User's Manual

AQ2200 Series Multi Application Test System Startup Guide

YOKOGAWA
Yokogawa Test & Measurement Corporation

IM 735101-01EN
14th Edition

Product Registration

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http://tmi.yokogawa.com/

Thank you for purchasing this AQ2200 Series Multi Application Test System. The AQ2200 Series Multi Application Test System consists of the AQ2211/AQ2212 Frame Controller and multiple measurement modules. The frame controllers are capable of holding and controlling measurement modules.
This user's manual explains the features, operating procedures, and handling precautions of the AQ2200 Series. To ensure correct use, please read this manual thoroughly before operation. Keep this manual in a safe place for quick reference in the event a question arises.

List of Manual

The following manuals, including this one, are provided as manuals for the AQ2200 Series. Please read all manuals.

Manual Title	Manual No.	Description
AQ2200 Series Multi Application Test System User's Manual Startup Guide	IM 735101-01EN	This manual. The supplied CD contains the PDF file of this manual. This manual describes the handling precautions for, the names and functions of all parts of, and the firmware upgrade procedure for the AQ2200 Series.
AQ2200 Series Multi Application Test System Frame and Module Operation User's Manual	IM 735101-03EN	The supplied CD contains the PDF file of this manual. This manual describes all the features of the AQ2200 Series and how to use them, with the exception of some of the application and communication features.
AQ2200 Series Multi Application Test System Application Operation User's Manual	IM 735101-04EN	The supplied CD contains the PDF file of this manual. This manual describes the AQ2200 Series application features and how to use them.
AQ2200 Series Multi Application Test System Communication Interface User's Manual	IM735101-17EN	The supplied CD contains the PDF file of this manual. This manual describes the AQ2200 Series communication interface features and how to use them.
64 Mbit Program Pattern Option User's Manual	IM 810518801-61E	This manual describes how to create program patterns for the AQ2200-601 10 Gbit/s BERT module with the /M option.
SDH/SONET Frame Option User's Manual	IM 810518801-62E	This manual describes how to create SDH/SONET patterns for the AQ2200-601 10 Gbit/s BERT module with the /P1 option.
AQ2200 Series Modules Checking the Contents of the Package and Handling Precautions of the Modules	IM 810518901-04E	This is included with AQ2200 Series modules. It explains the handling precautions of the module and lists the package contents.
Connector Adapter for Multi-Fiber Cable User's Manual	IM AQ9340-01EN	This manual explains the handling precautions of the connector adapters and how to use them.

The "EN" and "E" in the manual numbers are the language codes.

Contact information of Yokogawa offices worldwide is provided on the following sheet.

Manual No.	Description
PIM 113-01Z2	List of worldwide contacts

14th Edition: August 2019 (YMI)

Notes

- The contents of this manual are subject to change without prior notice as a result of continuing improvements to the instrument's performance and functions.
  The figures given in this manual may differ from those that actually appear on your screen.
- Every effort has been made in the preparation of this manual to ensure the accuracy of its contents. However, should you have any questions or find any errors, please contact your nearest YOKOGAWA dealer.
- Copying or reproducing all or any part of the contents of this manual without the permission of YOKOGAWA is strictly prohibited.

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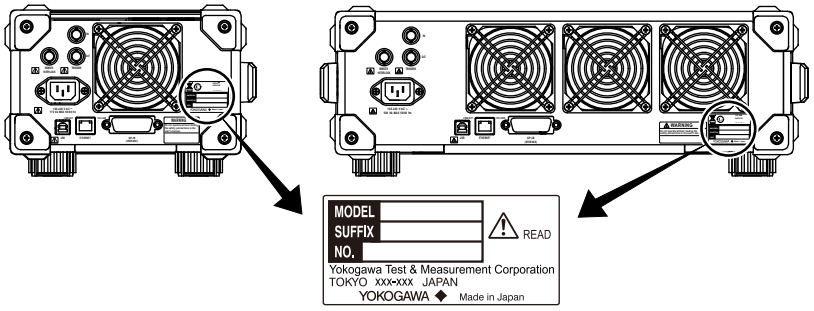
Revisions

- 1st Edition: August 2009
- 2nd Edition: November 2009
- 3rd Edition: January 2010
- 4th Edition: March 2010
- 5th Edition: November 2012
- 6th Edition: September 2014
- 7th Edition: May 2015
- 8th Edition: November 2015
- 9th Edition: May 2017
- 10th Edition: October 2017
- 11th Edition: February 2018
- 12th Edition: September 2018
- 13th Edition: February 2019
- 14th Edition: August 2019

Checking the Package Contents

After receiving the product and opening the package, check the items described below. If the wrong items have been delivered, if items are missing, or if there is a problem with the appearance of the items, contact your nearest YOKOGAWA dealer. When contacting the dealer from which you purchased the instrument, please give them the instrument number.
Also, check that the model name and suffix code given on the name plate on the side panel of the module are the same as those on your order.

AQ2211 Frame Controller **AQ2212 Frame Controller**



AQ2211/AQ2212 Frame Controller

MODEL	SUFFIX[1]	Description
735101		AQ2211 Frame Controller (Three slots)
735102		AQ2212 Frame Controller (Nine slots)
Power cord[2]	-D	UL/CSA standard and PSE compliant, Maximum rated voltage: 125 V
	-F	VDE/Korean standard, Maximum rated voltage: 250 V
	-R	Australian standard, Maximum rated voltage: 250 V
	-Q	British standard, Maximum rated voltage: 250V
	-H	Chinese standard, Maximum rated voltage: 250 V
	-N	Brazilian standard, Maximum rated voltage: 250 V
	-T	Taiwanese standard, Maximum rated voltage: 125 V
	-B	Indian standard, Maximum rated voltage: 250 V
	-U	IEC Plug Type B, Maximum rated voltage: 250 V
	-Y	No power cord included.[3]

1 For products whose suffix code contains “Z,” an exclusive manual may be included. Please read it along with the standard manual.
2 Make sure that the attached power cord meets the designated standards of the country and area that you are using it in.
3 Prepare a power cord that complies with the standard specified by the country or region that the instrument will be used in.

No. (Instrument Number)

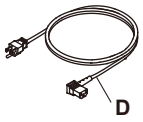
When contacting the dealer from which you purchased the instrument, please give them the instrument number.

Standard Accessories

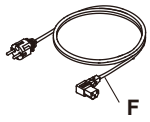
The standard accessories below are supplied with the instrument. Check that all contents are present and that they are undamaged.

Power cord (one cord that matches the suffix code is included)[1]

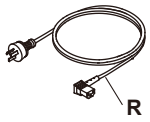
UL/CSA standard A1006WD



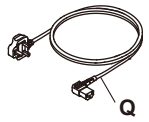
VDE/Korian standard A1009WD



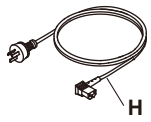
Australian standard A1024WD



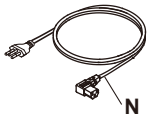
British standard A1054WD



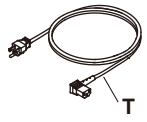
Chinese standard A1064WD



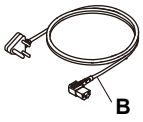
Brazilian standard A1088WD



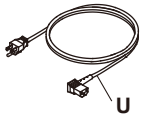
Taiwanese standard A1100WD



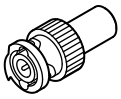
Indian standard A1101WD



IEC Plug Type B A1102WD



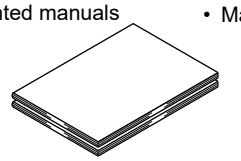
Interlock connector plug A1288JA 1 piece



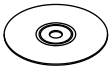
Rubber feet A9088ZM 1 set

Manuals[2]

- Printed manuals



- Manual CD



Standard accessories are not covered by warranty of this instrument.

1 Make sure that the attached power cord meets the designated standards of the country and area that you are using it in. If the suffix code is -Y, a power cord is not included.

2 Manuals

Item	Model or Part No.	Quantity	Specifications and Notes
Printed manuals	IM 735101-01EN	1	Startup Guide (this guide)
	PIM 113-01Z2	1	List of worldwide contacts
	IM 810518801-61E	1	For the AQ2200-601 10 Gbit/s BERT module with the /M option
	IM 810518801-62E	1	For the AQ2200-601 10 Gbit/s BERT module with the /P1 option
	IM 810518901-04E	1	For the AQ2200 series modules.
Manual CD	B8085NZ	1	Contains PDFs of the user's manuals (For the types of manuals that CD contains, see the next page.) Printed manuals can be purchased separately. Contact your nearest YOKOGAWA dealer to purchase a copy.

Optional Accessories (Sold separately)

The optional accessories below are available for purchase separately. For information about ordering accessories, contact your nearest YOKOGAWA dealer.

Item	Model or Part No.	Specifications
AQ2200-901 blank panel	AQ2200901	1-slot size
AQ2211 rack mount kit	735182-03	For mounting one AQ2211 to the left side of an EIA-standard rack.
AQ2212 rack mount kit	735182-09	For mounting one AQ2212 to an EIA-standard rack.

Optional accesories(sold separately) are not covered by warranty of this instrument.

Manual CD

The English folder in the manual CD contains the PDF files shown below. The CD also contains Japanese manuals.

Manual Title	Manual No.
AQ2200 Series Multi Application Test System User's Manual Startup Guide	IM 735101-01EN
AQ2200 Series Multi Application Test System Frame and Module Operation User's Manual	IM 735101-03EN
AQ2200 Series Multi Application Test System Application Operation User's Manual	IM 735101-04EN
AQ2200 Series Multi Application Test System Communication Interface User's Manual	IM 735101-17EN

To view the manuals above, you need Adobe Reader.

WARNING

Never play this manual CD in an audio CD player.
Doing so may cause loss of hearing or speaker damage due to the high-volume sound that may be produced.

French

AVERTISSEMENT

Ce CD contient les manuels d'utilisation. Ne jamais insérer ce CD dans un lecteur de CD audio. Cela pourrait entraîner une perte d'audition ou l'endommagement des enceintes en raison du volume potentiellement élevé des sons produits.

Safety Precautions

This product is designed to be used by a person with specialized knowledge.
This instrument is an IEC safety class I instrument (provided with a terminal for protective earth grounding).
The general safety precautions described herein must be observed during all phases of operation. If the instrument is used in a manner not specified in this manual, the protection provided by the instrument may be impaired. This manual is part of the product and contains important information. Store this manual in a safe place close to the instrument so that you can refer to it immediately. Keep this manual until you dispose of the instrument.
YOKOGAWA assumes no liability for the customer's failure to comply with these requirements.

The following symbols are used on this instrument.


Handle with care. Refer to the user's manual or service manual. This symbol appears on dangerous locations on the instrument which require special instructions for proper handling or use. The same symbol appears in the corresponding place in the manual to identify those instructions.


Alternating current

Power-on state


Power-off state


Laser radiation hazard

Power on


Power off

French


À manipuler délicatement. Toujours se reporter aux manuels d'utilisation et d'entretien. Ce symbole a été apposé aux endroits dangereux de l'instrument pour lesquels des consignes spéciales d'utilisation ou de manipulation ont été émises. Le même symbole apparaît à l'endroit correspondant du manuel pour identifier les consignes qui s'y rapportent.


Courant alternatif


Marche


Arrêt


Danger : Appareil laser à rayonnement.

Marche (alimentation)


Arrêt (alimentation)

Failure to comply with the precautions below could lead to injury or death or damage to the instrument.

WARNING

Use the Instrument Only for Its Intended Purpose
This optical measuring instrument is designed to measure the optical characteristics of light sources and evaluate their performance. Do not use this instrument for anything other than as an optical measuring instrument.

Check the Physical Appearance
Do not use the instrument if there is a problem with its physical appearance.

Use the Correct Power Supply
Make sure that the power supply voltage matches the instrument's rated supply voltage and that it does not exceed the maximum voltage range of the power cord to use.

Use the Correct Power Cord and Plug
To prevent electric shock or fire, be sure to use the power cord for the instrument. The main power plug must be plugged into an outlet with a protective earth terminal. Do not invalidate this protection by using an extension cord without protective earth grounding. Further, do not use this power cord with other instruments.

Connect to a Protective Earth Terminal
To prevent electric shock, be sure to connect to a protective earth terminal before turning on the frame controller's power. The power cord to use is a three-prong cord. Connect the power cord to a properly grounded three-prong outlet.

Do Not Impair the Protective Grounding
Never cut off the frame controller's internal or external protective earth wire or disconnect the wiring to the protective earth terminal. Doing so may result in electric shock or damage to the instrument.

Do Not Operate with Defective Protective Grounding or Fuses
Do not operate the frame controller if its protective grounding or one of its fuses might be defective. Check the grounding and the fuses before operating the frame controller.

Do Not Operate in an Explosive Atmosphere
Do not operate the instrument in the presence of flammable gasses or vapors. Doing so is extremely dangerous.

Do Not Remove the Covers or Disassemble or Alter the Instrument
Only qualified YOKOGAWA personnel may remove the covers and disassemble or alter the instrument. The inside of the frame controller is dangerous because parts of it have high voltages.

Ground the Instrument before Making External Connections
Securely connect the protective grounding before connecting to the item under measurement or to an external control unit. Before touching a circuit, turn off its power and check that it has no voltage.

Avoid Electric Shock When Using the Modules
Do not apply an input voltage that exceeds the maximum input voltage, withstand voltage, or allowable surge voltage.
To prevent the possibility of electric shock, be sure to fasten the screws that are at the bottom of the front panel of 2-slot and 3-slot modules. Otherwise, the electrical and mechanical protection functions will not be activated.
Do not leave the modules connected to the instrument in environments in which a voltage equal to or greater than the allowable surge voltage may occur.

Dispose the Instrument Properly
Do not throw this instrument into a fire to dispose of it. Doing so may cause the instrument to explode, resulting in fire or personal injury.
The devices used in this instrument contain gallium arsenide (GaAs) and indium phosphide (InP). When you dispose this instrument, you must separate it from general industrial waste and household garbage, and dispose of it according to local regulations.
Additionally, gallium arsenide powder and vapor are dangerous substances. Do not burn, cut, crush, chemically disassemble, or otherwise destroy this instrument.

Install or Use the Instrument in Appropriate Locations
- Do not install or use the instrument outdoors or in locations subject to rain or water.
- Install the instrument so that you can immediately remove the power cord if an abnormal or dangerous condition occurs.

CAUTION

Operating Environment Limitations
This is a class A instrument designed for an industrial environment. Operation of this equipment in a residential area can cause radio interference, in which case users will be required to correct the interference.

French

AVERTISSEMENT

Utiliser l’instrument aux seules fins prévues
Cet instrument de mesure optique est prévu pour mesurer les caractéristiques optiques des sources lumineuses et évaluer leur performance. Ne pas utiliser cet instrument à d’autres fins que celles de mesure optique.

Inspecter l’apparence physique
Ne pas utiliser l’instrument si son intégrité physique semble être compromise.

Vérifier l’alimentation
Assurez-vous que la tension d’alimentation correspond à la tension d’alimentation nominale de l’appareil et qu’elle ne dépasse pas la plage de tension maximale du cordon d’alimentation à utiliser.

Utiliser le cordon d’alimentation et la fiche adaptés
Pour éviter tout risque de choc électrique, utiliser exclusivement le cordon d’alimentation prévu pour cet instrument. La fiche doit être branchée sur une prise secteur raccordée à la terre. En cas d’utilisation d’une rallonge, celle-ci doit être impérativement reliée à la terre. Par ailleurs, ne pas utiliser ce cordon d’alimentation avec d’autres instruments.

Brancher la prise de terre
Avant de mettre l'instrument sous tension, penser à brancher la prise de terre pour éviter tout choc électrique. Le cordon d'alimentation à utiliser est un cordon d'alimentation à trois broches. Brancher le cordon d'alimentation sur une prise de courant à trois plots et mise à la terre.

Ne pas entraver la mise à la terre de protection
Ne jamais neutraliser le fil de terre interne ou externe, ni débrancher la borne de mise à la terre. Cela pourrait entraîner un choc électrique ou endommager l'instrument.

Ne pas utiliser avec un conducteur de terre ou un fusible défectueux
Ne pas utiliser l'instrument si le conducteur de terre ou le fusible est défectueux. Vérifier le conducteur de terre et le fusible avant d'utiliser l'instrument.

Ne pas utiliser dans un environnement explosif
Ne pas utiliser l'instrument en présence de gaz ou de vapeurs inflammables. Cela pourrait être extrêmement dangereux.

Ne pas retirer le capot, ni démonter ou modifier l'instrument
Seul le personnel YOKOGAWA qualifié est habilité à retirer le capot et à démonter ou modifier l'instrument. Certains composants à l'intérieur de l'instrument sont à haute tension et par conséquent, représentent un danger.

Relier l'instrument à la terre avant de le brancher sur des connexions externes
Toujours relier l'instrument à la terre avant de le brancher aux appareils à mesurer ou à une commande externe. Avant de toucher un circuit, mettre l'instrument hors tension et vérifier l'absence de tension.

Éviter les chocs électriques lors de l'utilisation des modules.
Ne pas dépasser les valeurs maximales de tension d'entrée, de tension de maintien ou de surtension admissible.
Pour éviter tout risque de choc électrique, veiller à serrer les vis situées au bas du panneau avant des modules à 2 et 3 emplacements, à défaut de quoi les fonctions de protection électrique et mécanique ne seront pas activées.
Ne pas laisser les modules branchés à l'instrument dans des environnements dans lesquels la tension pourrait être égale ou supérieure à la surtension admissible.

Mettre l'instrument au rebut de manière adéquate.
Ne pas mettre l'instrument au rebut en le jetant au feu. Il risquerait d'exploser et de provoquer un incendie ou de blesser quelqu'un.
Les dispositifs utilisés avec cet instrument contiennent de l'arséniure de gallium (AsGa) et du phosphure d'indium (InP). Lors de la mise au rebut de l'instrument, vous ne devez pas l'associer aux déchets industriels généraux ni aux déchets domestiques, mais l'éliminer conformément aux réglementations locales.
De plus, la poudre et les vapeurs d'arséniure de gallium sont des substances dangereuses. Ne pas brûler, couper, écraser, démonter chimiquement ou détruire cet instrument.

Installer et utiliser l'instrument aux emplacements appropriés

- Ne pas installer, ni utiliser l'instrument à l'extérieur ou dans des lieux exposés à la pluie ou à l'eau.
- Installer l'instrument de manière à pourvoir immédiatement le débrancher du secteur en cas de fonctionnement anormal ou dangereux.

ATTENTION

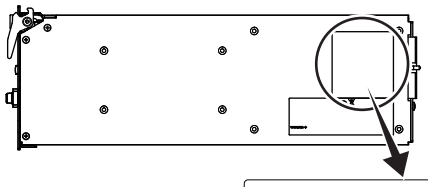
Limitations relatives à l'environnement opérationnel

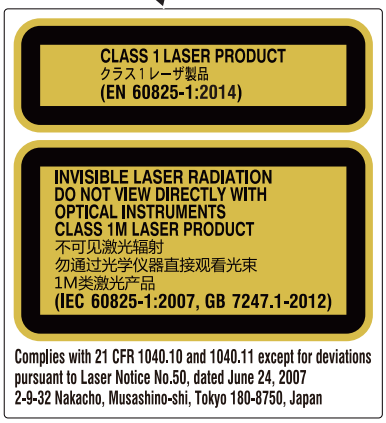
Ce produit est un produit de classe A (pour environnements industriels).
L'utilisation de ce produit dans un zone résidentielle peut entraîner une interférence radio que l'utilisateur sera tenu de rectifier.

Safety Precautions for Laser Products

This instrument uses a laser light source. This instrument is a Class 1M laser product as defined by IEC 60825-1:2007 Safety of Laser Products—Part1: Equipment Classification and Requirements. In addition, this instrument complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007.

AQ2200-112, AQ2200-131, and AQ2200-132 Modules





Laser Class 1 Label

Laser Class 1M Label

Using an optical instrument, such as a loupe, magnifying glass, or microscope, when observing the laser beam from a distance of less than 100 mm may cause eye injury.
Do not expose users of binoculars or telescopes.
Skin exposure near aperture may cause burns.

Model	Class	Laser Type[1]	Center Wavelength	Maximum Output Power[2]	Mode Field Diameter	Beam Divergence (full angle at $1/e^2$)	Pulse Duration and Repetition Rate
AQ2200112	1, 1M	DFB-Laser	1310 to 1650 nm	40 mW	9 µm	11.5 degree	CW
AQ2200131	1, 1M	ITLA	1527.60 to 1608.76 nm	63 mW	9 µm	11.5 degree	CW
AQ2200132	1, 1M	ITLA	1527.60 to 1608.76 nm	63 mW	9 µm	11.5 degree	CW

1 Class 1: EN 60825-1:2014
Class 1M: IEC 60825-1:2007, GB 7247.1-2012
2 Under single fault conditions.

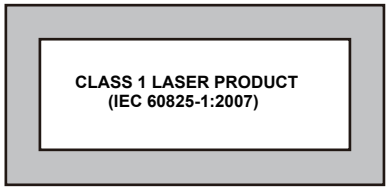
Note

Laser classes differ depending on the standard number and the year of the standard.
Take safety measures according to the laser class corresponding to the standard of the country or region that the instrument will be used in.

AQ2200-111, AQ2200-141, AQ2200-142, and AQ2200-136 Modules

Laser Class 1M Label

Using an optical instrument, such as a loupe, magnifying glass, or microscope, when observing the laser beam from a distance of less than 100 mm may cause eye injury.
Do not expose users of binoculars or telescopes.
Skin exposure near aperture may cause burns.



Laser Class 1 Label

Model	Class	Laser Type	Center Wavelength	Maximum Output Power[1]	Mode Field Diameter	Beam Divergence (full angle at $1/e^2$)	Pulse Duration and Repetition Rate
810518901	1M	DFB-Laser	1310 to 1650 nm	40 mW	9 µm	11.5 degree	CW
810518902	1	FP-Laser	1310/1550 nm	10 mW	9 µm	11.5 degree	CW
810518903	1	FP-Laser	1310/1550 nm	10 mW	9 µm	11.5 degree	CW
810518904	1M	EC-Laser	1440 to 1640 nm	50.2 mW	9 µm	11.5 degree	CW

1 Under single fault conditions.

Note

- Commercially available XFP transceivers installed in the AQ2200-641 XFP Interface Module are not covered under warranty.
- For save handling of the laser, consult the user's manual that came with the XFP transceiver.

Sales in Each Country or Region

Waste Electrical and Electronic Equipment

Waste Electrical and Electronic Equipment (WEEE), Directive
(This directive is valid only in the EU.)
This product complies with the WEEE directive marking requirement. This marking indicates that you must not discard this electrical/electronic product in domestic household waste.

Product Category
With reference to the equipment types in the WEEE directive, this product is classified as a “Monitoring and control instruments” product.

When disposing of products in the EU, contact your local Yokogawa Europe B.V. office. Do not dispose in domestic household waste.

EU Battery Directive

EU Battery Directive
(This directive is valid only in the EU.)
Batteries are included in this product. This marking indicates they shall be sorted out and collected as ordained in the EU battery directive.

Battery type: Lithium battery

You cannot replace batteries by yourself. When you need to replace batteries, contact your local Yokogawa Europe B.V. office.

Authorized Representative in the EEA

Yokogawa Europe B.V. is the authorized representative of Yokogawa Test & Measurement Corporation for this product in the EEA. To contact Yokogawa Europe B.V., see the separate list of worldwide contacts, PIM 113-01Z2

About Environmental Standard

This instrument complies with environmental standard EN50581, but it will not comply with the standard if an incompliant module is installed.
For details on compliant modules, see section 5.1.

關於在台灣銷售

This section is valid only in Taiwan.
關於在台灣所販賣的符合其相關規定的電源線 A1100WD 的限用物質含量信息，請至下麵的網址進行查詢
https://tmi.yokogawa.com/support/service-warranty-quality/product-compliance/

Symbols and Notation Used in This Manual

Notes and Cautions

The notes and cautions in this manual are categorized using the following symbols.

Improper handling or use can lead to injury to the user or damage to the instrument. This symbol appears on the instrument to indicate that the user must refer to the user's manual for special instructions. The same symbol appears in the corresponding place in the user's manual to identify those instructions. In the manual, the symbol is used in conjunction with the word "WARNING" or "CAUTION."

WARNING Calls attention to actions or conditions that could cause serious or fatal injury to the user, and precautions that can be taken to prevent such occurrences.

CAUTION Calls attentions to actions or conditions that could cause light injury to the user or damage to the instrument or user's data, and precautions that can be taken to prevent such occurrences.

French

AVERTISSEMENT Attire l'attention sur des gestes ou des conditions susceptibles de provoquer des blessures graves (voire mortelles), et sur les précautions de sécurité pouvant prévenir de tels accidents.

ATTENTION Attire l'attention sur des gestes ou des conditions susceptibles de provoquer des blessures légères ou d'endommager l'instrument ou les données de l'utilisateur, et sur les précautions de sécurité susceptibles de prévenir de tels accidents.

Note Calls attention to information that is important for proper operation of the instrument.

Character Notations

Bold characters in procedural explanations are used to indicate panel keys and soft keys that are used in the procedure and menu items that appear on the screen.

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Module Model Name, Suffix Code, and Accessories

AQ2200-111 DFB-LD Module

Model	Suffix Code[1]	Description
810518901		—
Wavelength	-Mxxxx	See section 5.2 for the list of supported wavelengths
	-W1310	1310 nm
	-W1490	1490 nm
Optical connector	-FCA	FC/Angled PC connector
Optical output level	-P10	10 mW optical output
	-P20	20 mW optical output
Optical fiber	-SMF	SM fiber
	-PMF	PM fiber
External modulation	-MODN	No external modulation
	-MODS	External modulation (sine)
	-MODC	External modulation (chop)

1 For products whose suffix code contains "Z," an exclusive manual may be included. Please read it along with the standard manual.

Standard Accessories

The standard accessories below are supplied with the instrument.

Item	Model or Part No.	Quantity	Notes
Protective cap*	—	1	Green
Protective cap*	—	1	White (for use with the external modulation option)
User's manual	IM 810518901-04E	1	Read before using the instrument

*: Already attached to the module

AQ2200-112 LS Module

(Firmware version 3.08 and later)

Model	Suffix Code[1]	Description
AQ2200112		—
Wavelength	-D300	DFB-LD, 1310 nm
	-D500	DFB-LD, 1550 nm
	-D600	DFB-LD, 1625 nm
	-D700	DFB-LD, 1650 nm
	-D3D3	DFB-LD, Ch1: 1310 nm, Ch2: 1310 nm
	-D3D5	DFB-LD, Ch1: 1310 nm, Ch2: 1550 nm
	-D3D6	DFB-LD, Ch1: 1310 nm, Ch2: 1625 nm
	-D3D7	DFB-LD, Ch1: 1310 nm, Ch2: 1650 nm
	-D5D5	DFB-LD, Ch1: 1550 nm, Ch2: 1550 nm
	-D5D6	DFB-LD, Ch1: 1550 nm, Ch2: 1625 nm
	-D5D7	DFB-LD, Ch1: 1550 nm, Ch2: 1650 nm
	-D6D6	DFB-LD, Ch1: 1625 nm, Ch2: 1625 nm
	-D6D7	DFB-LD, Ch1: 1625 nm, Ch2: 1650 nm
	-D7D7	DFB-LD, Ch1: 1650 nm, Ch2: 1650 nm

1 For products whose suffix code contains "Z," an exclusive manual may be included. Please read it along with the standard manual.

Standard Accessories

The standard accessories below are supplied with the instrument.

Item	Model or Part No.	Quantity	Notes
Protective cap*	—	1	1-channel model (-D300, -D500, -D600, -D700)
		2	2-channel model (-D3D3, -D3D5, -D3D6, -D3D7, -D5D5, -D5D6, -D5D7, -D6D6, -D6D7, -D7D7)
User's manual	IM 810518901-04E	1	Read before using the instrument

*: Already attached to the module

AQ2200-141 FP-LD Module

Model	Suffix Code[1]	Description
810518902		—
Wavelength	-W1310	1310 nm
	-W1550	1550 nm
Optical connector	/FCC	AQ9441 (FC) universal adapter
	/SCC	AQ9441 (SC) universal adapter

1 For products whose suffix code contains “Z,” an exclusive manual may be included. Please read it along with the standard manual.

Standard Accessories

The standard accessories below are supplied with the instrument.

Item	Model or Part No.	Quantity	Notes
Protective cap*	—	1	
User’s manual	IM 810518901-04E	1	Read before using the instrument

*: Already attached to the module

Optional Accessories

The optional accessories below are available for purchase separately.

Item	Model	Notes
AQ9441 (FC) universal adapter	813917321-FCC	FC connector
AQ9441 (SC) universal adapter	813917321-SCC	SC connector

AQ2200-142 DUAL FP-LD Module

Model	Suffix Code[1]	Description
810518903		—
Wavelength	-W135D	1310/1550 nm
Optical connector	/FCC	AQ9441 (FC) universal adapter
	/SCC	AQ9441 (SC) universal adapter

1 For products whose suffix code contains “Z,” an exclusive manual may be included. Please read it along with the standard manual.

Standard Accessories

The standard accessories below are supplied with the instrument.

Item	Model or Part No.	Quantity	Notes
Protective cap*	—	1	
User’s manual	IM 810518901-04E	1	Read before using the instrument

*: Already attached to the module

Optional Accessories

The optional accessories below are available for purchase separately.

Item	Model	Notes
AQ9441 (FC) universal adapter	813917321-FCC	FC connector
AQ9441 (SC) universal adapter	813917321-SCC	SC connector

AQ2200-131 Grid TLS Module

(-T2 and -T4:Firmware version 3.00 and later)
(-T6:Firmware version 3.05 and later)

Model	Suffix Code[1]	Description
AQ2200131		—
Wavelength	-C	C-band
	-L	L-band
LD type	-T4	Standard type
	-T2	Advanced type (Fine tuning)
	-T6	Advanced type (Fine tuning)
Optical fiber	-PA	PM fiber
Optical connector	-FCC	FC/PC connector
	-FCA	FC/Angled PC connector

1 For products whose suffix code contains “Z,” an exclusive manual may be included. Please read it along with the standard manual.

Standard Accessories

The standard accessories below are supplied with the instrument.

Item	Model or Part No.	Quantity	Notes
Protective cap*	—	1	
User’s manual	IM 810518901-04E	1	Read before using the instrument

*: Already attached to the module

AQ2200-132 Grid TLS Module

(-T2 and -T4:Firmware version 3.00 and later)
(-T6:Firmware version 3.05 and later)

Model	Suffix Code[1]	Description
AQ2200132		—
Wavelength	-CC	CH1: C-band, CH2: C-band
	-LL	CH1: L-band, CH2: L-band
	-CL	CH1: C-band, CH2: L-band
LD type	-T4	Standard type
	-T2	Advanced type (Fine tuning)
	-T6	Advanced type (Fine tuning)
Optical fiber	-PA	PM fiber
Optical connector	-FCC	FC/PC connector
	-FCA	FC/Angled PC connector

1 For products whose suffix code contains “Z,” an exclusive manual may be included. Please read it along with the standard manual.

Standard Accessories

The standard accessories below are supplied with the instrument.

Item	Model or Part No.	Quantity	Notes
Protective cap*	—	1	
User’s manual	IM 810518901-04E	1	Read before using the instrument

*: Already attached to the module

AQ2200-136 TLS Module

Model	Suffix Code[1]	Description
810518904		—
Optical connector	-FCA	FC/Angled PC connector
Optical fiber	-SMF	SM fiber
Wavelength	-WLSTD	Changeable

1 For products whose suffix code contains “Z,” an exclusive manual may be included. Please read it along with the standard manual.

Standard Accessories

The standard accessories below are supplied with the instrument.

Item	Model or Part No.	Quantity	Notes
Protective cap (small)*	—	2	Green
Protective cap (large)*	—	1	
User’s manual	IM 810518901-04E	1	Read before using the instrument

*: Already attached to the module

AQ2200-201 Interface Module

Model	Suffix Code[1]	Description
810518905		—

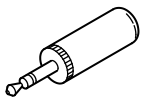
1 For products whose suffix code contains “Z,” an exclusive manual may be included. Please read it along with the standard manual.

Standard Accessories

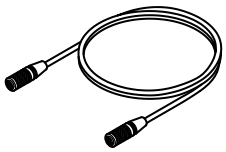
The standard accessories below are supplied with the instrument.

Item	Model or Part No.	Quantity	Notes
Analog out plug	955-230002662	1	
Optical sensor head connector cable	955-850002026	1	
User’s manual	IM 810518901-04E	1	Read before using the instrument

Analog out plug
955-230002662



Optical sensor head connector cable
955-850002026



Optional Accessory

The following optional accessory is available for purchase separately.

Item	Part No.	Notes
Analog out plug	955-230002662	

AQ2200-202 Interface Module

(Firmware version 3.05 and later)

Model	Suffix Code[1]	Description
AQ2200202		—

1 For products whose suffix code contains “Z,” an exclusive manual may be included. Please read it along with the standard manual.

Standard Accessories

The standard accessories below are supplied with the instrument.

Item	Model or Part No.	Quantity	Notes
User’s manual	IM 810518901-04E	1	Read before using the instrument

AQ2200-231 Optical Sensor Head

Model	Suffix Code[1]	Description
810518906		Large-aperture, long-wavelength sensor
Connector adapter	/FCC	AQ9355C (FC) connector adapter with a light shielding cap
	/SCC	AQ9335C (SC) connector adapter with a light shielding cap
	/STC	AQ9335C (ST) connector adapter with a light shielding cap

1 For products whose suffix code contains “Z,” an exclusive manual may be included. Please read it along with the standard manual.

Standard Accessories

The standard accessories below are supplied with the instrument.

Item	Model or Part No.	Quantity	Notes
Protective cap*	—	1	
Ring*	—	1	
User’s manual	IM 810518901-04E	1	Read before using the instrument

*: Already attached to the module

Optional Accessories

The optional accessories below are available for purchase separately.

Item	Model or Part No.	Notes
AQ9335C (FC) connector adapter	810518909-FCC	FC connector
AQ9335C (SC) connector adapter	810518910-SCC	SC connector
AQ9335C (ST) connector adapter	810518911-STC	ST connector
AQ9335C (LC) connector adapter	M3407JD	LC connector with a dust protection cap
AQ9335C (MU) connector adapter	M3407JE	MU connector with a dust protection cap
Light shielding cap (FC)	810518912-FCC	Light shielding cap for an FC connector
Light shielding cap (SC)	810518913-SCC	Light shielding cap for an SC connector
Light shielding cap (ST)	810518914-STC	Light shielding cap for an ST connector
AQ9346 tape fiber adapter	810517917	
AQ9302 (125) bare fiber adapter	819705500-0125	
AQ9440B MT connector	810517921-B	2, 4, 8, and 12 cores
Dust protection cap (LC)	M3407HD	Dust protection cap for an LC connector
Dust protection cap (MU)	M3407HE	Dust protection cap for an MU connector

AQ2200-232 Optical Sensor Head

(Firmware version 3.05 and later)

Model	Suffix Code[1]	Description
AQ2200232		Large-aperture, long-wavelength sensor
Connection cable	-L1	Length: 1 m
	-L4	Length: 4 m
Connector adapter	/FCC	AQ9335C (FC) connector adapter with a light shielding cap
	/SCC	AQ9335C (SC) connector adapter with a light shielding cap
	/LCC	AQ9335C (LC) connector adapter with a dust protection cap
	/MUC	AQ9335C (MU) connector adapter with a dust protection cap

1 For products whose suffix code contains “Z,” an exclusive manual may be included. Please read it along with the standard manual.

Standard Accessories

The standard accessories below are supplied with the instrument.

Item	Model or Part No.	Quantity	Notes
Protective cap*	—	1	
Ring*	—	1	
Connection cable	A1638WL	1	For -L1 model (cable length: 1 m)
	A1639WL	1	For -L4 model (cable length: 4 m)
User’s manual	IM 810518901-04E	1	Read before using the instrument

*: Already attached to the module

Optional Accessories

The optional accessories below are available for purchase separately.

Item	Model or Part No.	Notes
AQ9335C (FC) connector adapter	AQ9335C-FCC	FC connector
AQ9335C (SC) connector adapter	AQ9335C-SCC	SC connector
AQ9335C (LC) connector adapter	AQ9335C-LCC	LC connector with a dust protection cap
AQ9335C (MU) connector adapter	AQ9335C-MUC	MU connector with a dust protection cap
Light shielding cap (FC)	M3407HA	Light shielding cap for an FC connector
Light shielding cap (SC)	M3407HB	Light shielding cap for an SC connector
Connection cable	A1638WL	Cable le ght: 1 m
Connection cable	A1639WL	Cable le ght: 4 m
Dust protection cap (LC)	M3407HD	Dust protection cap for an LC connector
Dust protection cap (MU)	M3407HE	Dust protection cap for an MU connector

AQ2200-241 Optical Sensor Head

Model	Suffix Code[1]	Description
810518907		Large-aperture, short-wavelength sensor
Connector adapter	/FCC	AQ9355C (FC) connector adapter with a light shielding cap
	/SCC	AQ9335C (SC) connector adapter with a light shielding cap
	/STC	AQ9335C (ST) connector adapter with a light shielding cap

1 For products whose suffix code contains “Z,” an exclusive manual may be included. Please read it along with the standard manual.

Standard Accessories

The standard accessories below are supplied with the instrument.

Item	Model or Part No.	Quantity	Notes
Protective cap*	—	1	
Ring*	—	1	
User’s manual	IM 810518901-04E	1	Read before using the instrument

*: Already attached to the module

Optional Accessories

The optional accessories below are available for purchase separately.

Item	Model or Part No.	Notes
AQ9335C (FC) connector adapter	810518909-FCC	FC connector
AQ9335C (SC) connector adapter	810518910-SCC	SC connector
AQ9335C (ST) connector adapter	810518911-STC	ST connector
AQ9335C (LC) connector adapter	M3407JD	LC connector with a dust protection cap
AQ9335C (MU) connector adapter	M3407JE	MU connector with a dust protection cap
Light shielding cap (FC)	810518912-FCC	Light shielding cap for an FC connector
Light shielding cap (SC)	810518913-SCC	Light shielding cap for an SC connector
Light shielding cap (ST)	810518914-STC	Light shielding cap for an ST connector
AQ9346 tape fiber adapter	810517917	
AQ9302 (125) bare fiber adapter	819705500-0125	
AQ9440B MT connector	810517921-B	2, 4, 8, and 12 cores
Dust protection cap (LC)	M3407HD	Dust protection cap for an LC connector
Dust protection cap (MU)	M3407HE	Dust protection cap for an MU connector

AQ2200-242 Optical Sensor Head

(Firmware version 3.06 and later)

Model	Suffix Code[1]	Description
AQ2200242		Large-aperture, short-wavelength sensor
Connection cable	-L1	Length: 1 m
	-L4	Length: 4 m
Connector adapter	/FCC	AQ9335C (FC) connector adapter with a light shielding cap
	/SCC	AQ9335C (SC) connector adapter with a light shielding cap
	/LCC	AQ9335C (LC) connector adapter with a dust protection cap
	/MUC	AQ9335C (MU) connector adapter with a dust protection cap

1 For products whose suffix code contains “Z,” an exclusive manual may be included. Please read it along with the standard manual.

Standard Accessories

The standard accessories below are supplied with the instrument.

Item	Model or Part No.	Quantity	Notes
Protective cap*	—	1	
Ring*	—	1	
Connection cable	A1638WL	1	For -L1 model (cable length: 1 m)
	A1639WL	1	For -L4 model (cable length: 4 m)
User’s manual	IM 810518901-04E	1	Read before using the instrument

*: Already attached to the module

Optional Accessories

The optional accessories below are available for purchase separately.

Item	Model or Part No.	Notes
AQ9335C (FC) connector adapter	AQ9335C-FCC	FC connector
AQ9335C (SC) connector adapter	AQ9335C-SCC	SC connector
AQ9335C (LC) connector adapter	AQ9335C-LCC	LC connector with a dust protection cap
AQ9335C (MU) connector adapter	AQ9335C-MUC	MU connector with a dust protection cap
Light shielding cap (FC)	M3407HA	Light shielding cap for an FC connector
Light shielding cap (SC)	M3407HB	Light shielding cap for an SC connector
Connection cable	A1638WL	Cable le ght: 1 m
Connection cable	A1639WL	Cable le ght: 4 m
Dust protection cap (LC)	M3407HD	Dust protection cap for an LC connector
Dust protection cap (MU)	M3407HE	Dust protection cap for an MU connector

AQ2200-211 Sensor Module

Model	Suffix Code[1]	Description
810518908		Highly sensitive, long-wavelength sensor
Connector adapter	/FCC	AQ9447 (FC) connector adapter with a light shielding cap
	/SCC	AQ9447 (SC) connector adapter with a light shielding cap
	/STC	AQ9447 (ST) connector adapter with a light shielding cap

1 For products whose suffix code contains “Z,” an exclusive manual may be included. Please read it along with the standard manual.

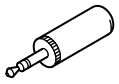
Standard Accessories

The standard accessories below are supplied with the instrument.

Item	Model or Part No.	Quantity	Notes
Protective cap*	—	1	
Analog out plug	955-230002662	1	
User’s manual	IM 810518901-04E	1	Read before using the instrument

*: Already attached to the module

Analog out plug
955-230002662



Optional Accessories

The optional accessories below are available for purchase separately.

Item	Model or Part No.	Notes
AQ9447 (FC) connector adapter	810804602-FCC	FC connector
AQ9447 (SC) connector adapter	810804602-SCC	SC connector
AQ9447 (ST) connector adapter	810804602-STC	ST connector
Light shielding cap (FC)	810518912-FCC	Light shielding cap for an FC connector
Light shielding cap (SC)	810518913-SCC	Light shielding cap for an SC connector
Light shielding cap (ST)	810518914-STC	Light shielding cap for an ST connector
AQ9346 tape fiber adapter	810517917	
AQ9302 (125) bare fiber adapter	819705500-0125	
AQ9440B MT connector	810517921-B	2, 4, 8, and 12 cores
Analog out plug	955-230002662	

AQ2200-215 Sensor Module

Model	Suffix Code[1]	Description
735125		High power sensor
Connector adapter	-NON	No connector adapter
	-FCC	AQ9335C (FC) connector adapter with a light shielding cap
	-SCC	AQ9335C (SC) connector adapter with a light shielding cap
	-STC	AQ9335C (ST) connector adapter with a light shielding cap
	-LCC	AQ9335C (LC) connector adapter with a dust protection cap
	-MUC	AQ9335C (MU) connector adapter with a dust protection cap

1 For products whose suffix code contains “Z,” an exclusive manual may be included. Please read it along with the standard manual.

Standard Accessories

The standard accessories below are supplied with the instrument.

Item	Model or Part No.	Quantity	Notes
Ring*	—	1	
Protective cover*	—	1	
User’s manual	IM 810518901-04E	1	Read before using the instrument

*: Already attached to the module

Optional Accessories

The optional accessories below are available for purchase separately.

Item	Model or Part No.	Notes
AQ9335C (FC) connector adapter	AQ9335C-FCC	FC connector
AQ9335C (SC) connector adapter	AQ9335C-SCC	SC connector
AQ9335C (LC) connector adapter	AQ9335C-LCC	LC connector with a dust protection cap
AQ9335C (MU) connector adapter	AQ9335C-MUC	MU connector with a dust protection cap
Light shielding cap (FC)	M3407HA	Light shielding cap for an FC connector
Light shielding cap (SC)	M3407HB	Light shielding cap for an SC connector
Dust protection cap (LC)	M3407HD	Dust protection cap for an LC connector
Dust protection cap (MU)	M3407HE	Dust protection cap for an MU connector

AQ2200-221 Sensor Module

Model	Suffix Code[1]	Description
735122		Two-channel, long-wavelength sensor
Connector adapter	-NON	No connector adapter
	-FCC	AQ9335C (FC) connector adapter with a light shielding cap
	-SCC	AQ9335C (SC) connector adapter with a light shielding cap
	-STC	AQ9335C (ST) connector adapter with a light shielding cap
	-LCC	AQ9335C (LC) connector adapter with a dust protection cap
	-MUC	AQ9335C (MU) connector adapter with a dust protection cap

1 For products whose suffix code contains “Z,” an exclusive manual may be included. Please read it along with the standard manual.

Standard Accessories

The standard accessories below are supplied with the instrument.

Item	Model or Part No.	Quantity	Notes
Ring*	—	2	
Protective cover*	—	2	
User’s manual	IM 810518901-04E	1	Read before using the instrument

*: Already attached to the module

Optional Accessories

The optional accessories below are available for purchase separately.

Item	Model or Part No.	Notes
AQ9335C (FC) connector adapter	AQ9335C-FCC	FC connector
AQ9335C (SC) connector adapter	AQ9335C-SCC	SC connector
AQ9335C (LC) connector adapter	AQ9335C-LCC	LC connector with a dust protection cap
AQ9335C (MU) connector adapter	AQ9335C-MUC	MU connector with a dust protection cap
Light shielding cap (FC)	M3407HA	Light shielding cap for an FC connector
Light shielding cap (SC)	M3407HB	Light shielding cap for an SC connector
Dust protection cap (LC)	M3407HD	Dust protection cap for an LC connector
Dust protection cap (MU)	M3407HE	Dust protection cap for an MU connector

AQ2200-271 ORL Module

Model	Suffix Code[1]	Description
735185		—
Optical fiber	-SA	SMF (10/125)

1 For products whose suffix code contains “Z,” an exclusive manual may be included. Please read it along with the standard manual.

Standard Accessories

The standard accessories below are supplied with the instrument.

Item	Model or Part No.	Quantity	Notes
Protective cap*	—	3	
User’s manual	IM 810518901-04E	1	Read before using the instrument

*: Already attached to the module

Optional Accessories

The optional accessories below are available for purchase separately.

Item	Part No.	Notes
ORL master cord	955-300001169	FC connector
ORL master cord	955-300001170	SC connector
ORL master cord	955-300900506	Open

AQ2200-311 ATTN Module

Model	Suffix Code[1]	Description
810518915		—
Optical connector	-FCC	FC/PC connector
	-SCC	SC/PC connector
	-FCA	FC/Angled PC connector
	-SCA	SC/Angled PC connector
Monitor port option	/MON	Monitor port included

1 For products whose suffix code contains “Z,” an exclusive manual may be included. Please read it along with the standard manual.

Standard Accessories

The standard accessories below are supplied with the instrument.

Item	Model or Part No.	Quantity	Notes
Protective cap*	—	2	
	—	3	When the monitor port (/MON) is available
User’s manual	IM 810518901-04E	1	Read before using the instrument

*: Already attached to the module

AQ2200-311A ATTN Module

Model	Suffix Code[1]	Description
735131		—
Optical fiber	-SA	SMF (10/125)
	-G5	MMF (50/125)
	-G6	MMF (62.5/125)
Optical connector	-FCC	FC/PC connector
	-SCC	SC/PC connector
Monitor port option	/MON	Monitor port included

1 For products whose suffix code contains “Z,” an exclusive manual may be included. Please read it along with the standard manual.

Standard Accessories

The standard accessories below are supplied with the instrument.

Item	Model or Part No.	Quantity	Notes
Protective cap*	—	2	
	—	3	When the monitor port (/MON) is available
User’s manual	IM 810518901-04E	1	Read before using the instrument

*: Already attached to the module

AQ2200-312 ATTN Module

(Firmware version 3.04 and later)

Model	Suffix Code[1]	Description
AQ2200312		—
Optical fiber	-SA	SMF (10/125)
	-G5	MMF (50/125)
	-G6	MMF (62.5/125)
Optical connector	-FCC	FC/PC connector
	-SCC	SC/PC connector
Monitor port option	/MON	Monitor port included

1 For products whose suffix code contains “Z,” an exclusive manual may be included. Please read it along with the standard manual.

Standard Accessories

The standard accessories below are supplied with the instrument.

Item	Model or Part No.	Quantity	Notes
Protective cap*	—	2	
	—	3	When the monitor port (/MON) is available
User’s manual	IM 810518901-04E	1	Read before using the instrument

*: Already attached to the module

AQ2200-331 ATTN Module

Model	Suffix Code[1]	Description
735133		Built-in monitor power meter
Optical fiber	-SA	SMF
	-G5	MMF (GI 50/125)
	-G6	MMF (GI 62.5/125)
Optical connector	-FCC	FC/PC connector
	-SCC	SC/PC connector

1 For products whose suffix code contains “Z,” an exclusive manual may be included. Please read it along with the standard manual.

Standard Accessories

The standard accessories below are supplied with the instrument.

Item	Model or Part No.	Quantity	Notes
Protective cap*	—	2	
User’s manual	IM 810518901-04E	1	Read before using the instrument

*: Already attached to the module

AQ2200-332 ATTN Module

(Firmware version 3.04 and later)

Model	Suffix Code[1]	Description
AQ2200332		Built-in monitor power meter
Optical fiber	-SA	SMF
	-G5	MMF (GI 50/125)
	-G6	MMF (GI 62.5/125)
Optical connector	-FCC	FC/PC connector
	-SCC	SC/PC connector

1 For products whose suffix code contains “Z,” an exclusive manual may be included. Please read it along with the standard manual.

Standard Accessories

The standard accessories below are supplied with the instrument.

Item	Model or Part No.	Quantity	Notes
Protective cap*	—	2	
User’s manual	IM 810518901-04E	1	Read before using the instrument

*: Already attached to the module

AQ2200-342 DUAL ATTN Module

(Firmware version 3.01 and later)

Model	Suffix Code[1]	Description
AQ2200342		Built-in monitor power meters
Optical fiber	-SA	SMF
Optical connector	-FCC	FC/PC connector
	-FCA	FC/Angled PC connector

1 For products whose suffix code contains “Z,” an exclusive manual may be included. Please read it along with the standard manual.

Standard Accessories

The standard accessories below are supplied with the instrument.

Item	Model or Part No.	Quantity	Notes
Protective cap*	—	1	
User’s manual	IM 810518901-04E	1	Read before using the instrument

*: Already attached to the module

AQ2200-411 OSW Module

Model	Suffix Code[1]	Description
735141		1×4 or 1×8
Port configuration	-04	1×4
	-08	1×8
Optical fiber	-SA	SMF
	-G5	MMF (GI 50/125)
	-G6	MMF (GI 62.5/125)
Optical connector	-FCC	FC/PC connector
	-SCC	SC/PC connector

1 For products whose suffix code contains “Z,” an exclusive manual may be included. Please read it along with the standard manual.

Standard Accessories

The standard accessories below are supplied with the instrument.

