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MN9662A/9672A/9664A/9674A
Optical Channel Selector
Operation Manual

Sixth Edition

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

Measuring Instruments Division
Measurement Group
ANRITSU CORPORATION

Document No.: M-W1489AE-6.0

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Safety Symbols

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

Safety Symbols Used in Manual

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

WARNING ⚠ This indicates a hazardous procedure that could result in death or serious injury 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/or in Manual

The following safety symbols are used inside or on the equipment near operation locations, and/or in manual 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.



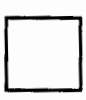
This indicates a prohibited operation. The prohibited operation is indicated symbolically in or near the barred circle.



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.

MN9662A/9672A/9664A/9674A
Optical Channel Selector
Operation Manual

31 July 1998 (First Edition)
28 April 2000 (Sixth Edition)

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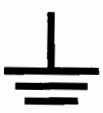
For Safety

WARNING ⚠

1. 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.
   - Laser Radiation Markings on a following page show the Laser Safety label attached to the equipment near the cable connector.



or



Repair

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

WARNING ⚠

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

Falling Over

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

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For Safety

CAUTION ⚠

Changing Fuse

CAUTION ⚠

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

   T___A indicates a time-lag fuse.
   ___A or F___ A indicate a normal fusing type fuse.

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

Cleaning

2. Keep the power supply and cooling fan free of dust.
   - Clean the power inlet regularly. If dust accumulates around the power pins, there is a risk of fire.

Changing memory back-up battery

This equipment uses a 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 changed before this period has elapsed.

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Equipment Certificate

Anritsu guarantees that this equipment was inspected at shipment and meets 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

If this equipment develops a fault, contact Anritsu Corporation or its representatives at the address in this manual.

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CE Marking

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

CE Conformity Marking

CE

1. Product Name/Model Name

Product Name: Optical Channel Selector

Model Name: MN9662A, MN9664A, MN9672A and MN9674A

2. Applied Directive

EMC : Council Directive 89/336/EEC

Safety: Council Directive 73/23/EEC

3. Applied Standards

EMC:

Electromagnetic radiation:

EN55011 (ISM, Group 1, Class A equipment)

Immunity: EN50082-1

		Performance Criteria*
IEC801-2 (ESD)	4 kVCD, 8 kVAD	B
IEC801-3 (Rad.)	3 V/m	A
IEC801-4 (EFT)	1 kV	B

*: Performance Criteria

A: No performance degradation or function loss

B: Self-recovered temporary degradation of performance or temporary loss of function

Harmonics:

EN61000-3-2

Note: This product isn't applied to the EN61000-3-2

Safety: EN61010-1 (Installation Category II, Pollution Degree 2)

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

C-tick marking



1. Product Name/Model Name

Product Name: Optical Channel Selector
Model Name: MN9662A, MN9672A,
MN9664A, MN9674A

2. Applied Standards

EMC:

Emission:

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

Immunity:

AS/NZS 4252.1

		*Performance Criteria
IEC801-2 (ESD)	8 kVAD	B
IEC801-3 (Rad.)	3 V/m	A
IEC801-4 (EFT)	1 kV(peak)	B

* Performance Criteria

A: No performance degradation or function loss

B: Self-recovered temporary degradation of performance or temporary loss of function

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1.1 Functions and Use of the Optical Channel Selector

Functions

The optical channel selector, a unit for connecting light that propagates through optical fibers to one of multiple optical fibers, plays a similar role to the rotary switch in the electric circuit.

The optical channel selector can be controlled remotely by an RS-232C and GPIB interface .

Use

In the communications system, the optical channel selector is used to select the communications line or the communications equipment.

In the measuring system, the optical channel selector is used to select the device under test or the measuring instrument.

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1.2 Product Lineup

Select an appropriate model depending on the number of channels.
Each optical channel selector has the following model names and numbers of channels.

Model name	Number of common channels	Number of channels
MN9662A	1	8
MN9672A	2	8
MN9664A	1	16
MN9674A	2	16

The MN96☐2A optical channel selector connects the light of the optical fiber connected to the common channel to one of the eight channels.
The MN96☐4A optical channel selector connects the light of the optical fiber connected to the common channel to one of the 16 channels.
The MN967☐A optical channel selector has two common channels.

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1.3 Features

The MN9662A, 9672A, 9664A, and 9674A optical channel selectors have the following features.

- The optical channel selector contributes to the construction of optical communications or optical measuring systems by reducing the connection loss of light and implementing high switching reproducibility and switching life.
- Five types of optical connectors can be used by replacing adapters in the optical connector, allowing flexible system construction.
- The optical channel selector comes standard with RS-232C and GPIB interface ports for remote control, enabling automatic operation and remote control of the system.
- Since the optical channel selector is compact in size, it saves system space.

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Section 2 Specifications

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2.1 Product Configuration

Main unit

MN9662A	Optical channel selector	1
MN9672A	Optical channel selector	1
MN9664A	Optical channel selector	1
MN9674A	Optical channel selector	1

Standard accessories

W1489AW	Optical channel selector operation manual	1
J0017F	Power cable	1
J0266	2- to 3-pole converting adapter	1
F0008	Fuse T1A	2
Z0397A	FC adapter cap Option 37	Note 1
Z0411A	ST adapter cap Option 38	Note 1
Z0412A	DIN adapter cap Option 39	Note 1
Z0413A	SC adapter cap Option 40	Note 1
Z0414A	HMS-10/A adapter cap Option 43	Note 1
	Note 1:	
	MN9662A	9 pieces
	MN9672A	10 pieces
	MN9664A	17 pieces
	MN9674A	18 pieces
B0329L	Front cover	1

Option

MN9662A-01	Parallel interface for connecting MW9070B With four contact outputs
MN96☐☐A-37	FC-PC connector mounting unit
MN96☐☐A-38	ST connector mounting unit
MN96☐☐A-39	DIN connector mounting unit
MN96☐☐A-40	SC connector mounting unit
MN96☐☐A-43	HMS-10/A connector mounting unit

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Application parts

J0617B	Replaceable optical adapter (FC-PC)
J0618B	Replaceable optical adapter (ST)
J0618E	Replaceable optical adapter (DIN)
J0618F	Replaceable optical adapter (SC)
J0619B	Replaceable optical adapter (HMS-10/A)
Z0397A	FC adapter cap Option 37
Z0411A	ST adapter cap Option 38
Z0412A	DIN adapter cap Option 39
Z0413A	SC adapter cap Option 40
Z0414A	HMS-10/A adapter cap Option 43
J0575	Optical fiber cable, 2 m
Z0282	Ferrule cleaner
Z0283	Ferrule cleaner replacement tape (six pieces/set)
Z0284	Adopter cleaner (stick type, 200 pieces/set)
J0006	GPIB cable, 0.5 m
J0007	GPIB cable, 1 m
J0008	GPIB cable, 2 m
J0009	GPIB cable, 4 m
J0654A	RS-232C cable, 9P-9P
J0655A	RS-232C cable, 9P-25P
J0897B	MT9810A connecting cable, 1 m
J0897C	MT9810A connecting cable, 2 m
J0897D	MT9810A connecting cable, 5 m
J0897E	MT9810A connecting cable, 10 m

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2.2 Specifications

Item/model name	MN9662A	MN9672A	MN9664A	MN9674A
Number of channels	1 × 8	2 × 8	1 × 16	2 × 16
Wavelength range used	1.2 to 1.65 μm			
Optical fiber used	ITU-T G.652			
Switching reproducibility	0.02 dB or less*2, *1			
Insertion loss	1.6 dB or less*3, *1	2.5 dB or less*3, *1	1.6 dB or less*3, *1	2.5 dB or less*3, *1
Polarization dependent loss	0.03 dB or less*4, *1	0.05 dB or less*5, *1	0.03 dB or less*4, *1	0.05 dB or less*5, *1
Switching life	10 million times or more			
Cross-talk	-80 dB or less			
Maximum input light level	+23 dBm (200 mW)			
Minimum switching time	600 mS or less*6			
Maximum switching time	800 mS or less*7		1100 mS or less*8	
Return loss	45 dB or more*9			
Conforming light connector	FC-PC, ST, DIN, SC, HMS-10/A			
Operating temperature range	0 to 50 °C			
Storage temperature range	-30 to 71 °C			
Dimensions	213W, 88H, 351D mm			
Mass	4.5 kg or less			
Power voltage	85-132/170-250 VAC			
Power consumption, Frequency	35 VA or less, 47.5 to 63 Hz			
Monitor	7-segment LED, green			
Remote control	Control by GPIB, RS-232C (D sub 9 pins), and MT9810A			

*1 The master optical fiber is used for measurement.

*2 In a constant temperature within the operating temperature range and in a constant polarization state

*3 Includes two connector loss. Specified at 1.31 and 1.55 μm wavelengths

*4 In a constant temperature within the operating temperature range. Specified at 1.31 and 1.55 μm wavelengths

*5 In a constant temperature within the operating temperature range. Specified at 1.55 μm wavelength

*6 Between Channels 1 and 2

*7 Between Channels 7 and 8

*8 Between Channels 15 and 16

*9 The return loss is dependent on the connector connected.
The specification is applied for the measurement at 1.31 and 1.55 μm wavelengths using a PC connector with a return loss of 50 dB or more.

Option

Item/model name	MN9662A-01
Remote control	RS-232C (D sub 9 pins), parallel interface (36 pins)
Contact output	4 circuits

The specifications other than the remote control and contact output are the same as those of the MN9662A.

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Section 3 Before Using this Equipment

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3.1 Installing Method

The Optical Channel Selector (hereinafter, referred to as "this equipment") operates normally under an ambient temperature of 0 to 50°C To ensure that this equipment is used under the best conditions, avoid use in the following locations.

- Locations with severe vibration
- Locations with much moisture and dust
- Locations exposed to direct sunlight
- Locations that may be exposed to active gas

This equipment emits heat by natural air cooling and there is a unit that operates mechanically inside this equipment. Therefore, install this equipment on a level surface in the direction shown in Figure 3-1 and never turn this equipment sideways.
On the side panels of this equipment, there are ventilating holes to emit heat. Separate this equipment from the surrounding walls by 5cm or more.

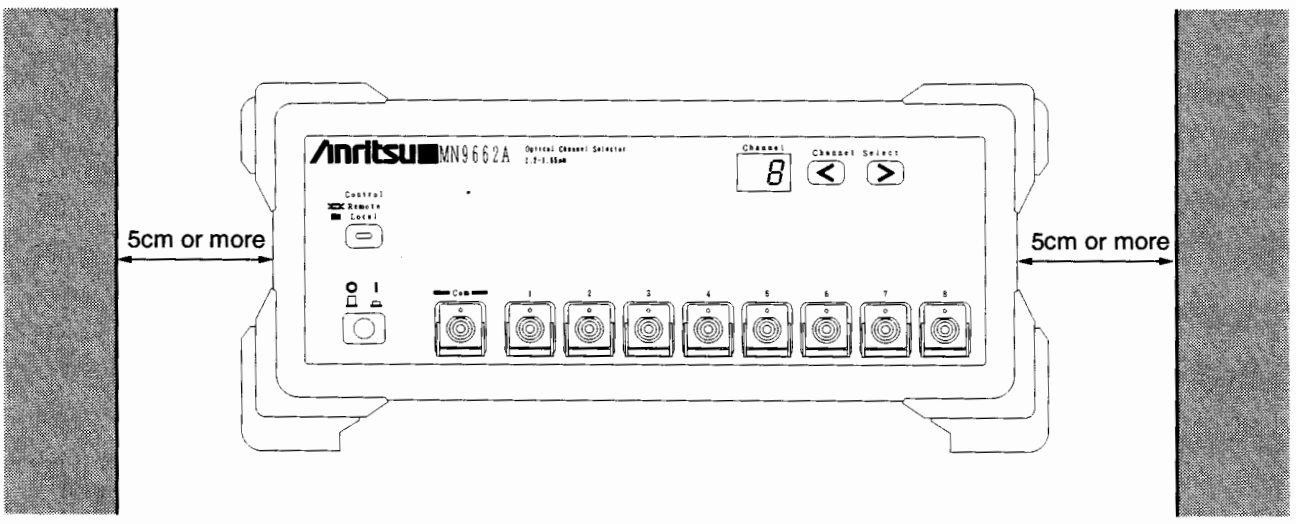


Figure 3-1

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3.2 Grounding Power Cable and Grounding Wire

To supply power to this equipment, connect the attached three-pole power cable to the ground-type power outlet and ground this equipment.

If a ground-type power outlet is not available, convert this three-pole power cable to a two-pole power cable using the attached conversion adapter. Be sure to ground the terminal of the green cable (grounding wire) extended from the conversion adapter or the protection grounding terminal on the rear side of this equipment before plugging the power cable into the outlet.

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3.3 Replacing an Optical Connector

The adapter of optical connector can be removed to replace with an optionally available adapter of another shape or to clean inside.

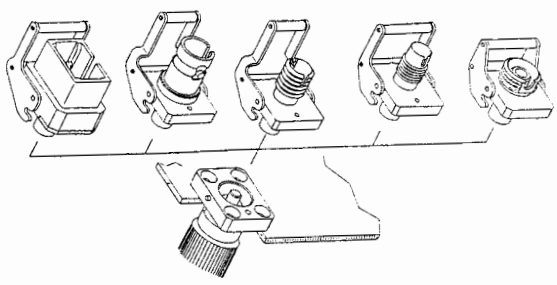


Figure 3-2 Replaceable connector

Replace the optical connector in the following procedure.

1) Raise the lever (Figure 3-3). After confirming that the latch is opened, gently pull out the connector towards you horizontally (Figure 3-4).

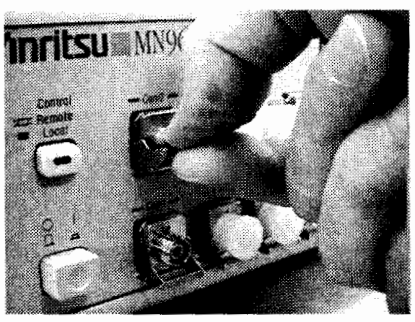


Figure 3-3

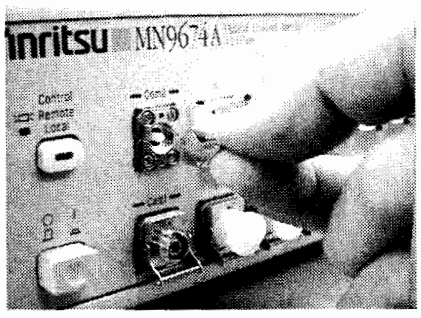


Figure 3-4

2) To mount the connector, follow the reversal of the removal. Take sufficient care not to damage the edge of the ferrule with adapter when mounting the connector.
For the cleaning method, see Section 7-1.

