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FIBERAMP-BT 17

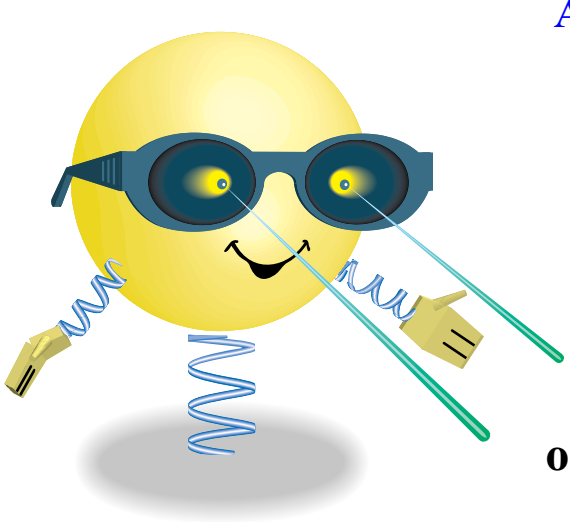


C-BAND ERBIUM-DOPED FIBER AMPLIFIER

Instruction Manual

Document #MU/3624/DSC/001
January 2001

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FIBERAMP-BT 17

C-BAND ERBIUM-DOPED FIBER AMPLIFIER

Instruction Manual

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FIBERAMP-BT 17 C-band Erbium-Doped Fiber Amplifier

Instruction Manual

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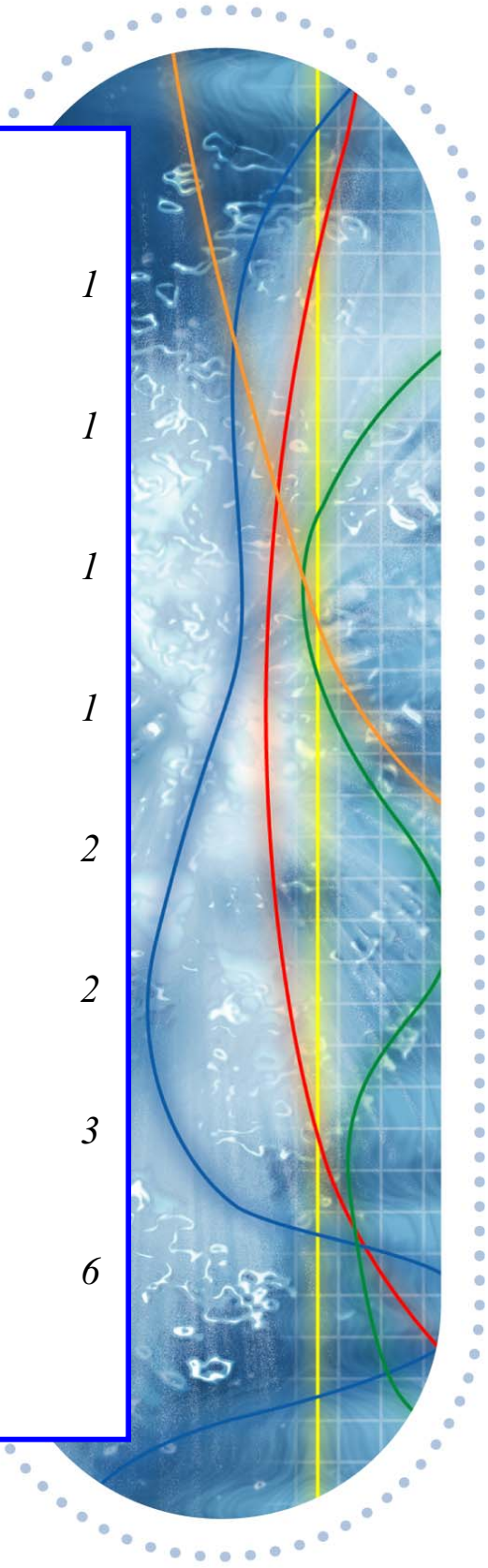
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About this MANUAL

Purpose

The purpose of this instruction manual is to explain how to set up the FIBERAMP-BT 17 Erbium-doped fiber amplifier and to operate the various features in the available control modes:

- FIBERAMP-BT 17 manual mode
- IEEE-488.1 remote mode

Information in this manual applies to FIBERAMP-BT 17 as well as their various options.

Audience

This manual is for anyone wishing to use a FIBERAMP-BT 17 Erbium-doped fiber amplifier to test fiber-optic systems and components as well as all other performance-intensive laser source applications.

This manual's architecture and its contents are designed to appeal to professionals with the necessary technical background and prerequisites needed to use this type of laser equipment.

Prerequisites

For this instruction manual it is assumed that you:

- Are familiar with fiber optic technology.
- Are familiar with the IEEE-488.1 interface used to control the FIBERAMP-BT 17 in remote mode.

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About this MANUAL

Introduction

This manual is divided into:
- Contents
- Chapters
- Appendices

To aid in searching for specific information, you will find clearly marked divider pages that indicate the various sections of the manual.

Chapters/Appendices

This document consists of six chapters designed to guide you through a correct installation/operation of your laser equipment. It also introduces theoretical/design considerations and provides servicing/maintenance information, as well. In addition, you will find four appendices that contain useful information on troubleshooting the system, the valid range of parameters setting, the product certification and declarations of compliance, and a list of replaceable parts.

Table 1 - 1: Finding information

Chapter/Appendix	Main Topics Covered
General Information	• Product Overview • Optical Design • Standard Features and Benefits • Specifications
Getting Started	• Unpacking • Standard Accessories • Options • Installation & First-Time Operation
Front & Rear Panels	• Front Panel • Rear Panel
Operation	• Introduction • Launched Pump Power and Diode Current Adjustments • Auxiliary Inputs and Outputs
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General Safety Considerations

Terms and Symbols in this Manual

The following terms and symbols may appear throughout this manual:

	***WARNING***	Warning statements identify conditions or practices that could result in injury or loss of life.
	***CAUTION***	Caution statements identify conditions or practices that could result in damage to this product or other property.

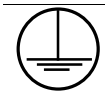
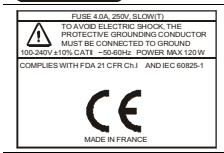
Terms on the Product

The following terms may appear on the product:

DANGER	Indicates an injury hazard immediately accessible as you read the marking.
WARNING	Indicates an injury hazard not immediately accessible as you read the marking.
CAUTION	Indicates a hazard to property, including the product itself.

Symbols and Labels on the Product

The following symbols and labels may appear on the product:

	CAUTION: refer to manual
	Risk of electric shock
	Protective Ground (Earth) Terminal
	AVOID EXPOSURE Label • Located on the front panel of the benchtop unit. • Located on the back panel of the 19" rack-mount unit.
	LASER SYMBOL Label • Located on the front panel of the benchtop unit. • Located on the back panel of the 19" rack-mount unit.
	Electrical Warning, Fuse description and Standard Compliance (This label is located on the rear panel.)
	DANGER Label • Located on the back panel of the benchtop unit. • Located on the front panel of the 19" rack-mount unit.

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Laser Safety

The following tables provide information on general laser specifications, laser class, and output power of the FIBERAMP-BT 17.

Table 1 - 2: General Laser Specifications

Amplifier type	Erbium-doped fiber amplifier
Optical input and output	Single mode optical fiber
Output divergence (half angle @ $1/e^2$)	0.09 rad

Table 1 - 3: Laser Class

Standard	**Laser Class**
IEC 60825-1	Class 3B
21 CFR Subchapter J	Class IIIb

Note: FIBERAMP-BT 17 is a Class IIIb product (21 CFR Subchapter J) equipped with a Remote Interlock connector (See the *Auxiliary Inputs and Outputs* section).

	***WARNING***	**The use of controls or adjustments not specified herein as well as the performance of unauthorized procedures may result in hazardous radiation exposure.**
	***WARNING***	**The use of optical instruments with this product will increase eye hazard.** Do **not** under any circumstances look directly into the fiber end of an optical cable attached to the optical output while the device is in use for this may cause permanent eye damage and possible loss of eyesight. Note that the laser radiation is not visible to the human eye, therefore, protective cap must always be replaced on the laser output connector after use to avoid involuntary exposure to laser radiation.
	***WARNING***	**Disable the laser output before connecting or disconnecting a fiber optic cable on the instrument.**

Equipment Safety Warning

If this equipment is mishandled, abused, or used in a manner not as specified by NetTest in this instruction manual, the protection provided by the equipment may be impaired.

	***CAUTION***	The pump laser diode inside the FIBERAMP-BT 17 is very sensitive to static electricity. However, there is no risk of damage to the laser diode while the electronic enclosure remains closed. **The user is therefore discouraged from opening the enclosure, and should the enclosure be opened without written factory authorization, the warranty shall be null and void.**
	***CAUTION***	Optical connectors plugged into the FIBERAMP-BT 17 must be of the same type as those used in the electronic enclosure: FC-APC, with a polish angle of 8°. **Use of other types of connectors will result in poor performance to the FIBERAMP-BT 17.**

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Ventilation of the Unit

	***CAUTION***	**Make sure there is sufficient clearance below and at the back of the unit to ensure proper ventilation.** The apertures (under the unit) and the fan (behind the unit) are used for the inside ventilation. When used as a stand-alone benchtop unit, this product is designed so that the feet should leave enough room under the unit to enable proper the ventilation. If you plan to rack-mount this unit, make sure to allow at least a 15-mm (0.6 inches) gap between two units. For the 19" rack-mount version, you may take the feet off because of existing front ventilation intake.

