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430-B0008-AH02

FITEL

OPTICAL DESKTOP AMPLIFIER
ErFA1200/1300 SERIES

USER'S GUIDE

FURUKAWA ELECTRIC

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Introductory Note

This user's guide uses the warning labels and indications listed below. Their purpose is to protect the user from personal injury and the user's property from damage, and to ensure safe operation of operate the amplifier.
Be sure that you clearly understand the meanings of the warning labels and indications.

<< Safety Precautions >>

⚠ **DANGER**	DANGER indicates that death or serious personal injury is likely if the warning is disregarded.
⚠ **WARNING**	WARNING indicates that death or serious personal injury could result if the warning is disregarded.
⚠ **CAUTION**	CAUTION indicates that personal injury or property damage could result if the warning is disregarded.

Meanings of warning labels

Warning label	Meaning
	Caution required: This label indicates that personal injury or property damage could result if the user disregards the caution.
	Caution: Laser beam: This label indicates that an invisible high-power laser beam is being output. Loss of eyesight, eye injury, or burns could result if the user looks directly at the output connector or the user's hand is exposed to the laser beam.
	Caution: Electric shock: This label indicates that the user could receive an electric shock if the user handles the indicated part incorrectly.
	Caution: Rotating part: This label indicates a rotating part, such as a fan. Personal injury or property damage could be result if the user removes the guard attached for the rotating part or inserts an object through the guard.
	Prohibited: This label indicates a prohibited action. Personal injury or property damage could result if the user takes the prohibited action.
	Do not look!: This label tells the user not to look directly at the laser beam. Loss of eyesight or eye injury could result if the user looks directly at the laser beam.
	Do not disassemble!: This label tells the user not to disassemble or modify the amplifier. Personal injury or property damage could result if the user disassembles or modifies the amplifier.

Continue to next page.

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Meanings of warning labels (continued)

Warning label	Meaning
	Do not use where damp!: This label tells the user not to use the amplifier where it is wet or humid. Personal injury or property damage could result if the user uses the amplifier where it is wet or humid.
	Do not touch!: This label tells the user not to touch the amplifier or other object. Personal injury could result if the user touches the amplifier or the indicated object.
	Disconnect plug!: This label tells the user to disconnect the power plug from the outlet.
	Ground!: This label tells the user to be sure to ground the amplifier.
	Perform an action: This label tells the user to take a specified action.

The symbol △ indicates a caution or warning.

The symbol ⃠ indicates a prohibited action.

The symbol ● indicates a specified action that the user must take.

Preface

Thank you for purchasing an ErFA1200/1300 Series Optical Fiber Amplifier.
This user's guide explains the basic ways in which the ErFA1200/1300 series of amplifiers can be used.

To ensure correct operation of the amplifier, read through this guide before using the amplifier, and keep the guide handy while using the amplifier.

Verify the contents of your amplifier package.

Make sure that you have received all of the items listed below.

• ErFA1200 or ErFA1300 Optical Fiber Amplifier	(one unit)
• User's guide (this manual)	(one copy)
• Power keys	(two)
• Power cable (one)	(one)

If any item is defective, please notify the store or agent that sold you the amplifier.

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Organization of User's Guide

Chapter 1 Before Using the Amplifier

Chapter 1 provides views of the amplifier and important information on its use. Read this chapter before using the amplifier.

Chapter 2 Functions

Chapter 2 explains the functions of the amplifier. Read this chapter before using the amplifier.

Chapter 3 Installation and Connection

Chapter 3 explains how to install the amplifier and how to connect the optical fiber cables.

Chapter 4 Operation

Chapter 4 explains how to operate the amplifier.

Chapter 5 Troubleshooting

Chapter 5 describes items you should check if a problem occurs during operation of the amplifier. Also read this chapter if the amplifier does not seem to be operating properly.

Chapter 6 Specifications

Chapter 6 contains the specifications of the amplifier.

Appendixes

The appendixes explain the interface specifications of the amplifier and list the functions of the amplifier. Read the appendixes as required.

Notation

This guide uses the following notation. Refer to the following table as necessary while reading the guide:

Symbol	Meaning
Amplifier or AMP	"Amplifier" or "AMP" means an ErFA1200/1300 desktop amplifier.
[MODE]	Text enclosed in brackets [ ] indicates the name of a switch.
{ACT}	Text enclosed in { } indicates the name of an LED indicator.
(→ 1-1)	A number enclosed in parentheses indicates the number of a reference page. If a reference page is indicated, please read the appropriate material on that page.
Note	"Note" indicates information about an amplifier function or operation you should pay special attention to. Be sure to read each Note.
Reference	"Reference" indicates information you should know about the operation of the amplifier.

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Chapter 1 Before Using the Amplifier

The ErFA1200/1300 series of optical fiber amplifiers amplify an optical transmission signal in the 1550-nanometer band by using an excitation light with a wavelength of 1480 or 980 nanometers. The amplifiers output the amplified light via an erbium-doped fiber cable.
This chapter explains the features of the amplifiers and provides important information you need to know to ensure their safe operation.

1.1 Features

An ErFA1200/1300 series amplifier is a desktop optical fiber amplifier designed for experimental use in systems. The optical fiber amplifier has the following features:

(1) An input signal light can be amplified independently of the level of the input signal light.

(2) Maximum output level is +24 dBm (ErFA1224).

(3) Maximum gain is 40 dB (ErFA1224).

(4) An optical I-O monitoring function monitors input and output levels. (This feature is optional for some models.)

(5) Output control is available for the following three operating modes:
- ACC mode: Stabilizes the current to drive the excitation light source.
- APC1 mode: Stabilizes the light output from the excitation light source.
- APC2 mode: Stabilizes the light output from the amplifier.

(6) Output levels can be set and displayed in each operating mode.

(7) ErFA1300 series models that use an excitation light with a wavelength of 980 nanometers have less noise than the other models.

(8) The input and output units have optical isolators to prevent the input light or output light from returning to the input cable or the amplifier, respectively.

1.2 Models

The ErFA1200/1300 series of amplifiers consist of the models listed below. The models differ in the wavelength of the excitation light source and the maximum level of output. Make sure that the model you purchased matches your specifications.

Table 1.1 Models

Model number	Maximum output level (*1)	Wavelength of excitation light source
ErFA1215	+15dBm	1480nm
ErFA1220	+20dBm	
ErFA1224	+24dBm	
ErFA1313	+13dBm	980nm
ErFA1316	+16dBm	

*1 This maximum output level assumes that the input signal level is more than 0 dBm. The tolerance for the maximum output level is ±1 dB.

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1.3 Notes on Use

The ErFA1200/1300 amplifiers are precision instruments. Observe the following precautions to ensure that you install and use your amplifier correctly:

1.3.1 Safety precautions

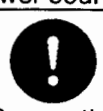
⚠ DANGER

 Caution: Invisible light  Do not look!	◆ Use extreme care around high-power invisible light output. The ErFA1200/1300 amplifiers output high-power light from their output connectors. Although the output light is invisible, loss of eyesight, eye injury, or burns could result if you look at the output connector or your hands are exposed to the light.
 Wear protective goggles!	◆ Wear protective goggles to protect your eyes. Be sure to wear goggles or glasses specially designed to protect your eyes from invisible, high-power laser beams. Failure to wear them could result in loss of eyesight or eye injury.

⚠ WARNING

 Disconnect power plug from outlet!	◆ Take quick action if you see smoke. If you see smoke coming from the amplifier or notice an unusual smell, stop operating the amplifier immediately. Using the amplifier in such an abnormal condition may result in a fire or electric shock. Disconnect the power plug from the outlet immediately. After making sure that the smoke or smell has stopped, ask the store where you purchased the amplifier to repair it. Never try to repair the amplifier yourself.
 Prohibited	◆ Handle the power cable carefully. Do not scratch or damage the power cable, modify it, bend or pull it with force, twist it, or bundle it with other cables. Do not put heavy objects on the power cable or heat it. Doing any of these actions may result in damage to the power cable, fire, or electric shock.
 Do not touch!  Disconnect power plug from outlet!	◆ Do not touch the amplifier if lightning occurs. If lightning occurs, do not touch the amplifier. Stop operating the amplifier, and disconnect the power plug from the outlet. Lightning may cause a fire or electric shock, or damage the amplifier.
 Prohibited	◆ Do not use the amplifier in medical, aeronautical and space, rail and transportation, or nuclear power control facilities. ErFA1200/1300 amplifiers are not intended for the use in life-critical systems, such as medical instrumentation, aeronautical and space equipment, transportation equipment, and nuclear power control equipment.

⚠ CAUTION

 Foreign matter prohibited  Disconnect power plug from outlet!	◆ Take the following action if a foreign substance or liquid enters the amplifier. Be careful that a foreign substance, such as metal objects or flammable materials, or liquids, such as water, do not enter the amplifier through a louver. If a foreign substance or liquid enters the amplifier, disconnect the power plug from the outlet and notify the store where you purchased the amplifier. If the amplifier is allowed to operate while a foreign substance or liquid remains inside, an electric shock or failure may result.
 Foreign matter prohibited	◆ Do not insert a foreign substance into the connector. Never insert any substance other than the specified cable connector into the connector on the amplifier. Doing so may cause an electric shock or damage the amplifier.
 Do not disassemble!	◆ Do not disassemble or modify the amplifier. Do not open the cover of the amplifier, or disassemble or modify the amplifier. Doing so may cause injury or electric shock, or damage the amplifier. The manufacturer bears no responsibility for accidents caused by disassembly or modification of the amplifier.
 Ground the amplifier!  Caution: Electric shock	◆ Be sure to ground the amplifier. Be sure to ground the amplifier to prevent an electric shock resulting from electrical leakage. To ground the amplifier, connect the power cable to an outlet having a ground terminal that has already been grounded.
 Caution: High voltage  Do not make multiple connections to power source!	◆ Use a voltage that falls within the power cable rating. The ErFA1200/1300 amplifiers can use both 100 VAC and 200 VAC power, but the power cable used depends on the voltage. Use a voltage that satisfies the voltage rating of the accessory power cable. Do not use a DC power cable. Be sure to use the accessory power cable that was supplied with the amplifier. Do not modify the power cable or make multiple connections (that is, a star-burst connection) to the power source. Doing so may cause a fire or electric shock.
 Secure the amplifier!	◆ Secure the amplifier. If the amplifier is installed in an elevated position, secure the amplifier to prevent it from falling. If the amplifier falls, it may be damaged or cause injury.
 Install cables properly!	◆ Install cables properly. Route and secure the amplifier's optical fiber and power cables properly so that no one will trip on the cables. Tripping on the cables may result in injury or damage the amplifier.

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[Safety precautions] (Continued)

⚠ CAUTION

 Do not touch!	◆ Do not operate the amplifier with wet hands. Neither hold the power plug with wet hands while connecting or disconnecting power, nor touch the amplifier with wet hands. Doing so may cause an electric shock.
 Do not touch!	◆ Do not touch the amplifier when the temperature is very high or very low. The amplifier has a metal cabinet. Do not touch it if it has been left in a high-temperature or low-temperature environment. Doing so may cause burns or frostbite.

1.3.2 Notes on use

⚠ CAUTION

 Do not stack!	◆ Do not put anything on the amplifier. Neither put anything on the amplifier nor stack amplifiers. Doing so may cause the amplifier to malfunction.
 Do not connect or disconnect cables in excitation state!	◆ Be sure to turn off excitation before connecting or disconnecting an optical fiber cable. Do not connect optical fiber cables to or disconnect them from the amplifier when the amplifier is in the excitation state. Before connecting or disconnecting them, make sure that amplifier excitation and amplifier input signal light are off. If excitation is not turned off, a malfunction or damage may be caused.
 Do not pull cables!	◆ Do not forcefully pull connected cables. Do not pull the cables connected to the amplifier with any amount of force. When disconnecting the power cable, be sure to hold it by the power plug. Pulling the power cable with excess force may result in damage.
 Use in a redundant configuration!	◆ Design a redundant and safe configuration. The ErFA1200/1300 amplifiers are intended for the use in system experiments and for evaluation. If the amplifier is to be used in a system requiring a high level of reliability, be sure to design a redundant configuration and adequate safety mechanisms to guard against incorrect operation. If you use the amplifier for any purpose other than a system experiment or evaluation, contact the manufacturer first. The manufacturer bears no responsibility for damage or accidents that are caused by an amplifier failure or malfunction if the amplifier has been used for any purpose other than a system experiment or evaluation.
 Caution: Rotating part	◆ Use caution around the rotating parts of the cooling fan unit. Do not remove the guard from the amplifier's cooling fan unit or insert your finger or another object through the guard. Doing so may result in personal injury or damage the amplifier.
 Caution: Dust	◆ Take appropriate precautions if the amplifier will not be used for a long time. If you do not use the amplifier for a long time, securely cover each optical I-O connector securely with a connector cover to prevent dust from entering the connector. If dust enters a connector, optical loss may increase or the connector pins may seize.
 Do not use chemicals!	◆ Note the following when cleaning the amplifier. When cleaning the amplifier, lightly wipe off dirt with a dry soft cloth or a soft cloth dipped in water or neutral detergent. Do not use benzene or a thinner (volatile chemical). Also, make sure that the amplifier is not exposed to insecticides or other chemicals.

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[Notes on use] (Continued)

⚠ CAUTION

Caution regarding disposal Do not dispose of the amplifier illegally!	◆ When you dispose of the amplifier, treat it as industrial waste. If you dispose of your amplifier, never dispose of it illegally, but dispose of it as industrial waste at an industrial waste disposal center in accordance with the Law Concerning Disposal and Cleaning of Wastes. Recycle the packing materials used for the amplifier or dispose of them as instructed by the local government authorities.
Stop using the amplifier!	◆ If a malfunction or damage occurs, take appropriate action. If the amplifier malfunctions or is damaged, immediately stop using it then, ask the store where you purchased it to repair it. Using an unrepaired amplifier when an abnormal condition has occurred may result in fire, electric shock, or personal injury.

1.3.3 Conditions for Installation and Use

⚠ CAUTION

 Observe power requirements!	◆ Use a power source that complies with power requirements. Voltage: 100 to 120 VAC (100 VAC system) 100 to 240 VAC (200 VAC system) Frequency: 50 to 60 Hz
 Comply with temperature and humidity requirements!	◆ Use the amplifier under the proper temperature and humidity conditions. Temperature: 0°C to +40°C Relative humidity: 20 to 80 % (no condensation)
 Do not use in high- or low-temperature environment!	◆ Do not use the amplifier in high-temperature and low-temperature environments. Do not install and use the amplifier when the temperature is extremely high or low nor in an environment where sudden changes in temperature occur. Doing so may cause the amplifier to malfunction. Comply with the ambient operating temperature.
 Do not install where temperature high!	◆ Do not install the amplifier where it is exposed to heat. Do not install and use the amplifier in a location exposed to direct sunlight or a location near a heater or fire. Doing so may cause the amplifier to malfunction.
 Do not use where damp!	◆ Do not use the amplifier where there is moisture. Do not use the amplifier where it is humid or where water can be splashed on the amplifier. The amplifier does not have a waterproof design. If the amplifier is exposed to moisture, electric shock or a malfunction may occur. Comply the ambient humidity requirements.
 Do not use where dusty!	◆ Do not use the amplifier where it is dusty. Do not use the amplifier in a location, such as near a window or on the floor, where there is much dust. Using the amplifier where it is dusty may result in the optical fiber connector pins becoming dirty or seizing, an increase in optical loss, a malfunction, or electric shock.
 Do not install where unstable!	◆ Install the amplifier in a stable location. Do not install the amplifier on a shaky desk or tilted surface or in any other unstable location. Also do not install the amplifier where it could be subject to strong shocks or vibration. If the amplifier is installed where it is unstable, it may fall, resulting in personal injury, damage, or a malfunction.
 Do not expose to fumes!	◆ Do not use the amplifier in special environments. Do not use the amplifier in environments where the amplifier could be exposed to fumes from spilled chemicals or to the chemicals themselves. Doing so may corrode the amplifier or cause it to malfunction.