CAUTION ⚠

If a laser beam is input to a channel of this equipment, the laser beam will be output from another channel although this unit itself does not emit a laser beam.
Be sure to confirm that a laser beam is not input before replacing or cleaning the optical connector.
Mount attached optical adapter cap to the unused channels.
If there is dirt on the ferrule when inputting a high-level laser beam (+10 dBm = 10 mW or more) to this equipment, the dirt will be heated by the laser beam and the ferrule will get damaged. To avoid such an accident, clean the ferrule thoroughly.

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3.4 Replacing a Fuse

If a fuse is blown, eliminate the cause and follow the procedure below.

Warning ⚠

Before replacing the fuse, be sure to turn off the power and plug out the power cable. If the fuse is replaced without plugging out the power cable, there is danger of electric shock.
For a fuse for replacement, use a fuse described in this manual or a fuse of the same rating or performance indicated on the rear side of the cabinet. Use of improper fuses may cause frequent blowing or burning of fuses or fire. In the fuse display, T□□□A indicates a time-lag type fuse. In this equipment, 1 A time-lag type fuses are used.

Procedure for fuse replacement

1) The lower portion of the AC inlet on the rear side of this equipment is a fuse holder. Pull out the fuse holder by putting the tip of a slotted screwdriver on the upper portion of the fuse holder. (Figure 3-5)

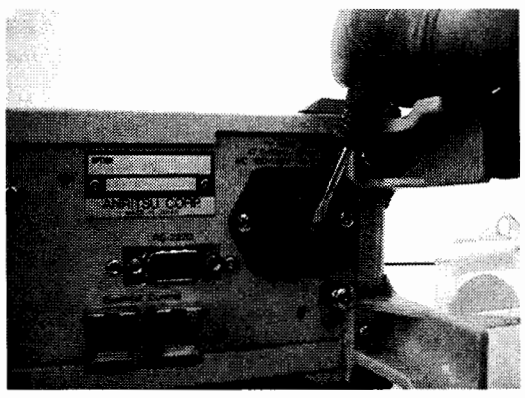


Figure 3-5 Removing the fuse holder

2) Two fuses are installed on the fuse holder. Remove the fuses and install new ones.

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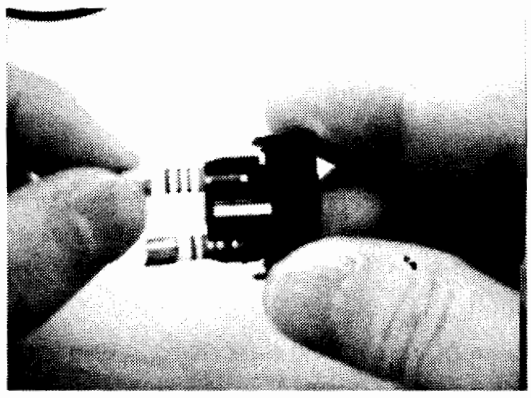


Figure 3-6

3) Reinstall the fuse holder to the lower portion of the AC inlet.

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Section 4 Operation

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4.1 Panel Features

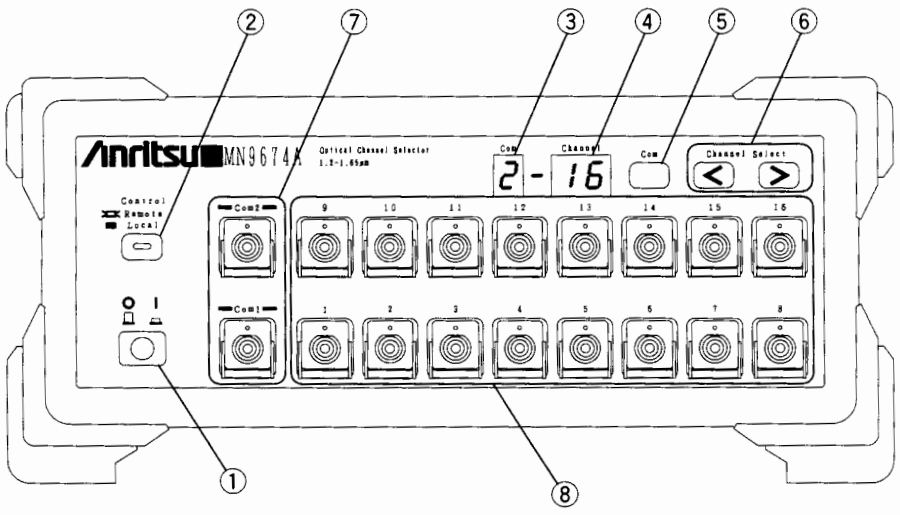


Figure 4-1 MN9674A front panel

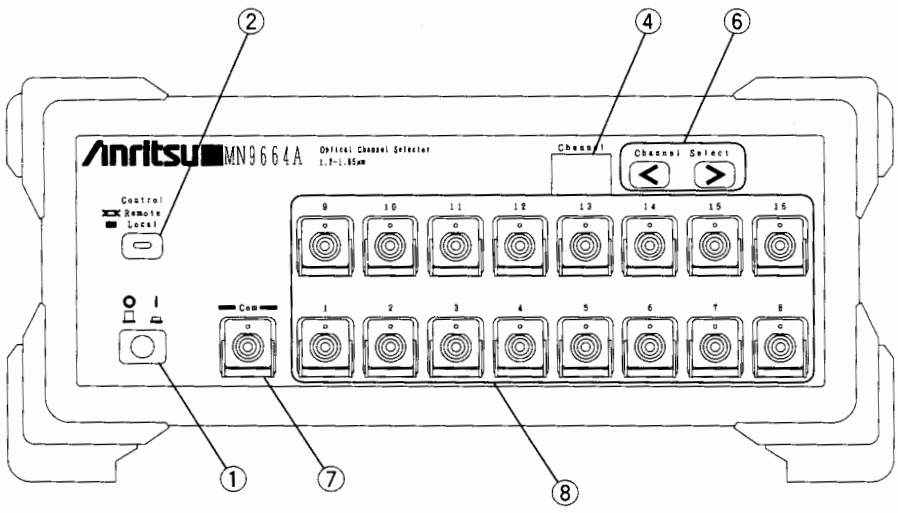


Figure 4-2 MN9664A front panel

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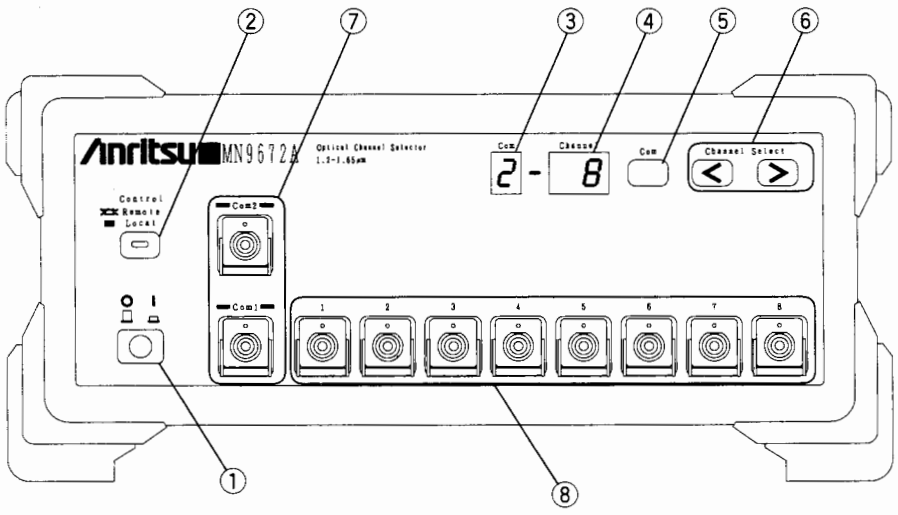


Figure 4-3 MN9672A front panel

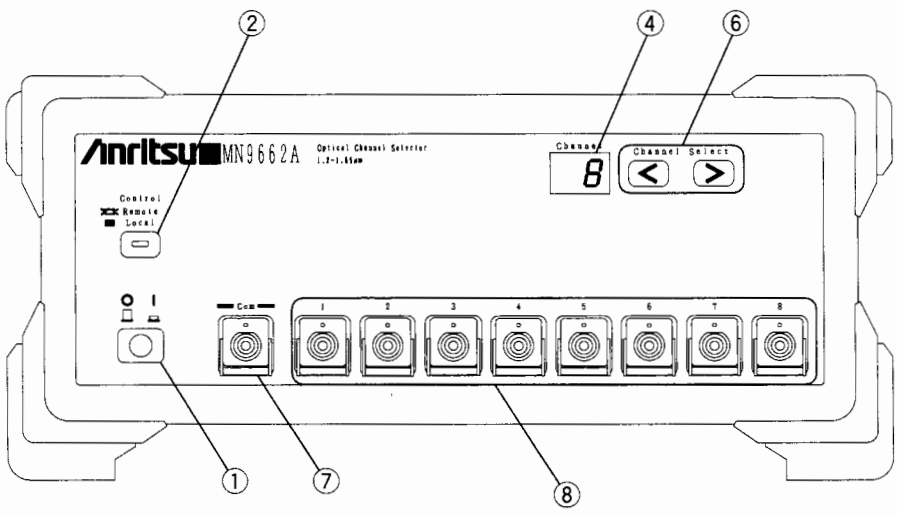


Figure 4-4 MN9662A front panel

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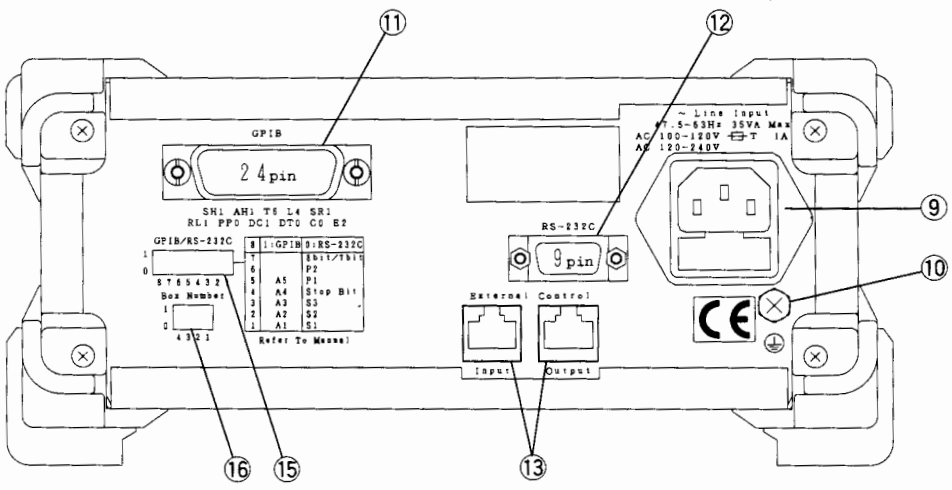


Figure 4-5 Rear panel

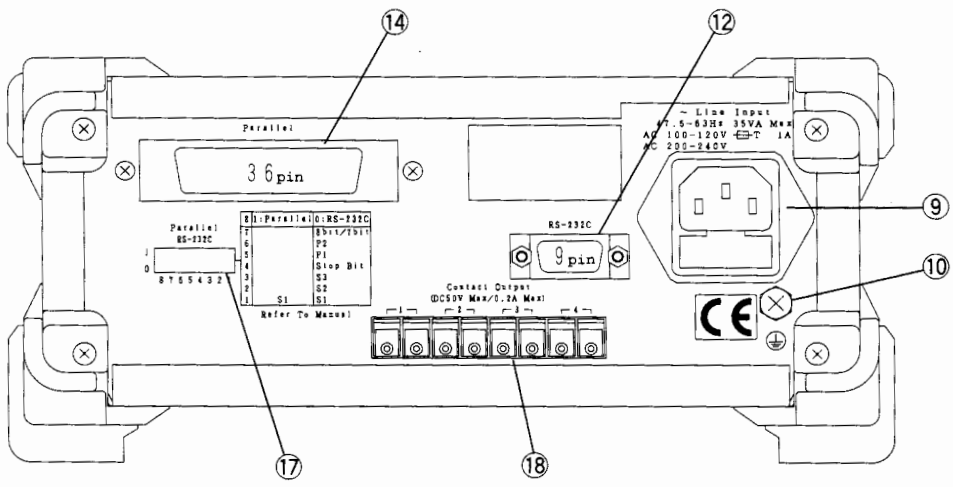


Figure 4-6 Option 01 Rear panel

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A description of the panel is provided in Table 4-1 below.

Table 4-1 Explanation of the panel

Number	Name	Function
1	Power switch	The power is turned off at position ○ and turned on at position |.
2	Control key	When this equipment is controlled remotely, the lamp lights to show remote status. If the key is pressed while the lamp is lit, the lamp goes out to show local status, enabling channel setting with the panel key.
3	Common channel display	In the MN9672A and MN9674A, the connected common channel is displayed.
4	Channel display	The connected channel is displayed. If an error occurs on this equipment, the error message is displayed. Refer to appendix B to know the details of error messages.
5	Common channel selection key	In the MN9672A and MN9674A, the common channel is selected by pressing this key.
6	Channel selection key	Used to select the channel number to be connected. Pressing the < key decreases the number and pressing the > key increases the number.
7	Common channel	Connects the optical fiber cable.
8	Channel	Connects the optical fiber cable. The channel number is displayed above the connector.
9	AC inlet	Connects the power cable. Fuses are built in it.
10	Protection grounding terminal	Connects a grounding wire to protect from electric shock.
11	GPIB connector	Connects a GPIB cable.
12	RS-232C connector	Connects an RS-232C cable.
13	External control connector	Connects an MT9810A optical test set or optical channel selector.
14	Parallel interface connector	Connects an MW9070B-02 OTDR.
15	GPIB/RS-232C setting switch	Sets the RS- 232C communications condition or the GPIB address.
16	Box number setting switch	Sets the number identified by the MT9810A when the optical channel selector is controlled by the MT9810A.
17	Parallel/RS-232C setting switch	Sets the RS-232C communications condition or parallel interface control target.
18	Contact Output	Connects the unit to be controlled. This output is controlled from the MW9070B-02 OTDR. For the use method, see the MX907002B operation manual.