Electrical Safety

	***WARNING***	**Power Supply Safety Requirements** FIBERAMP-BT 17 is intended to operate from a power source that does not apply more than 265 volts RMS between the supply conductors or between either of the supply conductors and the ground. FIBERAMP-BT 17 has a chassis connected to ground via the power supply cable. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation. To avoid the possibility of injury, insert the power cable only into a socket outlet with a protective earth contact. Before switching on the instrument, make sure the electrical installation fulfills the local safety requirements. Use only the power cord and connector specified for your product. This power cord should be in good condition.
	***WARNING***	**Do not attempt to perform servicing or maintenance.** Do not make any service or maintenance of any kind to the system. Refer servicing only to authorized personnel from NetTest.
	***WARNING***	**Do not operate without covers.** To avoid personal injury, do not operate this equipment without the protective cover of the chassis.
	***WARNING***	**Use the proper fuse.** To avoid fire hazard, use only the correct type fuse, voltage, and current ratings as specified in the *Maintenance* section in the *Service Information* chapter.
	***WARNING***	**Operate under proper environmental conditions.** FIBERAMP-BT 17 is not designed for outdoor use. To avoid the possibility of injury, do not expose the instrument to rain or excessive moisture. Do not operate the instrument in the presence of flammable gases or fumes.

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Contacting NetTest

Product Information

For application-oriented questions about a NetTest product, contact your local NetTest distributor or our Sales Department.

Or contact us by e-mail:
info.photonics@nettest.com

Technical Information

Contact your local NetTest distributor or our Customer and Product Support Department.

Or contact us by e-mail:
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Service Information

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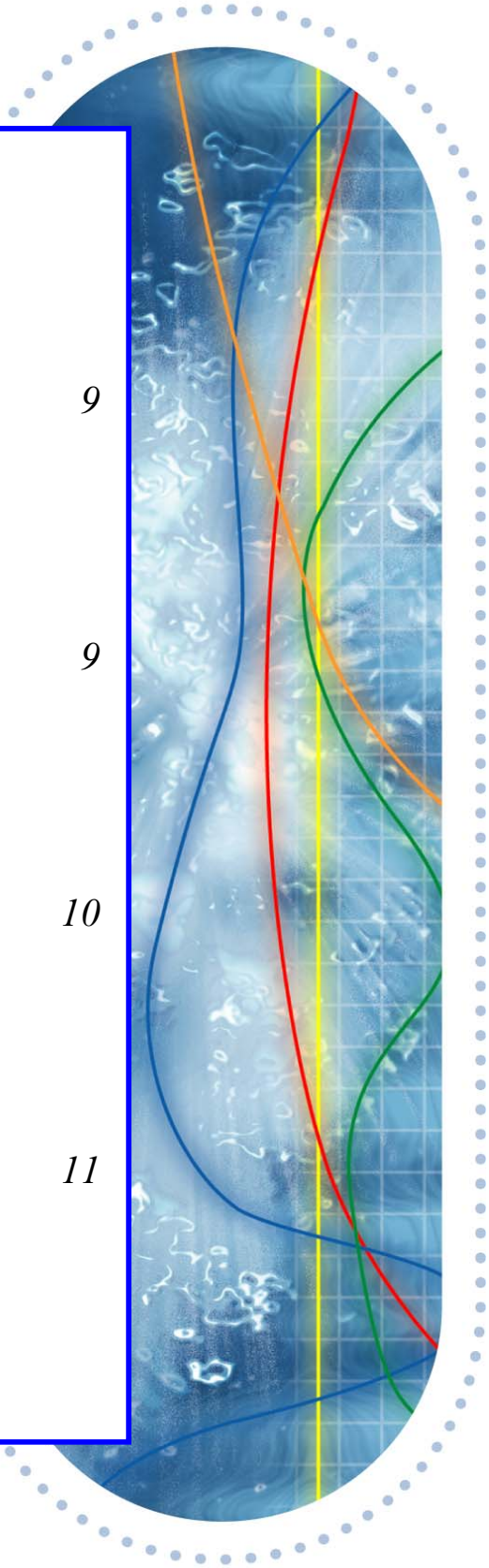
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General Information

Product Overview

FIBERAMP-BT 17 is a high-performance Erbium-Doped Fiber Amplifier that operates in the 1.55 µm spectral window. It features a single-pump configuration that delivers an outstanding high output power of +17 dBm[1] of saturated output. Its co-propagating configuration (using a 980 nm pump-diode) provides a low 4.5 dB (typ.) noise figure and is ideally suited as a source booster.

FIBERAMP-BT 17 can operate either in "Constant Power Mode" or in "Constant Current Mode". Either pump power or current is user-programmable via the IEEE-488.1 remote interface or can be adjusted directly by using front-panel dials.

The FIBERAMP-BT 17 erbium-doped fiber amplifier comes in fully-integrated, bench-top units with onboard amplifier module, electronic controls, and power supply. A standard 19'' rack-mount version, which allows for easy fiber-testing system integration is also available upon order.

Optical Design

From signal-in to signal-out, the FIBERAMP-BT 17 unit contains all necessary optical-gain, power monitoring and micro-control equipment elements to boost input signals provided by other user equipment:

- Micro-controller onboard to ensure proper monitoring and regulation of the laser-diode current, output power and temperature.
- Amplifier module to generate adequate optical gain to reach the required output level as set by the user.

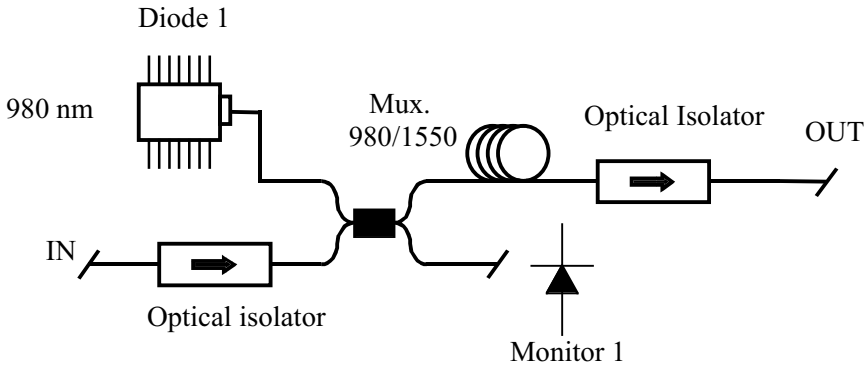


Figure 2 - 1: FIBERAMP-BT 17 optical design

[1] With 0 dBm input signal power at 1550 nm.

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Optical gain is achieved by stimulated-emission in the neighborhood of 1.55 µm in a Erbium-doped silica fiber. Energy is provided by the co-propagating pump-diode, which emits light near Erbium absorption line at 980 nm..

The Erbium-doped fiber enables optimum confinement of pump and signal waves and has an alumino-silicate make, which provides large gain over a broad spectral range.

The amplifier is a single-stage module, with pump and signal propagating in the same direction. The pump and signal waves are combined into the Erbium doped fiber by a Wavelength Division Multiplexers coupler. The pump power remaining in the monitor arm of the WDM is measured by a photodetector, and the signal is used to control the launched pump power.

Standard Features and Benefits

Standard features of the FIBERAMP-BT 17 amplifier include:

Table 2 - 1: FIBERAMP-BT 17 standard features and benefits

Standard Features	**Benefits**
Single-pump configuration	Features a 980 nm pump diode set in a co-propagating configuration.
+17 dBm of saturated output power in the C-band	Over 17 dBm of output power guaranteed over the entire 1525-1560 nm wavelength range.
Outstanding 4.5 dB (typ.) noise figure	Noise level guaranteed low whatever for any and all combinations of signal and pump power levels.
Over 25 dB[2] of small-signal gain at 1550 nm	Typical flat-spectrum response around 1550 nm with a 25 dB gain guaranteed for small signal levels.
Bench-top and modular models	Comes either in bench-top units for plug-and-play applications around the lab or in standard 19" rack-mount version for easy system integration.
Easy settings via front panel control knobs and readouts	Both bench-top and rack-mount versions feature launched pump power and laser diode current readouts.
Programmable operation via IEEE-488.1 interface	Standard IEEE-488.1 allows for both remote and programmable operation of the laser.

[2] With -40 dBm input signal power at 1550 nm.

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Specifications

Table 2 - 2 lists the technical specifications of the FIBERAMP-BT 17 Erbium-doped fiber amplifier bench-top and rack-mount units.

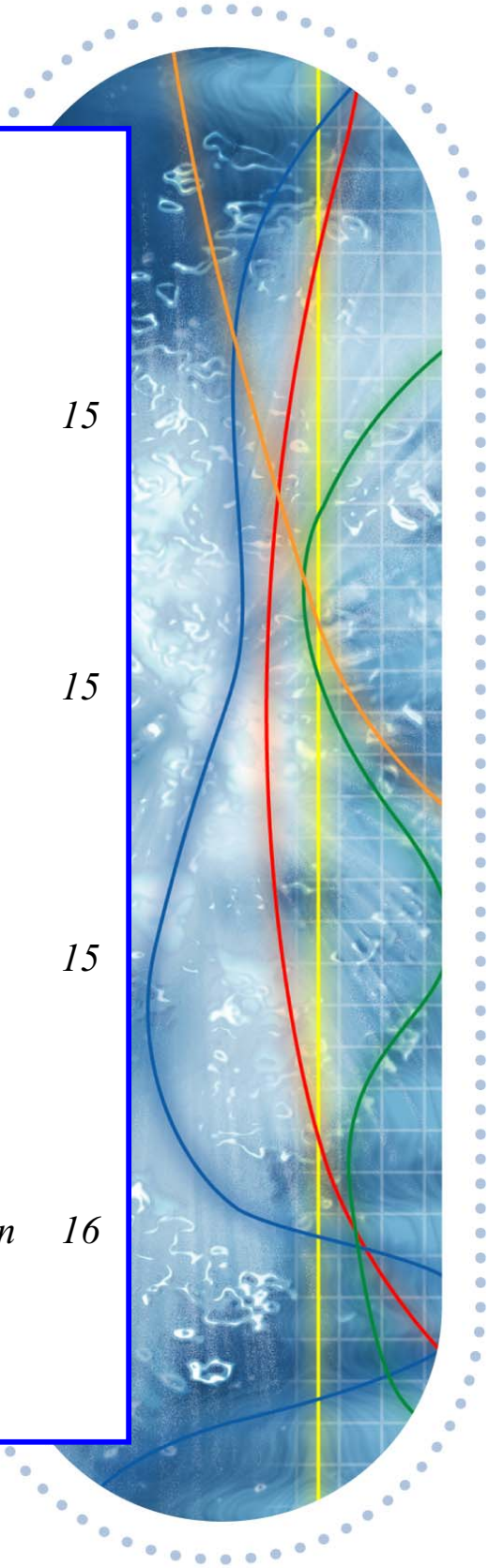
Table 2 - 2: FIBERAMP-BT 17 specifications

