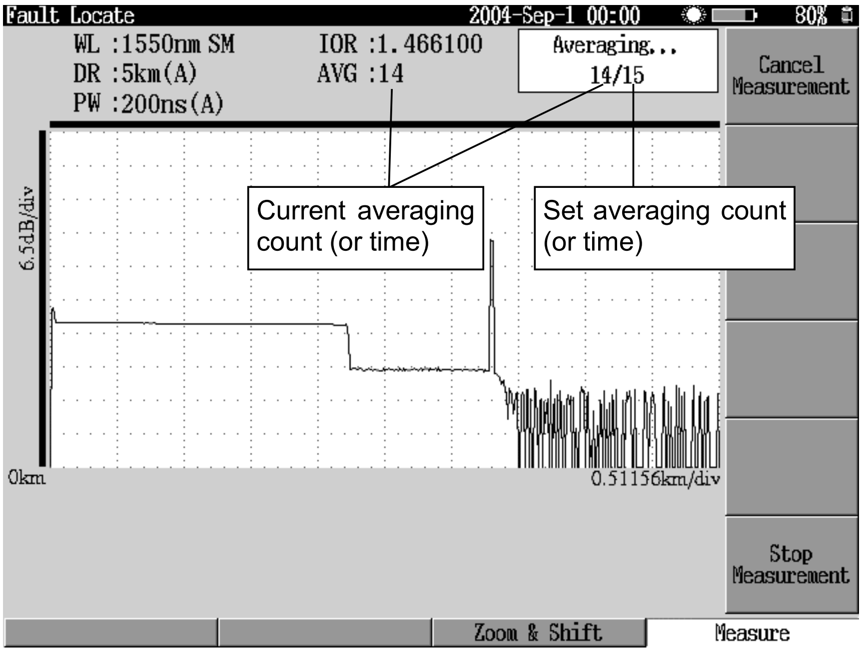


Fig. 4.4-1 OTDR (Fault Locate) in progress screen

- Canceling measurement during processing
  The currently set averaging count (or time) and the currently measured averaging count (or time) are shown at the top of the screen. To cancel measurement during processing before the averaging count (or time) is reached, press f1 (Cancel Measurement). When measurement is canceled, the waveform data that was obtained from the averaging process up to now is discarded. Because auto event detection is not performed, you can immediately abort measurement and start another process.

- Stopping measurement during processing
  The currently set averaging count (or time) and the currently measured averaging count (or time) are shown at the top of the screen. To stop measurement during processing before the averaging count (or time) is reached, press f6 (Stop Measurement). When measurement is stopped, auto event detection is performed using the waveform data that was obtained from the averaging process up to now, and the event table is shown.

4.5 Zoom and Shift

When [F3] (Zoom & Shift) is pressed, the function keys are displayed as shown in Fig. 4.5-1 below. The vertical and horizontal scale can be enlarged/reduced centered on the cursor (on the waveform).
Press the [ESC] key to cancel the Zoom & Shift function.

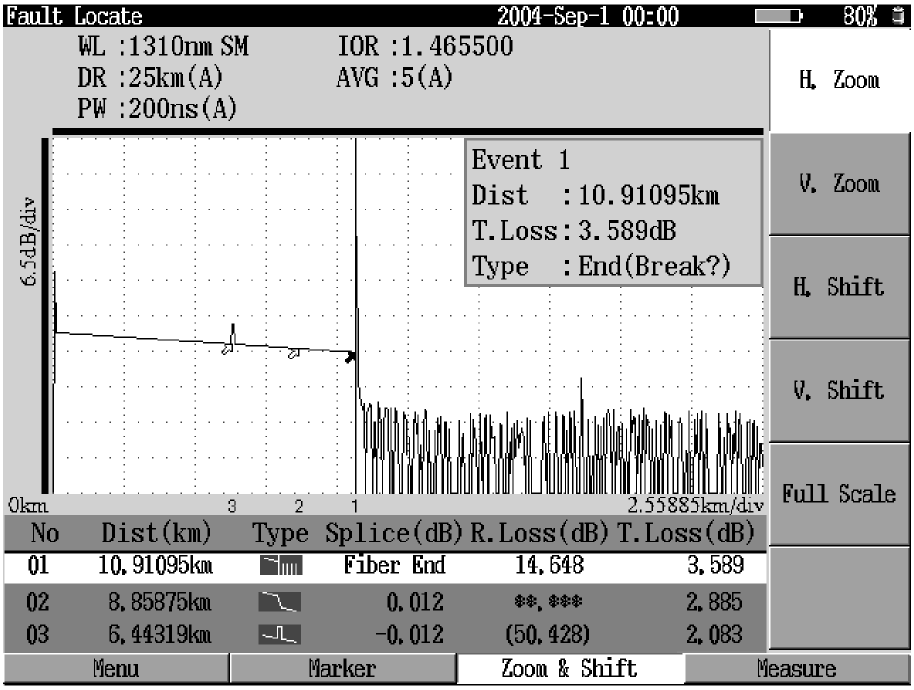


Fig. 4.5-1 Zoom & Shift screen

H. Zoom (Horizontal)

Pressing [f1] (H. Zoom) allows to enlarge or reduce the scale horizontally using the [∧] and [∨] keys.

[∨] key: Enlarges the waveform horizontally.
[∧] key: Reduces the waveform horizontally.

V. Zoom (Vertical)

Pressing [f2] (V. Zoom) allows to enlarge or reduce the scale vertically using the [∧] and [∨] keys.

[∨] key: Enlarges on the waveform vertically.
[∧] key: Reduces the waveform vertically.

H. Shift (Horizontal)

With the waveform enlarges on horizontally, pressing [f3] (H. Shift) allows to shift the waveform horizontally using the [∧] and [∨] keys.

[∧] key: Shifts the waveform to the left (toward the direction in which the fiber far end is visible). If a marker is displayed, it shifts to the left together with the waveform.

[∨] key: Shifts the waveform to the right (toward the direction in which the fiber near end is visible). If a marker is displayed, it shifts to the right together with the waveform.

To speed up the shift, press and hold down the [∧] or [∨] key.

V. Shift (Vertical)

With the waveform enlarged on vertically, pressing [f4] (V. Shift) allows to shift it vertically using the [∧] and [∨] keys.

[∧] key: Shifts the waveform up.
[∨] key: Shifts the waveform down.

To speed up the shift, press and hold down the [∧] or [∨] key.

Full Scale

Pressing [f5] (Full Scale) displays the whole waveform.

Note:

In the Full Scale view, neither [f3] (H. Shift) nor [f4] (V. Shift) works.

4.6 Comparing Waveforms - Waveform Compare Function

When it is required to observe the aging of the optical fiber, it is possible to compare the previously measured waveform data [Reference Waveform] and the current waveform data [Current Waveform].

For details, refer to Section 5.7 "Comparing Waveforms -- Waveform Compare Function".

4.7 Changing to OTDR (Trace Analysis) Screen

To change to the OTDR (Trace Analysis) screen, press f6 (Trace Analysis Mode). Refer to Section 5 "Optical Pulse Test – OTDR (Trace Analysis)" for details.

4.8 Shortcut Menu

In the OTDR (Fault Locate) screen shown in Fig. 4.3-1, for example, when F1 (Menu) is pressed, the shortcut menu is displayed as shown in Fig. 4.8-1 below. Other functions can be selected from this shortcut menu.

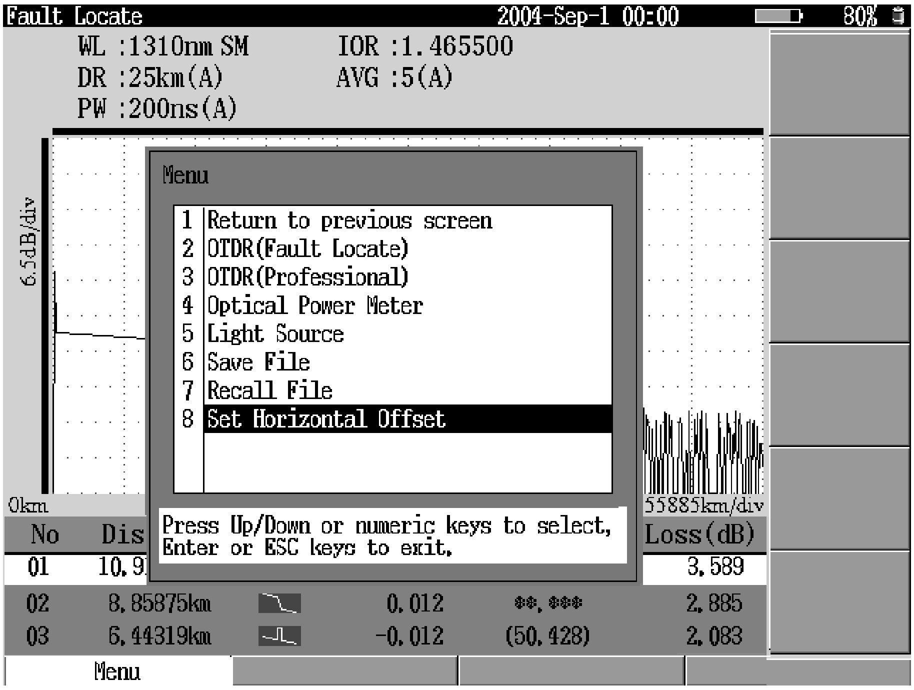


Fig. 4.8-1 Shortcut menu on OTDR (Fault Locate) screen

Selecting "1 Return to previous screen" returns to the measurement screen before the current screen (OTDR (Fault Locate) screen in this example) was selected. This function is useful when alternating use of two functions.

For example, when the OTDR (Fault Locate) screen was selected from the Optical Pulse Meter screen, the Optical Pulse Meter screen can be displayed again quickly by using this operation.

For details on the other menus, refer to the corresponding section for each function.

Press the ESC key to close the shortcut menu.

Section 5 Optical Pulse Test – OTDR (Trace Analysis)

This section describes about operations method of OTDR (Trace Analysis).

The items displayed in the [   ] in this section indicate panel keys.

5.1 Optical Pulse Test - OTDR (Trace Analysis)

Detailed settings and operations omitted from OTDR (Fault Locate) are available in OTDR (Trace Analysis).

OTDR (Trace Analysis) contains “Event Table” (equivalent to that of OTDR (Fault Locate)), which can be used to perform auto analysis (auto event detection) of the measured results. In addition, OTDR (Trace Analysis) enables to execute [Splice & Return Loss] or [Loss & Total R. Loss] of the manual analysis function.

Table 5.1-1 Functions of optical pulse test measurement modes (Fault Locate vs. Trace Analysis)

Function	Fault Locate mode	Trace Analysis mode
Display Possible Fault Points	Available	Not available
Event Table	Available	Available
Event Edit	Not available	Available
Real-time Sweep	Not available	Available
Manual Measurement [Splice & Return Loss] [Loss & Total R. Loss]	Not available	Available
Set Measurement Conditions Individually	Partially available	Available

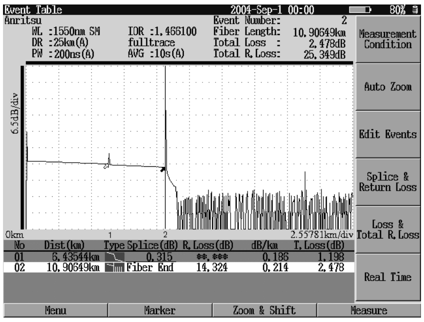
In the screen shown in Fig. 3.2.1-1, select “OTDR (Trace Analysis)” using the [∧] and [∨] keys and press the [Enter] key, or press the [4] key to display the Event Table, Splice & Return Loss, or Loss & Total R. Loss screen (the previously selected screen appears).

(1) Event Table:
Automatically measures the distance, splice loss, fiber loss, and other attributes of the optical fiber. Splice points with splice loss or return loss exceeding the preset threshold are detected, and listed in an event table.

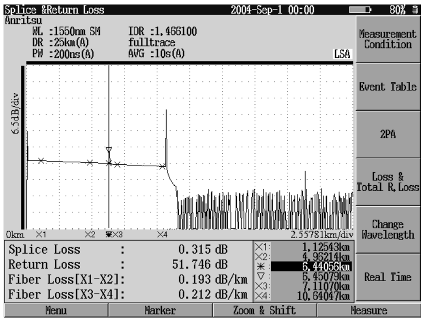
(2) Splice & Return Loss:
Allows the user to set markers (on the waveform) which are used to measure the connection or return loss (return loss or level difference (reflection)) of the splice point.

(3) Loss & Total R. Loss:
Allows the user to set markers (on the waveform) which are used to measure the distance, loss or fiber loss between two points and the total return loss.

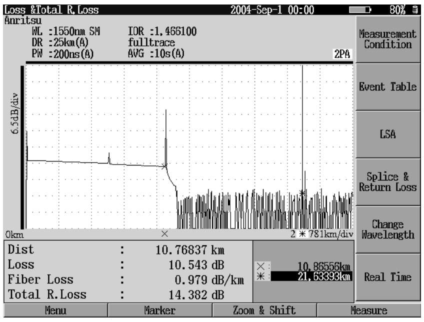
[Event Table]



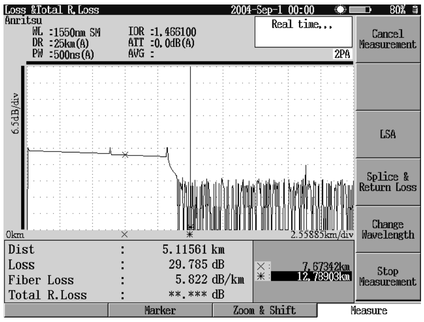
[Splice & Return Loss]



[Loss & Total R. Loss]



[Real-time Sweep]



5.2 Setting Measurement Conditions

When f1 (Measurement Condition) is pressed on the Event Table, Splice & Return Loss, or Loss & Total R. Loss screen, the screen shown in Fig. 5.2-1 is displayed.

When the MT9080 Series is turned off, the currently set measurement conditions are stored in the internal memory. They are recalled from the memory when the power is turned on next time.

The measurement conditions can be simply saved by pressing F3 (Save DFN). And if the measurement conditions are changed, the conditions before change can be simply restored and applied by pressing F2 (Recall DFN).

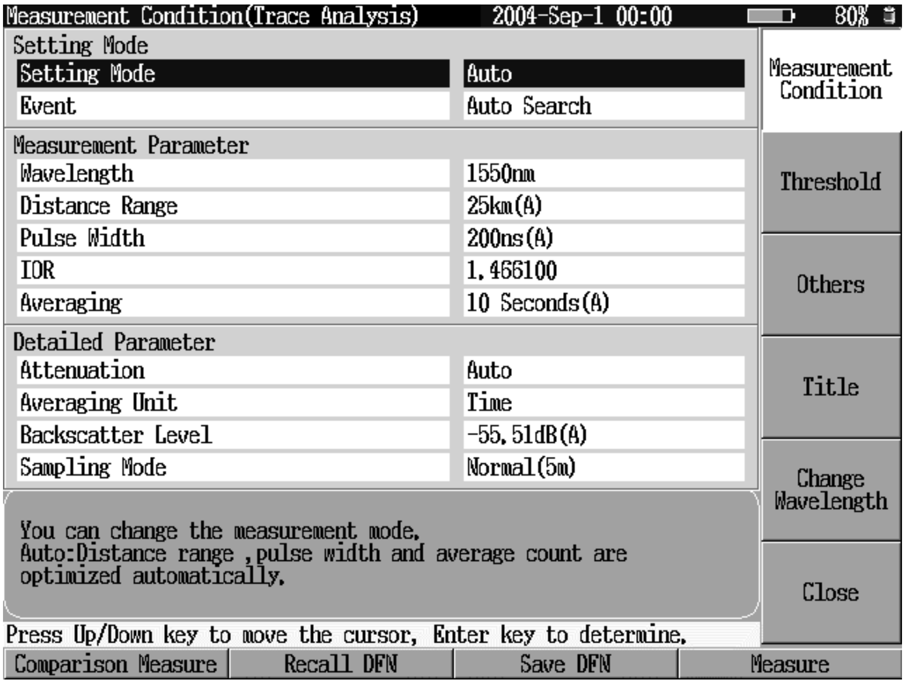


Fig. 5.2-1 Measurement Condition (Trace Analysis): Measurement Condition screen

The following subsections detail the parameters on the Measurement Condition screen. The factory shipment settings are summarized in Appendix F "Settings at Factory Shipment".

5.2.1 Measurement conditions

(1) Setting Mode

<1> Setting Mode

<2> Event

(2) Measurement Parameter

<1> Wavelength

<2> Distance Range

<3> Pulse Width

<4> Index Of Refraction (IOR)

<5> Averaging

For the parameters of the Measurement Condition screen above, refer to Section 4.2 "Setting Measurement Conditions."

(3) Detailed Parameter

<1> Attenuation

Switch the attenuator.

It is necessary to increase the pulse width to measure a long distance optical fiber. However, increasing the pulse width may causes saturation at the near end of the received waveform. If this occurs, set the attenuator. The attenuator value that can be set depends on the pulse width.

When [Auto] is set, the optimal attenuator value is set automatically. The same will occur also when [Setting Mode] is set to [Auto].

<2> Backscatter Level

Input the offset value of the backscatter light level (–9.99 to +9.99 dB). This field, however, shows the backscatter level of the selected pulse width.

The backscatter light level value is a constant used to calculate the return or total return loss. Set this value when the measured result of the return loss does not equal the existing value, or when measuring a special optical fiber.

<3> Sampling Mode

Switch the sampling mode between normal and high density.

For normal mode, the number of sampling points is 5001. For high density mode, it is 25001 (or 20001). The table below summarizes the relationship between the sampling mode, (i.e., number of points), distance range, and sampling resolution. The values in parentheses ( ) represent the sampling resolution.

Distance range (km)	Sampling points	
	Normal	High density
0.5	5001 (10 cm)	–
1	5001 (20 cm)	20001 (5 cm)
2.5	5001 (50 cm)	25001 (10 cm)
5	5001 (1 m)	25001 (20 cm)
10	5001 (2 m)	20001 (50 cm)
25	5001 (5 m)	25001 (1 m)
50	5001 (10 m)	25001 (2 m)
100	5001 (20 m)	25001 (5 m)
200	5001 (40 m)	25001 (10 m)

Note:

In OTDR (Fault Locate) measurement, Sampling Mode is fixed to Normal.

5.2.2 Threshold

When [f2] (Threshold) is pressed, the screen shown in Fig. 5.2.2-1 is displayed. Set the thresholds at which event points (splice, reflection, and fiber end) are detected automatically and displayed.

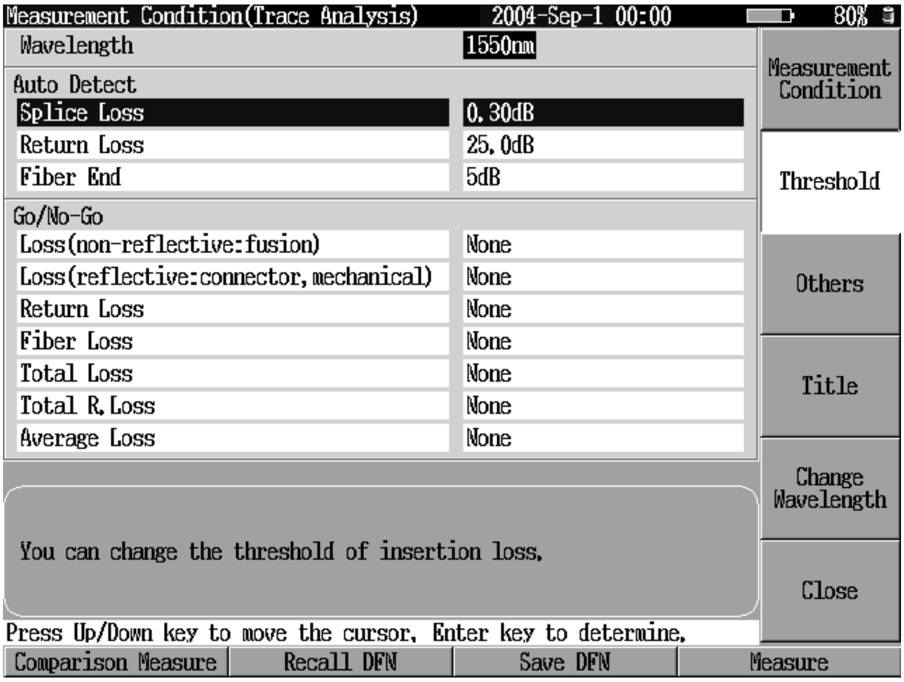


Fig. 5.2.2-1 Measurement Condition (Trace Analysis): Threshold screen

(1) Wavelength

(2) Auto Detect

<1> Splice Loss
<2> Return Loss
<3> Fiber End

(3) Go/No-Go (event pass/fail judgment)

<1> Loss (non-reflective: fusion)
<2> Loss (reflective: connector, mechanical)
<3> Return Loss (or Level Difference (reflection))
<4> Fiber Loss
<5> Total
<6> TORL (Total Return Loss)
<7> Average

For the parameters of the Measurement Condition screen above, refer to Section 4.2 “Setting Measurement Conditions”.

5.2.3 Additional functions

When [f3] (Others) is pressed, the screen shown in Fig. 5.2.3-1 is displayed.

In this screen, the conditions of the additional functions can be set.

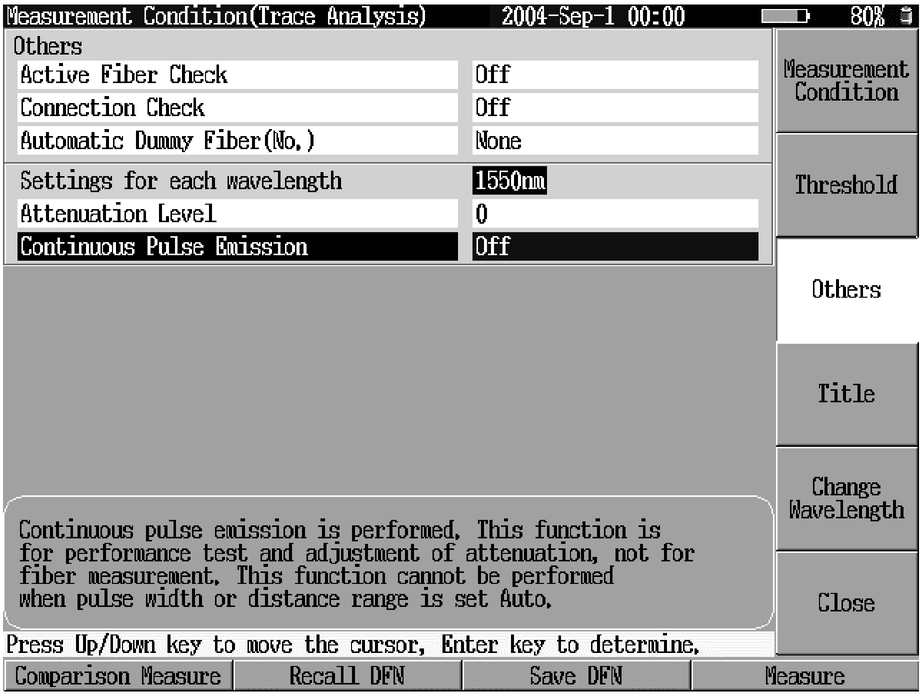


Fig. 5.2.3-1 Measurement Condition (Trace Analysis): Others screen

(1) Others

<1> Active Fiber Check

<2> Connection Check

<3> Automatic Dummy Fiber (No.)

<4> Attenuation Level

<5> Continuous Pulse Luminescence

For the parameters of the Measurement Condition screen above, refer to Section 4.2 “Setting Measurement Conditions.”

5.2.4 Title

When [f4] (Title) is pressed, the screen shown in Fig. 5.2.4-1 is displayed.
In this screen, management comments to be saved in a file can be entered.

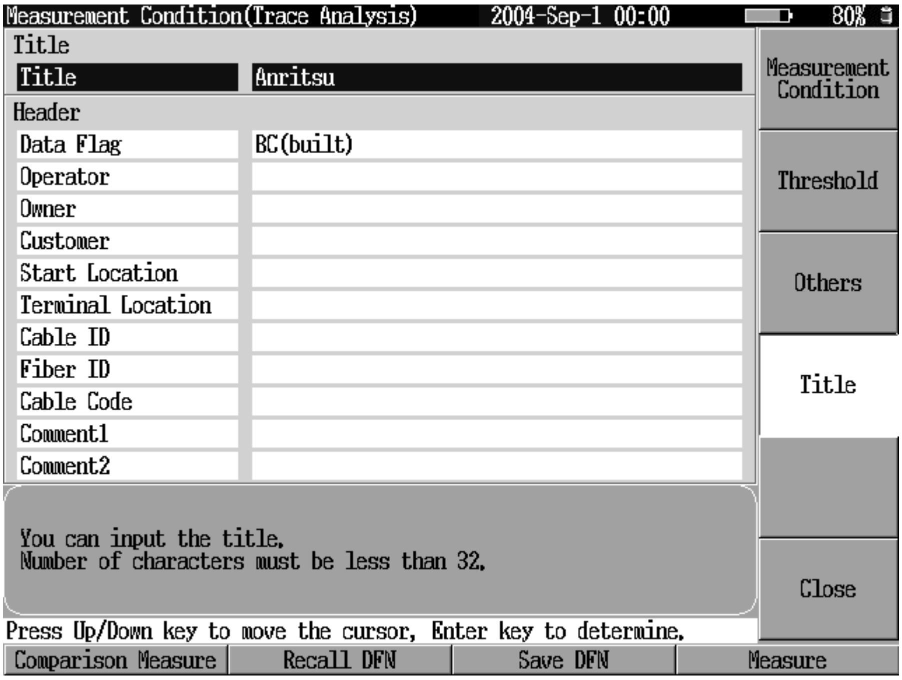


Fig. 5.2.4-1 [Measurement Condition (Trace Analysis): Title] screen

(1) Title

<1> Title

(2) Header

<1> Data Flag
<2> Operator
<3> Owner
<4> Customer
<5> Start Location
<6> Terminal Location
<7> Cable ID
<8> Fiber ID
<9> Cable Code
<10> Comment 1
<11> Comment 2

For the parameters of the Measurement Condition screen above, refer to Section 4.2 "Setting Measurement Conditions."

5.3 Performing Measurement

Measurement is performed under the conditions set in Section 5.2 "Setting Measurement Conditions". This section assumes that all the settings have already been completed.
First of all, connect the optical fiber to be measured. For how to make the connection, refer to Section 2.5 "Connecting Optical Fiber Cables".

CAUTION ⚠

The MT9080 Series emits high output optical pulses. Disconnect communications devices, etc. from the target measurement optical fiber during measurement to prevent the optical sensors from being damaged.

5.3.1 Starting measurement

When the connection is complete, press [F4] (Start).

The MT9080 Series sets up the measurement conditions. When [Distance Range], [Pulse Width], [Attenuation], and/or [Averaging] is set to [Auto], the MT9080 Series detects the optimal values at this time. The MT9080 Series then starts averaging measurement.
When [f6] (Stop Measurement) is pressed at this time, the averaging process stops, the waveform at that point is displayed, and averaging measurement ends. When [f1] (Cancel Measurement) is pressed, the waveform is cleared and averaging measurement ends.
When averaging measurement is complete, the MT9080 Series proceed with the measured result analysis operation (Auto or Manual; described later in Sections 5.4 and 5.5).

<<Remarks>>

Averaging

To make event point detection or loss measurement more accurate, it is necessary to set a longer time or more count values to average, so as to improve the signal-to-noise (S/N) ratio (amount of noise on waveform).
When the time or count values to average is unknown, set higher values temporarily, and when the S/N ratio is improved, press [f6] (Stop Measurement).

Note:

When a longer time or more count values is set to average, measurement will take longer.

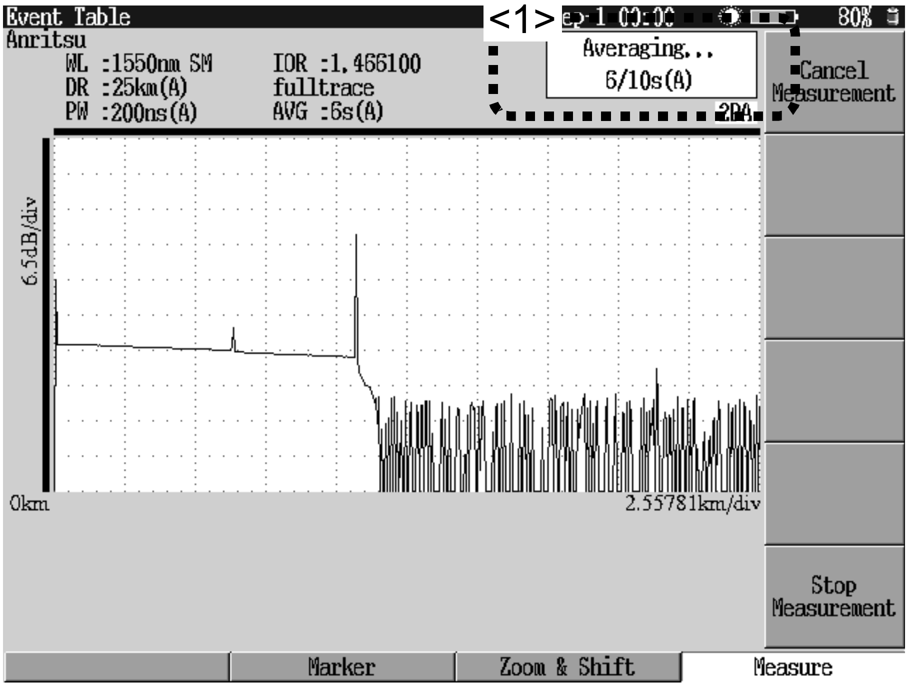


Fig. 5.3.1-1 Averaging measurement in progress

When F4 (Start) is pressed, the screen shown in Fig. 5.3.1-1 is displayed, in which the progress is shown at the upper right of the screen (indicated by <1> in the figure).

- Measurement condition setting in progress:
  [Setting…]
- Averaging in progress:
  [Averaging…] and
  [Current averaging count (or time)/Set averaging count (or Time)]
- Auto analysis in progress (only for the event table):
  [Prep Table...]

5.4 Measurement Results - Auto Analysis (Auto Event Detection)

5.4.1 Event Table

After completion of averaging measurement, event details obtained from the auto analysis results are displayed on the screen. The screen changes to the view as shown in Fig. 5.4.1-1, which displays the measurement waveform and event table.

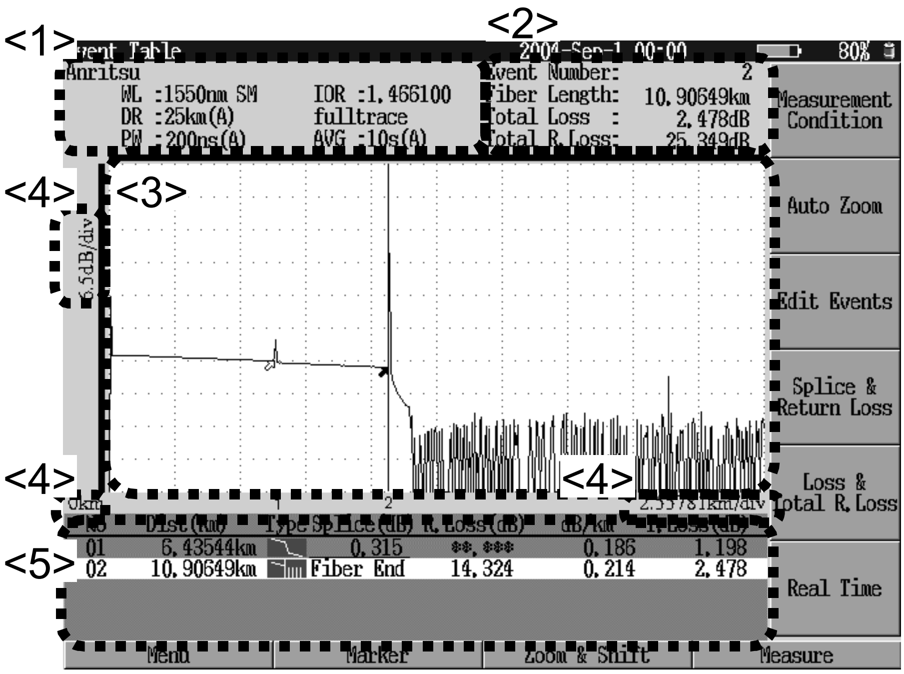


Fig. 5.4.1-1 OTDR (Trace Analysis): Event Table

<1> Measurement condition area

Lists the measurement conditions. Contains the following information:

- WL (Wavelength): Displays the wavelength.
- DR (Distance Range):

  Displays the distance rage. When automatic setting is enabled, “***” is displayed before the distance range is determined; after it is determined, the distance range with “(A)” suffixed is shown.

- PW (Pulse Width): Displays the pulse width. When automatic setting is enabled, "***" is displayed before the pulse width is determined; after it is determined, the pulse width with "(A)" suffixed is shown.
- IOR: Displays the index of refraction.
- Attenuation: Displays the attenuator value. When measurement is performed while automatic setting has been enabled for attenuator values, [full-trace] is displayed in this field. When measurement is performed in real-time while automatic setting has been enabled for attenuator values, the automatically determined value with "(A)" suffixed is displayed.
- AVG (Averaging): Displays the average over the already totaled count or time. When automatic setting is enabled, the value is immediately followed by "(A)". For real-time measurement, this field is blank.

<2> Auto event detection results area

- Event Number: Displays the number of events detected by auto event detection. The detailed results obtained by auto event detection are displayed in the event information area.
- Fiber Length: Displays the distance of the fiber end obtained by auto event detection. When the fiber end position is unknown, "***" is displayed.
- Total Loss: Displays the loss from the near end to the fiber end that was obtained by auto event detection. If calculation is disabled, "***" is displayed.
- Total R. Loss (Total Return Loss):
  Displays the total return loss obtained by auto event detection. It is equivalent to the integral value of the reflective light in the measurement light. If calculation is disabled, "**.***" is displayed.

<3> Trace waveform

Contains a graph of the measurement waveform. This area displays the arrows obtained by auto event detection and the cursor. It also contains a scroll bar that defines the display range at the top and the left of the waveform.

<4> Scale

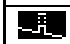
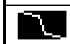
The scale along the vertical axis is shown at the upper left of the screen, while that along the horizontal scale is shown at the lower right. The start point of the display distance is shown on the left.

<5> Event table

Contains a table that lists the splice points exceeding the threshold set as the auto event detection threshold value, as well as the fiber end. The selected event point and the information of the event that exceeds the warning level are highlighted.

- No: Fault point event number that is counted, starting from the left end of the screen (0 to 99).
- Distance: Distance from the MT9080 Series to the event point. The unit of distance is set on the Display Setting screen. Refer to Section 3.5.2 “Display settings” for details.
- Type: Displays event type by an image (see Table 5.4.1-1 below). There are the following event types: Reflection, Reflection (Saturated), Non-Reflection, Group, or Far End.

Table 5.4.1-1 Event types

Image	Type	Description
	Reflection	Reflection from an unsaturated splice point (Fresnel reflection), etc.
	Reflection (Saturated)	Reflection from a saturated splice point (Fresnel reflection), etc. The MT9080 Series judges whether it is saturated or not.
	Non-Reflection	None reflection from fusion point, etc.
	Group	When a few events are too close to be separated, they are processed as a single event. In the event table, the results of the entire group are displayed at the first event of each group.
	Far End	Far end of the measured optical fiber.

- Splice: Loss at each splice point.
  [Far End] is displayed when the event type is [Far End].
- R. Loss: Return loss or level difference (amount of reflection). (The reflective type is selected on the Measurement Setting screen. Refer to Section 3.5.4 “Measurement settings” for details.) When correct measurement failed because of saturation, a “<” mark is added before the measurement result.
- dB/km: Fiber loss between events. The unit of distance may be replaced with kf or mi, depending on the display setting.
- T. Loss: Total loss from the near end to the event.

Note:

Any detected event within the threshold is enclosed within parentheses. If the measured value cannot be obtained, for example, because a fault point is being approximated, this is displayed as “**.*”.

Auto event detection is an auxiliary function that facilitates measurement; it does not guarantee the measured values. Because erroneous detection or other problems may occur, make the final OK/NG judgment after reviewing the waveform data.

5.4.2 Auto zoom

When f2 (Auto Zoom) is pressed on the Event Table screen, an enlarged view of the event that is obtained by auto event detection and positioned by the cursor is displayed. Detailed information about that event is displayed at the bottom of the screen. At this time, pressing the ∧ or ∨ key displays an enlarged view of the previous or next event. Refer to Section 5.4.5 “Editing events” for editing an event.

Press f2 (Event Table) in the Auto Zoom screen to cancel Auto Zoom. Each time the f2 key is pressed, therefore, the on-screen waveform switches between Event Table and Auto Zoom.

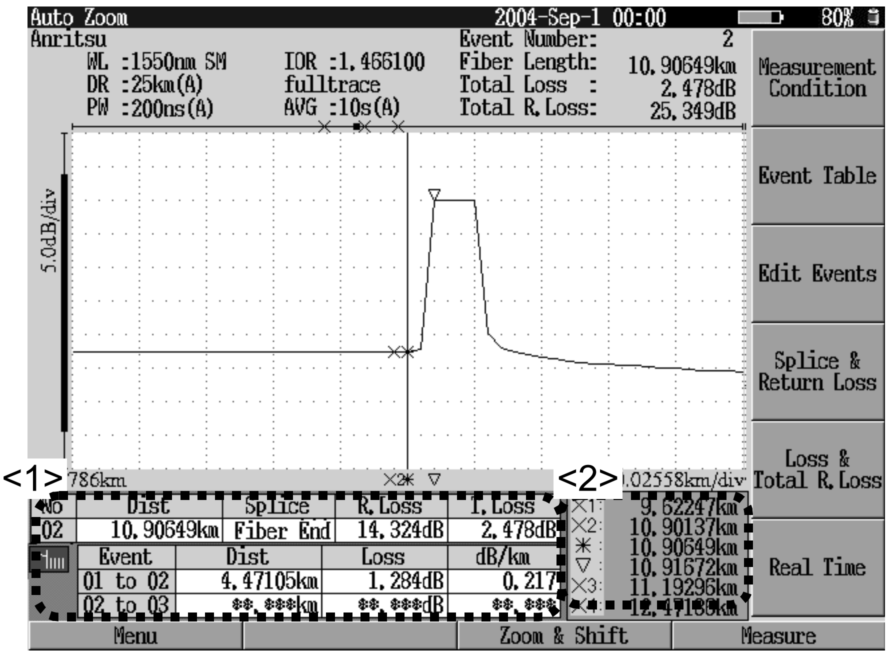


Fig. 5.4.2-1 OTDR (Trace Analysis): Auto Zoom

The Auto Zoom screen shown in Fig. 5.4.2-1 above displays the following information:

<1> Event information area

Event information (upper row in table).

- No: Number of the order of the fault point event numbers counted, beginning on the left side of the screen.
- Dist: Distance (km) to the event point from the MT9080 Series. The unit of distance may be replaced with m, kf, ft, or mi, depending on the display setting.
- Splice: Loss at each splice point (dB).
  [Far End] is displayed when [Event Type] is [Fiber End].

- R. Loss: Return loss or amount of reflection (dB).
- T. Loss: Total loss from the near end to the event.

Event information (lower row in table).

- Event Type: See Table 5.4.1-1 “Event types” for the event types.
- 00 to 01: Displays information about the currently selected event and previous event. If no previous event exists, information about the interval from the near end is displayed.
- Dist: Distance between events.
- Loss: Loss in the interval from the previous event to the currently selected event (dB).
- dB/km: Fiber loss in the interval from the previous event to the currently selected event (dB).
  The unit of distance may be replaced with kf or mi, depending on the display setting.
- 01 to 02: Displays information about the currently selected event and next event. If no next event exists, “***” is displayed.
- Dist: Distance between events.
- Loss: Loss in the interval from the currently selected event to the next event (dB).
- dB/km: Fiber loss in the interval from the currently selected event to the next event (dB).
  The unit of distance may be replaced with kf or mi, depending on the display setting.

<2> Marker information area

Displays the distances of the auto setting markers of the event indicated by the cursor. For moving and setting a marker, refer to Section 1.2.7 “Measuring distance, splice loss, and fiber loss of optical fiber - OTDR (Trace Analysis)” or Appendix B “Linear Least Square Approximation Method.”

X1 marker
X2 marker
* marker
∇ marker
X3 marker
X4 marker

5.4.3 Zoom & shift

When F3 (Zoom & Shift) is pressed, the function keys as shown in Fig. 5.4.3-1 are displayed on the screen. The vertical and/or horizontal axis scale can be enlarged/reduced centered on the cursor on the waveform. Press the ESC key to cancel the Zoom & Shift function.

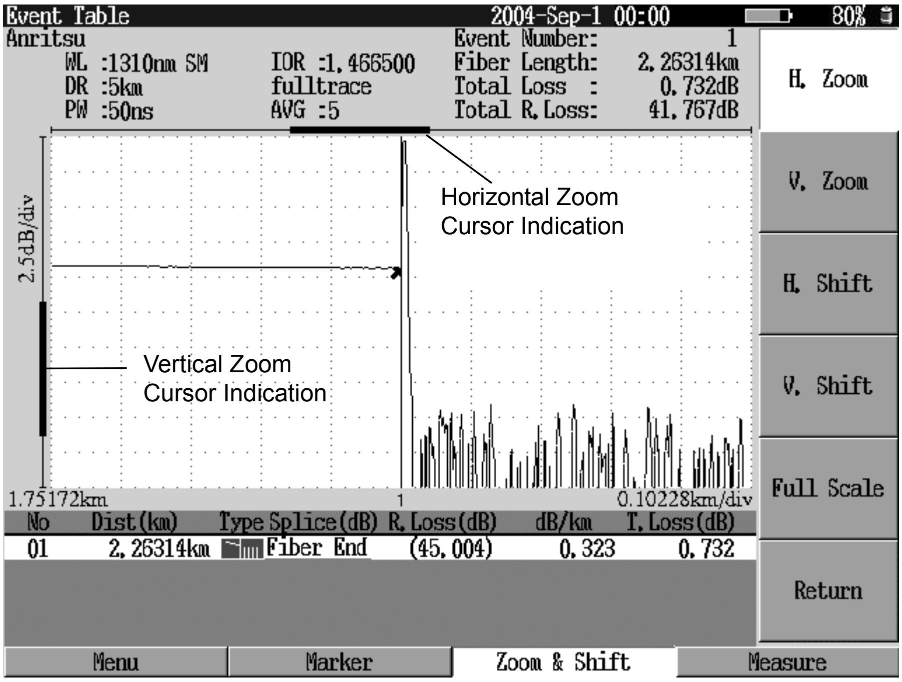


Fig. 5.4.3-1 Zoom & Shift screen

H. Zoom (Horizontal)

Pressing f1 (H. Zoom) allows to enlarge or reduce the scale horizontally using the ∧ and ∨ keys.

∨ key: Enlarges the waveform horizontally.
∧ key: Reduces the waveform horizontally.

V. Zoom (Vertical)

Pressing f2 (V. Zoom) allows to enlarge or reduce the scale vertically using the ∧ and ∨ keys.

∨ key: Enlarges on the waveform vertically.
∧ key: Reduces the waveform vertically.

H. Shift (Horizontal)

With the waveform enlarges on horizontally, pressing [f3] (H. Shift) allows to shift the waveform horizontally using the [∧] and [∨] keys.

[∧] key: Shifts the waveform to the left (toward the direction in which the fiber end is visible). If a marker is displayed, it shifts to the left together with the waveform.

[∨] key: Shifts the waveform to the right (toward the direction in which the near end is visible). If a marker is displayed, it shifts to the right together with the waveform.

To speed up the shift, press and hold down the [∧] or [∨] key.

V. Shift (Vertical)

With the waveform enlarged on vertically, pressing [f4] (V. Shift) allows to shift it vertically using the [∧] and [∨] keys.

[∧] key: Shifts the waveform up.
[∨] key: Shifts the waveform down.

To speed up the shift, press and hold down the [∧] or [∨] key.

Full Scale

Pressing [f5] (Full Scale) displays the whole waveform.

Note:

In the Full Scale view, neither [f3] (H. Shift) nor [f4] (V. Shift) works.

5.4.4 Markers

When [F2] (Marker) is pressed on the Event Table screen, the function keys as shown in Fig. 5.4.4-1 are displayed on the screen.
Press the [ESC] key to cancel the marker operation.

Note:

Note that the [F2] key is left blank when an event point is displayed enlarged by the Auto Zoom function.

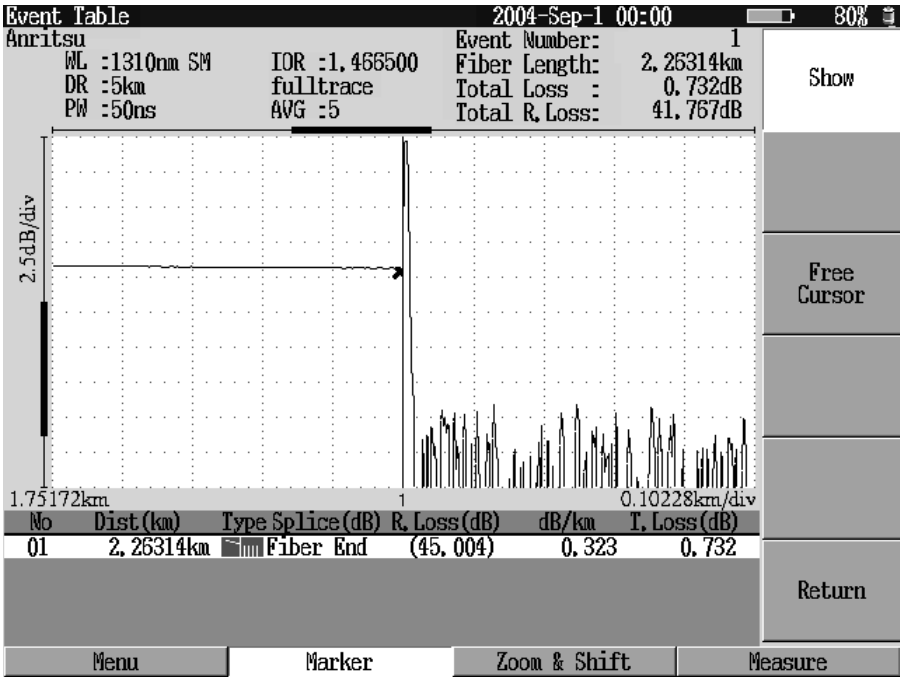


Fig. 5.4.4-1 [Marker (Event Table)] screen

Show/Hide

Each time [f1] (Show) is pressed, the [f1] key display state is switched between recessed (selected) and raised (unselected).

Recessed: Shows the arrow marker placed at the event point on the waveform.

Raised: Hides the arrow marker placed at the event point on the waveform.

Free Cursor

Each time [f3] (Free Cursor) is pressed, the [f3] key display state is switched between recessed (selected) and raised (unselected).

Recessed: The cursor can be moved to the left and right freely by using the [∧] and [∨] keys. The area around the desired point can be enlarged when the cursor can be moved freely.

When [f3] (Free Cursor) is pressed and recessed, the screen becomes as shown in Fig. 5.4.4-2.

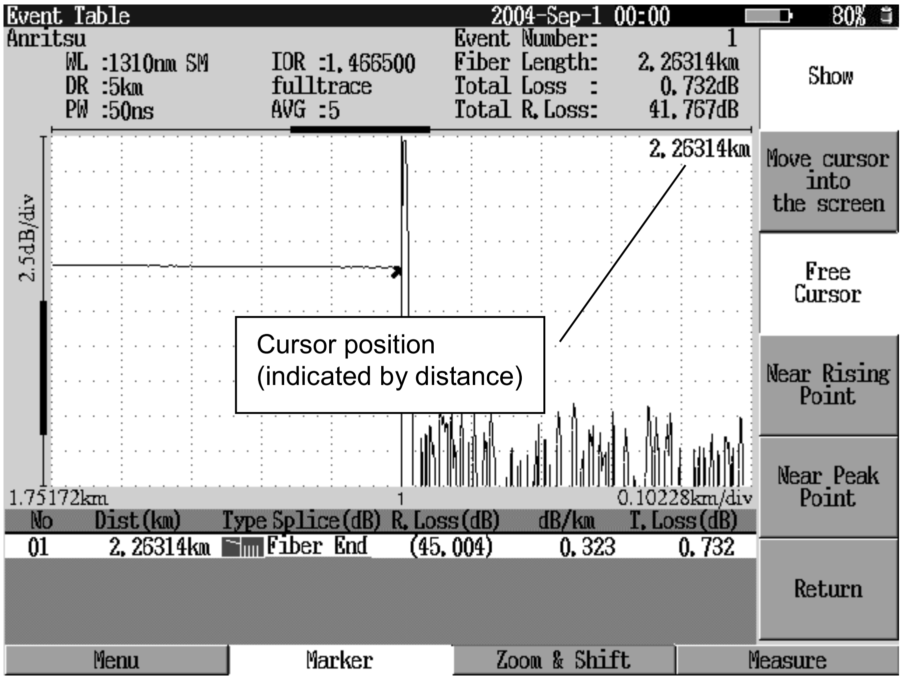


Fig. 5.4.4-2 Free Cursor screen

When the screen becomes as shown above, the cursor can be moved to the left and right by using the [∧] and [∨] keys. The cursor position (distance) is shown at the upper right part of the waveform display area. When the cursor comes close to the next event point, the cursor in the event table also begins to move to the next one. Once the cursor reaches either the left or right end of the screen, it is fixed there and the waveform shifts horizontally at this time.