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4.2 Operation Procedure

1. Connect the optical fiber cables to a common channel and channel.
2. Turn on the power.
3. Select the channel to be connected with the channel selection key. Pressing the key continuously increments or decrements the number automatically.
4. After the key is released and the blinking of the channel display stops, the channel changing operation is completed.
5. In the MN9672A and MN9674A, select a common channel by pressing the common channel selection key. If the key is pressed, a click is heard and the common channel is switched.

When this equipment is controlled remotely, the lamp of the control key is lit. In this case, this equipment cannot be operated with the common channel selection key and the channel selection key. After the remote control is canceled by pressing the control key and the lamp goes out, this equipment can be operated with the common channel selection key and the channel selection key.

The channel setting is backed up in memory. The channel at the time of turning off the power previously is set when the power is turned on.

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4.3 Connecting the Contact Output

Connect a unit to be controlled (e.g., lamp, buzzer) to the contact output of Option 01. The AWG26-18 (solid wire) and the AWG22-20 (stranded wire) are suitable.

1. Strip off about 10 mm of the insulation of the wire to be connected.
2. Push the button above the hole with a slotted screwdriver or other means.
3. Insert the wire into the hole.

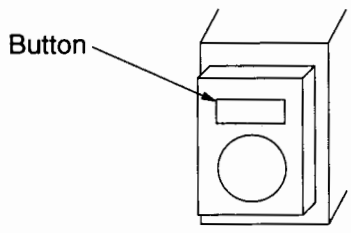


Figure 4-7 Connecting to the contact output terminal

To remove the wire, pull out the wire while pressing the button.
To suppress noise generated by an electric wire, use the EMI-proof ferrite core. A use example is shown in Figure 4-8.

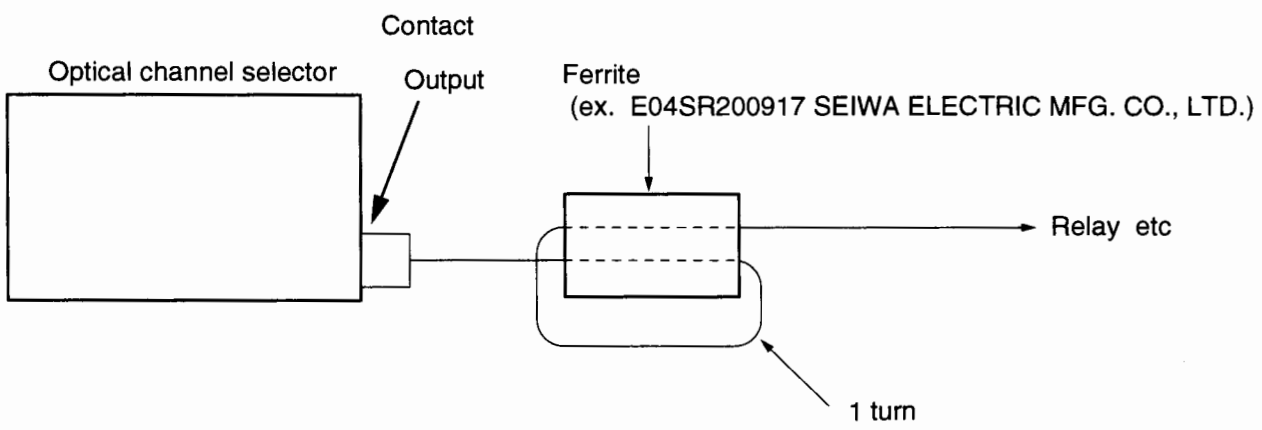


Figure 4-8 How to connect the wire to the contact output.

CAUTION ⚠

If the EMI-proof ferrite core is not used, it may not satisfy the EMC Electromagnetic Radiation Standard.

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4-8.

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Section 5 Remote Control

This equipment can be controlled remotely in the following three methods.

(1) GPIB
(2) RS-232C
(3) Control from the MT9810A
(4) Control from the MW9070B. Only when Option 01 is mounted,
The GPIB and RS-232C interfaces cannot be used simultaneously.
When this equipment is controlled from the MT9810A, the GPIB and RS-232C interfaces cannot be used.

Though RS-232C is called EIA-232-E in ANSI/EIA, the general term RS-232C is used in this document and this equipment.

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5.1 Setting

5.1.1 When using GPIB or RS-232C

Set the eight-pin dip switch assembly (Figure 5-1) on the rear panel.

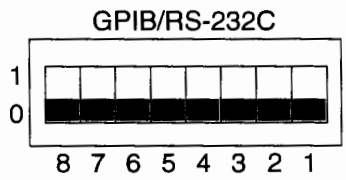


Figure 5-1

When GPIB is used

Pin 8: Set to 1.

Pin 6: Unused. Neither setting affects the communication.

Pin 7: 0: The commands conforming to IEEE488.2 are used.

1: The commands compatible with the MN9601C/D/E optical channel selectors are used. In this case, this equipment does not conform to the IEEE488.2 standard, but conforms to the IEEE488.1 standard.

Pin 5: Address setting 2^4 is set.

Pin 4: Address setting 2^3 is set.

Pin 3: Address setting 2^2 is set.

Pin 2: Address setting 2^1 is set.

Pin 1: Address setting 2^0 is set.

The GPIB address is set in binary using Pins 1 to 5.

The setting example is shown in Figure 5-2.



Figure 5-2 Setting example

GPIB address 9 ($= 0 \cdot 2^4 + 1 \cdot 2^3 + 0 \cdot 2^2 + 0 \cdot 2^1 + 1 \cdot 2^0$)

Command conforming to IEEE488.2

Hint

When Option 01 is mounted, the GPIB interface cannot be used.

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When RS-232C is used

Pin 8: Set to 0.

Pin 7: Set the bit length. 1: 7 bits 0: 8 bits

Pin 6: Set whether the parity is valid or invalid. 0: Invalid 1: Valid
If "1:" is set, the setting of Pin 5 becomes valid.

Pin 5: Set the parity. 1: Odd 0: Even

Pin 4: Set the stop bit. 0: 1 bit 1: 2 bits

Pin 3: Set the speed. S3

Pin 2: Set the speed. S2

Pin 1: Set the speed. S1

The speed setting is shown in next table.

Speed (bps)	S3	S2	S1
1200	0	0	0
2400	0	0	1
4800	0	1	0
9600	0	1	1
14400	1	0	0
19200	1	0	1
19200	1	1	0
19200	1	1	1

A setting example is shown in Figure 5-3.



Figure 5-3 Setting example

RS-232C, 7 bits, no parity, stop bit: 2 bits, 9600bps

Hint

If the dip switch setting is changed, turn off the power once, and then turn on the power again to operate this equipment with the changed dip switch setting.

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5.1.2 When controlling from the MT9810A optical test set

Set the box number that is identified by MT9810A with the four-pin dip switch (Figure 5-4) on the rear panel.

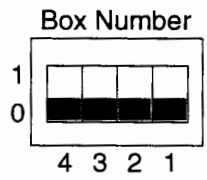


Figure 5-4

Pin 4	Number setting	Set 2^3
Pin 3	Number setting	Set 2^2
Pin 2	Number setting	Set 2^1
Pin 1	Number setting	Set 2^0

Set the box number between 1 and 9 (inclusive).
If the box number is set outside this range, this equipment cannot be controlled from the optical test set.
If other optical channel selectors are used, take care not to use the same box number. The setting example is shown in Figure 5-5.

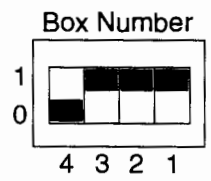


Figure 5-5 Box number 7 (= $0 \cdot 2^3 + 1 \cdot 2^2 + 1 \cdot 2^1 + 1 \cdot 2^0$)

Hint

If the dip switch setting is changed, turn off the power once, and then turn on the power again to operate this equipment in the changed dip switch setting.

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5.1.3 Connecting multiple optical channel selectors

Using the MT9810A optical test set, up to nine optical channel selectors can be controlled.
On the rear panel of each optical channel selector, there are two External Control connectors.
To connect to the MT9810A, connect to Input of an optical channel selector.
To connect two or more optical channel selectors, be sure to connect Input of one optical channel selector to Output of another optical channel selector. A connection example is shown in Figure 5-6.

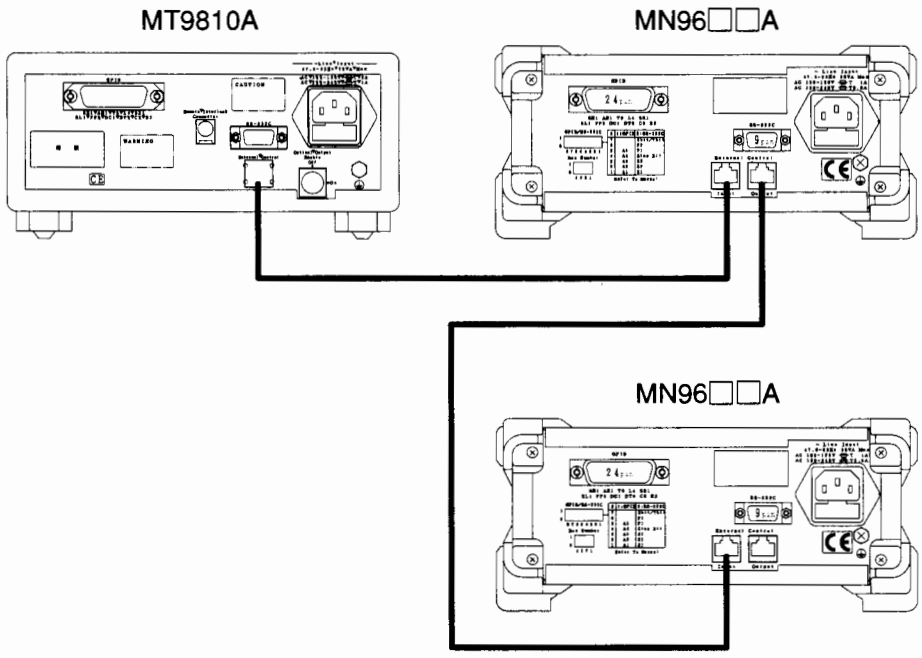


Figure 5-6

CAUTION ⚠

For the cable connecting to the External Control, use the one specified in "2.1 Application parts."
If the cable produced by other company is used, it may not satisfy the EMC Electromagnetic Radiation Standard.

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5.1.4 When controlling from the MW9070B-02 OTDR

To control the optical channel selector from MW9070B-02 Optical Time Domain Reflectometer with Option 02, using Parallel Interface of Option 01, set the 8-pin dip switch on the rear panel (Figure 5-7).

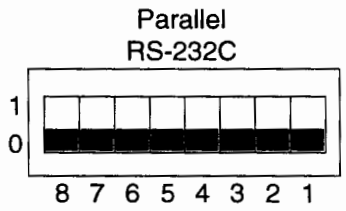


Figure 5-7

8-pin	Set to 1
7-pin to 2-pin	Not used
1-pin	1: Controls Contact Output 1 to 4 and channel 1 to channel 4. It cannot control channel 5 to channel 8. 0: It controls channel 1 to channel 8.

The setting examples are shown in Figure 5-8.

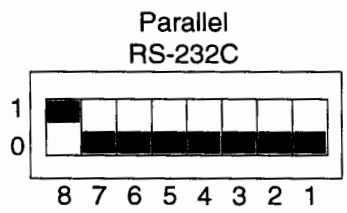


Figure 5-8 Setting example Control of channel 1 to channel 8 by MW9070B-02

Hint

If the setting of the dip switch is changed, that comes to be valid when the power is turned on again.
Refer to MX907002B Operation Manual about the details to control this equipment from MW9070B-02 OTDR.

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5.2 Specifications

5.2.1 GPIB specifications

This equipment conforms to IEEE488.2.

This equipment can be controlled as a device from an external controller.

The interface function of this equipment is shown in Table 5-1.

Table 5-1 Interface function

Specification category	Description
SH1	All functions of source handshake
AH1	All functions of acceptor handshake
T6	With basic talker function, with serial port function Without talk only function, with MLA talker cancel function
L4	With basic listener function, without listen only function With MLA listener cancel function
SR1	With service request function
RL1	With remote/local operation selection function
PP0	Without parallel poll function
DC1	With device clear function
DT0	Without device trigger function
C0	Without control function

5.2.2 RS-232C specifications

The RS-232C specifications of this equipment are shown in Table 5-2.

Table 5-2 RS-232C specifications

Item	Standard value
Function	Control from external controller
Communications method	Asynchronous, half duplex
Communications control method	Without flow control
Baud rate	1200, 2400, 4800, 9600, 14400, 19200 bps
Data bit	7 bits, 8 bits
Parity	Odd, Even, None
Start bit	1 bit
Stop bit	1 bit, 2 bits
Connector	D-sub 9 pin, female

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5.3 IEEE 488.2 Standard Status Model

The diagram shown below is the standard model of the status data structure specified by IEEE 488.2.

