MP1861A
56G/64Gbit/s MUX
Operation Manual

Second Edition

- **For safety and warning information, please read this manual before attempting to use the equipment.**
- **Additional safety and warning information is provided in the MP1800A Signal Quality Analyzer Installation Guide and the MT1810A 4 Slot Chassis Installation Guide. Please also refer to one of these documents before using the equipment.**
- **Keep this manual with the equipment.**

ANRITSU CORPORATION

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. Ensure that you clearly understand the meanings of the symbols BEFORE using the equipment. Some or all of the following symbols may be used on all Anritsu equipment. In addition, there may be other labels attached to products that 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. Ensure 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 a 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.

MP1861A 56G/64Gbit/s MUX
Operation Manual

15　May　　　2015 (First Edition)
10　July　　　2015 (Second Edition)

For Safety

⚠ WARNING

Electric Shock

- ALWAYS refer to the operation manual when working near locations at which the alert mark shown on the left is attached. If the advice in the operation manual is not followed, there is a risk of personal injury or reduced equipment performance. The alert mark shown on the left may also be used with other marks and descriptions to indicate other dangers.

- Overvoltage Category
  This equipment complies with overvoltage category II defined in IEC 61010. DO NOT connect this equipment to the power supply of overvoltage category III or IV.

- To ensure that the equipment is grounded, always use the supplied 3-pin power cord, and insert the plug into an outlet with a ground terminal. If power is supplied without grounding the equipment, there is a risk of receiving a severe or fatal electric shock or causing damage to the internal components.

Repair

⚠ **WARNING**
NO OPERATOR SERVICE-
ABLE PARTS INSIDE.
REFER SERVICING TO
QUALIFIED PERSONNEL.

- Only qualified service personnel with a knowledge of electrical fire and shock hazards should service this equipment. This equipment cannot be repaired by the operator. DO NOT attempt to remove the equipment covers or unit covers or to disassemble internal components. 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.

For Safety

⚠ WARNING

Calibration

- 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. Be careful not to break the seal by opening the equipment or unit covers. If the performance-guarantee seal is broken by you or a third party, the performance of the equipment cannot be guaranteed.

Falling Over

- This equipment should always be positioned in the correct manner. 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.
  Always set up the equipment in a position where the power switch can be reached without difficulty.

For Safety

⚠ CAUTION

Cleaning
- Always remove the main power cable from the power outlet before cleaning dust around the power supply and fan.
    - Clean the power inlet regularly. If dust accumulates around the power pins, there is a risk of fire.
    - Keep the cooling fan clean so that the ventilation holes are not obstructed. If the ventilation is obstructed, the cabinet may overheat and catch fire.

Check Terminal

- Never input a signal of more than the indicated value between the measured terminal and ground. Input of an excessive signal may damage the equipment.

Use in a Residential Environment

This equipment is designed for an industrial environment.
In a residential environment, this equipment may cause radio interference in which case the user may be required to take adequate measures.

Use in Corrosive Atmospheres

Exposure to corrosive gases such as hydrogen sulfide, sulfurous acid, and hydrogen chloride will cause faults and failures.
Note that some organic solvents release corrosive gases.
solvents release corrosive gases.

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 one year after shipment due to a manufacturing fault. However, software fixes will be made in accordance with the separate Software End-User License Agreement. Moreover, Anritsu Corporation will deem this warranty void when:

- The fault is outside the scope of the warranty conditions separately 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, wind, flooding, earthquake, lightning strike, or volcanic ash, etc.
- The fault is due to damage caused by acts of destruction, including civil disturbance, riot, or war, etc.
- The fault is due to explosion, accident, or breakdown of any other machinery, facility, or plant, etc.
- The fault is due to use of non-specified peripheral or applied equipment or parts, or consumables, etc.
- The fault is due to use of a non-specified power supply or in a non-specified installation location.
- The fault is due to use in unusual environments[Note].
- The fault is due to activities or ingress of living organisms, such as insects, spiders, fungus, pollen, or seeds.

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

Anritsu Corporation shall assume no liability for injury or financial loss of the customer due to the use of or a failure to be able to use this equipment.

Note:

For the purpose of this Warranty, "unusual environments" means use:

- In places of direct sunlight
- In dusty places
- Outdoors
- In liquids, such as water, oil, or organic solvents, and medical fluids, or places where these liquids may adhere
- In salty air or in place chemically active gases (sulfur dioxide, hydrogen sulfide, chlorine, ammonia, nitrogen dioxide, or hydrogen chloride etc.) are present
- In places where high-intensity static electric charges or electromagnetic fields are present
- In places where abnormal power voltages (high or low) or instantaneous power failures occur
- In places where condensation occurs
- In the presence of lubricating oil mists
- In places at an altitude of more than 2,000 m
- In the presence of frequent vibration or mechanical shock, such as in cars, ships, or airplanes

Anritsu Corporation Contact

In the event of 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 need to be broken/shredded so as not to be unlawfully used for military purpose.

Crossed-out Wheeled Bin Symbol

Equipment marked with the Crossed-out Wheeled Bin Symbol complies with council directive 2012/19/EC (the "WEEE Directive") in European Union.

For Products placed on the EU market after August 13, 2005, please contact your local Anritsu representative at the end of the product's useful life to arrange disposal in accordance with your initial contract and the local law.

Software End-User License Agreement (EULA)

Please read this Software End-User License Agreement (hereafter this EULA) carefully before using (includes executing, copying, registering, etc.) this software (includes programs, databases, scenarios, etc., used to operate, set, etc., Anritsu electronic equipment). By reading this EULA and using this software, you are agreeing to be bound by the terms of its contents and Anritsu Corporation (hereafter Anritsu) hereby grants you the right to use this Software with the Anritsu-specified equipment (hereafter Equipment) for the purposes set out in this EULA.

1. Grant of License and Limitations

1. Regardless of whether this Software was purchased from or provided free-of-charge by Anritsu, you agree not to rent, lease, lend, or otherwise distribute this Software to third parties and further agree not to disassemble, recompile, reverse engineer, modify, or create derivative works of this Software.
2. You may make one copy of this Software for backup purposes only.
3. You are not permitted to reverse engineer this software.
4. This EULA allows you to install one copy of this Software on one piece of Equipment.

2. Disclaimers

To the extent not prohibited by law, in no event shall Anritsu be liable for personal injury, or any incidental, special, indirect or consequential damages whatsoever, including, without limitation, damages for loss of profits, loss of data, business interruption or any other commercial damages or losses, arising out of or related to your use or inability to use this Software.

3. Limitation of Liability

a. If a fault (bug) is discovered in this Software, preventing operation as described in the operation manual or specifications whether or not the customer uses this software as described in the manual, Anritsu shall at its own discretion, fix the bug, or exchange the software, or suggest a workaround, free-of-charge. However, notwithstanding the above, the following items shall be excluded from repair and warranty.
   i) If this Software is deemed to be used for purposes not described in the operation manual or specifications.
   ii) If this Software is used in conjunction with other non-Anritsu-approved software.
   iii) Recovery of lost or damaged data.
   iv) If this Software or the Equipment has been modified, repaired, or otherwise altered without Anritsu's prior approval.
   v) For any other reasons out of Anritsu's direct control and responsibility, such as but not limited to, natural disasters, software virus infections, etc.

b. Expenses incurred for transport, hotel, daily allowance, etc., for on-site repairs by Anritsu engineers necessitated by the above faults shall be borne by you.

c. The warranty period for faults listed in article 3a above covered by this EULA shall be either 6 months from the date of purchase of this Software or 30 days after the date of repair, whichever is longer.

4. Export Restrictions

You may not use or otherwise export or re-export directly or indirectly this Software except as authorized by Japanese and United States law. In particular, this software may not be exported or re-exported (a) into any Japanese or US embargoed countries or (b) to anyone on the Japanese or US Treasury Department's list of Specially Designated Nationals or the US Department of Commerce Denied Persons List or Entity List. By using this Software, you warrant that you are not located in any such country or on any such list. You also agree that you will not use this Software for any purposes prohibited by Japanese and US law, including, without limitation, the development, design and manufacture or production of missiles or nuclear, chemical or biological weapons of mass destruction.

5. Termination

Anritsu shall deem this EULA terminated if you violate any conditions described herein. This EULA shall also be terminated if the conditions herein cannot be continued for any good reason, such as violation of copyrights, patents, or other laws and ordinances.

6. Reparations

If Anritsu suffers any loss, financial or otherwise, due to your violation of the terms of this EULA, Anritsu shall have the right to seek proportional damages from you.

7. Responsibility after Termination

Upon termination of this EULA in accordance with item 5, you shall cease all use of this Software immediately and shall as directed by Anritsu either destroy or return this Software and any backup copies, full or partial, to Anritsu.

8. Dispute Resolution

If matters of dispute or items not covered by this EULA arise, they shall be resolved by negotiations in good faith between you and Anritsu.

9. Court of Jurisdiction

This EULA shall be interpreted in accordance with Japanese law and any disputes that cannot be resolved by negotiation described in Article 8 shall be settled by the Japanese courts.

Cautions Against Computer Virus Infection

- Copying files and data

  Only files that have been provided directly from Anritsu or generated using Anritsu equipment should be copied to the instrument.

  All other required files should be transferred by means of USB or CompactFlash media after undergoing a thorough virus check.

- Adding software

  Do not download or install software that has not been specifically recommended or licensed by Anritsu.

- Network connections

  Ensure that the network has sufficient anti-virus security protection in place.

Protection Against Computer Virus Infections

Prior to the software installation

Before installing this software or any other software recommended or approved by Anritsu, run a virus scan on your computer, including removable media (e.g. USB memory stick and CF memory card) you want to connect to your computer.

When using this software and connecting with the measuring instrument

- Copying files and data
  On your computer, do not save any copies other than the following:
  - Files and data provided by Anritsu
  - Files created by this software
  - Files specified in this document
  Before copying these files and/or data, run a virus scan, including removable media (e.g. USB memory stick and CF memory card).
- Connecting to network
  Connect your computer to the network that provides adequate protection against computer viruses.

Cautions on Proper Operation of Software

This software may not operate normally if any of the following operations are performed on your computer:

- Simultaneously running any software other than that recommended or approved by Anritsu
- Closing the lid (Laptop computer)
- Turning on the screen saver function
- Turning on the battery-power saving function (Laptop computer)

For how to turn off the functions, refer to the operation manual that came with your computer.

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

C E

1. Product Model

Model: MP1861A 56G/64Gbit/s MUX

2. Applied Directive and Standards

EMC: Directive 2004/108/EC

LVD: Directive 2006/95/EC

3. Applied Standards

• EMC: Emission: EN 61326-1: 2013 (Class A)

Immunity: EN 61326-1: 2013 (Table 2)

	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 61000-4-8 (RPFMF)	A
IEC 61000-4-11 (V dip/short)	B, C

*: Performance Criteria

A: The equipment shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the equipment if used as intended.

B: The equipment shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed. No change of actual operating state or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the equipment if used as intended.

C: Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls.

Harmonic current emissions:
EN 61000-3-2: 2006 +A1:2009 A2:2009
  (Class A equipment)
No limits apply to this equipment with an active input power under 75 W.

• LVD: EN 61010-1: 2010 (Pollution Degree 2)

4. Authorized representative

Name:	Murray Coleman
	Head of Customer Service EMEA
	ANRITSU EMEA Ltd.
Address, city:	200 Capability Green, Luton
	Bedfordshire, LU1 3LU
Country:	United Kingdom

C-Tick Conformity Marking

Anritsu affixes the C-Tick mark 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: MP1861A 56G/64Gbit/s MUX

2. Applied Standards

     EMC: Emission: EN 61326-1: 2013 (Class A equipment)

About This Manual

A testing system combining an MP1800A Signal Quality Analyzer or MT1810A 4 Slot Chassis mainframe, module(s), and control software is called a Signal Quality Analyzer Series. The operation manuals of the Signal Quality Analyzer Series consist of separate documents for the installation guide, the mainframe, remote control operation, module(s), and control software, as shown below.
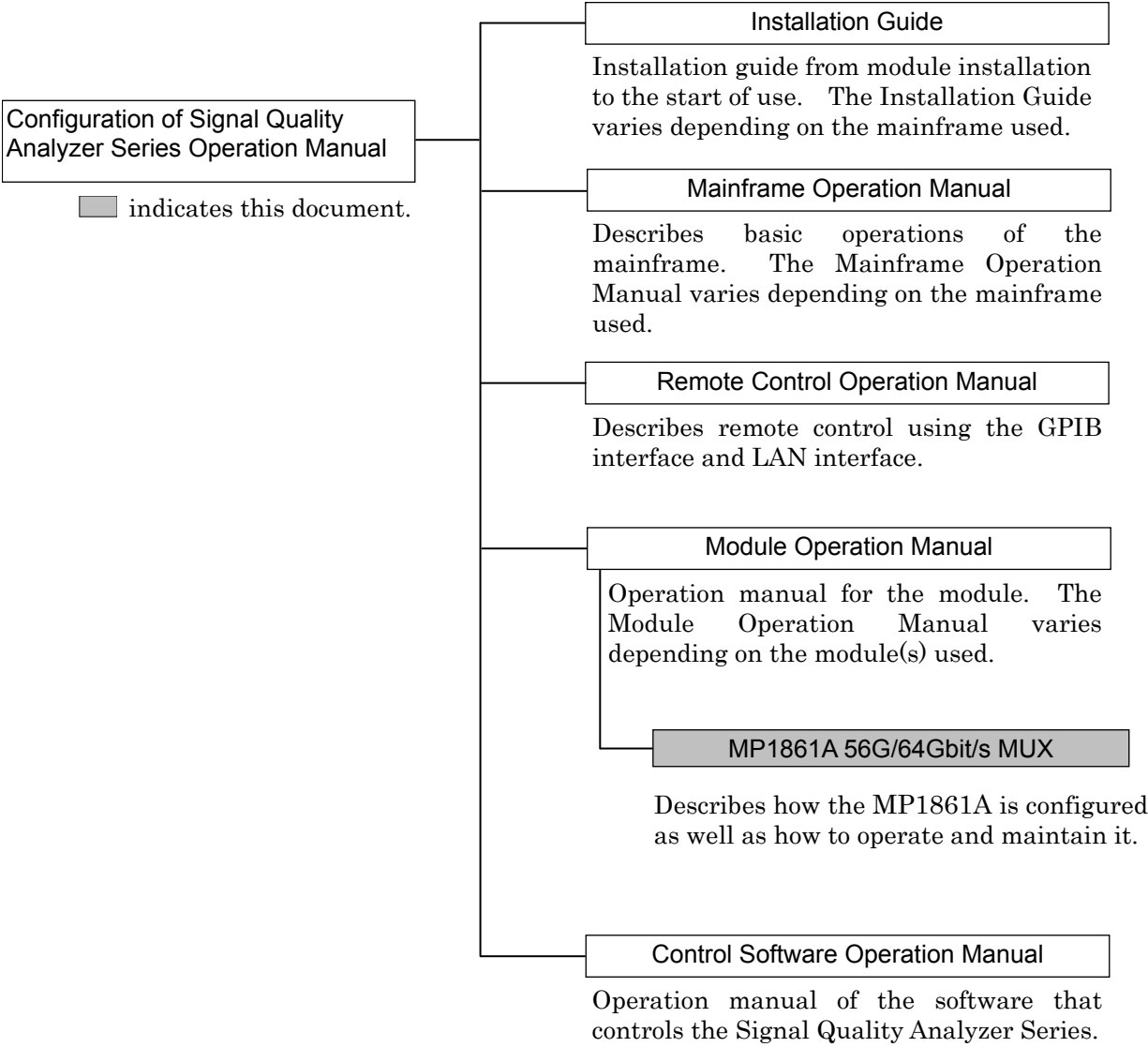
Configuration of Signal Quality
Analyzer Series Operation Manual

▭ indicates this document.

Installation Guide

Installation guide from module installation to the start of use. The Installation Guide varies depending on the mainframe used.

Mainframe Operation Manual

Describes basic operations of the mainframe. The Mainframe Operation Manual varies depending on the mainframe used.

Remote Control Operation Manual

Describes remote control using the GPIB interface and LAN interface.

Module Operation Manual

Operation manual for the module. The Module Operation Manual varies depending on the module(s) used.

MP1861A 56G/64Gbit/s MUX

Describes how the MP1861A is configured as well as how to operate and maintain it.

Control Software Operation Manual

Operation manual of the software that controls the Signal Quality Analyzer Series.

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Appendix

III

IV.

Chapter 1   Overview

This chapter provides an overview of the MP1861A 56G/64Gbit/s MUX (MP1861A hereafter).

1

Overview

1.1 Product Overview

The MP1861A is a plug-in module that can be built into a Signal Quality Analyzer main frame. This equipment 2:1 multiplexes the output signal of the MU183020A 32 Gbit/s and MU181021A 32 Gbit/s 4ch PPG (hereafter MU18302xA) to generate 8 to 64.2 Gbit/s PRBS, DATA and Zero-Substitution patterns.

Various option configurations are available for the MP1861A. This module is therefore useful for research, development, and production of various types of digital communication equipment, modules, and devices.

Features of the MP1861A:

- Operating rates: 8 to 56.2 Gbit/s (64.2 Gbit/s using additional options)
- Multiplexes input data signal to 2:1
- High-quality output signal waveform
- Flexible for functional expansion in the future, by installing additional options.
- Controlled by MX180000A Signal Quality Analyzer Control Software (hereafter MX180000A) when either MP1800A or controller PC connected

1.2 Product Composition

1.2.1 Standard composition

Table 1.2.1-1 shows the standard composition of the MP1861A.

Table 1.2.1-1   Standard composition for MP1861A

Item	Model	Product name	Q'ty	Remarks
Main frame	MP1861A	56G/64Gbit/s MUX	1	
Accessory	J1658A	Coaxial skew match pair cable (1.3 m, K connector)	1	Data Input1/2
	J1652A	Coaxial cable (0.5 m, K connector)	1	External Clock Input
	J1654A	U Link Cable B	1	Delayed Clock Output to Mux Clock Input
	J1363A	Protection cap	2	Data Output/XData Output
	41V-6	Precision fixed attenuator 6 dB	2	Data Output/XData Output
	J1632A	Terminator	4	Clock Output1/2 1/2 Clock OutputBuffered Clock Output
	J1341A	Open	3	External Clock Input Data Input1/2
	J1655A	Semi-rigid Cable (0.2 m, V)	1	
	J1475A	USB cable	1	
	Z1312A	AC Adapter	1	
	G0342A	ESD Discharger	1	
		Power cord 2.6 m	1	
	Z0897A	MP1800A Manual CD	1	CD-ROM version
	Z0918A	MX180000A Software CD	1	CD-ROM version

1.2.2 Options

Table 1.2.2-1 shows the options for the MP1861A. All options are sold separately.

Table 1.2.2-1   Options for MP1861A

Model name	Product name	Remarks
MP1861A-x01	64 Gbit/s Extension	
MP1861A-x11	Variable Data Output (0.5 to 2.5 Vp-p)	Mandatory option Cannot be installed together with MP1861A-x13.
MP1861A-x13	Variable Data Output (0.5 to 3.5 Vp-p)	Mandatory options Cannot be installed together with MP1861A-x11.
MP1861A-x30	Variable Data Delay	

Option name format is as follows:

MP1861A- x   x x

Indicates function.
This value is recognized by the mainframe.

Anritsu management number.
This value is not recognized by the mainframe.
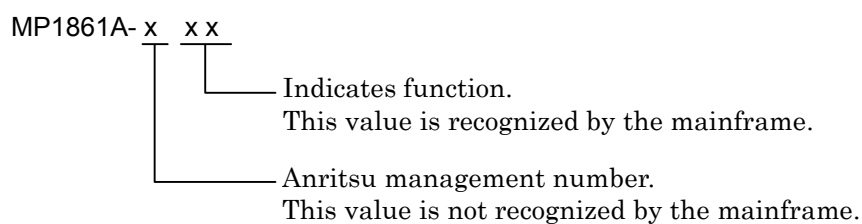
1.2.3 Application parts

Table 1.2.3-1 shows the application parts for the MP1861A. All application parts are sold separately.

Table 1.2.3-1   Application parts

Model	Product name	Remarks
J1600A	Skew match pair cable (0.2 m, V connector)	Cable for measurement
J1656A	Coaxial cable set (MP1861A-MP1862A)	Two (a pair) for jitter tolerance measurement
J1646A	Passive Equalizer 6dB (V connector)	
Z0306A	Wrist strap	
J1678A	ESD Protection Adapter-K	K connector
J1679A	ESD Protection Adapter-V	V connector

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Overview

1.3 Specifications

1.3.1 Specifications for MP1861A

The input/output specification value is defined assuming that a sampling oscilloscope range with 70 GHz is used.

Table 1.3.1-1   Specifications for MP1861A

Item		Specifications	Remarks
Operating Bit Rate		8 to 56.2 Gbit/s 8 to 64.2 Gbit/s (when MP1861A-x01 installed)	
External Clock Input	Number of Input	1 (Ext Clk Input)	From the MU18302xA Clock Output connector (Full rate Clock Output setting)
	Frequency	4 to 28.1 GHz 4 to 32.1 GHz (when MP1861A-x01 installed)	
	Input Amplitude	0.3 to 1.0 Vp-p	
	Termination	50 Ω/AC	
	Connector	K (f.)	
Data Input	Number of Input	2 (Data Input 1, Data Input 2)	From MU18302xA Data Output
	Level	0/–0.7 V (H:–0.15 to +0.05, L: –0.85 to –0.55)	
	Termination	50 Ω/GND	
	Connector	K (f.)	
1/2 Clock Output	Number of Output	1 (1/2 Clk Output)	To be terminated into 50 Ω when not in use. Output frequency: Half of the frequency input to the **Ext Clk Input** connector.
	Frequency	2 to 14.05 GHz 2 to 16.05 GHz (when MP1861A-x01 installed)	
	Output Amplitude	0.3 to 1.0 Vp-p	
	Termination	50 Ω/AC	
	Connector	SMA(f.)	
Clock Output	Number of Output	2 (Clk Output1, Clk Output2)	Output frequency: The same as the frequency input to the **Ext Clk Input** connector. To the MP1862A Ext. Clock Input connector or DUT
	Frequency	4 to 28.1 GHz 4 to 32.1 GHz (when MP1861A-x01 installed)	
	Output Amplitude	0.4 to 1.0 Vp-p	
	Termination	50 Ω/AC	
	Connector	K (f.)	

Table 1.3.1-1   Specifications for MP1861A (Cont'd)

Item		Specifications	Remarks
Buffered Clock Output	Number of Output	1 (Buffered Clk Output)	To be terminated into 50 Ω when not in use. Output frequency: The same as the frequency input to the **Ext Clk Input** connector.
	Frequency	4 to 28.1 GHz 4 to 32.1 GHz (when MP1861A-x01 installed)	
	Output Amplitude	0.2 to 1.0 Vp-p	
	Termination	50 Ω/AC	
	Connector	K (f.)	
Delayed Clock Output	Number of Output	1 (Delayed Clk Output)	To be connected to the **Mux Clk Input** connector. Output frequency: The same as the frequency input to the **Ext Clk Input** connector.
	Frequency	4 to 28.1 GHz 4 to 32.1 GHz (when MP1861A-x01 installed)	
	Output Amplitude	0.2 to 1.0 Vp-p	
	Termination	50 Ω/AC	
	Connector	K (f.)	
MUX Clock Input	Number of Input	1 (MUX Clk Input)	To be connected to the **Delayed Clk Output** connector. Input frequency: The same as the frequency input to the **Ext Clk Input** connector.
	Frequency	4 to 28.1 GHz 4 to 32.1 GHz (when MP1861A-x01 installed)	
	Input Amplitude	0.2 to 1.0 Vp-p	
	Termination	50 Ω/AC	
	Connector	K (f.)	
Data Output[1] MP1861A-x11 (Variable Data Output (0.5 to 2.5 Vp-p))	Number of Output	2 (Data Output/$\overline{\text{Data}}$ Output)	
	Bit Rate	8 to 56.2 Gbit/s 8 to 64.2 Gbit/s (when MP1861A-x01 installed)	

*1:   Defined under the following test pattern conditions:
　　・PRBS2^31–1
　　・Mark Ratio1/2

Table 1.3.1-1   Specifications for MP1861A (Cont'd)

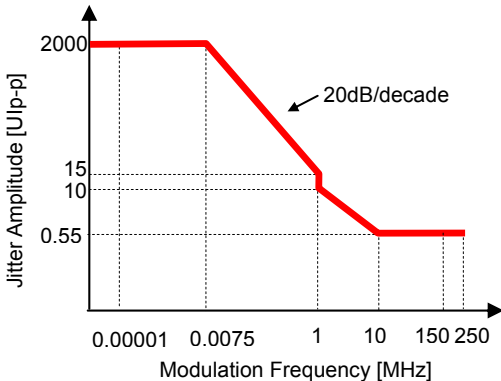| Item		Specifications	Remarks
Data Output*1 MP1861A-x11 (Variable Data Output (0.5 to 2.5 Vp-p)) (Continued)	Amplitude*2, *3	0.5 to 2.5 Vp-p/2 mV Step 0.5 to 2.5 Vp-p/2 mV Step (≤56.2 Gbit/s) *5 1.0 to 2.5 Vp-p/2 mV Step (>56.2 Gbit/s) The range of 0.5 to 0.998 V is not guaranteed but can be set. *5	Data and $\overline{\text{Data}}$ can be set separately.
		Accuracy: ±50 mV ±17% of Amplitude*4,*5	
	Offset	−2.0 to +3.3 Voh /1 mV Step Min. −4.0 Vol	
		Accuracy: ± 65 mV ±10% of Offset (Vth) ±(Amplitude Accuracy/2)	
		Current Limit: Sourcing 100 mA/Sinking 100 mA	
	Defined Interface	NECL, SCFL, NCML, PCML, LVPECL	
	Cross Point	45% to 55% / 0.1% Step (≤56.2 Gbit/s) "Overload" is displayed in the following cases because the cross point of 50 % cannot be guaranteed. ・ >56.2 Gbit/s ・ When MP1861A-x01 is installed	
	Tr/Tf*2, *3	Typ.8 ps (20 to 80%)*4,*5	
	Half Period Jitter	−20 to 20/1 Step With monitor display in units of UI.	
	Jitter (RMS)*2, *3	Typ. 450 fs, ≤550 fs*4,*7 Typ. 650 fs *5,*7	
	Random Jitter (RMS)	Typ. 200 fs *4,*7	
	Waveform Distortion (0-peak)*2,*3	Typ. ± 25 mV ± 10% of Amplitude *4,*5,*6	
	ON•OFF	Can be switched ON/OFF	
	Termination	Can be switched between AC and DC, 50 Ω/GND, −2 V, + 1.3 V (when DC selected)	
	Connector	V (f.)	
	Offset reference	Can be switched between Voh, Vth and Vol	
	Data/XData Tracking	Yes	
	Level Guard	Yes	
	External ATT Factor	Yes	Data and $\overline{\text{Data}}$ can be set separately.

*2:   Defined based on the condition the cross point is 50%.

*3: Defined based on the following observation conditions:
   ・The coaxial cable (J1655A) is used
   ・The sampling oscilloscope band is 70 GHz.

*4: At a bit rate of 56.2 Gbit/s

*5: At a bit rate of 64.2 Gbit/s (with MP1861A-x01 installed)

*6: At an output amplitude of 2.5 Vp-p

*7: The specified value applies when using an oscilloscope with residual jitter of less than 200 fs (RMS).

1

Overview

Table 1.3.1-1   Specifications for MP1861A (Cont'd)

Item		Specifications	Remarks
Data Output*1 (Cont'd) MP1861A-x13 (Variable Data Output (0.5 to 3.5 Vp-p))	Number of Output	2 (Data Output / $\overline{\text{Data}}$ Output)	
	Bit Rate	8 to 56.2 Gbit/s 8 to 64.2 Gbit/s (when MP1861A-x01 installed)	
	Amplitude*2, *3	0.5 to 3.5 Vp-p/2 mV Step 0.5 to 3.5 Vp-p/2 mV Step (≤56.2 Gbit/s) *5 1.0 to 3.5 Vp-p/2 mV Step (>56.2 Gbit/s) The range of 0.5 to 0.998 V is not guaranteed but can be set.*5	Data and $\overline{\text{Data}}$ can be set separately.
		Accuracy:± 50 mV ± 17% of Amplitude*3	
	Offset	−2.0 to + 3.3 Voh/1 mV Step Min. −4.0 Vol	
		Accuracy: ±65 mV ±10% of Offset (Vth) ± (Amplitude Accuracy/2)	
		Current Limit: Sourcing 100 mA/Sinking 100 mA	
	Defined Interface	NECL, SCFL, NCML, PCML, LVPECL	
	Cross Point	45 to 55% /0.1% Step (≤56.2 Gbit/s) "Overload" is displayed in the following cases because the cross point of 50 % cannot be guaranteed. ・ >56.2 Gbit/s ・ When MP1861A-x01 is installed	
	Tr/Tf*2,*3	Typ.8 ps (20 to 80%)*4,*5	
	Half Period Jitter	−20 to 20/1 Step With monitor display in units of UI.	
	Jitter (RMS)*2,*3	Typ. 450 fs, ≤550 fs*4, *7 Typ. 650 fs, *5, *7	
	Random Jitter (RMS)	Typ. 200fs *4, *7	
	Waveform Distortion (0-peak) *2,*3	Typ. ± 25 mV ± 10% of Amplitude *4,*5,*6	
	ON/OFF	Can be switched ON/OFF	
	Termination	Can be switched between AC and DC, 50 Ω/GND, −2 V, + 1.3 V (when DC selected)	
	Connector	V (f.)	
	Offset reference	Can be switched between Voh, Vth and Vol	
	Data/XData Tracking	Yes	
	Level Guard	Yes	
	External ATT Factor	Yes	Data and $\overline{\text{Data}}$ can be set separately.

Table 1.3.1-1   Specifications for MP1861A (Cont'd)

Item		Specifications	Remarks

Jitter tolerance *1,*4,*5	When interacting with MU181500B+ MU18302xA	This item is defined under the following conditions:
		・ Bit rate:
		   56.2 Gbit/s
		   64.2 Gbit/s (With MP1861A-x01 installed)
		・ Pattern: PRBS2^31–1
		・ Temperature: 20 to 30°C
		・ Loopback connection with MP1862A
		The following shall be applied simultaneously by using MU181500B:
		・ SSC with a 5300 ppm amplitude
		・ RJ of 0.3 UI
		Modulation frequency:
		56.2 Gbit/s: Up to 250 MHz
		64.2 Gbit/s: Up to 150 MHz	

Variable Data Delay	Variable phase range	−64000 to +64000 mUI/ 4 mUI Step	With MP1861A-x30 installed
	Phase setting error	Typ. ±50 mUIp-p (≤56.2 Gbit/s) *8 Typ. ±150 mUIp-p (>56.2Gbit/s, (when MP1861A-x01 installed)) *8	
	mUI-ps conversion	Available	
	Calibration	Available (When jitter modulation is off)	
	Relative 0	Available	
	Jitter Input	Available	

*8:   The values are specified, assuming an oscilloscope with a linearity of less than 200 fs will be used.

Table 1.3.1-1   Specifications for MP1861A (Cont'd)

Item		Specifications	Remarks
Control interface		USB 2.0 or 1.1 Type B ×1	
Channel setting		Can be selected from CH1 to CH4.	
Power (AC adapter)	Input voltage	AC 100 to 240 V *9	
	Input frequency	50 to 60 Hz	
	Output power	DC 19 V, 7.9 A (Max)	
Power consumption		DC 19 V, 4 A	
Dimensions (Excluding protrusions)		90.9 mm(H), 120 mm (W), 140 mm (D)	
Mass		5.0 kg or less	
Environmental Performance	Operation Temperature	+ 15 to + 35°C (ambient temperature of equipment)	
	Storage Temperature	−20 to +60°C	

*9:   Operating voltage: within the range of +10% to −15% from the rated voltage

This chapter describes preparation required before using MP1861A.

2

Before Use

2.1   Preparation Before Use

This section explains the installation position of the mainframe and how to turn on the power.

2.1.1   Environmental Conditions of Installation Site

The MP1861A operates in the temperature range from 15 to 35°C. Avoid using it under any of the following environment conditions that may cause failure.

- Strong vibrations
- High humidity or dust
- Direct sunlight
- Chemically active gases
- Substantial temperature changes

Note:

Condensation may form inside of the MP1861A if it is moved to a warm location after operating for a long time in a cool location. In such a case, be sure to wait until the MP1861A becomes completely dry before turning on the power. Doing so with condensation present may cause a short circuit and damage the MP1861A.

2.1.2   Clearance from Fan

A cooling fan is provided on the side of the MP1861A. Install the MP1861A at least 10 cm away from walls, peripheral devices, or the like to prevent blockage of ventilation. Insufficient ventilation may cause the internal temperature to rise, resulting in failure.
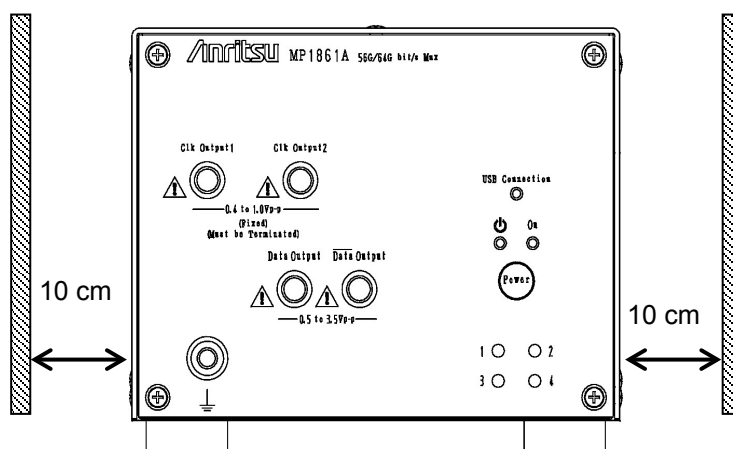

Figure 2.1.2-1   Clearance from fan

2.1.3 Power Connection

This section describes the procedures for supplying power.

Use a supplied AC adapter. If AC adapter other than the supplied one is used, the MP1861A may be damaged.