When the cursor moves outside the waveform area currently displayed after performing a horizontal shift, if [f3] (Free Cursor) is pressed and then the [∧] or [∨] key, the waveform view changes so that the locations where the markers were previously placed are shown.

Move all markers into the screen

When the cursor is located outside the screen, press [f2] (Move all markers into the screen) to move the cursor to the center of the screen.

Near Rising Point

When [f4] (Near Rising Point) is pressed while [f3] (Free Cursor) is selected (recessed), the marker moves to the nearest waveform rising point by pressing the [∧] or [∨] key. If the nearest rising point is an event point, the cursor in the event information area also moves to the line containing the corresponding event.

Near Peak Point

When [f5] (Near Peak Point) is pressed while [f3] (Free Cursor) is selected (recessed), the marker moves to the nearest return peak point by pressing the [∧] or [∨] key. If the nearest return peak point is an event point, the cursor in the event information area also moves to the line containing the corresponding event.

Note:

Moving to the nearest rising or peak point is an auxiliary function that helps the user move the marker. Note that the rising or peak point cannot always be found.

5.4.5 Editing events

When saving the splice points that cannot be detected by Auto Search into the event table or when deleting the events that were detected erroneously as fault points because of noise, it is required to edit events..

When [f3] (Edit Events) is pressed on the Event Table screen, the screen shown in Fig. 5.4.5-1 is displayed.

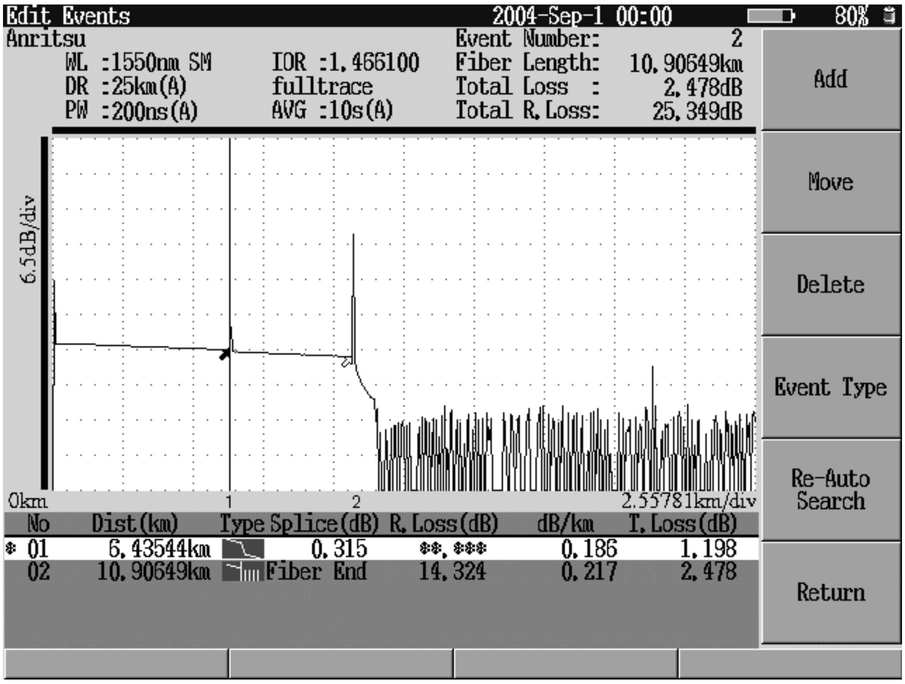


Fig. 5.4.5-1 Edit Events screen

The following editing operations can be executed for events:

(1) Adding an event

(2) Moving an event

(3) Deleting an event

(4) Changing the event type

(5) Redetecting an event

(6) Exiting the edit event mode

5.4.6 Adding event

Use this function when adding an event point that was not detected as a fault point during auto event detection following completion of measurement.

Press f1 (Add) on the Edit Events screen, and then press F2 (Marker) to display the screen shown in Fig. 5.4.6-1.

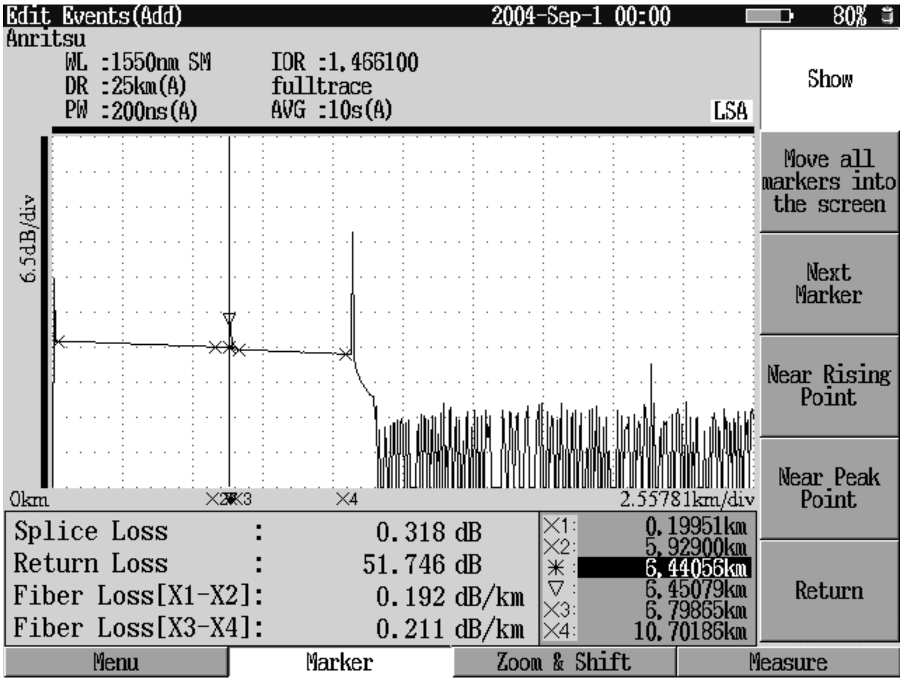


Fig. 5.4.6-1 Edit Events (Add) screen

The * marker is selected at this time. Move the * marker to the location to which an event should be added by using the ∧ and ∨ keys. Then set the X1 through X4 markers, performing operations such as zoom if necessary. For the setting procedure, refer to <<Remarks>> in Section 5.5.4 "Marker (splice & return loss)".

After completing the setting, press the ESC key to return from the Add Events screen from the Markers or Zoom & Shift screen. After this, the event point type can also be changed by pressing f2 (Event Type). Refer to Table 5.4.1-1 for details.

After the event type has been changed and the screen is returned to the Edit Events screen, press f1 (Execute Add) to add the event. As shown in Fig. 5.4.6-2 below, an asterisk (*) is added to the event table line corresponding to the added event. An asterisk is also added when an event is moved or the event type is changed in the same manner of event addition.

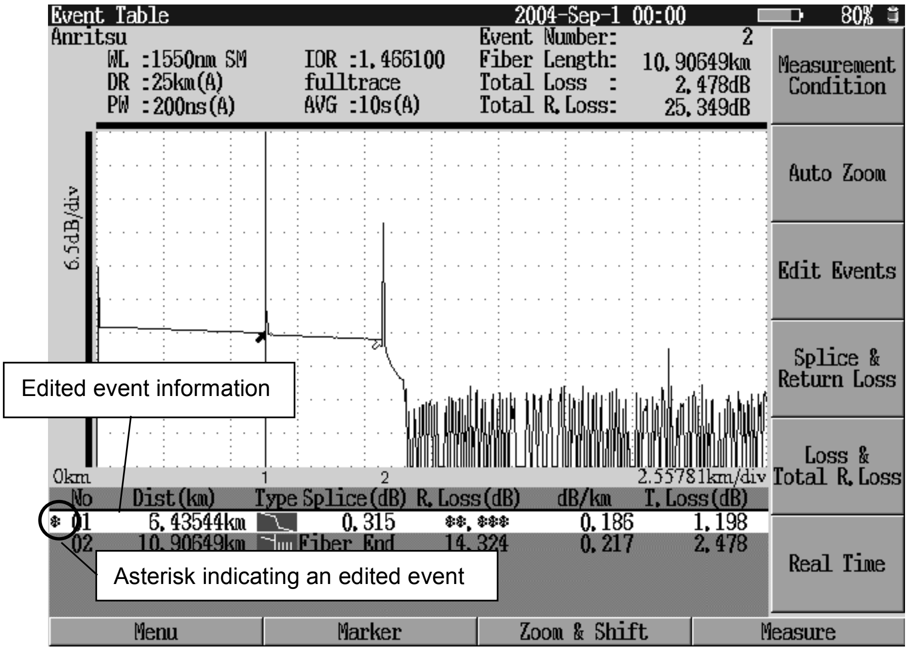


Fig. 5.4.6-2 Screen after event addition

5.4.7 Moving event

When the view containing an event point obtained by the auto event detection following by completion of measurement is enlarged, the position of a marker placed, for example, at a waveform rising point, may be misaligned due to noise. This function is useful to move this marker to an accurate event point.

Select an event to be moved on the Edit Events screen by pressing the [∧] and [∨] keys.
Then, press [f2] (Move) to enlarge the view containing the selected event and to display the screen shown in Fig. 5.4.7-1. The * marker is selected at this time. Move the * marker to the event point to be corrected by using the [∧] and [∨] keys. Then set the X1 through X4 markers, performing operations such as zoom if necessary. For the setting procedure, refer to <<Remarks>> in Section 5.5.4 "Marker (splice & return loss)".

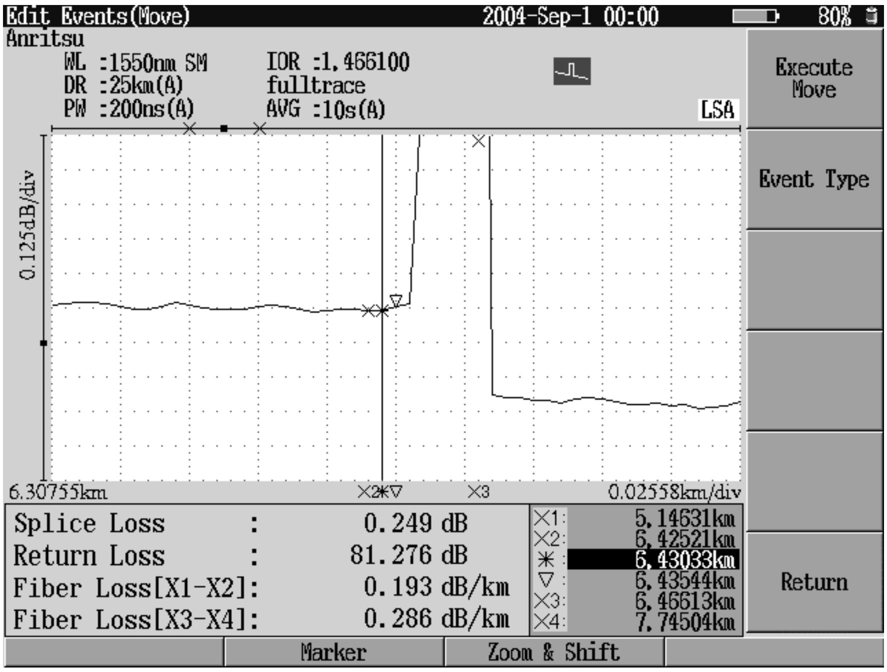


Fig. 5.4.7-1 Edit Events (Move) screen

When all the markers have been moved to the desired locations, press [f1] (Execute Move). The event moves are finalized, and the distances for the moved events are corrected. At this time, an asterisk (*) is added to the head of each moved event in the Event Table screen.

To change the type of a moved event, press [f2] (Event Type) to change the event to the desired type before pressing [f1] (Execute Move).

5.4.8 Deleting event

Use this function to delete a point that was erroneously judged as a fault point due to noise, or to delete a normal event point from the event table for some reason.

Select an event to be deleted on the Edit Events screen by pressing the ∧ and ∨ keys.
Then press f3 (Delete).

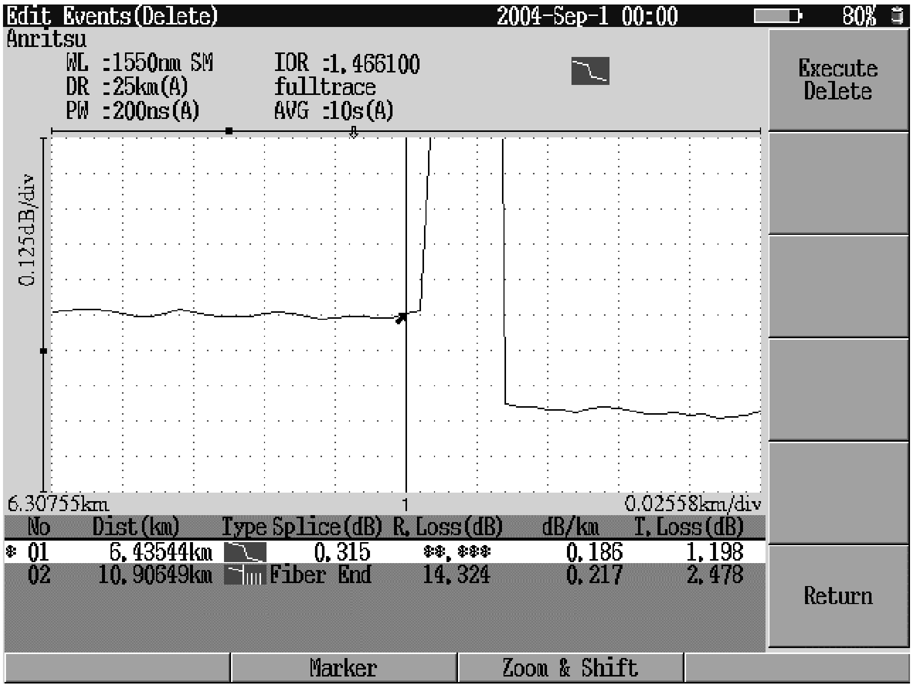


Fig. 5.4.8-1 Edit Events (Delete) screen

Confirm that the selected event is surely to be deleted, the press f1 (Execute Delete).
The target event is deleted, and the Event Table screen is displayed again.

The event information cannot be restored once it is deleted. When deleting an event, therefore, be sure to confirm that the target event is surely to be deleted.

5.4.9 Event type

Use this function to correct an event that was categorized as an erroneous event type during auto event detection following completion of measurement.

Press [f4] (Event Type) on the Edit Events screen to display the screen shown in Fig. 5.4.9-1.

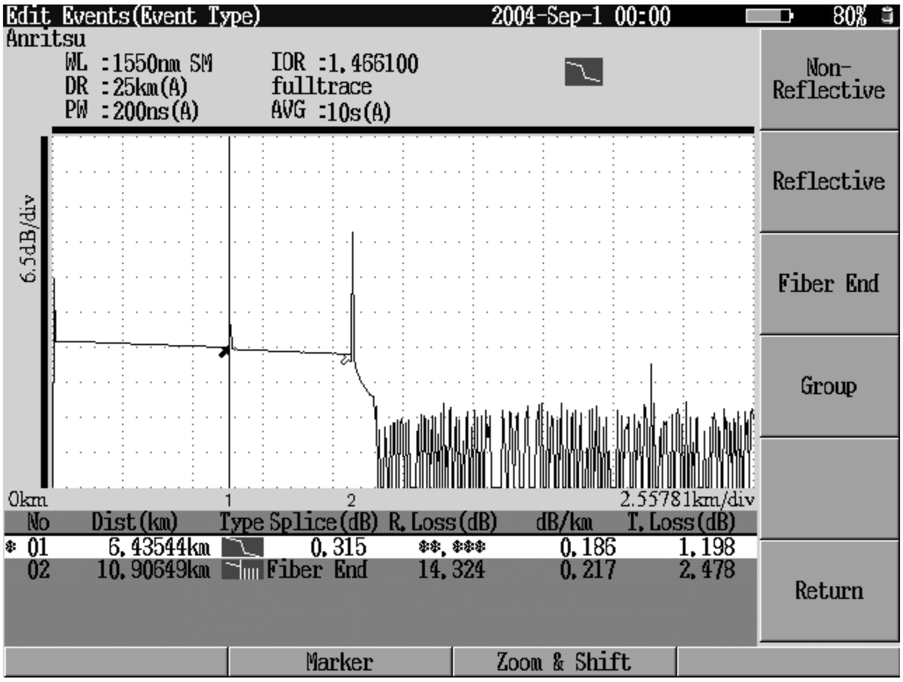


Fig. 5.4.9-1 Edit Events (Event Type) screen

Press one of the [f1] to [f4] keys for the corresponding event type on the screen shown in Fig. 5.4.9-1. Then select or change the event type. If the event type cannot be determined, select [Reflective].

When the type is changed, the Event Table screen is displayed again.

[f1]: Non-reflective

[f2]: Reflective

[f3]: Fiber End

[f4]: Group

[f6]: Return

When [f6] (Return) is pressed, the event type remains unchanged, and the screen returns to the Event Table screen.

Note:

Refer to Table 5.4.1-1 "Event types" for details of the f1 to f4 keys. When "Far End" is selected for the event type, the information of the further events from that event is ignored. When changing the event type, note that [Reflection (Saturated)] cannot be selected for [Event Type] by the user since the MT9080 Series judges whether the splice point (Fresnel reflection) is saturated or not.

5.4.10 Fixing and redetecting event

Fixing an event

To fix the position information of an event point while the event type is displayed, select [Event] to [Fixed] referring to Section 5.2.1 "Measurement conditions". The position information of all events that are displayed at this time is stored in the MT9080 Series.

By starting measurement under this condition, a search is performed near the stored position during auto event detection.

This function is useful if the event points are the same on all the optical fibers (e.g., for repeated measurement of a multi-core optical fiber (which consists of multiple optical fibers constructed in the same location)).

Redetecting an event

To perform auto event detection for the currently shown waveform again, press f5 (Re-Auto Search) while the event table is displayed.

Once event redetection has been performed, the fixed event point information previously stored in the MT9080 Series is deleted.
In addition, the event editing information up to that time is deleted and cannot be restored. Be sure to confirm before performing event redetection.

5.5 Measurement Results - Manual Analysis

5.5.1 Splice & return loss

Press [f4] (Splice & Return Loss) on the Event Table screen to display the screen shown in Fig. 5.5.1-1 below.

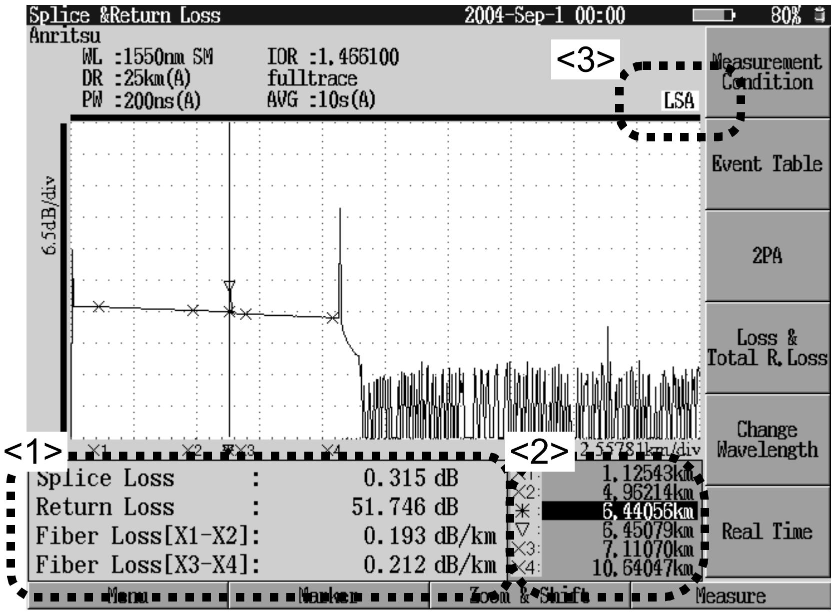


Fig. 5.5.1-1 OTDR (Trace Analysis): Splice & Return Loss screen

The OTDR (Trace Analysis): Splice & Return Loss screen includes the following information:

<1> Calculation results area

Lists information about six marker points and the values calculated from the waveform. The following information is listed:

Splice Loss: Shows the splice loss at the * marker positions that was obtained by linear-approximating the interval between the X1 and X2 markers and between the X3 and X4 markers. Shown in dB units.

Return Loss: Shows the return loss that was obtained by calculating the difference between the ∇ and * markers. Shown in dB units.

Fiber Loss [X1-X2]: Shows the average loss over the interval between the X1 and X2 markers.

Fiber Loss [X3-X4]: Shows the average loss over the interval between the X3 and X4 markers.

<2> Marker information area

Displays the distances to the following markers from the near end of the MT9080 Series.

X1 marker

X2 marker

* marker

∇ marker

X3 marker

X4 marker

<3> Linear approximation

Shows the linear approximation method, which is either [LSA] (least square approximation) or [2PA] (two-point approximation).

<<Remark>>

LSA/2PA Selection

As a rule, to obtain the splice loss, least square approximation should be used; to obtain the total loss, two-point approximation should be used. Refer to Appendix B "Linear Least Square Approximation Method" for details.

5.5.2 Loss & total return loss

Press [f5] (Loss & Total R. Loss) on the Event Table screen to display the screen shown in Fig. 5.5.2-1.

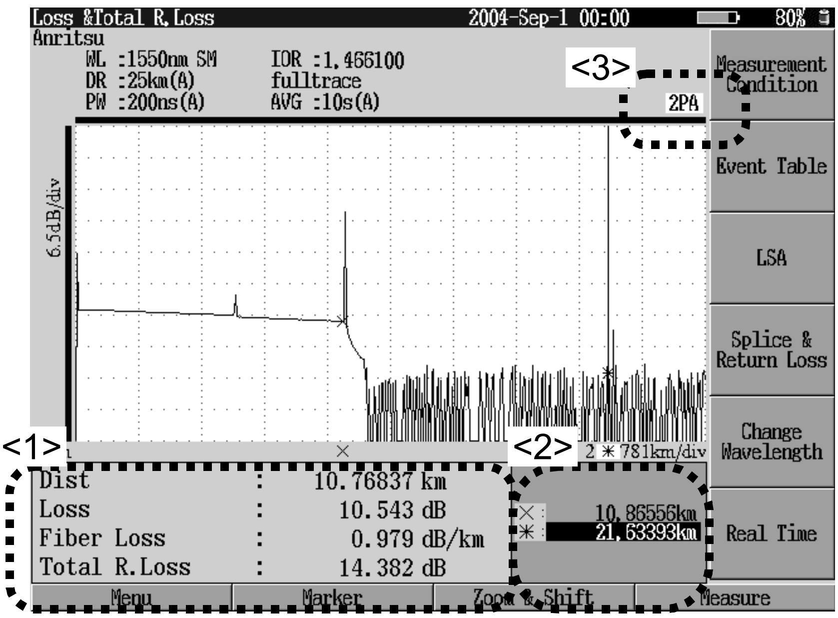


Fig. 5.5.2-1 OTDR (Trace Analysis): Loss & Total R. Loss screen

The OTDR (Trace Analysis): Loss & Total R. Loss screen shown in Fig. 5.5.2-1 above displays the following information:

<1> Calculation results area

Lists information about two-point markers and the values calculated from the waveform. The following information is listed:

- Dist: Displays the distance between two marker points.
- Loss: Displays the loss between two marker points.
- Fiber Loss: Displays the average loss relative to the distance between two marker points.
- Total R. Loss: Displays the total return loss that was obtained from the integral value between two marker points.

<2> Marker information area

Displays the distances to the markers from the near end of the MT9080 Series.

X marker

* marker

<3> Linear approximation

Displays the linear approximation method, which is either [LSA] (least square approximation) or [2PA] (two-point approximation).

5.5.3 Zoom & shift

When F3 (Zoom & Shift) is pressed, the vertical and/or horizontal axis scale can be enlarged/reduced centered on the cursor on the waveform. Refer to Section 5.4.3 “Zoom & shift” for operation.

5.5.4 Marker (splice & return loss)

When F2 (Marker) is pressed on the Splice & Return Loss measured result screen, the screen shown in Fig. 5.5.4-1 is displayed.

Press the ESC key to cancel the marker operation and display the function keys for measured results.

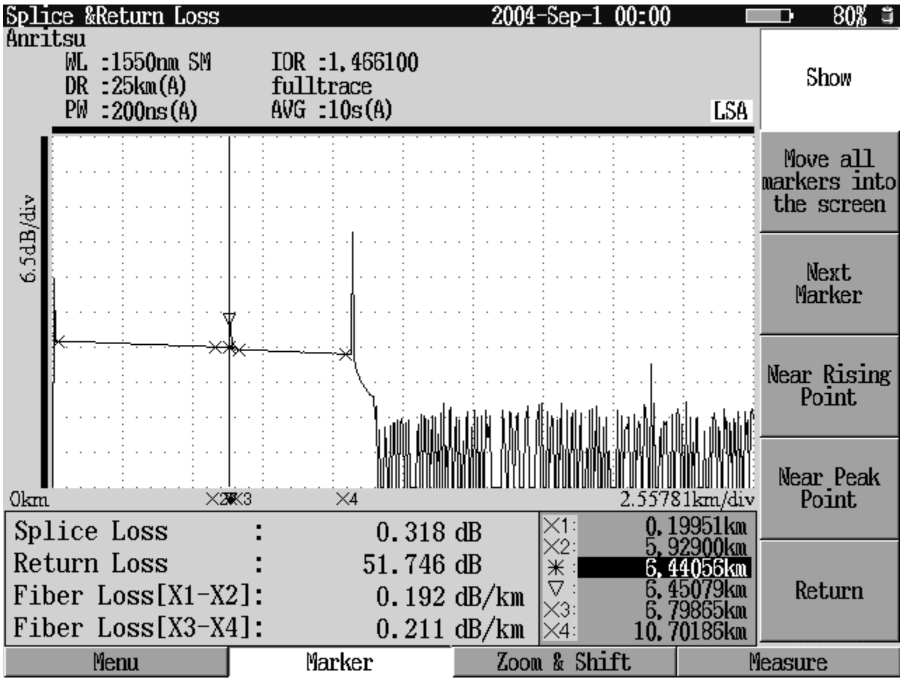


Fig. 5.5.4-1 Marker (Splice & Return Loss) screen

In this screen, the selected marker can be moved to the left and right by using the ∧ and ∨ keys.

Show/Hide

The markers on the waveform are shown and hidden alternately each time f1 (Show) is pressed.

When it is selected to show the markers, the markers are displayed on the waveform as shown in Fig. 5.5.4-2 below.

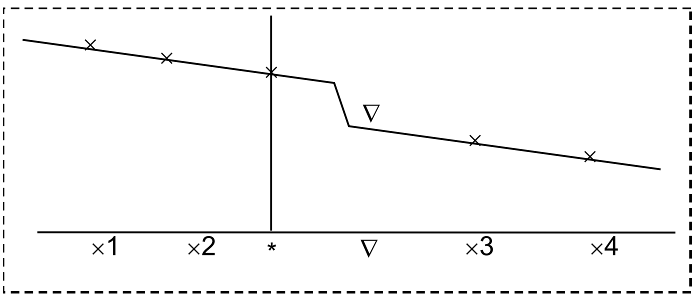


Fig. 5.5.4-2 Show Markers (Splice & Return Loss)

Move all markers into the screen

When [f2] (Move all markers into the screen) is pressed, the markers located outside the screen are moved into the screen. Note, however, that some markers outside the screen may not be displayed in the screen according to the displayed resolution.

Next Marker

Each time [f3] (Next Marker) is pressed, the marker is selected in the following order: X1, X2, *, ∇, X3, X4, and X1. The marker selection can also be switched by pressing the [Enter] key in the same manner.

Near Rising Point

When [f4] (Near Rising Point) is pressed, the marker moves to the nearest waveform rising point by pressing the [∧] or [∨] key.

Near Peak Point

When [f5] (Near Peak Point) is pressed, the marker moves to the nearest return peak point by pressing the [∧] or [∨] key.

Note:

Moving to the nearest rising or peak point is an auxiliary function that helps the user move the marker. Note that the rising or peak point cannot always be found.

<<Remarks>>

Measuring splice loss

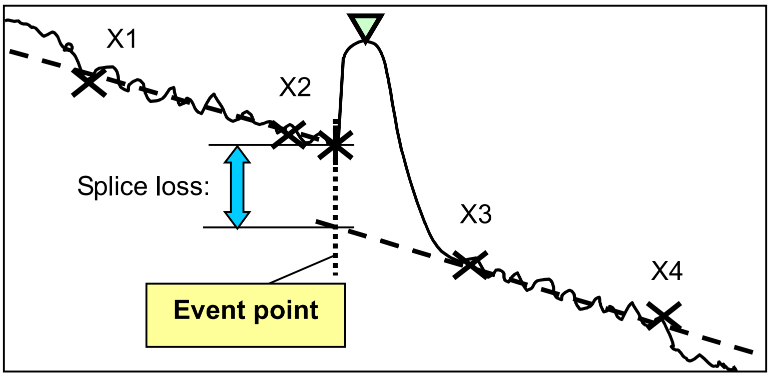


Fig. 5.5.4-3　Splice loss

<Setting Procedure for Six Markers>

1. Set the * marker at the point where the event occurred.
2. Set the X1 and X2 markers to the left of the event point.
(Determining the slope of the loss located in front of the event)
3. Set the X3 and X4 markers to the right of the event point.
(Determining the slope of the loss located behind the event)
4. If Fresnel reflection occurs, set the ∇ marker at the peak.

Refer to Appendix B “Linear Least Square Approximation Method” for details.

5.5.5 Markers (Loss & Total R. Loss)

When F2 (Marker) is pressed on the Loss & Total R. Loss measured result screen, the function keys as shown in Fig. 5.5.5-1 are displayed on the screen.

Press the ESC key to cancel the marker operation and display the function keys for measured results.

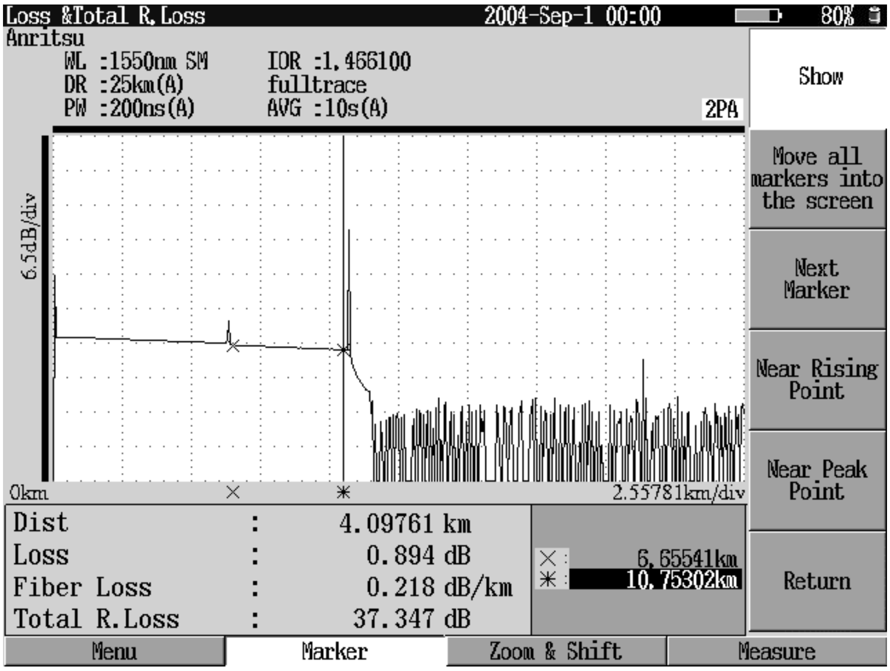


Fig. 5.5.5-1 Marker (Loss & Total R. Loss) screen

In this screen, the selected marker can be moved to the left and right by using the ∧ and ∨ keys.

Show/Hide

The markers on the waveform are shown and hidden alternately each time f1 (Show) is pressed.

When it is selected to show the markers, the markers are displayed on the waveform as shown in Fig. 5.5.5-2 below.

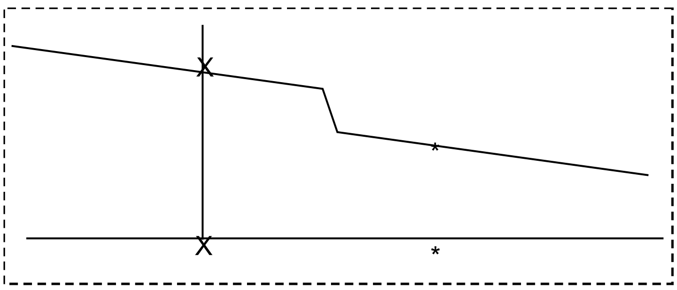


Fig. 5.5.5-2 Show Markers (Loss & Total R. Loss)

Marker selection

Each time [f3] (Next Marker) is pressed, the marker is switched between the X and * markers. The marker selection can also be switched by pressing the [Enter] key in the same manner.

The currently selected markers move as shown below:

Table 5.5.5-1 Marker selection switching

Select the X marker. Move the X marker using the [∧] and [∨] keys. • [∧] key • [∨] key	 • Only the X marker moves to the left. Once the marker reaches the left end, it does not move any further. • Only the X marker moves to the right. When the X marker overlaps the * marker, they move to the right in this state. Once the markers reach the right end, they do not move any further. In this case, if you attempt to move them to the left, only X moves to the left.
Select the * marker. Move the * marker using the [∧] and [∨] keys. • [∧] key • [∨] key	 • Only the * marker moves to the left. When the * marker overlaps the X marker, they move to the left in this state. Once the markers reach the left end, they do not move any further. In this case, if you attempt to move them to the right, only * moves to the right. • Only the * marker moves to the right. Once the marker reaches the right end, it does not move any further.

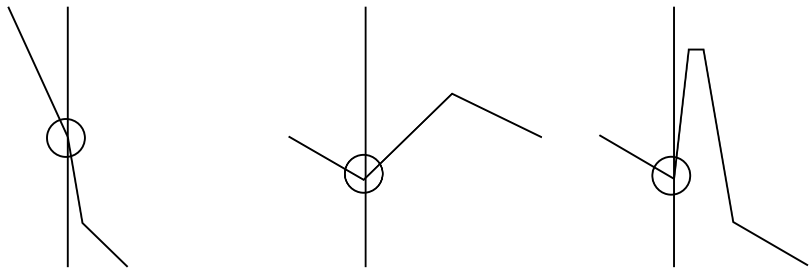
<<Remarks>>

Setting a marker properly

If markers are not set properly, the measurement results will be corrupted and no accurate results will be obtained. This section shows examples of correct and incorrect marker settings.

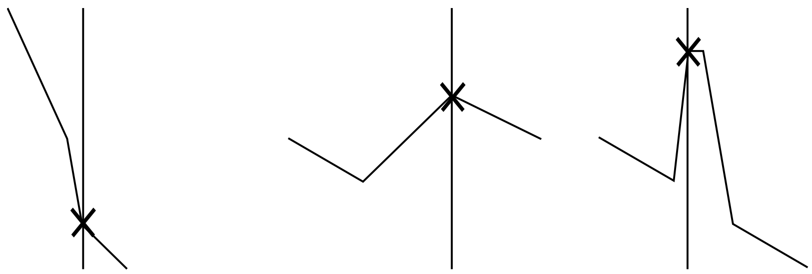
To measure the splice loss and distance correctly, set the * and X markers that specify splice points to the trace waveform step start point.

Example of correct setting:



(a) Falling step (b) Rising step (c) Falling step (Fresnel reflection)

Example of incorrect setting:



(a) Falling step (b) Rising step (c) Falling step (Fresnel reflection)

5.5.6 Real-time measurement

Pressing f6 (Real Time) on the Splice & Return Loss or Loss & Total R. Loss measured result screen starts real-time sweep (preview).

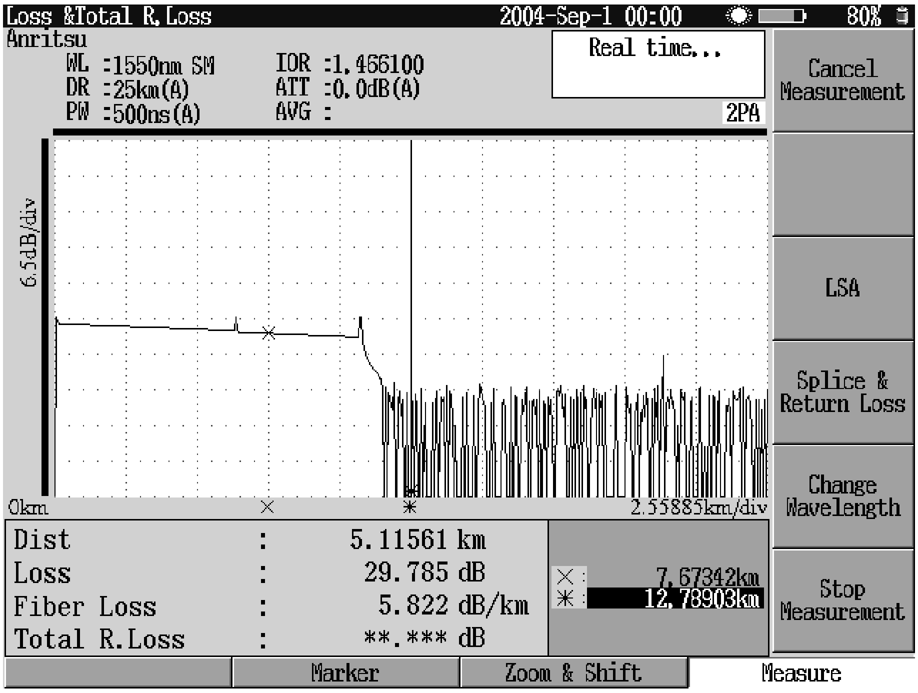


Fig. 5.5.6-1 Real-time measurement

5.6 Setting Absolute/Relative Distance Measurement

Relative distance setting is a function that calculates and displays the distance on the assumption that the position where the relative distance cursor, i.e., zero cursor, has been set is 0 km. This function is useful if you use a dummy fiber before the optical fiber to be measured, or to measure the distance relative to a certain event point.

The data shown and calculated with respect to the relative distance cursor includes the total loss and total return loss values displayed in the event table.

While no waveform is being displayed, you cannot set the zero cursor.

Press [F1] (Menu) on the measurement end screen opens the shortcut menu shown below.

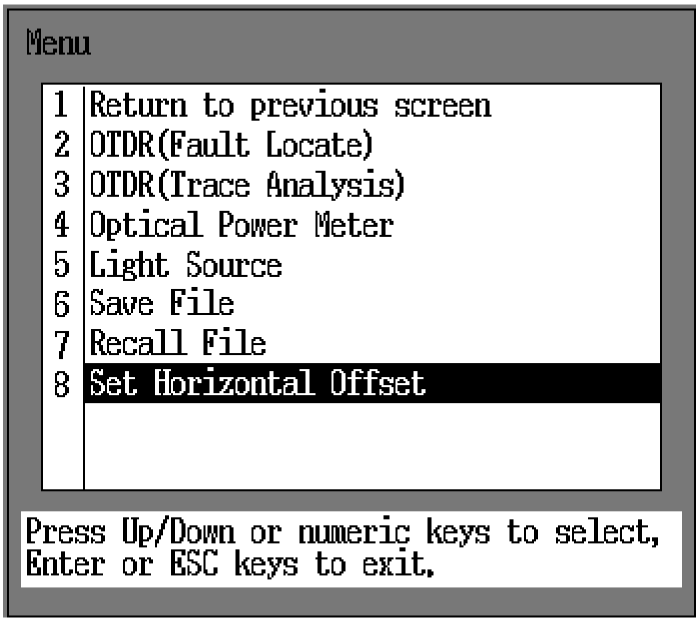


Fig. 5.6-1 Shortcut menu screen to relative distance setting

Select [Edit horizontal offset] from the shortcut menu.

Note:

The menu items in the shortcut menu vary depending on the installed option types.
When both the IP Network Connectivity Check Function and Visible Light Source options are installed, for example, [Edit horizontal offset] is located in the 11th menu, and is not displayed in the default screen. In this event, scroll the screen using the [∨] key to display [11. Edit horizontal offset].

As shown in Fig. 5.6-2 below, the distance of the zero cursor is shown at the bottom of the screen, and the waveform window shows the relative distance marker (zero cursor, represented by dashed lines).

When the relative distance setting is performed from the Event Table screen, the distance of the selected event is displayed under the zero cursor distance display, and the event is indicated by the solid cursor in the waveform screen.
When the relative distance setting is performed from the Splice & Return Loss or Loss & Total R. Loss screen, the distance of the selected marker is displayed under the zero cursor distance display, and the marker currently selected (solid line) is displayed.

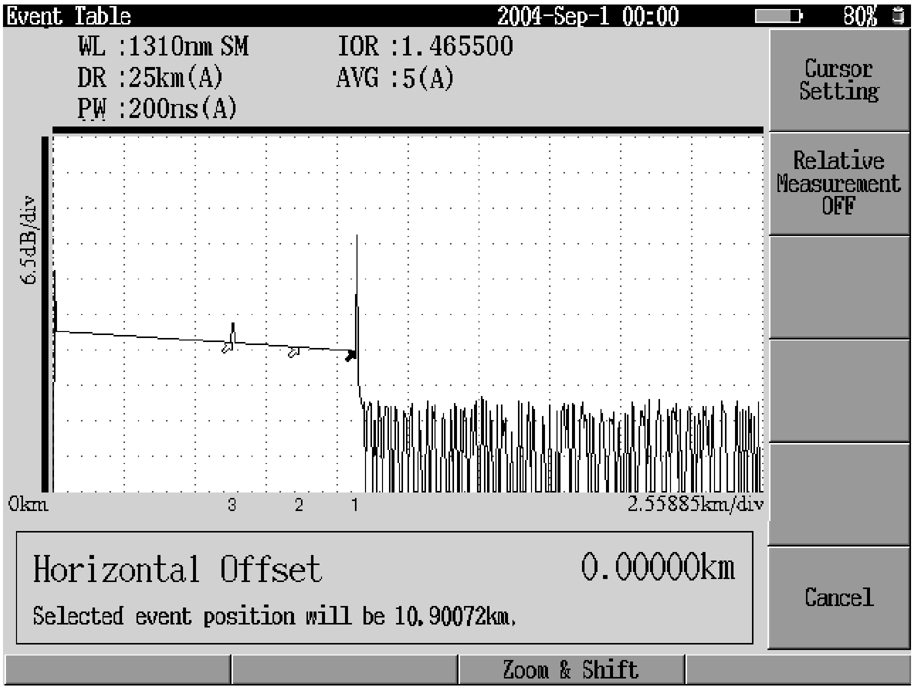


Fig. 5.6-2 Relative distance zero cursor setting screen

Cursor Setting

Move the zero cursor by using the [∧] and [∨] keys. When [f1] (Cursor Setting) is pressed, the zero cursor position at that time on the waveform (i.e., distance) is set to 0 km.

Relative Measurement OFF

Pressing [f2] (Relative Measurement OFF) cancels the relative distance setting and clears the zero cursor.
After completing the setting, the usual markers appear and can be moved.

Near Event

Each time [f3] (Near Event) is pressed, the [f3] key display state is switched between recessed (selected) and raised (unselected).

Recessed: The zero cursor can be moved to the nearest event position by pressing the [∧] and [∨] keys.

Note that an error sound beeps when the [∧] or [∨] key is pressed while there is not any event.

Near Rising Point

When the [∧] or [∨] key is pressed while [f4] (Near Rising Point) is pressed (recessed), the zero cursor moves to the nearest waveform rising point. Refer to Section 5.4.4 “Markers” for details.

Near Peak Point

When the [∧] or [∨] key is pressed while [f5] (Near Peak Point) is pressed (recessed), the marker moves to the nearest return peak point. Refer to Section 5.4.4 “Markers” for details.

When relative distance setting is performed, the absolute distance to the zero cursor is subtracted from the distances other than the following distance ranges:

- Marker position
- Fiber length at the top of the screen
- Distance in the event table
- Distance scale on the waveform view window

In addition, in the section on the left of the zero cursor in the waveform view area, the distance scale indication is shown by a negative number. The event points placed leftward of the position at which you have set the zero cursor on the waveform disappear from the event table. Also, any events on the left of the zero cursor cannot be edited at this time.

When [Edit horizontal offset] is selected on the shortcut menu while [Automatic Dummy Fiber (No.)] has not been set to [None] on the Measurement Condition (Trace Analysis): Others screen, the following warning message appears: “Auto dummy fiber is valid. Do you discard it and enable horizontal offset?” When [f1] (Yes) is selected at this time, [Automatic Dummy Fiber (No.)] is automatically set to [None].

The relative distance setting is not canceled even when the distance range is set to [Auto].

When the MT9080 Series is turned off and then turned on again, the distance data will be calculated from the set relative distance and be displayed.

Restrictions on relative distance measurement

(1) Relative distance setting is impossible when a waveform is not being displayed.

(2) When the relative distance goes outside the distance range due to change of the distance range after the relative distance has been set, the relative distance setting will be cancelled automatically.

5.7 Comparing Waveforms - Waveform Compare Function

When it is required to observe the aging of the optical fiber, it is possible to compare the previously measured waveform data [reference waveform] and the current waveform data [current waveform].

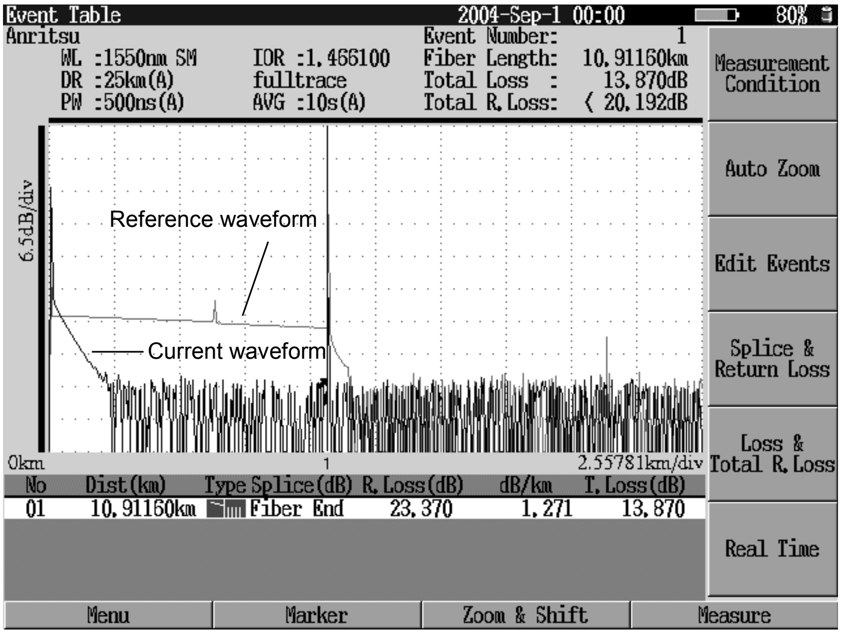


Fig. 5.7-1 Example of reference waveform view

Waveform data on the reference waveform can be always displayed on-screen.

For the current waveform, the measurement conditions can be changed and re-measured in the same manner as usual measurement. The marker moves over the current waveform, and the displayed measured results are from the current waveform. The current waveform can also be saved and recalled.

There are two ways to display the reference waveform. One is to press [f2] (Recall as Reference) on the Recall screen after pressing [F1] (Comparison Measure) on the Measurement Condition (Trace Analysis) screen. And the other is to press [f2] (Recall as Reference) on the Recall screen at "File" menu.
When the reference waveform has already been recalled, [f2] (Clear Reference) is displayed on the Recall screen. Press [f2] (Clear Reference) when deleting the current reference waveform or when recalling another waveform data as a reference waveform.
Refer to Section 8.1.2 "Recalling file" for details.

5.8 Saving File

The MT9080 Series can save the measured waveform data in a file.

To save the waveform data, press F1 (Menu) on the measurement end screen to open the shortcut menu, and select [5. Save File], or press the Save key in the state where the numeric keys are disabled. Refer to Section 8.1.6 “Saving file” for details.

5.9 Shortcut Menu

In the screen shown in Fig. 5.4.1-1, for example, when [F1] (Menu) is pressed, the shortcut menu is displayed as shown in Fig. 5.9-1 below. Other functions can be selected from this shortcut menu.