Item	Model or Part No.	Quantity	Notes
Protective cap*	—	5	When the port configuration is 1×4
	—	9	When the port configuration is 1×8
User’s manual	IM 810518901-04E	1	Read before using the instrument

*: Already attached to the module

AQ2200-412 OSW Module

Model	Suffix Code[1]	Description
735143		1×16
Port configuration	-16	1×16
Optical fiber	-SA	SMF
	-G5	MMF (GI 50/125)
Optical connector	-FCC	FC/PC connector
	-SCC	SC/PC connector

1 For products whose suffix code contains “Z,” an exclusive manual may be included. Please read it along with the standard manual.

Standard Accessories

The standard accessories below are supplied with the instrument.

Item	Model or Part No.	Quantity	Notes
Protective cap*	—	17	
User’s manual	IM 810518901-04E	1	Read before using the instrument

*: Already attached to the module

AQ2200-421 OSW Module

Model	Suffix Code[1]	Description
735142		1×2 or 2×2
Port configuration	-21	1×2
	-22	2×2
Optical fiber	-SA	SMF
	-G5	MMF (GI 50/125)
	-G6	MMF (GI 62.5/125)
Optical connector	-FCC	FC/PC connector
	-SCC	SC/PC connector

1 For products whose suffix code contains "Z," an exclusive manual may be included. Please read it along with the standard manual.

Standard Accessories

The standard accessories below are supplied with the instrument.

Item	Model or Part No.	Quantity	Notes
Protective cap*	—	6	When the port configuration is 1×2
	—	8	When the port configuration is 2×2
User's manual	IM 810518901-04E	1	Read before using the instrument

*: Already attached to the module

AQ2200-601 10 Gbit/s BERT Module

Model	Suffix Code[1]	Description
810518801		—
Options	/M	PC software for creating 64 Mbit program patterns
	/P1	PC software for creating SDH/SONET frame patterns

1 For products whose suffix code contains "Z," an exclusive manual may be included. Please read it along with the standard manual.

Standard Accessories

The standard accessories below are supplied with the instrument.

Item	Model or Part No.	Quantity	Notes
Protective cap*	—	5	
Terminator for circuit protection*	—	6	
User's manual	IM 810518901-04E	1	Read before using the instrument

*: Already attached to the module

AQ2200-621 10 Gbit/s Optical Modulator

Model	Suffix Code[1]	Description
810518802		1.55 µm
Crystal orientation of the LN modulator	-A	X-cut
	-B	Z-cut
Optical connector	-S	SC connector
	-F	FC connector
Cable	/P	PMF (FC-SC) for 1.5 µm
	/U	U-link coaxial cable

1 For products whose suffix code contains "Z," an exclusive manual may be included. Please read it along with the standard manual.

Standard Accessories

The standard accessories below are supplied with the instrument.

Item	Model or Part No.	Quantity	Notes
Protective cap*	—	2	
Terminator for circuit protection*	—	1	
User's manual	IM 810518901-04E	1	Read before using the instrument

*: Already attached to the module

AQ2200-622 10 Gbit/s Optical Modulator

Model	Suffix Code[1]	Description
810518804		1.31 µm
Crystal orientation of the LN modulator	-A	X-cut
	-B	Z-cut
Optical connector	-S	SC connector
	-F	FC connector
Cable	/P	PMF (FC-SC) for 1.3 µm
	/U	U-link coaxial cable

1 For products whose suffix code contains “Z,” an exclusive manual may be included. Please read it along with the standard manual.

Standard Accessories

The standard accessories below are supplied with the instrument.

Item	Model or Part No.	Quantity	Notes
Protective cap*	—	2	
Terminator for circuit protection*	—	1	
User’s manual	IM 810518901-04E	1	Read before using the instrument

*: Already attached to the module

AQ2200-631 10 Gbit/s Optical Receiver

Model	Suffix Code[1]	Description
810518803		1.31/1.55 µm
Optical connector	-S	SC connector
	-F	FC connector
Cable	/U	U-link coaxial cable

1 For products whose suffix code contains “Z,” an exclusive manual may be included. Please read it along with the standard manual.

Standard Accessories

The standard accessories below are supplied with the instrument.

Item	Model or Part No.	Quantity	Notes
Protective cap*	—	1	
Terminator for circuit protection*	—	1	
User’s manual	IM 810518901-04E	1	Read before using the instrument

*: Already attached to the module

AQ2200-641 XFP Interface Module

Model	Suffix Code[1]	Description
735161		—

1 For products whose suffix code contains “Z,” an exclusive manual may be included. Please read it along with the standard manual.

Standard Accessories

The standard accessories below are supplied with the instrument.

Item	Model or Part No.	Quantity	Notes
Protective cap*	—	3	
Terminator for circuit protection*	—	2	
User’s manual	IM 810518901-04E	1	Read before using the instrument

*: Already attached to the module

AQ2200-642 Transceiver I/F Module

Model	Suffix Code[1]	Description
735162		—

1 For products whose suffix code contains “Z,” an exclusive manual may be included. Please read it along with the standard manual.

Standard Accessory

The standard accessory below is supplied with the instrument.

Item	Model or Part No.	Quantity	Notes
User’s manual	IM 810518901-04E	1	Read before using the instrument

AQ2200-651 SG Module

Model	Suffix Code[1]	Description
735163		—

1 For products whose suffix code contains “Z,” an exclusive manual may be included. Please read it along with the standard manual.

Standard Accessories

The standard accessories below are supplied with the instrument.

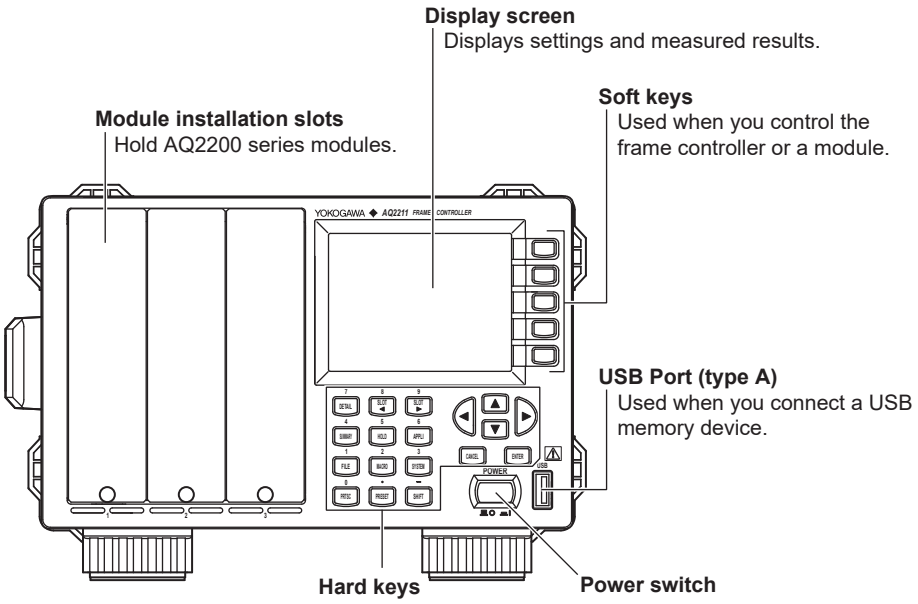
Item	Model or Part No.	Quantity	Notes
Protective cap*	—	1	
Terminator for circuit protection*	—	6	
User’s manual	IM 810518901-04E	1	Read before using the instrument

*: Already attached to the module

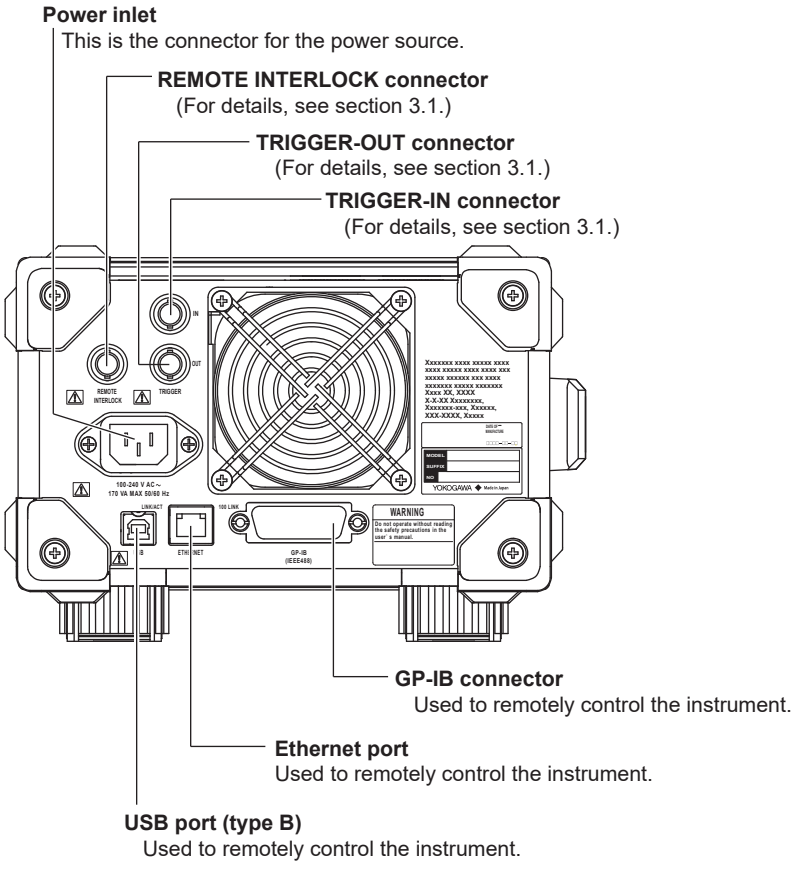
1.1 Frame Controller

Three-Slot Type

Front

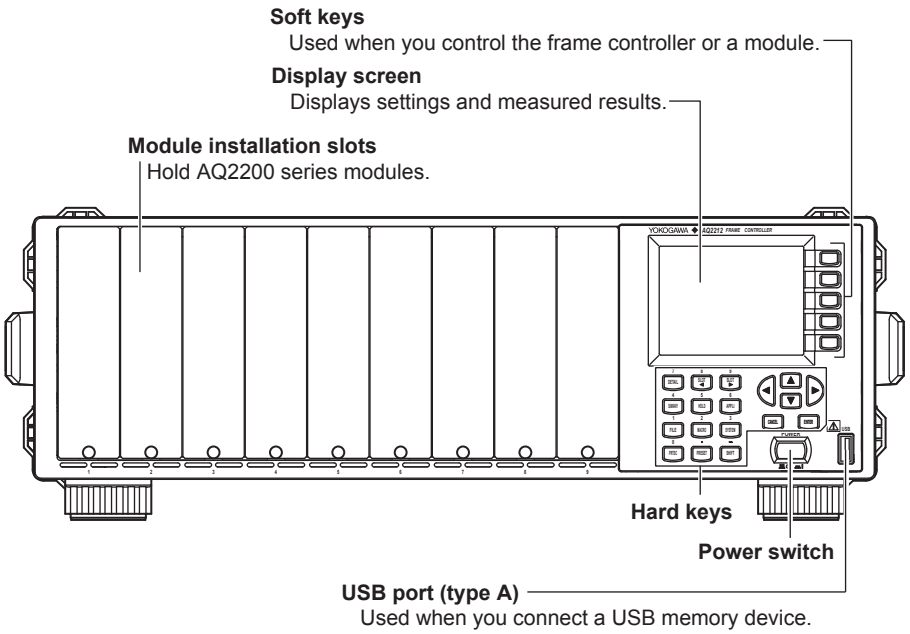


Back

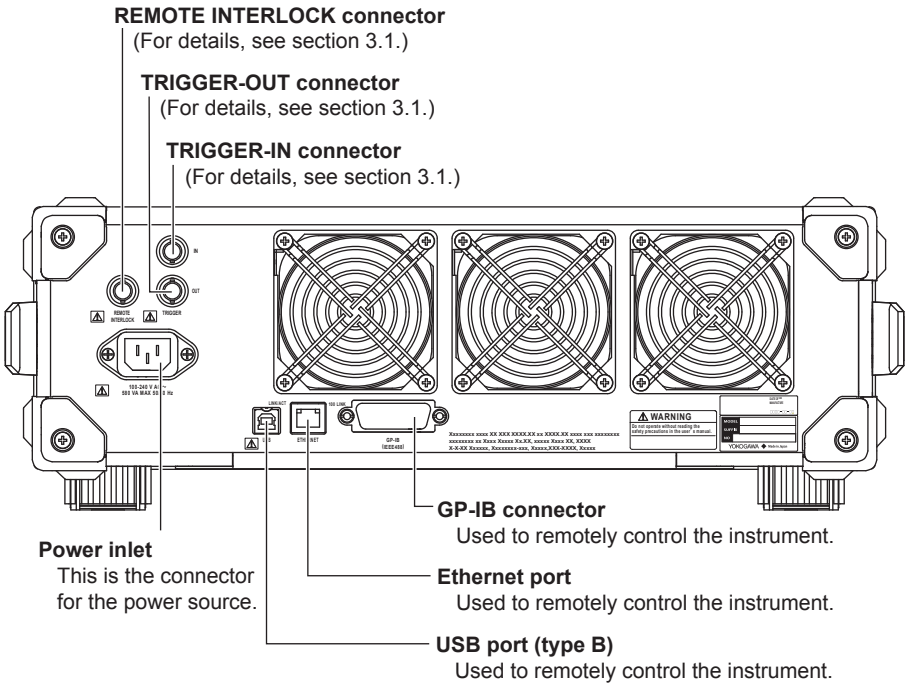


Nine-Slot Type

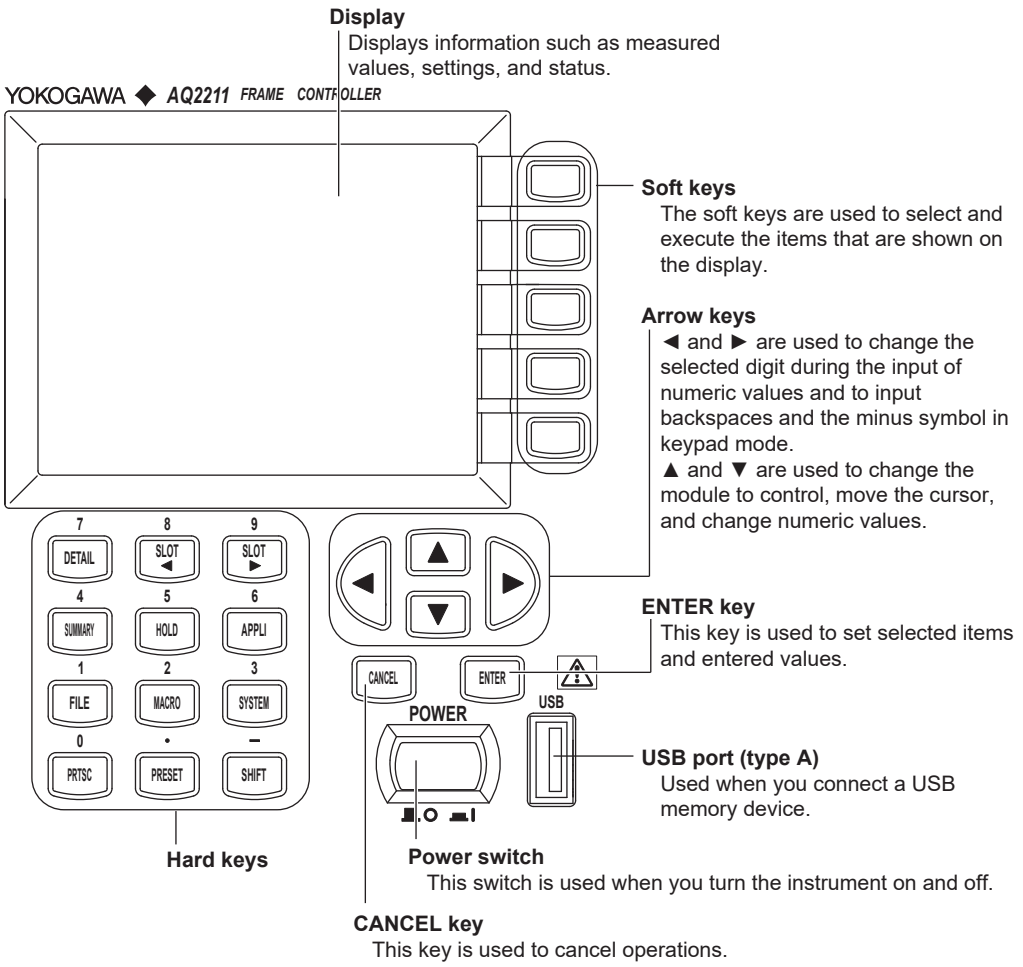
Front



Back



Display and Key Operation Console



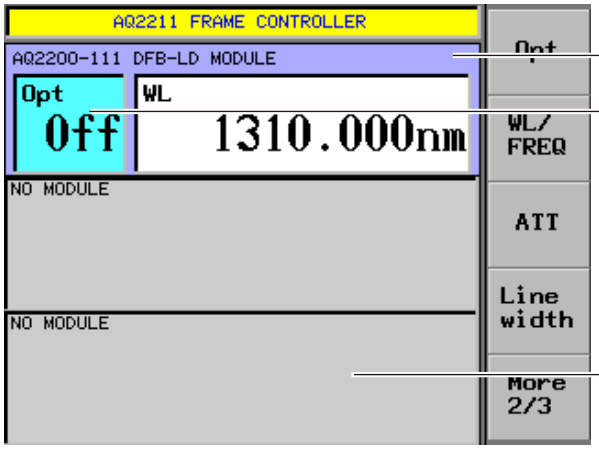
Hard Keys

Key Name	Description
DETAIL	Switches the displayed screen to the DETAIL screen. This hard key is “7” in keypad mode.
SLOT ◄	Switches the module to control. Each time you press this hard key, you switch the module that is being controlled to the module in the previous slot. This hard key is “8” in keypad mode.
SLOT ►	Switches the module to control. Each time you press this hard key, you switch the module that is being controlled to the module in the next slot. This hard key is “9” in keypad mode.
SUMMARY	Switches the displayed screen to the SUMMARY screen. This hard key is “4” in keypad mode.
HOLD	Stops updating the screen display. If you press this hard key again or if you press another hard key, the screen display will start updating again. This hard key is “5” in keypad mode.
APPLI	Displays the APPLICATION screen. This hard key is “6” in keypad mode.
FILE	Displays the FILE LIST screen. This hard key is “1” in keypad mode.
MACRO	Displays the MACRO screen. This hard key is “2” in keypad mode.
SYSTEM	Displays the SYSTEM screen. This hard key is “3” in keypad mode.
PRTSC	Saves a capture of the displayed screen to a file. This hard key is “0” in keypad mode.
PRESET	Initializes the parameters of the frame and the installed modules. This hard key is “.” in keypad mode.
SHIFT	Extension key. This hard key is “-” in keypad mode.

SUMMARY Screen

The SUMMARY screen displays the information from all the installed modules at once. You can view the main parameters, and confirm and change all the parameters.

- Current module: Module with a blue background.
  You can change this module's parameters. The parameters that you can change are displayed as soft keys.
- Current parameter: Parameter with a light blue background.

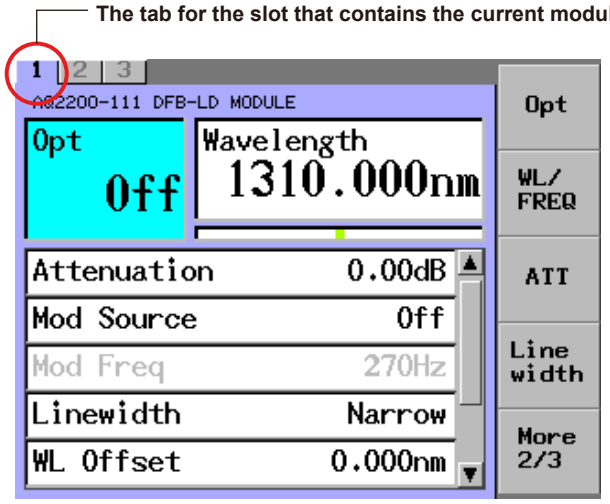


Note

Error No. 1014 may appear on this screen immediately after unit start up.
This error shows that, due to a discrepancy between the release version of the firmware installed in the frame controller and the firmware installed in the module, there is a possibility that some operations may not work properly.
Please update the firmware if this error appears.

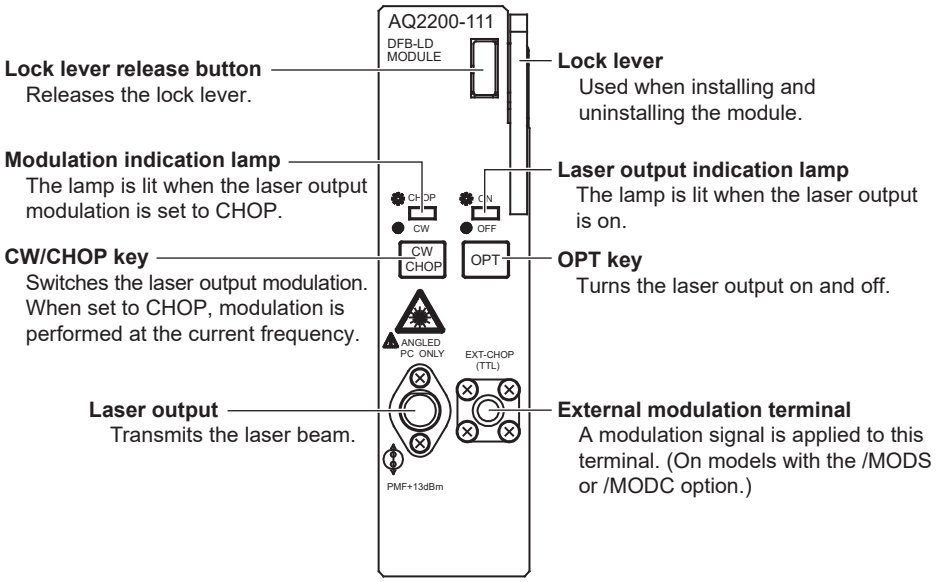
DETAIL Screen

The DETAIL screen displays the detailed information about the selected module (the current module).
You can view, confirm, and change all the current-module parameters.



1.2 Light Source Modules

AQ2200-111 DFB-LD Module



Lock lever release button
Releases the lock lever.

Modulation indication lamp
The lamp is lit when the laser output modulation is set to CHOP.

CW/CHOP key
Switches the laser output modulation. When set to CHOP, modulation is performed at the current frequency.

Laser output
Transmits the laser beam.

Lock lever
Used when installing and uninstalling the module.

Laser output indication lamp
The lamp is lit when the laser output is on.

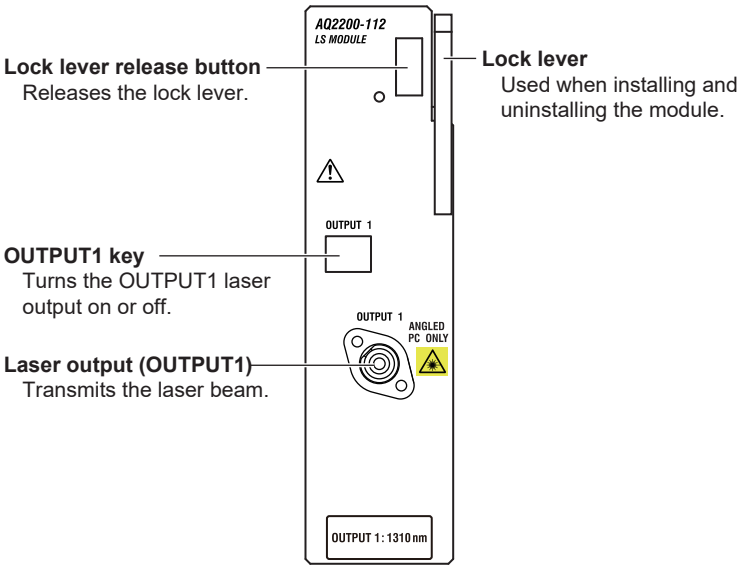
OPT key
Turns the laser output on and off.

External modulation terminal
A modulation signal is applied to this terminal. (On models with the /MODS or /MODC option.)

AQ2200-112 LS Module

Firmware version 3.08 and later

1-Channel Model



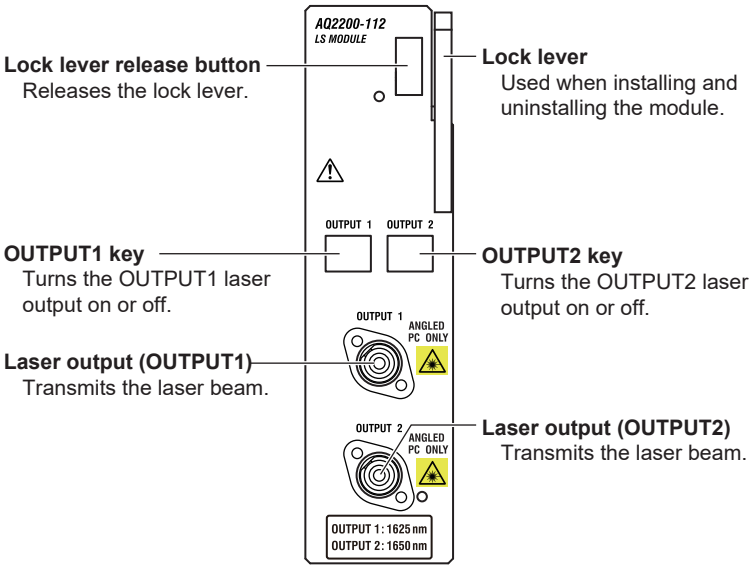
Lock lever release button
Releases the lock lever.

Lock lever
Used when installing and uninstalling the module.

OUTPUT1 key
Turns the OUTPUT1 laser output on or off.

Laser output (OUTPUT1)
Transmits the laser beam.

2-Channel Model



Lock lever release button
Releases the lock lever.

Lock lever
Used when installing and uninstalling the module.

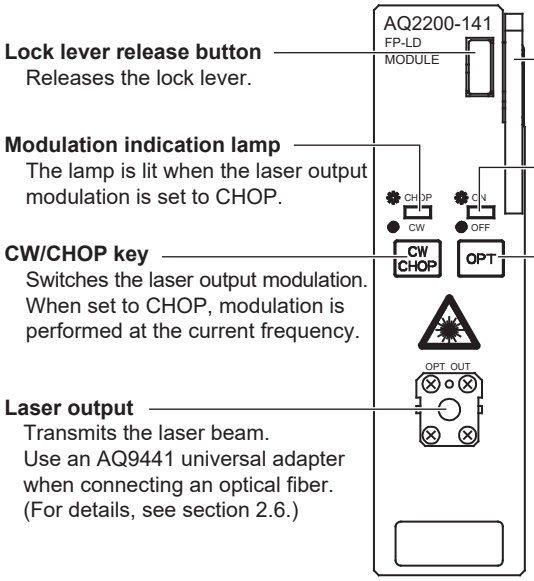
OUTPUT1 key
Turns the OUTPUT1 laser output on or off.

OUTPUT2 key
Turns the OUTPUT2 laser output on or off.

Laser output (OUTPUT1)
Transmits the laser beam.

Laser output (OUTPUT2)
Transmits the laser beam.

AQ2200-141 FP-LD Module



Lock lever release button
Releases the lock lever.

Modulation indication lamp
The lamp is lit when the laser output modulation is set to CHOP.

CW/CHOP key
Switches the laser output modulation. When set to CHOP, modulation is performed at the current frequency.

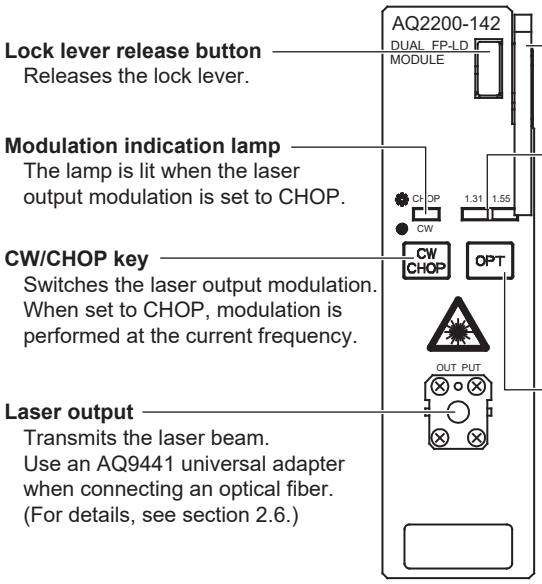
Laser output
Transmits the laser beam. Use an AQ9441 universal adapter when connecting an optical fiber. (For details, see section 2.6.)

Lock lever
Used when installing and uninstalling the module.

Laser output indication lamp
The lamp is lit when the laser output is on.

OPT key
Turns the laser output on and off.

AQ2200-142 DUAL FP-LD Module



Lock lever release button
Releases the lock lever.

Modulation indication lamp
The lamp is lit when the laser output modulation is set to CHOP.

CW/CHOP key
Switches the laser output modulation. When set to CHOP, modulation is performed at the current frequency.

Laser output
Transmits the laser beam. Use an AQ9441 universal adapter when connecting an optical fiber. (For details, see section 2.6.)

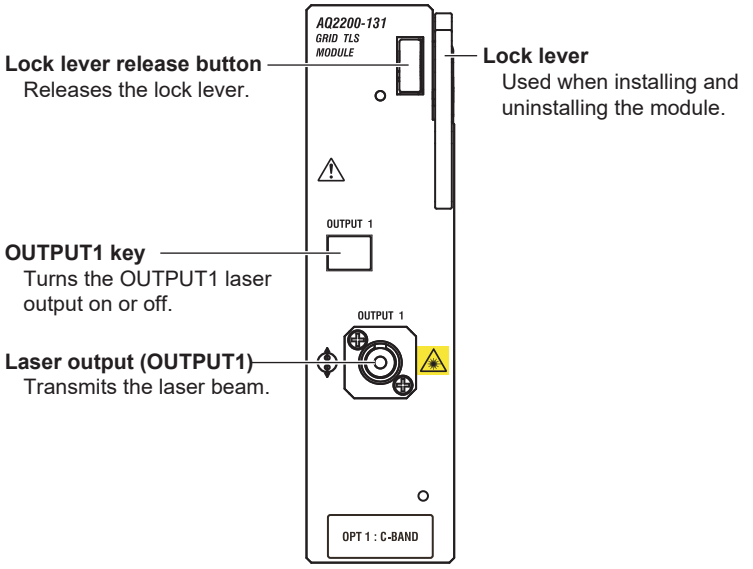
Lock lever
Used when installing and uninstalling the module.

Laser output indication lamp
The 1.31 lamp is lit when the 1310 nm laser output is on.
The 1.55 lamp is lit when the 1550 nm laser output is on.
When both lamps are lit, both laser outputs are on.

OPT key
Turns the laser output on and off.

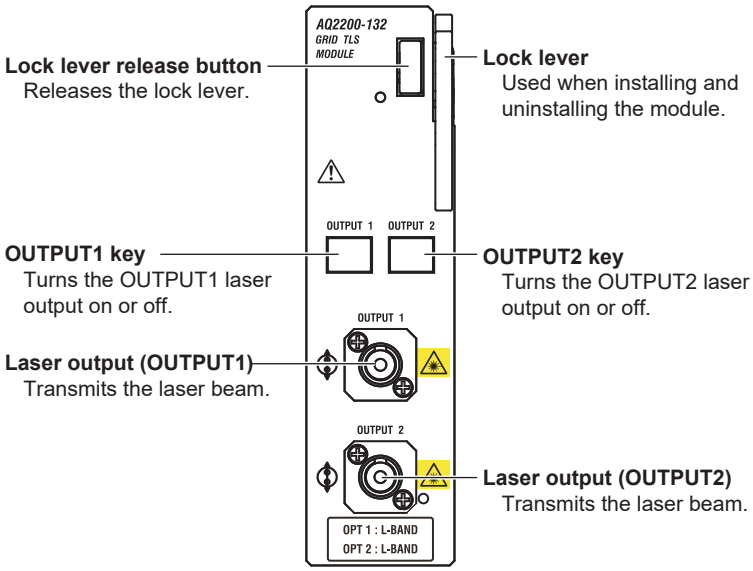
AQ2200-131 Grid TLS Module

-T2, -T4: Firmware version 3.00 and later
-T6: Firmware version 3.05 and later

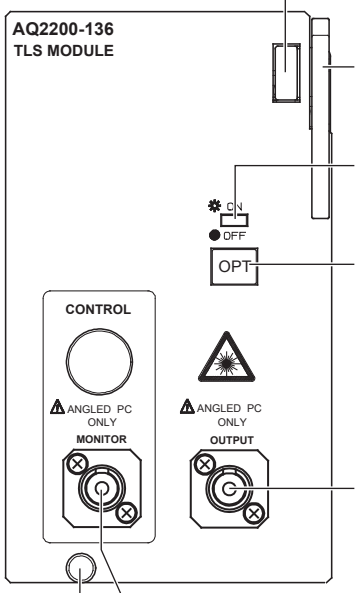


AQ2200-132 Grid TLS Module

-T2, -T4: Firmware version 3.00 and later
-T6: Firmware version 3.05 and later



AQ2200-136 TLS Module



Lock lever release button
Releases the lock lever.

Lock lever
Used when installing and uninstalling the module.

Laser output indication lamp
The lamp is lit when the laser output is on.

OPT key
Turns the laser output on and off.

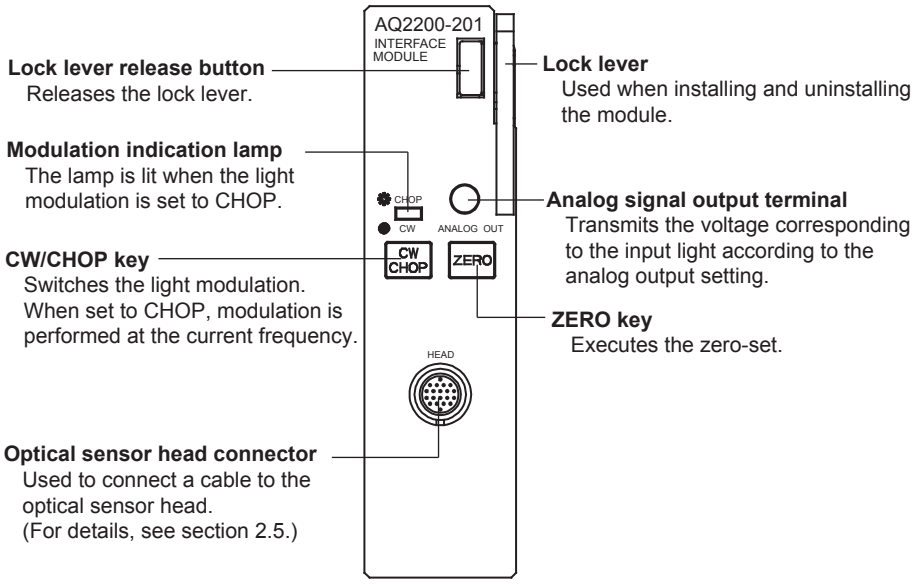
Laser output
Transmits the laser beam.

Wavelength monitor output
Transmits the laser beam for the wavelength monitor.

Fixing screw
When you install the module, tighten the screws to fix the module in place.

1.3 Optical Sensor Modules

AQ2200-201 Interface Module



Lock lever release button
Releases the lock lever.

Modulation indication lamp
The lamp is lit when the light modulation is set to CHOP.

CW/CHOP key
Switches the light modulation. When set to CHOP, modulation is performed at the current frequency.

Optical sensor head connector
Used to connect a cable to the optical sensor head.
(For details, see section 2.5.)

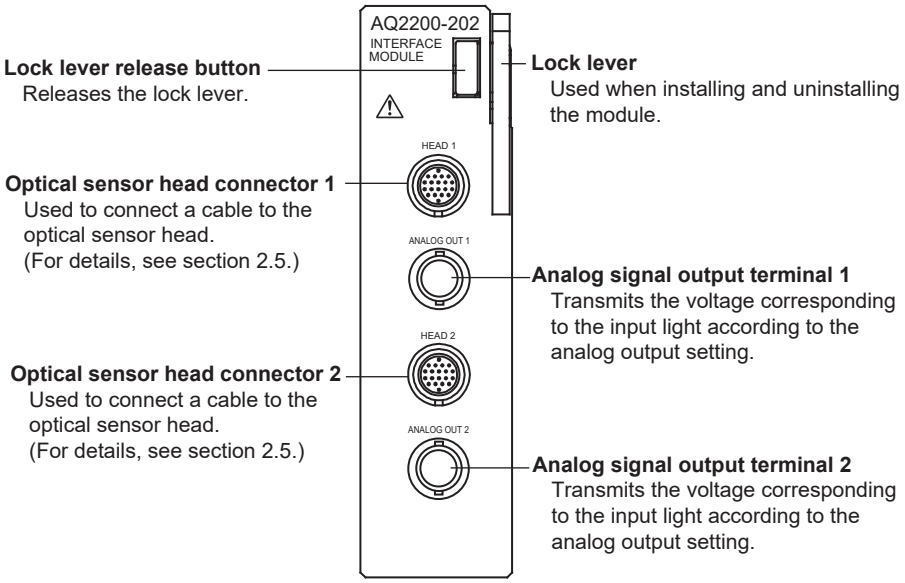
Lock lever
Used when installing and uninstalling the module.

Analog signal output terminal
Transmits the voltage corresponding to the input light according to the analog output setting.

ZERO key
Executes the zero-set.

AQ2200-202 Interface Module

Firmware version 3.05 and later



Lock lever release button
Releases the lock lever.

Optical sensor head connector 1
Used to connect a cable to the optical sensor head.
(For details, see section 2.5.)

Optical sensor head connector 2
Used to connect a cable to the optical sensor head.
(For details, see section 2.5.)

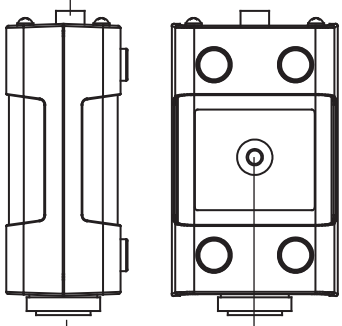
Lock lever
Used when installing and uninstalling the module.

Analog signal output terminal 1
Transmits the voltage corresponding to the input light according to the analog output setting.

Analog signal output terminal 2
Transmits the voltage corresponding to the input light according to the analog output setting.

AQ2200-231/241 Optical Sensor Head

Interface module connector
You can use a cable to connect the optical sensor head to an AQ2200-201 interface module.



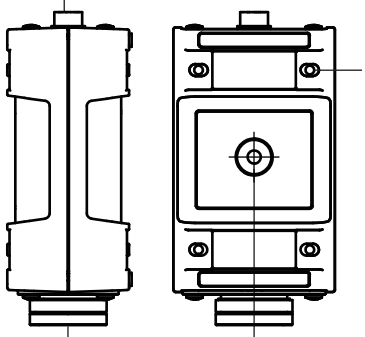
Optical input
The optical input receives optical signals. Use an AQ9335C connector adapter when connecting an optical fiber. (For details, see section 2.6.)

Mounting screw hole
The mounting screw hole is used to fix the unit in place. You can use 5 mm M6 screws.

AQ2200-232/242 Optical Sensor Head

-232: Firmware version 3.05 and later
-242: Firmware version 3.06 and later, AQ2200-202 Firmware version 2.00 and later

Interface module connector
You can use a cable to connect the optical sensor head to an AQ2200-202 interface module.

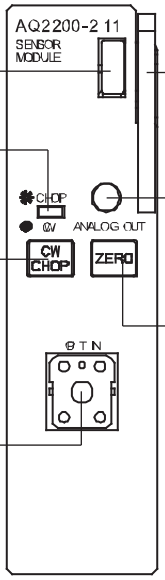


Mounting screw hole(four)
The mounting screw holes are used to fix the unit in place. You can use 7 mm M4 screws.

Optical input
The optical input receives optical signals. Use an AQ9335C or AQ9340 connector adapter when connecting an optical fiber. (For details, see section 2.6.)

Mounting screw hole
The mounting screw hole is used to fix the unit in place. You can use 5 mm M6 screws.

AQ2200-211 Sensor Module (Highly sensitive type)



Lock lever release button
Releases the lock lever.

Lock lever
Used when installing and uninstalling the module.

Modulation indication lamp
The lamp is lit when the light modulation is set to CHOP.

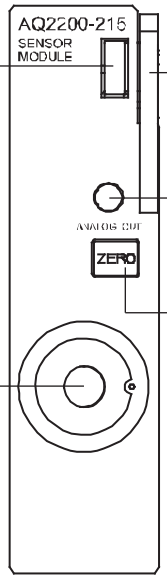
Analog signal output terminal
Transmits the voltage corresponding to the input light according to the analog output setting.

CW/CHOP key
Switches the light modulation. When set to CHOP, modulation is performed at the current frequency.

ZERO key
Executes the zero-set.

Optical input
The optical input receives optical signals.
Use an AQ9447 connector adapter when connecting an optical fiber.
(For details, see section 2.6.)

AQ2200-215 Sensor Module (High power type)



Lock lever release button
Releases the lock lever.

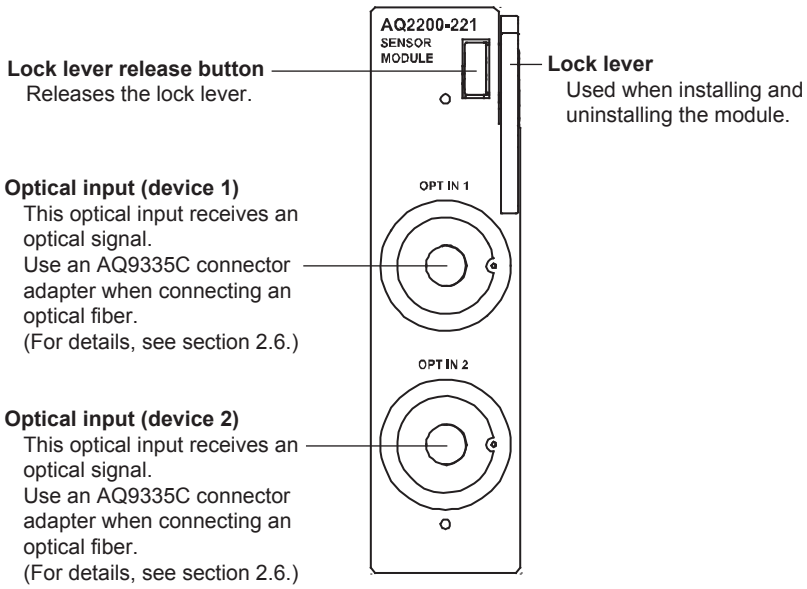
Lock lever
Used when installing and uninstalling the module.

Analog signal output terminal
Transmits the voltage corresponding to the input light according to the analog output setting.

ZERO key
Executes the zero-set.

Optical input
The optical input receives optical signals.
Use an AQ9335C connector adapter when connecting an optical fiber.
(For details, see section 2.6.)

AQ2200-221 Sensor Module (Dual)



Lock lever release button
Releases the lock lever.

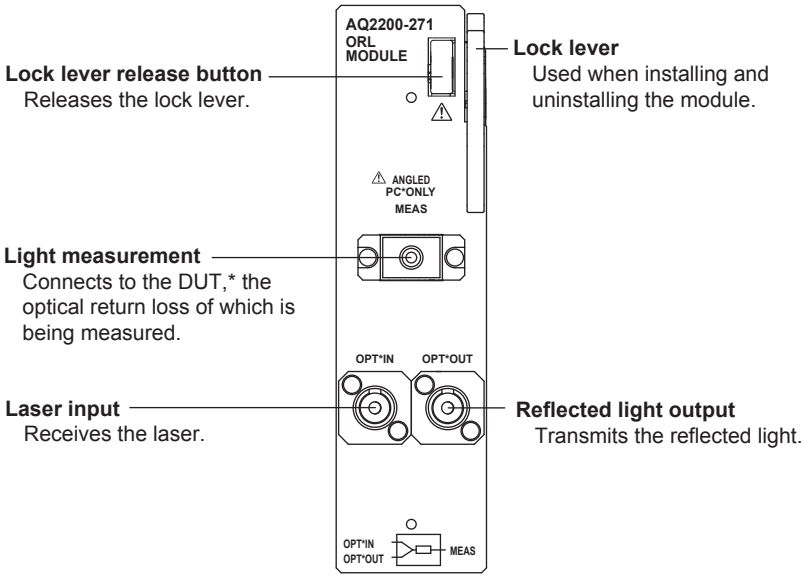
Lock lever
Used when installing and uninstalling the module.

Optical input (device 1)
This optical input receives an optical signal.
Use an AQ9335C connector adapter when connecting an optical fiber.
(For details, see section 2.6.)

Optical input (device 2)
This optical input receives an optical signal.
Use an AQ9335C connector adapter when connecting an optical fiber.
(For details, see section 2.6.)

1.4 ORL Module

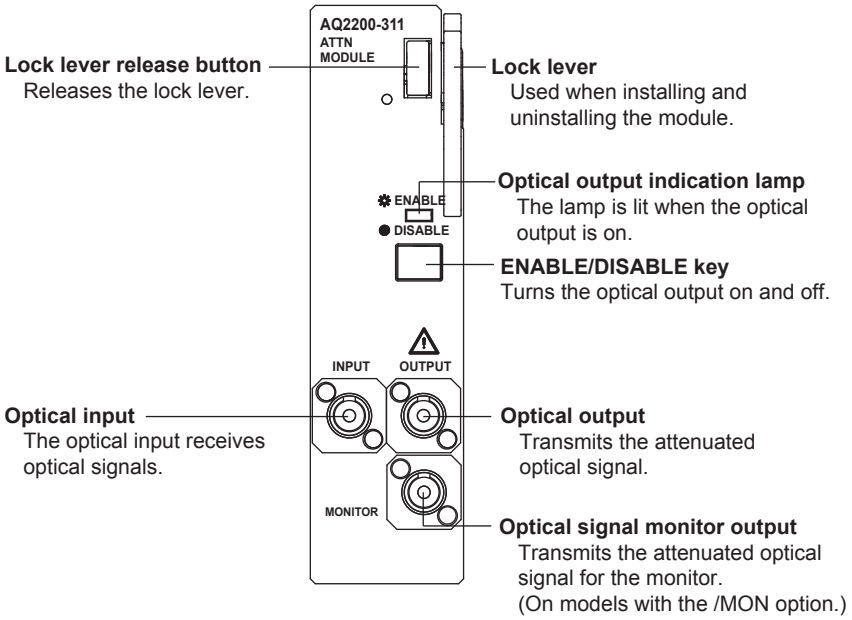
AQ2200-271 ORL Module



* DUT stands for device under test.

1.5 Attenuator Modules

AQ2200-311 ATTN Module



Lock lever release button
Releases the lock lever.

Lock lever
Used when installing and uninstalling the module.

Optical output indication lamp
The lamp is lit when the optical output is on.

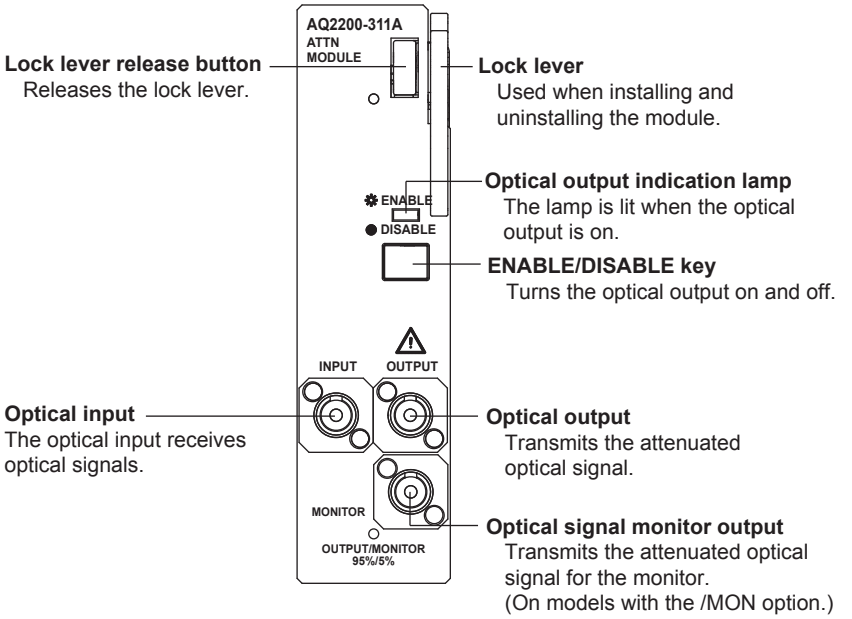
ENABLE/DISABLE key
Turns the optical output on and off.

Optical input
The optical input receives optical signals.

Optical output
Transmits the attenuated optical signal.

Optical signal monitor output
Transmits the attenuated optical signal for the monitor.
(On models with the /MON option.)

AQ2200-311A ATTN Module



Lock lever release button
Releases the lock lever.

Lock lever
Used when installing and uninstalling the module.

Optical output indication lamp
The lamp is lit when the optical output is on.

ENABLE/DISABLE key
Turns the optical output on and off.

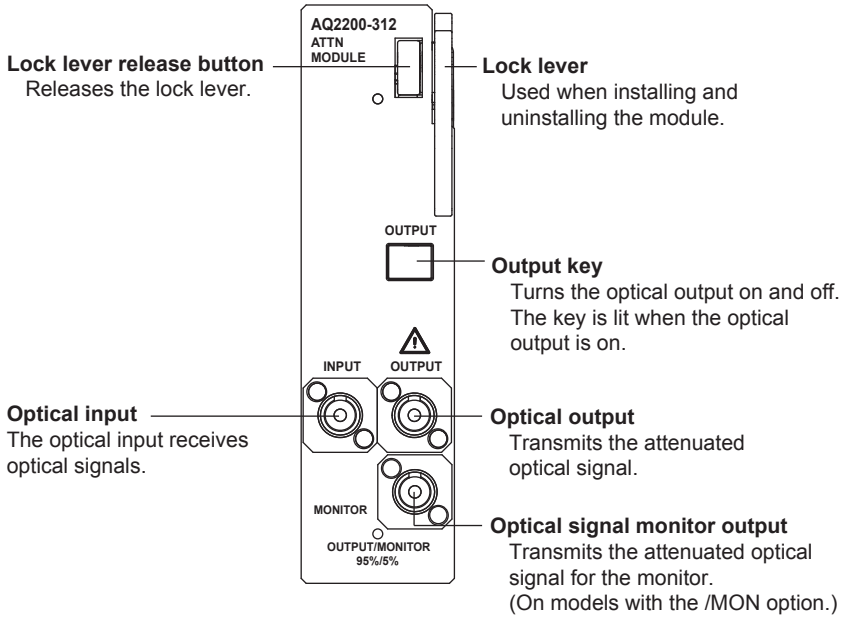
Optical input
The optical input receives optical signals.