Connect the shielded connector from the AC adapter to the rear panel connector of the MP1861A. Refer to Figure 2.1.3-1.
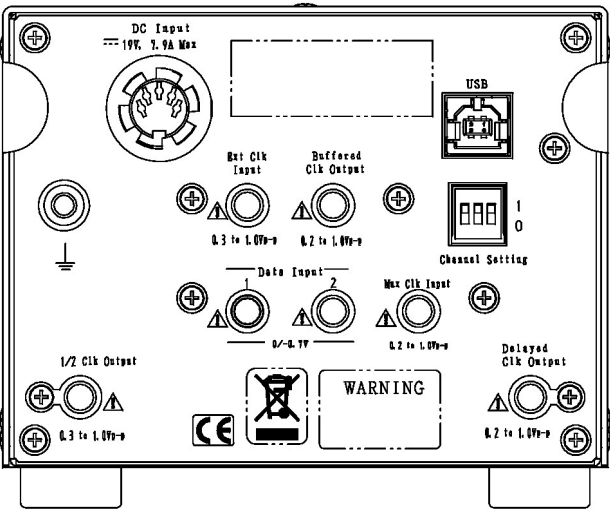

Figure 2.1.3-1   Rear Panel of MP1861A

Insert the power plug into an outlet, and connect the other end to the power inlet on the rear panel. To ensure that the instrument is earthed, always use the supplied 3-pin power cord, and insert the plug into an outlet with an earth terminal.

⚠ WARNING

If the power cord is connected without grounding MP1861A, there is a risk of receiving a fatal electric shock. In addition, the peripheral devices connected to MP1861A may be damaged.
When connecting to the power supply, DO NOT connect to an outlet without a ground terminal. Also, avoid using electrical equipment such as an extension cord or a transformer.

2.1.4 Usage Patterns of MP1861A

This section describes the two ways to control MP1861A and how to connect to MP1800A or control PC.

MP1861A is controlled via the MX180000A installed to MP1800A or control PC. When connecting MP1861A to MP1800A (control PC), use the standard accessory USB cable.

(1) Connecting MP1800A:

Connect the USB connector (type A) to the front panel or rear panel of MP1800A, and then connect the USB connector (type B) to MP1861A.

MP1800A with MX180000A

MP186xA

USB
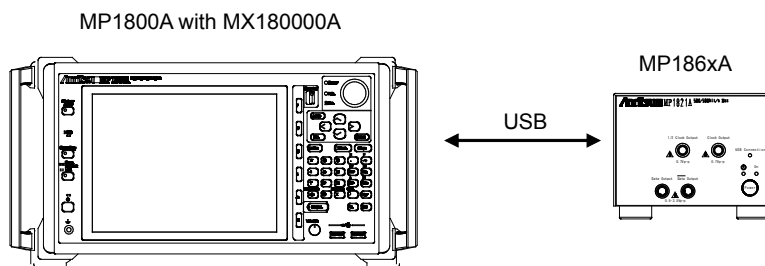
Figure 2.1.4-1   Connecting to MP1800A

To connect two MP1861As to MP1800A, connect them to the USB connectors (type A) on MP1800A's front panel.
MP1861As may not be able to function properly if one of them is connected to the USB connector on MP1800's rear panel. To connect more than two MP1861As, connect a USB hub to the front or rear panel of MP1800A, and then connect each of MP1861As to MP1800A via the USB hub.
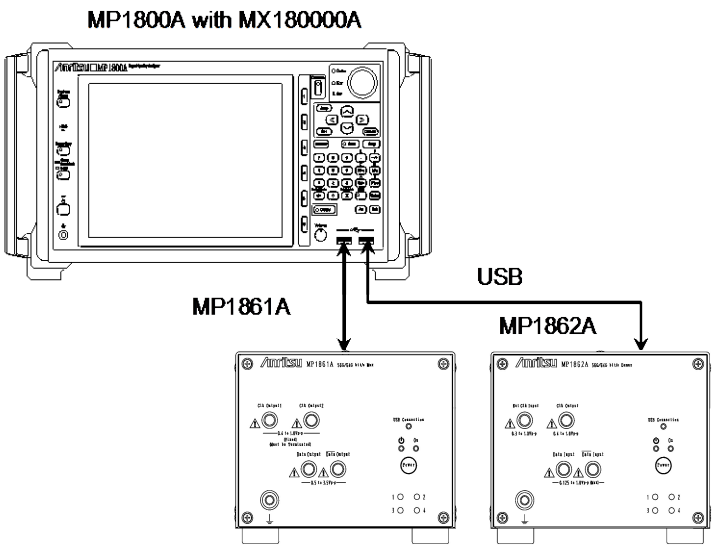
Figure 2.1.4-2   Connecting Multiple MP186xAs to MP1800A

(2)   Connecting to control PC:

Connect the USB connector (type A) to PC, and then connect the USB connector (type B) to the MP1861A.

Control PC with MX180000A

MP186xA

USB

Figure 2.1.4-3   Connecting to Control PC

Note the following when connecting two MP186xAs to control PC:

- For PC with multiple USB connectors, connect to the USB connector with the same USB controller, as shown below.
  It may not function normally if connecting to the connector with different USB controller.

- If the number of USB connectors on the Control PC is not enough, use a USB hub.

Note：

Anritsu is not responsible for the proper functioning of all USB hubs.

Figure 2.1.4-4   Connecting Control PC to Two MP186xAs

Figure 2.1.4-5   Connecting Control PC Using A USB Hub

Using other USB devices

Refer to the following for how to use commercially available USB devices when MP1861A is in use.

Connect the USB device before starting the MP1800A; do not connect or disconnect USB devices while using the MX180000A Control Software. In addition, only read measurement data using a USB device after exiting the MX180000A Control Software (closing selector screen).

Use a PC that meets or exceeds the following specifications.

Table 2.1.4-1   Required Specifications for Control PC (For Windows XP)

Item	Specifications
Compatibility	IBM-PC or compatible PC
CPU	Pentium4 processer and 1.6 GHz or higher
OS	Windows XP Version 2002 Service Pack 2
Memory	$\geq$ 512 MB
Monitor resolution	800 × 600 dots or more
Display color	$\geq$ 256 colors
CD-ROM driver	Required when installing the software package
Hard Disk	Required free disk space for installing the software package: At least 200 MB
USB Interface	USB 2.0 or USB 1.1

Table 2.1.4-2   Required Specifications for Control PC (For Windows 7)

Item	Specifications
Compatibility	IBM-PC or compatible PC
CPU	1 GHz or faster 32-bit (x86) or 64-bit (x64) processor
OS	Windows 7 Professional/Enterprise/Ultimate
Memory	32-bit: 1 GB RAM 64-bit: 2 GB RAM
Monitor resolution	800 × 600 dots or more
Display color	≥ 256 colors
CD-ROM driver	Required when installing the software package
Hard Disk	Required free disk space for installing the software package: At least 200 MB
USB Interface	10 BASE-T or 100 BASE-TX

The MP1861A will not operate normally when performing the following operations and functions on the PC while the MX180000A is operating.

(1)   Running another application at same time

(2)   Closing lid of laptop PC

(3)   Running screen saver

(4)   Running battery save function

Read the PC instruction manual to switch off the screen saver and battery save functions described in items (3) and (4) above.

Note:

Operation is not assured even with PCs meeting the specifications outlined in Table 2.1.4-1 or Table 2.1.4-2.

2

Before Use

2.2   Getting Started with MX180000A

This section explains how to install the software and how to start and exit MX180000A.

2.2.1   Installing MX180000A

Note the following procedure when installing software for the MP1861A in the MP1800A or remote PC.

The following examples show the case when the software is installed in the MP1800A. For the general software installation procedures, refer to the *MP1800A Installation Guide (W2747AE)* or *MT1810A Installation Guide (W2748AE)*.

(1)   When the general procedures are followed by the installer, the confirmation dialog is displayed. Press **Yes** to start installation.
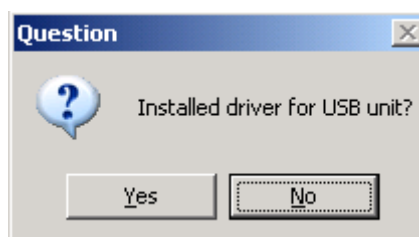
Figure 2.2.1-1   Confirmation Dialog of USB Driver Installation (1)

(2)   For Windows 7, a confirmation dialog box is displayed to ask if you want to install Anritsu Corporation Universal Serial BUS Controller.

Click **Yes** to continue installation.

Click **Continue Anyway** to continue installation.

(3) For Windows XP, when the screen shown in Figure 2.2.1-2 is displayed, click **Continue Anyway** to continue.

Figure 2.2.1-2   Confirmation Dialog of USB Driver Installation (2)

Note:

The screen as shown in Figure 2.2.1-1 may not be displayed on the front page. If software installations take a long time, check that the screen as shown in Figure 2.2.1-1 is hidden at the back of the other screen.

(4) The following window is displayed when the installation completes normally. Click **Finish** to end the installation procedure.
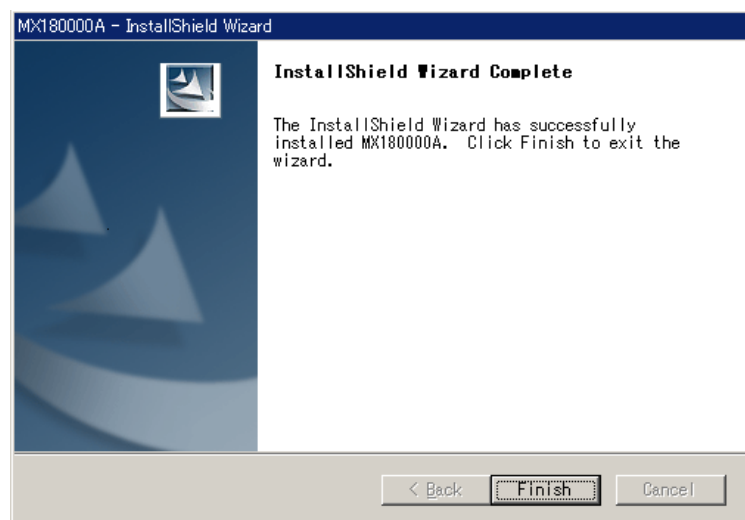
Figure 2.2.1-3   Completing Installation

When the MP1861A is connected to the MP1800A or remote PC after software installation, install the driver using the following procedures. The following example show when the MP1861A is connected to the MP1800A.

(1)   Connect the MP1800A and MP1861A using an USB cable.
      For Windows 7, the driver is installed automatically.
      For Windows XP, perform the step 2 to 5 to install the driver.

(2)   The Found New Hardware Wizard screen is displayed to confirm windows update. Select **No, not this time** and press **Next**.
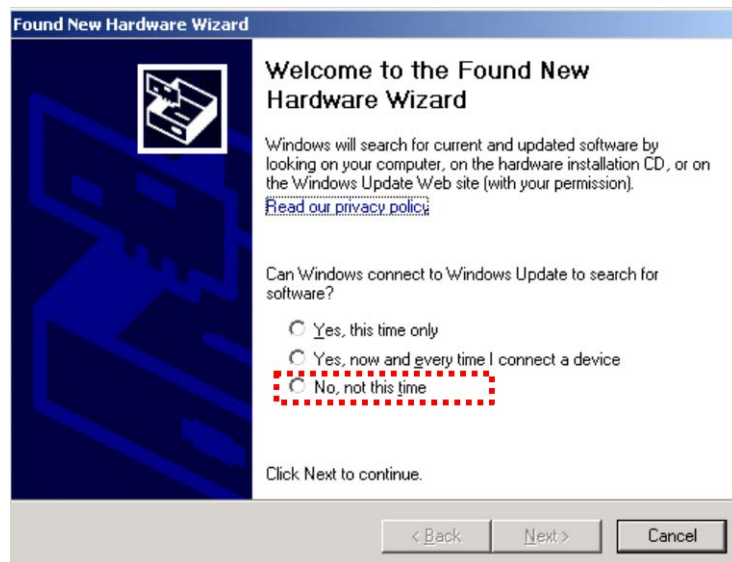
Figure 2.2.1-4   Confirmation of Windows Update

(3)   Select **Install the software automatically** and press **Next**.

Figure 2.2.1-5   Software Installation

(4) Figure 2.2.1-6 is displayed when the hardware is found.
Press **Continue Anyway** to continue the installation procedures.
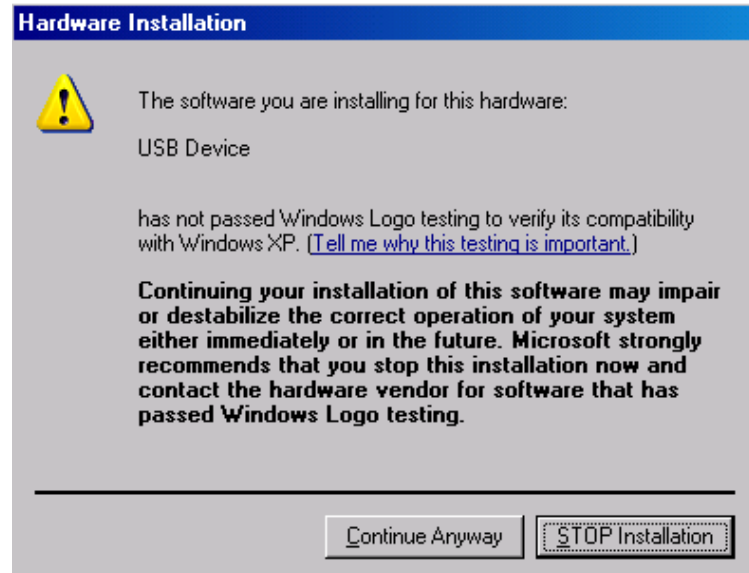
Figure 2.2.1-6 Hardware Installation

(5) Click **Finish** to end the installation procedure.

Figure 2.2.1-7 Completing Installation

If the installed driver is no longer needed, uninstall it as follows.

(1)   Select **Start** menu →**Control Panel**, and then open the Control Panel.

(2)   Double-click **Add/Remove Programs** in the Control Panel.

(3)   Select **Anritsu USB Device Driver** from the list and click **Remove** to start the uninstallation.
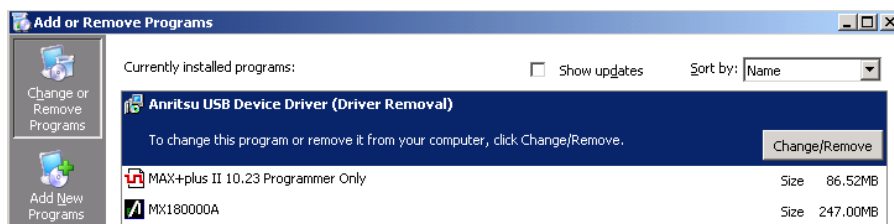
Figure 2.2.1-8   Removing USB Driver

2.2.2 Starting MX180000A

When connecting to MP1800A:

(1) Connect the MP1861A and MP1800A as explained in Section 2.1.4.

(2) Connect the AC adapter to the MP1861A and set the power switch to ON.
The LED lights green while power is on.

(3) When the MP1800A is turned on, Windows boots and the MX180000A starts automatically. Select [Main application] on the selector screen.

(4) The MP1861A control screen is displayed.

When connecting to control PC:

(1) Connect the MP1861A and control PC as explained in Section 2.1.4.

(2) Connect the AC adapter to the MP1861A and set the power switch to ON.
The LED lights green while power is on.

(3) Start the MX180000A controller PC and select Main application on the selector screen.

(4) The MP1861A control screen is displayed.

Figure 2.2.2-1   Selector Screen

2.2.3 Exiting MX180000A

When connecting to MP1800A:

(1)   Press and hold the power switch on the MP1800A front panel or click the Shut down button on the selector screen. After the application are shut down, the MP18000A Power lamp goes off, and then the Standby LED lights up.

(2)   Set the MP1861A power switch to OFF.
The LED lights orange, indicating the standby status.

When connecting to control PC:

(1)   Close **Main application** to display the selector screen.

(2)   Press **Exit** on the selector screen to close the window.

(3)   Set the MP1861A power switch to **OFF**.
The LED lights orange, indicating the standby status.

Notes:

- To cut the power without following the above procedure, press the MP1861A power switch for more than 10 seconds to enter the standby status.

- Do not disconnect the power cord and AC adapter without first turning off the MP1861A as described above, otherwise the MP1861A may be damaged.

2.2.4 Messages that are displayed when connecting/disconnecting the USB cable

This section describes the messages that are displayed when the USB cable is connected to or disconnected from MP1861A.

When disconnecting the USB connection of this equipment for some unexpected reason, follow the procedure described below to minimize the impact on running applications. However, all the USB disconnection cannot be assured by this operation. Normally, follow the startup and shutdown procedures described in sections 2.2.2 and 2.2.3, respectively.

When USB connection disconnected while application running:

(1) The following dialog screen is displayed when the USB connection is disconnected.
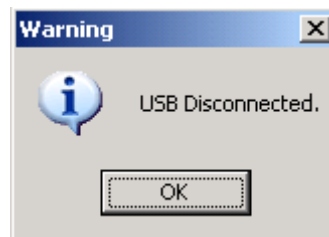
Figure 2.2.4-1   USB Disconnected

(2) The buttons for calling screens are disabled and the screen goes blank. The Data Output and Clock Output are set forcibly to OFF.

(3) The MP1800A module connected to this equipment can still be used.

When USB device connected while application running:

(1) The following USB connection dialog is displayed.
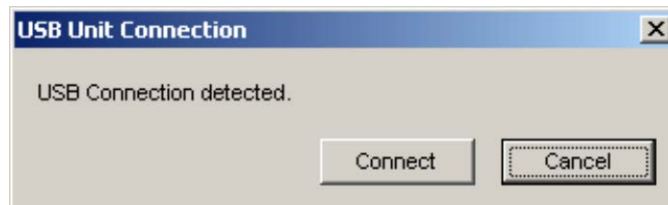
Figure 2.2.4-2   USB Connection Message

(2)   If there is a backup file (saved when previous application terminated when connection made), each setting is restored. Each setting is restored when reconnecting previously connected equipment that has been disconnected.

(3)   The button for calling screens is enabled and the screen is displayed for use. The Data Output and Clock Output are OFF.

When USB connection disconnected while using Setup utility:

(1)   No warning is issued at the instant of disconnection.

(2)   If processing is executed when the equipment is already disconnected, a message indicating that the equipment is not connected is displayed.

**Figure 2.2.4-3   USB Disconnection Message
while Setup Utility in Use**

(3)   The MP1800A module connected to this equipment can still be used.

When USB device connected while using Setup utility:

(1)   When a connection is made while using the Setup utility, the equipment is not recognized.

(2)   Restart from the selector screen after setting the power OFF and ON and running the Setup utility once more.

⚠ CAUTION

If the connection between MP1861A, MP1800A and controller PC is broken during downloading with the Setup utility, MP1861A may no longer operate normally. NEVER break the connection during downloading.

2.3 Other Usage Methods

This section explains how to check the installed software version, perform software updates, and initialize the settings.

For how to operate the MX180000A, refer to the *MX180000A Signal Quality Analyzer Control Software Operation Manual*.

2.3.1 Checking Installed Software Version

Check the installed software version using the **Help** item at the Main Application menu bar or the Setup utility.

Select **Version** from the **Help** item at the Main Application menu bar. The following screen opens to display the currently installed software version.
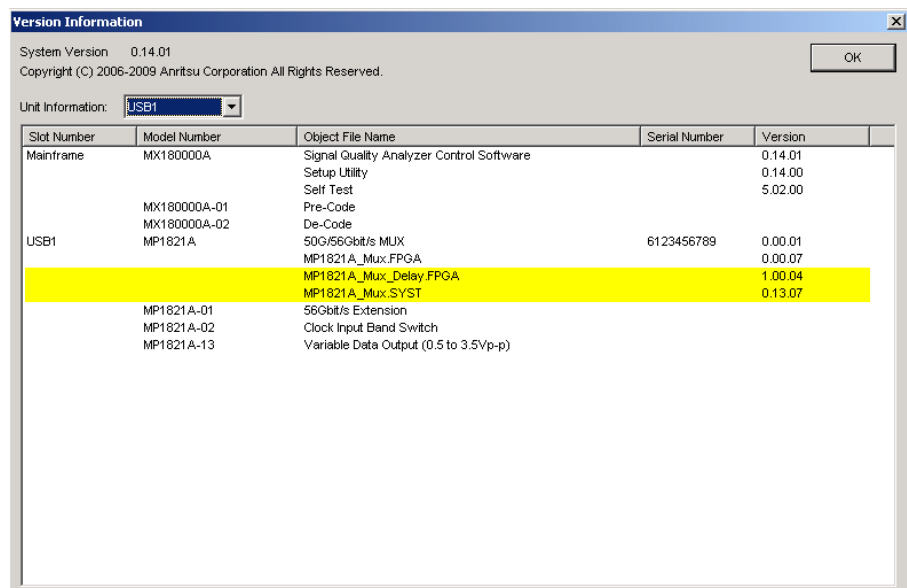
Figure 2.3.1-1　Version Display Screen

Objects displayed with yellow highlighting on the Version Display screen have a version other than the installed version. In this case, update the installed software as described in section 2.3.2. If the installed software versions are mismatched, operation may not be normal.

The Setup utility is selected by choosing **Setup utility** from the selector screen displayed when the MX180000A is started; log-in using **Login** – **User**.

Click the **Version** tab to display the software version. The screen shown below opens to display the version information.
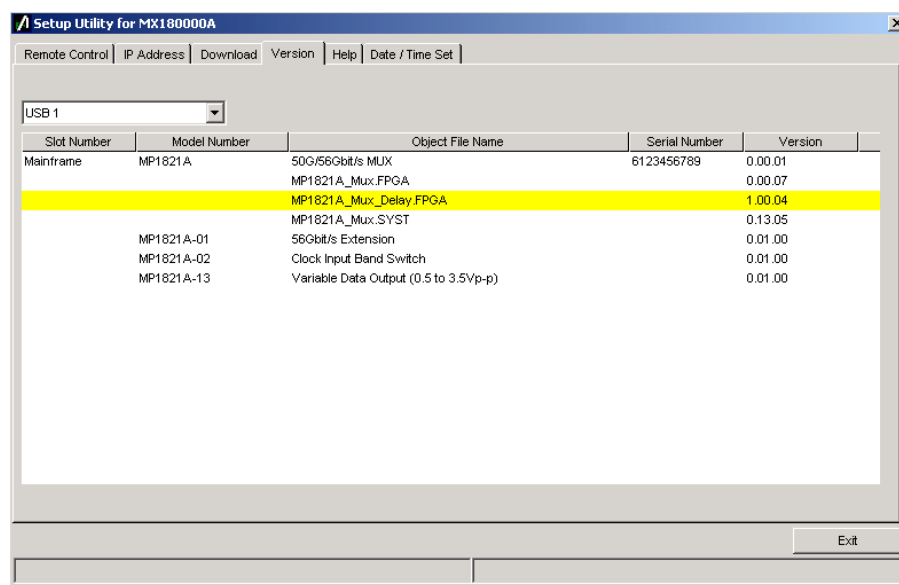
Figure 2.3.1-2   Version Display Screen

Objects displayed with yellow highlighting on the Version Display screen have a version other than the installed version. In this case, update the installed software as described in section 2.3.2. If the installed software versions are mismatched, operation may not be normal.

2.3.2 Updating Software

The equipment software can be updated from the Setup utility screen.

When installing a new software version, there may sometimes be a mismatch with already installed software and operation is not assured. To solve the problem of mismatched installed software versions, start the Setup utility and click the **Download** tab to display the download files in the downloaded file display field. Put checkmarks in the boxes opposite the files to be upgraded and click the **Load** button to start the download. When download is completed normally, the installed software can be upgraded.

Normally, the installed software is upgraded to the latest version when the **Load** button is clicked.
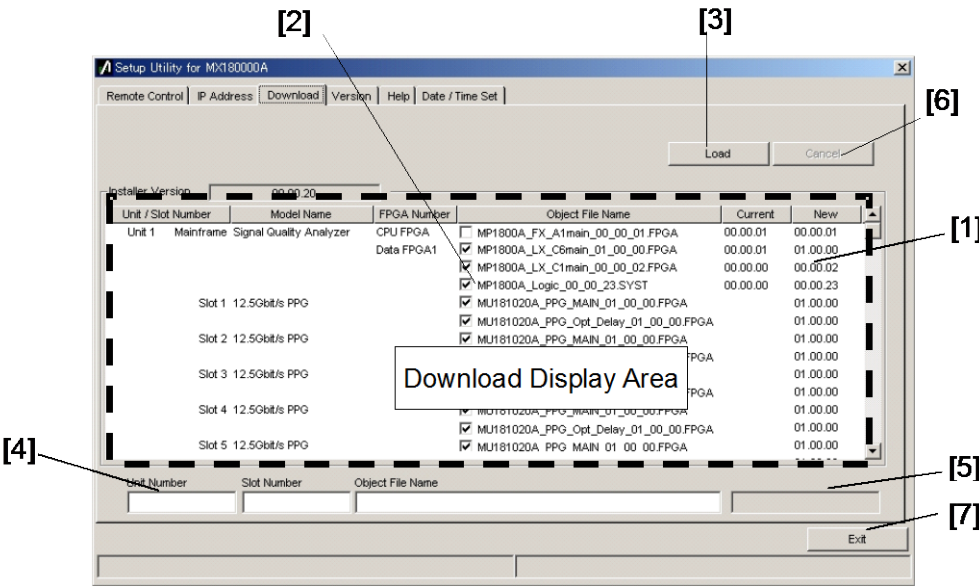
Figure 2.3.2-1   Download Screen

Table 2.3.2-1   Download Screen

No.	Function and Usage
[1]	This displays files that can be downloaded Versions displayed in the New column are versions of object files offered by the MX180000A SQA control software. Versions displayed in the Current column are the versions of software already installed in the equipment. If there is a mismatch between versions in New and Current, place checkmarks in the boxes and download the new files.
[2]	These are checkboxes for files to download. When it is necessary to download the latest version (because there are differences between the New and Current versions), the checkbox is marked automatically.
[3]	This executes download using the MX180000A SQA control software installer. The versions of files saved to the internal hard disk are compared with versions to be downloaded for each module in this equipment, and if there are differences, the files are downloaded.
[4]	This displays the download slot number and file name.
[5]	This displays the download status.
[6]	This suspends downloading.
[7]	This quits the setup utility.

Notes:

- If the Current version is not displayed and there is no checkmark in the checkbox, put a checkmark in the checkbox and execute download.

- Downloading the FPGA as described below takes about 10 minutes per file. The power must be toggled OFF and ON to enable the update. Set the power to OFF as described in section 2.2.3.

  xx in the filename MP186xA_MUX_Opt_Delay_xx_xx_xx.FPGA indicates the version.

⚠ CAUTION

If the connection between MP1861A, MP1800A and controller PC is broken during downloading with the Setup utility, MP1861A may no longer operate normally. NEVER break the connection during downloading.

2.3.3 Initializing Settings

Click **Initialize** in the File menu of the MX180000A SQA control software to initialize the equipment to the factory defaults. In addition, the equipment settings can be returned to the factory defaults using the Setup utility; start the utility and click the **Help** tab.
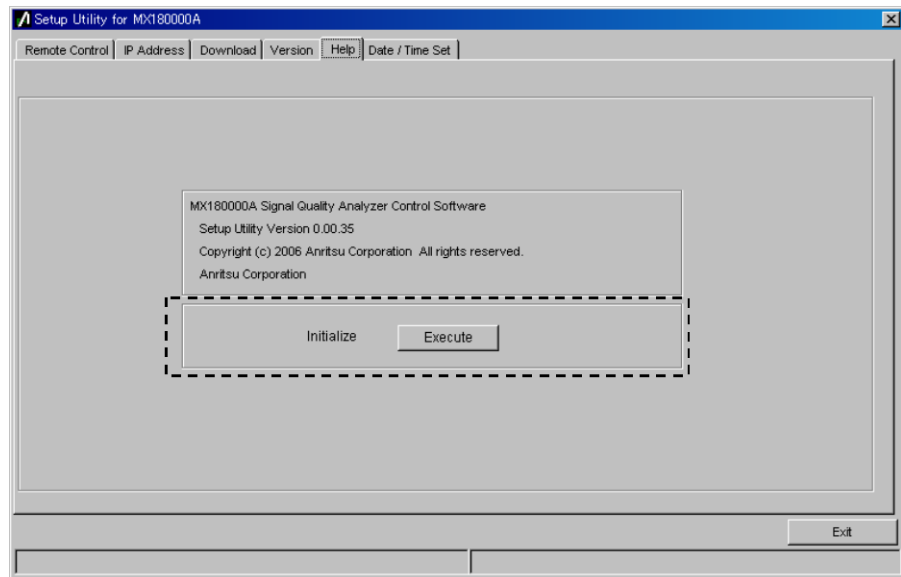
Figure 2.3.3-1 Initializing Settings

When **Execute** in the Initialize group box is clicked, the equipment is initialized to the factory default settings.

2.4   Preventing Damage

Be sure to observe the rating ranges when connecting input and output of the MP1861A. Otherwise, the MP1861A may be damaged.

⚠ CAUTION

- **Do not apply a voltage exceeding the rated voltage of MP1861A. Excessively high input voltage can damage the circuit.**

- **When output is used at the 50 Ω/GND terminator, never feed any current or input signals to the output.**

- **As an antistatic measure, make sure the other devices (including experimental circuits) to be connected with ground wires before connecting the I/O connectors.**

- **The outer conductor and core of the coaxial cable may become charged as a capacitor. Use any metal to discharge the outer conductor and core before use.**

- **Never open the MP1861A. If you open it and the MP1861A has failed or sufficient performance cannot be obtained, we may decline to repair the MP1861A.**

- **The MP1861A has many important circuits and parts including hybrid ICs. These parts are extremely sensitive to static electric charges, so never open the case of the MP1861A.**

- **The hybrid ICs used in the MP1861A are sealed in airtight containers; never open them. If you open it and the MP1861A has failed or sufficient performance cannot be obtained, we may decline to repair the MP1861A.**

- **To protect the MP1861A from e being damaged by static electricity, be sure to observe the following:**
  - **Spread a conductive sheet on a workbench.**
  - **Wear a wrist strap connected to the conductive sheet or the frame ground of MP1861A**

⚠ CAUTION

- When connecting an external device such as a Bias-T to the output connectors of this equipment (PPG or MUX), if the output signal includes any DC voltage, variations in the output of the DC power supply or load may change the level of the output signal, risking damage to the internal circuits. Note the following precautions when using this equipment:
  - Do not connect or disconnect any external devices while DC voltage is impressed.
  - Only switch DC power sources ON and OFF when all equipment connections have been completed.

<Recommended procedure>
Measurement Preparation 1:
1. Connect all equipment.
2. Set the DC power supply output to ON.
3. Set the equipment output to ON and complete measurement.

Measurement Preparation 2:
1. Set the equipment output to OFF.
2. Set the DC power supply output to OFF.
3. Disconnect the equipment, or change the DUT connections.

Since even unforeseen fluctuations in DC voltage and load (open or short circuits at the equipment output side and changes caused by using a high-frequency probe, etc.) can damage the DUT and equipment, we recommend connecting a 50–ohm resistance in series with the DC terminal of the Bias-T to prevent risk of damage.

2

Before Use
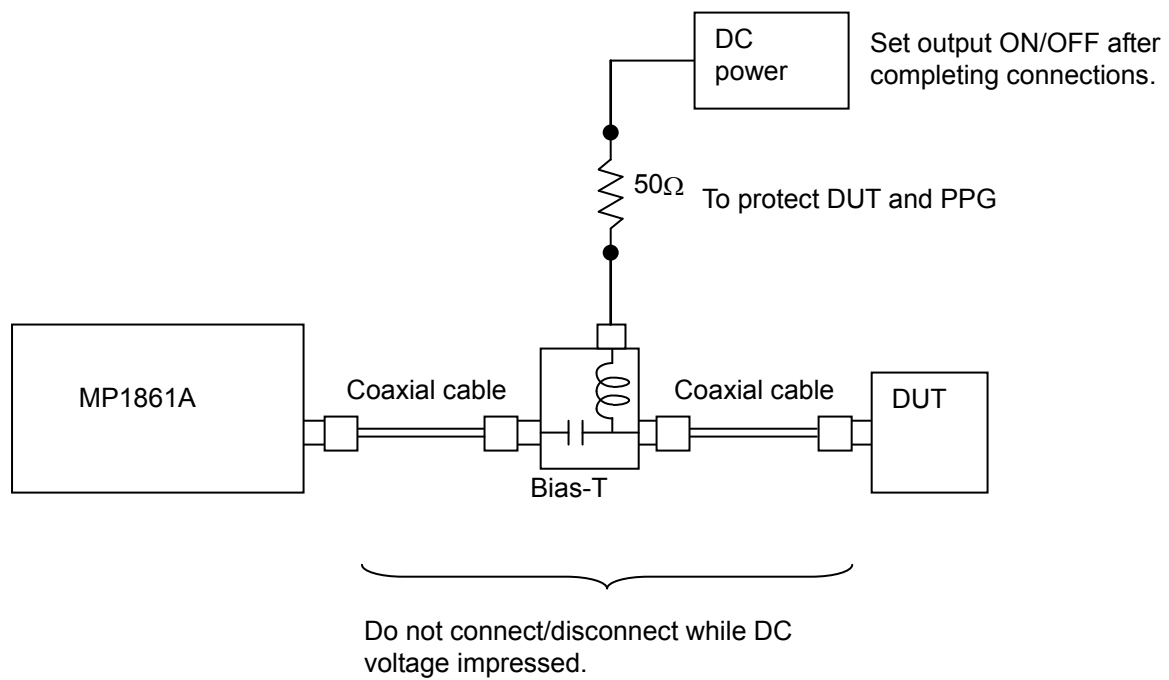
Figure. 2.4-1   Bias-T Connection Example

Chapter 3 Panel Layout and Connectors

This chapter describes the panels and connectors of MP1861A.

3

Panel Layout and Connectors

3.1 Panel Layout

This section describes the components located on the front and rear panels of MP1861A.

3.1.1 MP1861A Front Panel
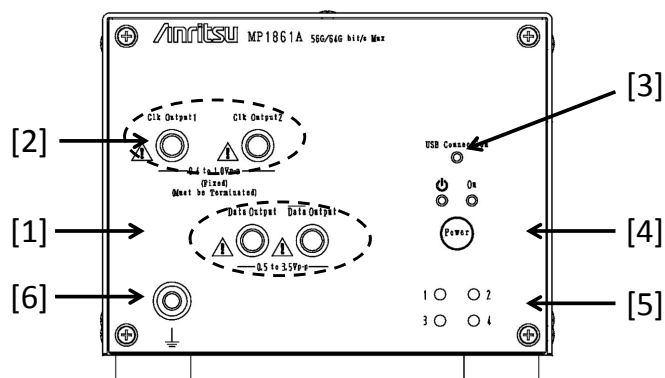
Figure 3.1.1-1   MP1861A (Option-x13) Front Panel

Table 3.1.1-1   MP1861A Front Panel Name and Function

No.	Name	Description
[1]	Data Output connector Data Output connector	Output for 2:1 multiplexed differential data signal Supports various interfaces by selecting option
[2]	Clock Output 1 connector Clock Output 2 connector	Output for Clock signal for MP1862A
[3]	USB Connection LED	Displays status of connection between MP1861A and MP1800A or control PC The LED is lit when the MP1861A can be controlled.
[4]	Power Switch	Switches from ON to Standby When AC adapter and power code are connected, the switch LED lights orange in the Standby status and green at ON.
[5]	Channel number indicators (LEDs)	The lamp of the set channel number illuminates. 1: Blue, 2: Pink, 3: Purple, 4: Orange Set the channel number with the Channel Setting switch on the rear panel of MP1861A.
[6]	Frame ground	To which connects a wrist strap for antistatic measures before using MP1861A. Always wear the wrist strap when using MP1861A.