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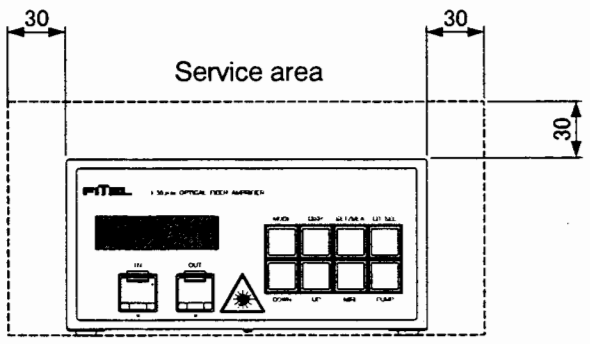
[Conditions for Installation and Use] (Continued)

⚠ CAUTION

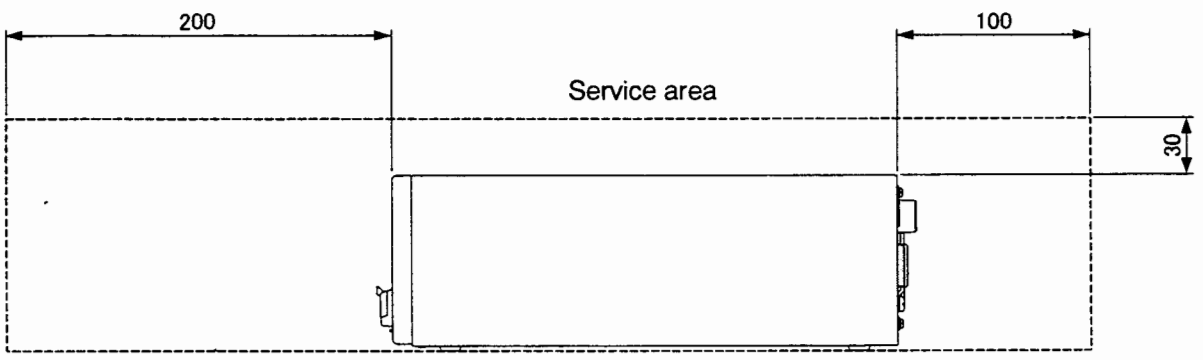
 Do not use in strong magnetic field!	◆ Do not use the amplifier where it is exposed to strong magnetic fields. Do not use the amplifier near a device such as a motor or near a high-current cable that could generate a strong magnetic field. Doing so may result in incorrect operation or damage the amplifier from external noise.
 Ventilate!	◆ Do not block the louvers. The amplifier has louvers at the back and on the bottom to allow internal heat to escape. When installing the amplifier, be careful not to block the louvers. If the louvers are blocked so that internal heat cannot escape, the amplifier may be damaged or malfunction.
 Preserve service area!	◆ Make sure that the service area is adequate. Maintain the space and area required for ventilation by the louvers and for the handling of cables. If you install amplifiers side by side, provide an adequate service area for each amplifier. An insufficient service area may result in cable problems or other problems.
 Transport carefully!	◆ When transporting the amplifier, handle appropriately When carrying the amplifier during installation or a move, hold both sides of the amplifier tightly. Do not hold the amplifier with one hand, since it may fall, resulting in personal injury or damage to the amplifier.

1.4 Installation Space

Figure 1.1 shows the space required for installing the amplifier.
Prepare a space that is larger than the service area indicated by the dimensions below.



Front



Side

(Unit: mm)

Figure 1.1 Space for amplifier installation (common to all models)

For the dimensions of each model, see the exterior views or amplifier specifications.

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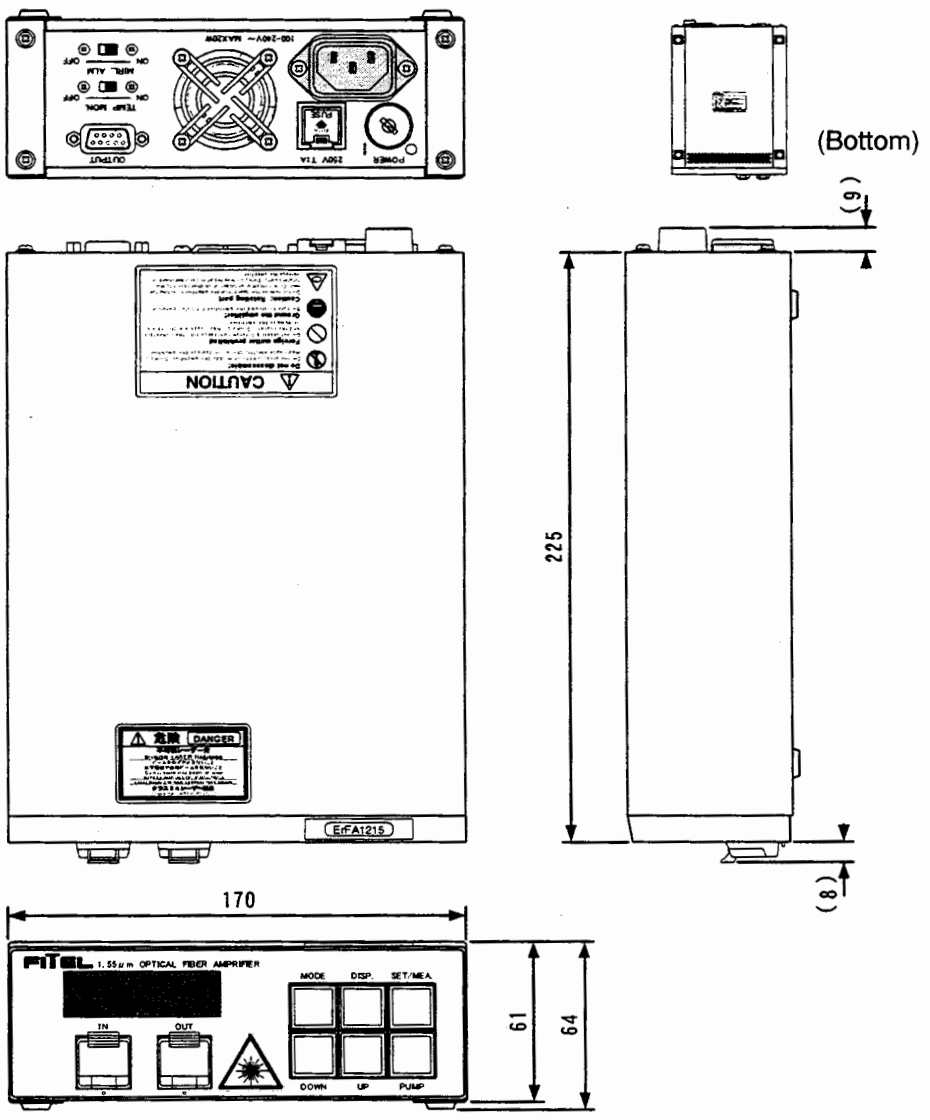
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1.5 Exterior Views

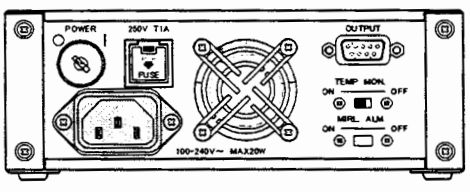
Figures 1.2 to 1.4 show the ErFA1200/1300 series models.

1.5.1 ErFA1215/1313

O Model with input level monitoring option mounted



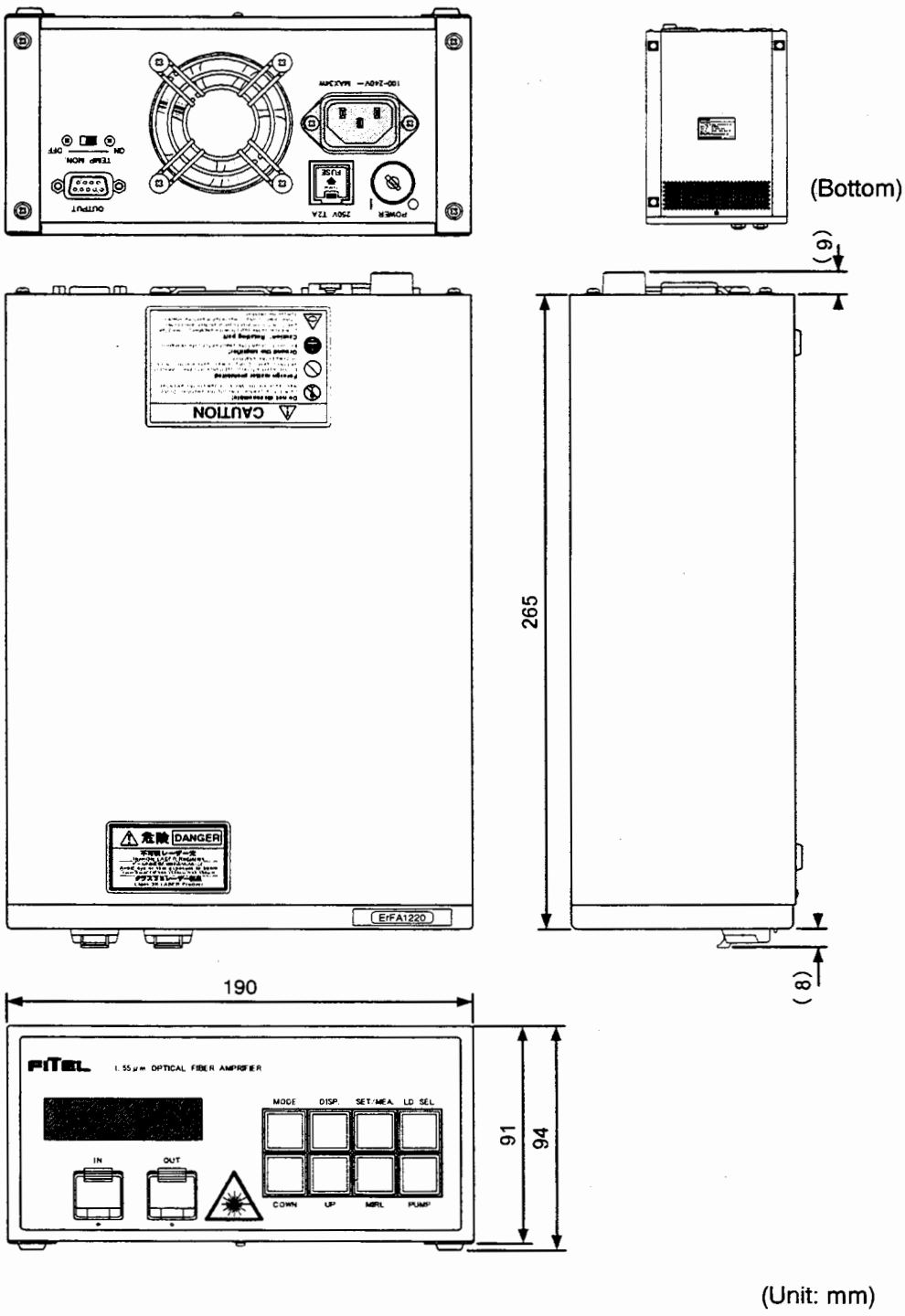
O Back of standard model (without input level monitoring option mounted)



(Unit: mm)

Figure 1.2 ErFA1215/1313

1.5.2 ErFA1220/1316



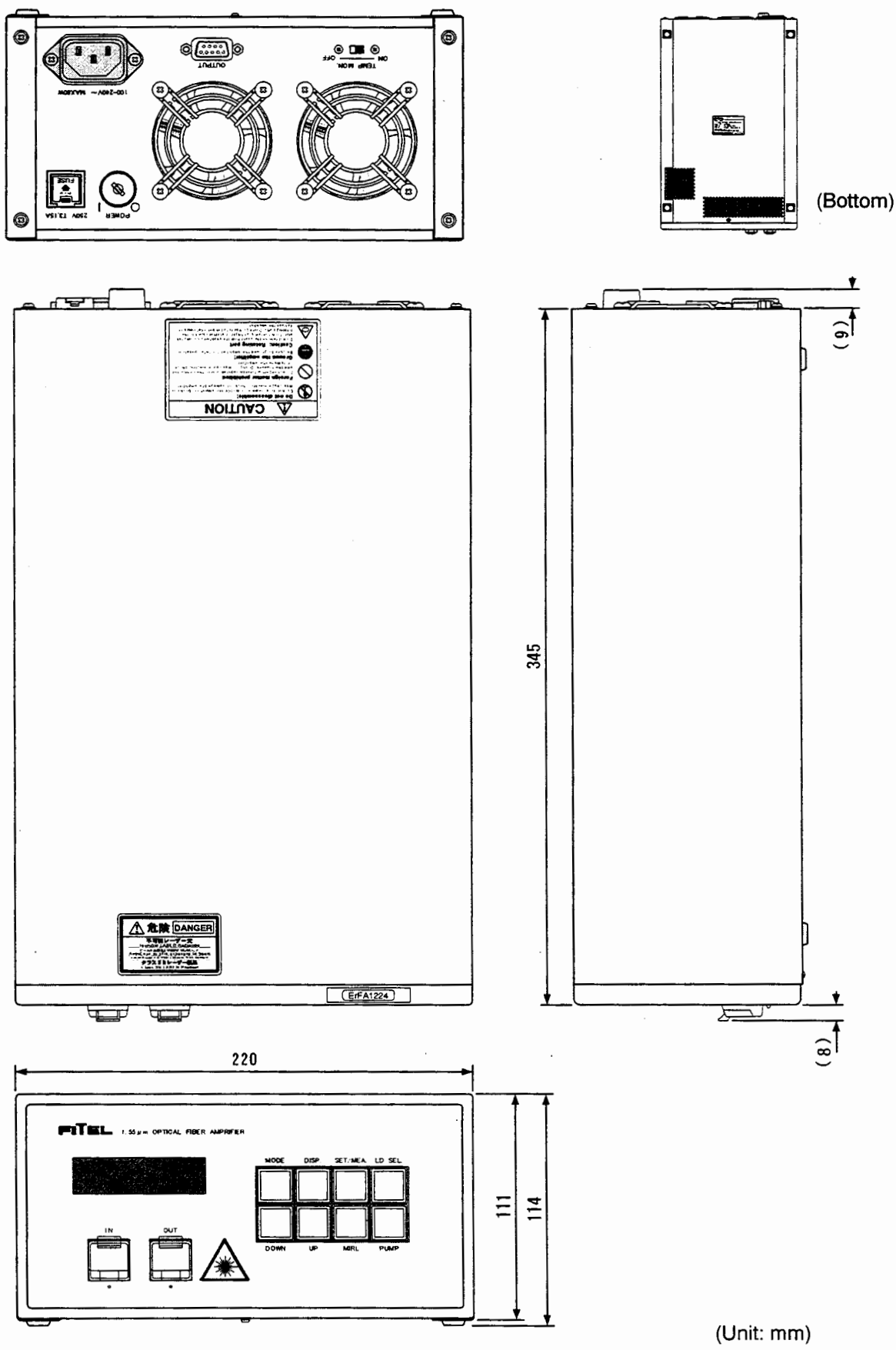
(Unit: mm)