Optical output
Transmits the attenuated optical signal.

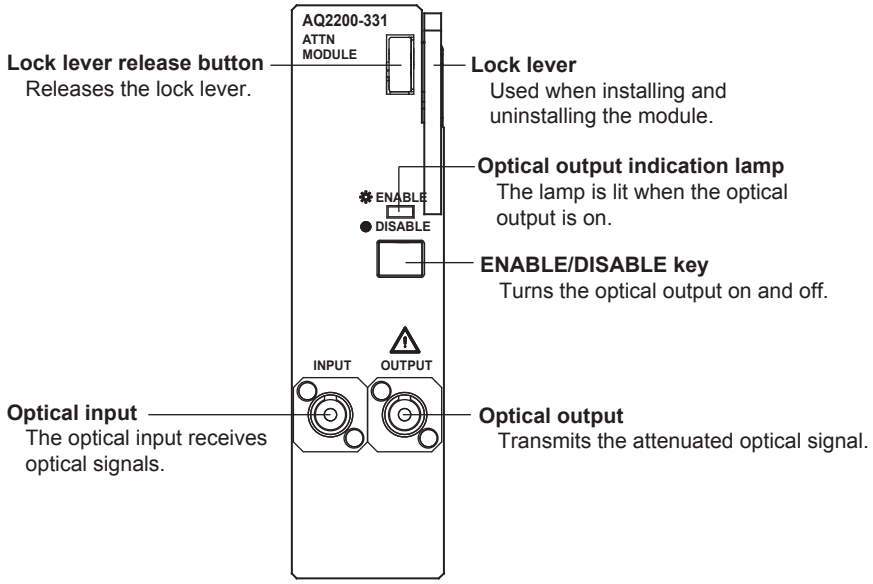
Optical signal monitor output
Transmits the attenuated optical signal for the monitor.
(On models with the /MON option.)

AQ2200-312 ATTN Module

Firmware version 3.04 and later

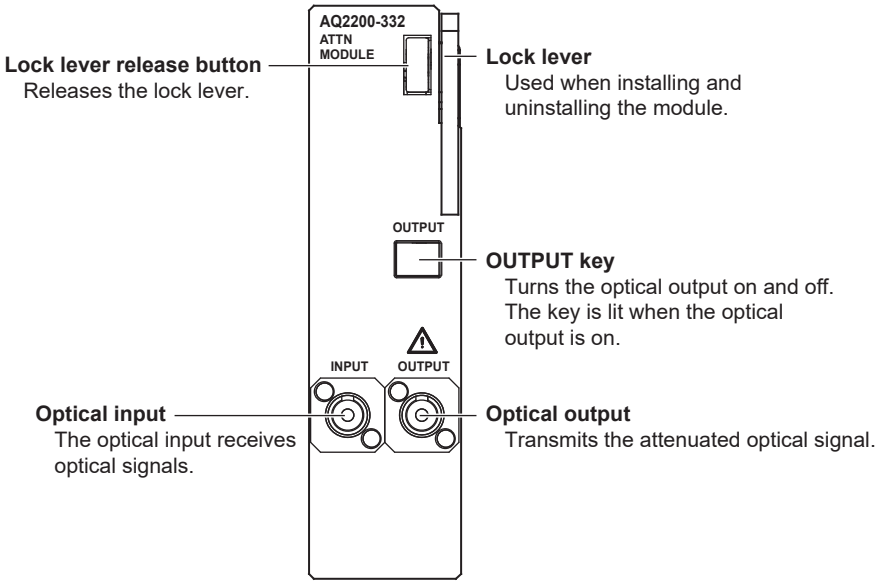


AQ2200-331 ATTN Module (Built-in monitor power meter)



AQ2200-332 ATTN Module (Built-in monitor power meter)

Firmware version 3.04 and later



Lock lever release button
Releases the lock lever.

Lock lever
Used when installing and uninstalling the module.

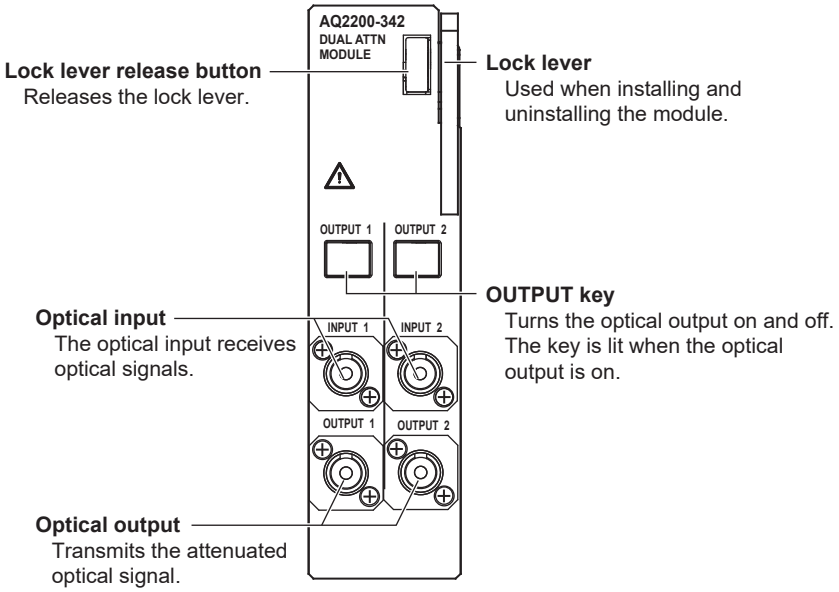
OUTPUT key
Turns the optical output on and off. The key is lit when the optical output is on.

Optical input
The optical input receives optical signals.

Optical output
Transmits the attenuated optical signal.

AQ2200-342 DUAL ATTN Module (Built-in monitor power meters)

Firmware version 3.01 and later



Lock lever release button
Releases the lock lever.

Lock lever
Used when installing and uninstalling the module.

OUTPUT key
Turns the optical output on and off. The key is lit when the optical output is on.

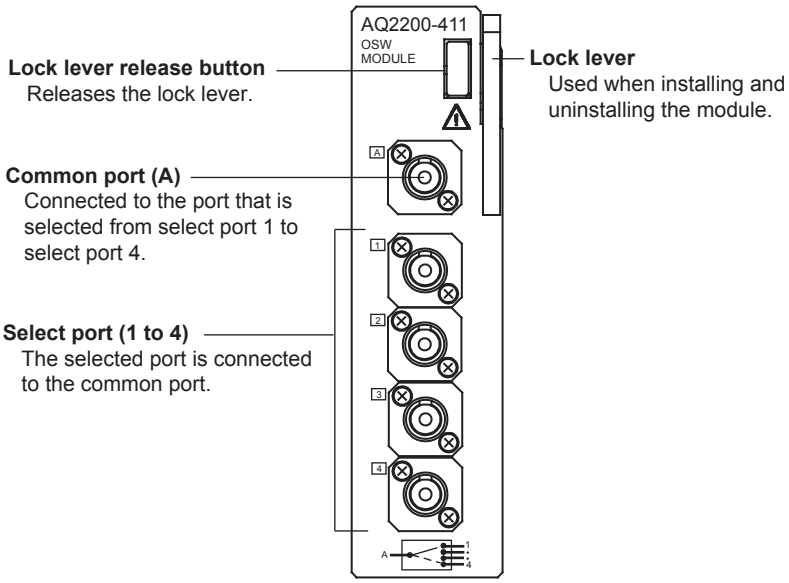
Optical input
The optical input receives optical signals.

Optical output
Transmits the attenuated optical signal.

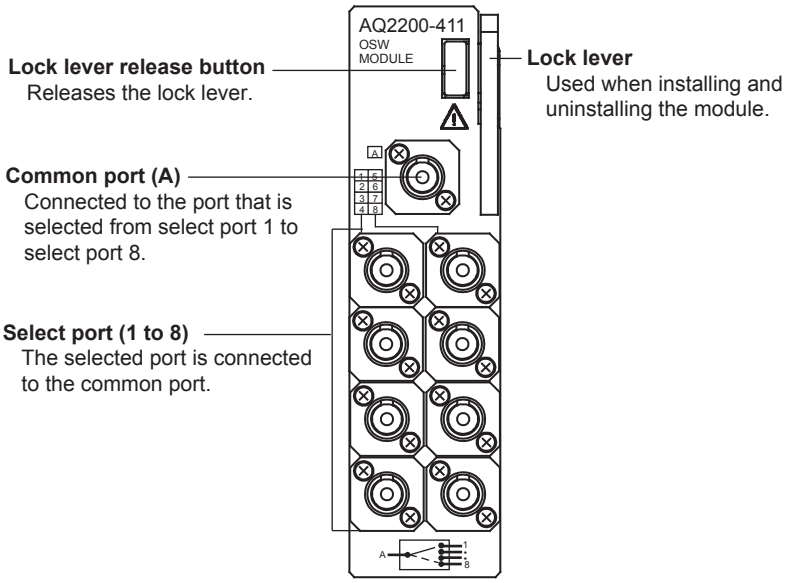
1.6 Optical Switch Modules

AQ2200-411 OSW Module

1×4 Type

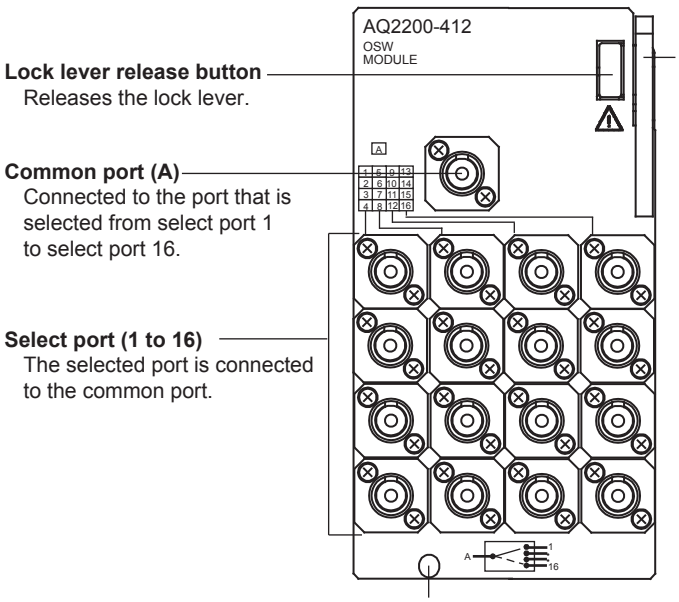


1×8 Type



AQ2200-412 OSW Module

1×16 Type



Lock lever release button
Releases the lock lever.

Common port (A)
Connected to the port that is selected from select port 1 to select port 16.

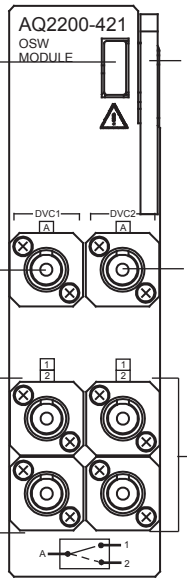
Select port (1 to 16)
The selected port is connected to the common port.

Lock lever
Used when installing and uninstalling the module.

Fixing screw
When you install the module, tighten the screws to fix the module in place

AQ2200-421 OSW Module

1×2 Type



Lock lever release button
Releases the lock lever.

Lock lever
Used when installing and uninstalling the module.

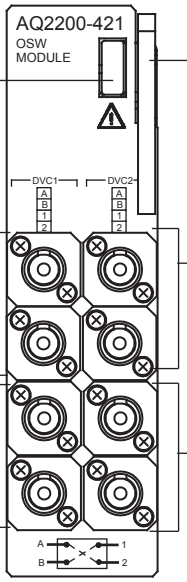
Common port (A)
Device 1
Connected to the port that is selected from select port 1 and 2 on device 1.

Common port (A)
Device 2
Connected to the port that is selected from select port 1 and 2 on device 2.

Select port (1 and 2)
Device 1
The selected port is connected to the device 1 common port.

Select port (1 and 2)
Device 2
The selected port is connected to the device 2 common port.

2×2 Type



Lock lever release button
Releases the lock lever.

Lock lever
Used when installing and uninstalling the module.

Common port (A and B)
Device 1
The selected port is connected to select port 1 or select port 2 (whichever is selected) on device 1.

Common port (A and B)
Device 2
The selected port is connected to select port 1 or select port 2 (whichever is selected) on device 2.

Select port (1 and 2)
Device 1
The selected port is connected to port A or port B (whichever is selected) on device 1.

Select port (1 and 2)
Device 2
The selected port is connected to port A or port B (whichever is selected) on device 2.

1.7 BERT Module

AQ2200-601 10 Gbit/s BERT Module

Signal output indication lamp
This lamp shows the status of the PPG signal output.The lamp is lit when the output is on.

Signal output ON/OFF key
Turns all of the PPG output terminals on or off at once. Each time this key is pressed, signal output switches between on and off.

Data output terminal (to the optical modulator)
Non-inverted data output terminal. Used when this module is combined with an optical modulator module.

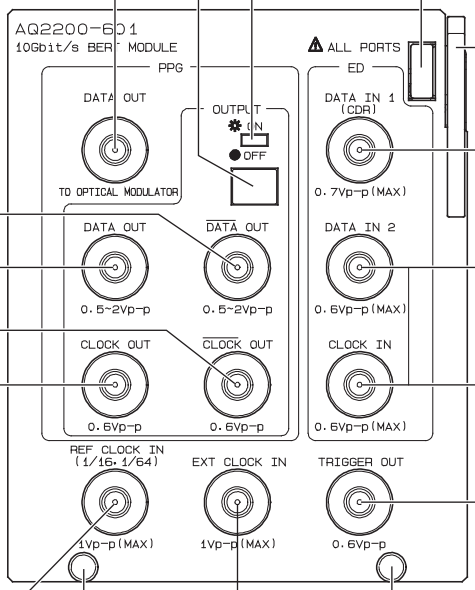
Inverted data output terminal
When output is on, this terminal transmits the 10 Gbit/s inverted data.

Non-inverted data output terminal
When output is on, this terminal transmits the 10 Gbit/s non-inverted data.

Inverted clock signal output terminal
Transmits the 10 GHz inverted clock signal. When output is on, this terminal transmits the inverted clock signal of the 10 GHz band.

Non-inverted clock signal output terminal
Transmits the 10 GHz non-inverted clock signal. When output is on, this terminal transmits the non-inverted clock signal of the 10 GHz band.

External synchronization signal input terminal
If you want to synchronize the BERT module with an external clock signal and have the module generate a PPG signal, without using the internal SG, apply a reference signal that has a frequency that is 1/16 or 1/64 of the 10 Gbit/s rate to this terminal. This clock is used not only for the PPG, but also for the clock signal to operate the CDR function of the ED.



Lock lever release button
Releases the lock lever.

Lock lever
Used when installing and uninstalling the module.

Data input 1 terminal
ED data input terminal. Because this terminal has a built-in CDR (clock and data recovery), it does not require clock input.

Data input 2 terminal
ED data input terminal. This terminal requires a clock signal to be applied to the clock signal input terminal.

Clock signal input terminal
ED clock signal input terminal. When you apply a signal to the data input 2 terminal, apply a clock signal to the clock signal input terminal. Adjust the phase by using an instrument such as an external phase shifter.

Trigger signal output terminal
Transmits one of the following trigger signals.
(For details, see section 1.6 in IM 735101-03E.)
- Clock trigger (1/16 or 1/64)
- Pattern trigger
- Error trigger

Fixing screw

External clock signal input terminal
If you want to operate the BERT module with an external clock signal at a rate of 10 Gbit/s, without using the internal SG, apply a 10 Gbit/s clock signal to this terminal. This clock is used not only for the PPG, but also for the reference clock signal to operate the CDR function of the ED.

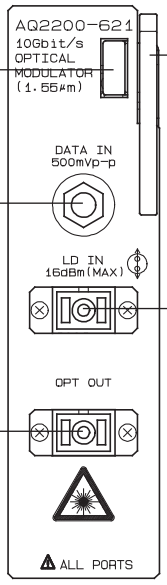
Fixing screw
When you install the module, tighten the screws to fix the module in place.

Note

- **When using the external synchronization input terminal and the data input 1 terminal:**
  If the signal applied to the ED's data input 1 terminal is not synchronized with the PPG, adjust the settings so that the frequency 16 or 64 times larger than the reference signal to be applied to the external synchronization input terminal is within ±100 ppm of the input data rate.
- **When using the external clock input terminal and the data input 1 terminal:**
  If the signal applied to the ED's data input 1 terminal is not synchronized with the PPG, adjust the settings so that the frequency 16 or 64 times larger than the reference signal to be applied to the external clock input terminal is within ±100 ppm of the input data rate.

1.8 Optical Modulator Modules

AQ2200-621 10 Gbit/s Optical Modulator (Wavelength: 1.55 µm)



Lock lever release button
Releases the lock lever.

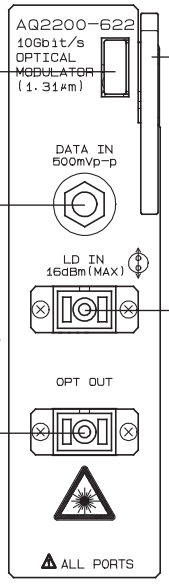
Lock lever
Used when installing and uninstalling the module.

Data input terminal
Data input terminal.
Use a U-link (/U option) or coaxial cable to connect this terminal to the DATA OUT (TO OPTICAL MODULATOR) terminal on the PPG of a BERT module.

Laser input terminal
Connects to the light source.
If you use an AQ2200-111 (PMF specifications) for the light source, connect it with a PANDA fiber (/P option). If you use any other light source, adjust the Slow axis of the polarized wave to the connector key position.

Optical output terminal
Transmits the optical signal, the light intensity of which is modulated.

AQ2200-622 10 Gbit/s Optical Modulator (Wavelength: 1.31 µm)



Lock lever release button
Releases the lock lever.

Lock lever
Used when installing and uninstalling the module.

Data input terminal
Data input terminal.
Use a U-link (/U option) or coaxial cable to connect this terminal to the DATA OUT (TO OPTICAL MODULATOR) terminal on the PPG of a BERT module.

Laser input terminal
Connects to the light source.
If you use an AQ2200-111 (PMF specifications) for the light source, connect it with a PANDA fiber (/P option). If you use any other light source, adjust the Slow axis of the polarized wave to the connector key position.

Optical output terminal
Transmits the optical signal, the light intensity of which is modulated.

Note

If you require a stable extinction ratio, we recommend that you warm up this module for a period of approximately 100 minutes before use.

1.9 Optical Receiver Module

AQ2200-631 10 Gbit/s Optical Receiver

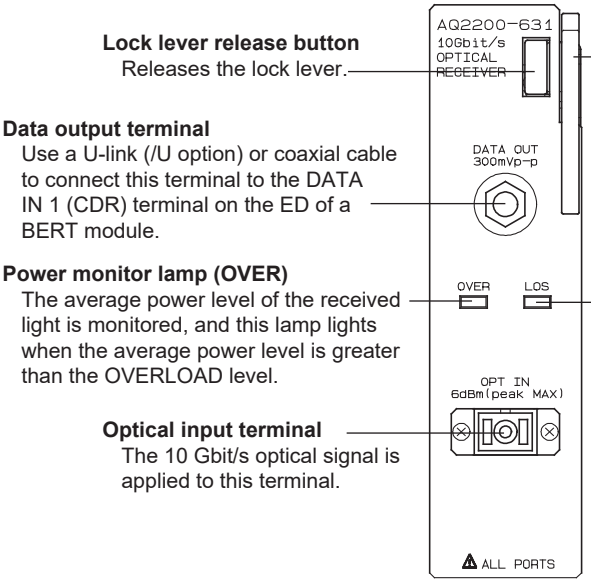
CAUTION

Use an optical ATT to protect the terminal if there is a chance that the input level of the 10 Gbit/s optical signal that will be applied to the optical input terminal (OPT IN) will exceed the maximum input power (6 dBm).

French

ATTENTION

Utiliser un atténuateur optique pour protéger la borne si le niveau d'entrée du signal optique de 10 Gbit/s appliqué à la borne d'entrée optique (OPT IN) risque de dépasser la puissance d'entrée maximum (6 dBm).



Lock lever release button
Releases the lock lever.

Lock lever
Used when installing and uninstalling the module.

Data output terminal
Use a U-link (/U option) or coaxial cable to connect this terminal to the DATA IN 1 (CDR) terminal on the ED of a BERT module.

Power monitor lamp (OVER)
The average power level of the received light is monitored, and this lamp lights when the average power level is greater than the OVERLOAD level.

Power monitor lamp (LOS)
The average power level of the received light is monitored, and this lamp lights when the average power level is lower than the LOS level.

Optical input terminal
The 10 Gbit/s optical signal is applied to this terminal.

Note

- Because the OVER and LOS lamps are used in detecting the level of the received light, there is not necessarily a bit error in the received data even if these lamps are lit.
- If you require a stable minimum sensitivity for received light, we recommend that you warm up this module for a period of approximately 30 minutes before use.

1.10 XFP Interface Module

AQ2200-641 XFP Interface Module

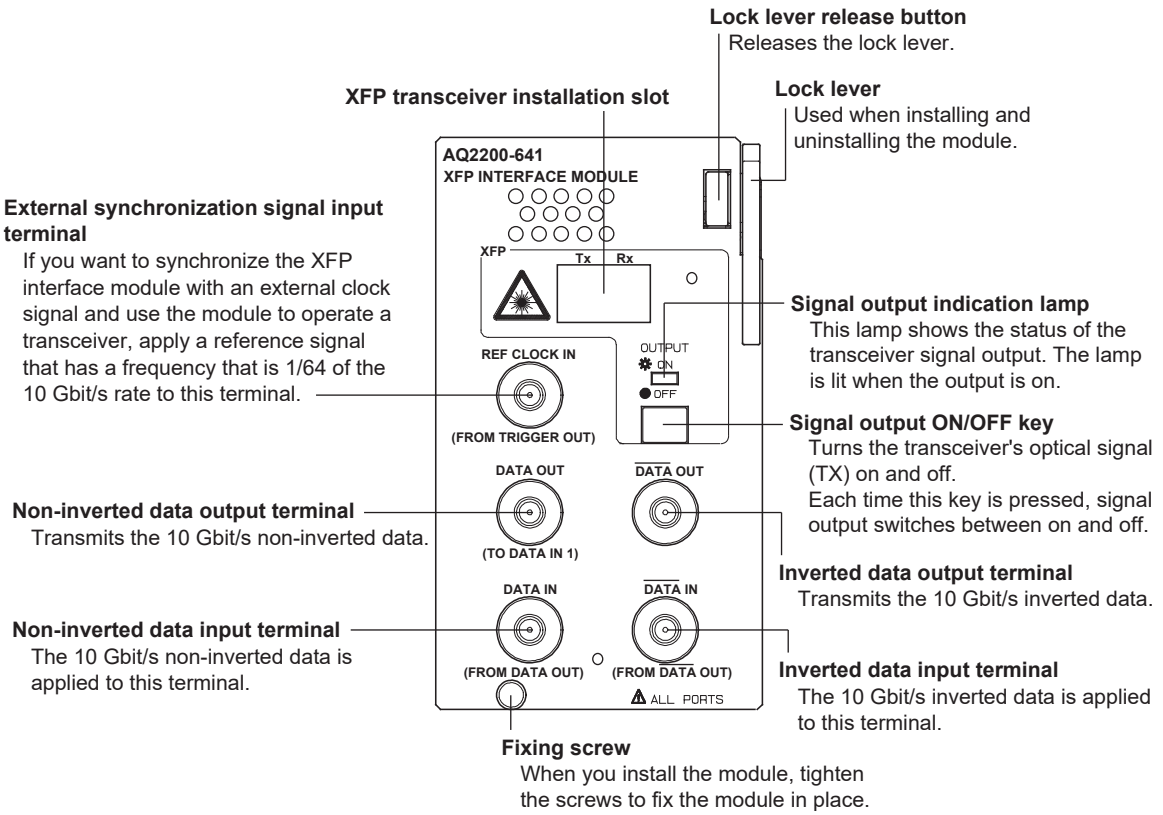
CAUTION

If an XFP transceiver is not installed, cover the DATA IN and $\overline{\text{DATA}}$ IN input terminals with the included protective caps.

French

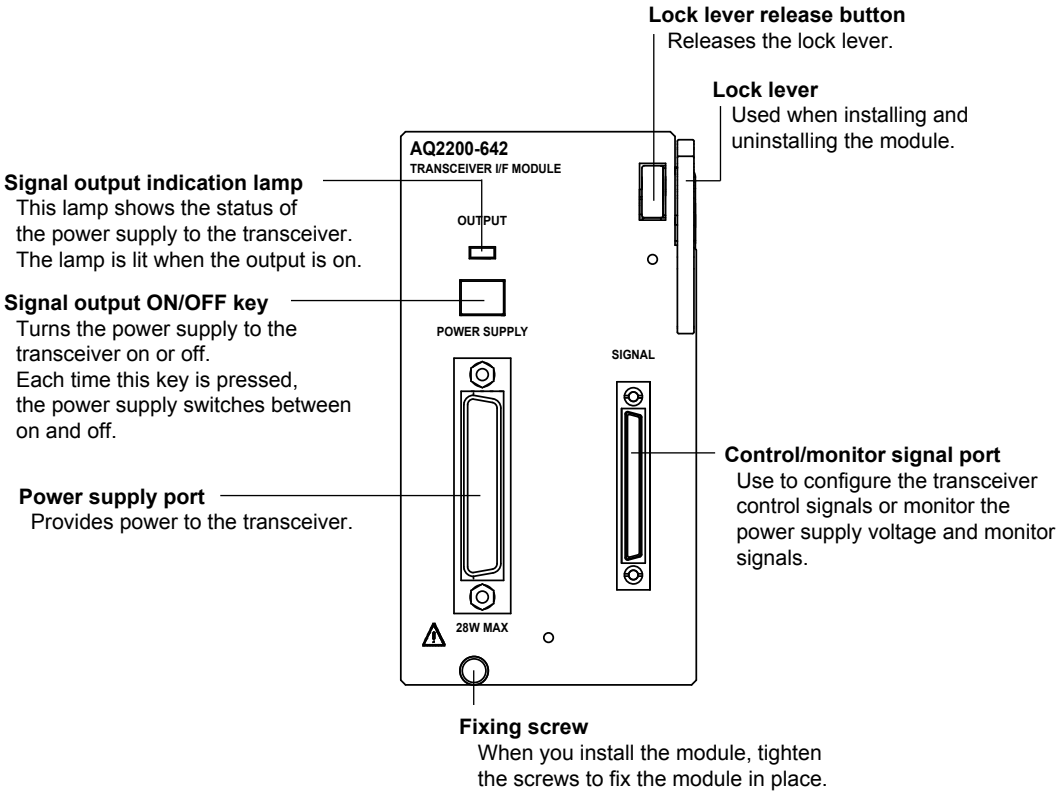
ATTENTION

En l'absence d'émetteur-récepteur XFP, couvrir les bornes d'entrée DATA IN et $\overline{\text{DATA}}$ IN à l'aide des capuchons de protection fournis.



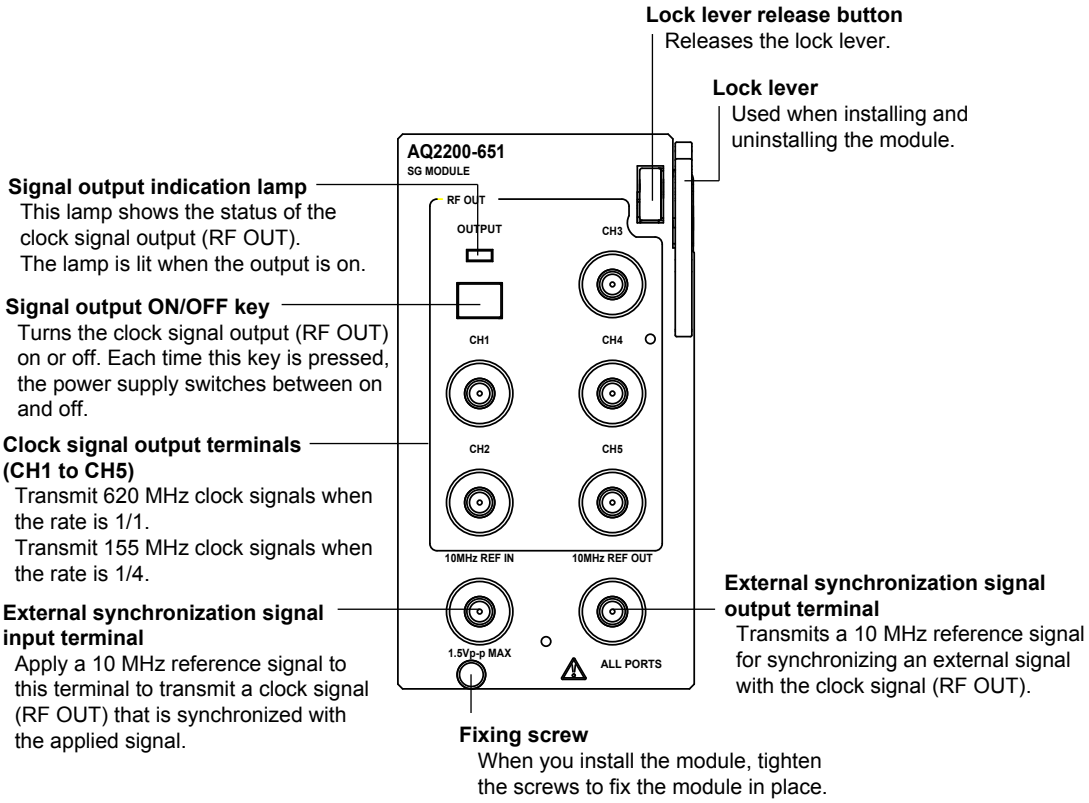
1.11 Transceiver I/F Module

AQ2200-642 Transceiver I/F Module



1.12 SG Module

AQ2200-651 SG Module



2.1 Handling Precautions

Safety Precautions

If you are using this instrument for the first time, make sure to thoroughly read the safety precautions given on pages vi to xi.

Do Not Remove the Case

Do not remove the case from the frame controller. Some parts of the instrument use high voltages and are extremely dangerous. For internal inspection and adjustment, contact your nearest YOKOGAWA dealer.

Unplug If Abnormal Behavior Occurs

If you notice smoke or unusual odors coming from the instrument, immediately turn off the power and unplug the power cord. Then, contact your nearest YOKOGAWA dealer.

Do Not Damage the Power Cord

Nothing should be placed on top of the power cord, and it should be kept away from any heat sources. When removing the plug from the power outlet, do not pull on the cord. Pull from the plug. If the power cord is damaged or if you are using the instrument in a location where the power supply specifications are different, purchase a power cord that matches the specifications of the region that the instrument will be used in.

Operating Environment and Conditions

This instrument complies with the EMC standard under specific operating environment and operating conditions. If the installation, wiring, and so on are not appropriate, the compliance conditions of the EMC standard may not be met. In such cases, the user will be required to take appropriate measures.

General Handling Precautions

Do Not Place Objects on Top of the Instrument

Never place objects such as other instruments or objects that contain water on top of the instrument. Doing so may damage the instrument.

Do Not Damage the LCD

Because the LCD is very vulnerable and can be easily scratched, do not allow any sharp objects near it. Also, the LCD should not be exposed to vibrations or shocks.

Unplug during Extended Non-Use

Unplug the power cord from the outlet.

Module Handling Precautions

- Do not expose the modules to excessive shock.
- Do not remove the module cases.
- Do not touch the metal parts of the module connectors with your hands.

CAUTION

Do not carry the AQ2211 or AQ2212 Frame Controller while modules are installed in the instrument.

French

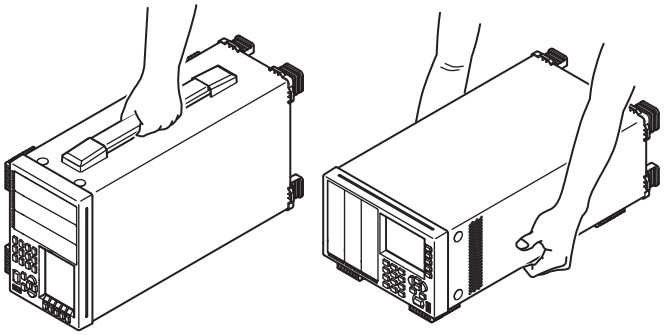
ATTENTION

Ne pas transporter le contrôleur AQ2211 ou AQ2212 pendant l'installation des modules dans l'instrument.

When Carrying the Instrument

Remove the power cord, all modules, and cables. When carrying the instrument, either hold the handle or hold the instrument with both hands as shown in the figure below.

AQ2211 Frame Controller



When Cleaning the Instrument

When cleaning the case or the operation panel, first remove the power cord from the outlet, and then wipe with a dry, soft, clean cloth. Do not use chemicals such as benzene or thinner. Doing so may cause discoloring and deformation.

2.2 Installing the Instrument

Installation Conditions

Install the instrument in a place that meets the following conditions.

WARNING

- Do not install the instrument outdoors or in locations subject to rain or water.
- Install the instrument so that you can immediately remove the power cord if an abnormal or dangerous condition occurs.

CAUTION

If you block the inlet holes on the right and bottom or the exhaust holes on the rear side of the instrument, the instrument will become hot and may break down.

French

AVERTISSEMENT

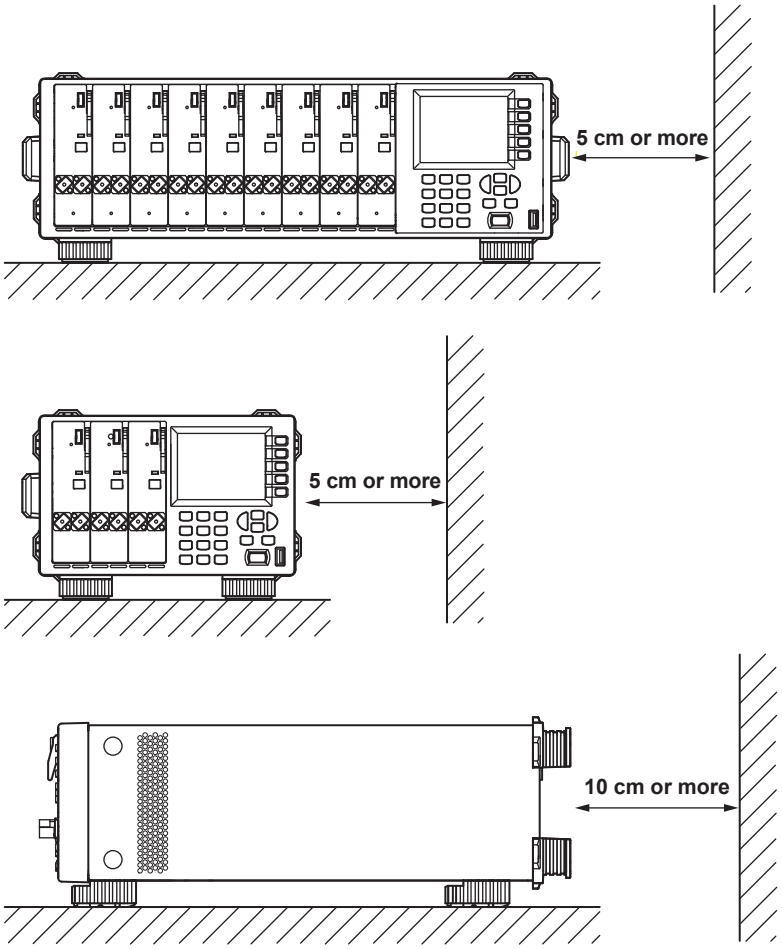
- Ne pas installer l’instrument à l’extérieur ou dans des lieux exposés à la pluie ou à l’eau.
- Installer l’instrument de manière à pourvoir immédiatement le débrancher du secteur en cas de fonctionnement anormal ou dangereux.

ATTENTION

Si vous bloquez les orifices d’entrée situés à droite et sous l’instrument ou les orifices de sortie arrière, l’instrument surchauffe et risque de tomber en panne.

Well-Ventilated Location

Inlet holes are located on the right and bottom of the instrument. There are also exhaust holes on the rear side. To prevent internal overheating, allow for enough space around the instrument (see the figure below), and do not block the inlet and exhaust holes.



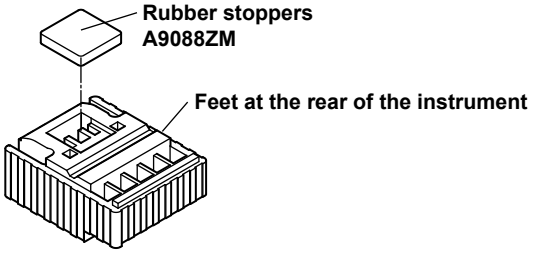
When connecting cables, allow for enough space, above and beyond the space shown in the figure above, to carry out the procedure.

Ambient Temperature and Humidity

Ambient temperature	5 to 40°C
Ambient humidity	20 to 80% RH (no condensation)

Flat, Even Surface

Install the instrument with the correct orientation on a stable, horizontal surface. If the instrument is installed in a horizontal position, rubber stoppers can be attached to the feet at the rear of the instrument to prevent the instrument from sliding. One set of rubber stoppers (two stoppers) are included with the instrument.



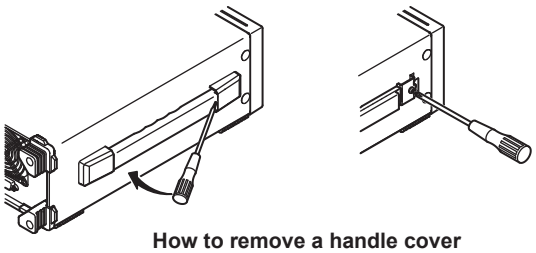
Rack Mounting

To rack-mount the instrument, use the separately sold rack mount kit.

Product Name	Model
AQ2211 rack mount kit (for mounting one AQ2211 to an EIA-standard rack)	735182-03
AQ2212 rack mount kit (for mounting one AQ2212 to an EIA-standard rack)	735182-09

An outline of the mounting procedure is given below. For detailed instructions, see the manual that is included with the rack mount kit.

1. Remove the handles from both sides of the instrument (from the left side of the instrument in the case of an AQ2211).
2. Remove the four feet from the bottom of the instrument.
3. Remove the four seals the rack mount attachment holes on each side of the instrument near the front.
4. Place seals over the feet and handle attachment holes.
5. Attach the rack mount kit to the instrument.
6. Mount the instrument on a rack.

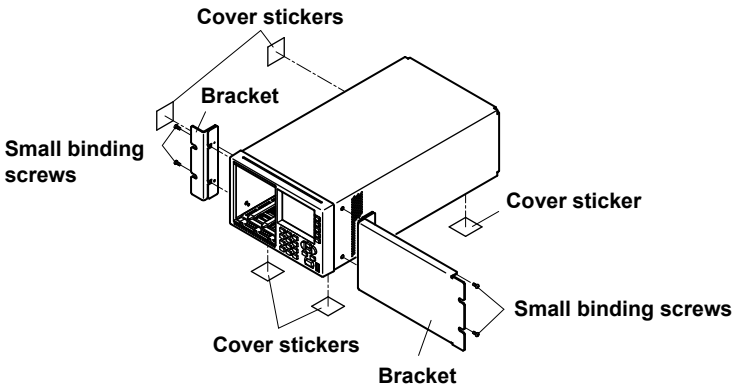


How to remove a handle cover

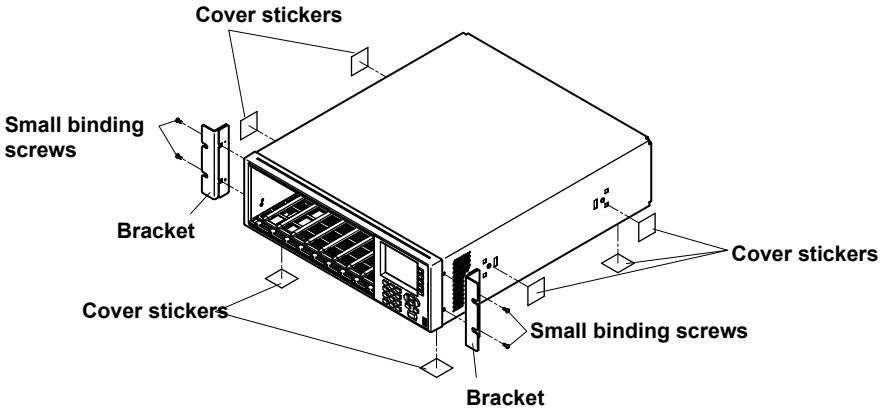
Note

- When rack-mounting the instrument, allow at least 10 cm of space around the inlet and exhaust holes to prevent internal heating.
- Make sure to provide adequate support from the bottom of the instrument. The support should not block the inlet and exhaust holes.
- Store the removed parts in a safe place.
- When rack-mounting the instrument, remove the feet from the rear of the instrument if they are coming into contact with the rack and are thus preventing you from rack-mounting the instrument. After you have rack-mounted the instrument, re-attach the feet to the rear of the instrument. In this case, be sure to attach the brackets to the instrument before you remove the feet from the rear of the instrument. If you don’t, the instrument’s cover may come loose and fall when you rack-mount the instrument.

• **Rack-Mounting to the AQ2211 Frame Controller**



• **Rack-Mounting to the AQ2212 Frame Controller**



Do Not Install the Instrument in the Following Kinds of Places

- In direct sunlight, or near sources of heat
- Near sources of strong magnetic fields
- In an environment where static electricity can easily be generated
- Near high-voltage equipment or power lines
- In an environment with excessive amounts of soot, steam, dust, or corrosive gases
- In an environment that is subject to large levels of mechanical vibration
- On an unstable surface

Storing the Instrument

- We recommend that the instrument be stored in an environment where the temperature is between 5 and 40°C and the relative humidity is between 20 and 80% RH.
- When storing the instrument, avoid the following kinds of places.
  - In direct sunlight
  - Where the temperature is 60°C or higher
  - Where the relative humidity is 80% or higher
  - Near a high-temperature heat source
  - Where the level of mechanical vibration is high
  - Where there are corrosive or explosive gasses
  - Where an excessive amount of soot, dust, salt, or iron is present
  - Where water, oil, or chemicals may splash
  - Outdoors or in locations subject to rain or water

2.3 Attaching and Removing Blank Panels

WARNING

To prevent electric shock, and to ensure that the instrument performs within its specifications, be sure to cover any unused slots with the blank panels sold separately.
If you use the instrument without covering empty slots with blank panels, the instrument may malfunction due to dust getting inside of it or its internal temperature rising.

French

AVERTISSEMENT

Pour éviter tout choc électrique et garantir un fonctionnement de l'instrument conforme aux spécifications, veiller à couvrir tous les emplacements non utilisés des panneaux vides vendus séparément.
Si vous utilisez l'instrument sans couvrir les emplacements non utilisés des panneaux vides, celui-ci risque de ne pas fonctionner correctement en raison de l'accumulation de poussière ou d'une surchauffe interne.

Remove the blank panel when you install a module into the frame controller.

Removing a Blank Panel

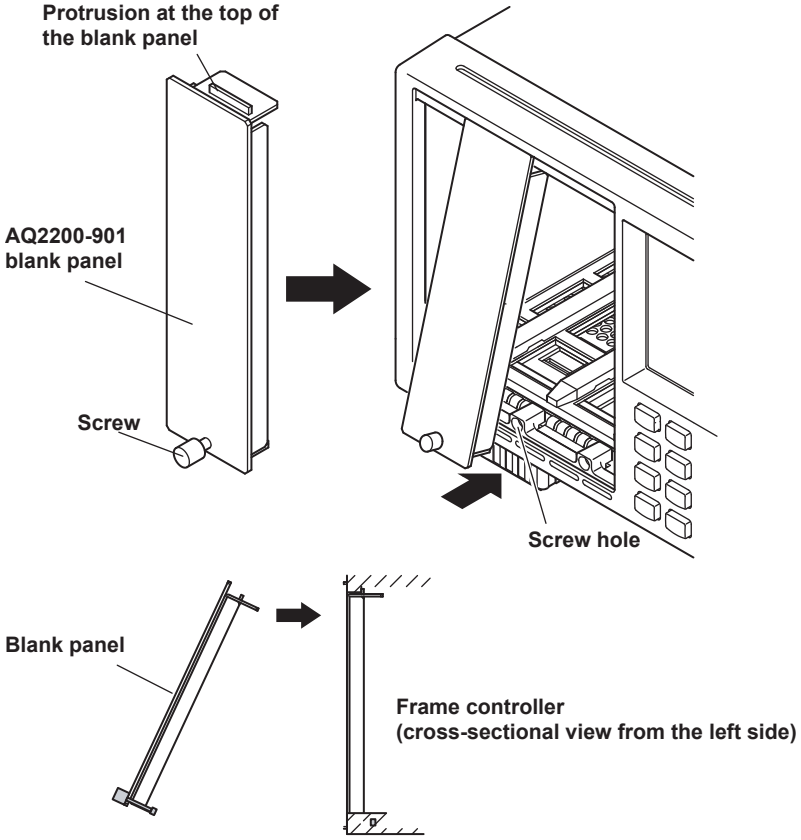
1. Loosen the screw at the bottom of the blank panel.
2. Grasp the screw at the bottom of the blank panel, and pull the panel toward you.
3. Slide the blank panel down until you remove it from the frame controller.

Note

The blank panel is constructed so that the screw does not fall out.

Attaching a Blank Panel

1. Align the protrusion at the top of the blank panel such that it catches on the top part of the frame controller slot.
2. Fasten the blank-panel screw into the screw hole on the bottom part of the frame controller slot.



2.4 Installing and Uninstalling Modules

WARNING

- Do not apply a voltage that exceeds the maximum input voltage, withstand voltage, or allowable surge voltage.
- Be sure to fasten the screws that are at the bottom of the front panel of 2-slot and 3-slot modules. Otherwise, the mechanical protection function will not be activated.
- Do not leave the modules connected to the instrument in environments in which a voltage that exceeds the allowable surge voltage may occur.

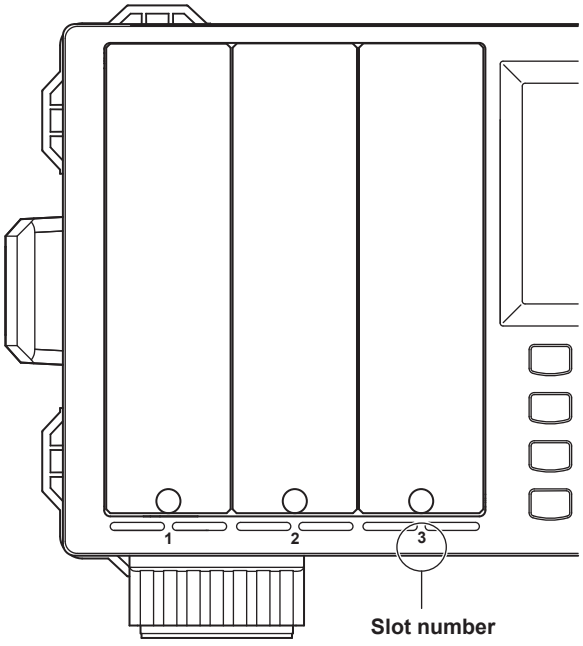
French

AVERTISSEMENT

- Ne pas dépasser les valeurs maximales de tension d'entrée, de tension de maintien ou de surtension admissible.
- Pour éviter tout risque de choc électrique, veiller à serrer les vis situées au bas du panneau avant des modules à 2 et 3 emplacements, à défaut de quoi les fonctions de protection électrique et mécanique ne seront pas activées.
- Ne pas laisser les modules branchés à l'instrument dans des environnements dans lesquels la tension pourrait être égale ou supérieure à la surtension admissible.

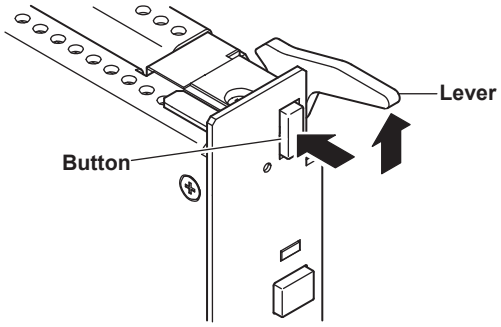
Module Installation Slots

You can install a maximum of three modules into the AQ2211 Frame Controller and a maximum of nine modules into the AQ2212 Frame Controller. The slots are assigned numbers 1, 2, 3, etc., starting from the left of the instrument, when the frame controller is viewed from the front.



Installing a Module

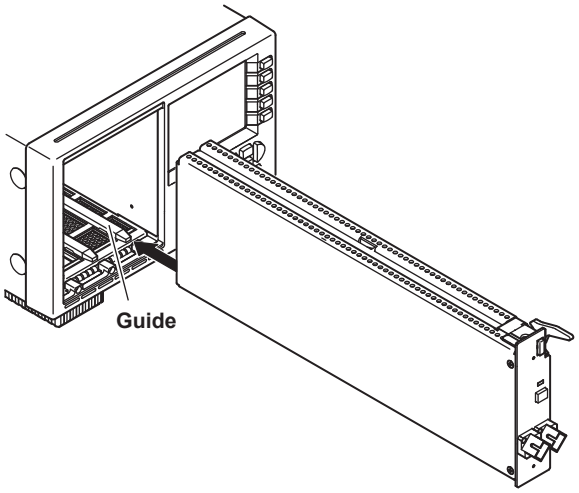
1. While pressing the button on the module panel, pull up on the lever.



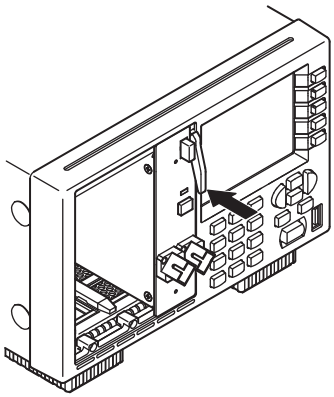
Note

When inserting a module, always check its vertical orientation.

2. Align the groove on the bottom of the module with the guide on the slot that you want to install the module into, and slowly insert the module into the frame controller.



3. After you have fully inserted the module, slowly but firmly push the lever until the button clicks.



Note

When you install a two-slot or three-slot module, tighten the screws to fix it in place.