3.1.2　MP1861A Rear Panel
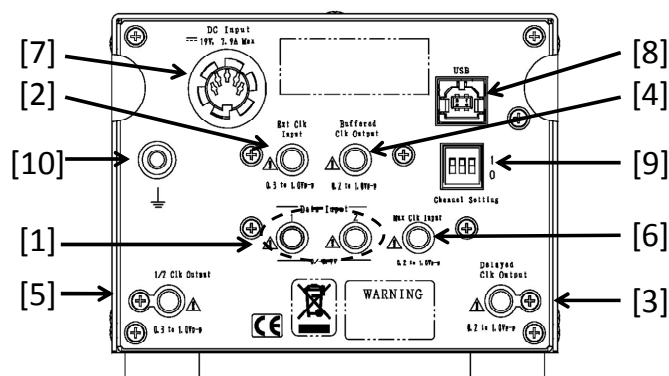
Figure 3.1.2-1　MP1861A Rear Panel

Table 3.1.2-1　MP1861A Rear Panel Name and Function

No.	Name	Description
[1]	Data Input 1 connector Data Input 2 connector	Inputs for data signals from dual MU18302xA Multiplexes signal to Data Output
[2]	Ext. Clock Input connector	Connector for inputting the clock signal used as reference for equipment operation
[3]	Delayed Clock Output connector	Connector for outputting the same frequency clock as the clock that is input to the **Ext. Clock Input** connector. Connect to the **MUX Clock Input** connector using the supplied J1654A U-link cable B.
[4]	Buffered Clock Output connector	Connector for outputting the same frequency clock as the clock that is input to the **Ext. Clock Input** connector. Terminate into 50 Ω when not in use.
[5]	1/2 Clock Output connector	Connector for outputting the frequency clock signal that is half of the frequency clock input to the **Ext. Clock Input** connector. Terminate into 50 Ω when not in use.
[6]	Mux Clock Input connector	Connector for inputting the same frequency clock as the clock that is input to the **Ext. Clock Input** connector. Connect to the **Delayed Clock Output** connector using the supplied J1654A U-link cable B.
[7]	DC Input connector	Connector for connecting AC adapter supplied as standard accessory. Do not use non-Anritsu AC adapters, otherwise there is a risk of damage to the equipment.
[8]	USB port	Used for connecting MP1800A or controller PC to this equipment Do NOT connect anything other than the MP1800A or controller PC.

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Panel Layout and Connectors

Table 3.1.2-1   MP1861A Rear Panel Name and Function (Cont'd)

No.	Name	Description
[9]	Channel Setting switch	Sets the channel number of MP1861A. | Channel Number	Switch Setting | |---|---| | 1 | 0,0,0 | | 2 | 1,0,0 | | 3 | 0,1,0 | | 4 | 1,1,0 | Make sure the power to MP1861A has been shut off before changing the channel switch settings. The new channel number setting is enabled when powering on the next time.
[10]	Frame ground	Connector for wrist strap to discharge static electricity Always wear a wrist strap when using this equipment.

3.2 Inter-Module Connection

This section describes precautions to follow when handling the equipment. Prevent the equipment from being damaged by static electricity.

⚠ WARNING

- **Do not apply a voltage exceeding the rated voltage of MP1861A. Excessively high input voltage can damage the circuit.**

- **As an antistatic measure, make sure the other devices (including experimental circuits) to be connected with ground wires before connecting the I/O connectors.**

- **Be sure to discharge static electricity from the outer conductors and cores of the coaxial cables by touching them with any metal object before connecting the coaxial cables.**

- **To protect the MP1861A from e being damaged by static electricity, be sure to observe the following:**
    - **Spread a conductive sheet on a workbench.**
    - **Wear a wrist strap connected to the conductive sheet or the frame ground of MP1861A.**

- **Do not apply excessive force to connectors when removing the cables from MP1861A. Excessive force can degrade the characteristics or cause failures.**
  Be sure to use a torque wrench when connecting/disconnecting the cables. (Recommended torque: 0.9 N-M)

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Panel Layout and Connectors

⚠ CAUTION

Avoid inputting the signal exceeding the maximum input level of MP1861A when connecting the Data Output connector of MU183020A/MU183021A to the Data Input1 and 2 connectors of MP1861A.

Maximum input level of the Data Input1 and 2 connectors of MP1861A: 0/–0.7 V (Vth = –0.35V)

Maximum data output level:
- **MU183020A-x13/x23, MU183021A-x13:   3.50 Vp-p**
- **MU183020A-x12/x22, MU183021A-x12:   2.50 Vp-p**

The Data Input connector of MP1861A can be damaged if the signal exceeding the maximum input level is input.

3.2.1   1ch TRx connection

This section describes a connection example using one MP1861A and one MP1862A 56G/64G DEMUX (hereafter, MP1862A). According to the following procedure, connect the equipment as shown in Figure 3.2.1-1.

[Equipment configuration]
MP1861A (this module)
MP1862A
MP1800A
MU183020A-x22/x23+x31
MU183040B
MU181500B
MU181000A
DUT (Device under test)

[Procedure]

1. Connect the **Clock Output** connector of MU181000A and the **Ext. Clock Input** connector of MU181500B by using the J1624A coaxial cable that comes with MU181000A.

2. Connect the **Jittered Clock Output** connector of MU181500B and the **Ext. Clock Input** connector of MU183020A by using the J1624A coaxial cable that comes with MU181500B.

3. Connect the **Data Input1/2** connectors on the rear panel of MP1861A and the **Data Output1/2** connectors of MU183020A respectively by using coaxial cables. The coaxial cables must be one of the following:
    ・J1658A coaxial skew match pair cable that comes with MP1861A
    ・Coaxial cables that are of the same length

4. Connect the **Clock Output** connector of MU183020A and the **Ext. Clock Input** connector on the rear panel of MP1861A by using the J1652A coaxial cable that comes with MP1861A.

5. Connect the **Buffered Clock Output** and **MUX Clock Input** connectors that are on the rear panel of MP1861A, by using the J1653A cable that comes with MP1861A. If the MP1861A-x30 Variable Data Delay is installed to MP1861A, connect the **Delayed Clock Output** and **MUX Clock Input** connectors that are on the rear panel of MP1861A, by using the J1654A cable that comes with MP1861A.

6. Connect the **Data Output** and $\overline{\textbf{Data}}$ **Output** connectors on the front panel of MP1861A to the DUT by using coaxial cables.

7. Connect the **Clock Output** connector on the front panel of MP1861A and the **Ext. Clock Input** connector on the front panel of MP1862A by using a coaxial cable.

8. Connect the DUT and the **Data Input** and $\overline{\textbf{Data}}$ **Input** connectors on the front panel of MP1862A by using coaxial cables.

9. Connect the **Delayed Clock Output** and **DEMUX Clock Input** connectors on the rear panel of MP1862A by using the J1654A cable that comes with MP1862A.

10. Connect the **Data Output1/2** connectors on the rear panel of MP1862A and the **Data Input1/2** connectors of MU183040B respectively by using coaxial cables. The coaxial cables must be one of the following:
    ・J1657A coaxial cables that come with MP1862A
    ・Coaxial cables that are of the same length

11. Connect the **1/2 Clock Output** connector on the rear panel of MP1862A and the **Ext. Clock Input** connector of MU183040B by using the J1668A coaxial cable that comes with MP1862A.
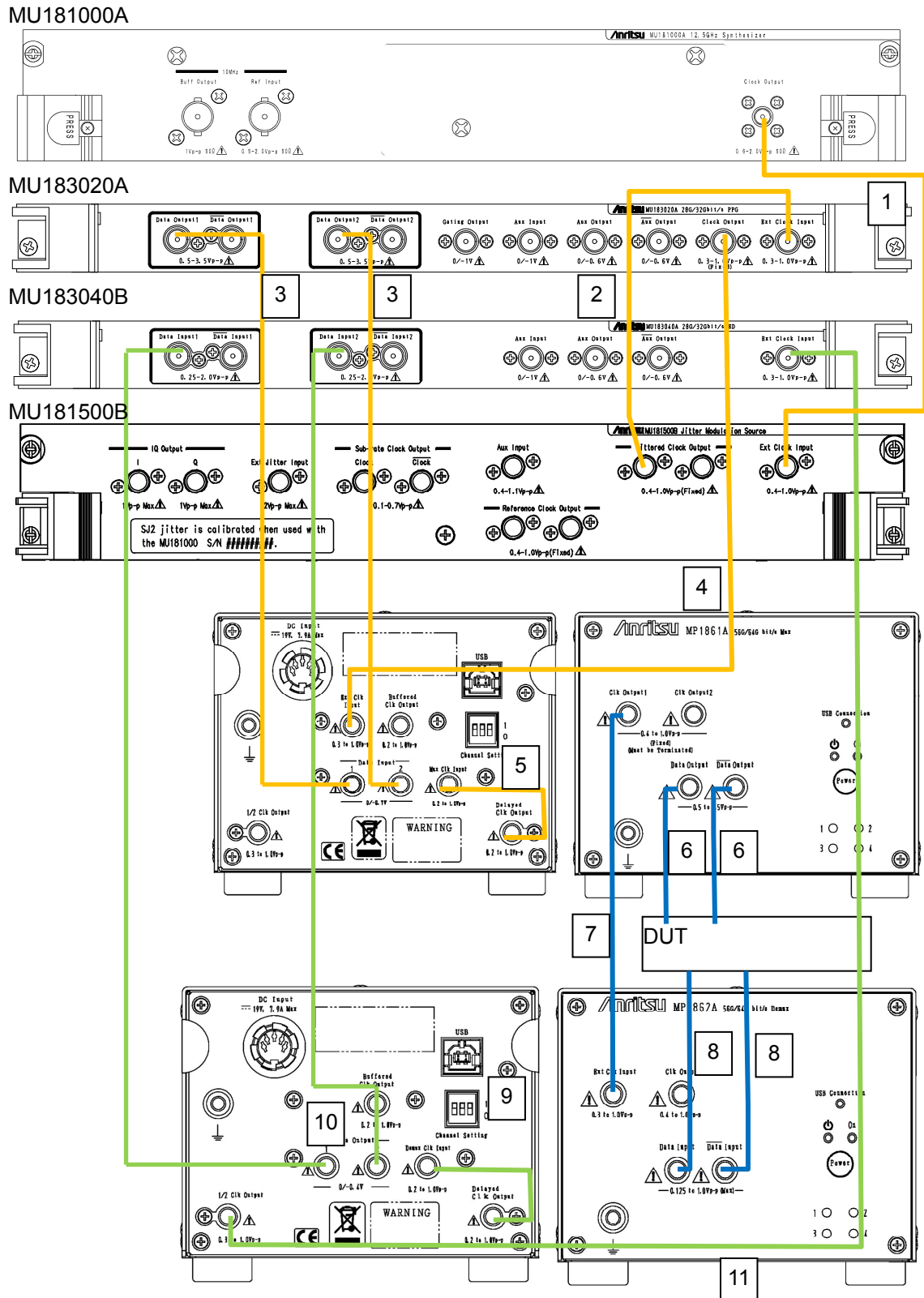
Figure 3.2.1-1   1ch TRx Connection Example

3.2.2   2ch Tx connection

This section describes a connection example using two MP1861As and two MU183020As.
According to the following procedure, connect the equipment as shown in Figure 3.2.2-2.

[Equipment configuration]
Two MP1861As (Two sets of this module)
MP1800A
Two sets of MU183020A-x22/x23+x30
MU181500B
MU181000A
DUT (Device under test)

[Procedure]

1. Connect the **Clock Output** connector of MU181000A and the **Ext. Clock Input** connector of MU181500B by using the J1624A coaxial cable that comes with MU181000A.

2. Connect the **Jittered Clock Output** connectors of MU181500B and the **Ext. Clock Input** connector of each of two MU183020As by using the coaxial cables. The coaxial cables must be one of the following:
    ・ J1624A coaxial cables that come with MU181500B
    ・ Coaxial cables that are of the same length

3. Connect the **Data Input1/2** connectors on the rear panel of each of two MP1861As and the **Data Output1/2** connectors of two MU183020As, respectively by using coaxial cables. The coaxial cables must be one of the following:
    ・ J1658A coaxial skew match pair cable that comes with MP1861A
    ・ Coaxial cables that are of the same length

4. Connect the **Clock Output** connector of MU183020A and the **Ext. Clock Input** connector on the rear panel of MP1861A by using the J1652A coaxial cable that comes with MP1861A.

5. Connect the **Buffered Clock Output** and **MUX Clock Input** connectors that are on the rear panel of MP1861A, by using the J1653A cable that comes with MP1861A. If the MP1861A-x30 Variable Data Delay is installed to MP1861A, connect the **Delayed Clock Output** and **MUX Clock Input** connectors that are on the rear panel of MP1861A, by using the J1654A cable that comes with MP1861A.

6. Connect the **Data Output** and $\overline{\textbf{Data}}$ **Output** connectors on the front panel of MP1861A to the DUT by using coaxial cables.

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Panel Layout and Connectors

MU183020A

MU183020A

MU181000A

MU181500B

Figure 3.2.2-1   2ch Tx Connection Example

Chapter 4 Window Operations

This chapter describes the items on each tab of the operation window.

4

Window Operations

4.1 Configuration of Operation Screen

This section describes the items on the operation window for MP1861A.
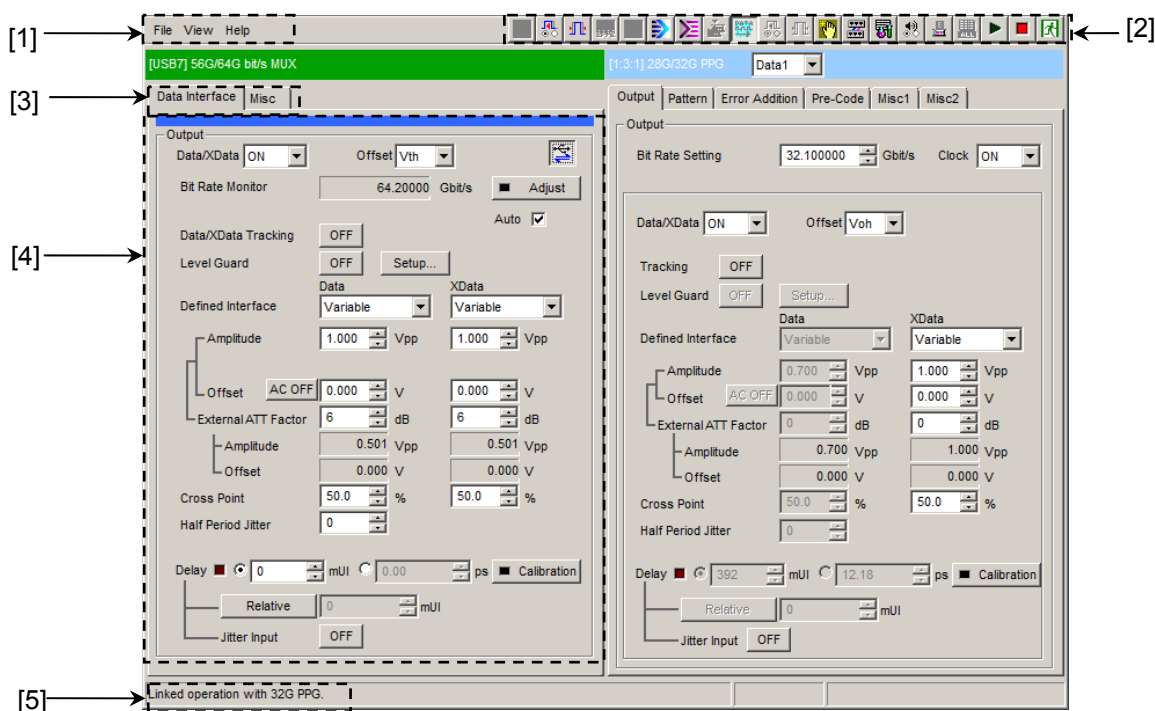
Figure 4.1-1 Overall View of Operation Screen

The operation window is composed of five blocks as shown in Figure 4.1-1.

The function of each block is described in Table 4.1-1.

Table 4.1-1 Function of Each Block

No.	Block	Function
[1]	Menu bar	Selects the setting functions related to the entire device.
[2]	Module function buttons	Shortcut buttons for the function items specific to the displayed module. Users can customize up to 17 pre-defined function buttons according to their own applications. To open the MP1861A operation window, click the ![button] button.
[3]	Function setting selection tabs	Switches the module operation tab according to the function items.
[4]	Operation window	Configures settings specific to each module.
[5]	USB	Displays USB connection status.

4.2 Configuration of the Operation Window

This section describes the tabs of the operation window for MP1861A.

Figure 4.2-1   Function Setting Selection Tabs

Table 4.2-1   Function Setting Selection Tabs

Tab name	Function
Data Interface	Sets Data/XData Various output interface settings can be configured here.
Misc	Sets whether to operate linked with the MU18302xA 32G PPG and opens the configuration dialog box for the PPG you want to operate linked with MP1861A.

Up to 4 MP1861As (CH1 to CH4) can be controlled by using one MP1800A or control PC. The operation window can be toggled one after another (CH1 to CH4) by repeatedly clicking the **USB MUX** button (   ).

Table 4.2-2   Channel Numbers and Title-Bar Names

Channel Number of MP1861A	Name on Title Bar
1	[USB7] 56G/64G bit/s MUX
2	[USB8] 56G/64G bit/s MUX
3	[USB9] 56G/64G bit/s MUX
4	[USB10] 56G/64G bit/s MUX

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Window Operations

4.3 Setting Output Interface

To set the output interface, select the **Data Interface** tab of the operation window.

4.3.1 Setting Data/XData

The data output settings can be changed depending on the options installed in the MP1861A.

The screen Data and $\overline{\text{Data}}$ settings each correspond to the signals output from the Data and $\overline{\text{Data}}$ connectors, respectively. The following explains the settings related to the $\overline{\text{Data}}$ connector called XData.
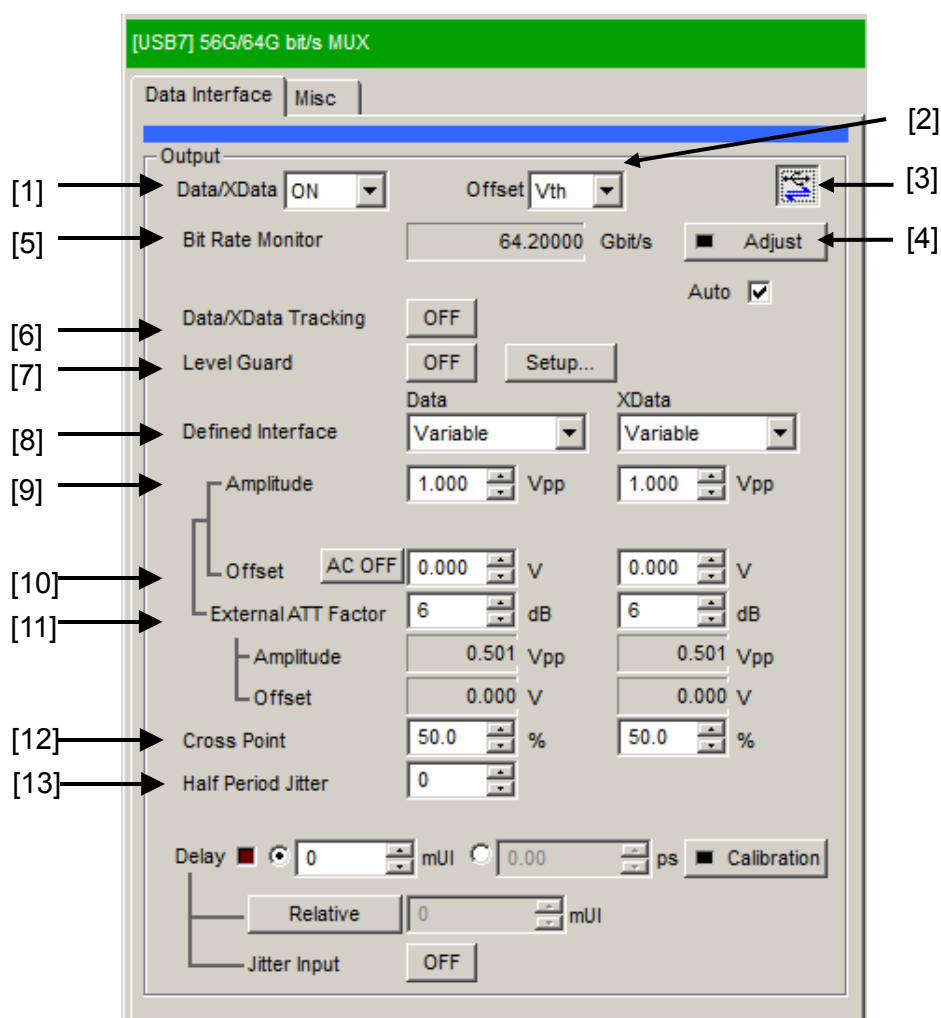
Figure 4.3.1-1   Data Interface Tab

[1] Select ON or OFF for the data output.
     When turning ON the Output signal, set the Output of the signal
     generator to ON, and in addition to this configuration, set the
     Output of the entire equipment to ON by the Module function button
     on the menu bar.

[2] Select the offset reference. The Offset and Amplitude settings are
     restricted according to the set offset reference and the currently set
     Offset and Amplitude. In addition, when changing the offset
     reference, the offset value is also changed according to the set
     reference.

Table 4.3.1-1   Offset Reference

Offset reference	Description
Voh	The offset value is set based on the high level.
Vth	The offset value is set based on the center level between the high and low levels.
Vol	The offset value is set based on the low level.
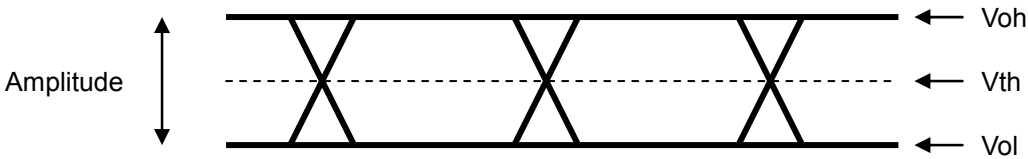
Figure 4.3.1-2   Setting Data Offset

[3] Switch the link between MP1861A and the PPG module. When this
     MUX/PPG Link button is ON, the PPG module output setting and
     Delay setting are performed automatically to optimize the data
     output of MP1861A. The button status is displayed as Link ON,
     Link OFF and Unavailable as shown from the left in Figure 4.3.1-3.

Figure 4.3.1-3   MAX/PPG Link Button

[4]   Click **Adjust** to adjust the data and clock phases between MP1861A and PPG module.
If the **Auto** check box is selected, the MUX-PPG Adjust function runs automatically in the following cases:

- When turning on the **MUX/PPG Link** button
- When turning on the MUX output
- When there is a change in the input clock frequency

Notes:
- If a frequency fluctuation occurs in an input clock within 500 ms, the MUX-PPG Adjust function does not run automatically. If it occurs within 500 ms, click **Adjust** to run the MUX-PPG Adjust function.

- If the input clock connection has not been established, the MUX-PPG Adjust function may not complete. In this case, click **Abort**, check the clock connection, and then click **Adjust**. If the Adjust function is aborted by **Abort**, then the **Auto** check box is cleared.

[5]   The bit rate of the output data signal is displayed.

[6]   When Tracking is ON, the settings for Defined Interface, Amplitude, Offset, External ATT Factor, and Cross Point of XData are set to the same values as for Data.

[7]   Click **Setup** to set Amplitude (max. and min.), Offset Max (Voh) (max. value of Offset High level), and Offset Min (Vol) (min. value of Offset Low level) for performing Level Guard.

When Level Guard is ON, the Offset operation and amplitude are held within the range set by **Setup** so that the above-required voltages are not imposed on the DUT.
When External ATT Factor described in **11** is set, the Level Guard setting restricts the output levels for the Amplitude, Offset Max (Voh), and Offset Min (Vol) settings after passage through the fixed attenuator connected between this device and the DUT. As a result, take care that the signal output level does not exceed the settings when using without a fixed attenuator.

[8]   Separately configure the defined interface setting for Data and XData.
Sometimes, some items cannot be selected, depending on the installed data output options and the Level Guard settings.

Table 4.3.1-2   Amplitude Setting Values

Item	Amplitude		Offset
	Voh	**Vol**	**Vth**
Variable	—	—	—
PCML	+3.3 V	+2.8 V	+3.05 V
NCML	0.0 V	−0.5 V	−0.25 V
SCFL	0.0 V	−0.9 V	−0.45 V
NECL	−0.9 V	−1.7 V	−1.3 V
LVPECL	+ 2.4 V	+1.6 V	+2.0 V

[9]   Separately set the amplitude for Data and XData.

The setting range varies depending on the level guard setting, offset setting, and installed option.

The amplitude setting ranges when Defined Interface is set to Variable are shown in the table below.

Table 4.3.1-3   Amplitude setting range

Installed Option	Amplitude setting range	Resolution
x11	0.5 to 2.5 Vp-p	0.002 V
x13	0.5 to 3.5 Vp-p	0.002 V

[10] Separately set the offset for Data and XData.

The setting range varies depending on the level guard setting, amplitude setting, and installed option.

The offset setting ranges when Defined Interface is set to Variable are shown in the table below.

Clicking to change **AC OFF** to **AC ON** enables AC-coupled output.

The lower band cutoff frequency is about 100 kHz.

Table 4.3.1-4   Offset Setting Range

Installed Option	Offset setting range	Resolution
x11	−4.0 to 3.3 V	0.001 V
x13	−4.0 to 3.3 V	0.001 V

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[11] Separately set the external ATT factor for Data and XData.
When a fixed attenuator is connected to the Data/XData output
connector of the MP1861A, the attenuation of the attenuator is
added to the value for the DUT and displayed.
A value from 0 to 40 dB can be set in 1 dB steps. When Defined
Interface is not set to Variable, the setting is reset to 0 and becomes
invalid. Values displayed in the External ATT Factor-Amplitude and
Offset display areas indicate the amplitude and offset value after
passing through the attenuator, respectively.

[12] Separately set the cross point setting for Data and XData.

Table 4.3.1-5   Cross Point Setting Range

Installed Option	Cross point setting range	Resolution
x11/x13	45.0 to 55.0%*	0.1%

*:   "Overload" is displayed if the bit rate exceeds 56.2 Gbit/s because
other than 50 % is not guaranteed.

[13] Set the half-period jitter that is common to Data and XData.
Additionally, the monitor value calculated from the operating bit
rate is displayed.

Table 4.3.1-6   Range of Half Period Jitter

	Range	Step
Setting	−20 to 20	1

Notes:

- The DUT may be damaged if the output setting is configured
incorrectly. To prevent damage to the DUT, confirming the
interface condition with the DUT, or configuring the level guard
setting before making the output setting is recommended.

- When PCML, LVPECL, or ECL is selected for Defined Interface,
the voltage corresponding to the DUT's termination voltage is
applied to the output side of the MP1861A. In this event, the
DUT may be damaged if the interface conditions do not match.
Be sure to confirm the interface conditions.

- Waveforms may be distorted (what is known as a ringing
phenomenon) when a commercially available ECL terminator is
used to observe output waveforms. This is, however, caused by
the characteristics of the ECL terminator; the waveform output
from the mainframe is not distorted.

- The current for the output part is limited (50 mA for sourcing current and 80 mA for sinking current) for protection. Sometimes, the observed waveform offset voltage may not match the set offset voltage when, for example, connected under the wrong interface conditions.

- Be sure to confirm that a fixed attenuator is connected between the MP1861A and the DUT before setting the external ATT factor. If the external ATT factor is set when no fixed attenuator is connected or when the fixed attenuator has an attenuation value less than that set in the External ATT Factor area, the DUT may be damaged.

4.3.2 Setting delay

When MP1861-x30 is installed into the MP1861A, the phase of the data output can be changed relative to the clock output.
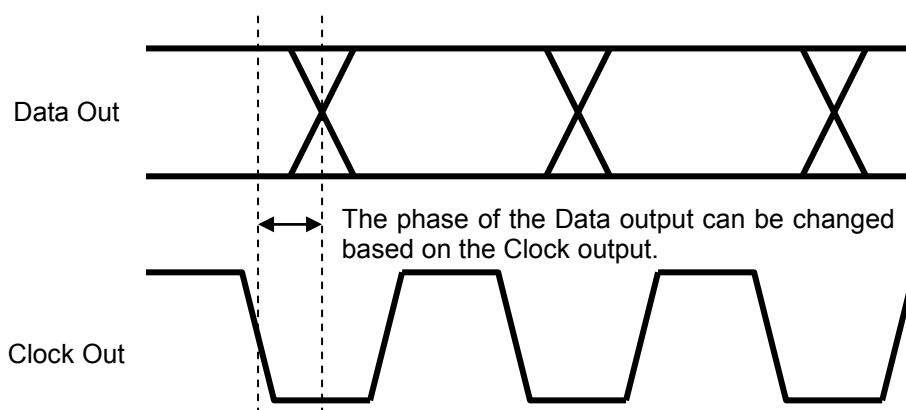
Figure 4.3.2-1   Delay setting

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Window Operations
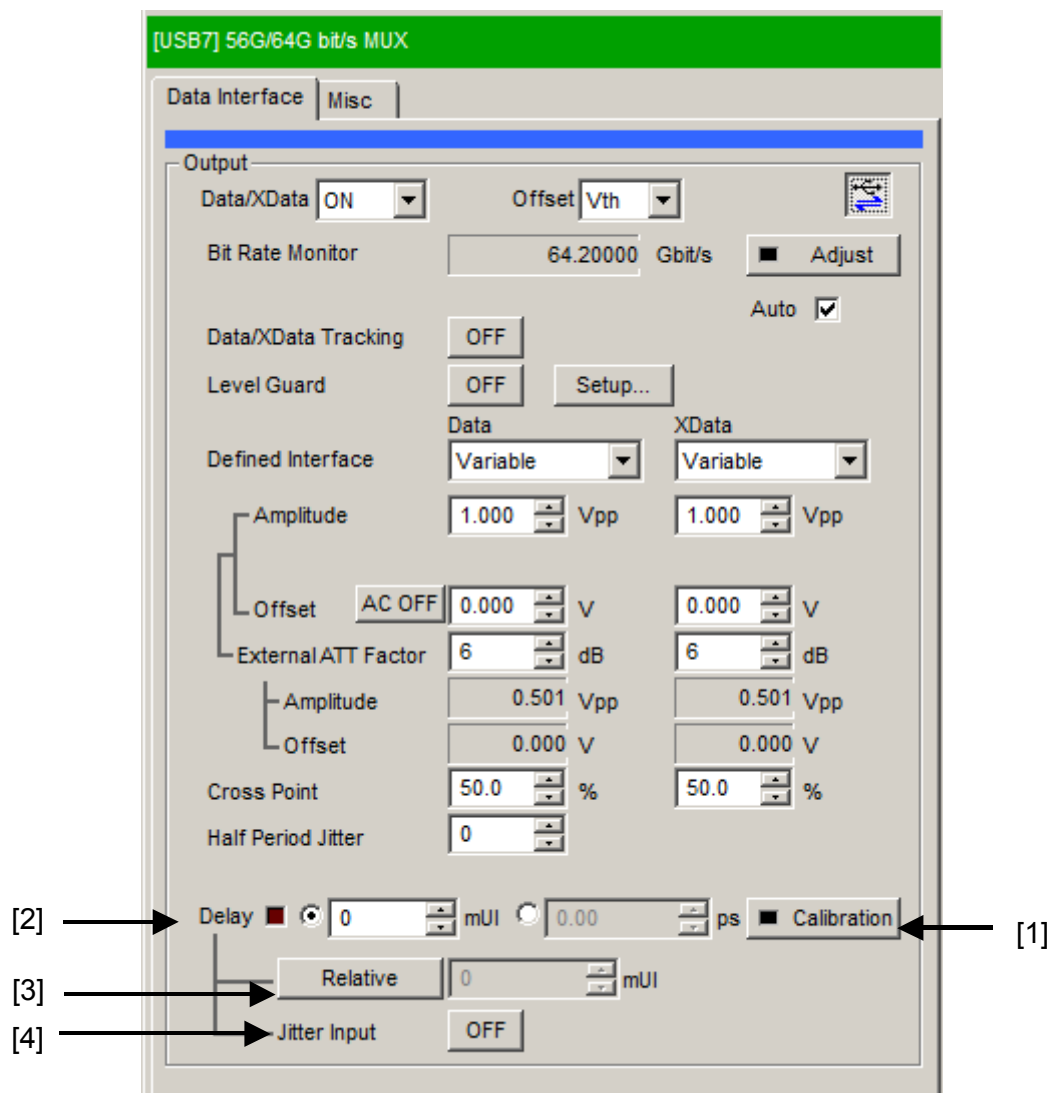
Figure 4.3.2-2 Delay Setting Area of the Data Interface Tab

[1] Click **Calibration** to perform calibration, which is a phase variable function. When the power is supplied, the frequency is changed, or the ambient temperature fluctuates, the calibration prompting alarm LED lights up. In such a case, click this button to perform calibration. When the LED indicator on the button is red, it is recommended to perform calibration. When the LED indicator is green, it shows the unit is well calibrated.
As the delay amount varies significantly during execution of calibration, keep this in mind for execution during measurement. Calibration will finish within 1 second.

[2] Set the delay in mUI or ps units.

<mUI units>
Setting range: Can be set from −64,000 to 64,000 mUI in 4-mUI steps

<ps units>
Can be set in ps steps equivalent to 4 mUI
The setting range is converted from −64,000 to 64,000 mUI to ps units.
Example:

64 GHz:	−100 to 100 ps, 0.06 ps steps
56 GHz:	−114.2 to 114.2 ps, 0.07 ps steps
25 GHz:	−256 to 256 ps, 0.16 ps steps

When the read frequency counter value range is incorrect, "…" is displayed.