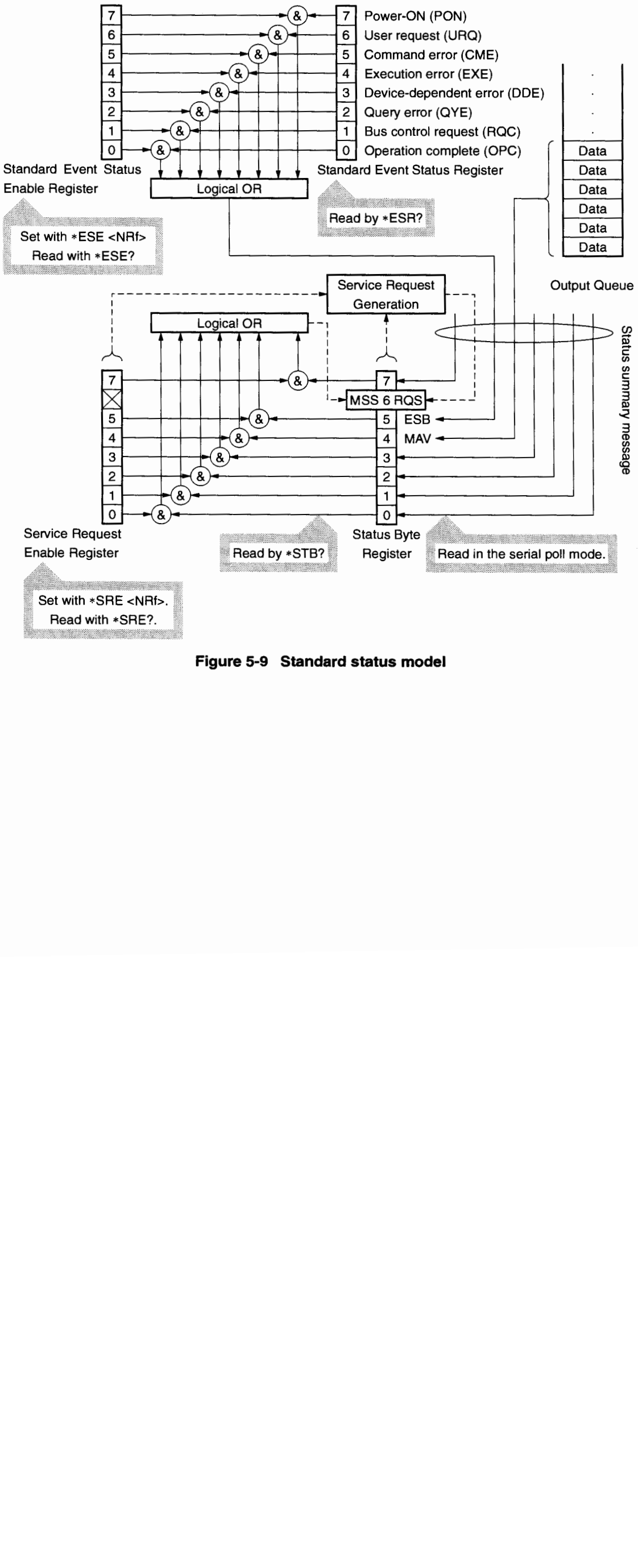


Figure 5-9 Standard status model

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The status model uses an IEEE 488.1 status byte. This status byte consists of seven summary message bits provided by the status data structure. To generate these summary message bits, the status data structure is comprised of two models: a register model and a queue model.

Register model

A pair of registers used to record an event that a device has encountered and a condition. It consists of an event status register and an event status enable register. When the results of ANDing the values of bits of these registers is not 0, the corresponding status register bits are set to 1s. In other cases, the corresponding status register bits are set to 0s. If the result of ORing the values of status register bits is 1, the summary message bit is set to 1. If the result of ORing these bits is 0, the summary message bit is set to 0.

Queue model

A data structure in which status values or information are removed in the same order of which those were entered. Only when the queue structure contains data, the corresponding bit is set to 1. If it is empty, the corresponding bit is set to 0. Based on the concept of the abowtàregister model and queue model, the IEEE 488.2 standard status model is constructed from two types of register models and a queue model.

(1) Standard event status register and standard event status enable register

This register has the register model structure mentioned above. It has eight bits corresponding to eight standard events listed below encountered by the device.

(a) power on
(b) user request
(c) command error
(d) execution error
(e) device dependent error
(f) query error
(g) bus control request
(h) operation complete.

The result of logical OR is output to the status byte register bit 5 (DIO 4) as an event status bit (ESB) summary message.

(2) Status byte (STB) register and service request enable (SRE) register

The status byte register consists of an RQS bit and seven summary message bits for setting status summary messages from the status data structure. It is used in combination with a service request enable register. When the result of ORing the values of these two registers is 0, the SRQ is set ON. In this case, the status byte register bit "DIO 7" is reserved by the system as an RSQ bit, so this bit indicates to an external controller that a service request exists. The function of the SRQ conforms to IEEE 488.1.

(3) Output queue

This queue has the queue model structure mentioned above. Its contents are summarized and transferred to the status byte register bit 4 (DIO 5) as a MAV (message available) summary message.

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5.4 Status Byte Register

The status byte register consists of device STB and RQS (or MSS) messages. IEEE 488.1 defines the method of reporting STB and RQS messages, but it does not define the setting and clearing protocols and STB meaning. IEEE 488.2 defines device status summary messages and MSS transferred to bit 6 along with an STB in response to the *STB? common query.

5.4.1 ESB and MAV Summary Message

The followings are the explanations of an ESB summary message and an MAV summary message.

(1) ESB summary message

The ESB (event summary bit) summary message is defined by IEEE 488.2. It appears in status byte register bit 5. This bit indicates whether one or more IEEE 488.2 defined events have occurred, with the service request enable register set to allow events to occur, after the standard event status register was read or cleared last. The ESB summary message bit becomes True when at least one event registered in the standard event status register becomes True with event occurrence enabled. Conversely, the ESB summary bit becomes False when none of the registered events has occurred even if event occurrence is enabled.

(2) MAV summary message

The MAV (message available) summary message is defined by IEEE 488.2. It appears in status byte register bit 4. This bit indicates whether the output queue is empty. When a device is ready for accepting response messages from the controller, the MAV summary message bit becomes 1 (True). When the output queue is empty, this bit becomes 0 (False). This message is used to synchronize information exchange with the controller. For example, the controller can send a query message to the device and wait for the MAV to become True. The controller can perform another processing while waiting for a response from the device. If the controller has started reading the output queue without checking the MAV, all system bus operations are suspended until a response is received from the device.

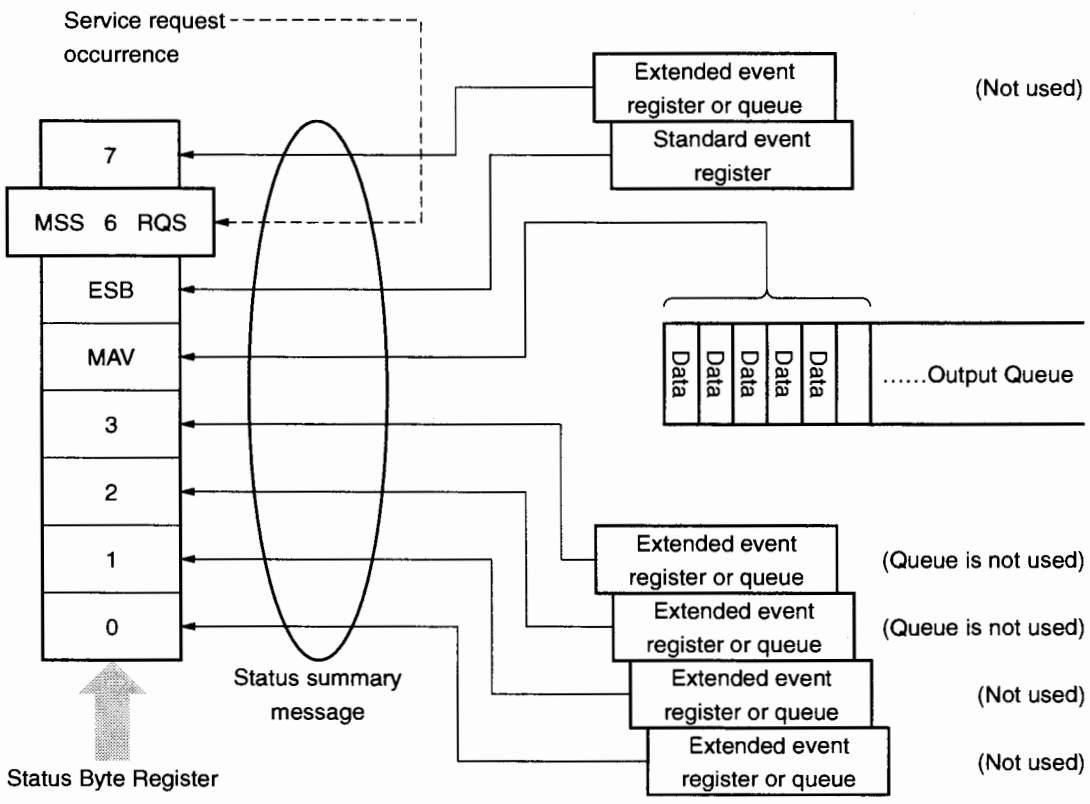
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5.4.2 Device Dependent Summary Message

IEEE 488.2 does not define whether status register bit 7 (DIO 8) and bit 3 (DIO 4) to bit 0 (DIO 1) are used as status register summary bits or the bits indicating existence of data in the queue. Accordingly, these bits can be used as device dependent summary message bits.

Device dependent summary messages have a register model or queue model status data structure. This status register is a pair of registers used to report events and states in parallel or a queue used to report states and information sequentially. The summary bit provides a summary of the current status of the corresponding status data structure. For the register model, the summary message bit becomes True when one or more events have become True with occurrence of events enabled. For the queue model, the summary message bit becomes True when the queue is not empty.

In the MT9810A, bit 1 and bit 0 are unused, and bits 3 and 7 are used as summary bits of the status register; bit 2 is allocated to the queue as shown in the following diagram. Therefore, there are four types (two types for extension) of register models and there are two types (one type for extension) of queue models.



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5.4.3 Reading and Clearing the Status Byte Register

Status byte register contents can be read using serial polling or an *STB? common inquiry. IEEE 488.1 defined STB messages can be read by either method, but the value transferred to bit 6 (position) varies depending on the method. status byte register contents can be cleared using a *CLS command.

(1) Reading the status byte register using serial polling (only when a GPIB interface bus is used)

When IEEE 488.1 defined serial polling is carried out, the device must return a 7 bit status byte and IEEE 488.1 defined RQS message bit. According to IEEE 488.1, the RQS message indicates whether the device has issued SRQs in the True state. The status byte value is not affected by serial polling. Immediately after being polled, the device must set the rsv message in the False state. If the device is polled again before a cause of issuing a new service request occurs, the RQS message has already been set in the False state.

(2) Reading the status byte register using an *STB? common query

The *STB? common query causes the device to output status byte register contents and one <NR1 NUMERIC RESPONSE DATA> from the MSS summary message. The response is the total of the status register value assigned binary weights and MSS summary message value. Status byte register bits 0 to 5 and 7 are assigned weighs 1, 2, 4, 8, 16, 32, and 128 respectively, and the MSS is assigned weights 64. The response to the *STB? is the same as that to serial polling with the exception that an MSS summary message appears in bit 6 instead of an RQS message.

(3) Definition of MSS (Master Summary Status)

The MSS indicates that the device has at least one cause of issuing a service request. In the device's response to the *STB? query, the MSS message appears in bit 6. However, it does not appear in the response to serial polling. It must not be regarded as part of the IEEE 488.1 defined status byte. The MSS is the result of ORing the values of status byte register and SRQ enable (SRE) register bits totally. Specifically, the MSS is defined as follows:

(STB Register bit 0 AND SRE Register bit 0)
OR
(STB Register bit 1 AND SRE Register bit 1)
OR
:
:
(STB Register bit 5 AND SRE Register bit 5)
OR
(STB Register bit 7 AND SRE Register bit 7)

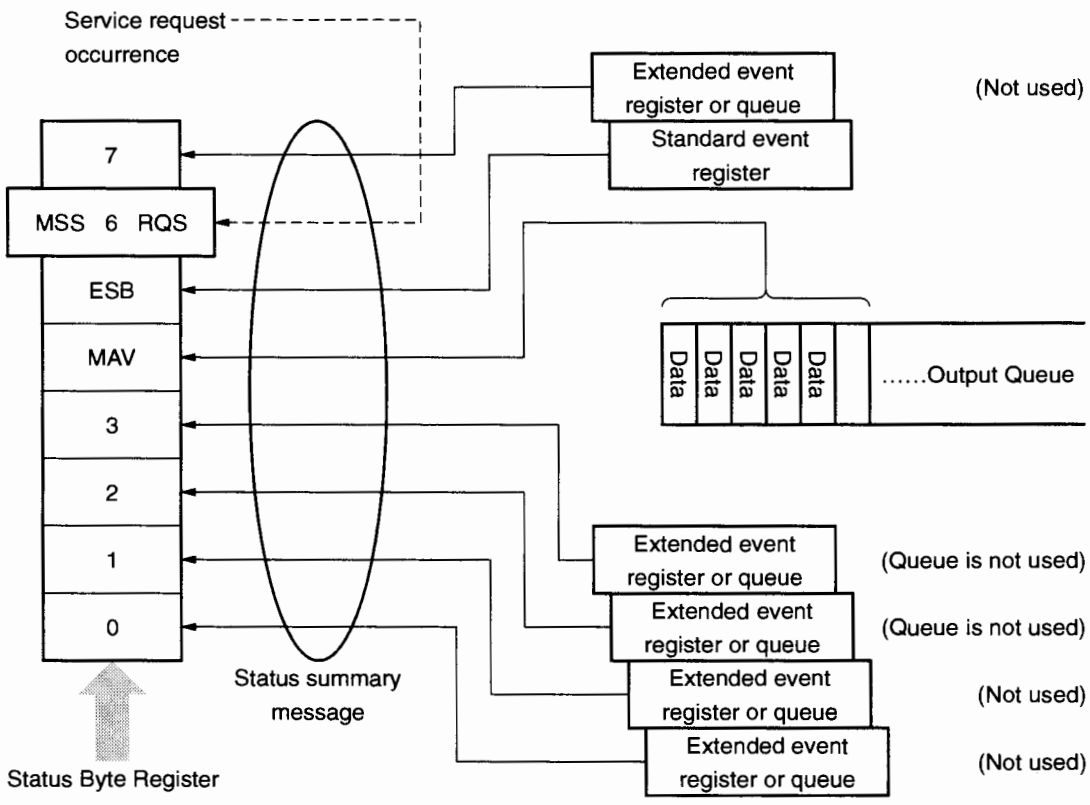
In the definition of the MSS, the values of bits 6 of the status byte register and SRQ enable register are ignored. Accordingly, when calculating the MSS value, the status byte may be handled assuming that it is represented by 8 bits and bit 6 is always 0.

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(4) Clearing the status byte register using a *CLS common command

The *CLS common command clears all status structures, except the output queue and MAV summary message (i.e., event registers and queues), and the corresponding summary messages.

