


BLA 1000-I

- E Amplifier 15-400 MHz
User and Service Manual
Version 002



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This manual was written by

Jean Marc Roehrig

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For further technical assistance for this product, please do not hesitate to contact your nearest BRUKER dealer or contact us directly at:

Bruker Corporation
34, rue de l'Industrie
67166 WISSEMBOURG Cedex
France
Phone: + 49 721 5161 0
FAX: +33 3 88 06 60 05
E-mail: nmr-support@bruker.de
Internet: www.bruker.com

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1 About This Manual

This manual enables safe and efficient handling of the device.

This manual is an integral part of the device, and must be kept in close proximity to the device where it is permanently accessible to personnel. In addition, instructions concerning labor protection laws, operator regulations tools and supplies must be available and adhered to.

Before starting any work, personnel must read the manual thoroughly and understand its contents. Compliance with all specified safety and operating instructions, as well as local work safety regulations, are vital to ensure safe operation.

The figures shown in this manual are designed to be general and informative and may not represent the specific Bruker model, component or software/firmware version you are working with. Options and accessories may or may not be illustrated in each figure.

1.1 Policy Statement

It is the policy of Bruker to improve products as new techniques and components become available. Bruker reserves the right to change specifications at any time.

Every effort has been made to avoid errors in text and figure presentation in this publication. In order to produce useful and appropriate documentation, we welcome your comments on this publication. Support engineers are advised to regularly check with Bruker for updated information.

Bruker is committed to providing customers with inventive, high quality products and services that are environmentally sound.

1.2 Symbols and Conventions

Safety instructions in this manual are marked with symbols. The safety instructions are introduced using indicative words which express the extent of the hazard.

In order to avoid accidents, personal injury or damage to property, always observe safety instructions and proceed with care.

 **DANGER**



DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

This is the consequence of not following the warning.

1. This is the safety condition.
 - ▶ This is the safety instruction.

WARNING



WARNING indicates a hazardous situation, which, if not avoided, could result in death or serious injury.

This is the consequence of not following the warning.

1. This is the safety condition.
 - ▶ This is the safety instruction.

CAUTION



CAUTION indicates a hazardous situation, which, if not avoided, may result in minor or moderate injury.

This is the consequence of not following the warning.

1. This is the safety condition.
 - ▶ This is the safety instruction.

NOTICE

NOTICE indicates a property damage message.

This is the consequence of not following the notice.

1. This is a safety condition.
 - ▶ This is a safety instruction.

SAFETY INSTRUCTIONS

SAFETY INSTRUCTIONS are used for control flow and shutdowns in the event of an error or emergency.

This is the consequence of not following the safety instructions.

1. This is a safety condition.
 - ▶ This is a safety instruction.



This symbol highlights useful tips and recommendations as well as information designed to ensure efficient and smooth operation.

2 General Information

2.1 Introduction

- The **BLA1000-I E** amplifiers are commercialized under the BRUKER BIOSPIN Part Number ⇒ **W1345501**.

The electronic protection circuitry has been designed to protect against:

- Excessive power output level (overdrive).
- Excessive pulse repetition rate (over duty-cycle protection).
- Excessive pulse duration (over pulse-width).
- More than 50% reflected RF power (mismatch when VSWR \geq 6).
- Thermal protection (overheat).

3 Safety

The BLA1000-I E Amplifier 15-400 MHz is in accordance with the standard 61010-1 and with the UL 61010-1 / CSA C22.2 No. 61010-1-04 Safety Requirements for Electrical Equipment.

3.1 Labels

Labels are provided to alert operating and service personnel to conditions that may cause personal injury or damage to the equipment from misuse or abuse. Please read the labels and understand their meaning before working with this unit.

3.1.1 Identifying Plate

The BLA1000-I E assembly can be identified by an identifying plate at the front panel of the different subsets. The plates contain the following information.

- (A) Part Number: This field indicates the part number of the product.
- (B) Variant: This field indicates the variant number that identifies the production category of the product. The default variant is 00.
- (C) ECL: This field indicates the revision number that identifies the product configuration. The initial revision is 0.00.
- (D) Serial Number: This field indicates the serial number of the product.
- (E) Type: This field contains the designation of the product.
- (F) Information: This field contains additional information about the product.