Note:

The Delay setting of MP1861A is shared with MU18302xA when both of the following conditions are met:
・MP1861A is connected to MP1800A to which MU18302xA set as 2ch Combination is installed.
・The **MUX/PPG Link** button is turned on.
For how to operate MP1861A linked to MU18302xA, refer to Appendix B.4 "Combination Operation".

[3] Click **Relative** to use the current set phase value as the reference of relative 0 for delay setting.
Pressing **Relative** allows you to set the current delay amount in units of "4 mUI" relative to the reference. When the **Relative** button is pressed again, the setting is converted from the relative value to the current delay value.

[4] Set the jitter input.
ON: Select when inputting Jitter clock to this module.
OFF: Default setting

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Window Operations

Notes:

- When the frequency or temperature condition changes, the indicator on the **Calibration** button changes to red. If calibration is not performed at this time, the error in the phase setting may be greater than at a normal phase setting.

- Values displayed in ps units vary as the frequency changes, because the MP1861A sets phases in mUI units as an internal standard.

- When Burst is selected at Pattern Sequence of the Misc screen, the phase setting accuracy becomes worse than when Repeat is selected.

- When inputting a jitter-modulated clock while Jitter Input of Delay is OFF, sometimes, the phase becomes unstable.

- When inputting a jitter-modulated clock, if the Delay lamp is lit, sometimes, the phase setting error becomes large.

- When inputting a signal to this module, do not input a voltage exceeding the specified value, otherwise the circuits may be damaged.

- As countermeasure to static electricity, before connecting to an input connector, always ground the other equipment (including test circuit).

- Sometimes, a coaxial cable can accumulate a charge between the outer and inner conductors rather like a capacitor. Always take antistatic measures such as grounding the outer conductor before connecting the cable.

4.4 Operating the Linked Module

MP1861A operates linked with MU18302xA. On the **Misc** tab, you can set whether to operate MP1861A linked with MU18302xA, and check the combination setting, bit rate setting and pattern settings. (Figure 4.4-1)
By clicking **Show PPG Setting**, the operation window of MU18302xA (which MP1861A operates linked with) and the operation window of MP1861A are displayed side by side. (Figure 4.4-2)
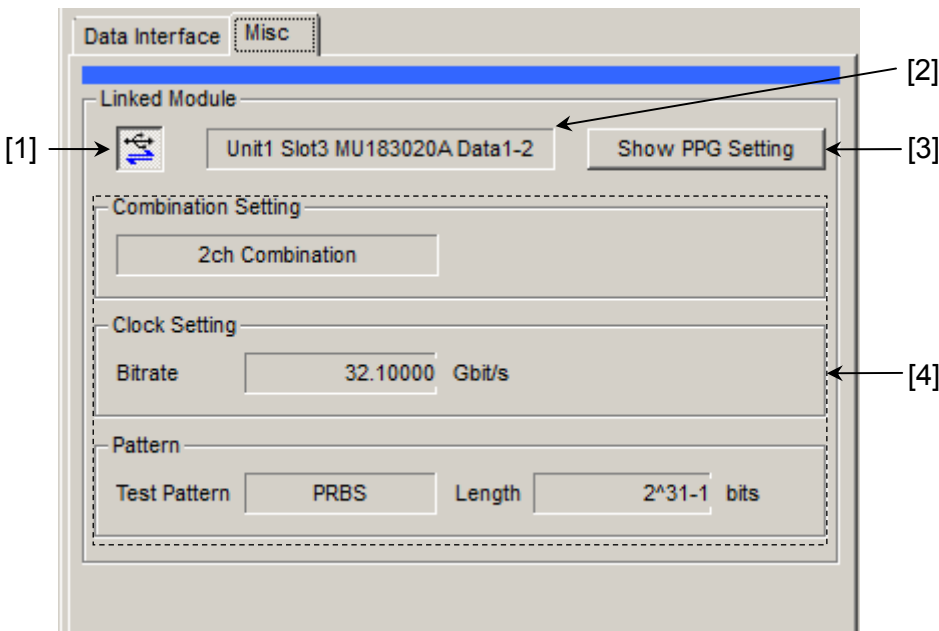
Figure 4.4-1   Misc tab

[1]   Set whether to operate MP1861A with linked to the PPG module. If the **MUX/PPG Link** button is clicked, the output settings and delay settings for the linked PPG module are automatically configured for optimizing MP1861A's data output. Figure 4.4-2 shows the appearance of the **MUX/PPG Link** button that varies depending on the button state. (From left to right: "Link ON", "Link OFF" and "Not available")

Figure 4.4-2   MUX/PPG Link Button

Window Operations

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[2] The module information (slot and data interface) of the MU18302xA 32G PPG is displayed.

Unit: Mainframe number
                   1 to 4 (MT1810A)
                   Fixed to 1 (MP1800A)

Slot: Slot number 1 to 6

Model name: MU183020A or MU183021A

Data interface: Data1-2 or Data3-4

For more information on linked operation of MP1861A and MU18302xA, refer to Appendix B.2 to B.4.

[3] Clicking this button displays the operation window for the linked PPG module indicated in [2], next to this window. (Refer to Figure 4.4-3.)
In the operation window of MU18302xA, the settings like bit rate and pattern can be edited.
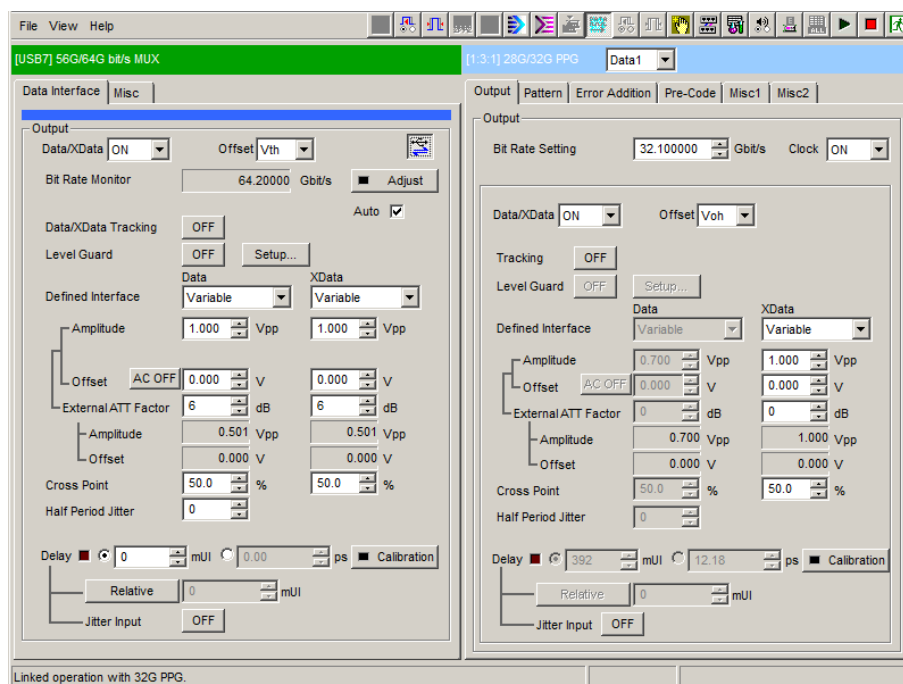
Figure 4.4-3   Operation Window of the Linked PPG

[4] The settings (bit rate and pattern) for the module linked by clicking the **MUX/PPG Link** button are displayed. The settings can be changed in the PPG window displayed by clicking [3]. For how to edit the settings, refer to the *MU18302xA Operation Manual*.

4.5 Multi Channel Functions

MU183020A and MU183021A provide the Multi-channel functions that can generate data combining outputs from multiple channels.

The Multi-channel functions include the Combination and Channel Synchronization functions.

Available functions vary depending on model and its option.

Combination Function Types

(1)   4ch Combination: MU183021A

(2)   2ch Combination: MU183020A-x22, MU183020A-x23, MU183021A

(3)   64Gx2 Combination: One MU183021A or two MU183020As

Channel Synchronization Function Types

(1)   CH Synchronization: MU183020A-x22, MU183020A-x23, MU183021A

(2)   2ch CH Synchronization: MU183021A

(3)   Inter modules CH Synchronization: MU183020A, MU183021A

Table 4.5-1   Multi-channel functions that the respective models support

Model/Option	2ch Combi*1	4ch Combi*1	2ch CH Sync*1	CH Sync*1	Inter-module CH Sync*1	64Gx2 Combi*1
MU183020A-x12 MU183020A-x13						
MU183020A-x22 MU183020A-x23	✓			✓	✓	✓*2
MU183021A	✓	✓	✓	✓	✓	✓

*1:   MU183020A-x31 or MU183021A-x30 is required.

*2:   Two MU183020As are required.

4.5.1 Combination function

The Combination function can synchronize generation or reception of patterns among channels of MU183020A/MU183021A and MU183040A/MU183041A and evaluate 40 Gbit/s application and 100 Gbit/s application.

By combining four 28 Gbit/s channels by the MU183021A, the serial data at 111.8 Gbit/s of OTU4 (Optical channel Transport Unit 4) can be generated.
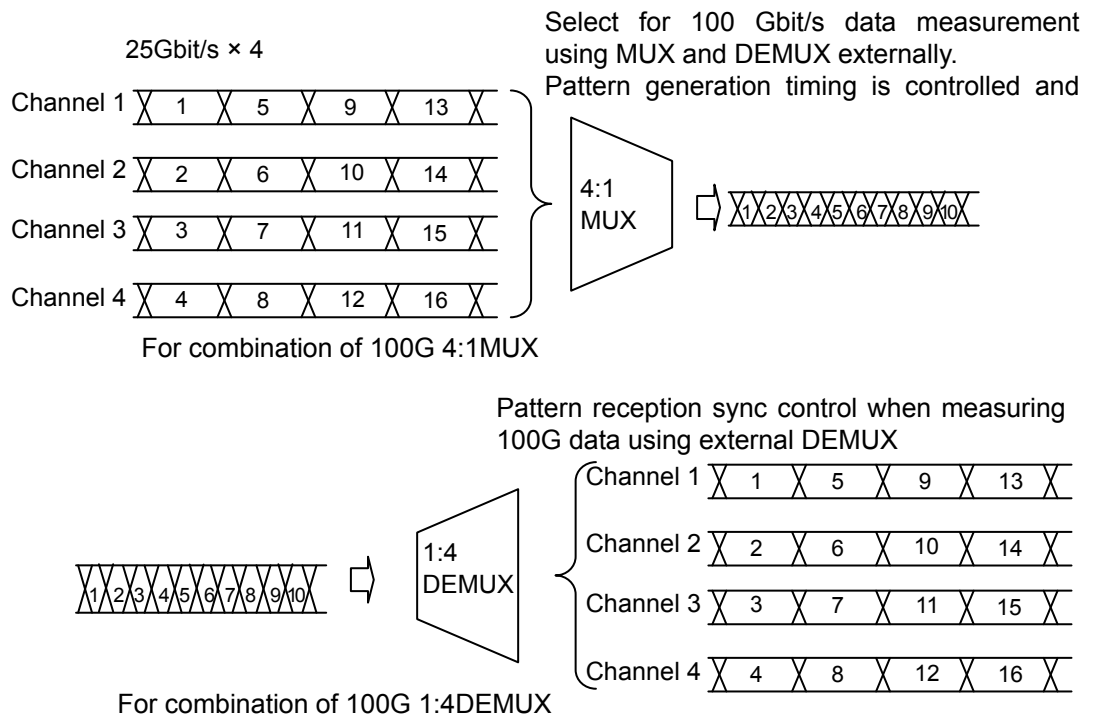
Figure 4.5.1-1   4ch Combination pattern generation/reception

By combining two channels of 20 Gbit/s data, 40 Gbit/s serial data that is bit rate of 40 GbE or OTU3 can be generated.

Different from the conventional method of combining four 10 Gbit/s data, this function can evaluate multiple DUTs by using a single MP1800A or MT1810A

Pattern generation control to create 40G 1 ch data using MUX

20 Gbit/s × 2

Channel 1 | 1 | 3 | 5 | 7 |

Channel 2 | 2 | 4 | 6 | 8 |

2:1 MUX

| 1 | 2 | 3 | 4 | 5 |

For combination of 40G 2:1 MUX

Sync control to receive 40G 1 ch data using DEMUX

| 1 | 2 | 3 | 4 | 5 |

1:2 DEMUX

20 Gbit/s × 2

Channel 1 | 1 | 3 | 5 | 7 |

Channel 2 | 2 | 4 | 6 | 8 |

For combination of 40G 1:2 DEMUX
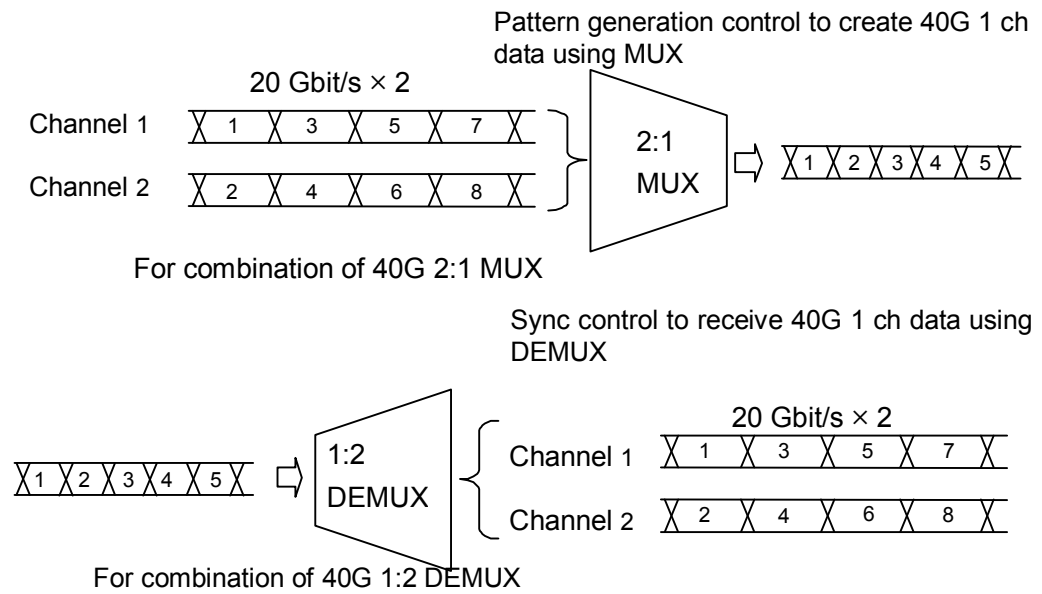
Figure 4.5.1-2   2ch Combination pattern generation/reception

4

Window Operations

4.5.2 Synchronization function

The Channel Synchronization function synchronizes the timing of data of multiple channels.

This function can also synchronize the timing of inter-modules (MU183020As and MU183021As). In addition, you can adjust the time delay between channels by setting the skew.

For PON and other applications
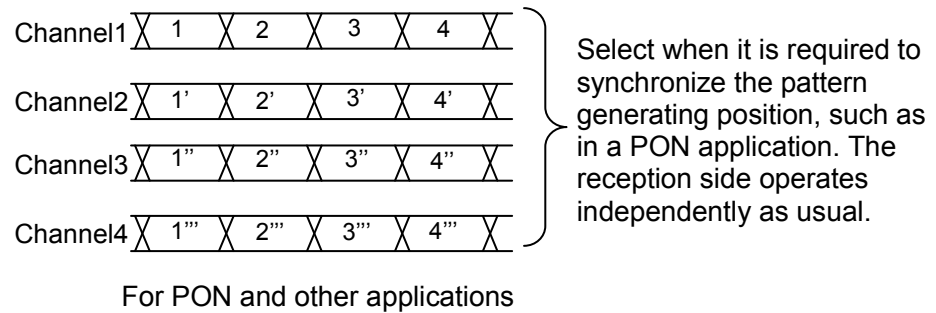
Figure 4.5.2-1 Channel Synchronization pattern generation/reception

For Skew Control
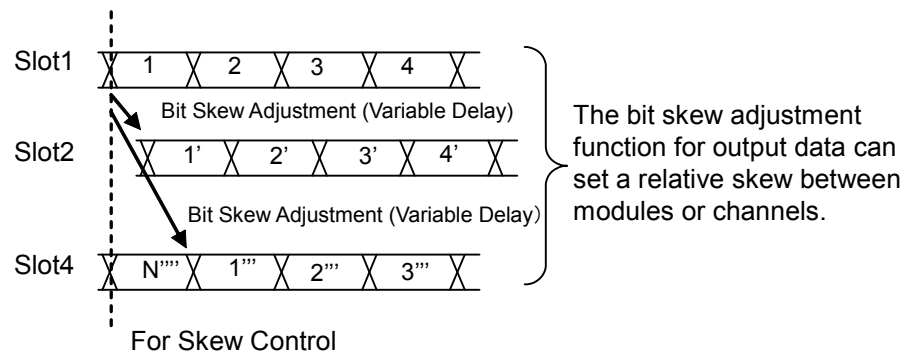
Figure 4.5.2-2 Skew Channel Synchronization Pattern

MU183021A can synchronize two signals Combination1-2 and Combination3-4 that are combined separately by 2ch Combination function.
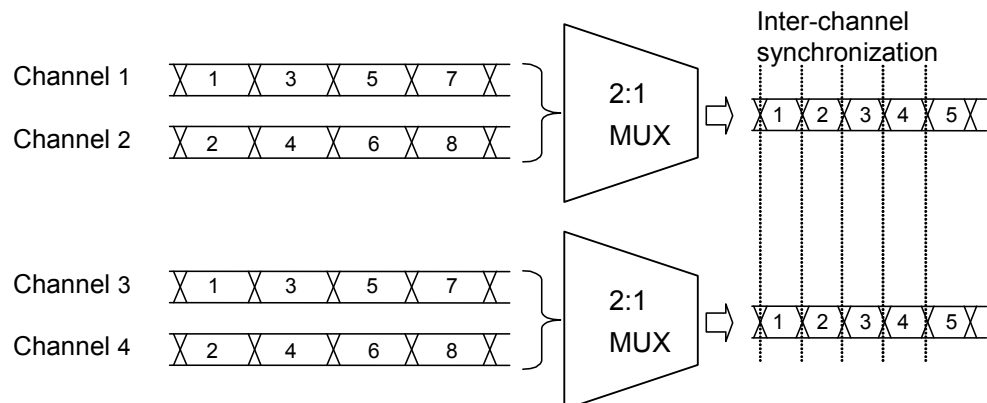
Figure 4.5.2-3 Channel Synchronization of 2Ch Combination

4.5.3   64Gx2 combination function

The 64G x2 Combination function allows MP1861A to combine data of up to 32G and generate 64G data of two systems. The generated data patterns of two systems can also be combined by an external MUX. This function is available if two MU183020A-x22/x23s or one MU183021A is installed to the mainframe.
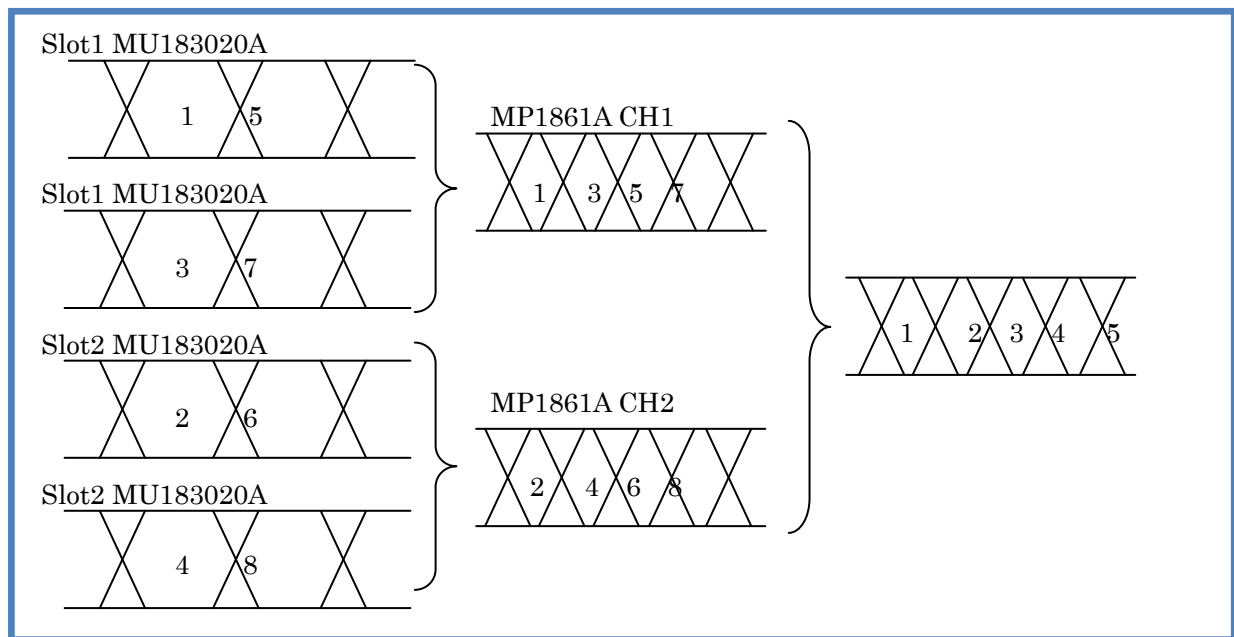
Figure 4.5.3-1   64Gx2 Combination Pattern Generation (Two MU183020As)
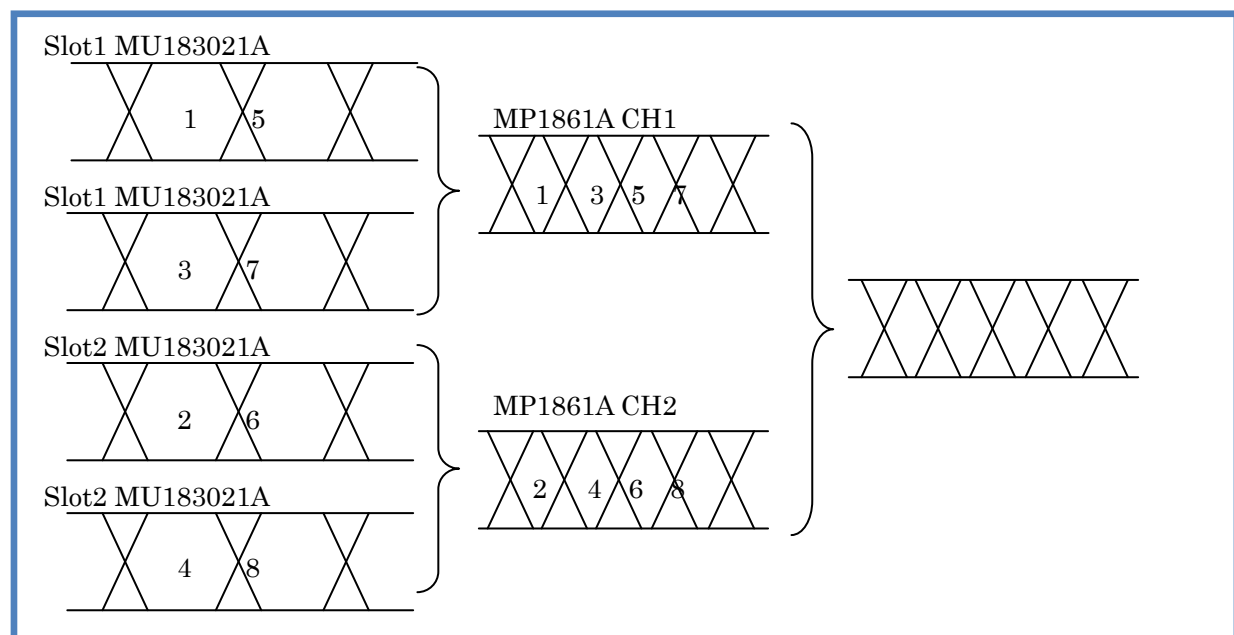
Figure 4.5.3-2   64Gx2 Combination Pattern Generation (MU183021A)

4.5.4 Combination Setting

To use the Multi-channel function, click **Setting** on the **Misc2** tab, and then in the **Combination Setting** dialog box, configure the settings for the multi-channel function.
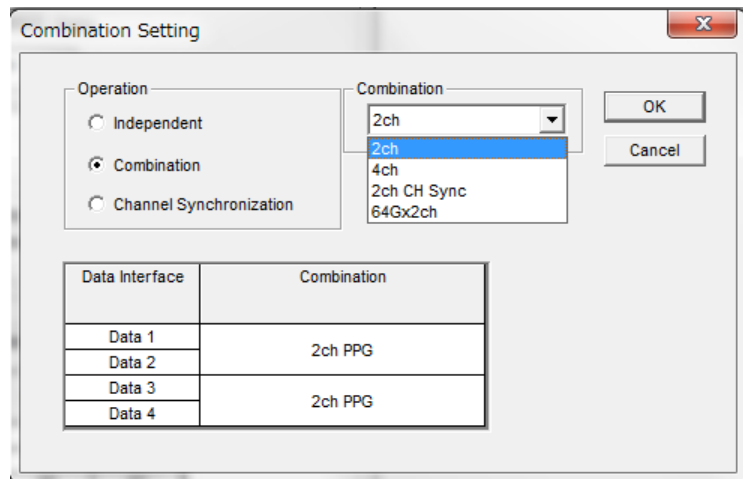
Figure 4.5.4-1   Combination Setting dialog box (2ch Combination)
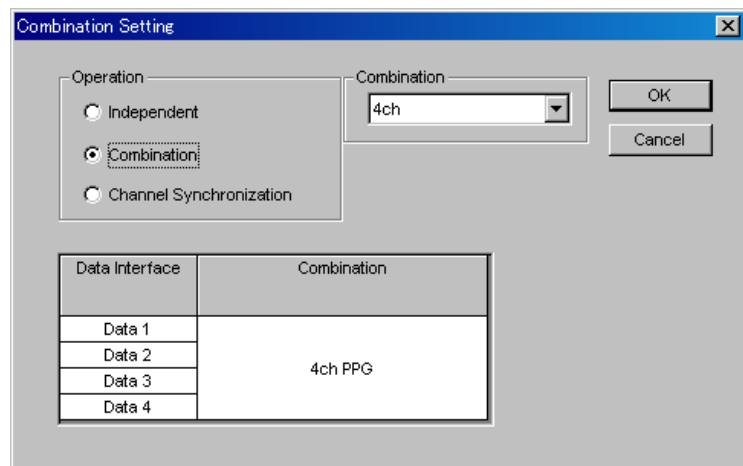
Figure 4.5.4-2   Combination Setting dialog box (4ch Combination)
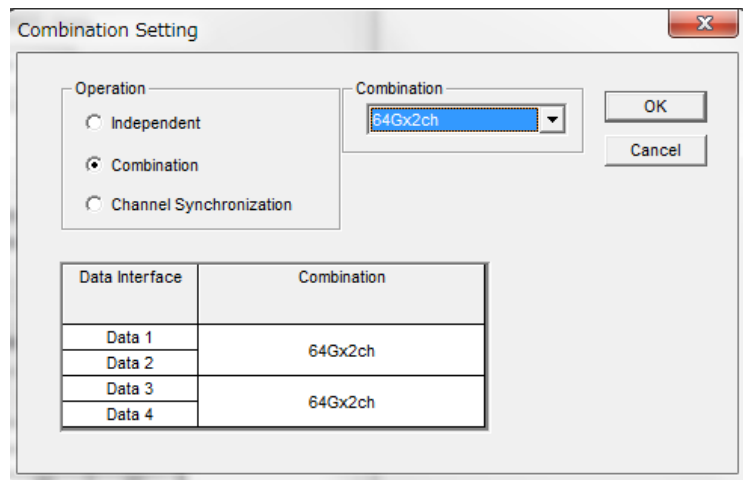
Figure 4.5.4-3   Combination Setting dialog box (64G×2ch Combination)
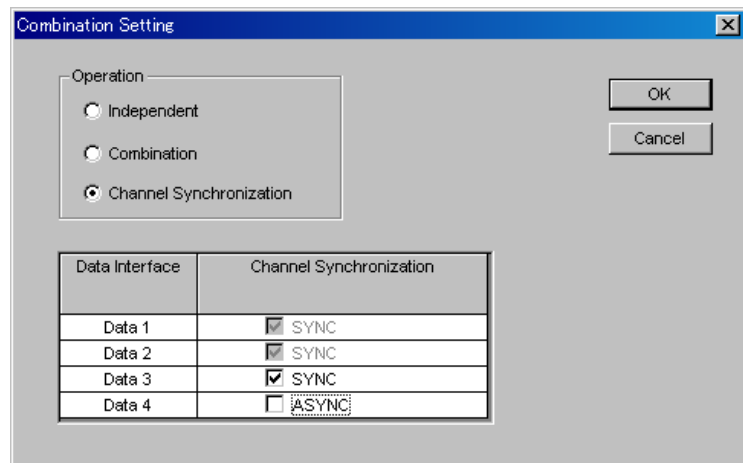
Figure 4.5.4-4   Combination Setting dialog box (Channel Synchronization)

4

Window Operations

Table 4.5.4-1   Setting items for Combination Setting

Operation Settings		Description
Independent		Operates channel of MU183020A/MU183021A independently.
Combination	2ch*1, *2	Sets the Combination function for two channels.
	4ch*2	Sets the Combination function for four channels of MU183021A.
	2ch CH Sync*2	Sets the Combination function to two channels of MU183021A and sets the Channel Synchronization function to two combined signals.
	64Gx2ch Combination*2	Sets the Combination function for two channels of MU183021A and generates combined patterns 1-2 and 3-4 with a delay of 1/4 clock cycle with each other.
Channel Synchronization*1, *2		Sets the Channel Synchronization function to all channels.

*1:   MU183020A-x22/x23 and MU183020A-x31 are required.

*2:   MU183021A-x30 is required.

4.5.5 Inter-module synchronization function

To use the Inter-module synchronization function, click the Combination Setting module function button and set the parameters on the Combination Setting screen.

Inter-module synchronization function synchronizes the timing of modules using two sets of MU183020A or MU183021A. Refer to the release notes for the installation slots in the modules.
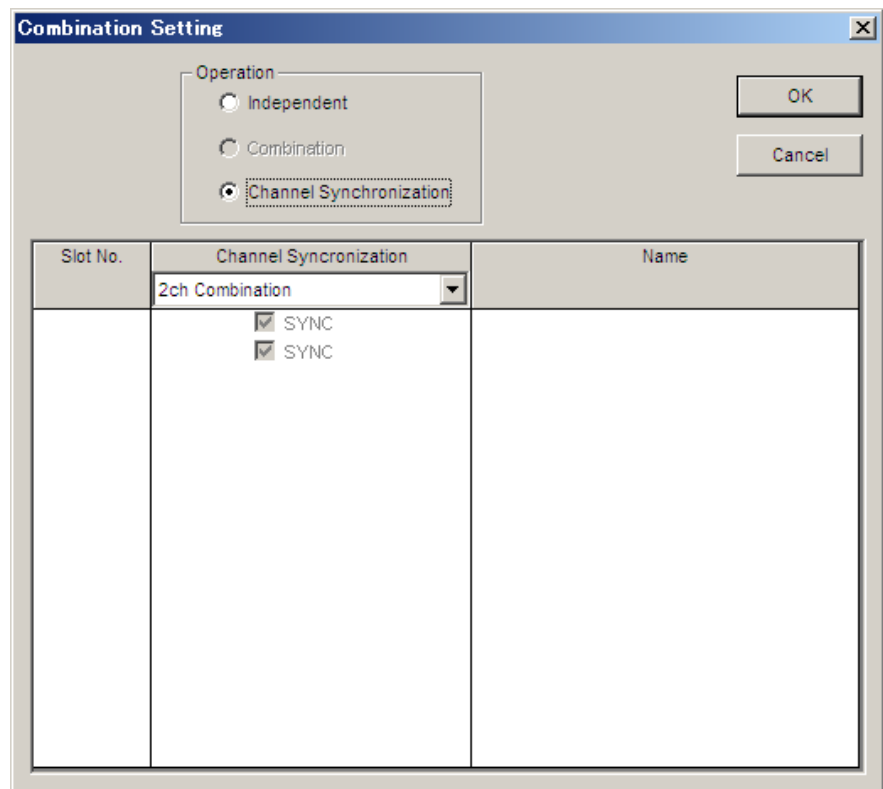
Figure 4.5.5-1 Combination Setting dialog box

Table 4.5.5-1   Setting items for Combination Setting

Operation Settings		Description
Independent		Operates the MU183020A or MU183021A independently.
Channel Synchronization	CH Sync*1, *2	Sets the Channel Synchronization function to all channels of the target modules.
	2ch Combination*1, *2	Sets the 2ch Combination to the target modules and sets the Channel Synchronization between modules.
	4ch Combination*2	Sets the 4ch Combination to the target modules and sets the Channel Synchronization among modules.
Combination	64Gx2ch Combination*1	Sets the 2ch Combination to the target modules when two MU183020As are installed. Patterns are generated with a delay of 1/4 clock cycle with each other. 2ch Combination must be set as described in Section 4.5.4, in advance. When using this setting, apply the same pattern settings to each of two MU183020As.

*1: MU183020A-x22/x23 and MU183020A-x31 are required.

*2: MU183021A-x30 is required.

Chapter 5 Use Examples

This chapter provides use examples of measurement using the MP1861A/MP1862A.

5

Use Examples

5.1 Achieving Error-Free Data Transmission

This section describes how to remove all bit errors (achieve an error-free data transmission) with MP1861A and MP1862A placed in an opposite state.

The equipment used in the following example is:

MP1800A-016:	1
MU183020A-x01/x23/x31:	1
MU183040B-x01/x20:	1
MU181000A:	1
MU181500B:	1
MP1861A-x01/x13/x30:	1
MP1862A-x01:	1

1. Connect MP1800A, MP1861A and MP1862A to the same ground.

2. Connect the power cords of MP1861A, MP1862A and MP1800A.

3. Turn on the power to MP1861A, MP1862A and MP1800A, and then set the measurement conditions as follows:

4. On the menu bar of MX180000A, click the **File** menu, and then click **Initialize** to reset all the settings to the factory defaults.

5. Connect the equipment as shown in Figure 5.1-1 "Equipment Connection for Error-Free Check".

6. In the MU181500B window, click **Synthesizer**, and then select **MU181000A**.

7. On the **Misc2** tab of MU183020A, select **MU181500B** in the **Clock Source** box.

8. On the **Misc2** tab of MU183020A, input the operating bit rate in the **Bit Rate** box.

    The bit rate of the signal output from MP1861A is twice of the bit rate set here.

    Example:

    To output a signal with a bit rate of 60 Gbit/s from MP1861A, input "30" here.

