BBS SERIES
OPTICAL BROADBAND SOURCE

User's Manual

JDS Uniphase

Contents

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SD000031 Rev. H July 1999

Safety Information, Instructions, and Symbols

Safety Information

Classification

The unit consists of an exposed metal chassis that is connected directly to earth via a power cord and, therefore, is classified as a Class 1 instrument. Class 1 refers to equipment relying on ground protection as a means of shock protection.

The following symbol is used to indicate a protective conductor terminal in the unit.

Disconnecting from Line Power

Some of the circuits are powered whenever the unit is connected to the AC power source (line power). To ensure that the unit is not connected to the line power, disconnect the power cord from either the power inlet on the unit's rear panel or from the AC line-power source (receptacle). The power cord must always be accessible from one of these points. If the unit is installed in a cabinet, the operator must be able to disconnect the unit from the line power by the system's line-power switch.

Line Power Requirements

The unit can operate from any single-phase AC power source that supplies between 100 and 240 V at a frequency range of 50 to 60 Hz. The maximum power consumption is 80 VA.

Fuse Type

The fuse type used by the unit is (5x20) mm, T1A/250 V (slow).

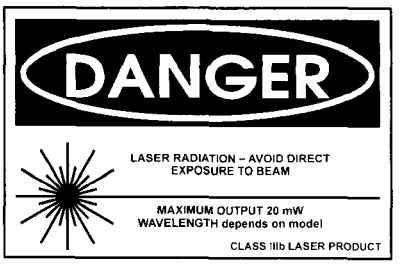
Laser Specifications

Laser specifications are outlined in Table 1.

Table 1: Laser Specifications

Parameter	Specification
Wavelength	varies by model
Class	IIIb
Output power	20 mW maximum

Under the laser classification of the US Food and Drug Administration (FDA) Center for Devices and Radiological Health (CDRH), the laser contained in the unit is a Class IIIb laser.



Warning

Class IIIb lasers are hazardous to eyes and skin if viewed directly.

Safety Instructions

The following safety instructions must be observed whenever the unit is operated, serviced, or repaired. Failure to comply with any of these instructions or with any precaution or warning contained in the user's manual is in direct violation of the standards of design, manufacture, and intended use of the unit. JDS Uniphase assumes no liability for the customer's failure to comply with any of these safety requirements.

Before Initializing and Operating the Unit

☑ Inspect the unit for any signs of damage, and read the user's manual thoroughly.

☑ Install the unit as specified in the **Getting Started** section.

☑ Ensure that the unit and any devices or cords connected to it are properly grounded.

Operating the Unit

Warning

To avoid the risk of injury or death, always observe the following precautions before initializing the unit:

- If using a voltage-reducing autotransformer to power the unit, ensure that the common terminal connects to the earthed pole of the power source.
- Use only the type of power cord supplied with the unit.
- Connect the power cord only to a power outlet equipped with a protective earth contact. Never connect to an extension cord that is not equipped with this feature.
- Willfully interrupting the protective earth connection is prohibited.
- Never look into the end of an optical cable connected to an optical output device that is operating. Laser radiation is invisible, and direct exposure can severely injure the human eye. For more information, see the user's manual of the laser source in use.
- To prevent potential fire or shock hazard, do not expose the unit to any source of excessive moisture.
- Do not operate the unit when its covers or panels have been removed.
- Do not interrupt the protective earth grounding. Any such action can lead to a potential shock hazard that can result in serious personal injury.
- Do not operate the unit if an interruption to the protective grounding is suspected. In this case, ensure that the unit remains inoperative.
- Use only the type of fuse specified by the manufacturer as appropriate for this unit. Do not use repaired fuses, and avoid any situations that can short-circuit the fuse.
- Unless absolutely necessary, do not attempt to adjust or perform any maintenance or repair procedure when the unit is opened and connected to a power source.