Optical characteristics	
Wavelength range	1525-1560 nm
Output power[3]	>+ 17 dBm
Small signal gain[4]	> 25 dB (30 dB typ.)
Noise Figure	< 6 dB (4.5 dB typ.)
Polarization sensitivity of gain[5]	< 0.5 dB
Spectral gain flatness @ -30 dBm[6]	3 dB typ.
Interfaces	
Input and output optical connectors:	(2 x) "Wide Key" FC/APC connectors on Corguide™ SMF-28 fiber
• Bench top unit	(located on front-panel)
• 19" rack-mount unit	(located on rear-panel)
Input and output isolation	35 dB
Return loss	-60 dB
Remote control	IEEE-488.1
Displays and Controls	
Launched pump power	Numeric display (mW)
Laser diode current	Numeric display (mA)
Current limit	LED indicator
Temperature control error	LED indicator
Pump power monitor output	BNC connector, (30 mW / V), (0-10 V)
Current monitor output	BNC connector, (100 mA / V), (0-10 V)
Electrical characteristics	
Power supply voltage	100 - 240 VAC ±10%
Power supply frequency	50 - 60 Hz ±5%
Maximum power consumption	120 W
Environment	
Dimensions (W x H x D)	
• Bench top unit	235 (9.2 in) x 180 (7 in) x 325 mm (12.7 in)
• 19" rack-mount unit	448 (17.6 in) x 133 (5.2 in) x 370 mm (14.6 in)

[3] Measured with 0 dBm input signal power @ 1550 nm.
[4] Measured with -40 dBm input signal power @ 1550 nm.
[5] Polarization sensitivity of gain can also be specified at 0.25 dB, as an option.
[6] Specified for a single channel @ -30 dBm of input power over 1540-1560 nm range.

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Getting Started

Unpacking

Handle the device with care when unpacking. Note that the 19" rack-mount unit comes with two lateral retractable handles. To pull out the 19" unit from its packaging, hold it by its handles to help you keep the unit horizontal.
After unpacking, set the device on a flat stable surface that is free of excessive vibration.

	***CAUTION***	**Keep the original shipping container** for use in case the instrument needs to be returned to NetTest for repair or servicing.

Standard Accessories

The FIBERAMP-BT 17 Erbium-doped fiber amplifier comes with the following standard accessories:

- Acceptance test report (ATR)
- FC/PC to FC/APC adapter cable
- Safety-lock key
- Instruction manual
- Power cord

Options and Ordering Information

FIBERAMP-BT 17 comes in various options available upon order by specifying the corresponding ordering code.

Options

Available options include:

Table 3 - 1: Options and ordering codes

Ordering Code	Option
R	19" rack-mount version (3U)
LP	Polarization sensitivity of gain < 0.25 dB
J-APC	Fiber-optic jumper FC-APC/FC-APC
J-PC	Fiber-optic jumper FC-APC/FC-PC (standard fiber-optic jumper, included with all benchtop unit packages.)

Note 1: For the standard benchtop model, you do not need to specify any option.
Note 2: Each benchtop instrument is delivered as a standard with a fiber-optic jumper

Ordering code

Ordering information must be provided in the following manner, as shown in the table below (as an example only):

Instrument name	Model		Option 1		Option 2		Other options…
FIBERAMP-BT	17	/	R	/	LP	/	Other options…/

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Installation & First-Time Operation

To move the unit from place to place, make sure to keep the instrument horizontal.

Installation

⚠	***CAUTION***	To obtain the optimum performances of the system, it is recommended to place the optical head, or the instrument, on a stable surface isolated from any source of vibrations.

To install the FIBERAMP-BT 17 Erbium-doped fiber amplifier proceed as follows:

1. Set the device on a flat stable surface that is free of excessive vibration.
2. Allow the flow of air from the cooling fan to circulate freely around the device and remove any equipment or paper that could bloc the air-flow.
3. Use the proper power cord for your location.
4. Make sure the keyed switch on the front panel is in the Standby mode before applying power.
5. Connect on end of the power supply cable to the rear panel of the unit and plug the other end to the proper voltage mains supply point. FIBERAMP-BT 17 is equipped with a self-regulating power supply that adapts to both AC 110V and 230V voltages and 50 Hz or 60 Hz frequencies.
6. To turn ON the unit, set the main switch located on the rear panel to the “I” position.

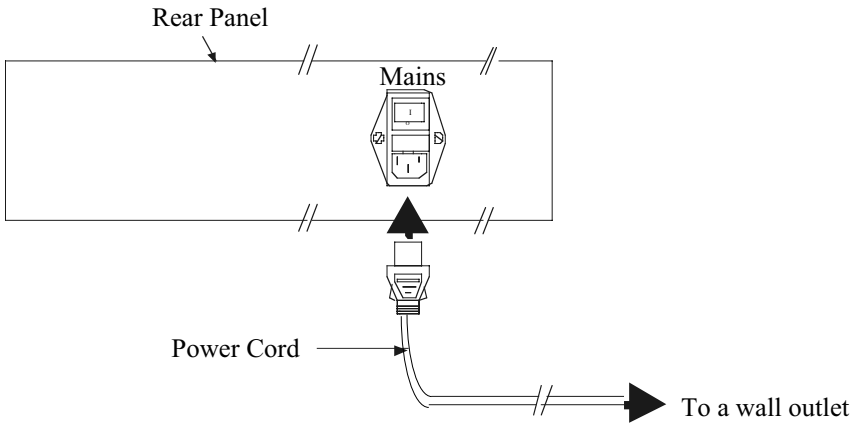


Figure 3 - 1:
Connect the power cord
to the rear panel of FIBERAMP-BT 17

Initializing the FIBERAMP-BT 17 Amplifier

For safe operation, use the following procedure to initialize the FIBERAMP-BT 17 amplifier:

- Make sure the key-lock switch on the front panel is in the Standby position.
- Set the rear panel MAINS switch to ON (I) (*See Description of the Rear Panel Connectors and Switches* on page 25).
- Turn the front panel key clockwise to power the front panel displays. Note that at turn on, both power and current displays show "zero", which indicates that the laser diode is still off.

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- To power the laser diode, press the **Output** switch on the front panel of the FIBERAMP-BT 17 once. The device sounds a continuous beep for several seconds to indicate that the laser emission is on.

	***WARNING***	For laser safety reasons, all optical connections must be completed BEFORE activating the laser diode.

	***CAUTION***	Avoid switching the unit off before the system is fully initialized.

Enabling the Laser Output

For laser safety reasons the FIBERAMP-BT 17 laser output is not immediately enabled after system turn-on and initialization. The FIBERAMP-BT 17 features an "Output" key to enable/disable laser output.

- To enable the laser output, press the **Output** button (the device sounds a beep and the "Output" LED is on).
- To disable the laser output, press the **Output** button again and check that the "Output" LED is off.

Optical Connection to the Unit

External optical equipment can connect to FIBERAMP-BT 17 via the two FC/APC fiber-optic connectors located either on the front panel (benchtop unit) or on the back panel (19" rack-mount version).

	***CAUTION***	Keeping fiber-optic connectors clean at all times is essential to achieve optimum system performance. Refer to the cleaning instructions in the *Maintenance* section. The standard output connector is a "Wide Key" FC/APC type connector. Never connect another type of connector to the optical output.

IMPORTANT: In case of frequent connect/disconnect to the optical ports, the use of an intermediate jumper is recommended in order to prevent premature wear-out and potential failure of the FIBERAMP-BT 17 internal optical connectors.

Shutting Down the FIBERAMP-BT 17 Amplifier

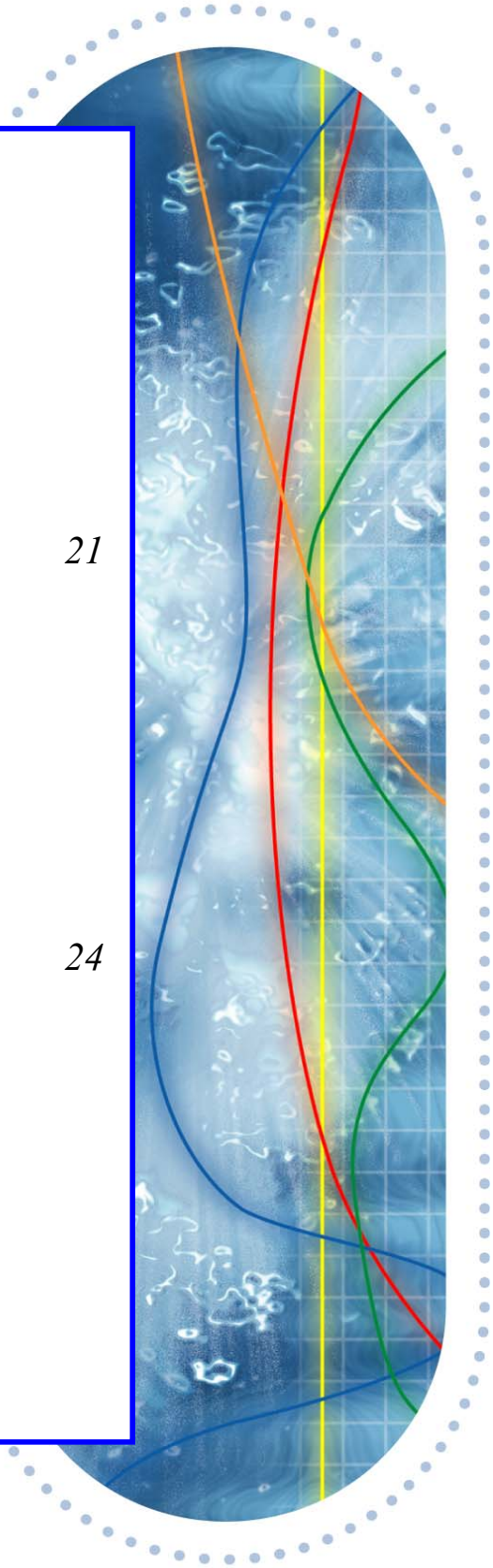
To shut down the unit, follow these steps:

- Press the **Output** button to disable the laser output and make sure the Enable key LED is off.
- Turn the front panel key to the Standby position (counterclockwise).