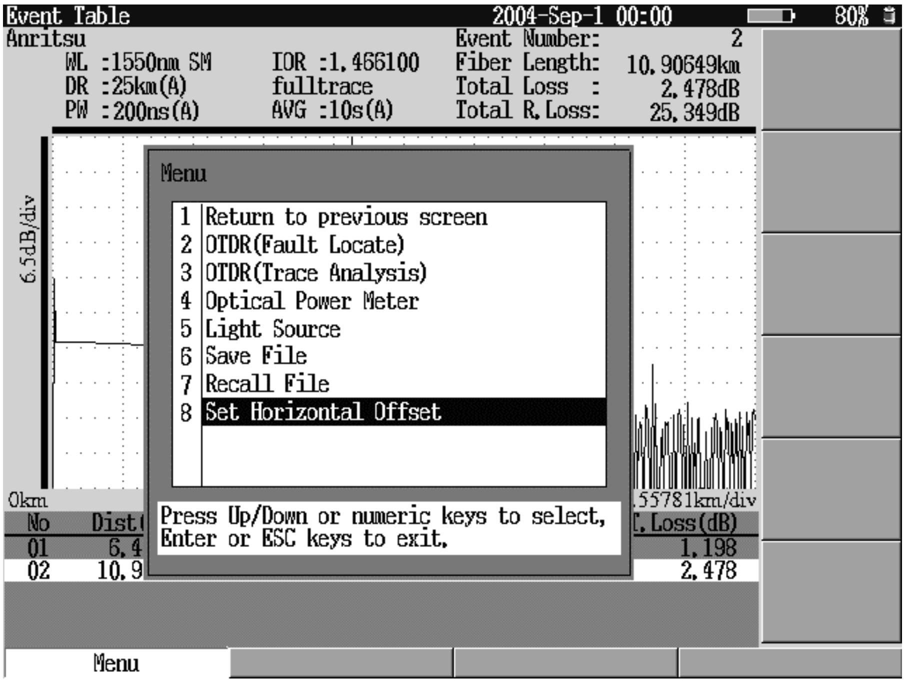


Fig. 5.9-1 Shortcut menu on OTDR (Trace Analysis): Event Table screen

Selecting "1 Return to previous screen" returns to the measurement screen before the current screen (OTDR (Trace Analysis): Event Table screen in this example) was selected. This function is useful when alternating use of two functions.
For example, when the OTDR (Trace Analysis) screen was selected from the Optical Pulse Meter screen, the Optical Pulse Meter screen can be displayed again quickly by using this operation.

For details on the other menus, refer to the corresponding section for each function. Press the [ESC] key to close the shortcut menu.

Note:

The menu items in the shortcut menu vary depending on the installed option types.

Section 6 Optical Power Meter (OPM)/Optical Light Source (OLS) for Fiber Identification

In addition to the optical pulse test function (OTDR: Optical Time Domain Reflectometer), the MT9080 Series also provides an optical power meter (OPM) function, which allows checking of the optical communications power level, and an optical light source function required for fiber identification measurement.

The items displayed in the ☐ in this section indicate panel keys.

6.1 Optical Power Meter (OPM) Function

The optical communications power level from a station can be measured using the optical power meter function before the operating optical fiber is measured by the optical pulse test function (OTDR).
Breakage, loss increases, and other optical fiber conditions can be checked by measuring the optical communications power level.

6.1.1 Measurement

Select "Optical Power Meter" from the Top Menu (Fig. 3.2.1-1) using the [∧] and [∨] keys and press the [Enter] key, or press the [5] key on the Top Menu to display the screen shown in Fig. 6.1.1-1 below.

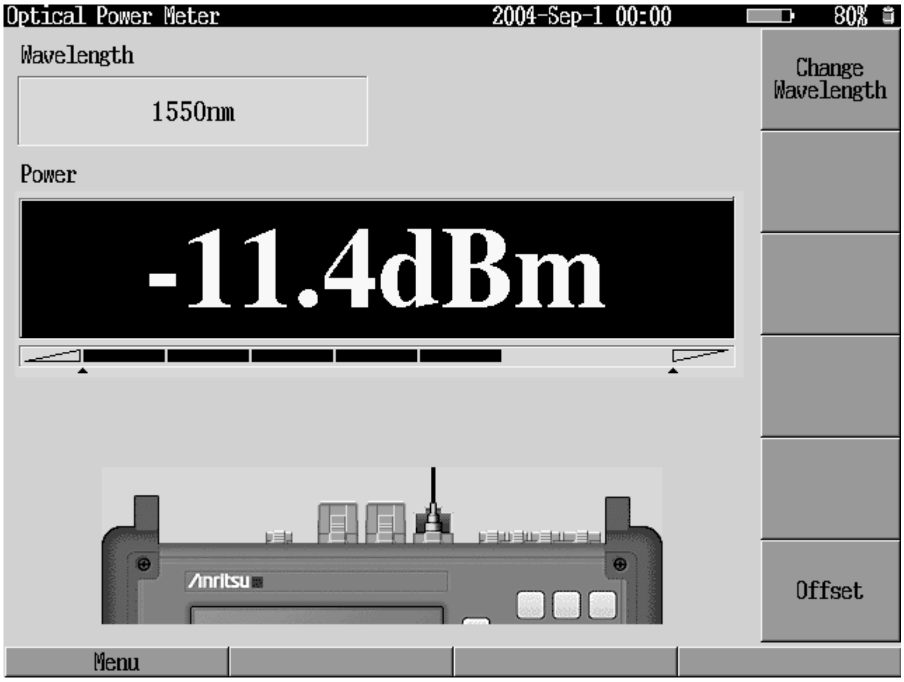


Fig. 6.1.1-1 Optical Power Meter screen

Wavelength
The wavelength used for measurement by the optical power meter is displayed.

Power
The value measured by the optical power meter is displayed.

Optical power meter measurement range: –50 to –5dBm

When an optical power level under the measurement range (including light shielding) is measured, it is regarded as “under range” and the screen shown in Fig. 6.1.1-2 is displayed.
When an optical power level over the measurement range is measured, it is regarded as “over range” and the screen shown in Fig. 6.1.1-3 is displayed.
Correct measurements cannot be performed in the under range or over range status.

The measurement port varies according to the optical wavelength of the light to be injected. Check the measurement port referring to the image on the screen shown in Fig. 6.1.1-1.

Range Indicator
Each scale of the range indicator located under the measurement value equals one measurement range. The greater the optical power level being measured, the greater the measurement range, and the level indicator display will also extend to the right side.

CAUTION ⚠

The light receiving part of the MT9080 Series may be damaged if light exceeding +10 dBm is injected.

Fig. 6.1.1-2 Optical Power Meter screen (under range)

Fig. 6.1.1-3 Optical Power Meter screen (over range)

Function Key Details

f1 (Change Wavelength)

The wavelength is switched each time f1 (Change Wavelength) is pressed as follows: "1310 nm → 1550 nm → 1625 nm → 1650 nm." Select the wavelength to be used for measurement.

f6 (Offset)

When f6 (Offset) is pressed, the screen shown in Fig. 6.1.1-4 is displayed to adjust the optical power meter offset.

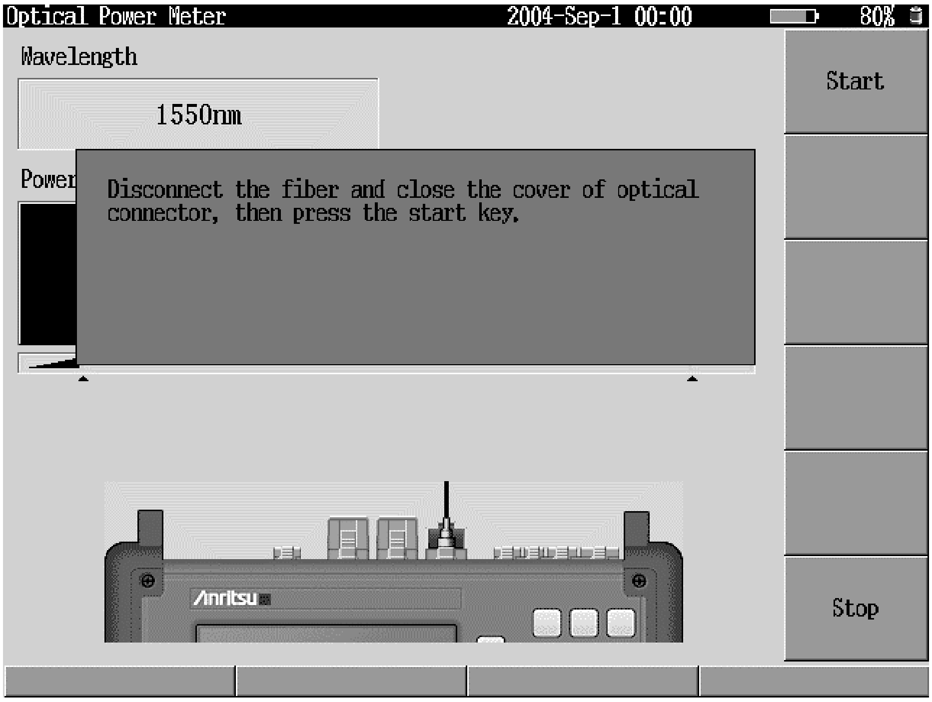


Fig. 6.1.1-4 Zero offset start screen

Close the connector cover to shield the measurement port from incident light before starting zero offset.

The following message may be displayed when executing zero offset without light shielding. This message disappears when any button is pressed.

Failed in offset. The incident light might fail this function. Please confirm that light is shut out, and try again.

Perform light shielding for the measurement port and then execute zero offset again in this instance.

F1 (Menu)

When F1 (Menu) is pressed, the shortcut menu is displayed on the screen as shown in Fig. 6.1.1-5. Other functions can be selected from this shortcut menu.

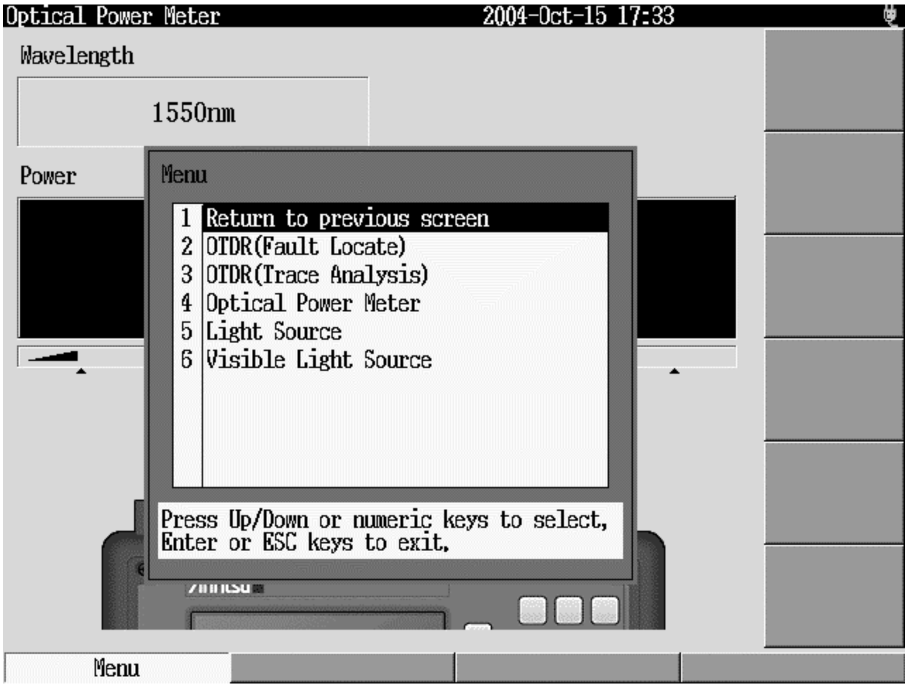


Fig. 6.1.1-5 Shortcut menu on Optical Power Meter screen

Selecting “1 Return to previous screen” returns to the measurement screen before the optical power meter was selected. This function is useful when alternating use of two functions.
For example, when the Optical Pulse Meter screen was selected from the OTDR (Fault Locate) screen, the OTDR (Fault Locate) screen can be displayed again quickly by using this operation.

For details on the other menus, refer to the corresponding section for each function.

Press the ESC key to close the shortcut menu.

6.1.2 Measurement example (optical power level measurement)

The following shows how to measure the optical power level.

The optical power meter only supports single mode fibers.

<Measurement Procedure>

1. Close the measurement port connector cover to shield it from incident light, then execute zero offset for the optical power meter.
2. Set the optical power meter wavelength.
3. Connect the optical fiber to be measured to the measurement port on the optical power meter.
4. The optical power level of the target optical fiber is displayed on screen.

Note:

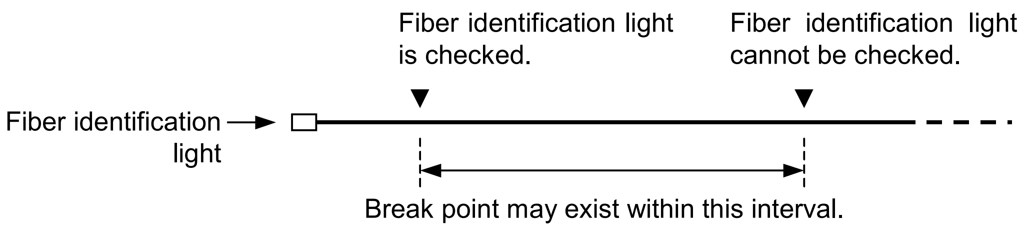
Correct measurement may not be obtained until zero offset is executed. Be sure to perform light shielding and execute zero offset before measurement.

6.2 Optical Light Source (OLS) Function for Fiber Identification

The fiber identification measurement is used for a comparatively simple approximation of the optical fiber break point.

Fiber identification measurements refer to injecting fiber identification light into the optical fiber and detect this fiber identification light with the fiber identification device (ID tester) to approximate the break point.

The optical light source for fiber identification is equipped as standard to the MT9080 Series, and is combined with the fiber identification device (ID tester) to enable fiber identification measurement.



6.2.1 Turning light source On/Off

Select “Light Source” from the Top Menu (Fig. 3.2.1-1) using the [∧] and [∨] keys and press the [Enter] key, or press the [6] key on the Top Menu to display the screen shown in Fig. 6.2.1-1 below.

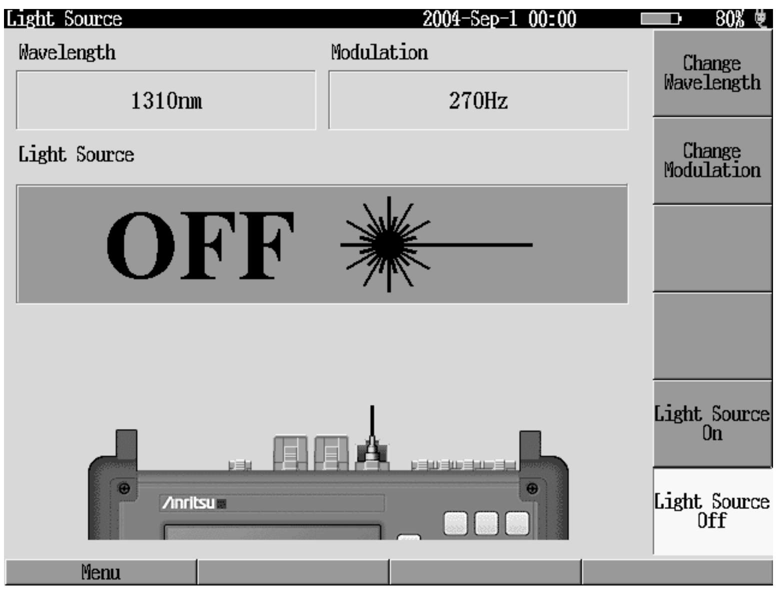


Fig. 6.2.1-1 Light Source screen

Wavelength

The wavelength of the optical light source for fiber identification is displayed.

Modulation

The modulation frequency of the optical light source for fiber identification is displayed.

Light Source

The conditions of the optical light source for fiber identification are displayed.

Press [f5] (Light Source On) to display "ON" and press [f6] (Light Source Off) to display "OFF."

The measurement port varies according to the optical wavelength of the light to be emitted. Check the measurement port referring to the image on the screen shown in Fig. 6.2.1-1.

Function Key Details

[f1] (Change Wavelength)

The wavelength is switched each time [f1] (Change Wavelength) is pressed. Refer to Appendix A "Specifications" for the settable wavelengths.
With the MT9080F, for example, the wavelength is switched as follows: "1310 nm → 1550 nm → 1650 nm → 1310 nm..."

Note that [f1] (Change Wavelength) is not displayed when there is only one wavelength.

[f2] (Change Modulation)

The modulation frequency is switched each time [f2] (Change Modulation) is pressed as follows:
For MT9080 Series: 270 Hz → 1 kHz → 2 kHz → 270 Hz...
For MT9081 Series: 270 Hz → 1 kHz → 2 kHz → CW → 270 Hz...

[f5] (Light Source On)

Press [f5] (Light Source On) to turn the optical light source for fiber identification On. The measurement port varies according to the optical wavelength of the light to be emitted. Check the measurement port referring to the image on the screen shown in Fig. 6.2.1-1.

[f6] (Light Source Off)

Press [f6] (Light Source Off) to turn the optical light source for fiber identification Off.

F1 (Menu)

When F1 (Menu) is pressed, the shortcut menu is displayed on the screen as shown in Fig. 6.2.1-3. Other functions can be selected from this shortcut menu.

Note:

Indication of warm-up operation and out of operating temperature range status:

Certain units may require a warm-up operation under the specific conditions (refer to Section 4.2.1 “Measurement conditions”).

If f5 (Light Source On) is pressed during a warm-up operation, a message is displayed (see Fig. 6.2.1-2 below) and the optical light source for fiber identification does not turn on. The message is also displayed when the wavelength is changed to the level subject to the condition while the light source is turned on. Close the window by pressing any key, and try to turn on the light source after a while.

If f5 (Light Source On) is pressed at a temperature that is out of the operating temperature range, a message “Out of the operating temperature range. Cannot use this function now.” is displayed and the light source does not turn on.

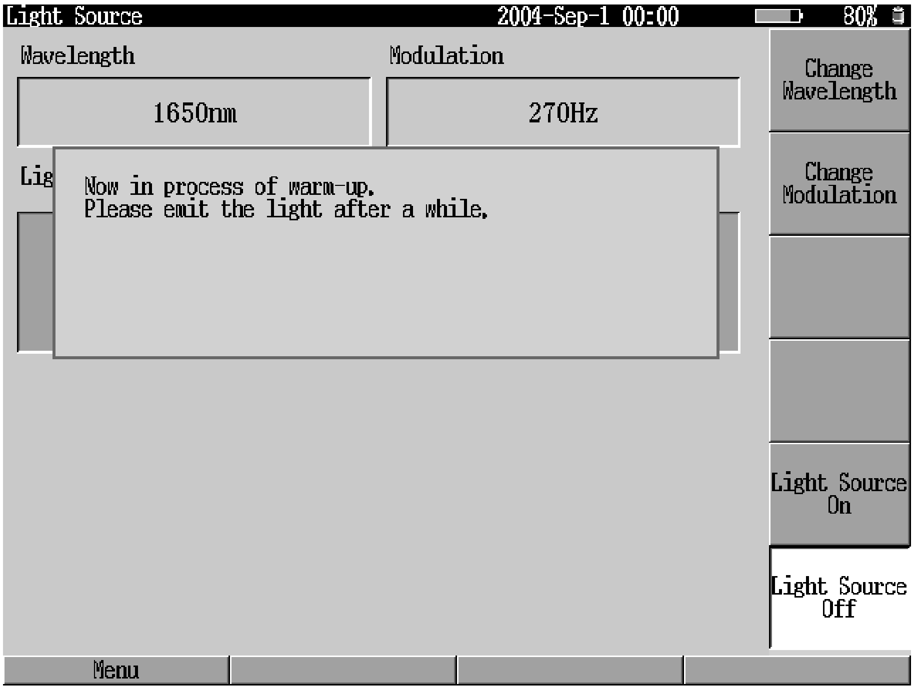


Fig. 6.2.1-2 Message during warm-up operation

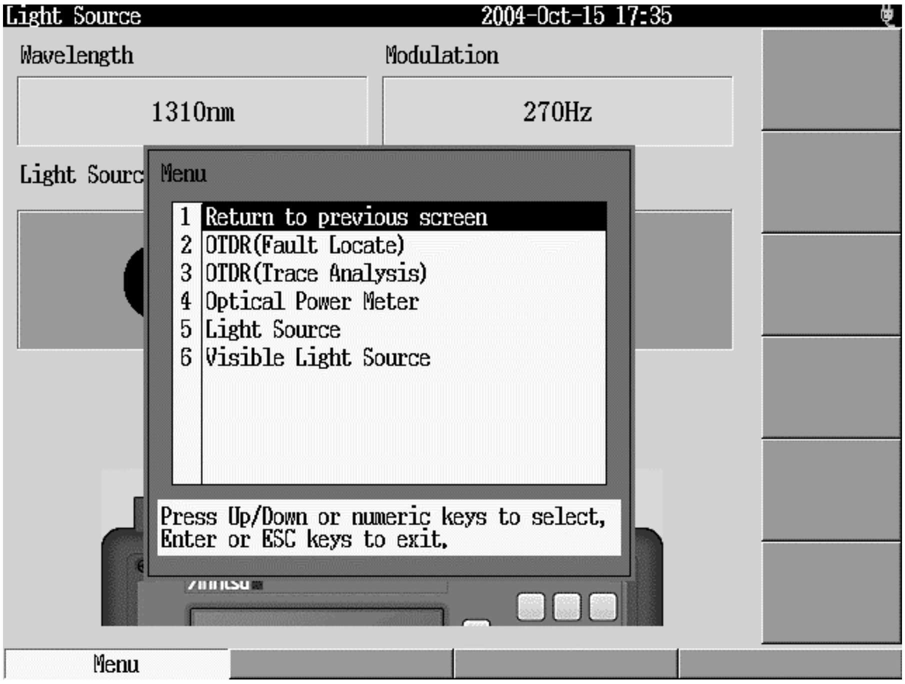


Fig. 6.2.1-3 Fiber Identification Light Source screen shortcut menu

Selecting "1 Return to previous screen" returns to the measurement screen before the optical light source for fiber identification was selected. This function is useful when alternating use of two functions.
For example, when the optical light source for fiber identification was selected on the OTDR (Fault Locate) screen, the OTDR (Fault Locate) screen can be displayed again quickly by using this operation.

For details of the other menus, refer to the corresponding section for each function.

Press the ESC key to close the shortcut menu.

WARNING ⚠

NEVER look directly into the cable connector on the MT9080 Series nor into the end of a cable connected to the MT9080 Series. If laser radiation enters the eye, there is a risk of injury.

CAUTION ⚠

The MT9080 Series emits high output optical pulses. Disconnect communications devices, etc. from the target measurement optical fiber during measurement to prevent the optical sensors from being damaged.

6.2.2 Measurement example (fiber identification measurement)

The following shows how to measure the optical light source for fiber identification.

The optical light source for fiber identification only supports the single mode fiber.

<Measurement Procedure>

1. Set the wavelength and modulation frequency for the optical light source for fiber identification. The modulation frequency must match the modulation frequency of the fiber identification device (ID tester).
2. Connect the optical fiber to be measured to the measurement port of the optical light source for fiber identification.
3. Turn the optical light source for fiber identification On.
4. Measure the target optical fiber with the fiber identification device (ID tester).
5. Turn the optical light source for fiber identification Off when measurement is completed.

Notes:

1. The fiber identification light may interrupt communications if the target measurement optical fiber is connected to the optical fiber currently operating. Disconnect the target measurement optical fiber from the operating line.

2. The MT9080 Series emits high output optical pulses. Disconnect communications devices, etc. from the target measurement optical fiber during measurement to prevent the optical sensors from being damaged.

Section 7 Optional Functions

Optional functions are prepared for the MT9080 Series. Optical fiber laying and maintenance work can be performed more efficiently by applying optional functions.
When using an MT9080 Series unit with the hardware version 2 or later, both the visible light source function and IP network connectivity check function can be installed together. Refer to Section 8.4 “Self Test Function” for checking the hardware version.

The items displayed in the $\boxed{}$ in this section indicate panel keys.

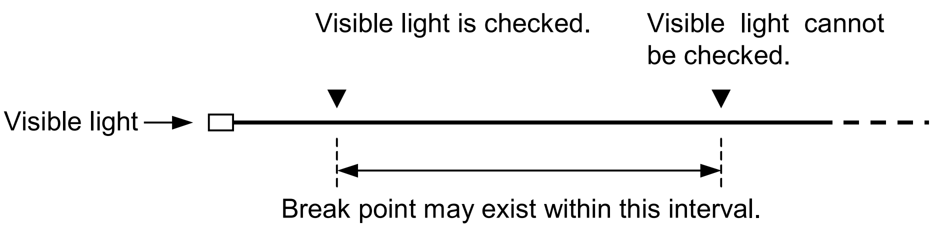
7.1 Visible Light Source Function

The MT9080 Series is optionally provided with a visible light (red) source. Since the light from this light source is visible, it is useful for locating fault points in the dead zone by visually checking the diffusing light. It is also useful for fiber identification of a multi-core optical fiber.

When visible light is injected into a non-coated optical fiber, diffusing light can be visually checked by manually bending the fiber. It is possible to determine whether there is a break point on the optical fiber by checking the diffusing light.

This enables checking for break points when there is no fiber identification device (ID tester).

Note, however, that the further the distance from the light source, the less easy it is to check the visible light.



7.1.1 Turning On/Off or blinking light source

When the optional visible light source function is applied to the MT9080 Series, the screen shown in Fig. 7.1.1-1 below is displayed.

Fig. 7.1.1-1 Top Menu with Visible Light Source

Select "Visible Light Source" from the screen shown in Fig. 7.1.1-1 using the [∧] and [∨] keys and press the [Enter] key, or press the [7] key to display the screen shown in Fig. 7.1.1-2.

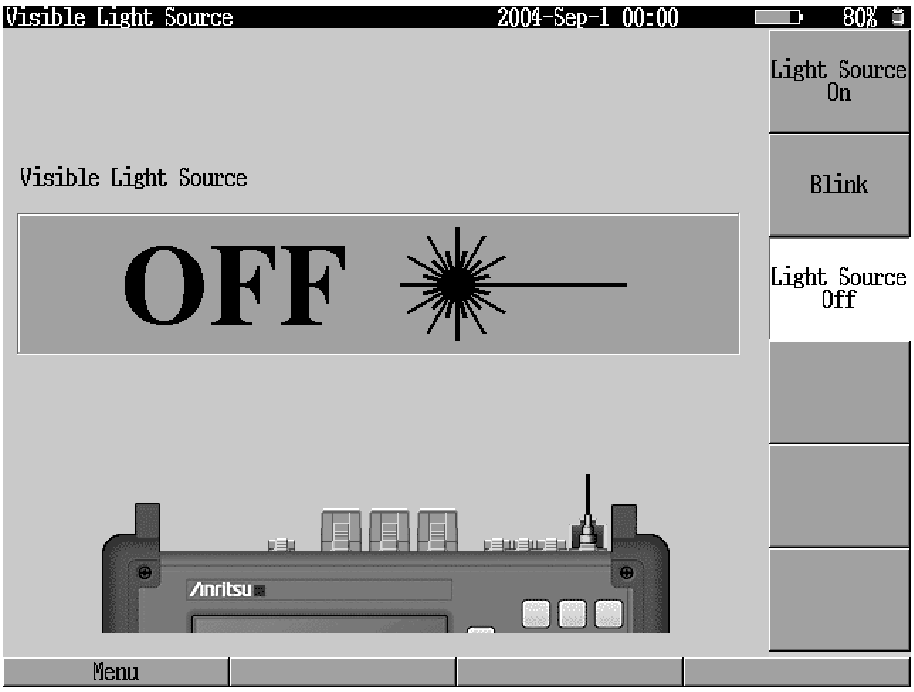


Fig. 7.1.1-2 Visible Light Source screen

Visible Light Source

The visible light emission conditions are displayed.

Press [f1] (Light Source On) to display “ON.”

Press [f2] (Blink) to display blinking “ON”

Press [f3] (Light Source Off) to display “OFF”

Check the measurement port for the visible light referring to the image on the screen shown in Fig. 7.1.1-2.

Function Key Details

[f1] (Light Source On)

Press [f1] (Light Source On) to turn the visible light source On.
Check the measurement port for the visible light referring to the image on the screen shown in Fig. 7.1.1-2.

[f2] (Blink)

Press [f2] (Blink) to make the visible light source blink for each 1 Hz.
Check the measurement port for the visible light referring to the image on the screen shown in Fig. 7.1.1-2.

[f3] (Light Source Off)

Press [f3] (Light Source Off) to turn the visible light source Off.

F1 (Menu)

When F1 (Menu) is pressed, the shortcut menu is displayed on the screen as shown in Fig. 7.1.1-3. Other functions can be selected from this shortcut menu.

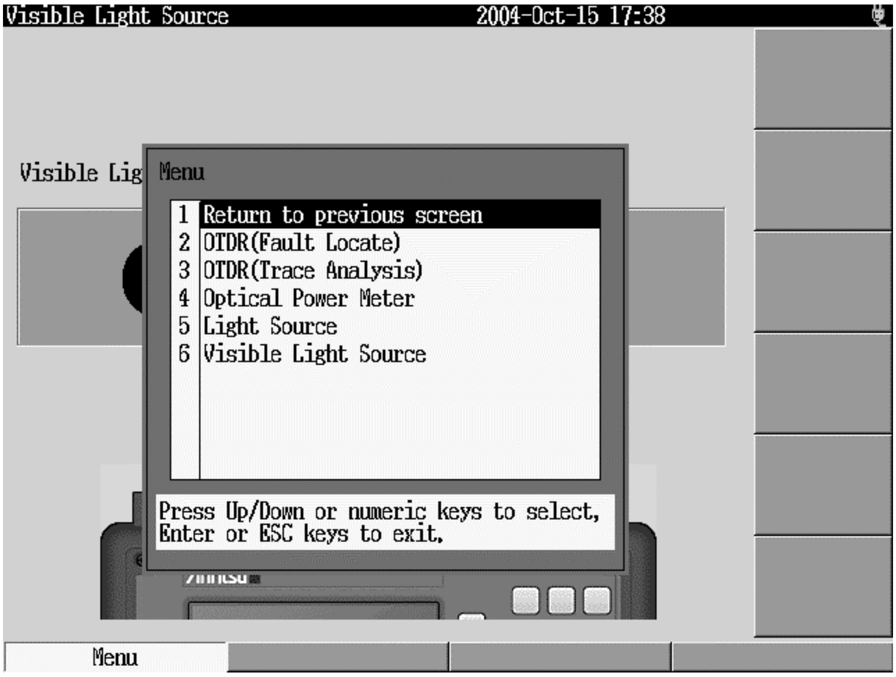


Fig. 7.1.1-3 Shortcut menu on Visible Light Source screen

Selecting "1 Return to previous screen" returns to the measurement screen before the visible light source was selected. This function is useful when alternating use of two functions.
For example, when the visible light source was selected on the OTDR (Fault Locate) screen, the OTDR (Fault Locate) screen can be displayed again quickly by using this operation.

For details of the other menus, refer to the corresponding section for each function.

Press the ESC key to close the shortcut menu.

WARNING ⚠

NEVER look directly into the cable connector on the MT9080 Series nor into the end of a cable connected to the MT9080 Series. If laser radiation enters the eye, there is a risk of injury.

7.1.2 Measurement example (visually checking visible light)

The following shows how to visually check visible light.

<Measurement Procedure>

1. Connect the optical fiber to be measured to the measurement port of the visible light source.
2. Turn on or blink the visible light source.
3. Bend the target measurement optical fiber lightly to visually check for diffusing light.
4. Turn off the visible light source when measurement is completed.

Note:

Loss measurement and event-point detection cannot be performed using the visible light source.

7.2 IP Network Connectivity Check Function

The function to test connectivity with the IP network can be added by attaching the IP test board to the MT9080 Series.

The IP test function includes the connectivity check (PPPoE, DHCP), connection test (Ping, trace route), download throughput measurement, throughput measurement, and counter measurement.

Refer to the MT9080 Series ACCESS Master IP Network Connectivity Check Function Operation Manual for details.

Section 8 Operating Functions Other Than Measurement

This section describes functions other than measurement such as file-related operations.
For the file operation, self test function, and firmware updates of the IP test function, refer to the MT9080 Series ACCESS Master IP Network Connectivity Check Function Operation Manual.

The items displayed in the [ ] in this section indicate panel keys.

8.1 Operating Files

The following shows methods to save and recall files.

8.1.1 Overview

The MT9080 Series enables the following operations for saved files.

(1) Recalling measured result files

(2) Copying files

(3) Deleting files

(4) Saving measured results in a file

The MT9080 Series can operate files for the internal memory and USB memory.
Refer to Section 9.1 “USB Memory” for using a USB memory.

The following three file types are available for recalling or creating files with the MT9080 Series.

- File with extension.sor: Waveform data files in the standard format (*1) or standard V2 format (*2)
- File with extension.dat: Waveform data files in the analysis format used by Anritsu MW9070 or MW9076 (*3)
- File with extension.log: Refer to Section 8.1.6 “Saving file”.

.sor/.dat files may be recalled in the emulation mode according to the saved measurement conditions.

Note that MT9080 Series operations are not assured when recalling .sor files saved by a third-party product.
Refer to Section 8.3 “Emulation Function” for details.

*1: The standard format refers to a format that conforms to GR-196-CORE (Issue 1, Revision 1, December 1997) standards established by Bellcore Inc., the United States.

*2: The standard V2 format is a format that conforms to SR-4731 (Issue 1, February 2000) standards established by Telecordia Technologies Inc., the United States (formerly Bellcore). Although the standard number is different, the standard V2 corresponds to the GR-196-CORE Version 2.

*3: These are files saved with the Anritsu MW9070B Firmware Version V3.0 or later, or an Anritsu MW9076 Series product.
Note that MT9080 Series operations are not assured for files saved with MX3607A/B, MW9070A, or MW9070B with the firmware version earlier than V3.0.

CAUTION ⚠

- **Folders and files cannot be restored to their original state when they are once deleted. Be careful when deleting folders and/or files.**
- **An accessing mark is displayed on the screen when recalling, saving, copying or deleting folders or files. Do not remove the USB memory while accessing it. Or the data in the USB memory or files may be damaged.**
- **Some subfolders or files are not displayed with folders that have more than 1,500 subfolders or files. Be careful not to exceed a total of 1,500 subfolders and/or files.**

8.1.2 Recalling file

Perform any of the following operations to display the Recall screen shown in Fig. 8.1.2-1 below.

- Select a file using the ∧ and ∨ keys on the Top Menu (Fig. 3.2.1-1), then press the Enter key.
- Press the 9 key on the Top Menu.
- Press the File key on the OTDR (Fault Locate) or OTDR (Trace Analysis) screen.

Note that f1 (Execute Recall) is not displayed on the Recall screen when it is opened from the OTDR (Fault Locate) or OTDR (Trace Analysis) comparison screen.

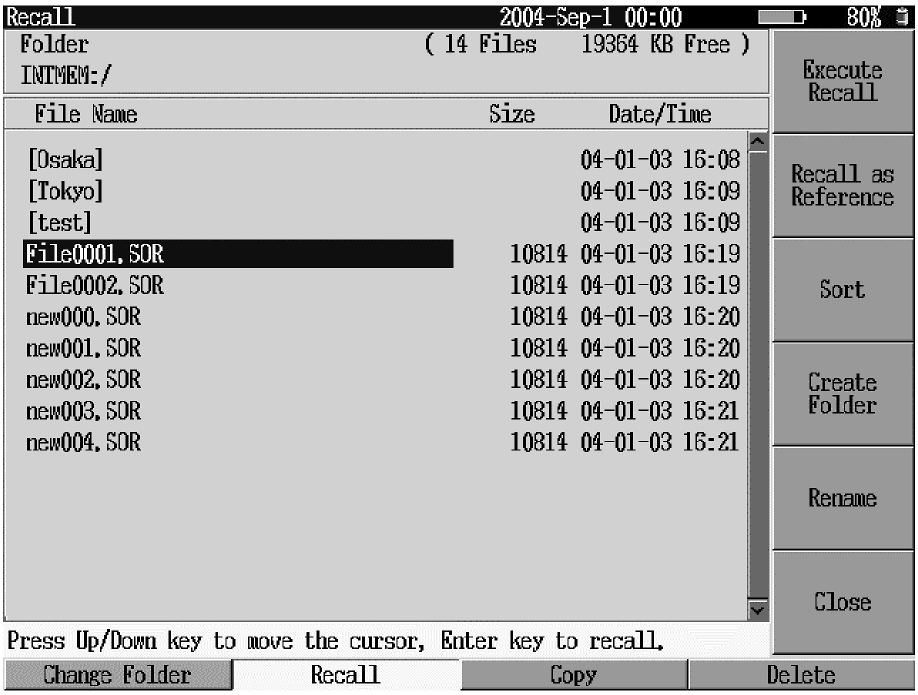


Fig. 8.1.2-1 Recall screen

The files that can be recalled by the MT9080 Series are displayed in this screen.

The cursor for selecting folders and files can be moved by using the ∧ and ∨ keys.

To open the contents of a folder, select the folder and press the Enter key. To return to the upper directory, select [..] and press the Enter key.

The folder is retained until changes are made. When there is no folder recorded while this screen is displayed, an error message will be displayed. Refer to Section 8.1.7 "Error messages" for details.

Folder

For the specified folder, total count of the folders and files, and media free space are displayed.

The following table shows the folder display format according to the media.

Media	Folder displayed
Internal Memory	INTMEM:/...
USB Memory	USB Memory:/...

For example, the Recall screen in Fig. 8.1.2-1 shows that the initial folder (root directory: "/") for the internal memory is selected and the free space is 19,364 KB.

Folder: Similar to a box for saving files. A name should be added to each folder. Folders can be created within a folder, which are called subfolders.

Root directory: A directory that cannot be moved to an upper directory level any more.
For example, the directory "Internal Memory:/" is the root directory for the internal memory, and "USB Memory:/" for the USB memory.

Media: Physical memory media where folders and/or files are saved. Internal memory and USB memory are the media used with the MT9080 Series.

File Name, Size, Date/Time

Folder names (displayed with [ ]), file names, file sizes (Units: byte), updated times & dates are displayed, respectively.

Function Key Details

[f1] (Execute Recall)

Select a file using the [∧] and [∨] keys, and then press [f1] (Execute Recall) or the [Enter] key to recall the selected file. The screen shown in Fig. 8.1.2-2 below is displayed after recalling the file.
The screen actually displayed varies according to the selected file.

Whether the recalled file is displayed depends on the system configuration. Refer to Section 3.5.2 “Display settings” for details.

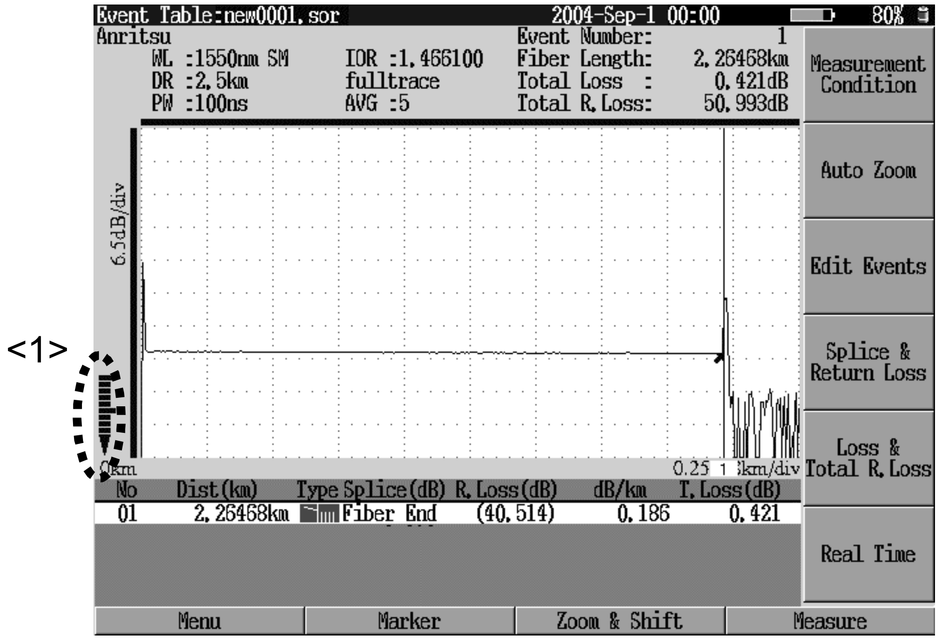


Fig. 8.1.2-2　Screen after recalling a file

When a file is recalled, the measurement conditions are changed to those saved in the file, except for the following conditions:

- Setting values related to Go/No-Go (event pass-fail judgment) described in Sections 4.2.2 “Threshold” and 5.2.2 “Threshold.”
- All setting values described in Sections 4.2.3 “Additional functions” and 5.2.3 “Additional functions.”

The OTDR optical attenuator level indicator displayed in the screen after recall (indicated by <1> in Fig. 8.1.2-2 above) indicates the attenuator level recalled from the file. Note that, however, the attenuation level set by Measurement Condition => Others will not be changed.

If measurement is started or real-time sweep is performed at this time, data will be measured and displayed with the attenuator level set by Measurement Condition => Others.

Note that some files may be recalled in the emulation mode. Refer to Section 8.3 “Emulation Function” for details.

f2 (Recall as Reference)

Select a file using the ∧ and ∨ keys, and then press f2 (Recall as Reference) to recall the selected file as a reference waveform. The screen shown in Fig. 8.1.2-3 below is displayed after recalling the reference waveform.

Note that the recalled file name is not displayed.

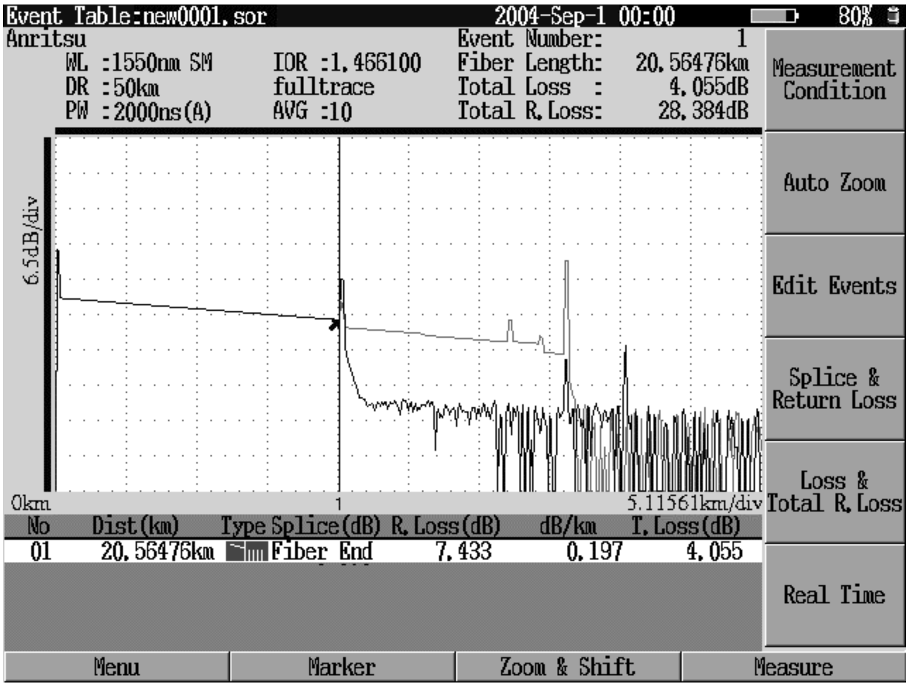


Fig. 8.1.2-3 Screen after recalling a reference waveform

“Clear Reference” is displayed for the f2 key after the reference waveform is recalled.

Only one waveform can be displayed as a reference waveform. When changing the reference waveform, therefore, press f2 (Clear Reference) to delete the current reference waveform and then recall another reference waveform.

Only waveform data is recalled from a file and the measurement conditions will not be changed by this operation.

When recalling a reference waveform, the reference waveform is displayed overwriting the normal measurement waveform, making it easy to find fault points.

Refer to Sections 4.6 “Comparing Waveforms – Waveform Compare Function” and 5.7 “Comparing Waveforms – Waveform Compare Function” for details on the comparison measurement function.

f3 (Sort)

Press f3 (Sort) to display the sort screen shown in Fig. 8.1.2-4 below.

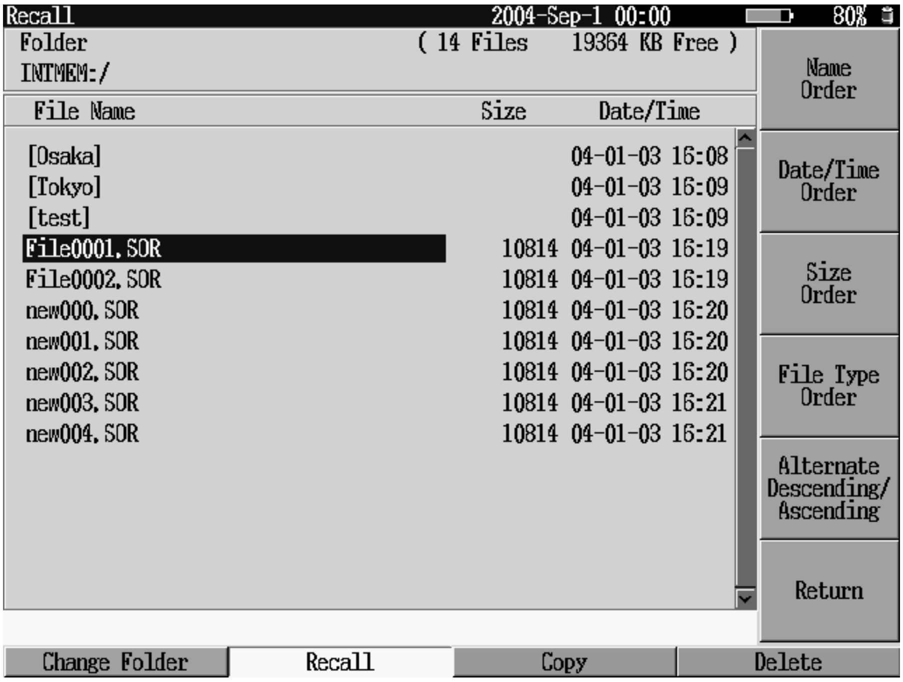


Fig. 8.1.2-4 Sort screen

Press f1 (Name Order) to arrange the display in order of file names.

Press f2 (Date/Time Order) to arrange the display in order of times and dates in which files are updated.

Press f3 (Size Order) to arrange the display in order of file sizes.

Press f4 (File Type Order) to arrange the display in order of extensions.

Press f5 (Alternate Descending/Ascending) to arrange the display by switching between normal order (ascending) and reverse order (descending).

Press f6 (Return) to return the function key to its original status.

f4 (Create Directory)

Press f4 (Create Directory) to create a folder.
The folder name can be input up to 50 characters.
Press the ESC key to cancel folder creation.
Refer to Section 3.2.3 “Character entry procedure” for how to input characters.

f5 (Rename)

Press f5 (Rename) to change folder names and file names.

The folder name and file name can be input up to 50 characters.
A message is displayed when the same folder name or file name already exists, and rename is cancelled. Press any of the MT9080 Series buttons to erase the message.
The following message appears when the same file name already exists.

File exists already.

Note that capital and small characters are not differentiated (non-case sensitive) for alphabetical character input.
Press the ESC key to cancel rename.
Refer to Section 3.2.3 “Character entry procedure” for how to input characters.

f6 (Close)

Press f6 (Close) to close the Recall screen (Fig. 8.1.2-1) and return to the previous screen.

F1 (Change Folder)

Press F1 (Change Folder) to change the folder.
Refer to Section 8.1.3 “Changing folder” for details.

F2 (Recall)

Press F2 (Recall) to recall saved files.
Refer to Section 8.1.2 “Recalling file” for details.

F3 (Copy)

Press F3 (Copy) to copy saved folders or files.
Refer to Section 8.1.4 “Copying file” for details.

F4 (Delete)

Press F4 (Delete) to delete saved folders or files.
Refer to Section 8.1.5 “Deleting file” for details.

8.1.3 Changing folder

Select [F1] (Change Folder) from the Recall screen (Fig. 8.1.2-1) to display the Change Folder screen shown in Fig. 8.1.3-1 below.