3.1.2 Manufacturer's Nameplate

The BLA1000-I E can be identified by a manufacturer's nameplate at the back panel of the unit that has following information:

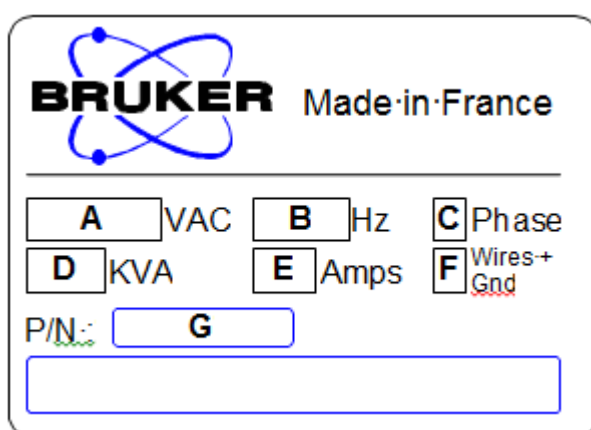


Figure 3.1: Manufacturer's Nameplate

- (A) Voltage: This field indicates the input mains voltage of the product.
- (B) Frequency: This field indicates the input mains frequency of the product.
- (C) Phases: This field indicates the number of phases of the mains.

- (D) Power: This field indicates the absorbed power of the product.
- (E) Current: This field indicates the absorbed current of the product.
- (F) Wires: This field indicates number of wires with the ground in the mains cord.
- (G) Part Number: This field indicates the assembly number that identifies the part number of the product.

3.2 Warning Signs



WARNING

Danger of injury from electrical shock!

A life threatening shock may result when the housing is open during operation.

- ▶ Only qualified personnel should open the housing.
- ▶ Disconnect the device from the electrical power supply before opening the device. Use a voltmeter to verify that the device is not under power!
- ▶ Be sure that the power supply cannot be reconnected without notice.



WARNING

Danger of injury due to improper dismantling!

Stored residual energy, angular components, points and edges on and in the device or on the tools needed can cause injuries.

- ▶ Ensure sufficient space before starting work.
- ▶ Handle exposed, sharp-edged components with care.
- ▶ Dismantle the components properly.
- ▶ Secure components so that they cannot fall down or topple over.
- ▶ Consult the manufacturer if in doubt.



Note: If the equipment is used in a manner not specified by BRUKER, the protection provided by the equipment may be impaired.

3.3 Empowerment

Every intervention on the device must be carried out by an authorized and qualified person. Any failure due to a non-respect of the following instructions will not be attributable to BRUKER BIOSPIN and will not be covered by the guarantee clause.

4 Installation



Installation, initial commissioning, retrofitting, repairs, adjustments or dismantling of the device must only be carried out by Bruker Service or personnel authorized by Bruker. Damage due to servicing that is not authorized by Bruker is not covered by your warranty.

4.1 Initial Inspection

Upon receipt, immediately inspect the delivery for completeness and transport damage.

In the event of apparent external transport damage, proceed as follows:

- Do not accept the delivery, or only accept it subject to reservation.
- Note the extent of the damage on the transport documentation or the shipper's delivery note.
- Initiate complaint procedures.



Note: Issue a complaint in respect to each defect immediately following detection. Damage compensation claims can only be asserted within the applicable complaint deadlines.

4.1.1 Mechanical Check

If damage of the shipping carton is evident, request the carrier's agent to be present when the instrument is unpacked. Check the equipment for damage and inspect the cabinet and panel surfaces for dents and scratches.

4.1.2 Claim for Damage

If the unit is mechanically damaged or fails to meet specifications upon receipt, notify BRUKER or our representative immediately. Retain the shipping carton and packing material for the carriers inspection, as well as for subsequent use in returning the unit if necessary.

4.1.3 Storage

Store the packages under the following conditions:

- Do not store outdoors.
- Store in dry and dust-free conditions.
- Do not expose to aggressive media.
- Protect against direct sunlight.
- Avoid mechanical shocks.
- Storage temperature: 15 to 35°C.
- Relative humidity: maximum 60%.

- If stored for longer than 3 months, regularly check the general condition of all parts and the packaging. If necessary, top-up or replace any preservative materials.



Note: Under certain circumstances, storage instructions may be affixed to packages, which expands the requirements specified here. Comply with these accordingly.