9. On the **Misc2** tab of MU183020A, select **Fullrate** in the **Output Clock Rate** box.

10. On the **Misc2** tab of each MU183020A and MU183040B, click **Setting** in the **Combination Setting** area, and then in the **Combination Setting** dialog box, click **Combination**, and then select **2ch** in the **Combination** box.

11. On the **Pattern** tab of each MU183020A and MU183040B, select a test pattern. The selected test pattern is reflected to all the channels.

12. On the **Data Interface** tab of MP1861A, click the **MUX-PPG Link** button ( ).

13. On the **Data Interface** tab of MP1862A, click the **DEMUX-ED Link** button ( ).

14. Turn on the output from MP1861A by click the **Output** module function button ( ) or pressing the **Output** key on the front panel of MP1800A.

15 Click the **Auto Search** module function button ( ).

16. In the Auto Search window, select the **USB11 DEMUX** check box in the **Slot/CH** column, and then click **Start**.
   Refer to Section 4.5 "Executing Auto Search" in the *MP1862A 56G/64G bit/s DEMUX Operation Manual*.

17. Click the **Start** module function button ( ).

18. On the **Result** tab of MP1862A, check the measurement results.
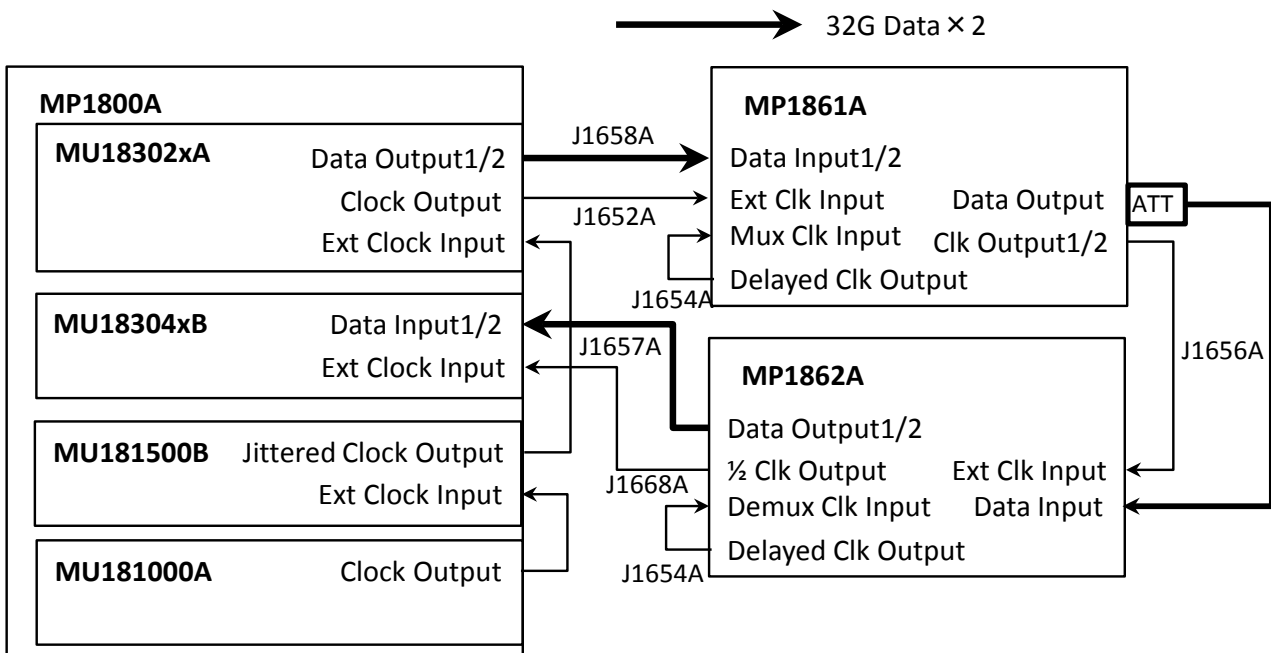
Figure 5.1-1   Equipment Connection for Error-Free Check

5

Use Examples

5.2 Measuring Optical Transceiver Module

This section explains how to measure 56G optical devices using the MP1800A and MP1861A/MP1862A.

⚠ CAUTION

Check that the output level of the DUT (O/E) matches the data input range for MP1862A. If it is out of range, adjust the input level to MP1862A using an attenuator.

The equipment used in the following example is:

MP1800A-016:	1
MU183020A-x01/x23/x31:	1
MU183040B-x01/x20:	1
MU181000A:	1
MU181500B:	1
MP1861A-x01/x13/x30:	1
MP1862A-x01:	1

1. Place the equipment in the error-free state according to the procedure in 5.1 "Achieving Error-Free Data Transmission".

2. Turn off the output from MP1861A by clicking the **Output** module function button (🔲) or pressing the **Output** key on the front panel of MP1800A.

3. On the **Data Interface** tab of MP1861A, set the data output interface so that it does not exceed the input voltage range of the DUT (E/O).

4. On the **Pattern** tab of MU183020A, select a test pattern for the Tx side.
    Once a test pattern is set for a channel of MU183020A, the set test pattern is reflected to all the channels.

5. On the **Interface** tab of MP1862A, set the data input interface so that it can detect the signal output from the DUT (O/E).

6. On the **Pattern** tab of MU183040B, select a test pattern for the Rx side.
    Once a test pattern is set for a channel ofMU183040B, the set test pattern is reflected to all the channels.

7. Turn off the power to MP1861A, MP1862A and MP1800A.

8. Connect MP1861A, MP1862A and DUT by using applicable coaxial cables or equivalent.

    Before connecting the DUT, short the cores and outer conductors of the cables by using a thin pointed metal stick such as tweezers. Connect the equipment as shown in Figure 5.2-1.
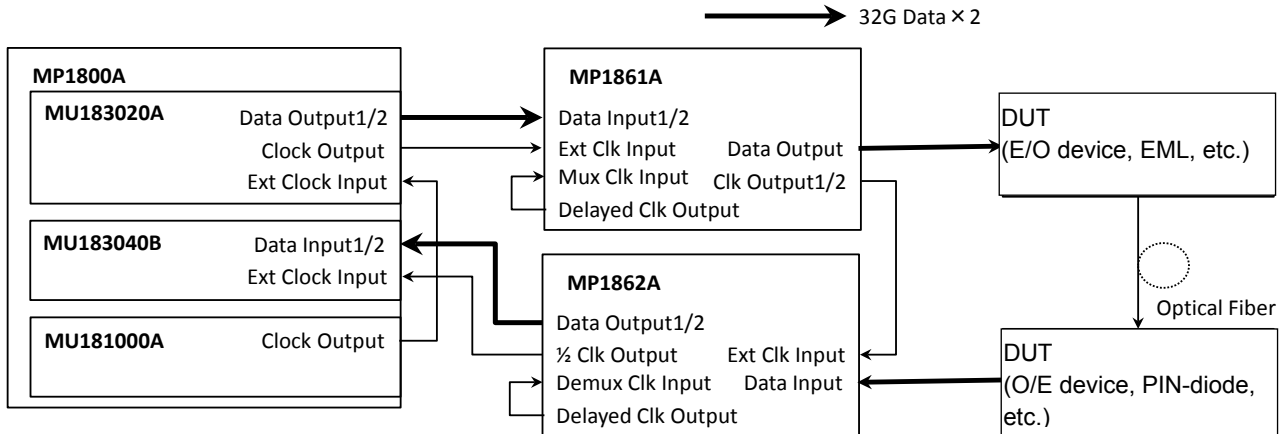
Figure 5.2-1   Connection diagram for Optical module evaluation

9.   Turn on the MP1862A, DUT, MP1861A and MP1800A in order.

⚠ **CAUTION**

The DUT may be damaged if a signal line is connected or disconnected while the output is ON. Be sure to turn off the MP1800A and MP1861A before changing the cable connection.

10.   On the **Data Interface** tab of MP1861A, select **ON** in the **Data/XData** box.

11.   Turn on the output from MP1861A by clicking the **Output** module function button ( ) or pressing the **Output** key on the front panel of MP1800A.

12.   Click the **Auto Search** module function button ( ).

13.   Click the **Start** module function button ( ).

14.   On the **Result** tab of MP1862A, check the measurement results.

15.   On the **Data Interface** tab of MP1861A, measure the sensitivity of the DUT (E/O), changing the values in the **Amplitude** and **Offset** boxes.

5

Use Examples

5.3 Testing Jitter Tolerance

This section describes how to test jitter tolerance by using MP1861A and MP1862A.

The equipment used in the following example is:

MP1800A-016:	1
MU183020A-x01/x23/x31:	1
MU183040B-x01/x20:	1
MU181000A:	1
MU181500B:	1
MP1861A-x01/x13/x30:	1
MP1862A-x01:	1

1. Place the equipment in the error-free state according to the procedure in 5.1 "Achieving Error-Free Data Transmission". Be sure to use the cables that come with MP1861A and MP1862A.

2. Turn off the output from MP1861A by clicking the **Output** module function button ( ) or pressing the **Output** key on the front panel of MP1800A.

3. On the **Data Interface** tab of MP1861A, set the data output interface so that it does not exceed the input voltage range of the DUT.

4. On the **Interface** tab of MP1862A, set the data input interface so that it can detect the signal output from the DUT.

5. Connect the **Data Output** and $\overline{\text{Data}}$ **Output** connectors of MP1861A to the input connectors of the DUT by using coaxial cables.

6. Connect the **Data Input** and $\overline{\text{Data}}$ **Input** connectors of MP1862A to the output connectors of the DUT by using coaxial cables.

7. Adjust the length of the cable used for the **Clk Output1/2** connector of MP1861A and the **Ext Clk Input** connector of MP1862A so that it becomes equivalent to the delay between the **Data Output** connector of MP1861A and the **Data Input** connector of MP1862A.

   Jitter tolerance may not be tested properly unless the delay length is set properly.

8. On the **Data Interface** tab of MP1861A, switch the **Jitter Input** to **ON**.

9. Turn on the output from MP1861A by clicking the **Output** module function button ( ) or pressing the **Output** key on the front panel of MP1800A.

10. Click the **Auto Measurement** module function button ( ).

11. Click **Jitter Noise Tolerance Test Software**.
    For how to use the MX181500A Jitter/Noise Tolerance Test Software,

refer to the *MX181500A Jitter/Noise Tolerance Test Software Operation Manual.*

5

Use Examples

Chapter 6 Performance Test

This chapter describes the performance testing of the MP1861A.

6

Performance Test

6.1 Overview

Performance tests are executed to check that the major functions of the MP1861A meet the required specifications. Execute performance tests at acceptance inspection, operation check after repair, and periodic (once every six months).

6.2 Devices Required for Performance Tests

Before starting performance tests, warm up the MP1861A and the measuring instruments for at least 30 minutes. Table 6.2-1 shows the devices required for performance tests.

Table 6.2-1   Devices Required for Performance Test

Device Name	Required Performance	
Pulse pattern generator (MP1800A-015/016 + MU183020A-x22/x23. x31 + MU181000A/B) Error detector (MU183040A/B-x20) DEMUX (MP1862A)	Operating frequency: Data input sensitivity:	8 to 56.2 GHz 100 mVp-p or more
Pulse pattern generator (MP1800A-015/016 + MU183020A-x01, x22/x23, x31 + MU181000A/B) Error detector (MU183040A/B-x01, x20) DEMUX (MP1862A-x01)	Operating frequency: Data input sensitivity:	8 to 64.2 GHz 100 mVp-p or more
Sampling Oscilloscope	Band frequency: 70 GHz or more	

Notes:

Before starting the performance tests, warm up the device under test and the measuring instruments for at least 30 minutes and wait until they become sufficiently stabilized, unless otherwise specified. Additional conditions are required for maximum measurement accuracy: measurements must be performed at room temperature, fluctuations of AC power supply voltage must be small, and noise, vibration, dust, and humidity must be insignificant.

6

Performance Test

6.3   Performance Test Items

This section describes the following test items.

- Operating frequency range
- Waveform

6.3.1   Operating frequency range A

(1)   Specifications

Table 6.3.1-1 Specifications

Model	Option x01	Specifications
MP1861A	No	4 to 28.1 GHz
	Yes	4 to 32.1 GHz

(2)   Device connection

Figure 6.3.1-1 shows the connection example using MP1861A, MU183020A (MU183020A-x01, x22/x23, x30), MP1862A, MU183040B (MU183040B-x01, x20), and MU181000A/B. Before connecting the devices, confirm that the MP1861A output appropriate frequency and level of signals.
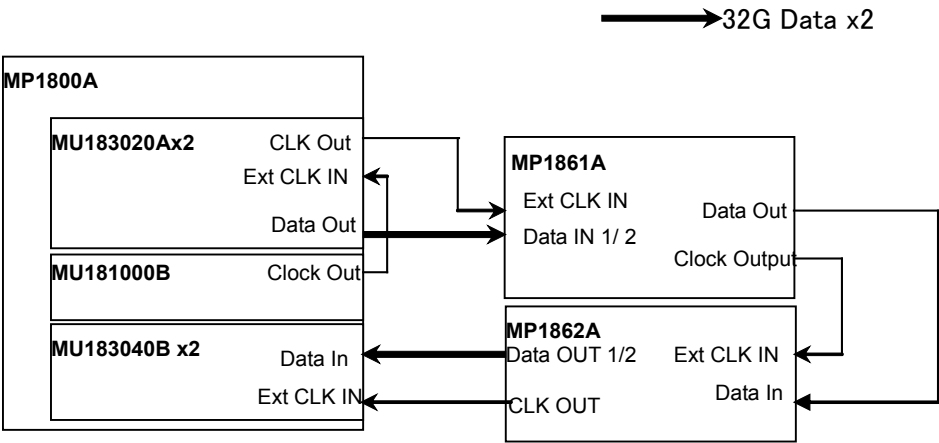
Figure 6.3.1-1   Connection Diagram for Operating Frequency Range Test

(3) Test procedure

1. Connect each measuring instrument using cables as shown in Figure 6.3.1-1.

2. Connect the MP1861A to the MP1800A and switch on the power. Switch on the power of the MP1800A and each measuring instrument and allow them to warm up.

3. On the **Misc2** tab of each MU183020A and MU183040B, click [Setting], and then in the **Combination Setting** dialog box, click **Combination** and then click **2ch**. In addition, in the **Clock Setting** area, click **Fullrate** in the **Output Clock Rate** box.

4. Set the parameters as follows, and then perform the Auto Adjust function for Data1 and 2 of MU183040B.
   Data Interface tab (MP1861A)
   ・Amplitude: 0.5 Vpp
   ・Offset: Vth, 0 V
   Pattern tab (Each of MU183020A and MU183040B)
   ・Test Pattern: PRBS 31
   ・Mark Ratio: 1/2

5. Select the **Output** module function button ( ).

6. On the **Output** tab of MU183020A and the **Data Interface** tab of MP1861A, click **ON** in the **Data/XData** box to turn on the signal output.

7. Adjust the MP1862A phase and threshold to the optimum values. (Use the auto search function.)

8. Check that no error is detected by the MU183040B.

9. By repeating steps 6 and 7 while varying the operating frequency, check for any error in the rated operating frequency range.

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Performance Test

6.3.2 Waveform evaluation test

(1) Specifications

Table 6.3.2-1 Specifications

Option	Specifications	
MP1861A-x11 Data Output (0.5 to 2.5 Vp-p)	Amplitude:	0.5 V to 2.5 Vp-p
	Offset:	−2.0 to +3.3 Voh, Min. −4.0 Vol
	Cross Point:	45 to 55%
	Tr/Tf:	Typ.8 ps (20 to 80%) @56/64Gbit/s, 2.5 Vp-p
	Jitter (RMS):	Typ. 450 fs ≤550 fs @56.2 Gbit/s Typ. 650 fs @64.2 Gbit/s *
	Random Jitter (RMS):	Typ.200 fs
	Waveform distortion:	Typ. ±25 mV ±10%@50 Gbit/s
MP1861A-x13 Data Output (0.5 to 3.5 Vp-p)	Amplitude:	0.5 to 3.5 Vp-p
	Offset:	−2.0 to +3.3 Voh, Min. −4 Vol
	Cross Point:	45 to 55%
	Tr/Tf:	Typ.8 ps (20 to 80%) @56.2/64.2 Gbit/s, 2.5 Vp-p
	Jitter (RMS):	Typ. 450 fs, ≤550 fs @56.2 Gbit/s Typ. 650 fs @64.2 Gbit/s*
	Random Jitter (RMS):	Typ.200 fs
	Waveform distortion:	Typ. ±25 mV ±10%@56.2 Gbit/s, 2.5 Vp-p

*: The values for jitter are specified, assuming an oscilloscope with a linearity of less than 200 fs will be used.

(2) Device connection
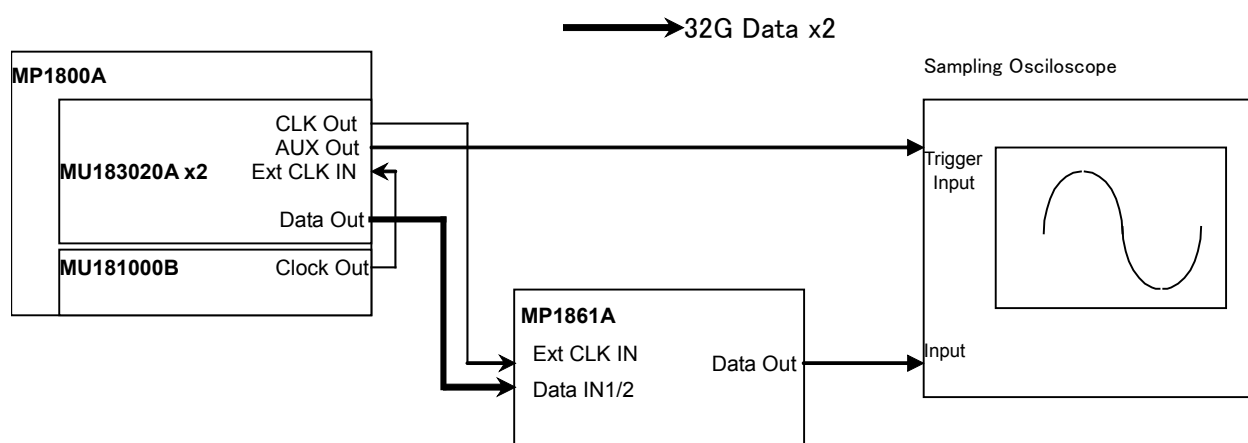
Figure 6.3.2-1 Connection Diagram for Waveform Test

(3) Test procedure

1. Connect the cables among the measuring instruments, referring to Figure 6.3.2-1.

2. Connect the MP1861A to the MP1800A, and turn on the MP1800A. Set the power of the MP1800A and each measuring instrument to on and allow them to warm up.

3. On the **Misc2** tab of MU183020A, click [Setting], and then in the **Combination Setting** dialog box, click **Combination** and then click **2ch**. In addition, in the **Clock Setting** area, click **Fullrate** in the **Output Clock Rate** box.

4. Set the Amplitude, Offset, and Cross Point of the output test data at the setting screen.

5. Set the test pattern in the MU183020A **Pattern** tab. Since the specification parameters are evaluated by observing an Eye pattern, set the test pattern to PRBS 31, and the mark ratio to 1/2.

    Use a repeated pattern of 1 and 0 in the data pattern when measuring the random jitter.

6. Configure the trigger signal setting. Select 1/N Clock in the AUX Output area on the MU183020A **Misc** tab, and set the division ratio according to the sampling oscilloscope used.

7. When output of the signal generator, MP1861A, and MP1800A signal is set to ON, signal is output.

8. Observe the output waveform on the sampling oscilloscope, and check that all the items conform to the specifications.

6

Performance Test

Chapter 7 Remote Commands

This chapter provides the MP1861A remote commands.

For the MX180000A remote functions, refer to "*MX180000A Signal Quality Analyzer Control Software Operation Manual Remote Control*".

7

Remote

7.1 Status Commands

This section explains the Alarm/Error status commands for the MP1861A 56G/64Gbit/s MUX.

:INSTrument:MUX[:EVENt]?

Response	\<numeric>=\<NR1 NUMERIC RESPONSE DATA>
	0 to 60 Sum total of the bit of event register (DECIMAL)
	Available bit
	4 (Bit2) Delay Busy
	8 (Bit3) Adjust Require
	16 (Bit4) Delay Calibration Require
	32 (Bit5) MUX-PPG Adjustment in Progress
Function	Queries event at 64Gbit/s MUX status.
Example	> :INSTrument:MUX:EVENt?
	Or
	> :INSTrument:MUX?
	< 4

:INSTrument:MUX:CONDition?

Response	\<numeric>=\<NR1 NUMERIC RESPONSE DATA>
	0 to 60 Sum total of the bit of condition register (DECIMAL)
	Available bit
	4 (Bit2) Delay Busy
	8 (Bit3) Adjust Require
	16 (Bit4) Delay Calibration Require
	32 (Bit5) MUX-PPG Adjustment in Progress
Function	Queries condition at 64Gbit/s MUX status.
Example	> :INSTrument:MUX:CONDition?
	< 4

:INSTrument:MUX:PTRansition <numeric>

Parameter	<numeric>=<DECIMAL NUMERIC PROGRAM DATA>
	0 to 60 Sum total of the bit of transition filter (DECIMAL)
	Available bit
	4 (Bit2) Delay Busy
	8 (Bit3) Adjust Require
	16 (Bit4) Delay Calibration Require
	32 (Bit5) MUX-PPG Adjustment in Progress
Function	Sets the transition filter (positive transition) of the 64Gbit/s MUX status.
Example	To set the transition filter (positive transition) of the 64Gbit/s MUX status to 1:
	> :INSTrument:MUX:PTRansition 4

:INSTrument:MUX:PTRansition?

Response	<numeric>=<NR1 NUMERIC RESPONSE DATA>
	0 to 60 Sum total of the bit of transition filter (DECIMAL)
Function	Queries the condition of the transition filter (positive transition) of the 64Gbit/s MUX status.
Example	> :INSTrument:MUX:PTRansition?
	< 4

:INSTrument:MUX:NTRansition <numeric>

Parameter	<numeric>=<DECIMAL NUMERIC PROGRAM DATA>
	0 to 60 Sum total of the bit of transition filter (DECIMAL)
	Available bit
	4 (Bit2) Delay Busy
	8 (Bit3) Adjust Require
	16 (Bit4) Delay Calibration Require
	32 (Bit5) MUX-PPG Adjustment in Progress
Function	Sets the transition filter (negative transition) of the 64Gbit/s MUX status.
Example	To set the transition filter (negative transition) of the 64Gbit/s MUX status to 1:
	> :INSTrument:MUX:NTRansition 4

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Remote

:INSTrument:MUX:NTRansition?

Response	\<numeric\>=\<NR1 NUMERIC RESPONSE DATA\>
	0 to 60 Sum total of the bit of transition filter (DECIMAL)
Function	Queries the transition filter (negative transition) of the 64Gbit/s MUX status.
Example	> :INSTrument:MUX:NTRansition?
	< 4

:INSTrument:MUX:RESet

Function	Initializes event at 64Gbit/s MUX status.
Example	> :INSTrument:MUX:RESet

7.2 Common Commands

7.2.1 Configuration Commands

Table 7.2.1-1   Configuration Commands

No.	Item	Command
1	Setting for USB unit number	:USB:ID
		:USB:ID?
2	Module screen display	:DISPlay:ACTive
3	Query for model name of USB module	:SYSTem:CONDition:USB?
4	Query for software status of the	:SYSTem:CONDition?
5	MP1861A	CND?
6	Query for system error	:SYSTem:INFormation:ERRor?
7		INF?
8	Query for mainframe information	:SYSTem:UNIT?
9		UNT?

:USB:ID <usb number>

Parameter	<usb_number>=<DECIMAL NUMERIC PROGRAM DATA>
	7 USB number 7 (Channel 1)
	8 USB number 8 (Channel 2)
	9 USB number 9 (Channel 3)
	10 USB number 10 (Channel 4)
	To perform channel setting (CH1 to CH4 (USB No. 7 to 10), use the Channel Setting switch on the rear panel of MP1861A.
Function	Sets the USB number of MP1861A you want to operate.
Example	`> :USB:ID 7`

:USB:ID?

Response	<usb_number>=< NR1 NUMERIC RESPONSE DATA >
	7 to 10 USB number 7 to 10 (Channel 1 to 4)
Function	Queries USB number of MP1861A that is being operated.
Example	`> :USB:ID?`
	`> 7`

Note:

In order to remote control the module mounted in MP1800A/MP1810A after remote controlling MP1861A with this command, use :UENTry:ID, :MODule:ID to switch the target unit to MP1800A.

For details of UENTry:ID, :MODule:ID commands, refer to 7.1 "Common Commands" in *MX180000A Signal Quality Analyzer Control Software Operation Manual Remote Control*.

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Remote

:DISPlay:ACTive <unit>,<slot>[,<tab>]

Parameter	<unit>=<DECIMAL NUMERIC PROGRAM DATA>
	1 to 4 Mainframe No. 1 to 4
	When installing the MT1810A, the mainframe No. is specified.
	When using the MP1800A, No.1 is fixed.
	0 USB module
	When specifying MP1825B, MP1821A, MP1822A, MP1861A or MP1862A
	<slot>=<DECIMAL NUMERIC PROGRAM DATA>
	1 to 6 Slot No. 1 to 6 when using MP1800A
	1 to 4 Slot No. 1 to 4 when using MT1810A
	1 to 14 USB No. 1 to 14 when using a USB module (<unit>=0)
	[<tab>]=<DECIMAL NUMERIC PROGRAM DATA>
	1 to X Tab ID No.1 to X
	If [,<tab>] is omitted, 1 is assumed.
	The far left tab is assigned to Tab ID 1. The Tab ID of next right tab will increase as 2, 3, 4.
	The number (X) of tab IDs depends on the modules and options you are using.
Function	Displays the specified module screen to the front.
	Note:
	When the screen processing for measurement result is Off, this function cannot be used. If using this function, set the screen processing to On using the :SYSTem:DISPlay:RESult .
Example	To display the Interface tab of the operation window of MP1861A:
	(When MP1861A is connected to USB7)
	`> :DISPlay:ACTive 0,7,1`
Compatibility	Incompatible with existing models

:SYSTem:CONDition:USB?

Response	<usb1>,…,<usb127>=<STRING RESPONSE DATA>
	"XXXX" Model Name Example:MP1861A
	Refer to Table 7.2.1-2 "Option character
	correspondence table".
Function	Queries USB module model name.
Example	> :SYSTem:CONDition:USB?
	< MP1861A, MP1862A,NONE,NONE,...,NONE

Table 7.2.1-2   Option Character Correspondence Table

Model Name	Option Number	Option Name
MP1861A 56G/64Gbit/s MUX	OPTx01	64Gbit/s Extension
	OPTx11	Data Output(0.5 to 2.5 Vp-p)
	OPTx13	Data Output (0.5 to 3.5 Vp-p)
	OPTx30	Variable Data Delay
MP1862A 56G/64Gbit/s DEMUX	OPTx01	64Gbit/s Extension

:SYSTem:CONDition?

Response	"<mainframe>, <slot x>,...,<usb x>,..., <usb 127>"
	<mainframe> Previous function omitted
	<slot x> Previous function omitted
	<usb x>=<module>,<serial>,<fpga1>[,<fpga2>],<boot>,<application>,<opt>
	x indicates a USB number. The USB number is 1 to 127.
	number as follows.
	<module>=<STRING RESPONSE DATA>
	XXXXXXXXX Module Name Example: MP1861A
	Refer to Table 7.2.1-2 "Option Character
	Correspondence Table".
	Note:
	NONE is output if no option is installed.
	<serial>=<STRING RESPONSE DATA>
	XXXXXXXXXX 0000000000 to 9999999999
	Serial number
	Note:
	"------------" is output if no module is
	installed.
	<fpga1>[,<fpga2>,.....]=<STRING RESPONSE DATA>
	XXXX.XX.XX 1.00.00 to 9999.99.99
	FPGA version
	<boot>=<STRING RESPONSE DATA>
	XXXX.XX.XX 1.00.00 to 9999.99.99
	Logic Boot version

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Note:

"------------" is output if Logic boot is not installed.

\<application>=\<STRING RESPONSE DATA>

XXXX.XX.XX   1.00.00 to 9999.99.99

Logic Application version

Note:

"------------" is output if Logic Application is not installed.

\<opt>=\<STRING RESPONSE DATA>

XXXXXX/XXXXX   Option number

OPTXXX

Note:

All installed options are output. NONE is output if no option is installed.

Function	Queries the software status of the MP1861A.
Example	> :SYSTem:CONDition?

```
<
6201234567,1.00.00,1.00.20,OPT302,1.00.00,1.00.00,OPT12,OPT
14,
MU181000A,6201234568,1.00.00,1.00.00,1.00.00,OPT101,
MU181020A,6201234569,1.00.00,1.00.00,1.00.00,OPT001,OPT220,
MU181040A,6201234571,1.00.00,1.00.00,1.00.00,OPT002,OPT220
MP1861A,6201234571,1.00.00,1.00.00,1.00.00,OPT002,OPT030
```

CND?

Response	\<mainframe\>,\<slot1\>,...,\<slot644\>,\<usb1\>,...,\<usb1274\>
	\<mainframe\> Previous function omitted
	\<slotx\> Previous function omitted
	\<usb x\>=\<module\>,\<serial\>,\<fpga1\>[,\<fpga2\>],\<boot\>,\<application\>,\<opt\>
	x indicates a USB number. The USB number is 1 to 127.

\<module\>=\<STRING RESPONSE DATA\>

XXXXXXXXX (FIX9)	Refer to Table 7.2.1-2 "Option Character Correspondence Table".
	Note:
	NONE is output if no module is installed.

\<serial\>=\<STRING RESPONSE DATA\>

XXXXXXXXXX (FIX10)	0000000000 to 9999999999
	Serial number
	Note:
	"------------" is output if no module is installed.

\<fpga1\>[,\<fpga2\>,.....] = \<STRING RESPONSE DATA\>

XXXX.XX.XX (FIX10)	1.00.00 to 9999.99.99
	FPGA version

\<boot\>=\<STRING RESPONSE DATA\>

XXXX.XX.XX (FIX10)	1.00.00 to 9999.99.99
	Logic Boot version
	Note:
	"------------" is output if Logic boot is not installed.

\<application\>=\<STRING RESPONSE DATA\>

XXXX.XX.XX (FIX10)	1.00.00 to 9999.99.99
	Logic Application version
	Note:
	"------------" is output if Logic Application is not installed.

\<opt\>=\<STRING RESPONSE DATA\>

XXXXXX (FIX6)	Option number
	OPTXXX:
	Note:
	All installed options are output.
	NONE is output if no option is installed.

Function	Queries the software status of the MP1861A.
Example	`> CND?`
	`< CND 6201234567,  1.00.00,   1.00.20,OPT301,OPT302,`
	`   1.00.00,   1.00.00,OPT 12,`
	`...,`
	`MP1861A,6201234571,   1.00.00,   1.00.00,1.00.00,OPT002,`

```
OPT030
```

:SYSTem:INFormation:ERRor? <unit>[,<usb>]

Parameter	\<unit\>=\<DECIMAL NUMERIC PROGRAM DATA\>
	1 to 4 1 to 4/1 Step
	*\<unit\> must be set to 1 when querying USB.
	\<usb\>=\<DECIMAL NUMERIC PROGRAM DATA\>
	1 to 127 1 to 127/1 Step
Response	\<numeric\>=\<NR1 NUMERIC RESPONSE DATA\>
	0 NONE
	1 PLL Unlock
	2 Temperature
	3 Fan
	4 Overcurrent
	All the system errors that have currently occurred are displayed, delimited with a comma (,).
Function	Queries the system error status of MP1861A connected to USB 7.
Example	> :SYSTem:INFormation:ERRor? 1,7
	< 1, 2, 3 (when a system error has occurred for PLL Unlock, Temperature, or Fan)
	< 0 (when no system error has occurred)

INF? <unit>[,<usb>]

Parameter	\<unit\>=\<DECIMAL NUMERIC PROGRAM DATA\>
	1 to 4 Mainframe number
	*\<unit\> must be set to 1 when querying USB.
	\<usb\>=\<DECIMAL NUMERIC PROGRAM DATA\>
	1 to 127 USB Mainframe number
Response	\<numeric\> =
	\<DEFINITE LENGTH ARBITORARY BLOCK RESPONSE DATA\>
	#B0000 NONE
	#B100 PLL Unlock
	#B0100 Temperature
	#B0010 Fan
	#B0001 Overcurrent
Function	Queries the content of the system error that has currently occurred.
Example	To query the System Error contents using one mainframe:
	> INF? 1,7
	< INF #B1000

:SYSTem:UNIT? <numeric>[,<usb>]

Parameter	<numeric>=<NR1 NUMERIC PROGRAM DATA>
	1 to 4 Mainframe number
	"1" for the MP1800A, "1 to 4" for the MT1810A.
	<numeric>=<NR1 NUMERIC PROGRAM DATA>
	1 to 127 Mainframe number
Response	<mainframe>=
	<unit>,<serial>,<mver>,<hver>,<opt1>,<sbver>,<saver>,<opt2>
	<unit>=<STRING RESPONSE DATA>

XXXXXXXXX   Model name Example: MP1861A

                       See Table 7.2.1-2 "Option Character Correspondence Table".

                       Note:

                             NONE is output if no module is installed.

<serial>=<STRING RESPONSE DATA>

XXXXXXXXXX   0000000000 to 9999999999

                       Mainframe serial number

                       Note:

                             Alphabetic characters may be included.

<mver>=<STRING RESPONSE DATA>

XXXX.XX.XX   1.00.00 to 9999.99.99

                       Main application software version

<hver>=<STRING RESPONSE DATA>

XXXX.XX.XX   1.00.00 to 9999.99.99

                       Mainframe hardware version

<opt1>=<STRING RESPONSE DATA>

OPTXXX   For option number, see Table 7.1.1-2 "Option character correspondence table".

                       Note:

                             All installed options are output.

                             NONE is output if no option is installed.