	• Repairs are to be carried out only by a qualified professional. • Operating the unit in the presence of flammable gases or fumes is extremely hazardous. • Do not perform any operating or maintenance procedure that is not described in the user's manual. • Some of the unit's capacitors can be charged even when the unit is not connected to the power source.

Safety Symbols

The following symbols and messages can be marked on the unit (Table 2). Observe all safety instructions that are associated with a symbol.

Table 2: Safety Symbols

Symbol	Description
	Laser safety. See the user's manual for instructions on handling and operating the unit safely.
	See the user's manual for instructions on handling and operating the unit safely.
	Electrostatic discharge (ESD). See the user's manual for instructions on handling and operating the unit safely.
	Frame or chassis terminal for electrical grounding within the unit.
	Protective conductor terminal for electrical grounding to the earth.
WARNING	**The procedure can result in serious injury or loss of life if not carried out in proper compliance with all safety instructions. Ensure that all conditions necessary for safe handling and operation are met before proceeding.**
CAUTION	The procedure can result in serious damage to or destruction of the unit if not carried out in compliance with all instructions for proper use. Ensure that all conditions necessary for safe handling and operation are met before proceeding.

Compliance

FCC Compliance

The Federal Communications Commission (FCC) of the United States of America requires that equipment operating in that country does not cause interference to communications. The unit has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of Title 47 of the Code of Federal Regulations for Radio Frequency Devices. Operation is subject to the following two conditions, which the FCC requires to be labeled on the unit:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

FCC rules require that the following note and subsequent information be included in this manual:

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

These limits are designed to provide reasonable protection against harmful interference in a commercial installation. The unit generates, uses, and radiates radio frequency energy and, if not installed and used in accordance with instructions, can cause harmful interference to radio communications.

Any user modification made to the unit voids the user's authority to operate the unit under the FCC rules.

If this unit is used in a residential setting, resulting interference must be corrected by the user.

For more information, see Title 47 of the Code of Federal Regulations at http://www.access.gpo.gov/nara/cfr/cfr-table-search.html.

CE Compliance

The unit has been designed and tested to comply with directive 73/23/EEC and its subsequent amendments by the European Community (EC or CE). The directive relates to electrical equipment designed for use within certain voltage limits. It ensures that electrical equipment is constructed with good engineering practice in safety matters.

The unit has been designed and tested to comply with directive 89/336/EEC and its subsequent amendments. The directive relates to electromagnetic compatibility. It demands that electromagnetic disturbance does not exceed a prescribed level; that the equipment be immune to a prescribed level of ambient level of interference; that the equipment be protected against electrostatic discharges; and that the equipment be immune to all electrical shock wave

disturbances. As of 1997, measures have been added to test for fire hazard, electric shock hazard, and also external exposure to other forms of energy.

The requirements specified by directive 89/336/EEC are as follows. CE compliance requires that the manufacturer or its authorized representative established within the Community affix the EC conformity mark to the apparatus or else to the packaging, instructions for use, or guarantee certificate. The EC conformity mark shall consist of the letters CE as specified and the figures of the year in which the mark was affixed. This mark should, where appropriate, be accompanied by the distinctive letters used by the notified body issuing the EC type-examination certificate. Where the apparatus is the subject of other Directives providing for the EC conformity mark, the affixing of the EC mark shall also indicate conformity with the relevant requirements of those other Directives.

FDA-CDRH Compliance

Under the US Food and Drug Administration (FDA) Center for Devices and Radiological Health (CDRH), the unit complies with the Code of Federal Regulations (CFR), Title 21, Subchapter J, which pertains to laser safety and labeling. See http://www.fda.gov/cdrh/radhlth/cfr/21cfr1000-1050.pdf for more information.

General Information and Specifications

General Information

This user's manual for the BBS Series Optical Broadband Source contains complete operating instructions. The inspection report and a description of any customer-requested information are found in the **Customized Features and Test Data** section.