4.1.4 Reshipment and Repackaging Requirements

Whenever possible, the original carton and packing material should be used for reshipment. If the original packing material is not available, wrap the instrument in heavy paper or plastic. Use a strong shipping container. If cardboard is used, it should be at least 200 lbs. test material.

Use shock absorbing material around all sides of the instrument to provide a firm cushion and to prevent movement from inside the container wall on each side. Protect the front panel by means of cardboard spacers inserted between the front panel and the shipping carton. Make sure that the instrument cannot move in the container during shipping. Seal the carton with a good grade of shipping tape and mark the container:

"FRAGILE ELECTRONIC INSTRUMENT"

4.2 Installation Requirements

No special precautions are necessary. Mount the equipment in an area which is relatively free of vibration, and has sufficient room for cable connections.

The amplifier set is a class II installation category.

4.2.1 Bench Operation

The amplifier set can be placed onto a secure flat surface.

4.2.2 Environment Requirements

The amplifiers and the combiner unit are built for inside use only, at a maximum elevation of 2000 meters above sea level (6600 feet).

No specific cooling or ventilation is required.

Be sure that the amplifiers have enough area around them, so that the air flows freely into and out of the amplifier and is not obstructed.

The units should be located in an environment which conforms to:

- the 5°C - 45°C (41°F - 113°F) thermal specifications,
- a 80% maximum relative humidity of air and
- a contamination level of two (which means a normal non-conductive contamination, temporary conductivity due to condensation is possible).

4.3 Power Requirements

The BLA1000-I E is designed with a built-in switched power supply. The mains line on the rear panel connector is a CEI 10A.

One phase line requirements:

Amplifier

AC input voltage:	220-230 VAC
Input current maximum:	7A
Inrush current maximum:	30 A
Frequency:	50/60 Hz

4.4 System Check

Before applying power for the first time the following items should be checked:

- The AC input voltage 220-230 VAC range must be compatible with the power supply.
- An external blanking (gating) pulse must be supplied to the amplifier in order for the unit to function. Ensure that this pulse has a proper level and logic polarity (1=blanking, 0=RF).
- The BLA2000-I E has a nominal input level of +4 dBm. Ensure that the system drivers are operating at these levels.
- The output RF loads are connected.

4.5 Initial Power On Procedure

Before starting this procedure, make sure that you have properly followed instructions during the [System Check](#) [13].

- Connect the AC line to the power supply and set all power switches to the ON position.
- Observe the indicators on the front panel of the amplifiers and the combiner:
 - The +32V ON LED's will illuminate.
 - The +15 V, -15 V and +3.3 V ON LED's will illuminate.
- The output "Amplifier default" is high (+3.3 V) if no problem at initialization.
- The system should now be fully operational.

5 Operation

5.1 Front Panel

The BLA1000-I E combiner front panel contains 12 indicators for status monitoring, 5 x RF connectors and 1 interface connector.

5.1.1 Indicators

Normal operation is indicated when the following LED's are ON.

5.1.2 Coaxial Connectors

5.1.3 Interface Connector Ethernet 10/100

The RJ45 connector for the Ethernet 10/100 Mbps link is mounted directly on the BLA Control Board.

Pin 1	Transmit + (Tx+)
Pin 2	Transmit - (Tx-)
Pin 3	Receive + (Rx+)
Pin 4	N/A
Pin 5	N/A
Pin 6	Receive - (Rx-)
Pin 7	N/A
Pin 8	N/A

Table 5.1: RJ45 Pin Assignment

5.1.4 Device Design

5.2 Rear Panel

The rear panel of the BLA1000-I E amplifier has only a CEI10A line connector.

6 Technical Description

6.1 System Overview

- The entire system is controlled by a Digital Signal Processing control board, processing information from the amplifier and blanking signal, providing protection from excessive peak power, duty cycle and pulse width for average power, maximum reflected power and heatsink over-temperature.
- The DSP Control Board reads identification information for the amplifier (BIS). Circuits such as Fan Status board, Supply Status board and the LED's Status board, complete the amplifier assembly.

See also

 Routing Information [[▶ 22](#)]

6.2 Theory of Operation

6.2.1 RF Amplifier

The BLA1000-I E amplifier (P/N W1345501) consists of a class A/AB driver and a class AB power amplifier.