<sbver>=<STRING RESPONSE DATA>

XXXX.XX.XX   1.00.00 to 9999.99.99

                       Sub application software version

                       (Boot part)

<saver>=<STRING RESPONSE DATA>

XXXX.XX.XX   1.00.00 to 9999.99.99

                       Sub application software version

                       (Application part)

<opt2>=<STRING RESPONSE DATA>

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Function	Queries the mainframe information including model and serial number.
Example	To query the mainframe information including model and serial number for USB1:

```
> :SYSTem:UNIT? 1,7
<
"MP1861A,6201234568,1.00.00,1.00.00,OPT301,1.00.00,1.00.00"
```

UNT? <numeric>[,<usb>]

Parameter	<numeric>=<NR1 NUMERIC PROGRAM DATA>
	1 to 4 Mainframe number
	"1" for the MP1800A, "1 to 4" for the MT1810A when querying USB.
	<numeric>=<NR1 NUMERIC PROGRAM DATA>
	1 to 127 Mainframe number
Response	<mainframe>,
	<mainframe>=<module>,<serial>,<mver>,<hver>,<opt1>,<sbver>,
	<saver>,<opt2>
	<unit>=<STRING RESPONSE DATA>
	XXXXXXXX Model name Example: MP1800A and MT1810A
	Refer to Table 7.2.1-2 "Option Character Correspondence Table".
	Note:
	NONE is output if no module is installed.
	<serial>=<STRING RESPONSE DATA>
	XXXXXXXXXX 0000000000 to 9999999999
	Mainframe serial number
	Note:
	Alphabetic characters may be included.
	<mver>=<STRING RESPONSE DATA>
	XXXX.XX.XX 1.00.00 to 9999.99.99
	Main application software version
	<hver>=<STRING RESPONSE DATA>
	XXXX.XX.XX 1.00.00 to 9999.99.99
	Mainframe hardware version
	<opt1>=<STRING RESPONSE DATA>
	OPTXXX Option number
	Refer to Table 7.2.1-2 "Option Character Correspondence Table".
	Note:
	All installed options are output.
	NONE is output if no option is installed.

<sbver>=<STRING RESPONSE DATA>

XXXX.XX.XX   1.00.00 to 9999.99.99

                               Sub application software version

                               (Boot part)

<saver>=<STRING RESPONSE DATA>

XXXX.XX.XX   1.00.00 to 9999.99.99

                               Sub application software version

                               (Application part)

Function	Queries the mainframe information including model and serial number.
Example	To query the USB7 information:

```
> UNT? 1,7
< MP1861A,6201234568,1.00.00,1.00.00,OPT01,1.00.00,1.00.00
```

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7.2.2 File menu commands

Table 7.2.2-1   File Menu Commands

No.	Item	Command
1	Open	:SYSTem:MMEMory:MUX:RECall
2	Save	:SYSTem:MMEMory:MUX:STORe

:SYSTem:MMEMory:MUX:RECall <file_name>

Parameter	<file_name>=<STRING PROGRAM DATA>
	"<drv>:\[<dir>]<file>"
	<drv> = C,D,E,F
	<dir>=<dir1>\<dir2>\…(This parameter is not required if the file resides immediately below the root directory.)
	<file> = File name
Function	Opens the configuration file for MUX.
Example	`> :SYSTem:MMEMory:MUX:RECall "C:\Test\example"`

:SYSTem:MMEMory:MUX:STORe <file_name>,<data_type>,<file_type>

Parameter	<file_name>=<STRING PROGRAM DATA>
	"<drv>:\[<dir>]<file>"
	<drv> = C,D,E,F
	<dir>=<dir1>\<dir2>\…(This parameter is not required if you want to save a file to the root directory.)
	<file> = File name
	<data_type>=<CHARACTER RESPONSE DATA>
	UMX 64G MUX Setup
	<file_type>=<CHARACTER PROGRAM DATA>
	BIN Binary file
Function	Saves the configuration of MUX to a file.
	Note:
	The saved settings cannot be read if the file name is changed.
Example	To save the settings for MUX, specifying the save destination, file name and file format:
	`> :SYSTem:MMEMory:MUX:STORe "C:\Test\example",UMX,BIN`

7.3 64G MUX Commands

This section explains the commands and queries for MP1861A 56G/64Gbit/s MUX.

The commands on each tab are described in separate sections below. Before executing a command or query, execute the :USB:ID command to specify the USB number of the module you want to remote-control. For how to specify the USB number using the :USB:ID command, refer to Section 7.2.1 "Configuration Commands".

This section also describes the command compatibility with the following existing modules:

・MU182020A 25Gbit/s 1ch MUX (MU182020A)
・MU182021A 25Gbit/s 2ch MUX (MU182021A)
・MP1821A 50G/56Gbit/s MUX (MP1821A)

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7.3.1   Data Interface tab
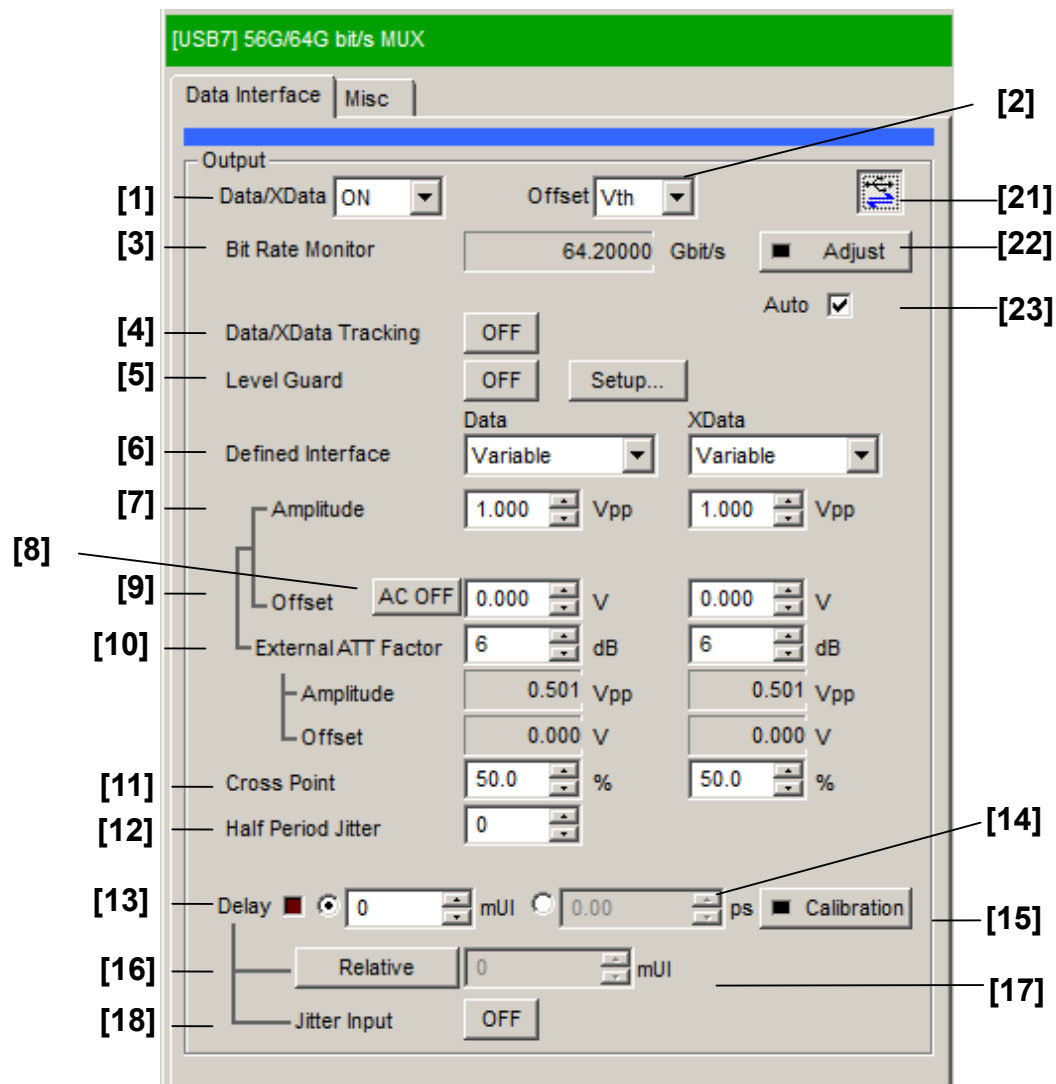
Figure 7.3.1-1   Data Interface Tab
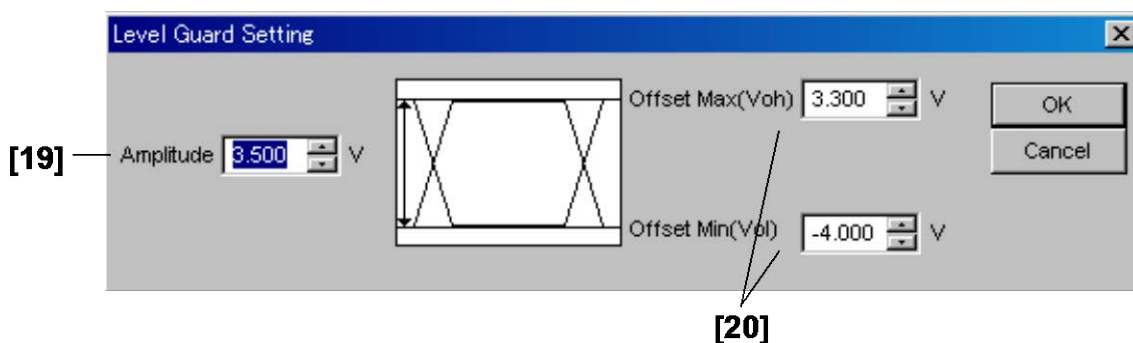
Figure 7.3.1-2   Level Guard Setting Dialog Box

Table 7.3.1-1   Commands and Queries for Items on the Data Interface Tab

No.	Item	Command
[1]	Data/XData ON/OFF	:MUX:DATA:OUTPut
		:MUX:DATA:OUTPut?
[2]	Offset	:MUX:OUTPut:OFFSet
		:MUX:OUTPut:OFFSet?
[3]	Bit Rate Monitor	:MUX:OUTPut:BMONitor?
[4]	Data/XData Tracking	:MUX:DATA:TRACking
		:MUX:DATA:TRACking?
[5]	Level Guard	:MUX:DATA:LEVGuard
		:MUX:DATA:LEVGuard?
[6]	Defined Interface	:MUX:DATA:LEVel
		:MUX:DATA:LEVel?
[7]	Amplitude	:MUX:DATA:AMPLitude
		:MUX:DATA:AMPLitude?
[8]	AC ON/OFF	:MUX:DATA:AOFFset
		:MUX:DATA:AOFFset?
[9]	Offset	:MUX:DATA:OFFSet
		:MUX:DATA:OFFSet?
[10]	External ATT Factor	:MUX:DATA:ATTFactor
		:MUX:DATA:ATTFactor?
[11]	Cross Point	:MUX:DATA:CPOint
		:MUX:DATA:CPOint?
[12]	Half Period Jitter	:MUX:DATA:HPJitter
		:MUX:DATA:HPJitter?
[13]	Delay (mUI setting)	:MUX:DATA:UIPadjust
		:MUX:DATA:UIPadjust?
[14]	Delay (ps setting)	:MUX:DATA:PADJust
		:MUX:DATA:PADJust?
[15]	Calibration	:MUX:DATA:PCALibration
[16]	Relative	:MUX:DATA:RELative
		:MUX:DATA:RELative?
[17]	No label (settings of Relative values)	:MUX:DATA:RDELay
		:MUX:DATA:RDELay?
[18]	Jitter Input	:MUX:DATA:JINPut
		:MUX:DATA:JINPut?
[19]	Amplitude	:MUX:DATA:LIMitter:AMPLitude
		:MUX:DATA:LIMitter:AMPLitude?
[20]	Offset Max/Min	:MUX:DATA:LIMitter:OFFSet
		:MUX:DATA:LIMitter:OFFSet?
[21]	MUX•PPG Link ON/OFF	:SYSTem:LINK:MUXPpg
		:SYSTem:LINK:MUXPpg?

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Table 7.3.1-1   Commands and Queries for Items on the Data Interface Tab (Cont'd)

No.	Item	Command
[22]	MUX-PPG Adjustment	:SYSTem:INPut:DCADjust
[23]	MUX-PPG Adjustment (Auto execution ON/OFF)	:SYSTem:INPut:DCADjust:AUTO
		:SYSTem:INPut:DCADjust:AUTO?

:MUX:DATA:OUTPut <boolean>

Parameter	<boolean>=<BOOLEAN PROGRAM DATA>
	OFF or 0 Data/XData output Off
	ONor1 Data/XData output On
Function	Sets Data/XData outputs ON/OFF.
Example	To set Data/XData output of Data Interface to ON:
	> :MUX:DATA:OUTPut ON
Compatibility	Compatible with MU182020A, MU182021A and MP1821A

:MUX:DATA:OUTPut?

Response	<numeric>=<NR1 NUMERIC RESPONSE DATA>
	0 Data/XData output Off
	1 Data/XData output On
Function	Queries Data/XData output On/Off.
Example	To query whether Data/XData output of Data Interface is ON or OFF:
	> :MUX:DATA:OUTPut?
	< 1
Compatibility	Compatible with MU182020A, MU182021A and MP1821A.

:MUX:OUTPut:OFFSet <offset>

Parameter	<offset>=<CHARACTER PROGRAM DATA>
	VOH High level
	VTH High level and Low level center value
	VOL Low level
Function	Sets offset reference value for Data/XData and Clock/XClock outputs.
Example	To set offset reference value for Data/XData and Clock/XClock outputs to VOH:
	> :MUX:OUTPut:OFFSet VOH
Compatibility	Compatible with MU182020A, MU182021A and MP1821A.

:MUX:OUTPut:OFFSet?

Response	\<offset\>=\<CHARACTER RESPONSE DATA\>
	VOH, VTH, VOL
Function	Queries offset reference value for Data/XData.
Example	To query offset reference value for Data/XData for Data Interface:
	> :MUX:OUTPut:OFFSet?
	< VOH
Compatibility	Compatible with MU182020A, MU182021A and MP1821A.

:MUX:OUTPut:BMONitor?

Response	\<string\>=\<STRING RESPONSE DATA\>

Format	Description
"XX.XXXXX"	XX.XXXXX Gbit/s
"-----"	When no data corresponds to the query

Function	Queries BitRate
Example	To query BitRate of Data Interface:
	> :MUX:OUTPut:BMONitor?
	< "64. 20000"
Compatibility	Compatible with MU182020A, MU182021A and MP1821A.

:MUX:DATA:TRACking \<boolean\>

Parameter	\<boolean\>=\<BOOLEAN PROGRAM DATA\>
	OFF or 0 Sets shared settings for Data Interface to OFF.
	ON or 1 Sets shared settings for Data Interface to ON.
Function	Sets shared settings for Data Interface ON/OFF.
Example	To set shared settings for Data Interface of Data/XData to ON:
	> :MUX:DATA:TRACking ON
Compatibility	Compatible with MU182020A, MU182021A and MP1821A.

:MUX:DATA:TRACking?

Response	\<numeric\>=\<NR1 NUMERIC RESPONSE DATA\>
	0 Shared settings for Data/XData output are OFF.
	1 Shared settings for Data/XData output are ON.
Function	Queries shared ON/OFF settings for Data/XData output.
Example	To query shared ON/OFF settings for Data/XData output of Data Interface:
	> :MUX:DATA:TRACking?
	< 1
Compatibility	Compatible with MU182020A, MU182021A and MP1821A.

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:MUX:DATA:LEVGuard <boolean>

Parameter	<boolean>=<BOOLEAN PROGRAM DATA>
	OFF or 0 Data/XData output range limit is OFF.
	On or 1 Data/XData output range limit is ON.
Function	Sets Data/XData output range limit to ON/OFF.
Example	To set Data/XData output range limit for Data Interface to ON:
	> :MUX:DATA:LEVGuard ON
Compatibility	Compatible with MU182020A, MU182021A and MP1821A.

:MUX:DATA:LEVGuard?

Response	<numeric>=<NR1 NUMERIC RESPONSE DATA>
	0 Data/XData output range limit is OFF.
	1 Data/XData output range limit is ON.
Function	Queries Data/XData output range limit to ON/OFF.
Example	To query Data/XData output range limit for Data Interface to ON:
	> :MUX:DATA:LEVGuard?
	< 1
Compatibility	Compatible with MU182020A, MU182021A and MP1821A.

:MUX:DATA:LEVel <port>,<level>

Parameter	<port>=<CHARACTER PROGRAM DATA>
	DATA Data
	XDATa XData
	<level>=<CHARACTER PROGRAM DATA>
	VARiable Variable (MP1861A-x11, x13)
	PCML PCML level (MP1861A-x11, x13)
	NCML NCML level (MP1861A-x11, x13)
	SCFL SCFL level (MP1861A-x11, x13)
	NECL NECL level (MP1861A-x11, x13)
	LVPecl LVPECL level (MP1861A-x11, x13)
Function	Sets data output level for specific port.
Example	To set XData output level of Data Interface to NECL level:
	> :MUX:DATA:LEVel XDATa,NECL
Compatibility	Compatible with MU182020A, MU182021A and MP1821A.

:MUX:DATA:LEVel? <port>

Parameter	\<port>=\<CHARACTER PROGRAM DATA>
	DATA,XDATa
Response	\<level>=\<CHARACTER RESPONSE DATA>
	VAR, PCML, NCML, SCFL, NECL, LVP
Function	Queries data output level for specific port.
Example	To query data output level for specific port:
	> :MUX:DATA:LEVel? XDATa
	< NECL
Compatibility	Compatible with MU182020A, MU182021A and MP1821A.

:MUX:DATA:AMPLitude <port>,<numeric>

Parameter	\<port>=\<CHARACTER PROGRAM DATA>	
	DATA	Data
	XDATa	XData
	\<numeric>=\<DECIMAL NUMERIC PROGRAM DATA>	
	0.500 to 2.500	V/0.002 V Step (MP1861A-x11)
	0.500 to 3.500	V/0.002 V Step (MP1861A -x13)
Function	Sets data output amplitude for specific port.	
Example	To set data output amplitude for Data of Data Interface to 1.000 V:	
	> :MUX:DATA:AMPLitude DATA,1.000	
Compatibility	Compatible with MU182020A, MU182021A and MP1821A.	

:MUX:DATA:AMPLitude? <port>

Parameter	\<port>=\<CHARACTER PROGRAM DATA>
	DATA, XDATa
Response	\<numeric>=\<NR2 NUMERIC RESPONSE DATA>
Function	Queries data output amplitude for specific port.
Example	To query data output amplitude for Data of Data Interface:
	> :MUX:DATA:AMPLitude? DATA
	< 1.000
Compatibility	Compatible with MU182020A, MU182021A and MP1821A.

:MUX:DATA:AOFFset \<boolean\>

Parameter	\<boolean\>=\<BOOLEAN PROGRAM DATA\>
	OFF or 0 Offset OFF (DC output)
	On or 1 Offset ON (AC output)
Function	Sets Data output offset ON/OFF.
Example	To set Data output offset for Data Interface to ON:
	> :MUX:DATA:AOFFset ON
Compatibility	Compatible with MU182020A, MU182021A and MP1821A.

:MUX:DATA:AOFFset?

Response	\<numeric\>=\<NR1 NUMERIC RESPONSE DATA\>
	0 Offset OFF
	1 Offset ON
Function	Queries Data output offset ON/OFF
Example	To query Data output offset of Data Interface:
	> :MUX:DATA:AOFFset?
	< 1
Compatibility	Compatible with MU182020A, MU182021A and MP1821A.

:MUX:DATA:OFFSet \<port\>,\<numeric\>

Parameter	\<port\>=\<CHARACTER PROGRAM DATA\>
	DATA Data
	XDATa XData
	\<numeric\>=\<DECIMAL NUMERIC PROGRAM DATA\>
	–2.000 to 3.300 Voh/0.001 V Step (MP1861A-x11, x13)
	–3.000 to 3.050 Vth/0.001 V Step (MP1861A-x11, x13)
	–4.000 to 2.800 Vol/0.001 V Step (MP1861A-x11, x13)
Function	Sets data output offset for specific port.
Example	To set data output offset for Data of Data Interface to 1.000 Voh:
	> :MUX:DATA:OFFSet DATA,1.000
Compatibility	Compatible with MU182020A, MU182021A and MP1821A.

:MUX:DATA:OFFSet? <port>

Parameter	<port>=<CHARACTER PROGRAM DATA>
	DATA, XDATa
Response	<numeric>=<NR2 NUMERIC RESPONSE DATA>
Function	Queries data output offset for specific port
Example	To query data output offset for Data of Data Interface:
	> :MUX:DATA:OFFSet? DATA
	< 1.000
Compatibility	Compatible with MU182020A, MU182021A and MP1821A.

:MUX:DATA:ATTFactor <port>,<numeric>

Parameter	<port>=<CHARACTER PROGRAM DATA>
	DATA Data
	XDATa XData
	<numeric>=<DECIMAL NUMERIC PROGRAM DATA>
	0 to 40 0 to 40 dB/1 dB Step
Function	Sets data output ATT Factor for specific port.
Example	To set data output ATT Factor for Data of Data Interface to 20 dB:
	> :MUX:DATA:ATTFactor DATA,20
Compatibility	Compatible with MU182020A, MU182021A and MP1821A.

:MUX:DATA:ATTFactor? <port>

Parameter	<port>=<CHARACTER PROGRAM DATA>
	DATA, XDATa
Response	<numeric>=<NR2 NUMERIC RESPONSE DATA>
Function	Queries data output ATT Factor for specific port.
Example	To query data output ATT Factor for Data of Data Interface:
	> :MUX:DATA:ATTFactor? DATA
	< 20
Compatibility	Compatible with MU182020A, MU182021A and MP1821A.

:MUX:DATA:CPOint <port>,<numeric>

Parameter	<port>=<CHARACTER PROGRAM DATA>
	DATA Data
	XDATa XData
	<numeric>=<DECIMAL NUMERIC PROGRAM DATA>
	45 to 55 45 to 55%/0.1% Step
Function	Sets data output crosspoint for specific port.
Example	To set data output crosspoint for XData of Data Interface to 55.0%:
	> :MUX:DATA:CPOint XDATa,55.0
Compatibility	Partially compatible with MU182020A, MU182021A and MP1821A.
	The parameter range is different.

:MUX:DATA:CPOint? <port>

Parameter	<port>=<CHARACTER PROGRAM DATA>
	DATA, XDATa
Response	<numeric>=<NR2 NUMERIC RESPONSE DATA>
Function	Queries data output crosspoint for specific port.
Example	To query data output crosspoint for XData of Data Interface:
	> :MUX:DATA:CPOint? XDATa
	< 55.0
Compatibility	Partially compatible with MU182020A, MU182021A and MP1821A.
	The response range is different.

:MUX:DATA:HPJitter <numeric>

Parameter	<numeric>=<DECIMAL NUMERIC PROGRAM DATA>
	–20 to 20 –20 to 20/1 Step
Function	Sets the half period jitter of output data.
Example	To set the half period jitter to 10:
	> :MUX:DATA:HPJitter 10
Compatibility	Partially compatible with MU182020A and MU182021A, except for decrease
	in the number of parameters.

:MUX:DATA:HPJitter?

Response	<numeric>=<NR2 NUMERIC RESPONSE DATA>
Function	Queries the half period jitter of output data.
Example	> :MUX:DATA:HPJitter?
	< 10
Compatibility	Partially compatible with MU182020A and MU182021A, except for the
	parameter name and the range of response.

:MUX:DATA:UIPadjust \<numeric>

Parameter	\<numeric>=\<DECIMAL NUMERIC PROGRAM DATA>
	–1000 to 1000 –1000 to 1000 mUI/4 mUI Step
Function	Sets the common phase for the Data and XData outputs in mUI units.
Example	To set the common phase for the data outputs to 500 mUI:
	> :MUX:DATA:UIPadjust 500
Compatibility	Compatible with MU182020A, MU182021A and MP1821A.

:MUX:DATA:UIPadjust?

Response	\<numeric>=\<NR1 NUMERIC RESPONSE DATA>
Function	Queries the common phase for the Data and XData outputs in mUI units.
Example	To query the common phase for the data outputs:
	> :MUX:DATA:UIPadjust?
	< 500
Compatibility	Compatible with MU182020A, MU182021A and MP1821A.

:MUX:DATA:PADJust \<numeric>

Parameter	\<numeric>=\<DECIMAL NUMERIC PROGRAM DATA>
	–20 to 20 –20 to 20 ps/0.8 ps Step (50 GHz)
	–17.85 to 17.85 –17.85 to 17.85 ps/0.07 ps Step (56 GHz)
	–15.62 to 15.62 –15.62 to 15.62 ps/0.06 ps Step (64 GHz)
	Converts mUI setting resolution from calculated frequency value to reference
Function	Sets the common phase for the Data and XData outputs in ps units.
	The specified value may not be exactly set as is, due to the limitation of the setting resolution. In this event, the value is adjusted to the most approximate value and set.
Example	To set the common phase for the data outputs to 10 ps:
	> :MUX:DATA:PADjust 10
Compatibility	Compatible with MU182020A, MU182021A and MP1821A.

:MUX:DATA:PADJust?

Response	\<numeric>=\< NR2 NUMERIC RESPONSE DATA>
Function	Queries the common phase for the Data and XData outputs in ps units.
Example	To query the common phase for the data outputs:
	> :MUX:DATA:PADJust?
	< 10
Compatibility	Compatible with MU182020A, MU182021A and MP1821A.

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:MUX:DATA:PCALibration

Function	Calibrates Data and XData output phase.
Example	To calibrate Data and XData output phase:
	> :MUX:DATA:PCALibration
Compatibility	Compatible with MU182020A, MU182021A and MP1821A.

:MUX:DATA:RELative <boolean>

Parameter	<boolean>=<BOOLEAN PROGRAM DATA>	
	OFF or 0	Reference OFF
	On or 1	Reference ON
Function	Sets the data output delay reference ON or OFF.	
Example	To set the data output delay reference ON:	
	> :MUX:DATA:RELative ON	
Compatibility	Compatible with MU182020A, MU182021A and MP1821A.	

:MUX:DATA:RELative?

Response	<numeric>=<NR1 NUMERIC RESPONSE DATA>	
	0	Reference OFF
	1	Reference ON
Function	Queries Data output delay reference ON or OFF.	
Example	To query the data output delay reference setting:	
	> :MUX:DATA:RELative?	
	< 1	
Compatibility	Compatible with MU182020A, MU182021A and MP1821A.	

:MUX:DATA:RDELay <numeric>[,<unit>]

Parameter	<numeric>=<DECIMAL NUMERIC PROGRAM DATA>	
	(mUI unit) –2000 to 2000 –2000 to 2000 mUI/4 mUI Step	
	(ps unit) Converted from the calculated frequency value, based on the setting resolution of mUI.	
	<unit>=<CHARACTER PROGRAM DATA>	
	UI	mUI units
	PS	ps units (If <unit> is not specified, ps is set by default.)
Function	Sets value and units for data output delay reference.	
	The setting is performed as an increment from the reference value.	
	Sometimes at PS setting, some values cannot be set depending on the setting resolution. In this case, set the closest approximation.	
Example	To set the value for the data output delay reference to –1000 mUI:	
	> :MUX:DATA:RDELay -1000,UI	
Compatibility	Compatible with MU182020A, MU182021A and MP1821A.	

:MUX:DATA:RDELay? [<unit>]

Parameter	<unit>=<CHARACTER PROGRAM DATA>
	UI mUI units
	PS ps units (If <unit> is not specified, ps is set by default.)
Response	<numeric>=< NR2 NUMERIC RESPONSE DATA>
Function	Queries data output delay reference value.
Example	To query the value for the data output delay reference in UI units:
	> :MUX:DATA:RDELay? UI
	< -1000
Compatibility	Compatible with MU182020A, MU182021A and MP1821A.

:MUX:DATA:JINPut <boolean>

Parameter	<boolean>=<BOOLEAN PROGRAM DATA>
	OFF or 0 Jitter Input OFF
	On or 1 Jitter Input ON
Function	Sets Jitter Input.
Example	To set Jitter Input to ON:
	> :MUX:DATA:JINPut ON
Compatibility	Compatible with MU182020A, MU182021A and MP1821A.

:MUX:DATA:JINPut?

Response	<numeric>=< NR2 NUMERIC RESPONSE DATA>
Function	Queries Jitter Input setting.
Example	To query Jitter Input setting:
	> :MUX:DATA:JINPut?
	< 1
Compatibility	Compatible with MU182020A, MU182021A and MP1821A.

:MUX:DATA:LIMitter:AMPLitude <numeric>

Parameter	<numeric>=<DECIMAL NUMERIC PROGRAM DATA>
	0.500 to 2.500 0.500 to 2.500 V/0.002 V step (MP1861A-x11)
	0.500 to 3.500 0.500 to 3.500 V/0.002 V step (MP1861A -x13)
Function	Sets the upper limit for the Data/XData output amplitude.
Example	To set the upper limit for the Data/XData output amplitude to 2.000:
	> :MUX:DATA:LIMitter:AMPLitude 2.000
Compatibility	Compatible with MU182020A, MU182021A and MP1821A.

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:MUX:DATA:LIMitter:AMPLitude?

Response	<numeric>=<NR2 NUMERIC RESPONSE DATA>
Function	Queries the upper limit for the Data/XData output amplitude.
Example	To query the upper limit for the Data/XData output amplitude: > :MUX:DATA:LIMitter:AMPLitude? < 2.000
Compatibility	Compatible with MU182020A, MU182021A and MP1821A.

:MUX:DATA:LIMitter:OFFSet <max>,<min>

Parameter	<max>,<min>=<DECIMAL NUMERIC PROGRAM DATA> –2.000 to 3.300 Voh/0.001 V Step (MP1861A- x11, x13) –4.000 to 2.800 Vol/0.001 V Step (MP1861A -x11, x13)
Function	Sets the limit values for the Data/XData offset.
Example	To set the limit values for the Data/XData output offset to 3.000 Voh max. and –2.000 Vol min.: > :MUX:DATA:LIMitter:OFFSet 3.000,-2.000
Compatibility	Compatible with MU182020A, MU182021A and MP1821A.

:MUX:DATA:LIMitter:OFFSet?

Response	<max>=<NR2 NUMERIC RESPONSE DATA> <min>=<NR2 NUMERIC RESPONSE DATA>
Function	Queries Data/XData output offset limit.
Example	To query the limit values for the Data/XData output offset: > :MUX:DATA:LIMitter:OFFSet? 1 < 3.000, -2.000
Compatibility	Compatible with MU182020A, MU182021A and MP1821A.

:SYSTem:LINK:MUXPpg <boolean>

Parameter	<boolean>=<BOOLEAN PROGRAM DATA> OFF or 0, ON or 1
Function	Sets link between 64G MUX and 32G PPG ON/OFF.
Example	To set link between 64G MUX and 32G PPG to ON: > :SYSTem:LINK:MUXPpg ON
Compatibility	Compatible with MP1821A.

:SYSTem:LINK:MUXPpg?

Response	\<numeric>=\<NR1 NUMERIC RESPONSE DATA>
	0 Link between 64G MUX and 32GPPG OFF
	1 Link between 64G MUX and 32G PPG ON
Function	Queries link between 64G MUX and 32G PPG ON/OFF
Example	> :SYSTem:LINK:MUXPpg?
	< 1
Compatibility	Compatible with MP1821A.

:SYSTem:INPut:DCADjust

Parameter	None
Function	Optimizes the data and clock phases to be input to 64G MUX by setting the delay of 32G PPG.
Example	> :SYSTem:INPut:DCADjust
Compatibility	Incompatible with existing models.

:SYSTem:INPut:DCADjust:AUTO \<boolean>

Parameter	\<boolean>=\< BOOLEAN PROGRAM DATA>
	ON or 1 Auto execution ON
	OFF or 0 Auto execution OFF
Function	Sets whether to automatically run the MUX-PPG Adjust function.
Example	To set to automatically run the MUX-PPG Adjust function:
	> :SYSTem:INPut:DCADjust:AUTO ON
Compatibility	Incompatible with existing models.

:SYSTem:INPut:DCADjust:AUTO?

Response	< setting >=\<NR1 NUMERIC RESPONSE DATA >
	1 Auto execution ON
	0 Auto execution OFF
Function	Queries whether the auto MUX-PPG Adjust function is ON or OFF.
Example	> :SYSTem:INPut:DCADjust:AUTO?
	< 1
Compatibility	Incompatible with existing models.

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Remote

7.3.2 Misc Tab
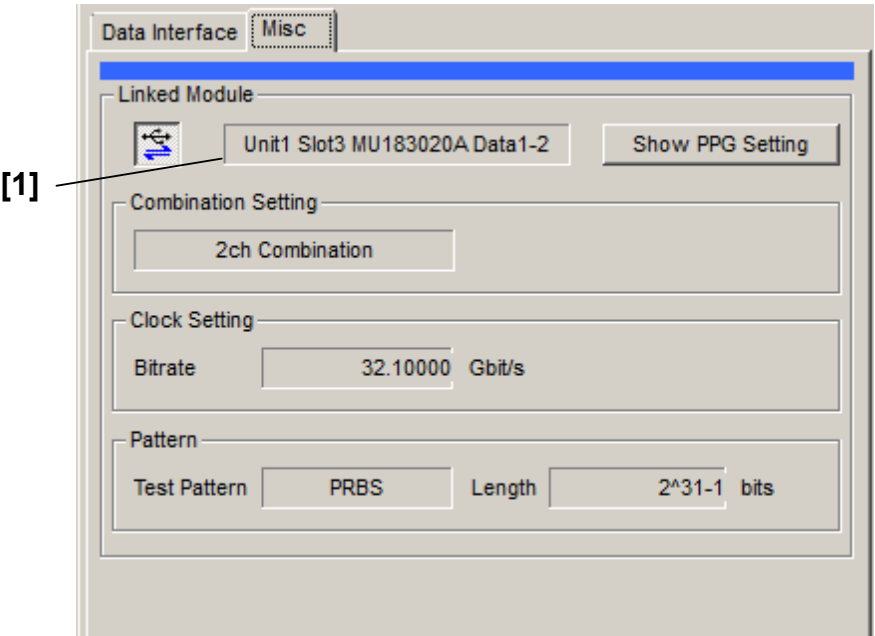
Figure 7.3.2-1   Misc Tab

Table 7.3.2-1   Command for the Item on the Misc Tab

No.	Item	Command
[1]	Linked-PPG information	:SYSTem:LINK:MUXPpg:INFO?

:SYSTem:LINK:MUXPpg:INFO?

Response	\<info>=\<STRING RESPONSE DATA>
	"\<unit>:\<slot> \<module_name> \<data>"
	\<unit>:1 to 4 Unit No.1 to 4
	\<slot>:1 to 6 Slot No.1 to 6
	\<module>:MU183020A or MU183021A
	\<data>:Data1-2 or Data3-4
Function	Queries the information of the 32G PPG that operates linked with the 64G MUX.
Example	> :SYSTem:LINK:MUXPpg:INFO?
	< "1:1 MU183020A Data1-2"
Compatibility	Incompatible with existing models.

Chapter 8 Maintenance

This chapter describes the maintenance of the MP1861A.

8

Maintenance

8.1   Daily Maintenance

- Wipe off any external stains with a cloth damped with diluted mild detergent.
- Vacuum away any accumulated dust or dirt with a vacuum cleaner.
- Tighten any loose parts fixed with screws, using the specified tools.