	***CAUTION***	Before moving the unit, or when the unit is not in use for a long period of time, the rear panel Mains O/I switch must be set prior to the “O” position. Be sure the system is completely turned off before transporting it

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FRONT & REAR PANELS



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Rear Panel 24

Front & Rear Panels

This section provides an overview of the operating controls of all FIBERAMP-BT 17 functions in local (manual) mode.

Front Panel

Benchtop Unit Front Panel

Figure 4 - 1 shows the front panel of the FIBERAMP-BT 17 Erbium-doped fiber amplifier benchtop unit.



Figure 4 - 1: FIBERAMP-BT 17 benchtop unit front panel

19" Rack-mount Unit Front Panel

Figure 4 - 2 shows the front panel of the FIBERAMP-BT 17 Erbium-doped fiber amplifier 19" rack-mount unit.



Figure 4 - 2: FIBERAMP-BT 17 rack-mount 19"-unit front panel

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Description of the Front Panel Elements

The FIBERAMP-BT 17 front panel provides functional elements such as digital displays, LED indicators, buttons and knobs, and optical ports as described below.

Power and Standby keylocks

Power and Standby keylocks	Description
Power (on benchtop unit) **Standby** (on rack-mount unit)	This works as a keylock for the FIBERAMP-BT 17. Use the key included in the FIBERAMP-BT 17 package. Turning the key clockwise results in turning on the "Laser diode current" and "Launched pump power" displays. **Note:** The pump laser diode is still not on. User needs to press the **Output** button to activate the laser output of the FIBERAMP-BT 17.

Digital displays

Display Element	Description
Launched pump power (mW)	Displays either the user-defined pump power in mW or the pump power that corresponds to the laser diode current set by the user. This value indicates the actual pump power launched into the amplifying fiber. It is measured by a photodetector inside the FIBERAMP-BT 17 and takes into account and encompasses the influence of such parameters as insertion loss into the amplifying fiber and spectral calibration of the detector
Laser diode current (mA)	Displays the value of the actual current within the pump laser diode.

LED indicators

LED Indicator	Description
Limit	This LED is lit when user attempts to set the current to a value greater than the maximum allowable current intrinsic to the laser diode. The system then limits the diode current to this maximum value, which cannot be exceeded.
Limit display	This LED is lit when the "Mode" selector button is placed in "Limit display" mode
Output	The "Output" LED stays lit for as long as the laser emission is active, provided the "Output" key was pressed after system turn on.

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LED indicators (cont'd)

Temperature control error	This LED lits to indicate the control board (which regulates the temperature control system) has detected excessive and uncontrolled temperature drifts throughout the system and, therefore, the temperature regulation and current supply to the pump laser diode is shut down. (See the *Maintenance* section in the *Service Information* chapter.)

Buttons and Knobs

Button or Knob	Description
Mode selector	**Allows to select the system operating mode:** • "Const P": to select constant power mode. • "Const I": to select constant current mode. • "Limit display": to display the laser diode maximum allowable current. To display this value, the laser diode must be turned off, which explains why this value cannot display while the system is operating in "Const P" or in "Const I" mode.
Output key	Press the "Output" key to activate the laser diode current (the system sends a beep during a few seconds to indicate that laser emission is on and the "Output" LED is lit). Press this button again to turn off the laser emission.
Spinner knob	This spinner knob sets both the "Laser diode current (mA)" and the corresponding "Launched pump power (mW)" system parameters, simultaneously. **The spinner knob is acceleration-sensitive.** When turned slowly, it allows precision tuning of pump power and diode current. To allow fast tuning over the whole parameter range, simply rotate this knob in a swift fashion to apply the necessary acceleration. When the upper limit for the diode current is reached, the numeric displays are both locked to the system-supported maximum value of diode current and pump power. The spinner knob is located in the "PUMP SET-UP" area of the FIBERAMP-BT 17 front panel.

Optical Ports (on front-panel of benchtop unit)

Optical Ports	Description
Optical input **Optical output**	Fiber-optic output and input connectors. The standard connector is a FC/APC type connector.

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Rear Panel

Benchtop Unit Rear Panel

Figure 4 - 3 shows the rear panel of the FIBERAMP-BT 17 Erbium-doped fiber amplifier benchtop unit.



Figure 4 - 3: FIBERAMP-BT 17 benchtop unit rear panel

19" Rack-mount Unit Rear Panel

Figure 4 - 4 shows the rear panel of the FIBERAMP-BT 17 Erbium-doped fiber amplifier 19" rack-mount unit.



Figure 4 - 4: FIBERAMP-BT 17 rack-mount 19"-unit rear panel

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Description of the Rear Panel Connectors and Switches

The FIBERAMP-BT 17 rear panel includes the case fan air-outlet, the mains power connector and switch, the fuse drawer, various input and output ports, and product labels and markings.

Rear panel elements common to benchtop unit and rack-mount unit are as follows:

Mains socket

Mains socket elements	Description
Power switch	This is a ON(I)/OFF(O) switch used to power-on or off the system. (Refer *to Installation & First-Time Operation* on page 16 for details on how to connect the Mains power supply.)
Fuse drawer	This fuse drawer contains a T4Amp L 250V type fuse. (See *Replacing the Line Fuse* in the *Maintenance* section on page 47.)

Interface

Interface	Description
IEEE 488 connector	Enables to connect a computer equipped with a IEEE-488 emulation program. The IEEE-488 interface allows remote and programmed operation of the system. (Refer to the *Remote Control* chapter.)
Remote Interlock connector	DB9 connector used to connect a Remote On/Off switch for increased laser safety. *See Auxiliary Inputs and Outputs* in the *Operation* chapter.
Pump / Current monitor	BNC analog output connector for laser diode current monitoring.
Pump / Power monitor	BNC analog output connector for launched pump power monitoring.

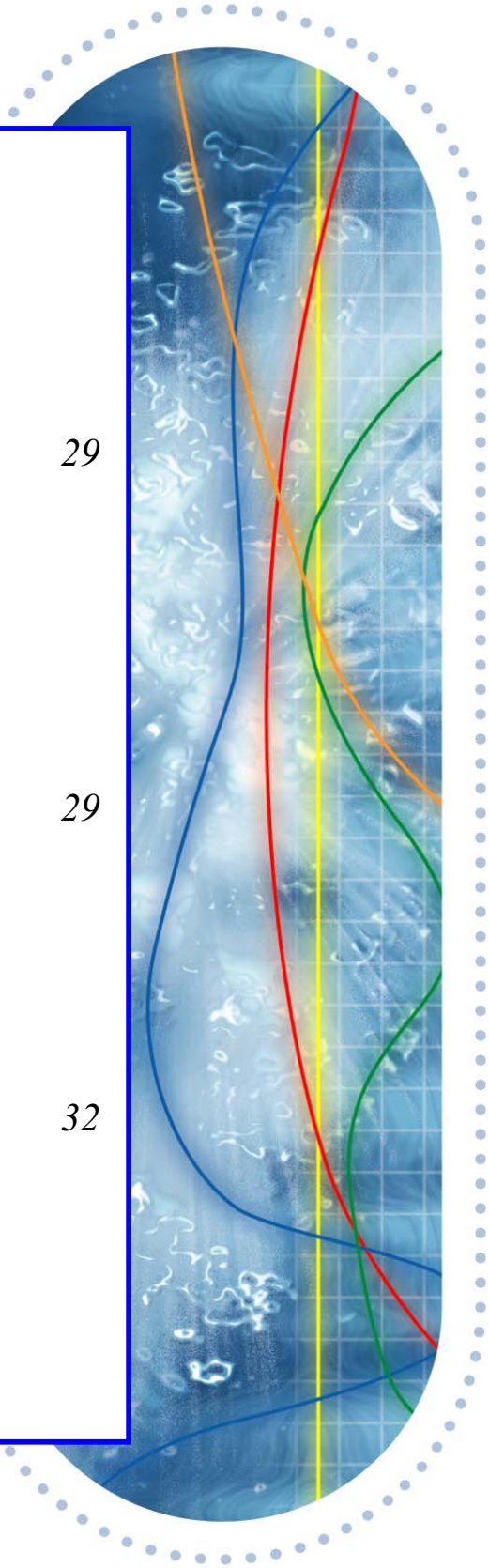
The following optical ports are located at the rear-panel of the rack-mount unit

Optical Ports (on rear-panel of rack-mount unit only)

Optical Ports	Description
Input **Output**	Fiber-optic output and input connectors. The standard connector is a FC/APC type connector.

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OPERATION



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Operation

Introduction

This section describes how to use the FIBERAMP-BT 17 Erbium-doped fiber amplifier in manual (or local) mode. FIBERAMP-BT 17 front panel allows direct access to pump power and diode current adjustments, operating mode selection, and various system controls.

Operating mode selection is described in the following sections:
- Switching Between Constant Power and Constant Current Modes
- Limit Display Mode

The launched pump power and diode current adjustments are described in the following sections:
- Constant Current Mode Operation
- Constant Power Mode Operation

Finally, auxiliary input and output are described at the end of this chapter.