The BBS Series Optical Broadband Source is a high-power, broadband, optical source unit ideal for laboratory or manufacturing use. Spectral measurements of couplers, wavelength division multiplexers (WDMs), isolators, and other optical components can be tested or verified easily with this instrument when combined with a scanning receiver.

Optics

The optics of the BBS unit consist of either an erbium doped fiber amplifier (EDFA), a semiconductor amplifier (SOA), or a super-luminescent laser diode (SLD), and supporting components specifically designed to achieve maximum output power at the bulkhead-mounted optical connector.

Key Features

- Total output power from >3 to >20 mW (depending on model)
- High stability (< 0.05 dB) for EDFA-based models
- Broadband source spectral density from -25 to -3 dBm/nm (depending on model)
- Bulkhead optical output connector (FC/HPC, FC/APC, SC/HPC, SC/APC)
- Half width of a 19 inch (48.26 cm) rack
- Remote interlock and key enable switch

Applications

The BBS source is used for optical component measurement and telecommunications transmission testing:

- Spectral measurements of couplers, WDMs, isolators, and other optical components
- Noise loading in system experiments
- Polarization mode dispersion (PMD) measurements

Figure 1 shows how a BBS source can be interconnected for optical component and transmission system testing.

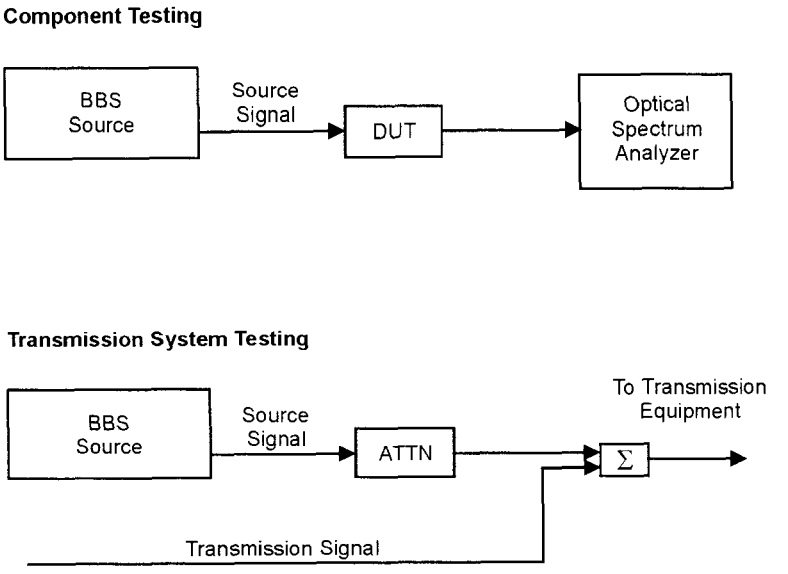


Figure 1: Component and Transmission System Testing

Standard Accessories

- AC power cord
- Remote interlock connector
- Two keys
- Rack-mount kit with assembly instructions
- User's manual

Specifications

The following optical specifications describe the warranted characteristics of the unit (Table 3). Supplementary specifications describe the typical non-warranted performance of the unit (Table 4).

Table 3: Optical Specifications

Parameter	BBS1550	BBS1590	BBS1560	BBS1460	BBS980	BBS980-1	BBS1310
Operating wavelength (minimum)	1530 to 1559 nm	1570 to 1600 nm	1530 to 1560 nm, 1570 to 1600 nm	1440 to 1540 nm	950 to 980nm	950 to 980 nm	1290 to 1360 nm
Operating wavelength (typical)	1525 to 1565 nm	1565 to 1605 nm	1525 to 1560 nm, 1570 to 1605 nm	1420 to 1580 nm	950 to 1010nm	950 to 1010 nm	1250 to 1400 nm
Pump	Single	Single	Single	Single	Single	Single	Single
Total output power (minimum)	≥20 mW[1]	≥8 mW[1]	≥10 mW[1]	≥5 mW[2]	≥3.2 mW[2]	≥3.2 mW[2]	≥18 mW[2]
Optical spectral density[3] (minimum)	≥-5 dBm/nm	≥-8 dBm/nm	≥-15 dBm/nm	≥-25 dBm/nm	≥-18 dBm/nm	≥-18 dBm/nm	≥-15 dBm/nm
Optical spectral uniformity[4]	2 dB	2 dB	10 dB	--	--	--	--
Optical output stability[5] (minimum)	≤0.05 dB[1]	≤0.05 dB[1]	≤0.05 dB[1]	≤0.15dB[2]	≤0.15dB[2]	≤0.15dB[2]	≤0.02dB[2]
Output isolation	35 dB	20 dB	20 dB	≥15dB[2]	--	≥15dB[2]	≥20dB[2]
Output polarization[2]	--	--	--	5%	5%	5%	5%
Optical interface	FC/HPC, FC/APC, SC/HPC, SC/APC						

[1] Measured at 1550 / 1590 / 1570 nm at 23 °C.
[2] Measured at 1475 / 980 / 1310 nm at 23 °C.
[3] Measured over operating wavelength range with 1nm resolution bandwidth.
[4] Measured peak to peak over minimum operating wavelength range.
[5] Measured over 12 hours after 15 minute warm-up with broadband detector at 1550/1590/1570/980/1310 nm at 23 °C.

Table 4: Other Specifications

Electrical	
Input voltage	100 to 240 V AC, 50 to 60 Hz
Power consumption	80 VA maximum
Physical	
Dimensions (W x H x D)	21.2 cm x 8.9 cm x 35.5 cm, 1/2 rack wide benchtop
Weight	<4 kg
Environmental	
Operating temperature	-10 to 60 °C
Storage temperature	0 to 50 °C
Humidity	maximum 95% RH non condensing

Getting Started

The BBS Series Optical Broadband Source consists of the source unit, an AC power cord, two keys, and a rack-mount kit.

Before Initializing and Operating the Unit

☑ Inspect the unit for any signs of damage.

☑ Read the user's manual thoroughly, and become familiar with all safety symbols and instructions to ensure that the unit is operated and maintained safely.

Initial Inspection

Warning

To avoid electrical shock, do not initialize or operate the unit if it bears any sign of damage to any portion of its exterior surface, such as the outer cover or panels.

Check that the unit and contents are complete:

1. Wear an anti-static wrist strap, and work in an electrostatic discharge (ESD) controlled area.
2. Inspect the shipping container for any indication of excessive shock to the contents, and inspect the contents to ensure that the shipment is complete.
3. Inspect the unit for structural damage that can have occurred during shipping.
4. Connect the unit to a power source, using the AC power cord provided.
5. Set the power switch to **I** (on).
6. Keep the packaging.

Immediately inform JDS Uniphase and, if necessary, the carrier if the contents of the shipment are incomplete, if the unit or any of its components are damaged or defective, or if the unit does not pass the initial inspection.

Operating Environment

In order for the unit to meet the warranted specifications, the operating environment must meet the following conditions for temperature, humidity, and ventilation.

Temperature

The unit can be operated in the temperature range of 0 to 50 °C.

Humidity

The unit can be operated in environments with up to 95% humidity. Do not expose it to any environmental conditions or changes to environmental conditions that can cause condensation to form inside the unit.

Ventilation

The unit contains a built-in cooling fan. Do not install it in any location where the ventilation is blocked. For optimum performance, the unit must be operated from a location that provides at least 75 mm (3 inches) of clearance at the rear and at least 12.5 mm (0.5 inch) of clearance at the bottom. Blocking the air circulation around the unit can cause the unit to overheat, compromising its reliability.

Warning

- Do not use the unit outdoors.
- To prevent potential fire or shock hazard, do not expose the unit to any source of excessive moisture.

Storing and Shipping

To maintain optimum operating reliability, do not store the unit in locations where the temperature falls below -10 °C or rises above 60 °C. Avoid any environmental condition that can result in internal condensation. Ensure that these temperature and humidity requirements can also be met whenever the unit is shipped.

Claims and Repackaging

Immediately inform JDS Uniphase and, if necessary, the carrier, if

- The contents of the shipment are incomplete
- The unit or any of its components are damaged or defective
- The unit does not pass the initial inspection

In the event of carrier responsibility, JDS Uniphase will allow for the repair or replacement of the unit while a claim against the carrier is being processed.

Returning Shipments to JDS Uniphase

JDS Uniphase only accepts returns for which an approved Return Material Authorization (RMA) has been issued by JDS Uniphase sales personnel. This number must be obtained prior to shipping any material to JDS Uniphase. The owner's name and address, the model number and full serial number of the unit, the RMA number, and an itemized statement of claimed defects must be included with the return material.

Ship return material in the original shipping container and packing material. If these are not available, packaging guidelines are as follows:

1. Wear an anti-static wrist strap and work in an ESD controlled area.

2. Cover the front panel with a strip of cardboard.

3. Wrap the unit in anti-static packaging. Use anti-static connector covers, if applicable.

4. Pack the unit in a reliable shipping container.

5. Use enough shock-absorbing material (10 to 15 cm or 4 to 6 in on all sides) to cushion the unit and prevent it from moving inside the container. Pink poly anti-static foam is the best material.

6. Seal the shipping container securely.

7. Clearly mark FRAGILE on its surface.

8. Always provide the model and serial number of the unit and, if necessary, the RMA number on any accompanying documentation.

9. Ship the unit only to the address given at the beginning of this document.

Cleaning Connectors

Caution

- Connecting damaged or dirty fibers to the unit can damage the connectors on the unit.
- Never force an optical connector. Some connectors have a ceramic ferrule that can easily be broken.

Optical cable ends need to be cleaned before using them with the unit.

The following items are required for cleaning:

- Filtered compressed air or dusting gas (for example, Tech Spray Envi-Ro-Tech Duster 1671 gas, available from http://www.techspray.com/1671.htm)
- Lint-free pipe cleaners (for example, from 3M[1]) or lint-free swab
- Lint-free towels (for example, 10 x 10 cm or 4 x 4 in HydroSorb III wipers, available from http://www.focenter.com/acctech/hydrosobr_wipers.htm)
- Optical grade isopropyl alcohol or optical grade 200° ethanol (do not use rubbing alcohol, which contains 30% water)

To clean the connectors:

1. Blow the sleeve with filtered compressed air (Figure 2).

[1] 3M is a trademark of 3M.

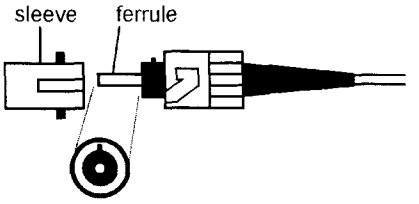


Figure 2: Connector Cleaning (connector type can vary)

2. Apply optical grade isopropyl alcohol or optical grade ethanol (do not use rubbing alcohol) to a small area of a lint-free towel and rub the end of the ferrule over the wet area.

3. Wipe the ferrule on a dry area of the lint-free towel.

4. Using the dusting gas or compressed air, blow the end of the ferrule.

5. Apply the alcohol or ethanol to a lint-free pipe cleaner or swab and wipe off the remaining parts of the connector.

6. With the other end of the pipe cleaner or swab, dry the areas cleaned.

7. Using the dusting gas or compressed air, blow the areas cleaned.

Front Panel

The front of the unit is shown in Figure 3 and described in Table 5.

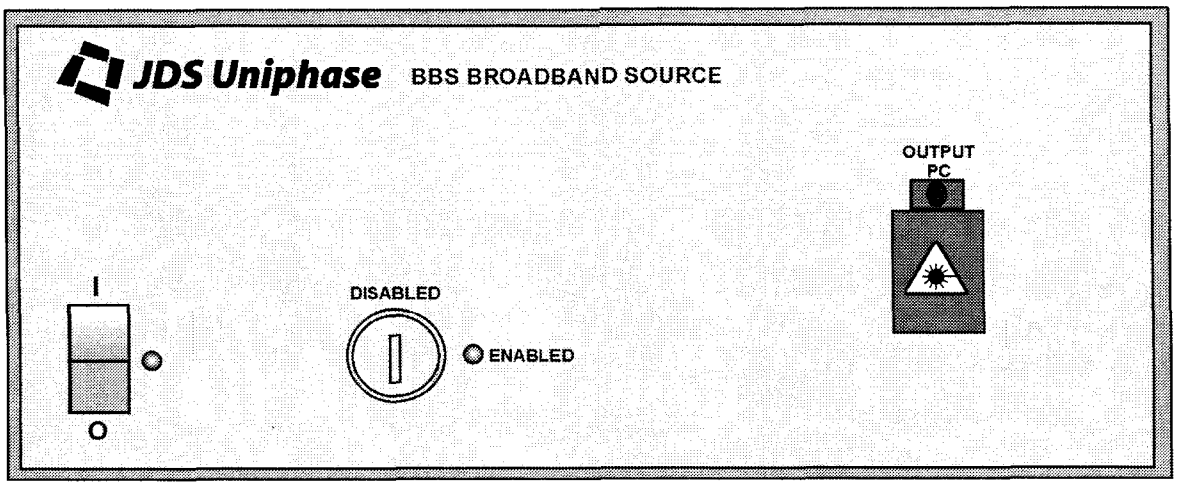


Figure 3: Front of Unit

Table 5: Operating Controls and LEDs

Control or LED	Description
I/O	Power on (**I**) off (**O**) switch.
I/O LED indicator	Power-on LED--an illuminated green LED indicates power is on
Enabled/Disabled key switch	When Enabled, turns on current supply to laser diode. When Disabled, turns off the current supply to laser diode.
Enabled/Disabled LED indicator	Power-on laser LED--an illuminated green LED indicates laser diode is enabled
Output	Provides the amplified output signal from the source to the device under test (DUT)

Rear Panel

The back of the unit is shown in Figure 4 and described in Table 6.

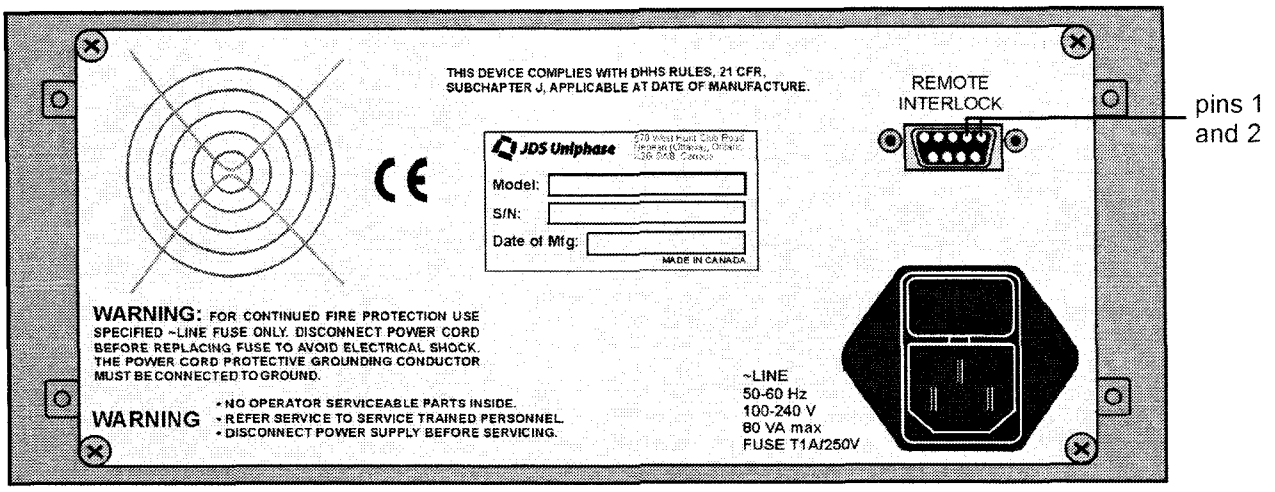


Figure 4: Back of Amplifier

Table 6: Rear Panel Details

Feature	Description
AC line connector	100 to 240 V AC, 50 to 60 Hz line cord interconnection
Remote Interlock	Pins 1 and 2 of the remote interlock connector must be interconnected to enable operation of the broadband source

Connecting the Remote Interlock

Before the BBS unit can be operated, the remote interlock must be connected. The remote interlock allows a connection for a remote on/off switch.

To connect the remote interlock:

1. Do this remotely with an electrical relay circuit or locally by utilizing the electrical connector supplied with the instrument, interconnecting pins 1 and 2 of the connector at the back of the unit.

Using the Broadband Source

Warning

Use of protective eyewear is recommended.

Use of the BBS unit entails its key switch and connections:

1. Ensure that the unit is turned off (**O**) and that the key switch on the front panel is set to the Disabled position.

2. Raise the Output optical connector port protective safety cover to expose the output connector and remove the protective optical connector cap.

3. Connect the DUT to the Output connector on the front panel via a suitable connectorized optical fiber (Figure 5). Ensure that APC connectors, if used, are mated to like connectors.

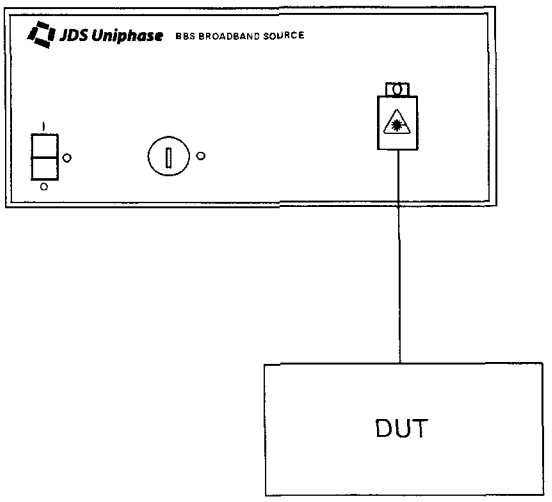


Figure 5: Setup

4. Turn the power switch on (**I**) and turn the key switch to the Enabled position. The Enabled LED lights and the laser starts emitting after approximately 3 s. This delay is a safety feature that enables the user to turn off the unit quickly in an emergency situation during start-up. With the unit operating, there are no user adjustments.

5. To turn off the amplifier, set the key switch to the Disabled position or turn the power switch off (**O**).

Caution

After turning off the unit, wait at least 30 seconds before powering it up again. Avoid switching off the unit before it is fully initialized.

Checking Calibration

The unit does not require routine calibration. It is recommended that a yearly spectral plot be produced and compared with the spectrum supplied at time of purchase. Address any variation of more than ±5% of optical specifications following maintenance instructions (next section).

Maintaining the Unit

Before every optical connector mating, thoroughly clean the connector end with a lint-free tissue and alcohol (see the **Cleaning Connectors** section).

When the unit is used in a high capacity environment, such as a manufacturing or quality assurance department, ensure that the front panel bulkhead optical connector is cleaned daily with compressed "clean air":

1. Carefully remove the optical connector protective cap and gently blow compressed air into the units bulkhead connector.

Customized Features and Test Data

There are two attachments:

- Inspection report
- Optical spectrum