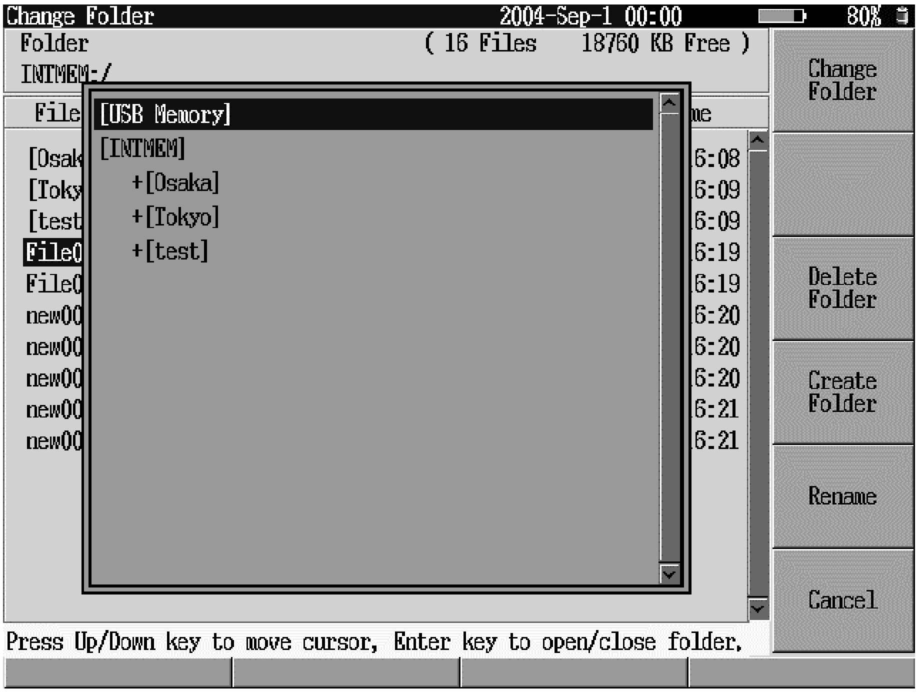


Fig. 8.1.3-1 Change Folder screen

Note that "USB Memory" is not displayed when USB memory is not connected.

The cursor for selecting media and folders can be moved by using the [∧] and [∨] keys.
Press the [Enter] key when there is a "+" mark to the left of the selected folder name to display subfolders. In contrast, the subfolder display will be hidden when there is a "–" mark. The "+" and "–" marks are simply switched when there is no subfolder.

Function Key Details

[f1] (Change Folder)

Press [f1] (Change Folder) to set the selected folder as currently specified folder and display subfolders and files saved within this folder.

[f3] (Delete Directory)

Press [f3] (Delete Directory) to delete the selected folder.
Press [f1] (Yes) to allow deletion, and press [f2] (No) to cancel deletion.

f4 (Create Directory)

Press f4 (Create Directory) to create a folder.
Refer to Section 8.1.2 “Recalling file” for details.

f5 (Rename)

Press f5 (Rename) to change folder names.
Refer to Section 8.1.2 “Recalling file” for details.

f6 (Cancel)

Press f6 (Cancel) to return to the previous screen.

8.1.4 Copying file

Select F3 (Copy) from the Recall screen (Fig. 8.1.2-1) to display the Copy screen shown in Fig. 8.1.4-1 below.

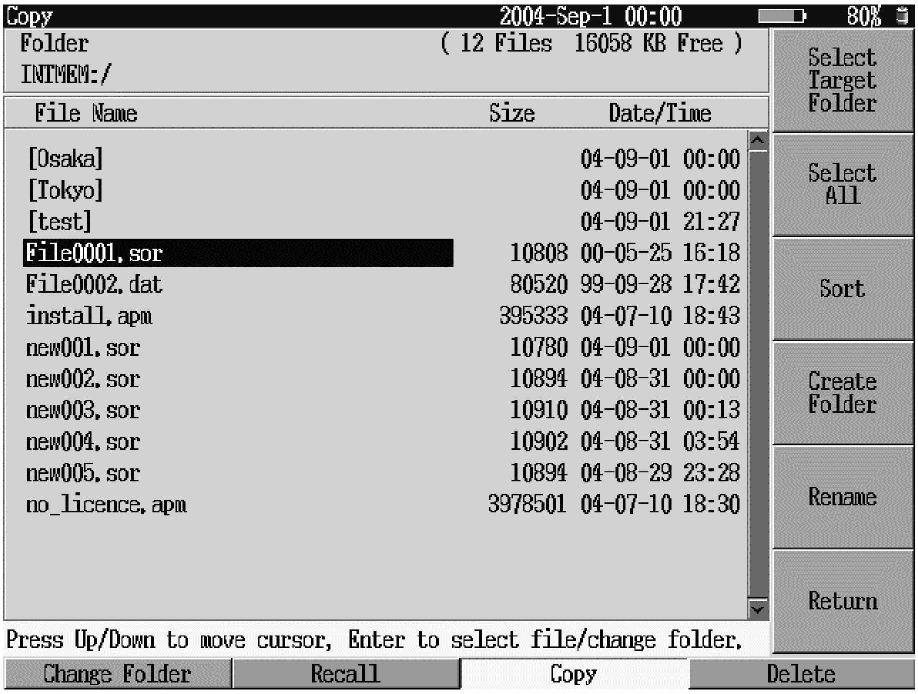


Fig. 8.1.4-1 Copy screen

The cursor for selecting folders and files can be moved by using the ∧ and ∨ keys
When a file is selected and then the Enter key is pressed, a “□” mark is added to the left of the selected file name, indicating that it is selected as a copy source file.
The selected files can be copied when the copy destination is selected in this state. This is useful when copying multiple files at once.

When the copy destination is selected while there are no files with "□" marks to the left of their names, the highlighted files and folders are copied. This is useful when copying files in folder units.

CAUTION ⚠

Be careful of overwriting and copy destination media free space when copying files.

Function Key Details

f1 (Select Target Directory)

Select a file or folder and press f1 (Select Target Directory) to display the Selecting Target Directory screen shown in Fig. 8.1.4-2 below.

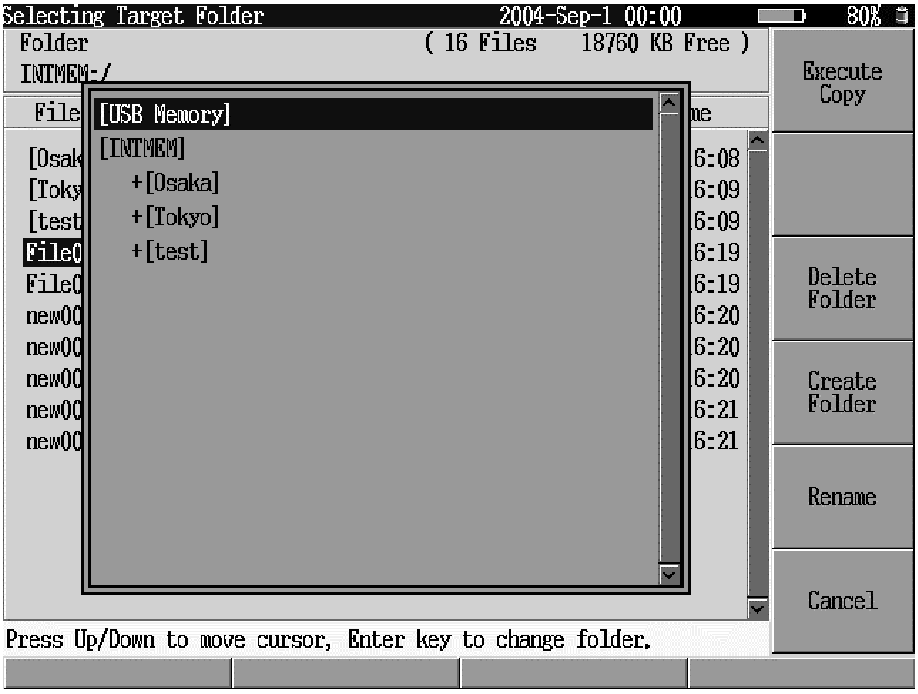


Fig. 8.1.4-2 Selecting Target Directory screen

The cursor for selecting folders can be moved by using the ∧ and ∨ keys.

When f1 (Execute Copy) is pressed, the selected folder is set to the copy destination and copying to the selected folder starts.

A message is displayed when same folder name or file name as the copy destination exists.
The following message appears when the same file name already exists:

File exists already.

Press f3 (All) to allow copying, and press f6 (Cancel) to cancel.

Note that capital and small characters are not differentiated (non-case sensitive) for alphabetical character input.

Press f3 (Delete Folder) to delete the selected folder.
Refer to Section 8.1.3 "Changing folder" for details.

Press f4 (Create Folder) to create a folder.
Refer to Section 8.1.2 "Recalling file" for details.

Press f5 (Rename) to change the folder name.
Refer to Section 8.1.2 "Recalling file" for details.

Press f6 (Cancel) to return to the Copy screen (Fig. 8.1.4-1).

CAUTION ⚠

Some subfolders or files are not copied when copying folders with more than 1,500 subfolders or files. Copy with less than 1,500 total subfolders and/or files when copying in folder units.

f2 (Select All)
Press f2 (Select All) to select all files within the displayed folder. "□" marks will be added to the left of all file names. Indication for the f2 key will be changed to "Deselect All".

f2 (Clear All)
Press f2 (Deselect All) to clear the selected status of all files within the displayed folder. All "□" marks on the left of file names will be erased. Indication for the f2 key will be changed to "Select All".

f3 (Sort)
Press f3 to arrange files for display.
Refer to Section 8.1.2 "Recalling file" for details.

[f4] (Create Folder)

Press [f4] (Create Folder) to create a folder.
Refer to Section 8.1.2 "Recalling file" for details.

[f5] (Rename)

Press [f5] (Rename) to change the folder name or file name.
Refer to Section 8.1.2 "Recalling file" for details.

[f6] (Return)

Press [f6] (Return) to close the Copy screen (Fig. 8.1.4-1) and return to the previous screen.

8.1.5 Deleting file

Select [F4] (Delete) from the Recall screen (Fig. 8.1.2-1) to display the Delete screen shown in Fig. 8.1.5-1 below.

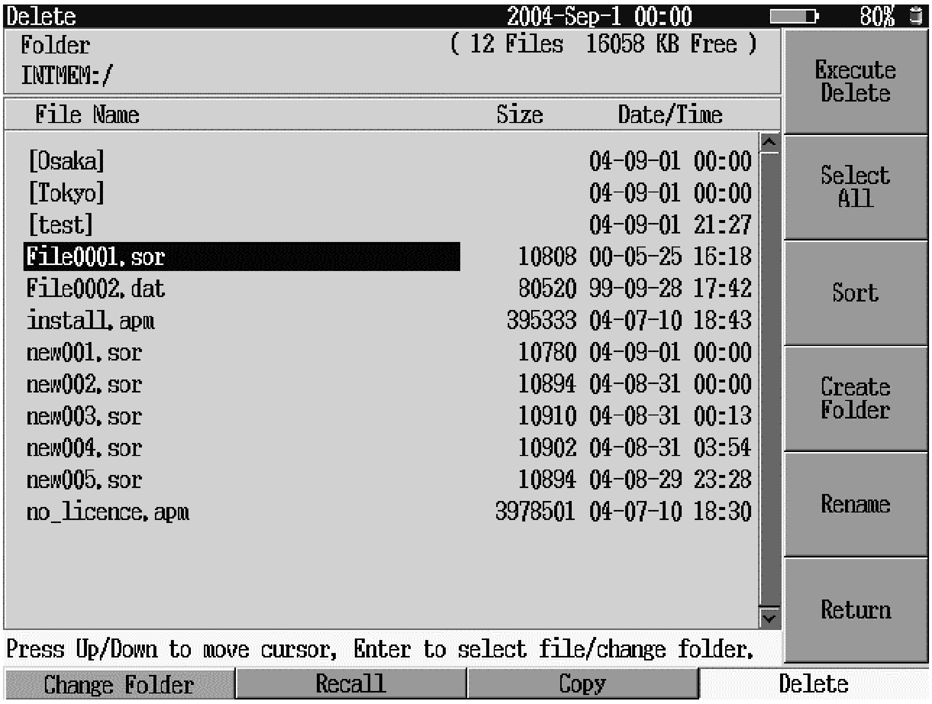


Fig. 8.1.5-1 Delete Screen

The cursor for selecting folders can be moved by using the [∧] and [∨] keys.

When a file is selected and then the [Enter] key is pressed, a "□" mark is added to the left of the selected file name, indicating that it is selected as a file to be deleted.
The selected files can be deleted when deletion is executed in this state.
This is useful when deleting multiple files at once.

When deletion is executed while there are no files with "□" marks to the left of their names, the highlighted files and folders are deleted. This is useful when deleting files in folder units.

Function Key Details

[f1] (Execute Delete)

When a file or folder is selected and [f1] (Execute Delete) is pressed, a confirmation message will be displayed.

Press [f1] (Yes) to allow deletion, and press [f2] (No) to cancel.

[f2] (Select All)

Press [f2] (Select All) to select all files within the displayed folder.
Refer to Section 8.1.4 "Copying file" for details.

[f2] (Deselect All)

Press [f2] (Deselect All) to clear the selected status of all files within the displayed folder.
Refer to Section 8.1.4 "Copying file" for details.

[f3] (Sort)

Press [f3] (Sort) to arrange files for display.
Refer to Section 8.1.2 "Recalling file" for details.

[f4] (Create Folder)

Press [f4] (Create Directory) to create a folder
Refer to Section 8.1.2 "Recalling file" for details.

[f5] (Rename)

Press [f5] (Rename) to change the folder name or file name.
Refer to Section 8.1.2 "Recalling file" for details.

[f6] (Return)

Press [f6] (Return) to close the Delete screen (Fig. 8.1.5-1) and return to the previous screen.

8.1.6 Saving file

This section describes settings and header information for saving measured results to files.

(1) Save settings

Press the [Save] key from the OTDR (Fault Locate) or OTDR (Trace Analysis) measurement screen to display the Save screen shown in Fig. 8.1.6-1 below.

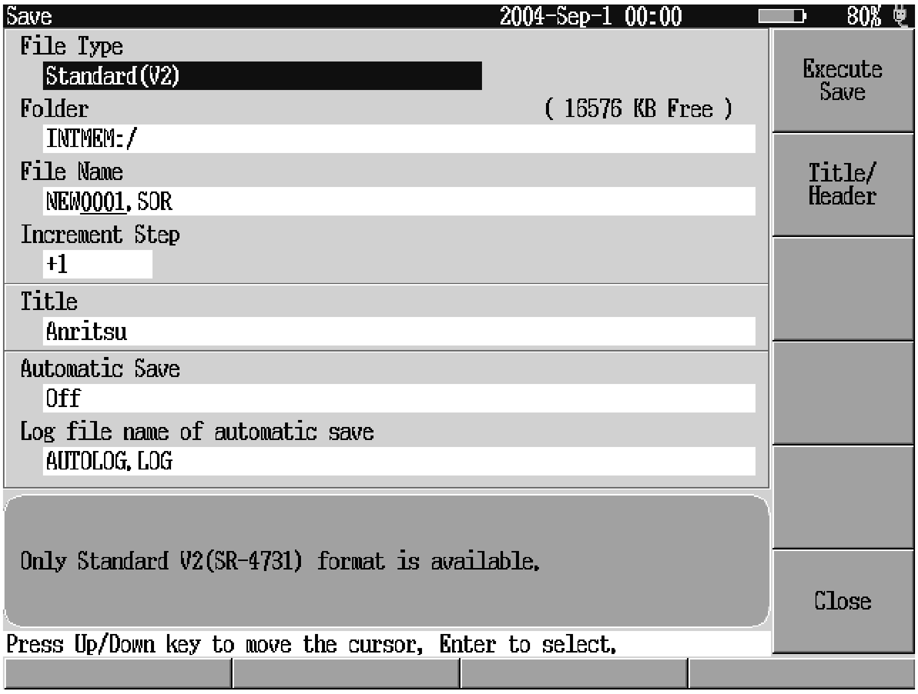


Fig. 8.1.6-1 Save screen

The setting for saving measured results to a file can be executed from this file.

The values set in this screen are used commonly for the OTDR (Fault Locate) and OTDR (Trace Analysis) measurement screen.

The cursor for selecting items can be moved by using the [∧] and [∨] keys.

Select the set item then press the [Enter] key to select the set values or input characters.

Press the [ESC] key to cancel the set item selection.

Refer to Section 3.2.3 “Character entry procedure” for how to input characters.

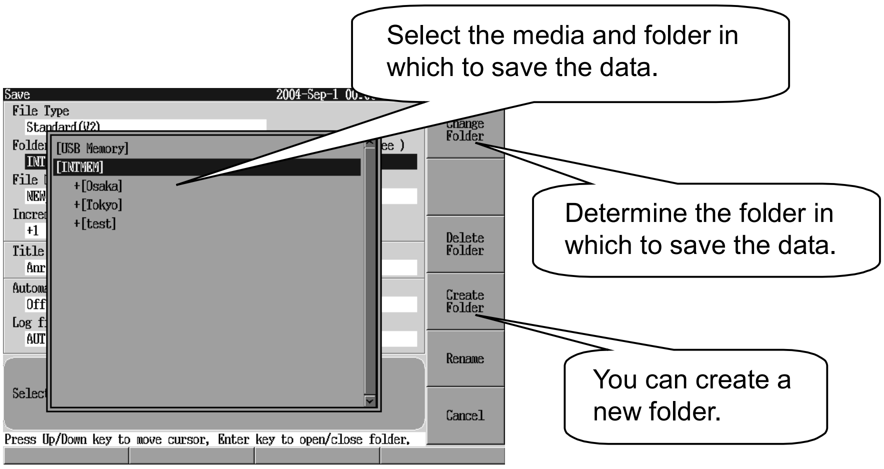
File Type

The type of the file where waveform data and measured results are saved is displayed.

The MT9080 Series can save a file only in a standard V2 format (conforming to SR-4731). The file type cannot be changed.

Folder

Set the folder in which the created file is to be saved. The following dialog box is displayed by pressing Enter key when the cursor is in the entry area for Folder. Select the destination folder by pressing ∧ or ∨ key and then press f1 (Change Folder). Refer to Section 8.1.3 "Changing folder" for details.



The following table shows the folder display format according to the media.

Media	Folder displayed
Internal Memory	INTMEM:/...
USB Memory	USB Memory:/...

For example, the Save screen in Fig. 8.1.6-1 shows that the root directory for the internal memory is selected and the free space is 16,576 KB.

File Name

Set the name of the file to be saved.
The file name can be input up to 50 characters (excluding the extension).
The automatic increment function is enabled when an underline is displayed for the file name numerical part. The value set at increment step is calculated for each save completed, and the next file name is updated.
Refer to Section 8.2 “Automatic Increment Function” for details of the automatic increment function.

Capital and small characters are not differentiated for file name alphabets (non-case sensitive). Be careful of file overwriting.

Increment Step

Set an additional value for the automatic increment function within the following setting range:

Increment Step: –10 to +10

The numerical keys, [f1] (switching +/–), and the [∧] and [∨] keys can be used for setting Increment Step.
Refer to Section 3.2.2 “Setting procedure” for how to set.

When the measured results are saved to a file, the Increment Step value set here is added to the setting items subject to the automatic increment function and the set values at the next save are updated.
Refer to Section 8.2 “Automatic Increment Function” for details of the automatic increment function.

Title

Set a title for the file.
When a numerical value for the automatic increment function is set to a part of the title, that part is underlined. This underlined number is incremented for each measurement by the value set by Increment Step, and the next title name is updated.
Refer to Section 8.2 “Automatic Increment Function” for details of the automatic increment function.

Automatic Save

Set enable/disable the automatic save.
The following settings can be selected using the [∧] and [∨] keys:

Off: The automatic save function is disabled. Press [f1] (Execute Save) to save the file.

On: The file is saved automatically for each measurement completed. Note that the file is not saved automatically after real-time measurement or when measurement is cancelled.

Efficiency will be degraded when saving measured results for each fiber core when measuring a multi-core optical fiber. Measurement time can be shortened by combining the automatic increment function with the automatic save function in this instance.

CAUTION ⚠

Be careful of the media free space when using the automatic save function.

Log file name of automatic save

Set the name of the log file created when the measured results are automatically saved.

The file name and the measured results (maximum values of splice loss/return loss/transmission loss, and wavelength) are recorded to this log file and saved in the location set by Folder.

When there already exists a log file with the same name in the save destination, it is overwritten.
Logs cannot be checked with the MT9080 Series. Check logs with the PC.

Function Key Details

[f1] (Execute Save)

Press [f1] (Execute Save) to save measured results to a file.
Save measured results with this key when Automatic Save is set to "Off". When a file with the same name already exists in the save destination, the following message is displayed:

File exists already.

Press [f1] (Yes) to allow saving, and press [f6] (No) to cancel.

[f2] (Title/Header)

Press [f2] (Title/Header) to display the Title screen (title/header input screen) shown in Fig. 8.1.6-2 below for setting title and header information. See the following description.

(2) Title/header

Select [f2] (Title/Header) from the Save screen (Fig. 8.1.6-1) to display the Title screen (title/header input screen) shown in Fig. 8.1.6-2 below.

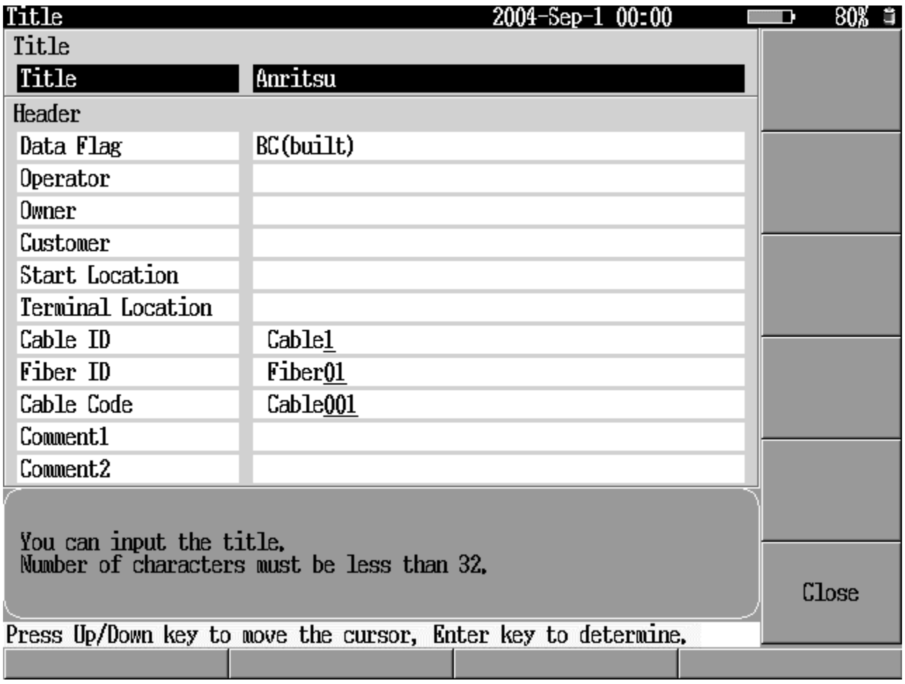


Fig. 8.1.6-2 Title screen for inputting title/header information

The title and header information when saving measured results to a file can be set in this screen.
The values set in this screen are used commonly for the OTDR (Fault Locate) and OTDR (Trace Analysis) measurement screen.

The cursor for selecting items can be moved by using the [∧] and [∨] keys.
Select the set item then press the [Enter] key to select set values or input characters.
Press the [ESC] key to cancel the set item selection.
Refer to Section 3.2.3 “Character entry procedure” for how to input characters.

Title
Set the title.
When a numerical value for the automatic increment function is set to a part of the title, that part is underlined. This underlined number is incremented for each measurement by the value set by Increment Step, and the next title name is updated.
Refer to Section 8.2 “Automatic Increment Function” for details of the automatic increment function.

Data Flag
Set the state of the optical fiber to be measured.
The following settings can be selected for Data Flag using the [∧] and [∨] keys.

BC (built):	A state where the measured optical fiber is being built.
RC (recover):	A state where the measured optical fiber is being recovered.
OT (others):	Others

Operator
Enter the operator name, operator department name, operator team name, and other information related to the operator.

Owner
Enter the owner name, management department name, company name, and other information related to the owner.

Customer
Enter the customer name and other information related to the customer.

Start Location

Enter the measurement start location name and other information related to the measurement start location.

Terminal Location

Enter the measurement terminal location name and other information related to the measurement terminal location.

Cable ID

Set the cable ID.
When a numerical value for the automatic increment function is set to a part of the cable ID, that part is underlined. This underlined number is incremented for each measurement by the value set by Increment Step, and the next cable ID is updated.
Refer to Section 8.2 "Automatic Increment Function" for details of the automatic increment function.

Fiber ID

Set the fiber ID.
When a numerical value for the automatic increment function is set to a part of the fiber ID, that part is underlined. This underlined number is incremented for each measurement by the value set by Increment Step, and the next fiber ID is updated.
Refer to Section 8.2 "Automatic Increment Function" for details of the automatic increment function.

Cable Code

Set the cable code.
When a numerical value for the automatic increment function is set to a part of the cable code, that part is underlined. This underlined number is incremented for each measurement by the value set by Increment Step, and the next cable code is updated.
Refer to Section 8.2 "Automatic Increment Function" for details of the automatic increment function.

Comment1/Comment2

Enter the comment (memo, general notes, etc.).

8.1.7 Error messages

An error message is displayed when a mistaken operation is performed or when a failure occurs in the MT9080 Series operations.

Error messages, potential causes, and response methods are shown in Table 8.1.7-1 below.

Table 8.1.7-1 Error messages and their causes, response methods

No.	Error message : Potential causes → Response method
1	The folder does not exist. / No file exists. : Folder and file not existing were accessed. → Select an existing folder or file again.
2	Invalid file. : Attempted to recall a file that does not conform to SR-4731 or GR-196, a file not in the MW9070/MW9076 analysis format, or a file that cannot be handled by the MT9080 Series. → Select a file that conforms to SR-4731 or GR-196, or a file in the MW9070/MW9076 analysis format.
3	Invalid file format. : Attempted to directly edit measured results with PC, etc. and re-call with the MT9080 Series. → Select a file that conforms to SR-4731 or GR-196, or a file in the MW9070/MW9076 analysis format.
4	File name is too long. / Folder name is too long. : File name exceeds 54 characters. Or, Folder name exceeds 244 characters. Or, Amount of folder and file name from '/' as a root directory exceeds 255 characters. → Change the file name to less than 54 characters. → Change the folder name to less than 244 characters. → Change the folder or file name to less than 255 characters.
5	The folder does not exist. : The selected folder does not exist due to folder name has been changed by a device other than the MT9080 Series. → The folder is set as the initial folder (root directory: "/"). Set the target folder again.
6	USB memory does not exist. : Accessed USB memory when USB memory was not connected. → Check that the USB memory is connected correctly. → Check the folder for saving.

Table 8.1.7-1 Error messages and their causes, response methods (Cont'd)

No.	Error message : Potential causes → Response method
7	The internal Memory is now used. Please disconnect the USB cable. : Attempted to access the internal memory when the MT9080 Series is connected to the PC, etc., via USB connection. → Disconnect the connection with the PC or other devices and remove the USB cable. (Refer to Section 9.2 "USB Storage" for how to remove the USB cable.)
8	The internal Memory may be broken. Please recover it by "INTMEM Recovery" in SelfTest. : Internal memory may be corrupted. → Recover the internal memory using the self test function. (Refer to Section 8.4 "Self Test Function" for how to recover the internal memory.)
9	Same folder. Cannot copy. : Attempted to copy within the same folder. → Change the copy destination folder.
10	Too many files exist in this folder. : The total number of subfolders and files in the initial folder (root directory: "/") has exceeded the permissible number. Up to 512 files can be saved in the internal memory when each file name is within 8 characters (excluding the extension). However, the number of folders and files that can be saved will be reduced when a long file name is used. This restriction is applied to the root directory only. → Backup folders and files located in the root directory then delete the files, etc. → Save files in subfolders. → More files can be saved in the root directory by shortening the file name within 8 characters.
11	Too many files in a folder. : The total number of subfolders and files in the folder has exceeded the maximum number of 1,500. → Backup subfolders and files located in the folder then delete the file, etc.
12	Media is full. : Free space required for copying and saving is insufficient. → Backup folders and files then delete files, etc.
13	Media is write-protected. : The USB memory is write-protected. → Remove the USB memory from the MT9080 Series, and switch the lock switch to release write-protection.

Table 8.1.7-1 Error messages and their causes, response methods (Cont'd)

No.	Error message : Potential causes → Response method
14	The USB memory was not recognized normally. Insert the USB memory again. : The USB memory is not recognized correctly. → Remove the USB memory from the PC and then insert it again.
15	The folder does not exist. : No copy destination folder exists. → Check the copy destination folder, and set it again.
16	Invalid name. : Unusable characters contained in the folder/file name. → Check the folder/file names.
17	File exists already. : Same folder or file name already exists when copying, saving or renaming the file. → Change the name of the copy destination folder/file. → Change the file name to be saved or change the copy destination file name. → Change the name to be changed or change the folder or file name already existing.
18	No waveform. : Saved even though measurement is incomplete at measurement cancel, etc. → Complete measurements before saving.
19	Operation is aborted. : A folder that contains more than 1,500 subfolders and files was deleted. : An unexpected error occurred. → There are subfolders or files that have not been deleted. Delete the folder again. → Contact Anritsu or our sales dealer if abnormal end continues.
20	Auto-saving failed. : Displayed along with another error message, indicating that an error occurred during automatic saving. → Refer to the corresponding Response Method described above.
21	The reference waveform cannot be recalled because no waveform data is saved in the file. : Attempted to recall the file in which no waveform is saved. → Recall the reference waveform from another file that contains waveform data.

8.2 Automatic Increment Function

When the automatic increment function is used, file names, titles, etc. do not have to be set again for each time saving the measured results. Measurement can be performed efficiently when repeating measurement several times.

8.2.1 Overview

The automatic increment function is a function for updating a number of item set values for each time saving the measured results.
The file names, titles, etc. do not have to be input each time when repeating measurement while saving measured results to a file.

The automatic increment function is available for the following item. All or a part of them are incremented.

(1) File Name
(2) Title
(3) Cable ID
(4) Fiber ID
(5) Cable Code

8.2.2 Saving using automatic increment function

Press the Save key from the OTDR (Fault Locate) or OTDR (Trace Analysis) measurement screen to display the Save screen shown in Fig. 8.2.2-1 below.

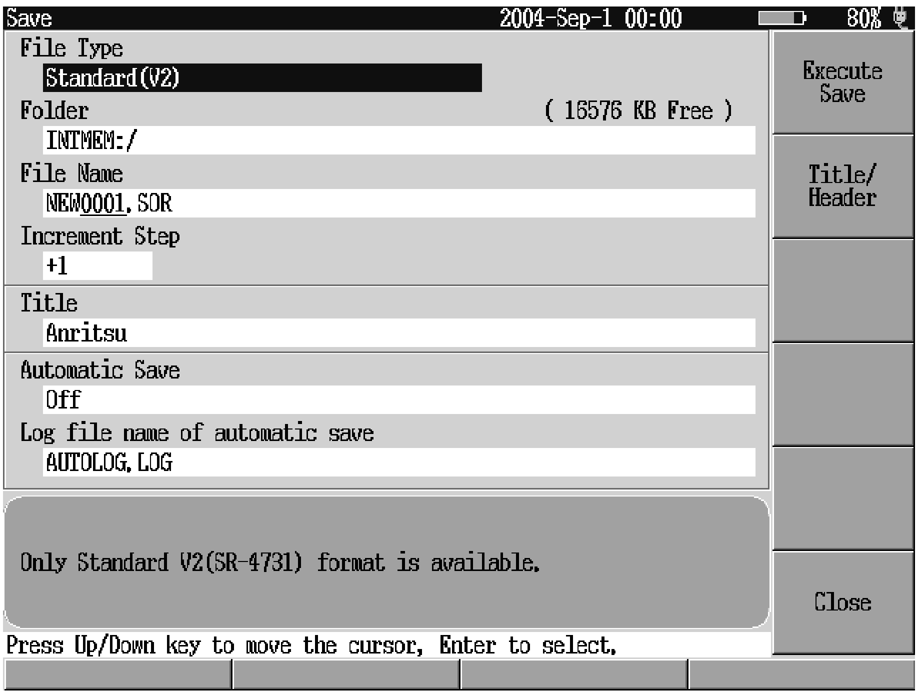


Fig. 8.2.2-1 Save screen

When [f2] (Title/Header) on the Save screen (Fig. 8.2.2-1) is pressed, the Title screen (title/header input screen) shown in Fig. 8.2.2-2 below is displayed.

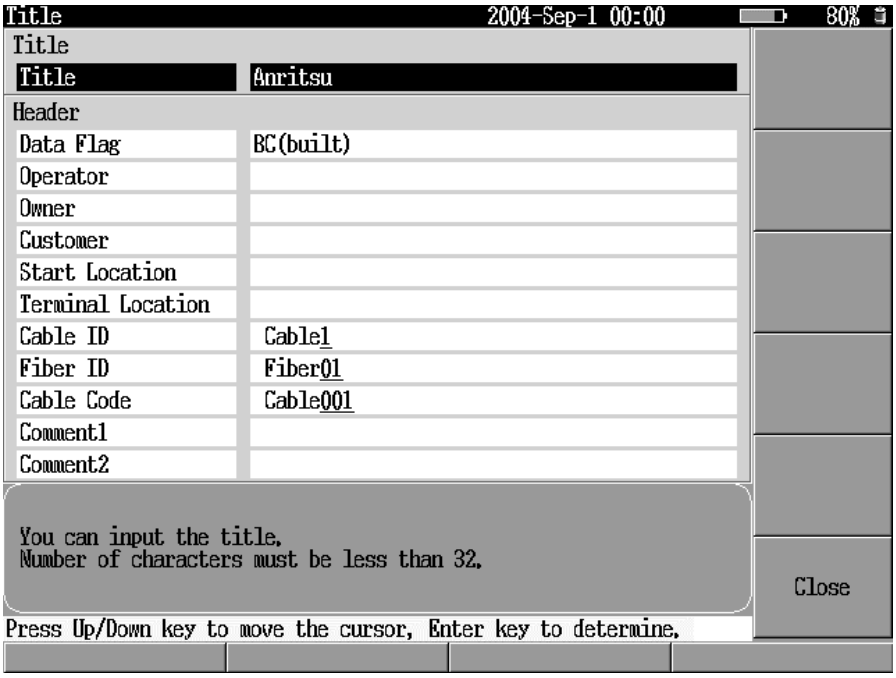


Fig. 8.2.2-2 Title screen for inputting title/header information

The automatic increment function updates the next set values when the measured results are saved. Set values are updated regardless of whether the automatic saving function is enabled or disabled.

The following are the items to be updated automatically. All or a part of them are incremented.

(1) File Name
(2) Title
(3) Cable ID
(4) Fiber ID
(5) Cable Code

For example, in the Save screen shown in Fig. 8.2.2-1, the underlined part “0001” of the set file name “NEW0001.SOR” is subject to the increment setting. When the measured results are saved in this event, the file name is updated (incremented) to “NEW0002.SOR” since Increment Step is set to “+1”. If there are other items for which the automatic increment function is set, these items are also updated simultaneously.

The following shows the procedure for increment setting:

<Increment setting procedure>

1. Select an item for which the automatic increment function is set by using the ∧ and ∨ keys.
2. Press the Enter key to enable character entry.
   Refer to Section 3.2.3 “Character entry procedure” for how to input characters.
3. Press the F1 and F2 keys several times at the location for incremental setting to set the character type to number (numeric), then press f6 (Increment). (f6 (Increment) is recessed.)
4. Press the number keys to input the value for the increment setting.
5. Press f6 (Increment) again when inputting characters continuously. (f6 (Increment) is raised.)
6. Press the Enter key to set the input contents.
7. Set the Increment Step.
   Refer to Section 8.1.6 “Saving file” for how to set increment steps.

The following show general notes on increment settings.

(1) Press f6 (Increment) before inputting numerical values.
Increment will not be set when numerical values are input while f6 (Increment) is raised (even if the numerical values are input to the place where the increment part is deleted using the Back Space key).

(2) Maximum 4 digits for numerical values
Numerical values of up to 4 digits can be set for the increment setting part. No more characters can be input than 4 digits. Delete one character or more to change the numerical value then input.

(3) Digits in the increment setting part are fixed.
The numerical values on the right end are extruded when normal numerical values are input in the middle of the increment setting part.
For example, inputting the normal numerical value “4” between “2” and “3” of “123” results in “1243” (“3” is extruded).

(4) One increment setting part for each item
If another increment setting part is input to a set value that already has one increment setting part, the one previously set will be cancelled.
For example, inputting “4” between “d” and “e” of “ab123cde” results in “ab123cd4e” (“123” is cancelled).

(5) The digits are fixed even when the digits are carried over or cancelled.
The following table shows an example of updating when carrying over or canceling digits at incrementing.

Increment part	**Increment step**	**Updated value**
9	+1	0
9	+2	1
1	–1	0
1	–2	9
9999	+1	0000
9999	+2	0001
0001	–1	0000
0001	–2	9999

8.3 Emulation Function

Even if a waveform data file saved with the MT9080 Series or MW9076 contains the measurement conditions that cannot be set with the MT9080 Series, it can be recalled in the emulation mode.
In addition, a file that is saved with the MW9070 can also be recalled in the emulation mode.

8.3.1 Overview

The file formats that can be recalled with the MT9080 Series are .sor (standard format, standard V2 format) and .dat (Anritsu analysis format). The following files among these are recalled in the emulation mode.

(1) Files that are saved by the MT9080 Series or MW9076 Series and contain the measurement conditions that cannot be set by the MT9080 Series.

(2) Files saved by the MW9070 Series.

The recalled waveform data and measured results can be displayed in the emulation mode.

Recalling the reference waveform in the emulation mode is performed in the same manner when handling files saved by the MT9080 Series. Refer to Section 8.1.2 “Recalling file” for how to recall a reference waveform.

Refer to Sections 4.6 “Comparing Waveforms – Waveform Compare Function” and 5.7 “Comparing Waveforms – Waveform Compare Function” for details on the comparison measurement function.

Note that the emulation mode has restriction in functions and operations. Refer to Section 8.3.3 “Restrictions” for details.
In addition, although all functions and operations are available when the emulation mode is released, some measurement conditions are changed to values settable by the MT9080 Series.

8.3.2 Displaying waveform and measured results

When a file is recalled in the emulation mode, the recalled file name is displayed on the title bar following “Emulation:” regardless of the system configuration.

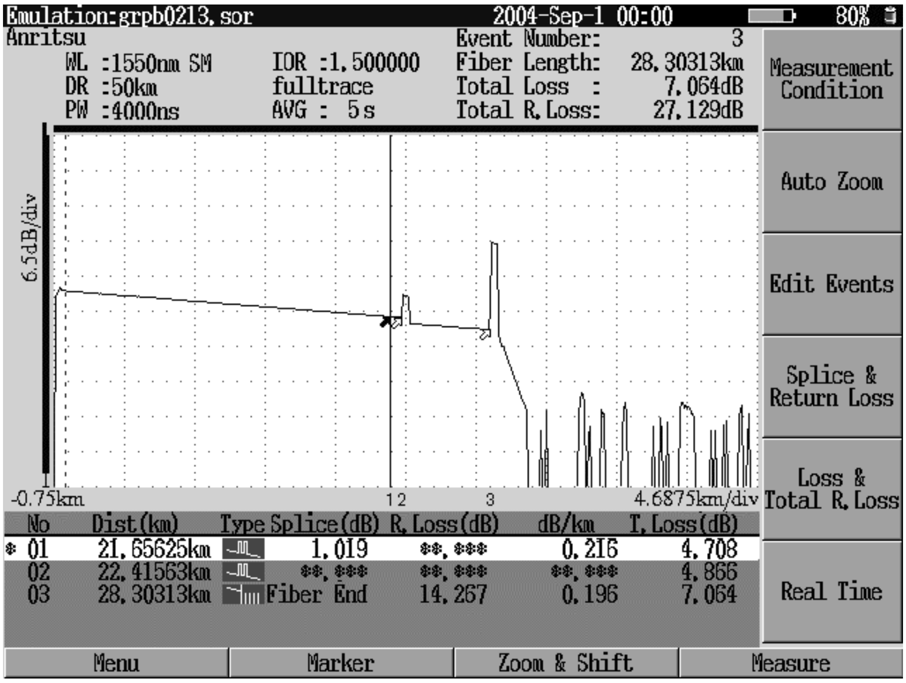


Fig. 8.3.2-1 Example of emulation mode screen

Press f5 (Release Emulation) on the measurement condition setting screen to release the emulation mode.

When attempting to start measurement or real-time sweep in the emulation mode, the message “Release emulation mode?” is displayed. Select f1 (Yes) when it is OK to release, and select f2 (No) to cancel release.

When the emulation mode is released, the waveform and measured results are deleted and the restrictions described in Section 8.3.3 “Restrictions” are removed.
Note that some measurement conditions are changed to values selectable by the MT9080 Series at this time.

A reference waveform can be recalled from a file that should be recalled in the emulation mode. Refer to Section 8.1.2 “Recalling file” for how to recall a reference waveform.

8.3.3 Restrictions

Some functions and operations of the MT9080 Series are restricted until the emulation mode is released. The restriction details vary according to the recalled file.

The following table shows the relationship between the file type and restricted functions/operations.

Table 8.3.3-1 Functions and operations restricted for files

Function		Files saved by the MT9080 Series* or MW9076 Series and contains unsettable measurement conditions	MW9070 Series* file
Measurement Conditions			
	Change of measurement conditions	– (*1, *2)	– (*1, *2)
	Change of threshold value	✓ (*1, *3)	– (*1, *2)
	Change of additional functions	– (*1, *2)	– (*1, *2)
	Change of title	✓ (*1)	– (*1, *2)
	Recall of reference waveform	✓	✓
	Recall of measurement conditions	✓ (*4)	✓ (*4)
	Save of measurement conditions	–	–
Change of wavelength		–	–
Start of measurement		✓ (*5)	✓ (*5)
Real-time sweep		✓ (*5)	✓ (*5)
Set of relative distance		✓	–
Marker		✓	✓
Zoom, shift		✓	✓
Event edition		✓	–
Automatic event detection		✓	–
Auto zoom		✓	–
Splice loss and return loss measurement		✓	✓
Loss and all return loss measurement		✓	✓
Fault location		✓	✓ (*6)
Save of files		✓	– (*7)

✓: No Restrictions, –: Function disabled/No operation available

*1: f5 (Release Emulation) is displayed.

*2: Although the set value can be viewed on the screen, the cursor is not displayed and the set values cannot be changed.

*3: The set values related to Go/No-Go (event pass/fail judgment) are the values exclusively used for the emulation mode.

*4: The emulation mode is released automatically.

*5: The message "Release emulation mode?" is displayed. Press f1 (Yes) when it is OK to release, and press f2 (No) to cancel the release.

*6: The automatic event detection function is disabled.

*7: The message "Files with a format that cannot be saved are recalled with the MT9080 Series" is displayed, and the Save screen is not displayed.

The waveform and measured results are deleted when the emulation mode is released.
Note that some measurement conditions are changed to values settable by the MT9080 Series at this time.

8.4 Self Test Function

The MT9080 Series comes with a self test function that checks the firmware version and other system information and displays the results of testing the MT9080 Series status.
In addition, internal memory can be recovered and formatted by using this function.

8.4.1 Overview

The self test function includes the following:

(1) Displaying system information
(2) Executing a self test and displaying test results
(3) Restoring internal memory
(4) Formatting internal memory
(5) Updating MT9080 Series firmware

It is recommended to execute a self test periodically.

8.4.2 Performing self test

Press [f1] (SelfTest) on the Top Menu (Fig. 3.2.1-1) to display the Selftest screen shown in Fig. 8.4.2-1 below.

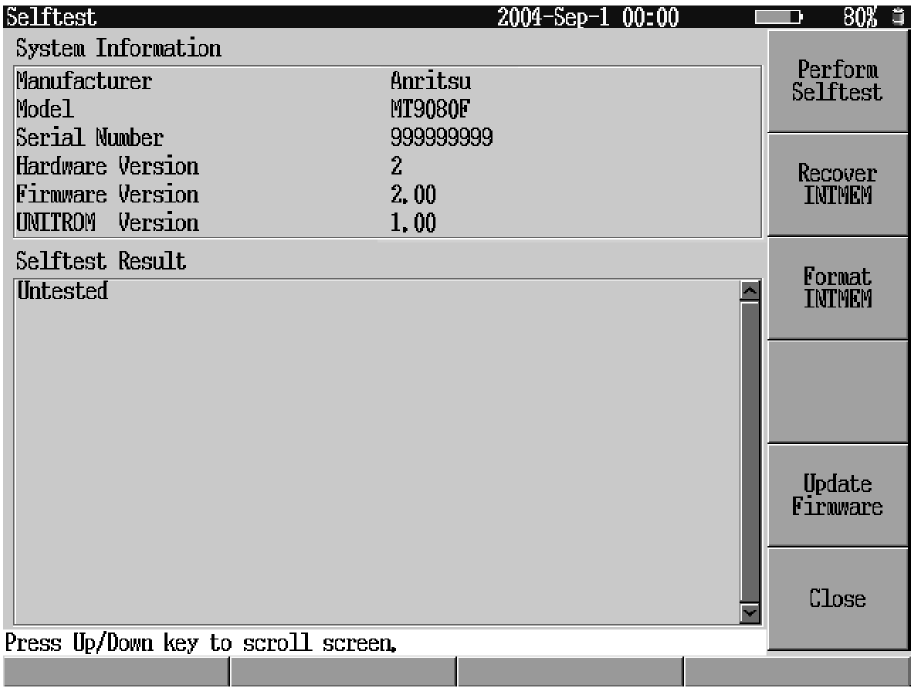


Fig. 8.4.2-1 Selftest screen

System information is displayed in the upper part of the screen.

Function Key Details

[f1] (Perform Selftest)

Press [f1] (Perform Selftest) to start a self test.

The test results are displayed in order from the completed items during the self test. The Selftest Result screen shown in Fig. 8.4.2-2 below is displayed when the self test is complete.

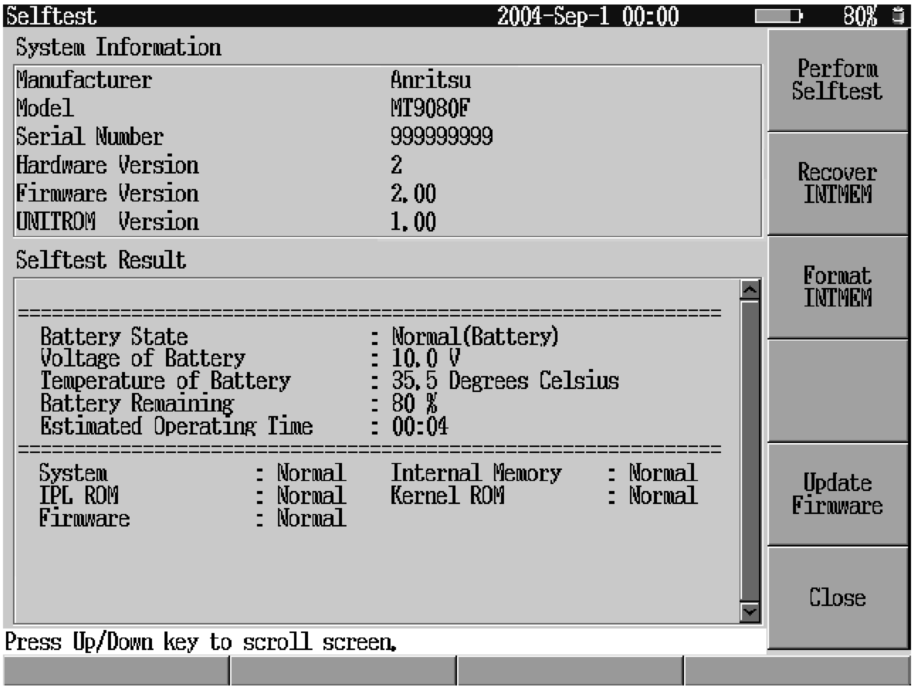


Fig. 8.4.2-2 Selftest Result screen

When AC adapter is used, the estimated usable time is displayed as "--;--".

The following table shows the response method when abnormalities occur in the test items.

Table 8.4.2-1 Abnormal item and response method

Test item	Response method
Battery State	Temperature abnormality may exist. Turn the power to the MT9080 Series Off to remove the battery pack, and lower the battery pack temperature.
System/ IPL ROM	The system may be damaged. Request repairs from Anritsu or our sales dealer.
Internal Memory	The file system may be corrupted. Restore the internal memory, and format it if the abnormality continues to exist. It may be damaged when the abnormality continues to exist even after formatting the internal memory. Request repairs from Anritsu or our sales dealer.
Kernel ROM/ Firmware	The internal program may be corrupted. Update the firmware. It may be damage when the abnormality continues even after updating the firmware. Request repairs from Anritsu or our sales dealer. Refer to Section 8.5 “Updating Firmware” for firmware update.

f2 (Recover INTMEM)

When f2 (Recover INTMEM) is pressed, the following message is displayed for confirmation, asking whether to restore the internal memory.

> It will take a few seconds.
> Are you sure you perform INTMEM Recovery?

Press f1 (Yes) to allow recovery, and press f2 (No) to cancel.