Figure 1.3 ErFA1220/1316

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1.5.3 ErFA1224



(Bottom)

(Unit: mm)

Figure 1.4 ErFA1224

Chapter 2 Functions

2.1 Functions

The main functions of the amplifier are as follows:

(1) The amplifier amplifies an input signal light independently of the level of the input light signal.
(2) The amplifier monitors input and output levels with an optical I-O monitoring function. (→ 2-8)
(3) The amplifier controls output in the three following operating modes. (→ 2-8)
- ACC mode
- APC1 mode
- APC2 mode

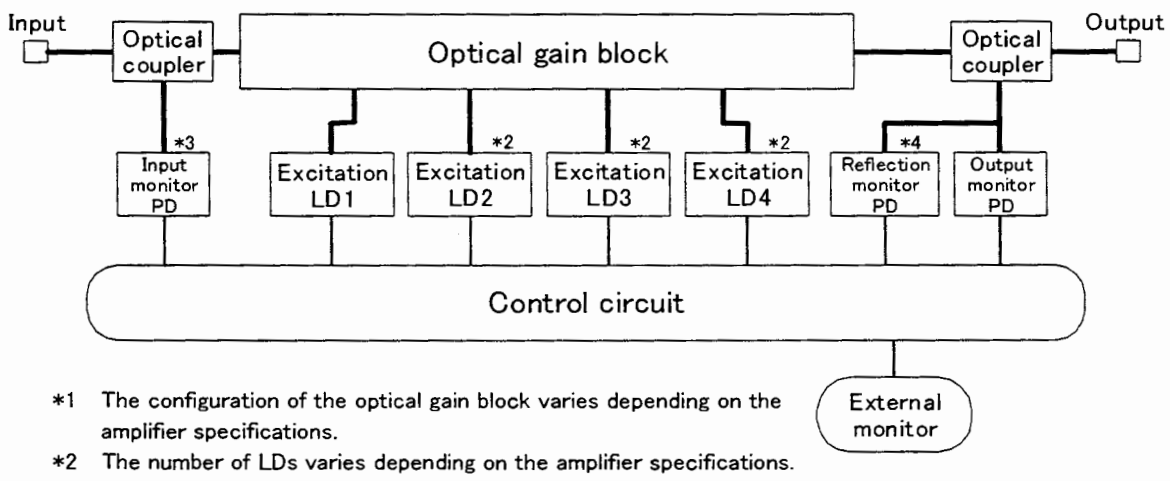
(4) The amplifier displays the output status in each operating mode. (→ 2-6)
(5) The amplifier stops excitation forcibly if the input signal light, reflection of output light, or laser diode (LD) temperature is abnormal. (→ 2-8)
(6) The amplifier outputs an analog voltage indicating the status of the amplifier to an external-monitor terminal. (→ 2-10)

Reference

- Functional specifications of the amplifier vary depending on the model. For the specifications of standard and optional functions, see Appendix B, "List of Amplifier Functions." (→ B-1)

2.2 Configuration of Amplifier

Figure 2.1 shows the basic configuration of the amplifier.



*1 The configuration of the optical gain block varies depending on the amplifier specifications.
*2 The number of LDs varies depending on the amplifier specifications.
*3 The input monitor PD is optional for the ErFA1215 and ErFA1313.
*4 The reflection monitor PD is not mounted on the ErFA1215, ErFA1313, and ErFA1316

Optical coupler: Self-explanatory
PD: Photodiode
LD: Laser diode

Figure 2.1 Basic configuration of the ErFA1200/1300 series amplifiers

Note

- The configuration of the optical gain block, number of LDs, and number of PDs may change according to the specification requirements of the user. Before using the amplifier, read through this guide so that you understand the amplifier's operation.

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2.3 Names and Functions of Parts

This section provides the names and functions of the parts of the amplifier.

2.3.1 Front panel

Figures 2.2.1 and 2.2.2 show the front panels of different amplifier models.

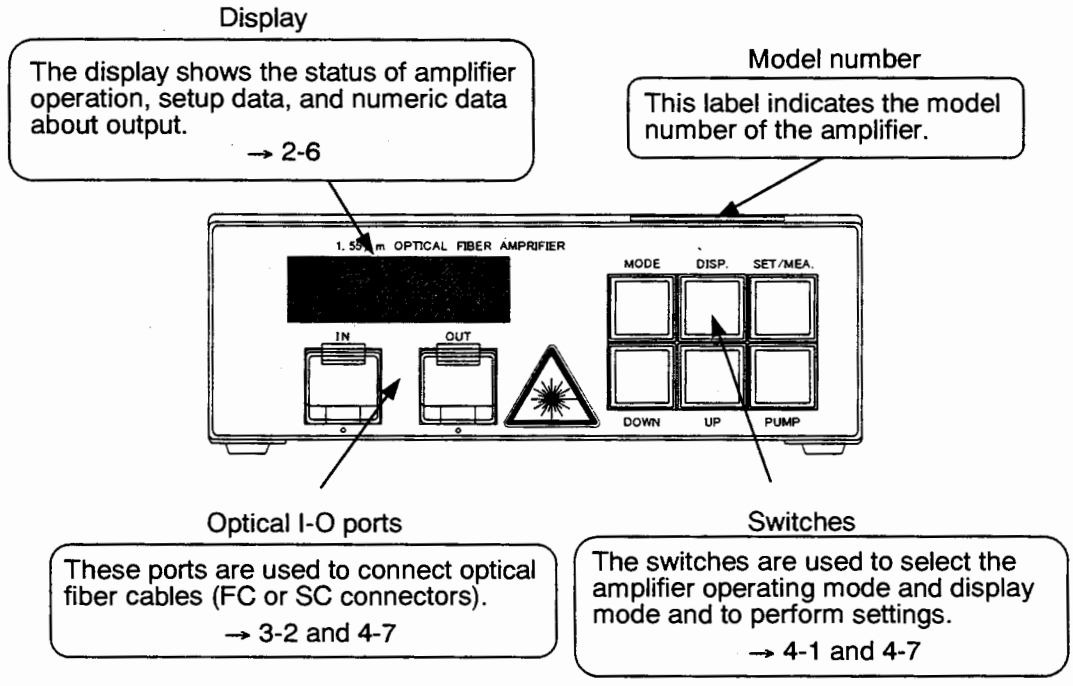


Figure 2.2.1 Names and functions of the parts on the front panel of the ErFA1215/1313

* For details, see the page indicated by the arrow (→).

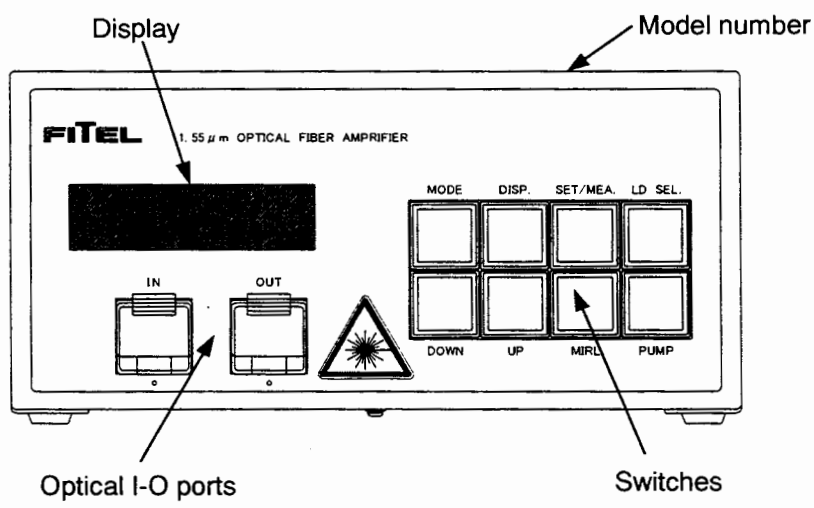


Figure 2.2.2 Names and functions of the parts on the front panel of the ErFA1220/1316

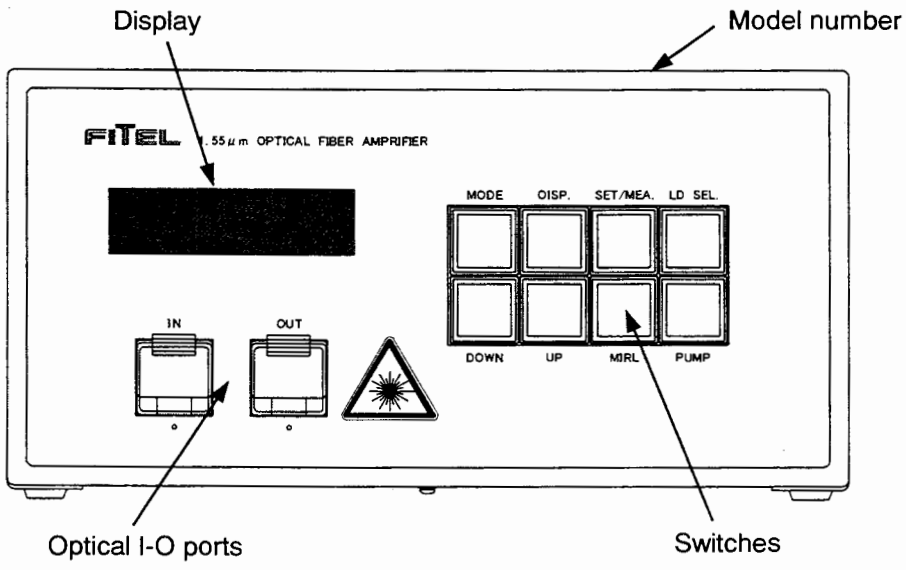


Figure 2.2.3 Names and functions of the parts on the front panel of the ErFA1224

2.3.2 Back panel

Figures 2.3.1 and 2.3.2 show the back panels of different amplifier models.

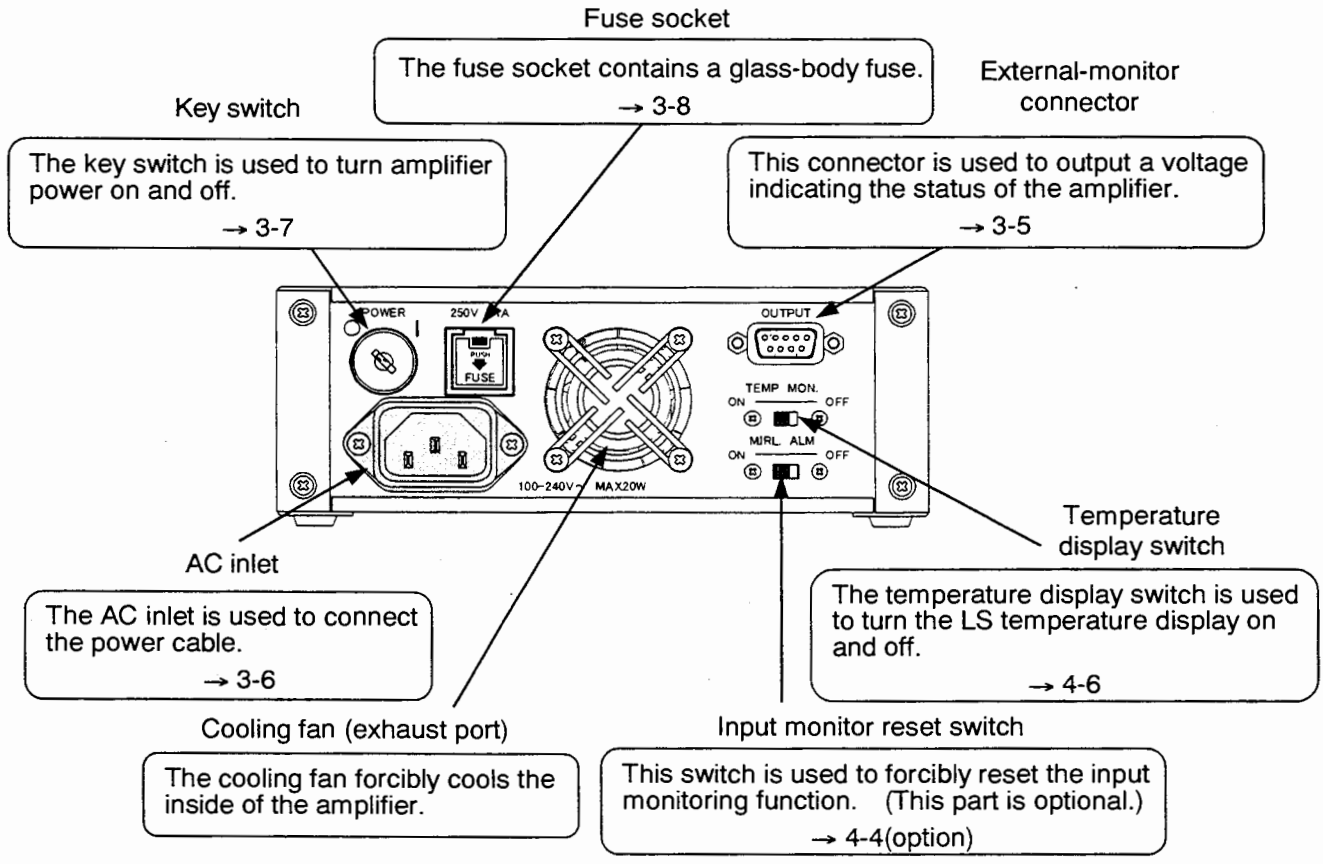


Figure 2.3.1 Names and functions of the parts on the back panel of the ErFA1215/1313