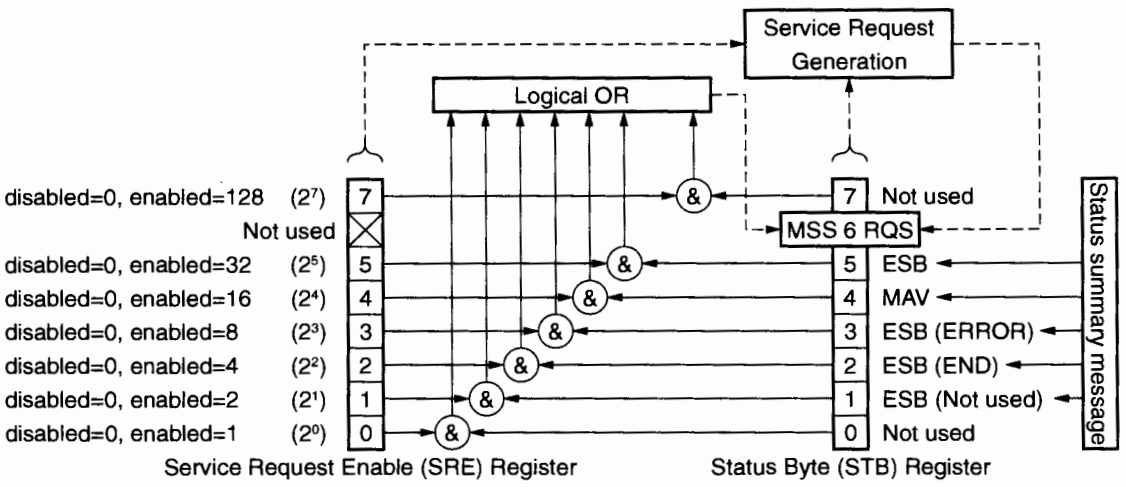
Issuing a *CLS command after the <PROGRAM MESSAGE TERMINATOR> element or before the <Query MESSAGE UNIT> element clears all status bytes. With this method, all unread messages in the output queue are cleared and the MAV message becomes False. When replying to the *STB?, the MSS message becomes False, too. Values of enable registers are not affected by *CLS.



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5.5 Enabling the SRQ

Enabling the SRQ allows a summary message in the status byte register to be selected in response to a service request. The service request enable (SRE) register shown below can be used to select a summary message.
Bits of the service request enable register correspond to the bits of the status byte (STB) register. When 1 is set in a status byte bit corresponding to a significant bit of the service request enable register, the devices sets the RQS bit to 1 and issues a service request to the controller. For example, when bit 4 of the service request enable register is set (enabled) in advance, a service request can be issued to the controller each time the MAV bit is set to 1 (if the output queue has data).



(1) Reading the service request enable register

service request enable register contents can be read using an *SRE? common inquiry. The response message to this query is <NR1 NUMERIC RESPONSE DATA>, an integer ranging from 0 to 255. It is a total of values of the service request enable register. Service request enable register bits 0 to 5 and 7 are assigned weights 1, 2, 4, 8, 16, 32, and 128, respectively. Unused bit 6 must always be 0.

(2) Updating the service request enable register

The service request enable register is written using an *SRE common command. The *SRE common instruction is followed by a <DECIMAL NUMERIC PROGRAM DATA> element. <DECIMAL NUMERIC PROGRAM DATA> is rounded to an integer. It is represented in binary notation using a base 2, indicating the total of values of service request enable register bits (weight value). When the value of this bit is 1, it indicates the enabled state. When the value of this bit is 0, it indicates the disabled state. The value of bit 6 must always be ignored.

(3) Clearing the service request enable register

The service request enable register can be cleared by executing an *SRE common command or turning on the power. When an *SRE common command is used, the service request enable register can be cleared by bringing the <DECIMAL NUMERIC PROGRAM DATA> element value to 0. Clearing the service request enable register disables the status information to generate an rsv local message, suppressing issue of a service request.
When the power is turned on, the service request enable register is cleared if the Power-ON status clear flag is True and the *PSC command for disabling clearing of this register is not supported.

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5.6 Commands

5.6.1 Common commands

The following commands are essential in IEEE488.2.
The common commands can be used only for GPIB.

* CLS
Processing: Clears the status byte register.
Clear Status Command

* ESE/* ESE?
Processing: Sets or clears the standard event status enable register.
Inquires about the standard event status enable register.
Standard Event Status Enable Command/Query
Contents of status register
Bit 7: Turning on power
Bit 6: Unused
Bit 5: Command error
Bit 4: Execution error
Bit 3: Device dependent error
Bit 2: Query error
Bit 1: Unused
Bit 0: Processing not completed

* ESR?
Processing: Returns the current value of the standard event status enable register.
Standard Event Status Register Query

* IDN?
Processing: Returns the manufacturer name, model name, serial number, and firmware of the product.
Identification Query
Manufacturer name: ANRITSU
Model name: MN9662A
MN9672A
MN9664A
MN9674A
Serial number: 0
Firmware: 0

* OPC/*OPC?
Processing: Sets Bit 0 of the standard event status enable register after the device operation is completed.
Generates an MAV summary message by flagging 1 in the output queue after the device operation is completed.
Operation Complete Command/Query

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* RST

  Processing: Resets the device in Level 3.

  Reset Command

  This command does not affect the following items.

  - The state of the IEEE488.1 interface
  - Device address
  - Output queue
  - Service request enable register
  - Standard event status enable register
  - RS-232C interface condition

* SRE

  Processing: Sets the bit of the service request enable register.

  Service Request Enable Command

* STB?

  Processing: Returns the current value of the status byte including the MSS bit.

  Read Status Byte Command

* TST?

  Processing: Conducts internal test and returns the presence/absence of an error.

  Self-Test Query

  Result

  0: Test is completed without detecting an error.

  1: Test is not conducted or an error is detected in test.

* WAI

  Processing: Queues the next command while the device is executing a command.

  Wait to Continue Command

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5.6.2 Device messages

The following commands are unique to the MN9662A, 9672A, 9664A, and 9674A Optical Channel Selectors.
Lowercase characters can be omitted.
The command is common to the GPIB/RS-232C. When this equipment is used with RS-232C, send the carriage return (CR) and the line feed (LF) after command.

CSEL: CHANnel — Channel setting/query

Program message

CSEL: CHANnel <no>

CSEL: CHANnel ?

Response message

CSEL: CHANnel <no>

Parameter

no = {x | 1 ≤ x ≤ 8} — MN9662A/9672A

no = {x | 1 ≤ x ≤ 16} — MN9664A/9674A

Processing

Sets the channel to the channel number no.

The common channel is not changed.

CSEL: COMMon — Common channel setting/query

Program message

CSEL: COMMon <no>

CSEL: COMMon ?

Response message

CSEL: COMMon <no>

Parameter

no = {x | 1} — MN9662A/9664A

no = { | 1 ≤ x ≤ 2} — MN9672A/9674A

Processing

Sets the common channel to the channel number no.

CSEL: PORT — Channel count query

Program message

CSEL: PORT ?

Response message

CSEL: PORT <com>, <ch>

Parameter

com = {x | 1 ≤ x ≤ 2}

ch = {x | 8 ≤ x ≤ 16}

Processing

Inquires about the number of common channels and the number of channels.

SYSTem: ERRor — Error value query

Program message

SYSTem: ERRor ?

Response message

SYSTEM: ERROR <code>

Processing

Inquires about error value.

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The contents of error codes

One hundreds: Indicates that a syntax error of IEEE488.2 occurred.

code	Description
101	An invalid character is included in the header or parameter.
104	The parameter type is different from the specified one.
105	GET (Group Exchange Trigger) is sent to the program message.
108	The number of parameters is larger than the specified number.
112	The program mnemonic has 12 characters or more.
113	Though the syntax of the header is correct, it is not defined in this equipment.
120	There is an error in the numeric data.
121	There is an illegal character in the numeric data.
130	There is an error in the suffix.
144	The character data has 12 characters or more.

Two hundreds: Indicates that an error occurred in the execution control of this equipment.

code	Description
220	There is an error in the parameter.
221	Though the parameter is correct, it cannot be executed because of the state of this equipment.
222	The numeric data exceeds the value specified for this equipment.
224	The received parameter cannot be used.
240	The command cannot be executed because of the failure of this equipment.

Three hundreds: Indicates that an error other than command errors or execution errors occurred in this equipment.

code	Description
310	There is an error in the system.
315	The resume memory is lost.
350	There is an abnormality in the accident diagnosis.

Four hundreds: Indicates that an error occurred in the data output of this equipment.

code	Description
410	An interrupt occurred due to a new command before this equipment completed transmission of the response message.
420	A command that corresponds to the response message to be read is not sent.
430	An attempt is made to buffer data that is larger than the free space of the storage.

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5.6.3 Commands compatible with the MN9601C/D/E

These commands can be used in GPIB mode. They cannot be used in RS-232C mode. To use this command, set the dip switch on the rear panel in referring to section 5.1.1.

Command	Processing
S1	Selects Channel 1.
S2	Selects Channel 2.
S3	Selects Channel 3.
S4	Selects Channel 4.
S5	Selects Channel 5.
S6	Selects Channel 6.
S7	Selects Channel 7.
S8	Selects Channel 8.
S9	Selects Channel 9.
S10	Selects Channel 10.
S11	Selects Channel 11.
S12	Selects Channel 12.
S13	Selects Channel 13.
S14	Selects Channel 14.
S15	Selects Channel 15.
S16	Selects Channel 16.
C1	Selects Common Channel 1.
C2	Selects Common Channel 2.

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5.7 Control from MT9810A Optical Test Set

The MT9810A optical test set enables the user to operate devices connected with an external control connector, using the concept of logical channels, not the units inserted in the slot of the main unit. This section explains how to control the optical channel selector using the MT9810A.

The logical channels mean the CH1 and CH2 of the MT9810A defined as logical channels. These logical channels are allocated to units to control them. A device inserted in an MT9810A and one connected with an external control connector are assumed to be "units", and they can be operated in the same way.

To use the MT9810A singly, a unit connected to a slot is automatically allocated to a logical channel. To control an external device, it must be allocated to a logical channel.

"Unit" is identified by a unit identification number composed of two integers. Ten digits indicate a box number. (For example, when the box number is 3, the unit identification number is 31.) However, the MT9810A does not have any box number; so, the identification number is indicated by one digit.

5.7.1 Setup

(1) Connection
Connect the MT9810A to the optical channel selector. In this case, connect their external control connectors (INPUT for the optical test set) with the connection cable (see Section 2.1, "Product Configuration").

(2) Setting
Set a box number for the optical channel selector. See Section 5.1.2, "When controlling from the MT9810A optical test set", and set the DIP switches on the rear of the optical channel selector.

(3) Power input
Press the MT9810A POWER switch to turn the power on. When the self-check ends and the system is set up, turn the power of the optical channel selector on.

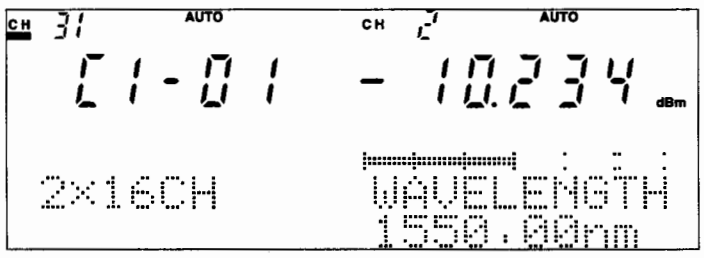
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5.7.2 Control from Panel

(1) Logical channel setting

Operations	Remarks
Press the Chan key.	Select CH1 or CH2.
	The selected channel is underlined and the channel number blinks.
Press the ↑ or ↓ key.	Change the channel number and select an optical channel selector to be controlled.
Press the ENTER key.	

The following screen shows an example where the MN9674A (2 × 16CH) having box number 3 is allocated to the CH1. This means that the optical channel selector having unit identification number 31 is allocated to logical channel 1 of the MT9810A.



(2) Channel setting

Operations	Remarks
Press the Select key.	Select channel display.
	The selected display blinks.
Press the ↑ or ↓ key.	Select a desired channel.
Press the ENTER key.	

To select channel digits, use the ← or → key.

(3) Common channel setting

Operations	Remarks
Press the Select key.	Select common channel display.
	The selected display blinks.
Press the ↑ or ↓ key.	Select a desired common channel.
Press the ENTER key.	

Point

The MN9662A or MN9664A has only one common channel, hence a common channel cannot be selected. If the Select key is pressed, the user cannot select common channel display. (The display does not blink.)

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5.7.3 Remote control

This unit can be controlled with the GPIB or RS-232C via the MT9810A.

5.7.3.1 Device messages

(1) SYSTem: CHANnel: DEFine

■ Function: Sets a logical channel

■ Program message:

SYSTem: CHANnel: DEFine (@[< uno1 >, < uno2 >])
SYSTem: CHANnel: DEFine?

■ Response message:

SYSTEM: CHANNEL: DEFINE (@[< uno1 >, < uno2 >])

■ Parameter:

< uno1 >: = {1, 11, 21, 31, 41, 51, 61, 71, 81, 91}
< uno2 >: = {2, 11, 21, 31, 41, 51, 61, 71, 81, 91}

■ Description:

Allocate a logical channel number to the unit identification number listed in (@,). The unit allocated to the logical channel is regarded as a selected unit. Information about the unit is displayed on the left of the screen for logical channel 1 and on the right of the screen for logical channel 2. The unit can be operated.
Logical channels must be paired. The same channel cannot be specified, e.g., (@1,1).
If a logical channel is specified, operation is performed for the logical channel. (For example, "CSEL1" means an optical channel selector allocated to logical channel 1.)
When a logical channel is allocated to units in the mainframe, the unit on the left is set only to logical channel 1 and one on the right only to logical channel 2.
When no unit identification number is suffixed to @ and just after the power is turned on, (@1,2) is assumed to be specified. (In the mainframe, the unit on the left is channel 1, and one on the right is channel 2.)

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(2) SYSTem: CHANnel: STATe

■ **Function: Inquires an inserted unit**

■ **Program message:**

SYSTem: CHANnel: STATe?

■ **Response message:**

SYSTEM: CHANNEL: STATE NOUNIT |< uid > (@ < uno >) {; < uid > (@ < uno >)}

■ **Parameter**

< uid >: = {OCS}

< uno >: = {1, 2, 11, 21, 31, 41, 51, 61, 71, 81, 91}

■ **Description**

The type and unit identification number are displayed for all the currently inserted unit. If no unit is inserted, "NOUNIT" is returned as response data.

The unit type is indicated by <uid>. For the optical channel selector, the unit type is determined as follows:

< uid >	Unit name
ocs	Optical channel selector

The unit identification number is indicated by < uno >.

Example:

○ Power meter unit inserted on the right of the mainframe
OPM (@2)

○ Optical channel selector having box number 3
OCS (@31)

For the subsequent commands, [1|2] indicates a logical channel number allocated to the optical channel number. In this case, brackets ([ ]) are not required.

(3) CSEL[1|2]:CHANnel

■ **Function: Sets a channel**

■ **Program message:**

CSEL[1|2]:CHANnel < no >

CSEL[1|2]:CHANnel?

■ **Response message:**

CSEL[1|2]:CHANNEL < no >

■ **Parameter:**

< no >:= {x| 1 ≤ × ≤ 8} MN9662A/9672A

< no >:= {x| 1 ≤ × ≤ 16} MN9664A/9674A

■ **Description:**

This function sets a channel to the channel indicated by < no >.