Launched Pump Power and Diode Current Adjustments

To Switch Between Constant Power and Constant Current Modes

After you rotate the **Power** key (on benchtop unit) or **Standby** key (on rack-mount unit) a 1/4-turn clockwise, both launched pump power and diode current displays are lit, and the laser diode can be operated either in constant power or in constant current mode.

To operate in constant power mode, place the **Mode selector** to the *"Const P"* position. To switch to constant current operation, place the **Mode selector** to the *"Const I"* position.

Constant Current Mode Operation

Regulation boards of the laser diode ensure that the current flowing through the laser diode remains constant at all times, regardless of operating conditions.

Selecting Constant Current Mode

To select constant current mode, place the "Mode" selector on the *"Const I"* marking. Regardless of the previous operating mode ("Constant P" or "Limit display"), as you switch to constant current mode, the diode optical power output is automatically turned off. To activate the operating current, press the "Output" key once. The system's operating current is then set to the previous current level last specified before mode change.

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Adjusting Diode Current and Launched Pump Power

Rotate the spinner knob to adjust the laser diode current and launched pump power to the desired level. Both current and power displays show actual, real-time values of current and pump power through the pump diode.

Reaching the Maximum Operating Current

To prevent any potential damage to the laser diode, the pump current is software-limited to the maximum operating level intrinsic to the diode. User may not overshoot the maximum diode current, as the spinner knob does not update the diode current over the maximum value.

Halting the Constant Current Mode

The current mode is automatically halted and the pump current turned off if any of the following three events occurs:

- The system has switched to “Constant Power” or “Limit display” mode.
- The system's operating mode is switched to remote mode.
- The pump diode alarm has been triggered.

Constant Power Mode Operation

Select constant power mode to ensure that the pump diode delivers stable power to the Erbium-doped fiber.

Selecting Constant Power Mode

To select constant power mode, place the “Mode” selector on the *“Const P”* marking.
As with constant current mode, the diode optical power output is automatically turned off until the “Output” key is pressed once. The system's pump power is then set to the previous power level last specified before mode change.

Adjusting Diode Current and Launched Pump Power

Use the spinner knob to adjust the laser diode current and launched pump power to the desired level.

Absolute Maximum Rating for Pump Power

When the pump power is about to exceed the absolute maximum rating, the system automatically sets the diode current to a level corresponding to the maximum power rating. Should the diode current overshoot the absolute current limit, the “Limit” LED is lit.

Halting the Constant Power Mode

The constant power mode is automatically halted and the pump current turned off if any of the following three events occurs:

- The system has switched to “Constant Current” or “Limit display” mode.
- The system's operating mode is switched to remote mode.
- The pump diode alarm has been triggered.

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Limit Display Mode

In order to set the FIBERAMP-BT 17 operating current within valid operating range, user needs to know the system's absolute maximum rating for the laser diode current (current limit). The current limit is a characteristic intrinsic to your particular FIBERAMP-BT 17 system. This value is stored in the system's memory board and can be accessed either at the front panel directly in local mode or through the IEEE-488.1 remote interface.

Limit Display in Local Mode

When operating originally in local mode, the system first needs to go offline (no laser diode emission) to allow access to the current limit value.

To put the system offline, simply rotate the **Mode selector** knob and place it on the "Limit display" tab. The value of the laser diode current limit then appears on the "Laser diode current (mA)" display.

To resume system operation simply rotate the **Mode selector** knob back to "Const P" or "Const I", then press the "Output" key to enable the laser output. The system then resumes operation as you left it when switching to "Limit display mode".

Getting the Current Limit Value in Remote (IEEE-488.1) mode

Unlike local mode that requires the system to go offline, the current limit value can be accessed directly in remote mode by using the command query "ILIMIT?" which returns the current limit value in the form "ILIMIT=nnn.n", where n is an integer ranging from 0 to 9.

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Auxiliary Inputs and Outputs

Rear Panel Monitoring Output Signals

The two BNC connectors labeled “Current” and “Power” and located in the “Pump” area on the rear panel of the FIBERAMP-BT 17 provide analog output signals for diode current and pump power monitoring.

Output signal levels are rated as follows:

Table 5 - 1: Monitoring signal levels

Monitor Output	Description	Voltage range	Scale factor
Current output	Diode current monitoring	0-10 V	100 mA/V
Power output	Launched pump power monitoring	0-10 V	30 mW/V

Remote Interlock

FIBERAMP-BT 17 is a Class IIIb product (21 CFR Subchapter J) equipped with a Remote Interlock connector. User can, therefore, attach a remote interlock switch to the Remote Interlock SUBD-9 connector located on the rear panel.

When connecting the remote interlock switch, user must provide a connector that meets the following pin assignment:

Remote Interlock Connector Pin Assignment

Pins 1-2	*Shorted*
Pins 6-7	*Connect to external switch*

Note: User must ensure the external switch is electrically isolated from other circuits, including earth ground.

Opening the interlock switch disables the laser output. The laser output may be turned on again by simply closing the interlock switch, and pressing the **Output** key on the FIBERAMP-BT 17 front panel.

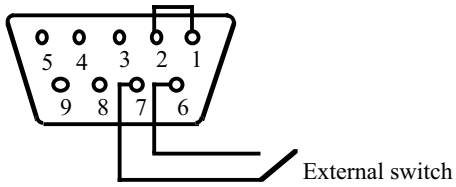
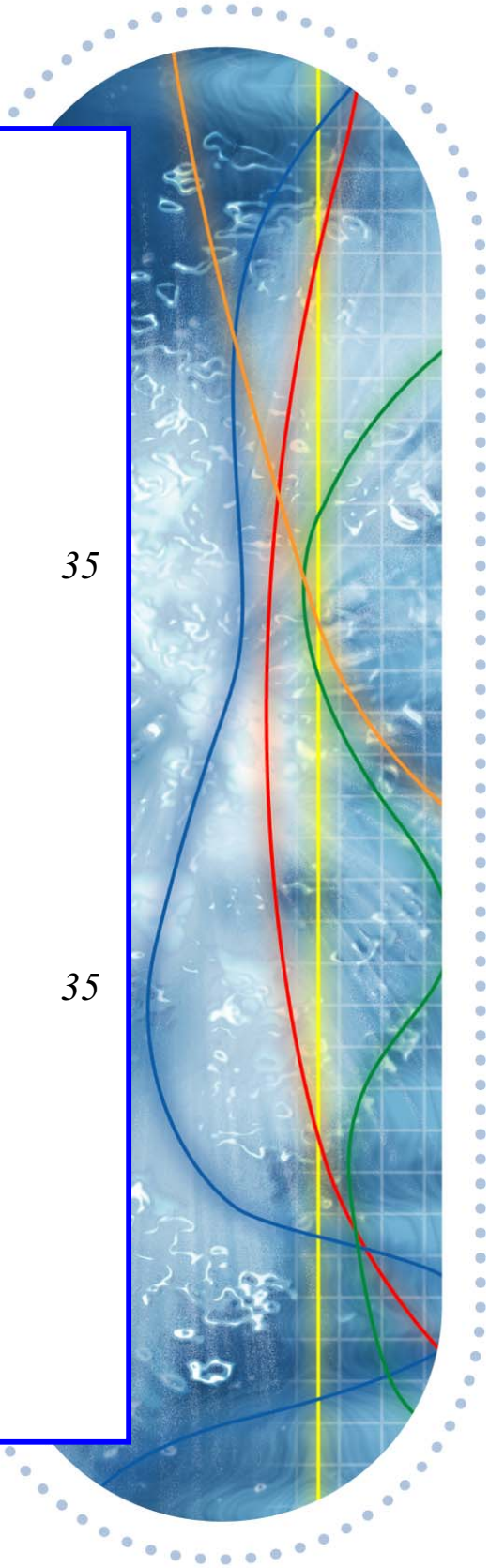


Figure 5 - 1: Remote Interlock SUBD-9 connector

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REMOTE CONTROL



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IEEE-488.1 Remote Control 35

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Remote Control

Introduction

FIBERAMP-BT 17 supports the IEEE-488.1 interface, also known as GPIB. When FIBERAMP-BT 17 receives an IEEE-488 interrupt on the bus, it automatically switches to remote control mode and the pump diode current is turned off (the “Output” LED is off).

When FIBERAMP-BT 17 is operating in remote mode, the spinner knob and all function keys on the front panel are disabled. However, digital displays remain active and continue to display real-time values of the launched pump power and diode current, alternating with the “rE” message to indicate the system is currently operated in remote mode.

When switching to remote mode and back to local mode (and vice versa), all previous system parameters can be restored automatically and the system resumes operation in the same state as when the last mode change was performed.

IEEE-488.1 Remote Control

GPIB Overview

The "GPIB" (General Purpose Interface Bus) communications link of FIBERAMP-BT 17 is compatible with the IEEE-488.1 Standard. The purpose of the normalized IEEE-488 bus is to allow communications between instruments and computers through a specialized parallel interface. The data transfer rate is as high as 1 Mbytes/s, and the information transfer is highly secured. The GPIB link is often used to automate measurement processes.

The standard configuration is composed of a controller device (which is usually a computer equipped with a GPIB interface board and corresponding IEEE-488 terminal emulation software) linked to various instruments. The controller manages the flow of information to, from, and between devices. One “talker” device and one or more “listener” devices may be present at any time on the GPIB link. Data sent on the bus is encoded in ASCII strings.

Each instrument on the bus is identified by its own GPIB address. The GBIP address is an integer in the range 1 to 30. For each instrument, different control registers can be used to determine the instrument operation state. The default FIBERAMP-BT 17 GPIB address is 10 but it can be changed (see *Change of the GPIB Address* on page 41).