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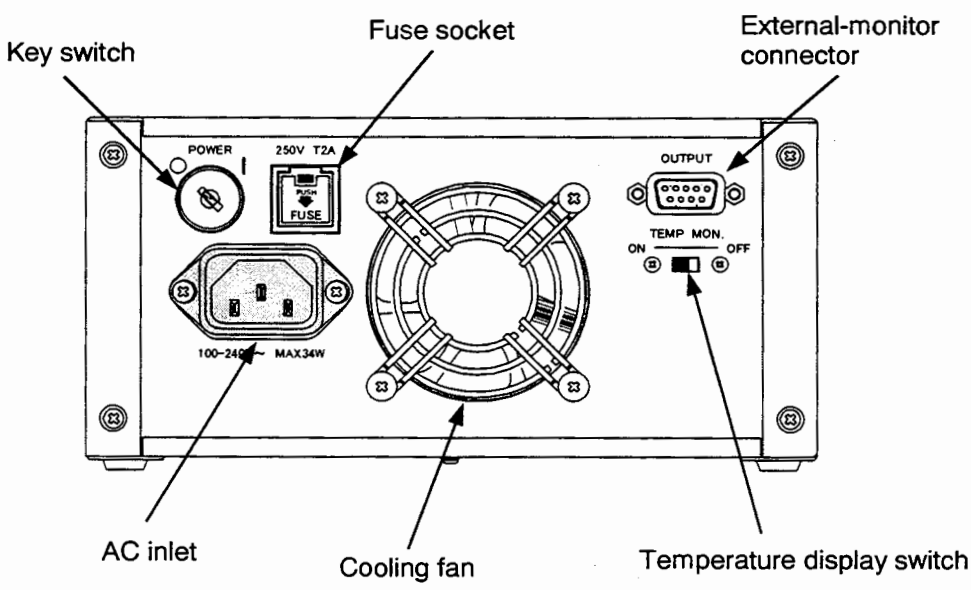


Figure 2.3.2 Names and functions of the parts on the back panel of the ErFA1220/1316

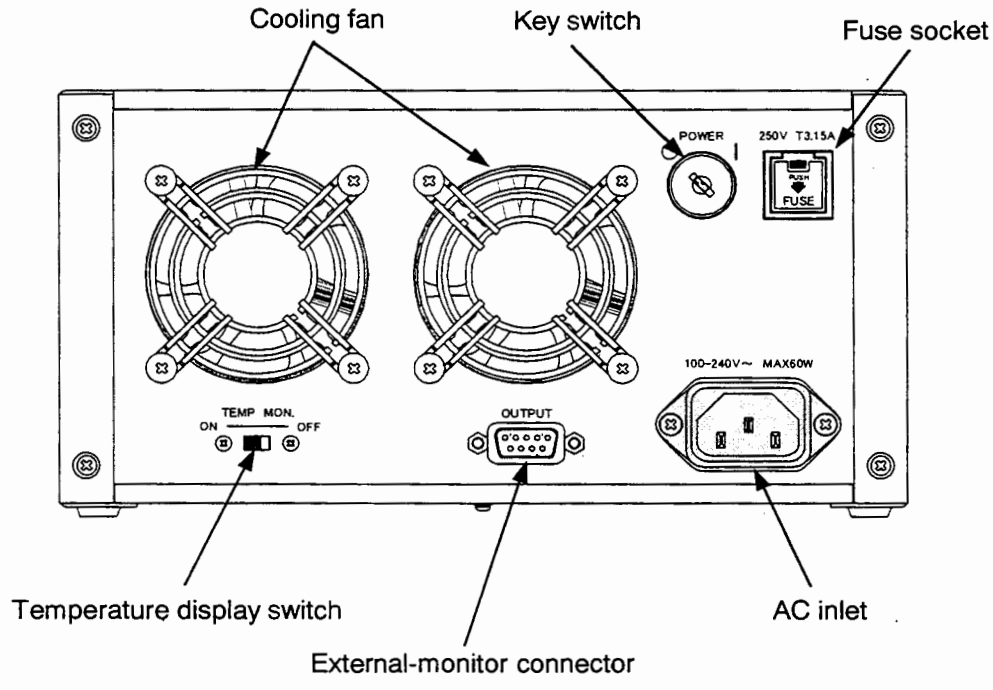


Figure 2.3.3 Names and functions of the parts on the back panel of the ErFA1224

2.3.3 Bottom panel

Figures 2.4 shows the bottom panels of different amplifier models.

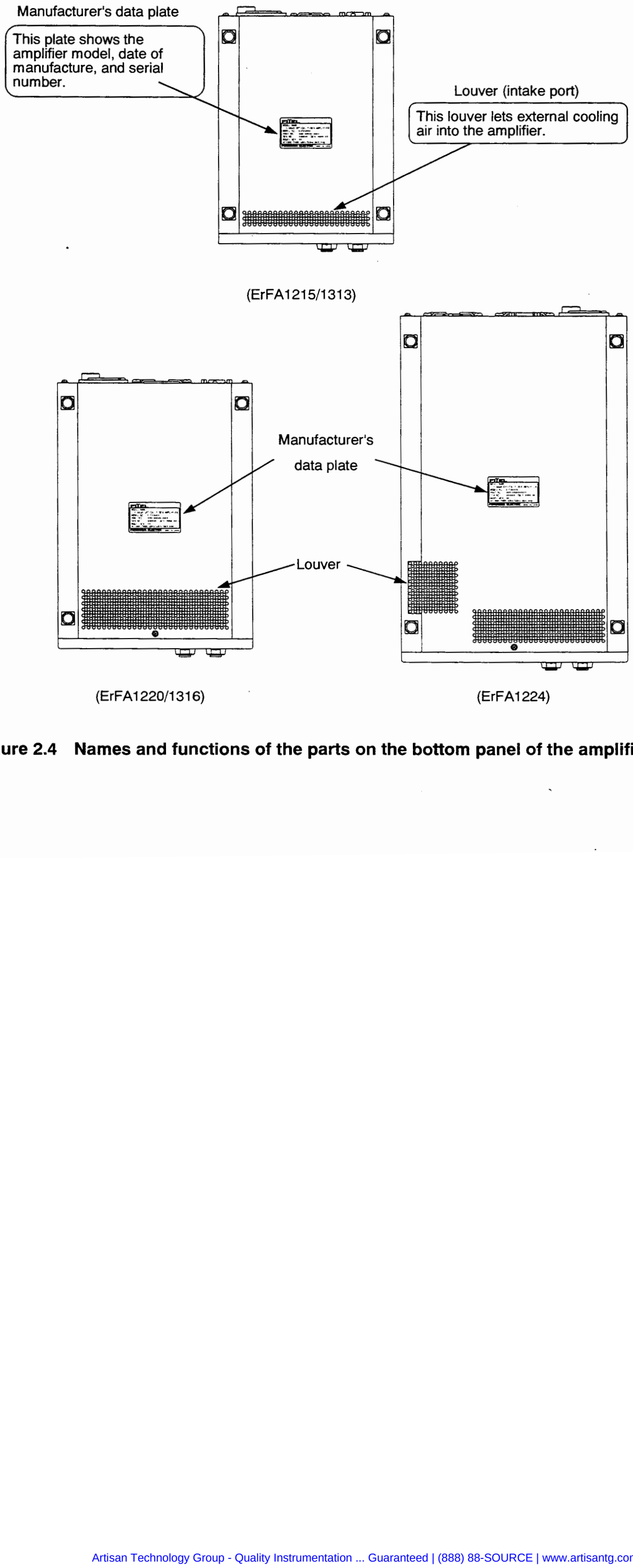


Figure 2.4 Names and functions of the parts on the bottom panel of the amplifier

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2.4 LED Display

This section explains the amplifier operating states indicated by the light-emitting diodes (LEDs).

2.4.1 LED arrangement

Figures 2.5.1 to 2.5.3 show the arrangement of LEDs on the amplifier.

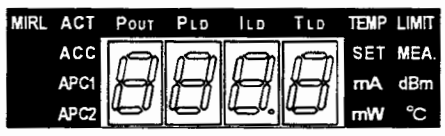


Figure 2.5.1 Arrangement of LEDs on the ErFA1215/1313

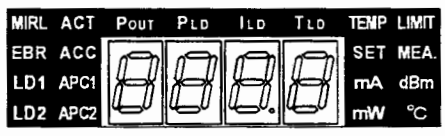


Figure 2.5.2 Arrangement of LEDs on the ErFA1220/1316

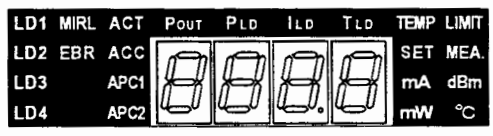


Figure 2.5.3 Arrangement of LEDs on the ErFA1224

2.4.2 Classification of LEDs

Figure 2.6 shows the classification of LEDs.

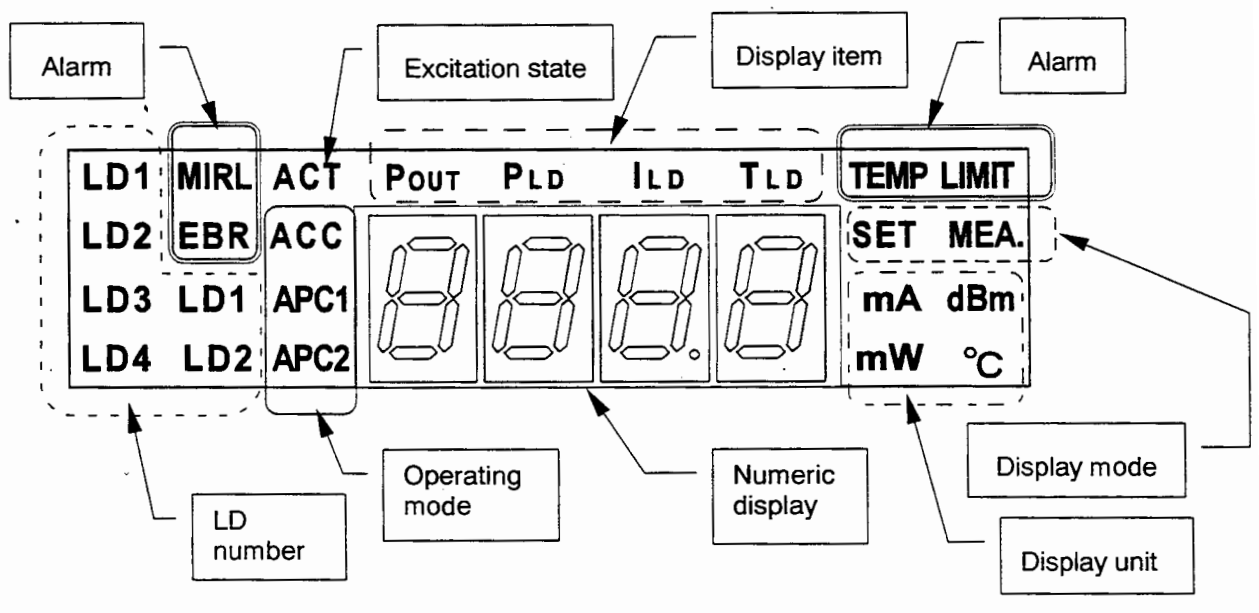


Figure 2.6 Classification of LEDs (common to all models)

2.4.3 Meaning of LED indications

Table 2.1 lists the LED indications.

Table 2.1 LED indications

No	Classification	LED name (characters lit)	Color	Meaning
1	Excitation state	ACT	Red	Indicates the status of the excitation LDs. When ACT is on, the excitation LDs are on. When ACT is off, the excitation LDs are off.
2	Operating mode	ACC	Green	Lights when the amplifier is in Automatic Current Control (ACC) mode.
		APC1	Green	Lights when the amplifier is in Automatic Power Control 1 (APC1) mode.
		APC2	Green	Lights when the amplifier is in Automatic Power Control 2 (APC2) mode.
3	Display item (*2)	POUT	Green	Lights when the amplifier output is displayed in the numeric display.
		PLD	Green	Lights when the LD output is displayed in the numeric display.
		ILD	Green	Lights when the LD current is displayed in the numeric display.
		TLD	Green	Lights when the LD temperature is displayed in the numeric display.
4	Display Unit (*2)	dBm	Green	Lights to indicate the unit when amplifier output is displayed.
		mW	Green	Lights to indicate the unit when LED output is displayed.
		mA	Green	Lights to indicate the unit when LD current is displayed.
		°C	Green	Lights to indicate the unit when LD temperature is displayed.
5	Display mode	SET	Green	Lights to indicate that a set value is displayed.
		MEA.	Green	Lights to indicate that a measured value is displayed.
6	Alarm (*1)	TEMP	Red	Lights when the LD temperature is abnormal.
		LIMIT	Red	Lights when the LD drive current is over the maximum limit.
		MIRL	Red	Lights when the input level is abnormal. Indicates that protection by the input monitoring function is in effect.
		EBR	Red	Lights when the level of reflected output light is abnormal. Indicates that protection by the output monitoring function is in effect.
7	LD number (*1)	LD1-4	Green	One of these LEDs lights to indicate that the corresponding LD is selected. The number of the LD is displayed.
8	Numeric display	8888	Green	Displays a four-digit numeric indicating an operating mode or data.

*1 Some models do not have all of these LED display functions.
*2 The display item and the unit indications are linked.

Reference

- With the exception of an alarm, every indication item is selected according to a switch operation by the user.

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2.5 Output Control

The ErFA1200/1300 amplifiers have three operating modes for controlling the stability of output.
You can select and set a desired operating mode, or output control method, with the [MODE] switch. (→ 4-1)

Table 2.2 Output control modes

Select No.	Operating mode	Output control method	
1	ACC (Automatic Current Control)	LD drive current	The current to the excitation light source LD is controlled to be consistent.
2	APC1 (Automatic Power Control 1)	LD output power	The optical output from the excitation light source LD is controlled to be consistent.
3	APC2 (Automatic Power Control 2)	Amplifier output power	The optical output from the amplifier is controlled to be consistent.

Returned

2.6 Alarm and Protection Functions

Because ErFA1200/1300 series amplifiers output invisible high-power laser beams (when the output level is +17 dBm or more), they have input monitoring and output monitoring functions that provide alarms during use to ensure safety.
As protective functions, the amplifiers also have circuits to limit the LD drive current and protect LDs from abnormal temperatures.

2.6.1 Input level monitoring function

- The input level monitoring function is standard on all models except the ErFA1215 and ErFA1313. On the ErFA1215 and ErFA1313, it is an option.

This function stops LD excitation forcibly when the level of the input signal light drops to -10 dBm or less.
In other words, the function operates when no input signal light is found or the level of the input signal light is low because the input optical fiber cable is not connected correctly. The function also operates when the level of the input signal light drops or the input optical fiber cable is disconnected during excitation. In theses cases, the function stops excitation and amplifier output.
Operation of the input level monitoring function is indicated when the {MIRL} LED is lit. (→ 2-6)

Reference

- While the input level monitoring function is operating (MIRL LED is on), you cannot start excitation even though you press the [PUMP] switch.
- You can reset the input level monitoring function by pressing the [MIRL] switch.

⚠ DANGER



- If you press the [MIRL] switch to forcibly reset the protection provided by the input level monitoring function, output of invisible high-power laser beams is enabled regardless of whether the input signal light is input. After pressing the MIRL switch, be careful not to look at the output connector or to touch it. Doing so may cause loss of eyesight, eye injury, or burns.