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(4) CSEL[1|2]:COMMon

■ **Function: Sets a common channel**

■ **Program message:**

CSEL[1|2]:COMMon < no >
CSEL[1|2]:COMMon?

■ **Response message:**

CSEL[1|2]:COMMon < no >

■ **Parameter:**

< no >: = {1}	MN9662A/9664A
< no >: = {1, 2}	MN9672A/9674A

■ **Description:**

This function sets a common channel to the channel indicated by < no >.

(5) CSEL[1|2]:PORT

■ **Function: Inquires the number of channels**

■ **rogram message:**

CSEL[1|2]:PORT?

■ **Response message:**

CSEL[1|2]:PORT < com >, < ch >

■ **Parameter:**

< com >: = {1, 2}
< no >: = {8, 16}

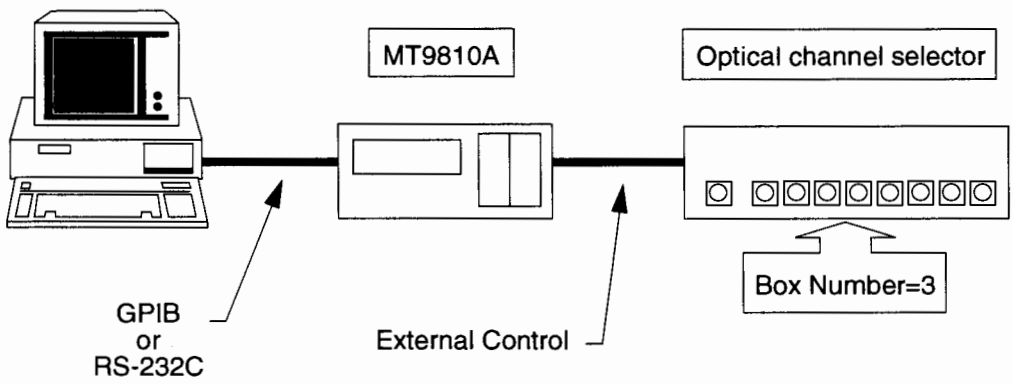
■ **Description**

This function inquires the number of common channels and one of channels.

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5.7.3.2 Control example

This section shows a concrete control example.
As an example, allocate the optical channel selector having box number 3 to logical channel 1 of the MT9810A, then control it via the GPIB or RS-232C.



First specify a box number for optical channel selector. See Section 5.1.2, "When controlling from the MT9810A optical test set", and set the DIP switches on the rear of the optical channel selector.
Next set an optical channel selector to logical channel 1. Send the command below.

SYSTEM:CHANNEL:DEFINE (@31, 2)

The optical channel selector is then set. Confirm that the optical test set screen changes to the screen shown in Section 5.4.2, "Control from Panel". In this case, the unit inserted on the right (channel 2) of the mainframe is set as it remains unchanged.
To check that the unit can be controlled, set the channel of the optical channel selector to 8. Send the command below.

CSEL1:CHANNEL 8

"1" succeeding CSEL1 indicates logical channel 1. After the command is sent, check the displayed optical test set and optical channel selector; the user can confirm that the channel is switched.

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Section 6 Performance Test

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6.1 Performance Test Items

(1) Insertion loss
(2) Cross-talk
(3) Return loss
(4) Switching reproducibility
(5) Polarization dependent loss
(6) Switching time

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6.2 Measuring Instruments Required for Performance Test

The measuring instruments required for performance test are shown in Table 5-1.

Table 5-1

Measuring instrument	Major performance
Optical power meter	Display resolution: 0.001 dB
Optical detector	Optical power range: +3 to -90 dBm
Stabilizing light source (LD)	Wavelength: 1310/1550 nm Stability: ±0.003 dB
Optical directional coupler	Isolation: 70 dB or more
Total reflection fiber cable	
Refractive index matching agent	
3 optical fiber cables	Fiber specification: ITU-T G-652 Return loss: 48 dB or more
Optical Isolator	30 dB or more
PDL meter	Any polarized state can be generated.
2 waveform monitors	Frequency: 1 kHz or more
Storage oscilloscope	Dual trace
Optical adapter	

Note:

Select the stabilizing light source depending on the wavelength to be measured.

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6.3 Insertion Loss

(1) Measure the output level of the light source. Figure 6-1 a.
Connect Optical Fiber Cable 1 to the light source and optical power meter.

(2) Measure the light level output from Optical Fiber Cable 2 using the optical power meter. Set the display of the optical power meter to Relative, and set the light level at this time to 0 dB.

(3) Connect Optical Fiber Cable 1 to the Com channel of the optical channel selector. Connect Optical Fiber Cable 2 to the channel to be measured.
The reading of the optical power meter is the insertion loss of the channel.

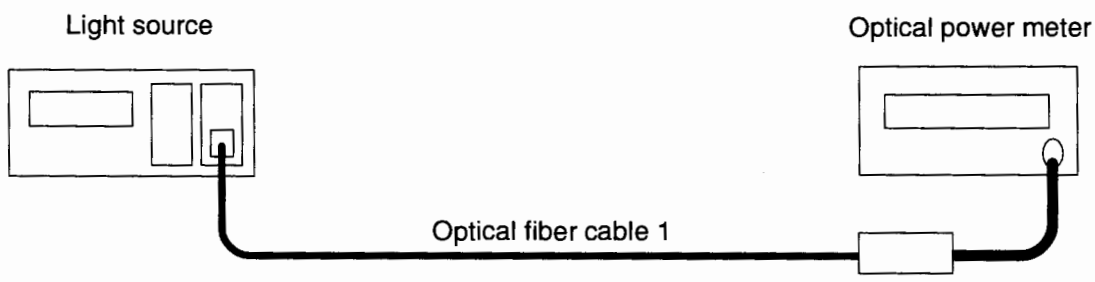


Figure 6-1 a

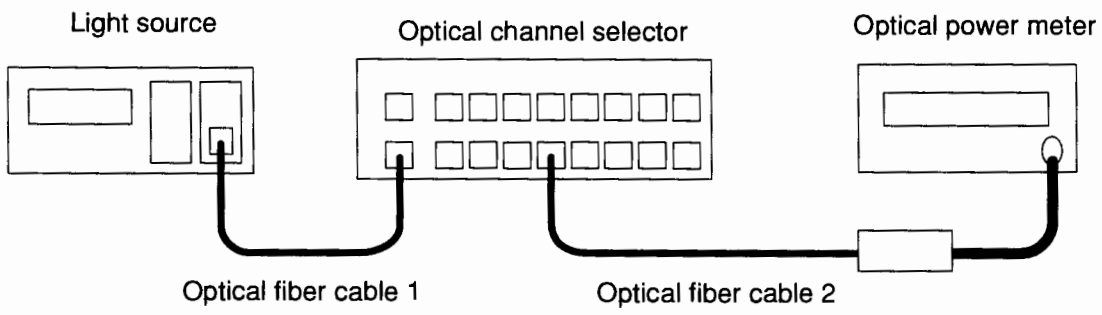


Figure 6-1 b

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6.4 Cross-Talk

(1) Connect in the same way as in Step (3) of Section 6.3.

(2) Set the display of the optical power meter to Relative, and set the optical level at that time to 0dB.

(3) Set to a channel to which Optical Fiber Cable 2 is not connected. The reading of the optical power meter is the crosstalk of the channel.

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6.5 Return Loss

(1) Figure 6-2 shows the block diagram of the measuring system of the return loss.

(2) Connect the total reflection fiber cable to the optical directional coupler and measure the reflected light level at this time using the optical power meter. Figure 6-2 a
Set the display of the optical power meter to Relative and set the light level at this time to 0 dB.

(3) Remove the total reflection fiber cable and connect Optical Fiber Cable 1 to the Com channel of the optical channel selector.

(4) Connect Optical Fiber Cable 2 to the set channel and apply refractive index matching agent to the end of the connector. Figure 6-2 b
The reading of the optical power meter is the return loss of the Com channel.

(5) To measure the return loss of each channel, reverse the connection of Optical Fiber Cable 1 and Optical Fiber Cable 2. Figure 6-2 c

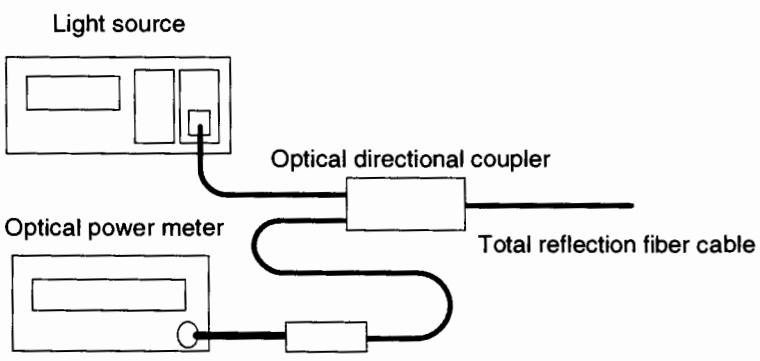


Figure 6-2 a

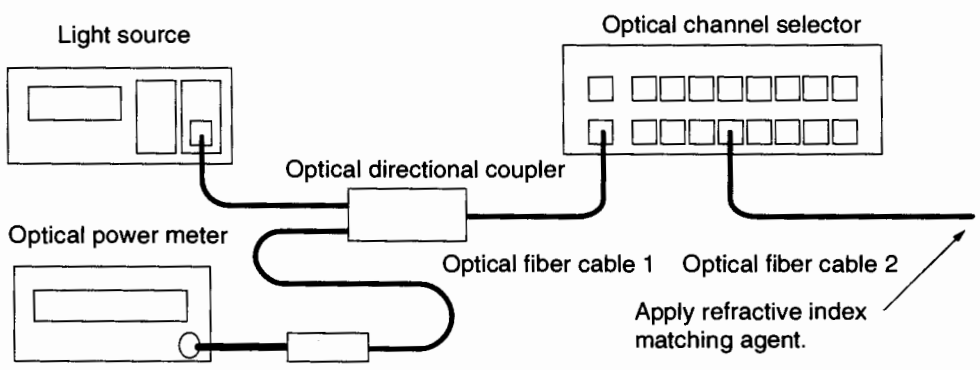


Figure 6-2 b

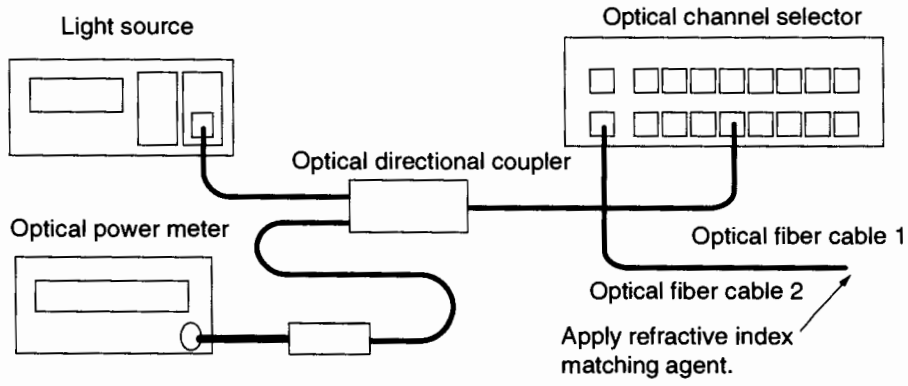


Figure 6-2 c

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6.6 Switching Reproducibility

(1) Connect the light source, optical channel selector, and optical power meter as shown in Figure 8-1b. Set to the channel to which Optical Fiber Cable 2 is connected.
Set the display of the optical power meter to Relative and set the light level at this time to 0dB.

(2) Set to the channel to which Optical Fiber Cable 2 is not connected and set to the original channel again. Record the reading of the optical power meter.

(3) Repeat Step (2) ten times. The difference between the maximum and minimum values recorded is the switching reproducibility.

(4) Perform the above procedure for all channels.

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6.7 Polarization Dependent Loss

(1) Connect the output of the light source to the PDL meter via the optical isolator.
Connect the output of the PDL meter and the Com channel of the optical switch with Optical Fiber Cable 1. Connect the channel to be measured and the optical power meter with Optical Fiber Cable 2.
Figure 6-3

(2) Change the polarization state with the PDL meter and connect to the optical power meter. The difference between the maximum and minimum values of the optical power meter is the polarization dependent loss.

(3) Make measurement in Steps (1) and (2) for all channels.

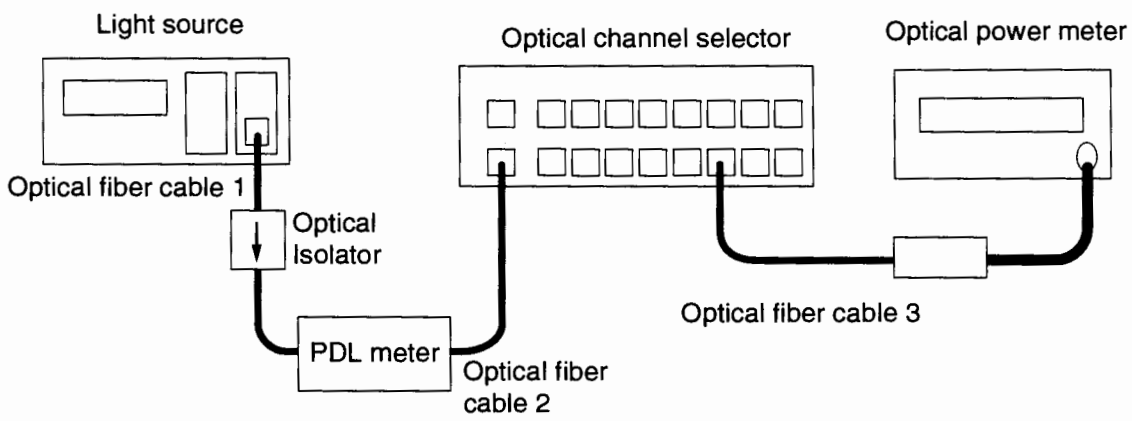


Figure 6-3

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6.8 Switching Time

(1) Connect the output of the light source to the Com channel of the optical channel selector with an optical fiber cable. Connect the channel to be measured and the waveform monitor with an optical fiber cable. Connect the output of the waveform monitor to the storage oscilloscope.
Figure 6-4

(2) Switch the channels and observe the output of the waveform monitor with the storage oscilloscope. The time period from the point at which the light output of the channel before switching in Figure 6-5 begins to decrease to the point at which the light output after switching is stabilized is the switching time.