A nominal input power level of +4 dBm produces a rated linear output power of:

- 300 W peak for 5% duty cycle at 100 ms pulse width maximum on the High Resolution output 300 W, when selected as a high resolution amplifier.

In this case, the 300 W is directly switched to the front panel via a mechanical relay and preceded by a bi-directional high dynamic coupler.

The unit is also capable of longer pulses for lower average power, up to 15W CW power on the 300 W output.

- 1000 W peak for 5% duty-cycle at 100 ms pulse width maximum on the 1000 W output.

The unit is also capable of longer pulses for lower average power, up to 50 W CW power on the 1000 W output.

RF Driver

In the first section of the driver, the RF input signal is preamplified with a low noise stage, followed by a 2 dB variable attenuator and a thermo-compensated attenuator for temperature compensation.

Then follows a gating switch and a switchable attenuator to get the appropriate gain in the two modes 1000 W and 300 W.

Next is a two stage class A amplifier to build a nominal 40 dB gain block. The second section of the driver includes two power MOS FET transistors.

The circuitry around the transistors consists of complementary input and output transformers and baluns and operates the devices in push-pull.

This section requires a control board conditioned gating signal to control the bias voltage on the gates of the FETs.

The input-output gain of this section is at nominal 13 dB.

The entire RF driver has a nominal 53dB gain, able to develop more than 250W linear power and operates at +32 V DC.

RF Splitter

The RF Splitter acts as a 4 ways in-phase splitter between the output of the RF driver and the inputs of the 4 power amplifiers PA.

RF Power Amplifier

Each of the four Power Amplifiers (PA) include two FET transistors mounted on a single flange. The circuitry around each transistor consists of complementary input and output transformers and baluns and operates the devices in push-pull. The four PA require a control board conditioned gating signal in order to control the bias gate voltage on the gates of the FETs.

The four PA operate at +32 V DC and are followed by an in-phase combiner.

6.2.2 BLA Control Board

The BLA Control board has 3 functions:

- Monitors the output characteristics of the amplifier. This is done thanks to the DC peak detections of the bi-directional high dynamic coupler.
- Conditions the input blanking (BLNK) signal. The board delivers it to the above mentioned RF paths.
- Provides Ethernet communication with the workstation.

The monitoring circuitry is also useful for processing the detection information and protecting the amplifier from overstress at peak power, average power versus duty cycle and pulse width, so as excess of reflected power.

The control board also monitors the RF path heat sink temperature to protect against thermal overstress.

Information from power supplies and fan status boards are also analyzed by the control board.

If one of the above overstresses or faults appears on the power supplies or fans, the gating signal is disabled, and the status LED board on the front panel will display the fault.

6.2.2.1 RF Power Information Conditioning

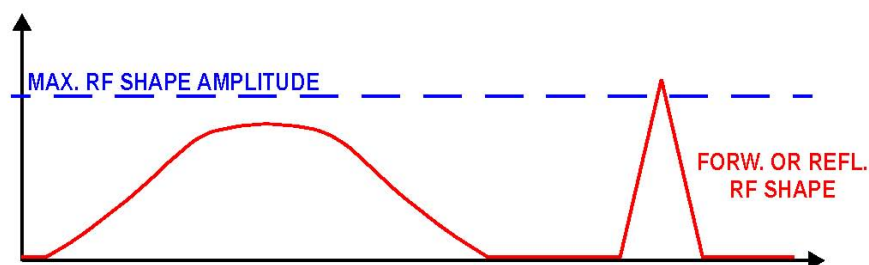


Figure 6.1: Peak Power Limitation

6.2.2.2 Fault Protection

Electronic circuitry processes the detection information and protects the unit from overstress like:

- Forward and reflected peak power.

The peak power limitation is the maximum RF forward shape amplitude at the amplifier output.

Limitation range: from 1% to 200% of nominal power.

The peak power limitation is checked for each sample (10 million samples per second), and the maximum peak value is latched then cleared by a read operation (for monitoring purpose).

- Excess of reflected power (mismatch).

The mismatch value is the ratio between the reflected power value and the forward power value.

Limitation range: from 1% to 100%.

The mismatch value is updated every 100 μ s.

- Other protections. The control board also detects the following faults:
 - Power supply fault.
 - Fan failure.
 - Heat sink temperature to protect against thermal overstress.

Fault	Detection delay (max)
Peak power	500 ns
Mismatch	100 μ s
Power supply, fan	200 ns
Heat sink temperature	500 ms

Table 6.1: Peak Power Limitation

Peak, pulse width, duty cycle, mismatch and mean power values can be read out at any time from the main DSP for monitoring purpose.

6.2.2.3 Fault Protection Reset

If one of these overstresses appears:

- The board automatically resets the fault flags after 2 seconds.,
- the gating signal is disabled,
- and the status LED board on the front panel displays the fault.

This means, for example, that when a pulse width fault occurs, the amplifier channel is disabled after the detection delay. The side effect is that the fault condition disappears since the channel's output power is null.

After 2 seconds, the channel is switched on and the cycle begins again (unless the channel RF input signal is re-adjusted to meet the power limitations).

6.2.3 Status Led Board

The Status LED board, on the front panel of the Combiner Unit, displays overstress functions, status, and so on, as described in [Indicators \[15\]](#) and [BLA Control Board \[18\]](#).

6.2.4 BLA Extension Board

This board gives the information to the control board of RF detection.

6.2.5 BIS Board

The universal BIS board is located on the combiner case and contains identifications of the amplifier.



For technical help please contact your local representative.

7 Servicing the BLA

Diagnosis and servicing access to the BLA amplifier relies on HTTP, which allows service access using any web browser.

7.1 Accessing the BLA Amplifier

The BLA1000-I E amplifier 15-400MHz is accessible via the BLA control board using its IP address.

The IP address is given during **cf** by using TOPSPIN 2.xx software under PARAVISION 5 on the workstation. In case of problems:

- Check the RJ45 cabling between amplifier, Ethernet switch and workstation.
- Check the Ethernet switch power.
- Check if the green LED on the Combiner Unit RJ45 connector lights up.
- Check the front panel of the amplifiers and the Combiner Unit. LED's indicators +32 V, +15 V, -15 V and +3.3 V ON must have lit.

To access the BLA1000-I E amplifier 15-400 MHz, type **ha** in TOPSPIN 2.xx and select the BLA that should be accessed, or start your favorite web browser and enter the given IP address as URL.

The following page should open:

The left panel is the navigation menu. It can be used to navigate through the various service pages.

7.1.1 Amplifier Status

This action leads you to a page providing information about the current status from the selected channel of the amplifier.

7.1.2 Amplifier Limitations

This action leads you to a page listing several defaults and current limits of the amplifier.

To change the current limit of the amplifier, or the limits of the selected channel of the amplifier, press **Change limits**.

If you want, for any reasons, to change the current limits from the selected channel of the amplifier, press **Change limits**.

Read the warnings carefully before changing the limit parameters and press **Apply** if you are sure you want to change them.

7.1.3 Routing Information

7.1.4 Self-Test and Software Reset

Selecting this option leads you to a page allowing you to do a self-test on the BLA control board (hardware test) and to do a software reset.

Both operations can be done if the amplifier is not working correctly.

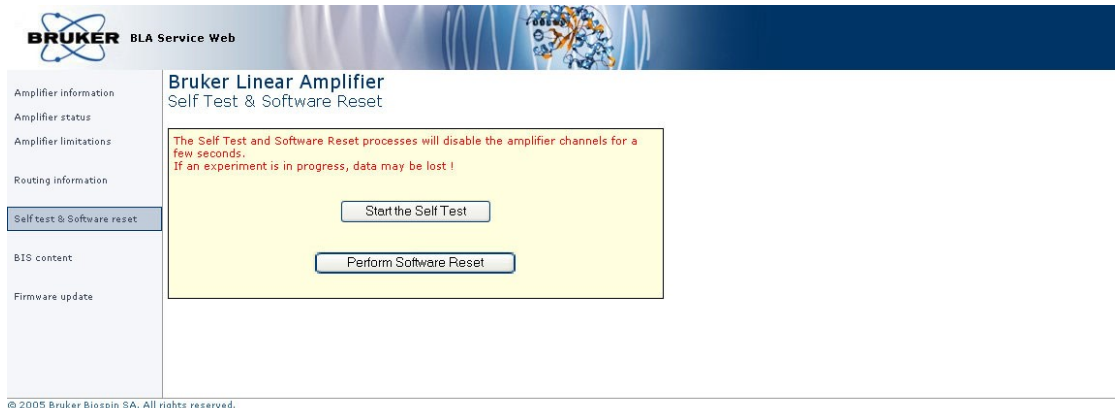
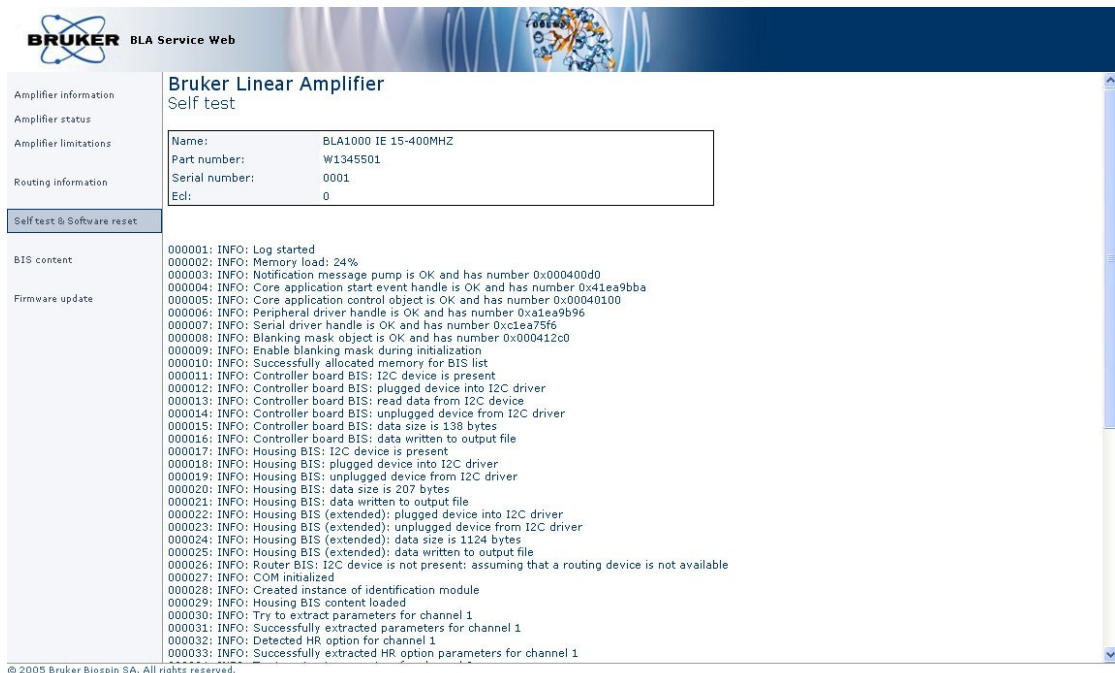


Figure 7.1: Self-test, Software Reset and Reports



Read the warnings carefully before changing the limit parameters and press **Start the self-test** if you are sure you want to change them. You should only have blue lines of text in the report.

7.1.5 BIS Content

This option leads you to a page providing information about the current BIS programmed on the amplifier.

7.1.6 Firmware Update

This option leads you to a page allowing you to download new firmware.

Read the warnings carefully, and press the **Browse** button to select the new firmware file to download. Press **Update** to download the new firmware, it may take a few minutes.



Note: The button caption may vary depending on your operating system's language settings.

8 Specifications

8.1 Common Characteristics

Constant Internal Protection	Supplies faults & over temperature Forward Power: <ul style="list-style-type: none"> • Peak & CW power • Pulse width • Duty cycle Reflected Power: peak & CW power
Front Panel Indicators	Amplifier Status Led Board
Front Panel Interfaces	1 x I/O 8 pins RJ45 connector
Front Panel controls	1 x SEL1000/300 control signal, 1 x amplifier default signal
Front Panel connectors	1 x RF input, 2 x RF output, 1 x grating input
Rear Panel connectors	1 x main line CEI 10A connector
Cooling System	Forced-air cooling (from front to rear)
Temperature Limits	5 °C to 45 °C (41 °F to 113 °F)
Size	19" rack cabinet x 4U height x 520 mm depth
Weight	30 kg

Table 8.1: BLA2000-I E Common Characteristics

9 Service Information and Maintenance

Every intervention on the device must be carried out by an authorized and qualified person. Any failure due to a non-respect of the following instructions will not be attributable to BRUKER and will not be covered by the guarantee clauses.

9.1 Cleaning

Do not use any detergent or other cleaning solvents.