8.2   Cautions on Storage

Wipe off any dust, soil, or stain on the MP1861A prior to storage. Avoid storing the MP1861A in any of the following locations:

- Where there is direct sunlight
- Where there is dust
- Where humidity is high and dew may accumulate
- Where chemically active gases are present
- Where the MU181020A may become oxidized
- Where strong vibrations are present
- Under either of the following temperature and humidity conditions:
  Temperature range of $\leq-20°C$ or $\geq60°C$
  Humidity range of $\geq85\%$

Recommended storage conditions
In addition to the abovementioned storage cautions, the following environment conditions are recommended for long-term storage.

- Temperature range of 5 to 30°C
- Humidity range of 40 to 75%
- Slight daily fluctuation in temperature and humidity

8.3 Transportation

Use the original packing materials, if possible, when packing the
MP1861A for transport. If you do not have the original packing materials,
pack the MP1861A according to the following procedure. When handling
the MP1861A, always wear clean gloves, and handle it gently so as not to
damage it.

<Procedure>

1.   Use a dry cloth to wipe off any stain or dust on the exterior of the
     MP1861A.

2.   Check for loose or missing screws.

3.   Provide protection for structural protrusions and parts that can
     easily be deformed, and wrap the MP1861A with a sheet of
     polyethylene. Finally, cover with moisture-proof paper.

4.   Place the wrapped MP1861A into a cardboard box, and tape the
     flaps with adhesive tape.   Furthermore, store it in a wooden box as
     required by the transportation distance or method.

5.   During transportation, place it under an environment that meets
     the conditions described in Section 8.2 "Cautions on Storage".

8.4 Calibration

Regular maintenance such as periodic inspections and calibration is
essential for the Signal Quality Analyzer Series for long-term stable
performance. Regular inspection and calibration are recommended for
using the Signal Quality Analyzer Series in its prime condition at all
times. The recommended calibration cycle after delivery of the Signal
Quality Analyzer Series is twelve months.

If you require support after delivery, 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.

We may not provide calibration or repair if any of the following cases
apply.

•   Five or more years have elapsed after production and parts for the
    instrument are difficult to obtain, or it is determined that reliability
    cannot be maintained after calibration/repair due to significant wear.

•   Circuit changes, repair, or modifications are done without our
    approval.

•   It is determined that the repair cost would be higher than the price of
    a new item.

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Maintenance

8.5 Disposal

Confirm the notes described in the Signal Quality Analyzer Series Installation Guide and observe national and local regulations when disposing of the MP1861A. When disposing this product, check with your local solid waste officials for details in your area for recycling options or proper disposal.

Chapter 9 Troubleshooting

This chapter describes how to check for errors that may occur during MP1861A operation.

9

Troubleshooting

9.1 Problems That May Occur When Starting MP1861A

Table 9.1-1   Remedies for Problems That May Occur When Starting MP1861A

Symptom	Location to Check	Remedy
A MP1861A is not recognized.	Is the MP1861A connected with MP1800A or control PC properly?	Install the MP1861A again by referring to Section 2.1 "Before Use".
	Has the power been feed to MP1861A?	Confirm that the MP1861A is set to ON, referring to 2.1 Preparation Before Use.
	Does the using software support the MP1861A operation?	To check the software version of the MP1861A, access to "MP1800 Series Signal Quality" on your Web site (http://www.anritsu.com). If the MP1861A is not recognized, it may have failed. 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.

9.2 Problems That May Occur During Output Waveform Observation

Table 9.2-1   Remedies for Problems That May Occur During Output Waveform Observation

Symptom	Location to Check	Remedy
Output waveform cannot be monitored normally.	Is the [Data/XData] on the **Output** tab set to ON?	On the **Output** tab, set [Data/XData] to be output to ON. When the module function button [Output ON/OFF] is enabled, click it to set to ON.
	Is the **Output ON/OFF** module function button ( ) selected on each MP1861A and MU183020A/B?	Click the module function button [Output ON/OFF] to ON.
	Is the operating clock supplied normally?	Make sure that the following coincide with each other: ・Frequency of the signal output from the signal generator ・The Bit Rate Setting value for MU18302xA ・The Bit-rate monitor value When the clock is supplied externally, check the connection interface. Refer to Section 3.1 "Panel Layout" for the interface.
	Is the trigger clock of MU18302xA set properly?	It is recommended to use the signal output from AUX output connector as the trigger clock. Check the AUX output connector settings and interface with the sampling oscilloscope to be measured.
	Is the coaxial cable loose?	Tighten the connector.
	Do the cables used have good high-frequency characteristics?	Use the cables and connectors which have enough frequency range to the measurement frequency, and less insertion loss as possible.
	Are the connection cables between this module and the MU18302xA connected correctly?	Connect the cables between this module and the MU18302xA as described in Chapter 3 in the correct sequence.
	Is Link operation between MP1861A and the MU18302xA set to ON?	Set Link operation between MP1861A and the MU18302xA to ON and optimize the MP1861A data output. Link operation cannot be turned on unless **Combination** is clicked in the **Combination Setting** dialog box for MU18302xA.

9

Troubleshooting

9.3 Problems That May Occur During Error Rate Measurement

Table 9.3-1   Remedies for Problems That May Occur During Error Rate Measurement

Symptom	Location to Check	Remedy
An error occurs.	Is the connection interface with the DUT to be measured correct?	Check that the data rate, level, offset and termination conditions are the same.
	Is the logic pattern of the MP1861A (or the MU18302xA) and the MP1862A (or the MU18304xA/B) set correctly?	Check that the pattern generated by this module can be received by the DUT, and that the settings for the pattern generated by the DUT and the MP1862A (or MU18304xA/B) detection pattern are matched. If the DUT outputs the patterns from the MP1861A as they are, connect the MP1861A and MP1862A directly to check if an error is detected.
	Were the cables between the MP1861A and the MP1862A connected in the correct sequence?	Connect the cables between the MP1861A and the MP1862A correctly as described in Section 3.2 Connecting modules.
	Is the error addition function set to off?	Check that the MU18302xA [Error Addition] switch on the Error Addition screen is set to off.
	Is the coaxial cable loose?	Tighten the connector.
	Do the cables used have good high-frequency characteristics?	Use the cables and connectors with less insertion loss as possible. (Frequency range: Higher than the measurement frequency)
	Are sufficient phase margin and bias margin secured?	Optimize the phase and offset between the MP1861A and the DUT as well as between the MP1862A and DUT, respectively.

If a problem cannot be solved using any of the items listed above, perform initialization and check the items again. If the problem still occurs, 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.

Appendix A List of Initial Settings

Appendix A describes the default settings for MP1861A.

To initialize all the settings to the factory defaults, click the **File** menu, and then click **Initialize**.

Table A-1   List of Default Settings for MP1861A

Setting Function	Main Item	Secondary Item	Tertiary Item	Default Setting
Data Interface	Data/XData Output ON/OFF			ON
	Amplitude Offset			Vth
	Data/XData	Tracking		OFF
		Level Guard		OFF
		Level Guard Setup	Amplitude	1.000 Vp-p (MP1861A-x11/x13)
			Offset limit	−4.000 Vol/3.300 Voh (MP1861A-x11/x13)
		Defined Interface		Variable (MP1861A-x11/x13)
			Amplitude	1.000 Vp-p (MP1861A-x11/x13)
			Offset switching	AC OFF (MP1861A-x11/x13)
			Offset	0.000 V
			External ATT Factor	0 dB
		Cross Point		50% (MP1861A-x11/x13)
		Half Period Jitter		0
		Adjust		OFF
		Delay		0 mUI (MP1861A-x30)
			Calibration	− (MP1861A-x30)
			Jitter Input	OFF (MP1861A-x30)
			Delay Relative	OFF (MP1861A-x30)
Misc	Linked PPG Module information			−
	Clock Settings, Combination Settings, Pattern			−
−	MUX・PPG Link button			OFF

Appendix B Setting Restrictions

Appendix

Appendix B

B.1 Setting range of offset and amplitude

■ Relationship between offset reference value and amplitude
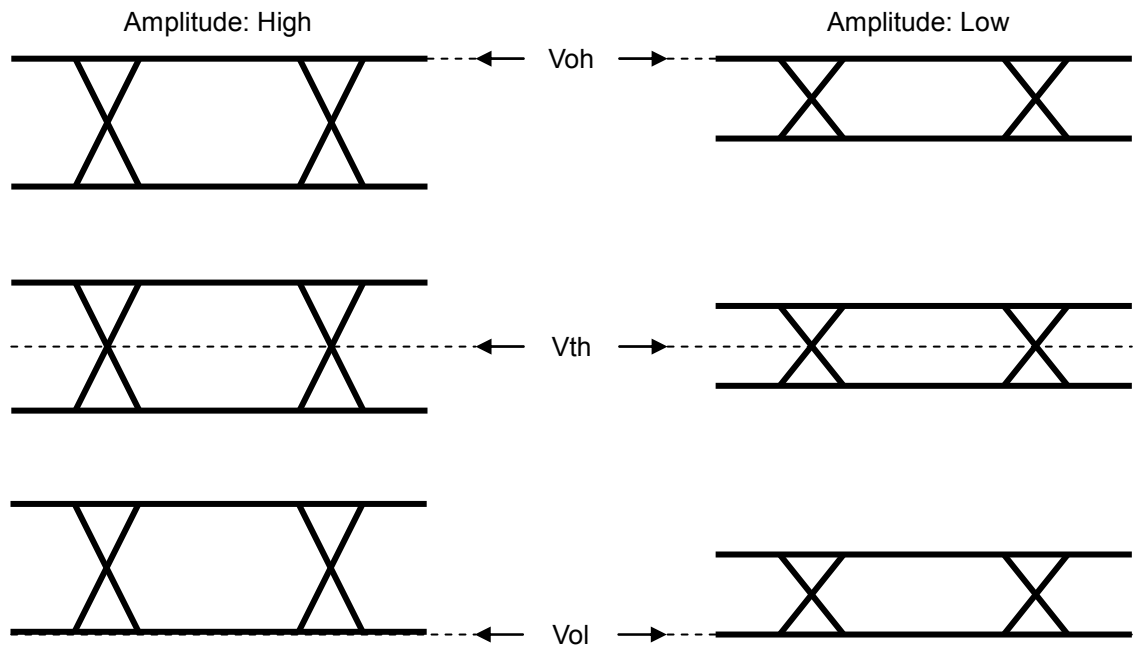
Figure B.1-1   Relationship between offset reference value and amplitude

B.1.1 MP1861A-x11 Variable Data Output (0.5 to 2.5 Vp-p)

<Specification>

Amplitude: 0.5 to 2.5 Vp-p

Offset: −2.0 to +3.3 V (Voh)

(a) Voh
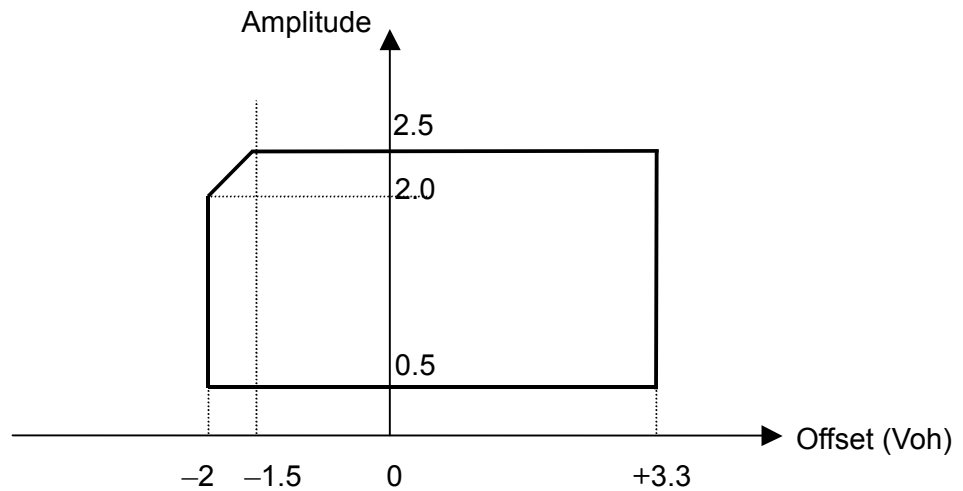
Figure B.1.1-1 Setting range of amplitude and offset based on offset reference (Voh) (MP1861A-x11)

(b) Vth
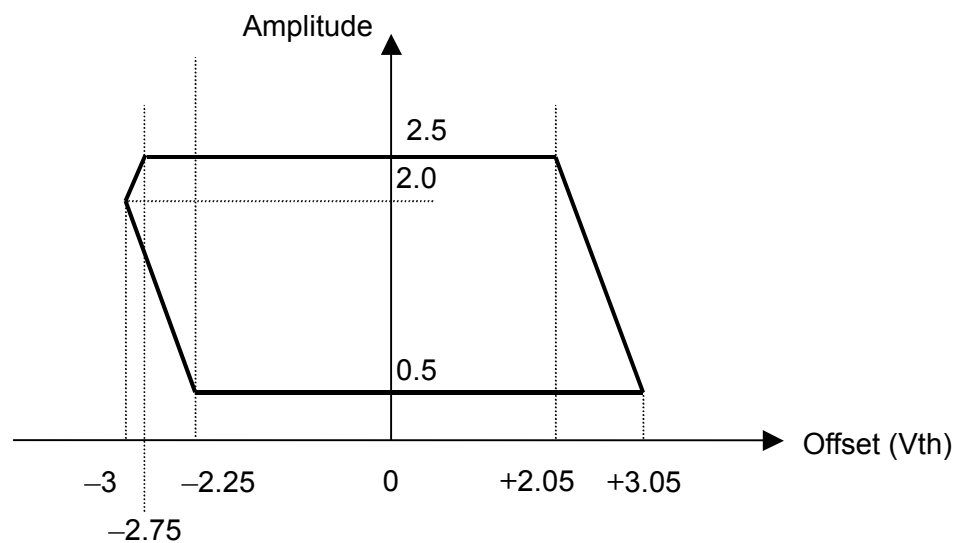
Figure B.1.1-2 Setting range of amplitude and offset based on offset reference (Vth) (MP1861A-x11)

(c)   Vol
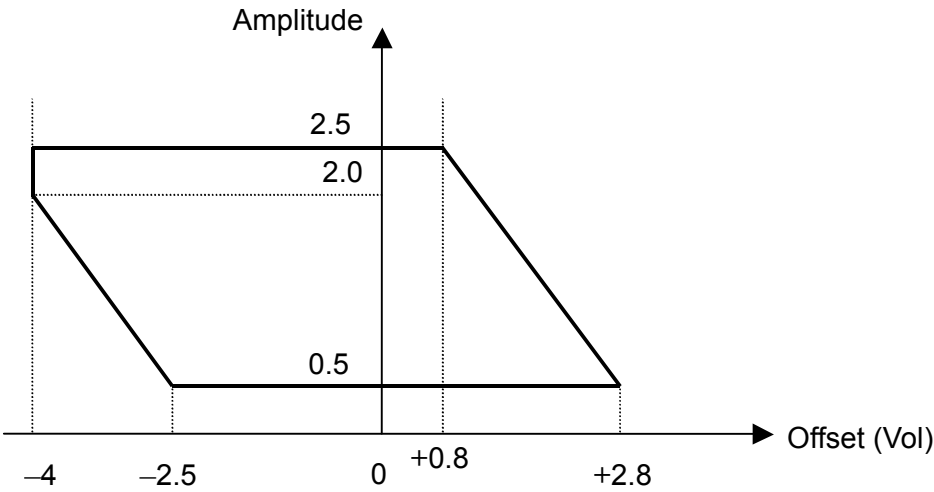
Figure B.1.1-3   Setting range of amplitude and offset based on offset reference (Vol) (MP1861A-x11)

B.1.2 MP1861A-x13 Variable Data Output (0.5 to 3.5 Vp-p)

<Specification>

Amplitude: 0.5 to 3.5 Vp-p

Offset: −2.0 to +3.3 V (Voh)

(a) Voh
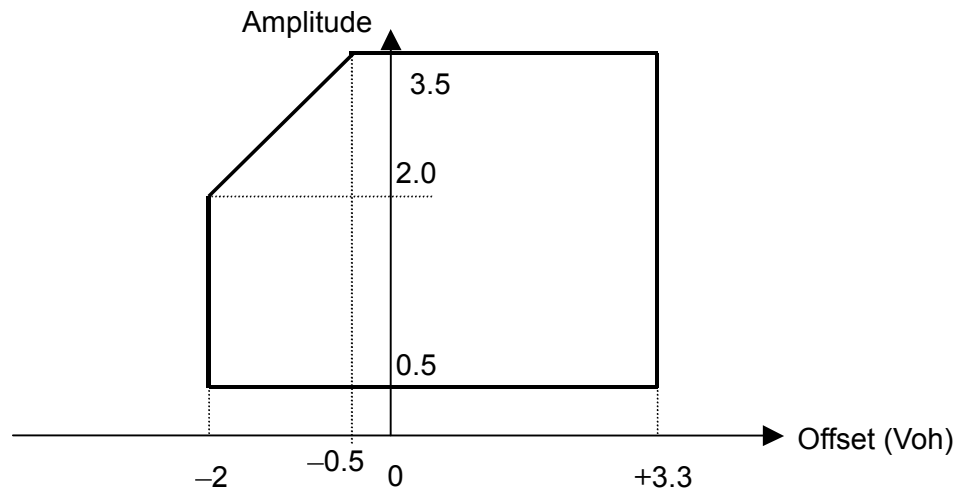
Figure B.1.2-1   Setting range of amplitude and offset based on offset reference (Voh) (MP1861A-x13)

(b) Vth
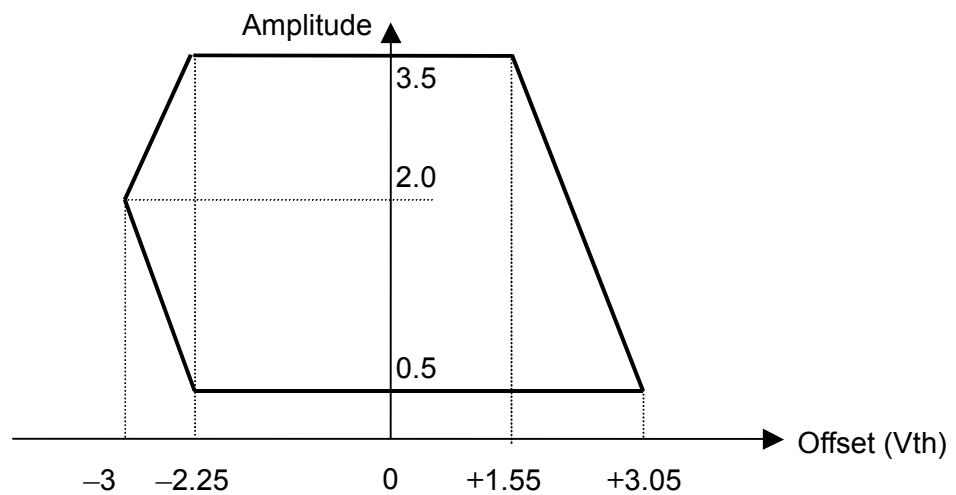
Figure B.1.2-2   Setting range of amplitude and offset based on offset reference (Vth) (MP1861A-x13)

(c) Vol
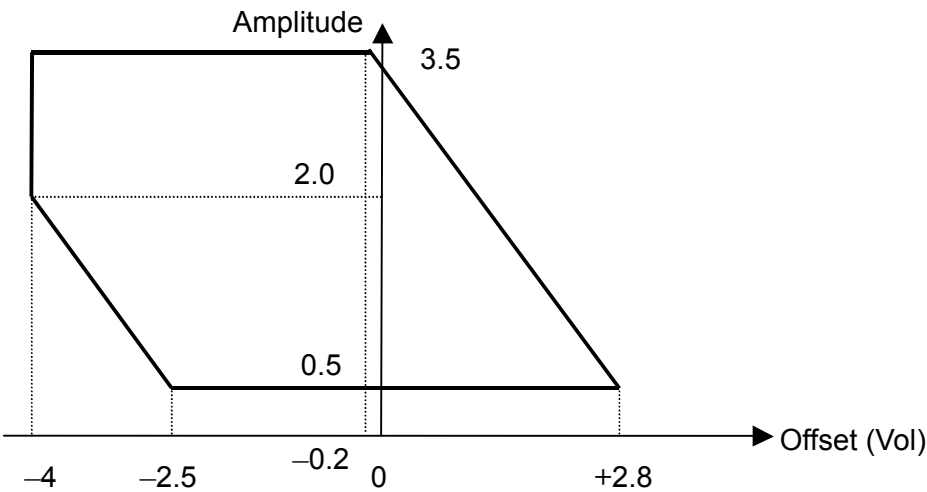
Figure B.1.2-3   Setting range of amplitude and offset based on offset reference (Vol) (MP1861A-x13)

B.2 Combination Function Configuration

This section describes the requirements for executing the Combination function by using multiple MU181020A/B modules.

Following requirements must be met to execute the Combination function.

The module is the MU183020A-x22/x23 or MU183021A.

In addition, the following restriction applies when executing the Combination function.

The Combination function cannot be set between different modules.

B.3 Channel Synchronization Function Configuration

The conditions required to execute the Channel Synchronization function by using multiple MU181020A/B modules are described below.

All of the following conditions must be satisfied to execute the Channel Synchronization function.

Enabling conditions for Channel Synchronization function

- Inter-module Channel Synchronization can be set by the following modules.

  MU183020A-x22/x23

  MU183021A

- 2 Channel Synchronization within a module is available to MU183021A.

B.4 Combination Operation

When MP1861A and MU18302xA are installed in the same mainframe and either 2 Ch Combination or 25G x 2 Ch Combination is selected, operation of MP1861A and MU18302xA can be linked (combined).

The following restrictions apply to the options and Combination setting of the MU18302xA module that can operate linked with MP1861A.

- MU183020A with the MU183020A-x22/x23 2ch Option installed

- MU18302xA with the MU18302xA-x30/x31 Delay Option installed

- The Combination setting for MU18302xA is 2ch Combination, 2ch CH Sync or 64Gx2 Combination.

In addition, the following restrictions apply to the slot position of MU18302xA that operates linked with MP1861A.

- MP1861A set to CH1 operates linked with the MU18302xA installed to the slot of the smallest slot number.

- The order of MP1861A's channel numbers always matches the slot numbers to which MU18302xAs are installed.

MP1861A CH1	→	Slot1	MU183020A Data1−2
MP1861A CH2	→	Slot2	MU183020A Data1−2
MP1861A CH3	→	Slot3	MU183020A Data1−2
MP1861A CH4	→	Slot4	MU183020A Data1−2
		Slot5	−−−
		Slot6	−−−

CH1 and CH2 of MP1861A operate, respectively linked to Slot1 (topmost-installed MU183020A) and Slot2 (second MU183020A from the top).

		Slot1	−−−
MP1861A CH2		Slot2	MU183020A Data1−2
MP1861A CH3		Slot3	MU183020A Data1−2
MP1861A CH4	✖	Slot4	MU183020A Data1−2
		Slot5	−−−
		Slot6	−−−

CH2 of MP1861A operates, linked to not Slot2 (topmost-installed MU183020A) but Slot3 (second MU183020A from the topmost one). CH3 operates, linked to Slot4 (third MU183020A from the topmost one). CH4 is linked to no slot.

MP1861A CH1	→	Slot1	MU183021A Data1−2
MP1861A CH2	→	Slot2	MU183021A Data3−4
MP1862A CH1	→	Slot3	MU183041A Data1−2
MP1862A CH2	→	Slot4	MU183041A Data3−4
		Slot5	−−−
		Slot6	−−−

Channels and slots are linked to each other from the top even when your 32G PPGs are MU183021A.

Figure B.4-1   Restrictions That Apply When Linking to Slots

Appendix

Appendix B

B.5 Settings Common in Combination System

When the MU18302xA is used in a Combination system, some setting items will apply to all the other modules in the Combination system.

Table B.5-1 shows whether the setting items are common or independent in a Combination system.

Table B.5-1   Common/Independent Setting Items in Combination System

Function	Main Category	Sub-Category	Individual Setting Item	Common/ Independent
Output	Data/XData Output ON/OFF			Independent
	Clock Output ON/OFF			Independent
	Amplitude Offset			Independent
	Data/XData	Tracking		Independent
		Level Guard		Independent
		Level Guard Setup		Independent
			Amplitude limit	Independent
			Offset limit	Independent
		Defined Interface		Independent
			Amplitude	Independent
			Offset switching	Independent
			Offset	Independent
			External ATT Factor	Independent
		Cross Point		Independent
		Delay		Independent
			Calibration	Independent
			Jitter Input	Common

Table B.5-1   Common/Independent Setting Items in Combination System (Cont'd)

Function	Main Category	Sub-Category	Individual Setting Item	Common/ Independent
Pattern				Common
	PRBS	Number of Rows		Common
		Logic		Common (Pattern Common)
		Mark Ratio		Common (Pattern Common)
		Bit Shift		Common (Common with Mixed Data)
	Zero-Substitution	Number of Rows		Common
		Zero Substitution Length		Common
		Additional Bit		Common
	Data	Data Pattern		Common
	Mixed Data	Logic		Common (Pattern Common)
		Bit Shift		Common (Common with PRBS)
		Block count		Common
		Row Length		Common
		Data Length		Common
		Row count		Common
		PRBS	Pattern	Common
			Mark Ratio	Common (Pattern Common)
		Scramble		Common
		Scramble Setup		Common
		PRBS Sequence		Common
	Pattern Editor	Zoom		Independent
		Block count		Common
		Row Length		Common
		Data Length	Data	Common
			Mixed	Common
		Row count		Common
Error Addition	Error Addition			Common
		Source		Common
		Variation		Common
		Route		Independent
		Error Rate		Common
		When test pattern is Mixed: Row 1		Common

Table B.5-1   Common/Independent Setting Items in Combination System (Cont'd)

Function	Main Category	Sub-Category	Individual Setting Item	Common/ Independent
Misc1	Pattern Sequence			Common
		Repeat	Pulse Width	Common
			Delay	Common
		Burst	Source	Common
			Data Sequence	Common
			Enable Period	Common
			Burst Cycle	Common
			Delay	Common
			Pulse Width	Common
	Aux Input			Common
	Aux Output			Independent
		1/N Clock		Independent
		Pattern Sync	PRBS, Zero Substitution, Data: Position	Independent
			Mixed Data: Block No. Row No.	Independent
		Burst Output 2	Delay	Common
			Pulse Width	Common
Misc2	Clock Setting	Clock Source		Common
		Bit Rate		Common
		Clock Source Output		Common
		Reference Clock		Common
	Combination Setting	Operation method		Common
		Number of channels for Combination		Common
	Grouping Setting	Grouping item setting		Common

Appendix C Performance Test Record Sheet

C.1 Performance Test Record Sheet

Equipment Name: MP1861A 56G/64Gbit/s MUX

Serial No.:

Ambient Temperature: °C

Relative Humidity: %

Table C.1-1   MP1861A

Option Configuration	Signal Source	Operating Frequency Range Specification	Results
–	Operating Bit Rate	8.0 to 56.2 Gbit/s	
		8.0 to 64.2 Gbit/s (When MP1861-x01 is installed)	
MP1861A-x11 (Variable Data Output (0.5 to 2.5 Vp-p))	Amplitude Setting Error	0.5 to 2.5 Vp-p / 2 mV Step Setting Error: ±50 mV ±17% of Amplitude	
	Offset Setting Error	–2.0 to +3.3 Voh, Min. –4.0 Vol/1 mV Step Setting Error: ±65 mV ±10% of Offset (Vth) ± (Amplitude Setting Error /2)	
	Cross Point Setting Range	45 to 55 %/ 0.1% Step (≤56.2Gbit/s)	
	Tr/Tf	Typ.8 ps (20 to 80%) @56.2 Gbit/s, 2.5 Vp-p	
		Typ.8 ps (20 to 80%) @64.2 Gbit/s, 2.5 Vp-p (When MP1861-x01 is installed)	
	Jitter (RMS)	Typ. 450 fs,≤550 fs*@56.2 Gbit/s, 2.5 Vp-p	
		Typ. 650 fs @64.2 Gbit/s, 2.5 Vp-p (When MP1861-x01 is installed)	
	Random Jitter (RMS)	Typ. 200 fs @56.2 Gbit/s, 2.5 Vp-p *	
	Waveform Distortion (0-peak)	Typ. ±25 mV ±10%@50 Gbit/s, 2.5 Vp-p	

*:   The jitter specification is the value when using an item with an oscilloscope residual jitter of less than 200 fs (rms).

Table C.1-1   MP1861A (Cont'd)

Option Configuration	Signal Source	Operating Frequency Range Specification	Results
MP1861A-x13 (Variable Data Output (0.5 to 3.5 Vp-p))	Amplitude Setting Error	0.5 to 3.5 Vp-p / 2 mV Step Setting Error: ±50 mV ±17% of Amplitude	
	Offset Setting Error	−2.0 to +3.3 Voh, Min.−4.0 Vol/1 mV Step Setting Error: ±65 mV ±10% of Offset(Vth) ±(Amplitude Setting Error/2)	
	Cross Point Setting Range	45〜55%/0.1% Step (≤56.2Gbit/s)	
	Tr/Tf	Typ.8ps (20 to 80%) @56.2 Gbit/s, 2.5 Vp-p	
		Typ.8ps (20 to 80%) @64.2 Gbit/s, 2.5 Vp-p (When MP1861-x01 is installed)	
	Jitter (RMS)	Typ. 450 fs,≤550 fs*@56.2 Gbit/s, 2.5 Vp-p	
		Typ. 650 fs @64.2 Gbit/s, 2.5 Vp-p (When MP1861-x01 is installed)	
	Random Jitter (RMS)	Typ. 200 fs @56.2 Gbit/s, 2.5 Vp-p *	
	Waveform Distortion (0-peak)	Typ. ±25 mV ±10%@50 Gbit/s.	
MP1861A-x30 (Variable Data Delay)	Phase Setting Range	−64000 to +64000 mUI/4 mUI Steps	
	Accuracy	Typ. ±50 mUIp-p	

Appendix D Fault Diagnosis Tool

This appendix describes the fault diagnosis tool using the MP1861A and MP1862A, 32G PPG, ED, and synthesizer.

- The fault diagnosis tool diagnoses hardware faults by running loop-back tests on the MP1861A and MP1862A.
- It supports MX180000A version 8.00.00 or later.

Appendix

Appendix D

D.1 Startup procedure

The startup procedure for the diagnosis tool is shown below.

Select Remote Script Application on the Windows Start menu.The Start menu can be displayed by connecting a keyboard and pressing the Windows key.
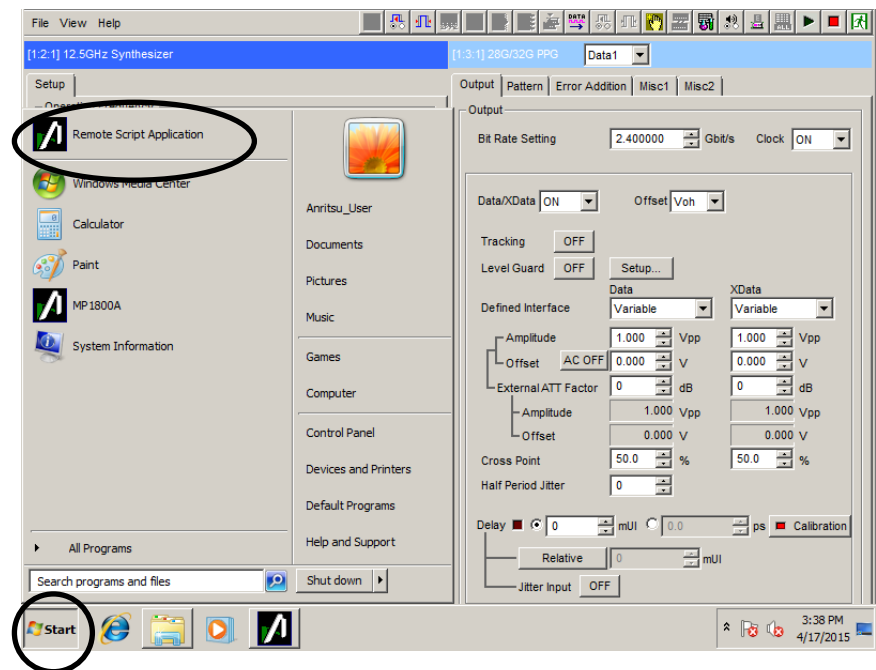
Figure D.1-1   Start button

D.2 Execution procedure

The diagnosis procedure is shown below.

(1) Once the Remote Script tool has launched, click "File" → "DEMUX Diagnosis" in the menu.
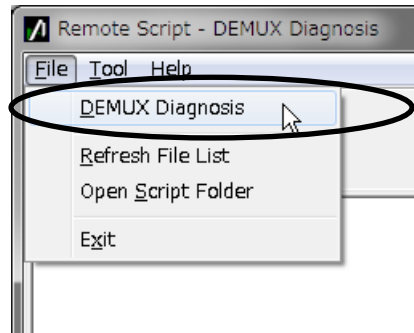
Figure D.2-1　File menu

(2) Click the Setup button and select the test condition.
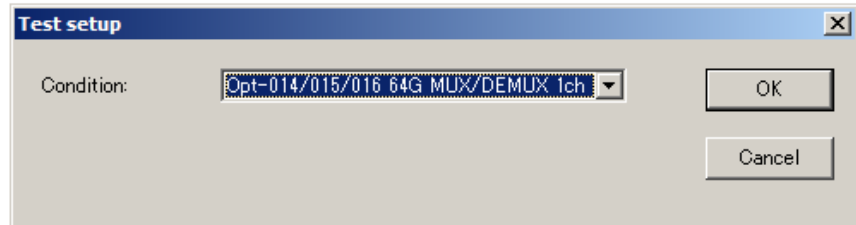
Figure D.2-2　Test condition selection

(3) After selecting the condition, clicking the Guide button displays the connection diagram.
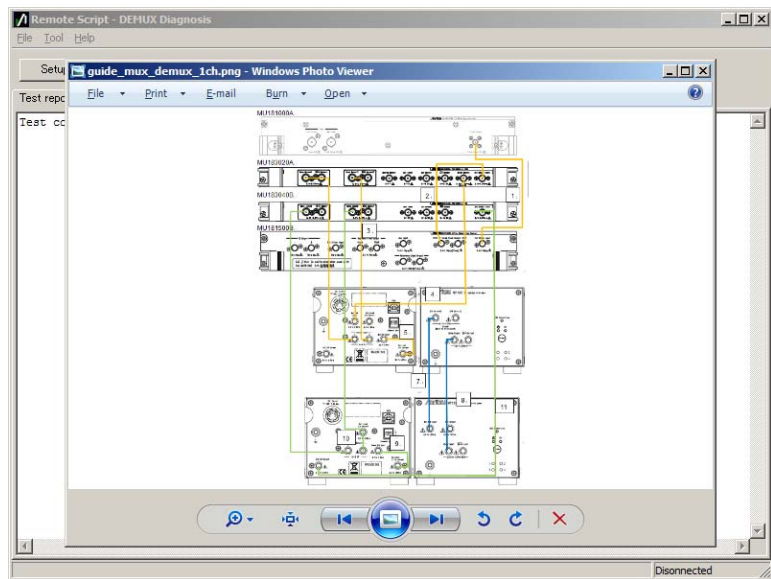
Figure D.2-3   Connection diagram

(4) Click the Start button to start the diagnosis.

Note:

Executing fault diagnosis initializes the other module settings for the MP1861A and MP1862A.
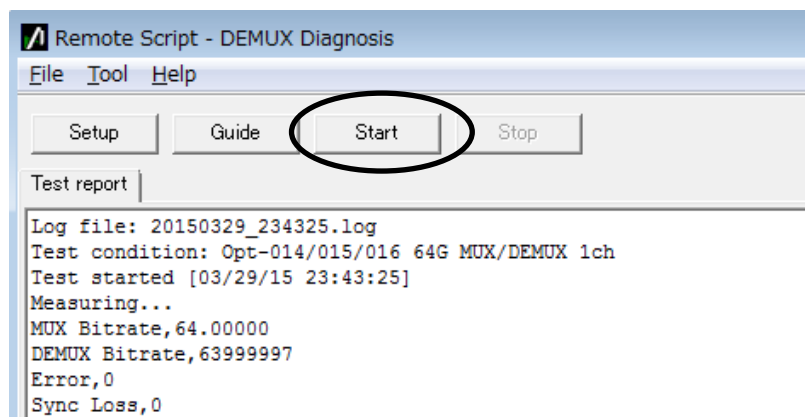
Figure D.2-4   Starting diagnosis

D.3 Viewing and saving results

The results are displayed once diagnosis is complete.

The diagnosis results are also automatically saved as a log file. The log file name is determined automatically from the time and date.

The destination for saving the log file will be as follows for the default installation configuration.

C:\Anritsu\MP1800A\DiagnosticTool\Script\DemuxDiag\Log
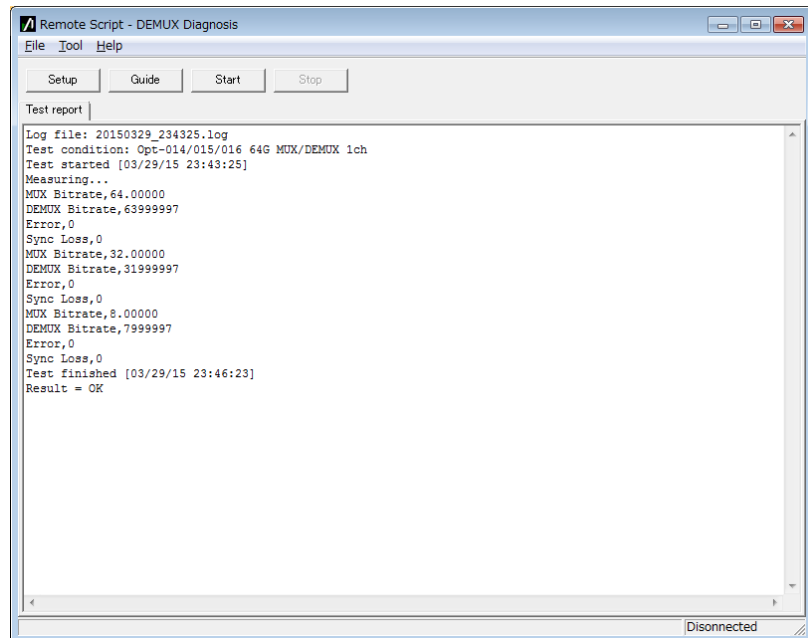
Figure D.3-1   Displaying diagnosis results

D.4 Remote setting

This tool performs a diagnosis via an Ethernet using remote functions.Set the remote setting to Ethernet in the Setup Utility.For details of the Setup Utility and remote settings, refer to the MX180000A Operation Manual.

Note:

> To use Ethernet remote with the MP1800A, Option MP1800-x02 is required.

The remote settings for this tool are set by selecting Tool and then Remote Interface in the menu.
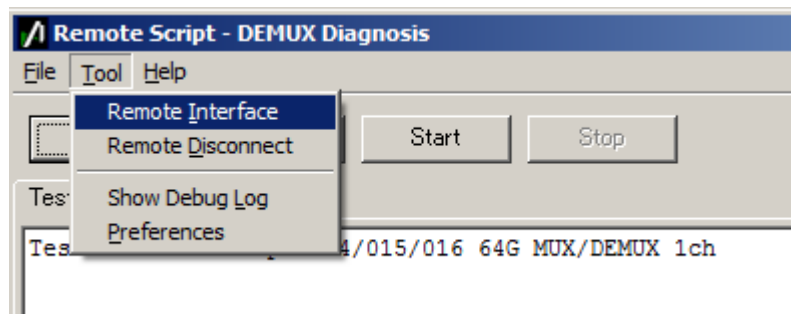
The initial settings are as follows:

Remote Host: 127.0.0.1 (Loopback address)
Remote Port: 5001(MP1800A default)
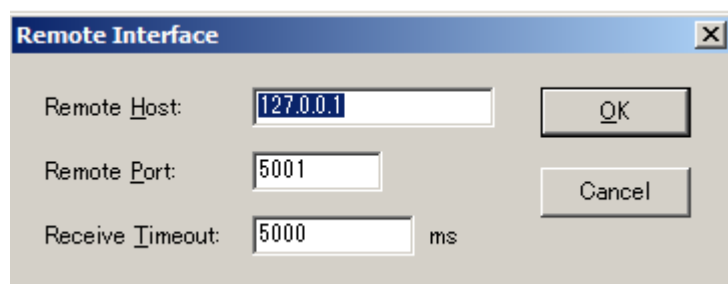
D.5 Software Licenses

This instrument comes with the package software as described in Table D.5-1.

For inquiries about software licenses, refer to the Anritsu website.(http://www.anritsu.com)

Note, however, that the package software is not covered by the Anritsu Software License Agreement.

Table D.5-1 Package Name and License

Package	License
Lua	MIT

Lua:

License for Lua 5.0 and later versions

Copyright © 1994–2010 Lua.org, PUC-Rio.
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Appendix

Appendix D

Appendix E Sequence Examples

This appendix describes sequence examples for BER and automatic measurement using 64G MUX and 64G DEMUX with remote commands.

E.1 System Configuration

The system configuration for the sequence examples consists of the MP1800A with the following devices installed.
The values of "X" in "MOD:ID X" and ":USB:ID X" should be altered if the device installation locations are changed.

Table E.1-1   System configuration for sequence examples

Unit	Module	Module Name	Remarks
UENT (MP1800A)	MOD1	MU181000A	Synthesizer
	MOD2		
	MOD3	MU183020A	PPG
	MOD4	MU183040B	ED
	MOD5	MU181500B	Jitter Module
	MOD6		The setting procedure, such as for initialization, will differ if the MU181500B is not installed.
USB7	-	MP1861A	MUX
USB11	-	MP1862A	DEMUX

Execution examples described from E.2 onward should be used with the examples combined as shown below.

```
                    ┌─────────────────────────────────────┐
                    │        E.2 Initialization            │
                    └─────────────────────────────────────┘
                                      │
      ┌──────────────────────────────▶│
      │             ┌─────────────────────────────────────┐
      │             │  E.3.1, E.3.2, E.3.3 Test Condition  │
      │             │  setting                             │
      │             │  Execute as necessary.               │
      │             └─────────────────────────────────────┘
      │                               │
      │             ┌─────────────────────────────────────┐
      │             │  E.3.4. Setting example of Test      │
      │             │  Conditions - Jitter Input-*¹        │
      │             └─────────────────────────────────────┘
      │                               │
      │             ┌─────────────────────────────────────┐
      │             │  E.3.5. Setting example of Test      │
      │             │  Conditions - Data Output ON-        │
      │             └─────────────────────────────────────┘
      │                               │
      │             ┌─────────────────────────────────────┐
      │             │  E.4. Auto Search Execution Example  │
      │             └─────────────────────────────────────┘
      │                               │
      │            ┌──────────────────┼──────────────────────────┐
      │            │                  │                           ┊
      │     ┌────────────┐   ┌────────────────┐          ┌ ─ ─ ─ ─ ─ ┐
      │     │ E.5.1 BER  │   │ E.5.2 Eye      │                 …
      │     │ measurement│   │ Margin         │          └ ─ ─ ─ ─ ─ ┘
      │     │ execution  │   │ measurement    │                ┊
      │     │ example    │   │ execution      │                ┊
      │     └────────────┘   │ example        │                ┊
      │            │         └────────────────┘                ┊
      │            └──────────┴──────────────────────────────────┘
      └────────────┘
```
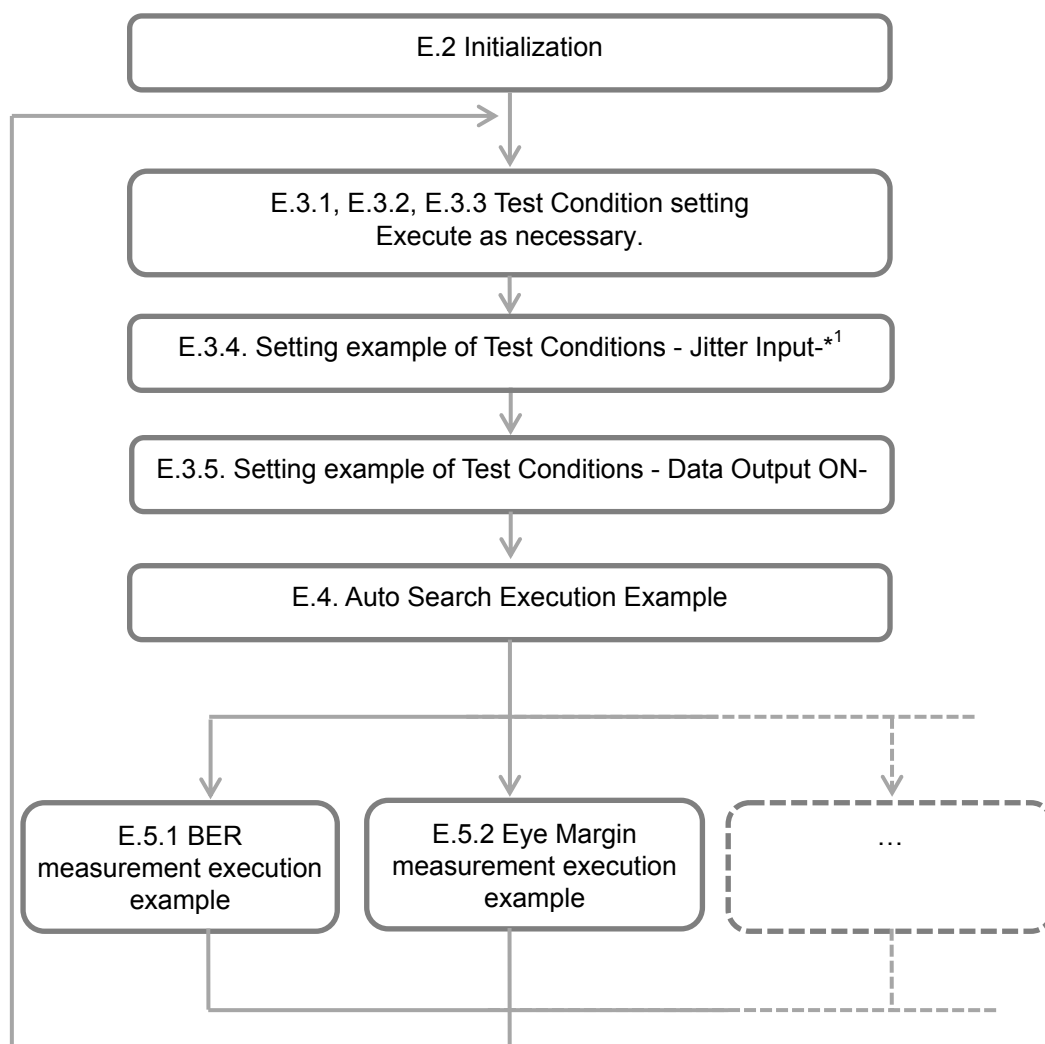
*: Will vary depending on the device configuration and items measured. For specific details, refer to the individual items.

E.2 Initialization

This section describes an example procedure for enabling MUX and DEMUX after initializing the system.

Table E.2-1   Initialization procedure example

Remote Commands	Explanation of Commands

`:UENT:ID 1`
`:SYST:MEM:INIT`
 	
`Wait 10000 ms.`*[2]
	Sets the remote command destination to MP1800A.[1]
	Initializes the system.
	Initialization takes up to 10 seconds to complete.

`:UENT:ID 1;:MOD:ID 6`
 	
`:SYST:INP:CSEL INT1`
`Wait 1000 ms.`*[2]
`:UENT:ID 1;:MOD:ID 3`
`:SYST:INP:CSEL INT2`
`Wait 1000 ms.`*[2]
	Sets the remote command destination to Jitter Module.[1]
	Links the Jitter Module and Synthesizer.
	Link setting requires about one second.
	Sets the remote command destination to PPG.[1]
	Links the PPG and Jitter Module.
	Link setting requires about one second.

`:SYST:OUTP:CRAT FULL`
`:MCOM:OPER:SETT 2`
`Wait 5000 ms. `*[2]
	Sets the PPG Clock Output to "Full Rate".
	Sets the PPG combination to "2ch".
	Combination setting requires about five seconds.

`:USB:ID 7`
`:SYST:LINK:MUXP ON`
`Wait 3000 ms.`*[2]
	Sets the remote command destination to MUX.[1]
	Links the PPG and MUX.
	Link setting requires about 3 seconds.

`:UENT:ID 1;:MOD:ID 4`
`:MCOM:OPER:SETT 2`
`Wait 5000 ms.`*[2]
	Sets the remote command destination to ED.[1]
	Sets the ED combination to "2ch".
	Combination setting requires about five seconds.

`:USB:ID 11`
`:SYST:LINK:DEM ON`
`Wait 3000 ms.`*[2]
	Sets the remote destination to DEMUX.[1]
	Links the ED and DEMUX.
	Link setting requires about 3 seconds.

[1]: Sets the remote command destination for the MX180000A Main Application.

[2]: Wait indicates the recommended wait time for the MX180000A before transmitting the next command. This command is not supported by the MP1800A.

The items shaded in gray in the table above should be replaced with the following remote commands if the MU181500B Jitter Module is not installed in Slot 5 and 6.

Remote Commands	Explanation of Commands
:UENT:ID 1;:MOD:ID 3 :SYST:INP:CSEL INT Wait 1000 ms. *2	Sets the remote command destination to PPG. Links the PPG and Synthesizer. Link setting requires about one second.

E.3 Setting Examples of Measurement Conditions

E.3.1 Setting example of Test Conditions - Pattern, Measurement-

This section describes an example procedure for setting measurement conditions.

Test Pattern, Measurement settings apply to the PPG/ED linked to the MUX/DEMUX.

Table E.3.1-1 Setting example of Test Pattern and Measurement

Remote Commands	Explanation of Commands

`:UENT:ID 1;:MOD:ID 3`
`:SOUR:PATT:TYPE PRBS`
`:SOUR:PATT:PRBS:LENG 31`
	Sets the remote command destination to PPG.
	Sets the PPG Test Pattern to "PRBS31".

`:UENT:ID 1;:MOD:ID 4`
`:SENS:PATT:TYPE PRBS`
`:SENS:PATT:PRBS:LENG 31`
	Sets the remote command destination to ED.
	Sets the ED Test Pattern to "PRBS31".

`:SENS:MEAS:EAL:MODE SING`
 	
`:SENS:MEAS:EAL:UNIT CLOC`
`:SENS:MEAS:EAL:CLOC E_12`
	Sets the ED measurement mode to "single".
	Measurement stops when the following measurement cycle conditions are satisfied.
	Sets the ED measurement cycle units to "Clock".
	Sets the ED measurement cycle to a Clock Count of 1E + 12.

E.3.2 Setting example of Test Conditions - RF Output/Input-

This section describes an example procedure for setting the functions displayed in the MUX "Data Interface tab" or DEMUX "Interface tab".

Table E.3.2-1 Setting example of Data Input/Output

Remote Commands	Explanation of Commands

`:USB:ID 11`
`:DEM:DATA:INT DIF50`
`:DEM:DATA:DIFF ALT`
	Sets the remote command destination to DEMUX.
	Sets the DEMUX Data Input Condition to "Differential 50ohm" "Alternate".

`:USB:ID 7`
`:MUX:DATA:TRAC ON`
 	
`:MUX:DATA:AMPL DATA,0.500`
	Sets the remote command destination to MUX.
	Sets the MUX Data and Xdata output conditions to the same values.
	Sets the MUX Data Output Amplitude to "0.5 Vpp".

E.3.3 Setting example of Test Conditions - Data Bitrate-

This section describes an example procedure for setting Output Bitrate. The Bitrate settings apply to the PPG/ED linked to the MUX/DEMUX.

Table E.3.3-1   Setting example of Output Bitrate

Remote Commands	Explanation of Commands
`:UENT:ID 1;:MOD:ID 3`	Sets the remote command destination to PPG.
`:OUTP:DATA:BITR 28.0`	Sets the PPG output bit rate to 25G (56G for MUX output).
`Wait 10000 ms.*`	Up to 10 seconds are required for the system clock to stabilize and for completion of phase adjustment of the Data and Clock input to the MUX.

*:   Wait- indicates the recommended wait time for sending the command. This command is not supported by the MP1800A.

E.3.4 Setting example of Test Conditions - Jitter Input-

This section describes an example procedure for setting Jitter Input. The recommended Jitter Input setting varies depending on the measurement conditions.

For Eye Diagram, Eye Margin, and Bathtub measurement:
- Send the following remote commands when the MU181500B Jitter Module is installed.

Table E.3.4-1   Jitter Input examples with MU181500B installed

Remote Commands	Explanation of Commands
`:USB:ID 7`	Sets the remote command destination to MUX.
`:MUX:DATA:JINP OFF`	Sets MUX Jitter Input to OFF.
`:USB:ID 11`	Sets the remote command destination to DEMUX.
`:DEM:CLOC:JINP OFF`	Sets DEMUX Jitter Input to OFF.
`:DEM:CLOC:BAND QUAT`	Sets DEMUX Clock Input to Quarter Rate.*
	The DEMUX Ext Clk Input and Jitter Module Reference Clock Output must be connected using a coaxial cable.
`:UENT:ID 1;:MOD:ID 6`	Sets the remote command destination to Jitter Module.
`:OUTP:AUX:REFC 1`	Sets Reference Clock to 1/1 clock output.

*:   Sets the argument as shown below depending on the measurement bit rate.

60 Gbps < Bitrate ≤ 64 Gbps 1/8 Clock Rate(EIGH)

30 Gbps < Bitrate $\leq$ 60 Gbps Quarter Clock Rate(QUAT)

Bitrate $\leq$ 30 Gbps   Half Clock Rate(HALF)

- Send the following remote commands when the MU181500B (Jitter Module) is not installed.

Table E.3.4-2   Jitter Input examples with MU181500B not installed

Remote Commands	Explanation of Commands
:USB:ID 7 :MUX:DATA:JINP OFF :USB:ID 11 :DEM:CLOC:JINP OFF :DEM:CLOC:BAND HALF	Sets the remote command destination to MUX. Sets MUX Jitter Input to OFF.*1 Sets the remote command destination to DEMUX. Sets DEMUX Jitter Input to OFF.*1 Sets DEMUX Clock Input to Half Rate. The DEMUX Ext Clk Input and MUX Clk Output (or equivalent signal) must be connected using a coaxial cable.

Send the following remote commands for MX181500A Jitter Application measurement.
MX181500A Jitter Application is launched after this command is sent.
For example command sequences and how to start MX181500A, refer to the MX181500A Operation Manual.

Table E.3.4-3   Jitter Input examples for MX181500A Jitter Application Measurement

Remote Commands	Explanation of Commands
:USB:ID 7 :MUX:DATA:JINP ON :USB:ID 11 :DEM:CLOC:JINP ON :DEM:CLOC:BAND HALF	Sets the remote command destination to MUX. Sets MUX Jitter Input to ON. Sets the remote command destination to DEMUX. Sets DEMUX Jitter Input to ON. Sets DEMUX Clock Input to Half Rate. The DEMUX Ext Clk Input and MUX Clk Output (or equivalent signal) must be connected using a coaxial cable.

E.3.5 Setting example of Test Conditions - Data Output ON-

This section describes the procedure for setting the MUX Data Output to ON.

Table E.3.5-1   Setting example of MP1861A Data Output ON

Remote Commands	Explanation of Commands
:USB:ID 7	Sets the remote command destination to MUX.
:MUX:DATA:OUTP ON	Enables the MUX Data Output.
:SOUR:OUTP:ASET ON	Enables Data Output for the entire system.
Wait 6000 ms. *2	The phase of the Data and Clock input to the MUX is automatically adjusted after initialization. About six seconds are required until completion.*1
:SYST:INP:DCAD:AUTO ON	Enables the function to automatically adjust the phase of the Data and Clock input to the MUX.*2

*1: Wait- indicates the recommended wait time for sending the command. This command is not supported by the MP1800A.

*2: To specify the timing for executing phase adjustment of the Data and Clock input to the MUX, set to OFF. If set to OFF, the Wait processing unit can be replaced using the procedure described in "E.6 Use Example of Status Command".

Appendix

Appendix E

E.4 Auto Search Execution Example

This section describes an example procedure for Auto Search with respect to DEMUX.

Using Auto Search sets the optimum Vth, Delay for the input Data.

Table E.4-1   Auto Search execution setting example

Remote Commands	Explanation of Commands
`:SYST:CFUN OFF`	Closes the Automatic Measurement screen currently open.
`:SYST:CFUN ASE32`	
`:SENS:MEAS:ASE:SLAS`	Opens the Auto Search screen.
	Enables all modules allowing Auto Search.
`:SENS:MEAS:ASE:SMOD COAR`	Selects Auto Search Coarse.
`:SENS:MEAS:ASE:MODE PTHR`	Selects Search for the Vth, Phase direction.
`:SENS:MEAS:ASE:STAR`	Starts Auto Search.
`:SENS:MEAS:ASE:STAT?`	About 20 seconds are required for DEMUX Auto Search (Coarse) to complete. (When the DEMUX Input Condition is Single ended)
`:SENS:MEAS:ASE:STAT?`	Determines that Auto Search has started. A return value of "1" indicates that measurement has started.*
`:SYST:CFUN OFF`	Determines that Auto Search has ended. A return value of "0" indicates that measurement has ended, and a value of "–1" indicates that measurement failed.*
	Closes the Auto Search screen.

*: Use processing corresponding to C language "for" and "While" statements for this processing to send queries until the expected value is detected. Set the sending interval between queries to at least 200 ms to avoid overloading the instrument used for the measurement processing. Execute the next command after the expected value has been detected.

E.5 Measurement

E.5.1 BER measurement execution example

This section describes an example procedure for BER measurement.

Table E.5.1-1   BER measurement setting example

Remote Commands	Explanation of Commands
`:USB:ID 11;:DISP:ACT 0,11,1` `:DEM:MEAS:STAR`	Sets the remote command destination to DEMUX.
`:DEM:MEAS:EAL:STAT?`	Starts BER measurement.
`:DEM:MEAS:EAL:STAT?`	Determines that BER measurement has started. A return value of "1" indicates that measurement has started.*
`:DEM:MEAS:STOP`	Determines that BER measurement has ended. The return value will be "0" when measurement ends if the ED Measurement Conditions are set to "Single".*
`:DEM:CALC:DATA:EAL? "CURR:FREQ"` `:DEM:CALC:DATA:EAL? "CURR:ER:TOT"`	Stops BER measurement after the wait time if the ED measurement cycle is set to "Repeat" or "Untimed".
`:DEM:CALC:DATA:EAL? "CURR:EC:TOT"`	Queries Frequency.
`:DEM:CALC:DATA:EAL? "CURR:CC:TOT"`	Queries Error Rate.
`:DEM:CALC:DATA:EAL? "CURR:AINT:PSL"`	Queries Error Count.
	Queries Clock Count.
	Queries the Sync Loss occurrence state.

*:   Use processing corresponding to C language "for" and "While" statements for this processing to transmit queries until the expected value is detected. Set the sending interval between queries to at least 200 ms to avoid overloading the instrument used for the measurement processing. Execute the next command after the expected value has been detected.

E.5.2 Eye Margin measurement execution example

This section describes an example procedure for Eye Margin.

Table E.5.2-1   Eye Margin measurement setting example

Remote Commands	Explanation of Commands

`:UENT:ID 1`
`:SYST:CFUN OFF`
`:SYST:CFUN EMAR32`
`:SENS:MEAS:EMAR:MARG:SLOT`
`USB11,1,ON`
	Sets the remote command destination to MP1800A.
	Closes the Automatic Measurement screen currently open.
	Opens the Eye Margin measurement screen.
	Sets the measurement target to USB11 (DEMUX).

`:SENS:MEAS:EMAR:MARG:ASE ON,1`
`:SENS:MEAS:EMAR:MARG:RES COAR`
`:SENS:MEAS:EMAR:MARG:THR E_8`
`:SENS:MEAS:STAR`
`:SENS:MEAS:EMAR:STAT?`
	Executes Auto Search Coarse when measurement starts.
	Sets the measurement accuracy to Coarse.
	Sets the measured BER value to 1E–8.
	Starts Eye Margin measurement.

`:SENS:MEAS:EMAR:STAT?`
 	
`:SENS:MEAS:STOP`
	Determines that Eye Margin measurement has started. A return value of "1" indicates that measurement has started.[1]
	Determines that Eye Margin measurement has ended. A return value of "0" indicates that measurement has ended, and a value of "–1" indicates that measurement failed. [1]
	Stops Eye Margin measurement.

`:CALC:DATA:EMAR?`
`USB11,1,"THR"`
`:CALC:DATA:EMAR?`
`USB11,1,"PHAS"`
	Returns the Eye Margin (Threshold) results.
	
	Returns the Eye Margin (Phase) results.

`:SYST:MMEM:MARG:STOR`
`"C:\Test\emexample",CSV`
`:SYST:MMEM:MARG:STOR`
`"C:\Test\emexample",BIN`
`:SYST:CFUN OFF`
	Saves the measurement results in CSV format to a specified folder.[2]
	Saves the measurement results in BIN format to a specified folder.[2, 3]
	Closes the Eye Margin measurement screen.

*1: Use processing corresponding to C language "for" and "While" statements for this processing to send queries until the expected value is detected. Set the sending interval between queries to at least 200 ms to avoid overloading the instrument used for the measurement processing. Execute the next command after the expected value has been detected.

*2: If no directory exists for saving measurement results ("C:\Test" in this example), one must be created beforehand by the user. Saving using the same file name ("example" in this example) will overwrite

the previous results. Alter the file name if you wish to repeatedly save results.

*3:   Saved BIN results can be loaded by sending the following command with the Eye Margin measurement screen open.

`:SYST:MMEM:MARG:REC "C:\Test\emexample"`

E.5.3 Eye Diagram measurement execution example

This section describes an example procedure for Eye Diagram.

Table E.5.3-1   Eye Diagram measurement setting example

Remote Commands	Explanation of Commands

`:UENT:ID 1`
`:SYST:CFUN OFF`
`:SYST:CFUN EDI32`
`:SENS:MEAS:EDI:DIAG:SLOT`
`USB11,1,ON`
`:SENS:MEAS:EDI:DIAG:TYPE`
`POIN16`
`:SENS:MEAS:EDI:DIAG:ASE OFF`
 	
`:DISP:RES:EDI:TABS DIAG`
 	
`:SENS:MEAS:EDI:DIAG:ATHR OFF`
`:DISP:RES:EDI:AER OFF`
`:SENS:MEAS:EDI:DIAG:THR E_3,ON`
`:DISP:RES:EDI:ERAT E_3,1`
`:SENS:MEAS:EDI:DIAG:THR E_8,ON`
`:DISP:RES:EDI:ERAT E_8,1`
`:SENS:MEAS:EDI:DIAG:STAR`
`:SENS:MEAS:EDI:STAT?`
 	
`:SENS:MEAS:EDI:STAT?`
 	
`:SENS:MEAS:EDI:DIAG:STOP`
`:DISP:RES:EDI:SCAL:ASC`
`:SYST:MMEM:DIAG:STOR`
`"C:\Test\edexample",EDG,CSV`
`:SYST:MMEM:DIAG:STOR`
`"C:\Test\edexample",EDG,BIN`
`:SYST:CFUN OFF`
	Sets the remote command destination to MP1800A.
	Closes the Automatic Measurement screen currently open.
	Opens the Eye Diagram measurement screen.
	Sets the measurement target to USB11 (DEMUX).
	
	Sets the number of measurement points to 16.
	
	Does not execute Auto Search Coarse when measurement starts.
	Displays the Eye Diagram Diagram screen.
	
	Clears the measurement and BER value displayed.
	
	Sets the measurement and displayed BER value to 1E-3.
	
	Sets the measurement and displayed BER value to 1E-8.
	
	Starts Eye Diagram measurement.
	Determines that Eye Diagram measurement has started. A return value of "1" indicates that measurement has started.[1]
	Determines that Eye Diagram measurement has ended. A return value of "0" indicates that measurement has ended, and a value of "–1" indicates that measurement failed.[1]
	Stops Eye Diagram measurement.
	Adjusts the measurement screen scale.
	Saves the measurement results in CSV format to a specified folder.[2]
	Saves the measurement results in BIN format to a specified folder.[2, 3]
	Closes the Eye Diagram measurement screen.

*1:   Use processing corresponding to C language "for" and "While" statements for this processing to send queries until the expected value is detected. Set the sending interval between queries to at least 200 ms to avoid overloading the instrument used for the

measurement processing. Execute the next command after the expected value has been detected.

*2: If no directory exists for saving measurement results ("C:\Test" in this example), one must be created beforehand by the user. Saving using the same file name ("example" in this example) will overwrite the previous results. Alter the file name if you wish to repeatedly save results.

*3: Saved BIN results can be loaded by sending the following command with the Bathtub measurement screen open.

```
:SYST:MMEM:DIAG:REC "C:\Test\edexample",BIN
```

E.5.4 Bathtub measurement execution example

This section describes an example procedure for Bathtub measurement. This example assumes that DEMUX has been synchronized with the input data by executing Auto Search beforehand. (Refer to E.4 Auto Search Execution Example.)

Table E.5.4-1   Bathtub measurement setting example

Remote Commands	Explanation of Commands
`:UENT:ID 1`	Sets the remote command destination to MP1800A.
`:SYST:CFUN OFF`	Closes the Automatic Measurement screen currently open.
`:SYST:CFUN BTUB32`	Opens the Bathtub measurement screen.
`:SENS:MEAS:BATH:SELS USB11,1,ON`	Sets the Bathtub measurement target to USB11 (DEMUX).
`:SENS:MEAS:BATH:ASE OFF`	Sets so that Auto Search is not performed when measurement starts.
`:SENS:MEAS:BATH:MODE REP`	Sets measurement to Repeat mode.
`:SENS:MEAS:BATH:TIM 5`	Set the repeat measurement count to five times.
`:SENS:MEAS:BATH:RES:MUI 4`	Sets the minimum number of Delay steps to "4 mUI".
`:SENS:MEAS:BATH:ECO COAR`	Determines BER for a measurement point when an error is counted during measurement at that measurement point.
`:SENS:MEAS:BATH:RANG E_10`	Sets the lower limit for the measured BER range to 1E–10.
`:SENS:MEAS:BATH:CALR E_5,E_10`	Sets the BER range used for jitter calculation from 1E–5 to 1E–10.
`:SENS:MEAS:BATH:STAR`	Starts Bathtub measurement.
`:SENS:MEAS:BATH:STAT?`	Determines that Bathtub measurement has started. A return value of "1" indicates that measurement has started.[1]
`:SENS:MEAS:BATH:STAT?`	Determines that Bathtub measurement has ended. A return value of "0" indicates that measurement has ended.[1]
`:SENS:MEAS:BATH:STOP`	Stops Bathtub measurement.
`:SYST:MMEM:BATH:STOR "C:\Test\btexample",PSB,CSV`	Saves the measurement results in CSV format to a specified folder.[2]
`:SYST:MMEM:BATH:STOR "C:\Test\btexample",PSB,BIN`	Saves the measurement results in BIN format to a specified folder.[2, 3]
`:SYST:CFUN OFF`	Closes the Bathtub screen.

[1]: Use processing corresponding to C language "for" and "While" statements for this processing to send queries until the expected value is detected. Set the sending interval between queries to at least 200 ms to avoid overloading the instrument used for the

measurement processing. Execute the next command after the expected value has been detected.

*2: If no directory exists for saving measurement results ("C:\Test" in this example), one must be created beforehand by the user. Saving using the same file name ("example" in this example) will overwrite the previous results. Alter the file name if you wish to repeatedly save results.

*3: Saved BIN results can be loaded by sending the following command with the Bathtub measurement screen open.

```
:SYST:MMEM:BATH:REC "C:\Test\btexample"
```

E.6 Use Example of Status Command

This section describes an example procedure for executing PPG-MUX Adjustment and loading status using remote commands.

Table E.6-1   Use Example of Status Command

Remote Commands	Explanation of Commands
`:USB:ID 7;:DISP:ACT 0,7,1`	Sets the remote command destination to MUX.
`:INST:MUX:RES`	Initializes the status register.
`:INST:MUX:PTR 32`	Sets the positive logic Transition. Set to 32 (bit 5) here to determine the Adjustment state between PPG-MUX.
`:INST:MUX:NTR 0`	Sets the negative logic Transition. Set to 0 here, as negative logic is not checked.
`:INST:MUX:EVEN?`	Clears Event with one query.
`:SYST:INP:DCAD`	Starts PPG-MUX Adjustment.
`:INST:MUX:EVEN?`	Determines that Adjustment has started. Querying continues until the return value is "32".*
`:INST:MUX:COND?`	Determines that Adjustment has ended. Querying continues until the return value is "0".*

*:   Use processing corresponding to C language "for" and "While" statements for this processing to send queries until the expected value is detected. Set the sending interval between queries to at least 200 ms to avoid overloading the instrument used for the measurement processing. Execute the next command after the expected value has been detected.