

MP1821A 50G/56Gbit/s MUX Operation Manual

Fifth 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.

MP1821A 50G/56Gbit/s MUX
Operation Manual

18 June 2010 (First Edition)
20 June 2013 (Fifth Edition)

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The contents of this manual may be changed without prior notice.

Printed in Japan

For Safety

WARNING



- 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.

Electric Shock

- 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 

- 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.

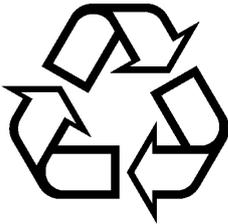
Use in Corrosive Atmospheres

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.

For Safety

FOR U.S. CUSTOMERS

Please Recycle.



Ni-Cd

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

Before disposing of this product, discharge the battery and mail it to your Anritsu Service or Sales office.

1. Attach the battery pack to the product.
2. Disconnect the AC adapter, if used.
3. Turn the power switch to on.
4. Leave the product on until the power indicator goes off; the battery is now discharged.
5. Remove the battery.
6. Insulate the battery terminals with adhesive tape.
7. Mail it to your Anritsu Service or Sales office, or to the following address.

ANRITSU COMPANY
490 Jarvis Drive, Morgan Hill, CA 95037-2809, USA

For Safety

FOR EU & EFTA CUSTOMERS

Please Recycle.



Ni-Cd



Read the following when using products to which the mark shown on the above is attached.

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

Before disposing of this product, discharge the battery and mail it to your Anritsu Service or Sales office.

1. Disconnect the AC adapter, if used.
2. Turn the power switch to on.
3. Leave the product on until the power indicator goes off; the battery is now discharged.
4. Remove the battery.
5. Insulate the battery terminals with adhesive tape.
6. Please recycle in accordance with your national or regional legislation.

Nach Gebrauch der Ver Kaufsstelle Zurückgeben.

Après usage à rapporter au point de vente.

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 environment" 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 places where chemically active gases (SO₂, H₂S, Cl₂, NH₃, NO₂, or HCl, 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 2002/96/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.

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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.

CE Conformity Marking

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

CE marking



1. Product Model

Model: MP1821A 50G/56Gbit/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: 2006 (Class A)
Immunity: EN 61326-1: 2006 (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: During testing, normal performance within the specification limits.
- B: During testing, temporary degradation, or loss of function or performance which is self-recovering.
- C: During testing, temporary degradation, or loss of function or performance which requires operator intervention or system reset occurs.

Harmonic current emissions:

EN 61000-3-2: 2006 +A1:2009 A2:2009

(Class A equipment)

: No limits apply for 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 marking on the following product(s) in accordance with the regulation to indicate that they conform to the EMC framework of Australia/New Zealand.

C-Tick marking



1. Product Model

Model: MP1821A 50G/56Gbit/s MUX

2. Applied Directive and Standards

EMC: Emission: EN 61326-1: 2006 (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.

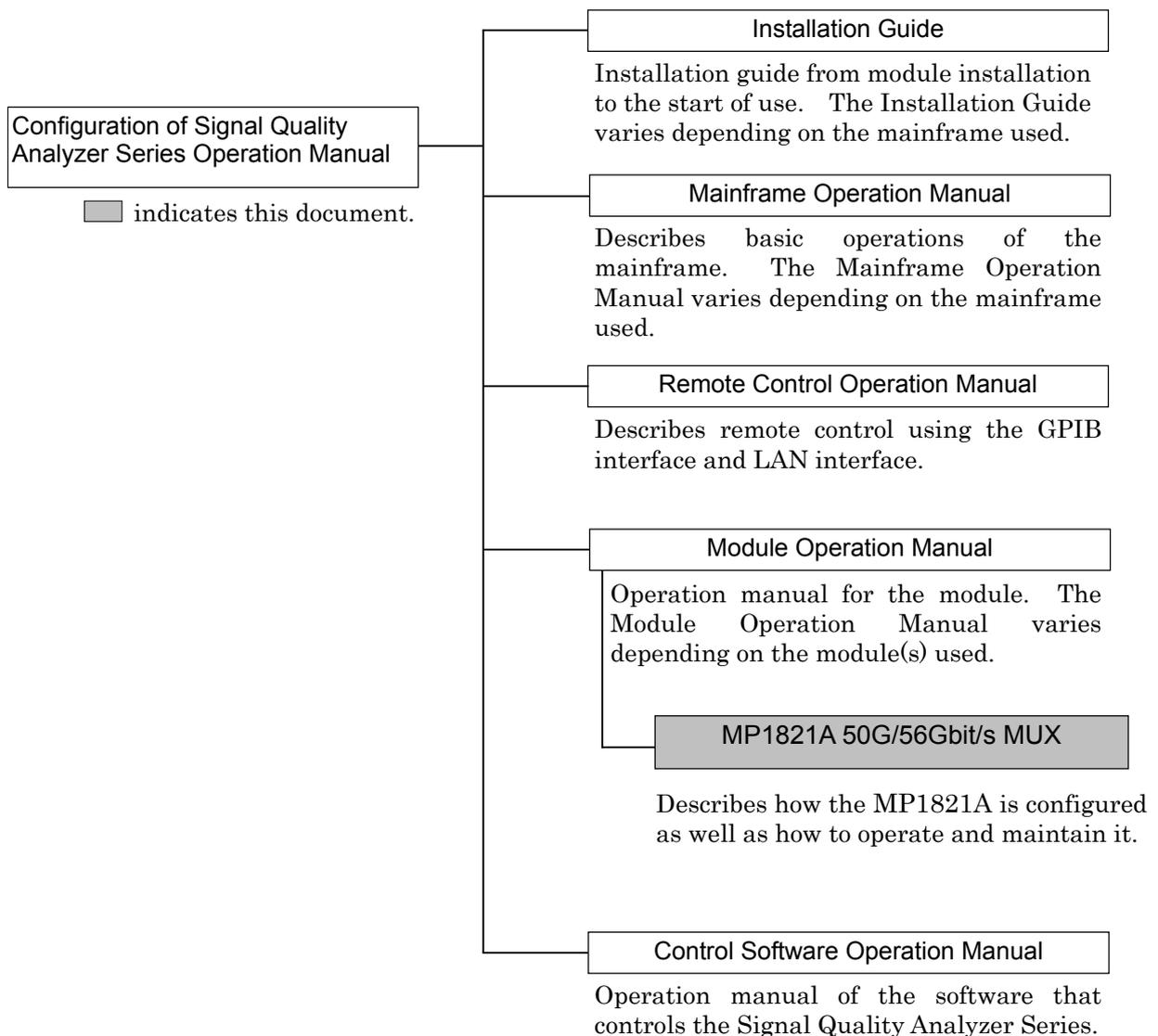


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Chapter 1 Overview

This chapter provides an overview of the MP1821A 50G/56Gbit/s MUX (MP1821A hereafter).

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1.1 Product Overview

The MP1821A is a plug-in module that can be built into a Signal Quality Analyzer main frame. This equipment 4:1 multiplexes the output signal of the MU181020A 12.5 Gbit/s and MU181020B 14 Gbit/s pulse pattern generators (hereafter MP1821A) to generate 8 to 56 Gbit/s PRBS, DATA and Zero-Substitution patterns.

Various option configurations are available for the MP1821A. This module is therefore useful for research, development, and production of various types of digital communication equipment, modules, and devices.

Features of the MP1821A:

- Operating rates: 8 to 50 Gbit/s (56 Gbit/s using additional options)
- Multiplexes input data signal to 4:1
- High-quality output signal waveform
- Flexible for functional expansion in the future, by installing additional options.
- Controlled by MX180000A Control Software when either MP1800A or controller PC connected

1.2 Product Composition

1.2.1 Standard composition

Table 1.2.1-1 and Table 1.2.1-2 show the standard composition of the MP1821A.

Table 1.2.1-1 Standard composition for MP1821A

Item	Model name/symbol	Product name	Q'ty	Remarks
Main frame	MP1821A	50G/56Gbit/s MUX	1	
Accessory	J1343A	Coaxial cable 1m	5	SMA connector
	J1145	Coaxial Terminator	2	V connector
	J1137	Coaxial Terminator	1	SMA connector
	J1341A	Open	7	SMA connector Five of this model are included when installing the MP1821A-x02.
	J1475A	USB cable	1	
	Z1312A	AC Adapter	1	
		Power code 2.6 m	1	
	Z1307A	MP1821A/22A 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 MP1821A. Table 1.2.2-2 shows the accessories for the MP1821A. All options are sold separately.

Table 1.2.2-1 Options for MP1821A

Model name	Product name	Remarks
MP1821A-x01	56 Gbit/s Extension	
MP1821A-x02	Clock Input Band Switch	
MP1821A-x10	Data Output (0.4 Vp-p fixed)	Mandatory option Cannot be installed together with MP1821A-x11, x13.
MP1821A-x11	Variable Data Output (0.5 to 2.5 Vp-p)	Mandatory option Cannot be installed together with MP1821A-x10, x13.
MP1821A-x13	Variable Data Output (0.5 to 3.5 Vp-p)	Mandatory options Cannot be installed together with MP1821A-x10, x11.
MP1821A-x30	Variable Data Delay	
MP1821A-x80*	MUX-PPG Calibration	

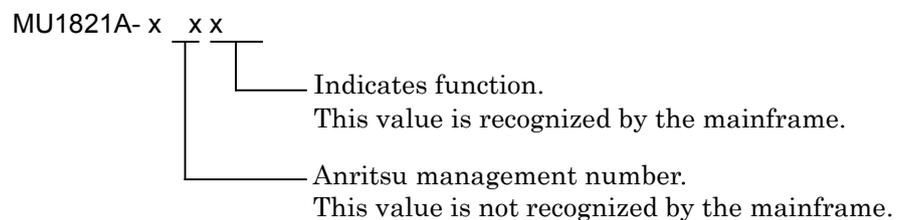
*: Notice of MP1821A-x80 option name indication

Note that the MP1821A-x80 option name is labeled onto the module and is not displayed on the software's option display.

Table 1.2.2-2 Accessory for the MP1821A Option

Target Option	Model name/symbol	Product name	Q'ty	Remarks
MP1821A-x02	J1363A	Protection cap	2	V connector

Option name format is as follows:



1.2.3 Application parts

Table 1.2.3-1 shows the application parts for the MP1821A. All application parts are sold separately.

Table 1.2.3-1 Application parts

Model name/symbol	Product name	Remarks
J1474A	Cable kit (for 4ch PPG)	4 sets of semi-rigid coaxial cable
J1476A	Cable kit (for 4ch ED)	4 sets of semi-rigid coaxial cable
J1137	Terminator	SMA connector
J1145	Terminator	V connector
J1439A	Coaxial cable 0.8 m	K connector
J1090	Coaxial cable 30 cm	V connector
J1108	Coaxial cable 50 cm	V connector
J1359A	Coaxial adapter (K-P,K-J,SMA)	K connector
J1477A	Coaxial adapter	V connector
J1486A	V(m.)-K(f.) adapter	V-K converter connector
J1379A	Coaxial attenuator (3 dB)	41V-3
J1144	Coaxial attenuator (6 dB)	41V-6
J1380A	Coaxial attenuator (10 dB)	41V-10
J1381A	Coaxial attenuator (20 dB)	41V-20
W3207AE	MP1821A Operation Manual	Printed version
Z0306A	Wrist strap	

1.3 Specifications

1.3.1 Specifications for MP1821A

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 MP1821A

Item		Specifications	Remarks
Operating bit rate		8 to 50 Gbit/s 8 to 56 Gbit/s (when MP1821A-x01 installed)	
External clock input (from System Clock)	Number of Input	1	
	Frequency	4 to 25 GHz 4 to 28 GHz (when MP1821A-x01 installed)	
		4 to 25 GHz 8 to 50 GHz (switchable when MP1821A-x02 installed)	
		4 to 28 GHz 8 to 56 GHz (switchable when MP1821A-x01, and x02 installed)	
	Input Amplitude	0.4 to 1.0 V _{p-p}	
	Termination	AC/50 Ω	
Connector	K(f.) V(f.) (when MP1821A-x02 installed)		
1/4 Data Input	Number of Input	4 (Data1, Data2, Data3, Data4)	From MU181020A/B Data Output
	Level	0/-1 V (H: -0.25 to 0.05 / -1.4 to -0.85 V)	
	Termination	50 Ω/GND	
	Connector	SMA (f.)	
1/2 Clock Output	Number of Input	1	To MP1822A Ext. Clock Input
	Frequency	4.0 to 25 GHz 4.0 to 28 GHz (when MP1821A-x01 installed)	
		Output Amplitude	
	Termination	AC/50 Ω	
	Connector	K(f.)	
1/4 Clock Output	Number of Input	1	To MU181800A/B Clock Input
	Frequency	2.0 to 12.5 GHz 2.0 to 14.0 GHz (when MP1821A-x01 installed)	
		Output Amplitude	
	Termination	AC/50 Ω	
	Connector	SMA (f.)	

Table 1.3.1-1 Specifications for MP1821A (Cont'd)

Item		Specifications	Remarks
Data Output* ² MP1821A- x10 (Data Output (0.4 V _{p-p} Fixed)) Fixed))	Number of Output	2(Data/ $\overline{\text{Data}}$)	Defined with PRBS 2 ³¹ -1, Mark Ratio 1/2
	Output Level	0/-0.4 V (H:-0.15 to 0.05V, L:-0.6 to -0.3 V)	
	Cross Point	50 % ± 15% * ³	
	Tr/Tf	Typ.10 ps(20~80%) * ³	
	Total Jitter* ¹	Typ. 4 psp-p	
	Waveform Distortion (0-peak)	Typ. ±25 mV ±15% of Amplitude @50 Gbit/s	
	Termination	50 Ω/GND	
	Connector	V (f.)	
	External ATT Factor* ⁴	Yes	

*1: The jitter specification value is defined assuming that an oscilloscope with residual jitter less than 200 fs (RMS) is used.

*2: The specification of data output waveform is defined assuming that a coaxial cable (J1108) with a sampling oscilloscope band of 70 GHz is used.

*3: When operating bit rate is 50 Gbit/s.

*4: Data/ $\overline{\text{Data}}$ can be set individually.

Table 1.3.1-1 Specifications for MP1821A (Cont'd)

Item	Specifications	Remarks	
Data Output* ² MP1821A- x11 (Variable Data Output (0.5 to 2.5 V _{p-p}))	Number of Output	2 (Data/ $\overline{\text{Data}}$)	Defined with PRBS 2 ³¹ -1, Mark Ratio 1/2 Output Amplitude Tr/Tf, Total Jitter, Waveform Distortion specified at 50% Cross point
	Amplitude* ⁴	0.5 to 2.5 V _{p-p} /2 mV Step	
		Accuracy: ±50 mV ±17% of Amplitude * ³	
	Offset* ⁴	-2.0 to +3.3 V _{oh} Min. -4.0 V _{ol} /1 mV Step	
		Accuracy: ± 65 mV ±10% of Offset (V _{th}) ± (Amplitude Accuracy/2)	
		Current Limit (Sourcing 50 mA / Sinking 80 mA)	
	Defined Interface* ⁴	NECL, SCFL, NCML, PCML, LVPECL	
	Cross Point* ⁴	30 % to 70 % / 0.1 % Step	
		Accuracy: ±5% * ³ ,* ⁵	
	Tr/Tf	Typ.8 ps (20% to 80%) * ³ ,* ⁶	
	Total Jitter* ¹	Typ. 4 psp-p	
	Waveform Distortion (0-peak)	Typ. ± 25 mV ± 10% of Amplitude * ³ ,* ⁶	
	ON•OFF	Can be switched ON/OFF	
	Termination	Can be switched between AC and DC, 50 Ω GND, -2 V, + 1.3 V (LVDS) (when DC selected)	
	Connector	V (f.)	
Offset reference	Can be switched between V _{oh} ,V _{th} and V _{ol}		
Level Guard	Yes		
Data/XData Tracking	Yes		
External ATT Factor* ⁴	Yes		

*5: When amplitude is 2.0 V_{p-p} or more.

*6: When amplitude is 2.5 V_{p-p}.

Table 1.3.1-1 Specifications for MP1821A (Cont'd)

Item	Specifications	Remarks	
Data Output* ² (continued) MP1821A- x13 (Variable Data Output (0.5 to 3.5 Vp-p))	Number of Output	2 (Data/ $\overline{\text{Data}}$)	Defined with PRBS 2 ³¹ -1, Mark Ratio 1/2 Output Amplitude Tr/Tf, Total Jitter, Waveform Distortion specified at 50% Cross point
	Amplitude* ⁴	0.5 to 3.5 Vp-p/2 mV Step (Independent, variable)	
		Accuracy: $\pm 50 \text{ mV} \pm 17\%$ of Amplitude * ³	
	Offset* ⁴	-2.0 to + 3.3 Voh Min. -4.0 Vol/1 mV Step (Independent, variable)	
		Accuracy: $\pm 65 \text{ mV} \pm 10\%$ of Offset (Vth) \pm (Amplitude Accuracy/2)	
		Current Limit (Sourcing 50 mA/Sinking 80 mA)	
	Defined Interface* ⁴	PCML, NCML, SCFL, NECL, LVPECL	
	Cross Point* ⁴	30 % to 70% /0.1% Step (independent)	
		Accuracy: $\pm 5\%$ * ^{3,5}	
	Tr/Tf	Typ. 8 ps (20 % to 80%) * ^{3,7}	
	Total Jitter* ¹	Typ. 4 ps p-p	
	Waveform Distortion (0-peak)	Typ. $\pm 25 \text{ mV} \pm 10\%$ of Amplitude * ^{3,7}	
	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* ⁴	Yes		

*7: When amplitude is 3.5 Vp-p..

Table 1.3.1-1 Specifications for MP1821A (Cont'd)

Item		Specifications	Remarks
Clock Output	Number of Output	1	
	Frequency	Equal to inputting frequency to the external clock	
	Output Amplitude	Min. 0.4 Vp-p, Max. 1.0 Vp-p (@ external clock input \geq 0.6 Vp-p)	
	ON/OFF	Can be switched ON/OFF	
	Termination	AC/50 Ω Coupling	
	Connector	K(f) V (f.) (when MP1821A-x02 installed)	
Variable Data Delay	Variable phase range	-1000 to + 1000 mUI/ 4 mUI Step	When MP1821A-x30 installed
	Phase setting error	Typ. \pm 50 mUIp-p	
	mUI-ps conversion	Available	
	Calibration	Available	
	Relative 0	Available	
Control interface		USB 2.0 or 1.1 Type B \times 1	
Power	Voltage	AC 100 to 240 V *8	
	Frequency	50 to 60 Hz	
	Power consumption	DC 19 V, 4 A	
Dimension		70 mm(H), 100 mm (W), 140 mm (D) 90.9 mm, 100 mm (W), 140 mm (D) (when MP1821A-x30 installed)	
Mass		5.0 kg or less	
Environmental Performance	Operation Temperature	+ 15° to + 35°C (ambient temperature around equipment when installed in the main frame)	
	Storage Temperature	-20° to +60°C	

*8: Operating voltage: within the range of +10% to -15% from the rated voltage

Chapter 2 Preparation Before Use

This chapter describes preparations required before using the MP1821A/MP1822A.

2.1	Preparation Before Use	2-2
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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 MP1821A/MP1822A operates in the temperature range from 15° to 35°C. Avoid using it under any of the following environment conditions that may cause failure.

1. Strong vibrations
2. High humidity or dust
3. Direct sunlight
4. Chemically active gases
5. Substantial temperature changes

Note:

Dew may form inside of the MP1821A/MP1822A 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 MP1821A/MP1822A becomes completely dry before turning on the power. Doing so with condensation present may cause a short circuit and damage the MP1821A/MP1822A.

2.1.2 Distance from Fan

A cooling fan is provided on the sides of the MP1821A/MP1822A. Install the MP1821A/MP1822A 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.

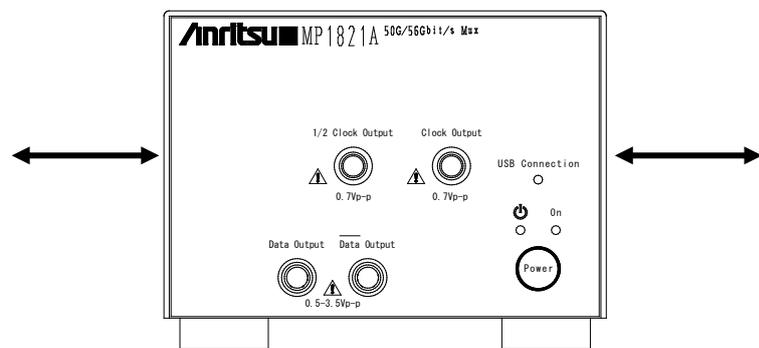


Figure 2.2-1 Distance from fan

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 MP1821A/MP1822A may be damaged.