Use only water or neutral cleaning fluids.

Usage of cleaners like thinner or benzene may damage the surface of the unit.

- Clean the outside of the device chassis with a soft, lint-free cloth dampened in water.
- Wait until the unit is completely dry before you reconnect the power cable.

9.2 Dismantling and Disposal

Following the end of its operational life, the device must be dismantled and disposed of in accordance with the environmental regulations.



Installation, initial commissioning, retrofitting, repairs, adjustments or dismantling of the device must only be carried out by Bruker Service or personnel authorized by Bruker. Damage due to servicing that is not authorized by Bruker is not covered by your warranty.

10 Troubleshooting

In the event that the product does not function properly, isolate the problem to determine if it originates in the computer or the amplifier.

This chapter explains how to troubleshoot amplifier problems. If you cannot solve a problem using the steps given in this chapter, you should contact BRUKER.

10.1 Power System Problems

A possible cause of system malfunction is a problem in the power system. If the system is not functional, it is possible that it is not receiving power. If this is the case, both of the LED status indicator lights will be off. To troubleshoot this problem, complete the following steps in sequence until the problem is solved:

- Check that the power switch on the amplifier is turned ON.
- Check that the power cord is plugged in firmly between the power input on the amplifier and the external power supply and also between the power supply and the wall outlet.
 - If the cable is plugged in, ensure that it is not damaged in any way.
- Check that the LED on the power supply is illuminated.
 - If the LED is not illuminated, check the wall outlet using a device approved for that purpose.
 - If the wall outlet is working and the voltage is acceptable, unplug the external power supply from the amplifier, but leave it plugged into the wall.
 - If the LED is not lit, the power supply is faulty and requires replacement.
 - If the LED is lit when unplugged from the amplifier but turns off when plugged into the amplifier, the amplifier may have an internal short and requires repair.
 - If the external power supply LED is illuminated while plugged into the amplifier, cycle the amplifier power switch. The gripper should move up and the amplifier should initialize. After initialization, the status LED on the front of the amplifier should light up.
 - If the cords are properly connected, power is available, the external power supply is good, and the device still does not initiate, continue troubleshooting.

10.2 RF Problems

A malfunction of the amplifier sends an error signal (AMPLIFIER ERROR). To investigate the cause of error, look on the front panel of the amplifier.

10.3 Communications Interface Problems

Operation of the amplifier is directed by the computer. A malfunction can indicate a problem with the RJ45 cable or with the configuration of the software on the computer.

The following sections explain how to troubleshoot these problems.

10.3.1 USB Cable Problems

When USB cable problems occur:

- Check the RJ45 cable to ensure that it is plugged into the port on the amplifier.
- Check the computer to ensure that the RJ45 cable is connected to the appropriate port.

- Check that the RJ45 cable is not damaged in any way.
- Check the computer to ensure that the appropriate drivers are installed.

10.4 Returning the Product for Service

Refer to the following information if you need to return the product for service.

10.4.1 Shipping the Product

Follow these guidelines when shipping the product:

- **Use the original packing materials.** If the original shipping materials are not available, place a generous amount of shock absorbing material around the instrument and place it in a box that does not allow movement during shipping. Seal the box securely.
- Contact BRUKER before shipping the product.
- Prepay all shipping expenses including adequate insurance.
- Write the following information on a tag and attach it to the product:
 - Name and address of the owner.
 - Product model number and serial number.
 - Description of service required or failure indications.
- Mark the shipping container as FRAGILE.
- In all correspondence, refer to the instrument by model name or number and full serial number.



Note: Contact BRUKER or refer to the warranty information which came with your product for the exact terms of your warranty.

Technical help: *Please contact your local representative.*

11 Contact

Manufacturer:

Bruker BioSpin
34, rue de l'Industrie
67166 WISSEMBOURG Cedex
France
Phone: + 33 3 88 06 60 60
Fax: + 33 3 88 06 60 05

<http://www.bruker.com>

WEEE DE43181702

NMR Hotlines:

Contact our CMR service centers.

Bruker BioSpin CMR provides dedicated hotlines and service centers, so that our specialists can respond as quickly as possible to all your service requests, applications questions, software or technical needs.

Please select the CMR service center or hotline you wish to contact from our list available at:

<http://www.bruker.com/service/information-communication/helpdesk/magnetic-resonance.html>

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