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GBIP Functions Available on FIBERAMP-BT 17

FIBERAMP-BT 17 supports the following GPIB functions, as listed in the table below:

Table 6 - 1: Supported GBIP functions

Mnemonic	Meaning	Implementation
SH1	Source handshake	Complete
AH1	Acceptor handshake	Complete
T5	Talker	Complete
L3	Listener	Complete
SR1	Service request	Complete
RL1	Remote / Local	Complete
PP0	Parallel poll	No
DC1	Device clear	Complete
DT0	Device trigger	No
C0	Controller	No

Checking System Status with the Status Word Variable

Definition of the Status Word

The status word is an 8-bit variable that reflects the status of the FIBERAMP-BT 17. It contains a number of binary indicators which can be used by the controller for an optimal synchronization between FIBERAMP-BT 17 and the controller. They indicate to the controller the nature of the current operation as well as the errors encountered.

The only way to read the status word is to perform an operation called serial polling.

Table 6 - 2: Status Byte Register (STB)

Bit number	Name	Meaning
7	ERRORT (Temperature error)	Activated in case of temperature overflow.
6	RQS (ReQuest Service)	Set when a service request has been sent by the instrument. This bit is cleared when the bus controller reads the status register.
4	MAV (Message AVailable)	Set when a message is placed in the output buffer. This bit remains set for as long as the output buffer is not polled.
3	LIM (Current LIMitation)	Activated when the laser diode maximum current is reached.
2	ERRV (ERror in Received parameter Value)	Indicates that the value entered as a parameter could not been read, exhibits an invalid format, or is outside the valid range. (For example, a parameter value becomes invalid when the parameter's unit is provided.) (The indicator is disabled when a correct instruction is received.)
1	ERRC (ERror in Received Command)	Indicates that an invalid command has been received. (Disabled when a valid command is received.)
0	OPC	Indicates the execution of the last command is

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	(OPeration Complete)	complete. FIBERAMP-BT 17 is ready to receive new instruction.

Note: When a condition is in effect, the corresponding binary indicator takes a bit-value of (1); otherwise, the default bit-value is (0).

Use of the Service Request (SRQ)

The SRQ (Service Request) line is part of the definition of the IEEE-488.1 standard. The SRQ line can be triggered by any device on the bus. It alerts the central controller that a particular device requests to perform a specific operation.

When the controller detects that the SRQ line is active, it can probe all of the devices present on the bus to determine which device has initiated the service request and for what reason. This operation by which the controller reads the status word of each device is called "serial polling". The controller then monitors the bit-value of each indicator within the status word (see below).

The IEEE-488.1 standard specifies that when a device sends a service request, bit-value # 6 is set to 1. The other bits of the status word can reflect the state of different logical indicators of the system.

To help synchronize operations between FIBERAMP-BT 17 and the computer/terminal, the latter can instruct FIBERAMP-BT 17 to send a service request whenever certain bit-values are set to 1, as defined by the user. This can be achieved by using the instruction *SRE. Therefore, user does not need to repeatedly prompt for the status word since the FIBERAMP-BT 17 automatically notifies the computer/terminal when a particular event occurs.

User can configure the *SRE instruction to perform a particular service request. The transmitted parameter associated with the instruction *SRE is an integer that takes a value between 0 and 255. The *SRE can also be presented as an 8-bit binary value, each bit-value is either 0 or 1 depending on whether the corresponding status indicator is off or on.

For example, if the instruction *SRE=16 is received by FIBERAMP-BT 17, this corresponds to the binary value 00010000, as shown in Table 6 - 3. Since in this example the bit indicator #4 is set to 1 (Bit #4 = MAV = Message Available), the SRQ line will be automatically activated each time a message becomes available.

The following table provides examples of SRE values when individual indicator bit-values are set to 1.

Table 6 - 3: Examples of single-indicator SRE values

Indicator	SRE decimal value	Bit position #	Binary value
ERRORT	128	indicator #7	10000000
MAV	16	indicator #4	00010000
LIM	8	indicator #3	00001000
ERRV	4	indicator #2	00000100
ERRC	2	indicator #1	00000010
OPC	1	indicator #0	00000001

To calculate the parameter value to send with the instruction *SRE, simply add together the decimal values found in Table 6 - 3 of each individual indicators you would like to

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combine. For example, to obtain a service request each time an error is made, you must send the instruction "*SRE=6", obtained by adding the corresponding values of the two error indicators, which are ERRV(4) and ERRC(2).

Once FIBERAMP-BT 17 has activated a service request, the status word is no longer automatically updated, until the controller performs a new serial poll on the GPIB link. As the status word indicators remain unchanged, this allows the status word to provide reliable system-status information at the time of service request.

IMPORTANT: Since the processing of an instruction begins with the deactivation of the OPC indicator, no new instruction can be processed until the computer has performed the serial poll. Therefore, user should perform a serial poll as soon as a service request is received by the computer. Once the status word is read, the service request is deactivated and the FIBERAMP-BT 17 can resume normal operation.

Syntax for Parameter Commands

Syntax and Message Conventions

Each instruction is sent over the bus as an ASCII character string. The following syntax applies to messages send and receive:

- Each message string sent by the computer/terminal to FIBERAMP-BT 17 is ended with the "line-feed" character (LF, ASCII code10), or the "EOI" (End Of Instruction) GPIB control line, or both.
- Instruction syntax is not case sensitive.
- Messages may contain one or more instruction. When a string containing several messages is sent, consecutive instructions must be separated by the semi-column ";" character.

Instructions are divided into two groups:

- **Commands** are used to configure FIBERAMP-BT 17 by selecting operating modes and setting operating parameters such as pump power ouput, and more. (For example, to set the pump power output to 5 mW, user simply needs to type in the command string "P=5".)
- **Queries** are used to monitor parameter values at any time during system operation. (For example, the command string "P?" probes the pump power output level. FIBERAMP-BT 17 is addressed as the "talker" and returns the present parameter value, for example, "P=5" if the power output is 5 mW at the time of query.)

Each command/query is immediately handled by the FIBERAMP-BT 17 microprocessor.
Messages are sent using the following format: **instruction_string <CR>.**
"Instruction_string" consists of a keyword with or without a question mark "?". Some commands require a parameter. The parameter and the keyword are separated by a "=" sign or a "white space".

Instructions received by FIBERAMP-BT 17 are either processed or stored by the system whether the laser output is in ENABLE or DISABLE state, respectively. Should the laser output be disabled, commands are stored by FIBERAMP-BT 17 pending activation of the laser diode. Note that a diode current query or pump power query received at a time when the laser diode is disabled will generate a "DISABLED" response message.

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In constant current mode “Const I”, user may not configure a diode current setting over the absolute current limit; otherwise, this instruction is not processed, the system activates the “command error” bit (ERRC) of the status word, and FIBERAMP-BT 17 continues to operate normally with the previous diode current setting unchanged.

In constant power mode “Const P”, however, FIBERAMP-BT 17 does not return any error message (ERRC) if the power setting exceeds the absolute maximum rating for pump power, and the system continues to operate normally with the previous pump power setting unchanged.

Sending series of instructions

It is possible to send a group of instructions as a single string. The set of commands is processed as soon as the "line-feed" character is detected by FIBERAMP-BT 17.

Successive instructions must be separated by ";" and are executed in the order received.

Note: The FIBERAMP-BT 17 input buffer is 255 characters long. If a single command string contains more than 255 characters, the input buffer is automatically cleared and all received instructions lost (this generates a "ERRC" event). Same, if new instructions are received while FIBERAMP-BT 17 is still executing previous instructions in progress.

Response messages

Upon completion of an instruction, FIBERAMP-BT 17 does not return any response message unless the command string contains one or more queries.

If a single command string contains several query statements, all response messages are returned as a single character string, with response statements separated by “;” characters (for example, P=5; P?; APCON<CR>).

Value Format

The following format rules apply to parameter values:

- Numeric, non-integer values such as the laser output power (P) must be transmitted in a fixed-decimal-dot format (for example, P=5.1). However, integer values such as the validation byte SRE instruction do not take a decimal-dot.
- “White space”[7] characters are allowed in some places inside the strings sent to FIBERAMP-BT 17. They can be placed at the beginning of an instruction, after an instruction, as well as before, after, or in place of the “=” character. They cannot be inserted either in an instruction mnemonic and a numeric value, or between a mnemonic and the “?” character.
- Leading zero ("0") characters are allowed at the beginning of a value.
- Digits after the decimal point may be sent or omitted.

[7] On the IEEE-488 interface, all characters with ASCII codes lower than or equal to 32, except the line-feed character (LF, ASCII code10), are considered as white space characters.

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- Decimal coma is not equivalent to decimal point.
- Values are ended with the "line-feed" character.
- Do not specify any units to parameter values. All values take the default units, factory-set for FIBERAMP-BT 17 as shown in Table 6 - 4 below.

Table 6 - 4: Sample command syntax (GPIB)

Entry	Correct/Incorrect	Description
I= 1 53.2	Incorrect (no space allowed between "1" and "5")	Command error
I=153.2	Correct	Set diode current to 153.2 mA
I=153,2	Incorrect (no decimal coma allowed)	Command error
P=20 mW	Incorrect (unit abbreviations "mW" are not allowed)	Command error
P=50	Correct	Set pump power to 50 mW.
P=01	Correct	Set pump power to 1 mW.

Synchronization of Messages

To accelerate and secure the exchange of information between the computer/terminal and FIBERAMP-BT 17, we recommend checking the value of the status word obtained by serial polling (see *Definition of the Status Word*).

This status word contains the information letting the computer/terminal to know the status of commands received by FIBERAMP-BT 17, and therefore to decide when a new instruction can be sent or when the requested parameter can be read.

Various flags in the status byte register (STB) indicate the outcome of the command last processed and the type of error event, if any.

Message synchronization is essential in the following two cases:

- **To ensure that a pending command has been completely executed before proceeding to perform other operations.** This can be checked through the OPC flag (bit 0 of STB). This flag remains false (0) as long as a command line has not been completely executed, and is set to true (1), afterwards. The computer should test this flag until it becomes true, and only then, proceed with the next instruction. In this case the STB byte must be read through a serial poll.
- **When a query statement has been sent, the computer must wait until the response is actually available before reading it.** This is signaled by the MAV flag (bit 4 of the STB byte). In this case the STB byte must be read through a serial poll. This flag remains false (its bit value is 0) until a complete message is available for reading. Therefore, the computer should constantly check this flag until it becomes true (bit value equal to 1), and only then, the response message associated to the query becomes available.

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Error Handling

Two types of errors can occur in the transmission of instructions: command errors and value errors.

The system detects command errors each time a command string received by FIBERAMP-BT 17 is invalid due to a syntax error or the use of an unknown mnemonic. The ERRC indicator in the status word is then activated.

A value error occurs when the command is valid, but the value of the parameter is incorrect, either because it could not be read or because it is outside the valid range. In both cases, the provided command is ignored and the ERRV indicator in the status word is activated.

Both ERRC and ERRV indicators are automatically reset when a new valid is received.

Change of the GPIB Address

The FIBERAMP-BT 17 system GPIB link primary address is factory-set to 10. However, user can change the GPIB link address at system initialization by proceeding as follows:

- Hold down the **Output** button while turning on the FIBERAMP-BT 17 by rotating the **Power** key clockwise. The current system GPIB address appears on the FIBERAMP-BT 17 front panel display.
- Rotate the **Spinner knob** to set the new GPIB address.
- Press the **Output** button again to save the new GPIB address.

Note: You may also use the GPIB command “GPAD=nn” in remote mode, where “nn” is an integer the range 1-30.

Local Lockout

When FIBERAMP-BT 17 receives a message through its IEEE-488.1 interface, it switches automatically to remote mode operation.

The diode current display shows alternatively the “rE” message and the value of the pump diode current, as an indication that the system is currently operating in remote mode. Similarly, the power display alternates between “rE” and the value of the power output. The local operating mode can be reactivated only by pressing the "Output" button.

Local lockout may be obtained by sending the proper GPIB command (refer the user's guide that comes with your GPIB interface board). Local lockout tells the FIBERAMP-BT 17 to ignore front panel (local) controls. This means that once the local lockout command is sent in remote mode, front control buttons, switches and knobs are no longer active, especially that pressing the “Output” button can no longer turn off the laser output or restore the remote mode.

Note: While in remote mode, when front panel controls are still active, the “loc” message is displayed for two seconds.

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IEEE-488.1 Control Commands

IEEE Standard Commands

The following standard commands of the IEEE-488.1 interface can be processed by FIBERAMP-BT 17:

Note: These correspond to basic commands which syntax varies depending on the particular GPIB driver software you are using. For the exact syntax of standard commands, please refer to the user's manual that comes with your GPIB hardware and software.

Table 6 - 5: IEEE Standard commands

Function	Description
Remote change	Switches from remote to local mode or local to remote mode
Local lockout	Disables all controls from the front panel
Status reading	Conduct a serial poll.
Write	Write data to a device
Read	Read data from a device
Clear	Reset a specific device

Changing Parameter Settings

Parameter setting commands are listed in Table 6 - 6 below, where n is an integer in the range 0 to 9.

Table 6 - 6: Parameter setting commands (GPIB)

Command	Description
I=nnn.n	Sets the laser diode current to nnn.n mA and switches to the constant current mode.
P=nnn	Sets launched pump power to nnn mW and switches to the constant power mode.
GPAD=nn	Sets the FIBERAMP-BT 17 GPIB address.

Changing Operating Mode

Table 6 - 7: Operating mode commands (GPIB)

Command	Description
ENABLE	Enables the pump laser output. (Same as pressing the **Output** key in local mode and "Output" LED is ON.)
DISABLE	Disables the pump laser output. (Same as pressing the **Output** key in local mode and "Output" LED is OFF.)
APCON	Sets the FIBERAMP-BT 17 in Constant Power mode (also known as APC mode). The APC (Automatic Power Control) mode maintains the operation of the pump diode at a constant output power level.
APCOFF	Disables the constant power (APC) mode. Constant Current mode is restored.

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System and Parameter Queries

Table 6 - 8: System and parameter queries (GPIB)

Queries	Description	FIBERAMP-BT 17 returns
ILIMIT?	Returns the laser diode maximum allowable current (mA). (Same as setting the Mode selector knob to "Limit display" in local mode. But unlike local mode, probing for ILIMIT in remote mode does not disable the laser diode output.)	ILIMIT=nnn.n
P?	Returns the present pump diode power output level (mW).	P=nnn
I?	Returns the present laser diode current (mA).	I=nnn.n
APC?	Returns the present operating mode: • "Const P" • "Const I"	 ON OFF
ERRORT?	Prompts the Temperature Error boolean indicator: • "Temperature Error" • "Normal"	 1 0
INTERLOCK?	Prompts the Interlock mode	ON OFF

Bus Management Commands

The main bus management instructions are described herein.

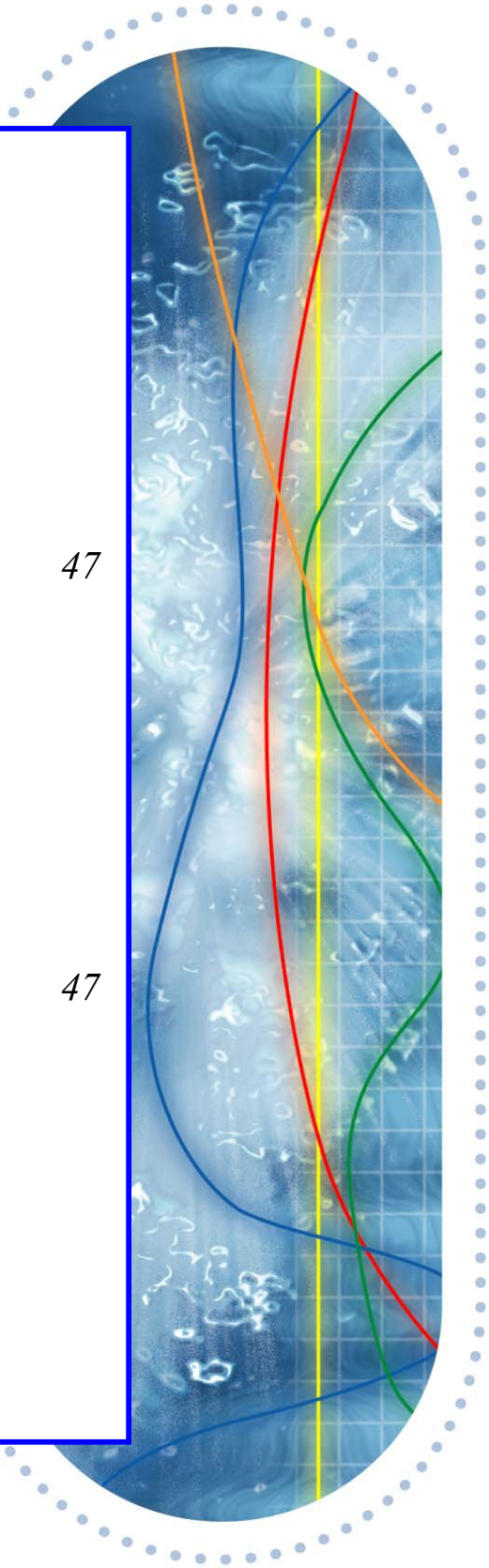
- All standard GPIB bus management instructions start with a star ("*") character.
- Only single instructions are valid. No other channel mnemonic should be inserted in front of these instructions.

Table 6 - 9: Bus management commands (GPIB)

Command	Description	FIBERAMP-BT 17 returns
*IDN?	IDeNtification query	NETTEST,FIBERAMP-BT 17,0,n.nn (where "n.nn" is the software release).
*SRE	Defines the conditions under which FIBERAMP-BT 17 will automatically send a service request (SRQ) to the controller. The status register mask is set to a value equal to the argument of this command. If the argument is outside the interval 0 to 255, the Execution Error sequence is executed.	
*SRE?	The value of the status byte register is copied into the output buffer.	Status register value between 0 and 255

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SERVICE INFORMATION



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Service Information

Performance Verification

If the performances do not meet warranted specifications, a complete servicing of the instrument may be required.

The complete servicing requires the adjustment or replacement of internal components and must be performed by NetTest authorized personnel only.

Maintenance

User maintenance of the FIBERAMP-BT 17 is limited to the following:

- Replacing the Line Fuse.
- Cleaning optical connectors for optimum power.
- Checking the performance of optical connections and cables.
- Cleaning the instrument.

⚠	***WARNING***	**DO NOT MAKE ANY SERVICE OR MAINTENANCE TO THE FIBERAMP-BT 17** Under no circumstances shall the user make any service or maintenance repairs of any kind to the FIBERAMP-BT 17. The user shall not remove the protective cover of the FIBERAMP-BT 17. User shall refer servicing to authorized NetTest personnel only.

Replacing the Line Fuse

Before replacing the Line Fuse make sure you unplug the power cord.

- Insert a small flat-blade screwdriver into the notch just inside the power cord socket of the line filter (see Figure 7 - 1).
- Use the notch to pull the fuse holder straight out to remove the fuse.
- Replace the fuse (T4Amp L 250V) in the fuse holder and snap the fuse holder back into the lined filter.

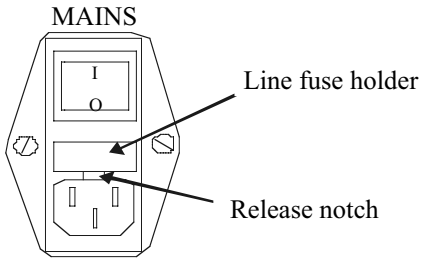


Figure 7 - 1: Replacing the line fuse

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Cleaning and Caring for Optical Connectors and Fibers

- Handle optical fiber with appropriate care and keep optical connectors free of outside contaminant to preserve optical-signal integrity.
- Use the following items to clean the optical connectors:
  - clean compressed air
  - fiber-optic cleaning swabs
  - isopropyl alcohol
- Follow these steps to clean the optical connectors:

1. Hold the can of compressed air upright and spray the can into the air to purge any propellant.
2. Spray the clean compressed air on the connectors to remove any loose particles or moisture.
3. Moisten a clean optical swab with isopropyl alcohol, then lightly swab the surfaces of the connectors.
4. Spray the clean compressed air on the connectors again to remove any loose particles or isopropyl alcohol.