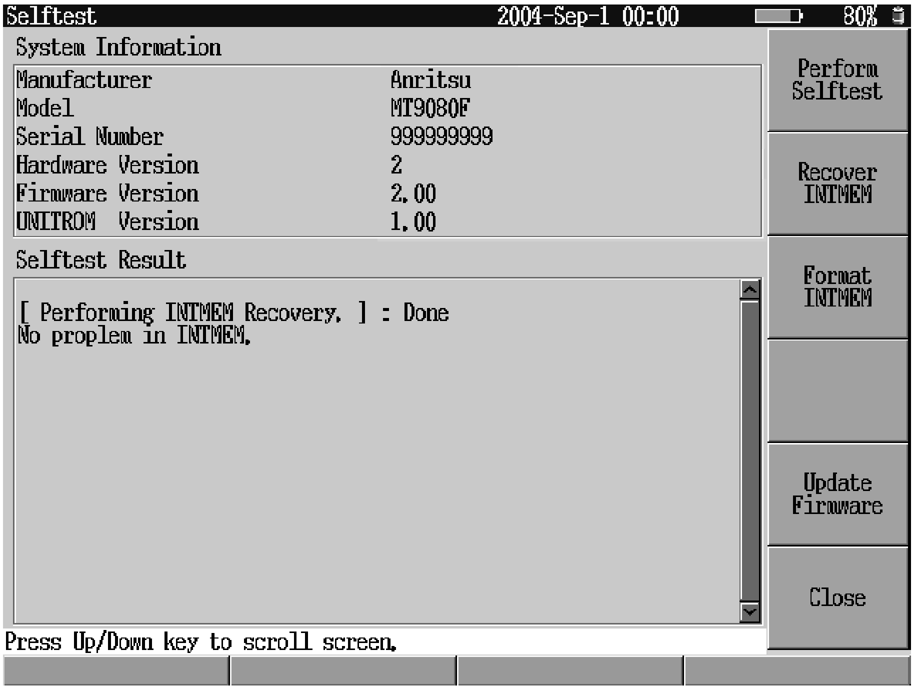


Fig. 8.4.2-3 Internal memory recovery screen

When internal memory recovery is completed, “Done” is displayed on the top line followed by the recovery process message.

Note that internal memory may not be recovered when the remaining battery power is less than 10% in order to prevent the remaining battery power from running out during recovery.

f3 (Format INTMEM)

When f3 (Format INTMEM) is pressed, the following message is displayed for confirmation, asking whether to format the internal memory.

All data in INTMEM will be deleted.
Are you sure you perform it?

Press f1 (Yes) to allow formatting, and press f2 (No) to cancel.

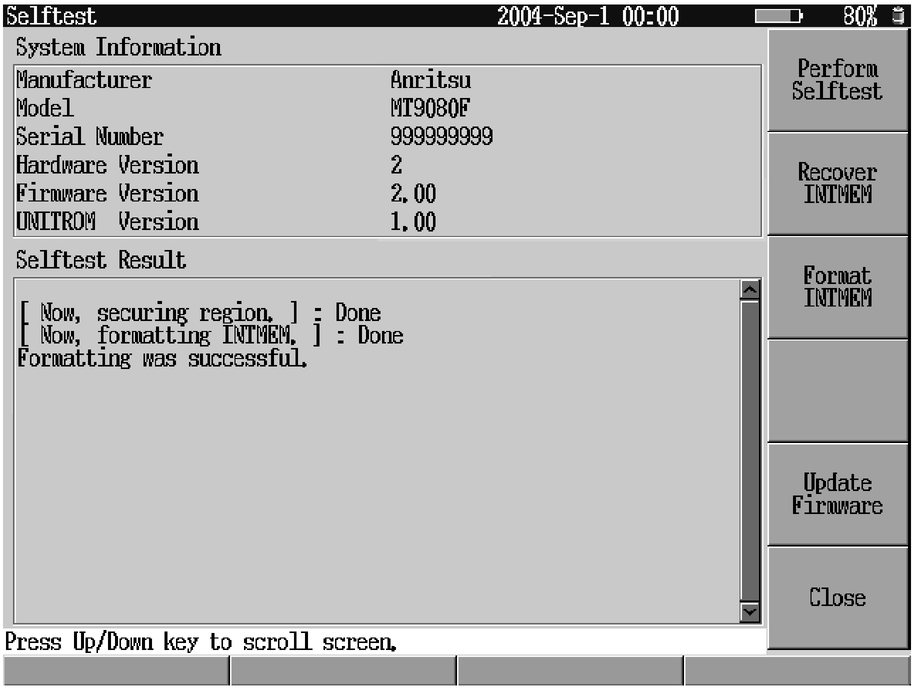


Fig. 8.4.2-4 Internal memory format screen

The process sequence and their results are displayed in order during formatting the internal memory. A completion message is displayed at the end when the internal memory format is completed.
Note that internal memory may not be formatted when the remaining battery power is less than 10% in order to prevent the remaining battery power from running out during formatting.

CAUTION ⚠

All folders and files saved in the internal memory will be erased when it is formatted.
Folders or files cannot be restored once deleted. Be careful when formatting the internal memory.

[f5] (Update Firmware)

Press [f5] (Update Firmware) to update the firmware for the MT9080 Series.

Refer to Section 8.5 “Updating Firmware” for details.

8.5 Updating Firmware

The firmware for the MT9080 Series can be updated by recalling the update installation files released by Anritsu.

8.5.1 Overview

The MT9080 Series comes with a firmware update function to add new functions and resolve malfunctions.
The latest firmware can be obtained from the download site at our website: https://www1.anritsu.co.jp/Download/Mservice/Login.asp.
Refer to the supplied manual "MT9080 Series ACCESS Master Download Manual" for details on the downloaded files and the firmware updating methods using the firmware update file that is copied to a USB memory.

The file to update the firmware for the MT9080 Series is as follows:

- .apm (extension) file: Update installation file

Contact the Anritsu or our sales dealer for details on the update installation file.

8.5.2 Recalling installation file

Press f5 (Update Firmware) on the Selftest screen (Fig. 8.4.2-1) to display the Update Firmware screen shown in Fig. 8.5.2-1 below.

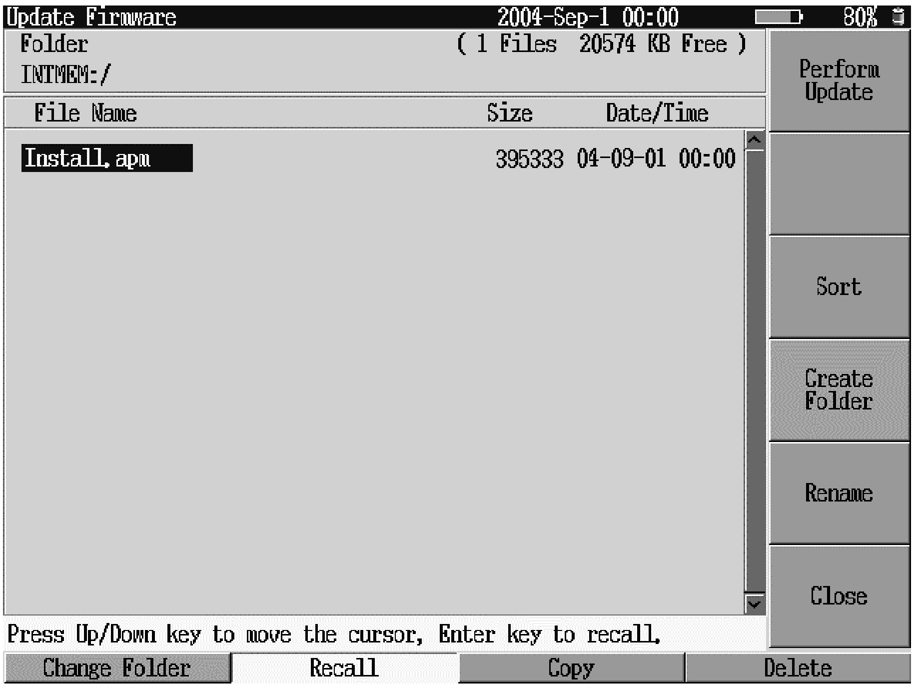


Fig. 8.5.2-1 Update Firmware screen

The file required for updating the firmware is displayed in this screen. Refer to Section 8.1 “Operating Files” for file operation.

Select the installation file for updating the firmware, and then press f1 (Perform Update) to display the license key input screen shown in Fig. 8.5.2-2 below.

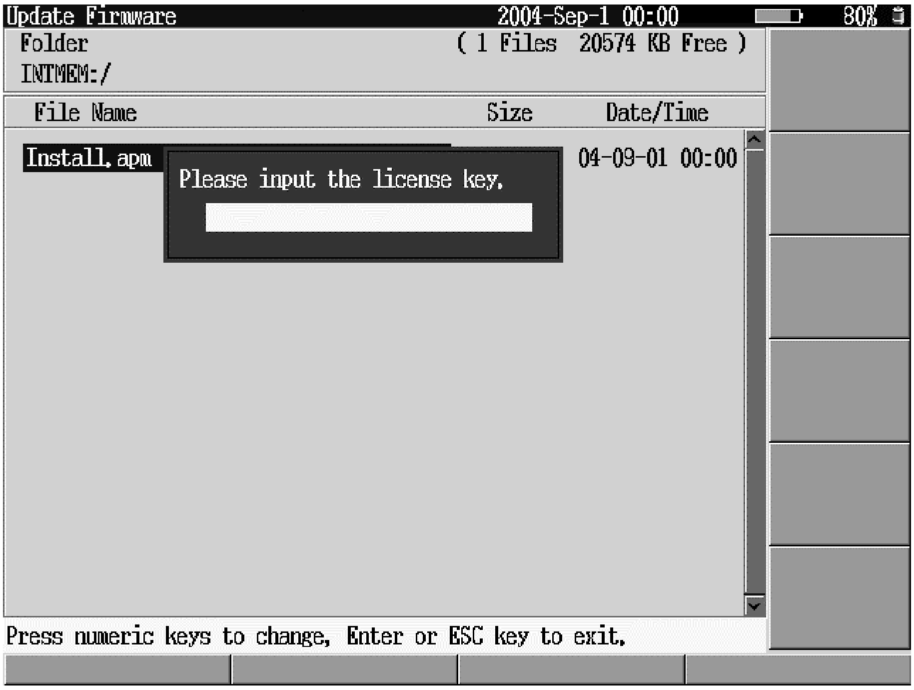


Fig. 8.5.2-2 License key input screen

The update start screen shown in Fig. 8.5.2-3 is displayed when the license key is not required.

Input the license key using the numerical keys, and then press the Enter key. The update start screen shown in Fig. 8.5.2-3 is displayed.

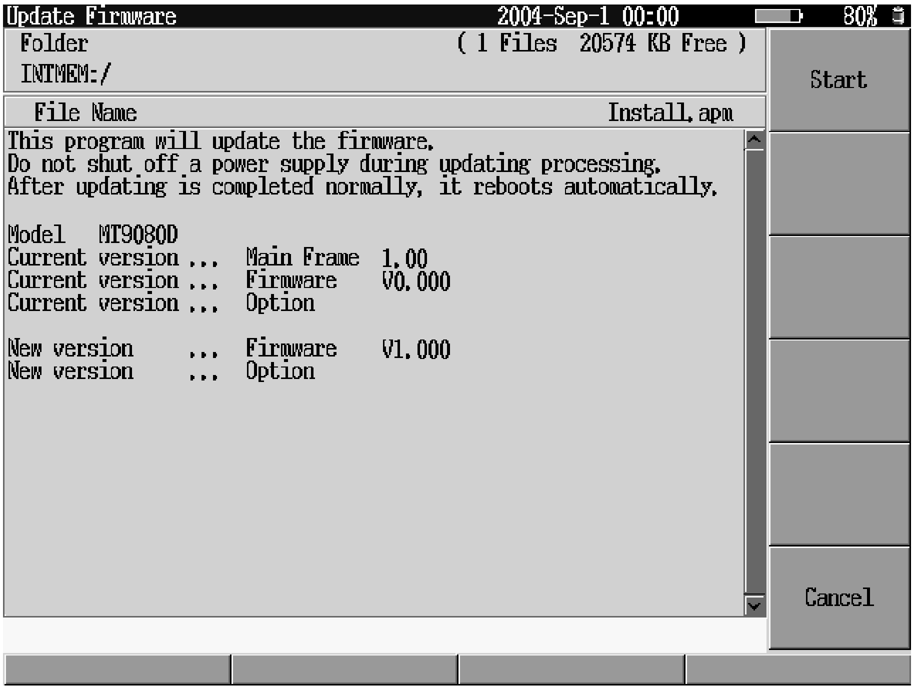


Fig. 8.5.2-3 Update start screen

The current environment and installation file firmware information are displayed on screen.

Press f1 (Start) if it is OK to start firmware update, and press f6 (Cancel) to cancel the update.
When the firmware update is cancelled, the screen is returned to the returns to the Update Firmware screen shown in Fig. 8.5.2-1.

When firmware update starts and complete, the update completion screen shown in Fig. 8.5.2-4 below is displayed.

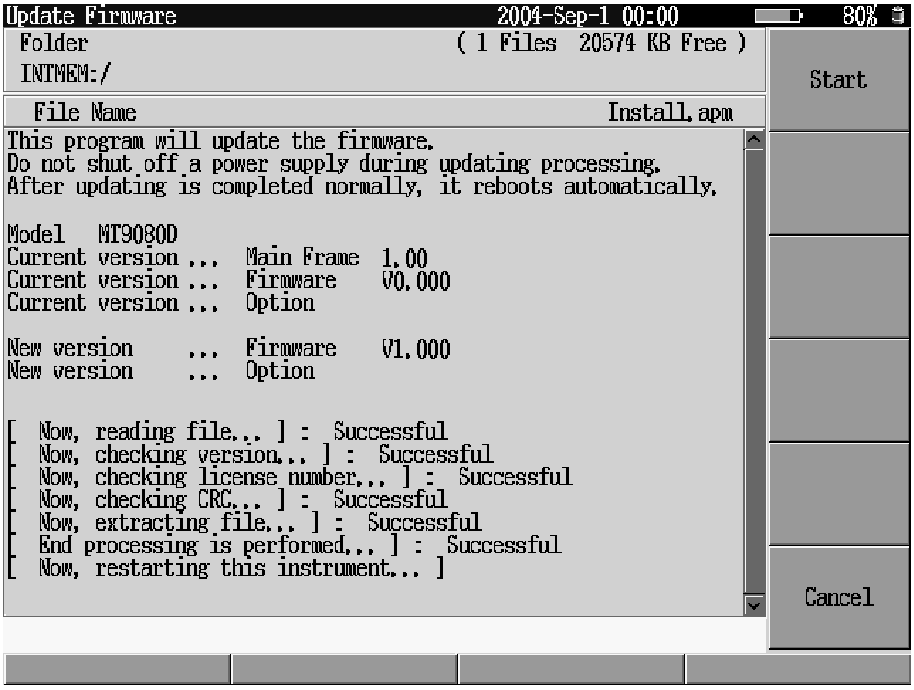


Fig. 8.5.2-4 Update completion screen

The MT9080 Series will be restarted automatically when firmware update is completed successfully.

When the MT9080 Series is restarted, check that the firmware has been updated on the Selftest screen (Fig. 8.4.2-1).

When the license key is not input correctly, firmware update fails and the update interruption screen shown in Fig. 8.5.2-5 below is displayed.

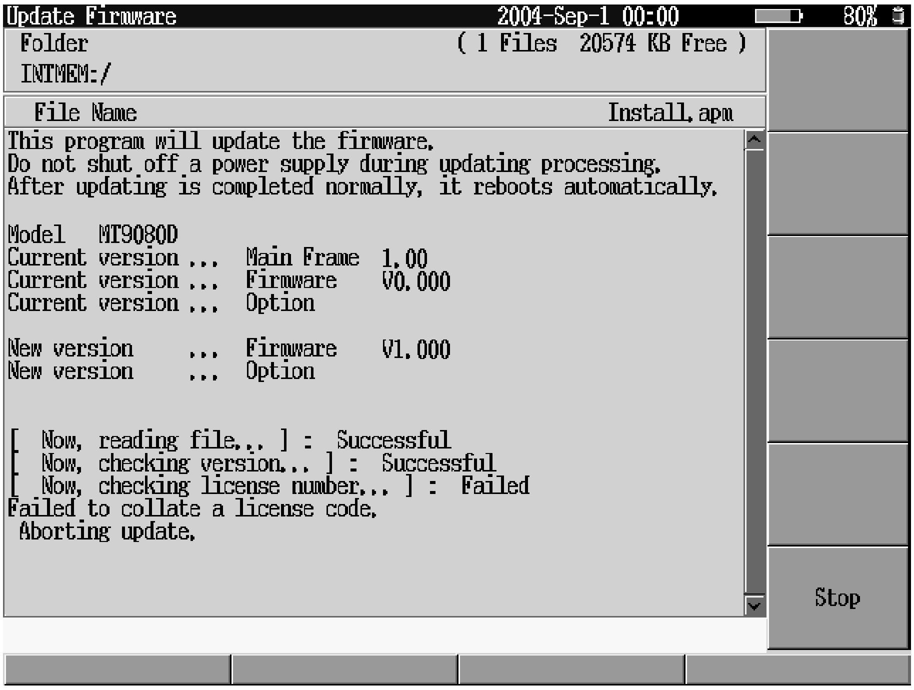


Fig. 8.5.2-5 Update interruption screen

Press f6 (Stop) to return to the Update Firmware screen shown in Fig. 8.5.2-1. Check the license key, and then perform firmware update again.

Note that firmware may not be updated when the remaining battery power is less than 10% in order to prevent the remaining battery power from running out during firmware update.

Section 9 Peripheral Interface

The MT9080 Series is equipped with a USB port as standard. USB memory and PCs can be connected.

9.1 USB Memory

Connect USB memory to the USB Down port for the MT9080 Series to access USB memory from the MT9080 Series.

USB memory is used to fetch measured results to PCs and to fetch files saved to PCs with the MT9080 Series.
Refer to Section 8.1 “Operating Files” for how to operate files.

Chinese characters and special symbols will also be displayed in folder names and file names. Note that long names will be omitted and displayed as shown in the following.

12345678901234567890123456789O1~.sor

Although characters can be deleted and changed when changing folder names and file names (excluding extensions) with more than 51 single-byte characters, additions cannot be performed.
Note that additions can be performed when there are 50 or less single-byte characters.
In addition, name changes can also be cancelled.

Normal operations may not be performed when displaying USB memory contents, removing the USB memory from the MT9080 Series then changing the details with a PC.
Change the internal memory once, change the path to the USB memory again then display the USB contents in this instance.

Refer to Section 9.1.1 “General notes” as well as the items described above for use.

9.1.1 General notes

(1) Do not remove the USB memory when accessing it for recalling, copying, or deleting files, etc. Otherwise, the USB memory or files may be damaged.

(2) Insert the USB memory firmly into the MT9080 Series.
The USB memory or files may be damaged if it is removed while being accessed. In addition, the USB memory may be damaged if it is dropped.

(3) Insert and remove the USB memory gently.
If it is inserted and removed several times quickly, the contents of the USB memory may be damaged and not be recognized correctly.

CAUTION ⚠

A mark during access is displayed on screen when recalling, saving, copying or deleting folders and/or files. Do not remove USB memory while accessing it.
Do not haphazardly nor repeatedly insert and remove the USB memory.
Otherwise, the USB memory or files may be damaged.

9.2 USB Storage

Internal memory can be directly accessed from a PC when a USB Up (to PC) port of the MT9080 Series is connected to a PC with a USB cable.
This is used for loading files saved in the internal memory of the MT9080 Series directly to the PC or for copying files saved in the PC directly to the MT9080 Series.

Use the following cable types for USB cables to be used for connection.

- USB (A) male ⟷ USB (B) male

The MT9080 Series cannot access internal memory when it is connected to a PC.
A message stating that the MT9080 Series is attempting to access files saved to internal memory or attempting to save measured results is displayed, indicating that these operations will be stopped.

It is recommended to use an AC adapter when connecting the MT9080 Series to a PC.
The MT9080 Series battery will be consumed during file access that may damage important customer data.

The following are supported PC OS that can be connected to the MT9080 Series.
The MT9080 Series may not be recognized by a PC with an OS other than those shown below.

- Windows Me/2000/XP

Note:

Does not support Windows 95/98.

Refer to Section 9.2.1 “General notes” as well as the items described above for use.

9.2.1 General notes

(1) Do not remove the USB cable when accessing the internal memory of the MT9080 Series from a PC.
Otherwise, the internal memory of the MT9080 Series may be damaged.

(2) Prepare to safely remove the MT9080 Series using the steps in Section 9.2.2 “Removing MT9080 Series” before removing the connection between the MT9080 Series and the PC.
Internal memory of the MT9080 Series may be damaged without making these preparations for removal.

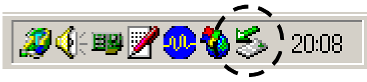
9.2.2 Removing MT9080 Series

Prepare to safely remove the MT9080 Series from the PC using the following steps.
Internal memory of the MT9080 Series may be damaged without making these preparations for removal.

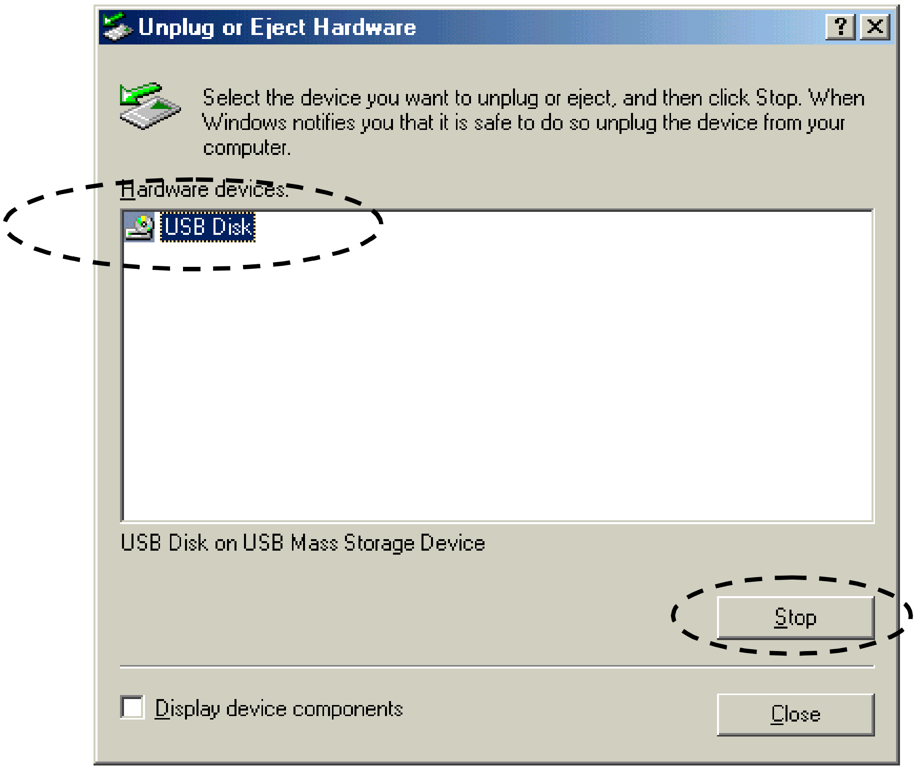
The following removal steps are described for Windows 2000 as an example.

<Removal Procedure>

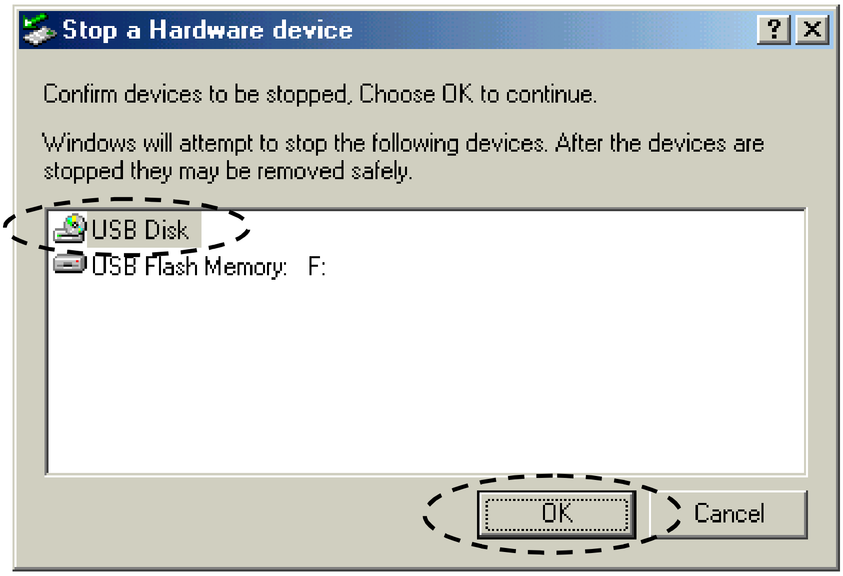
1. Right-click the “Unplug or Eject Hardware” icon displayed in the PC task tray then click “Unplug or Eject Hardware.”



2. Select “USB Disk” from the Unplug or Eject Hardware screen then click the [Stop] button.

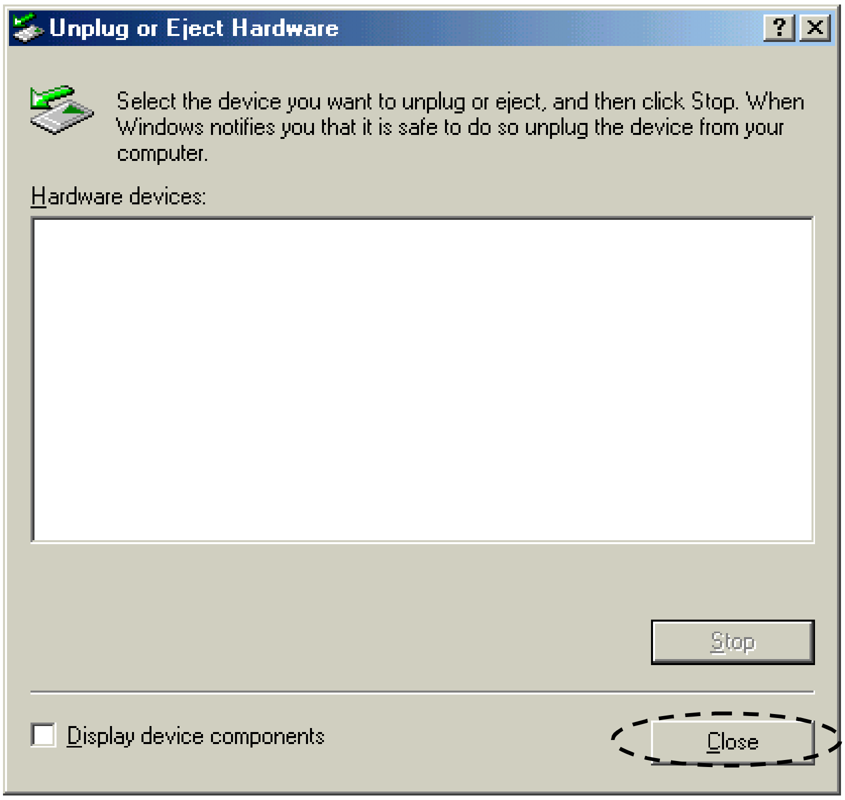


3. Select "USB Disk" from the Stop a Hardware device screen then press the [OK] button.



4. Click the [OK] button when the following message is displayed.

5. Click the [Close] button to close the Unplug or Eject Hardware screen.



6. Disconnect the USB cable connecting the MT9080 Series to the PC.

CAUTION ⚠

Before disconnecting the USB cable between the MT9080 Series and the PC, be sure to prepare the PC so that the hardware can be removed. Otherwise, the internal memory may be damaged.

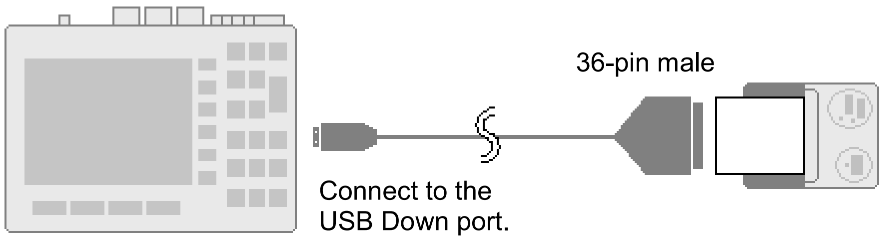
9.3 Printer

The MT9080 Series can connect with a printer using a USB cable. Refer to Section 3.5.1 “General settings” for setting a printer.

9.3.1 Connecting printer

(1) For BL-80RII

Connect the MT9080 Series and the BL-80RII using a USB printer conversion cable as shown in the figure below:



Section 10 Performance Test and Calibration

This section describes how to check the performance of the MT9080 Series and calibrate measurement values.

Contact Anritsu or our sales dealer when specifications are determined not to have been satisfied based on the performance test described here.

Check the following items beforehand when requesting repairs.

(1) Device name and serial number located on the bottom side

(2) Failure conditions

(3) The name and contact point of the supervisor who checked the failure conditions or contact when repairs are completed.

WARNING ⚠

Never look directly into the cable connector on the MT9080 Series nor into the end of a cable connected to the MT9080 Series. If laser radiation enters the eye, there is a risk of injury.

There are risks from laser light when performing operations outside those noted in this manual.

10.1 Performance Test

The following eight items are tested to check the performance of the MT9080 Series (Item 6 is tested when Option 02 or 002 is installed).

(1) Optical output and wavelength of the optical pulse test (OTDR)

(2) Pulse width

(3) Dynamic range (One-way back-scattered light dynamic range test)

(4) Distance measurement accuracy

(5) Loss measurement accuracy (linearity)

(6) Optical output and wavelength of the visible light source (VLD) (Option 02 or 002)

(7) Optical output and wavelength of optical light source (OLS) for fiber identification

(8) Measurement accuracy of the optical power meter (OPM)

Clean the optical connector before testing. Test steps in this section are described based on conditions where the power is On and the MT9080 Series is activated.

Rated Values for Each Test Item

Unless otherwise specified, the following rated values are guaranteed at a temperature of 25 ±5°C.

Table 10.1-1 MT9080A/B/C/D/E/F specifications

<table>
<tr><th colspan="3">Item</th><th>Rated values</th><th>Remarks</th></tr>
<tr><td colspan="3">Wavelength</td><td>1310 ±30 nm (MT9080A)
1550 ±30 nm (MT9080B)
1645 –1655 nm[*1] (MT9080C)
1310/1550 ±30 nm (MT9080D)
1550 ±30 nm/1645 –1655 nm[*1] (MT9080E)
1310/1550 ±30 nm/1645 –1655 nm[*1] (MT9080F)</td><td>Pulse width of 1 μs</td></tr>
<tr><td colspan="3">Pulse Width (ns)</td><td>3 / 20±25% / 50±23% / 100±16% / 200±10%
500±10% / 1000±10% / 2000±10%</td><td>No specifications are provided for 3 ns.</td></tr>
<tr><td colspan="3">Dynamic Range (dB) (S/N = 1)[*2]</td><td></td><td></td></tr>
<tr><td rowspan="6"></td><td colspan="2">MT9080A</td><td>26.5 dB (1.31 μm)</td><td rowspan="6">25°C,
Pulse width: 2 μs,
Distance range: 50 km,
Average time: 180 sec.
*3</td></tr>
<tr><td colspan="2">MT9080B</td><td>25 dB (1.55 μm)</td></tr>
<tr><td colspan="2">MT9080C</td><td>22 dB (1.65 μm)</td></tr>
<tr><td colspan="2">MT9080D</td><td>26/24.5 dB (1.31/1.55 μm)</td></tr>
<tr><td colspan="2">MT9080E</td><td>24.5/22 dB (1.55/1.65 μm)</td></tr>
<tr><td colspan="2">MT9080F</td><td>25.5/24/22 dB (1.31/1.55/1.65 μm)</td></tr>
<tr><td colspan="3">Distance Measurement Accuracy</td><td>±1 m ±3 × measurement distance × 10^{-5} ± marker resolution (Note that this does not include optical fiber refraction index (IOR) based uncertainty.)</td><td></td></tr>
<tr><td colspan="3">Loss Measurement Accuracy (Linearity)</td><td>±0.05 dB/dB or ±0.1 dB (Whichever is greater)</td><td></td></tr>
<tr><td colspan="3">Fiber Identification Light Source</td><td></td><td rowspan="8">270 Hz
25°C
*4</td></tr>
<tr><td rowspan="7"></td><td colspan="2">Light Source Output</td><td>–8 dBm min.</td></tr>
<tr><td rowspan="6">Center Wave-length</td><td>MT9080A</td><td>1310 ±30 nm</td></tr>
<tr><td>MT9080B</td><td>1550 ±30 nm</td></tr>
<tr><td>MT9080C</td><td>1650 ±5 nm</td></tr>
<tr><td>MT9080D</td><td>1310/1550 ±30 nm</td></tr>
<tr><td>MT9080E</td><td>1550 ±30 nm, 1650 ±5 nm</td></tr>
<tr><td>MT9080F</td><td>1310/1550 ±30 nm, 1650 ±5 nm</td></tr>
<tr><td colspan="3">Optical Power Meter*5</td><td></td><td></td></tr>
<tr><td></td><td colspan="2">Measurement Accuracy</td><td>±6.5%</td><td>1550 nm, CW,
–20 dBm, 23 ±2°C
After executing zero offset</td></tr>
</table>

*1 Wavelength range of less than 20 dB from peak value. Peak value (optical output): +15 dBm max.

*2 S/N = 1 Dynamic range value applies +2.6 dB to the noise peak values.

*3 Background light of 1550 nm and CW light of – 19 dBm are added when wavelength is 1650 nm.

*4 Operating temperature range for 1650 nm: 0 to 35°C

*5 Measurement range: –50 to –5 dBm (Peak power), absolute maximum input rating at +10 dBm, wavelength at 1550 nm

Table 10.1-2 MT9081A/B/C/D/E/F/A1/B1/C1/D1/E1/F1 specifications

Item	Rated values	Remarks
Wavelength	1310 ±30 nm (MT9081A/A1) 1550 ±30 nm (MT9081B/B1) 1645 –1655 nm[*1] (MT9081C/C1) 1310/1550 ±30 nm (MT9081D/D1) 1550 ±30 nm/1645 –1655 nm[*1] (MT9081E/E1) 1310/1550 ±30 nm/1645 –1655 nm[*1] (MT9081F/F1)	Pulse width of 1 μs
Pulse Width (ns)	3 / 10±35% / 20±35% / 50±23% / 100±10% 200±10% / 500±10% / 1000±10% / 2000±10% 4000±10% / 10000±10% / 20000±10%	No specifications are provided for 3 ns.
Dynamic Range (dB) (S/N = 1)[*2]		
MT9081A/A1	38.5 dB (1.31 μm)	25°C, Pulse width: 2 μs, Distance range: 100 km, Average time: 180 sec. *3
MT9081B/B1	37 dB (1.55 μm)	
MT9081C/C1	33.5 dB (1.65 μm)	
MT9081D/D1	38/36.5 dB (1.31/1.55 μm)	
MT9081E/E1	36/33.5 dB (1.55/1.65 μm)	
MT9081F/F1	37.5/36/33.5 dB (1.31/1.55/1.65 μm)	
Distance Measurement Accuracy	±1 m ±3 × measurement distance × 10^{-5} ± marker resolution (Note that this does not include optical fiber refraction index (IOR) based uncertainty.)	
Loss Measurement Accuracy (Linearity)	±0.05 dB/dB or ±0.1 dB (Whichever is greater)	
Fiber Identification Light Source		CW 25°C, SM fiber 2 m
Light Source Output	–5 dBm min.	
Center Wavelength: MT9081A/A1	1310 ±30 nm	
Center Wavelength: MT9081B/B1	1550 ±30 nm	
Center Wavelength: MT9081C/C1	1650 ±5 nm	
Center Wavelength: MT9081D/D1	1310/1550 ±30 nm	
Center Wavelength: MT9081E/E1	1550 ±30 nm, 1650 ±5 nm	
Center Wavelength: MT9081F/F1	1310/1550 ±30 nm, 1650 ±5 nm	
Optical Power Meter*4		
Measurement Accuracy	±6.5%	1550 nm, CW, –20 dBm, 23 ±2°C After executing zero offset

*1 Wavelength range of less than 20 dB from peak value. Peak value (optical output): +15 dBm max.

*2 S/N = 1 Dynamic range value applies +2.6 dB to the noise peak values.

*3 Background light of 1550 nm and CW light of – 19 dBm are added when wavelength is 1650 nm.

*4 Measurement range: –50 to –5 dBm (Peak power), absolute maximum input rating at +10 dBm, wavelength at 1550 nm

Table 10.1-3 Visible light source (VLD; option 02 or 002) specifications

Item	Rated values	Remarks
Center Wavelength	635 nm ±15 nm	CW
Optical Output Power	–3 ±1.5 dBm	

Table 10.1-4 Measuring instrument (recommended) and optical fiber required for performance test

Test item / Measuring instrument and cable	OTDR					(6)		(7)		(8)
	(1)	(2)	(3)	(4)	(5)	Optical output	Wavelength	Optical output	Wavelength	Measurement accuracy
Optical Spectrum Analyzer: MS9710B Wavelength: 0.6 to 1.75 μm Level: –65 to +20 dBm	✓						✓		✓	
Variable Attenuator: MN9610B Wavelength: 1.1 to 1.65 μm Attenuation: 60 dB min.	✓	✓	✓							✓
Waveform Monitor: MP9655A Wavelength: 1.2 to 1.6 μm Rising/Falling: 500 ps max.		✓								
Oscilloscope DC to 1 GHz		✓								
SM Optical Fiber (40 km)			✓		✓					
SM Optical Fiber (20 km)			✓							
SM Optical Fiber (2 km)				✓						
SM Optical Fiber (2 m)	✓	✓	✓			✓	✓	✓	✓	✓
Optical Power Meter: ML9001 + MA9001B + MA9411A Wavelength: 0.38 to 1.15 μm Level: –70 to 7 dBm						✓				
Optical Power Meter: ML9001A5 + MA9714B Wavelength: 0.75 to 1.8 μm Level: –57 to +20 dBm (270 Hz) –47 to +23 dBm (CW)	✓							✓		
Reference Light Source: MT9801A/MU952501A 1550 nm, +10 dBm(CW)			✓							✓
Optical Power Meter: MT9801A/MU931421A 0.75 to 1.7 μm –80 to +10 dBm(CW)										✓

Note:

See Conventions below for items (1) through (8).

Conventions:

(1): Optical output and wavelength

(2): Pulse width

(3): Dynamic range

(4): Distance measurement accuracy

(5): Loss measurement accuracy

(6): Visible light source (VLD: Visible Laser Diode)

(7): Optical light source for fiber identification (OLS: Optical Light Source)

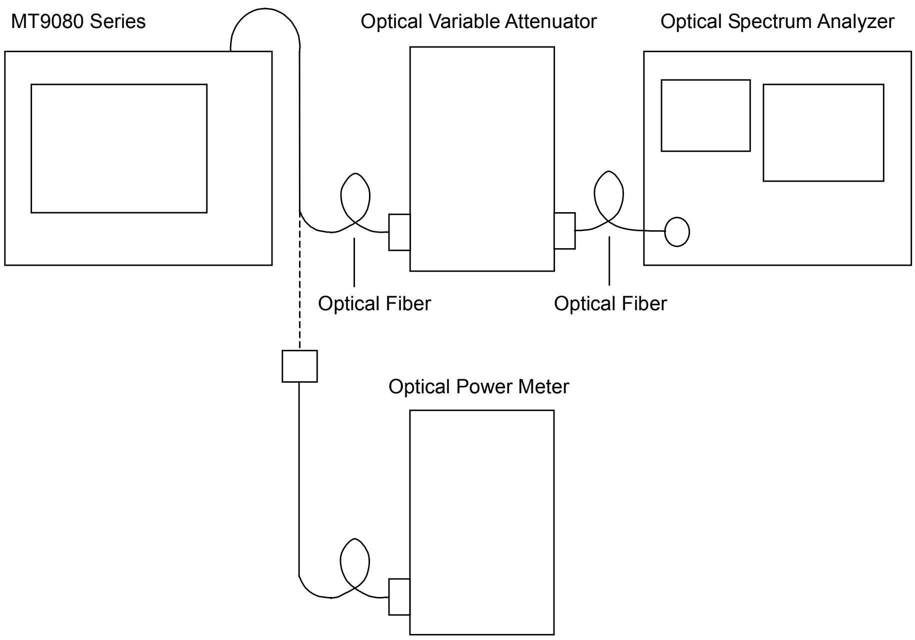
(8): Optical power meter (OPM)

10.1.1 Optical output and wavelength of OTDR

Check whether the optical output and center wavelength equivalent to the peak pulse level of OTDR satisfy the specifications.

Connection Diagram

Connect the devices as shown in the following figure.



<Test Procedure>

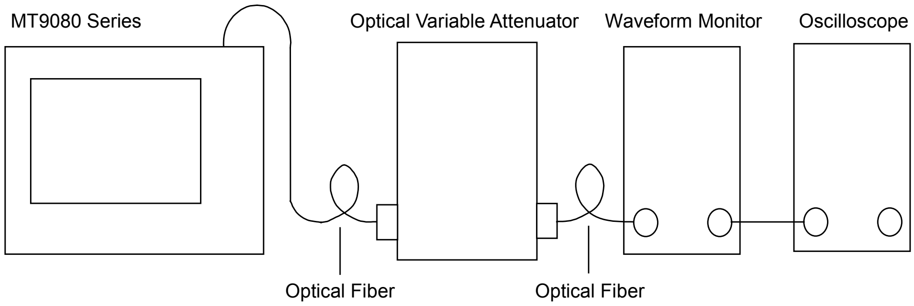
1. Open Top Menu → OTDR (Trace Analysis) → Measurement Condition (Trace Analysis) screen, and set the distance range, wavelength and pulse width.
2. Open the Measurement Condition (Trace Analysis) Others screen, and set Continuous Pulse Luminescence to On for continuous optical pulse output. Continuous optical pulse output can be stopped by setting Continuous Pulse Luminescence to Off.
3. Measure with the optical power meter when measuring optical output. Set the optical power meter wavelength and cal value beforehand then measure optical output.
4. Laser beam is received by the optical spectrum analyzer when measuring wavelength to adjust the optical spectrum analyzer measurement level and wavelength resolution. Optical spectrum analyzer measurement varies according to the wavelength. Select RMS for 1310 ±30 nm or 1550 ±30 nm, and select Threshold for 1645-1655 nm.
5. Check that the optical output and wavelength measured results are within the specifications.

6. When measuring another waveform continuously, set Continuous Pulse Luminescence to Off, set measurement conditions on the Measurement Condition (Trace Analysis) screen, and change the wavelengths to repeat measurement from step 3 above in the similar manner. Set Continuous Pulse Luminescence to Off and set continuous optical pulse output to OFF when finishing measurement.

10.1.2 Pulse width

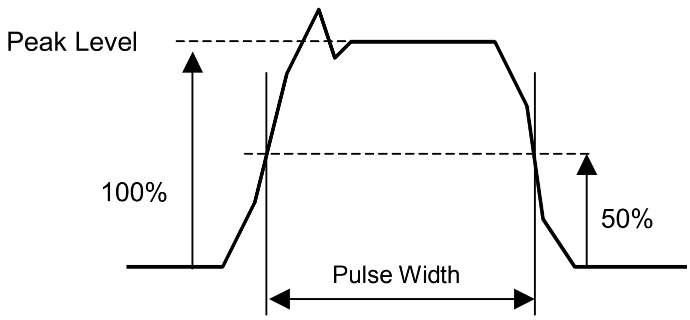
Check that the pulse width of the output light of OTDR satisfies the specifications.
This test is performed for each wavelength.

Connection Diagram
Connect the devices as shown in the following figure.



<Test Procedure>

1. Open Top Menu → OTDR (Trace Analysis) → Measurement Condition (Trace Analysis) screen, and set the distance range, wavelength and pulse width.
2. Set Realtime.
3. Adjust the oscilloscope amplitude and time base scale to display the waveform in the oscilloscope. Adjust the optical variable attenuator to prevent the waveform monitor from being saturated at this time.
4. Observe the oscilloscope waveform and measure the peak level half amplitude as shown in the following figure then check that measured results are with the specifications.



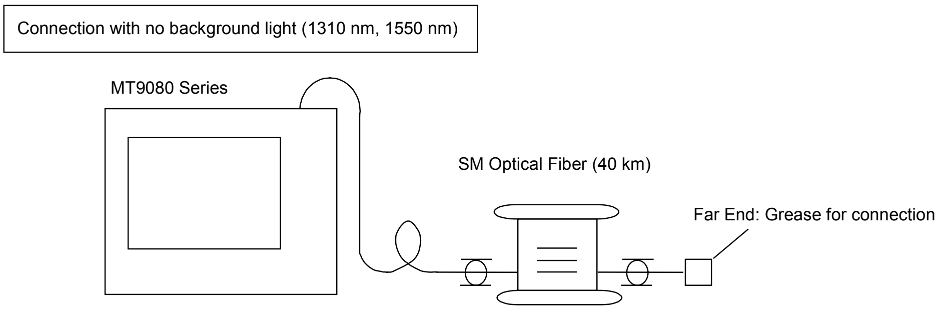
5. When measuring another pulse width continuously, return to the Measurement Condition (Trace Analysis) screen and set the pulse width again, the repeat measurement from step 2 above in the same manner.

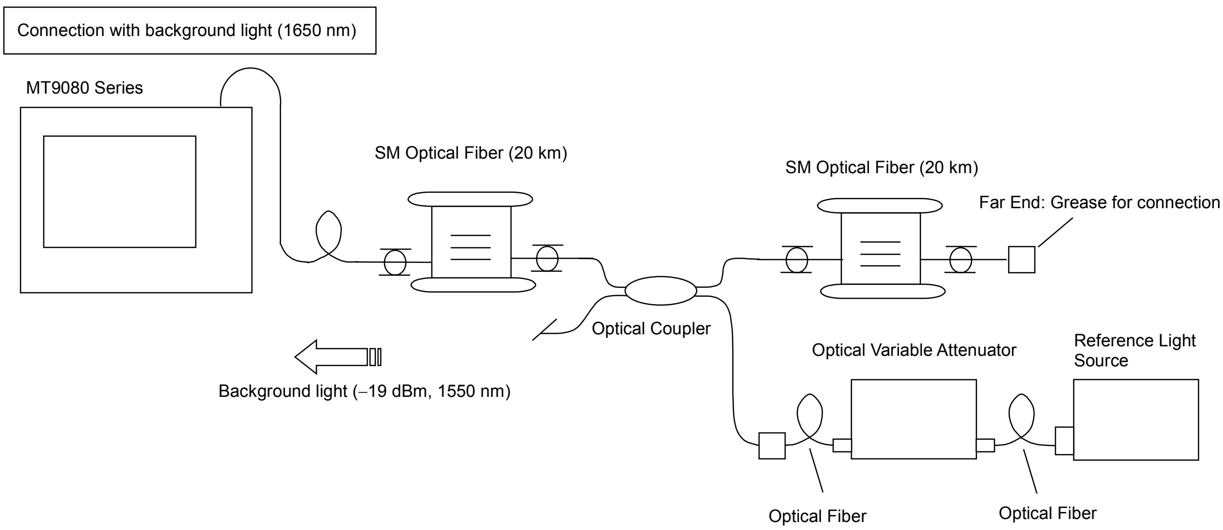
10.1.3 Dynamic range (one-way back-scattered light dynamic range test)

Check that the dynamic range satisfies the specifications. This test is performed for each wavelength and pulse width. Background light should be injected for this measurement. For example, when the wavelength is 1650 nm and the pulse width is 2 µs (or 20 µs for MT9081 Series), the background light of −19 dBm, 1.55 µm is injected. Background light is created using the reference light source and optical variable attenuator.

Connection Diagram

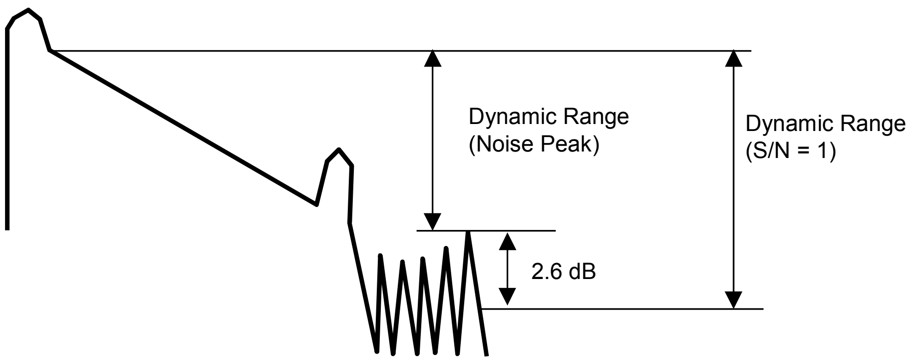
Connect the devices as shown in the following figure.





<Test Procedure>

1. Open Top Menu → OTDR (Trace Analysis) → Measurement Condition (Trace Analysis) screen, and perform settings as shown below:
   (1) Set Setting Mode: Setting Mode to Manual.
   (2) Set the measurement wavelength at Measurement Parameter: Wavelength.
   (3) Set the measurement distance range at Measurement Parameter: Distance Range.
   (4) Set the measurement pulse width at Measurement Parameter: Pulse Width.
   (5) Set Detailed Parameter: Averaging Unit to Count, and set the averaging time at Measurement Parameter: Averaging.
   (6) Set Detailed Parameter: Attenuation to Auto.
   (7) Set Detailed Parameter: Sampling Mode to Normal.
2. Start measurement.
3. Open the Splice & Return Loss screen and set 2PA (two-point approximation) for linear approximation.
4. When measurement is complete, read the following values from the measurement waveform:
   - Calculate the level gap between the MT9080 Series optical connector end level and the floor noise peak level, then apply +2.6 dB to this value.
5. Check that this value satisfies the standard values prescribed for each wavelength.