⚠ CAUTION

- If excitation is started after the input level monitoring function has been reset forcibly, a giant pulse light with a peak power of several watts to tens of watts may be produced. Such a giant pulse light may cause burning of internal optical parts or seizure of the optical output connector.

2.6.2 Level monitoring function for reflected/returned output light

◆ The level monitoring function for reflected/returned output light is standard only on the ErFA1220 and ErFA1224.

This function stops LD excitation forcibly when the level of the reflected or returned light entering from the output connector rises to about +3 dBm (when the level of amplifier output is +17 dBm or more).
In other words, the function operates when the level of reflected light is high because the output optical fiber cable is not connected correctly or the output connector is open. The function also operates when the level of reflected or returned light rises or the output optical fiber cable is disconnected during excitation. In theses cases, this function stops excitation and amplifier output.
Operation of the level monitoring function for reflected/returned output light is indicated when the {EBR} LED is lit. (→ 2-6)

Reference

- While the level monitoring function for reflected/returned output light is operating (BER LED is on), you cannot start excitation even though you press the [PUMP] switch.
- You can reset the level monitoring function for reflected/returned output light by pressing the [MIRL] switch.

⚠ DANGER

- If you press the {MIRL} switch to forcibly reset the protection provided by the level monitoring function, output of invisible high-power laser beams is enabled. The output is enabled regardless of whether an optical fiber cable is connected to the output connector or whether the output connector is open. After pressing the MIRL switch, be careful not to look at the output connector or to touch it. Doing so may cause loss of eyesight, eye injury, or burns.

2.6.3 LD drive current limit function

◆ The LD drive current limit function is standard on all models.

This function activates an alarm and limits LD drive current when the amplifier output reaches a specified level. Its operation suppresses excessive output and protects LDs.
That is, after the amplifier output reaches the specified limit, LD drive current is not increased even though the set level is increased.
Normally, operate the amplifier so that the level of its output is within the setting range for output (the {LIMIT} LED remains off).
Operation of the LD drive current limit function is indicated by the {LIMIT} LED. (→ 2-6)

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Note	• The limit level at which the {LIMIT} LED lights is preset slightly lower than the upper limit of the setting range for output. • Do not use the amplifier when the {LIMIT} LED has been lit for a long time. Doing so may cause the amplifier to malfunction.

2.6.4 LD temperature error protection function

♦ The LD temperature error protection function is standard on all models.

This function activates an alarm and stops LD excitation when the temperature of an excited LD reaches a specified level.
Normally, the function activates an alarm (the TRMP LED lights) when the preset temperature SET is exceeded by at least +5°C and stops LD excitation when the preset temperature is exceeded by +10°C.
Operation of the LD temperature error protection function is indicated by the {TEMP} LED. (→ 2-6)

Note	• The limit temperature at which the {TEMP} LED lights is preset slightly lower than the limit temperature at which excitation is actually stopped. • Do not use the amplifier when the {TEMP} LED has been lit for a long time. Doing so may cause the amplifier to malfunction.
Reference	• The {TEMP} LED may light temporarily when the amplifier is turned on or excitation is started. This temporary lighting is simply a transient state before LD temperature control starts functioning and can be ignored.

2.7 Setup Hold Function

The ErFA1200/1300 amplifiers have a function for retaining setup data.
This function retains the operating mode and output setup data in effect before the amplifier was turned off.
When the amplifier is turned on the next time, the function displays the final setup data used for the previous operation of the amplifier.

Reference	• Setup data is retained for about three or four days (depending on the time of amplifier operation). If the amplifier is left unused for a longer period, the retained setup data is cleared and replaced by the default data. • Setup data other than operating mode and output setup data is reset to the defaults each time the amplifier is turned off.

2.8 External-Monitor Function

The ErFA1200/1300 amplifiers have an external-monitor terminal that enables amplifier operation to be monitored and recorded externally. (→ 3-5)
The external-monitor terminal outputs an analog voltage from 0 to 10 VDC. It can also be used to input an external signal to stop excitation. (→ A-2)
If you connect a voltmeter or pen recorder to the external-monitor terminal, you can check or record amplifier operation.

Chapter 3 Installation and Connection

Unpack the amplifier, and check the location where you want to install the amplifier and the cables that will be connected to the amplifier. After installing the amplifier, confirm that the POWER switch on the amplifier is off, then connect the cables.

3.1 Installation

3.1.1 Checking the installation location

- See Section 1.3, "Notes on Use," and check the dimensions, conditions, and other environmental factors of where you want to install the amplifier.
- If any problems exist, resolve them before installing the amplifier. Failure to resolve a problem may result in an amplifier malfunction.

3.1.2 Positioning of amplifiers

- The ErFA1200/1300 amplifiers are desktop amplifiers. Install your amplifier on a level surface, such as a desk.
- Install an ErFA1200/1300 amplifier so that it does not tilt in any direction. The maximum allowable tilting angle is 10 degrees.

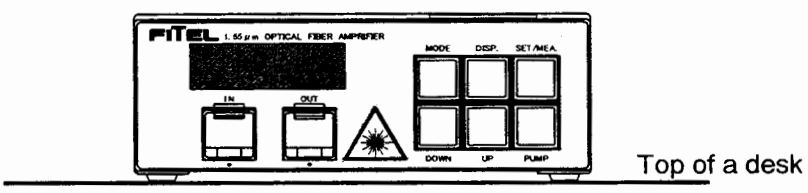


Figure 3.1 Level installation of an amplifier

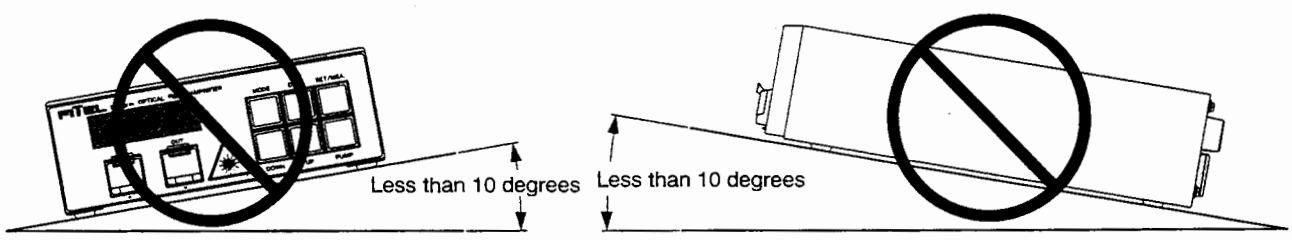


Figure 3.2 Installation on a tilted surface

⚠ CAUTION

- Be sure to install the amplifier on a level surface. Failure to do so may cause a malfunction.

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3.1.3 Securing the amplifier

When you install your amplifier, secure it properly in the following locations:

- On a high shelf
- Positioned on a desk near the edge
- Where vibration may cause the amplifier to fall
- Where the cables connected to the amplifier could be pulled out
- Any other location where the amplifier should be secured.

⚠ CAUTION

- If the amplifier is installed under any of the conditions above, secure it properly for extra safety.

3.2 Connecting Cables to Optical I-O Ports

⚠ DANGER

- Be sure to check that either the input signal light is off or the LD excitation on this amplifier is stopped before connecting optical fiber cables to optical input and optical output ports. Connecting the cables with the input signal light on or during LS excitation may result in loss of eyesight, eye injury, burns, or damage to the amplifier from the laser beam.

3.2.1 Connecting FC connectors

Figure 3.3.1 shows how to connect the FC connectors.

(1) Open the optical connector cover of the optical input (IN) or optical output (OUT) port.
(2) Clean the port FC receptacle (adapter) and the connector of the optical fiber cable to be connected to remove dust and dirt. (→ 4-7)
(3) Hold the FC connector plug of the optical fiber cable with its guide tab (convex section) up, and insert the ferrule of the FC connector plug into the port receptacle (adapter).
(4) Check that the guide tab of the plug is seated in the guide groove (concave section) of the receptacle (adapter), and tighten the knurl of the FC connector plug to secure it.

3.2.2 Connecting SC connectors

Figure 3.3.2 shows how to connect the SC connectors.

(1) Open the optical connector cover of the optical input (IN) or optical output (OUT) port.
(2) Clean the port SC receptacle (adapter) and the connector of the optical fiber cable to be connected to remove dust and dirt. (→ 4-7)
(3) Hold the SC connector plug of the optical fiber cable with its guide tab (convex section) up, and insert the ferrule of the FC connector plug into the port receptacle (adapter).
(4) Check that the guide tab of the plug is seated in the guide groove (concave section) of the receptacle (adapter). Then, push in the SC connector plug straight ahead until you hear a click and the insertion line drawn on the connector plug is hidden in the receptacle.

Reference

- You can select FC or SC connectors for the optical fiber cables to be connected to optical input and optical output ports.
- FC connectors are used as standard. The connector type may be the SC type if the user orders this type.
- Check the connector type, and use the optical fiber cables appropriate for the connector type.

⚠ CAUTION

- If the connector plug of the optical fiber cable is disconnected from a port, close the optical connector cover of the port tightly. Never leave the cover open. Leaving the cover open may cause increased optical loss or the ends of the optical fibers to become dirty or to seize.
- If an optical connector cover is damaged, stop using the amplifier.

⚠ CAUTION

- Do not turn the input signal light off and on during amplifier LD excitation. Doing so may cause the amplifier to malfunction.

  If the input signal light is turned off and on during LD excitation, a giant pulse light with a higher level than normal may be produced when the input signal light is turned on. (The input light may include a pulse light with a low duty ratio.)

  Because the peak power of such a giant pulse light is several watts to tens of watts, it may damage internal optical parts or cause the optical output connector (especially when the connector surface is dirty) to seize. (This is because the gain obtained from even the input at a saturated level can be the same as the gain obtained from low-level signal input.)
- If you want to use the amplifier for high-power output with the input of pulse light, contact our engineering department.

⚠ CAUTION

- The FC and SC receptacles (adapters) of amplifier's optical input and optical output ports use zirconium split sleeves. When inserting a connector plug, be sure to align the ferrule of the plug and the receptacle in a straight line. If the connector plug is pushed in or pulled out at an angle or lateral force is applied at insertion or removal, its split sleeve will be damaged and optical output may drop.
- If the split sleeve of a connector plug is damaged, stop using the amplifier. Failure to do so may damage the end of the ferrule.

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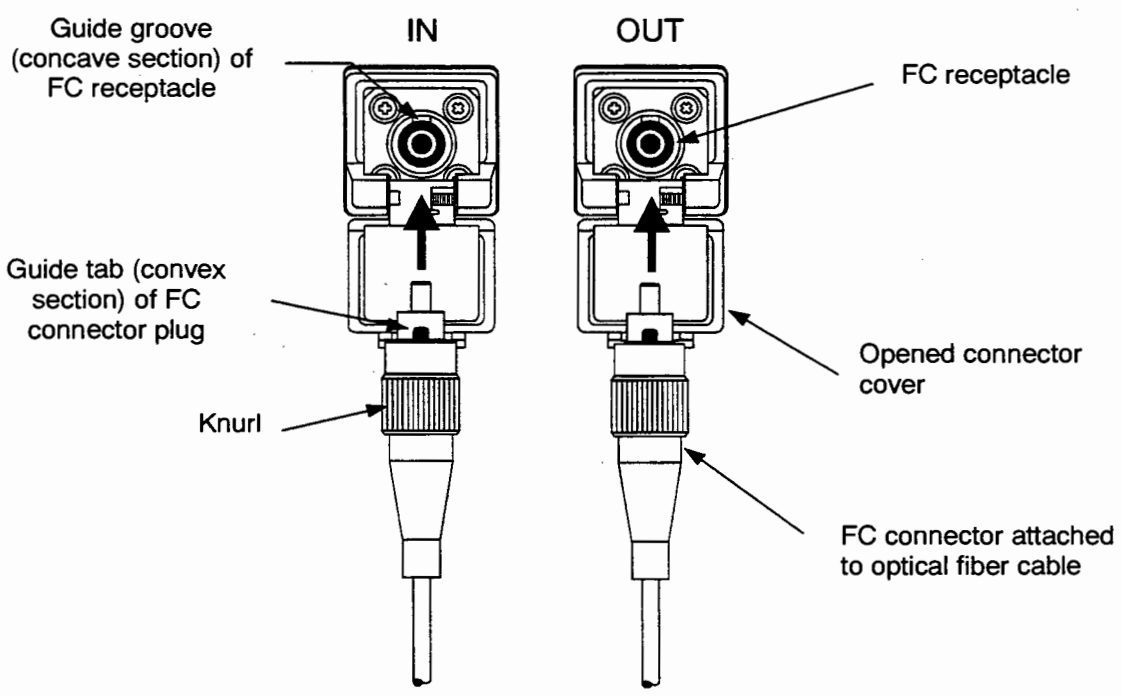


Figure 3.3.1 Connecting FC connectors

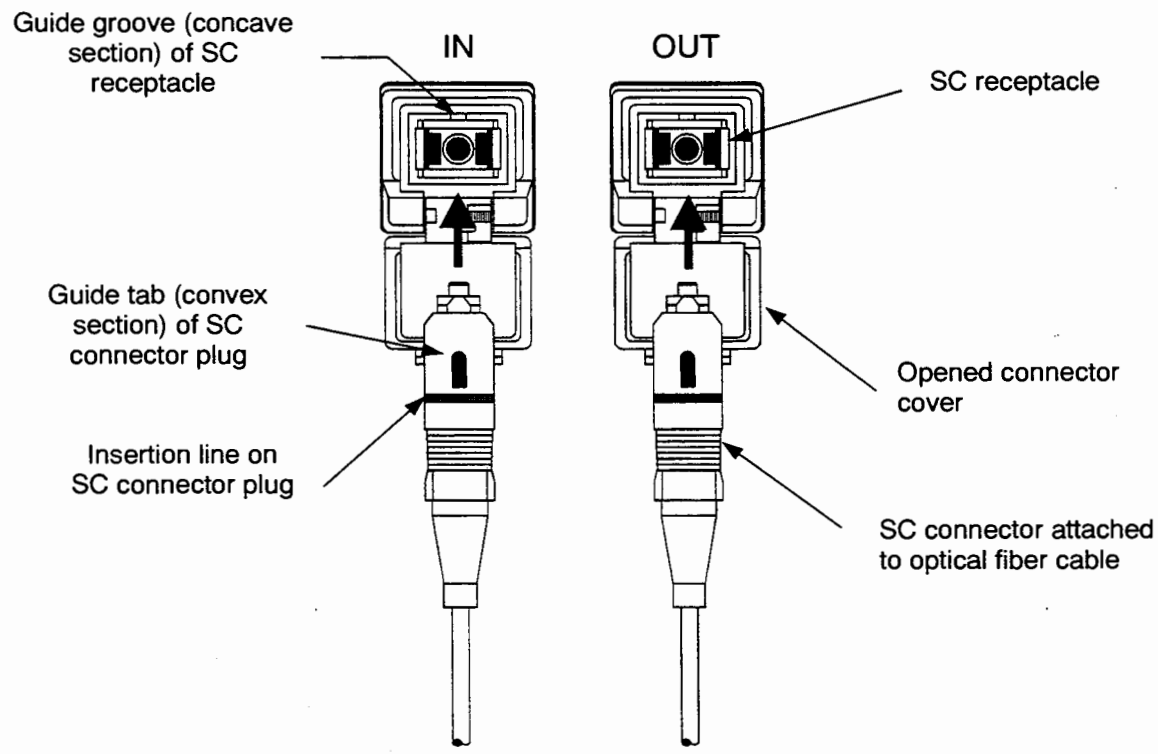


Figure 3.3.2 Connecting SC connectors

3.3 Connecting a Connector to the External-Monitor Terminal

Make or prepare a monitor harness that will be connected to the external-monitor terminal (OUTPUT).