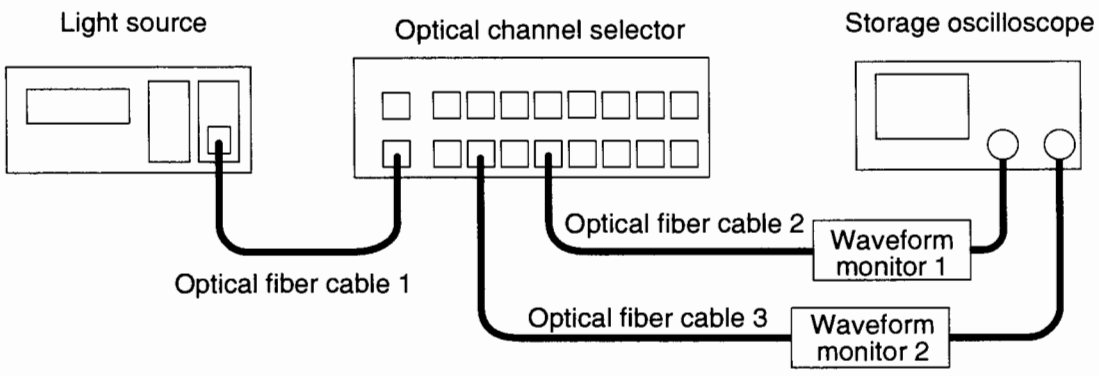


Figure 6-4

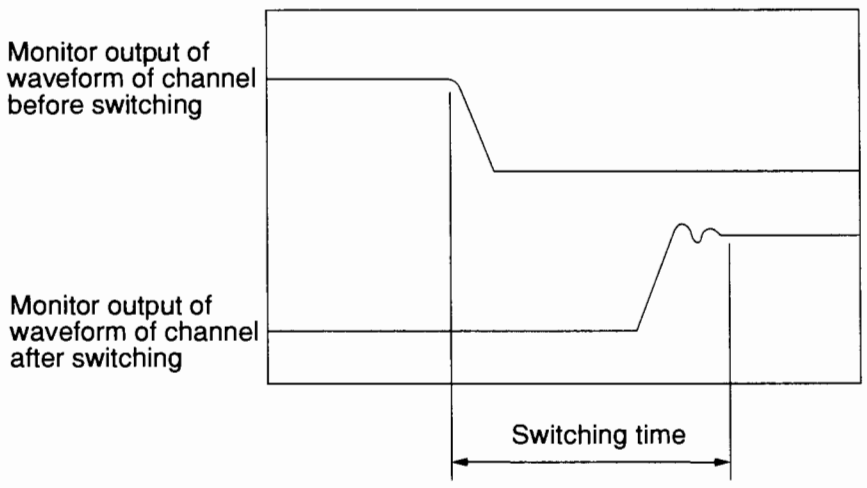


Figure 6-5

The minimum switching time is the period of switching from Channel 1 to Channel 2.
The maximum switching time is the period of switching from Channel 7 to Channel 8 for the MN96☐2A.
The maximum switching time is the period of switching from Channel 15 to Channel 16 for the MN96☐4A.

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6.9 Calculating the Uncertainty in the Measurement

There are two types of uncertainties.

Uncertainty of type A (ua): This is evaluated by a statistical method.

Uncertainty of type B (ub): This is evaluated by a method other than a statistical one.

(1) Evaluating the uncertainty of type A:

A set of measured values is substituted into the following formula for evaluating the uncertainty of the object. The results are used to evaluate the variation in the measurement system.

The measurement is repeated n-times and all the measured values (n pieces) are substituted into formula (1) for obtaining ua.

$$ua = \frac{1}{\sqrt{n}} \sqrt{\frac{\sum_{i=1}^{n} (Xi-Xm)^2}{n-1}} \quad \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots \quad (1)$$

Xi: The i-th measurement value Xm: The mean value of the measurement

The ua denotes the standard deviation of the difference between Xm and the actual values. The larger the number of times a measurement is performed (n), the smaller the uncertainty is.

(2) Evaluating the uncertainty of type B:

If the uncertainty cannot be evaluated by a statistical method like the uncertainty of type A, individual uncertainty terms are substituted into formula (2) to evaluate the uncertainty of type B.

$$ub = \sqrt{u_1^2 + u_2^2 + ui^2} \quad \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots \quad (2)$$

ui : Terms used to evaluate the uncertainty by a non-statistical method

In a performance test of an optical channel selector, uncertainty of type B is determined by specification with regard to linearity and stability of a light source in an optical power meter.

However, in the measurements of insertion loss, switching reproducibility and polarization dependent loss, the value of the loss is quite small so that linearity is set to 0 dB. Crosstalk and return loss values are directly taken from the optical power meter specifications. In addition, stability of a light source is set to 0 dB because the measurement time is short.

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(3) Evaluating the cumulative uncertainty:

To obtain the cumulative uncertainty (uc), uncertainties of type A and type B, calculated using formulas (1) and (2), respectively, are composed with RSS (root of square sum) formula.

$$uc = \sqrt{ua^2 + ub^2} \quad \cdots\cdots (3)$$

ua: uncertainty of type A ub: uncertainty of type B uc: cumulative uncertainty

(4) Evaluating the total uncertainty:

Total uncertainty (U) is defined as the total range corresponding to the measured results which covers the various ranges where values, which are associated with the measured object, are distributed.
It is calculated by multiplying the cumulative uncertainty (uc) by a confidence factor (k).

$$U = k \times uc \quad \cdots\cdots (4)$$

k: confidence factor (confidence ratio = 95% in the case of k = 2)

The value of Xm and U can be calculated from the n measured values and the probability of occurrence of a real value in the range between Xm - U and Xm + U is 95 %. If the difference between specifications of a measured object and Xm is greater than or equal to U, the probability that the value is not within specifications is less than or equal to 2.5%.

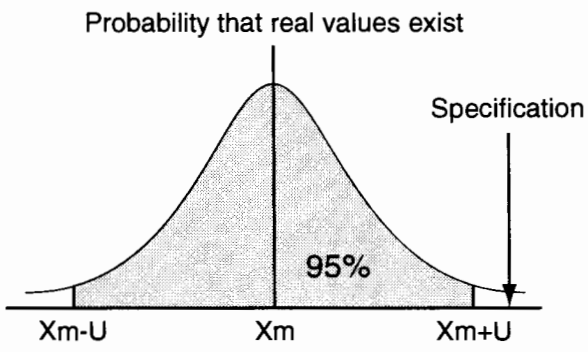


Figure 6-6 Probability distribution that real values exist

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An example calculation

In this case, the used light sources are Anritsu MG9001A and MG0948C, the optical power meter is Anritsu ML9001A and the optical sensor is Anritsu MA9612A.

According to specifications of the optical sensor, its linearity is ± 0.15 dB in the range between 0 and - 80 dBm and ± 0.45 dB in the range between - 80 and - 90 dBm. The emitted intensity of Anritsu MG0948C is - 3 dBm.

Items/Number of measurements	1	2	3	4	5	Mean value	Ua (dB)	Ub (dB)	U (dB)
Insertion loss (dB)	1.08	1.04	1.11	1.07	1.06	1.072	0.0116	0	0.0232
Polarization dependability (dB)	0.012	0.012	0.014	0.013	0.013	0.0128	0.00037	0	0.00074
Return loss (dB)	48.2	48.6	49.1	48.8	48.5	48.64	0.15	0.15	0.424
Crosstalk (dB)	- 85.2	- 84.8	- 84.5	- 85.0	- 85.2	- 84.94	0.132	0.45	0.938

Insertion loss	1.072 + 0.0232 = 1.0952 (dB)	Specification is 1.6 dB or less
Polarization dependability	0.0128 + 0.00074 = 0.01354 (dB)	Specification is 0.03 dB or less
Return loss	48.64 - 0.424 = 48.216 (dB)	Specification is 45 dB or more
Crosstalk	- 84.94 + 0.938 = - 84.002 (dB)	Specification is - 80 dB or less

For each of these measurements, the addition (difference) between the mean value of the measurement and total uncertainty should be within specifications.

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Section 7 Maintenance and Transportation

7.1 Daily Maintenance 7-2
7.2 Cautions on Storage 7-3
7.3 Transportation Method 7-4

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7.1 Daily Maintenance

Maintenance of the outside of this equipment

If the outside of this equipment is dirty, after this equipment is used in a dusty location, or before this equipment is stored for a long period, gently wipe off dirt on the equipment with cloth dipped in soapy water. The use of thinner or benzine may damage the coating on this equipment.

Cleaning ferrules

To clean the ferrules, use alcohol and an adapter cleaner or cotton swabs.

Dip the adapter cleaner in alcohol and insert it into the optical connector to clean the ferrules and the inside of the connector.



Figure 7-1 Cleaning using an adapter cleaner

Remove the optical adapter in accordance with the description in Section 3.3.
Dip cotton swabs into alcohol and wipe off dirt on the ferrules.



Figure 7-2 Cleaning using cotton swabs

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7.2 Cautions on Storage

When storing this equipment, avoid the following locations.

- Locations over 70 °C or more or -20 °C or less in temperature.
- Locations exposed to direct sunlight
- Dusty locations
- Locations that are so moist that water droplets attach on this equipment
- Locations that may be exposed to active gas

7.3 Transportation Method

To transport this equipment again, be careful about the following points.

- Use the packing material that was used for packing at the time of purchase.
- Instruct the carrier that this equipment is precision electronic equipment and that it must not be moistened or thrown.

If the packing material is lost or broken, pack this equipment using the following method.

(1) Pack this equipment with vinyl.
(2) Use a corrugated, wooden, or aluminum box that is larger than this equipment by 10 to 15cm in each direction.
(3) Lay cushioning material of 10 to 15cm at the bottom of the box.
(4) Put this equipment at the center of the box in Step (3) and pad the box with sufficient amounts of cushioning material in each direction.
(5) Firmly fasten the outside of the box with a packing rope, adhesive tape, or band.

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Appendix A
Performance Test Result Entry Form

Test location

Report No.

Date

Test is conducted by:

Remarks

Equipment name MN96 Optical channel selector

Serial No.

Ambient temperature °C Humidity %

No. Date

Model name	Switching time			
	Minimum	Standard	Maximum	Standard
MN96 ☐ 2A		600 ms or less		800 ms or less
MN96 ☐ 4A		600 ms or less		1100 ms or less

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Appendix A Performance Test Result Entry Form

Standard	Insertion loss		Cross-talk		Return loss		Polarization dependent loss		Switching reproducibility
	dB or less		-80 dB or less		45 dB or more		0.03 dB or less		0.02 dB or less
Port No.	1310 nm	1550nm	1310 nm	1550nm	1310 nm	1550nm	1310 nm	1550nm	—
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									

Standard	Insertion loss		Cross-talk		Return loss		Polarization dependent loss		Switching reproducibility
	dB or less		-80 dB or less		45 dB or more		0.03 dB or less		0.02 dB or less
Port No.	1310 nm	1550nm	1310 nm	1550nm	1310 nm	1550nm	1310 nm	1550nm	—
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									

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Appendix B Error Messages

The causes of error messages shown on the channel display of the panel are shown below.

Display	Cause
E1	The set channel is different from the actually connected channel.
E2	The set channel does not exist. (Example: The channel of the MN9662A is set to 10 in remote control.)
E3	Multiple channels are specified in the control from the MW9070B of Option 01.
E4	Reserved
E5	Memory check error
E6	Memory backup data error
E7	Other errors

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A

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B

Box number 5-4

C

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Anritsu Service and Sales offices

America

Anritsu Company (ACUS)

685-A Jarvis Drive Morgan Hill, CA
95037-2809, U.S.A.
Phone: +1-408-776-8300
Fax: +1-408-776-1738

Anritsu Company (ACUS-NJ) Dist.5

10 New Maple Avenue, P.O. Box 836
Pine Brook, NJ 07058-0836, U.S.A.
Phone: +1-973-227-8999
Fax: +1-973-575-0092

Anritsu Company (ACUS-Maryland) Dist.6

19630 Club House Road, #710
Gaithersburg, MD20879, U.S.A.
Phone: +1-301-590-0300
Fax: +1-301-216-2893

Anritsu Company (ACUS-Tx) NARO

1155 East Collins Blvd
Richardson, TX 75081, U.S.A.
Phone: +1-972-644-1777
Fax: +1-972-644-3416

Anritsu Electronics Ltd (ACCA)

5A-245 Matheson Blvd. East, Mississauga,
Ontario, L4Z 3C9, Canada
Phone: +1-905-890-7799
Fax: +1-905-890-2290

Anritsu Electronics Ltd (ACCA)

102-215 Stafford Road West Nepean,
Ontario, K2H 9C1, Canada
Phone: +1-613-828-4090
Fax: +1-613-828-5400

Anritsu Electronics Ltd (ACCA)

200-1405 Trans Canada Highway
Dorval, Quebec H9P 2V9, Canada
Phone: +1-514-421-3737
Fax: +1-514-685-9839

Anritsu Electronics Ltd (ACCA-Calgary)

Deerfoot Atrium, Suite 129, 6715-8th Street
N.E., Calgary, AB, T2E 7H7, Canada
Phone: +1-403-275-9855
Fax: +1-403-275-3609

Anritsu Eletrônica Ltd (ACBR)

Praia de Botafogo, 440-Sala 2401
CEP 22250-040, Rio de Janeiro, RJ, Brasil
Phone: +55-21-5276922
Fax: +55-21-537-1456

Anritsu Eletrônica Ltd (ACBR) Sao Paulo Branch Office

Praca Amadeu Amaral 27,
Primera Andar, Conj. 11, 12, 13, 14
Liberdade, Sao Paulo, Estado de
Sao Paulo, CEP : 01327-010, Brasil
Phone: +55-11-283-2511
Fax: +55-11-288-6940

Data Lab S.R.L

Edif. Ayfra, Pdte. Franco y Ayolas
Asuncion, Paraguay
Phone: +595-21-443-046
Fax: +595-21-441+935

Electro-Impex S.A.

P.O. Box 620-1000, San Jose, Costa Rica
Phone: +506-2-31-5701
Fax: +506-2-31-6531

Electronica 2000, S.A. DE C.V.

Blvd. Adolfo Lopez Mateos No.2016, Col.
Tlacopac, Del. Lopez Mateos, 01010,
Mexico D.F.
Phone: +525-662-8800
Fax: +525-662-5862

Electronic Engineering S.A.