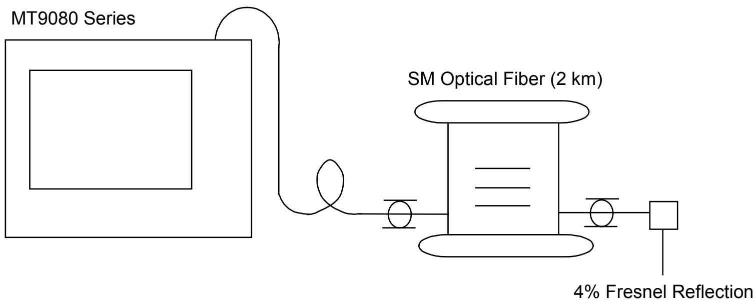


10.1.4 Distance measurement accuracy

Measure the optical fiber whose length and refraction index are known, then perform a horizontal axis (i.e., measurement distance) accuracy test. This is not required for other ranges when this test is performed at a certain distance range.

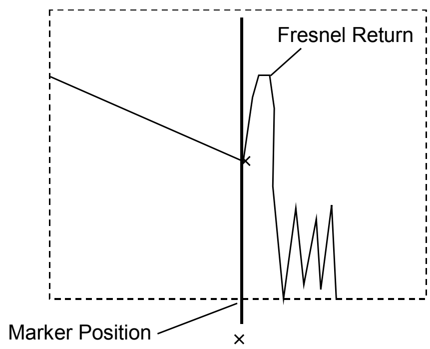
Connection Diagram

Connect the devices as shown in the following figure.



<Test Procedure>

1. Open Top Menu → OTDR (Trace Analysis) → Measurement Condition (Trace Analysis) screen, and perform settings as shown below:
   (1) Set the measurement wavelength at Measurement Parameter: Wavelength.
   (2) Set Measurement Parameter: Distance Range to 5 km.
   (3) Set the measurement pulse width at Measurement Parameter: Pulse Width.
   (4) Set the index of refraction at Measurement Parameter: IOR.
   (5) Set the averaging time at Measurement Parameter: Averaging.
2. Start measurement.
3. Align the marker with the rising point of the fiber far-end Fresnel return, then set the horizontal axis scale to 0.005 km/div.
   *0.005 km/div: IOR = 1.5 scale. (Varies depending on IOR.)
4. Accurately align the marker with the Fresnel return rising point, then read the absolute distance. Check that this value satisfies the specifications.

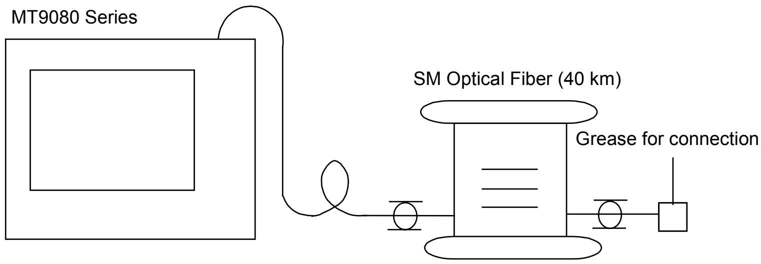


10.1.5 Loss measurement accuracy (linearity)

Perform a vertical axis (i.e., level measurement) accuracy test.

Connection Diagram

Connect the devices as shown in the following figure.

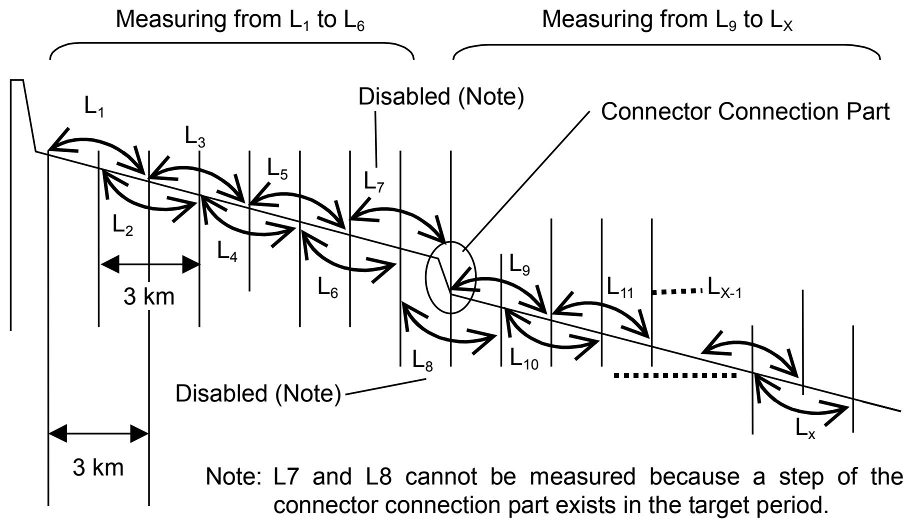


Only one wavelength is tested even if the device has multiple wavelengths. This section shows the measurement procedure at 1310 nm.

<Test Procedure>

1. Open Top Menu → OTDR (Trace Analysis) → Measurement Condition (Trace Analysis) screen, and perform settings as shown below:
   (1) Set the measurement wavelength at Measurement Parameter: Wavelength.
   (2) Set Measurement Parameter: Pulse Width to 100 ns.
2. Start measurement.
3. Open the Splice & Return Loss screen and set LSA (least square approximation) for linear approximation.
4. Measure the loss (L_x) for each 3 km (at 1310 nm) up to approx. 30 km, then calculate the average loss (L_{ave_m}) for these. Perform for each fiber when there are fibers connected at this time.
5. Calculate the difference (L_{diff_n}) between loss (L_x) and average loss (L_{ave_m}).
6. Check that the difference (L_{diff_n}) is less than ±0.1 dB.

Example: When a fiber (20 km × 2) is connected:



Measuring L_1 to L_6

$L_{ave\_1} = (L_1 + L_2 + L_3 + L_4 + L_5 + L_6)/6$

$L_{diff\_1} = (L_1 - L_{ave\_1})$, $L_{diff\_2}=(L_2 - L_{ave\_1})$, ... $L_{diff\_6} = (L_6 - L_{ave\_1})$

Measuring L_9 to L_x

$L_{ave\_2} = (L_9 + L_{10} + L_{11} + ... + L_x)/(x -9 +1)$

$L_{diff\_9} = (L_9 - L_{ave\_2})$, $L_{diff\_10}=(L_{10} - L_{ave\_2})$, ... $L_{diff\_x} = (L_x - L_{ave\_2})$

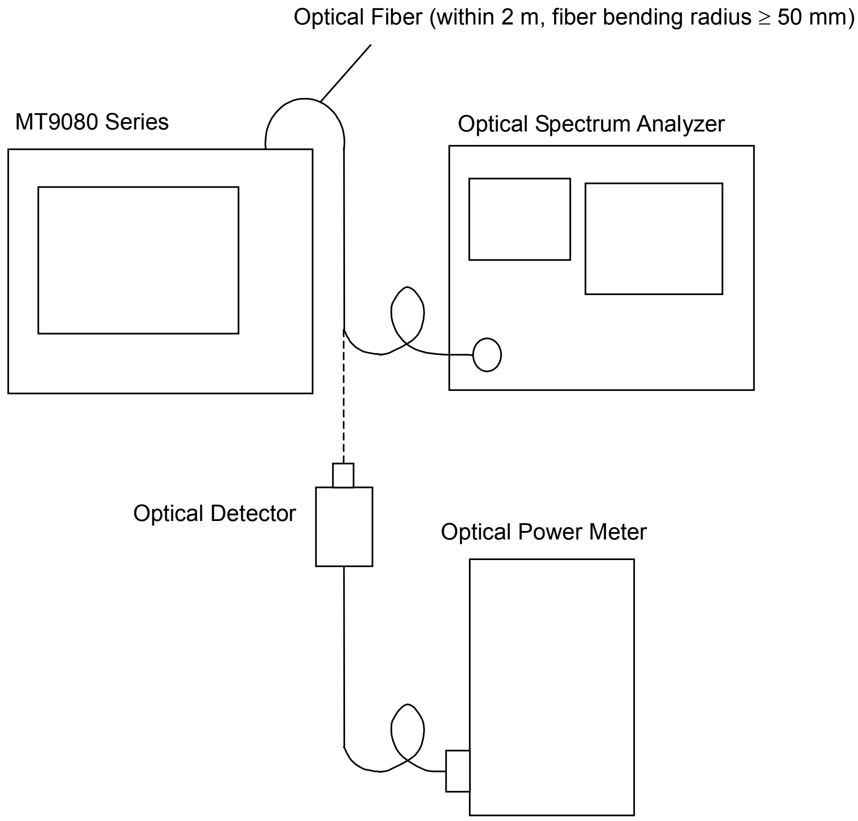
Check that the $L_{diff\_n}\{L_{diff\_1}, L_{diff\_2}, \ldots\ldots L_{diff\_6}, L_{diff\_9}, \ldots\ldots L_{diff\_X}\}$ is ±0.1 or less.

10.1.6 Optical output level and wavelength of visible light source (VLD: option 02 or 002)

This test can be performed when the visible light source (VLD: Visible Laser Diode) option is applied.

Connection Diagram

Connect the devices as shown in the following figure.



<Test Procedure>

1. Open Top Menu → Visible Light Source screen, and turn the visible light source On.
2. Measure the center wavelength using the optical spectrum analyzer and measure the optical output level using the optical power meter.

Note:

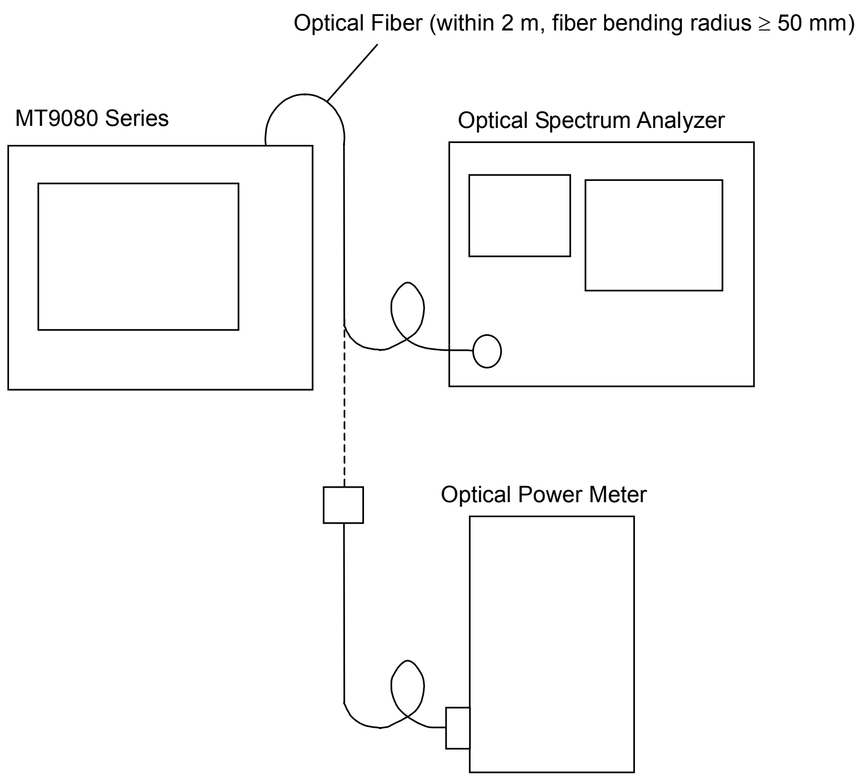
The wavelength and optical output performance test is performed with the visible light source set to the ON (turning On) status, not the Blink (blinking) status.

10.1.7 Optical output and wavelength of optical light source for fiber identification

Measure the optical output and center wavelength of the optical light source (OLS) for fiber identification.

Connection Diagram

Connect the devices as shown in the following figure.



<Test Procedure>

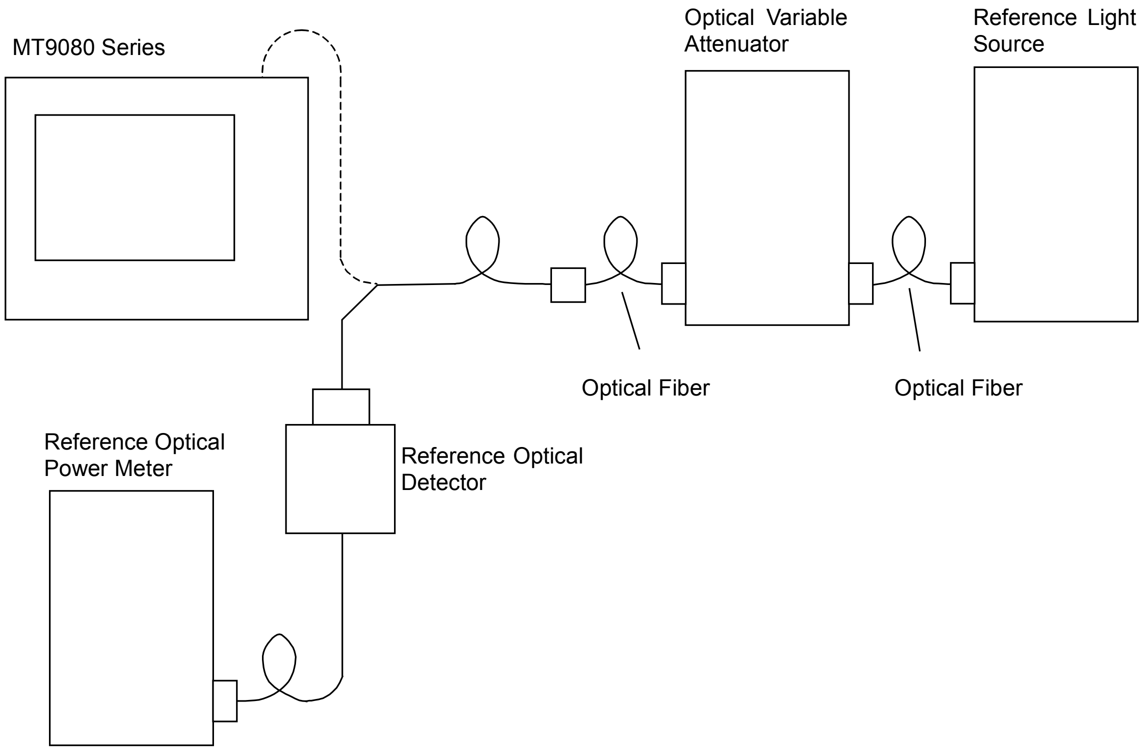
1. Open Top Menu → Light Source screen, and set the wavelength and modulation frequency.
2. Turn the optical light source On.
3. Check that the optical output satisfies the specifications by using the optical power meter.
4. Check that the center wavelength and spectrum width satisfy the specifications by using the optical spectrum analyzer.
5. When measurement is complete, turn the optical light source Off.

10.1.8 Measurement accuracy of the optical power meter

Check that the measurement accuracy of the optical power meter satisfies the specifications.
Be sure to execute zero offset for the optical power meter before starting measurement.

Connection Diagram

Connect the devices as shown in the following figure.



<Test Procedure>

Measure the measurement accuracy for input level –20 dBm and measurement wavelength of 1550 nm.

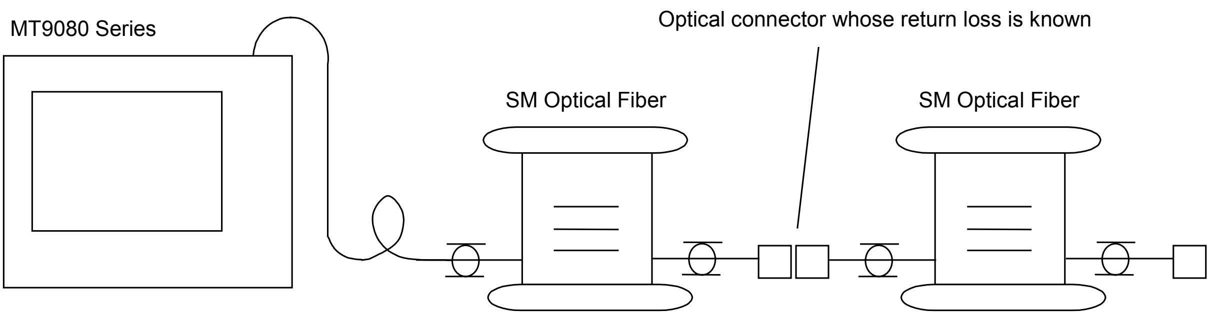
1. Connect the reference optical power meter to the optical variable attenuator.
2. Adjust the optical variable attenuator so that the indication value of the reference optical power meter is –20.00 dBm.
3. Connect the MT9080 Series to the optical variable attenuator.
4. Check that the indication value of the MT9080 Series is to –20.0 ±0.27 dBm (measurement accuracy ±6.5%).

10.2 Calibration

The parameter that can be calibrated with the MT9080 Series is only the back-scattered light level.

Connection Diagram

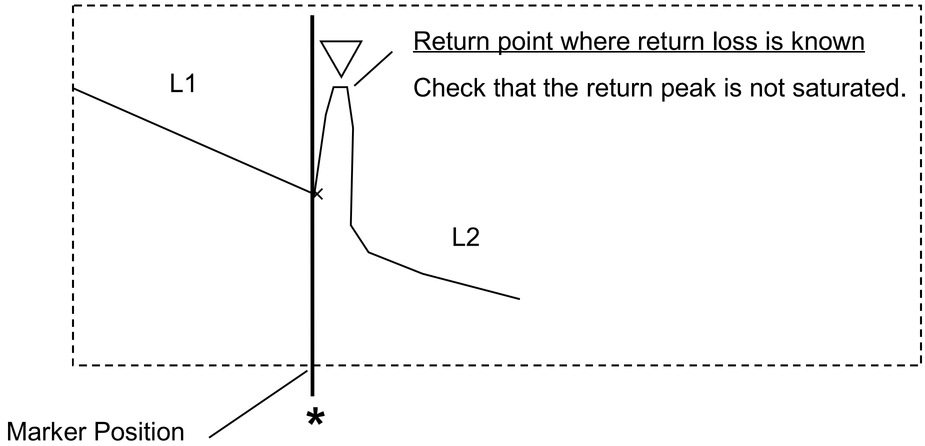
Prepare the optical connector whose return loss (R_0 dB) is known then connect the devices as shown in the following figure.



<Test Procedure>

1. Open Top Menu → OTDR (Trace Analysis) → Measurement Condition (Trace Analysis) screen.
2. Set Detailed Parameter: Backscatter Level to 0 dB.
3. Set Detailed Parameter: Attenuation to Auto.
4. Start measurement.
5. Open the Splice & Return Loss screen and set LSA (least square approximation) for linear approximation.
6. Measure the return point of the optical connector whose return loss is known.
7. Set the * marker for the rising point of the return, and set the ∇ mark for the peak of the return.
   Check that the return peak is not saturated.

8. Set so that the splice point is placed to the center of the screen, that the straight line part L1 and L2 at the front and back of this contain as long a length as possible and that there are no other splice points or fault points placed in the screen.



9. Perform settings for averaging at Detailed Parameters, and perform averaging until the noise is not noticeable.
10. The return loss is displayed on the bottom left of the screen. This value is assumed as R_1 dB.
11. Obtain the difference between R_1 dB and R_0 dB, which is an optical connector return loss value ($R_1 - R_0$), then set the back-scattered level compensate value, taking the codes into consideration.
12. Calibration is complete when the return loss displayed on the measurement screen equals R_0.

10.3 Performance Test Result Sheet

Test site: ______________________________

____

Report No.: ______________________________
Date: ______________________________
Test supervisor: ______________________________

Equipment name: ______________________________
Serial No: ______________________________
Ambient temperature: __________ °C
Relative humidity: __________ %

Note: ______________________________

____
____
____

MT9080A

Test item		Specifications	Results	Remarks
Wavelength	1310 nm	1310 nm ±30 nm		Pulse width: 1 µs
Pulse width	20 ns	20 ns ±25%		
	50 ns	50 ns ±23%		
	100 ns	100 ns ±16%		
	200 ns	200 ns ±10%		
	500 ns	500 ns ±10%		
	1 µs	1 µs ±10%		
	2 µs	2 µs ±10%		
Dynamic range (S/N = 1)		26.5 dB (1.31 µm)		Pulse width: 2 µs Distance range: 50 km, Average time: 180 seconds
Distance measurement accuracy		±1 m ±3 × measurement distance × 10^{-5} ± marker resolution		
Loss measurement accuracy (Linearity)		±0.05 dB/dB or ±0.1 dB (Whichever is greater)		
OLS	Light source output	–8 dBm or more		
	Center wavelength: 1310 nm	1310 ±30 nm		
OPM	Measurement accuracy	±6.5%		1550 nm, CW, –20 dBm
VLD	Center wavelength	635 nm ±15 nm		When Option 02 installed
	Optical output power	–3 ±1.5 dBm		

Note:

OLS: Optical light source for fiber identification

OPM: Optical power meter

VLD: Visible laser diode

MT9080B

Test item		Specifications	Results	Remarks
Wavelength	1550 nm	1550 nm ±30 nm		Pulse width: 1 μs
Pulse width	20 ns	20 ns ±25%		Pulse width: 1 μs
	50 ns	50 ns ±23%		
	100 ns	100 ns ±16%		
	200 ns	200 ns ±10%		
	500 ns	500 ns ±10%		
	1 μs	1 μs ±10%		
	2 μs	2 μs ±10%		
Dynamic range (S/N = 1)		25 dB (1.55 μm)		Pulse width: 2 μs Distance range: 50 km, Average time: 180 seconds
Distance measurement accuracy		±1 m ±3 × measurement distance × 10^{-5} ± marker resolution		
Loss measurement accuracy (Linearity)		±0.05 dB/dB or ±0.1 dB (Whichever is greater)		
OLS	Light source output	–8 dBm or more		
	Center wavelength: 1550 nm	1550 ±30 nm		
OPM	Measurement accuracy	±6.5%		1550 nm, CW, –20 dBm
VLD	Center wavelength	635 nm ±15 nm		When Option 02 installed
	Optical output power	–3 ±1.5 dBm		

Note:

OLS: Optical light source for fiber identification

OPM: Optical power meter

VLD: Visible laser diode

MT9080C

Test item			Specifications	Results	Remarks
Wavelength	1650 nm		1645 –1655 nm		Pulse width: 1 μs Wavelength range of 20 dB less than from peak value
Peak value (Optical output)	1650 nm		+15 dBm or less		
Pulse width	20 ns		20 ns ±25%		
	50 ns		50 ns ±23%		
	100 ns		100 ns ±16%		
	200 ns		200 ns ±10%		
	500 ns		500 ns ±10%		
	1 μs		1 μs ±10%		
	2 μs		2 μs ±10%		
Dynamic range (S/N = 1)			22 dB (1.65 μm)		Pulse width: 2 μs Distance range: 50 km, Average time: 180 seconds
Distance measurement accuracy			±1 m ±3 × measurement distance × 10^{-5} ± marker resolution		
Loss measurement accuracy (Linearity)			±0.05 dB/dB or ±0.1 dB (Whichever is greater)		
OLS	Light source output		–8 dBm or more		
	Center wavelength	1650 nm	1650 ±5 nm		
OPM	Measurement accuracy		±6.5%		1550 nm, CW, –20 dBm
VLD	Center wavelength		635 nm ±15 nm		When Option 02 installed
	Optical output power		–3 ±1.5 dBm		

Note:

OLS: Optical light source for fiber identification

OPM: Optical power meter

VLD: Visible laser diode

MT9080D

<table>
<tr><th colspan="3">Test item</th><th colspan="2">Specifications</th><th colspan="2">Results</th><th>Remarks</th></tr>
<tr><td rowspan="2">Wavelength</td><td colspan="2">1310 nm</td><td colspan="2">1310 nm ±30 nm</td><td colspan="2"></td><td>Pulse width: 1 μs</td></tr>
<tr><td colspan="2">1550 nm</td><td colspan="2">1550 nm ±30 nm</td><td colspan="2"></td><td></td></tr>
<tr><td rowspan="7">Pulse width</td><td colspan="2">20 ns</td><td colspan="2">20 ns ±25%</td><td colspan="2"></td><td></td></tr>
<tr><td colspan="2">50 ns</td><td colspan="2">50 ns ±23%</td><td colspan="2"></td><td></td></tr>
<tr><td colspan="2">100 ns</td><td colspan="2">100 ns ±16%</td><td colspan="2"></td><td></td></tr>
<tr><td colspan="2">200 ns</td><td colspan="2">200 ns ±10%</td><td colspan="2"></td><td></td></tr>
<tr><td colspan="2">500 ns</td><td colspan="2">500 ns ±10%</td><td colspan="2"></td><td></td></tr>
<tr><td colspan="2">1 μs</td><td colspan="2">1 μs ±10%</td><td colspan="2"></td><td></td></tr>
<tr><td colspan="2">2 μs</td><td colspan="2">2 μs ±10%</td><td colspan="2"></td><td></td></tr>
<tr><td rowspan="2">Dynamic range (S/N = 1)</td><td colspan="2" rowspan="2">Wavelength [μm]</td><td>1.31</td><td>1.55</td><td>1.31</td><td>1.55</td><td rowspan="2">Pulse width: 2 μs
Distance range: 50 km,
Average time: 180 seconds</td></tr>
<tr><td>26 dB</td><td>24.5 dB</td><td></td><td></td></tr>
<tr><td>Distance measurement accuracy</td><td colspan="2"></td><td colspan="2">±1 m ±3 × measurement distance × 10^{-5} ± marker resolution</td><td colspan="2"></td><td></td></tr>
<tr><td>Loss measurement accuracy (Linearity)</td><td colspan="2"></td><td colspan="2">±0.05 dB/dB or ±0.1 dB (Whichever is greater)</td><td colspan="2"></td><td></td></tr>
<tr><td rowspan="3">OLS</td><td colspan="2">Light source output</td><td colspan="2">–8 dBm or more</td><td colspan="2"></td><td></td></tr>
<tr><td rowspan="2">Center wavelength</td><td>1310 nm</td><td colspan="2">1310 ±30 nm</td><td colspan="2"></td><td rowspan="2"></td></tr>
<tr><td>1550 nm</td><td colspan="2">1550 ±30 nm</td><td colspan="2"></td></tr>
<tr><td>OPM</td><td colspan="2">Measurement accuracy</td><td colspan="2">±6.5%</td><td colspan="2"></td><td>1550 nm, CW,
–20 dBm</td></tr>
<tr><td rowspan="2">VLD</td><td colspan="2">Center wavelength</td><td colspan="2">635 nm ±15 nm</td><td colspan="2"></td><td rowspan="2">When Option 02 installed</td></tr>
<tr><td colspan="2">Optical output power</td><td colspan="2">–3 ±1.5 dBm</td><td colspan="2"></td></tr>
</table>

Notes:

1. OLS: Optical light source for fiber identification
   OPM: Optical power meter
   VLD: Visible laser diode

2. Note that the measurement port varies according to the measurement wavelength.

MT9080E

<table>
<tr><th colspan="3">Test item</th><th colspan="2">Specifications</th><th colspan="2">Results</th><th>Remarks</th></tr>
<tr><td rowspan="2">Wavelength</td><td colspan="2">1550 nm</td><td colspan="2">1550 nm ±30 nm</td><td colspan="2"></td><td>Pulse width: 1 μs</td></tr>
<tr><td colspan="2">1650 nm</td><td colspan="2">1645–1655 nm</td><td colspan="2"></td><td>Pulse width: 1 μs
Wavelength range of 20 dB less than from peak value</td></tr>
<tr><td>Peak value (Optical output)</td><td colspan="2">1650 nm</td><td colspan="2">+15 dBm or less</td><td colspan="2"></td><td></td></tr>
<tr><td rowspan="7">Pulse width</td><td colspan="2">20 ns</td><td colspan="2">20 ns ±25%</td><td colspan="2"></td><td></td></tr>
<tr><td colspan="2">50 ns</td><td colspan="2">50 ns ±23%</td><td colspan="2"></td><td></td></tr>
<tr><td colspan="2">100 ns</td><td colspan="2">100 ns ±16%</td><td colspan="2"></td><td></td></tr>
<tr><td colspan="2">200 ns</td><td colspan="2">200 ns ±10%</td><td colspan="2"></td><td></td></tr>
<tr><td colspan="2">500 ns</td><td colspan="2">500 ns ±10%</td><td colspan="2"></td><td></td></tr>
<tr><td colspan="2">1 μs</td><td colspan="2">1 μs ±10%</td><td colspan="2"></td><td></td></tr>
<tr><td colspan="2">2 μs</td><td colspan="2">2 μs ±10%</td><td colspan="2"></td><td></td></tr>
<tr><td rowspan="2">Dynamic range (S/N = 1)</td><td colspan="2" rowspan="2">Wavelength [μm]</td><td>1.55</td><td>1.65</td><td>1.55</td><td>1.65</td><td rowspan="2">Pulse width: 2 μs
Distance range: 50 km,
Average time: 180 seconds</td></tr>
<tr><td>24.5 dB</td><td>22 dB</td><td></td><td></td></tr>
<tr><td>Distance measurement accuracy</td><td colspan="2"></td><td colspan="2">±1 m ±3 × measurement distance × 10^{-5} ± marker resolution</td><td colspan="2"></td><td></td></tr>
<tr><td>Loss measurement accuracy (Linearity)</td><td colspan="2"></td><td colspan="2">±0.05 dB/dB or ±0.1 dB (Whichever is greater)</td><td colspan="2"></td><td></td></tr>
<tr><td rowspan="3">OLS</td><td colspan="2">Light source output</td><td colspan="2">–8 dBm or more</td><td colspan="2"></td><td></td></tr>
<tr><td rowspan="2">Center wavelength</td><td>1550 nm</td><td colspan="2">1550 ±30 nm</td><td colspan="2"></td><td rowspan="2">270 Hz</td></tr>
<tr><td>1650 nm</td><td colspan="2">1650 ±5 nm</td><td colspan="2"></td></tr>
<tr><td>OPM</td><td colspan="2">Measurement accuracy</td><td colspan="2">±6.5%</td><td colspan="2"></td><td>1550 nm, CW,
–20 dBm</td></tr>
<tr><td rowspan="2">VLD</td><td colspan="2">Center wavelength</td><td colspan="2">635 nm ±15 nm</td><td colspan="2"></td><td rowspan="2">When Option 02 installed</td></tr>
<tr><td colspan="2">Optical output power</td><td colspan="2">–3 ±1.5 dBm</td><td colspan="2"></td></tr>
</table>

Notes:

1. OLS: Optical light source for fiber identification
   OPM: Optical power meter
   VLD: Visible laser diode
2. Note that the measurement port varies according to the measurement wavelength.

MT9080F

Test item		Specifications	Results	Remarks
Wavelength	1310 nm	1310 nm ±30 nm		Pulse width: 1 μs
	1550 nm	1550 nm ±30 nm		Pulse width: 1 μs
	1650 nm	1645–1655 nm		Pulse width: 1 μs Wavelength range of 20 dB less than from peak value
Peak value (Optical output)	1650 nm	+15 dBm or less		
Pulse width	20 ns	20 ns ±25%		
	50 ns	50 ns ±23%		
	100 ns	100 ns ±16%		
	200 ns	200 ns ±10%		
	500 ns	500 ns ±10%		
	1 μs	1 μs ±10%		
	2 μs	2 μs ±10%		
Dynamic range (S/N = 1)	Wavelength [μm]	1.31 / 1.55 / 1.65	1.31 / 1.55 / 1.65	Pulse width: 2 μs Distance range: 50 km, Average time: 180 seconds
		25.5 dB / 24 dB / 22 dB		
Distance measurement accuracy		±1 m ±3 × measurement distance × 10^{-5} ± marker resolution		
Loss measurement accuracy (Linearity)		±0.05 dB/dB or ±0.1 dB (Whichever is greater)		
OLS	Light source output	–8 dBm or more		
	Center wavelength 1310 nm	1310 ±30 nm		270 Hz
	Center wavelength 1550 nm	1550 ±30 nm		
	Center wavelength 1650 nm	1650 ±5 nm		
OPM	Measurement accuracy	±6.5%		1550 nm, CW, –20 dBm
VLD	Center wavelength	635 nm ±15 nm		When Option 02 installed
	Optical output power	–3 ±1.5 dBm		

Notes:

1. OLS: Optical light source for fiber identification
   OPM: Optical power meter
   VLD: Visible laser diode

2. Note that the measurement port varies according to the measurement wavelength.

MT9081A/A1

<table>
<tr><th colspan="3">Test item</th><th>Specifications</th><th>Results</th><th>Remarks</th></tr>
<tr><td>Wavelength</td><td colspan="2">1310 nm</td><td>1310 nm ±30 nm</td><td></td><td>Pulse width: 1 μs</td></tr>
<tr><td rowspan="11">Pulse width</td><td colspan="2">10 ns</td><td>10 ns ±35%</td><td></td><td></td></tr>
<tr><td colspan="2">20 ns</td><td>20 ns ±35%</td><td></td><td></td></tr>
<tr><td colspan="2">50 ns</td><td>50 ns ±23%</td><td></td><td></td></tr>
<tr><td colspan="2">100 ns</td><td>100 ns ±10%</td><td></td><td></td></tr>
<tr><td colspan="2">200 ns</td><td>200 ns ±10%</td><td></td><td></td></tr>
<tr><td colspan="2">500 ns</td><td>500 ns ±10%</td><td></td><td></td></tr>
<tr><td colspan="2">1 μs</td><td>1 μs ±10%</td><td></td><td></td></tr>
<tr><td colspan="2">2 μs</td><td>2 μs ±10%</td><td></td><td></td></tr>
<tr><td colspan="2">4 μs</td><td>4 μs ±10%</td><td></td><td></td></tr>
<tr><td colspan="2">10 μs</td><td>10 μs ±10%</td><td></td><td></td></tr>
<tr><td colspan="2">20 μs</td><td>20 μs ±10%</td><td></td><td></td></tr>
<tr><td>Dynamic range (S/N = 1)</td><td colspan="2"></td><td>38.5 dB (1.31 μm)</td><td></td><td>Pulse width: 20 μs
Distance range: 100 km,
Average time: 180 seconds</td></tr>
<tr><td>Distance measurement accuracy</td><td colspan="2"></td><td>±1 m ±3 × measurement distance × 10^{-5} ± marker resolution</td><td></td><td></td></tr>
<tr><td>Loss measurement accuracy (Linearity)</td><td colspan="2"></td><td>±0.05 dB/dB or ±0.1 dB (Whichever is greater)</td><td></td><td></td></tr>
<tr><td rowspan="2">OLS</td><td colspan="2">Light source output</td><td>–5 dBm or more</td><td></td><td>CW</td></tr>
<tr><td>Center wavelength</td><td>1310 nm</td><td>1310 ±30 nm</td><td></td><td>CW</td></tr>
<tr><td>OPM</td><td colspan="2">Measurement accuracy</td><td>±6.5%</td><td></td><td>1550 nm, CW,
–20 dBm</td></tr>
<tr><td rowspan="2">VLD</td><td colspan="2">Center wavelength</td><td>650 nm ±15 nm</td><td></td><td rowspan="2">When Option 002 installed</td></tr>
<tr><td colspan="2">Optical output power</td><td>–3 ±1.5 dBm</td><td></td></tr>
</table>

Note:

OLS: Optical light source for fiber identification
OPM: Optical power meter
VLD: Visible laser diode

MT9081B/B1

Test item		Specifications	Results	Remarks
Wavelength	1550 nm	1550 nm ±30 nm		Pulse width: 1 μs
Pulse width	10 ns	10 ns ±35%		
	20 ns	20 ns ±35%		
	50 ns	50 ns ±23%		
	100 ns	100 ns ±10%		
	200 ns	200 ns ±10%		
	500 ns	500 ns ±10%		
	1 μs	1 μs ±10%		
	2 μs	2 μs ±10%		
	4 μs	4 μs ±10%		
	10 μs	10 μs ±10%		
	20 μs	20 μs ±10%		
Dynamic range (S/N = 1)		37 dB (1.55 μm)		Pulse width: 20 μs Distance range: 100 km, Average time: 180 seconds
Distance measurement accuracy		±1 m ±3 × measurement distance × 10^{-5} ± marker resolution		
Loss measurement accuracy (Linearity)		±0.05 dB/dB or ±0.1 dB (Whichever is greater)		
OLS	Light source output	–5 dBm or more		CW
	Center wavelength — 1550 nm	1550 ±30 nm		CW
OPM	Measurement accuracy	±6.5%		1550 nm, CW, –20 dBm
VLD	Center wavelength	650 nm ±15 nm		When Option 002 installed
	Optical output power	–3 ±1.5 dBm		

Note:

OLS: Optical light source for fiber identification
OPM: Optical power meter
VLD: Visible laser diode

MT9081C/C1

Test item		Specifications	Results	Remarks
Wavelength	1650 nm	1645 –1655 nm		Pulse width: 1 μs Wavelength range of 20 dB less than from peak value
Peak value (Optical output)	1650 nm	+15 dBm or less		
Pulse width	10 ns	10 ns ±35%		
	20 ns	20 ns ±35%		
	50 ns	50 ns ±23%		
	100 ns	100 ns ±10%		
	200 ns	200 ns ±10%		
	500 ns	500 ns ±10%		
	1 μs	1 μs ±10%		
	2 μs	2 μs ±10%		
	4 μs	4 μs ±10%		
	10 μs	10 μs ±10%		
	20 μs	20 μs ±10%		
Dynamic range (S/N = 1)		33.5 dB (1.65 μm)		Pulse width: 20 μs Distance range: 100 km, Average time: 180 seconds
Distance measurement accuracy		±1 m ±3 × measurement distance × 10^{-5} ± marker resolution		
Loss measurement accuracy (Linearity)		±0.05 dB/dB or ±0.1 dB (Whichever is greater)		
OLS	Light source output	–5 dBm or more		CW
	Center wavelength: 1650 nm	1650 ±5 nm		CW
OPM	Measurement accuracy	±6.5%		1550 nm, CW, –20 dBm
VLD	Center wavelength	650 nm ±15 nm		When Option 002 installed
	Optical output power	–3 ±1.5 dBm		

Note:

OLS: Optical light source for fiber identification

OPM: Optical power meter

VLD: Visible laser diode

MT9081D/D1

<table>
<tr><th colspan="3">Test item</th><th colspan="2">Specifications</th><th colspan="2">Results</th><th>Remarks</th></tr>
<tr><td rowspan="2">Wavelength</td><td colspan="2">1310 nm</td><td colspan="2">1310 nm ±30 nm</td><td colspan="2"></td><td>Pulse width: 1 μs</td></tr>
<tr><td colspan="2">1550 nm</td><td colspan="2">1550 nm ±30 nm</td><td colspan="2"></td><td>Pulse width: 1 μs</td></tr>
<tr><td rowspan="11">Pulse width</td><td colspan="2">10 ns</td><td colspan="2">10 ns ±35%</td><td colspan="2"></td><td></td></tr>
<tr><td colspan="2">20 ns</td><td colspan="2">20 ns ±35%</td><td colspan="2"></td><td></td></tr>
<tr><td colspan="2">50 ns</td><td colspan="2">50 ns ±23%</td><td colspan="2"></td><td></td></tr>
<tr><td colspan="2">100 ns</td><td colspan="2">100 ns ±10%</td><td colspan="2"></td><td></td></tr>
<tr><td colspan="2">200 ns</td><td colspan="2">200 ns ±10%</td><td colspan="2"></td><td></td></tr>
<tr><td colspan="2">500 ns</td><td colspan="2">500 ns ±10%</td><td colspan="2"></td><td></td></tr>
<tr><td colspan="2">1 μs</td><td colspan="2">1 μs ±10%</td><td colspan="2"></td><td></td></tr>
<tr><td colspan="2">2 μs</td><td colspan="2">2 μs ±10%</td><td colspan="2"></td><td></td></tr>
<tr><td colspan="2">4 μs</td><td colspan="2">4 μs ±10%</td><td colspan="2"></td><td></td></tr>
<tr><td colspan="2">10 μs</td><td colspan="2">10 μs ±10%</td><td colspan="2"></td><td></td></tr>
<tr><td colspan="2">20 μs</td><td colspan="2">20 μs ±10%</td><td colspan="2"></td><td></td></tr>
<tr><td rowspan="2">Dynamic range (S/N = 1)</td><td colspan="2">Wavelength [μm]</td><td>1.31</td><td>1.55</td><td>1.31</td><td>1.55</td><td rowspan="2">Pulse width: 20 μs
Distance range: 100 km,
Average time: 180 seconds</td></tr>
<tr><td colspan="2"></td><td>38 dB</td><td>36.5 dB</td><td></td><td></td></tr>
<tr><td>Distance measurement accuracy</td><td colspan="2"></td><td colspan="2">±1 m ±3 × measurement distance × 10^{-5} ± marker resolution</td><td colspan="2"></td><td></td></tr>
<tr><td>Loss measurement accuracy (Linearity)</td><td colspan="2"></td><td colspan="2">±0.05 dB/dB or ±0.1 dB (Whichever is greater)</td><td colspan="2"></td><td></td></tr>
<tr><td rowspan="3">OLS</td><td colspan="2">Light source output</td><td colspan="2">–5 dBm or more</td><td colspan="2"></td><td>CW</td></tr>
<tr><td rowspan="2">Center wavelength</td><td>1310 nm</td><td colspan="2">1310 ±30 nm</td><td colspan="2"></td><td rowspan="2">CW</td></tr>
<tr><td>1550 nm</td><td colspan="2">1550 ±30 nm</td><td colspan="2"></td></tr>
<tr><td>OPM</td><td colspan="2">Measurement accuracy</td><td colspan="2">±6.5%</td><td colspan="2"></td><td>1550 nm, CW,
–20 dBm</td></tr>
<tr><td rowspan="2">VLD</td><td colspan="2">Center wavelength</td><td colspan="2">650 nm ±15 nm</td><td colspan="2"></td><td rowspan="2">When Option 002 installed</td></tr>
<tr><td colspan="2">Optical output power</td><td colspan="2">–3 ±1.5 dBm</td><td colspan="2"></td></tr>
</table>

Note:

OLS: Optical light source for fiber identification

OPM: Optical power meter

VLD: Visible laser diode

MT9081E/E1

Test item		Specifications	Results	Remarks
Wavelength	1550 nm	1550 nm ±30 nm		Pulse width: 1 μs
	1650 nm	1645–1655 nm		Pulse width: 1 μs Wavelength range of 20 dB less than from peak value
Peak value (Optical output)	1650 nm	+15 dBm or less		
Pulse width	10 ns	10 ns ±35%		
	20 ns	20 ns ±35%		
	50 ns	50 ns ±23%		
	100 ns	100 ns ±10%		
	200 ns	200 ns ±10%		
	500 ns	500 ns ±10%		
	1 μs	1 μs ±10%		
	2 μs	2 μs ±10%		
	4 μs	4 μs ±10%		
	10 μs	10 μs ±10%		
	20 μs	20 μs ±10%		
Dynamic range (S/N = 1)	Wavelength [μm]: 1.55	36 dB	1.55:	Pulse width: 20 μs Distance range: 100 km, Average time: 180 seconds
	Wavelength [μm]: 1.65	33.5 dB	1.65:	
Distance measurement accuracy		±1 m ±3 × measurement distance × 10^{-5} ± marker resolution		
Loss measurement accuracy (Linearity)		±0.05 dB/dB or ±0.1 dB (Whichever is greater)		
OLS	Light source output	–5 dBm or more		CW
	Center wavelength 1550 nm	1550 ±30 nm		CW
	Center wavelength 1650 nm	1650 ±5 nm		
OPM	Measurement accuracy	±6.5%		1550 nm, CW, –20 dBm
VLD	Center wavelength	650 nm ±15 nm		When Option 002 installed
	Optical output power	–3 ±1.5 dBm		

Notes:

1. OLS: Optical light source for fiber identification
   OPM: Optical power meter
   VLD: Visible laser diode

2. Note that the measurement port varies according to the measurement wavelength.

MT9081F/F1

<table>
<tr><th colspan="3">Test item</th><th colspan="3">Specifications</th><th colspan="3">Results</th><th>Remarks</th></tr>
<tr><td rowspan="3">Wavelength</td><td colspan="2">1310 nm</td><td colspan="3">1310 nm ±30 nm</td><td colspan="3"></td><td>Pulse width: 1 μs</td></tr>
<tr><td colspan="2">1550 nm</td><td colspan="3">1550 nm ±30 nm</td><td colspan="3"></td><td>Pulse width: 1 μs</td></tr>
<tr><td colspan="2">1650 nm</td><td colspan="3">1645–1655 nm</td><td colspan="3"></td><td>Pulse width: 1 μs
Wavelength range of 20 dB less than from peak value</td></tr>
<tr><td>Peak value (Optical output)</td><td colspan="2">1650 nm</td><td colspan="3">+15 dBm or less</td><td colspan="3"></td><td></td></tr>
<tr><td rowspan="11">Pulse width</td><td colspan="2">10 ns</td><td colspan="3">10 ns ±35%</td><td colspan="3"></td><td></td></tr>
<tr><td colspan="2">20 ns</td><td colspan="3">20 ns ±35%</td><td colspan="3"></td><td></td></tr>
<tr><td colspan="2">50 ns</td><td colspan="3">50 ns ±23%</td><td colspan="3"></td><td></td></tr>
<tr><td colspan="2">100 ns</td><td colspan="3">100 ns ±10%</td><td colspan="3"></td><td></td></tr>
<tr><td colspan="2">200 ns</td><td colspan="3">200 ns ±10%</td><td colspan="3"></td><td></td></tr>
<tr><td colspan="2">500 ns</td><td colspan="3">500 ns ±10%</td><td colspan="3"></td><td></td></tr>
<tr><td colspan="2">1 μs</td><td colspan="3">1 μs ±10%</td><td colspan="3"></td><td></td></tr>
<tr><td colspan="2">2 μs</td><td colspan="3">2 μs ±10%</td><td colspan="3"></td><td></td></tr>
<tr><td colspan="2">4 μs</td><td colspan="3">4 μs ±10%</td><td colspan="3"></td><td></td></tr>
<tr><td colspan="2">10 μs</td><td colspan="3">10 μs ±10%</td><td colspan="3"></td><td></td></tr>
<tr><td colspan="2">20 μs</td><td colspan="3">20 μs ±10%</td><td colspan="3"></td><td></td></tr>
<tr><td rowspan="2">Dynamic range
(S/N = 1)</td><td colspan="2">Wavelength [μm]</td><td>1.31</td><td>1.55</td><td>1.65</td><td>1.31</td><td>1.55</td><td>1.65</td><td rowspan="2">Pulse width: 20 μs
Distance range: 100 km,
Average time: 180 seconds</td></tr>
<tr><td colspan="2"></td><td>37.5 dB</td><td>36 dB</td><td>33.5 dB</td><td></td><td></td><td></td></tr>
<tr><td>Distance measurement accuracy</td><td colspan="2"></td><td colspan="3">±1 m ±3 × measurement distance × 10^{-5} ± marker resolution</td><td colspan="3"></td><td></td></tr>
<tr><td>Loss measurement accuracy (Linearity)</td><td colspan="2"></td><td colspan="3">±0.05 dB/dB or ±0.1 dB (Whichever is greater)</td><td colspan="3"></td><td></td></tr>
<tr><td rowspan="4">OLS</td><td colspan="2">Light source output</td><td colspan="3">–5 dBm or more</td><td colspan="3"></td><td>CW</td></tr>
<tr><td rowspan="3">Center wavelength</td><td>1310 nm</td><td colspan="3">1310 ±30 nm</td><td colspan="3"></td><td rowspan="3">CW</td></tr>
<tr><td>1550 nm</td><td colspan="3">1550 ±30 nm</td><td colspan="3"></td></tr>
<tr><td>1650 nm</td><td colspan="3">1650 ±5 nm</td><td colspan="3"></td></tr>
<tr><td>OPM</td><td colspan="2">Measurement accuracy</td><td colspan="3">±6.5%</td><td colspan="3"></td><td>1550 nm, CW,
–20 dBm</td></tr>
<tr><td rowspan="2">VLD</td><td colspan="2">Center wavelength</td><td colspan="3">650 nm ±15 nm</td><td colspan="3"></td><td rowspan="2">When Option 002 installed</td></tr>
<tr><td colspan="2">Optical output power</td><td colspan="3">–3 ±1.5 dBm</td><td colspan="3"></td></tr>
</table>

Notes:

1. OLS: Optical light source for fiber identification
   OPM: Optical power meter
   VLD: Visible laser diode

2. Note that the measurement port varies according to the measurement wavelength.

Section 11 Maintenance

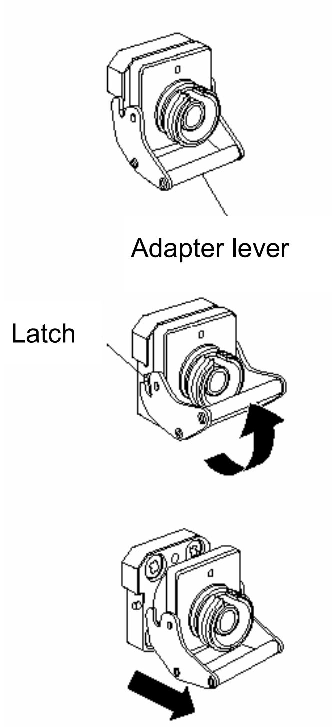
This section describes notes on cleaning and handling to maintain the performance of the MT9080 Series.