(1) Prepare any male D-SUB 9-pin connector and wires.
(2) See the pin layout of the external-monitor terminal (→ A-2), and solder wires of the required length to the pins of the prepared D-SUB 9-pin connector.
If the prepared D-SUB 9-pin connector has an accessory cover, attach the cover to the connector.
(3) Connect the prepared monitor harness to the external-monitor terminal, and secure it with screw locks or screws.
At the other end of the monitor harness, connect a voltmeter or pen recorder to check or record amplifier operation.
The D-SUB connector must be positioned correctly when it is connected. Check the position of the D-SUB connector, and connect it correctly.

⚠ CAUTION

- Be sure to turn off amplifier power before connecting the monitor harness to the amplifier and measuring equipment to the monitor harness. Do not allow wires (conductors) of the monitor harness connected to the amplifier to contact each other while amplifier power is on. Doing so results in a short circuit and may cause the amplifier to malfunction.

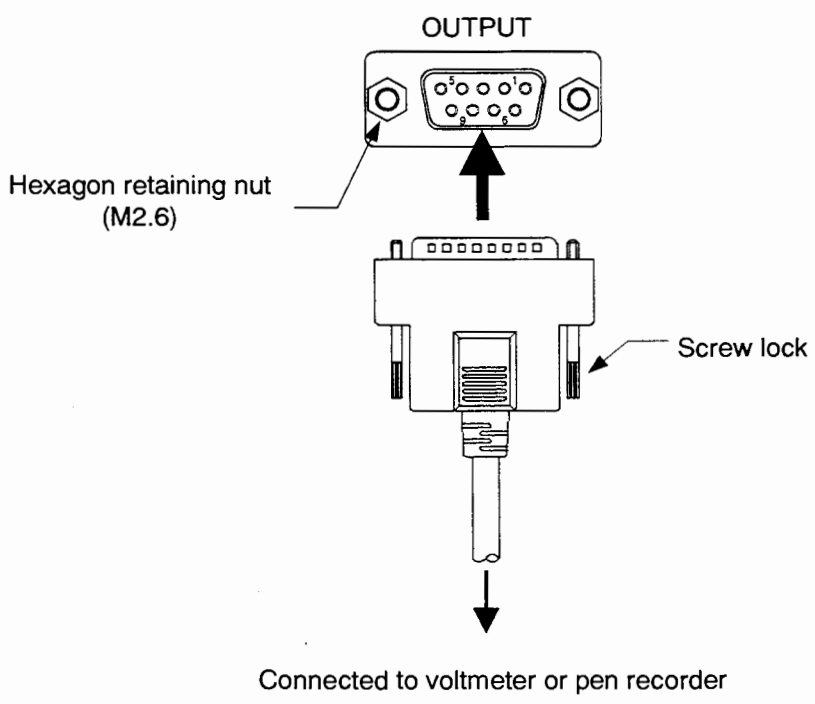


Figure 3.4 Connecting a connector to the external-monitor terminal

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3.4 Connecting the Power Cable

The accessory power cable for the amplifier is about two meters long. Prepare a grounded outlet appropriate for the plug on the power cable within the rating of the power cable.

(1) Connect the female connector of power cable to the AC inlet terminal of the amplifier.
(2) Insert the plug into the outlet.

⚠ CAUTION

- Be sure to use the accessory power cable and do not modify it.
- Be sure to ground the amplifier. Failure to do so may result in an electric shock.
- If the shape of the outlet to be used does not match the plug on the power cable, use a conversion plug. Be sure to ground the connection with the ground wire on the conversion plug. Failure to ground the ground wire may result in an electric shock.
- Before connecting the power cable , check that the POWER switch on the amplifier is off.

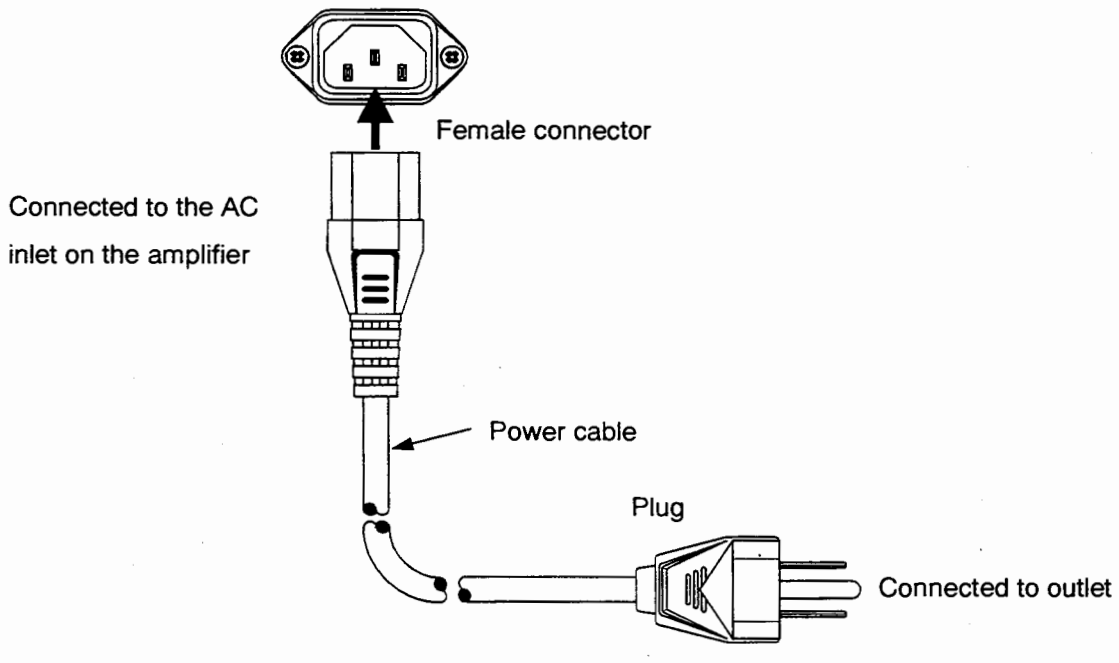


Figure 3.5 Connecting the power cable

3.5 Turning Power On and Off

To turn amplifier power on and off, use the POWER key switch located on the back of the amplifier.

《Turning on the power》

(1) Insert the accessory key into the POWER key switch.
(2) Turn the key to " | " marking (ON) side to turn on the power.

Note

- When set to " | " marking (ON) position, the key cannot be removed.

《Turning off the power》

(3) After using the amplifier, return the key to "○" marking (OFF) side to turn off the power.
(4) Remove the key from the key switch, and store the key.

Note

- The amplifier comes with two accessory keys. Use one key, and keep the other as a spare.

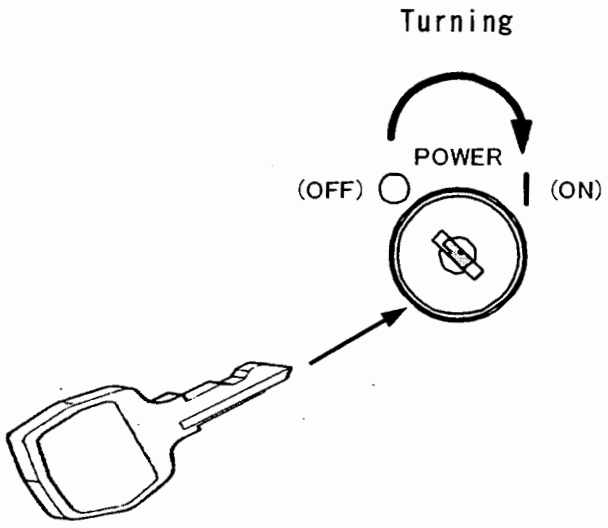


Figure 3.6 Operating the key switch

When amplifier power is turned on, the LEDs for the operating mode light. Check the lighting of the LEDs before starting to use the amplifier. (→ 2-6)

Note

- Be sure to use the key switch to turn power on and off. Never connect or disconnect the power cable as a method for turning power on and off. In addition, do not pull the power cable with force.
- Wait at least 10 seconds before turning power on after power-off and at least 10 seconds before turning power off before power-on.
- Do not operate any switches immediately after power has been turned on. If a switch is used too soon, the display may be incorrect. To prevent incorrect display, wait at least 30 seconds to operate switches after power-on.

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3.6 Checking and Replacing the Fuse

When necessary, check and replace the fuse for the amplifier in the fuse holder on the back of the amplifier.

Note

- The ErFA1200/1300 amplifiers do not come with a spare fuse. Prepare a glass-body fuse appropriate for the amplifier, and use it if the amplifier's fuse blows. (→ 6-2)

《Checking the fuse》

(1) Check that the POWER switch on the amplifier is off, and disconnect the power cable from the outlet.
(2) Push the cover of the fuse holder to open it.
(3) Check the element wire fastened to the back side of the cover.

If the fuse is normal, return it to the fuse holder cover to close it tightly.

《Replacing the fuse》

If the fuse has blown, replace it as follows:
(4) Replace the blown fuse with a spare.
(5) Seat the fuse in the fuse holder, cover to close it tightly.

⚠ CAUTION

- Handle the fuse carefully. If you drop the fuse, its glass body may break.
- If the glass body is broken, be careful not to cut yourself when you pick up the pieces of broken glass.
- Be sure to turn off the amplifier and disconnect the power cable from the outlet before checking and replacing the fuse. Failure to do so may result in an electric shock or an amplifier malfunction.

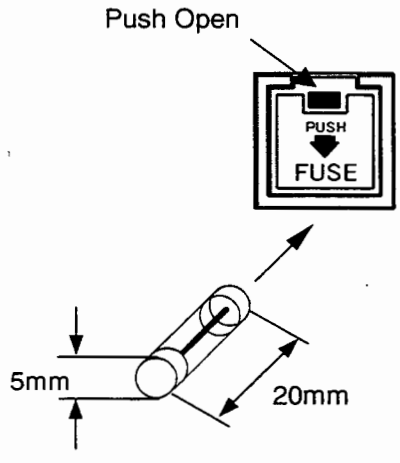


Figure 3.7 Replacing the fuse

Chapter 4 Operation

This section explains the switches on the amplifier, the switch operations used for setup, and the information displayed for switch operations.

4.1 Switch Operation and Settings

This section explains the switches on the amplifier, the switch operations used for setup, and the information displayed for switch operations.
Figure 4.1 shows the switches on the front panel of the amplifier.

Reference

- In this guide, switch operations are explained using the switch operations for the ErFA1220 (and some ErFA1215 switch operations) as an example. The use of switches and how information is displayed are the same for all models.

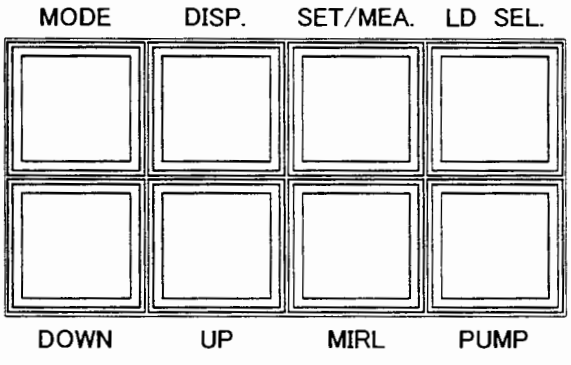
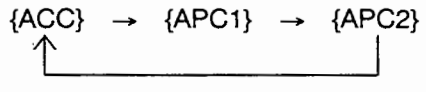


Figure 4.1 Switches (front panel)

4.1.1 MODE switch

The MODE switch is used to select an operating mode, or an output control method, for the amplifier.
Each time the [MODE] switch is pressed twice in succession, the operating mode and the displayed information change as shown below.



Note

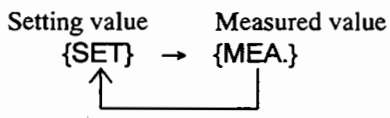
- To prevent incorrect operation of the MODE switch, the switch will not operate if it is pressed only once. To operate, the MODE switch must be pressed twice without any intervening action.
- If the operating mode is changed during LD excitation, the amplifier stops LD excitation to protect its circuits.

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4.1.2 SET/MEA. switch

The SET/MEA. switch is used to select the mode used for the numeric display.
Each time the [SET/MEA.] switch is pressed, the display mode changes as shown below.

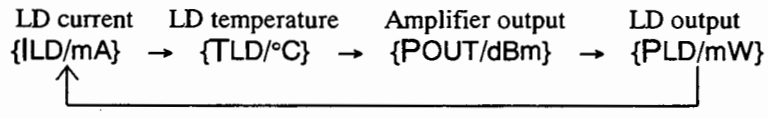


Note

- The sequence of the display modes of the SET/MEA. switch varies depending on the settings of the [MODE], [DISP]., and [TEMP MON.] switches. (See Table 4.1.)

4.1.3 DISP. switch

The DISP. switch is used to select the display item, which is the type of amplifier data displayed.
Each time the [DISP.] switch is pressed, the data displayed and its unit change as shown below.



The sequence of the data displayed by the DISP. switch varies depending on the settings of the [MODE], [SET/MEA.], and [TEMP MON.] switches.

Reference

- Depending on the display item and the unit, a setting value or a measured value is displayed in the numeric display.

Table 4.1 Data display transitions

MODE setting	SET/MEA. setting	TEMP MON. setting	Number of times of DISP. switch pressed			
			1	2	3	4
ACC	SET	ON	ILD/mA	TLD/°C	-*1	-
APC1	SET	ON	PLD/mW	TLD/°C	-	-
APC2	SET	ON	POUT/dBm	TLD/°C	-	-
ACC	SET	OFF	ILD/mA	-	-	-
APC1	SET	OFF	PLD/mW	-	-	-
APC2	SET	OFF	POUT/dBm	-	-	-
All modes	MEA.	ON	ILD/mA	TLD/°C	POUT/dBm	PLD/mW
All modes	MEA.	OFF	ILD/mA	POUT/dBm	PLD/mW	-

*1 A dash indicates that there is no corresponding display data and that the initial setting value is displayed.

Note

- When excitation has been halted, the only measured value (MEA.) displayed is TLD/°C. To indicate no-measurement status in all other cases, the minimum value 0 or ---- is displayed.

4.1.4 DOWN and UP switches

The DOWN and UP switches are used to set a value in each operating mode.
Pressing the [DOWN] or [UP] switch decreases or increases the setting value in the numeric display.

Usually, a setting value is decreased or increased one point when the DOWN or UP switch is pressed twice.
There are some cases, however, where the increase or decrease is not one point.

Reference

- Holding down the [DOWN] or [UP] switch decreases or increases a setting value without pausing. You can hold down one of the switches until you near the value you want, then press the switch as many times as necessary to set the value.

Note

- The DOWN and UP switches are disabled when an LD temperature {TLD/°C} is being displayed.
- Even though you press the DOWN or UP switch while an LD temperature {TLD/°C} is displayed, the setting value will not change. In this case, change the display item and set a value.

Note

- The setting values for a display item are unique to the amplifier model. If the operating mode is changed, the numeric display shows a value corresponding to the value set in the previous operating mode. Check and correct the setting value for each operating mode.

Table 4.2 lists the range of setting values for the DOWN and UP switches by amplifier model and operating mode.

Table 4.2 Setting ranges for the DOWN and UP switches

Amplifier model	ACC	ACP1	ACP2
ErFA1215/1313	0 - 2048mA	0.0 - 204.8mW	- - - - +20.4dBm
ErFA1220/1316	0 - 2048mA	0.0 - 204.8mW	- - - - +25.2dBm
ErFA1224	0 - 2048mA	0.0 - 204.8mW	- - - - +25.2dBm

The setting ranges listed in Table 4.2 are not the same as the actual operating ranges.
The range of valid settings depends on the model because of differences in output control among the models.

Note

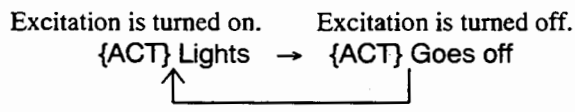
- For the valid operating range (range of output) corresponding to each setting, see the Inspection Result appended to this guide.

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4.1.5 PUMP switch

The PUMP switch is used to turn each amplifier excitation LD on and off.
Each time the [PUMP] switch is pressed, the excitation light source and the LED indicating excitation are turned on or off alternately.



Note

- The PUMP switch is disabled when excitation is stopped by an alarm or a protection function (the {MIRL} LED is lit). If this occurs, remove the factor triggering the alarm or protection function so that you can use the PUMP switch. (→ 2-7)

⚠ CAUTION



- Before pressing the PUMP switch to start excitation, check that the optical fiber cables are connected to the input and output ports and that the other end of the output cable has been treated correctly. Also, wear protective goggles and gloves to protect your eyes and hands from laser beams. Failure to do so may result in loss of eyesight, eye injury, or burns.

4.1.6 MIRL switch

(1) MIRL switch (front panel)

- ◆ This switch is standard only on the ErFA1220, ErFA1316, and ErFA1224.

The MIRL switch is used to reset the alarm and protection functions of the amplifier.
Pressing the [MIRL] and [PUMP] switches at the same time forcibly resets the stopping of excitation by an alarm or protection function and enables LD excitation (optical output).

⚠ WARNING



- When excitation is started by forcible reset of an alarm or protection function with the [MIRL] switch, an invisible high-power laser beam may be output. For this reason, make another safety check before pressing the [MIRL] switch. Do not look at the open end of the optical output cable or touch it. Doing so may result in loss of eyesight, eye injury, or burns.

When excitation is started after the protection function is reset, the {MIRL} LED goes off and the {ACT} LED lights.
If the PUMP switch is pressed to turn off excitation, the {MIRL} LED lights and alarm and protection functions are enabled.

Reference

- After pressing the [MIRL] and [PUMP] switches at the same time, release the [PUMP] switch first, then release the [MIRL] switch. If the [MIRL] switch is released earlier than the PUMP switch, the [MIRL] switch operation is ineffective and the protection function cannot be reset. If this occurs, retry the switch operation correctly.

(2) MIRL ALM switch (back panel)

- This switch is an option on the ErFA1215 and ErFA1313.

The MIRL ALM switch is a slide flip-flop switch that resets the alarm and protection functions of the amplifier.
Setting the [MIRL ALM] switch to OFF and pressing the [PUMP] switch forcibly resets the stopping of excitation by an alarm or protection function and enables LD excitation (optical output).

Setting the MIRL ALM switch to ON: Enables the alarm and protection functions.
Setting the MIRL ALM switch to OFF: Resets (disables) the alarm and protection functions.

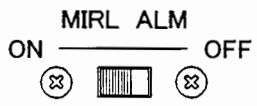


Figure 4.2 MIRL ALM switch

- When using the MIRL ALM switch, heed the WARNING label provided for the MIRL switch on the front panel.

When excitation is started after the protection function is reset, the {MIRL} LED goes off and the {ACT} LED lights.

Note

- Unlike the [MIRL] switch on the front panel, the [MIRL ALM] switch must be set to ON when the alarm and protection functions are enabled because the switch is a slide flip-flop type of switch.
  After excitation is stopped, be sure to return the [MIRL ALM] switch to the ON side.
  Do not use the amplifier with the alarm and protection functions disabled.

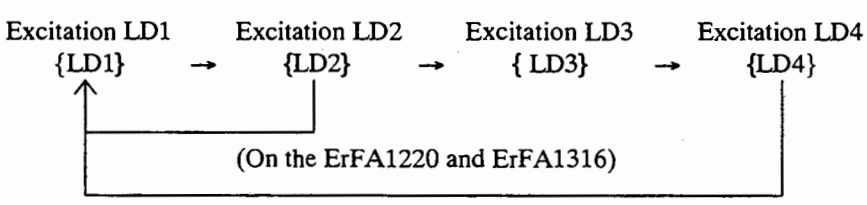
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4.1.7 LD SEL. switch

◆ This switch is standard only on the ErFA1220, ErFA1316, and ErFA1224.

The LD SEL. switch is used to select an amplifier excitation LD.
Each time the [LD SEL.] switch is pressed, the displayed LD number changes as shown below.



Reference

- The ERFA1215 and ErFA1313 do not have the LD SEL. switch, since each model has only one LD.

Note

- The data for the LD selected by the LD SEL. switch varies according to the settings of the MODE, SET/MEA., DISP, and TEMP MON. switches. The set output level and amplifier output, however, are common display items. These values are unique regardless of the number of LDs. Other values are displayed as data specific to each LD.

4.1.8 TEMP MON. switch

The TEMP MON. switch is a slide flip-flop switch that specifies whether to display the temperature of the selected excitation LD.
Setting the [TEMP MON.] switch to ON or OFF specifies whether the LD temperature is displayed.

Setting the TEMP MON. switch to ON: Displays {TLD/°C}.
Setting the TEMP MON. switch to ON: Does not display {TLD/°C}.

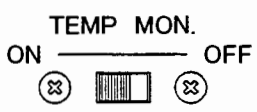


Figure 4.3 TEMP MON. switch

Note

- When the TEMP MON. switch is OFF, {TLD/°C} is not displayed even though the associated display item is selected with the DISP. switch.

For the transition of display items, see Table 4.1.

4.2 Operation

This section explains how to use the amplifier.

4.2.1 Preparation

Make the following preparations before using the amplifier:

(1) Unpack the amplifier, and decide where to install it as explained in Sections 1.3 and 1.4.
(2) Prepare the optical signal transmitter and receiver to be connected to the amplifier (these must match the user's system) and the optical fiber cables to be used. Ready them for use. For information about connecting and using the optical transmitter and receiver, refer to the manuals provided with the equipment.
(3) Install the amplifier and connect the cables as explained in Chapter 3.

4.2.2 Cleaning the optical connectors

Clean all optical connectors before connecting optical fiber cables to the amplifier.

(1) Apply isopropyl alcohol (cleaning type) with gauze or a cotton swab to the top end of the ferrule and the inside of the FC adapter. Next, blow away any foreign matter and dust with an air blower.
(2) Wipe off the top end of the ferrule of optical connector with gauze dipped in alcohol to remove any remaining foreign matter, dust, and dirt.
(3) Wipe off the inside of the sleeve (including the top end of the ferrule) of the FC adapter with a tapering cotton swab dipped in alcohol to remove any remaining foreign matter, dust, and dirt.

Note

- Do not scrub the surface of the optical connector. Scrubbing may scratch the top end of the ferrule if any foreign matter or dust is present.
- Clean each connector every time it is disconnected.

Reference

- Kuretop, manufactured by NTT International, is recommended as the cleaner for the optical connector ferrule.

4.2.3 Procedure for using the amplifier

After the above preparations, use the amplifier as explained below.

- Reconfirm the following:
  - O The power cable is correctly connected to the amplifier and an outlet, and is grounded.
  - O Optical fiber cables are correctly connected to the optical input and optical output ports.
  - O You are wearing protective goggles and gloves to protect your eyes and hands.

(1) Set the POWER key switch on the amplifier to ON to turn on the power.

- When the power is on, the LEDs such as {ACC}, {SET}, {ILD/mA}, and mA light, and the numeric display indicates {0}.

Reference

- If the amplifier has been used before and has retained its setup data, the operating mode and setup data set for the previous operation are displayed.

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(2) Select the operating mode that matches your use of the amplifier.

- Press the [MODE] switch until the LED indicating the desired operating mode lights.

ACC or APC1: The output of excitation LD is held at the same level by stabilizing the LD drive current or output power regardless of any changes in the input signal light.

APC2: Amplifier output is held at the same level regardless of any changes in the input signal light. That is, the output of the excitation LD changes according to the level of the input signal light.

(3) Turn on the input signal light source connected to the amplifier to input the signal light to be amplified.
- On a model that has the input level monitoring function, the {MIRL} LED goes off.

Note

- If the {MIRL} LED stays lit, determine the cause and correct it. After the {MIRL} LED goes off, start excitation.

(4) Start light amplification.
- Press the [PUMP] switch to start LD excitation.

(5) Set the output level for the selected operating mode.
- Use the [UP] or [DOWN] switch to adjust the value shown in the numeric display to the desired output level (SET).
- The output level increases or decreases as the setting value is increased or decreased.

Note

- Steps (4) and (5) can be reversed. However, avoid starting excitation with a high output level set. Start excitation only with a low output level, then increase the output level gradually.
- Do not turn the input signal light off and on after starting excitation.

(6) Check the output level.
- Press the [SET/MEA.] switch to set the display mode of the numeric display to measured value (the {MEA.} LED lights).
- Use the [DISP.] switch to select the display item for the value to be displayed, and check the measured output level displayed.

Reference

- While checking the measured value (MEA.), adjust the output level with the [UP] and [DOWN] switches as required. Note that the UP and DOWN switches are disabled for the temperature display {TLD/°C}.

Note

- The displayed amplifier output level is merely a reference value. If you want to know the actual output level, measure it with a commercial optical power meter.

(7) Stop light amplification.
- Press the [PUMP] switch to stop excitation.
- Turn off the input signal light source.
- Hold down the [DOWN] switch until the setting value drops to the minimum value.
- Set the POWER key switch on the amplifier to OFF.

Note

- When stopping amplification, be sure to stop excitation first, then turn off the input signal light source. If the input signal light is turned off first, a large change in amplifier output could occur, potentially causing excessive output might result in an amplifier malfunction or seizure of the optical fibers.

Chapter 5 Troubleshooting

Read this chapter if you encounter any problems while using your amplifier.

5.1 If the Amplifier Is Abnormal

If the optical output of the amplifier, LED operation, or data display is abnormal, find the LED status in the table below and perform the corresponding check.
If you cannot determine the cause of a failure, report the failure to the store where you purchased your amplifier or our sales department.

LED status	Check procedure	Corrective action
All LEDs are off.	Check whether the power cable is connected correctly and whether the POWER switch is set to ON.	Set the POWER switch to ON, or connect the power cable to the outlet correctly. (→ 3-6)
	Check whether the outlet has a voltage.	Check that voltage is being supplied (the circuit breaker for the power line is on).
LIMIT is on.	Check the output level setting.	The output level setting may be higher than the upper limit. Decrease the setting. (→ 4-3)
	Check the measured output level.	The output level may be higher than the upper limit. Decrease the output level setting. (→ 4-3)
TEMP is on.	Check the measured LD temperature.	The LD temperature may be abnormally high. Stop excitation, then restart it. (→ 2-10)
MIRL is on.	Check whether the optical fiber cable is connected to the optical input port correctly.	Check the connection of the optical fiber cable to the input port. (→ 3-2)
	Check whether the input signal light is being input.	The input signal light is not being input or the level is low. Check the transmitter and its connection to the amplifier. (→ 2-8)
EBR is on.	Check whether the optical fiber cable is connected to the optical output port correctly.	Check the connection of the optical fiber cable to the output port. (→ 3-2)
	Check the polishing method used for the optical fiber cable.	Replace the optical fiber cable with one that has been polished using low-reflection polishing.
ACT does not light.	Check whether an alarm or protection function has been triggered.	Remove the factor that caused the protection function to operate, or reset the protection function. (→ 2-8)
	Check whether an external stop signal has been input.	Check the equipment connection to the external-monitor terminal. (→ A-2)
TLD/°C does not light.	Check whether the TEMP MON. switch is off.	Set the TEMP MON. switch to ON. (→ 4-6)
ACC, APC1, and APC2 are all off, or the mode settings are not interchangeable.	Press the MODE switch, and check the LED status.	If the same condition occurs again, turn off the amplifier and notify the store where you purchased the amplifier or our sales department.
SET and MEA are both off, or the value type is not interchangeable.	Press the SET/MEA. switch, and check the LED status.	If the same condition occurs again, turn off the amplifier and notify the store where you purchased the amplifier or our sales department.

Continue to next page.

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(If the amplifier is abnormal)

LED status	Check procedure	Corrective action
POUT/dBm, PLD/mw, ILD/mA, and TLD/°C are all off, or the display item cannot be replaced by another.	Press the DISP. switch, and check the LED status.	If the same condition occurs again, turn off the amplifier and notify the store where you purchased it or our sales department.
LD1, LD2, LD3, and LD4 are all off, or the LDs are not interchangeable.	Press the LD SEL. switch, and check the LED status.	No value is shown in the numeric display.
Press the DISP. switch to switch display items, and check whether a value is displayed.	The measured value (MEA.) continues to be 0.	If the same condition occurs again, turn off the amplifier and notify the store where you purchased it or our sales department.
The measured value (MEA.) continues to be 0.	Check whether excitation is occurring.	Press the PUMP switch to start excitation. (→ 4-4)
The measured value (MEA.) fluctuates.	Check whether the value fluctuates within the range from -5 to +5 points.	The value is within the normal range. This is not an abnormal status. (→ 4-8)
	Check whether the value fluctuates outside the range from -6 to +6 points.	Turn off the amplifier, and notify the store where you purchased it or our sales department.
The setting value (SET) cannot be increased or decreased.	Press the DOWN and UP switches, and check whether the value can be decreased and increased.	If the same condition occurs again, turn off the amplifier and notify the store where you purchased it or our sales department.
Values are skipped when the setting value (SET) is increased or decreased.	Press the DOWN and UP switches, and check whether the value can be decreased and increased normally.	If the same condition occurs again, turn off the amplifier and notify the store where you purchased it or our sales department.

5.2 If Other Problems Occur

If you encounter a problem while using the amplifier, perform the corresponding check described below.