Note: Cleaning kits for optical connectors are available from many fiber optic suppliers.

	***CAUTION***	• To optimize the performance of the system and to prevent loss of optical power or damage to the optical connectors, keep the connectors clean at all times. • When cleaning the connectors with a swab, use gentle circular motion. Use only high quality cleaning supplies that are non-abrasive and leave no residue. • To reduce the need for cleaning, immediately replace protective caps on the optical connectors when not in use. • Do not over stress or sharply bend optical fiber beyond tolerances specified by the manufacturer.

Cleaning of the Instrument

If necessary, follow these steps to clean the FIBERAMP-BT 17 instrument:

- Disconnect the instrument from the mains supply before cleaning.
- Clean with a cloth slightly damped with an isopropyl alcohol liquid.

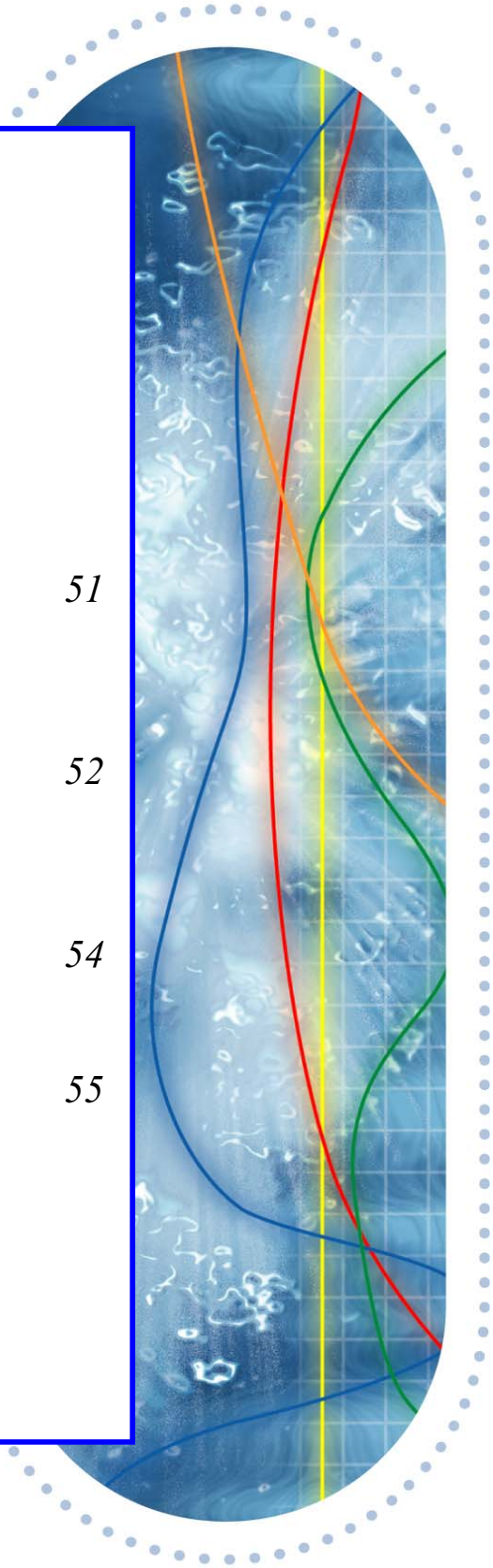
	***CAUTION***	Do not use chemically active or abrasive materials to clean the instrument.

Packaging for Shipment

When you receive the instrument, please keep the original packaging for potential use.
Use the original packaging in case you need to return the FIBERAMP-BT 17 unit to NetTest for servicing. For instructions on returning the instrument, please contact NetTest (see *Contacting NetTest* on page 6).

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Appendices

Appendix A: Troubleshooting

This section presents troubleshooting information for FIBERAMP-BT 17 potential operating problems.

Table 8 - 1: Troubleshooting

Problem	Possible cause	Troubleshooting
"Temperature control error" LED is lit.	Temperature control is not working properly.	Rotate the "Power" key counterclockwise to turn off the FIBERAMP-BT 17. Wait for 15 seconds before you turn on again the FIBERAMP-BT 17. Wait for another 15 seconds before you press the "Output" button to turn on the laser diode.
"Temperature control error" LED remains lit.		FIBERAMP-BT 17 must be serviced by authorized NetTest service personnel .
No display	Bad fuse	Check the line fuse at the rear panel of FIBERAMP-BT 17.
No pump power	Either the laser diode or the power detector may be out of order.	If you set a nominal pump current (100 mA typ.) and the pump power stays low (< 10 mW typ.) then please contact your authorized NetTest distributor or the NetTest Service Department.

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Appendix B: Certification and Compliance

Declaration of Conformity

Manufacturer's Name: NetTest

Address: 52, avenue de l'Europe – BP 39 – 78160 Marly le Roi – France

Product Name: Fiberamp-BT 17

Model Numbers: 3624

Special Characteristics: -

This product complies with the requirements of the EMC Directive 89/336/EEC and Low Voltage Directive 73/23/EEC (with amendments), as identified Standards hereof:

- **EMC Directive - 89/336/EEC (OJEU 23.05.89 L-139/19):** Council Directive on the approximation of the laws of the member states relating to electromagnetic compatibility.

- **Low Voltage Directive (as amended by directive 93/68/EEC) 73/23/EEC (OJEU 26.03.73 L-77/29):** Council Directive on the harmonization of the laws of Member States relating to electrical equipment designed for use within certain voltage limits.

This product conforms to the following Standards:

- **Electrical Safety**
  - *EN 61010-1 ed. 1993 + EN 61010-1/A2 ed. 1995 Safety requirements for electrical equipment for measurement control and laboratory use.*
  - *EN 60825-1/A1 ed. 1994 Safety for Laser Products, Part 1. Equipment classification requirements and user's guide.*
  - *UL3111-1 Standard for electrical measuring and test equipment.*
  - *CAN/CSA 1010-1-92 including MOD: 1997 safety requirements for electrical equipment for measurement, control, and laboratory use.*

- **EMC**
  - ***EN 50081-1 ed. 1992 Generic Emission Standard***
    - *EN 55022 ed. 1994 : Class B Radiated and conducted emissions*
    - *EN 61000-3-2 ed. 1995 : Class A Limits for harmonic current emissions*
    - *EN 61000-3-3 ed. 1995 Limitation of voltage fluctuations and flicker on low-voltage supply systems*
  - ***EN 50082-1 ed. 1997 Immunity***
    - *EN 61000-4-2 ed. 1995 : Electrostatic discharge immunity (± 4 kV contact discharge, ± 8 kV air discharge)*
    - *EN 61000-4-3 ed. 1996 : Radiated immunity (3 V/m AM f = 1 kHz 80 %)*
    - *ENV 50204 ed. 1995 : Radiated electromagnetic field from digital radio telephones (3 V/m @ 900 MHz)*
    - *EN 61000-4-4 ed. 1995 : Electrical fast transients (± 1 kV AC power ports, ± 500 V signal line peak)*
    - *EN 61000-4-5 ed. 1996 : Surge immunity (power lines only) (± 2kV common mode, ± 1 kV differential mode)*
    - *EN 61000-4-6 ed. 1996 : Conducted RF immunity (3 Vrms AM f = 1 kHz 80 %)*
    - *EN 61000-4-11 ed. 1996 : Voltage dips, short interrupts, and line voltage variations (30 %-10 ms dips, 60 %-100 ms dips, over 95 %-5s interrupts)*

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Table 8 - 2: Safety Compliance

Equipment type	**Test and Measuring**
Safety Class	Class 1 (as defined in IEC 61010-1, annex H)- grounded product
Mains supply voltage	100 - 240 V AC with ± 10% fluctuation max
Installation (Overvoltage) category	**Overvoltage category II** (as defined in IEC 61010-1, Annex J) Local-level mains (wall sockets). Equipment at this level includes appliances, portable tools, and similar products. Equipment is usually cord-connected.
Pollution Degree	**Pollution Degree 2** (as defined in IEC 61010-1). **Note:** rated for indoor use only. Normally only dry, nonconductive pollution occurs. Occasionally a temporary conductivity that is caused by condensation must be expected. This location is a typical office/home environment. Temporary condensation occurs only when the product is out of service.
Safe operating temperature range	0°C to +50°C
Maximum relative humidity	80% for temperatures up to 31°C decreasing linearly to 50% relative humidity at 40°C
Altitude (maximum operating)	2000 meters

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Appendix C: Replaceable Parts

For information about replaceable parts, contact your NetTest sales representative.

Table 8 - 3: Standard accessories

Name	Description
Fuse	T4Amp L 250V
Manual, tech : instruction	FIBERAMP-BT 17 Instruction Manual
Optical fiber cable	single-mode cable

Table 8 - 4: Optional power cords

Name		Description
North America	110 V, 60 Hz	CSA STD C22.2 NO21-M1984, ECN 436C approved, 5-15P attachment plug cap molded into No18 AWG, type SVT,SJT flexible cord, 2 meter (78.7 inch), 125V/10A AC, US
Universal European	220 V, 50 Hz	DIN 49441/2, CEE7, DIN 0625, VDE approved, IEC attachment plug cap, HO5VV-F3G 0.7 mm^2 flexible cord, 2.5 meter (98.4 inch), 250V/10A AC, EUROPEAN
United Kingdom	240 V, 50 Hz	BS4491.EN60.320,BASEC BS6500, ASTA BS 1363A, VDE, SEV, BSI approved, 1.0 mm^2 flexible cord, 2 meter (78.7 inch), 250V/10A AC, 25.4 mm fused UK plug (13A fuse)

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