11.1 Optical Connector/Optical Adapter Cleaning

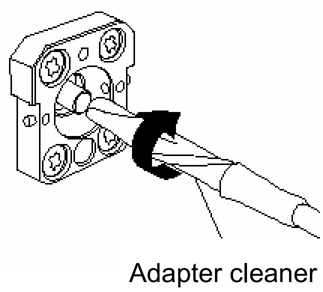
Cleaning the MT9080 Series Connector Ferrule End Surface

Use an MT9080 Series dedicated adapter cleaner product to clean the ferrule inside the MT9080 Series measurement port. The ferrule should be cleaned periodically. Although the FC adapter is described as the example, clean other adapters according to the same methods and steps.

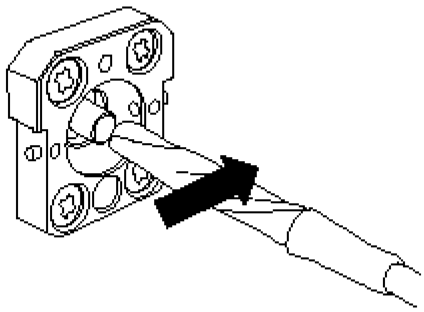
(1) Raise the adapter lever and check that the latch is removed then gently pull the adapter out straight towards you.



(2) Press the adapter cleaner soaked with alcohol into the ferrule end surface and sides to clean.



(3) Press the tip of a new adapter cleaner not soaked in alcohol into the ferrule end surface then wipe in one direction 2 to 3 times to finish. (Dust and dirt in the alcohol may remain on the ferrule end surface if cleaning is not finished properly.)



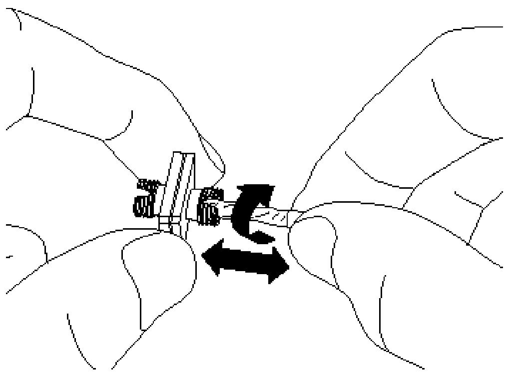
(4) Clean the adapter interior with the adapter cleaner. (Refer to optical adapter cleaning described below.)

(5) Attach the adapter in the reverse order of (1). Be careful not to scratch the ferrule end surface at this time.

Cleaning Optical Adapter

Use an MT9080 Series dedicated adapter cleaner product to clean the optical fiber cable optical adapter. Although the FC adapter is described as the example, clean other adapters according to the same methods and steps. In addition, clean the adapter removed at cleaning of the ferrule end surface installed in the MT9080 Series according to the following steps.

Insert the adapter cleaner into the split sleeve of the adapter then rotate in one direction while moving it back and forth.



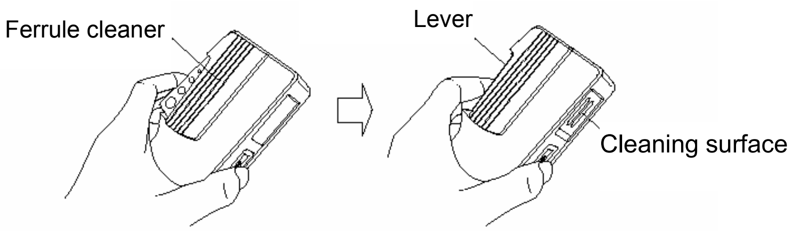
Note:

Check the ferrule diameter and use a cleaner exclusively for the ϕ 1.25-mm or ϕ 2.5-mm adapter.

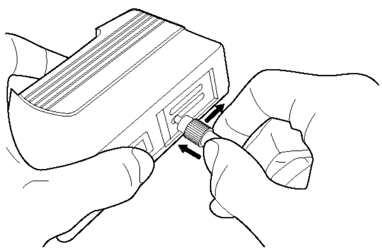
Cleaning the Optical Fiber Cable Ferrule End Surface

Use an MT9080 Series dedicated ferrule cleaner to clean the cable end ferrule. Although the FC adapter is described as the example, clean other adapters according to the same methods and steps.

(1) Pull the ferrule cleaner lever to expose the cleaning surface.



(2) Keep the lever in this state then press the optical connector ferrule end surface into the cleaning surface then rub in one direction.



General Notes on Cleaning

(1) Do not clean with a used ferrule cleaner.

(2) Do not finish cleaning with a swab as the swab fibers may adhere.

(3) Cap the cleaned connector.

WARNING

Check that no light is being emitted when cleaning and checking the ferrule end surface.

CAUTION

The MT9080 Series may not satisfy performance when used with dirt or dust adhering to the ferrule end surface. In addition, the connected fiber and/or the MT9080 Series ferrule end surface may be burned if high output light is emitted in this state. Fully clean the fiber to be connected and the MT9080 Series ferrule end surface before measurement.

11.2 Notes on Storage

Note the following when storing for long periods.

(1) Remove any dust or dirt adhering to the MT9080 Series before storage.

(2) Avoid storing in locations with high temperatures above 60°C, low temperatures below –20°C or in humidity above 85%.

(3) Avoid storing in locations where there is direct sunlight or in dusty locations.

(4) Avoid storing in locations where water droplets are adhering or where exposed to active gases.

(5) Avoid storing in locations that may oxidize the MT9080 Series or in locations with severe vibrations.

(6) Remove the battery pack from the MT9080 Series and store separately.

Recommended Storage Conditions

It is recommended to store the MT9080 Series in the following conditions, as well as to satisfy the general notes described above.

(1) Temperature: 5 to 30°C

(2) Humidity: 40 to 75%

(3) Locations where there are few daily temperature or humidity changes

11.3 Transporting

Use the packaging materials that were packed with the MT9080 Series at purchase and repack for transport. Repack according to procedures (3) and (4) as shown below when packaging materials are not stored.

The following shows the steps for repacking.

(1) Clean around the MT9080 Series with a dry cloth.

(2) Check whether the screws are loose or have dropped out.

(3) Protect the parts where there are protrusions or which warp easily and wrap the MT9080 Series with a polyester sheet.

(4) Place the wrapped MT9080 Series into a cardboard box then close it with adhesive tape along the seam. Further store it in a wooden box as per transport distance or steps, etc.

Appendix

Appendix A Specifications

Item	Specifications	Remarks
Model name, unit name	MT9080A ACCESS Master MT9080B ACCESS Master MT9080C ACCESS Master MT9080D ACCESS Master MT9080E ACCESS Master MT9080F ACCESS Master	Refer to the MT9080 Series ACCESS Master IP Network Connectivity Check Function Operation Manual for the specifications of the IP test function.
Wavelength MT9080A MT9080B MT9080C MT9080D MT9080E MT9080F	 1310 ±30 nm 1550 ±30 nm 1645 to 1655 nm* 1310/1550 ±30 nm 1550 ±30 nm/1645 to 1655 nm* 1310/1550 ±30 nm/1645 to 1655 nm*	Temperature: 25°C, Pulse width: 1 μs * Wavelength range for 20 dB lower than the peak value. Peak value + 15 dB or less.
Fiber under test	10/125 μm single mode fiber (ITU-T G.652)	
Optical connector	• LC: Option 33 • FC: Option 37 • ST: Option 38 • DIN: Option 39 • SC: Option 40 • HMS-10/A: Option 43 PC type • FC-APC: Option 025 • SC-APC: Option 026 • HRL-10: Option 047 APC type	One specified connection is supplied. Can be replaced by the user. Factory option
Automatic measurement (Note)		
Measurement item	Total loss, total return loss, or average loss Distance, splice loss, return loss, or reflectance, and total return loss or average loss of each event (Table display)	
Threshold value		
Slice loss	0.01 to 9.99 dB (0.01 dB steps)	
Return loss	20.0 to 60.0 dB (0.1 dB steps)	
Far end of fiber	1 to 99 dB (1 dB steps)	
No. of detected events	Up to 99 events	
Auto setting	Distance range, pulse width, the number of times of averaging (time)	
Connection check	Check the connection status of the mouth connector.	
Communication light check	Check that the connection light in the test optical fiber is –40 dBm or more.	

Note:

The automatic measurement is an auxiliary function to facilitate measurement operations, and does not assure any detected results. As there may be a case of miss detection, be sure to check waveform data as well for final judgment of measured results.

Item	Specifications	Remarks
Manual measurement Measurement item Real time sweeping	 Loss and distance between any two points, loss per unit length between two points, splice loss, return loss or reflection Sweeping time: 0.2 seconds or less	 With distance range = 50 km, full scale, Loss mode [2PA], at room temperature, 25-km fiber connected
OTDR (Fault Locate)	Events detected as a failure are displayed sequentially from the first possible event. The distance of the possible event point, total loss or splice loss, and event type are displayed at the upper right of the wavelength display screen.	IOR = 1.500000
Distance range	0.5/1/2.5/5/10/25/50 km	IOR = 1.500000
Pulse width	 3 ns: No specification 20 ns: ±25% 50 ns: ±23% 100 ns: ±16% 200 ns: ±10% 500 ns: ±10% 1 μs: ±10% 2 μs: ±10%	
Dynamic range (S/N = 1) MT9080A MT9080B MT9080C MT9080D MT9080E MT9080F	 26.5 dB (1.31 μm) 25 dB (1.55 μm) 22 dB (1.65 μm) 26/24.5 dB (1.31/1.55 μm) 24.5/22 dB (1.55/1.65 μm) 25.5/24/22 dB (1.31/1.55/1.65 μm)	Temperature: 25°C, Pulse width: 2 μs, Distance range: 50 km, Averaging time: 180 sec. At 1.65 μm: With background light, 1.31/1.55 μm – 19 dBm CW light
Dead zone Back-scattered light Fresnel reflection	 1.31 μm: ≤7.5 m 1.55 μm: ≤8.5 m 1.65 μm: ≤11 m 1.31 μm: ≤1 m 1.55 μm: ≤1 m 1.65 μm: ≤1 m	Temperature: 25°C, Pulse width: 20 ns, Return loss: 40 dB, Deviation: ±0.5 dB Temperature: 25°C, Pulse width: 3 ns, Return loss: 40 dB The width for 1.5 dB lower than the peak value of the reflected waveform
Marker resolution	0.05 to 100 m	IOR = 1.500000
Sampling resolution	0.05 to 10 m	IOR = 1.500000
Number of sampling points	Normal: 5001 High density: 20001 or 25001*	* Either value is automatically selected depending on the distance range.
Vertical scale	0.05, 0.125, 0.25, 0.5, 1.25, 2.5, 5, 6.5 dB/div	

Item	Specifications	Remarks
IOR settings	1.000000 to 1.999999 (0.000001 steps)	
Distance measurement accuracy	± 1 m ±3 × measured distance × 10^{-5} ± marker resolution	
Loss measurement accuracy (linearity)	±0.05 dB/dB or ±0.1 dB (whichever is greater)	
Return loss measurement accuracy	±2 dB	
OTDR pulse optical attenuation level setting function	This function attenuates the peak power of the optical pulse output during OTDR measurement.	• When the attenuation value is changed greater, the optical pulse may not be output for the range of several steps. • The specifications of wavelength, dynamic range, etc., are not assured during optical output attenuation.
Optical light source (OLS) for fiber identification		
Applicable fiber	SM fiber (ITU-T G.652), PC type	
Optical connector	Shared with OTDR (same port)	
Light emission element	FP-LD	
Central wavelength	1310 ±30 nm (MT9080A/D/F) 1550 ±30 nm (MT9080B/D/E/F) 1650 ±5 nm (MT9080C/E/F)	25°C, 270 Hz
Optical output power	–8 dBm or more	Temperature: 25°C, SM fiber length: 2 m, Modulation light @270 Hz, Averaged power with 50% duty Operating temperature range for 1.65 μm wavelength of the MT9080C/E/F: 0 to +35°C
Optical output waveform	270 Hz/1 kHz/2 kHz (Modulation light is square wave) Modulated frequency: 270 Hz/1 kHz/2 kHz ± 1.5%	
Warm-up time	10 minutes (after turning optical output On)	
Laser safety level	21CFR Class I, IEC Pub 60825-1 Class 1	

Item	Specifications	Remarks
Optical power meter (OPM) function		
Applicable fiber	SM fiber (ITU-T G.652)	
Wavelength setting	MT9080A/B/D (1310/1550 nm port): 1310/1550/1625/1650 nm MT9080C/E/F (1310/1550 nm port): 1310/1550/1625 nm (Range: 1280 to 1625 nm) MT9080C/E/F (1650 nm port): 1650 nm (Range: 1650 ±5 nm)	
Optical connector	Shared with OTDR	
Optical power measurement range	–50 to –5 dBm (peak power) Wavelength: 1550 nm Absolute maximum rated input: +10 dBm	
Measurement accuracy	±6.5% (–20 dBm, CW light, 23°C ±2°C, after executing zero offset, Wavelength: 1550 nm)	
Other functions	• Waveform storage: SR-4731 format • Horizontal offset setting (zero cursor setting) • Internal memory • Language display: English/Japanese switchable by system configuration • Power-saving setting function Backlight off: Disable/1 to 99 min. Shutdown: Disable/1 to 99 min. • Two-waveform display function • Calendar and watch • Distance unit setting: km, kf, mi, f, m • Title entry: 32 characters max. • Battery indication • Auto dummy fiber setting function • Continuous light emitting function • Buzzer setting	
Display	6.2-inch monochrome LCD (Option 04, 640 × 480 dots, with backlight, semi-transparent)	
Interface	USB 1.1 Type A × 1 (memory) Type B × 1 (USB mass storage class; the internal memory of the MT9080 series product can be read/written as a PC disk drive by connecting with the PC via a USB cable.)	
Laser safety	21CFR Class I IEC Pub 60825-1 Class 1	

Item	Specifications	Remarks
Power supply	DC: 10.8 to 15 V AC: Rating: 100 to 240 V Allowable input voltage range: 90 to 264 V Rated frequency: 50/60 Hz (when using the dedicated AC adapter) Battery pack: DR15SBA available	
Power consumption	20 W max. (when charged) Standard 5 W (with backlight Off, sweeping halted)	
Battery operating time	Continuous operating time: 6.5 hours (typical)	* With backlight Off, sweeping halted, at 25°C
Battery charging time	3 hours or shorter	With power Off, temperature range: 0 to +30°C
Dimensions (excluding protrusion)	254 (W) × 162 (H) × 61 (D) mm	
Mass	2 kg or less 2.2 kg or less	Main body only, excluding options Including battery pack, excluding options
Environmental conditions		
Operating temperature, humidity	0 to +40°C, ≤85% (≤80% when using AC adapter) During battery charge: 0 to 30°C (power Off)	No condensation
Storage temperature, humidity	–20 to +60°C, ≤85%	
Vibration	Conforms to MIL-T-28800E Class 3	
EMC	EN61326: 1997/A2: 2004 (Class A) EN61326: 1997/A2: 2004 (Annex A)	

Item	Specifications	Remarks
Model name, unit name	MT9081A/A1 ACCESS Master MT9081B/B1 ACCESS Master MT9081C/C1 ACCESS Master MT9081D/D1 ACCESS Master MT9081E/E1 ACCESS Master MT9081F/F1 ACCESS Master	Refer to the MT9080 Series ACCESS Master IP Network Connectivity Check Function Operation Manual for the specifications of the IP test function.
Wavelength MT9081A/A1 MT9081B/B1 MT9081C/C1 MT9081D/D1 MT9081E/E1 MT9081F/F1	 1310 ±30 nm 1550 ±30 nm 1645 to 1655 nm* 1310/1550 ±30 nm 1550 ±30 nm/1645 to 1655 nm* 1310/1550 ±30 nm/1645 to 1655 nm*	Temperature: 25°C, Pulse width: 1 μs * Wavelength range for 20 dB lower than the peak value. Peak value + 15 dB or less.
Fiber under test	10/125 μm single mode fiber (ITU-T G.652)	
Optical connector	• LC: Option 033 • FC: Option 037 • ST: Option 038 • DIN: Option 039 • SC: Option 040 • HMS-10/A: Option 043 PC type • FC-APC: Option 025 • SC-APC: Option 026 • HRL-10: Option 047 APC type	One specified connection is supplied. Can be replaced by the user. Factory option
Automatic measurement (Note) Measurement item	 Total loss, total return loss, or average loss Distance, splice loss, return loss or reflectance, and total return loss or average loss of each event (Table display) The reflection is the value inverting the positive/negative sign of the return loss.	
Threshold value Slice loss Return loss Far end of fiber	 0.01 to 9.99 dB (0.01 dB steps) 20.0 to 60.0 dB (0.1 dB steps) 1 to 99 dB (1 dB steps)	
No. of detected events	Up to 99 events	
Auto setting	Distance range, pulse width, the number of times of averaging (time)	
Connection check	Check the connection status of the mouth connector.	
Communication light check	Check that the connection light in the test optical fiber is –40 dBm or more.	

Note:

The automatic measurement is an auxiliary function to facilitate measurement operations, and does not assure any detected results. As there may be a case of miss detection, be sure to check waveform data as well for final judgment of measured results.

Item	Specifications	Remarks
Manual measurement		
Measurement item	Loss and distance between any two points, loss per unit length between two points, splice loss, return loss or reflection The reflection is the value inverting the positive/negative sign of the return loss.	
Real time sweeping	Sweeping time: 0.2 seconds or less	With distance range = 50 km, full scale, Loss mode [2PA], at room temperature, 25-km fiber connected
OTDR (Fault Locate)	Events detected as a failure are displayed sequentially from the first possible event. The distance of the possible event point, total loss or splice loss, and event type are displayed at the upper right of the wavelength display screen.	IOR = 1.500000
Distance range	0.5/1/2.5/5/10/25/50/100/200 km	IOR = 1.500000
Pulse width	3 ns: No specification 10 ns: ±35% 20 ns: ±35% 50 ns: ±23% 100 ns: ±16% 200 ns: ±10% 500 ns: ±10% 1 μs: ±10% 2 μs: ±10% 4 μs: ±10% 10 μs: ±10% 20 μs: ±10%	
Dynamic range (S/N = 1)		Temperature: 25°C, Pulse width: 2 μs, Distance range: 100 km, Averaging time: 180 sec. At 1.65 μm: With background light, 1.31/1.55 μm – 19 dBm CW light
MT9081A/A1	38.5 dB (1.31 μm)	
MT9081B/B1	37 dB (1.55 μm)	
MT9081C/C1	33.5 dB (1.65 μm)	
MT9081D/D1	38/36.5 dB (1.31/1.55 μm)	
MT9081E/E1	36/33.5 dB (1.55/1.65 μm)	
MT9081F/F1	37.5/36/33.5 dB (1.31/1.55/1.65 μm)	
Dead zone		
Back-scattered light	1.31 μm: ≤7.0 m 1.55 μm: ≤8.0 m 1.65 μm: ≤11 m	Temperature: 25°C, Pulse width: 20 ns, Return loss: 40 dB, Deviation: ±0.5 dB
	1.31 μm: ≤5.0 m 1.55 μm: ≤5.5 m 1.65 μm: ≤6.5 m	Temperature: 25°C, Pulse width: 20 ns, Return loss: 55 dB, Deviation: ±0.5 dB

Item	Specifications	Remarks
Dead zone (Cont'd) Fresnel reflection	1.31 μm: ≤1.0 m 1.55 μm: ≤1.0 m 1.65 μm: ≤1.0 m	Temperature: 25°C, Pulse width: 3 ns, Return loss: 40 dB The width for 1.5 dB lower than the peak value of the reflected waveform
Marker resolution	0.05 to 400 m	IOR = 1.500000
Sampling resolution	0.05 to 40 m	IOR = 1.500000
Number of sampling points	Normal: 5001 High density: 20001 or 25001*	* Either value is automatically selected depending on the distance range.
Vertical scale	0.05, 0.125, 0.25, 0.5, 1.25, 2.5, 5, 6.5 dB/div	
IOR settings	1.000000 to 1.999999 (0.000001 steps)	
Distance measurement accuracy	± 1 m ±3 × measured distance × 10^{-5} ± marker resolution	
Loss measurement accuracy (linearity)	±0.05 dB/dB or ±0.1 dB (whichever is greater)	
Return loss measurement accuracy	±2 dB	
OTDR pulse optical attenuation level setting function	This function attenuates the peak power of the optical pulse output during OTDR measurement.	• When the attenuation value is changed greater, the optical pulse may not be output for the range of several steps. • The specifications of wavelength, dynamic range, etc., are not assured during optical output attenuation.
Optical light source (OLS) for fiber identification Applicable fiber Optical connector Light emission element Central wavelength Optical output power Optical output waveform Warm-up time Laser safety level	 SM fiber (ITU-T G.652), PC type Shared with OTDR (same port) FP-LD 1310 ±30 nm (MT9081A/A1/D/D1/F/F1) 1550 ±30 nm (MT9081B/B1/D/D1/E/E1/F/F1) 1650 ±5 nm (MT9081C/C1/E/E1/F/F1) –5 dBm or more CW/270 Hz/1 kHz/2 kHz (Modulation light is square wave) Modulated frequency: 270 Hz/1 kHz/2 kHz ± 1.5% 10 minutes (after turning optical output On) 21CFR Class I, IEC Pub 60825-1 Class 1	 25°C, CW Temperature: 25°C, SM fiber length: 2 m, CW

Item	Specifications	Remarks
Optical power meter (OPM) function		
Applicable fiber	SM fiber (ITU-T G.652)	
Wavelength setting	MT9081A/A1/B/B1/D/D1 (1310/1550 nm port): 1310/1550/1625/1650 nm MT9081C/C1/E/E1/F/F1 (1310/1550 nm port): 1310/1550/1625 nm (Range: 1280 to 1625 nm) MT9081C/C1/E/E1/F/F1 (1650 nm port): 1650 nm (Range: 1650 ±5 nm)	
Optical connector	Shared with OTDR	
Optical power measurement range	–50 to –5 dBm (peak power) Wavelength: 1550 nm Absolute maximum rated input: +10 dBm	
Measurement accuracy	±6.5% (–20 dBm, CW light, 23°C ±2°C, after executing zero offset, Wavelength: 1550 nm)	
Other functions	• Waveform storage: SR-4731 format • Horizontal offset setting (zero cursor setting) • Internal memory • Language display: English/Japanese switchable by system configuration • Power-saving setting function Backlight off: Disable/1 to 99 min. Shutdown: Disable/1 to 99 min. Power-saving in OTDR: High/Low/None • Two-waveform display function • Calendar and watch • Distance unit setting: km, kf, mi, f, m • Title entry: 32 characters max. • Battery indication • Auto dummy fiber setting function • Continuous light emitting function • Buzzer setting	
Display	6.2-inch monochrome LCD panel (MT9081x1, 640 × 480 dots, with backlight, semi-transparent) 6.2-inch color TFT-LCD panel (MT9081x1, 640 × 480 dots, with backlight, transparent)	
Interface	USB 1.1 Type A × 1 (memory) Type B × 1 (USB mass storage class; the internal memory of the MT9081x/x1 Series product can be read/written as a PC disk drive by connecting with the PC via a USB cable.)	

Item	Specifications	Remarks
Laser safety	21CFR Class I IEC Pub 60825-1 Class 1	
Power supply	DC: 10.8 to 15 V AC: Rating: 100 to 240 V Allowable input voltage range: 90 to 264 V Rated frequency: 50/60 Hz (when using the dedicated AC adapter) Battery pack: DR15SBA available	
Power consumption	20 W max. (when charged) Standard 5 W (with backlight Off, sweeping halted)	
Battery operating time	Continuous operating time: 6.5 hours (typical)	* With backlight Off, sweeping halted, at 25°C, monochrome LCD panel
Battery charging time	3 hours or shorter	With power Off, temperature range: 0 to +30°C
Dimensions (excluding protrusion)	254 (W) × 162 (H) × 61 (D) mm	
Mass	2 kg or less 2.2 kg or less	Main body only, excluding options Including battery pack, excluding options
Environmental conditions		
Operating temperature, humidity	0 to +40°C, ≤85% (≤80% when using AC adapter) During battery charge: 0 to 30°C (power Off)	No condensation
Storage temperature, humidity	–20 to +60°C, ≤85%	
Vibration	Conforms to MIL-T-28800E Class 3	
EMC	EN61326: 1997/A2: 2004 (Class A) EN61326: 1997/A2: 2004 (Annex A)	

Battery pack (DR15SBA)

Item	Specifications	Remarks
Battery type	Ni-MH secondary battery	
Voltage, capacity	10.8 VDC, 2100 mAh	
Dimensions, mass	145 (W) × 52.8 (H) × 19.3 (D) mm, 305 g (Typ.)	
Operating temperature	Charging: 0 to +45°C Discharging: –20 to +50°C Storage: –20 to +35°C	

AC adapter (SA165A-1250V-3)

Item	Specifications	Remarks
AC rated input	100 to 240 VAC, 50/60 Hz	
DC rated output	12 VDC, 3 A	
Dimensions, mass	122 (L) × 60 (W) × 34 (H) mm, 305 ±5 g	
Environmental conditions	Operating: 0 to +40°C, 20 to 80%RH Storage: –20 to +80°C, 10 to 95%RH	

Visible laser source

Item	Specifications	Remarks
Central wavelength	650 nm ±15 nm	At 25°C
Optical output	–3 ±1.5 dBm	
Optical output fiber	10/125 μm single mode (ITU-T G.652)	
Output connector	Same as OTDR	
Optical safety	IEC60825-1 Class 1M, 21CFR Class II	
Environmental conditions	Same as those for the MT9080 Series.	

When using an MT9080 Series unit with the hardware version 2 or later, both the visible light source function and IP network connectivity check function can be installed together. Refer to Section 8.4 “Self Test Function” for checking the hardware version.

Parts and accessories

Item	Specifications	Model Name
MT9080 Series Operation Manual (CD version)		W2487AE (Note 1)
FC-type adapter		J0057
Optical fiber cable with FC-PC at both ends for SM fiber		J0635× (Note 2)
Replaceable optical FC connector		J0617B
Replaceable optical ST connector		J0618D
Replaceable optical DIN connector		J0618E
Replaceable optical HMS-10/A connector		J0618F
Replaceable optical SC connector		J0619B
Replaceable optical LC connector		J1270
Ferrule cleaner	CLETOP type (one)	Z0282
Replacement reel for ferrule cleaner	Six reel / pack	Z0283
Adapter cleaner	Stick type (200 pcs./set)	Z0284
External charger	Battery holders: 2	Z0740
Battery pack	Ni-MH secondary battery, 10.8 VDC, 2100 mAh	DR15SBA
AC adapter	100 to 240 VAC, 50/60 Hz, 12 VDC, 3 A	SA165A-1250V-3
Soft carrying case	An MT9080 Series unit with Option 10 attached cannot be stored.	B0547
Soft carrying case	Business case type	B0548
Hard carrying case		B0549
Front protective cover	Used for Option 10 protective cover only.	B0550
MT9080 Series Operation Manual (printed version)		W2462AE
Thermal printer (* AC adapter, AC cord, battery pack, and battery pack charger are sold separately.)	Printing width: 72 mm Printing speed: Approx. 6 sec. Operating temperature: 0 to 40°C Dimensions: 119 (W) × 77 (H) × 174 (D) mm	BL-80RII
AC adapter (* AC cord is sold separately.)	For BL-80RII, 100 to 240 VAC	BL-100W
AC cord	For BL-80RII	AC-100J (For Japan) AC-100E (For Europe) AC-100U (For US)
Battery pack	For BL-80RII	UR-121
Battery pack charger	For BL-80RII, 100 to 240 VAC	NC-LSC05
Recoding sheet	For BL-80RII, 80 mm × 30 m (10 rolls/set)	BL-80-30

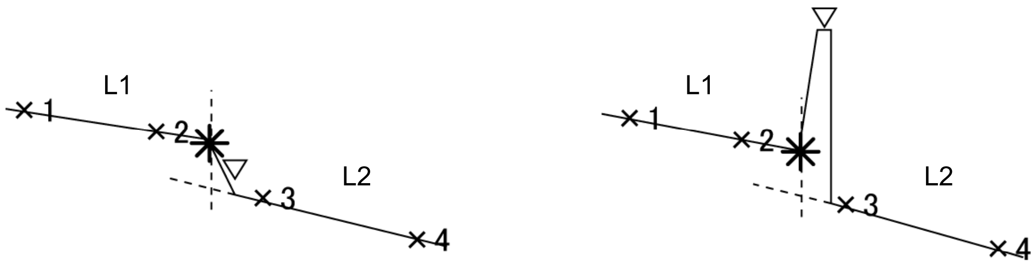
Notes:

1. Also includes the MT9080 Series ACCESS Master IP Network Connectivity Check Function Operation Manual.

2. Apply A, B, or C to “×” according to the length of the code: A for 1 m, B for 2 m, and C for 3 m.

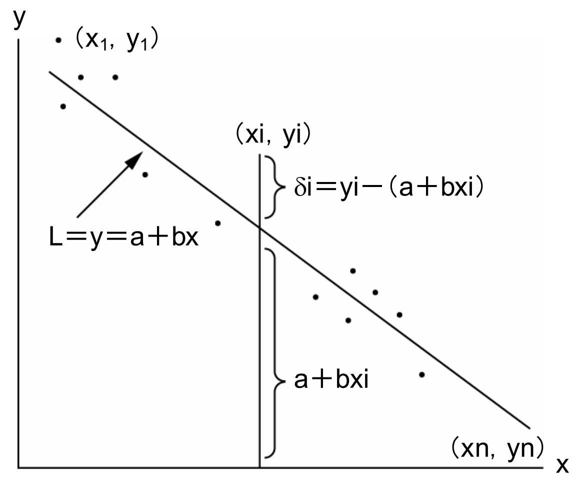
Appendix B Linear Least Square Approximation Method

When splice loss is measured, assume two lines, L1 and L2, from the measurement data and obtain the loss as shown in the figure below.



There are two methods for determining these lines: the LSA and 2PA methods.
Of these methods, this section explains the LSA (Least Square Approximation) method.

The Least Square Approximation method obtains a straight line such that the variation of distances from all the measurement data points that exist between the markers to the straight line is a minimum.



As shown in the figure above, assume the straight line L from which the variation of distances from n data points (x_1, y_1), (x_2, y_2), ... (x_n, y_n) becomes minimum as $y = a + bx$. The straight line L is determined by finding the deviation from each point (δ1, δ2, δ3, ...) to the straight line L as a value including the variables a and b and finding the variables a and b so that the sum E of the squares of the deviation of points δi becomes minimum.

$$\delta i = yi - (a + bxi)$$

$$E = \sum_{i=1}^{n} \delta i^2 = (y_1 - a - bx_1)^2 + (y_2 - a - bx_2)^2 + \ldots + (y_n - a - bx_n)^2$$

In the above equation, the necessary and sufficient condition to minimize E is:

$$\frac{\partial E}{\partial a} = 0, \quad \frac{\partial E}{\partial b} = 0$$

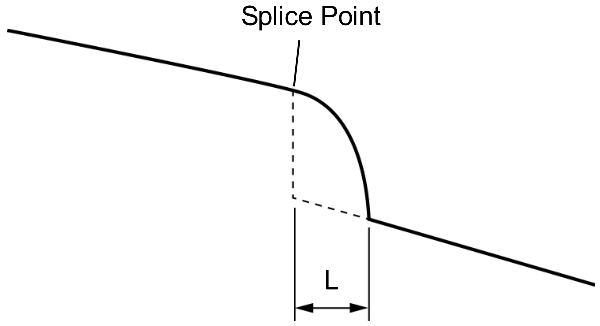
When this equation is solved, the variables a and b can be found as shown below.

$$a = \frac{\bar{y}\sum_{i=1}^{n}(xi)^2 - \bar{x}\sum(xiyi)}{\sum_{i=1}^{n}(xi)^2 - n(\bar{x})^2}, \quad b = \frac{\sum_{i=1}^{n}(xiyi) - n\bar{x}\,\bar{y}}{\sum_{i=1}^{n}(xi)^2 - n(\bar{x})^2}$$

where, $\bar{x} = \frac{1}{n}\sum_{i=1}^{n}(xi)$, $\bar{y} = \frac{1}{n}\sum_{i=1}^{n}(yi)$

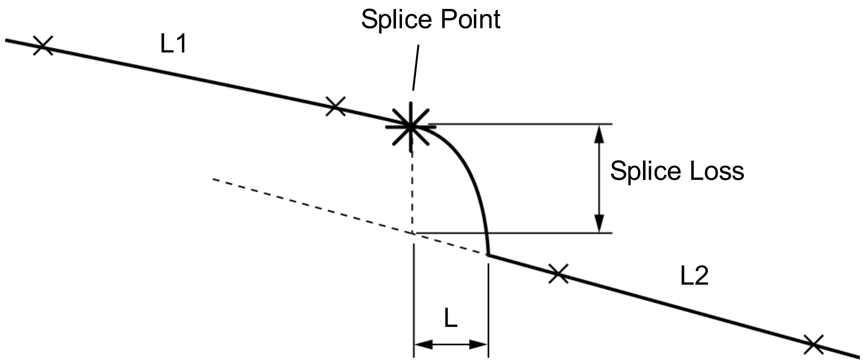
Appendix C Splice Loss Measurement Principle

The trace waveform at the splice point should be displayed as indicated by the dotted line in the figure below, but is actually displayed as indicated by the solid line. The reason why section L is generated is because the waveform input to this unit shows a sharp falling edge at the splice point so that the circuit cannot respond correctly. Section L increases as the pulse width increases.



Therefore, the splice loss cannot be measured correctly in the Loss mode. In the Splice & Return Loss mode, two markers are set on each side of the splice point. The splice loss is calculated as shown below.

Draw Lines L1 and L2 as shown below. The part of the straight line immediately after the splice point is the forward projection of straight line L2. The splice loss is found by dropping a perpendicular from the splice point to this projection of L2 and measuring the level difference between the splice point and the intersection.



Appendix D   Return Loss Measurement Principle

The return loss R is found from the following equation.

$$R = -(10\log_{10}\mathrm{bsl} + 10\log_{10}(10^{L/5} - 1))$$

$$\mathrm{bsl} = S \cdot \alpha_R \cdot V \cdot \frac{W}{2}$$

$$S = K \cdot \frac{N1^2 - N2^2}{N1^2}$$

$$V = \frac{C}{N_e}$$

W (sec): Currently set pulse width
L: Difference of levels between * and ∇ markers
$BSL = 10\log_{10}\mathrm{bsl}$: Back-scattered light level
S: Back-scattered coefficient
αR: Rayleigh scattering loss (Np/m)
$= 0.23026 \times 10^{-3} \times RSL$
RSL: Rayleigh scattering loss (dB/km)
V: Group velocity in optical fiber
K: Available constant of optical fiber
N1: Index of refraction of optical fiber core
N2: Index of refraction of optical fiber cladding
Ne: Effective group index of refraction of optical fiber
C (m/s): Speed of light (3×10^8)

Appendix E Total Return Loss Measurement Principle

Use the following equation to obtain the total loss or TRL, in dB.

$$\begin{aligned}
\mathrm{TRL} &= -10\log_{10}\frac{\mathrm{ER}}{\mathrm{Ein}} \\
&= -10\log_{10}\frac{\int_0^\infty \mathrm{P(t)dt}}{\mathrm{P_0W}} \\
&= -10\log_{10}\frac{\mathrm{bsl}\int_0^\infty \mathrm{P'(t)dt}}{\mathrm{W}}\text{, where } \mathrm{P'(t)} = \frac{\mathrm{P(t)dt}}{\mathrm{P_o bsl}} \\
&= -10\log_{10}\mathrm{bsl} + 10\log_{10}\mathrm{W} - 10\log_{10}\int_0^\infty \mathrm{P(t)dt}
\end{aligned}$$

ER: Reflected light energy
Ein: Incident light energy
P(t): OTDR measurement power
P0: Incident light pulse peak power at t = 0
W: Incident light pulse width
$10\log_{10}$bsl: Back-scattered light level
$\int_0^\infty$ P'(t)dt : Measured waveform normalized and integrated over the back-scattered light intensity at the incident end.

Reference:

bsl is determined according to the fiber, wavelength, and pulse width. Typical values for 1.3 μm single mode optical fiber are shown below.

Pulse Width	Back-Scattered Light Level		
	λ = 1.31 μm	λ = 1.55 μm	λ = 1.65 μm
100 ns	–60	–62.5	–63.5
1 μs	–50	–52.5	–53.5
10 μs	–40	–42.5	–43.5

Appendix F Settings at Factory Shipment

Settings for the MT9080 Series at factory shipment are shown below.

Items shown in Table F-1 "Factory settings (items initialized)" are initialized when the F2 (Recall DFN) key is pressed on the Measurement Condition screen, and then press the f1 (Factory Default) key.

Table F-1 Factory settings (items initialized)

Item	Set value
Setting Mode	[Auto] for all items
Event	[Auto Search]
Wavelength	First wavelength (the shortest wavelength)
Distance Range	[Auto]
Pulse Width	[Auto]
IOR	1310 nm: 1.465500 1550 nm: 1.466100 1650 nm: 1.466500
Averaging	[Auto]
Attenuation	[Auto]
Averaging Unit	[Count]
Backscatter Level	0.00 dB
Sampling Mode	[Normal]
Auto Detect	
Splice Loss	0.30 dB
Return Loss	25.0 dB
Fiber End	5 dB
Go/No-Go	[None] for all items
Active Fiber Check	[Off]
Connection Check	[Off]
Automatic Dummy Fiber (No.)	[None]
Attenuation Level	0
Continuous Pulse Luminescence	[Off]
Title	[Anritsu]
Header	
Data Flag	[BC (built)]
Other than Data Flag	Left blank

Items shown in Table F-2 “Factory settings (items not initialized)” are not initialized when the F2 (Recall DFN) key is pressed on the Measurement Condition screen, and then press the f1 (Factory Default) key.

Table F-2 Factory settings (items not initialized)

Item	Set value
Buzzer	[On]
Printer	BL-80RII
Feed Paper	On
Distance Unit	[km]
Format of Date	[Year-Month-Date]
Date on Title Bar	[Display]
Time on Title Bar	[Display]
Name on Title Bar	[Screen & File Name]
Color Pallet	Sunflower
Auto Backlight Off	[None]
Auto Power Off	[None]
Reflective Type	[Return Loss]
Auto Result Display	[Total Return Loss]
Media	Internal memory
Path	INTMEM:/
File Name	NEW001.SOR (“001” part is subject to auto increment function.)
Increment Step	+1
Automatic Save	[Off:]
Log file name of automatic save	AUTOLOG.LOG
OTDR mode	OTDR (Fault Locate)
Optical Power Meter: Wavelength	1310 nm
Light Source: Wavelength	First wavelength (shortest wavelength)
Light Source: Modulation	270 Hz
Background light	Low
File Type (for screen image save)	PNG
File Name (for screen image save)	NEW001.PNG (“001” part is subject to auto increment function.)
Increment Step (for screen image save)	+1

Appendix G Software License

The MT9080 Series contains the software shown in the table below.

Refer to our website for more detailed information on the MT9080 Series.
Anritsu Corporation Website: http://www.anritsu.co.jp

The package software on the table below is not covered in the Software License Agreement of Anritsu Corporation.

Package Name	License	Remarks
linux-2.4.18-mvl30	GPL (*1)	
modutil	GPL (*1)	
busybox	GPL (*1)	
e2fsprogs	GPL (*1)	
glibc	LGPL (*2)	
mount	GPL (*1)	
libgcc1	GPL (*1)	In addition to the permissions in the GNU General Public License, the Free Software Foundation gives you unlimited permission to link the compiled version of this file into combinations with other programs, and to distribute those combinations without any restriction coming from the use of this file. (The General Public License restrictions do apply in other respects; for example, they cover modification of the file, and distribution when not linked into a combine executable.)
libstdc++5	LGPL (*2)	
mtd-utils	GPL (*1)	
sh-ipl+g	GPL (*1)	
sh-lilo	GPL (*1)	
murasaki-0.7.12	GPL (*1)	
microwindows-0.90	MPL (*3)	
flnx-0.18	LGPL+ exceptions (*4)	[program/widget] is based in part on the work of the FLTK project (http://www.fltk.org).
dosfstools-2.8	GPL (*1)	
busybox-1.0-pre9	GPL (*1)	
FreeWnn-Server-1.10	GPL (*1)	
gerodic-1.00	Others (*5)	
fping	GPL (*1)	Used by the IP network connectivity check function option.
pppd	GPL (*1)	Used by the IP network connectivity check function option.

(*1) GPL:

GNU GENERAL PUBLIC LICENSE
Version 2, June 1991

Preamble

The licenses for most software are designed to take away your freedom to share and change it. By contrast, the GNU General Public License is intended to guarantee your freedom to share and change free software--to make sure the software is free for all its users. This General Public License applies to most of the Free Software Foundation's software and to any other program whose authors commit to using it. (Some other Free Software Foundation software is covered by the GNU Library General Public License instead.) You can apply it to your programs, too.

When we speak of free software, we are referring to freedom, not price. Our General Public Licenses are designed to make sure that you have the freedom to distribute copies of free software (and charge for this service if you wish), that you receive source code or can get it if you want it, that you can change the software or use pieces of it in new free programs; and that you know you can do these things.

To protect your rights, we need to make restrictions that forbid anyone to deny you these rights or to ask you to surrender the rights. These restrictions translate to certain responsibilities for you if you distribute copies of the software, or if you modify it.

For example, if you distribute copies of such a program, whether gratis or for a fee, you must give the recipients all the rights that you have. You must make sure that they, too, receive or can get the source code. And you must show them these terms so they know their rights.

We protect your rights with two steps: (1) copyright the software, and (2) offer you this license which gives you legal permission to copy, distribute and/or modify the software.

Also, for each author's protection and ours, we want to make certain that everyone understands that there is no warranty for this free software. If the software is modified by someone else and passed on, we want its recipients to know that what they have is not the original, so that any problems introduced by others will not reflect on the original authors' reputations.

Finally, any free program is threatened constantly by software patents. We wish to avoid the danger that redistributors of a free program will individually obtain patent licenses, in effect making the program proprietary. To prevent this, we have made it clear that any patent must be licensed for everyone's free use or not licensed at all.

The precise terms and conditions for copying, distribution and modification follow.

GNU GENERAL PUBLIC LICENSE
TERMS AND CONDITIONS FOR COPYING, DISTRIBUTION AND MODIFICATION

0. This License applies to any program or other work which contains a notice placed by the copyright holder saying it may be distributed under the terms of this General Public License. The "Program", below, refers to any such program or work, and a "work based on the Program" means either the Program or any derivative work under copyright law: that is to say, a work containing the Program or a portion of it, either verbatim or with modifications and/or translated into another language. (Hereinafter, translation is included without limitation in the term "modification".) Each licensee is addressed as "you".

Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running the Program is not restricted, and the output from the Program is covered only if its contents constitute a work based on the Program (independent of having been made by running the Program). Whether that is true depends on what the Program does.

1. You may copy and distribute verbatim copies of the Program's source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice and disclaimer of warranty; keep intact all the notices that refer to this License and to the absence of any warranty; and give any other recipients of the Program a copy of this License along with the Program.

You may charge a fee for the physical act of transferring a copy, and you may at your option offer warranty protection in exchange for a fee.

2. You may modify your copy or copies of the Program or any portion of it, thus forming a work based on the Program, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:

a) You must cause the modified files to carry prominent notices stating that you changed the files and the date of any change.

b) You must cause any work that you distribute or publish, that in whole or in part contains or is derived from the Program or any part thereof, to be licensed as a whole at no charge to all third parties under the terms of this License.

c) If the modified program normally reads commands interactively when run, you must cause it, when started running for such interactive use in the most ordinary way, to print or display an announcement including an appropriate copyright notice and a notice that there is no warranty (or else, saying that you provide a warranty) and that users may redistribute the program under these conditions, and telling the user how to view a copy of this License. (Exception: if the Program itself is interactive but does not normally print such an announcement, your work based on the Program is not required to print an announcement.)

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Program, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Program, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Program.

In addition, mere aggregation of another work not based on the Program with the Program (or with a work based on the Program) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

3. You may copy and distribute the Program (or a work based on it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you also do one of the following:

a) Accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange; or,

b) Accompany it with a written offer, valid for at least three years, to give any third party, for a charge no more than your cost of physically performing source distribution, a complete machine-readable copy of the corresponding source code, to be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange; or,

c) Accompany it with the information you received as to the offer to distribute corresponding source code. (This alternative is allowed only for noncommercial distribution and only if you received the program in object code or executable form with such an offer, in accord with Subsection b above.)

The source code for a work means the preferred form of the work for making modifications to it. For an executable work, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the executable. However, as a special exception, the source code distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

If distribution of executable or object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place counts as distribution of the source code, even though third parties are not compelled to copy the source along with the object code.

4. You may not copy, modify, sublicense, or distribute the Program except as expressly provided under this License. Any attempt otherwise to copy, modify, sublicense or distribute the Program is void, and will automatically terminate your rights under this License. However, parties who have received copies, or rights, from you under this License will not have their licenses terminated so long as such parties remain in full compliance.

5. You are not required to accept this License, since you have not signed it. However, nothing else grants you permission to modify or distribute the Program or its derivative works. These actions are prohibited by law if you do not accept this License. Therefore, by modifying or distributing the Program (or any work based on the Program), you indicate your acceptance of this License to do so, and all its terms and conditions for copying, distributing or modifying the Program or works based on it.

6. Each time you redistribute the Program (or any work based on the Program), the recipient automatically receives a license from the original licensor to copy,

distribute or modify the Program subject to these terms and conditions. You may not impose any further restrictions on the recipients' exercise of the rights granted herein. You are not responsible for enforcing compliance by third parties to this License.

7. If, as a consequence of a court judgment or allegation of patent infringement or for any other reason (not limited to patent issues), conditions are imposed on you (whether by court order, agreement or otherwise) that contradict the conditions of this License, they do not excuse you from the conditions of this License. If you cannot distribute so as to satisfy simultaneously your obligations under this License and any other pertinent obligations, then as a consequence you may not distribute the Program at all. For example, if a patent license would not permit royalty-free redistribution of the Program by all those who receive copies directly or indirectly through you, then the only way you could satisfy both it and this License would be to refrain entirely from distribution of the Program.

If any portion of this section is held invalid or unenforceable under any particular circumstance, the balance of the section is intended to apply and the section as a whole is intended to apply in other circumstances.

It is not the purpose of this section to induce you to infringe any patents or other property right claims or to contest validity of any such claims; this section has the sole purpose of protecting the integrity of the free software distribution system, which is implemented by public license practices. Many people have made generous contributions to the wide range of software distributed through that system in reliance on consistent application of that system; it is up to the author/donor to decide if he or she is willing to distribute software through any other system and a licensee cannot impose that choice.

This section is intended to make thoroughly clear what is believed to be a consequence of the rest of this License.

8. If the distribution and/or use of the Program is restricted in certain countries either by patents or by copyrighted interfaces, the original copyright holder who places the Program under this License may add an explicit geographical distribution limitation excluding those countries, so that distribution is permitted only in or among countries not thus excluded. In such case, this License incorporates the limitation as if written in the body of this License.

9. The Free Software Foundation may publish revised and/or new versions of the General Public License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns.

Each version is given a distinguishing version number. If the Program specifies a version number of this License which applies to it and "any later version", you have the option of following the terms and conditions either of that version or of any later version published by the Free Software Foundation. If the Program does not specify a version number of this License, you may choose any version ever published by the Free Software Foundation.

10. If you wish to incorporate parts of the Program into other free programs whose distribution conditions are different, write to the author to ask for permission. For software which is copyrighted by the Free Software Foundation, write to the Free Software Foundation; we sometimes make exceptions for this. Our decision will be guided by the two goals of preserving the free status of all derivatives of our free software and of promoting the sharing and reuse of software generally.

NO WARRANTY

11. BECAUSE THE PROGRAM IS LICENSED FREE OF CHARGE, THERE IS NO WARRANTY FOR THE PROGRAM, TO THE EXTENT PERMITTED BY APPLICABLE LAW. EXCEPT WHEN OTHERWISE STATED IN WRITING THE COPYRIGHT HOLDERS AND/OR OTHER PARTIES PROVIDE THE PROGRAM "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE PROGRAM IS WITH YOU. SHOULD THE PROGRAM PROVE DEFECTIVE, YOU ASSUME THE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION.