Problem	Check procedure	Corrective action
Light is not output.	Check whether the ACT LED is on.	Press the PUMP switch to start excitation. (→ 4-4)
	Check whether a protection function has been triggered.	Remove the factor that caused the protection function to be triggered. (→ 2-8)
	Check whether an external stop signal has been input.	Check the equipment connection to the external-monitor terminal. (→ A-2)
	Check whether an amplifier output level is displayed.	Check the measured output level (MEA.) displayed.
Optical output is inconsistent.	Check whether the level of the input signal light fluctuates.	Stop the input signal light, and check the consistency of the optical output.
	Check whether optical fiber cables are connected correctly.	Check the connection of the optical fiber cables. (→ 3-2)
	Check whether the optical connectors are dirty.	Clean the optical fiber connectors. (→ 4-7)
	Check whether the displayed data for the LD is consistent.	Check the displayed measured data (MEA.) for the LD.
The optical output level is much lower than the set level.	Check whether optical fiber cables are connected correctly.	Check the connection of the optical fiber cables. (→ 3-2)
	Check whether the optical connectors are dirty and whether the ends of the optical fibers are damaged.	Clean the optical fiber connectors, and check for damage to the ends of the optical fibers.
	Check whether the sleeve of the FC or SC receptacle is damaged.	Check whether the sleeve of the FC or SC receptacle is damaged. (→ 3-3)
	Check whether the displayed amplifier output level is almost the same as the set output level.	Check the measured amplifier output level (MEA.) displayed.
Other optical characteristics have deteriorated.	Check the optical characteristic specifications.	Notify the store where you purchased the amplifier or our sales department.
The switches are ineffective.	Turn the power off and on, and check the operation of the switches.	Turn amplifier power off, and notify the store where you purchased it or our sales department.
No signal is output from the external-monitor terminal.	Check whether the layout of the connector pins is correct.	Check whether wires are connected to the connector pins correctly. (→ A-2)
The cooling fan does not operate.	Turn the power off and on, and check the operation of the fan.	Turn amplifier power off, and notify the store where you purchased it or our sales department.
Amplifier power cannot be turned on.	Check whether the power cable is connected to an outlet.	Connect the power cable to the outlet correctly. (→ 3-6)
	Check whether there is a voltage at the outlet.	Check whether a voltage is being supplied and whether the circuit breaker for the power line is on.
	Check whether the fuse has blown.	Check the fuse. (→ 3-8)

Continue to next page.

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(If other problems occur)

Problem	Check procedure	Corrective action
The key for POWER key switch has been lost.	Check whether you have a spare key.	If you do not have a spare key, notify the store where you purchased the amplifier or our sales department.
An optical connector cover cannot be closed.	Check whether the spring on the cover has been damaged.	If the spring has been damaged, immediately ask the store where you purchased the amplifier or our sales department to replace it.

If you encounter any problems not covered in this guide while using your amplifier, notify the store where you purchased it or our sales department.

Chapter 6 Specifications

Chapter 6 contains the specifications for the ErFA1200/1300 amplifiers and electrical and environmental requirements.

6.1 Amplifier Specifications

Table 6.1 Amplifier specifications

Item		Specification					Remarks
		ErFA1215	ErFA1220	ErFA1224	ErFA1313	ErFA1316	
Signal wavelength		1550-1560nm					
Wavelength of excitation light source		1480nm			980nm		
Maximum output (*1)		+15dBm ±1dB	+20dBm ±1dB	+24dBm ±1dB	+13dBm ±1dB	+16dBm ±1dB	
Gain (*2)		30dB	35dB	40dB	25dB	30dB	
Noise level (*2)		≤7.5dB			Typ.5dB	Typ.6dB	
Number of excitation LDs		1	2	4	1	2	
Optical fiber		SMF					DSF can be supported, too.
I/F	Optical input and output ports	FC-SPC or SC-SPC					
	External-monitor terminal	Female D-SUB 9-pin connector					
Display accuracy		±5% of displayed value (MEA.)					
LD temperature accuracy		±5% of set value					
Outside dimensions (mm)	(W)	170	190	220	170	190	Excluding projections
	(D)	225	265	345	225	265	
	(H)	64	94	114	64	94	
Mass (kg)		About 1.7	About 2.8	About 4.3	About 1.7	About 2.8	Amplifier alone

*1 Input signal level is more than 0 dBm.
*2 Input signal level is -35 dBm or more.

Note

- For more information about optical characteristics, see the Inspection Result appended to this guide.
- The specifications for operation and control methods, including optical specifications, may be changed at the request of the user. If the specifications for your amplifier have been changed, see the specifications that apply to your amplifier.

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6.2 Electrical and Environmental Requirements

6.2.1 Electrical requirements

Table 6.2 Electrical requirements

Item		Specification			Remarks
		ErFA1215/1313	ErFA1220/1316	ErFA1224	
Power voltage		100-240VAC+4%, -10%			
Frequency		50-60Hz +2%, -4%			
Power consumption		MAX 20W	MAX 34W	MAX 60W	LD Pump
Fuse		250VAC T 1A	250VAC T 2A	250VAC T 3.15A	φ5×20mm Time lag type
Power cable	100 VAC system	2-meter, gray or black, 3-pin straight cable with a two-pole connector and ground			Rated voltage: 125 VAC
	200 VAC system	2-meter, gray or black, 2-pin straight cable a with two-pole connector with ground			Rated voltage: 250 VAC

⚠CAUTION

- The amplifier comes with an accessory power cable whose rated voltage matches the local voltage used in the customer's region. Check your local voltage and the rating of the power cable.
- Be sure to use the accessory power cable. Failure to do so may result in an amplifier malfunction or electric shock.
- Use not Fast-Acting type fuse.

6.2.2 Environmental requirements

Table 6.3 Environmental requirements

Item		Specification	Remarks
Temperature	Operating state	0~+40°C	Temperature change must be 15°C per hour or less.
	Stopped state	-10~+50°C	
Relative humidity	Operating state	20~80%	No condensation
	Stopped state	8~90%	
Airborne dust		0.15 mg/m^3 or less	

Note

- To avoid problems with the amplifier, be sure to comply with the electrical and environmental requirements.
- Use your amplifier correctly by complying with the electrical and environmental requirements.
- If you need to use your amplifier in a special region such as a coastal region (possibility of damage from salt) or a polar region or in a special environment (for example, high-altitude environment or environment exposed to fumes), notify the store where you purchased the amplifier or our sales department.

Appendix A Interface Specifications

A.1 Optical I-O Ports

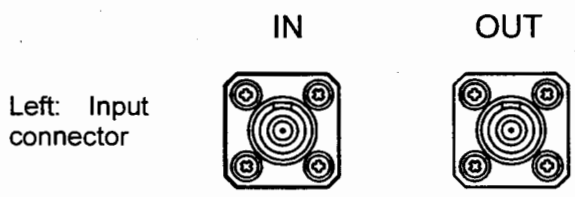
(1) Number of ports: One input port and one output port
(2) Connector: FC or SC receptacle

Note

- Either FC or SC connectors are mounted at the request of the user. Check the type of the connectors that have been mounted.
- The standard type is FC connectors.

(3) Port layout and signal directions: Figures A.1.1 and A.1.2 show the layout of the optical I-O connectors and the direction of the optical signals.

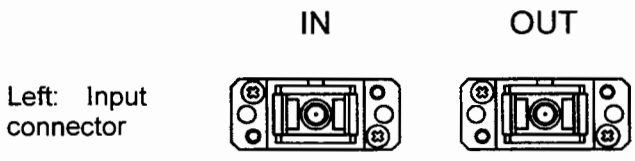
《FC type》



(Connector covers are not shown in this figure.)

Figure A.1.1 FC-type optical I-O ports

《SC type》



(Connector covers are not shown in this figure.)

Figure A.1.2 SC-type optical I-O ports

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A.2 External-Monitor Terminal

(1) Number of ports: One port
(2) Connector: Female D-SUB 9-pin connector (with screw locks)
(3) Signal assignments and direction: Table A.1 lists the pins of the external-monitor terminal, signal assignments to pins, and signal direction. Figure A.2 shows the pin layout.

Table A.1 External-monitor terminal pins and signal assignments

Pin number	Symbol	Signal name	Signal direction AMP External equipment	Signal level	Remarks
1	M-POUT	Amplifier output	→	1mW/25mV	
2	M-PLD1	LD1 output	→	1mW/40mV	
3	M-ILD1	LD1 current	→	1mA/4mV	
4	M-TLD1	LD1 temperature	→	1°C/40mV	
5	SET-P	Setting value	→	1 step = 1/4 mV	In linear mode
6	SG	Signal GND		GND	
7	RIL	Excitation stop	←	Low	Stopping excitation by grounding
8	SG	Signal GND		GND	
9	(NC)	(Unused)			

Note

- There is a slight difference (offset) between the actual output voltage and the displayed value.
- Only the output level, current, and temperature of LD1 are output as LD data.

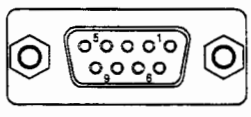


Figure A.2 External-monitor terminal

Appendix B List of Amplifier Functions

B.1 Amplifier Functions

Table B.1 lists the functions of the ErFA1200/1300 amplifiers.

Table B.1 Amplifier functions

Model	Operating mode			Input monitoring	Output monitoring	Reflection monitoring	LD current limiting	LD temperature error protection	Temperature display switching	Forcible reset by MIRL	External-monitor terminal	Remarks
	ACC	APC1	APC2									
ErFA1215	○	○	○	△	○	×	○	○	○	△	○	
ErFA1220	○	○	○	○	○	○	○	○	○	○	○	
ErFA1224	○	○	○	○	○	○	○	○	○	○	○	
ErFA1313	○	○	○	△	○	×	○	○	○	△	○	
ErFA1316	○	○	○	○	○	×	○	○	○	○	○	

Meaning of symbols:
○: Standard function
△: Optional function
×: Unsupported function
* Input monitoring and forcible reset by MIRL can be implemented as an option as paired functions.

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Appendix C Power Cables

Figure C.1 shows the two types of power cables available as the accessory power cables for he ErFA1200/1300 amplifiers.

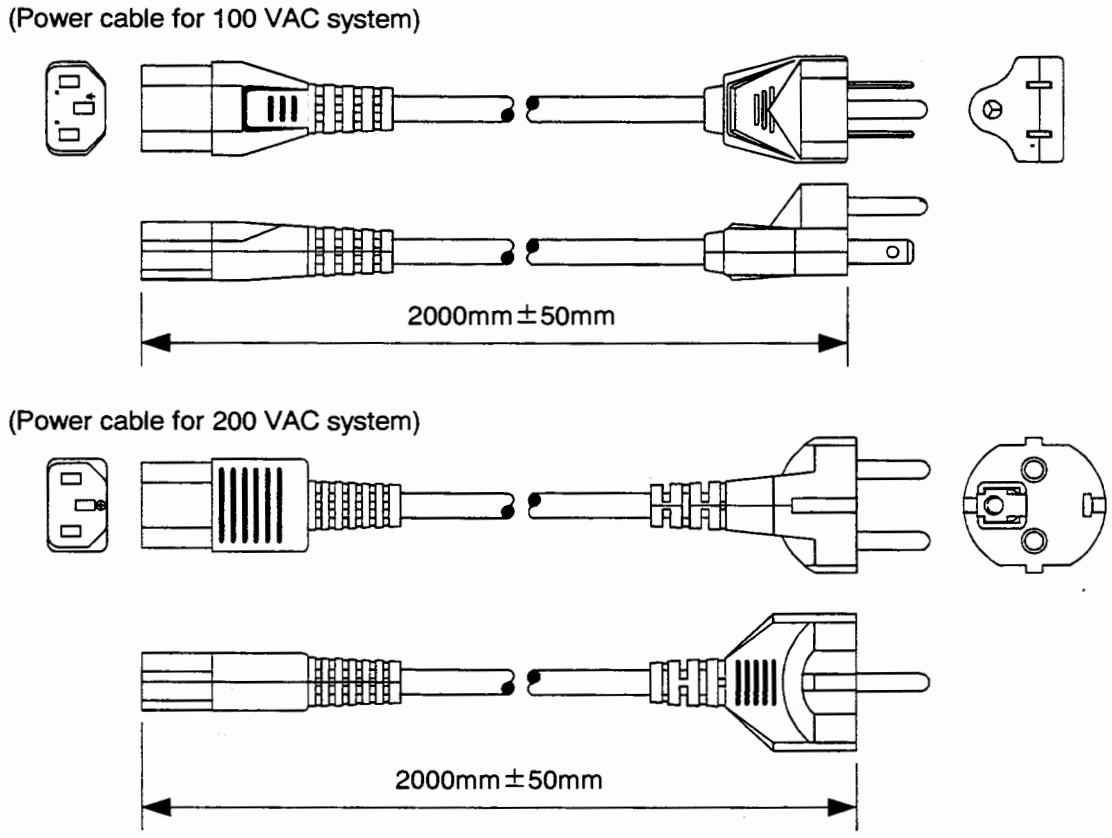


Figure C.1 Power cables

Note

- The shape of the molded grip of each receptacle or plug shown in Figure C.1 may not be identical to that used on an actual accessory power cable.
- Only one power cable, for a 100 VAC or 200 VAC system, whichever matches the power in the user's region, is supplied as an accessory power.

MEMO

- Write the name of the store where you purchased the amplifier or "Furukawa Sales Department" for our sales department.

Contact:

- Store name:
- Sales representative and department:
- TEL/FAX:

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Warranty

- The manufacturer warranties your ErFA1200/1300 amplifier for a period of one year from the date of purchase.
- During the warranty period, however, you will be responsible for amplifier replacement and repair costs if your amplifier is damaged or fails for any of the following reasons:
  1. Natural phenomenon such fire, earthquake, wind, flooding, or lightning
  2. Environmental pollution, exposure to salt air, exposure to a corrosive gas, or a power surge
  3. Unreasonable or improper use, improper repair or modification, or incorrect connection by the user
- The manufacturer will keep a supply of spare parts for ErFA1200/1300 amplifiers for six years from the date that their manufacture ends.

Contact information

- If you have any technical questions about your amplifier or encounter a problem you cannot resolve, contact:

Engineering Department, FITEL Products Division, The Furukawa Electric Co., Ltd.

Headquarters address:

Furukawa Sogo Building, 2-6-1, Marunouchi, Chiyoda-Ku, Tokyo, 100-8322, Japan

Telephone: +81-3-3286-3443

Fax: +81-3-3286-3708

(Before requesting a repair or inquiring about a problem)

Before inquiring about a problem, read through this user's guide again, and check amplifier connections and setup.

Before making a request for repair, asking a technical question, or inquiring about a problem, provide the following information:

- Symptoms of the failure or problem and the conditions under which it occurs or has occurred
- Equipment and devices connected to the amplifier
- Connection methods and types
- Amplifier serial number

Please report the above information in detail.

Send your inquiry and report to the store where you purchased the amplifier or our sales department.

Optical Desktop Amplifier
ErFA1200/1300 Series

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