Connect the shielded connector from the AC adapter to the rear panel connector of the MP1821A/MP1822A. Refer to Figure 2.1.3-1.

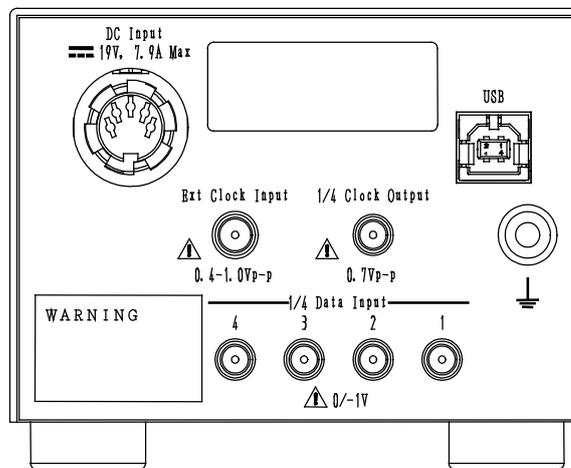


Figure 2.1.3-1 Rear Panel of MP182xA

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 the instrument earthed, there is a risk of receiving a fatal electric shock. In addition, the peripheral devices connected to the instrument may be damaged.

When connecting to the power supply, DO NOT connect to an outlet without an earth terminal. Also, avoid using electrical equipment such as an extension cord or a transformer.

2.1.4 Usage Pattern of MP1821A/MP1822A

This section explains the usage patterns of MP1821A/MP1822A and how to connect to the MP1800A or control PC.

The MP1821A/MP1822A is controlled via the MX180000A control software installed in the MP1800A or control PC. The following list two usage patterns of MP1821A/MP1822A. When connecting the MP1821A/MP1822A 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 the MP1800A, and then connect the USB connector (type B) to the MP1821A/MP1822A.

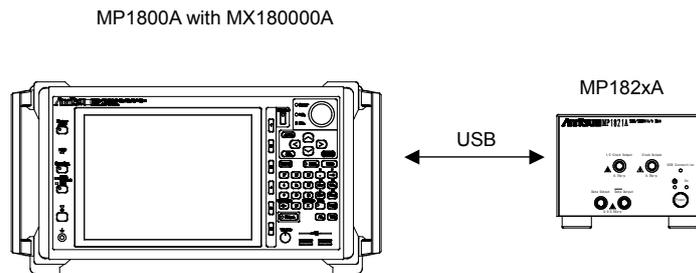


Figure 2.1.4-1 Connecting MP1800A

(2) Connecting control PC:

Connect the USB connector (type A) to PC, and then connect the USB connector (type B) to the MP1821A/MP1822A.

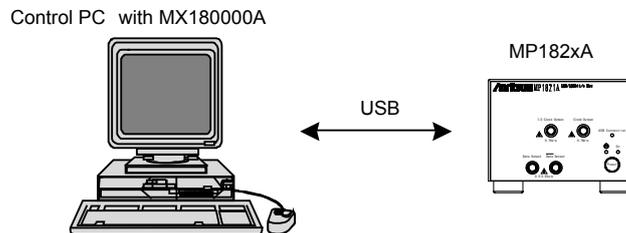


Figure 2.1.4-2 Connecting Control PC

Use a PC satisfying the following specifications.

Table 2.1.4-1 Required Specifications for Control PC

Item	Specifications
Compatibility	IBM-PC or compatible PC
CPU	Pentium4 @ ≥ 1.6 GHz
OS	Windows XP Version 2002 Service Pack 2
Memory	≥ 512 MB
Monitor resolution	$\geq 800 \times 600$ bits
Display color	≥ 256 colors
CD-ROM driver	Required when installing MP1821A/MP1822A
Hard Disk	≥ 200 MB of free space
USB Interface	USB 2.0 or USB 1.1

The MP1821A/MP1822A will not operate normally when performing the following operations and functions on the PC while the MX180000A Signal Quality Analyzer control Software 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.

2.2 Starting and Stopping

This section explains how to install the software and how to start and stop the applications.

2.2.1 Installing the software

Note the following general notes when installing software for the MP1821A/MP1822A 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 “MP1800A Installation Guide” (W2747AE) and “MT1810A Installation Guide” (W2748AE).

- (1) When the general procedures are followed by the installer, the confirmation dialog is displayed. Press **Yes** to start installation.

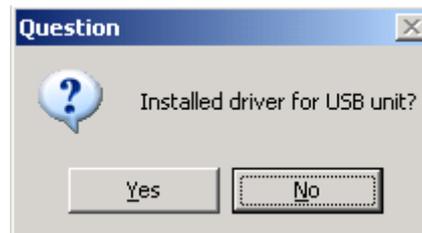


Figure 2.2.1-1 Confirmation Dialog of USB Driver Installation (1)

- (2) Figure 2.2.1-2 is displayed when the installation is in progress. Press **Continue Anyway** to continue the installation procedures.

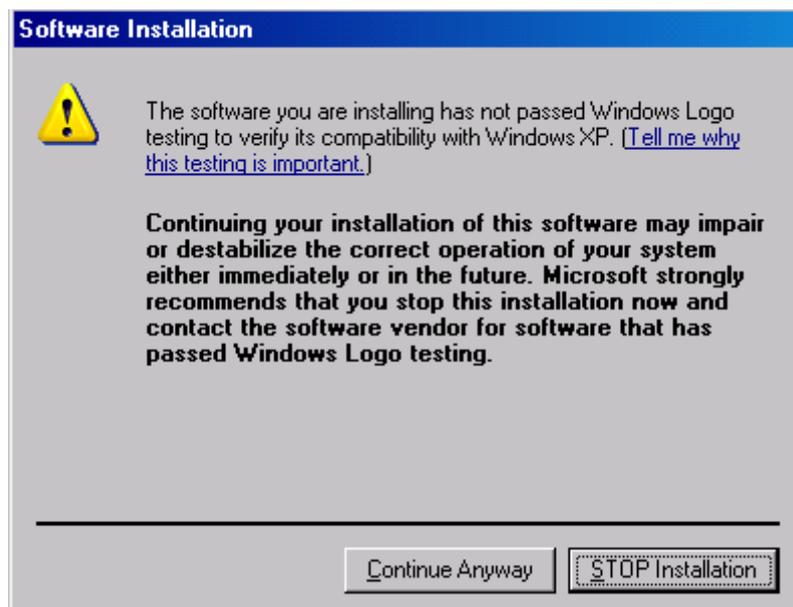


Figure 2.2.1-2 Confirmation Dialog of USB Driver Installation (2)

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

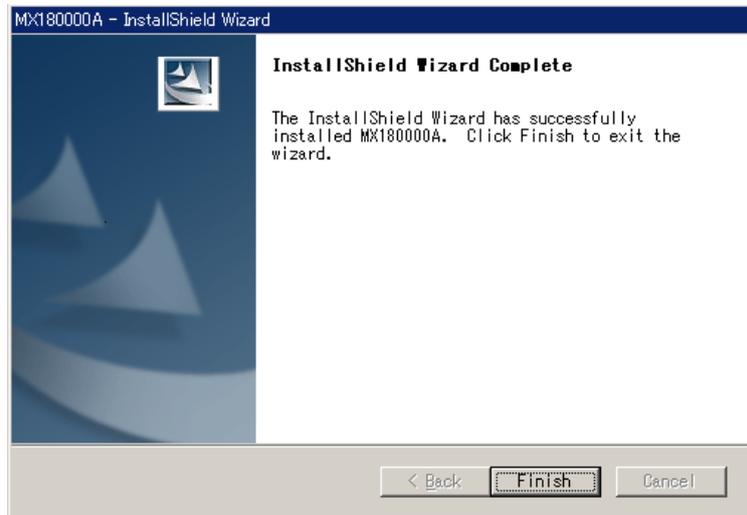


Figure 2.2.1-3 Completing Installation

When the MP1821A/MP1822A is connected to the MP1800A or remote PC after software installation, install the driver using the following procedures. The following example show when the MP1821A/MP1822A is connected to the MP1800A.

- (1) Connect the MP1800A and MP1821A/MP1822A using an USB cable.
- (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.

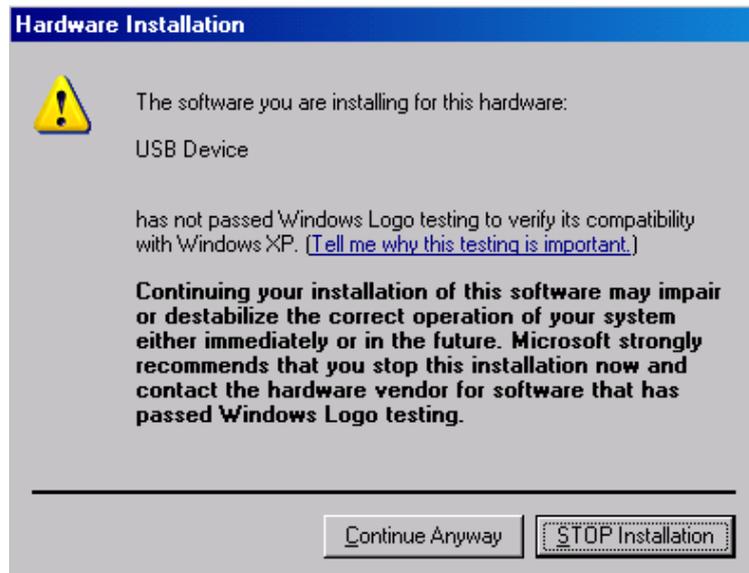


Figure 2.2.1-6 Hardware Installation

- (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.

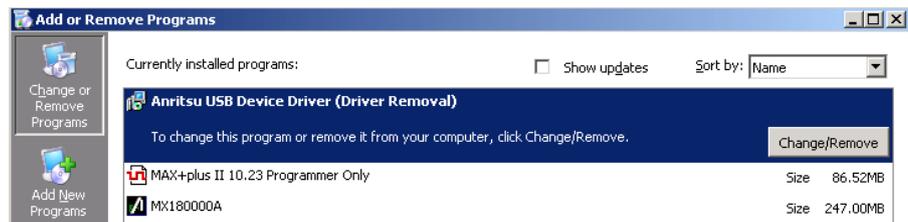


Figure 2.2.1-8 Removing USB Driver

2.2.2 Start Procedures

When connecting to MP1800A:

- (1) Connect the MP1821A/MP1822A and MP1800A as explained in Section 2.1.4.
- (2) Connect the AC adapter to the MP1821A/MP1822A 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 MP1821A/MP1822A control screen is displayed.

When connecting to control PC

- (1) Connect the MP1821A/MP1822A and control PC as explained in Section 2.1.4.
- (2) Connect the AC adapter to the MP1821A/MP1822A 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 MP1821A/MP1822A control screen is displayed.



Figure 2.2.2-1 Selector Screen

2.2.3 Stop Procedure

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 MP1821A/MP1822A 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 MP1821A/MP1822A power switch to **OFF**.
The LED lights orange, indicating the standby status.

Note:

1. To cut the power without following the above procedure, press the MP1821A/MP1822A power switch for more than 10 seconds to enter the standby status.
2. Do not disconnect the power cord and AC adapter without first turning off the MP1821A/MP1822A as described above, otherwise the MP1821A/MP1822A may be damaged.

2.2.4 USB Connection

This section describes the notes of USB connection.

2.2.4.1 Hot Swap

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 2.2.4.1-1 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.

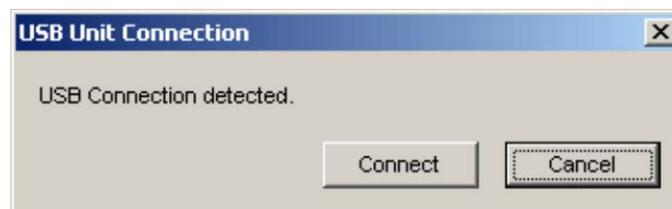


Figure 2.2.4.1-2 USB Connection Message

- (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 2.2.4.1-3 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 the equipment, MP1800A and controller PC is broken during downloading with the Setup utility, the equipment may no longer operate normally. NEVER break the connection during downloading.

2.2.4.2 How to use the USB

This section explains the general usage of the USB, using the MP1821A/MP1822A.

Connect the USB to the MP1800A before starting it. Do not connect or disconnect the USB when using the MX180000A Control Software. Furthermore, when reading and writing the measurement data through the USB, be sure to finish the MX180000A Control Software.

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 “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.

Slot Number	Model Number	Object File Name	Serial Number	Version
Mainframe	MX180000A	Signal Quality Analyzer Control Software		0.14.01
		Setup Utility		0.14.00
		Self Test		5.02.00
	MX180000A-01	Pre-Code		
	MX180000A-02	De-Code		
USB1	MP1821A	50G/56Gbit/s MUX	6123456789	0.00.01
		MP1821A_Mux.FPGA		0.00.07
		MP1821A_Mux.Delay.FPGA		1.00.04
		MP1821A_Mux.SYST		0.13.07
	MP1821A-01	56Gbit/s Extension		
	MP1821A-02	Clock Input Band Switch		
	MP1821A-13	Variable Data Output (0.5 to 3.5Vp-p)		

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.

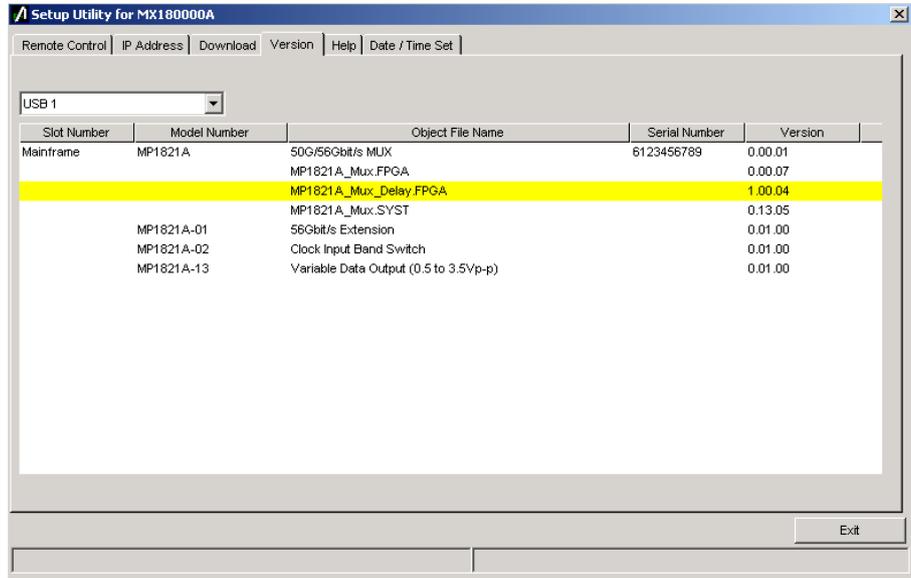


Figure 2.3.1-2 Version Display Screen

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.

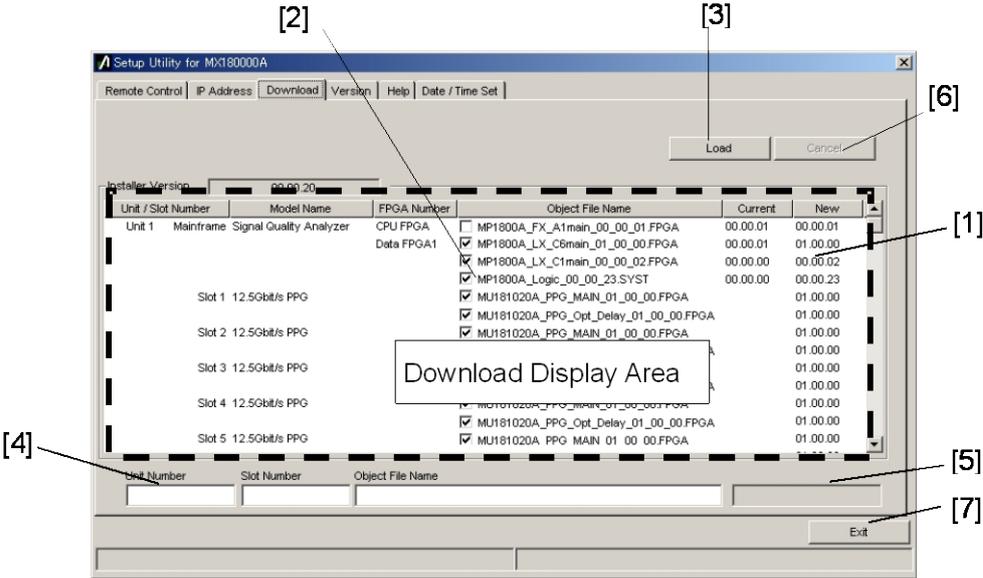


Figure 2.3.2-1 Download Screen

Table 2.3.2-1 Download Screen

No.	Function and Usage
[1]	<p>This displays files that can be downloaded</p> <p>Versions displayed in the New column are versions of object files offered by the MX180000A SQA control software.</p> <p>Versions displayed in the Current column are the versions of software already installed in the equipment.</p> <p>If there is a mismatch between versions in New and Current, place checkmarks in the boxes and download the new files.</p>
[2]	<p>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.</p>
[3]	<p>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.</p>
[4]	<p>This displays the download slot number and file name.</p>
[5]	<p>This displays the download status.</p>
[6]	<p>This suspends downloading.</p>
[7]	<p>This quits the setup utility.</p>

Note:

1. If the Current version is not displayed and there is no checkmark in the checkbox, put a checkmark in the checkbox and execute download.
2. 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 MP182xA_MUX_Opt_Delay_xx_xx_xx.FPGA indicates the version.

 **CAUTION**

If the connection between the equipment, MP1800A and controller PC is broken during downloading with the Setup utility, the equipment 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.

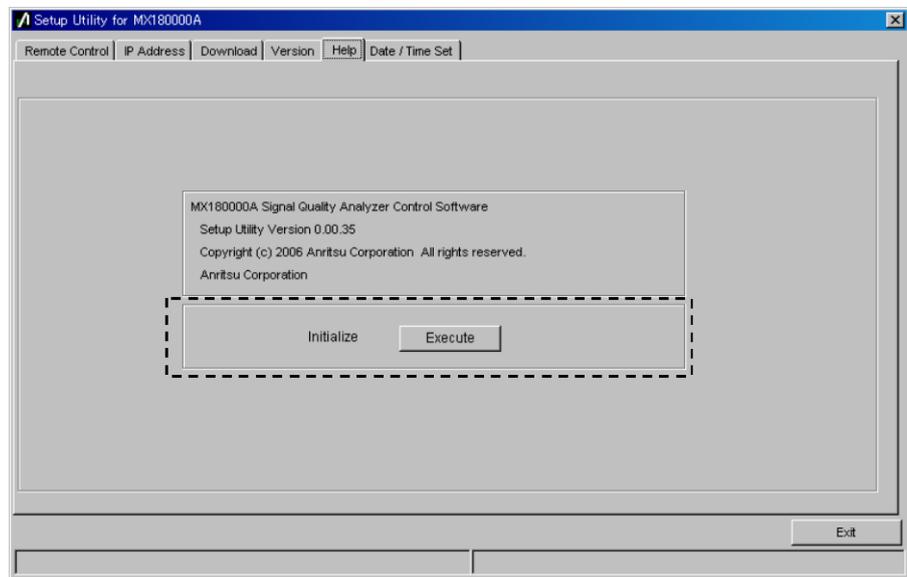


Figure 2.3.3-1 Initializing Settings

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 MP1821A/MP1822A. Otherwise, the MP1821A/MP1822A may be damaged.

 **CAUTION**

1. When signals are input to the MP1821A/MP1822A, avoid excessive voltage beyond the rating. Otherwise, the circuit may be damaged.
2. When output is used at the 50 $\bar{\Omega}$ GND terminator, never feed any current or input signals to the output.
3. As a countermeasure against static electricity, ground other devices to be connected (including experimental circuits) with ground wires before connecting the I/O connector.
4. 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.
5. As an antistatic measure, always ensure that other equipment to be connected (including test circuits) to input and output connectors, is grounded to earth first.
6. Before using a coaxial cable, always touch the external and internal conductors to a grounded metallic object to discharge any electric charge, because the external conductor and internal core of a coaxial cable can become charged as a condenser and can damage the equipment if connected while charged.
7. Never open the MP1821A/MP1822A. If you open it and the MP1821A/MP1822A has failed or sufficient performance cannot be obtained, we may decline to repair the MP1821A/MP1822A.

8. discharge failure, a conductive sheet should be placed onto the workbench, and the operator should wear an electrostatic discharge wrist strap. Connect the ground connection end of the wrist strap to the conductive sheet or to the ground terminal of the mainframe.

9. 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:
 1. Do not connect or disconnect any external devices while DC voltage is impressed.
 2. 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.

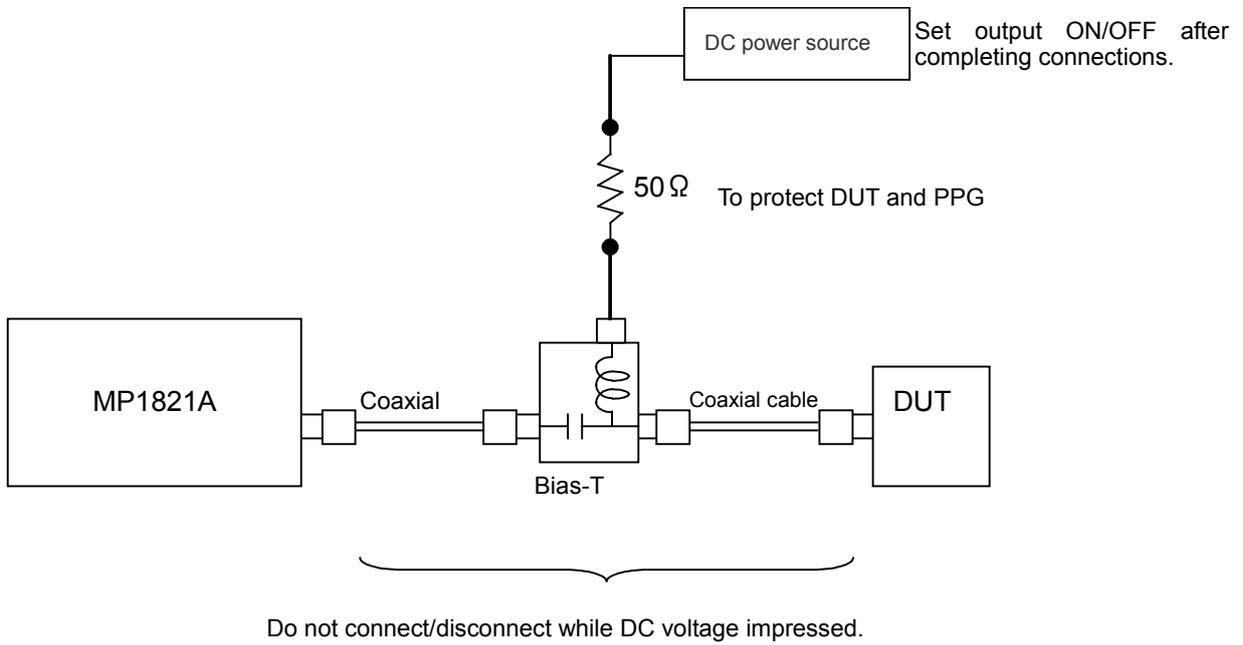


Figure. 2.4-1 Bias-T Connection Example

Chapter 3 Panel Layout and Connectors

This chapter describes the panel and connectors of the MP1821A.

3.1	Panel Layout.....	3-2
3.1.1	MP1821A Front Panel	3-2
3.1.2	MP1821A Rear Panel.....	3-4
3.2	Inter-Module Connection	3-6

3.1 Panel Layout

3.1.1 MP1821A Front Panel

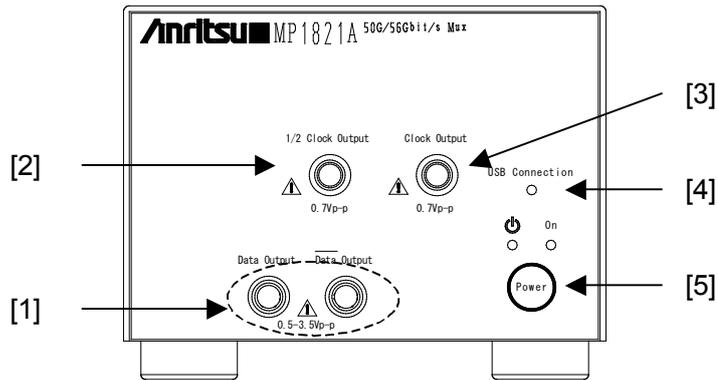


Figure 3.1.1-1 MP1821A Front Panel

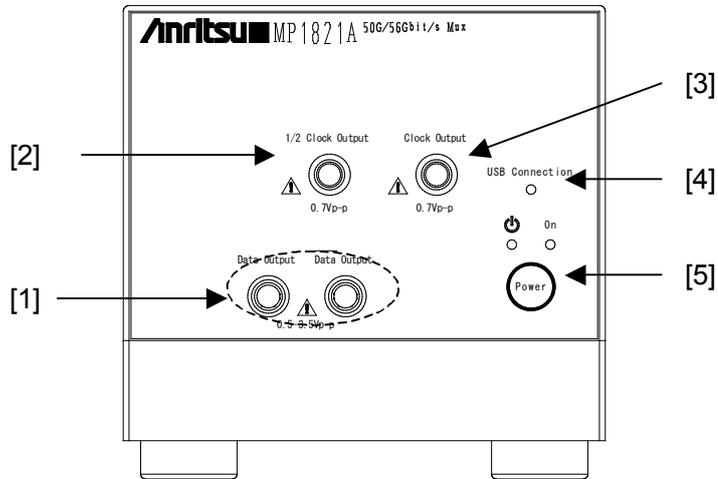


Figure 3.1.1-2 MP1821A (with MP1821A-x30) Front Panel

Table 3.1.1-1 MP1821A Front Panel Name and Function

No.	Name	Description
[1]	Data Output connectors Data Output connectors	Output for 4:1 multiplexed differential data signal Supports various interfaces by selecting option
[2]	1/2 Clock Input connector	Inputs for Clock signal from MP1821A
[3]	Clock Output connector	Output for Clock signal Same output frequency as Clock input to Ext. Clock Input
[4]	USB Connection LED	Displays status of connection between MP1821A and MP1800A or control PC The LED is lit when the MP1821A can be controlled.
[5]	Power Switch	Switches from ON to Standby When AC adapter and power cable are connected, the switch LED lights orange in the Standby status and green at ON.

3.1.2 MP1821A Rear Panel

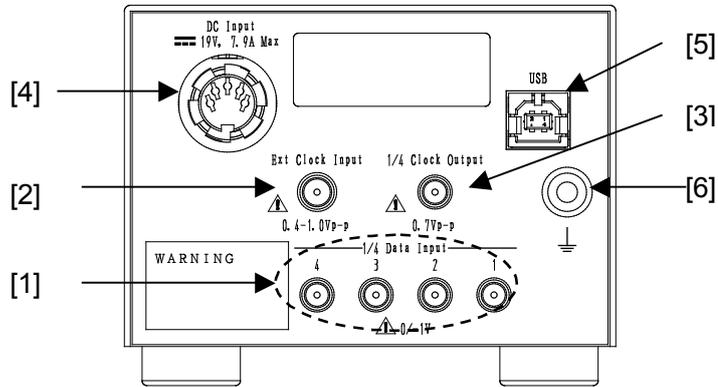


Figure 3.1.2-1 MP1821A Rear Panel

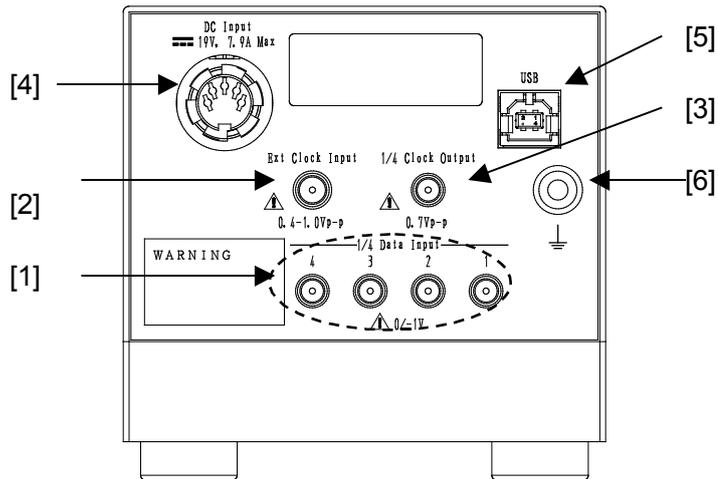


Figure 3.1.2-1 MP1821A (with MP1821A-x30) Rear Panel

Table 3.1.2-1 MP1821A Rear Panel Name and Function

No.	Name	Description
[1]	1/4 Data Input 1 connectors 1/4 Data Input 2 connectors 1/4 Data Input 3 connectors 1/4 Data Input 4 connectors	Inputs for data signals from dual MU181020A/B Multiplexes signal to Data Output
[2]	Ext. Clock Input connectors	Connectors for inputting clock signal used as reference for equipment operation
[3]	1/4 Clock Output connectors	Outputs reference clock signal from MU181020A/B
[4]	DC Input connectors	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.
[4]	USB port	Used for connecting MP1800A or controller PC to this equipment Do NOT connect anything other than the MP1800A or controller PC.
[5]	Ground	Connector for wrist strap to discharge static electricity Always wear a wrist strap when using this equipment.

3.2 Inter-Module Connection

Always take anti-static measures when handling each device.

A connection example between the MU181020A/B and MU181800B 14 Gbit/s PPG (hereinafter, referred to as “MU181800B”) that are installed into a mainframe is shown below. Use the following procedure to connect these devices, and refer to Figure 3.2-1 and Figure 3.2-2.

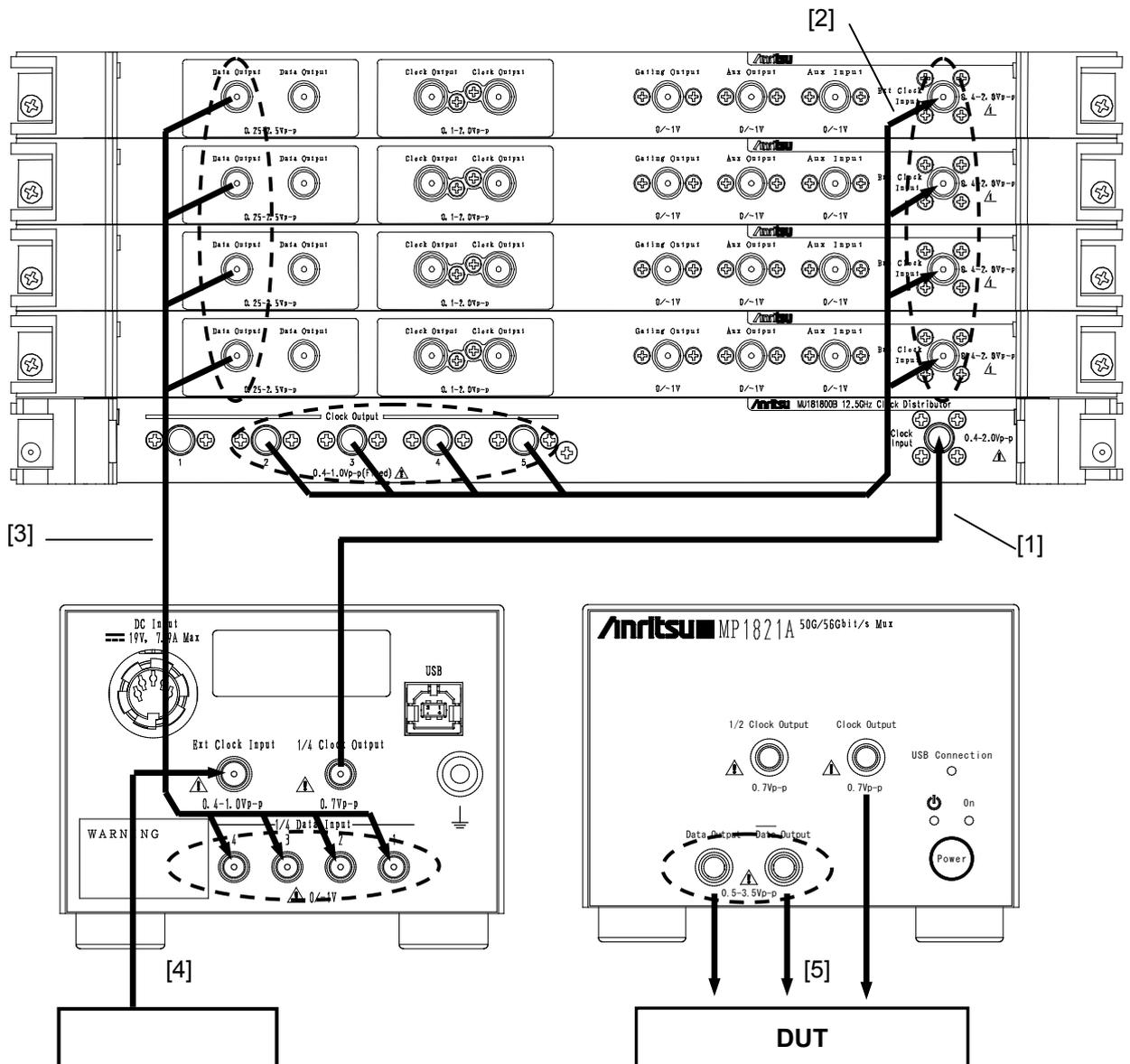


Figure 3.2-1 Inter-module connection example

1. Use coaxial cables to connect the Ext. Clock Input connectors of the MU181800B unit with the 1/4 Clock Output connectors of this module. Use the supplied accessory cables (J1473A).
2. Use coaxial cables to connect the Clock Output connectors of the MU181800B unit with the Ext. Clock Input connectors of the MU181020A/B unit. Ensure that the coaxial cables are exactly the same length or use the supplied accessory cables (J1474A).
3. Use coaxial cables to connect the four Data Output connectors of the MU181020A/B units with the 1/4 Clock Input 1/2/3/4 connectors of this module. In this case, connect MU181020A/B unit and the MU181020A/B unit in the Slot1, and then connect the 1/4 Clock Input2 to Slot 2, 1/4 Clock Input3 to Slot3, and 1/4 Clock Input4 to Slot4, respectively. Ensure that the coaxial cables are exactly the same length or use the supplied accessory cables (J1473A).
4. Use a coaxial cable to connect the Clock signal source to the Ext. Clock Input connector of this front panel.
5. Use a coaxial cable to connect the DUT to Data Output (Xdata Output) and Clock Output on the front panel.

WARNING

1. When signals are input to this MP1821A, avoid excessive voltage beyond the rating. Otherwise, the circuit may be damaged.
 2. As a countermeasure against static electricity, ground other devices to be connected (including experimental circuits) with ground wires before connecting the I/O connector.
 3. 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.
 4. The power supply voltage rating for the mainframe is shown on the rear panel. Be sure to operate the mainframe within the rated voltage range. The mainframe may be damaged if a voltage out of the rating range is applied.
 5. To protect the MP1821A from electrostatic discharge failure, a conductive sheet should be placed onto the workbench, and the operator should wear an electrostatic discharge wrist strap. Connect the ground connection end of the wrist strap to the conductive sheet or to the ground terminal of the mainframe.
 6. When removing a cable from a connector on the front panel of the MP1821A, be careful not to add excessive stress to the connector. Addition of excessive stress to a connector may result in characteristic degradation or a failure.
Use a torque wrench (recommended torque: 0.9 N-M) when attaching or removing a cable.
-

Chapter 4 Configuration of Setup Dialog Box

This chapter explains the functions in each tab of the procedure window.

4.1	Configuration of Entire Setup Dialog Box	4-2
4.2	Operation Tab Window	4-3
4.3	Setting Output Interface	4-4
4.3.1	Setting Data/XData.....	4-4
4.3.2	Setting delay.....	4-12
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4.4	Setting Test Patterns	4-17
4.5	Multi Channel Function	4-18
4.5.1	Combination Function.....	4-19
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4.1 Configuration of Entire Setup Dialog Box

When the MP1821A is inserted into a mainframe, the configuration of the setup dialog box is displayed.

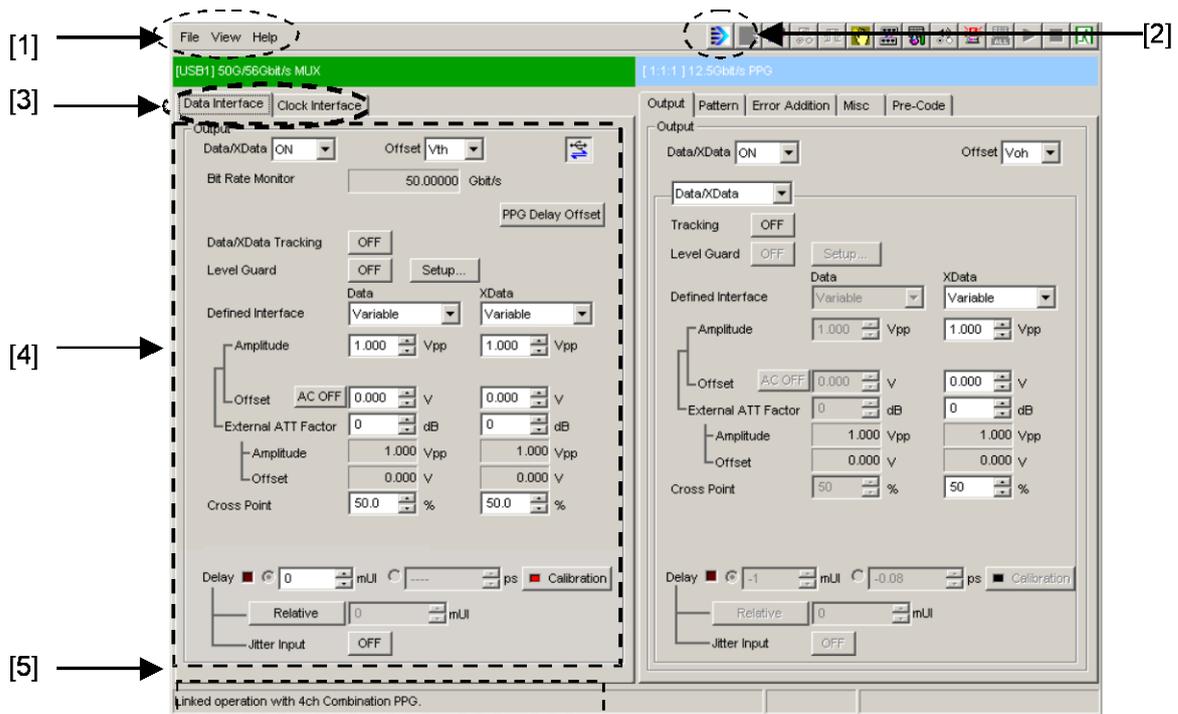


Figure 4.1-1 Configuration of Entire Setup Dialog Box

The setup dialog box consists of five blocks ([1] to [5] in the figure above). Table 4.1-1 lists the function of each block.

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. Pressing the 56G MUX function key displays the operation window.
[3]	Function setting selection tabs	Switches the module operation tab window according to the function items.
[4]	Operation tab window	Configures settings specific to each module.
[5]	USB	Displays USB connections.

4.2 Operation Tab Window

The MP1821 operation tabs are listed below.



Figure 4.2-1 Function Setting Selection Tab

Table 4.2-1 Function Setting Selection Tab

Tab name	Function
Data Interface	Sets Data/Xdata Various output interface settings can be configured in this tab window.
Clock Interface	Sets Clock Various output interface settings can be configured in this tab window.

4.3 Setting Output Interface

To set the output interface, select the Data Interface and Clock Interface tabs of the operation window.

4.3.1 Setting Data/XData

The data output settings can be changed depending on the options installed in the MP1821A.

The screen Data and Data settings each correspond to the signals output from the Data and Data connectors, respectively. The following explains the settings related to the Data connector called XData.

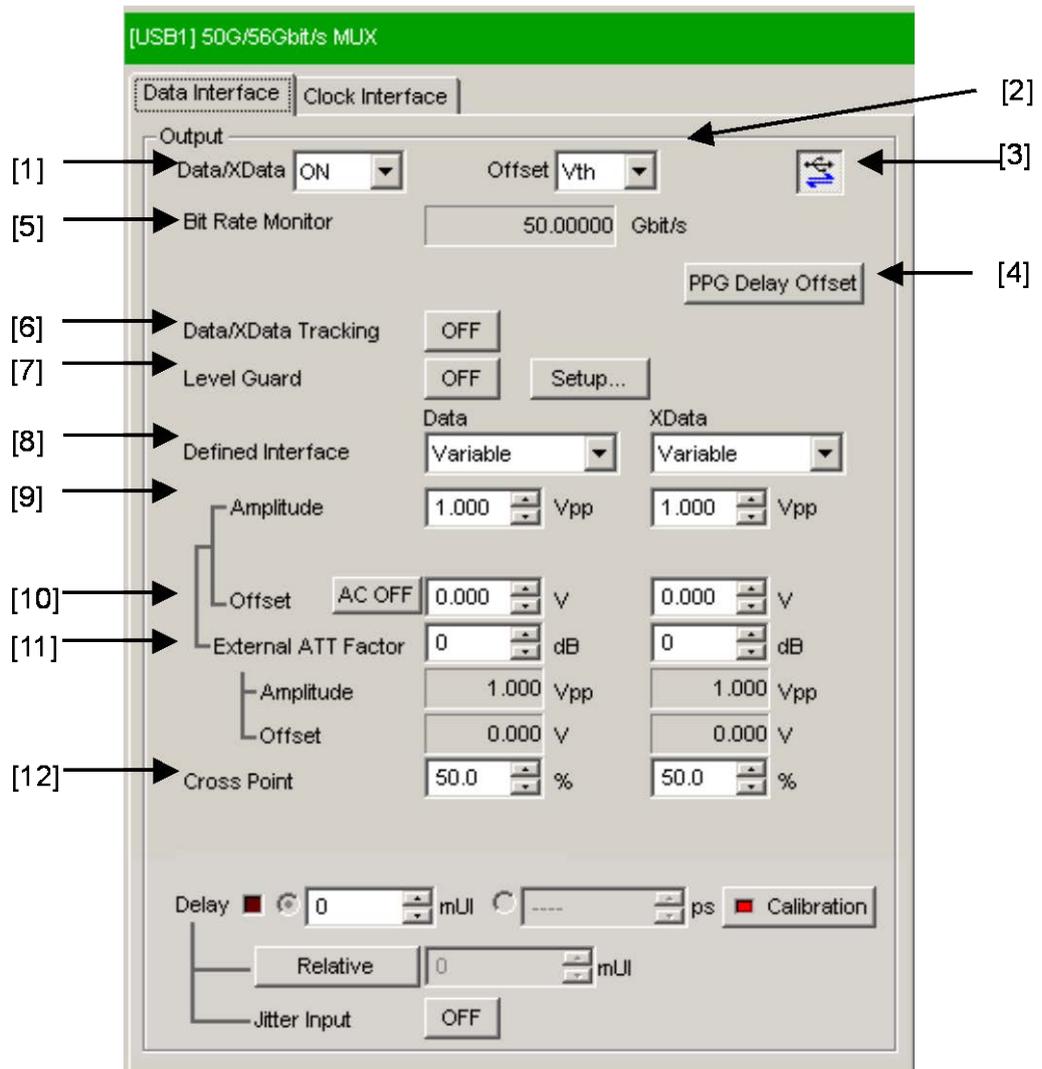


Figure 4.3.1-1 Output Tab Window for Setting Data/XData

- [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.

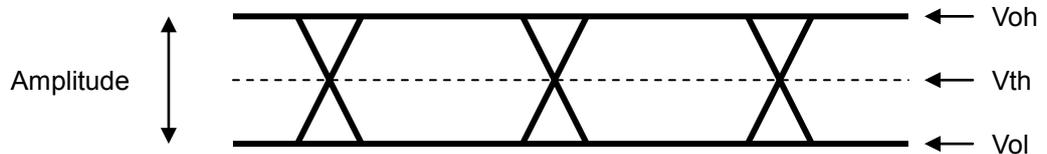


Figure 4.3.1-2 Setting Data Offset

- [3] Switch the link between this device and the PPG module. When this MUX/PPG Link button is ON, the 4 ch PPG module output setting and Delay setting are performed automatically to optimize the data output of this device. The button status is displayed as Link ON, Link OFF and disabled as shown from the left in Figure 4.3.1-3.



Figure 4.3.1-3 Link Button

- [4] Adjust the Data and Clock phases between this device and the PPG module. These settings are set to the optimum phase values for the equipment composition at shipment, so they should be changed only under the following circumstances.
1. When the coaxial cables connecting Data and Clock between this device and the PPG module are changed
 2. When the PPG module used in combination with this device is changed or the Clock divider is changed.

At item 2, it is necessary to change these settings each time the operation bit rate is changed.

Adjust so there are no errors in the data output from this device.

Table 4.3.1-2 PPG Delay Offset Setting Range

Setting Range	Step
-4000 to 4000 ps	1 ps

Note:

The length of the standard J1343A coaxial cable accessory is 1000 mm. If the coaxial cable is changed, be sure to adjust the PPG Delay Offset by 5 ps for every 1 mm change in the cable length.

If this adjustment is incorrect, there will be errors in the output data.



Figure 4.3.1-4 PPG Delay Offset Setting Window

Also, clicking the Combination Info button checks the information for the module optimized for the phase relation with the MP1821A.

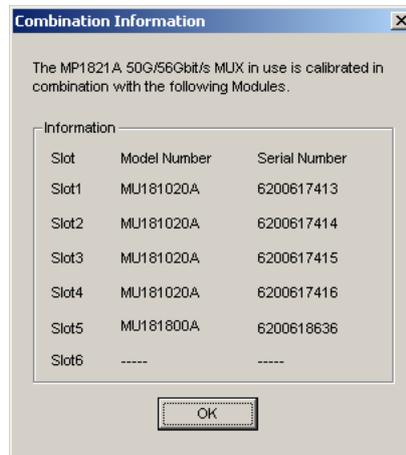


Figure 4.3.1-5 Combination Information Window

Note:

The Combination Information window displays information about calibrated modules used with this device at shipment.

When replacing the module listed in Combination Information to other module, the message as shown in Figure 4.3.1-6 is displayed. When the following message is displayed, confirm the combination of the MP1821A and PPG modules and the PPG module slot location.

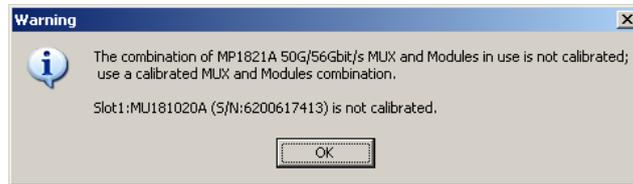


Figure 4.3.1-6 Warning Screen When Changing Module

- [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] Press **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 4.3.1-3 Amplitude Setting Values

Item	Amplitude		Offset Vth
	Voh	Vol	
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 4.3.1-4 Amplitude setting range

Installed Option	Amplitude setting range	Resolution
x10	0.4 Vp-p fixed	—
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 4.3.1-5 Offset Setting Range

Installed Option	Offset setting range	Resolution
x10	0 Voh fixed	—
x11	-4.0 to 3.3 V	0.001 V
x13	-4.0 to 3.3 V	0.001 V

[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 MP1821A, 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 4.3.1-6 Cross Point Setting Range

Installed Option	Cross point setting range	Resolution
x10	50% fixed	—
x11/x13	30.0 to 70.0%	0.1%

Notes:

1. 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.
2. 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 MP1821A. In this event, the DUT may be damaged if the interface conditions do not match. Be sure to confirm the interface conditions.
3. 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.
4. 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.
5. Be sure to confirm that a fixed attenuator is connected between the MP1821A 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 MP1821-x30 is installed into the MP1821A, the phase of the data output can be changed relative to the clock output.

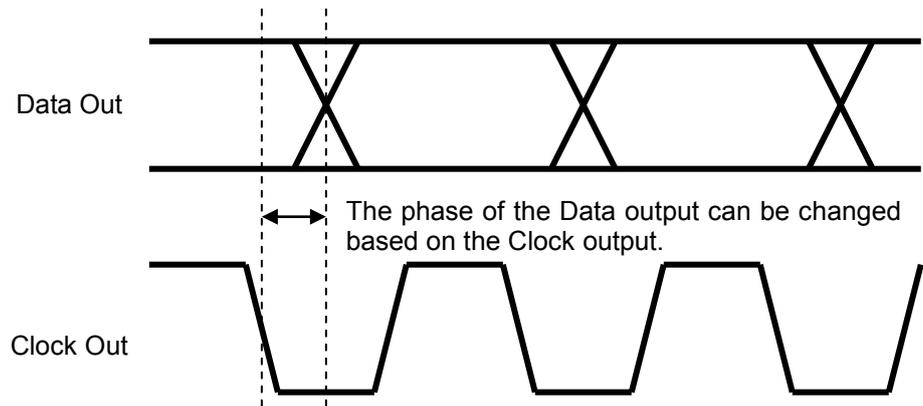


Figure 4.3.2-1 Delay setting

[1] Calibration

[2] Delay 0 mUI

[3] Relative 0 mUI

[4] Jitter Input OFF

Figure 4.3.2-2 Output Tab Window for Setting Delay

- [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 -1,000 to 1,000 mUI in 4-mUI steps

<ps units>

Can be set in ps steps equivalent to 4 mUI

The setting range is converted from -1,000 to 1,000 mUI to ps units.

Example:

50 GHz: -20 to 20 ps, 0.08 ps steps

25 GHz: -40 to 40 ps, 0.16 ps steps

12.5 GHz: -80 to 80 ps, 0.32 ps steps

When the red frequency counter value range is incorrect, ... **ps** is displayed.

Note:

When MU181020A/B and MP1821A are mounted in the same unit with 4ch Combination selected, the delay settings of MU181020A/B and MP1821A are interlinked.

For the setting varies in conjunction with MP1821A and the MU181020A/B, 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

Notes:

1. When the frequency or the temperature condition is changed, the LED on the **Calibration** lights, prompting performance of calibration. If calibration is not performed at this time, the error in the phase setting may be greater than at a normal phase setting.
2. Values displayed in ps units vary as the frequency changes, because the MP1821A sets phases in mUI units as an internal standard.
3. When Burst is selected at Pattern Sequence of the Misc screen, the phase setting accuracy becomes worse than when Repeat is selected.
4. When inputting a jitter-modulated clock while Jitter Input of Delay is OFF, sometimes, the phase becomes unstable.
5. When inputting a jitter-modulated clock, if the Delay lamp is lit, sometimes, the phase setting error becomes large.
6. When inputting a signal to this module, do not input a voltage exceeding the specified value, otherwise the circuits may be damaged.
7. As countermeasure to static electricity, before connecting to an input connector, always ground the other equipment (including test circuit).
8. 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.

4.3.3 Setting clock

The clock output can be set using the MP1821A. Also, if the MP1821A-x02 is installed, the clock input can be set as well.

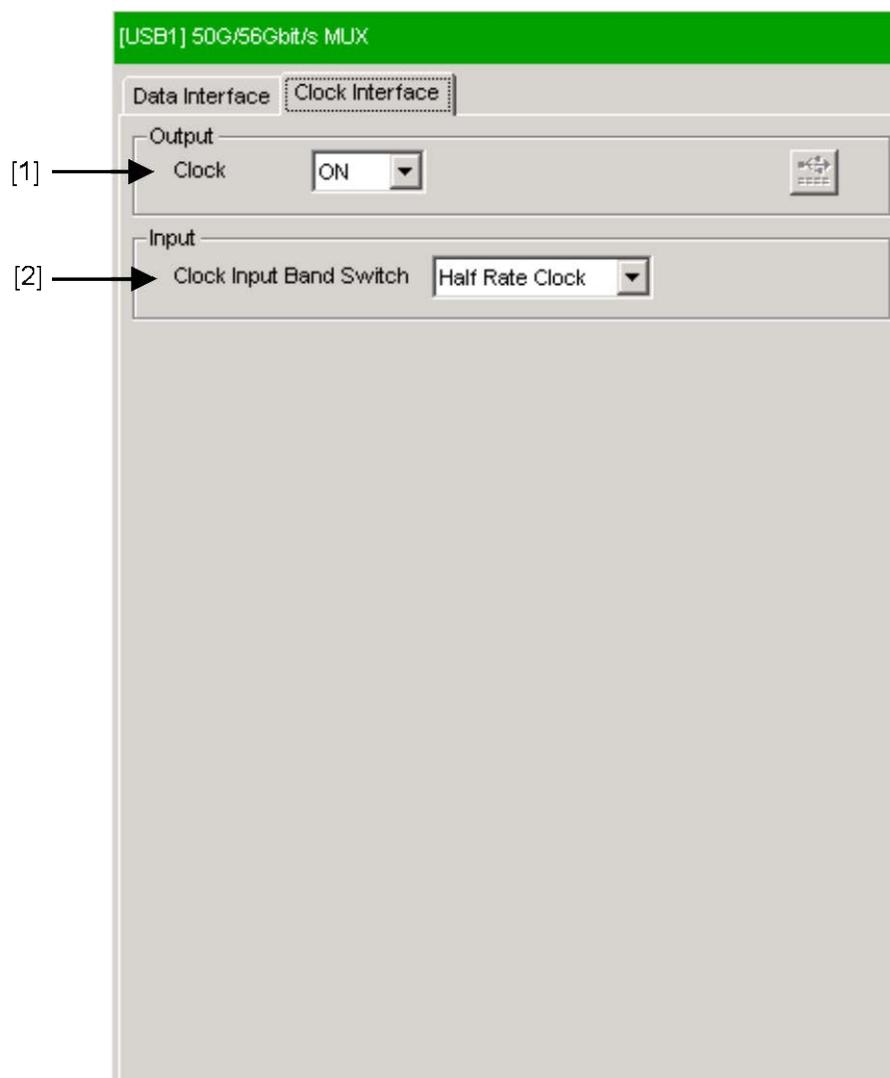


Figure 4.3.3-1 Output Tab Window for Setting Clock

- [1] Select ON or OFF for the clock output.
- [2] Set input clock band switching.
When outputting data at twice the input clock, select **Half Rate Clock**. When outputting data at the same rate as the input clock, select **Full Rate Clock**.
If the MP1821A-02 is not installed, operate at **Half Rate Clock**.

Notes:

1. The DUT may be damaged if the output setting is configured incorrectly. To prevent damage to the DUT, confirm the interface condition with the DUT.
2. The current for the output part is limited (50 mA for sourcing current and 80 mA for sinking current) for protection. If an over-current flows due to the wrong interface condition, the offset voltage for an observed waveform may therefore not reach the set level.
3. Immediately after changing the frequency of the reference signal generator from a high frequency to a low frequency, the amplitude may increase temporarily about 30%, then settled down to a specified value.
If it exceeds the rated value of the DUT, turn OFF the Output of MP1800A prior to change of the frequency first, and then turn ON the Output after the frequency change.

4.4 Setting Test Patterns

The data patterns output by the MP1821A are determined by the Combination setting (see section 4.5), and by the pattern setting of the MU181020A/B Pulse Pattern Generator. When Combination is set, the pattern selected at the MU181020A/B Operation screen becomes the multiplexed pattern output from the MP1821A.

Patterns setting is performed at the **Pattern** Tab of the MU181020A/B Operation screen.

For the setting method, refer to the MU181020A/B operation manual.



Figure 4.4-1 Pattern Tab Window

4.5 Multi Channel Function

Multi-channel sync operation is performed by installing multiple MU181020A/B Pulse Pattern Generator boards in the MP1800A. Multi-channel functions include the Combination and Channel Synchronization functions.

Combination Function Types

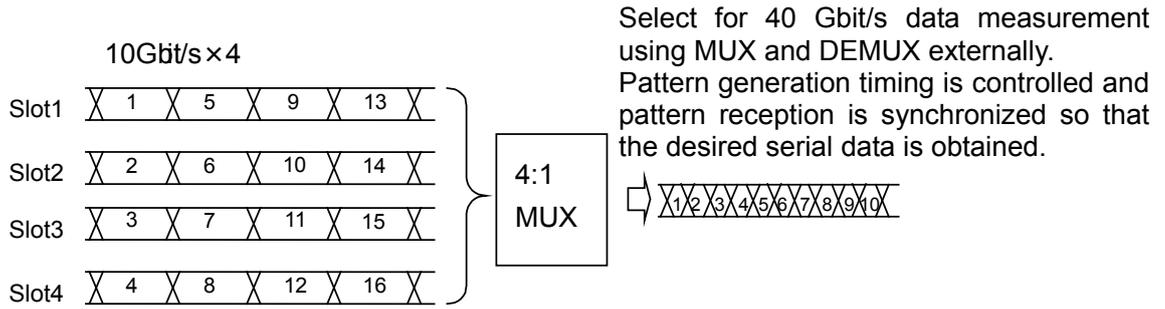
- (1) 4ch Combination: when four PPG/ED modules installed
- (2) 25Gx2ch Combination: when four PPG/ED modules installed
- (3) 2ch Combination: when two or more PPG/ED modules installed

Channel Synchronization Function Types

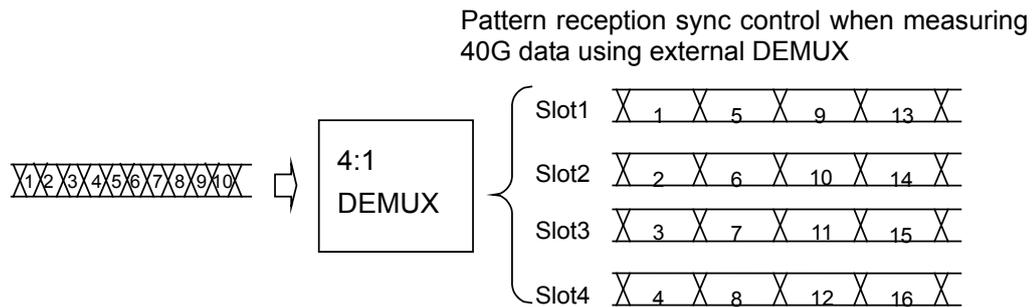
- (1) 12.5G Channel Synchronization: when two or more PPG modules installed
- (2) 25G Channel Synchronization: when four PPG modules installed

4.5.1 Combination Function

When using the Multi Channel function, pattern generation can be synchronized between modules and receiving can be synchronized too. It is possible to evaluate 40G applications by multiplexing a 25G signal using this function.



For combination of MP1821 50G/56G MUX



For combination of MP1822A 50G/56G DEMUX

Figure 4.5.1-1 4 Ch Combination Pattern Generation/Reception

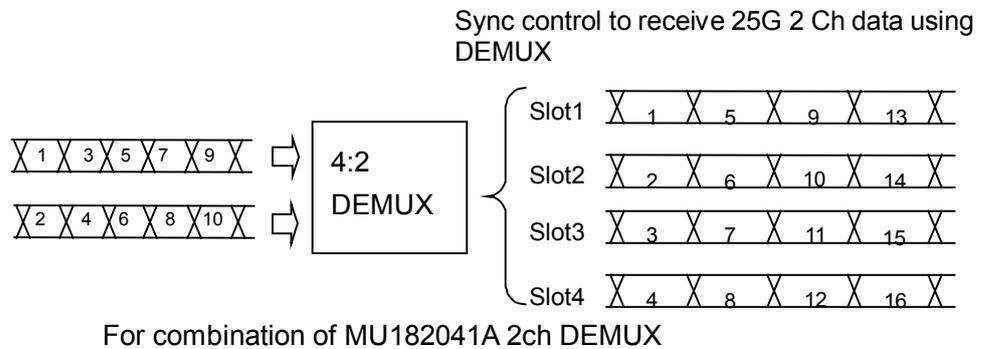
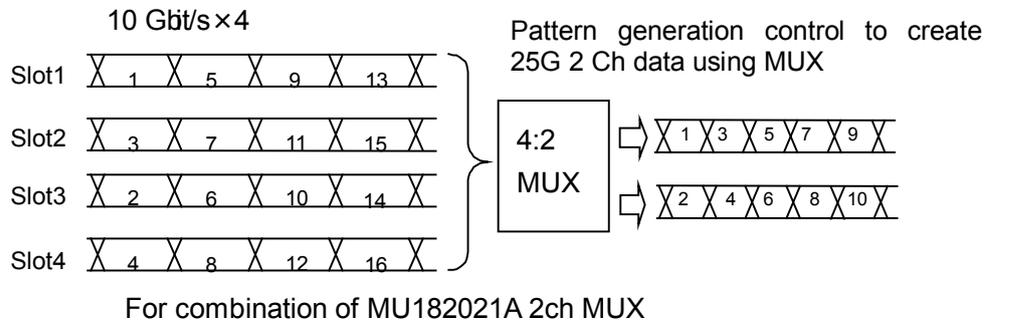


Figure 4.5.1-2 25Gx2ch Combination Pattern Generation/Reception

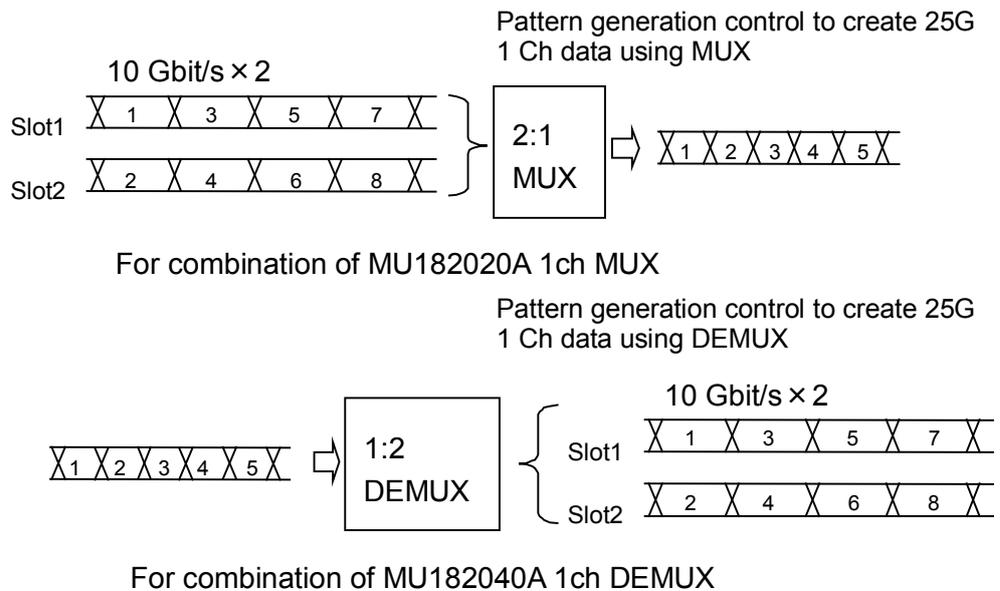


Figure 4.5.1-3 2ch Combination Pattern Generation/Reception

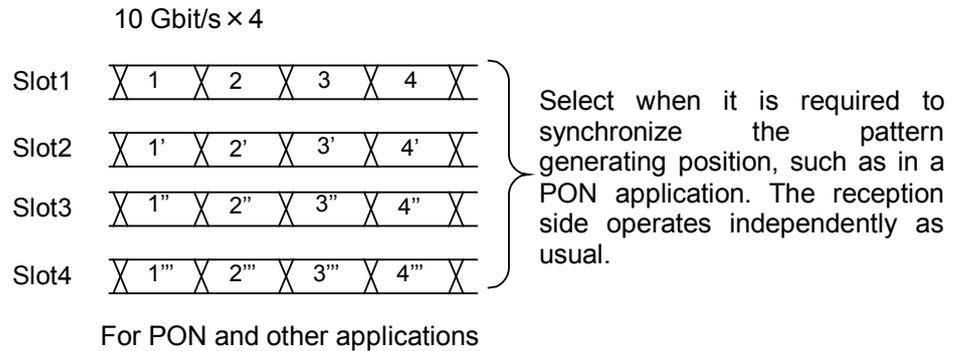


Figure 4.5.1-4 Channel Synchronization Pattern Generation

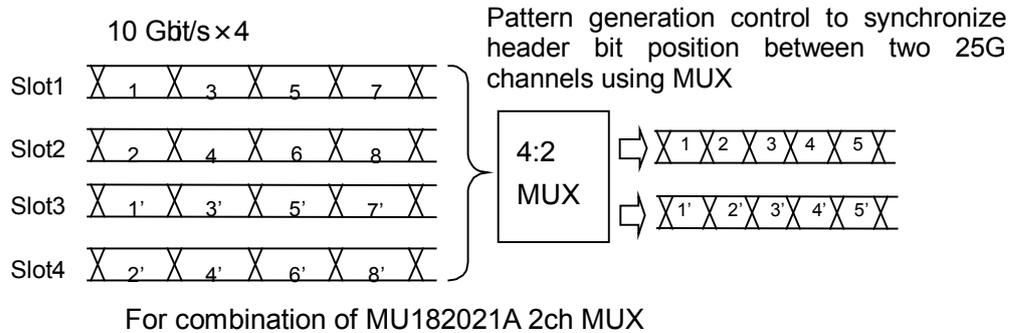


Figure 4.5.1-5 25Gx2ch Combination Pattern Generation/Reception

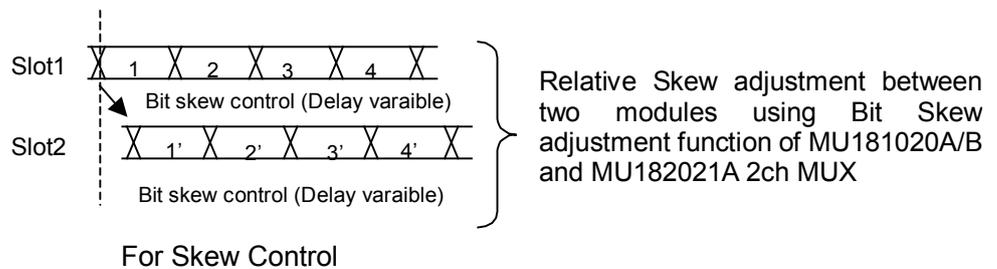


Figure 4.5.1-6 Bit Skew Adjustment Function

4.5.2 Combination setting

To use the Multi-channel function, click the **Combination Setting** module function button to open the Combination Setting dialog box for setting. For details, refer to Section 5.3.3 “Combination setting” in the MX180000A Operation Manual.

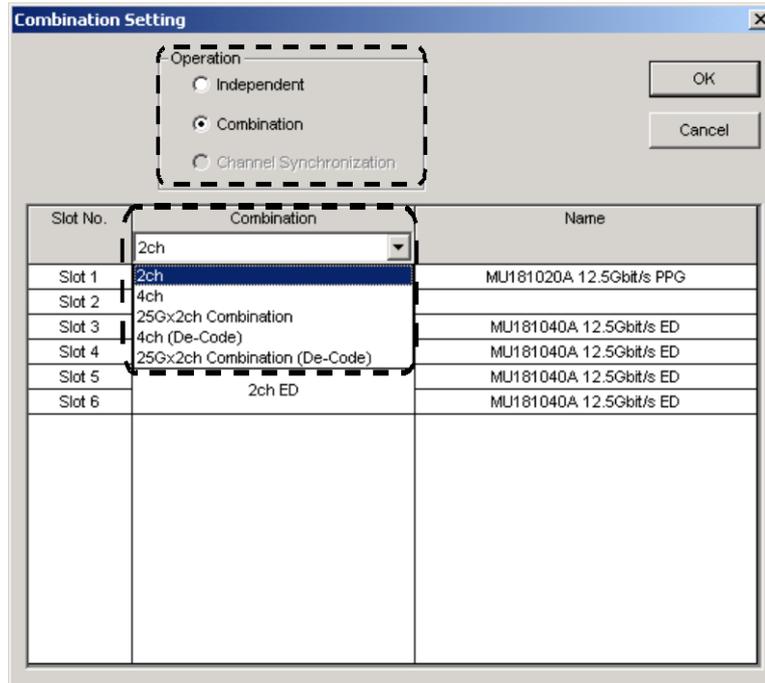


Figure 4.5.2-1 Combination Setting Dialog Box

Table 4.5.2-1 Screen Layout of Combination Setting

Operation Settings		Contents
Independent		Select to operate PPG and ED independently.
Combination	2ch	Select when performing 25 Gbit/s.
	4ch	Select when performing 8 to 56 Gbit/s tests using the MP1821A and MP1822A.
	25Gx2ch Combination	Select when generating/receiving 25 Gbit/s 2 Ch data.
Channel Synchronization	12.5G CH Sync	Select when always outputting with synchronized header bit for PON applications, etc.
	25G CH Sync	Select when always outputting with synchronized header bit between two 25 Gbit/s channels.

Confirm the selected operation by pressing the **OK** button.

Chapter 5 Use Example

This chapter provides use examples of measurement using the MP1821A.

5.1	Measuring Optical Transceiver Module	5-2
5.2	DPSK Transmission Test.....	5-6

5.1 Measuring Optical Transceiver Module

This section explains how to measure 56G optical devices using the MP1800A and MP1821A.

This measurement is explained using a test setup with MP1821A, MP1822A, MP1800A, MU181020B, MU181040B, and MU181800B installed in the MP1800A.

The options configuring the test system are as follows:

MP1800A-016: 2 modules
MU181020B-002/x11/x30: 4 modules
MP1821A-x01/x02/x13/x30: 1 module
MU181040B-002/x30: 4 modules
MU181800B: 2 modules
MP1822A-x01/x02/x30: 1 module
MG3693B: 1 module

1. Connect the GND of the MP1800A and that of the DUT.
2. Connect the power cables.
3. Turn on the MP1800A, and set the measurement conditions as follows.
 - (1) Connect MP1821A, MP1822A, MP1800A, MU181020B, MU181040B, MU181800B, and MG3693B Signal Generator (hereafter, MG3693B), referring to Fig. 5.1-1.
 - (2) When connecting this equipment and the MU181020A/B, the two MU181020A/B modules must be synchronized. (This equipment requires synchronization of the four MU181020A/B modules when using the MU182021A.)
In addition, when connecting MU182040A and MU181040A/B, the two MU181040A/B modules must be synchronized. (This equipment requires synchronization of the four MU181040A/B when using the MU182041A.)
Press the [Combination] button for the module function and select 2 Ch Combination.
 - (3) Adjust the data output interface of the MU182020A to the input interface of the DUT. The output is already OFF at this time.
 - (4) Set a test pattern for the sender side. The test pattern is selected at the MU181020A Pattern screen.
Changing the setting for one channel of the MU181020A/B is reflected in the settings for all channels.

- (5) Set the operation bit rate at the MG3693B.
When the DUT requires a 1/1 Clock frequency, set the 1/1 operation rate at the MG3693B.
When the DUT requires a 1/1 Clock frequency, set the 1/2 operation rate at the MG3693B.
The Clock Input Band SW at the Clock Interface Tab is switched according to the input operation rate.
 - (6) Match the MP1822AA data input interface to the DUT output. Set the termination and threshold conditions at the MP1822AA Data Interface screen.
 - (7) Set the test pattern for the received side. The test pattern is selected at the MU181040A/B Pattern screen.
Changing the setting for one channel of the MU181040A/B is reflected in the settings for all channels.
 - (8) Set the operation rate for the clock input to the MP1822A Ext. Clock Input connector.
The Clock Input Band SW at the Data Interface Tab is switched according to the input operation rate.
 - (9) After all parameters have been set, turn off the MP1800A.
4. Connect the MPMP1821A, MP1822A and DUT.
Connect the input/output signals using the coaxial cable of application parts or an equivalent coaxial cable. At this time, short the core of the cables using a thin pointed metal stick, such as tweezers, before connection. See Figure 5.1-1 for connection of the instruments.
Check that the output level of the DUT(O/E) matches the data input range for this module. If it is out of range, adjust the level using an attenuator.

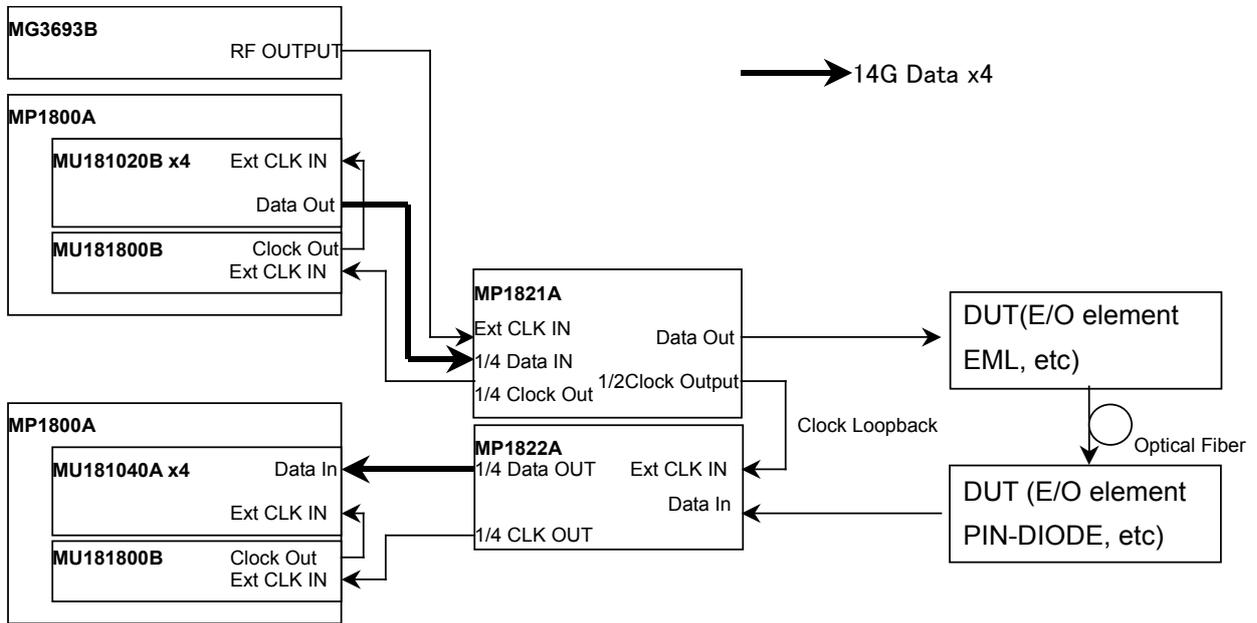


Figure 5.1-1 Connection diagram for XFP module evaluation

5. Turn on the power.
When turning on the power, turn on the MP1800A (installed in the MU181040B), MP1822A, DUT, MP1821A and MP1800A (installed in the MU181020B) 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 MP1821A before changing the cable connection.

6. Enable the signal output of the MU182020A.
Set the Output of MG3693B and Data/XData Output in the Data Interface screen to ON.
Then, set [Output ON/OFF] of the module function button or [Output] of the MP1800A front panel to ON.
7. Set the threshold voltage and phase of MP1822A. When the Auto Adjust function is used, clicking the Auto Adjust module function button on the menu bar automatically adjusts the threshold voltage to the optimum value for the DUT.
8. Start measurement.
The BER measurement results can be checked at the MP1822A Result screen.
9. Confirm that the DUT operates normally. If so, DUT (E/O) sensitivity measurement can be performed for the DUT by adjusting the output level of the MP1821A.

5.2 DPSK Transmission Test

This section describes how to perform 40 Gbit/s DPSK transmission test using MP1800A.

This measurement is explained using a test setup with MP1821A, MP1822A, MP1800A, MU181020B, MU181040B, and MU181800B installed in the MP1800A.

The options configuring the test system are as follows:

MP1800A-016:2 modules
MU181020B-002/x11/x30:4 modules
MP1821A-x01/x02/x13/x30:1 module
MU181040B-002/x30:4 modules
MP1822A-x01/x02/x30:1 module
MG3693B:1 module

1. Connect the GND of the MP1800A, device under test (DUT).
2. Connect the power cables.
3. Turn on the MP1800A on which the MU181020B modules are mounted, and set the measurement conditions as follows.
 - (1) Connect MP1800A, MU181020B, MP1821A, MU181040B, MP1822A, and MG3693B, referring to Fig. 5.1-1.
 - (2) When connecting the MP1821A and the MU181020B, the four MU181020B modules must be synchronized. In addition, when connecting the MP1822A and MU181040B, the four MU181040B modules must be synchronized.
Press the [Combination] button for the module function and select 4 Ch Combination.
 - (3) Match the data output interface of this equipment to the input of the DUT (DPSK Transmitter). The output is already off at this time.
 - (4) Set the test pattern for the send side.
Select a test pattern at the MU181020B Pattern screen.
Changing the setting for one channel of the MU181020B is reflected in the settings for all channels.
 - (5) Set the operation bit rate at the MG3693B.
When generating a RZ signal, set a 1/2 operation rate at the MG3693B. Set Clock Input Band SW in the Clock Interface screen of this equipment to Half Rate Clock.

- (6) Match the clock output interface to the input of the DUT (Driver AMP driving the LN Modulator used for RZ generation). The Output is already set to off at this time.
 - (7) Set the reception test pattern.
Select the test pattern from the Pattern screen of MU181040A/B. Changing the setting of one channel of MU181040A will reflect the setting in all channels.
 - (8) Set the operation rate of Clock to be input to Ext. Clock Input of MP1822A. Clock Input Band SW in the Data Interface screen is toggled in accordance with the input operation rate.
 - (9) When setting the parameters completely, turn off the MP1821A, MP1822A, MP1800A and MG3693B.
4. Connect the MP1821A, MP1822A and the DUT.
- Connect the I/O signals, using the supplied coaxial cables (cables equivalent to the supplied ones can also be used). At this time, short the cable cores, using a thin pointed metal stick such as tweezers before connection.

See Fig. 5.2-1 for connection of the instruments.

Check whether the output level of the DUT (RZ-DPSK Receiver Module) is conformed to the input data range of this equipment or not. When it is not conformed, adjust the level using an attenuator.

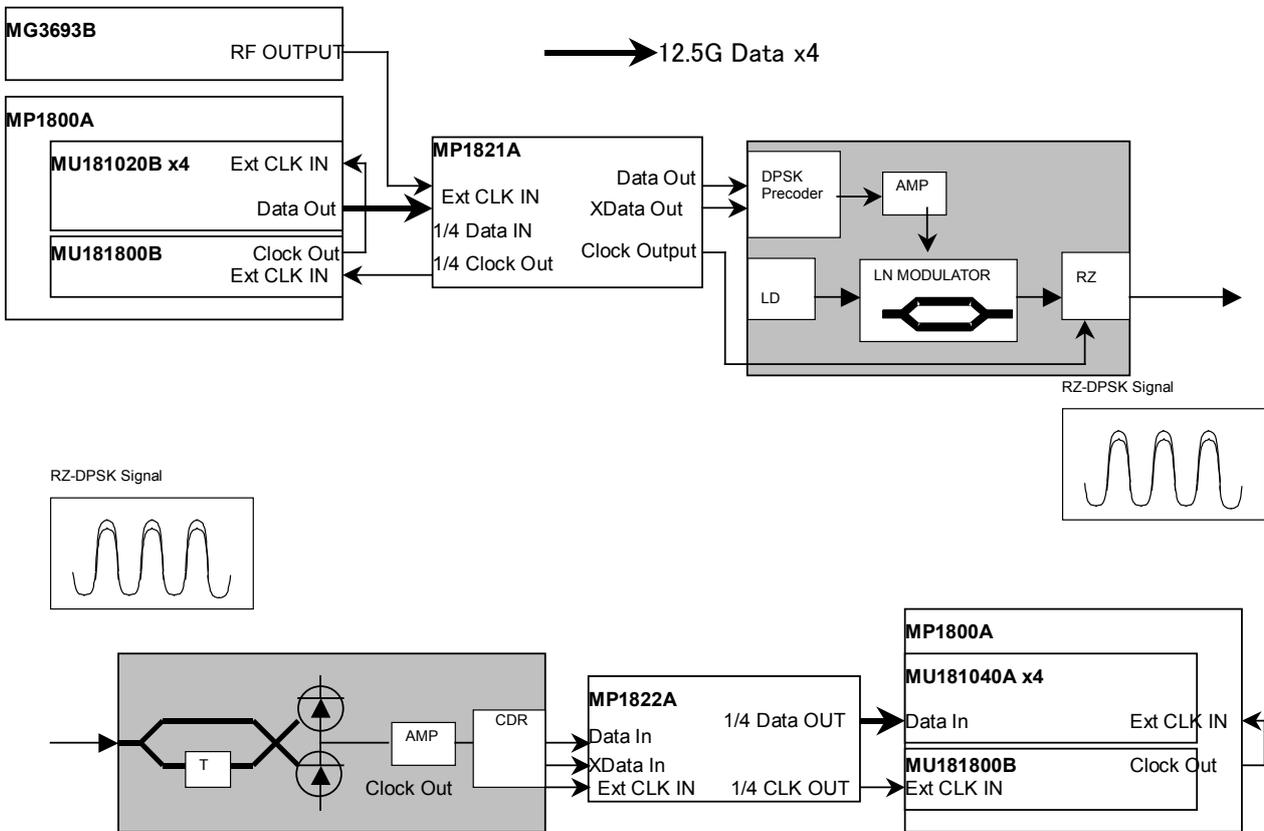


Figure 5.2-1 CSRZ-DPSK Modulator connection diagram

5. Turn the power on. When turning the power on, press the power of MP1800A (installed in MU181040B), MP1822A, DUT, MP1821A, and MP1800A (installed in MU181020B) 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,MP1821A before changing the cable connection.

6. Enable the signal output of the MP1821A.
Set Output of MG3693B and Data/XData Output in the Data Interface screen to ON.
In addition, set Clock/XClock Output of the Clock Interface screen to ON.
Last, set the [Output] button of the module function buttons to ON.
7. Set the threshold voltage and phase of MP1822A.
Clicking [Auto Search] of the module function button will always automatically set the optimum position with respect to the DUT.
8. Start the measurement.
The BER measurement results can be confirmed in the Result screen of MP1822A.
9. . After confirming that the DUT (transmission section/reception section) is operating normally, it is possible to perform transmission test by the CSRZ-DPSK signal if the test object (such as Fiber) is placed between transmission section and reception section.

Chapter 6 Performance Test

This chapter describes the performance testing of the MU182020A/21A.

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6.2	Devices Required for Performance Tests.....	6-3
6.3	Performance Test Items	6-4
	6.3.1 Operating frequency range.....	6-4
	6.3.2 Waveform evaluation test.....	6-6

6.1 Overview

Performance tests are executed to check that the major functions of the MP1821A meet the required specifications. Execute performance tests at acceptance inspection, operation check after repair, and periodic (once ever six months).

6.2 Devices Required for Performance Tests

Before starting performance tests, warm up the MP1821A 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 +4 MU181040A/B units +MU181800A/B) Error detector (MP1800A-015/016 +4 MU181040A/B units +MU181800A/B) DEMUX (MP1822A)	Operating frequency: 8 to 50 GHz Data input sensitivity: 100 mVp-p or more
Pulse pattern generator (MP1800A-015/016 +4 MU181020B units +MU181800B) Error detector (MP1800A-015/016 +4 MU181040B units +MU181800B) DEMUX (MP1822A-x01)	Operating frequency: 8 to 56 GHz Data input sensitivity: 100 mVp-p or more
Signal generator (MG3693B)	Operating frequency: 4 to 60 GHz Output amplitude: 0.3 to 1.0 Vp-p
Sampling Oscilloscope	Band frequency: 70 GHz or more

Notes:

1. 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.

6.3 Performance Test Items

This section describes the following test items.

- (1) Operating frequency range
- (2) Waveform

6.3.1 Operating frequency range

- (1) Specifications

Table 6.3.1-1 Specifications

Model	Options		Specifications
	x01	x02	
MP1821A	No	No	4 to 25 GHz
	Yes	No	4 to 28 GHz
	No	Yes	At Full Rate Clock: 8 to 50 GHz When selecting Half Rate Clock:4 to 25 GHz
	Yes	Yes	When selecting Full Rate Clock:8 to 56 GHz When selecting Half Rate Clock:4 to 28 GHz

- (2) Device connection

Figure 6.3.1-1 shows the example of connection MP1821A, MU181020A/B (MU181020A/B-x02, x11, x30), MP1822A, MU181040A/B (MU181040A/B-x02, x30), MU181800A/B, and MG3693B.

Before connecting the devices, confirm that the MP1821A output appropriate frequency and level of signals.

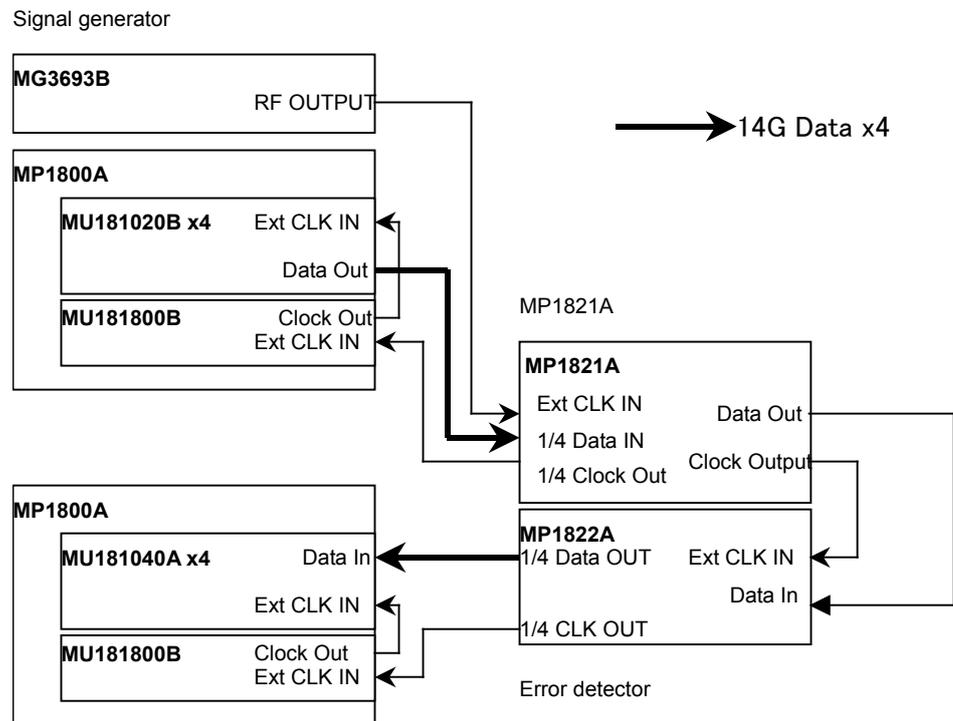


Figure 6.3.1-1 Connection Diagram for Operating Frequency Range Test

(3) Test procedure

1. Connect each measuring instrument using cables as shown in Figure 6.3.1-1.
2. Install the MP1821A in 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. Press the [Combination] button for the module function and select 4 Ch Combination.
4. Set the Data signal output amplitude of the MP1821A to 500 mVp-p, offset (Vth) to 0 V, MU181020A/B test pattern to PRBS 31, and Mark Ratio to 1/2. Set the Error Detector test pattern in the same way.
5. Set the MP1821A and MP1800A signal output to ON to output the signal.
6. Adjust the MP1822A phase and threshold to the optimum values. (Use the auto search function.)
7. Check that no error is detected by the MU181040A/B.
8. Change the operating frequency and check if no error occurs within the rated operating frequency range.

6.3.2 Waveform evaluation test

(1) Specifications

Table 6.3.2-1 Specifications

Option	Specifications
MP1821A-x10 Data Output (0.4 Vp-p)	Level : 0 / -0.4 V Cross Point : 50% Tr/Tf : Typ.10 ps (20 to 80%) @50 Gbit/s, 0.4 Vp-p Total Jitter : Typ. 4 psp-p* Waveform distortion : Typ. ±25 mV ±10% @50 Gbit/s
MP1821A-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 : 30 to 70% Tr/Tf : Typ.8 ps (20 to 80%) @50 Gbit/s, 2.5 Vp-p Total Jitter : Typ. 4 psp-p* Waveform distortion : Typ. ±25 mV ±10%@50 Gbit/s
MP1821A-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 : 30 to 70% Tr/Tf : Typ.8 ps (20 to 80%) @50 Gbit/s, 3.5 Vp-p Total Jitter : Typ. 4 psp-p* Waveform distortion : Typ. ±25 mV ±10%@50 Gbit/s

*: The jitter specification value is defined assuming use of an oscilloscope with residual jitter of less than 200 fs (RMS).

(2) Device connection

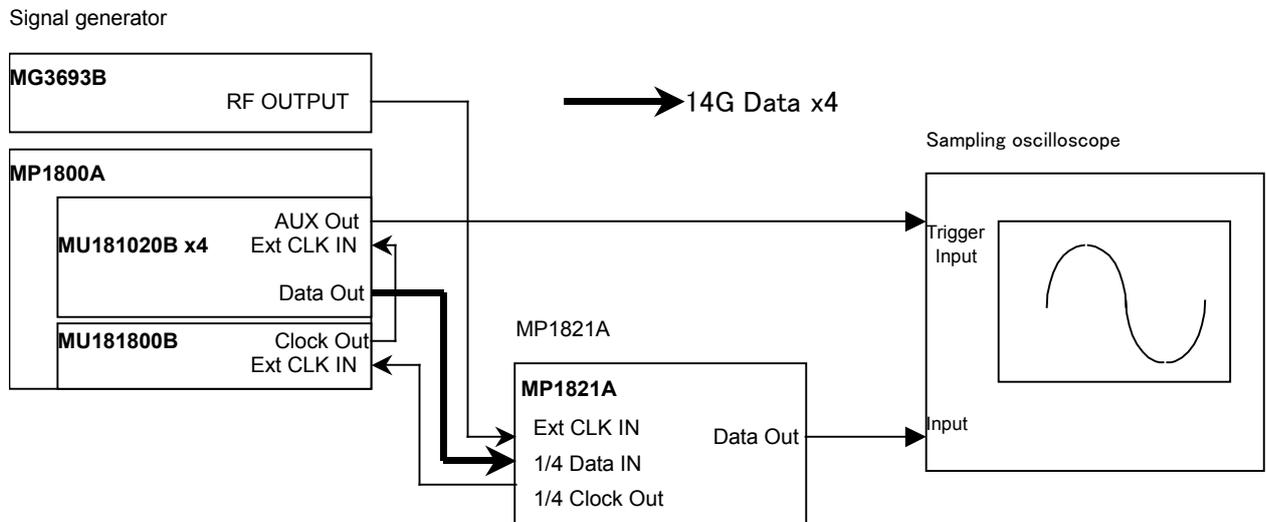


Figure 6.3.2-1 Connection Diagram for Waveform Test

(3) Test procedure

1. Connect the cables among the measuring instruments, referring to Figure 6.3.2-1.
2. Install the MP1821A in 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. Press the [Combination] button for the module function and select 4 Ch Combination.
4. Set the Amplitude, Offset, and Cross Point of the output test data at the setting screen.
5. Set the test pattern in the MU181020A/B Pattern tab window. 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.
6. Configure the trigger signal setting. Select 1/N Clock in the AUX Output area on the MU181020A/B Misc tab window, and set the division ratio according to the sampling oscilloscope used.
7. When output of the signal generator, MP1821A, 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.

Chapter 7 Remote Commands

This chapter provides the MP1821A remote commands.

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

7.1	Status Commands	7-2
7.2	Common Commands	7-4
	7.2.1 New Commands	7-4
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7.1 Status Commands

This section explains the Alarm/Error status commands for the MP1821A 50G/56Gbit/s MUX.

:INSTrument:MUX[:EVENT]?

Response	<numeric>=<NR1 NUMERIC RESPONSE DATA> 0 to 20 Sum total of the bit of event register (DECIMAL) Available bit 4 (Bit2) Delay Busy 16 (Bit4) Delay Calibration Require
Function	Queries event at 56Gbit/s MUX status.
Example	> :INSTrument:MUX:EVENT? Or > :INSTrument:MUX? < 4

:INSTrument:MUX:CONDition?

Response	<numeric>=<NR1 NUMERIC RESPONSE DATA> 0 to 20 Sum total of the bit of condition register (DECIMAL) Available bit 4 (Bit2) Delay Busy 16 (Bit4) Delay Calibration Require
Function	Queries condition at 56Gbit/s MUX status.
Example	> :INSTrument:MUX:CONDition? < 4

:INSTrument:MUX:PTRansition <numeric>

Parameter	<numeric>=<DECIMAL NUMERIC PROGRAM DATA> 0 to 20 Sum total of the bit of transition filter (DECIMAL) Available bit 4 (Bit2) Delay Busy 16 (Bit4) Delay Calibration Require
Function	Sets the transition filter (positive transition) of the 56Gbit/s MUX status.
Example	Sets the transition filter (positive transition) of the 56Gbit/s MUX status to 1. > :INSTrument:MUX:PTRansition 4

:INSTrument:MUX:PTRansition?

Response	<numeric>=<NR1 NUMERIC RESPONSE DATA> 0 to 20 Sum total of the bit of transition filter (DECIMAL)
Function	Queries the condition of the transition filter (positive transition) of the 56Gbit/s MUX status.
Example	> :INSTrument:MUX:PTRansition? < 4

:INSTrument:MUX:NTRansition <numeric>

Parameter	<numeric>=<DECIMAL NUMERIC PROGRAM DATA> 0 to 20 Sum total of the bit of transition filter (DECIMAL) Available bit 4 (Bit2) Delay Busy 16 (Bit4) Delay Calibration Require
Function	Sets the transition filter (negative transition) of the 56Gbit/s MUX status.
Example	Sets the transition filter (negative transition) of the 56Gbit/s MUX status to 1. > :INSTrument:MUX:NTRansition 4

:INSTrument:MUX:NTRansition?

Response	<numeric>=<NR1 NUMERIC RESPONSE DATA> 0 to 20 Sum total of the bit of transition filter (DECIMAL)
Function	Queries the transition filter (negative transition) of the 56Gbit/s MUX status.
Example	> :INSTrument:MUX:NTRansition? < 4

:INSTrument:MUX:RESet

Function	Initializes event at 56Gbit/s MUX status.
Example	> :INSTrument:MUX:RESet

7.2 Common Commands

This section describes the commands related to common settings and functions of the MX180000A. Only the commands for the MP1821A and changed the MX18000A commands are explained below.

7.2.1 New Commands

Table 7.2.1-1 explains the new commands. These commands are not compatible with the MX180000A.

Table 7.2.1-1 Common Commands (New)

No.	Setting Item	Command
1	Setting for USB unit number	:USB:ID
		:USB:ID?
2	Query for USB name of mainframe	:SYSTem:CONDition:USB?
3	Open	:SYSTem:MMEMory:MUX:RECall
4	Save	:SYSTem:MMEMory:MUX:STORe

:USB:ID <usb number>

Parameter <usb_number>=<DECIMAL NUMERIC PROGRAM DATA>
 1 USB number 1
 Function Sets MP1821A to be controlled using USB number.
 Example > :USB:ID 1

:USB:ID?

Response <usb_number>=< NR1 NUMERIC RESPONSE DATA >
 1 USB number 1
 Function Queries USB number of controlled MP1821A.
 Example > :USB:ID?
 > 1

Note:

In order to remote control the module mounted in MP1800A/MP1810A after remote controlling MP1821A 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*.

:SYSTem:CONDition:USB?

Response	<usb1>, ..., <usb127>=<STRING RESPONSE DATA> "XXXX" Model Name Example:MP1821A Refer to Table 7.2.1-2 "Option character correspondence table".
Function	Queries USB module model name.
Example	> :SYSTem:CONDition:USB? < MP1821A, MP1822A,NONE,NONE, ...,NONE

Table 7.2.1-2 Option Character Correspondence Table

Model Name	Option Number	Opetion Name
MP1821A 50G/56Gbit/s MUX	OPTx01	56Gbit/s Extension
	OPTx02	Clock Input Band Switch
	OPTx10	Data Output (0.4 Vp-p fixed)
	OPTx11	Data Output(0.5 to 2.5Vp-p)
	OPTx13	Data Output (0.5 to 3.5Vp-p)
	OPTx30	Variable Data Delay
MP1822A 50G/56Gbit/s DEMUX	OPTx01	56Gbit/s Extension
	OPTx02	Clock Input Band Switch
	OPTx30	Variable Clock Delay

:SYSTem:MMEMory:MUX:RECall <file name>

Parameter	<file_name>=<STRING PROGRAM DATA> "<drv>:[<dir>]<file>" <drv> = C,D,E,F <dir>=<dir1>/<dir2>/... (Omitted for the root directory) <file> = File name
Function	Opens MUX setting data.
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>/... (Omitted for the root directory) <file> = File Name <data_type>=<CHARACTER RESPONSE DATA> UMX 56 G MUX Setup <file_type>=<CHARACTER PROGRAM DATA> BIN Binary file
Function	Saves MUX setting data. Note: The settings will not be read from the saved file if the file name is changed.
Example	To specify save destination for all setting files and save them with a comment and measurement result data: > :SYSTem:MMEMory:MUX:STORe "C:/Test/example",UMX,BIN

7.2.2 Changed Commands

This section explains the changed commands. They are compatible with the MX180000A.

Table 7.2.2-1 Common Commands (Changed)

No.	Setting Item	Command
1	Query for software status	:SYSTem:CONDition?
		CND?
2	Query for system error	:SYSTem:INFormation:ERRor?
		INF?
3	Query for mainframe information	:SYSTem:UNIT?
		UNT?

: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>

XXXXXXXXXX Module Name Example:MP1821A

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 000000000 to 999999999

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

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 MP1821A.
 Example > :SYSTem:CONDition?
 < 6201234567,1.00.00,1.00.20,OPT302,1.00.00,1.00.00,OPT12,OPT14,
 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
 MP1821A,6201234571,1.00.00,1.00.00,1.00.00,OPT002,OPT030

CND?

Response <mainframe>,<slot1>,....,<slot64>,<usb1>,....,<usb127>
 <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>
 XXXXXXXXXXX(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>
 XXXXXXXXXXXXX(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 MP1821A.

Example

> CND?

< CND△6201234567,△△△1.00.00, △△△1.00.20,OPT301,OPT302,
△△△1.00.00,△△△1.00.00,OPT 12,

...,

MP1821A,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 All the system errors that have currently occurred are displayed, delimited with a comma (.).
Function	Queries the System Error contents.
Example	> :SYSTem:INFormation:ERRor? 1,1 < 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
Function	Queries the System Error contents.
Example	To query the System Error contents using one mainframe: > INF?□1,1 < INF□#B1000

<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 USB1 information.

> UNT? 1,1

< MP1821A,6201234568,1.00.00,1.00.00,OPT01,1.00.00,1.00.00

7.3 56G MUX Commands

This section explains the setting and query commands of MP1821A 50G/56Gbit/s MUX.

The commands are explained per tab. Before executing these commands, specify the module USB number using :USB:ID command by remote operation. Refer to Section 7.2 Common Commands for how to specify the :USB:ID command and USB number..

Hereafter, the MU182020A 25Gbit/s 1ch DEMUX and MU182021A 25Gbit/s 2ch DEMUX are called the MU182020A and MU182021A, respectively. The command compatibility is explained below.

7.3.1 Data Interface tab

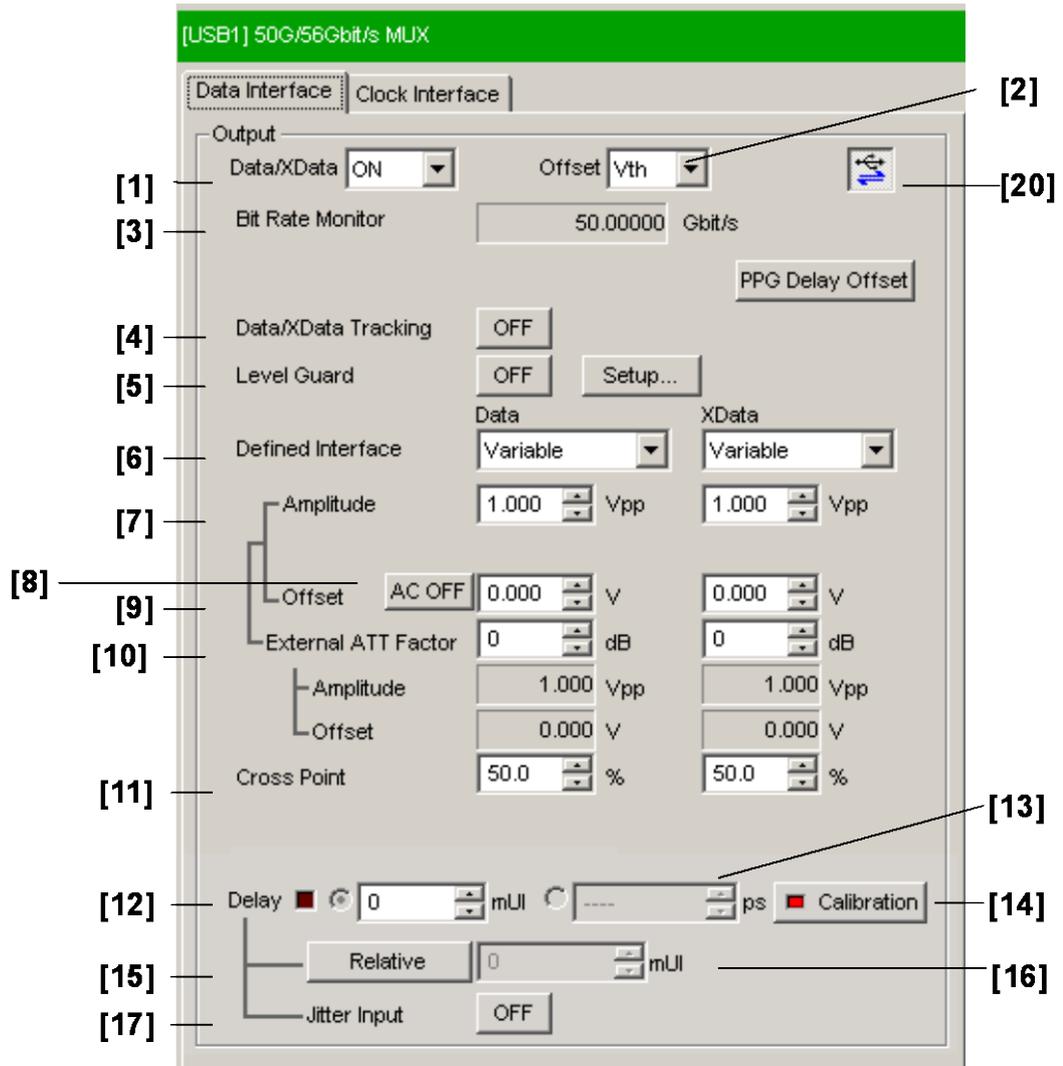


Figure 7.3.1-1 Data Interface Settings

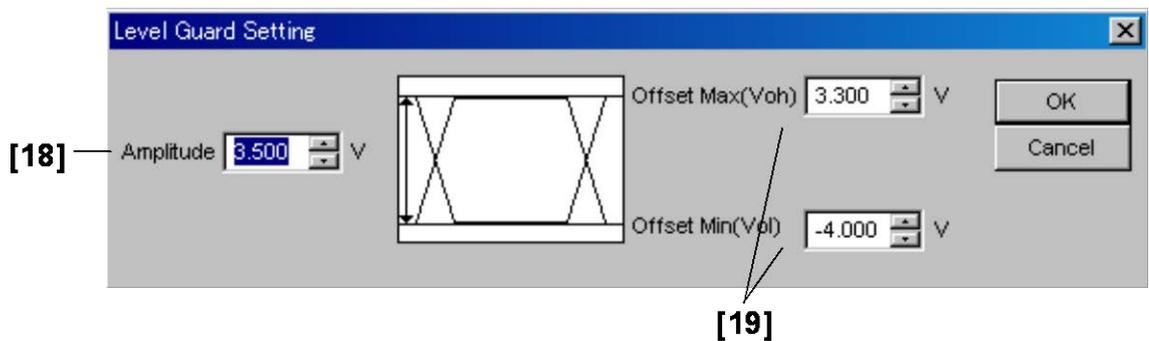


Figure 7.3.1-2 Level Guard Settings

Table 7.3.1-1 Data Interface Setting Commands

No.	Setting 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]	Delay (mUI setting)	:MUX:DATA:UIPadjust
		:MUX:DATA:UIPadjust?
[13]	Delay (ps setting)	:MUX:DATA:PADJust
		:MUX:DATA:PADJust?
[14]	Calibration	:MUX:DATA:PCALibration
[15]	Relative	:MUX:DATA:RELative
		:MUX:DATA:RELative?
[16]	No label (settings of Relative values)	:MUX:DATA:RDELay
		:MUX:DATA:RDELay?
[17]	Jitter Input	:MUX:DATA:JINPut
		:MUX:DATA:JINPut?
[18]	Amplitude	:MUX:DATA:LIMitter:AMPLitude
		:MUX:DATA:LIMitter:AMPLitude?
[19]	Offset Max/Min	:MUX:DATA:LIMitter:OFFSet
		:MUX:DATA:LIMitter:OFFSet?
[20]	MUX·PPG Link ON/OFF	:SYSTem:LINK:MUXPpg
		:SYSTem:LINK:MUXPpg?

: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 and MU182021A.

: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 and MU182021A.

: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 and MU182021A.

: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 and MU182021A.

:MUX:OUTPut:BMONitor?

Response	<code><string>=<STRING RESPONSE DATA></code> <table border="1"><thead><tr><th>Format</th><th>Description</th></tr></thead><tbody><tr><td>"XX.XXXXX"</td><td>XX.XXXXX Gbit/s</td></tr><tr><td>"-----"</td><td>When no data corresponds to the query</td></tr></tbody></table>	Format	Description	"XX.XXXXX"	XX.XXXXX Gbit/s	"-----"	When no data corresponds to the query
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? < "56.00000"						
Compatibility	Compatible with MU182020A and MU182021A.						

:MUX:DATA:TRACking <boolean>

Parameter	<code><boolean>=<BOOLEAN PROGRAM DATA></code> 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 and MU182021A.

:MUX:DATA:TRACking?

Response	<code><numeric>=<NR1 NUMERIC RESPONSE DATA></code> 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 and MU182021A.

: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 and MU182021A.

: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 and MU182021A.

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

Parameter	<port>=<CHARACTER PROGRAM DATA> DATA Data XDATA XData <level>=<CHARACTER PROGRAM DATA> VARIABLE Variable (MP1821A-x11, x13) PCML PCML level (MP1821A-x11,x13) NCML NCML level (MP1821A-x11,x13) SCFL SCFL level (MP1821A-x11,x13) NECL NECL level (MP1821A-x11,x13) LVPECL LVPECL level (MP1821A-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 and MU182021A.

: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 and MU182021A.

: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 (MP1821A-x11) 0.500 to 3.500 V/0.002 V Step (MP1821A -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 and MU182021A.

: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 and MU182021A.

: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 and MU182021A.

: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 and MU182021A.

: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 (MP1821A-x11,x13) -3.000 to 3.050 Vth/0.001 V Step (MP1821A-x11,x13) -4.000 to 2.800 Vol/0.001 V Step (MP1821A-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 and MU182021A.

: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 and MU182021A.

: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 and MU182021A.

: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 and MU182021A.

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

Parameter	<port>=<CHARACTER PROGRAM DATA> DATA Data XDATA XData <numeric>=<DECIMAL NUMERIC PROGRAM DATA> 30 to 70 30 to 70%/0.1% Step
Function	Sets data output crosspoint for specific port.
Example	To set data output crosspoint for XData of Data Interface to 60.0%. > :MUX:DATA:CPOint XDATA,60.0
Compatibility	Compatible with MU182020A and MU182021A.

: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 < 60.0
Compatibility	Compatible with MU182020A and MU182021A.

:MUX:DATA:UIPadjust <numeric>

Parameter	<numeric>=<DECIMAL NUMERIC PROGRAM DATA> -1000 to 1000 -1000 to 1000 mUI/4 mUI Step
Function	Sets shared settings for Data and Xdata output in mUI units.
Example	To set Data output shared settings for Data Interface to 500 mUI. > :MUX:DATA:UIPadjust 500
Compatibility	Compatible with MU182020A and MU182021A.

:MUX:DATA:UIPadjust?

Response	<numeric>=<NR1 NUMERIC RESPONSE DATA>
Function	Queries shared settings for Data and Xdata output in mUI units.
Example	Query shared settings for Data output of Data Interface. > :MUX:DATA:UIPadjust? < 500
Compatibility	Compatible with MU182020A and MU182021A.

:MUX:DATA:PADJust <numeric>

Parameter	<numeric>=<DECIMAL NUMERIC PROGRAM DATA> -20 to 20 -20 to 20 ps/0.8 ps Step (50 GHz) -40 to 40 -40 to 40 ps/0.16 ps Step (25 GHz)
Function	Converts mUI setting resolution from calculated frequency value to reference Sets shared settings for Data and Xdata output in ps units. Sometimes, the value cannot be set, depending on the setting resolution. In this case, sets the nearest approximation.
Example	To set Data output shared settings for Data Interface to 1000 ps > :MUX:DATA:PADjust 1000
Compatibility	Compatible with MU182020A and MU182021A.

:MUX:DATA:PADJust?

Response	<numeric>=< NR2 NUMERIC RESPONSE DATA>
Function	Queries shared settings for Data and Xdata output in ps units.
Example	To query shared settings for Data of Data Interface. > :MUX:DATA:UIPadjust? < 1000
Compatibility	Compatible with MU182020A and MU182021A.

:MUX:DATA:PCALibration

Function	Calibrates Data and XData output phase
Example	Calibrate Data and XData output phase for Data Interface > :MUX:DATA:PCALibration
Compatibility	Compatible with MU182020A and MU182021A.

:MUX:DATA:RELative <boolean>

Parameter	<boolean>=<BOOLEAN PROGRAM DATA> OFF or 0 Reference OFF On or 1 Reference ON
Function	Sets Data output delay reference ON or OFF.
Example	To set Data output delay reference for Data1Interface to ON. > :MUX:DATA:RELative ON
Compatibility	Compatible with MU182020A and MU182021A.

: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 Data output delay reference of Data Interface. > :MUX:DATA:RELative? < 1
Compatibility	Compatible with MU182020A and MU182021A.

: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 Data output delay reference for Data Interface to -1000 mUI > :MUX:DATA:RDElay -1000,UI
Compatibility	Compatible with MU182020A and MU182021A.

: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 data output delay reference value for Data1Interface in mUi units. > :MUX:DATA:RDElay? UI < -1000
Compatibility	Compatible with MU182020A and MU182021A.

: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 addition status.
Example	Set Jitter Input addition status for Data Interface to ON. > :MUX:DATA:JINPut ON
Compatibility	Compatible with MU182020A and MU182021A.

:MUX:DATA:JINPut?

Response	<numeric>=< NR2 NUMERIC RESPONSE DATA>
Function	Queries Jitter Input addition status.
Example	To query Jitter Input addition status of Data Interface. > :MUX:DATA:JINPut? < ON
Compatibility	Compatible with MU182020A and MU182021A.

: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 (MP1821A-x11) 0.500 to 3.500 0.500 to 3.500 V/0.002 V step (MP1821A -x13)
Function	Sets Data/XData output amplitude limit
Example	To set Data/XData output amplitude limit for Data1Interface to 2.000. > :MUX:DATA:LIMitter:AMPLitude 2.000
Compatibility	Compatible with MU182020A and MU182021A.

:MUX:DATA:LIMitter:AMPLitude?

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

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

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

:MUX:DATA:LIMitter:OFFSet?

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

:SYSTem:LINK:MUXPpg <boolean>

Parameter	<boolean>=<BOOLEAN PROGRAM DATA> OFF or 0, ON or 1
Function	Sets link between 56G MUX and 4ch PPG ON/OFF
Example	To set link between 56G MUX and 4ch PPG to ON > :SYSTem:LINK:MUXPpg ON
Compatibility	Not backwards compatible

:SYSTem:LINK:MUXPpg?

Response	<numeric>=<NR1 NUMERIC RESPONSE DATA> 0 Link between 56G MUX and 4ch PPG OFF 1 Link between 56G MUX and 4ch PPG ON
Function	Queries link between 56G MUX and 4ch PPG ON/OFF
Example	> :SYSTem:LINK:MUXPpg? < 1
Compatibility	Not backwards compatible.

7.3.2 Clock Interface Tab

7.3.2.1 Clock Output Setting Commands

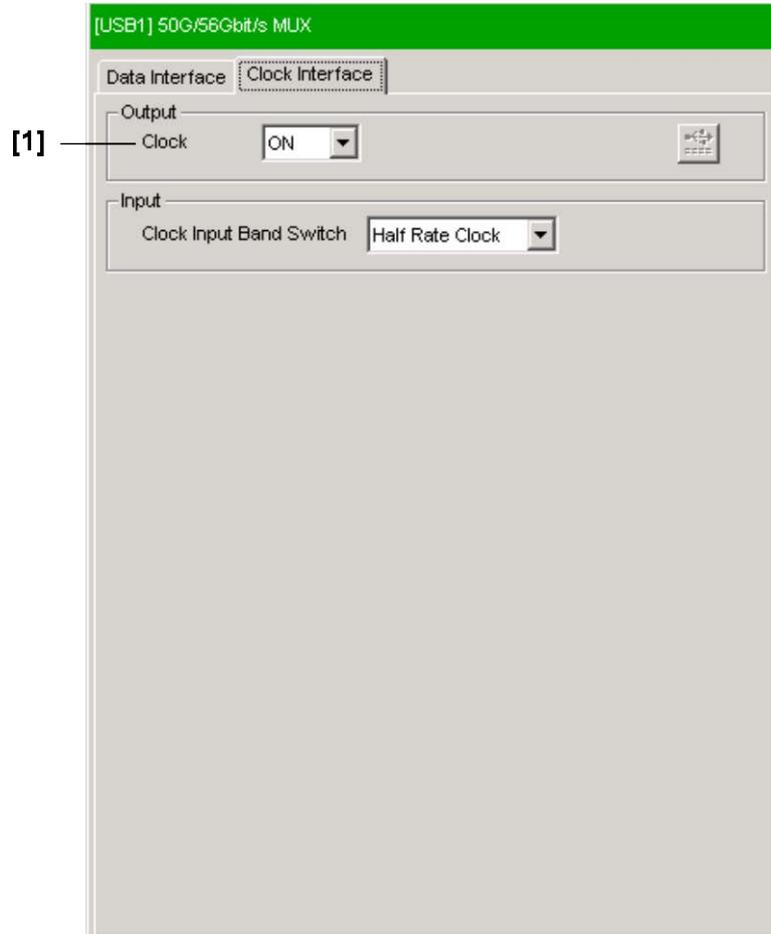


Figure 7.3.2.1-1 Clock Interface Settings

Table 7.3.2.1-1 Clock Interface Setting Command

No.	Setting Item	Command
[1]	ClockON/OFF	:MUX:CLOCK:OUTPut
		:MUX:CLOCK:OUTPut?

:MUX:CLOCK:OUTPut <boolean>

Parameter	<boolean>=<BOOLEAN PROGRAM DATA> OFF or 0 Shared settings for Clock/XClock OFF ON or 1 Shared settings for Clock/XClock ON
Function	Sets shared settings for Clock/XClock ON/OFF.
Example	To set shared settings for Clockoutput to ON. > :MUX:CLOCK:OUTPut ON
Compatibility	Compatible with MU182020A and MU182021A.

:MUX:CLOCK:OUTPut?

Response	<numeric>=<NR1 NUMERIC RESPONSE DATA> 0 Clock output OFF 1 Clock output ON
Function	Queries clock output ON/OFF.
Example	> :MUX:CLOCK:OUTPut? < 1
Compatibility	Compatible with MU182020A and MU182021A.

7.3.2.2 Clock Input Setting Command

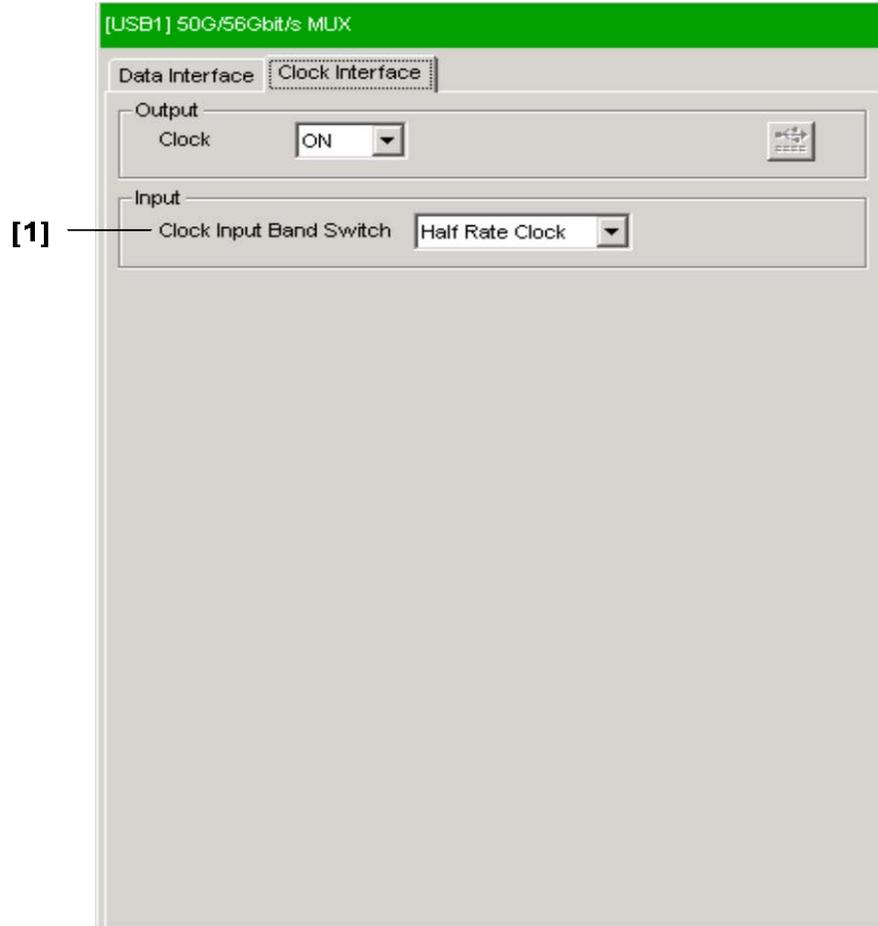


Figure 7.3.2.2-1 Clock Input Setting

Table 7.3.2.2-1 Clock Input Setting Command

No.	Setting Item	Command
[1]	Clock Input Band Switch	:MUX:CLOCKk:BAND
		:MUX:CLOCKk:BAND?

:MUX:CLOCK:BAND <sw>

Parameter	<sw>=<CHARACTER PROGRAM DATA> HALFrate Half rate FULLrate Full rate
Function	Sets input rate switching for external clock source.
Example	To set input rate switching for external clock source to Half Rate. > :MUX:CLOCK:BAND HALF
Compatibility	Compatible with MU182020A and MU182021A.

:MUX:CLOCK:BAND?

Response	<sw>=<CHARACTER RESPONSE DATA> HALF,FULL
Function	Queries input rate switching for external clock source.
Example	> :MUX:CLOCK:BAND? < HALF
Compatibility	Compatible with MU182020A and MU182021A.

Chapter 8 Maintenance

This chapter describes the maintenance of the MP1821A.

8.1	Daily Maintenance	8-2
8.2	Cautions on Storage	8-2
8.3	Transportation.....	8-3
8.4	Calibration.....	8-3
8.5	Disposal	8-4

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 MP1821A prior to storage. Avoid storing the MP1821A 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 $\leq -20^{\circ}\text{C}$ or $\geq 60^{\circ}\text{C}$
Humidity range of $\geq 85\%$

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 MP1821A for transport. If you do not have the original packing materials, pack the MP1821A according to the following procedure. When handling the MP1821A, 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 MP1821A.
2. Check for loose or missing screws.
3. Provide protection for structural protrusions and parts that can easily be deformed, and wrap the MP1821A with a sheet of polyethylene. Finally, cover with moisture-proof paper.
4. Place the wrapped MP1821A 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 7.2 “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.

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 MP1821A. 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 during MP1821A operation.

9.1	Problems Discovered during Module Replacement	9-2
9.2	Problems Discovered during Output Waveform Observation.....	9-2
9.3	Problems Discovered during Error Rate Measurement	9-4

9.1 Problems Discovered during Module Replacement

Table 9.1-1 Remedies for problems discovered during replacement of MP1821A module

Symptom	Location to Check	Remedy
A module is not recognized.	Is the module installed properly?	Install the module again by referring to Section 2.1 “Before Use”.
	Are the appropriate modules installed?	Confirm that the MP1821A is set to ON, referring to 2.1 Preparation Before Use.
	Are the appropriate modules installed?	To check the appropriate modules and software version of the MP1821A, access to “MP1800 Series Signal Quality” on your Web site (http://www.anritsu.com). Right-click the “MP1800 Series Signal Quality” and you can access to your area website. If the appropriate modulus are 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 Discovered during Output Waveform Observation

Table 9.2-1 Remedies for problems discovered during waveform observation

Symptom	Location to Check	Remedy
Output waveform cannot be monitored normally.	Is the [Data/XData] or [Clock/XClock] on the Output tab window set to ON?	In the Output tab window, set [Data/XData] or [Clock/XClock] to be output to ON. When the module function button [Output ON/OFF] is enabled, click it to set to ON.
	Is module function button [Output ON/OFF] is set to ON?	Click the module function button [Output ON/OFF] to ON.
	Is the operating clock supplied normally?	Check that the bit rate can be monitored using the frequency from the signal generator and the Clock Input Band Switch setting. When the clock is supplied externally, check the connection interface. Refer to Section 3.1 “Panel Layout” for the interface.
	Is the trigger clock set correctly?	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 electrical interface cable loose?	Tighten the connector.

Table 9.2-1 Remedies for problems discovered during waveform observation (Cont'd)

Symptom	Location to Check	Remedy
Output waveform cannot be monitored normally. (continued)	Do the cables used have good high-frequency characteristics?	Use cables or connectors with good high-frequency characteristics.
	Are the connection cables between this module and the MU181020A/B connected correctly?	Connect the cables between this module and the MU181020A/B as described in Chapter 3 in the correct sequence.
	Is the electrical interface between this module and the MU181020A/B matched?	When using a separate mainframe, match the electrical interface to satisfy the specifications in Chapter 1 and adjust Delay.
	Are the cables between the 1/4 Clock Output connector of this module and the MU181020A/B the same length?	The cables between the 1/4 Clock Output connector of this module and the MU181020A/B are the same length.
	Is Link operation between this device and the MU181020A/B set to ON?	Set Link operation between this device and the MU181020A/B to ON and optimize the device data output.

9.3 Problems Discovered during Error Rate Measurement

Table 9.3-1 Remedies for problems discovered 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 MP1821A (or the MU181020A/B) and the MP1822A (or the MU181040A/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 MP1822A (or MU181040A) detection pattern are matched. If the DUT outputs the patterns from the MP1821A as they are, connect the MP1821A and MP1822A directly to check if an error is detected.
	Were the cables between the MP1821A and the MP1822A connected in the correct sequence?	Connect the cables between the MP1821A and the MP1822A correctly as described in Section 3.2 Connecting modules.
	Is the error addition function set to off?	Check that the [Error Addition] switch on the Error Addition screen is set to off.
	Is the electrical interface cable loose?	Tighten the connector.
	Do the cables used have good high-frequency characteristics?	Use cables or connectors with good high-frequency characteristics.
	Are sufficient phase margin and bias margin secured?	Optimize the phase and offset between the MP1821A and the DUT as well as between the MP1822A 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

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Appendix A List of Initial Settings

A.1 List of Initialized Settings

This appendix shows the MP1821A settings that are initialized to the defaults at factory shipment.

In addition, all settings can be initialized using the Initialize pull-down from the File menu.

Table A.1–1 List of Initialized Items for MP1821A

Setting Function	Main Item	Secondary Item	Tertiary Item	Default Setting	
Output Data	Data/XData Output ON/OFF			ON	
	Amplitude Offset			Vth	
	Data/XData	Tracking		OFF	
		Level Guard		OFF	
		Level Guard Setup	Amplitude	2.500 Vp-p (MP1821A-x11) 3.500 Vp-p (MP1821A-x13)	
			Offset limit	–4.000 to 3.300 V (MP1821A-x11/x13)	
		Defined Interface			Variable (MP1821A-x11/x13)
				Amplitude	1.000 Vp-p (MP1821A-x11/x13)
				Offset switching	AC OFF (MP1821A-x11/x13)
				Offset	0.000 V
				External ATT Factor	0 dB
		Cross Point			50% (MP1821A-x11/x13)
		Delay			0 mUI (MP1821A-x30)
				Calibration	– (MP1821A-x30)
				Jitter Input	OFF (MP1821A-x30)
	Delay Relative		OFF (MP1821A-x30)		
Clock Interface	Output	Clock On/Off		ON	
	Input	Clock Input Band Switch		Half Rate Clock	
–	MUX PPG Link			OFF	

Appendix B Setting Restrictions

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B.1 Setting range of offset and amplitude

■ Relationship between offset reference value and amplitude

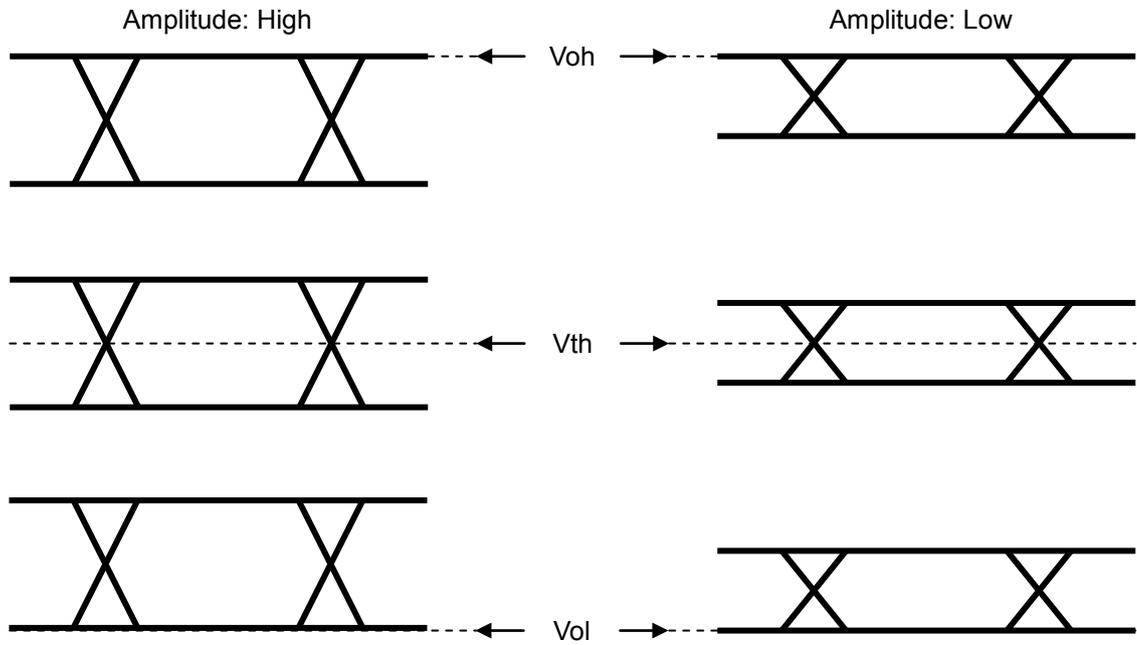


Figure B.1-1 Relationship between offset reference value and amplitude

B.1.1 MP1821A-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

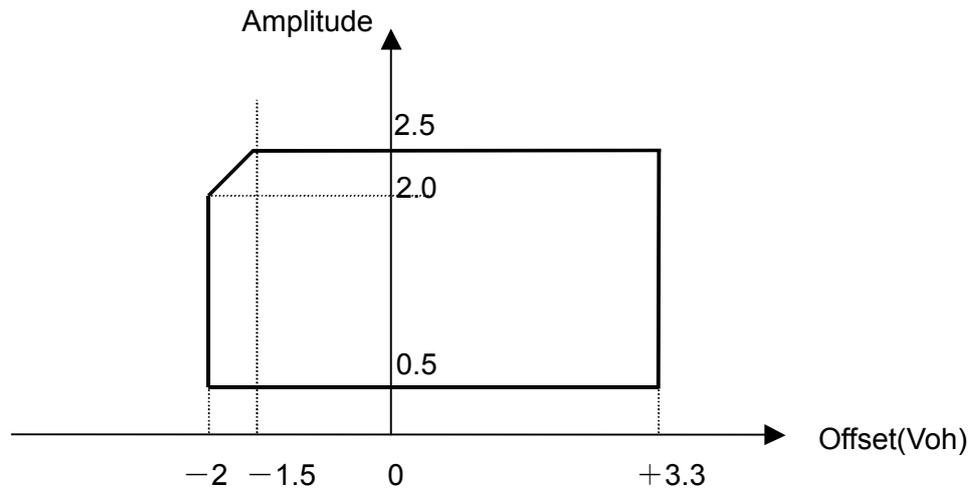


Figure B.1.1-1 Setting range of amplitude and offset based on offset reference (Voh) (MP1821A-x11)

(b) Vth

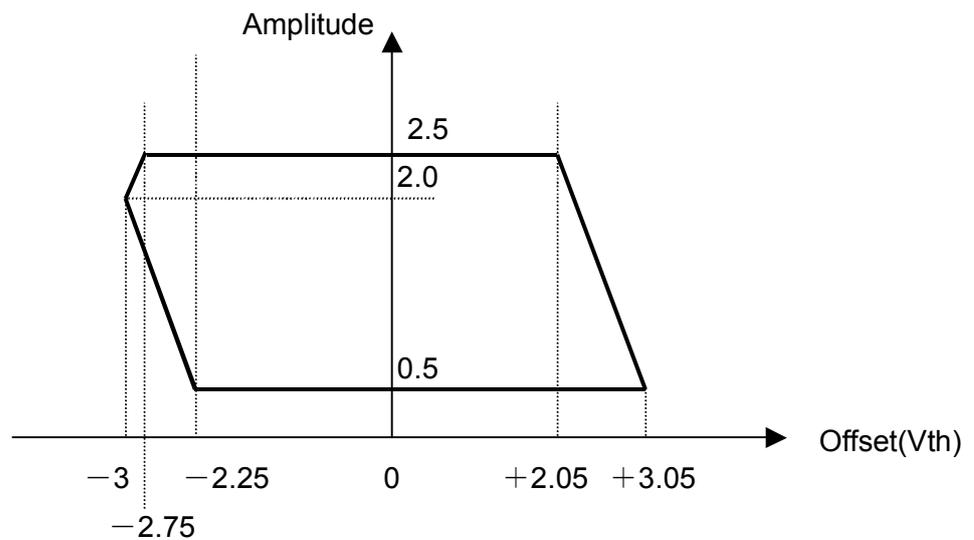


Figure B.1.1-2 Setting range of amplitude and offset based on offset reference (Vth) (MP1821A-x11)

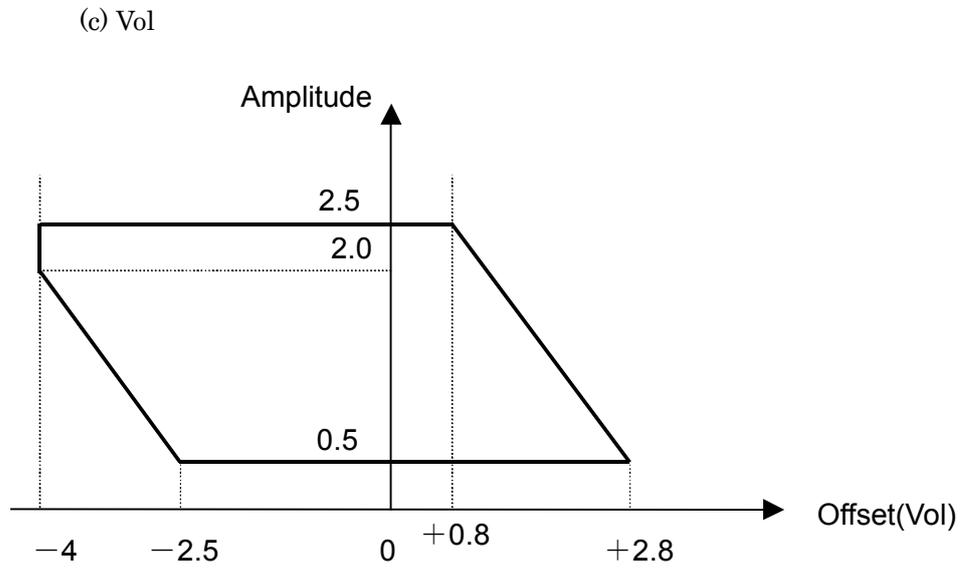


Figure B.1.1-3 Setting range of amplitude and offset based on offset reference (Vol) (MU182020/21A-x11)

B.1.2 MP1821A-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

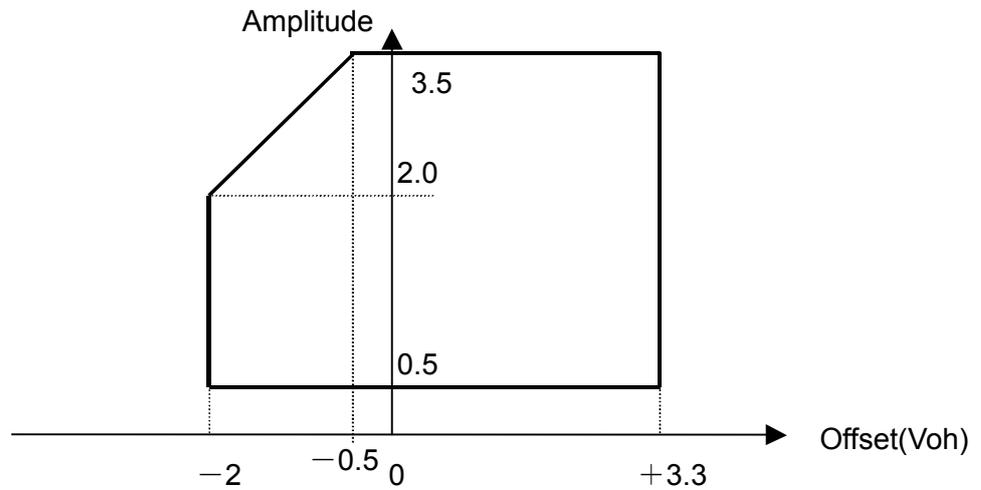


Figure B.1.2-1 Setting range of amplitude and offset based on offset reference (Voh) (MP1821A-x13)

(b) Vth

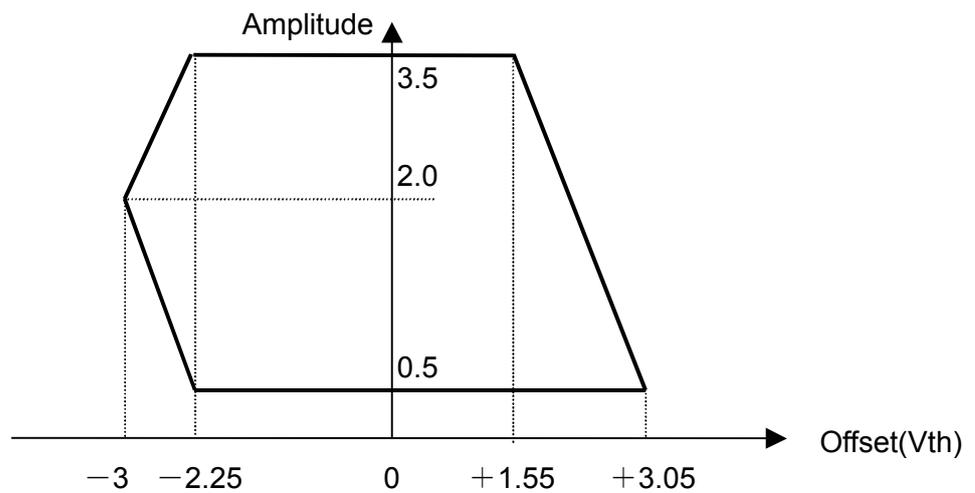


Figure B.1.2-2 Setting range of amplitude and offset based on offset reference (Vth) (MP1821A-x13)

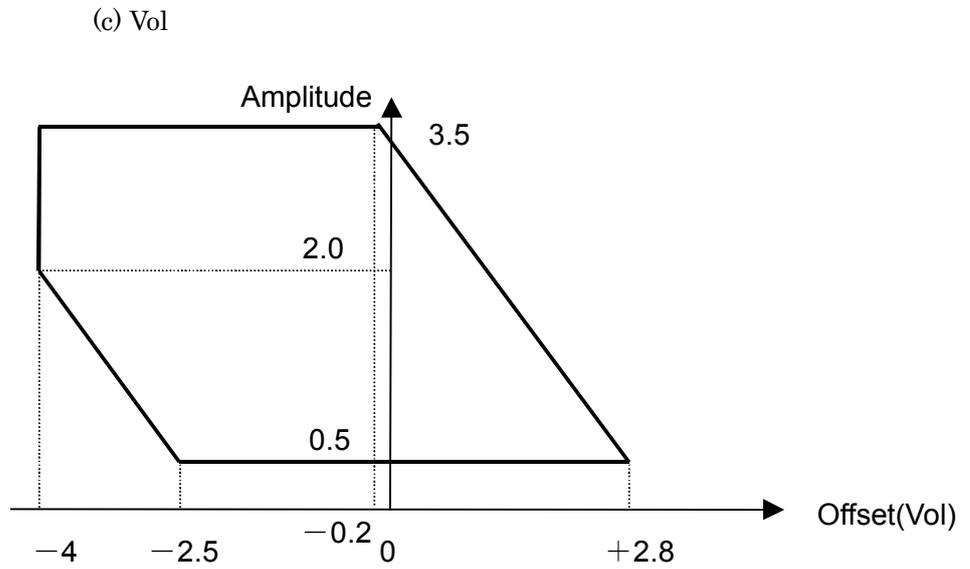


Figure B.1.2-3 Setting range of amplitude and offset based on offset reference (Vol)
(MP1821A-x13)

B.2 Combination Function Configuration

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

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

Enabling conditions for Combination function

- Two or more MU181020A/B modules are mounted in one mainframe. (To be mounted from the top slot 1 in order)
- Do not mix MU181020A and MU181020B modules.
In addition, do not mix options (MU181020A-x10/11x/12/x13/ and MU181020B-x/11x/12/x13).
- Installed modules must be either all MU181020A-002 modules or all MU181020B-002 modules.
- Installed modules must be either all MU181020A-x30 modules or all MU181020B-x30 modules.
- All or none of the inserted MU181020A/B modules must have MU181020A-x21 and MU181020B-x21 installed therein.
- The mainframe option is either MP1800A-015 or MP1800A-016.

In addition, the following restriction is added for the Combination function.

Restriction for Combination function

- The Alternate, Mixed-Alternate and Sequence patterns cannot be used as the test pattern.

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

- Two or more MU181020A/B modules are mounted on one mainframe. The MU181020A/B modules that are mounted contiguously starting from Slot 1 are enabled.
- Do not mix MU181040A and MU181040B modules.
In addition, do not mix options (MU181020A-x10/11x/12/x13/ and MU181020B-x/11x/12/x13).
- Installed modules must be either all MU181020A-002 modules or all MU181020B-002 modules.
- Installed modules must be either all MU181020A-x30 modules or all MU181020B-x30 modules.
- All or none of the inserted MU181020A/B modules must have MU181020A-x21 and MU181020B-x21 installed therein.

B.4 Combination Operation

When the MP1821A and the MU181020A/B are installed in the same mainframe and either 2 Ch Combination or 25G x 2 Ch Combination is selected, operation of the MP1821A and the MU181020A/B can be linked (combined).

a) MP1800A-015/016 4ch Combination

Figure B.4-1 shows combined operation of the MU181020A/B in slot1 to slot4.

The Delay setting at the Data Interface tab of the MP1821A is linked with the Delay of the MU181020A/B in slot1 to slot4.

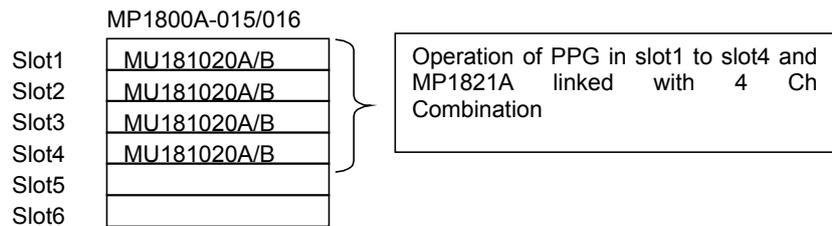


Figure B.4-1 MP1800A-015/016Combination operation

B.5 Settings Common in Combination System

When the MU181020A/B 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/XClock Output ON/OFF (MU181020A-x21, MU181020B-x21)			Independent	
	Amplitude Offset			Independent	
	Data/XData	Tracking			Independent
		Level Guard			Independent
		Level Guard Setup	Amplitude limit		Independent
			Offset limit		Independent
		Defined Interface			Independent
			Amplitude		Independent
			Offset switching		Independent
			Offset		Independent
		External Factor		ATT	Independent
		Cross Point			Independent
	Delay			Independent	
		Calibration		Independent	
	Clock/XClock (MU181020A-x21, MU181020B-x21)	Tracking			Independent
		Level Guard			Independent
		Level Guard Setup	Amplitude limit		Independent
			Offset limit		Independent
		Defined Interface			Independent
Amplitude			Independent		
Offset switching			Independent		
Offset			Independent		
External Factor		ATT	Independent		
Duty			Independent		

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

Function	Main Category	Sub-Category	Individual Setting Item	Common/Independent	
Pattern	PRBS			Common	
		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
Misc	Pattern Sequence	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

Appendix C Performance Test Record Sheet

C.1 Performance Test Record Sheet

Equipment Name: MP1821A 50G/56Gbit/s MUX

Serial No.:

Ambient Temperature: °C

Relative Humidity: %

Table C.1–1 MP1821A

Option Configuration	Signal Source	Operating Frequency Range Specification	Results
–	Operating Bit Rate	8.0 to 50.0 Gbit/s 8.0 to 56.0 Gbit/s (When MP1821-x01 is installed)	
MP1821A-x10 (Data Output (0.4 Vp-p Fixed))	Output level Setting Error	0/–0.4 V (H:–0.15 to 0.05V, L:–0.6 to –0.3 V)	
	Cross Point	50% ± 15% @50 Gbit/s	
	Tr/Tf	Typ.10 ps (20 to 80%) @50 Gbit/s	
	Total Jitter	Typ. 4 psp-p*	
	Waveform Distortion (0-peak)	Typ. ±25 mV ±10% @50 Gbit/s	
MP1821A-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	30 to 70 %/ 0.1% Step	
	Tr/Tf	Typ.8 ps (20 to 80%) @50 Gbit/s, 2.5 Vp-p	
	Total Jitter	Typ. 4psp-p*	
	Waveform Distortion (0-peak)	Typ. ±25 mV ±10%@50 Gbit/s, 2.5Vp-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 MP1821A (Cont'd)

Option Configuration	Signal Source	Operating Frequency Range Specification	Results
MP1821A-x13 (Variable Data Output (0.5 to 3.5Vp-p))	Amplitude Setting Error	0.5 to 3.5 Vp-p / 2 mV Step Setting Error: ± 50 mV $\pm 17\%$ of Amplitude	
	Offset Setting Error	-2.0 to +3.3 Voh, Min.-4.0 Vol/1 mV Step Setting Error: ± 65 mV $\pm 10\%$ of Offset(Vth) \pm (Amplitude Setting Error/2)	
	Cross Point Setting Range	30 to 70% / 0.1% Step	
	Tr/Tf	Typ.8ps (20 to 80%)@50 Gbit/s, 3.5 Vp-p	
	Total Jitter	Typ. 4psp-p*	
	Waveform Distortion (0-peak)	Typ. ± 25 mV $\pm 10\%$ @50 Gbit/s. 3.5Vp-p	
Clock Output	Amplitude	Min. 0.4 Vp-p, Max. 1.0 Vp-p @External Clock Input Amplitude \geq 0.6Vp-p	
MP1821A-x30 (Variable Data Delay)	Phase Setting Range	-1000 to +1000 mUI/4 mUI Steps	
	Accuracy	Typ. ± 50 mUIp-p	

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