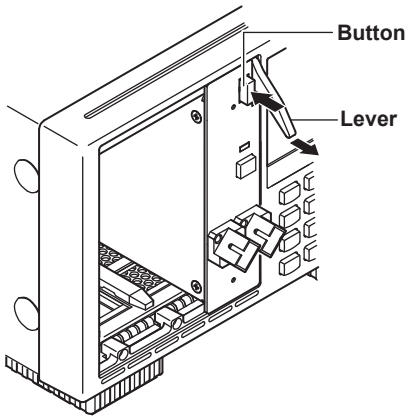
Uninstalling a Module

1. If you are uninstalling a two-slot or three-slot module, loosen the fixing screws.

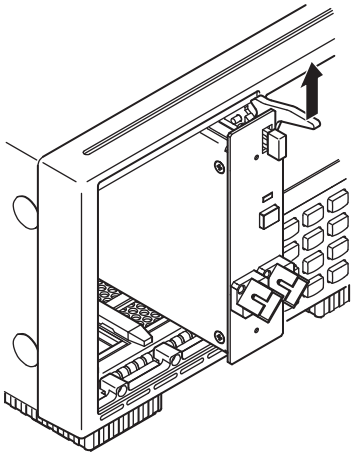
Note

The modules are constructed so that the fixing screws do not fall out.

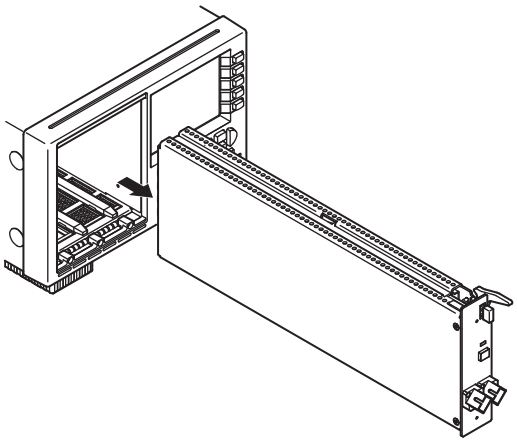
2. While pressing the button, lightly pull the lever up until it unlocks.



3. Slowly pull the lever up until the module projects approximately 1 cm out from the frame.



4 Slowly pull the module out from the slot.

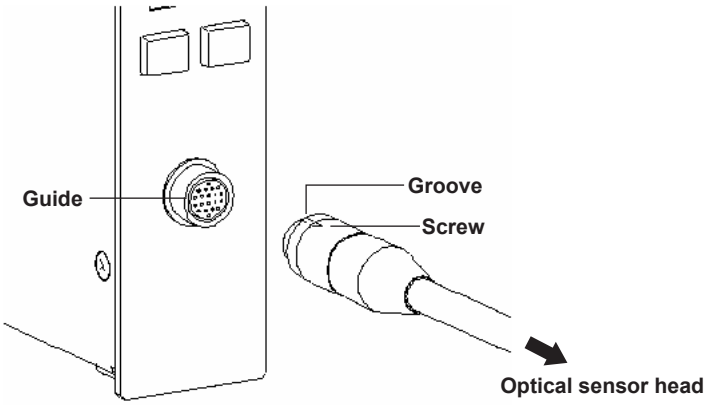


2.5 Connecting Cables

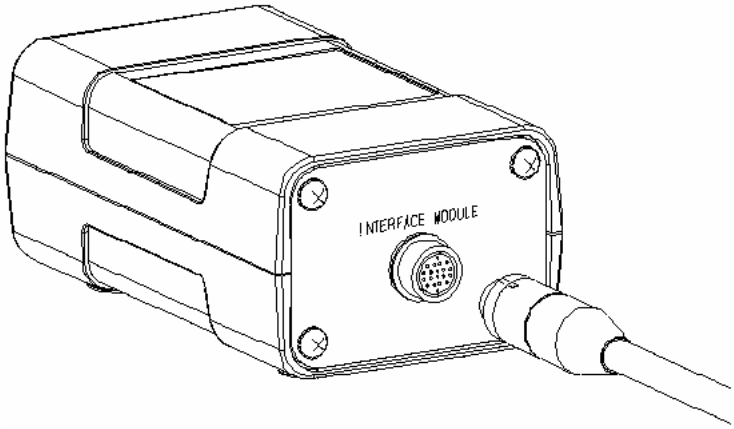
How to Connect the Optical Sensor Head and Interface Module

Connecting a Cable

1. Insert the cable connector into the connector on the front of the interface module (make sure that the guide pin of the connector on the module fits into the groove of the cable connector), and then tighten the screw to secure them.



2. Similarly, connect the cable to the connector on the rear panel of the optical sensor head.



CAUTION

If the interface module is currently installed in the frame controller, turn the frame controller off or uninstall the interface module from the frame controller, and then carry out the above procedure.

French

ATTENTION

Si le contrôleur dispose d'un module d'interface, mettre le contrôleur hors tension ou désinstaller le module d'interface, puis suivre la procédure ci-dessus.

How to Connect Cables for BER Measurement

CAUTION

- Be sure to attach terminators to any unused output terminals.
  Terminators are attached to the module terminals by factory default.
- When making connections to I/O terminals, use a grounding strap or other method to prevent electrostatic discharge.
  If the cable that you are connecting is charged with static electricity, the instrument may malfunction, so always connect cables after they have been discharged.

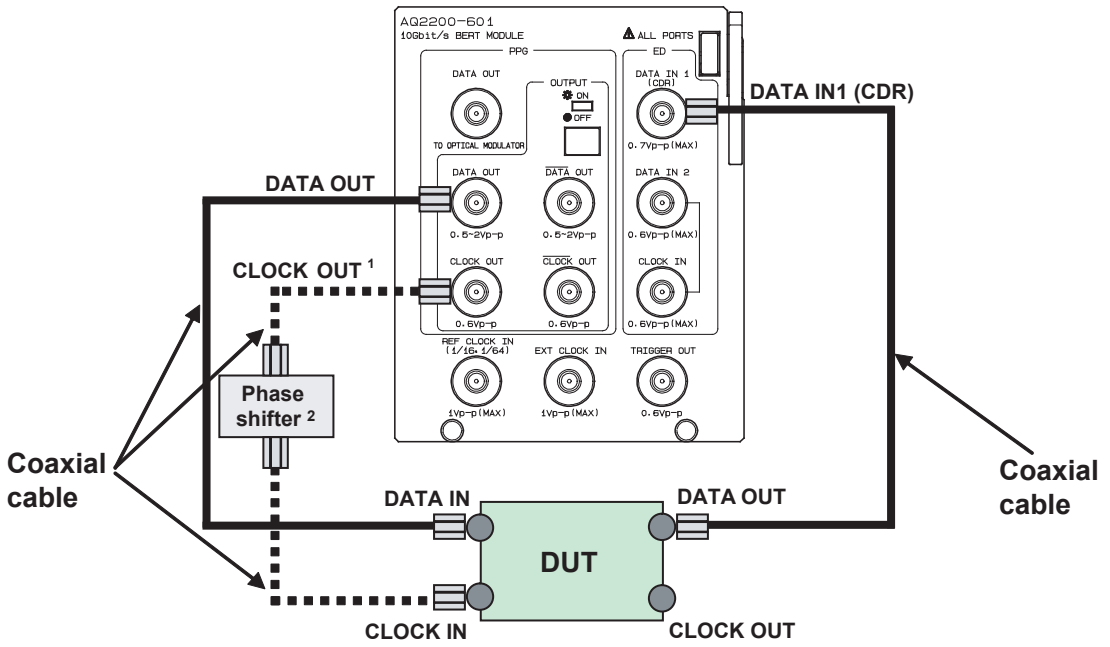
French

ATTENTION

- Veiller à raccorder les bornes à des bornes de sortie non utilisées. En usine, les bornes sont raccordées à celles du module par défaut.
- Pour les connexions aux bornes d'E/S, utiliser un ruban de mise à la terre ou tout autre moyen permettant d'éviter les décharges électrostatiques.
  Si le câble à connecter est chargé d'électricité statique, l'instrument risque de connaître des dysfonctionnements. Toujours brancher les câbles après les avoir déchargés de toute électricité statique.

Using the CDR Function through the Electrical Interface

Make the following connections to enable the DUT to use the CDR function of the BERT module through the electrical interface.



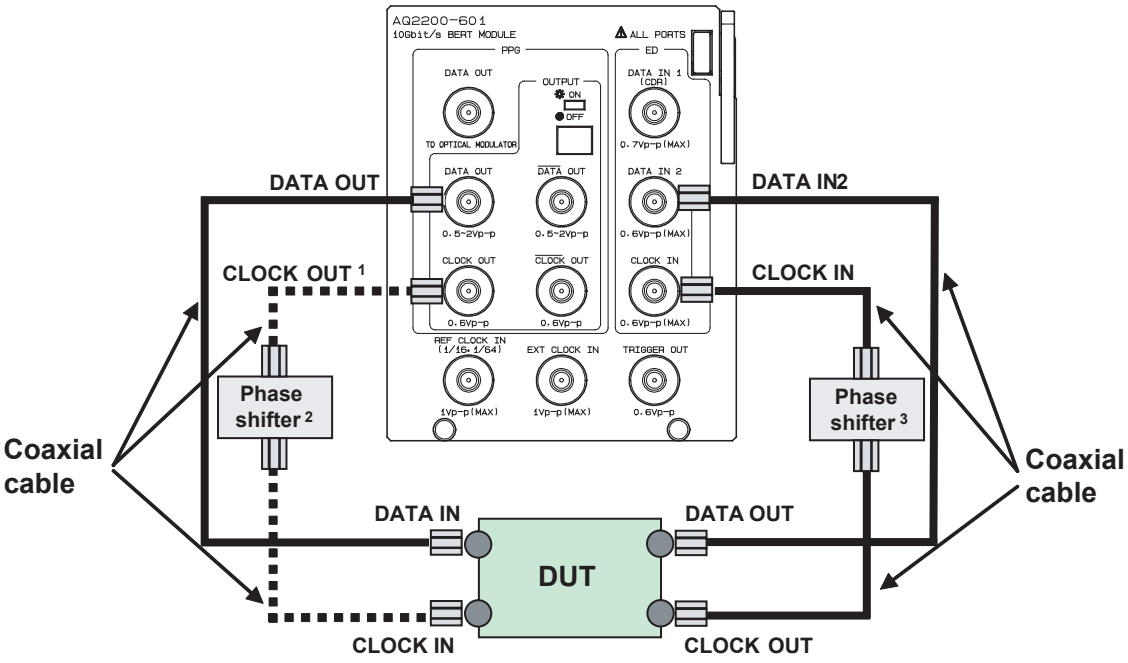
1 If the DUT needs the clock, connect the CLOCK OUT terminal to the DUT.
2 Use a phase shifter to adjust the phase to match the input of the DUT.

Note

The 10 Gbit/s data I/O terminals (DATA IN and DATA OUT) use 3.5 mm connectors that have excellent frequency characteristics. For the coaxial cables that you connect to these terminals, use low-loss, short cables that also have 3.5 mm connectors.

Not Using the CDR Function through the Electrical Interface

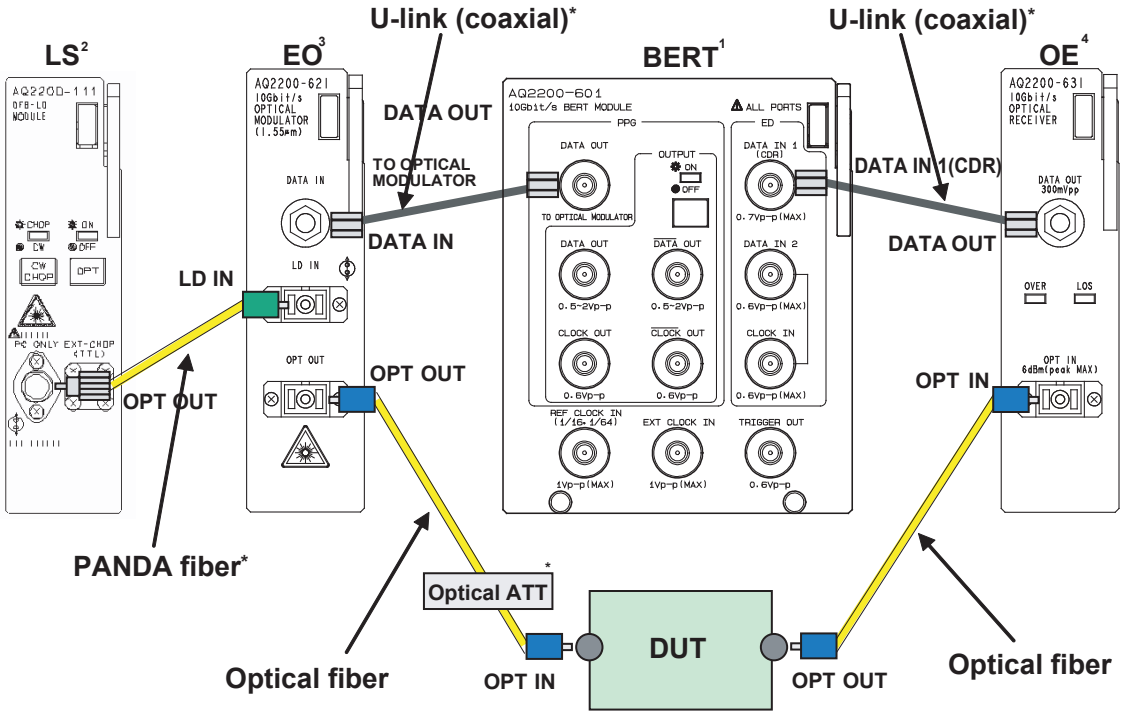
Make the following connections if the DUT will not use the CDR function of the BERT module through the electrical interface.



1 If the DUT needs the clock, connect the CLOCK OUT terminal to the DUT.
2 Use a phase shifter to adjust the phase to match the input of the DUT.
3 Because the CLOCK IN terminal of the ED does not have a phase adjustment function, use an external phase shifter to adjust the phase to match the input of the ED.

Using the Optical Interface

Make the following connections when the DUT has the optical interface and you are using a combination of a BERT module (BERT)[1], an AQ2200 series light source module (LS)[2], an optical modulator module (EO)[3], and an optical receiver module (OE)[4].



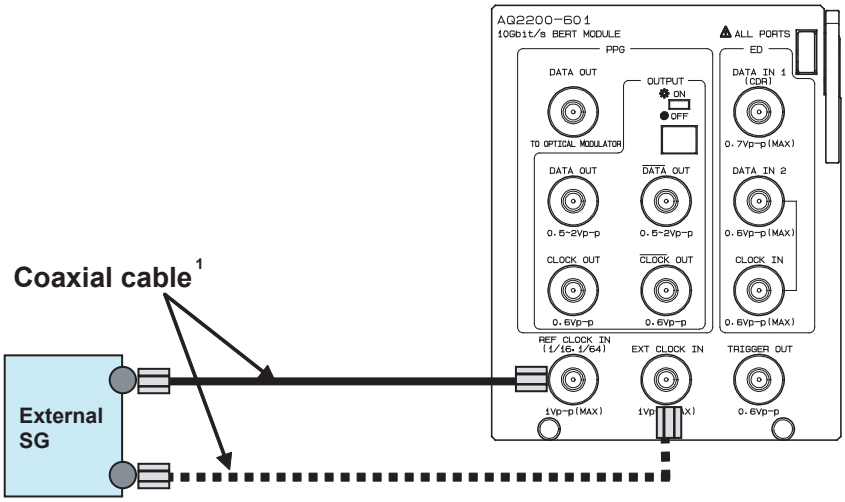
1 AQ2200-601 10 Gbit/s BERT module
2 AQ2200-111 DFB-LD module (-PMF suffix code)
3 AQ2200-621 10 Gbit/s optical modulator (1550 nm)
AQ2200-622 10 Gbit/s optical modulator (1310 nm)
4 AQ2200-631 10 Gbit/s optical receiver
* See Note below.

Note

- Use EO or OE modules with the /U option (sold separately) for U-links.
- Use EO modules with the /P option (sold separately) for PANDA fibers.
- To protect the DUT, insert optical attenuators as necessary.

Using an External SG

Make the following connections to use an external SG (signal generator).
See “Using the CDR Function through the Electrical Interface,” “Not Using the CDR Function through the Electrical Interface,” and “Using the Optical Interface,” for instructions on how to make connections to the DUT.



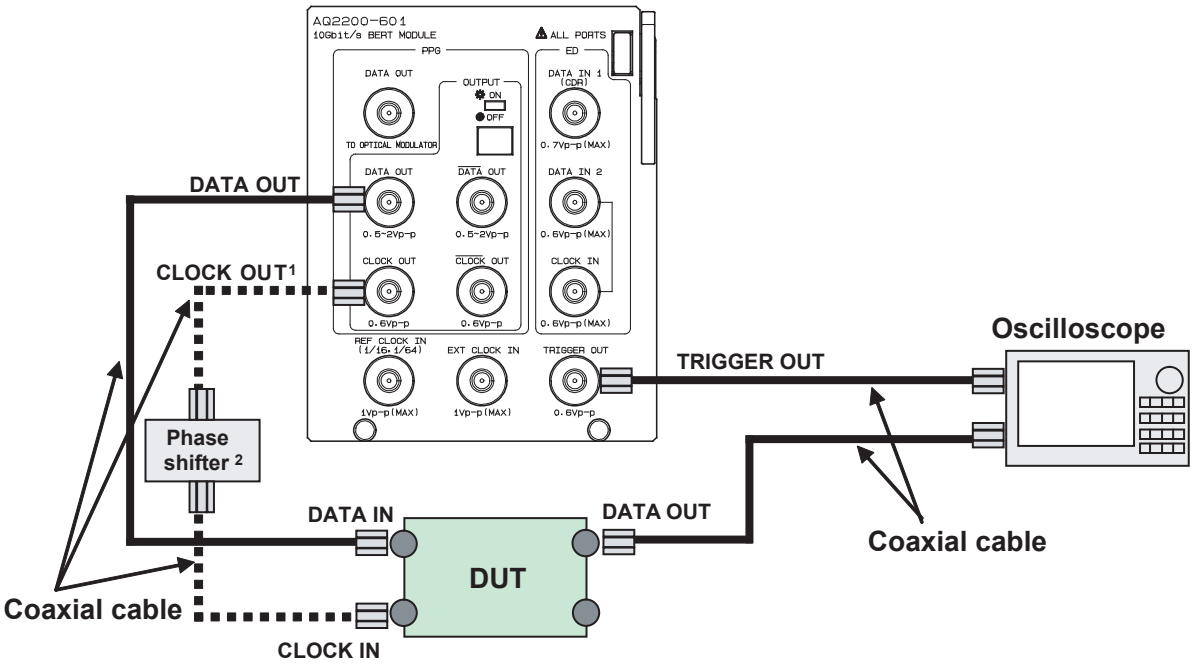
* If you want to use an external signal generator that has a frequency that is 1/16 or 1/64 the bitrate, connect it to the BERT module’s REF CLOCK IN terminal.
If you want to use an external signal generator of the 10 GHz band, connect it to the BERT module’s EXT CLOCK IN terminal.

Note

If you want to use a reference clock, make sure to apply a rectangular signal from the external signal generator.

Using the Trigger Terminal

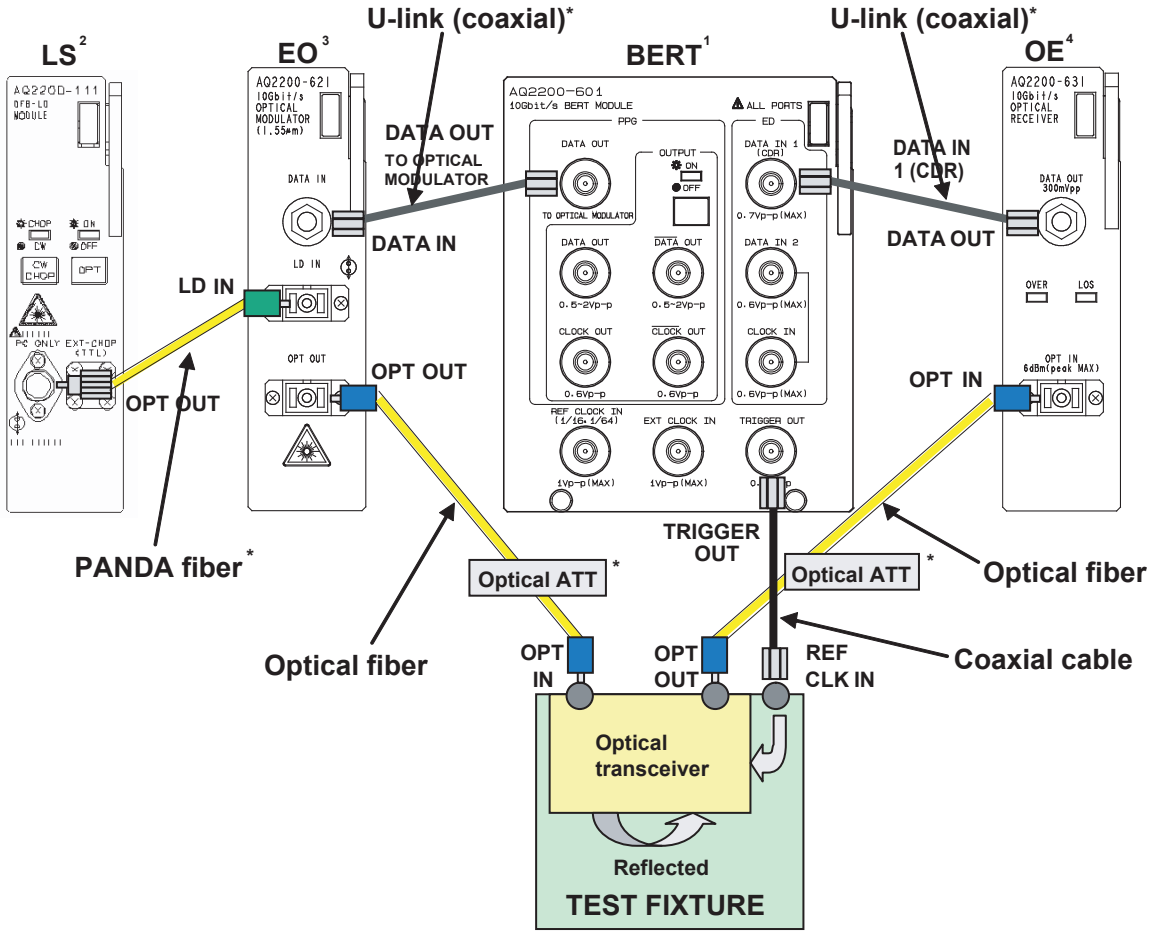
- **Using the Trigger Terminal to Generate Trigger Signals for Waveform Monitoring**
  Make the following connections if you want to use the trigger terminal to generate trigger signals for an oscilloscope.



1 If the DUT needs the clock, connect the CLOCK OUT terminal to the DUT.
2 Use a phase shifter to adjust the phase to match the input of the DUT.

Using the Trigger Terminal to Generate the Reference Clock of an Optical Transceiver

Make the following connections if you want to use the trigger terminal to generate the reference clock of an optical transceiver.



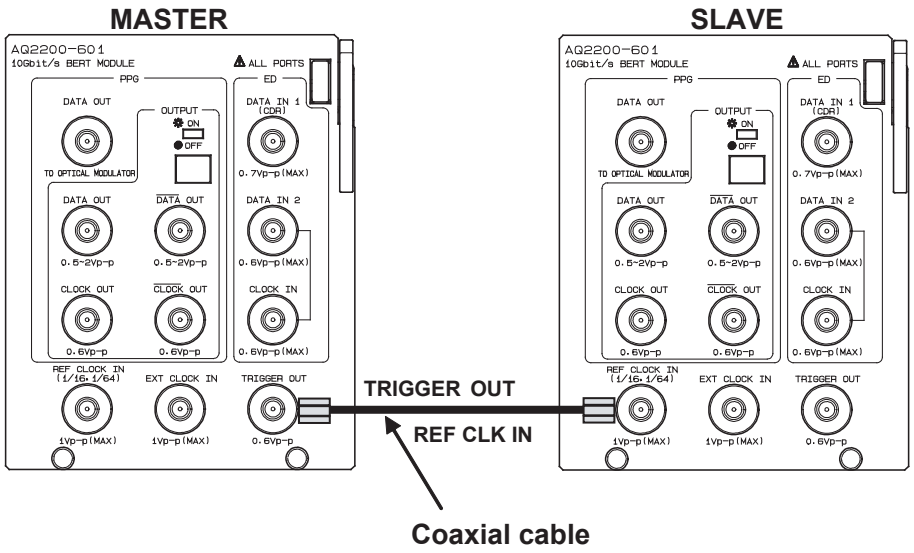
1 AQ2200-601 10 Gbit/s BERT module
2 AQ2200-111 DFB-LD module (-PMF suffix code)
3 AQ2200-621 10 Gbit/s optical modulator (1550 nm)
AQ2200-622 10 Gbit/s optical modulator (1310 nm)
4 AQ2200-631 10 Gbit/s optical receiver
* See Note below.

Note

- Use EO or OE modules with the /U option (sold separately) for U-links.
- Use EO modules with the /P option (sold separately) for PANDA fibers.
- To protect the DUT, insert optical attenuators as necessary.

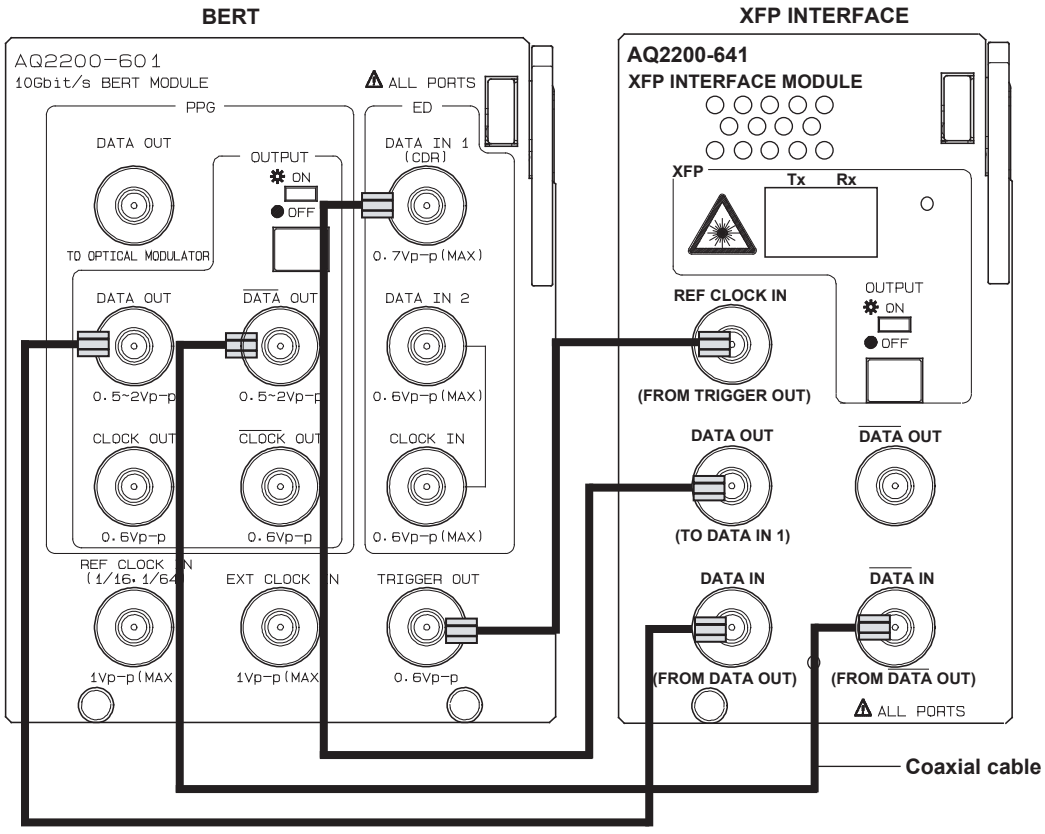
Using the Trigger Terminal to Generate a Reference Clock for Synchronizing Multiple Instruments

Make the following connections if you want to use the trigger terminal to synchronize multiple instruments.



Using the XFP Interface

Make the following connections between the BERT and the XFP interface if you want to use the XFP optical transceiver as the DUT.



Note

Before you install or uninstall the XFP transceiver, turn off the output from the connected AQ2200-601.

Connecting Cables

When connecting this instrument to the DUT, to another module, or to a measuring instrument, take appropriate measures to protect the instrument from static electricity.

CAUTION

Before attaching and detaching cables or terminators to this instrument's connectors, ground the instrument or connect the operator to a metallic part of the main frame to protect against static electricity.
Static electricity may cause the instrument to malfunction.

French

ATTENTION

Avant de brancher des câbles ou des bornes aux connecteurs de l'instrument ou de les débrancher, raccorder l'instrument à la terre ou connecter l'opérateur à une pièce métallique du cadre principal pour éviter les décharges d'électricité statique.
L'électricité statique risque de causer des dysfonctionnements de l'instrument.

Connectors

- When this instrument is not being used, attach terminators to the coaxial connectors and protective caps to the optical connectors.
- Before connecting a cable to a connector, turn off the signal generator and light source outputs.
- Use a torque wrench to tighten coaxial connectors. The proper tightening torque is 0.9 N-m. Excessive torque may cause damage to the connector.

CAUTION

If you are connecting a U-link or regular cable to a connector, match the cable's connector type to the instrument's connector, and connect the cable properly. Using unspecified connectors to connect cables may cause damage to the connectors.

French

ATTENTION

Pour brancher un câble standard ou de connexion en U à un connecteur, le type de connecteur du câble doit correspondre à celui de l'instrument. Le câble doit être correctement branché. L'utilisation de connecteurs non conformes aux spécifications risque de provoquer des dommages aux connecteurs.

2.6 Connecting and Disconnecting Connector Adapters

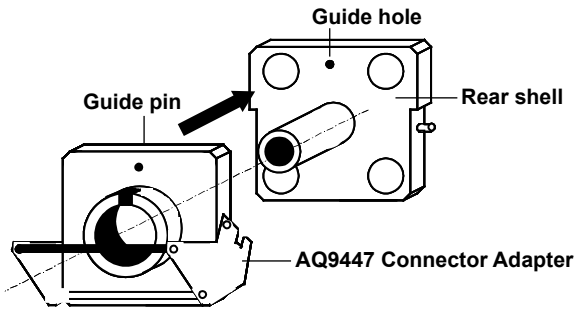
By changing the connector adapter, you can connect the light source modules (AQ2200-141 and AQ2200-142) and sensor modules to a variety of optical connectors.

How to Connect and Disconnect the AQ9447 Connector Adapter

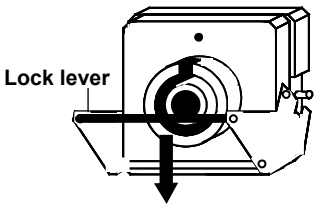
The AQ9447 Connector Adapter can be used with the AQ2200-211 sensor module.

Connecting the Adapter

1. Fit the guide pins of the connector adapter into the guide holes on the rear shell.

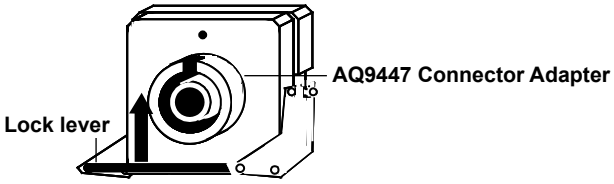


2. Lock the connector adapter by pushing the lock lever down until you hear a click.

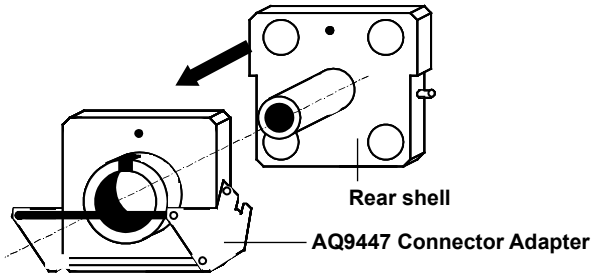


Disconnecting the Adapter

1. Lift the lock lever on the AQ9447 Connector Adapter to unlock it.



2. Pull the lock lever toward you and remove the connector adapter from the rear shell.

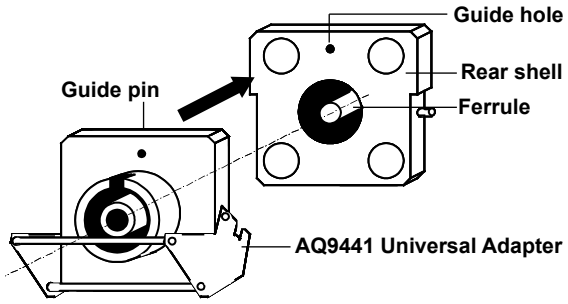


How to Connect and Disconnect the AQ9441 Universal Adapter

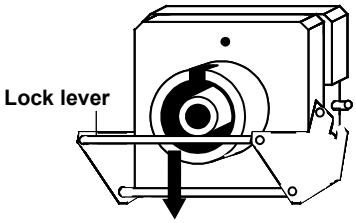
The AQ9441 Universal Adapter can be used with the AQ2200-141 FP-LD and AQ2200-142 DUAL FP-LD modules.

Connecting the Adapter

1. Fit the guide pins of the universal adapter into the guide holes on the rear shell. Take care not to let the universal adapter come in contact with the end of the ferrule that extends from the rear shell.

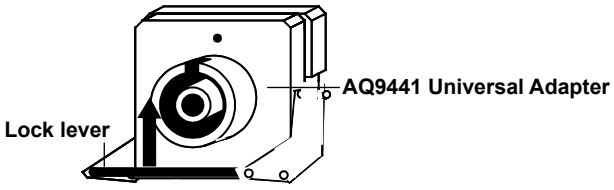


2. Lock the universal adapter by pushing the lock lever down until you hear a click.

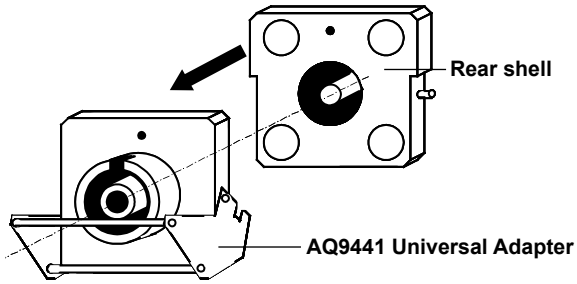


Disconnecting the Adapter

1. Lift the lock lever on the AQ9441 Universal Adapter to unlock it.



2. Pull the lock lever toward you, and slowly remove the universal adapter from the rear shell.



How to Connect and Disconnect the AQ9335C Connector Adapter

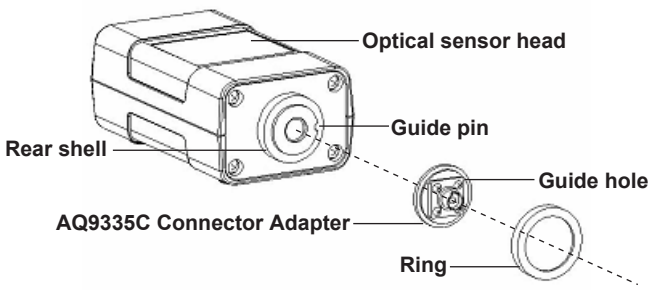
The AQ9335C Connector Adapter can be used with the AQ2220-231 Optical Sensor Head, AQ2220-232 Optical Sensor Head, AQ2200-241 Optical Sensor Head, AQ2200-242 Optical Sensor Head, AQ2200-215 Sensor Module, and AQ2200-221 Sensor Module.

Connecting the Adapter

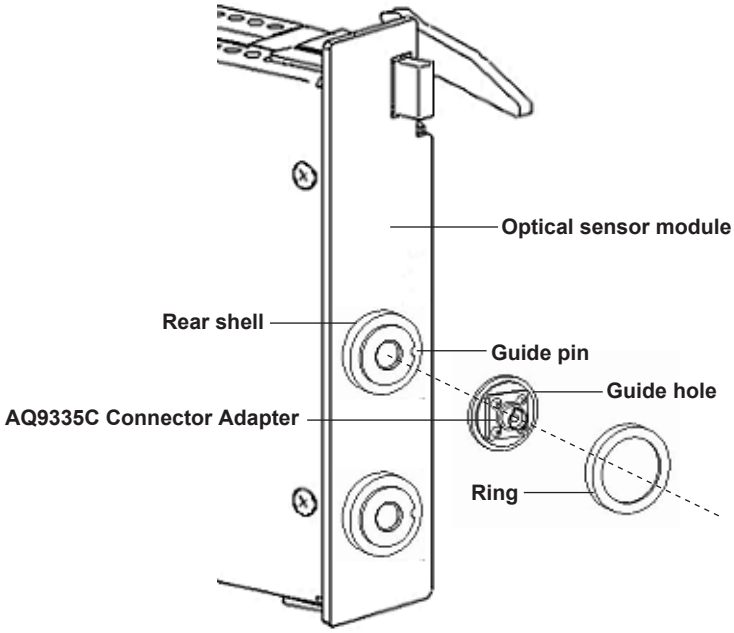
1. Fit the guide holes of the connector adapter onto the guide pins on the rear shell.
2. Screw in the connector adapter's ring to secure the adapter.

Disconnecting the Adapter

1. Turn the ring to remove the connector adapter.



How to Connect the Connector Adapter to an Optical Sensor Head



How to Connect the Connector Adapter to a Sensor Module

2.7 Connecting Optical Fiber Cables

CAUTION

Only connect angled-physical-contact type optical fibers to the ANGLED PC ONLY optical connector. Other types of connectors can damage the connector's ferrule end.

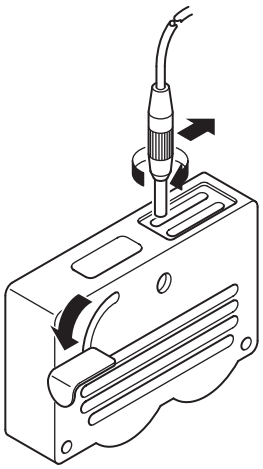
French

ATTENTION

Ne brancher que des fibres optiques de type APC (contact physique avec angle) au connecteur optique ANGLED PC ONLY. D'autres types de connecteurs pourraient endommager l'embout du connecteur.

Clean the connector end face of the optical fiber cable under measurement before connecting it to the instrument. If dust is adhered to the connector end face, it may damage the instrument's optical connector. If this happens, the instrument will not be able to make correct measurements.

1. Firmly press the connector end face of the optical fiber cable against the cleaning surface of the cleaner.
2. While pressing the end face against the cleaner, turn the cable.
3. While pressing the end face against the cleaner, move the cable.
4. Change the cleaning surface of the cleaner, and repeat steps 1 to 3.



Note

- If you do not firmly press the connector end face of the optical fiber cable against the cleaner, the end face may not be cleaned completely.
- You can purchase an optical fiber connector cleaner from NTT-AT Corporation.

2.8 Connecting to the Power Supply

Before Connecting the Power Supply

Make sure to follow the warnings below when connecting the power supply. Failure to do so may cause electric shock or damage to the instrument.

WARNING

- Make sure that the power supply voltage matches the instrument's rated supply voltage and that it does not exceed the maximum voltage range of the power cord to use.
- Confirm that the frame controller's power switch is off before connecting the power cord.
- To prevent electric shock or fire, be sure to use the power cord for the instrument.
- To prevent electric shock, make sure to ground the instrument. Insert the frame controller's power cord into a grounded three-prong outlet.
- Do not use an ungrounded extension cord. If you do, the instrument will not be grounded.
- If an AC outlet that conforms to the supplied power cord is unavailable and you can not ground the instrument, do not use the frame controller.

French

AVERTISSEMENT

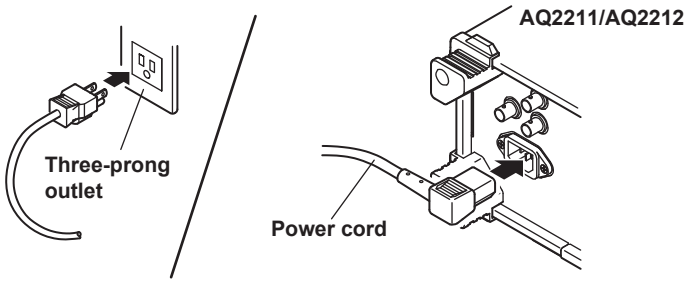
- Assurez-vous que la tension d'alimentation correspond à la tension d'alimentation nominale de l'appareil et qu'elle ne dépasse pas la plage de tension maximale du cordon d'alimentation à utiliser.
- Vérifier que l'interrupteur d'alimentation du contrôleur est hors tension avant de brancher le cordon d'alimentation.
- Pour éviter tout risque de choc électrique, utiliser exclusivement le cordon d'alimentation prévu pour cet instrument.
- Pour éviter tout risque de choc électrique, l'instrument doit impérativement être relié à la terre. Insérer le cordon d'alimentation du contrôleur dans une prise à trois broches reliée à la terre.
- Toujours utiliser une rallonge avec broche de mise à la terre, à défaut de quoi l'instrument ne serait pas relié à la terre.
- En l'absence de prise CA conforme au cordon d'alimentation fourni et dans l'impossibilité de mettre l'instrument à la terre, ne pas utiliser le contrôleur.

Connecting the Power Cord

1. Check that the power switch is off.
2. Connect the power cord plug to the power inlet on the rear panel.
3. Connect the other end of the cord to an outlet that meets the following conditions.
   Use a grounded three-prong outlet.

Rated supply voltage*	100 to 240 VAC (auto switching)
Rated supply frequency	50/60 Hz
Maximum power consumption	AQ2211: 170 VA; AQ2212: 580 VA (including installed modules)

* This instrument can use a 100 V or a 200 V power supply. The maximum rated voltage differs according to the type of power cord. Check that the voltage supplied to the instrument is less than or equal to the maximum rated voltage of the power cord that you will be using before use.



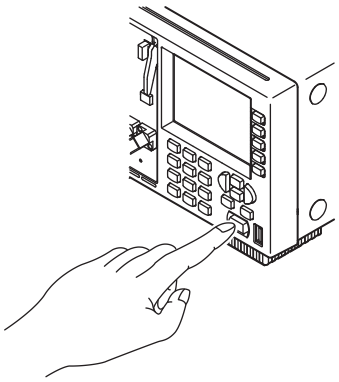
Turning the Instrument On

Before Turning On the Power, Check That:

- The instrument is installed properly (see section 2.2, “Installing the Instrument”).
- The power cord is connected properly (see the previous page).

Turning the Instrument On

1. Press the front panel power switch.



Turning the Instrument Off

CAUTION

- Turning the instrument off or unplugging the power cord while the instrument is saving data may corrupt the media on which data is being saved. The data being saved is also not guaranteed. Always turn the instrument off after data has been saved.
- Turn the BERT module's signal output off when you turn the instrument off. Otherwise, the BERT module may be damaged.

French

ATTENTION

- La mise hors tension de l'instrument ou le débranchement du cordon d'alimentation pendant que l'instrument enregistre des données risquent d'endommager le support sur lequel les données sont stockées. Les données en cours d'enregistrement pourraient également être perdues. Toujours mettre l'instrument hors tension après que les données ont été enregistrées.
- Mettre la sortie de signal du module BERT hors tension lors de la mise hors tension de l'instrument pour éviter l'endommagement du module BERT.

Turning the Instrument Off

1. Press the front panel power switch.

Operations Performed When the Power Is Turned On

When the power switch is turned on, a self-test starts automatically. If the results of the test are satisfactory, the SUMMARY screen or the DETAIL screen appears.

Note

- If the operations described above are not carried out after the power switch is turned on, or if the SUMMARY or DETAIL screen does not appear, turn the power switch off, and check that:
  - The power cord is securely connected.
  - The correct voltage is coming to the power outlet (see the previous page).

  If the instrument still does not work properly, contact your nearest YOKOGAWA dealer for repairs.
- Depending on the type and number of modules that are installed in the frame controller, it may take some time for the startup screen to appear.

For Taking Accurate Measurements

Allow the instrument to warm up for at least one hour after turning on the power switch.

3.1 Frame Controller

Interlock (REMOTE INTERLOCK)

CAUTION

Only apply signals that meet the specifications. Doing otherwise may damage the instrument.

French

ATTENTION

N’appliquer que des signaux correspondant aux spécifications. pour éviter d’endommager l’instrument.

Interlock Connector

The frame controller is equipped with an interlock terminal as a laser output safety device.

If this terminal is open (nothing is connected to it), the frame controller is in the OPT LOCK state, and the laser light source cannot generate a laser beam.

Item	Specifications
Connector type	BNC, contact input

Trigger In (TRIGGER IN)

CAUTION

Only apply signals that meet the specifications. Signals that do not meet the specifications, such as those with excessive voltage, may damage the instrument

French

ATTENTION

N’appliquer que des signaux correspondant aux spécifications. Les signaux non conformes aux spécifications, dont la tension est excessive par exemple, risquent d’endommager l’instrument

External Trigger Input Terminal

This terminal receives external trigger signals for starting measurements on sensor modules.

Item	Specifications
Connector type	BNC
Input level	TTL level
Input pulse width	50 µs or more
Input impedance	Approx. 5 kΩ

Trigger Out (TRIGGER OUT)

CAUTION

Do not apply an external voltage to the TRIGGER OUT terminal. Doing so may damage the instrument.

French

ATTENTION

Ne pas appliquer de tension externe à la borne TRIGGER OUT. Cela risquerait d’endommager l’instrument.

External Trigger Output Terminal

This terminal transmits an external trigger signal in sync with the measurement timing of the sensor modules.

Item	Specifications
Connector type	BNC
Output level	TTL level
Output pulse width	Approx. 50 µs
Output impedance	Approx. 100 Ω

3.2 Optical Sensor Modules

Analog Out (ANALOG OUT)

Analog Signal Output Terminal

This terminal transmits a voltage level that corresponds to the level of the optical signal that is applied to the sensor.

Use cables that are 3 m or shorter in length.

Other than AQ2200-202

ANALOG OUT

Item	Specifications
Connector type	Mini plug
Output level	
AUTO mode	Approx. 0 to 2 V, proportional to the measurement power (W) for each power range
LINEAR mode	Approx. 0 to 2 V, proportional to the range set for measurement power (W)
LOG mode	Approx. 0 to 2 V, proportional to the range set for measurement power (dBm)
Output impedance	Approx. 1 kΩ

AQ2200-202

Item	Specifications
Connector type	Mini plug
Output level	
AUTO mode	Approx. 0 to 2 V or 0 to 5 V, proportional to the measurement power (W) for each power range
LINEAR mode	Approx. 0 to 2 V or 0 to 5 V, proportional to the range set for measurement power (W)
LOG mode	Approx. 0 to 2 V or 0 to 5 V, proportional to the range set for measurement power (dBm)
TRIGGER mode	Approx. 0 to 2 V or 0 to 5 V, pulse output
Output impedance	Approx. 100 Ω

3.3 BERT Module

CAUTION

This precision measuring instrument handles high-speed signals at a rate of 10 Gbit/s. If the following precautions are not observed strictly, the instrument will not be able to deliver its maximum performance and may malfunction.

- Before removing modules from the frame controller, turn the output off.
- Before turning the frame controller off, turn the output off.
- Before connecting cables to or disconnecting cables from the I/O terminals, turn the output off.
- Before connecting cables to the I/O terminals, tighten the connectors at a specified torque using a torque wrench.
- Do not leave the DATA OUT, $\overline{\text{DATA}}$ OUT, CLOCK OUT, and $\overline{\text{CLOCK}}$ OUT output terminals open. Always terminate them with 50 Ω loads, such as the included terminators. Likewise, always terminate the cables that are connected to these output terminals with 50 Ω loads.
- Do not apply a signal that is greater than the specified maximum input voltage to the input terminals.
- When connecting cables to the I/O terminals, use a grounding strap to prevent electrostatic discharge.
  If the cables are charged with static electricity, the instrument may malfunction. Always connect cables after they have been discharged.
- Before connecting the unit to the DUT,* turn the output off.
- Before connecting the frame controller to the power supply, connect the power cord to a properly grounded three-prong outlet.
- Always use the specified connector to connect this module's I/O terminals. Using unspecified connectors to connect the I/O terminals may cause damage to the terminals and the connectors.
- When attaching connectors to the I/O terminals, always connect them straight, not at an angle. Attaching connectors to the I/O terminals at an angle may cause damage to the I/O terminals or the connectors' core wires.
- Do not apply external voltage to the output terminals.

* DUT stands for device under test.

French

ATTENTION

Cet instrument de mesure de précision prend en charge les signaux de haute vitesse d'un débit de 10 Gbit/s. Si vous ne respectez pas strictement les précautions suivantes, l'instrument ne peut pas fonctionner au maximum de ses performances et risque de connaître des dysfonctionnements.

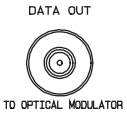
- Avant de retirer les modules du contrôleur, mettre la sortie hors tension.
- Avant de mettre le contrôleur hors tension, mettre la sortie hors tension.
- Avant de brancher les câbles aux bornes d'E/S ou de les débrancher, mettre la sortie hors tension.
- Avant de brancher les câbles aux bornes d'E/S, serrer les connecteurs selon le couple spécifié à l'aide d'une clé dynamométrique.

- Ne pas laisser les bornes de sortie DATA OUT, $\overline{\text{DATA}}$ OUT, CLOCK OUT et $\overline{\text{CLOCK}}$ OUT ouvertes. Toujours les raccorder à des charges de 50 Ω, telles que les bornes incluses. De même, toujours raccorder les câbles connectés à ces bornes de sortie à des charges de 50 Ω.
- Ne pas appliquer de signal supérieur à la tension d'entrée maximum spécifiée aux bornes d'entrée.
- Pour connecter les câbles aux bornes d'E/S, utiliser un ruban de mise à la terre afin d'éviter les décharges électrostatiques.
  Si les câbles sont chargés d'électricité statique, l'instrument risque de connaître des dysfonctionnements. Toujours brancher les câbles après les avoir déchargés de toute électricité statique.
- Avant de raccorder l'unité au DUT,* mettre la sortie hors tension.
- Avant de raccorder le contrôleur à l'alimentation électrique, brancher le cordon d'alimentation sur une prise de courant à trois plots mise à la terre.
- Toujours utiliser le connecteur spécifié pour le raccordement des bornes d'E/S de ce module. L'utilisation de connecteurs non conformes aux spécifications pour le raccordement des bornes d'E/S risque de provoquer des dommages aux bornes et aux connecteurs.
- Toujours brancher les connecteurs aux bornes d'E/S de manière droite et non inclinée pour éviter d'endommager ces dernières ou d'endommager les fils des connecteurs.
- Ne pas appliquer de tension externe aux bornes de sortie.

* DUT : device under test, dispositif testé.

Data Output Terminal to Optical Modulator (DATA OUT TO OPTICAL MODULATOR)

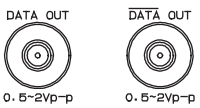
This terminal transmits non-inverted data. It is used when this module is combined with an optical modulator module.



Item	Specifications
Connector type	3.5 mm, female
Output level	0.50 ± 0.1 Vp-p
Offset voltage	0 V (fixed)
Cross point	50% (nominal value)
Output terminator conditions	50 Ω AC terminator

Data Output Terminals (DATA OUT and $\overline{\text{DATA}}$ OUT)

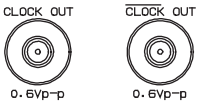
These terminals transmit 10 Gbit/s non-inverted and inverted data respectively.



Item	Specifications
Connector type	3.5 mm, female
Output level	0.5 to 2.0 Vp-p (in 10 mV steps)
Offset voltage	–2 to +3 V (in 10 mV steps)
Cross point	30 to 70% (in 1% steps)
Output terminator conditions	50 Ω AC or DC terminator
Bitrate	9.95 to 11.32 Gbit/s
Data format	NRZ
Tr/Tf (20 to 80%)	25 ps or less

Clock Signal Output Terminals (CLOCK OUT and $\overline{\text{CLOCK}}$ OUT)

These terminals transmit 10 GHz non-inverted and inverted clock signals respectively.



Item	Specifications
Connector type	SMA, female
Output level	0.6 Vp-p (typical) AC-coupling
Offset voltage	–2 to +3 V (in 10 mV steps)
Output terminator conditions	50 Ω AC or DC terminator
Tr/Tf (20 to 80%)	25 ps or less
Duty	50% ± 10%

Data Input Terminal (DATA IN 1 (CDR))

This receives ED data. It has a built-in CDR.

Item	Specifications
Connector type	3.5 mm, female
Input level	0.1 to 0.7 Vp-p
Minimum input sensitivity	100 mVp-p or less
Threshold voltage	±0.35 V (in 1 mV steps)
Input terminator conditions	50 Ω AC-coupling
Bitrate	9.95 to 11.32 Gbit/s
Allowable bitrate	±100 ppm of the PPG's operation bitrate
Data format	NRZ

Data Input Terminal (DATA IN 2)

This terminal receives 10 Gbit/s data.

Item	Specifications
Connector type	3.5 mm, female
Input level	0.1 to 0.6 Vp-p
Minimum input sensitivity	100 mVp-p or less
Threshold voltage	±0.3 V (in 1 mV steps)
Input terminator conditions	50 Ω AC-coupling
Bitrate	9.95 to 10.71 Gbit/s

Clock Signal Input Terminal (CLOCK IN)

This terminal receives 10 Gbit/s clock signals.

Item	Specifications
Connector type	SMA, female
Input level	0.2 to 0.6 Vp-p
Input terminator conditions	50 Ω AC-coupling
Frequency	The same frequency as DATA IN 2 (synchronized to the data input)

External Clock Signal Input Terminal (EXT CLOCK IN)

If you want to operate the BERT module with an external clock signal at a rate of 10 GHz, without using the internal SG, apply a 10 GHz clock signal to this terminal.

Item	Specifications
Connector type	SMA, female
Input level	0.4 to 1.0 Vp-p
Input terminator conditions	50 Ω AC-coupling or DC-coupling
Frequency	The same frequency as the bitrate
Duty	50% (nominal value)

External Synchronization Signal Input Terminal (REF CLOCK IN)

If you want to synchronize the BERT module with an external clock signal, without using the internal SG, apply a reference signal that has a frequency that is 1/16 or 1/64 of the 10 Gbit/s rate to this terminal.

Item	Specifications
Connector type	SMA, female
Input level	0.4 to 1.0 Vp-p
Input terminator conditions	50 Ω AC-coupling
Frequency	1/16 or 1/64 of the bitrate
Duty	50%-rectangular signal (nominal)

Trigger Output Signal Terminal (TRIGGER OUT)

This terminal transmits the selected trigger signal (clock, pattern, or error).

Item	Specifications
Connector type	SMA, female
Output level	0.6 Vp-p ± 0.3 V
Output terminator conditions	50 Ω AC or DC terminator

3.4 Optical Modulator Module

CAUTION

- When connecting a cable to the data input terminal, use a grounding strap to prevent electrostatic discharge. If the cable is charged with static electricity, the instrument may malfunction. Always connect cables after they have been discharged.
- If you are connecting a U-link or regular cable to a connector, match the cable's connector type to the instrument's connector, and connect the cable properly. Using unspecified connectors to connect cables may cause damage to the connectors.
- Do not apply voltages that exceed the maximum input level to the data input terminal.

French

ATTENTION

- Pour brancher un câble à la borne d'entrée des données, utiliser un ruban de mise à la terre afin d'éviter les décharges électrostatiques. Si le câble est chargé d'électricité statique, l'instrument risque de connaître des dysfonctionnements. Toujours brancher les câbles après les avoir déchargés de toute électricité statique.
- Pour brancher un câble standard ou de connexion en U à un connecteur, le type de connecteur du câble doit correspondre à celui de l'instrument. Le câble doit être correctement branché. L'utilisation de connecteurs non conformes aux spécifications risque de provoquer des dommages aux connecteurs.
- Ne pas appliquer de tension dépassant le niveau d'entrée maximum à la borne d'entrée des données.

Data Input Terminal (DATA IN)

Use a U-link (/U option) or coaxial cable to connect this terminal to the DATA OUT (TO OPTICAL MODULATOR) terminal on the PPG of a BERT module.

Item	Specifications
Connector type	3.5 mm jack or equivalent
Input level	0.5 ± 0.1 Vp-p (AC-coupling)
Maximum input level	1.2 Vp-p (AC-coupling)

3.5 Optical Receiver Module

CAUTION

- When connecting a cable to the data output terminal, use a grounding strap to prevent electrostatic discharge. If the cable that you are connecting is charged with static electricity, the instrument may malfunction, so always connect cables after they have been discharged.
- If you are connecting a U-link or regular cable to a connector, match the cable's connector type to the instrument's connector, and connect the cable properly. Using unspecified connectors to connect cables may cause damage to the connectors.
- Do not apply an external voltage to the data output terminal. Doing so may damage the instrument.

French

ATTENTION

- Pour brancher un câble à la borne de sortie des données, utiliser un ruban de mise à la terre afin d'éviter les décharges électrostatiques. Si le câble à connecter est chargé d'électricité statique, l'instrument risque de connaître des dysfonctionnements. Toujours brancher les câbles après les avoir déchargés de toute électricité statique.
- Pour brancher un câble standard ou de connexion en U à un connecteur, le type de connecteur du câble doit correspondre à celui de l'instrument. Le câble doit être correctement branché. L'utilisation de connecteurs non conformes aux spécifications risque de provoquer des dommages aux connecteurs.
- Ne pas appliquer de tension externe à la borne de sortie des données. Cela risquerait d'endommager l'instrument.

Data Output Terminal

Use a U-link (/U option) or coaxial cable to connect this terminal to the DATA IN terminal on the ED of a BERT module.

Item	Specifications
Connector type	3.5 mm jack or equivalent
Saturated output level	0.3 Vp-p or greater (AC-coupling)

3.6 XFP Interface Module

CAUTION

- Before connecting cables to or disconnecting cables from the I/O terminals, turn the output off.
- Before connecting cables to the I/O terminals, tighten the connectors at a specified torque using a torque wrench.
- Do not leave the data and clock output terminals open. Always terminate them with 50 Ω loads, such as the included terminators.
  Likewise, always terminate the cables that are connected to these output terminals with 50 Ω loads.
- Do not apply a signal that is greater than the specified maximum input voltage to the input terminals.
- When connecting cables to the I/O terminals, use a grounding strap to prevent electrostatic discharge.
  If the cables are charged with static electricity, the instrument may malfunction. Always connect cables after they have been discharged.
- Always use the specified connector to connect this module's I/O terminals. Using unspecified connectors to connect the I/O terminals may cause damage to the terminals and the connectors.
- When attaching connectors to the I/O terminals, always connect them straight, not at an angle. Attaching connectors to the I/O terminals at an angle may cause damage to the I/O terminals or the connectors' core wires.
- Do not apply external voltage to the output terminals.

French

ATTENTION

- Avant de brancher les câbles aux bornes d'E/S ou de les débrancher, mettre la sortie hors tension.
- Avant de brancher les câbles aux bornes d'E/S, serrer les connecteurs selon le couple spécifié à l'aide d'une clé dynamométrique.
- Ne pas laisser les bornes de sortie des données et de l'horloge ouvertes.
  Toujours les raccorder à des charges de 50 Ω, telles que les bornes incluses.
  De même, toujours raccorder les câbles connectés à ces bornes de sortie à des charges de 50 Ω.
- Ne pas appliquer de signal supérieur à la tension d'entrée maximum spécifiée aux bornes d'entrée.
- Pour connecter les câbles aux bornes d'E/S, utiliser un ruban de mise à la terre afin d'éviter les décharges électrostatiques.
  Si les câbles sont chargés d'électricité statique, l'instrument risque de connaître des dysfonctionnements. Toujours brancher les câbles après les avoir déchargés de toute électricité statique.
- Toujours utiliser le connecteur spécifié pour le raccordement des bornes d'E/S de ce module. L'utilisation de connecteurs non conformes aux spécifications pour le raccordement des bornes d'E/S risque de provoquer des dommages aux bornes et aux connecteurs.

- Toujours brancher les connecteurs aux bornes d'E/S de manière droite et non inclinée pour éviter d'endommager ces dernières ou d'endommager les fils des connecteurs.
- Ne pas appliquer de tension externe aux bornes de sortie.

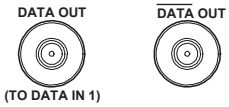
External Clock Input Terminal (REF CLOCK IN)

If you want to synchronize the XFP interface module with an external clock signal and use the module to operate a transceiver, apply a reference signal that has a frequency that is 1/64 of the 10 Gbit/s rate to this terminal.

Item	Specifications
Connector type	SMA, female
Input level	0.6 Vp-p ± 0.3 V
Frequency	1/64 of the bitrate

Data Output Terminals (DATA OUT and $\overline{\text{DATA}}$ OUT)

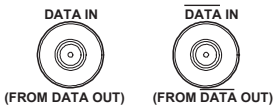
These terminals transmit 10 Gbit/s non-inverted and inverted data respectively.



Item	Specifications
Connector type	3.5 mm, female
Data format	NRZ

Data Input Terminals (DATA IN and $\overline{\text{DATA}}$ IN)

These terminals receive 10 Gbit/s non-inverted and inverted data respectively.



Item	Specifications
Connector type	3.5 mm, female
Data format	NRZ

3.7 Transceiver I/F Module

CAUTION

- Always use the specified connector to connect this module's I/O terminals. Using unspecified connectors to connect the I/O terminals may cause damage to the terminals and the connectors.
- Before connecting cables to or disconnecting cables from the connectors, turn the output off.
- Do not apply a signal that is greater than the specified maximum input voltage to an input pin (a pin whose I/O attribute is I) on the SIGNAL connector.
- Make sure that the maximum power consumption for POWER SUPPLY connector signals PS1 to PS5 is below 28 W.
- Do not apply more than 1 A to a POWER SUPPLY connector pin.

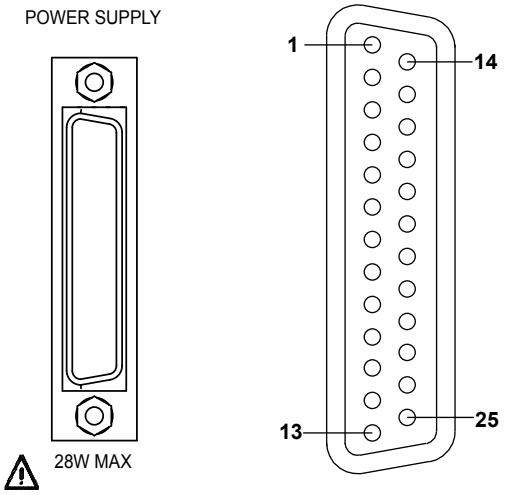
French

ATTENTION

- Toujours utiliser le connecteur spécifié pour le raccordement des bornes d'E/S de ce module. L'utilisation de connecteurs non conformes aux spécifications pour le raccordement des bornes d'E/S risque de provoquer des dommages aux bornes et aux connecteurs.
- Avant de brancher les câbles aux connecteurs ou de les débrancher, mettre la sortie hors tension.
- Ne pas appliquer de signal supérieur à la tension d'entrée maximum spécifiée à une broche d'entrée (dont l'attribut d'E/S est E) du connecteur SIGNAL.
- Veiller à ce que la consommation énergétique maximum des signaux de connecteur POWER SUPPLY PS1 à PS5 soit inférieure à 28 W.
- Ne pas appliquer plus de 1 A à une broche de connecteur POWER SUPPLY.

POWER SUPPLY Port (POWER SUPPLY)

Provides power to the transceiver.



D-Sub 25-pin receptacle

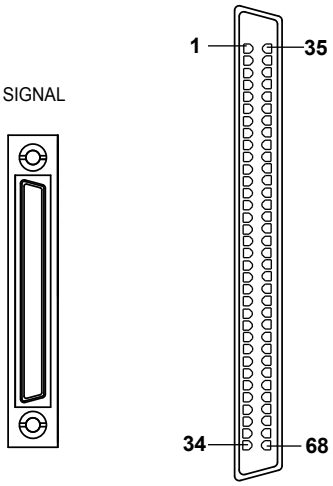
Item	Specification
Connector type	D-SUB 25 pin
Maximum power output	28 W

Pin No.	Signal	Specifications
1	PS1	5.250 V, 1 A/pin
2	PS1	5.250 V, 1 A/pin
3	PS2	3.465 V, 1 A/pin
4	PS2	3.465 V, 1 A/pin
5	PS2	3.465 V, 1 A/pin
6	PS2	3.465 V, 1 A/pin
7	PS3	1.890 V, 1 A/pin
8	PS3	1.890 V, 1 A/pin
9	PS4	–5.460 V, 1 A/pin
10	PS4	–5.460 V, 1 A/pin
11	PS4	–5.460 V, 1 A/pin
12	PS5	5.0 V, 1 A/pin 3.3 V, 1 A/pin
13	PS5	5.0 V, 1 A/pin 3.3 V, 1 A/pin

Pin No.	Signal	Specifications
14	GND	1 A/pin
15	GND	1 A/pin
16	GND	1 A/pin
17	GND	1 A/pin
18	GND	1 A/pin
19	GND	1 A/pin
20	GND	1 A/pin
21	GND	1 A/pin
22	GND	1 A/pin
23	GND	1 A/pin
24	GND	1 A/pin
25	GND	1 A/pin

Control/Monitor Signal Port (SIGNAL)

Use to configure the transceiver control signal or monitor the power supply voltage and status signals.



VHDCI 68-pin receptacle

Pin No.	Signal	I/O	Specification
1	GND	—	—
2	MDC	O	1.2 V CMOS
3	GND	—	—
4	MDIO	I/O	1.2 V CMOS
5	GND	—	—
6	GND	—	—
7	GND	—	—
8	SCL	I/O	3.3 V CMOS
9	GND	—	—
10	SDA	I/O	3.3 V CMOS
11	GND	—	—
12	CTRL11(3.3V)	O	3.3 V CMOS
13	GND	—	—
14	CTRL09(3.3V)	O	3.3 V CMOS
15	GND	—	—
16	CTRL07(1.2V)	O	1.2 V CMOS
17	GND	—	—
18	CTRL05(1.2V)	O	1.2 V CMOS
19	GND	—	—
20	CTRL03(1.2V)	O	1.2 V CMOS
21	GND	—	—
22	CTRL01(1.2V)	O	1.2 V CMOS
23	GND	—	—
24	AIN05	I	—
25	AIN COM	—	—
26	AIN03	I	—
27	AIN COM	—	—
28	AIN01	I	—
29	APS R1	I	—
30	PS5 SENS	I	—
31	PS4 SENS	I	—
32	PS3 SENS	I	—
33	PS2 SENS	I	—
34	PS1 SENS	I	—

Pin No.	Signal	I/O	Specification
35	CTRL17(3.3V)	O	3.3 V CMOS
36	GND	—	—
37	CTRL16(3.3V)	O	3.3 V CMOS
38	GND	—	—
39	CTRL15(3.3V)	O	3.3 V CMOS
40	GND	—	—
41	CTRL14(3.3V)	O	3.3 V CMOS
42	GND	—	—
43	CTRL13(3.3V)	O	3.3 V CMOS
44	GND	—	—
45	CTRL12(3.3V)	O	3.3 V CMOS
46	GND	—	—
47	CTRL10(3.3V)	O	3.3 V CMOS
48	GND	—	—
49	CTRL08(3.3V)	O	3.3 V CMOS
50	GND	—	—
51	CTRL06(1.2V)	O	1.2 V CMOS
52	GND	—	—
53	CTRL04(1.2V)	O	1.2 V CMOS
54	GND	—	—
55	CTRL02(1.2V)	O	1.2 V CMOS
56	GND	—	—
57	AIN06	I	—
58	GND	—	—
59	AIN04	I	—
60	AIN COM	—	—
61	AIN02	—	—
62	AIN COM	—	—
63	APS R1 COM	I	—
64	PS5 COM	I	—
65	PS4 COM	I	—
66	PS3 COM	I	—
67	PS2 COM	I	—
68	PS1 COM	I	—

Item	Specification
Connector type	SFF-8441 VHDCI 68 pin

3.8 SG Module

CAUTION

- Before removing modules from the frame controller, turn the output off.
- Before turning the frame controller off, turn the output off.
- Before connecting cables to or disconnecting cables from the I/O terminals, turn the output off.
- Before connecting cables to the I/O terminals, tighten the connectors at a specified torque using a torque wrench.
- Do not leave the REF OUT and 10 MHz REF OUT terminals open. Always terminate them with 50 Ω loads, such as the included terminators. Likewise, always terminate the cables that are connected to these output terminals with 50 Ω loads.
- Do not apply a signal that is greater than the specified maximum input voltage to the input terminals.
- Before connecting the unit to the DUT, turn the output off.
- Always use the specified connector to connect this module's I/O terminals. Using unspecified connectors to connect the I/O terminals may cause damage to the terminals and the connectors.
- When attaching connectors to the I/O terminals, always connect them straight, not at an angle. Attaching connectors to the I/O terminals at an angle may cause damage to the I/O terminals or the connectors' core wires.
- Do not apply external voltage to the output terminals.

French

ATTENTION

- Avant de retirer les modules du contrôleur, mettre la sortie hors tension.
- Avant de mettre le contrôleur hors tension, mettre la sortie hors tension.
- Avant de brancher les câbles aux bornes d'E/S ou de les débrancher, mettre la sortie hors tension.
- Avant de brancher les câbles aux bornes d'E/S, serrer les connecteurs selon le couple spécifié à l'aide d'une clé dynamométrique.
- Ne pas laisser les bornes REF OUT et REF OUT de 10 MHz ouvertes. Toujours les raccorder à des charges de 50 Ω, telles que les bornes incluses. De même, toujours raccorder les câbles connectés à ces bornes de sortie à des charges de 50 Ω.
- Ne pas appliquer de signal supérieur à la tension d'entrée maximum spécifiée aux bornes d'entrée.
- Avant de raccorder l'unité au DUT, mettre la sortie hors tension.
- Toujours utiliser le connecteur spécifié pour le raccordement des bornes d'E/S de ce module. L'utilisation de connecteurs non conformes aux spécifications pour le raccordement des bornes d'E/S risque de provoquer des dommages aux bornes et aux connecteurs.
- Toujours brancher les connecteurs aux bornes d'E/S de manière droite et non inclinée pour éviter d'endommager ces dernières ou d'endommager les fils des connecteurs.
- Ne pas appliquer de tension externe aux bornes de sortie.

Clock Signal Output (RF OUT CH1 to CH5)

Transmits a 622 MHz (output rate: 1/1) or 155 MHz (output rate: 1/4) clock signal.

Item	Specification
Connector type	SMA, female
Output amplitude	0.8 Vp-p ± 0.2 Vp-p, 1.3 Vp-p ± 0.2 Vp-p
Frequency	620.0 to 720.0 MHz (when the rate is 1/1)
	155.0 to 180.0 MHz (when the rate is 1/4)

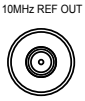
External Synchronization Signal Input (10 MHz REF IN)

Apply a 10 MHz reference signal to this terminal to transmit a clock signal (RF OUT) that is synchronized with the applied signal.

Item	Specification
Connector type	SMA, female
Output amplitude	300 to 1200 mVp-p
Absolute max. rating	1.5 Vp-p
Frequency range	10 MHz ± 2.0 ppm

External Synchronization Signal Output (10 MHz REF OUT)

Transmits a 10 MHz reference signal for synchronizing an external signal with the clock signal (RF OUT).



Item	Specification
Connector type	SMA, female
Output amplitude	800 mVp-p ± 200 mVp-p
Frequency	10 MHz ± 2.0 ppm (when using the internal oscillator)
	Depends on the signal received by 10 MHz REF IN (when using an external reference signal)

4.1 Troubleshooting

Dealing with Unusual Circumstances

- If a message appears on the screen, see the following pages for reference.
- If servicing is necessary, or if the instrument does not operate properly even after you have attempted to deal with the problem according to the instructions in this section, contact your nearest YOKOGAWA dealer.

Problem	Probable Cause	Corrective Action	Reference Section
The instrument does not power on.	The power source is not connected.	Check that the frame controller's power cable is connected. If it is loose, connect it firmly.	Section 2.8
Cannot perform panel operations.	The instrument is in remote control mode.	If the LOCAL soft key is showing, the instrument is in remote control mode (through GP-IB for example). To perform panel operations, cancel remote control mode from the remote controller or press LOCAL to put the instrument into local mode.	Sections 1.1, 2.1, and 3.1 in IM 735101-17EN
The laser beam is not generated. (Light source module)	The optical output is locked.	If the optical output is locked, "Lock" appears in the "Opt" box on the display. Unlock the laser output in the system settings. If you cannot unlock the laser output, an interlock connector plug may not be attached to the interlock connector on the rear of the frame controller. After you attach the plug, unlock the laser output.	
You cannot remember the password. (Light source module)		The default password is 1234. If you change the password, make sure that you change it to something that you will not easily forget.	
Unable to synchronize in PPG-ED loopback mode. (BERT module)	The cables are not connected.	Check that the cables are connected. If they are loose, connect them firmly.	Section 2.5
	The PPG Interface is not set to "Electric."	Check the PPG Interface setting. If it is set to "Optic," change it to "Electric."	Section 9.2 in IM 735101-03EN and section 7.4 and page 4-2 in IM 735101-04EN
	The input port settings are incorrect.	Check the input port settings (DATA IN 1 and DATA IN 2) of the ED against the actual connections. If the settings are different from the actual connections, change the settings to match the actual connections.	
	PPG output is not on.	Check the signal output. If the signal output is off, turn it on.	
	The PPG and ED settings (Pattern, PRBS length, Program length, Logic, etc.) do not match.	Check the DAT settings of the PPG and ED. If these settings do not match, change them so that they do.	
	The data amplitude is small.	Check the data amplitude value. If the amplitude is small, increase it.	
	The data threshold value is set to a value that would cause an error.	Check the data threshold value. If the threshold value is inappropriate, set it to an appropriate value.	
	The data and clock phases do not match when DATA IN 2 is in use.	When using DATA IN 2, you have to adjust the phase of the input clock using an external phase shifter. If the phase is not adjusted, use a phase shifter to adjust it.	
An error occurs in PPG-ED loopback mode. (BERT module)	The PPG and ED patterns do not match.	Check the PPG and ED patterns. If these patterns do not match, change them so that they do.	Section 9.2 in IM 735101-03EN and section 7.4 and page 4-2 in IM 735101-04EN
	Error-add is on.	Check the Error-add setting. If it is on, turn it off.	
	The data amplitude is small.	Check the data amplitude value. If the amplitude is small, increase it.	
	The data threshold value is incorrect.	Check the data threshold value. If the threshold value is inappropriate, set it to an appropriate value.	

Problem	Probable Cause	Corrective Action	Reference Section
The output waveform is not clear. (BERT module)	The cables are not connected well.	Check that the cables are connected. If they are loose, connect them firmly.	Section 2.5
	Unused output terminals are not terminated.	Check the output terminals. If they are open, terminate them using the supplied terminators.	Section 2.5
	The cables or connectors in use do not have good high-frequency characteristics.	Check the cables and connectors. If they do not have good high-frequency characteristics, replace them with cables or connectors that do.	-
The LOS alarm appears on the OE. (10 Gbit/s optical modulator)	The end face of the optical fiber is dirty.	Check the end face of the optical fiber. If it is dirty, clean it.	Section 2.7
	The optical fiber is not connected.	Check that the optical fiber is connected. If it is loose, connect it firmly.	
	The optical input power of the OE is less than the minimum light receiving sensitivity.	Check the optical power of the input signal. If it is less than the minimum light receiving sensitivity, insert optical AMPs into the system.	—
	The LD light source output is off.	Check the LD light source output. If it is off, turn it on.	—
	The output power setting of the LD light source is too low.	Check the output power setting of the LD light source. If it is too low, set it to an appropriate level.	—
The OVERLOAD alarm appears on the OE. (10 Gbit/s optical modulator)	The optical input power of the OE is too large.	Check the optical power of the input signal. If it is too large, insert optical ATTs into the system for protection.	—
Sync loss errors occur. (10 Gbit/s optical modulator and receiver)	The PPG Interface is not set to “Optic.”	Check the PPG Interface setting. If it is set to “Electric,” change it to “Optic.”	Section 9.2 in IM 735101-03EN and section 7.4 in IM 735101-04EN
	OE output is not on.	Check the OE data output. If it is off, turn the output on.	
	The optical input power of the OE is not within the light receiving range.	Check the optical power of the input signal. If it is not within the light receiving range, insert optical ATTs or optical AMPs so that the optical power of the input signal enters the light receiving range.	—
	The wavelength bands of the LD and EO do not match.	Check the wavelength bands of the LD and EO. If they do not match, use instruments that have matching wavelength bands. Use the AQ2200-621 at the 1.5 μm band and the AQ2200-622 at the 1.3 μm band.	—
	The polarization direction of the PMF that connects the LD and EO is incorrect.	Use a PMF with the /P option.	Section 2.5
	The logic settings of the PPG and ED conflict with the ABC slope settings of the EO.	Set all the settings to “Positive” to check the operation.	Section 9.2 in IM 735101-03EN and section 7.4 in IM 735101-04EN
	The OE data threshold value is incorrect.	Check the OE data threshold value. If the threshold value is inappropriate, set it to an appropriate value.	

Inspecting the BERT Module

You can perform an inspection of the BERT module by testing some of its specifications.

Recommended Test Instruments

The following table shows the measuring instruments that are necessary for carrying out performance tests.

You may use other instruments, provided that they perform better than the instruments listed here.

Recommended Test Instruments

Product Name	Required Performance	Recommended Device
Digital oscilloscope	Digital Communications Analyzer Dual Channel 50 GHz Electrical Plug-In Module	Agilent 86100A Agilent 83484A
Phase shifter	3.5 mm connector type	Hirose Electric HLS-JJ-13
Attenuator	10 dB (3.5 mm connector type) 20 dB (3.5 mm connector type)	INMET 41KC-10 INMET 41KC-20
Coaxial cable	3.5 mm connector type SMA connector type	

BER Measurements (With clock recovery)

This test inspects whether the SG-PPG-ED (CDR) module is operating properly by looping the signal from the PPG back to the ED and performing BER measurements.

- **Procedure**

  1. Insert a 10 dB attenuator in the DATA IN 1 terminal (with built-in CDR) of the AQ2200-601 10 Gbit/s BERT module's ED, and use a coaxial cable to connect this terminal to the DATA OUT terminal of the PPG.

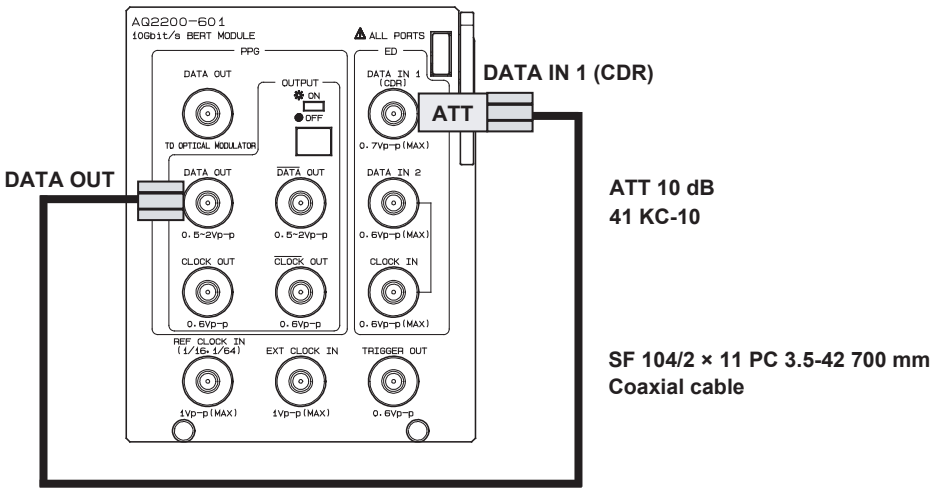
  2. Configure the AQ2200-601 10 Gbit/s BERT module as follows:

PPGIF:	Electric	Setup:	Couple
Data offset:	0.00 V	Pattern:	PRBS
Data cross point:	50%	PRBS length:	PRBS31
Clock source:	Internal	Error mode:	Single
Bitrate:	11.32 Gbit/s	Logic:	Positive
Bitrate offset:	0ppm	Meas mode:	Single
Clock offset:	0.00V	Meas day:	0 day
Input select:	DataIn 1(CDR)	Meas time:	5 min
Data threshold:	0mV	Disp mode:	Current
Auto sync:	ON		

  3. Set the instrument's data amplitude to 0.5 V, and perform the BER measurement. Check that no errors occur for five minutes.

  4. In the same way, set the data amplitude to 2.0 V, and perform the BER measurement. Check that no errors occur for five minutes.

- **Connection Diagram**



BER Measurements (Without clock recovery)

This test inspects whether the SG-PPG-ED (without CDR) module is operating properly by looping the signal from the PPG back to the ED and performing BER measurements.

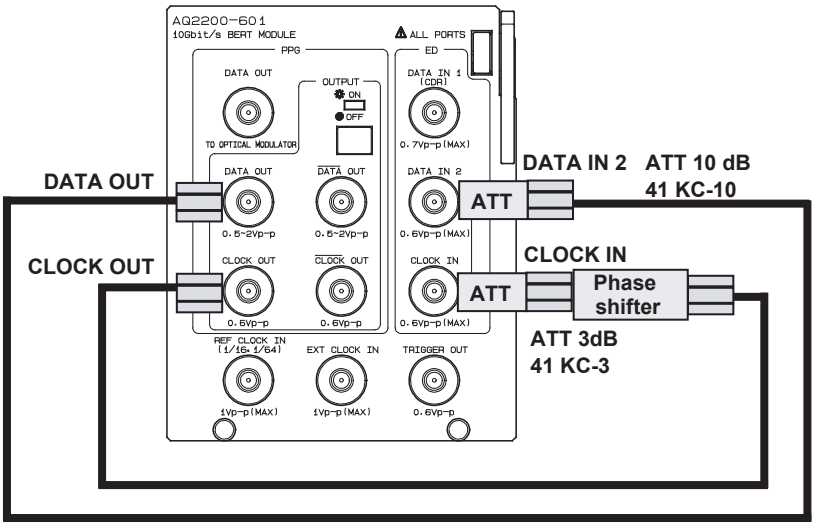
- **Procedure**

  1. Insert a 10 dB attenuator in the DATA IN 2 terminal (without CDR) of this instrument's ED, and use a coaxial cable to connect this terminal to the DATA OUT terminal of the PPG.
  2. Insert a phase shifter into the CLOCK IN terminal of this instrument's ED, and use a coaxial cable to connect this terminal to the CLOCK OUT terminal of the PPG.
  3. Configure the AQ2200-601 10 Gbit/s BERT module as follows:

PPGIF:	Electric	Setup:	Couple
Data offset:	0.00V	Pattern:	PRBS
Data cross point:	50%	PRBS length:	PRBS31
Clock source:	Internal	Error mode:	Single
Bitrate:	10.71 Gbit/s	Logic:	Positive
Bitrate offset:	0ppm	Meas mode:	Single
Clock offset:	0.00V	Meas day:	0 day
Input select:	DataIn 2	Meas time:	5 min
Data threshold:	0mV	Disp mode:	Current
Auto sync:	ON		

  4. Set the instrument's data amplitude to 0.5 V, and perform the BER measurement. Check that no errors occur for five minutes.
  5. In the same way, set the data amplitude to 2.0 V, and perform the BER measurement. Check that no errors occur for five minutes.

- **Connection Diagram**



If the Problem Cannot Be Resolved

If the cause of the problem cannot be located, or if the instrument cannot be returned to its original state, contact your nearest YOKOGAWA dealer.
Check the following before you contact your nearest YOKOGAWA dealer.

Instrument Name

The instrument name is shown on the nameplate that is on the rear of the frame controller or on the side of a module.

Frame Controller Firmware Version

Check the firmware version of the frame controller by selecting “Information” from the menu on the SYSTEM screen.

Each Module’s Firmware Version

Check the firmware version of each module by pressing the Information soft key.

Conditions That the Problem Occurs Under

- What sort of environment are you using the instrument in?
  Indoors or outdoors, temperature, how many modules are installed, etc.
- What happened? What were you doing at the time?
  Example: The instrument froze when I was operating it from the panel or through remote control.
- What settings were you using?
- What messages appeared on the display?
  Display screen, error messages, etc.

Date and Time That the Problem Occurred

4.2 Error Messages

Error Messages

Messages may appear on the screen while you are using this instrument. This section describes the error messages and the corrective action to take. If the corrective action states that serving is required, contact your nearest YOKOGAWA dealer. In addition to the messages listed here, other communication-related error messages may also appear. These error messages are described in the *Communications Interface User's Manual (IM 735101-17EN)*.

Frame Controller

Code	Error Message	Description	Corrective Action
600	File System Error	The file system is corrupt.	Try again with a different USB memory device. If the same message continues to appear, servicing is required.
649	Unknown file or folder	The specified file or folder cannot be found.	Check the file or folder name.
678	USB memory can not be recognized	The instrument could not detect the USB memory.	Contact your nearest YOKOGAWA dealer for details on what USB memory devices have been confirmed to work with the instrument.
729	Module Not Implement	The module that you are trying to load the file into is not installed.	Install the module that you are trying to load the file into.
730	File Sum Check Error	The file may be corrupt. Alternatively, the instrument could not load a setup file that was saved on an AQ2201/ AQ2202 frame controller.	Recreate the file that you are trying to load. You cannot load setup files that were saved on an AQ2201/AQ2202 frame controller. Create setup files on an AQ2211/AQ2212 frame controller.
731	File Already Exist	The same file already exists.	Check the file that you are trying to load. If you are sure, delete the already existing file.
732	File Open Error	The file could not be loaded. The file may be corrupt.	Recreate the file that you are trying to load.
733	Module Type Error	The module type stored in the file that you are trying to load is not the same as the installed module type.	Make the module type stored in the file that you are trying to load the same as the installed module type.
734	Illegal Parameter	There is an invalid module setting in the file that you are trying to load.	Use a file that contains valid module settings.
735	Product Error	The module product name stored in the file that you are trying to load is not the same as the product name of the installed module.	Make the module product name stored in the file that you are trying to load the same as the model product name of the installed module.
736	Option Error	The module option information stored in the file that you are trying to load is not the same as the option information of the installed module.	Make the module option information stored in the file that you are trying to load the same as the model option information of the installed module.
737	Software Version Error	The module software version stored in the file that you are trying to load is not the same as the software version of the installed module.	Make the module software version stored in the file that you are trying to load the same as the software version of the installed module.
738	File Size Error	The data size of the file that you are trying to load is invalid.	You cannot load setup files that were saved on an AQ2201/AQ2202 frame controller. Create setup files on an AQ2211/AQ2212 frame controller.
741	Module Error	The module type stored in the file that you are trying to load is invalid.	Use a file that contains a valid module type.
742	Format Version Error	The format version stored in the file that you are trying to load is not the same as the format version of the installed module.	Make the format version stored in the file that you are trying to load the same as the format version of the installed module.
743	SG Module Error	The SG module that you are trying to load the file into is not installed.	Install the SG module that you are trying to load the file into.
744	ATTN Module Error	The ATTN module that you are trying to load the file into is not installed.	Install the ATTN module that you are trying to load the file into.

Code	Error Message	Description	Corrective Action
745	Data Size Error	The data cannot be saved because it is too large.	When you are saving a measured result in CSV format, the maximum file size is 65536 lines. Divide the measured result so that each file is within the maximum file size.
746	File Name Error	The same file name already exists.	Save the file with a different name.
747	File Delete Error	The file may be corrupt.	Try again with a different USB memory device. If the same message continues to appear, servicing is required.
748	File Log File Error	More than 999 files that have automatically generated file names have been saved.	You can only save 999 files that have automatically generated file names. When you are logging, divide and save the log data so that the number of files does not reach this limit.
919	Hardware failed, and needs to be repaired. Please contact Yokogawa's representatives.	The system is malfunctioning.	Servicing is required.
920	Incorrect date and time setting. Set the correct date and time	The date and time settings are incorrect.	Configure the date and time correctly.
921	The writing processing to the EEPROM failed	The system is malfunctioning.	Servicing is required.
992	Cannot Operate During Measuring	The instrument cannot be operated while measurements are being performed.	Operate the instrument after the measurements finish.
993	Cannot Operate During Zero Set	The instrument cannot be operated while the zero-set procedure is ongoing.	Operate the instrument after the zero-set procedure finishes.
994	Cannot Operate During Updating	The instrument cannot be operated while it is being updated.	Operate the instrument after the updates finish.
995	Device Already In Use	The modules that you intend to use in the ORL application were not selected correctly.	Check the modules that you intend to use.
997	Application Internal Error	The system is malfunctioning.	Servicing is required.
998	Sequence Conflict	The instrument received a command while it was still processing the previous one.	Transmit commands after the processing of the previous command finishes.
999	Command Not Found	The system is malfunctioning.	Servicing is required.
1000	FAN Alarm	The fan has stopped.	Restart the instrument. If the same message continues to appear, servicing is required.
1002	Password Error	The entered password is incorrect.	Confirm that the password is correct, and then re-enter it.
1003	Slot Empty	The specified slot is empty.	Check whether a module is installed in the specified slot.
1007	Update Error	A failure occurred during a firmware update.	Restart the instrument. If the same message continues to appear, servicing is required.
1008	Memory Check Error	An error occurred during the start-up memory error check.	Restart the instrument. If the same message continues to appear, servicing is required.
1010	No Media	Storage medium (USB memory device) is not attached.	Attach the storage medium.
1011	Media Full	There is not enough space to write to the storage medium (USB memory device).	Delete files to increase the amount of free space on the storage medium, or switch to a different storage medium that has more space.
1012	Corrupt Error	The storage medium (USB memory device) may be damaged. Additionally, there may be too many files on the storage medium. If the format of the storage medium is FAT, there is a limit to the number of files it can store.	Delete files to decrease the number of files on the storage medium, or switch to a different storage medium that has more space.
1013	USB Host Error	The remote PC is malfunctioning.	Change the remote PC.

Code	Error Message	Description	Corrective Action
1014	Soft Version Error	There is a discrepancy between the version of the firmware installed in the frame controller and the firmware installed in the module.	Update the firmware on the frame controller and the module. Contact your local YOKOGAWA dealer for the latest version of the firmware.
1015	Module Type Error	The frame controller can not detect the module.	Update the firmware on the frame controller. Contact your local YOKOGAWA dealer for the latest version of the firmware.

Note

Error codes 1020 to 1099 are remote command errors. These error messages are described in the *Communications Interface User's Manual (IM 735101-17EN)*.

DFB-LD Module, FP-LD Module, and DUAL FP-LD Module

Code	Error Message	Description	Corrective Action
1100	LS Lock	Laser output is locked.	Attach an interlock connector to the rear of the frame controller. If the same message continues to appear, set Lock to Off on the frame controller's SYSTEM screen.
1101	Temperature Error	The temperature inside the module is too high.	Turn the power off, and confirm that the frame controller's inlet and exhaust holes are not blocked. After waiting for some time, restart the instrument. If the same message continues to appear, servicing is required.
1102	Update Error	A failure occurred during a firmware update.	Restart the instrument. If the same message continues to appear, servicing is required.
1104	Light Output Limit Operation1	The optical output of the light source (device 1) has exceeded its upper limit.	Restart the instrument. If the same message continues to appear, servicing is required.
1105	Memory Check Error	An error occurred during the start-up memory check.	Restart the instrument. If the same message continues to appear, servicing is required.
1106	Thermistor Temperature Error1	The thermistor detected a temperature error. (For laser light source 1.)	Restart the instrument. If the same message continues to appear, servicing is required.
1107	Thermistor Temperature Error2	The thermistor detected a temperature error. (For laser light source 2.)	Restart the instrument. If the same message continues to appear, servicing is required.
1108	PEL Over current Error1	The Peltier current is abnormal. (For laser light source 1.)	Restart the instrument. If the same message continues to appear, servicing is required.
1109	PEL Over current Error2	The Peltier current is abnormal. (For laser light source 2.)	Restart the instrument. If the same message continues to appear, servicing is required.
1110	Temperature Limit Error	The internal temperature is abnormal.	Turn the power off and confirm that the frame controller's inlet and exhaust holes are not blocked. After waiting for some time, restart the instrument. If the same message continues to appear, servicing is required.
1111	Opt Lock Error	Laser output is locked. Optical output cannot be turned on.	Unlock the laser output. For details see section 4.1, "Troubleshooting." If the same message continues to appear, servicing is required.
1112	Light Output Limit Operation 2	The optical output of the light source has exceeded its upper limit.	Restart the instrument. If the same message continues to appear, servicing is required.

LS Module (AQ2200-112)

Available in firmware versions 3.08 and later

Code	Error Message	Description	Corrective Action
1100	LS Lock	Laser output is locked.	Attach an interlock connector to the rear of the frame controller. If the same message continues to appear, set Lock to Off on the frame controller's SYSTEM screen.
1102	Update Error	A failure occurred during a firmware update.	Restart the instrument. If the same message continues to appear, servicing is required.
1110	Temperature Limit Error	The internal temperature is abnormal.	Turn the power off and confirm that the frame controller's inlet and exhaust holes are not blocked. After waiting for some time, restart the instrument. If the same message continues to appear, servicing is required.
1111	Opt Lock Error	Laser output is locked. Optical output cannot be turned on.	Unlock the laser output. For details see section 4.1, "Troubleshooting." If the same message continues to appear, servicing is required.
1170	Module Execution Error	The internal optical module is not operating.	Restart the instrument. If the same message continues to appear, servicing is required.
1172	Module Temperature Error	The temperature inside the internal optical module is too high.	Turn the power off. After waiting for some time, restart the instrument. If the same message continues to appear, servicing is required.
1175	Module Communication Error	Communication error with the internal optical module.	Restart the instrument. If the same message continues to appear, servicing is required.
1179	Module Power Error	The specified power value and the laser output power are different.	Restart the instrument. If the same message continues to appear, servicing is required.
1180	Module Fatal Error	Internal optical module error.	Restart the instrument. If the same message continues to appear, servicing is required..
1182	Module Voltage Error	The internal voltage is abnormal.	Restart the instrument. If the same message continues to appear, servicing is required.

Grid TLS Module

Available in firmware versions 3.00 and later

Code	Error Message	Description	Corrective Action
1111	Opt Lock Error	Laser output is locked. Optical output cannot be turned on.	Unlock the laser output. For details see section 4.1, "Troubleshooting." If the same message continues to appear, servicing is required.
1170	Module Execution Error	The internal optical module is not operating.	Restart the instrument. If the same message continues to appear, servicing is required.
1172	Module Temperature Error	The temperature inside the internal optical module is too high.	Turn the power off. After waiting for some time, restart the instrument. If the same message continues to appear, servicing is required.
1175	Module Communication Error	Communication error with the internal optical module.	Restart the instrument. If the same message continues to appear, servicing is required.
1177	Temperature Error	The temperature inside the module is too high.	Turn the power off and confirm that the frame controller's inlet and exhaust holes are not blocked. After waiting for some time, restart the instrument. If the same message continues to appear, servicing is required.
1178	Module Frequency Error	The specified frequency and the laser output frequency are different.	Restart the instrument. If the same message continues to appear, servicing is required.
1179	Module Power Error	The specified power value and the laser output power are different.	Restart the instrument. If the same message continues to appear, servicing is required.
1180	Module Fatal Error	Internal optical module error.	Restart the instrument. If the same message continues to appear, servicing is required..
1182	Module Voltage Error	The internal voltage is abnormal.	Restart the instrument. If the same message continues to appear, servicing is required.

TLS Module

Code	Error Message	Description	Corrective Action
1130	Temperature Error	The temperature inside the module is too high.	Turn the power off and confirm that the frame controller's inlet and exhaust holes are not blocked. After waiting for some time, restart the instrument. If the same message continues to appear, servicing is required.
1131	Update Error	A failure occurred during a software update.	If the same message continues to appear even after you restart the instrument, servicing is required.
1133	TEC Temperature Error	The thermistor detected a temperature error.	Turn the power off and confirm that the frame controller's inlet and exhaust holes are not blocked. After waiting for some time, restart the instrument. If the same message continues to appear, servicing is required.
1134	TEC Over Current Error	The thermistor drive current is abnormal.	If the same message continues to appear even after you restart the instrument, servicing is required.
1135	TEC Driver Temperature Error	The thermistor driver detected a temperature error.	If the same message continues to appear even after you restart the instrument, servicing is required.
1136	LD Over Current Error	The LD drive current is abnormal.	If the same message continues to appear even after you restart the instrument, servicing is required.
1137	TLS EL Error	A TLS end limit error occurred.	If the same message continues to appear even after you restart the instrument, servicing is required.
1138	TLS Initialization Error	A failure occurred during initialization.	If the same message continues to appear even after you restart the instrument, servicing is required.
1139	TLS WL Calibration Error	An error occurred during wavelength calibration.	Leave the optical output turned on for at least 30 minutes to warm up the instrument. If the same message continues to appear, restart the instrument. If the same message continues to appear even after you restart the instrument, servicing is required.
1135	TEC Driver Temperature Error	The thermistor driver detected a temperature error.	If the same message continues to appear even after you restart the instrument, servicing is required.
1140	APC PD Feed Back Error	The photodiode's automatic power control is malfunctioning.	If the same message continues to appear even after you restart the instrument, servicing is required.
1141	Gas Cell PD Feed Back Error	The wavelength calibration system that uses the internal gas cell is malfunctioning.	If the same message continues to appear even after you restart the instrument, servicing is required.
1151	ATT EL Error	The internal attenuator is malfunctioning.	If the same message continues to appear even after you restart the instrument, servicing is required.
1152	ATT Initialization Error	A failure occurred during the initialization of the internal attenuator.	If the same message continues to appear even after you restart the instrument, servicing is required.
1153	OSW Switching Error	The internal optical switch is malfunctioning.	If the same message continues to appear even after you restart the instrument, servicing is required.
1157	Wavelength Over Error	A wavelength was set that does not fall within the settable range.	Check the wavelength. Set the wavelength to a value that falls within the settable range.
1159	LD is inactive	The optical output is not active.	Turn the optical output on.
1160	Temperature Limit Error	The temperature inside the module is too high.	Turn the power off and confirm that the frame controller's inlet and exhaust holes are not blocked. After waiting for some time, restart the instrument. If the same message continues to appear, servicing is required.
1161	Memory Check Error	The internal memory is malfunctioning.	If the same message continues to appear even after you restart the instrument, servicing is required.
1162	Opt Lock Error	The optical output is locked.	Unlock the optical output.
1163	Sweep Parameter Error1	The sweep start wavelength is larger than the sweep stop wavelength.	Check the sweep start wavelength, and set it again.
1164	Sweep Parameter Error2	The number of sweep steps is 20001 or more in the Swept application.	Set the number of sweep steps to a value less than or equal to 20000.
1165	Sweep Parameter Error3	The sweep speed is set to a speed at which sweeps cannot be performed.	Check the sweep speed, and set it again.

Sensor Module

Code	Error Message	Description	Corrective Action
1200	Memory Check Error	An error occurred during the memory check.	Restart the instrument. If the same message continues to appear, servicing is required.
1201	Flash Rom Write Error	An error occurred during writing to the flash ROM.	Restart the instrument. If the same message continues to appear, servicing is required.
1202	Header Error	The sensor head type could not be detected correctly.	Restart the instrument. If the same message continues to appear, servicing is required.
1203	Temperature Error	The internal temperature is too high.	Turn the power off and confirm that the frame controller's inlet and exhaust holes are not blocked. After waiting for some time, restart the instrument. If the same message continues to appear, servicing is required.
1204	Update Error	A failure occurred during a firmware update.	Restart the instrument. If the same message continues to appear, servicing is required.
1206	No Head	The sensor head is not connected.	Check that the sensor head is firmly connected.
1207	Temperature Limit Error	The internal temperature is abnormal.	Turn the power off and confirm that the frame controller's inlet and exhaust holes are not blocked. After waiting for some time, restart the instrument. If the same message continues to appear, servicing is required.
1208	Head Voltage Error	The seneor head voltage is abnormal.	Restart the instrument. If the same message continues to appear, servicing is required.
1209	Head Communication Error	Communication error with the sensor head.	Restart the instrument. If the same message continues to appear, servicing is required.
1210	Head Flash Read Error1	An error occurred during reading data from the flash ROM.	Restart the instrument. If the same message continues to appear, servicing is required.
1211	Head Flash Read Error2	An error occurred during reading data from the flash ROM.	Restart the instrument. If the same message continues to appear, servicing is required.
1212	Head Flash Read Error3	An error occurred during reading data from the flash ROM.	Restart the instrument. If the same message continues to appear, servicing is required.
1213	Unknown Head Error	The instrument could not detect the model No. for sensor head.	Update the firmware on the frame controller and the module. If the same message continues to appear, servicing is required. Contact your local YOKOGAWA dealer for the latest version of the firmware.
1260	PD Module Error1	The Peltier temperature is abnormal.	Turn the power off and confirm that the frame controller's inlet and exhaust holes are not blocked. After waiting for some time, restart the instrument. If the same message continues to appear, servicing is required.
1261	PD Module Error2	The Peltier current is abnormal.	Turn the power off and confirm that the frame controller's inlet and exhaust holes are not blocked. After waiting for some time, restart the instrument. If the same message continues to appear, servicing is required.
1262	PD Module Error3	The Peltier control IC temperature is abnormal.	Turn the power off and confirm that the frame controller's inlet and exhaust holes are not blocked. After waiting for some time, restart the instrument. If the same message continues to appear, servicing is required.
1263	Zero set Error1	Light was not cut off during the zero-set procedure.	After checking that light can be cut off, execute the zero-set procedure again.
1264	Zero set Error2	There is a problem with the hardware.	Reset the instrument, and then execute the zero-set procedure. If the same message continues to appear, servicing is required.
1265	OPT Mode Error	An optical signal was applied that has a frequency that is different from the frequency that was set in CHOP mode.	Check the CHOP frequency settings.
1266	Input Power Over	An optical signal was applied that exceeds the maximum optical input level.	Set the optical input power to a value that is less than or equal to the maximum optical input level.
1267	Range Over	The optical input level is higher than the upper limit of the measurement range.	Adjust the measurement range so that the range bar on the Detail screen of the frame controller's sensor module becomes black. When the Range Over error occurs, the range bar is orange.
1268	A/D Read Error	There is a problem with the sensor module hardware.	Restart the instrument. If the same message continues to appear, servicing is required.
1269	Trigger Ignored	A remote measurement command was received during trigger input mode.	Check the measurement mode.

OSW Module

Code	Error Message	Description	Corrective Action
1401	Temperature Error	The internal temperature is too high.	Turn the power off and confirm that the frame controller's inlet and exhaust holes are not blocked. After waiting for some time, restart the instrument. If the same message continues to appear, servicing is required.
1402	Update Error	A failure occurred during a firmware update.	Restart the instrument. If the same message continues to appear, servicing is required.
1405	Memory Check Error	An error occurred during the memory check.	Restart the instrument. If the same message continues to appear, servicing is required.
1406	Temperature Limit Error	The internal temperature is too high.	Turn the power off and confirm that the frame controller's inlet and exhaust holes are not blocked. After waiting for some time, restart the instrument. If the same message continues to appear, servicing is required.
1407	Over Current Error	The module's drive current is abnormal.	Restart the instrument. If the same message continues to appear, servicing is required.

ATTN Module

Code	Error Message	Description	Corrective Action
1301	Temperature Error	The internal temperature is too high.	Turn the power off and confirm that the frame controller's inlet and exhaust holes are not blocked. After waiting for some time, restart the instrument. If the same message continues to appear, servicing is required.
1302	Update Error	A failure occurred during a firmware update.	Restart the instrument. If the same message continues to appear, servicing is required.
1304	Initialization Error	A failure occurred during initialization.	Restart the instrument. If the same message continues to appear, servicing is required.
1305	Memory Check Error	An error occurred during the memory check.	Restart the instrument. If the same message continues to appear, servicing is required.
1306	Temperature Limit Error	The internal temperature is abnormal.	Turn the power off and confirm that the frame controller's inlet and exhaust holes are not blocked. After waiting for some time, restart the instrument. If the same message continues to appear, servicing is required.
1307	Over Current Error	The module's drive current is abnormal.	Restart the instrument. If the same message continues to appear, servicing is required.
1308	Module Temperature Error	The temperature of the variable optical attenuator is abnormal.	Turn the power off and confirm that the frame controller's inlet and exhaust holes are not blocked. After waiting for some time, restart the instrument. If the same message continues to appear, servicing is required.
1311	ATTN Table Error	ATTN table is abnormal.	Restart the instrument. If the same message continues to appear, servicing is required.
1312	OSW Control Error	Optical switch control is abnormal.	Restart the instrument. If the same message continues to appear, servicing is required.
1363	Zero set Error1	Light was not cut off during the zero-set procedure.	After checking that light can be cut off, execute the zero-set procedure again.
1364	Zero set Error2	There is a problem with the hardware.	Reset the instrument, and then execute the zero-set procedure. If the same message continues to appear, servicing is required.
1365	Input Power Over	An optical signal was applied that exceeds the maximum optical input level.	Set the optical input power to a value that is less than or equal to the maximum optical input level.

XFP Interface Module

Code	Error Message	Description	Corrective Action
1600	Memory Check Error	An error occurred during the start-up memory check.	Restart the instrument. If the same message continues to appear, servicing is required.
1601	Flash Rom Write Error	An error occurred during writing to the flash ROM.	Restart the instrument. If the same message continues to appear, servicing is required.
1603	Temperature Error	The internal temperature is too high.	Turn the power off, and confirm that the frame controller's ventilation holes are not blocked. After waiting for some time, restart the instrument. If the same message continues to appear, servicing is required.
1604	Update Error	A failure occurred during a firmware update.	Restart the instrument. If the same message continues to appear, servicing is required.
1605	Not Running	The XFP interface module is not running.	Restart the instrument. If the same message continues to appear, servicing is required.
1607	Temperature Limit Error	The internal temperature is too high.	Turn the power off, and confirm that the frame controller's ventilation holes are not blocked. After waiting for some time, restart the instrument. If the same message continues to appear, servicing is required.
1660	I2C Communication Error	A CRC or NAK error was detected during communication with the XFP optical transceiver.	Check that the XFP optical transceiver is installed correctly. If the same message continues to appear, servicing is required.
1661	No XFP Module	An XFP optical transceiver is not installed.	Install an XFP optical transceiver into the XFP interface module.
1662	Opt Lock Error	The optical output is locked.	Unlock the optical output.
1663	XFP Power Voltage Error	The power that is being supplied to the XFP optical transceiver is abnormal.	Restart the instrument. If the same message continues to appear, servicing is required.
1664	Password Error	The entered password is incorrect, or the specified page cannot be selected.	Check the password or page, and then re-enter the correct password or page.

Transceiver I/F Module

Code	Error Message	Description	Corrective Action
1700	Temperature Error	The internal temperature is too high.	Turn the power off, and confirm that the frame controller's ventilation holes are not blocked. After waiting for some time, restart the instrument. If the same message continues to appear, servicing is required.
1701	Temperature Limit Error	The internal temperature is too high.	Turn the power off, and confirm that the frame controller's ventilation holes are not blocked. After waiting for some time, restart the instrument. If the same message continues to appear, servicing is required.
1702	I2C I/F Error I2C	The communication mode is not set properly.	Set the connected optical transceiver and the clock values to the same value.
1703	TRN Invalid Cal Data	The calibration data is abnormal.	Restart the instrument. If the same message continues to appear, servicing is required.
1704	Flash Rom Write Error	An error occurred during writing to the flash ROM.	Restart the instrument. If the same message continues to appear, servicing is required.
1705	Not Running	The Transceiver I/F module is not running.	Restart the instrument. If the same message continues to appear, servicing is required.
1706	PS1 Overload	The PS1 power supply current has exceeded the limit.	Check the current consumption of the connected optical transceiver, and set a new current limit. Make sure that the total current consumption for PS1 to PS5 is 28 W or less.
1707	PS2 Overload	The PS2 power supply current has exceeded the limit.	Check the current consumption of the connected optical transceiver, and set a new current limit. Make sure that the total current consumption for PS1 to PS5 is 28 W or less.
1708	PS3 Overload	The PS3 power supply current has exceeded the limit.	Check the current consumption of the connected optical transceiver, and set a new current limit. Make sure that the total current consumption for PS1 to PS5 is 28 W or less.
1709	PS4 Overload	The PS4 power supply current has exceeded the limit.	Check the current consumption of the connected optical transceiver, and set a new current limit. Make sure that the total current consumption for PS1 to PS5 is 28 W or less.
1710	PS5 Overload	The PS5 power supply current has exceeded the limit.	Check the current consumption of the connected optical transceiver, and set a new current limit. Make sure that the total current consumption for PS1 to PS5 is 28 W or less.
1711	MDIO I/F Error	An error occurred during MDIO communication.	Check that the optical transceiver is connected correctly.
1712	Update Error	A failure occurred during a firmware update.	Restart the instrument. If the same message continues to appear, servicing is required.
1713	Total Overload	The total optical transceiver current consumption has exceeded the upper limit.	Set a new limit value that matches the current consumption of the connected optical transceiver. Make sure that the total current consumption for PS1 to PS5 is 28 W or less.

SG Module

Code	Error Message	Description	Corrective Action
1800	Temperature Error	The internal temperature is too high.	Turn the power off, and confirm that the frame controller's ventilation holes are not blocked. After waiting for some time, restart the instrument. If the same message continues to appear, servicing is required.
1801	Temperature Limit Error	The internal temperature is too high.	Turn the power off, and confirm that the frame controller's ventilation holes are not blocked. After waiting for some time, restart the instrument. If the same message continues to appear, servicing is required.
1802	Not Running	The SG module is not running.	Restart the instrument. If the same message continues to appear, servicing is required.
1803	SG Invalid Cal Data	The calibration data is abnormal.	Restart the instrument. If the same message continues to appear, servicing is required.
1804	Update Error	A failure occurred during a firmware update.	Restart the instrument. If the same message continues to appear, servicing is required.

10Gbit/s BERT Module

Code	Error Message	Description	Corrective Action
2011	Command Error	Commend error	Check the command and send it again.
2012	Range Error	A parameter was set that does not fall within the settable range.	Check the parameter. Set the wavelength to a value that falls within the settable range.
2013	RAM Write Error	A failure occurred during a firmware update.	Restart the instrument. If the same message continues to appear, servicing is required.
2014	Serial Error	Serial communication error	Restart the instrument. If the same message continues to appear, servicing is required.
2015	Parameter Error	Parameter error	Check the command parameters and send the command again.
2016	Syntax Error	Syntax error	Check the syntax and send the command again.
2017	Temperature Error	The internal temperature is too high.	Turn the power off, and confirm that the frame controller's ventilation holes are not blocked. After waiting for some time, restart the instrument. If the same message continues to appear, servicing is required.
2018	Temperature Limit Error	The internal temperature is too high.	Turn the power off, and confirm that the frame controller's ventilation holes are not blocked. After waiting for some time, restart the instrument. If the same message continues to appear, servicing is required.
2021	Not Running	The BERT module is not running.	Restart the instrument. If the same message continues to appear, servicing is required.
2031	Invalid update memory	Update Memory of the Firmware is faulty.	Update the firmware again.
2032	Invalid ID information Memory	Update Memory of the Firmware is faulty.	Hardware is faulty. Servicing required.
2033	SG Initialize Unlock	Unlock error occurs at start-up.	Hardware is faulty. Servicing required.
2034	FPGA configuration error	Configuration of the FPGA is failed.	Hardware is faulty. Servicing required.
2035	A/D Timeout Error	An A/D timeout error occurred.	Restart the instrument. If the same message continues to appear, servicing is required.
2061	Fatal Error	The command is irregular.	Check the command, and enter it again.
2062	Hardware Missing	This module does not support the /M or /P1 option.	Use a module that supports these options.
2063	Measure State Error	Error caused by unstable measurement status as described below. • `:INIT:CONT ON` or `:TRIG:SOUR` is received during measurement. • `:TRIG:IMM` is received when `:INIT:CONT` is set at OFF.	Send the command in the correct status.
2064	Program load Error	The instrument was unable to load the program data.	Check the path of the file that you are trying to load. Specify the file with the absolute path. Also, enter “/USB-0/” at the start of the path.
2065	Module work in process	The module is performing another process.	Enter the command again after waiting for some time.
2066	Media Error	The medium may be corrupt.	Try again with a different USB memory device. If the same message continues to appear, servicing is required.
2067	Update Error	A failure occurred during a firmware update.	Restart the instrument. If the same message continues to appear, servicing is required.
2068	File Not Found	The specified file does not exist.	Specify a correct file name.
2069	Invalid File	An invalid file is selected.	Check the contents of the file.
2070	Setting Conflict	The device cannot execute the command.	Check the state of the device.

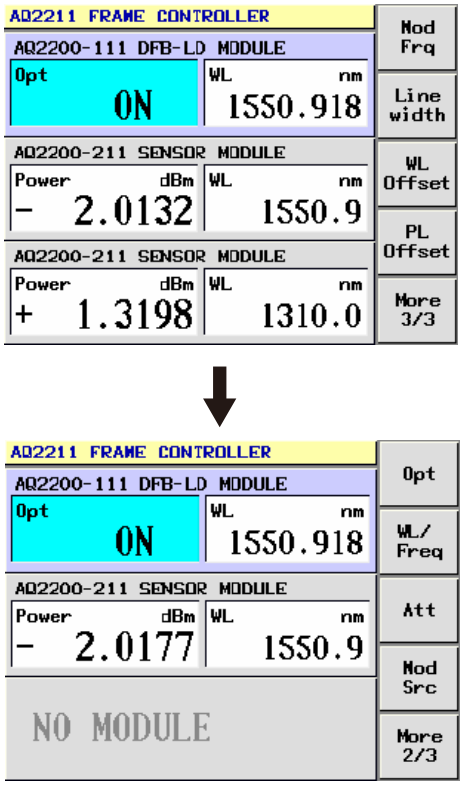
4.3 Changing Modules

You can install and uninstall modules while the frame controller is on.

Uninstalling a Module

You can uninstall modules while the instrument is on.

1. Uninstall the module that is installed in slot 3.



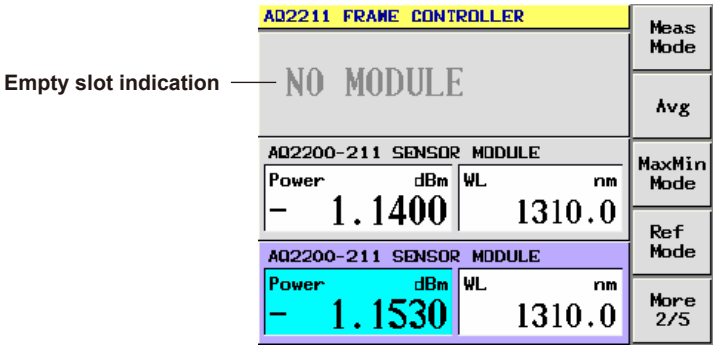
Note

When you remove the module while displaying a screen other than the DETAIL or SUMMARY screen, the screen closes and the DETAIL or SUMMARY screen appears.

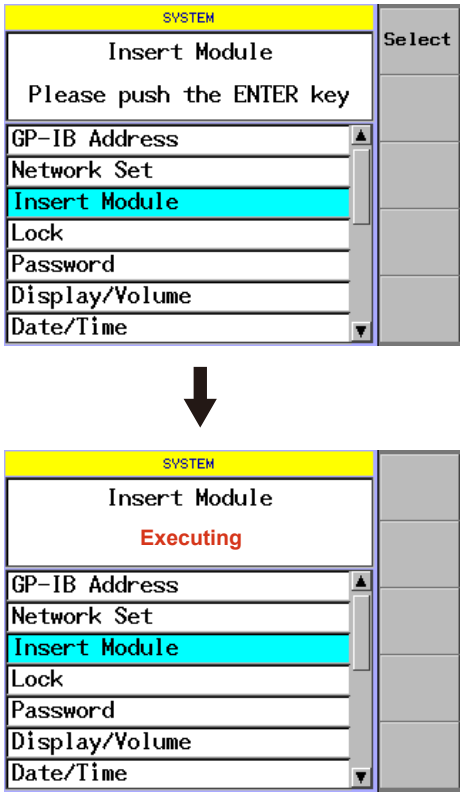
Installing a Module

You can install modules while the instrument is on.
When a module is installed, the instrument automatically detects it.
If the module is not automatically detected, follow the procedure below to force the instrument to detect the installed modules.

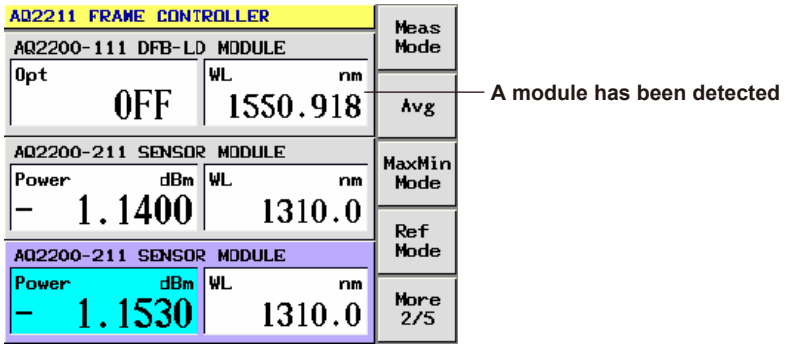
1. Install the module in an empty slot.



2. Press **SYSTEM** to display the SYSTEM screen.
3. Use the arrow keys to select Insert Module, and press the **Select** soft key or **ENTER**.
   The instrument starts detecting the installed modules, and “Executing” appears at the top of the screen. “Executing” disappears when the instrument finishes detecting the installed modules.



After the instrument finishes detecting the modules, the DETAIL or SUMMARY screen appears.



Note

- An error message may appear immediately after the instrument finishes detecting the installed modules.
  This error shows that, due to a discrepancy between the release version of the firmware installed in the frame controller and the firmware installed in the module, there is a possibility that some operations may not work properly.
  Please update the firmware if this error appears.
- The instrument takes approximately 5 seconds to automatically detect modules after they have been installed in the frame controller.
- When you remove the module while displaying a screen other than the DETAIL or SUMMARY screen, the screen closes and the DETAIL or SUMMARY screen appears.

4.4 Updating the Firmware

CAUTION

- After you update the firmware on an instrument, all of its settings are reset to their initial values.
  Where necessary, save the settings before you update the firmware.
- If you do not comply with the following precautions you will not be able to restart the instrument.
  - Do not turn the instrument off, install or uninstall modules, or connect or disconnect USB memory devices while the firmware is being updated.
  - Do not decode or modify the files that are used to update the firmware.
  - Always update the firmware to the most recent version.

French

ATTENTION

- Après la mise à jour du micrologiciel d'un instrument, tous les paramètres sont réinitialisés sur les valeurs initiales.
  Le cas échéant, enregistrer les paramètres avant de mettre le micrologiciel à jour.
- Si les précautions suivantes ne sont pas respectées, l'instrument ne pourra pas redémarrer.
  - Ne pas mettre l'instrument hors tension, installer ou désinstaller des modules, connecter ou déconnecter un dispositif de mémoire USB pendant la mise à jour du micrologiciel.
  - Ne pas décoder ou modifier les fichiers servant à la mise à jour du micrologiciel.
  - Toujours installer la mise à jour la plus récente du micrologiciel.

Procedure

Updating the Frame Controller Firmware

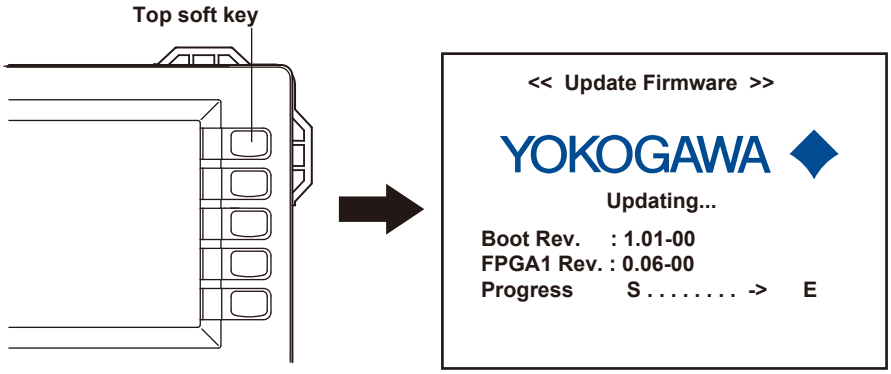
Update Procedure

1. Turn the frame controller off.
2. Connect a USB memory device that contains the most recent version of the firmware to the front of the frame controller.

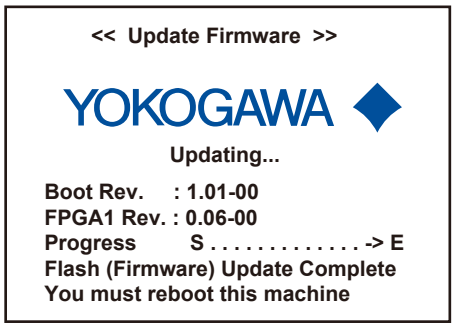
Note

- Connect the USB memory device directly, not through a USB hub.
- Name the update file as "aq221xlz.bin," and place the file in the root directory of the USB memory.

3. Turn the instrument on while holding down the top soft key.
   The update screen appears, and the instrument begins updating the firmware automatically.



A completion message appears at the bottom of the screen when the update finishes correctly. After that, the frame controller starts automatically.

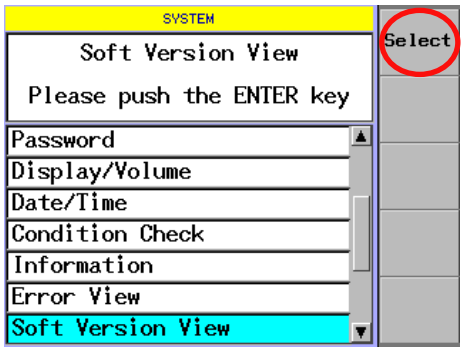


Note

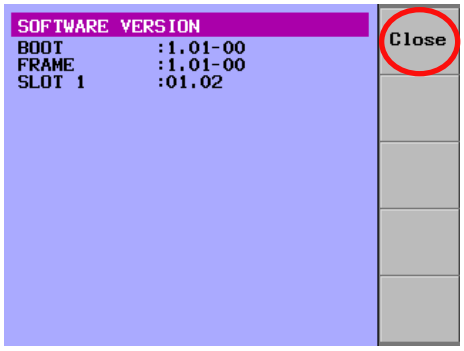
You can disconnect the USB memory device when the frame controller starts to run.

Displaying the Version Information

1. Press **SYSTEM** to display the SYSTEM screen.
2. Use the arrow keys to select Soft Version View, and press the **Select** soft key or **ENTER**.
   The SOFTWARE VERSION screen appears. This screen shows the version information for the frame controller and all of the installed modules.



3. Press the **Close** soft key to close the SOFTWARE VERSION screen.



Updating the Module Firmware

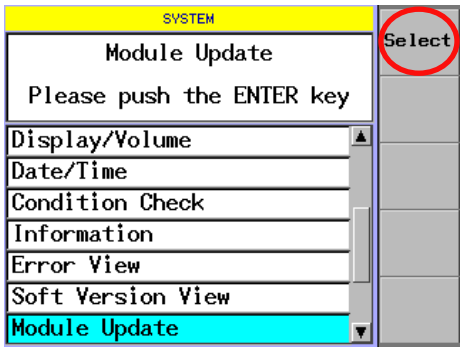
Update Procedure

1. Connect a USB memory device that contains the most recent version of the firmware to the front of the frame controller.

Note

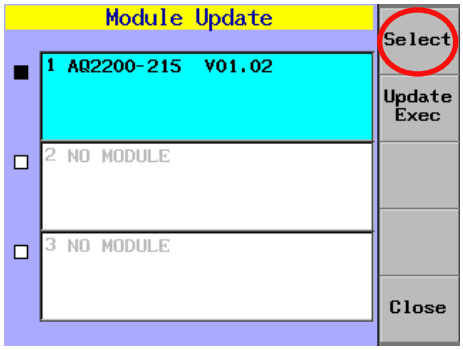
- Connect the USB memory device directly, not through a USB hub.
- Do not change the name of the update file.
- Place the update file in the “module” folder on the USB memory.

2. Press **SYSTEM** to display the SYSTEM screen.
3. Use the arrow keys to select Update, and press the **Select** soft key or **ENTER**.
   The Module Update screen appears. The following explanation is for the screen that is displayed on the AQ2211. On the AQ2212, you can scroll the screen to display the modules that are installed in the nine slots.

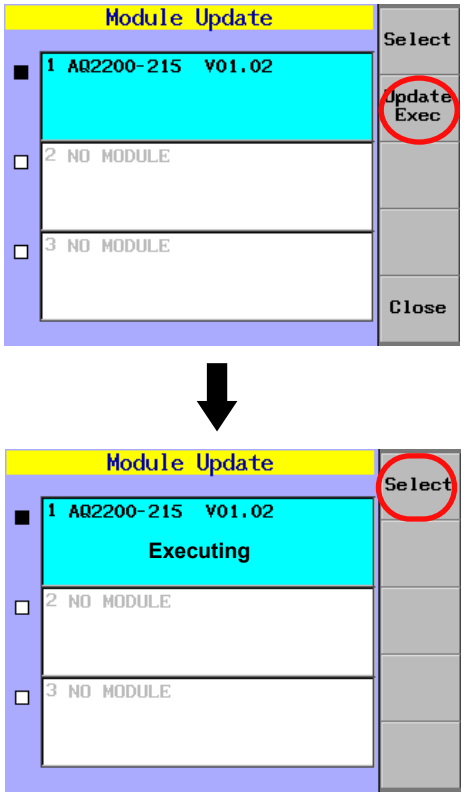


4. Use the arrow keys to select a module that you want to update, and press the **Select** soft key or **ENTER**.
   The check boxes for all the modules that you have selected are displayed in black.

Module selection screen (AQ2211)



5. Press the **Update Exec** soft key to update the firmware for the selected modules.



Note

If you select multiple modules to update, the progress indication is updated for each module. One of the following four progress indications is displayed.

- Executing: The firmware update is being executed.
- File Not Found: The USB memory device does not have the files that are required to update the module.
- Failed: The firmware update failed.
- Complete: The firmware update completed successfully.

6. After the firmware finishes updating, the message “Please Restart System” is displayed. Restart the frame controller.

Displaying the Version Information

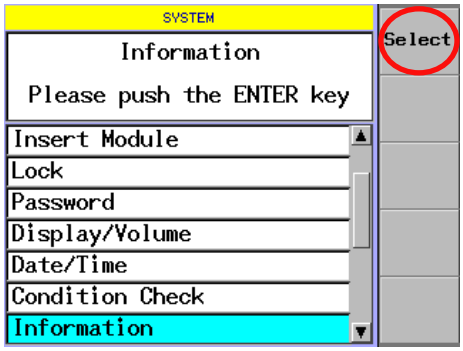
The procedure to display the version information is the same as that given for the frame controller. See page 4-20.

Displaying Instrument Information

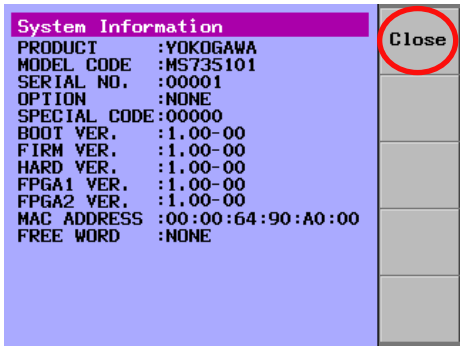
Displaying Frame Controller Information

You can display the frame controller's hardware and firmware information.
Follow the steps below to display this information.

1. Press **SYSTEM** to display the SYSTEM screen.
2. Use the arrow keys to select Information, and press the **Select** soft key or **ENTER**.
   The System Information screen appears.



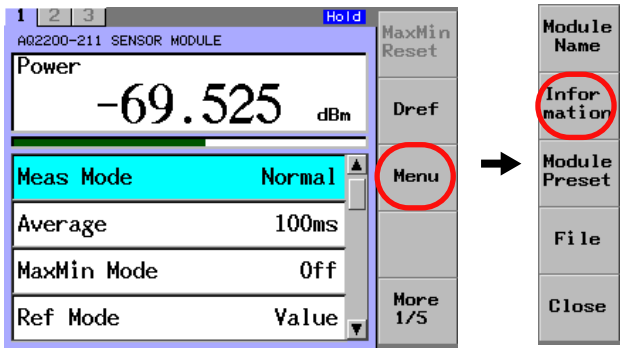
3. After checking the information, press the **Close** soft key.



Displaying Module Device Information

You can display the device information for the installed modules.

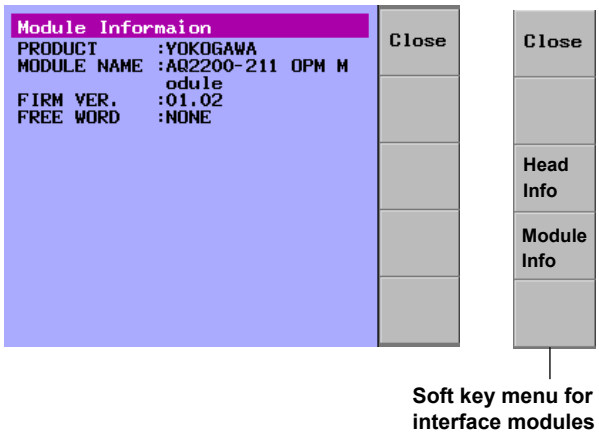
1. Use the **SLOT** keys to select the module that you want to display device information for.
2. Press the **Menu** soft key to display the module control soft keys.



Note

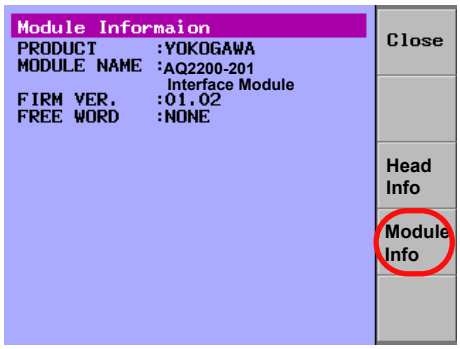
You can carry out this procedure to display the module information for AQ2200-1xx, AQ2200-2xx, AQ2200-3xx, and AQ2200-4xx modules. You cannot carry out this procedure to display the module information for AQ2200-6xx modules.

3. Press the **Information** soft key to display the Module Information screen.
The display will be slightly different depending on the installed modules.



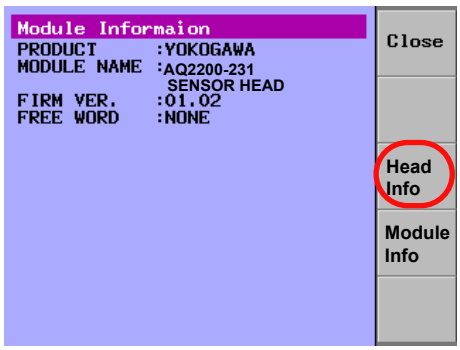
- **Displaying Interface Module Device Information**

4. Press the **Module Info** soft key to display the Module Information screen.



- **Displaying Sensor Head Device Information**

5. Press the **Head Info** soft key to display the Head Information screen.



Note

If a sensor head is not connected, the Head Info soft key is dimmed and cannot be pressed.

6. After checking the information, press the **Close** soft key.

Explanation

Firmware Updates

This instrument may require firmware version updates to support new modules and new or modified features.

How to Obtain the Firmware

If you do not always use the most recent version of the firmware when you update the instrument, it may not function properly. When you update the module firmware or purchase a newly released module, be sure to also update the frame controller firmware.

You can download the latest firmware from the YOKOGAWA website if you register as a user.
You can register as a user from the following website.
http://www.yokogawa.com/tm/

Note

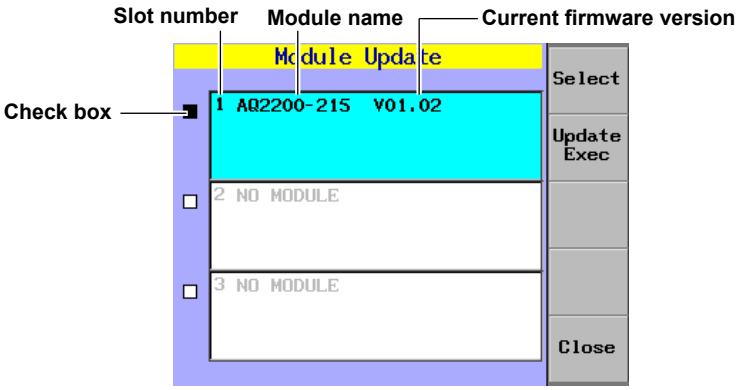
- You cannot use the frame controller's Ethernet port to connect to the Internet and directly download or update the firmware.
- You cannot update the firmware through a PC.

Things to Prepare before Updating the Firmware

- The frame controller
- The modules that you want to update
- A USB memory device (containing the most recent firmware)
  Be sure to save the most recent firmware program files to the root folder of the USB memory device. (Save the module program files to the Module folder.)
  The firmware will be updated properly even if unrelated files or folders are on the USB memory device.

Explanation of the Module Selection Screen and Features

You can select which modules you want to update the firmware for.



Item	Description
Check box	Displays whether the module will have its firmware updated or not. You can use the Select soft key to select modules. Selected modules have a black check box. Unselected modules have a white check box.
Slot number	Displays the slot number.
Module name	Displays the module name. If no module is installed, “NO MODULE” is displayed.
Current firmware version	Displays the current version of the firmware for the installed module.
Select	Switches whether the module will have its firmware updated or not.
Update Exec	Executes the firmware update.
Close	Returns to the SYSTEM screen.

Displaying Instrument Information

The instrument information appears in the following formats. The details are different depending on the instrument.

Frame Controller

Item	Description	Display Example
PRODUCT	Manufacturing company	YOKOGAWA
MODEL CODE	Model	735101
SERIAL NO.	Serial number	00001
OPTION	Options	NONE
SPECIAL CODE	Special code	00000
BOOT VER.	Boot program edition	1.00-00
FIRM VER.	Firmware edition	1.00-00
FPGA1 VER.	Hardware part edition	1.00-00
FPGA2 VER.	Hardware part edition	1.00-00
MAC ADDRESS	Ethernet MAC address	01:02:03:04:05:06

Modules

Item	Description	Display Example
PRODUCT	Manufacturing company	YOKOGAWA
MODULE NAME	Module name	AQ2200-211 Sensor Module
SERIAL NO.	Serial number	00001
ORDER CODE	Order code	735125-FCC
SPECIAL CODE	Special code	00000
FIRM VER.	Module firmware edition	01.00
HARD VER.	Hardware edition	1.00-00
FPGA VER.	Hardware part edition	1.00-00
OPTION	Options	NONE
CONNECTOR	Compliant connector	FC
FIBER	Compliant fiber	SM
WAVELENGTH	Wavelength	1564.679
FREE WORD	Comment	NONE

4.5 Routine Maintenance

Notes before Storage

Wipe the instrument off with a cloth to remove dust, fingerprints, and other dirt.
For instructions on how to clean the exterior of the instrument, see “Cleaning the Frame Controller and Modules.”
Carry out the condition check (fan alarm) and key check to confirm that the instrument operates correctly. For details, see section 10.7 in IM 735101-03E.

Notes When Re-Using the Instrument

When using the instrument again after storing it for a long period of time, first check that it operates correctly. Check that it operates correctly in the same way that was outlined above in the section “Notes before Storage.”

Cleaning the Frame Controller and Modules

To use this instrument for as long as possible and to prevent problems or malfunctions, routine maintenance is necessary.

- When cleaning the case or the operation panel, first remove the power cord from the outlet, and then wipe with a dry, soft, clean cloth.
- To clean the electrical interface, use compressed air to remove dust, and then cover unused output terminals with terminators and unused input terminals with caps.

CAUTION

Failure to comply with the following precautions may cause the instrument to malfunction.

- Turn the instrument off before starting maintenance.
- Do not use chemicals such as thinner, benzene, or alcohol.
  Doing so may cause discoloration and deformation.

French

ATTENTION

Le non-respect des précautions suivantes risque ce provoquer des dysfonctionnements de l’instrument.

- Mettre l’instrument hors tension avant la maintenance.
- Ne pas utiliser de produits chimiques (par exemple, diluants, benzène ou alcool) pour éviter toute décoloration ou déformation.

Why It Is Necessary to Clean the Optical Interface

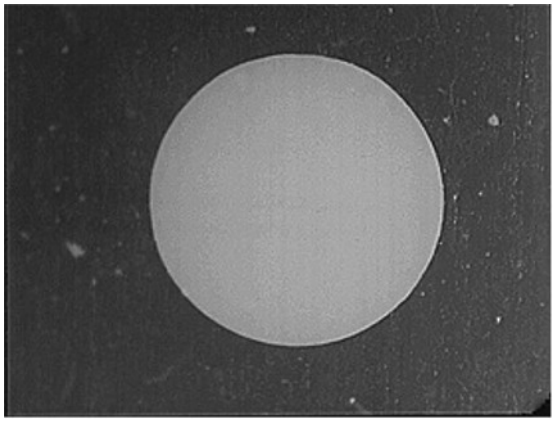
The optical connectors and optical plugs are the only optical components whose optical fiber end faces are exposed to the outside. Even a tiny scratch on their end faces that cannot be detected by the naked eye greatly affects their optical performance. If optical connectors are connected improperly, if they are connected without the removal of dust or dirt, or if they are cleaned improperly, the optical connector end faces may be damaged.

When connecting optical connectors, you must properly align the ferrule cores of both optical connectors. An optical adapter is used for this connection, but if the connection is made with dirt or dust attached to the ferrule side face or ferrule guide (sleeve) of the optical adapter, the cores cannot be properly aligned. This may lead to problems such as optical power loss, transmission mode disturbances, and an increased optical reflection at the connection point. Consequently, the instrument will not be able to take proper measurements.

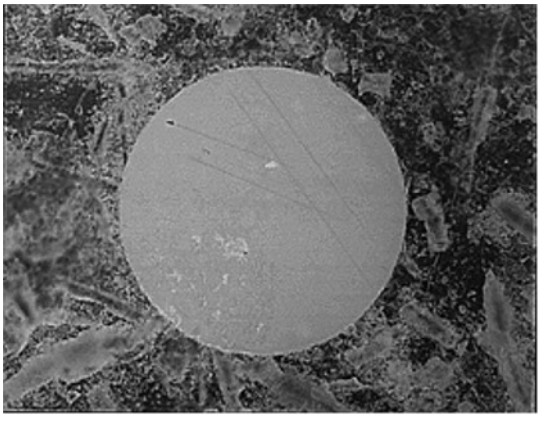
To prevent problems such as these, it is necessary to keep the optical connectors clean and to make proper connections when connecting optical connectors to measuring instruments or to other optical connectors.

When you use this instrument, clean the ferrule every time it is connected and clean the precision sleeve at least once every thirty connections. In particular, if you use optical connectors such as those described on the following page, we recommend that you clean them before every use.

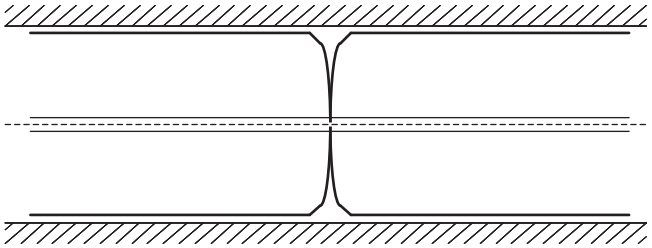
- Optical connectors are connected after a metallic sleeve has been inserted
  → Particles that are worn off of the metallic sleeve may stick to the ferrule side face or end face particularly easily.
- Optical connectors that have ferrule materials that easily wear out, such as metallic or crystallized glass ferrule
  → Ferrule particles may wear off easily from connecting and disconnecting the optical connector.
- Optical connectors and precision sleeves, with which plastic shell type optical connectors are repeatedly engaged
  → Plastic particles wear off easily from the repeated engagement of the shell.



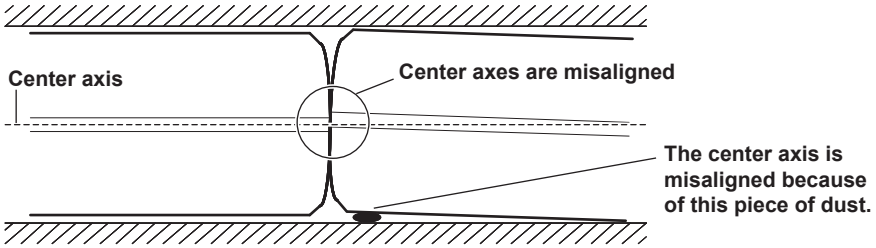
Enlarged photo of a good optical connector connection



Enlarged photo of a scratched optical connector connection



Correctly aligned optical connectors



Optical connectors whose axes are misaligned due to a piece of dust

Tools Required for Cleaning Optical Interfaces

When cleaning an optical interface, prepare the following:

- Isopropyl alcohol
- Cleaning paper
- Stick-type cleaners
- Compressed air
- An optical connector end face magnifying microscope

WARNING

Do not clean optical connectors or optical adapters while the laser beam is being generated. The laser beam is invisible. However, if it comes in contact with your eye it may cause eye damage.

French

AVERTISSEMENT

Ne pas nettoyer les connecteurs ou les adaptateurs optiques pendant la génération du faisceau laser. Le faisceau laser est invisible.
Mais s'il entre en contact avec l'œil, il peut causer des lésions oculaires.

How to Clean Optical Connectors

1. Soak a piece of cleaning paper in the isopropyl alcohol, and pinch the cleaning paper on the sides of the optical ferrule. Rub the sides of the ferrule with the cleaning paper.
2. Soak another piece of cleaning paper in the isopropyl alcohol, and rub the cleaning paper against the ferrule end face.
3. Wipe of the moisture with another piece of cleaning paper. After that, use the compressed air to remove any remaining dust.
4. Use the optical connector end face magnifying microscope to inspect the end face. Repeat the cleaning process until the end face is clear of dirt and dust.

CAUTION

If you use dirty cleaning paper, you may damage the end face. Always use new pieces of cleaning paper.

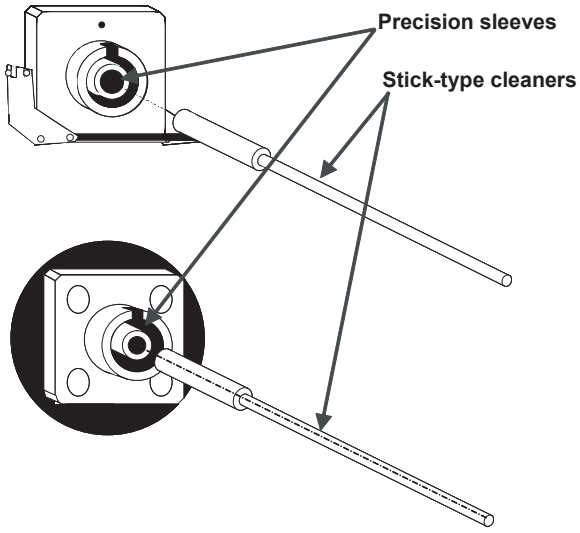
French

ATTENTION

L'utilisation de lingettes de nettoyage sales risque d'endommager l'extrémité.
Toujours utiliser des lingettes de nettoyage neuves.

How to Clean the AQ9441 and AQ9335C Optical Connector Adapters

1. Soak a stick-type cleaner in the isopropyl alcohol, and slowly insert it into the optical connector adapter's precision sleeve. Use the stick-type cleaner to clean the adapter's inner walls.
2. Wipe of the moisture with another stick-type cleaner. After that, use the compressed air to remove any remaining dust.



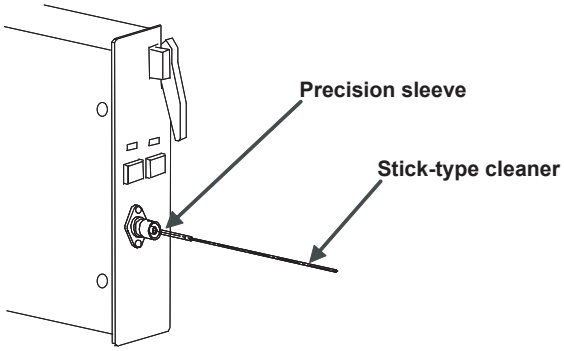
How to Clean the AQ9447 Optical Connector Adapter

Wipe the dust off the adapter, or use the compressed air to remove the dust.

How to Clean the Each Module

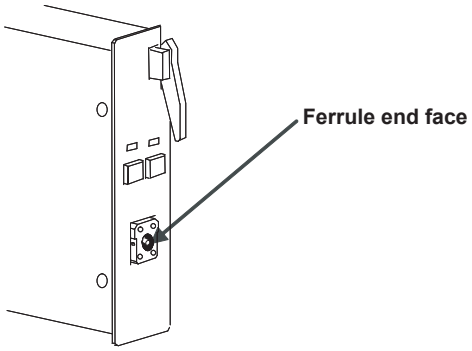
How to Clean the Optical Output Connector of the AQ2200-111 DFB-LD Module and AQ2200-112 LS Module

1. Soak a stick-type cleaner in the isopropyl alcohol, and slowly insert it into the optical output connector's precision sleeve. Rotate the stick-type cleaner while pressing lightly against the inner walls.



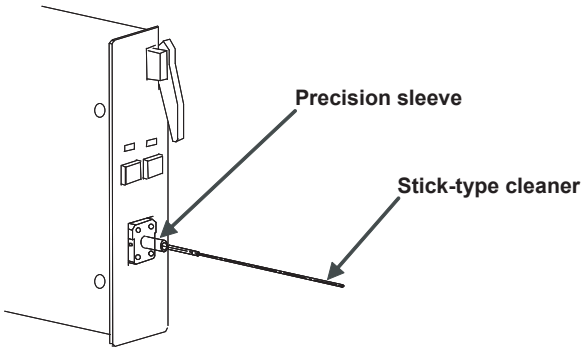
How to Clean the Optical Output Connector of the AQ2200-141 and AQ2200-142 FP-LD Modules

1. Soak a piece of cleaning paper in the isopropyl alcohol, and rub the cleaning paper against the ferrule end face.
2. Wipe of the moisture with another piece of cleaning paper. After that, use the compressed air to remove any remaining dust.



How to Clean the Optical Input Connector of the AQ2200-211 Sensor Module

1. Soak a stick-type cleaner in the isopropyl alcohol, and slowly insert it into the optical input connector's precision sleeve. Use the stick-type cleaner to clean the connector's inner walls and opening.
2. Wipe of the moisture with another stick-type cleaner. After that, use the compressed air to remove any remaining dust.



How to Clean the Optical Input Connector of the AQ2200-215 Sensor Module

Because the light receiving surface is very sensitive, never rub it to clean off dust particles.
Use the compressed air to remove small amounts of dust and dirt.

How to Clean the Optical Input Connector of the AQ2200-221 Sensor Module

An antireflection coating is applied to the light receiving glass of the AQ2200-221 sensor module.
Using a brush that has been used many times or a brush that has not been used for a long time may scratch the light receiving glass. Use new brushes when cleaning this optical input connector.

1. Use the compressed air to remove small amounts of dust and dirt.
2. If there is dirt or dust that you cannot remove with the compressed air, soak a piece of cleaning paper in the isopropyl alcohol, and softly wipe the surface of the light receiving glass. Then, use the compressed air to remove any lint that remains on the light receiving glass.

CAUTION

Wipe the light receiving glass softly. Strong pressure may scratch the glass or break the components.

French

ATTENTION

Nettoyer avec précaution le verre récepteur de lumière. Toute pression forte risque de rayer le verre ou de casser les composants.

How to Clean the Optical I/O Connectors of the AQ2200-131/132 Grid TLS Module
How to Clean the Optical I/O Connectors of the AQ2200-136 TLS Module
See “How to Clean the Optical Output Connector of the AQ2200-111 DFB-LD Module and AQ2200-112 LS Module.”

How to Clean the Optical Input Connector of the AQ2200-231/232/242 Optical Sensor Head
See “How to Clean the Optical Input Connector of the AQ2200-221 Sensor Module.”

How to Clean the Optical Input Connector of the AQ2200-241 Optical Sensor Head
Because the light receiving surface is very sensitive, never rub it to clean off dust particles. Use the compressed air to remove small amounts of dust and dirt.

How to Clean the Optical I/O Connectors of the AQ2200-271 ORL Module
How to Clean the Optical I/O Connectors of the AQ2200-311 ATTN Module
How to Clean the Optical I/O Connectors of the AQ2200-311A/312 ATTN Module
How to Clean the Optical I/O Connectors of the AQ2200-331/332 ATTN Module
How to Clean the Optical I/O Connectors of the AQ2200-342 DUAL ATTN Module
How to Clean the Optical I/O Connectors of the AQ2200-411/412 OSW Module
How to Clean the Optical I/O Connectors of the AQ2200-421 OSW Module
How to Clean the Optical I/O Connectors of AQ2200-621/622 10 Gbit/s Optical Modulator
How to Clean the Optical Input Connector of AQ2200-631 10 Gbit/s Optical Receiver
See “How to Clean the Optical Output Connector of the AQ2200-111 DFB-LD Module and AQ2200-112 LS Module.”

Precautions for Routine Use

To protect the optical interfaces, always strictly observe the following points during routine use.

- To prevent dust from adhering to the optical interfaces, always attach dust protection caps to the optical connectors and the instrument’s optical interfaces that are not being used.
- To prevent the connector end faces from getting dirty or being damaged, never touch the optical interfaces with anything (except when cleaning them or carrying out adjustments).
- When connecting the optical connectors, always insert them straight so that the connector end face does not touch the connector adapter, the nearby panel, or nearby components.

4.6 Recommended Replacement Parts

The following parts are susceptible to wear. We recommend replacing them at the following intervals. For part replacement, contact your nearest YOKOGAWA dealer.

Part Name	Recommended Replacement Interval	Notes
Cooling fan	40000 hours	
Lithium battery	3 years	If the instrument is turned off
ATTN module shutter	150000 times	AQ2200-311/311A/312/331/332 ATTN module

Part Name	Operating Life	Notes
LCD backlight	30000 hours*	Half brightness life for continuous use

* This is the operating life if the display adjustment “Back Light” setting is set to 5 (the default value).

4.7 Calibration

Periodic calibration is an effective means of keeping the instrument performing correctly for a long time and of detecting malfunctions at an early stage.
We recommend that you calibrate this instrument at least once a year.

- Calibration of the AQ2200-111
  Due to the properties of the semiconductors (semiconductor lasers) that the AQ2200-111 uses, the actual wavelength may deviate from the specified wavelength over time. To maintain consistent performance, calibrate and adjust the instrument once every six months.
  If YOKOGAWA calibrates the instrument, we can also perform adjustments as requested.
  If you calibrate the instrument, you can adjust it by entering the correction values that you obtained from the calibration into the instrument's CAL_Offset

4.8 Disposing of the Instrument

When disposing of the instrument, follow the laws and ordinances of your country or region.

5.1 AQ2211/AQ2212 Frame Controller

Performance and Functional Specifications

Item		Specifications
Number of slots		AQ2211: 3 AQ2212: 9
Display		Color LCD, 320 × 240 dots
Storage		
USB storage		USB Mass Storage Class flash memory. See “USB (for peripheral devices).”
Output format		
	Setup parameters	Proprietary format
	Measurement data	Log data: .csv Stability data: .csv Wavelength sweep data: .csv BERT log data: .txt Screen captures: .bmp, .jpg, and .png
Interface		
GP-IB	Electrical and mechanical specifications	Complies with IEEE488[1]
	Functional specifications	SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, and C0
	Protocol	Complies with IEEE488.2
	Code	ISO (ASCII)
	Mode	Addressable mode
	Addresses	0 to 30
	Clearing remote mode	The LOCAL soft key can be pressed to clear remote mode (except during Local Lockout).
Ethernet	Number of ports	1
	Connector type	RJ-45
	Electrical and mechanical specifications	Complies with IEEE802.3[1]
	Transmission system	Ethernet (100BASE-Tx)
	Transfer rate	100 Mbps max.
	Communication protocol	TCP/IP
	Supported services	DHCP and remote control. (Remote control supports a maximum of five users.)
	Ports	0 to 65535; port 10001 is reserved for the TMCTL protocol
USB (For connecting to a PC)	Number of ports	1
	Connector type	USB type B (receptacle)
	Electrical and mechanical specifications	Complies with USB Rev 1.1[1]
	Data rate	12 Mbps max.
	Supported protocols	USB-TMC
	Supported services	Remote control
	PC system requirements	The PC must be running Windows XP, or Windows Vista (32/64 bits), Windows 7 (32/64 bits), Windows 8 (32/64 bits) and must have a standard USB port.[2]
USB (For peripheral devices)	Number of ports	1
	Connector type	USB type A (receptacle)
	Electrical and mechanical specifications	Complies with USB Rev 2.0[1]
	Data rate	480 Mbps max.
	Compatible devices	USB Mass Storage Class flash memory
	Number of devices that can be connected	1
	Power supply	5 V, 500 mA
	Maximum usable capacity	2 TB (Disk partition style: MBR, Format: FAT32/FAT16)
Trigger unit	Connector type	BNC[1]
	Trigger in	TTL level input Input pulse width: 50 µs or greater Input impedance: approx. 5 kΩ
	Trigger out	TTL level output Output pulse width: approx. 50 µs Output impedance: approx. 100 Ω
Interlock connector unit	Connector type	BNC[1] Contact input

1 Use cables of 3 m or less in length.
2 A separate driver is required.

General Specifications

Item		Specifications
Operating environment		Ambient temperature: 5 to 40°C Ambient humidity: 20 to 80% RH (no condensation) Altitude: 2000 m or less
Storage environment		Ambient temperature: –20 to 60°C Ambient humidity: 20 to 80% RH (no condensation) Altitude: 3000 m or less
Recommended calibration period		1 year (including installed modules)
Rated supply voltage		100 to 240 VAC
Rated supply frequency		50/60 Hz
Maximum power consumption		AQ2211: 170 VA (including installed modules) AQ2212: 580 VA (including installed modules)
Withstand voltage (between the power supply and case)		1.5 kVAC for 1 minute
Insulation resistance (between the power supply and case)		500 VDC, 10 MΩ or greater
External dimensions		AQ2211: 212 (W) × 132.5 (H) × 400 (D) mm (excluding protrusions) AQ2212: 425 (W) × 132.5 (H) × 500 (D) mm (excluding protrusions)
Weight		AQ2211: approx. 6 kg (not including installed modules) AQ2212: approx. 11 kg (not including installed modules)
Safety standard	Compliant standard	EN 61010-1 Overvoltage category (installation category) II[1] Pollution degree 2[2] EN 60825-1 (Laser safety)
Emissions	Compliant standard	EN 61326-1 class A EN 55011 class A, group 1 EMC Regulatory Arrangement in Australia and New Zealand EN 55011 class A, group 1 Korea Electromagnetic Conformity Standard (한국 전자파적합성기준) EN 61000-3-2 EN 61000-3-3 This is a class A instrument designed for an industrial environment. Operation of this equipment in a residential area can cause radio interference, in which case users will be required to correct the interference.
	Cable conditions	• Interlock connector (REMOTE INTERLOCK) Use a BNC coaxial cable that is 3 m in length or less. • External trigger input terminal (TRIGGER IN) Use a BNC coaxial cable that is 3 m in length or less. • External trigger output terminal (TRIGGER OUT) Use a BNC coaxial cable that is 3 m in length or less. • USB port (type A) Use a shielded USB cable that is 3 m in length or less. • USB port (type B) Use a shielded USB cable that is 3 m in length or less. • Ethernet port Use a category 7 Ethernet cable that is 3 m in length or less.
Immunity	Compliant standard	EN 61326-1 Table 2 (for industrial locations)
	Cable conditions	Same as the emission cable conditions.
Environmental standard	Compliant Standard[3]	EN50581 Monitoring and control instruments including industrial monitoring and control instruments. Complied (735101, 735102, 735125, 735122, 735131, 735133, 735141, 735143, 735142, 735162, 735163, AQ2200112, AQ2200131, AQ2200132, AQ220202, AQ220232, AQ220242, AQ2200312, AQ2200332, AQ2200342)

1 The overvoltage category (installation category) is a value used to define the transient overvoltage condition and includes the rated impulse withstand voltage. Overvoltage category II applies to electrical equipment that is powered through a fixed installation, such as a switchboard.

2 The pollution degree refers to the degree of adhesion of a solid, liquid, or gas which deteriorates withstand voltage or surface resistivity. Pollution degree 2 applies to normal indoor atmospheres (with only non-conductive pollution).

3 The 735101 and 735102 do not comply with environment regulation standard EN50581:2012 when following modules are installed.

Model No	Module Name/Application Name	
810518901	AQ2200-111	DFB-LD Module
AQ2200131-T4	AQ2200-131	Grid TLS Module(suffix code is -T4 (standard) model)
AQ2200132-T4	AQ2200-131	Grid TLS Module(suffix code is -T4 (standard) model)
810518902	AQ2200-141	FP-LD Module
810518903	AQ2200-142	DUAL FP-LD Module
810518904	AQ2200-136	TLS Module
810518905	AQ2200-201	Interface Module
810518906	AQ2200-231	Optical Sensor Head (Long-Wavelength Sensor)
810518907	AQ2200-241	Optical Sensor Head (Short-Wavelength Sensor)
810518908	AQ2200-211	Sensor Module (High-Sensitivity Sensor)
735185	AQ2200-271	ORL Module
810518915	AQ2200-311	ATTN Module
810518801	AQ2200-601	BERT Module
810518802	AQ2200-621	10 Gbit/s Optical Modulator (Wavelength 1.55 µm)
810518804	AQ2200-622	10 Gbit/s Optical Modulator (Wavelength 1.31 µm)
810518803	AQ2200-631	10 Gbit/s Optical Receiver
735161	AQ2200-641	XFP Interface Module

5.2 AQ2200-111 DFB-LD Module

Performance and Functional Specifications

Item	Specifications
Center wavelength	1310 nm, 1490 nm: ±10 nm
	1524.111 to 1620.500 nm: As stated in the table of supported wavelengths
Specifiable wavelength range	1310, 1490, and 1524.111 to 1620.500 nm[1]
Wavelength accuracy[2, 17]	1310 nm, 1490 nm: ±0.05 nm or less
	1524.111 to 1620.500 nm: ±0.02 nm or less
Wavelength setting resolution	0.001 nm
Applicable optical fiber	SM (ITU-T G.652)
Spectrum line width[3]	NARROW: 5 MHz (typical)
	WIDE: 100 MHz (typical)
Optical output level[2, 4]	10 mW or greater
SMSR[3]	1310, 1490 nm: 30 dB or greater
	1524.111 to 1620.500 nm: 45 dB (typical)
Optical output level stability[5]	15 minutes: ±0.005 dB or less
	24 hours: ± 0.03 dB or less
Wavelength stability[2]	15 minutes: ±0.005 nm or less
	24 hours: ±0.01 nm or less
Wavelength adjustment width[2, 6]	1.6 nm or greater
Optical attenuation range	10 dB (in 0.01 dB steps)
RIN[3, 7]	–145 dB/Hz (typical)
Optical output modulation; internal CHOP modulation	
	Modulation frequency: 100 Hz to 300 kHz
Optical connector[8]	FC/Angled PC

Optional Specifications

Item	Specifications
High output option[2]	
Optical output[4, 16]	20 mW or greater
PMF option	
Polarization extinction ratio[9]	20 dB or greater
External sine modulation option[10, 16]	
Modulation frequency	100 Hz to 300 kHz
Input connector	SMA[12]
Input impedance	Approx. 50 Ω
Maximum input voltage	2 Vp-p
External CHOP modulation option[10, 16]	
Modulation frequency	100 Hz to 300 kHz
External modulation optical pulse delay time	1 µs (typical)[13, 14]
External modulation optical pulse rise time	1 µs or less[13, 15]
External modulation optical pulse fall time	1 µs (typical)[13, 15]
Input connector	SMA[12]
Input impedance	Approx. 2 kΩ
Input level	TTL level

General Specifications

Item	Specifications
Operating conditions	The same as the frame controller's operating environment
Temperature and humidity for storage	Ambient temperature: –20 to +60°C Ambient humidity: 20 to 80% RH (no condensation)
External dimensions	31 (W) × 117 (H) × 321.5 (D) mm (excluding protrusions; one slot)
Weight	Approx. 0.9 kg
Safety standard	EN 60825-1 class 1M

* All values in the specifications assume a warm-up period of one hour.

1 The range of wavelengths that you can specify complies with the ITU-T grid.

2 Ambient temperature: 23 ± 2°C (constant temperature), CW light, attenuation: 0.0 dB, center wavelength, outgoing point of connection fiber (FC/Angled PC-FC/SPC, 2 m, SMF), spectrum line width: NARROW

3 CW light, attenuation: 0.0 dB, center wavelength

4 When using the master cord

5 Ambient temperature: 23 ± 2°C (constant temperature), CW light, attenuation: 0.0 dB, center wavelength, outgoing point of connection fiber (FC/Angled PC-FC/SPC, 2 m, SMF), spectrum line width: WIDE

6 Setting resolution: 0.001 nm, reference wavelength: ±0.4 nm or greater

7 Spectrum line width: NARROW, frequency: 100 kHz to 2.5 GHz

8 Seiko Giken Angled PC or an equivalent (step type)

9 CW light, attenuation: 0.0 dB, spectrum line width: NARROW, outgoing end of the optical connector mounted on the panel

10 The external sine modulation option and external CHOP modulation option cannot be selected at the same time.

11 Input modulation signal: 2 Vp-p or less

12 Use a 50 Ω coaxial cable that is 3 m in length or less to connect the external modulation input connector.

13 Modulation signal: 100 Hz, attenuation: 0.0 dB, spectrum line width: NARROW

14 Modulated optical output delay time for the input modulation signal.

15 10 to 90% of the optical output signal rise or fall time.

16 You cannot select the high output and external modulation options for the 1490 nm wavelength.

17 During shipping (not including changes due to the passage of time)

DFB-LD Module Table of Supported Wavelengths

Optical frequency: THz, Wavelength: nm

Wavelength Code	Optical Frequency	Wavelength
M0290	191.60	1564.679
M0275	191.65	1564.271
M0270	191.70	1563.863
M0255	191.75	1563.455
M0250	191.80	1563.047
M0235	191.85	1562.640
M0230	191.90	1562.233
M0215	191.95	1561.826
M0210	192.00	1561.419
M0195	192.05	1561.013
M0190	192.10	1560.606
M0175	192.15	1560.200
M0170	192.20	1559.794
M0155	192.25	1559.389
M0150	192.30	1558.983
M0135	192.35	1558.578
M0130	192.40	1558.173
M0115	192.45	1557.768
M0110	192.50	1557.363
M0095	192.55	1556.959
M0090	192.60	1556.555
M0075	192.65	1556.151
M0070	192.70	1555.747
M0055	192.75	1555.343
M0050	192.80	1554.940
M0035	192.85	1554.537
M0030	192.90	1554.134
M0015	192.95	1553.731
M0010	193.00	1553.329
M0005	193.05	1552.926
M0000	193.10	1552.524
M000H	193.15	1552.122
M0020	193.20	1551.721
M0025	193.25	1551.319
M0040	193.30	1550.918
M0045	193.35	1550.517
M0060	193.40	1550.116
M0065	193.45	1549.715
M0080	193.50	1549.315
M0085	193.55	1548.915
M0100	193.60	1548.515
M0105	193.65	1548.115
M0120	193.70	1547.715
M0125	193.75	1547.316
M0140	193.80	1546.917
M0145	193.85	1546.518
M0160	193.90	1546.119
M0165	193.95	1545.720
M0180	194.00	1545.322
M0185	194.05	1544.924
M0200	194.10	1544.526
M0205	194.15	1544.128
M0220	194.20	1543.730
M0225	194.25	1543.333
M0240	194.30	1542.936
M0245	194.35	1542.539
M0260	194.40	1542.142
M0265	194.45	1541.746
M0280	194.50	1541.349
M0285	194.55	1540.953
M0300	194.60	1540.557
M0305	194.65	1540.162
M0320	194.70	1539.766
M0325	194.75	1539.371
M0340	194.80	1538.976
M0345	194.85	1538.581
M0360	194.90	1538.186
M0365	194.95	1537.792
M0380	195.00	1537.397
M0385	195.05	1537.003
M0400	195.10	1536.609
M0405	195.15	1536.216
M0420	195.20	1535.822
M0425	195.25	1535.429
M0440	195.30	1535.036
M0445	195.35	1534.643
M0460	195.40	1534.250
M0465	195.45	1533.858
M0480	195.50	1533.465
M0485	195.55	1533.073
M0500	195.60	1532.681
M0505	195.65	1532.290
M0520	195.70	1531.898
M0525	195.75	1531.507
M0540	195.80	1531.116
M0545	195.85	1530.725
M0560	195.90	1530.334
W1310	228.85	1310.000
W1490	201.203	1490.000

5.3 AQ2200-112 LS Module

Firmware version 3.08 and later

Performance and Functional Specifications

Item	Specifications			
Number of channel	1 or 2 channel			
Device type	DFB-LD			
Center wavelength [1, 2, 3, 5]	1310 nm ± 5 nm	1550 nm ± 5 nm	1625 nm ± 5 nm	1650 nm ± 5 nm
Optical output level [1, 2, 3, 6]	+10 dBm or more			
Optical level stability 5 minute [1, 2, 3, 6]	±0.005 dB			
Spectral linewidth [1, 2, 7]	Narrow: 10 MHz (typ.)			
	Wide: 100MHz (typ.)			
SMSR [1, 2, 3, 5]	35 dB or more			
RIN [1, 2, 3, 5, 7]	-135 dB/Hz (typ.)			
Optical attenuation range [1, 4, 6]	6 dB (resolution 0.01 dB (typ.))			
Fiber type	SMF (IYU-T G.652)			
Optical connector	FC/Angled PC			

General Specifications

Item	Specifications
Operating conditions	The same as the frame controller's operating environment
Temperature and humidity for storage	Ambient temperature: –20 to +60°C Ambient humidity: 20 to 80% RH (no condensation)
External dimensions	31 (W) × 117 (H) × 321.5 (D) mm (excluding protrusions; one slot)
Weight	Approx. 0.8 kg
Laser safety standard class	Class 1M (IEC 60825-1:2007, GB 7247.1-2012) Class 1 (EN 60825-1:2014)

* After 30 minutes warm up.

1 When a SM fiber is used.

2 At maximum output power

3 Ambient temperature: 23 ± 2°C

4 At constant temperature (within ±0.5°C)

5 Spectral linewidth: Narrow

6 Spectral linewidth: Wide

7 Characteristics

5.4 AQ2200-141/142 FP-LD Module

Performance and Functional Specifications

Item	Specifications	
	AQ2200-141	**AQ2200-142**
Center wavelength[1, 2]	1310 ± 20 nm (when 1310 nm is specified) 1550 ± 20 nm (when 1550 nm is specified)	1310 ± 20 nm, 1550 ± 20 nm
Applicable optical fiber	SM (ITU-T G.652)	
Spectrum width[1, 2, 3]	5 nm or less (when 1310 nm is specified) 10 nm or less (when 1550 nm is specified)	5 nm or less (when 1310 nm is specified) 10 nm or less (when 1550 nm is specified)
Optical output level[2]	+0 dBm or greater	–1 dBm or greater
Optical output level stability		
Temperature stability[2, 4]	0.2 dBp-p or less	0.3 dBp-p or less
Time stability[2]		
15 minutes[5]	±0.003 dB or less	±0.005 dB or less
24 hours:[6]	±0.03 dB or less	
Optical attenuation range	6 dB (in 0.01 dB steps)	
Optical output modulation Internal CHOP modulation frequency	270 Hz, 1 kHz, and 2 kHz	
Optical connector[7]	AQ9441 universal adapter	

General Specifications

Item	Specifications
Operating conditions	The same as the frame controller's operating environment
Temperature and humidity for storage	Ambient temperature: –20 to +60°C Ambient humidity: 20 to 80% RH (no condensation)
External dimensions	31 (W) × 117 (H) × 321.5 (D) mm (excluding protrusions; one slot)
Weight	Approx. 0.95 kg
Safety standard	EN 60825-1 class 1

* All values in the specifications assume a warm-up period of one hour.

1 Ambient temperature: 23 ± 2°C

2 CW light, attenuation: 0.0 dB, outgoing point of connection fiber (FC/SPC-FC/SPC, 2 m, SMF)

3 RMS (2 σ, –20 dB)

4 5 to 40°C (8 hours)

5 Constant temperature (one temperature from 20 to 30°C)

6 5 to 40 ± 1°C

7 Select either FC or SC

5.5 AQ2200-131/132 Grid TLS Module

-T2/-T4: Firmware version 3.00 and later
-T6: Firmware version 3.05 and later

Performance and Functional Specifications

Item		Specifications	
		Suffix code -T2/-T6	**Suffix code -T4**
Number of channel	C, L-Band	1 (AQ2200-131) or 2 (AQ2200-132)	
Device type	C, L-Band	Advanced type	Standard type
Frequency (Wavelength) range	C-Band	196.25 THz to 191.50 THz (1527.60 nm to 1565.50 nm)	196.10 THz to 191.70 THz (1528.77 nm to 1563.86 nm)
	L-Band	190.95 THz to 186.35THz (1570.01 nm to 1608.76 nm)	190.90 THz to 186.50 THz (1570.42 nm to 1607.47 nm)
Grid spacing	C, L-Band	100 GHz, 50 GHz, 25 GHz and Manual (min. 0.1 GHz)	100 GHz, 50 GHz
Frequency (Wavelength) setting resolution	C-Band	0.1 GHz (0.8 pm@1550 nm)	—
	L-Band	0.1 GHz (0.8 pm@1590 nm)	
Frequency (Wavelength) fine turning range	C-Band	Typ. ±6 GHz (±48 pm@1550 nm)	—
	L-Band	Typ. ±6 GHz (±51 pm@1590 nm)	
Frequency (Wavelength) fine turning resolution	C-Band	Typ. 1 MHz (8 fm@1550 nm)	—
	L-Band	Typ. 1 MHz (8 fm@1590 nm)	
Absolute frequency (Wavelength) accuracy[1, 2, 3, 4]	C-Band	±2.5 GHz (±20 pm@1550 nm)	±2.5 GHz (±20 pm@1550 nm)
	L-Band	±2.5 GHz (±21 pm@1590 nm)	±2.5 GHz (±21 pm@1590 nm)
Frequency (Wavelength) tuning time[5]	C-Band	30 seconds or less	
	L-Band		
Frequency (Wavelength) stability (24 hours)[1, 2, 4, 6]	C-Band	Typ. ±0.3 GHz (±2.4 pm@1550 nm)	Typ. ±0.3 GHz (±2.4 pm@1550 nm)
	L-Band	Typ. ±0.3 GHz (±2.5 pm@1590 nm)	Typ. ±0.3 GHz (±2.5 pm@1590 nm)
Optical output level[1, 2, 3, 4]	C-Band	≥ +12.5 dBm	≥ +12.0 dBm
	L-Band	≥ +12.5 dBm	≥ +9.0 dBm
Attenuation range	C, L-Band	6 dB (Resolution Typ. 0.01)	4 dB (Resolution Typ. 0.1)
Output level stability (24 hours)[1, 2, 4, 6]	C, L-Band	Typ. ±0.03 dB	Typ. ±0.03 dB
Spectral Linewidth[4, 7]	C, L-Band	Typ. 100 kHz	Typ. 3 MHz
SMSR[4, 7]	C, L-Band	Typ. 45 dB	Typ. 45 dB
RIN[4, 7, 8]	C-Band	Typ. –145 dB/Hz	Typ. –135 dB/Hz
	L-Band	Typ. –145 dB/Hz	Typ. –130 dB/Hz
Fiber type	C, L-Band	PANDA PMF Slow axis, in line with connector key	
Optical connector[9, 10]	C, L-Band	Select any of FC/PC[9] or FC/Angled PC[10]	
Dither function: SBS suppression dither frequency[11]	C, L-Band	-T2: 20.8 kHz, -T6: —	—
Dither function: SBS suppression FM modulation range[11]	C, L-Band	-T2: 0 to 1000 MHz, -T6: —	—
External dimensions	C, L-Band	31 (W) × 117 (H) × 321.5 (D) mm (excluding protrusions; one slot)	
Weight	C, L-Band	Approx. 0.8 kg	
Laser safety standard class	C, L-Band	Class 1M (IEC 60825-1:2007, GB 7247.1-2012) Class 1 (EN 60825-1:2014)	

General Specifications

Item	Specifications
Operation environment	Ambient temperature: 5 to 40°C, Ambient humidity: 20 to 80% RH (no condensation)
Storage environment	Ambient temperature: –20 to 60°C, Ambient humidity: 20 to 80% RH (no condensation)

After 30 minutes warm up.

The environmental conditions are subject to the specification of frame controller, unless otherwise specified

1 When a PM fiber is used.
2 Advanced type: At grid mode on, A grid spacing is except a manual setting.
3 Ambient temperature: 23 ± 5°C
4 At maximum output power
5 Excludes settings made by the frequency (wavelength) fine adjustment function (only for -T6).
6 At constant temperature (within ±0.5°C)
7 Dither function: OFF
8 20 MHz to 10 GHz
9 Optical return loss: 40 dB or more
10 Step type, narrow key
11 Characteristics

5.6 AQ2200-136 TLS Module

Performance and Functional Specifications

Item	Specifications
Variable wavelength width	1440 to 1640 nm
Wavelength setting resolution	1 pm
Absolute wavelength accuracy	≤ ±100 pm[1, 2]
Relative wavelength accuracy	≤ ±50 pm[1, 2]
Wavelength stability (over time)	±5 pm/h[4, 8, 10]
Spectrum line width	
NARROW	≤ 1 MHz[3, 4, 12]
WIDE	≥ 50 MHz[2, 4, 12]
Optical output	
Maximum output wavelength	≥ +7 dBm[2, 12]
1520 to 1610 nm	≥ +5 dBm[2, 12]
1475 to 1625 nm	≥ +1 dBm[2, 12]
Full-wavelength range	≥ –8 dBm[2, 12]
Optical output stability	
5 minutes	≤ ±0.01 dB[2, 6, 7, 10, 12]
1 hour	≤ ±0.05 dB[2, 6, 7, 10, 12]
24 hours	≤ ±0.1 dB[2, 6, 7, 10, 12]
Optical output reproducibility (for each wavelength)	≤ ±0.04 dB[2, 6, 7, 10, 12]
Variable optical output range	≥ 4 dB[5, 9, 12]
MONITOR output	
Maximum optical output	≤ +5 dBm[11]
Minimum optical output	≥ –25 dBm
Wavelength sweep speed	50 nm/s (maximum)
Applicable optical fiber	SM (ITU-T G.652)
Optical connector	FC/Angled PC[13]

General Specifications

Item	Specifications
Operating temperature range	+10 to +35°C[14]
Storage temperature range	–10 to +50°C
Humidity conditions	20 to 80% RH (no condensation)
External dimensions	62.5 (W) × 117 (H) × 321.5 (D) mm (excluding protrusions; two slots)
Weight	Approx. 2 kg
Safety standard	EN 60825-1 class 1M

Unless otherwise specified, the specification values have been obtained under reference operating conditions,[15] with a 2m SMF output point, and after calibration has been completed one hour after OPT ON.

1 ±2 σ, line width: NARROW
2 At maximum optical output
3 At minimum optical output
4 Wavelength: 1590 nm
5 Wavelength: 1560 to 1610 nm
6 Wavelength: 1460 to 1620 nm
7 Line width: WIDE
8 Line width: NARROW
9 In 0.1 dB steps
10 Constant temperature
11 When using the MONITOR connector
12 When using the OUTPUT connector
13 Seiko Giken Angled PC or an equivalent (step type)
14 The frame controller's guaranteed operating temperature range is +5 to 40°C, but it is limited when this module is installed.
15 Ambient temperature: 23 ± 2°C, temperature change rate: 1°C/10 minutes or 3°C/hour, humidity: 50 ± 5%

5.7 AQ2200-201 Interface Module

Performance and Functional Specifications

Item	Specifications
Number of channels	One AQ2200-231 or AQ2200-241 can be connected.
Analog output	Ambient temperature: –20 to +60°C
Outpu voltage range	Approx. 0 to 2 V
Output impedance	Approx. 1 kΩ
Connector type	Mini plug

General Specifications

Item	Specifications
Operating conditions	The same as the frame controller's operating environment
Temperature and humidity for storage	Ambient temperature: –20 to +60°C
	Ambient humidity: 20 to 80% RH (no condensation)
External dimensions	31 (W) × 117 (H) × 321.5 (D) mm (excluding protrusions; one slot)
Weight	Approx. 0.8 kg

5.8 AQ2200-202 Interface Module

Performance and Functional Specifications

Item	Specifications
Number of channels	Up to two AQ2200-232 or AQ2200-242 can be connected. • When AQ2200-232 is connected: Available in the frame controller's firmware version 3.05 and later • When AQ2200-242 is connected: Available in the frame controller's firmware version 3.06 and later and AQ2200-202's firmware version 2.00 and later
Analog output	Ambient temperature: –20 to +60°C
Outpu voltage range	Approx. 0 to 2 V / 0 to 5 V
Output impedance	Approx. 100 Ω
Connector type	BNC connector

General Specifications

Item	Specifications
Operating conditions	The same as the frame controller's operating environment
Temperature and humidity for storage	Ambient temperature: –20 to +60°C Ambient humidity: 20 to 80% RH (no condensation)
External dimensions	31 (W) × 117 (H) × 321.5 (D) mm (excluding protrusions; one slot)
Weight	Approx. 0.5 kg

5.9 AQ2200-231/241 Optical Sensor Head

Performance and Functional Specifications

Item	Specifications	
	AQ2200-231	**AQ2200-241**
Photo sensor element	InGaAs, 5 mm diameter	Si, 10 mm diameter
Measurement wavelength range	800 to 1700 nm	400 to 1100 nm
Power range	CW light: –90 to +10 dBm CHOP light: –90 to +7 dBm	
Minimum display resolution	1/10000	
Applicable optical fiber[1]	≤ 100/140 µm (SI), NA ≤ 0.3	≤ 200/230 µm (SI), NA ≤ 0.5
Uncertainty at reference conditions	±2%[2]	±2.5%[3]
Total uncertainty	±3.5% ± 50 pW[4]	±5% ± 50 pW[5]
Polarization dependence	0.025 dBp-p or less[6]	
Nonlinearity	±0.015 dB ± 50 pW[7]	±0.05 dB ± 50 pW[8]
Noise level[9, 10]		
CW light	50 pW or less	
CHOP light	50 pW or less	
Averaging time (minimum)	100 µs	
Analog output		
AUTO mode	Approx. 0 to 2 V, proportional to the measurement power (W) for each power range	
LINEAR mode	Approx. 0 to 2 V, proportional to the range set for measurement power (W)	
LOG mode	Approx. 0 to 2 V, proportional to the range set for measurement power (dBm)	
Connector type	Mini plug	
Output impedance	Approx. 1 kΩ	
Optical connector[11]	AQ9335C connector adapter	
Logging measurement		
Measurement power range	Fixed	
Minimum data sampling interval	100 µs	
Maximum number of data samples	20000	
Stability measurement		
Minimum data sampling interval	100 ms	
Maximum number of data samples	20000	
Maximum measurement time	99 days	

General Specifications

Item	Specifications
Operating conditions	The same as the frame controller's operating environment
Temperature and humidity for storage	
Ambient temperature	–20 to +60°C
Ambient humidity	20 to 80% RH (no condensation)
External dimensions	61 (W) × 42 (H) × 100 (D) mm (excluding protrusions)
Weight	Approx. 0.3 kg

* All values in the specifications assume a warm-up period of one hour.

1 Depends on the AQ9335C* and the diameter of the light receiving sensor. You can also perform atmospheric light measurements by removing the connector adapter.

2 Reference conditions:
- Power level: 100 µW (–10 dBm), CW light
- Wavelength: 1310 ± 20 nm
- Light source spectrum width: 10 nm or less
- Ambient temperature: 23 ± 2°C
- Optical fiber: SM (ITU-T G.652)
- Optical connector: FC/PC
- Wavelength setting error: 0.5 nm or less
- Changes to the measuring instrument due to the passage of time are not included in these conditions. Add 0.5% for each year since the last calibration.

3 Reference conditions:
- Power level: 100 µW (–10 dBm), CW light
- Wavelength: 850 ± 10 nm
- Light source spectrum width: 10 nm or less
- Ambient temperature: 23 ± 2°C
- Optical fiber: SM (ITU-T G.652)
- Optical connector: FC/PC
- Wavelength setting error: 0.5 nm or less
- Changes to the measuring instrument due to the passage of time are not included in these conditions. Add 0.5% for each year since the last calibration.

4 Operating conditions:
- Power level: 1 nW to 10 mW (–60 to +10 dBm), CW light
- Wavelength range: 1200 to 1600 nm (add ±3% for wavelengths less than 1200 nm; add ±30 pW for wavelengths from 1600 to 1650 nm)
- Optical fiber: ≤ GI 50 µm, NA ≤ 0.2 (add ±1.5% if SI 100 µm and NA ≤ 0.3)
- Range: Auto range
- Averaging: 1 second
- Other operating conditions are the same as the reference conditions listed in note 2.

5 Operating conditions:
- Power level: 1 nW to 10 mW (–60 to +10 dBm), CW light
- Wavelength range: 500 to 900 nm (add ±2% ± 100 pW if the wavelength is less than 500 nm or greater than 900 nm)
- Optical fiber: ≤ GI 50 µm, NA ≤ 0.2 (add ±1.5% if SI 200 µm and NA ≤ 0.5)
- Range: Auto range
- Averaging: 1 second
- Other conditions are the same as the reference conditions listed in note 3

6 Conditions:
- Wavelength: 1550 nm
- Ambient temperature: 23 ± 2°C
- Optical fiber: SM (ITU-T G.652)
- Optical connector: FC/PC

7 Conditions:
- Power level: 1 nW to 10 mW (–60 to +10 dBm), CW light
- Wavelength range: 1200 to 1600 nm (add ±30 pW for wavelengths from 1600 to 1650 nm)
- Ambient temperature: 23 ± 2°C (constant temperature)
- Optical fiber: SM (ITU-T G.652)
- Range: Auto range
- Averaging: 1 second

8 Conditions:
- Power level: 1 nW to 10 mW (–60 to +10 dBm), CW light
- Wavelength range: 500 to 900 nm (add ±2% ± 100 pW if the wavelength is less than 500 nm or greater than 900 nm)
- Ambient temperature: 23 ± 2°C (constant temperature)
- Optical fiber: SM (ITU-T G.652)
- Range: Auto range
- Averaging: 1 second

9 Conditions for the AQ2200-231:
- Wavelength range: 1200 to 1600 nm (add ±30 pW for wavelengths from 1600 to 1650 nm)
- Ambient temperature: 23 ± 2°C (constant temperature)
- Averaging: 1 second

10 Conditions for the AQ2200-241:
- Wavelength range: 500 to 900 nm (add ±100 pW if the wavelength is less than 500 nm or greater than 900 nm)
- Ambient temperature: 23 ± 2°C (constant temperature)
- Averaging: 1 second

11 Select FC, SC, or ST

5.10 AQ2200-232/242 Optical Sensor Head

Performance and Functional Specifications

Item	Specifications	
	AQ2200-232	**AQ2200-242**
Number of channels	1	
Photo sensor element	InGaAs, 5 mm diameter	Si, 5.8 mm × 5.8 mm
Measurement wavelength range	A800 to 1700 nm	400 to 1100 nm
Power range	–90 to +15 dBm[1, 2]	–90 to +10 dBm
Minimum display resolution	1/10000	
Applicable optical fiber[3]	SMF (ITU-T G.652) MMF (GI 50/125) (ITU-T G.651.1) MMF (GI 62.5/125) (IEC 60793-2)	SMF MMF (GI 50/125) (ITU-T G.651.1) MMF (GI 62.5/125) (IEC 60793-2)
Uncertainty at reference conditions	±1.8%[4]	±2.5%[5]
Total uncertainty[6, 7]	±5% ± 5 pW	
Polarization dependence	0.025 dBp-p(typ.)[8]	Not specified
Linearity	±0.015 dB ± 5 pW[9, 10]	±0.04 dB ± 5 pW (850 nm)[11, 12]
Noise level[13, 14]	5 pW (-83 dBm) or less	
Optical connector[15]	AQ9335C connector adapter	
Recommended calibration period	1 year	
Warm-up Time	1 hour	

General Specifications

Item	Specifications
Operating conditions	The same as the frame controller's operating environment
Temperature and humidity for storage	
Ambient temperature	–20 to +60°C
Ambient humidity	20 to 80% RH (no condensation)
External dimensions	61 (W) × 46 (H) × 100 (D) mm (excluding protrusions)
Weight	Approx. 0.3 kg

* All values in the specifications assume a warm-up period of one hour.

1 Power display range at 1310 nm.

2 Up to +11 dBm can be displayed in the auto range setting and up to +15 dBm in the hold range setting.

3 When use the AQ9335C* connector adapter. You can also perform atmospheric light measurements by removing the connector adapter.

4 Reference conditions:
- Power level: 100 µW (–10 dBm), CW light
- Wavelength: 1310 ± 20 nm
- Optical fiber: SMF (ITU-T G.652), NA=0.1
- Optical connector: FC/PC
- Light source spectrum width: 10 nm or less
- Averaging: 1 second
- Ambient temperature: 23 ± 2°C
- Polarization dependence (PDL): not includ
- Wavelength setting error: 0.5 nm or less
- Changes to the measuring instrument due to the passage of time are not included in these conditions (1 year or more after calibration but less than 2 years: add 0.4%, 2 years or more: add 0.8%).

5 Reference conditions:
- Power level: 100 µW (–10 dBm), CW light
- Wavelength: 850 ± 15 nm
- Optical fiber: SMF for 850 nm (Mode field diameter: 5.0 ±0.5 µm@850 nm, NA: 0.14 (typ.))
- Optical connector: FC/PC
- Light source spectrum width: 10 nm or less
- Averaging: 1 second
- Ambient temperature: 23 ± 2°C
- Polarization dependence (PDL): Not specified
- Wavelength setting error: 0.5 nm or less
- Changes to the measuring instrument due to the passage of time are not included in these conditions (1 year or more after calibration but less than 2 years: add 0.4%, 2 years or more: add 0.8%).

6 Operating conditions for the AQ2200-232:
- Power level: 1 nW to 10 mW (–60 to +10 dBm), CW light
- Wavelength range: 1000 to 1630 nm
- Optical fiber: ≤ GI 50 µm, NA ≤ 0.2 (add ±1% if GI 62.5 µm and NA ≤ 0.275)
- Range: Auto range
- Ambient temperature: 23 ± 5°C
- Other operating conditions are the same as the reference conditions listed in note 4.

7 Operating conditions for the AQ2200-242:
- Power level: 1 nW to 10 mW (–60 to +10 dBm), CW light
- Wavelength range: 500 to 900 nm
- Optical fiber: ≤ GI 50 µm, NA ≤ 0.2
- Ambient temperature: 23 ± 5°C
- Addition of uncertainty when changing conditions: add ±1.0% for MMF (GI 62.5/125) and NA ≤ 0.275
  add ±2.0% for 900 nm to 1000 nm
- Other operating conditions are the same as the reference conditions listed in note 5.

8 Conditions:
- Wavelength: 1550 nm
- Ambient temperature: 23 ± 2°C
- Optical fiber: SM (ITU-T G.652)
- Optical connector: FC/PC

9 When used with spatial light input, if the power density at the light-detecting surface is high, a value less than the actual input power may be displayed due to the saturation of the photodiode. Moreover, high power density can cause a malfunction. Use the instrument in a way that keeps the power density at the light-detecting surface from exceeding 30 mW/mm^2.

10 Conditions:
- Power level: 1 nW to 10 mW (–60 to +10 dBm), CW light
- Wavelength range: 1000 to 1630 nm
- Ambient temperature: 23 ± 2°C (constant temperature)
- Optical fiber: SM (ITU-T G.652)
- Range: Auto range
- Averaging: 1 second
- Optical connector: FC/PC

11 When used with spatial light input, if the power density at the light-detecting surface is high, a value less than the actual input power may be displayed due to the saturation of the photodiode. Moreover, high power density can cause a malfunction. Use the instrument in a way that keeps the power density at the light-detecting surface from exceeding 5 mW/mm^2.

12 Conditions:
- Power level: 1 nW to 10 mW (–60 to +10 dBm), CW light
- Wavelength range: 500 to 900 nm
- Ambient temperature: 23 ± 2°C (constant temperature)
- Optical fiber: SMF for 850 nm (Mode field diameter: 5.0 ±0.5 µm@850 nm, NA = 0.14 (typ.))
  MMF (GI 50/125) (ITU-T G.651.1), NA = 0.2 (typ.)
  MMF (GI 62.5/125) (IEC 60793-2), NA = 0.275 (typ.)
- Range: Auto range
- Averaging: 1 second
- Optical connector: FC/PC

13 Conditions for the AQ2200-232:
- Wavelength range: 1000 to 1630 nm
- Ambient temperature: 23 ± 2°C (constant temperature)
- Averaging: 1 second
- 5 minutes after zero setting

14 Conditions for the AQ2200-242:
- Wavelength range: 500 to 900 nm
- Ambient temperature: 23 ± 2°C (constant temperature)
- Averaging: 1 second
- 5 minutes after zero setting

15 Select FC, SC, LC, or MU

5.11 AQ2200-211 Sensor Module

Performance and Functional Specifications

Item	Specifications
Photo sensor element	InGaAs
Measurement wavelength range	700 to 1700 nm
Power range	
CW light	–110 to +10 dBm
CHOP light	–110 to +7 dBm
Minimum display resolution	1/10000
Applicable optical fiber	≤ 62.5/125 µm (GI), NA ≤ 0.275
Uncertainty at reference conditions[1]	±2%
Total uncertainty[2]	±3.5% ± 0.5 pW
Polarization dependence[3]	0.005 dBp-p or less
Nonlinearity[4]	±0.015 dB ± 0.2 pW
Noise level[5]	
CW light	0.2 pW or less
CHOP light	0.2 pW or less
Averaging time (minimum)	100 µs
Analog output[6]	
AUTO mode	Approx. 0 to 2 V, proportional to the measurement power (W) for each power range
LINEAR mode	Approx. 0 to 2 V, proportional to the range set for measurement power (W)
LOG mode	Approx. 0 to 2 V, proportional to the range set for measurement power (dBm)
Connector type	Mini plug
Output impedance	Approx. 1 kΩ
Optical connector[7]	AQ9447* connector adapter
Logging measurement	
Measurement power range	Fixed
Minimum data sampling interval	100 µs
Maximum number of data samples	20000
Stability measurement	
Minimum data sampling interval	100 ms
Maximum number of data samples	20000
Maximum measurement time	99 days

General Specifications

Item	Specifications
Operating conditions	The same as the frame controller’s operating environment
Temperature and humidity for storage	
Ambient temperature	–20 to +60°C
Ambient humidity	20 to 80% RH (no condensation)
External dimensions	31 (W) × 117 (H) × 321.5 (D) mm (excluding protrusions; one slot)
Weight	Approx. 0.8 kg

* All values in the specifications assume a warm-up period of one hour.

1 Reference conditions:
- Power level: 100 µW (–10 dBm), CW light
- Wavelength: 1310 ± 20 nm
- Light source spectrum width: 10 nm or less
- Ambient temperature: 23 ± 2°C
- Optical fiber: SM (ITU-T G.652)
- Optical connector: FC/PC
- Wavelength setting error: 0.5 nm or less
- Changes to the measuring instrument due to the passage of time are not included in these conditions. Add 0.5% for each year since the last calibration.

2 Operating conditions:
- Power level: 10 mW to 100 pW (–70 to +10 dBm), CW light
- Wavelength range: 1200 to 1600 nm (add ±3% for wavelengths less than 1200 nm; add ±0.3 pW for wavelengths from 1600 to 1650 nm)
- Optical fiber: ≤ GI 50 µm, NA ≤ 0.2 (add ±1.5% if GI 62.5 µm and NA ≤ 0.275)
- Range: Auto range
- Averaging: 1 second
- Other conditions are the same as the reference conditions.

3 Conditions:
- Wavelength range: 1550 ± 30 nm
- Ambient temperature: 23 ± 2°C
- Optical fiber: SM (ITU-T G.652)
- Optical connector: FC/PC

4 Conditions:
- Power level: 10 mW to 100 pW (–70 to +10 dBm), CW light
- Wavelength range: 1200 to 1600 nm (add ±0.3 pW for wavelengths from 1600 to 1650 nm)
- Ambient temperature: 23 ± 2°C (constant temperature)
- Optical fiber: SM (ITU-T G.652)
- Range: Auto range
- Averaging: 1 second

5 Conditions:
- Wavelength range: 1200 to 1600 nm (add ±0.3 pW for wavelengths from 1600 to 1650 nm)
- Ambient temperature: 23 ± 2°C (constant temperature)
- Averaging: 1 second

6 Output impedance: approx. 1 kΩ

7 Select FC, SC, or ST

5.12 AQ2200-215 Sensor Module

Performance and Functional Specifications

Item	Specifications
Photo sensor element	InGaAs
Measurement wavelength range	970 to 1660 nm
Power range	–70 to +30 dBm
Minimum display resolution	1/10000
Applicable optical fiber	≤ 62.5/125 µm (GI), NA ≤ 0.275
Uncertainty at reference conditions[1]	±3%
Total uncertainty[2, 7]	±5% ± 2 nW
Polarization dependence[3]	0.03 dBp-p (typical)
Nonlinearity[4, 7]	±0.05 dB ± 2 nW
Noise level[5]	2 nW or less
Averaging time (minimum)	100 µs
Analog output	
AUTO mode	Approx. 0 to 2 V, proportional to the measurement power (W) for each power range
LINEAR mode	Approx. 0 to 2 V, proportional to the range set for measurement power (W)
LOG mode	Approx. 0 to 2 V, proportional to the range set for measurement power (dBm)
Connector type	Mini plug
Output impedance	Approx. 1 kΩ
Optical connector[6]	AQ9335C* connector adapter
Logging measurement	
Measurement power range	Fixed
Minimum data sampling interval	100 µs
Maximum number of data samples	20000
Stability measurement	
Minimum data sampling interval	100 ms
Maximum number of data samples	20000
Maximum measurement time	99 days

General Specifications

Item	Specifications
Operating conditions	The same as the frame controller’s operating environment
Temperature and humidity for storage	
Ambient temperature	–20 to +60°C
Ambient humidity	20 to 80% RH (no condensation)
External dimensions	31 (W) × 117 (H) × 321.5 (D) mm (excluding protrusions; one slot)
Weight	Approx. 0.7 kg

* All values in the specifications assume a warm-up period of one hour.

1 Reference conditions:
- Power level: 100 µW (–10 dBm), CW light
- Wavelength: 1310 ± 20 nm
- Light source spectrum width: 10 nm or less
- Ambient temperature: 23 ± 2°C
- Optical fiber: SM (ITU-T G.652)
- Optical connector: FC/PC
- Wavelength setting error: 0.5 nm or less
- Changes to the measuring instrument due to the passage of time are not included in these conditions. Add 0.5% for each year since the last calibration.

2 Operating conditions:
- Power level: 1 µW to 1 W (–30 to +30 dBm), CW light
- Wavelength range: 1260 to 1620 nm
- Optical fiber: ≤ GI 50 µm, NA ≤ 0.2 (add ±2% if GI 62.5 µm and NA ≤ 0.275)
- Range: Auto range
- Averaging: 1 second
- Other conditions are the same as the reference conditions.

3 Conditions:
- Wavelength range: 1550 ± 30 nm
- Ambient temperature: 23 ± 2°C
- Optical fiber: SM (ITU-T G.652)
- Optical connector: FC/PC

4 Conditions:
- Power level: 1 µW to 1 W (–30 to +30 dBm), CW light
- Wavelength range: 1260 to 1620 nm
- Ambient temperature: 23 ± 2°C (constant temperature)
- Optical fiber: SM (ITU-T G.652)
- Range: Auto range
- Averaging: 1 second

5 Conditions:
- Wavelength range: 1260 to 1620 nm
- Ambient temperature: 23 ± 2°C (constant temperature)
- Averaging: 1 second

6 Select FC, SC, ST, LC, or MU

7 Add 0.001 dB/mW (typical) if the input power is greater than 10 mW.

5.13 AQ2200-221 Sensor Module

Performance and Functional Specifications

Item	Specifications
Photo sensor element	InGaAs, 3 mm diameter
Measurement wavelength range	800 to 1700 nm
Power range	–70 to +10 dBm
Minimum display resolution	1/10000
Applicable optical fiber	≤ 62.5/125 µm (GI), NA ≤ 0.275
Uncertainty at reference conditions[1]	±3%
Total uncertainty[2]	±5% ± 50 pW
Polarization dependence[3]	0.02 dBp-p (typical)
Nonlinearity[4]	±0.02 dB ± 50 pW
Noise level[5]	50 pW or less
Averaging time (minimum)	200 µs
Optical connector[6]	AQ9335C connector adapter
Logging measurement	
Measurement power range	Fixed
Minimum data sampling interval	200 µs
Maximum number of data samples	10000 data samples per channel
Stability measurement	
Minimum data sampling interval	100 ms
Maximum number of data samples	10000 data samples per channel
Maximum measurement time	99 days

General Specifications

Item	Specifications
Operating conditions	The same as the frame controller's operating environment
Temperature and humidity for storage	
Ambient temperature	–20 to +60°C
Ambient humidity	20 to 80% RH (no condensation)
External dimensions	31 (W) × 117 (H) × 321.5 (D) mm (excluding protrusions; one slot)
Weight	Approx. 0.9 kg

* All values in the specifications assume a warm-up period of one hour.

1 Reference conditions:
- Power level: 100 µW (–10 dBm), CW light
- Wavelength: 1310 ± 20 nm
- Light source spectrum width: 10 nm or less
- Ambient temperature: 23 ± 1°C
- Optical fiber: SM (ITU-T G.652)
- Optical connector: FC/PC
- Wavelength setting error: 0.5 nm or less
- Changes to the measuring instrument due to the passage of time are not included in these conditions. Add 0.5% for each year since the last calibration.

2 Operating conditions:
- Power level: 100 nW to 10 mW (–40 to +10 dBm), CW light
- Wavelength range: 1200 to 1600 nm (add ±3% for wavelengths less than 1200 nm; add ±30 pW for wavelengths from 1600 to 1650 nm)
- Optical fiber: ≤ GI 50 µm, NA ≤ 0.2 (add ±2% if GI 62.5 µm and NA ≤ 0.275)
- Range: Auto range
- Averaging: 1 second
- Other conditions are the same as the reference conditions.

3 Conditions:
- Wavelength range: 1550 ± 30 nm
- Ambient temperature: 23 ± 1°C
- Optical fiber: SM (ITU-T G.652)
- Optical connector: FC/PC

4 Conditions:
- Power level: 100 nW to 10 mW (–40 to +10 dBm), CW light
- Wavelength range: 1200 to 1600 nm (add ±30 pW for wavelengths from 1600 to 1650 nm)
- Ambient temperature: 23 ± 1°C (constant temperature)
- Optical fiber: SM (ITU-T G.652)
- Range: Auto range
- Averaging: 1 second

5 Conditions:
- Wavelength range: 1200 to 1600 nm (add ±30 pW for wavelengths from 1600 to 1650 nm)
- Ambient temperature: 23 ± 1°C (constant temperature)
- Averaging: 1 second

6 Select FC, SC, ST, LC, or MU

5.14 AQ2200-271 ORL Module

Performance and Functional Specifications

Item	Specifications
Wavelength range	1310 ± 30 nm, 1550 ± 30 nm
Directivity	68 dB or greater
Applicable optical fiber	SMF
Compliant optical measurement connector	SC/Angled PC
Compliant light source and sensor connector	FC/PC

General Specifications

Item	Specifications
Operating conditions	The same as the frame controller's operating environment
Temperature and humidity for storage	
Ambient temperature	–20 to +60°C
Ambient humidity	20 to 80% RH (no condensation)
External dimensions	31 (W) × 117 (H) × 321.5 (D) mm (excluding protrusions; one slot)
Weight	Approx. 0.7 kg

Return Loss Measurement Specifications

Item	Specifications	
System configuration		
Light source used	AQ2200-141 or AQ2200-142	
Sensor used	AQ2200-211	AQ2200-221
Wavelength range[1]	1310 ± 30 nm, 1550 ± 30 nm	
Measured dynamic range[2]	65 dB or greater	55 dB or greater
Relative measurement uncertainty[2, 3]		
RL ≤ 50 dB	±0.3 dB	±0.7 dB
RL ≤ 60 dB	±0.6 dB	–
Applicable optical fiber	SMF	
Compliant light source connector	FC/PC	
Compliant measurement connector	AC/Angled PC	

1 Depends on the wavelength of the light source used

2 23 ± 2°C when using a reference reflector and a YOKOGAWA-specified master cord at the Fresnel reflection reference. During use after calibration.

3 ±2 σ

5.15 AQ2200-311 ATTN Module

Performance and Functional Specifications

Item	Specifications	
Wavelength range	1200 to 1700 nm	
Insertion loss	1.0 dB (typical)[1, 2, 3, 4]	1.6 dB or less[1, 2, 3]
Maximum attenuation	60 dB	
Attenuation accuracy	± 0.1 dB or less[2, 3, 5, 6]	
Reproducibility	± 0.01 dB or less[1, 2, 7, 12]	
Display resolution	0.001 dB	
Return loss		
PC	45 dB or greater[3, 5, 8]	
Angled PC	60 dB or greater[3, 5, 9]	
Polarization dependence	0.08 dBp-p or less[3, 5]	
Maximum input power	+23 dBm	
Shutter isolation	90 dB or greater	
Applicable optical fiber	SM (ITU-T G.652)	
Optical connector	FC/PC, SC/PC, FC/Angled PC, SC/Angled PC	

Optional Specifications

Item	Specifications
Monitor port option	
Monitor port output[10]	–13 dB (typical)
Insertion loss (output)	2.3 dB or less[1, 2, 3]
Return loss[11]	50 dB or greater[3, 5]
Polarization dependence (output)	0.1 dBp-p or less[3, 5]

General Specifications

Item	Specifications
Operating conditions	The same as the frame controller's operating environment
Temperature and humidity for storage	
Ambient temperature	–20 to +60°C
Ambient humidity	20 to 80% RH (no condensation)
External dimensions	31 (W) × 117 (H) × 321.5 (D) mm (excluding protrusions; one slot)
Weight	Approx. 0.9 kg

* All values in the specifications assume a warm-up period of one hour. Unless otherwise noted, all specified values include connectors.

1 Wavelength: 1550 ± 15 nm, 1310 ± 15 nm
2 Ambient temperature: 23 ± 2°C (constant temperature)
3 When using the master cord
4 Connectors not included
5 Wavelength: 1550 ± 15 nm
6 0.15 dB (typical) if the wavelength is 1310 ± 15 nm
7 2 σ
8 When using PC connector ends (return loss of 48 dB or greater)
9 When using Angled PC connector ends (return loss of 63 dB or greater)
10 Output ratio
11 For Angled PC connector ends
12 Polarization dependent loss not included

5.16 AQ2200-311A/312 ATTN Module

AQ2200-312: Firmware version 3.04 and later

Performance and Functional Specifications

Item	Specifications		
Optical fiber	-SA	-G5	-G6
Wavelength range	1200 to 1700 nm	800 to 1370 nm	
Insertion loss[2]	1.0 dB (typical)[1, 3, 4] 1.6 dB or less[1, 3]	1.0 dB (typical)[4] 1.6 dB or less[9]	
Maximum attenuation	60 dB	45 dB	
Attenuation accuracy[2]	± 0.1 dB or less[3, 5, 6]	± 0.1 dB or less[8]	
Repeatability[2]	± 0.01 dB or less[1, 7]	± 0.01 dB or less[7, 8]	
Display resolution	0.001 dB		
Optical return loss	45 dB or greater[3, 5, 11]	20 dB or greater[8]	
Polarization dependence	0.08 dBp-p or less[3, 5]	—	
Maximum input power	+23 dBm	—	
Shutter isolation	90 dB or greater		
Applicable optical fiber	SMF(ITU-T G.652)	MMF (GI 50/125) (ITU-T G651.1)	MMF (GI 62.5/125) (IEC 60793-2)
Optical connector	FC/PC (when the optical connector specification is -FCC) SC/PC (when the optical connector specification is -SCC)		

Optional Specifications

Item		Specifications		
Optical fiber		-SA	-G5	-G6
Monitor port option (/MON)				
	Monitor port output[2, 11]	–13 dB (typical)[1, 3]	–13 dB (typical)[8]	
	Insertion loss[2]	2.3 dB or less[1, 3]	2.3 dB or less[9]	
	Polarization dependence	0.1 dBp-p or less[3, 5]	—	

General Specifications

Item		Specifications
Operating conditions		The same as the frame controller's operating environment
Temperature and humidity for storage		
	Ambient temperature	–20 to +60°C
	Ambient humidity	20 to 80% RH (no condensation)
External dimensions		31 (W) × 117 (H) × 321.5 (D) mm (excluding protrusions; one slot)
Weight		Approx. 0.9 kg

- All values in the specifications assume a warm-up period of one hour. Unless otherwise noted, all specified values include connectors.
- For models with MMF specifications, all specified values are guaranteed when a light source that is excited in steady model is used.

1 Wavelength: 1310 ± 15 nm, 1550 ± 15 nm
2 Ambient temperature: 23 ± 2°C (constant temperature)
3 When using the Yokogawa reference master cord (SMF)
4 Connectors not included
5 Wavelength: 1550 ± 15 nm
6 0.15 dB or less if the wavelength is 1310 ± 15 nm
7 2 σ
8 Wavelength: 850 or 1310 nm
9 +0.5 dB if the wavelength is 850 or 1310 nm
10 When using PC connectors (return loss 48 dB or greater)
11 Output ratio

5.17 AQ2200-331/332 ATTN Module

AQ2200-332: Firmware version 3.04 and later

Performance and Functional Specifications

Item	Specifications		
Optical fiber	-SA	-G5	-G6
Wavelength range	1200 to 1700 nm	800 to 1370 nm	
Insertion loss[2]	1.9 dB (typical)[1, 3, 4]	1.9 dB (typical)[4, 10]	
Maximum attenuation	60 dB	45 dB	
Attenuation accuracy[2]	± 0.1 dB or less[3, 5, 6]	± 0.1 dB or less[8]	
Repeatability[2]	± 0.01 dB or less[1, 7]	± 0.01 dB or less[7, 8]	
Display resolution	0.001 dB		
Output monitor accuracy	± 5% or less[2, 9, 11, 13]	± 5% or less[2, 13, 14]	
Optical return loss	45 dB or greater[3, 5, 12]	20 dB or greater[8]	
Polarization dependence	0.1 dBp-p or less[3, 5]	—	
Maximum input power	+23 dBm	—	
Shutter isolation	90 dB or greater		
Applicable optical fiber	SMF(ITU-T G.652)	MMF (GI 50/125) (ITU-T G651.1)	MMF (GI 62.5/125) (IEC 60793-2)
Optical connector	FC/PC (when the optical connector specification is -FCC) SC/PC (when the optical connector specification is -SCC)		

General Specifications

Item	Specifications
Operating conditions	The same as the frame controller's operating environment
Temperature and humidity for storage	
Ambient temperature	–20 to +60°C
Ambient humidity	20 to 80% RH (no condensation)
External dimensions	31 (W) × 117 (H) × 321.5 (D) mm (excluding protrusions; one slot)
Weight	Approx. 0.9 kg

- All values in the specifications assume a warm-up period of one hour. Unless otherwise noted, all specified values include connectors.
- For models with MMF specifications, all specified values are guaranteed when a light source that is excited in steady mode is used.

1 Wavelength: 1310 ± 15 nm or 1550 ± 15 nm
2 Ambient temperature: 23 ± 2°C (constant temperature)
3 When using the Yokogawa reference master cord (SMF)
4 Connectors not included. 2.3 dB or less when connectors are included.
5 Wavelength: 1550 ± 15 nm
6 0.15 dB or less if the wavelength is 1310 ± 15 nm
7 2 σ
8 Wavelength: 850 or 1310 nm
9 Polarization dependence is not included.
10 Wavelength: 850 nm. Add 0.5 dB if the wavelength is 1310 nm.
11 Any one wavelength within 1310 ± 15 nm or 1550 ± 15 nm
12 When using PC connectors (return loss 48 dB or greater)
13 Output power: –10 dBm
14 Wavelength: 850 nm

5.18 AQ2200-342 DUAL ATTN Module

Firmware version 3.01 and later

Performance and Functional Specifications

Item	Specifications
Number of channel	2
Wavelength range	1260 to 1640 nm
Insertion loss [1, 2, 3, 4, 8]	1.8 dB (typical), 2.4 dB or less
Maximum attenuation [1]	40 dB Min
Setting resolution	0.01 dB
Attenuation accuracy [1, 2, 3, 4, 5, 6]	± 0.15 dB (typical) (Attenuation 0 to 10 dB) ± 0.20 dB (typical) (Attenuation 10 to 20 dB) ± 0.45 dB (typical) (Attenuation 20 to 40 dB)
Reproducibility [1, 2, 3, 4, 5, 6, 12]	± 0.10 dB (typical) (Attenuation 0 to 20 dB) ± 0.15 dB (typical) (Attenuation 20 to 40 dB)
Polarization dependence [1, 2, 3]	0.3 dBp-p (Attenuation 0 to 10 dB) 0.4 dBp-p (Attenuation 10 to 20 dB) 0.6 dBp-p (typical) (Attenuation 20 to 40 dB)
Output monitor accuracy [1, 2, 3, 4, 6, 7, 9, 10]	± 5%
Power setting range	-50 dBm to +20 dBm
Optical return loss [1, 2, 3, 4]	40 dB or greater
Maximum input power	+23 dBm
Shutter isolation	70 dB or greater
Shutter life time	10 million cycles (typical)
Settling time	100 ms (typical)
Applicable optical fiber	SM (ITU-T G.652)
Optical connector	FC/PC or FC/Angled PC

General Specifications

Item	Specifications
Operating conditions	The same as the frame controller's operating environment
Temperature and humidity for storage	
Ambient temperature	–20 to +60°C
Ambient humidity	20 to 80% RH (no condensation)
External dimensions	31 (W) × 117 (H) × 321.5 (D) mm (excluding protrusions; one slot)
Weight	Approx. 0.8 kg

- All values in the specifications assume a warm-up period of one hour.

1 Wavelength: 1550 ± 15 nm
2 Ambient temperature: 23 ± 2°C (constant temperature)
3 When using the Yokogawa reference master cord
4 Polarization dependence is not included.
5 1 minutes later after the attenuation setting
6 2 σ
7 Connector repeatability is not included. Add ±5% when connector repeatability is included.
8 Connector loss not included. 3.0dB or less (2.2 dB typ.) when connector loss are included.
9 Attenuation setting: 0 dB
10 Output power: -10 dBm
11 When attenuation set from 0 dB to 20 dB.
12 When step operation (0, 10, 20, 30, 40 dB)

5.19 AQ2200-411/412 OSW Module

Performance and Functional Specifications

Item	Specifications		
Optical fiber	-SA	-G5	-G6 (Only supports the AQ2200-411)
Port configuration	AQ2200-411: 1×4, 1×8 AQ2200-412: 1×16		
Wavelength	1310 nm/1550 nm	850 nm/1310 nm	
Insertion loss[3, 5]	1.0 dB (typical)[1, 4]	1.0 dB (typical)[2]	
Repeatability[3, 6]	± 0.01 dB or less[1]	± 0.01 dB or less[2]	
Crosstalk	–60 dBm or less[1, 4]	–50 dBm or less[2]	
Optical return loss[1, 3, 6]	45 dB or greater[1, 4, 7]	20 dB or greater[2]	
Maximum input power	+23 dBm	—	
Polarization dependence	0.08 dBp-p or less[1, 4]	—	
Applicable optical fiber	SMF(ITU-T G.652)	MMF(GI 50/125) (ITU-T G651.1)	MMF(GI 62.5/125) (IEC 60793-2)
Optical connector	FC/PC (when the optical connector specification is -FCC) SC/PC (when the optical connector specification is -SCC)		

General Specifications

Item	Specifications
Operating conditions	The same as the frame controller's operating environment
Temperature and humidity for storage	
Ambient temperature	–20 to +60°C
Ambient humidity	20 to 80% RH (no condensation)
External dimensions	
1×4 and 1×8 ports	31 (W) × 117 (H) × 321.5 (D) mm (excluding protrusions; one slot)
1×16 ports	62.5 (W) × 117 (H) × 321.5 (D) mm (excluding protrusions; two slots)
Weight	
1×4 and 1×8 ports	Approx. 0.8 kg
1×16 ports	Approx. 1.5 kg

- All values in the specifications assume a warm-up period of one hour. Unless otherwise noted, all specified values include connectors.
- For models with MMF specifications, all specified values are guaranteed when a light source that is excited in steady mode is used.

1 Wavelength: 1310 ± 15 nm or 1550 ± 15 nm
2 Wavelength: 850 or 1300 nm
3 Ambient temperature: 23 ± 2°C (constant temperature)
4 When using the Yokogawa reference master cord (SMF)
5 Connectors not included. 1.4 dB or less when connectors are included.
6 2 σ
7 When using PC connectors (return loss 48 dB or greater)
8 Wavelength: 1550 ± 15 nm

5.20 AQ2200-421 OSW Module

Performance and Functional Specifications

Item	Specifications		
Optical fiber	-SA	-G5	-G6
Port configuration	1×2 (when the port configuration specification is -21) 2×2 (when the port configuration specification is -22)		
Wavelength	1310 nm/1550 nm	850 nm/1310 nm	
Insertion loss[3, 5]	1.0 dB (typical)[1, 4]	1.0 dB (typical)[2]	
Repeatability[3, 6]	± 0.01 dB or less[1]	± 0.01 dB or less[2]	
Crosstalk	–50 dB or less[1, 4]	–50 dB or less[2]	
Optical return loss	45 dB or greater[1, 4, 7]	20 dB or greater[2]	
Polarization dependence	0.08 dBp-p or less[4, 8]	—	
Applicable optical fiber	SMF(ITU-T G.652)	MMF(GI 50/125) (ITU-T G651.1)	MMF(GI 62.5/125) (IEC 60793-2)
Optical connector	FC/PC (when the optical connector specification is -FCC) SC/PC (when the optical connector specification is -SCC)		

General Specifications

Item	Specifications
Operating conditions	The same as the frame controller's operating environment
Temperature and humidity for storage	
Ambient temperature	–20 to +60°C
Ambient humidity	20 to 80% RH (no condensation)
External dimensions	31 (W) × 117 (H) × 321.5 (D) mm (excluding protrusions; one slot)
Weight	Approx. 0.7 kg

- All values in the specifications assume a warm-up period of one hour. Unless otherwise noted, all specified values include connectors.
- For models with MMF specifications, all specified values are guaranteed when a light source that is excited in steady mode is used.

1 Wavelength: 1310 ± 15 nm or 1550 ± 15 nm
2 Wavelength: 850 or 1300 nm
3 Ambient temperature: 23 ± 2°C (constant temperature)
4 When using the Yokogawa reference master cord (SMF)
5 Connectors not included. 1.4 dB or less when connectors are included.
6 2 σ
7 When using PC connectors (return loss 48 dB or greater)
8 Wavelength: 1550 ± 15 nm

5.21 AQ2200-601 10 Gbit/s BERT Module

Performance and Functional Specifications

Item		Specifications
Pulse Pattern Generator Interface		
Data output (DATA OUT and $\overline{\text{DATA OUT}}$)	Bitrate	9.95 to 11.32 Gbit/s
	Data format	NRZ
	Output amplitude	0.5 to 2.0 Vp-p (in 10 mV steps)
	Tr/Tf (20 to 80%)	25 ps or less
	Offset voltage	–2 to +3 V (in 10 mV steps)
	Cross point	30 to 70% (in 1% steps)
	Number of outputs	2 (non-inverted and inverted)
	Connectors	3.5 mm, female
	Output terminator conditions	50 Ω AC or DC terminator
	Inversion feature	Positive/negative logic inversion
	Output control	On/off function (GND level when off)
Data output (DATA OUT TO OPTICAL MODULATOR)	Output amplitude	0.50 ± 0.1 Vp-p
	Offset voltage	0 V (fixed)
	Cross point	50% (nominal value)
	Number of outputs	1
	Connector	3.5 mm, female
	Output terminator conditions	50 Ω AC terminator
	Inversion feature	Positive/negative logic inversion
	Output control	On/off function (GND level when off)
Clock output (CLOCK OUT and $\overline{\text{CLOCK OUT}}$)	Output amplitude	0.6 Vp-p (typical) AC-coupling
	Duty	50 ± 10%
	Tr/Tf (20 to 80%)	25 ps or less
	Offset	–2 to +3 V (in 10 mV steps)
	Number of outputs	2 (non-inverted and inverted)
	Connectors	SMA, female
	Output terminator conditions	50 Ω AC or DC terminator
	Output control	On/off function (GND level when off)
Error Detector Interface		
Data input (DATA IN 1 (CDR))	Bitrate	9.95 to 11.32 Gbit/s
	Allowable bitrate	±100 ppm of the PPG's operation bitrate
	Input amplitude range	0.1 to 0.7 Vp-p
	Minimum input sensitivity	100 mVp-p or less[1]
	Threshold voltage	±0.35 V (in 1 mV steps)
	Data format	NRZ
	Inversion feature	Positive/negative logic inversion
	Connector	3.5 mm, female
	Input terminator conditions	50 Ω AC-coupling
Data input (DATA IN 2)	Bitrate	9.95 to 10.71 Gbit/s
	Input amplitude range	0.1 to 0.6 Vp-p
	Minimum input sensitivity	100 mVp-p or less[1]
	Threshold voltage	±0.3 V (in 1 mV steps)
	Inversion feature	Positive/negative logic inversion
	Connector	3.5 mm, female
	Input terminator conditions	50 Ω AC-coupling
Clock input (CLOCK IN)	Frequency	The same frequency as DATA IN 2 (synchronized to the data input)
	Input amplitude range	0.2 to 0.6 Vp-p
	Connector	SMA, female
	Input terminator conditions	50 Ω AC-coupling

5.21 AQ2200-601 10 Gbit/s BERT Module

Item		Specifications
Clock and Common Interface		
Operation clock	Clock mode	Internal clock (Internal), external reference clock (REF Clk), and external clock (EXT Clk)
Internal clock	Frequency range	9.95 to 11.32 GHz
	Resolution	1 kHz
External reference clock (REF CLOCK IN)	Input frequency	1/16 or 1/64 of the bitrate
	Input amplitude	0.4 to 1.0 Vp-p
	Duty	50%-rectangular signal (nominal)
	Connector	SMA, female
	Input terminator conditions	50 Ω AC-coupling
External clock (EXT CLOCK IN)	Input frequency	The same frequency as the bitrate
	Input amplitude	0.4 to 1.0 Vp-p
	Duty	50% (nominal value)
	Connector	SMA, female
	Input terminator conditions	50 Ω AC-coupling or DC-coupling
Trigger output (TRIGGER OUT)	Trigger type	Clock trigger, pattern trigger, or error trigger
	Clock trigger	TX1/16, TX1/64, RX1/16, or RX1/64 A frequency that is 1/16 or 1/64 of the clock frequency
	Pattern trigger	TXPatt or RXPatt • PRBS Transmits high pulses at an interval that is 128 times larger than the PRBS pattern • Program (16 to 256 bits) Transmits high pulses at an interval that is 128 times larger than the pattern length • Program (256 to 67108864 bits) Transmits high pulses at an interval that is equivalent to the pattern length • SDH/SONET Transmits high pulses at an interval that is equivalent to one frame (1244160 bits)
	Error trigger	TXERR or RXERR Transmits a high pulse when an error is added in the PPG or when an error is detected in the ED.
	Output level	0.6 Vp-p ± 0.3 V
	Connector	SMA, female
	Output terminator conditions	50 Ω AC or DC terminator
Pulse Pattern Generator Data		
Transmission pattern	PRBS	2n-1 (n: 7, 9, 10, 11, 15, 23, or 31)
	PROGRAM	Standard: 16 to 256 bits (in 1-bit steps) Optional: 256 to 67108864 bits (in 128-bit steps)
	SDH/SONET	Optional Scramble: Fixed to ON Overhead: Programmable. The B1 and B2 bytes are program data. (They are provided with no computational parity bits.) Payload: PRBS 2n-1 (n: 9, 10, 11, 15, 23, or 31)
Error addition	SINGLE	Add a 1-bit error each time the user specifies it
	RATE	1.0E-n (n: 3 to 12 in steps of 1)

Item		Specifications
Error Detector Data		
Receive pattern	PRBS	2n-1 (n: 7, 9, 10, 11, 15, 23, or 31)
	PROGRAM	Standard: 16 to 256 bits (in 1-bit steps) Optional: 256 to 67108864 bits (in 128-bit steps)
	SDH/SONET	Optional Descramble: Fixed to ON Overhead: Programmable. The B1 and B2 bytes are program data. (They are provided with no computational parity bits.) Payload: PRBS 2n-1 (n: 9, 10, 11, 15, 23, or 31)
AUTO SYNC		ON, OFF
Measurement function	Measurement mode	Manual: Start measurement with Measure Start, then measure until measurement stops with Measure Stop. (If the measurement continues for 10 days, it will be stopped automatically.) Single: A single measurement is carried out at the user-specified time. (The measurement stops automatically.) Repeat: Measurements are repeatedly carried out at the user-specified time.
	Measurement time	10 days at the maximum
	Measurement result	Current, 100 ms, or Last
	Measurement items	Sync loss, Error count, Error rate, Overhead error count, Overhead error rate, TX bitrate, RX bitrate, and Receive opt pwr[2], ATT Power mon[3]
	Error log	Available

General Specifications

Item	Specifications
Operating conditions	The same as the frame controller's operating environment
Temperature and humidity for storage	
Ambient temperature	–10 to +50°C
Ambient humidity	20 to 80% RH (no condensation)
Dimensions and weight	
Dimensions	94 (W) × 117 (H) × 321.5 (D) mm (excluding protrusions; three slots)
Weight	Approx. 2.6 kg

- All values in the specifications assume a warm-up period of one hour.

1 Specified for PPG-ED loopback measurements under the PRBS31 and data crosspoint 50% conditions.

2 Only selectable if an optical modulator module (AQ2200-621 or AQ2200-622) and an optical receiver module (AQ2200-631) are used at the same time.

3 Only selectable if an ATTN module (AQ2200-331) is used at the same time.

5.22 AQ2200-621/622 10 Gbit/s Optical Modulator

Performance and Functional Specifications

Item	Specifications
Wavelength range[1]	AQ2200-621: 1530 to 1570 nm AQ2200-622: 1290 to 1330 nm
Wavelength variation	As stated in the specifications for the AQ2200-111 DFB-LD module
Optical power variation	As stated in the specifications for the AQ2200-111 DFB-LD module
LN Cut type[1]	X-cut or Z-cut
Optical insertion loss[2]	7 dB (typical), 10 dB or less
Maximum optical input	16 dBm
Optical input range for guaranteed performance[3, 5]	9 to 13 dBm
Extinction ratio[3, 4, 6]	AQ2200-621: 12 dB or greater at 1550 nm AQ2200-622: 12 dB or greater at 1310 nm
Tr/Tf (20 to 80%)[3, 4]	25 ps or less
Electric input amplitude[3]	500 ± 100 mVp-p (AC-coupling)
Maximum absolute input amplitude	1200 mVp-p (AC-coupling)
Compliant electric connector	3.5 mm jack or equivalent
Optical connector (LD IN)	SC/PC
Optical connector (OPTICAL DATA OUT)[1]	SC/PC or FC/PC
Applicable optical fiber	PMF (key-aligned slow axis) is used inside of the module. (You can connect a PMF or SMF to OPTICAL DATA OUT.)

General Specifications

Item	Specifications
Operating conditions	The same as the frame controller's operating environment
Storage temperature	–10 to +50°C
Storage humidity	20 to 80% RH (no condensation)
External dimensions	31 (W) × 117 (H) × 321.5 (D) mm (excluding protrusions; one slot)
Weight	Approx. 1.0 kg

1 Select either option

2 Includes modulation loss due to NRZ coding (mark ratio 50%)

3 Use the DATA OUT TO OPTICAL MODULATOR terminal of an AQ2200-601 BERT module and an AQ2200-111 DFB-LD module with /PMF option. Use the specified U-links (optional) and PMF (optional) to connect the modules. Use the 10 GHz CLOCK OUT terminal to generate triggers for monitoring waveforms. If you want to monitor optical waveforms, use an SMF that is 1 m or less in length.

4 Temperature range for guaranteed performance: 23 ± 5°C

5 This is the range in which the Auto-Bias Control operates stably.

6 Within the optical input range for guaranteed performance

Unless otherwise specified, the specifications apply to NRZ and PRBS31 (mark ratio 50%) coding.

5.23 AQ2200-631 10 Gbit/s Optical Receiver

Performance and Functional Specifications

Item	Specifications
Wavelength range	1290 to 1330 nm or 1530 to 1570 nm
Minimum optical receiving sensitivity[1, 2]	< –15 dBm at 1550 nm, Ex = 12 dB, 9.953 Gbit/s, PRBS31 < –14 dBm at 1310 nm, Ex = 12 dB, 9.953 Gbit/s, PRBS31
Maximum optical input	6 dBm peak, 3 dBm average
Overload[1, 2]	–1 dBm or greater
Saturated output amplitude[1]	300 mVp-p or greater (AC-coupling)
Electric connector	3.5 mm jack or equivalent
Optical connector[3]	SC/PC or FC/PC
Optical fiber	SMF

General Specifications

Item	Specifications
Operating conditions	The same as the frame controller's operating environment
Storage temperature	–10 to +50°C
Storage humidity	20 to 80% RH (no condensation)
External dimensions	31 (W) × 117 (H) × 321.5 (D) mm (excluding protrusions; one slot)
Weight	Approx. 1.0 kg

1 Use the DATA OUT TO OPTICAL MODULATOR terminal (on the PPG side) and a DATA IN terminal (on the ED side) of an AQ2200-601 BERT module, an AQ2200-111 DFB-LD module with /PMF option, and an AQ2200-621/622 Optical Modulator. Use the specified U-links (optional) and PMF (optional) to connect the modules. Use an SMF that is 1 m or less in length to connect the modules in a loopback configuration.

2 Temperature range for guaranteed performance: 23 ± 5°C

3 Select either option

5.24 AQ2200-641 XFP Interface Module

Performance and Functional Specifications

Item		Specifications
Data input ($\overline{\text{DATA IN}}$, $\overline{\text{DATA IN}}$)[1]	Data format	NRZ
	Connector	3.5 mm, female
Data output ($\overline{\text{DATA OUT}}$, $\overline{\text{DATA OUT}}$)[2]	Data format	NRZ
	Connector	3.5 mm, female
Reference clock input	Input level	0.6 Vp-p ± 0.3 V
	Input frequency	1/64 of the bitrate
	Connector	SMA, female
Number of times the transceiver can be installed and uninstalled		200

General Specifications

Item		Specifications
Operating conditions		The same as the frame controller's operating environment
Storage temperature		–20 to +60°C
Storage humidity		20 to 80% RH (no condensation)
Dimensions and weight	Dimensions	62.5 (W) × 117 (H) × 321.5 (D) mm (excluding protrusions; two slots)
	Weight	Approx. 1.0 kg

1 Direct input to the XFP optical transceiver

2 Direct output from the XFP optical transceiver

5.25 AQ2200-642 Transceiver I/F Module

Monitoring Specifications

Name		Rating		Measurement Range			Accuracy[1]
		Upper	Lower	Upper	Lower	Resolution	
Power supply voltage monitor	PS1	+7.5 V	–0.5 V	+6 V	+2 V	1 mV	±(0.2% of reading + 1 mV)
	PS2	+7.5 V	–0.5 V	+4 V	+2 V		
	PS3	+7.5 V	–0.5 V	+2.5 V	+0.5 V		
	PS4	–7.5 V	+0.5 V	–2 V	–6 V		
	PS5	+7.5 V	–0.5 V	+6 V	+2 V		
Power supply current monitor	PS1	—	—	1.8A	0A	1 mA	±(1% of reading + 2 mA)
	PS2			3 A	0 A		
	PS3			1.8 A	0 A		
	PS4			3 A	0 A		
	PS5			2 A	0 A		
Status signal monitor	AIN1	+7.5 V	–0.5 V	+6 V	+0 V	0.01 V	±(1% of reading + 20 mV)
	AIN2						
	AIN3						
	AIN4						
	AIN5						
	AIN6						
Resistance value monitor	R1	—	—	10000 Ω	0 Ω	1 Ω	±(0.5% of reading +2 Ω)
Power consumption monitor	PSPOWER	—	—	28 W	0 W	0.1 W	See the values for the voltage and current monitors.

Power Supply Specifications

Name	Voltage Range	Current Limit Range
PS1	+4.750 to +5.250 V	0.10 to 1.80 A
PS2	+3.135 to +3.465 V	0.10 to 3.00 A
PS3	+0.800 to +1.890 V	0.10 to 1.80 A
PS4	–5.460 to –4.940 V	0.10 to 3.00 A
PS5	5.0 or 3.3 V	0.10 to 1.00 A (when 5.0 V is selected)
		0.10 to 2.00 A (when 3.3 V is selected)

Control Signal Transmission Specifications

Item		Specifications	
DC response	CTRL01 (1.2V) to CTRL07 (1.2V)	VOLmax	0.2 V (100 µA), 0.3 V (1 mA)
		VOHmin	1.0 V (100 µA), 0.9 V (1 mA)
		IOLmax	+1 mA
		IOHmin	–1 mA
	CTRL08 (3.3V) to CTRL17 (3.3V)	VOLmax	0.5 V(3 mA)
		VOHmin	2.5 V(3 mA)
		IOLmax	+3 mA
		IOHmin	–3 mA

I²C Bus Signal Specifications

Item		Specifications	
Signal rate		100/400 kHz	
DC response	SDA	VOLmax	0.5 V
		VOHmin	— (Open Drain)
		IOLmax	+3 mA
		IOHmax	— (Open Drain)
		VILmax	0.7 V
		VIHmax	1.7 V
	SCL	VOLmax	0.5 V
		VOHmin	— (Open Drain)
		IOLmax	+3 mA
		IOHmax	— (Open Drain)
		VILmax	0.7 V
		VIHmax	1.7 V

MDIO Bus Signal Specifications

Item		Specifications	
Signal rate		625 kHz/1.25 MHz/ 2.5 MHz	
DC response	MDIO	VOLmax	0.35 V
		VOHmin	— (Open Drain)
		IOLmax	+3 mA
		IOHmax	— (Open Drain)
		VILmax	0.2 V
		VIHmax	1.0 V
	MDC	VOLmax	0.35 V
		VOHmin	0.85 V (3 mA)
		IOLmax	+3 mA
		IOHmax	+3 mA
		VILmax	—
		VIHmax	—

General Specifications

Item		Specifications
Operating conditions		The same as the frame controller's operating environment
Storage temperature		–20 to +60°C
Storage humidity		20 to 80% RH (no condensation)
Dimensions and weight	Dimensions	62.5 × 117 × 321.5 mm (excluding protrusions; two slots)
	Weight	Approx. 1.5 kg

1 Assuming an ambient temperature of 23 ± 2°C and a warm-up period of 20 minutes.

5.26 AQ2200-651 SG Module

Performance and Functional Specifications

Item			Specifications
RF OUT (CH1-CH5)	Frequency range		620.0 to 720.0 MHz (when the rate is 1/1) 155.0 to 180.0 MHz (when the rate is 1/4)
	Frequency resolution		1 Hz
	Frequency accuracy		±2.0 ppm (when using the internal oscillator) Depends on the signal received by 10 MHz REF IN (when using an external reference signal)
	Output	Amplitude	0.8 Vp-p ± 0.2 Vp-p 1.3 Vp-p ± 0.2 Vp-p
		Waveform	Rectangular
		Duty	50 ± 10%
		Terminator condition	50 Ω AC-coupling
	Connector		SMA, female
10MHz REF IN	Input	Frequency range	10 MHz ± 2.0 ppm
		Amplitude	0.3 Vp-p to 1.2 Vp-p
		Duty	50 ± 10%
		Absolute max. rating	1.5 Vp-p
		Terminator condition	50 Ω AC-coupling
	Connector		SMA, female
10MHz REF OUT	Output	Frequency range	10 MHz ± 2.0 ppm (when using the internal oscillator) Depends on the signal received by 10 MHz REF IN (when using an external reference signal)
		Amplitude	0.8 Vp-p ± 0.2 Vp-p
		Terminator condition	50 Ω AC-coupling
	Connector		SMA, female

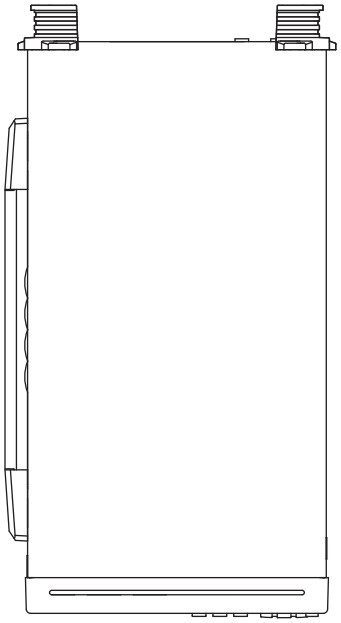
General Specifications

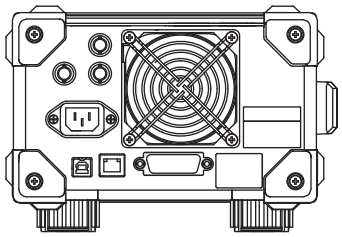
Item		Specifications
Operating conditions		The same as the frame controller's operating environment
Storage temperature		–20 to +60°C
Storage humidity		20 to 80% RH (no condensation)
Dimensions and weight	Dimensions	62.5 × 117 × 321.5 mm (excluding protrusions; two slots)
	Weight	Approx. 1.5 kg

5.27 External Dimensions

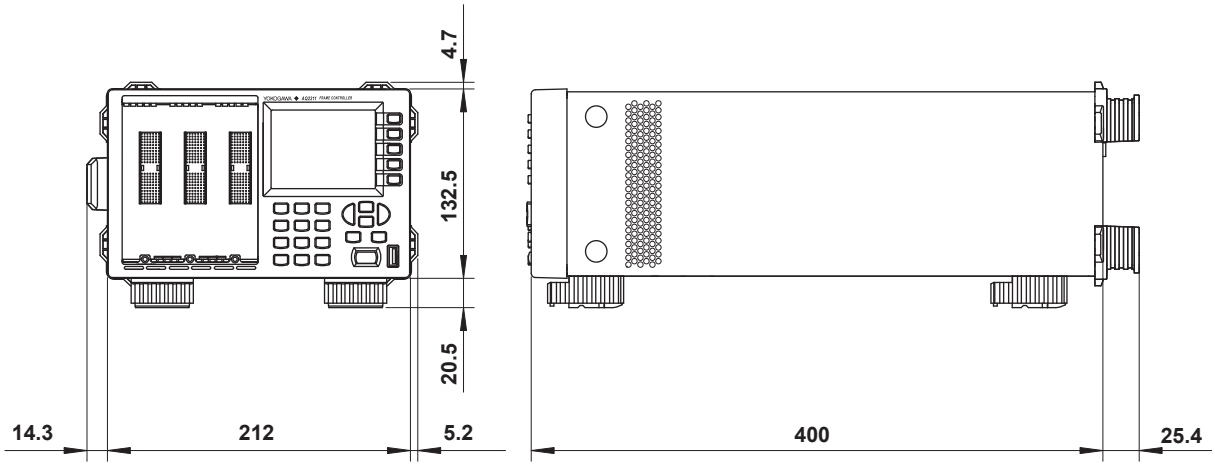
Unit: mm
Unless otherwise specified, tolerances are ±3% (however, tolerances are ±0.3 mm when below 10 mm).

AQ2211 Frame Controller

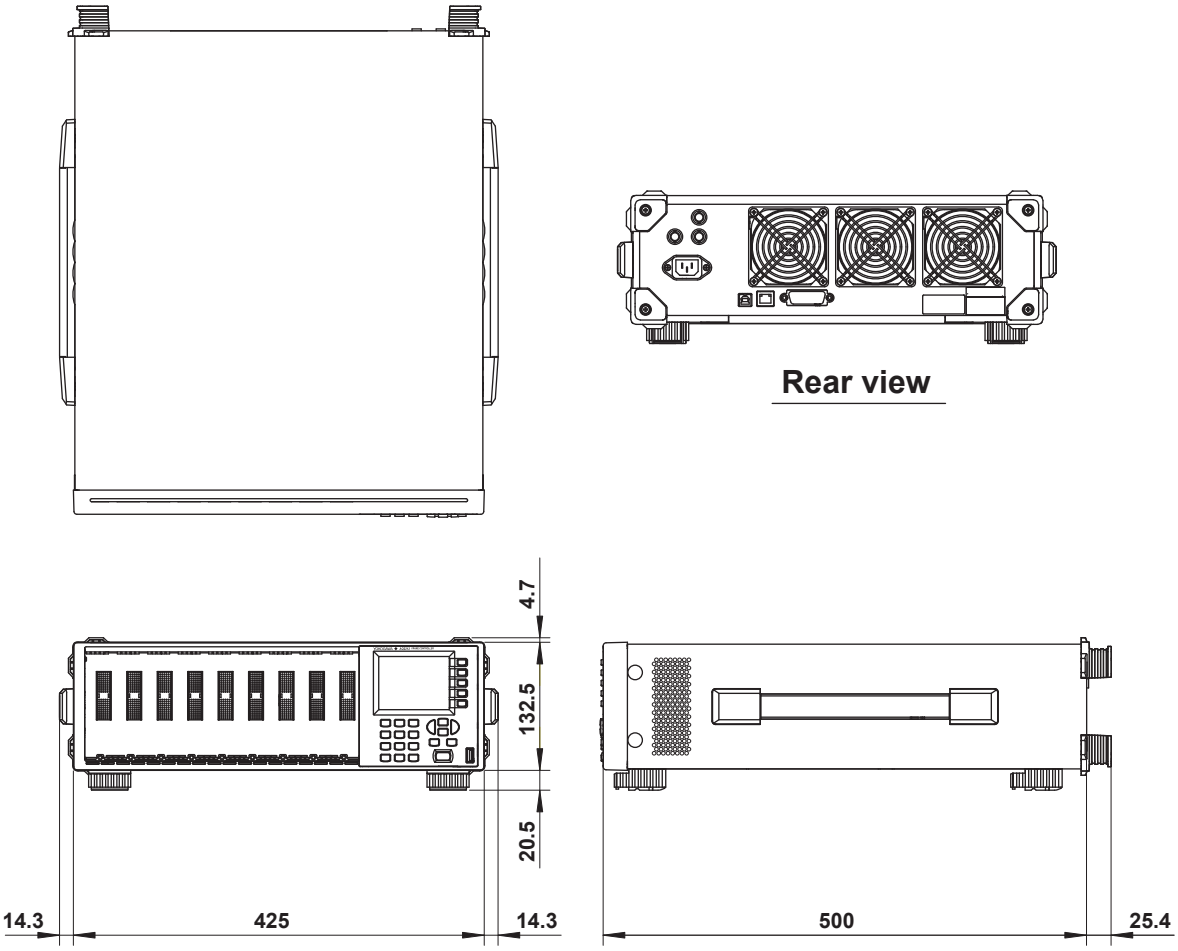




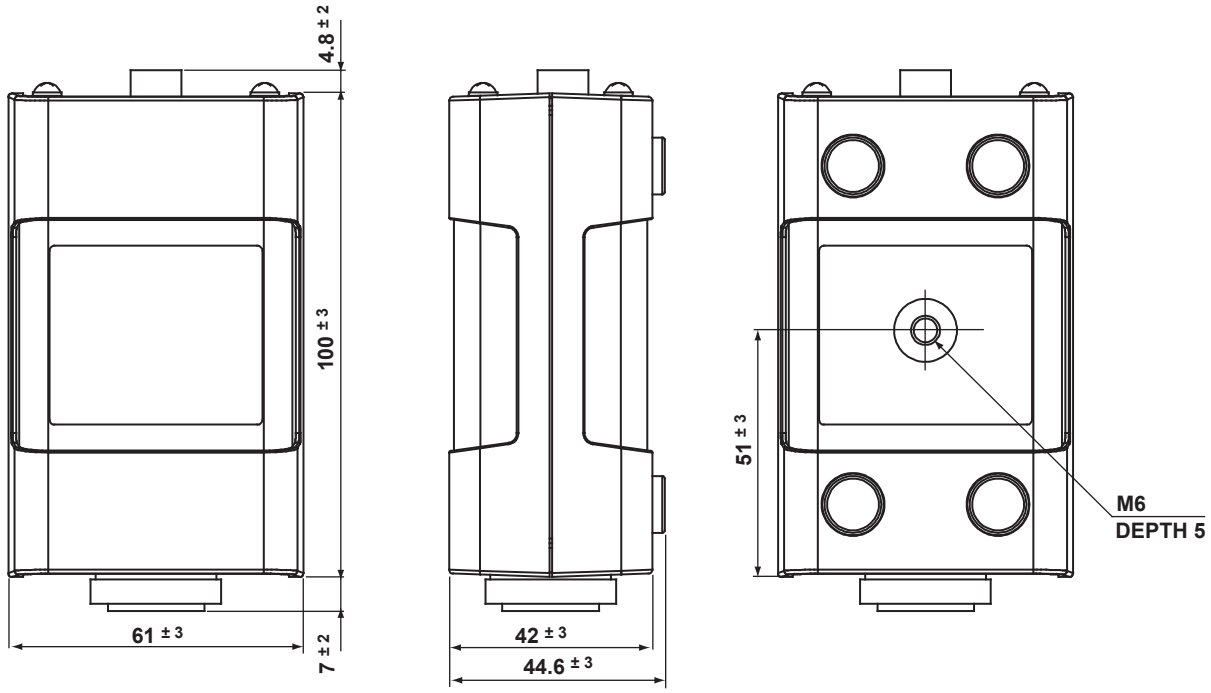
Rear view



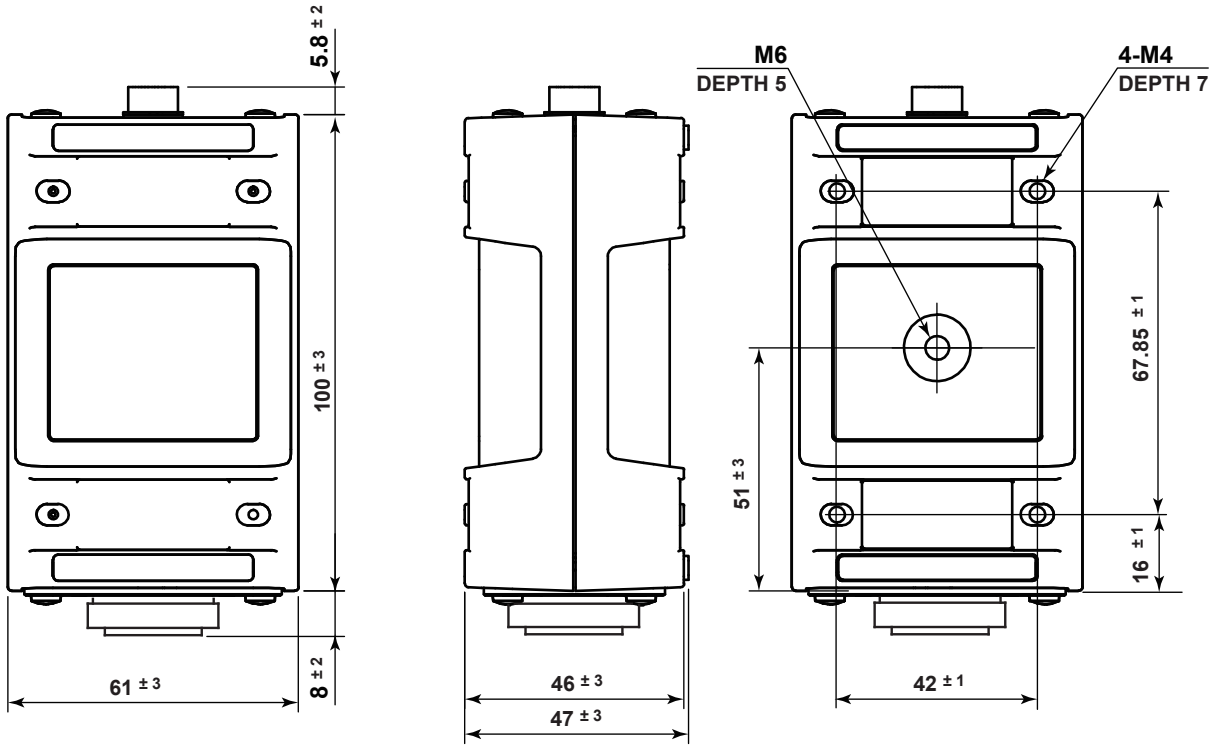
AQ2212 Frame Controller



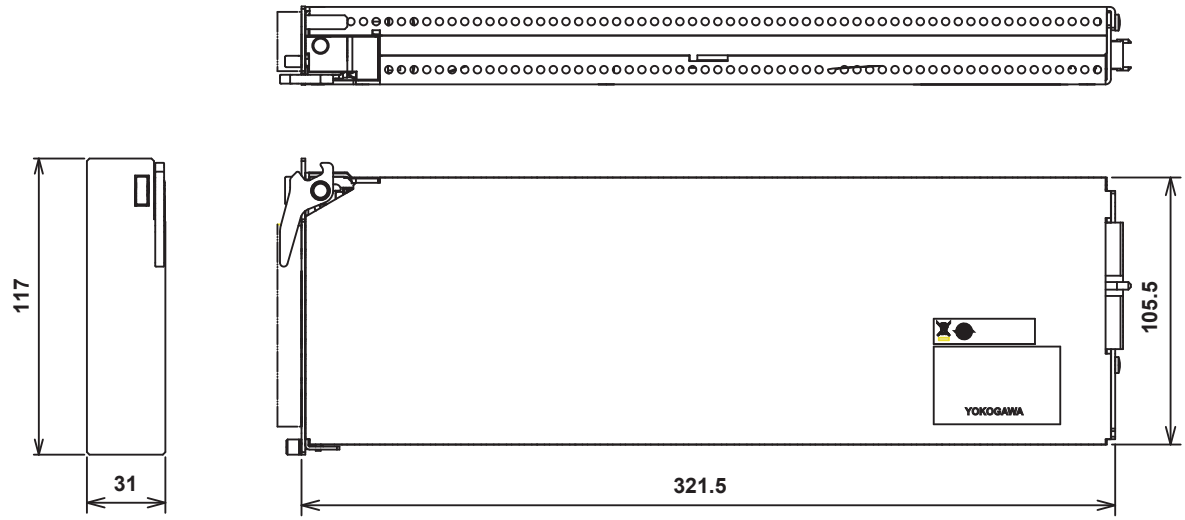
AQ2200-231/241 Optical Sensor Head



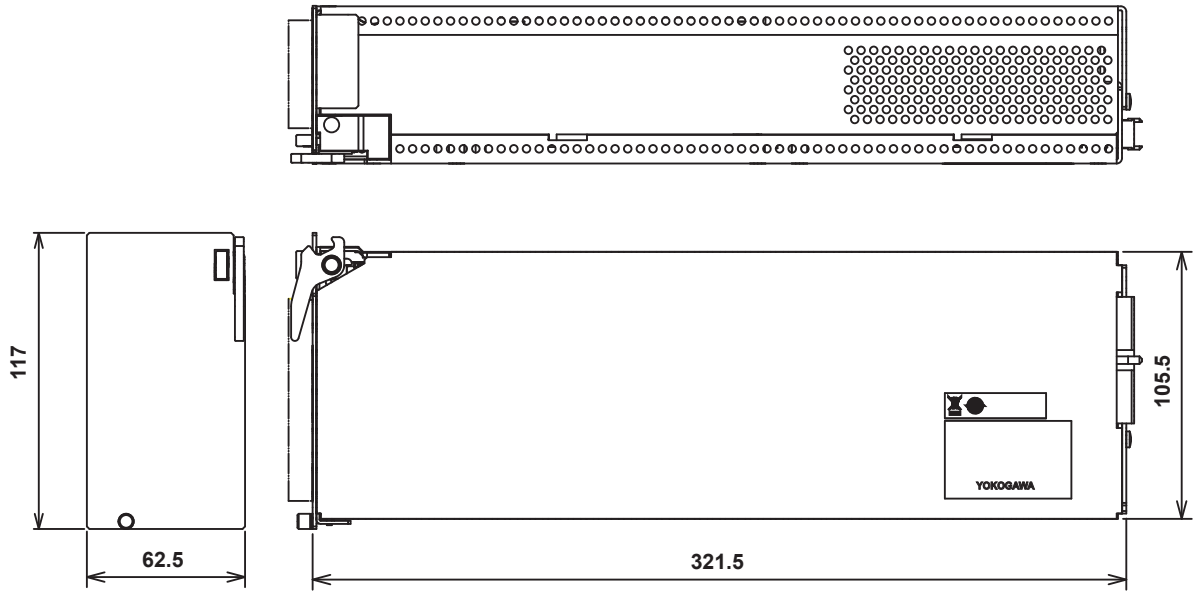
AQ2200-232/242 Optical Sensor Head



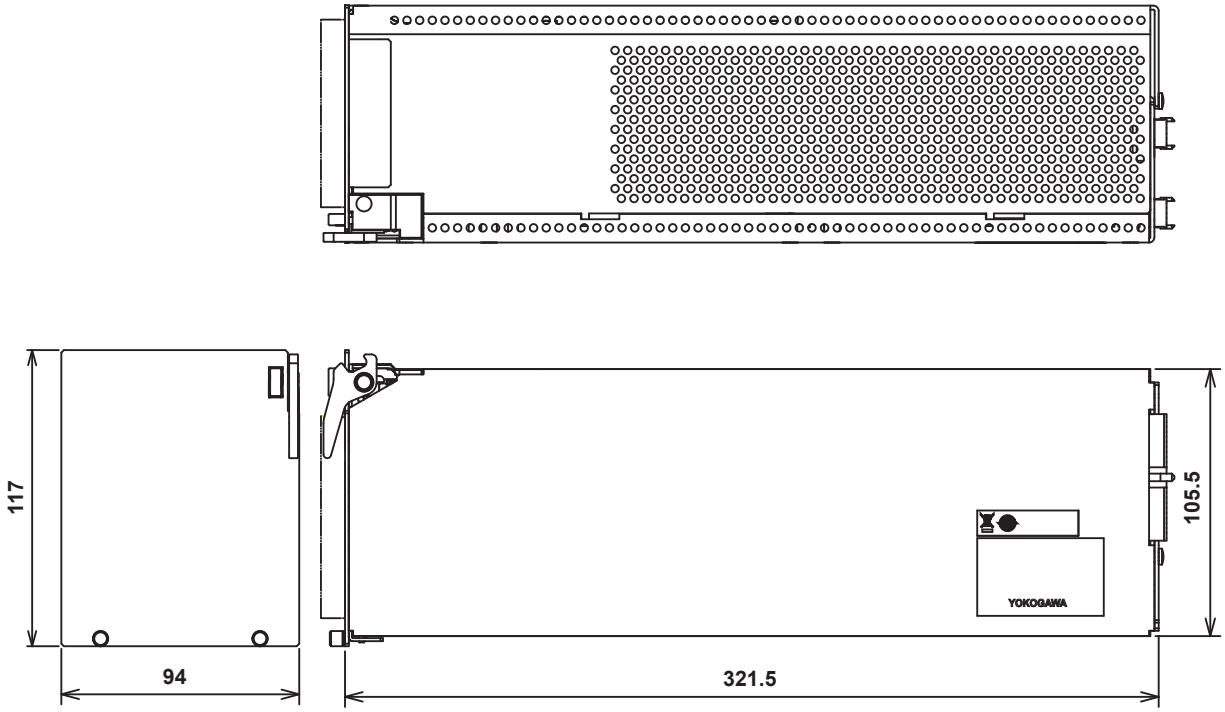
AQ2200 Series 1-Slot Size Module



AQ2200 Series 2-Slot Size Module



AQ2200 Series 3-Slot Size Module



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