Carretera de Circunvalavion, Sabanilla, Av
Novena, San Jose, Costa Rica
Phone: +506-2-25-8793
Fax: +506-2-25-1286

HDM Elquitecnica Cia. Ltda., Equitronics S.A.

Av. Republica de El Salvador, No.880,
Edificio, Almirante Colon 4to piso,
Quito, Ecuador
Phone: +593-9-704890
Fax: +593-2-48-2627

KRM Ingenieria Saciafs.

Viamonte 377,7° Piso 1053 Buenos Aires,
Argentina
Phone: +54-1-311-4165
Fax: +54-1-311-2297

SI Ltda.

E. Conchy Y Toro 65, Casilla 51888,
Santiago, Chile
Phone: +56-2-696-7534
Fax: +56-2-696-9665

Radiocom S.A.

Carrera 21 No.85-71, Conmutador
6100077, Santafe de Bogota, Columbia
Phone: +57-1-218-2054
Fax: +57-1-610-3272

Radiocomunicaciones cruz C.A.

Avda La Colina QTA. Elison, URB Colina
De Los Caobos, Caracas, Venezuela
Phone: +58-2-793-2322
Fax: +58-2-793-3429

Sakata Ingenieros S.A.

Av. Canaval Moreyra 840, Lima 27, Peru
Phone: +51-1225-7555
Fax: +51-1224-8148

Suministros Industriales S.A.

Casa 102, Calle 68 Este,
San Francisco, Balboa, Panama
Phone: +507-270-2328
Fax: +507-270-2329

Cabonorte S.A.

Colonia 1900, ESC. 603,
Montevideo, Uruguay
Phone: +598-2-430522
Fax: +598-2-418594

Europe

Anritsu Ltd (ACUK)

200 Capability Green, Luton
Bedfordshire, LU1 3LU, United Kingdom
Phone: +44-1582-433200
Fax: +44-1582-731303

Anritsu Ltd (ACUK-Manchester)

Kansas Avenue, Langworthy Park Salford,
Manchester M5 2GL, United Kingdom
Phone: +44-161-873-8041
Fax: +44-161-873-8040

Anritsu Ltd (ACUK-Bristol)

1230 Aztec West, Almondsbury
Bristol BS12 4SG, United Kingdom
Phone: +44-1454-615252
Fax: +44-1454-618017

Anritsu Ltd (ACUK-Livingston)

Unit 1, Knightsridge Industrial Estate
Turnbull Way, Knightsridge Livingston
EH54 8RB, United Kingdom
Phone: +44-1506-436111
Fax: +44-1506-436112

Anritsu GmbH (ACDE)

Grafenberger Allee 54-56
D-40237 Düsseldorf 1, Germany
Phone: +49-211-96855-0
Fax: +49-211-96855-55

Anritsu GmbH (ACDE-Sales Center South)

An der Steinernen Brücke 1 D-85757
Karlsfeld, Germany
Phone: +49-8131-3825-0
Fax: +49-8131-3825-95

August 2000

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Anritsu S.A. (ACFR)

9, Avenue du Québec ZA de Courtaboeuf 91951 Les Ulis Cedex, France
Phone: +33-1-60-92-15-50
Fax: +33-1-64-46-10-65

Anritsu S.A. (ACFR) (Toulouse Office)

Bureau de Toulouse
Région Centre Sud Ouest
Phone: +33-5-62070484
Fax: +33-5-62070668

Anritsu S.A. (ACFR) (Toulon Office)

Bureau de Toulon
Région Centre Sude Est
Phone: +33-4-94040264
Fax: +33-4-94040265

Anritsu S.A. (ACFR) (Rennes Office)

Bureau de Rennes
Région Ouest
Phone: +33-2-99521214
Fax: +33-2-99521224

Anritsu S.p.A. (ACIT)

Via Elio Vittorini, 129
00144 Roma EUR, Italy
Phone: +39-06-509-9711
Fax: +39-06-502-2425

Anritsu S.p.A (ACIT-Milano)

C.D. Colleoni, Via Paracelso, 420041 AGRATE B.ZA(MI), Italy
Phone: +39-039-65-7021
Fax: +39-039-605-6396

Anritsu AB (ACSE)

BOTVID CENTER
145 84 STOCKHOLM, Sweden
Phone: +46-8-53470700
Fax: +46-8-53470730

Anritsu AB-Norway Branch Office (ACNO)

Leangbukta 40 1370 Asker. Norway
Phone: +47-66-901190
Fax: +47-66-901212

Anritsu AB-Finland Branch Office (ACFI)

Piispanportti 9 FIN-02240 Espoo, Finland
Phone: +358-9-435-522-0
Fax: +358-9-435-522-50

Anritsu AB-Denmark Branch Office (ACDK)

SOHOJ 11, DK-2690 KARLSLUNDE
Denmark
Phone: +45-46160330
Fax: +45-46155299

C.N. Rood B.V.

Cort van der Linddenstraat 11-13, 2288 EV Rijswijk ZH, The Netherlands
Phone: +31-70-3996360
Fax: +31-70-3905740

C.N. Rood SA/NV

Pontbeeklaan 45, 1731 Zellik, Belgium
Phone: +32-2-4668199
Fax: +32-2-4662500

ELSINCO GMBH

h.e. Strelbishte, str. Kotlenski Prohod, bl. 96/6/14, BG-1408 Sofia, Bulgaria
Phone: +359-2-58-61-31
Fax: +359-2-58-16-98

ELSINCO Praha Spol.

Novedvorska 994, CZ 142 21 Praha 4-Branik , Czecho Republic
Phone: +42-2-49-66-89
Fax: +42-2-49-54-83

ELSINCO Budapest KFT

Pannonia utca 8. IV/I.
H-1136 Budapest, Hungary
Phone: +36-1-269-18-50
Fax: +36-1-132-69-27

ELSINCO Polska Sp. Z.O.O

ul. Dziennikarska 6/1, PL 01 605 Warszawa, Poland
Phone: +48-22-39-69-79
Fax: +48-22-39-44-42

ELSINCO Bratislava Spol. s.r.o.

Kudlakova 4, SK 844 15 Bratislava, Slovakia
Phone: +42-7-784-165
Fax: +42-7-784-454

G'Amungason Co.

Skulagata 40, 101 Reykjavik, Iceland
Phone: +354-1-677887
Fax: +354-1-625045

GMP S.A.

Av. des Baumettes 19, CH-1020 Renens 1 Lausanne, Switzerland
Phone: +41-21-6348181
Fax: +41-21-6353295

Instrutek Oeriferi A/S

Christiansholmsgade DK-8700 Horsens, Denmark
Phone: +45-75-611100
Fax: +45-75-615658

Kostas Karayannis SA

58, Kapodistriou str., GR-142 35 Nea Ionia, Athens, Greece
Phone: +30-1-680-0460-4
Fax: +30-1-685-3522

Omnitecnica S.A.

Estrada Alfragide 2700 Amadora, Portugal
Phone: +351-1-471-55-17
Fax: +351-1-471-36-10

Pema Ltd.

Doromiskin, Dundalk, Co. Louth, Ireland
Phone: +353-42-72899
Fax: +353-42-72376

Unitronics S.A.

Plaza Espana 18, Torre de Madrid, Pl. 12-ofc. 9, 28019 Madrid, Spain
Phone: +34-1-5425204
Fax: +34-1-5591957

Wien CHALL GMBH

Krichbaumgasse 25, 1120 Wien, Austria
Phone: +43-1-811-55140
Fax: +43-1-811-55180

Asia, Pacific and Africa

Anritsu Private Ltd (ACSG)

6, New Industrial Rd., #06-01/02
Hoe Huat Industrial Building
Singapore 536199
Phone: 65-282-2400
Fax: 65-282-2533

Anritsu Company Ltd (ACHK)

Suite 719, 7/F., Chinachem Golden Plaza, 77 Mody Road, Tsimshatsui East, Kowloon, Hong Kong
Phone: +852-2301-4980
Fax: +852-2301-3545

Anritsu Company Incorporated (ACTW)

6F, 96, Sec. 3, Chien Kou North Rd.
Taipei, Taiwan
Phone: +886-2-2515-6050
Fax: +886-2-2509-5519

Anritsu Corporation, Ltd (ACKR) Head Office

14F Hyunjuk Bldg. 832-41,
Yeoksam-dong, Kangnam-ku,
Seoul, Korea
Phone: +82-2-553-6603
Fax: +82-2-553-6604~5

Anritsu Proprietary Ltd (ACAU)

Unit 3, 170, Forster Rd., Mt. Waverley
Victoria 3149, Australia
Phone: +61-3-9558-8177
Fax: +61-3-9558-8255

Anritsu Proprietary Ltd (ACAU)

Suite 304/2 Rowe Street Eastwood
NSW 2122, Australia
Phone: +61-2-9874-9044
Fax: +61-2-9874-9920

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Anritsu Corporation
Beijing Liaison Office

Room No.1515, Beijing Fortune Bldg. 5
Dong-San-Huan-Bei-Lu Chao-Yang
District Beijing 100004, P.R. China
Phone: +86-10-6590-9230~9234
Fax: +86-10-6590-9235

Anritsu Corporation
Shanghai Liaison Office

No.511 Shanghai Jing Tai Building
No.58, Mao Ming Nan Rd. Sanghai
200020 P.R. China
Phone: +86-21-6415-5137
Fax: +86-21-6472-6677

Anritsu Company Ltd
Guangzhou Representative Office

Room 720, 7/F., Dongshan Plaza,
69 XianLie Road Central.
Guangzhou 510095 P.R. China
Phone: +86-20-8732-2231
Fax: +86-20-8732-2230

Anritsu Corporation
New Delhi Liaison Office

Room No. 508, Prakash Deep,
7 Tolstoy Marg, New Delhi-110001, India
Phone: +91-11-331-9133
Fax: +91-11-371-3948

Associated Electric Trading Corp.

Zia Chambers, 25 McLeod Rd., Lahore,
Pakistan
Phone: +92-42-722-1716
Fax: +92-42-7221456

Chris Radiovision Ltd.

Kouloumbris Building, 23 Crete Street,
P.O. Box 1989, Nicosia, Cyprus
Phone: +357-2-466121
Fax: +357-2-365177

Electronic Equipment Marketing Co.

P.O. Box 3750, Riyadh 11481,
Saudi Arabia
Phone: +966-1-4771650
Fax: +966-1-4785140

Etecsa (Pty) Ltd.

1st Floor Montrose Place, Waterfall Park,
Bekker Rd., Midrand, South Africa
Phone: +27-11-315-1366
Fax: +27-11-315-2175

Giza Systems Engineering

2 El Mesaha Square, Dokki A.R.E.,
P.O.Box 1913, Cairo 11511, Egypt
Phone: +20-2-349-0140
Fax: +20-2-360-9932

Infotechs Ltd.

23-1, Jaya Rd., Colombo 4, Sri Lanka
Phone: +94-1-580088
Fax: +94-1-584644

Inter Muhendislik Danismanlik ve Ticaret A.S.

Farabi Sokak No: 24/14
Cankaya-06680 Ankara, Turkey
Phone: +90-312-4277792
Fax: +90-312-4277937

Jasmine Telecom Systems Co., Ltd.

333 Laksi Plaza 6th Floor, Tower 2,
Chaengwatana Rd., Donmuang, Bangkok
10210, Thailand
Phone: +66-2-576-0200
Fax: +66-2-576-0420

Meera Agencies (P) Ltd.

A-23 Hauz Khas New Delhi 110 016, India
Phone: +91-11-685-3959
Fax: +91-11-685-2275

UAE
Utmost Electronics Trading (L.L.C.)

P.O. Box 41175 Abu Dhabi, U.A.E.
Phone: +971-2-768909
Fax: +971-2-768907

Martwell Electronics Pvt., Ltd

3rd Floor, Francis House, Stanley Avenue,
P.O. Box 1737, Harare, Zimbabwe
Phone: +263-4-793578
Fax: +263-4-737956

Mandeno Electronic Equip. Co.

463 Mt. Eden Rd. Mt. Eden,
Aukland 1003, New Zealand
Phone: +64-9-630-7871
Fax: +64-9-630-1720

National Projects and Technology Co. L.L.C

P.O. Box 97, Wadi Al Kabir, Postal Code 117,
Sultanate of Oman
Phone: +968-791704
Fax: +968-791697

O'Connors Engineering & Trading (Malaysia) Bhd

3rd Floor, Wisma Siong Huat,
Lot 13, Jalan 51A/223
46100 Petaling Jaya,
Selangor Darul Ehsan, Malaysia
Phone: +60-3-757-2828
Fax: +60-3-757-7871

P.T. Subur Sakti Putera

Jalan Musi No.32, Jakarta 10150,
Indonesia
Phone: +62-21-3803644
Fax: +62-21-3845043

Qatar Communications Ltd.

P.O. Box 2481, Doha, Qatar
Phone: +974-424347
Fax: +974-324777

Trading and Agency Services

P.O. Box 1884, Doha, Qater
Phone: +974-432212
Fax: +974-422255

Rajab & Silsilah & Co.

P.O. Box 203 Jeddah 21411, Saudi Arabia
Phone: +966-2-6610006
Fax: +966-2-6610558

Sairitsu International Trading Corporation

50B ODC International Plaza
Condominium, 219 Salcedo St., Legaspi
Village, Makati, Metro Manila, Philippines
Phone: +63-2-816-2646
Fax: +63-2-815-0986

Sedel

24, 26, Bd, Resistance, Casablanca,
Morocco
Phone: +212-2-302444
Fax: +212-2-449311

Superior Electronics Associated

B-98 Block H, North Nasimabad, Karachi-
33, Pakistan
Phone: +92-21-613655

Tareq Company

P.O. Box 20506 Safat, 13066 Safat, Kuwait
Phone: +965-2336-100
Fax: +965-2437-700

Tech-Cent Ltd.

Haarad St. No.7, Ramat Haahayal,
Tel-Aviv 69710, Israel
Phone: +972-3-6478563
Fax: +972-3-6478334

Test

Sehit Adem Yavuz Sokak No.6/17,
Kizilay-Ankara, Turkey
Phone: +90-41-71086
Fax: +90-41-74384

Japan

Head Office

5-10-27, Minamiazabu, Minato-ku,
Tokyo 106-8570
Phone: 03-3446-1111
Fax: 03-3442-0235

Atsugi Factory
Measurement Solutions

1800, Onna, Atsugi-si, Kanagawa 243-8555
Phone: 046-223-1111
Fax: 046-225-8379

August 2000

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