12. IN NO EVENT UNLESS REQUIRED BY APPLICABLE LAW OR AGREED TO IN WRITING WILL ANY COPYRIGHT HOLDER, OR ANY OTHER PARTY WHO MAY MODIFY AND/OR REDISTRIBUTE THE PROGRAM AS PERMITTED ABOVE, BE LIABLE TO YOU FOR DAMAGES, INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE PROGRAM (INCLUDING BUT NOT LIMITED TO LOSS OF DATA OR DATA BEING RENDERED INACCURATE OR LOSSES SUSTAINED BY YOU OR THIRD PARTIES OR A FAILURE OF THE PROGRAM TO OPERATE WITH ANY OTHER PROGRAMS), EVEN IF SUCH HOLDER OR OTHER PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

END OF TERMS AND CONDITIONS

How to Apply These Terms to Your New Programs

If you develop a new program, and you want it to be of the greatest possible use to the public, the best way to achieve this is to make it free software which everyone can redistribute and change under these terms.

To do so, attach the following notices to the program. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the "copyright" line and a pointer to where the full notice is found.

> <one line to give the program's name and a brief idea of what it does.>
> Copyright (C) <year>   <name of author>
>
> This program is free software; you can redistribute it and/or modify it under the terms of the GNU General Public License as published by the Free Software Foundation; either version 2 of the License, or (at your option) any later version.
>
> This program is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU General Public License for more details.
>
> You should have received a copy of the GNU General Public License along with this program; if not, write to the Free Software Foundation, Inc., 59 Temple Place, Suite 330, Boston, MA 02111-1307 USA

Also add information on how to contact you by electronic and paper mail.

If the program is interactive, make it output a short notice like this when it starts in an interactive mode:

> Gnomovision version 69, Copyright (C) year name of author Gnomovision comes with ABSOLUTELY NO WARRANTY; for details type `show w'.
> This is free software, and you are welcome to redistribute it under certain conditions; type `show c' for details.

The hypothetical commands `show w' and `show c' should show the appropriate parts of the General Public License. Of course, the commands you use may be called something other than `show w' and `show c'; they could even be mouse-clicks or menu items--whatever suits your program.

You should also get your employer (if you work as a programmer) or your school, if any, to sign a "copyright disclaimer" for the program, if necessary. Here is a sample; alter the names:

> Yoyodyne, Inc., hereby disclaims all copyright interest in the program `Gnomovision' (which makes passes at compilers) written by James Hacker.
>
> <signature of Ty Coon>, 1 April 1989
> Ty Coon, President of Vice

This General Public License does not permit incorporating your program into proprietary programs. If your program is a subroutine library, you may consider it more useful to permit linking proprietary applications with the library. If this is what you want to do, use the GNU Library General Public License instead of this License.

(*2) LGPL:

GNU LESSER GENERAL PUBLIC LICENSE
Version 2.1, February 1999

[This is the first released version of the Lesser GPL. It also counts as the successor of the GNU Library Public License, version 2, hence the version number 2.1.]

Preamble

The licenses for most software are designed to take away your freedom to share and change it. By contrast, the GNU General Public Licenses are intended to guarantee your freedom to share and change free software--to make sure the software is free for all its users.

This license, the Lesser General Public License, applies to some specially designated software packages--typically libraries--of the Free Software Foundation and other authors who decide to use it. You can use it too, but we suggest you first think carefully about whether this license or the ordinary General Public License is the better strategy to use in any particular case, based on the explanations below.

When we speak of free software, we are referring to freedom of use, not price. Our General Public Licenses are designed to make sure that you have the freedom to distribute copies of free software (and charge for this service if you wish); that you receive source code or can get it if you want it; that you can change the software and use pieces of it in new free programs; and that you are informed that you can do these things.

To protect your rights, we need to make restrictions that forbid distributors to deny you these rights or to ask you to surrender these rights. These restrictions translate to certain responsibilities for you if you distribute copies of the library or if you modify it.

For example, if you distribute copies of the library, whether gratis or for a fee, you must give the recipients all the rights that we gave you. You must make sure that they, too, receive or can get the source code. If you link other code with the library, you must provide complete object files to the recipients, so that they can relink them with the library after making changes to the library and recompiling it. And you must show them these terms so they know their rights.

We protect your rights with a two-step method: (1) we copyright the library, and (2) we offer you this license, which gives you legal permission to copy, distribute and/or modify the library.

To protect each distributor, we want to make it very clear that there is no warranty for the free library. Also, if the library is modified by someone else and passed on, the recipients should know that what they have is not the original version, so that the original author's reputation will not be affected by problems that might be introduced by others.

Finally, software patents pose a constant threat to the existence of any free program. We wish to make sure that a company cannot effectively restrict the users of a free program by obtaining a restrictive license from a patent holder. Therefore, we insist that any patent license obtained for a version of the library must be consistent with the full freedom of use specified in this license.

Most GNU software, including some libraries, is covered by the ordinary GNU General Public License. This license, the GNU Lesser General Public License, applies to certain designated libraries, and is quite different from the ordinary General Public License. We use this license for certain libraries in order to permit linking those libraries into non-free programs.

When a program is linked with a library, whether statically or using a shared library, the combination of the two is legally speaking a combined work, a derivative of the original library. The ordinary General Public License therefore permits such linking only if the entire combination fits its criteria of freedom. The Lesser General Public License permits more lax criteria for linking other code with the library.

We call this license the "Lesser" General Public License because it does Less to protect the user's freedom than the ordinary General Public License. It also provides other free software developers Less of an advantage over competing non-free programs. These disadvantages are the reason we use the ordinary General Public License for many libraries. However, the Lesser license provides advantages in certain special circumstances.

For example, on rare occasions, there may be a special need to encourage the widest possible use of a certain library, so that it becomes a de-facto standard. To achieve this, non-free programs must be allowed to use the library. A more frequent case is that a free library does the same job as widely used non-free libraries. In this case, there is little to gain by limiting the free library to free software only, so we use the Lesser General Public License.

In other cases, permission to use a particular library in non-free programs enables a greater number of people to use a large body of free software. For example, permission to use the GNU C Library in non-free programs enables many more people to use the whole GNU operating system, as well as its variant, the GNU/Linux operating system.

Although the Lesser General Public License is Less protective of the users' freedom, it does ensure that the user of a program that is linked with the Library has the freedom and the wherewithal to run that program using a modified version of the Library.

The precise terms and conditions for copying, distribution and modification follow. Pay close attention to the difference between a "work based on the library" and a "work that uses the library". The former contains code derived from the library, whereas the latter must be combined with the library in order to run.

GNU LESSER GENERAL PUBLIC LICENSE
TERMS AND CONDITIONS FOR COPYING, DISTRIBUTION AND MODIFICATION

0. This License Agreement applies to any software library or other program which contains a notice placed by the copyright holder or other authorized party saying it may be distributed under the terms of this Lesser General Public License (also called "this License"). Each licensee is addressed as "you".

A "library" means a collection of software functions and/or data prepared so as to be conveniently linked with application programs (which use some of those functions and data) to form executables.

The "Library", below, refers to any such software library or work which has been distributed under these terms. A "work based on the Library" means either the Library or any derivative work under copyright law: that is to say, a work containing the Library or a portion of it, either verbatim or with modifications and/or translated straightforwardly into another language. (Hereinafter, translation is included without limitation in the term "modification".)

"Source code" for a work means the preferred form of the work for making modifications to it. For a library, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the library.

Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running a program using the Library is not restricted, and output from such a program is covered only if its contents constitute a work based on the Library (independent of the use of the Library in a tool for writing it). Whether that is true depends on what the Library does and what the program that uses the Library does.

1. You may copy and distribute verbatim copies of the Library's complete source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice and disclaimer of warranty; keep intact all the notices that refer to this License and to the absence of any warranty; and distribute a copy of this License along with the Library.

You may charge a fee for the physical act of transferring a copy, and you may at your option offer warranty protection in exchange for a fee.

2. You may modify your copy or copies of the Library or any portion of it, thus forming a work based on the Library, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:

a) The modified work must itself be a software library.

b) You must cause the files modified to carry prominent notices stating that you changed the files and the date of any change.

c) You must cause the whole of the work to be licensed at no charge to all third parties under the terms of this License.

d) If a facility in the modified Library refers to a function or a table of data to be supplied by an application program that uses the facility, other than as an argument passed when the facility is invoked, then you must make a good faith effort to ensure that, in the event an application does not supply such function or table, the facility still operates, and performs whatever part of its purpose remains meaningful.

(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Library, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Library, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Library.

In addition, mere aggregation of another work not based on the Library with the Library (or with a work based on the Library) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

3. You may opt to apply the terms of the ordinary GNU General Public License instead of this License to a given copy of the Library. To do this, you must alter all the notices that refer to this License, so that they refer to the ordinary GNU General Public License, version 2, instead of to this License. (If a newer version than version 2 of the ordinary GNU General Public License has appeared, then you can specify that version instead if you wish.) Do not make any other change in these notices.

Once this change is made in a given copy, it is irreversible for that copy, so the ordinary GNU General Public License applies to all subsequent copies and derivative works made from that copy.

This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

4. You may copy and distribute the Library (or a portion or derivative of it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange.

If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not compelled to copy the source along with the object code.

5. A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or linked with it, is called a "work that uses the Library". Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

However, linking a "work that uses the Library" with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a "work that uses the library". The executable is therefore covered by this License. Section 6 states terms for distribution of such executables.

When a "work that uses the Library" uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessories, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

6. As an exception to the Sections above, you may also combine or link a "work that uses the Library" with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer's own use and reverse engineering for debugging such modifications.

You must give prominent notice with each copy of the work that the Library is used in it and that the Library and its use are covered by this License. You must supply a copy of this License. If the work during execution displays copyright notices, you must include the copyright notice for the Library among them, as well as a reference directing the user to the copy of this License. Also, you must do one of these things:

a) Accompany the work with the complete corresponding machine-readable source code for the Library including whatever changes were used in the work (which must be distributed under Sections 1 and 2 above); and, if the work is an executable linked with the Library, with the complete machine-readable "work that uses the Library", as object code and/or source code, so that the user can modify the Library and then relink to produce a modified executable containing the modified Library. (It is understood that the user who changes the contents of definitions files in the Library will not necessarily be able to recompile the application to use the modified definitions.)

b) Use a suitable shared library mechanism for linking with the Library. A suitable mechanism is one that (1) uses at run time a copy of the library already present on the user's computer system, rather than copying library functions into the executable, and (2) will operate properly with a modified version of the library, if the user installs one, as long as the modified version is interface-compatible with the version that the work was made with.

c) Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.

d) If distribution of the work is made by offering access to copy from a designated place, offer equivalent access to copy the above specified materials from the same place.

e) Verify that the user has already received a copy of these materials or that you have already sent this user a copy.

For an executable, the required form of the "work that uses the Library" must include any data and utility programs needed for reproducing the executable from it. However, as a special exception, the materials to be distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

It may happen that this requirement contradicts the license restrictions of other proprietary libraries that do not normally accompany the operating system. Such a contradiction means you cannot use both them and the Library together in an executable that you distribute.

7. You may place library facilities that are a work based on the Library side-by-side in a single library together with other library facilities not covered by this License, and distribute such a combined library, provided that the separate distribution of the work based on the Library and of the other library facilities is otherwise permitted, and provided that you do these two things:

a) Accompany the combined library with a copy of the same work based on the Library, uncombined with any other library facilities. This must be distributed under the terms of the Sections above.

b) Give prominent notice with the combined library of the fact that part of it is a work based on the Library, and explaining where to find the accompanying uncombined form of the same work.

8. You may not copy, modify, sublicense, link with, or distribute the Library except as expressly provided under this License. Any attempt otherwise to copy, modify, sublicense, link with, or distribute the Library is void, and will automatically terminate your rights under this License. However, parties who have received copies, or rights, from you under this License will not have their licenses terminated so long as such parties remain in full compliance.

9. You are not required to accept this License, since you have not signed it. However, nothing else grants you permission to modify or distribute the Library or its derivative works. These actions are prohibited by law if you do not accept this License. Therefore, by modifying or distributing the Library (or any work based on the Library), you indicate your acceptance of this License to do so, and all its terms and conditions for copying, distributing or modifying the Library or works based on it.

10. Each time you redistribute the Library (or any work based on the Library), the recipient automatically receives a license from the original licensor to copy, distribute, link with or modify the Library subject to these terms and conditions. You may not impose any further restrictions on the recipients' exercise of the rights granted herein. You are not responsible for enforcing compliance by third parties with this License.

11. If, as a consequence of a court judgment or allegation of patent infringement or for any other reason (not limited to patent issues), conditions are imposed on you (whether by court order, agreement or otherwise) that contradict the conditions of this License, they do not excuse you from the conditions of this License. If you cannot distribute so as to satisfy simultaneously your obligations under this License and any other pertinent obligations, then as a consequence you may not distribute the Library at all. For example, if a patent license would not permit royalty-free redistribution of the Library by all those who receive copies directly or indirectly through you, then the only way you could satisfy both it and this License would be to refrain entirely from distribution of the Library.

If any portion of this section is held invalid or unenforceable under any particular circumstance, the balance of the section is intended to apply, and the section as a whole is intended to apply in other circumstances.

It is not the purpose of this section to induce you to infringe any patents or other property right claims or to contest validity of any such claims; this section has the sole purpose of protecting the integrity of the free software distribution system which is implemented by public license practices. Many people have made generous contributions to the wide range of software distributed through that system in reliance on consistent application of that system; it is up to the author/donor to decide if he or she is willing to distribute software through any other system and a licensee cannot impose that choice.

This section is intended to make thoroughly clear what is believed to be a consequence of the rest of this License.

12. If the distribution and/or use of the Library is restricted in certain countries either by patents or by copyrighted interfaces, the original copyright holder who places the Library under this License may add an explicit geographical distribution limitation excluding those countries, so that distribution is permitted only in or among countries not thus excluded. In such case, this License incorporates the limitation as if written in the body of this License.

13. The Free Software Foundation may publish revised and/or new versions of the Lesser General Public License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns.

Each version is given a distinguishing version number. If the Library specifies a version number of this License which applies to it and "any later version", you have the option of following the terms and conditions either of that version or of any later version published by the Free Software Foundation. If the Library does not specify a license version number, you may choose any version ever published by the Free Software Foundation.

14. If you wish to incorporate parts of the Library into other free programs whose distribution conditions are incompatible with these, write to the author to ask for permission. For software which is copyrighted by the Free Software Foundation, write to the Free Software Foundation; we sometimes make exceptions for this. Our decision will be guided by the two goals of preserving the free status of all derivatives of our free software and of promoting the sharing and reuse of software generally.

NO WARRANTY

15. BECAUSE THE LIBRARY IS LICENSED FREE OF CHARGE, THERE IS NO WARRANTY FOR THE LIBRARY, TO THE EXTENT PERMITTED BY APPLICABLE LAW. EXCEPT WHEN OTHERWISE STATED IN WRITING THE COPYRIGHT HOLDERS AND/OR OTHER PARTIES PROVIDE THE LIBRARY "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE LIBRARY IS WITH YOU. SHOULD THE LIBRARY PROVE DEFECTIVE, YOU ASSUME THE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION.

16. IN NO EVENT UNLESS REQUIRED BY APPLICABLE LAW OR AGREED TO IN WRITING WILL ANY COPYRIGHT HOLDER, OR ANY OTHER PARTY WHO MAY MODIFY AND/OR REDISTRIBUTE THE LIBRARY AS PERMITTED ABOVE, BE LIABLE TO YOU FOR DAMAGES, INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE LIBRARY (INCLUDING BUT NOT LIMITED TO LOSS OF DATA OR DATA BEING RENDERED INACCURATE OR LOSSES SUSTAINED BY YOU OR THIRD PARTIES OR A FAILURE OF THE LIBRARY TO OPERATE WITH ANY OTHER SOFTWARE), EVEN IF SUCH HOLDER OR OTHER PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

END OF TERMS AND CONDITIONS

How to Apply These Terms to Your New Libraries

If you develop a new library, and you want it to be of the greatest possible use to the public, we recommend making it free software that everyone can redistribute and change. You can do so by permitting redistribution under these terms (or, alternatively, under the terms of the ordinary General Public License).

To apply these terms, attach the following notices to the library. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the "copyright" line and a pointer to where the full notice is found.

<one line to give the library's name and a brief idea of what it does.>
Copyright (C) <year> <name of author>

This library is free software; you can redistribute it and/or modify it under the terms of the GNU Lesser General Public License as published by the Free Software Foundation; either version 2.1 of the License, or (at your option) any later version.

This library is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU Lesser General Public License for more details.

> You should have received a copy of the GNU Lesser General Public License along with this library; if not, write to the Free Software Foundation, Inc., 59 Temple Place, Suite 330, Boston, MA 02111-1307 USA

Also add information on how to contact you by electronic and paper mail.

You should also get your employer (if you work as a programmer) or your school, if any, to sign a "copyright disclaimer" for the library, if necessary. Here is a sample; alter the names:

> Yoyodyne, Inc., hereby disclaims all copyright interest in the library `Frob' (a library for tweaking knobs) written by James Random Hacker.
>
> <signature of Ty Coon>, 1 April 1990
> Ty Coon, President of Vice

That's all there is to it!

(*3) MPL:

MOZILLA PUBLIC LICENSE
Version 1.1

----

1. Definitions.

1.0.1. "Commercial Use" means distribution or otherwise making the Covered Code available to a third party.

1.1. "Contributor" means each entity that creates or contributes to the creation of Modifications.

1.2. "Contributor Version" means the combination of the Original Code, prior Modifications used by a Contributor, and the Modifications made by that particular Contributor.

1.3. "Covered Code" means the Original Code or Modifications or the combination of the Original Code and Modifications, in each case including portions thereof.

1.4. "Electronic Distribution Mechanism" means a mechanism generally accepted in the software development community for the electronic transfer of data.

1.5. "Executable" means Covered Code in any form other than Source Code.

1.6. "Initial Developer" means the individual or entity identified as the Initial Developer in the Source Code notice required by Exhibit A.

1.7. "Larger Work" means a work which combines Covered Code or portions thereof with code not governed by the terms of this License.

1.8. "License" means this document.

1.8.1. "Licensable" means having the right to grant, to the maximum extent possible, whether at the time of the initial grant or subsequently acquired, any and all of the rights conveyed herein.

1.9. "Modifications" means any addition to or deletion from the substance or structure of either the Original Code or any previous Modifications. When Covered Code is released as a series of files, a Modification is:

A. Any addition to or deletion from the contents of a file containing Original Code or previous Modifications.

B. Any new file that contains any part of the Original Code or previous Modifications.

1.10. "Original Code" means Source Code of computer software code which is described in the Source Code notice required by Exhibit A as Original Code, and which, at the time of its release under this License is not already Covered Code governed by this License.

1.10.1. "Patent Claims" means any patent claim(s), now owned or hereafter acquired, including without limitation, method, process, and apparatus claims, in any patent Licensable by grantor.

1.11. "Source Code" means the preferred form of the Covered Code for making modifications to it, including all modules it contains, plus any associated interface definition files, scripts used to control compilation and installation of an Executable, or source code differential comparisons against either the Original Code or another well known, available Covered Code of the Contributor's choice. The Source Code can be in a compressed or archival form, provided the appropriate decompression or de-archiving software is widely available for no charge.

1.12. "You" (or "Your") means an individual or a legal entity exercising rights under, and complying with all of the terms of, this License or a future version of this License issued under Section 6.1. For legal entities, "You" includes any entity which controls, is controlled by, or is under common control with You. For purposes of this definition, "control" means (a) the power, direct or indirect, to cause the direction or management of such entity, whether by contract or otherwise, or (b) ownership of more than fifty percent (50%) of the outstanding shares or beneficial ownership of such entity.

2. Source Code License.

2.1. The Initial Developer Grant.
The Initial Developer hereby grants You a world-wide, royalty-free, non-exclusive license, subject to third party intellectual property claims:

(a) under intellectual property rights (other than patent or trademark) Licensable by Initial Developer to use, reproduce, modify, display, perform, sublicense and distribute the Original Code (or portions thereof) with or without Modifications, and/or as part of a Larger Work; and

(b) under Patents Claims infringed by the making, using or selling of Original Code, to make, have made, use, practice, sell, and offer for sale, and/or otherwise dispose of the Original Code (or portions thereof).

(c) the licenses granted in this Section 2.1(a) and

(b) are effective on the date Initial Developer first distributes Original Code under the terms of this License.

(d) Notwithstanding Section 2.1(b) above, no patent license is granted: 1) for code that You delete from the Original Code; 2) separate from the Original Code; or 3) for infringements caused by: i) the modification of the Original Code or ii) the combination of the Original Code with other software or devices.

2.2. Contributor Grant.
Subject to third party intellectual property claims, each Contributor hereby grants You a world-wide, royalty-free, non-exclusive license

(a) under intellectual property rights (other than patent or trademark) Licensable by Contributor, to use, reproduce, modify, display, perform, sublicense and distribute the Modifications created by such Contributor (or portions thereof) either on an unmodified basis, with other Modifications, as Covered Code and/or as part of a Larger Work; and

(b) under Patent Claims infringed by the making, using, or selling of Modifications made by that Contributor either alone and/or in combination with its Contributor Version (or portions of such combination), to make, use, sell, offer for sale, have made, and/or otherwise dispose of: 1) Modifications made by that Contributor (or portions thereof); and 2) the combination of Modifications made by that Contributor with its Contributor Version (or portions of such combination).

(c) the licenses granted in Sections 2.2(a) and 2.2(b) are effective on the date Contributor first makes Commercial Use of the Covered Code.

(d) Notwithstanding Section 2.2(b) above, no patent license is granted: 1) for any code that Contributor has deleted from the Contributor Version; 2) separate from the Contributor Version; 3) for infringements caused by: i) third party modifications of Contributor Version or ii) the combination of Modifications made by that Contributor with other software (except as part of the Contributor Version) or other devices; or 4) under Patent Claims infringed by Covered Code in the absence of Modifications made by that Contributor.

3. Distribution Obligations.

3.1. Application of License.
The Modifications which You create or to which You contribute are governed by the terms of this License, including without limitation Section 2.2. The Source Code version of Covered Code may be distributed only under the terms of this License or a future version of this License released under Section 6.1, and You must include a copy of this License with every copy of the Source Code You distribute. You may not offer or impose any terms on any Source Code version that alters or restricts the applicable version of this License or the recipients' rights hereunder. However, You may include an additional document offering the additional rights described in Section 3.5.

3.2. Availability of Source Code.
Any Modification which You create or to which You contribute must be made available in Source Code form under the terms of this License either on the same media as an Executable version or via an accepted Electronic Distribution Mechanism to anyone to whom you made an Executable version available; and if made available via Electronic Distribution Mechanism, must remain available for at least twelve (12) months after the date it initially became available, or at least six (6) months after a subsequent version of that particular Modification has been made available to such recipients. You are responsible for ensuring that the Source Code version remains available even if the Electronic Distribution Mechanism is maintained by a third party.

3.3. Description of Modifications.
You must cause all Covered Code to which You contribute to contain a file documenting the changes You made to create that Covered Code and the date of any change. You must include a prominent statement that the Modification is derived, directly or indirectly, from Original Code provided by the Initial Developer and including the name of the Initial Developer in (a) the Source Code, and (b) in any notice in an Executable version or related documentation in which You describe the origin or ownership of the Covered Code.

3.4. Intellectual Property Matters
(a) Third Party Claims.
If Contributor has knowledge that a license under a third party's intellectual property rights is required to exercise the rights granted by such Contributor under Sections 2.1 or 2.2, Contributor must include a text file with the Source Code distribution titled "LEGAL" which describes the claim and the party making the claim in sufficient detail that a recipient will know whom to contact. If Contributor obtains such knowledge after the Modification is made available as described in Section 3.2, Contributor shall promptly modify the LEGAL file in all copies Contributor makes available thereafter and shall take other steps (such as notifying appropriate mailing lists or newsgroups) reasonably calculated to inform those who received the Cov-

ered Code that new knowledge has been obtained.

(b) Contributor APIs.
If Contributor's Modifications include an application programming interface and Contributor has knowledge of patent licenses which are reasonably necessary to implement that API, Contributor must also include this information in the LEGAL file.

(c) Representations.
Contributor represents that, except as disclosed pursuant to Section 3.4(a) above, Contributor believes that Contributor's Modifications are Contributor's original creation(s) and/or Contributor has sufficient rights to grant the rights conveyed by this License.

3.5. Required Notices.
You must duplicate the notice in Exhibit A in each file of the Source Code. If it is not possible to put such notice in a particular Source Code file due to its structure, then You must include such notice in a location (such as a relevant directory) where a user would be likely to look for such a notice. If You created one or more Modification(s) You may add your name as a Contributor to the notice described in Exhibit A. You must also duplicate this License in any documentation for the Source Code where You describe recipients' rights or ownership rights relating to Covered Code. You may choose to offer, and to charge a fee for, warranty, support, indemnity or liability obligations to one or more recipients of Covered Code. However, You may do so only on Your own behalf, and not on behalf of the Initial Developer or any Contributor. You must make it absolutely clear than any such warranty, support, indemnity or liability obligation is offered by You alone, and You hereby agree to indemnify the Initial Developer and every Contributor for any liability incurred by the Initial Developer or such Contributor as a result of warranty, support, indemnity or liability terms You offer.

3.6. Distribution of Executable Versions.
You may distribute Covered Code in Executable form only if the requirements of Section 3.1-3.5 have been met for that Covered Code, and if You include a notice stating that the Source Code version of the Covered Code is available under the terms of this License, including a description of how and where You have fulfilled the obligations of Section 3.2. The notice must be conspicuously included in any notice in an Executable version, related documentation or collateral in which You describe recipients' rights relating to the Covered Code. You may distribute the Executable version of Covered Code or ownership rights under a license of Your choice, which may contain terms different from this License, provided that You are in compliance with the terms of this License and that the license for the Executable version does not attempt to limit or alter the recipient's rights in the Source Code version from the rights set forth in this License. If You distribute the Executable version under a different license You must make it absolutely clear that any terms which differ from this License are offered by You alone, not by the Initial Developer or any Contributor. You hereby agree to indemnify the Initial Developer and every Contributor for any liability incurred by the Initial Developer or such Contributor as a result of any such terms You offer.

3.7. Larger Works.
You may create a Larger Work by combining Covered Code with other code not governed by the terms of this License and distribute the Larger Work as a single product. In such a case, You must make sure the requirements of this License are fulfilled for the Covered Code.

4. Inability to Comply Due to Statute or Regulation.

If it is impossible for You to comply with any of the terms of this License with respect to some or all of the Covered Code due to statute, judicial order, or regulation then You must: (a) comply with the terms of this License to the maximum extent possible; and (b) describe the limitations and the code they affect. Such description must be included in the LEGAL file described in Section 3.4 and must be included with all distributions of the Source Code. Except to the extent prohibited by statute or regulation, such description must be sufficiently detailed for a recipient of ordinary skill to be able to understand it.

5. Application of this License.

This License applies to code to which the Initial Developer has attached the notice in Exhibit A and to related Covered Code.

6. Versions of the License.

6.1. New Versions.
Netscape Communications Corporation ("Netscape") may publish revised and/or new versions of the License from time to time. Each version will be given a distinguishing version number.

6.2. Effect of New Versions.
Once Covered Code has been published under a particular version of the License, You may always continue to use it under the terms of that version. You may also choose to use such Covered Code under the terms of any subsequent version of the License published by Netscape. No one other than Netscape has the right to modify the terms applicable to Covered Code created under this License.

6.3. Derivative Works.
If You create or use a modified version of this License (which you may only do in order to apply it to code which is not already Covered Code governed by this License), You must (a) rename Your license so that the phrases "Mozilla", "MOZILLAPL", "MOZPL", "Netscape", "MPL", "NPL" or any confusingly similar phrase do not appear in your license (except to note that your license differs from this License) and (b) otherwise make it clear that Your version of the license contains terms which differ from the Mozilla Public License and Netscape Public License. (Filling in the name of the Initial Developer, Original Code or Contributor in the notice described in Exhibit A shall not of themselves be deemed to be modifications of this License.)

7. DISCLAIMER OF WARRANTY.

COVERED CODE IS PROVIDED UNDER THIS LICENSE ON AN "AS IS" BASIS, WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, WITHOUT LIMITATION, WARRANTIES THAT THE COVERED CODE IS FREE OF DEFECTS, MERCHANTABLE, FIT FOR A PARTICULAR PURPOSE OR NON-INFRINGING. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE COVERED CODE IS WITH YOU. SHOULD ANY COVERED CODE PROVE DEFECTIVE IN ANY RESPECT, YOU (NOT THE INITIAL DEVELOPER OR ANY OTHER CONTRIBUTOR) ASSUME THE COST OF ANY NECESSARY SERVICING, REPAIR OR CORRECTION. THIS DISCLAIMER OF WARRANTY CONSTITUTES AN ESSENTIAL PART OF THIS LICENSE. NO USE OF ANY COVERED CODE IS AUTHORIZED HEREUNDER EXCEPT UNDER THIS DISCLAIMER.

8. TERMINATION.

8.1. This License and the rights granted hereunder will terminate automatically if You fail to comply with terms herein and fail to cure such breach within 30 days of becoming aware of the breach. All sublicenses to the Covered Code which are properly granted shall survive any termination of this License. Provisions which, by their nature, must remain in effect beyond the termination of this License shall survive.

8.2. If You initiate litigation by asserting a patent infringement claim (excluding declatory judgment actions) against Initial Developer or a Contributor (the Initial Developer or Contributor against whom You file such action is referred to as "Participant") alleging that:

(a) such Participant's Contributor Version directly or indirectly infringes any patent, then any and all rights granted by such Participant to You under Sections 2.1 and/or 2.2 of this License shall, upon 60 days notice from Participant terminate prospectively, unless if within 60 days after receipt of notice You either: (i) agree in writing to pay Participant a mutually agreeable reasonable royalty for Your past and future use of Modifications made by such Participant, or (ii) withdraw Your litigation claim with respect to the Contributor Version against such Participant. If within 60 days of notice, a reasonable royalty and payment arrangement are not mutually agreed upon in writing by the parties or the litigation claim is not withdrawn, the rights granted by Participant to You under Sections 2.1 and/or 2.2 automatically terminate at the expiration of the 60 day notice period specified above.

(b) any software, hardware, or device, other than such Participant's Contributor Version, directly or indirectly infringes any patent, then any rights granted to You by such Participant under Sections 2.1(b) and 2.2(b) are revoked effective as of the date You first made, used, sold, distributed, or had made, Modifications made by that Participant.

8.3. If You assert a patent infringement claim against Participant alleging that such Participant's Contributor Version directly or indirectly infringes any patent where such claim is resolved (such as by license or settlement) prior to the initiation of patent infringement litigation, then the reasonable value of the licenses granted by such Participant under Sections 2.1 or 2.2 shall be taken into account in determining the amount or value of any payment or license.

8.4. In the event of termination under Sections 8.1 or 8.2 above, all end user license agreements (excluding distributors and resellers) which have been validly granted by You or any distributor hereunder prior to termination shall survive termination.

9. LIMITATION OF LIABILITY.

UNDER NO CIRCUMSTANCES AND UNDER NO LEGAL THEORY, WHETHER TORT (INCLUDING NEGLIGENCE), CONTRACT, OR OTHERWISE, SHALL YOU, THE INITIAL DEVELOPER, ANY OTHER CONTRIBUTOR, OR ANY DISTRIBUTOR OF COVERED CODE, OR ANY SUPPLIER OF ANY OF SUCH PARTIES, BE LIABLE TO ANY PERSON FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES OF ANY CHARACTER INCLUDING, WITHOUT LIMITATION, DAMAGES FOR LOSS OF GOODWILL, WORK STOPPAGE, COMPUTER FAILURE OR MALFUNCTION, OR ANY AND ALL OTHER COMMERCIAL DAMAGES OR LOSSES, EVEN IF

SUCH PARTY SHALL HAVE BEEN INFORMED OF THE POSSIBILITY OF SUCH DAMAGES. THIS LIMITATION OF LIABILITY SHALL NOT APPLY TO LIABILITY FOR DEATH OR PERSONAL INJURY RESULTING FROM SUCH PARTY'S NEGLIGENCE TO THE EXTENT APPLICABLE LAW PROHIBITS SUCH LIMITATION. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THIS EXCLUSION AND LIMITATION MAY NOT APPLY TO YOU.

10. U.S. GOVERNMENT END USERS.

The Covered Code is a "commercial item," as that term is defined in 48 C.F.R. 2.101 (Oct. 1995), consisting of "commercial computer software" and "commercial computer software documentation," as such terms are used in 48 C.F.R. 12.212 (Sept. 1995). Consistent with 48 C.F.R. 12.212 and 48 C.F.R. 227.7202-1 through 227.7202-4 (June 1995), all U.S. Government End Users acquire Covered Code with only those rights set forth herein.

11. MISCELLANEOUS.

This License represents the complete agreement concerning subject matter hereof. If any provision of this License is held to be unenforceable, such provision shall be reformed only to the extent necessary to make it enforceable. This License shall be governed by California law provisions (except to the extent applicable law, if any, provides otherwise), excluding its conflict-of-law provisions. With respect to disputes in which at least one party is a citizen of, or an entity chartered or registered to do business in the United States of America, any litigation relating to this License shall be subject to the jurisdiction of the Federal Courts of the Northern District of California, with venue lying in Santa Clara County, California, with the losing party responsible for costs, including without limitation, court costs and reasonable attorneys' fees and expenses. The application of the United Nations Convention on Contracts for the International Sale of Goods is expressly excluded. Any law or regulation which provides that the language of a contract shall be construed against the drafter shall not apply to this License.

12. RESPONSIBILITY FOR CLAIMS.

As between Initial Developer and the Contributors, each party is responsible for claims and damages arising, directly or indirectly, out of its utilization of rights under this License and You agree to work with Initial Developer and Contributors to distribute such responsibility on an equitable basis. Nothing herein is intended or shall be deemed to constitute any admission of liability.

13. MULTIPLE-LICENSED CODE.

Initial Developer may designate portions of the Covered Code as "Multiple-Licensed". "Multiple-Licensed" means that the Initial Developer permits you to utilize portions of the Covered Code under Your choice of the NPL or the alternative licenses, if any, specified by the Initial Developer in the file described in Exhibit A.

EXHIBIT A -Mozilla Public License.

``The contents of this file are subject to the Mozilla Public License Version 1.1 (the "License"); you may not use this file except in compliance with the License. You may obtain a copy of the License at http://www.mozilla.org/MPL/

Software distributed under the License is distributed on an "AS IS" basis, WITHOUT WARRANTY OF ANY KIND, either express or implied. See the License for the specific language governing rights and limitations under the License.

The Original Code is ______________________________.

The Initial Developer of the Original Code is ________________________.

Portions created by ______________________ are Copyright (C) ______ _______________________. All Rights Reserved.

Contributor(s): ______________________________________.

Alternatively, the contents of this file may be used under the terms of the _____ license (the "[___] License"), in which case the provisions of [______] License are applicable instead of those above. If you wish to allow use of your version of this file only under the terms of the [____] License and not to allow others to use your version of this file under the MPL, indicate your decision by deleting the provisions above and replace them with the notice and other provisions required by the [___] License. If you do not delete the provisions above, a recipient may use your version of this file under either the MPL or the [___] License."

[NOTE: The text of this Exhibit A may differ slightly from the text of the notices in the Source Code files of the Original Code. You should use the text of this Exhibit A rather than the text found in the Original Code Source Code for Your Modifications.]

(*4) LGPL+ exception:

FLTK License Agreement - The Fast Light Toolkit Home Page[Home | Documentation | FAQ | Links/Bazaar | News | Newsgroups | Polls | Software | Support]

FLTK License Agreement

December 11, 2001

The FLTK library and included programs are provided under the terms of the GNU Library General Public License (LGPL) with the following exceptions:

Modifications to the FLTK configure script, config header file, and makefiles by themselves to support a specific platform do not constitute a modified or derivative work.

The authors do request that such modifications be contributed to the FLTK project - send all contributions to "fltk-bugs@fltk.org".

Widgets that are subclassed from FLTK widgets do not constitute a derivative work.

Static linking of applications and widgets to the FLTK library does not constitute a derivative work and does not require the author to provide source code for the application or widget, use the shared FLTK libraries, or link their applications or widgets against a user-supplied version of FLTK.

If you link the application or widget to a modified version of FLTK, then the changes to FLTK must be provided under the terms of the LGPL in sections 1, 2, and 4.

You do not have to provide a copy of the FLTK license with programs that are linked to the FLTK library, nor do you have to identify the FLTK license in your program or documentation as required by section 6 of the LGPL.

However, programs must still identify their use of FLTK. The following example statement can be included in user documentation to satisfy this requirement:

[program/widget] is based in part on the work of the FLTK project
(http://www.fltk.org).

GNU LIBRARY GENERAL PUBLIC LICENSE
Version 2, June 1991

Copyright (C) 1991 Free Software Foundation, Inc.
59 Temple Place - Suite 330, Boston, MA 02111-1307, USA
Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.

[This is the first released version of the library GPL. It is numbered 2 because it goes with version 2 of the ordinary GPL.]

Preamble

The licenses for most software are designed to take away your freedom to share and change it. By contrast, the GNU General Public Licenses are intended to guarantee your freedom to share and change free software--to make sure the software is free for all its users.

This license, the Library General Public License, applies to some specially designated Free Software Foundation software, and to any other libraries whose authors decide to use it. You can use it for your libraries, too.

When we speak of free software, we are referring to freedom, not price. Our General Public Licenses are designed to make sure that you have the freedom to distribute copies of free software (and charge for this service if you wish), that you receive source code or can get it if you want it, that you can change the software or use pieces of it in new free programs; and that you know you can do these things.

To protect your rights, we need to make restrictions that forbid anyone to deny you these rights or to ask you to surrender the rights. These restrictions translate to certain responsibilities for you if you distribute copies of the library, or if you modify it.

For example, if you distribute copies of the library, whether gratis or for a fee, you must give the recipients all the rights that we gave you. You must make sure that they, too, receive or can get the source code. If you link a program with the library, you must provide complete object files to the recipients so that they can relink them with the library, after making changes to the library and recompiling it. And you must show them these terms so they know their rights.

Our method of protecting your rights has two steps: (1) copyright the library, and (2) offer you this license which gives you legal permission to copy, distribute and/or modify the library.

Also, for each distributor's protection, we want to make certain that everyone understands that there is no warranty for this free library. If the library is modified by someone else and passed on, we want its recipients to know that what they have is not the original version, so that any problems introduced by others will not reflect on the original authors' reputations.

Finally, any free program is threatened constantly by software patents. We wish to avoid the danger that companies distributing free software will individually obtain patent licenses, thus in effect transforming the program into proprietary software. To prevent this, we have made it clear that any patent must be licensed for everyone's free use or not licensed at all.

Most GNU software, including some libraries, is covered by the ordinary GNU General Public License, which was designed for utility programs. This license, the GNU Library General Public License, applies to certain designated libraries. This license is quite different from the ordinary one; be sure to read it in full, and don't assume that anything in it is the same as in the ordinary license.

The reason we have a separate public license for some libraries is that they blur the distinction we usually make between modifying or adding to a program and simply using it. Linking a program with a library, without changing the library, is in some sense simply using the library, and is analogous to running a utility program or application program. However, in a textual and legal sense, the linked executable is a combined work, a derivative of the original library, and the ordinary General Public License treats it as such.

Because of this blurred distinction, using the ordinary General Public License for libraries did not effectively promote software sharing, because most developers did not use the libraries. We concluded that weaker conditions might promote sharing better.

However, unrestricted linking of non-free programs would deprive the users of those programs of all benefit from the free status of the libraries themselves. This Library General Public License is intended to permit developers of non-free programs to use free libraries, while preserving your freedom as a user of such programs to change the free libraries that are incorporated in them. (We have not seen how to achieve this as regards changes in header files, but we have achieved it as regards changes in the actual functions of the Library.) The hope is that this will lead to faster development of free libraries.

The precise terms and conditions for copying, distribution and modification follow. Pay close attention to the difference between a "work based on the library" and a "work that uses the library". The former contains code derived from the library, while the latter only works together with the library.

Note that it is possible for a library to be covered by the ordinary General Public License rather than by this special one.

TERMS AND CONDITIONS FOR COPYING, DISTRIBUTION AND MODIFICATION

0. This License Agreement applies to any software library which contains a notice placed by the copyright holder or other authorized party saying it may be distributed under the terms of this Library General Public License (also called "this License"). Each licensee is addressed as "you".

A "library" means a collection of software functions and/or data prepared so as to be conveniently linked with application programs (which use some of those functions and data) to form executables.

The "Library", below, refers to any such software library or work which has been distributed under these terms. A "work based on the Library" means either the Library or any derivative work under copyright law: that is to say, a work containing the Library or a portion of it, either verbatim or with modifications and/or translated straightforwardly into another language. (Hereinafter, translation is included without limitation in the term "modification".)

"Source code" for a work means the preferred form of the work for making modifications to it. For a library, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the library.

Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running a program using the Library is not restricted, and output from such a program is covered only if its contents constitute a work based on the Library (independent of the use of the Library in a tool for writing it). Whether that is true depends on what the Library does and what the program that uses the Library does.

1. You may copy and distribute verbatim copies of the Library's complete source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice and disclaimer of warranty; keep intact all the notices that refer to this License and to the absence of any warranty; and distribute a copy of this License along with the Library.

You may charge a fee for the physical act of transferring a copy, and you may at your option offer warranty protection in exchange for a fee.

2. You may modify your copy or copies of the Library or any portion of it, thus forming a work based on the Library, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:

The modified work must itself be a software library.

You must cause the files modified to carry prominent notices stating that you changed the files and the date of any change.

You must cause the whole of the work to be licensed at no charge to all third parties under the terms of this License.

If a facility in the modified Library refers to a function or a table of data to be supplied by an application program that uses the facility, other than as an argument passed when the facility is invoked, then you must make a good faith effort to ensure that, in the event an application does not supply such function or table, the facility still operates, and performs whatever part of its purpose remains meaningful. (For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Library, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Library, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Library.

In addition, mere aggregation of another work not based on the Library with the Library (or with a work based on the Library) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

3. You may opt to apply the terms of the ordinary GNU General Public License instead of this License to a given copy of the Library. To do this, you must alter all the notices that refer to this License, so that they refer to the ordinary GNU General Public License, version 2, instead of to this License. (If a newer version than version 2 of the ordinary GNU General Public License has appeared, then you can specify that version instead if you wish.) Do not make any other change in these notices. Once this change is made in a given copy, it is irreversible for that copy, so the ordinary GNU General Public License applies to all subsequent copies and derivative works made from that copy.

This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

4. You may copy and distribute the Library (or a portion or derivative of it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange.

If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not compelled to copy the source along with the object code.

5. A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or linked with it, is called a "work that uses the Library". Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

However, linking a "work that uses the Library" with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a "work that uses the library". The executable is therefore covered by this License. Section 6 states terms for distribution of such executables.

When a "work that uses the Library" uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessories, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

6. As an exception to the Sections above, you may also compile or link a "work that uses the Library" with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer's own use and reverse engineering for debugging such modifications.

You must give prominent notice with each copy of the work that the Library is used in it and that the

Library and its use are covered by this License. You must supply a copy of this License. If the work during execution displays copyright notices, you must include the copyright notice for the Library among them, as well as a reference directing the user to the copy of this License. Also, you must do one of these things:

Accompany the work with the complete corresponding machine-readable source code for the Library including whatever changes were used in the work (which must be distributed under Sections 1 and 2 above); and, if the work is an executable linked with the Library, with the complete machine-readable "work that uses the Library", as object code and/or source code, so that the user can modify the Library and then relink to produce a modified executable containing the modified Library. (It is understood that the user who changes the contents of definitions files in the Library will not necessarily be able to recompile the application to use the modified definitions.)

Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution. If distribution of the work is made by offering access to copy from a designated place, offer equivalent access to copy the above specified materials from the same place.

Verify that the user has already received a copy of these materials or that you have already sent this user a copy.

For an executable, the required form of the "work that uses the Library" must include any data and utility programs needed for reproducing the executable from it. However, as a special exception, the source code distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

It may happen that this requirement contradicts the license restrictions of other proprietary libraries that do not normally accompany the operating system. Such a contradiction means you cannot use both them and the Library together in an executable that you distribute.

7. You may place library facilities that are a work based on the Library side-by-side in a single library together with other library facilities not covered by this License, and distribute such a combined library, provided that the separate distribution of the work based on the Library and of the other library facilities is otherwise permitted, and provided that you do these two things:

Accompany the combined library with a copy of the same work based on the Library, uncombined with any other library facilities. This must be distributed under the terms of the Sections above.

Give prominent notice with the combined library of the fact that part of it is a work based on the Library, and explaining where to find the accompanying uncombined form of the same work.

8. You may not copy, modify, sublicense, link with, or distribute the Library except as expressly provided under this License. Any attempt otherwise to copy, modify, sublicense, link with, or distribute the Library is void, and will automatically terminate your rights under this License. However, parties who have received copies, or rights, from you under this License will not have their licenses terminated so long as such parties remain in full compliance.

9. You are not required to accept this License, since you have not signed it. However, nothing else grants you permission to modify or distribute the Library or its derivative works. These actions are prohibited by law if you do not accept this License. Therefore, by modifying or distributing the Library (or any work based on the Library), you indicate your acceptance of this License to do so, and all its terms and conditions for copying, distributing or modifying the Library or works based on it.

10. Each time you redistribute the Library (or any work based on the Library), the recipient automatically receives a license from the original licensor to copy, distribute, link with or modify the Library subject to these terms and conditions. You may not impose any further restrictions on the recipients' exercise of the rights granted herein. You are not responsible for enforcing compliance by third parties to this License.

11. If, as a consequence of a court judgment or allegation of patent infringement or for any other reason (not limited to patent issues), conditions are imposed on you (whether by court order, agreement or otherwise) that contradict the conditions of this License, they do not excuse you from the conditions of this License. If you cannot distribute so as to satisfy simultaneously your obligations under this License and any other pertinent obligations, then as a consequence you may not distribute the Library at all. For example, if a patent license would not permit royalty-free redistribution of the Library by all those who receive copies directly or indirectly through you, then the only way you could satisfy both it and this License would be to refrain entirely from distribution of the Library.

If any portion of this section is held invalid or unenforceable under any particular circumstance, the balance of the section is intended to apply, and the section as a whole is intended to apply in other circumstances. It is not the purpose of this section to induce you to infringe any patents or other property right claims or to contest validity of any such claims; this section has the sole purpose of protecting the integrity of the free software distribution system which is implemented by public license practices. Many people have made generous contributions to the wide range of software distributed through that system in reliance on consistent application of that system; it is up to the author/donor to decide if he or she is willing to distribute software through any other system and a licensee cannot impose that choice.

This section is intended to make thoroughly clear what is believed to be a consequence of the rest of this License.

12. If the distribution and/or use of the Library is restricted in certain countries either by patents or by copyrighted interfaces, the original copyright holder who places the Library under this License may add an explicit geographical distribution limitation excluding those countries, so that distribution is permitted only in or among countries not thus excluded. In such case, this License incorporates the limitation as if written in the body of this License.

13. The Free Software Foundation may publish revised and/or new versions of the Library General Public License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns.

Each version is given a distinguishing version number. If the Library specifies a version number of this License which applies to it and "any later version", you have the option of following the terms and conditions either of that version or of any later version published by the Free Software Foundation. If the Library does not specify a license version number, you may choose any version ever published by the Free Software Foundation.

14. If you wish to incorporate parts of the Library into other free programs whose distribution conditions are incompatible with these, write to the author to ask for permission. For software which is copyrighted by the Free Software Foundation, write to the Free Software Foundation; we sometimes make exceptions for this. Our decision will be guided by the two goals of preserving the free status of all derivatives of our free software and of promoting the sharing and reuse of software generally.

NO WARRANTY

15. BECAUSE THE LIBRARY IS LICENSED FREE OF CHARGE, THERE IS NO WARRANTY FOR THE LIBRARY, TO THE EXTENT PERMITTED BY APPLICABLE LAW. EXCEPT WHEN OTHERWISE STATED IN WRITING THE COPYRIGHT HOLDERS AND/OR OTHER PARTIES PROVIDE THE LIBRARY "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE LIBRARY IS WITH YOU. SHOULD THE LIBRARY PROVE DEFECTIVE, YOU ASSUME THE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION.

16. IN NO EVENT UNLESS REQUIRED BY APPLICABLE LAW OR AGREED TO IN WRITING WILL ANY COPYRIGHT HOLDER, OR ANY OTHER PARTY WHO MAY MODIFY AND/OR REDISTRIBUTE THE LIBRARY AS PERMITTED ABOVE, BE LIABLE TO YOU FOR DAMAGES, INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE LIBRARY (INCLUDING BUT NOT LIMITED TO LOSS OF DATA OR DATA BEING RENDERED INACCURATE OR LOSSES SUSTAINED BY YOU OR THIRD PARTIES OR A FAILURE OF THE LIBRARY TO OPERATE WITH ANY OTHER SOFTWARE), EVEN IF SUCH HOLDER OR OTHER PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

END OF TERMS AND CONDITIONS

(*5) Others: