


BLA 2000-I

- E Amplifier 15-400 MHz
User and Service Manual
Version 001



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1 About This Manual

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.



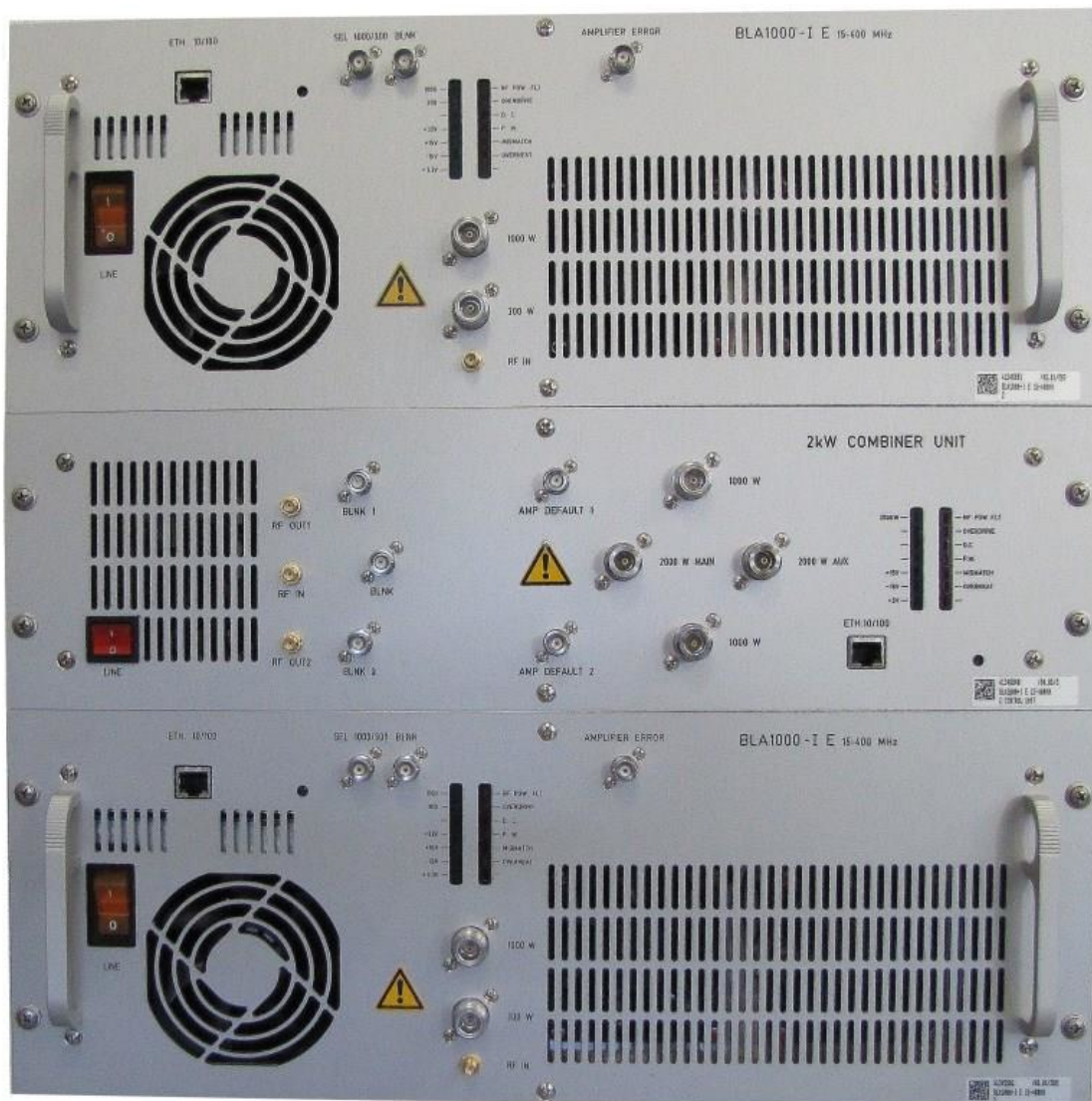
This symbol highlights useful tips and recommendations as well as information designed to ensure efficient and smooth operation.

2 General Information

2.1 Introduction

The BLA2000-I E 15-400 MHz is a combination of two amplifier linear pulse power amplifiers specifically designed for Nuclear Magnetic Resonance and Magnetic Resonance Imaging (NMR/MRI) applications and a Combiner Unit.

- The **BLA2000-I E** set is commercialized under the BRUKER BIOSPIN Part Number ⇒ **W134639**.
- The **Combiner Unit** is commercialized under the BRUKER BIOSPIN Part Number ⇒ **W134640**.
- The **BLA1000-I E** amplifiers are commercialized under the BRUKER BIOSPIN Part Number ⇒ **W1345501**.



The class AB linear amplifier provides 1000 W and more peak RF power at 15-400 MHz.

The amplifier is equipped with **N-Channel MOS Broadband RF POWER FETs** transistors of the latest generation. The unit can provide full power for any combination of pulse width and duty cycle up to 10 ms and 5%.

Its built-in protection circuitry allows lower power pulses for longer pulse widths and duty-cycles, up to 100 W average power on the RF output.

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).

The amplifier is powered by an internal switched power supply assembly that provides the +32 VDC for the power amplifiers, in addition to all low level voltages for the system.

The supply is self-protected for overcurrent and overvoltage.

The entire unit is housed in a 19", 4U, and 520 mm rack cabinet.

Control Unit

The control unit is equipped with a **2-Way Combiner 10-500MHz**.

The control unit can provide 2kW by combining both amplifiers BLA1000-I E.

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).

The control unit is powered by an internal switched power supply assembly that provides all low level voltages for the system.

The supply is self-protected for overcurrent and overvoltage.

The entire unit is housed in a 19", 3U, and 520 mm rack cabinet.

3 Safety

The BLA2000-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 BLA2000-I E assembly can be identified by an identifying plate at the front panel of the different subsets. The plates contain the following information.

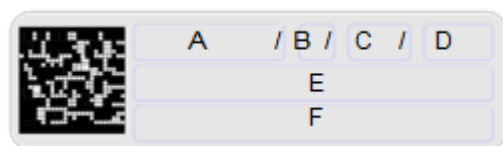


Figure 3.1: Identifying Plate

- (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 BLA2000-I E can be identified by a manufacturer's nameplate at the back panel of the unit that has following information:

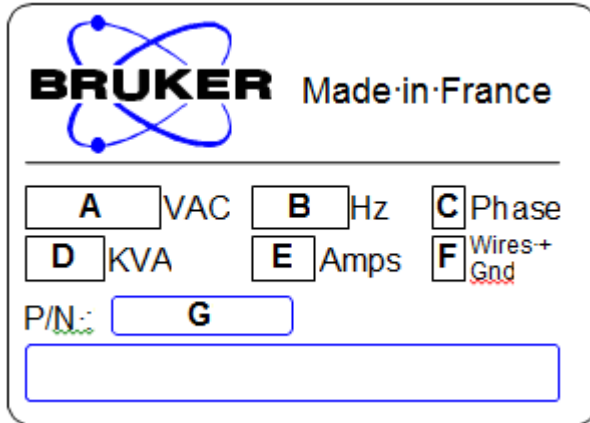




Figure 3.2: Manufacturer's Nameplate

- (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.

3.4 Amplifier Device



Note: Refer to the manual part number Z31782 for a description and information on installation, startup, operation and maintenance of the BLA1000-I E amplifier.

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 BLAH1000-I E amplifiers 15-400 MHz and the combiner unit have a built-in switched power supply. The mains line on the rear panel connector is a CEI 10A.

One phase line requirements:

Combiner

AC input voltage:	220-230 VAC
Input current maximum:	0.3 A
Frequency:	50/60 Hz

Amplifier

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

4.4 Front Panel Cabling

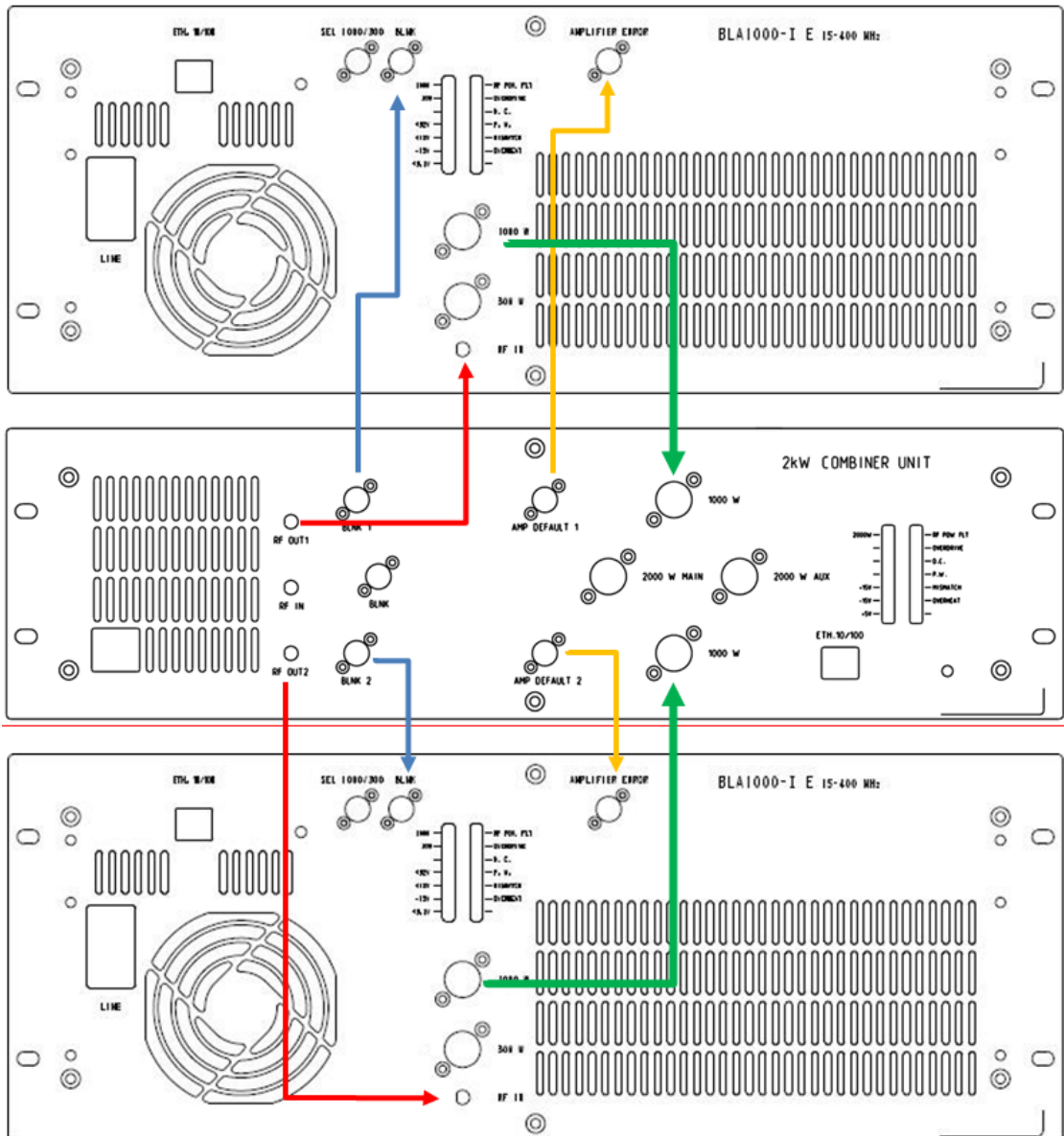


Figure 4.1: Front Panel Cabling

The amplifiers and the combiner unit are interconnected with the coax cables:

- The RF OUT1 & RF OUT2 coax cables must have the same length (red cables).
- The 1000W power cables must have the same length (green cables).
- Connect the AMPLIFIER ERROR coax cables between the units.
- Connect the BLNK1 & BLNK2 coax cables the units.
- Connect 2 x load-50Ω on inputs SEL 1000/300 of the amplifiers.

You only need to connect the connectors of the Combiner Unit to the spectrometer.

4.5 Combiner Block Diagram

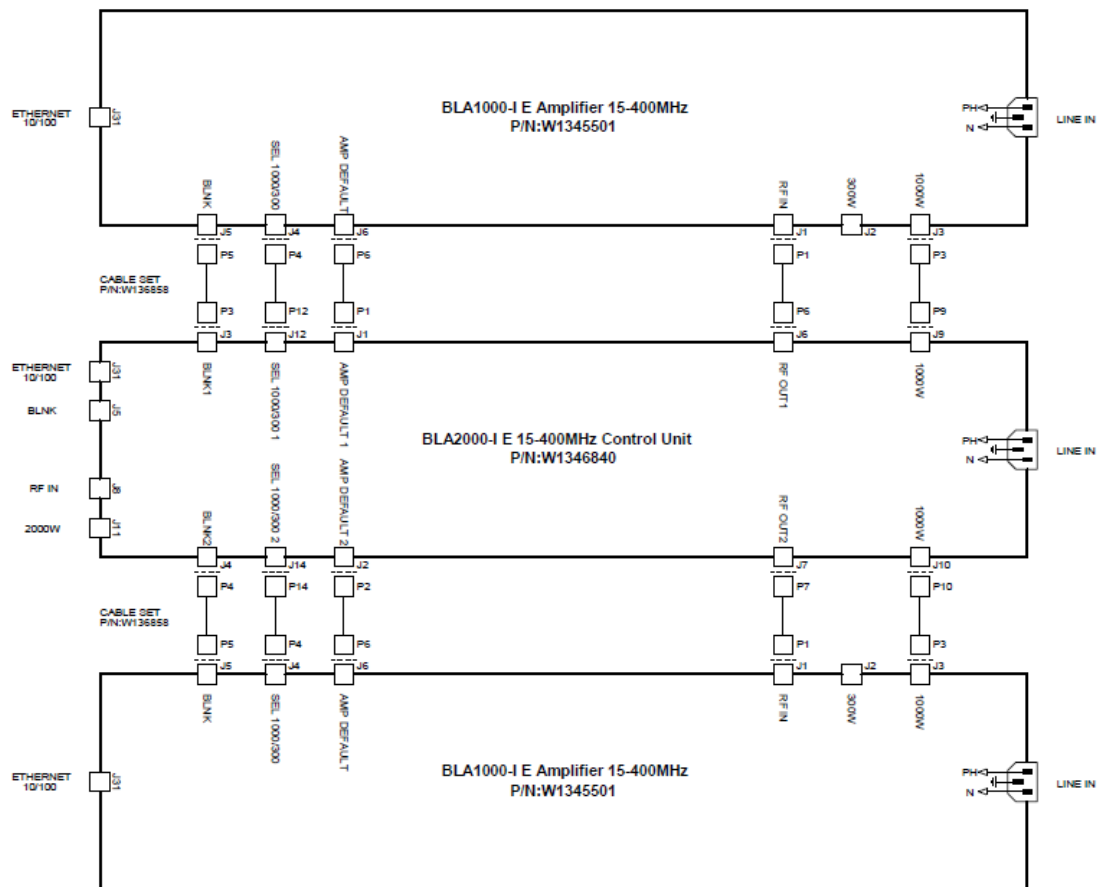


Figure 4.2: BLA2000-I E Block Diagram

4.6 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.
- The 50 Ω loads are connected to the SEL 1000/300 inputs.
- The ETH. 10/100 connectors from the combiner are connected.

The amplifier BLA2000 set is regarded as a unique amplifier, whereas the **ETH.10/100 connectors from the amplifiers BLA1000 are not connected.**

All Amplifier Error output coaxes must be connected to the combiner. An unconnected amplifier error output is not recognized as an error.

4.7 Initial Power On Procedure

The following list describes how to turn on the BLA1000-I E amplifiers and the BLA2000I-E combiner and what should be seen as this occurs.

Before starting this procedure, make sure that you have properly followed instructions during the [System Check \[▶ 17\]](#).

- 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 BLA2000-I E combiner front panel contains 10 indicators for status monitoring, 12 x RF connectors and 1 interface connector.



Figure 5.1: BLA2000-I E Front Panel

5.1.1 Indicators

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

+15V	Indicates that the +15 V supply is applied.
-15V	Indicates that the -15 V supply is applied.
+5V	Indicates that the +5 V supply is applied.
MAIN/AUX	Light is ON when 2000 W MAIN output is selected.
2000W	Light is ON when RF Power is present on the 2000 W output connector.
Overdrive	Indicates when the peak power limit has been reached.
Duty Cycle (D.C.)	Indicates when the duty cycle limit has been reached.
Pulse Width (P.W.)	Indicates when the pulse width limit has been reached.
Mismatch	Indicates when the maximum reflected power limit has been reached.
RF POW. FLT	Indicates when one of the above limits has been reached.
OVERHEAT	Indicates that the one of the two amplifiers has sent an error signal. The amplifiers are blanked until the problem is present. The function is self-resetting and no maintenance is needed.

Table 5.1: Indicators Assignment

5.1.2 Coaxial Connectors

RF IN	RF input, SMA type connector (female). Nominal input +4 dBm.
RF OUT 1 / 2	RF Output SMA type connector (female). Connect to RF IN of BLA1000-I E 15-400.

2000W MAIN /AUX	RF output, N type connector (female), nominal 2000 W (15-400 MHz).
2x 1000W	RF Power Input, N type connector (female). Nominal power 1000W (15-400 MHz).
BLNK	Blanking input, BNC type connector (female). TTL logic, 5 V = blanking on, 0 V = blanking off. When BLANKING signal is at TTL level high (+5 V), no gating is applied to the amplifier stages, and no RF power is possible. When BLANKING signal is at TTL level low (0 V), the amplifier stages are gated and RF Power is possible.
BLNK1/2	BNC type connector, connect to BLNK of BLA1000-I E 15-400.
AMPLIFIER ERROR	Default signal output, BNC type connector (female). TTL logic, 5 V = amplifier ready, 0 V = amplifier default. When the default signal is at TTL level high (5 V), the amplifier is ready. When the default signal is at TTL level low (0 V), the amplifier is fail. <input type="checkbox"/> An unconnected amplifier error output is not recognized as an error.

Table 5.2: Coaxial Connectors Assignment

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 5.3: RF45 Pin Assignment

5.1.4 Device Design

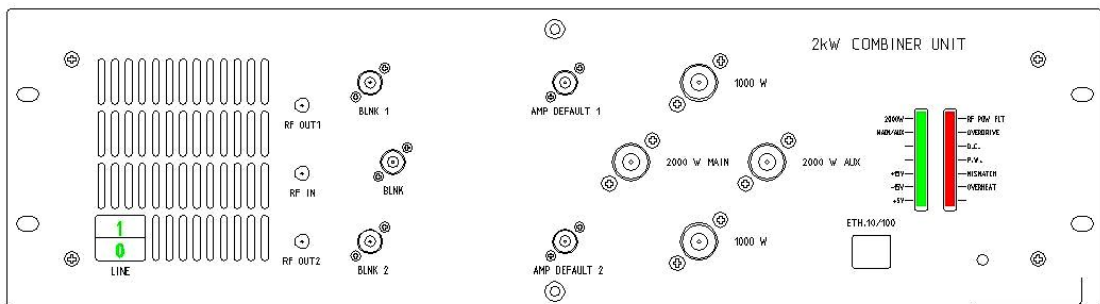


Figure 5.2: BLA2000-I E Combiner Front Panel Design

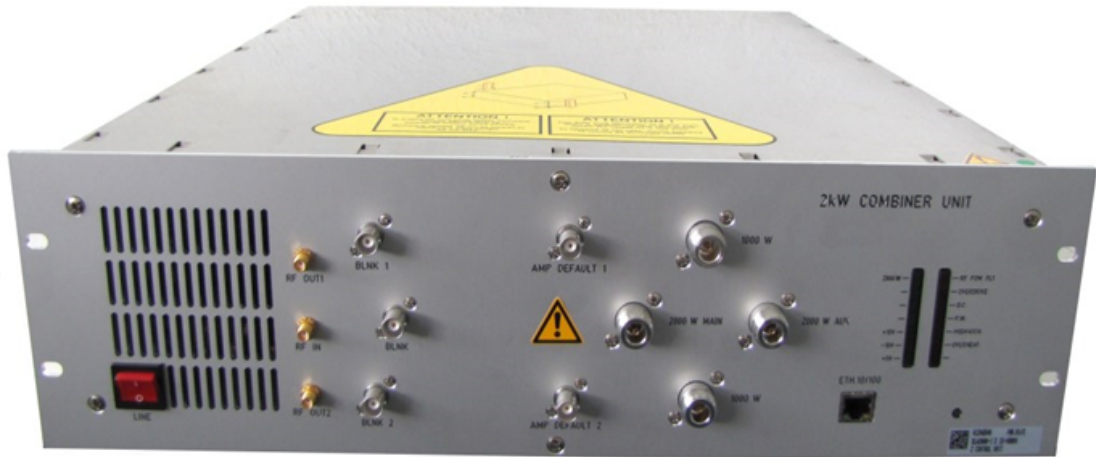


Figure 5.3: BLA2000-I E Combiner Front Panel View

5.2 Rear Panel

The rear panel of the BLA2000-I E amplifier has only a CEI10A line connector.



Figure 5.4: BLA2000-I E Combiner Rear Panel View

6 Technical Description

6.1 System Overview

The BLA2000-I E amplifier and combiner set provides:

- A RF output of 2000 W or more on the 2000 W output, over the full frequency range of 15 to 400 MHz on the 2000 W MAIN or 2000 W AUX output.
- The outputs 2000 W MAIN and 2000 W AUX are selectable. When powering up, the output 2000 MAIN is validated. The output is selectable in the browser-based service page in the menu [Routing Information](#) [▶ 31].
- The system consists of two BLA1000-I E 15-400 amplifiers and a combiner unit. The two amplifiers are combined to provide 2000 W at the output.
- 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.

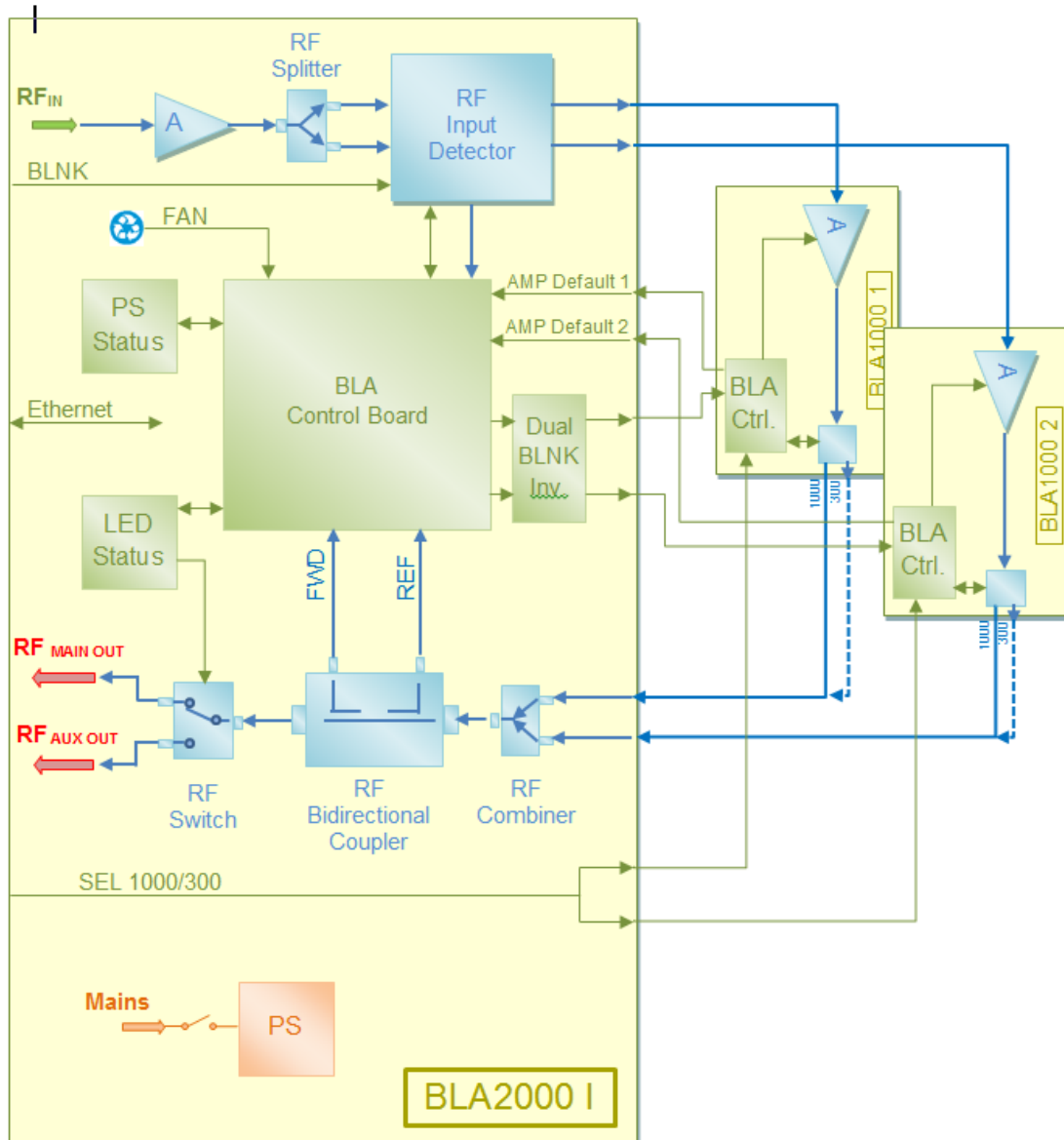


Figure 6.1: BLA2000-I E System Block Diagram

See also

▢ Routing Information [▶ 31]

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 Combiner Unit

The Combiner Unit (P/N W1346840) dispatches the RF and the blanking signals to the BLA1000-I E 15-400 amplifiers and combine the RF power to 2000 W output.

The fault signals of amplifiers are also collected by the combiner unit. To stop the RF power if one of the BLA1000 amplifiers have a default.

The combiner unit is equipped with a directional coupler 46 dB and a BLA control board.

The RF combiner acts as a combining network in phase between the two 1000 W inputs and the input of the bi-directional high dynamic coupler.

RF Coupler

The bi-directional high dynamic coupler provides an approximate 1 V peak DC (20 mV/dB) signal for full 1000 W and also a peak DC signal for reflected power on the 2000 W output.

Both signals forward and reflected, are analyzed by the BLA control board for monitoring and protection setting on the 2000 W output.

RF Relay 2000 W MAIN/AUX

The coaxial RF relay switches the RF power from the bi-directional high dynamic coupler to the 2000 W MAIN or 2000 AUX output on the front panel.

The 2000 W output connector is selectable on the service page in the menu [Routing Information](#) [▶ 31].

6.2.3 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.

6.2.3.1 RF Power Information Conditioning

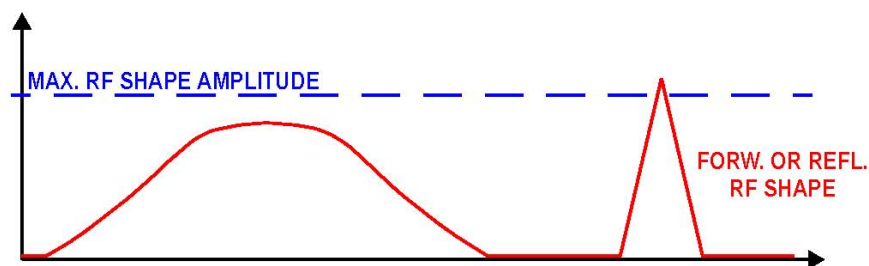


Figure 6.2: Peak Power Limitation

6.2.3.2 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.

6.2.3.3 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).

6.2.4 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 \[19\]](#) and [BLA Control Board \[26\]](#).

6.2.5 BLA Extension Board

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

6.2.6 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 BLA2000-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 BLA2000-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:

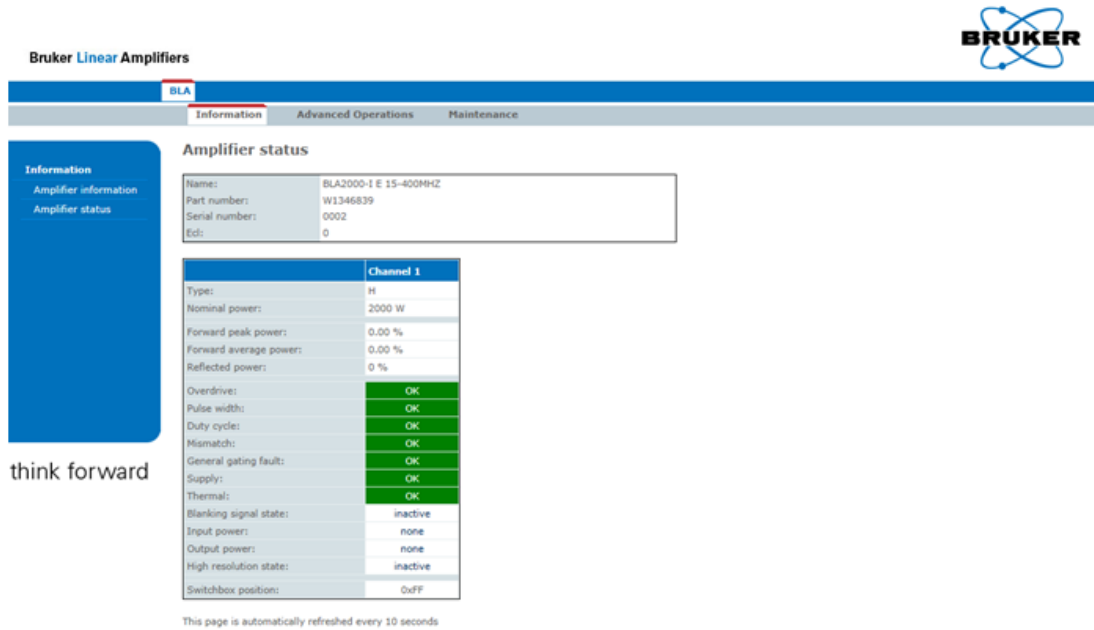
The screenshot shows the Bruker Linear Amplifiers web interface. At the top right is the Bruker logo. Below it is a navigation bar with tabs for 'BLA', 'Information', 'Advanced Operations', and 'Maintenance'. The 'Information' tab is selected. On the left is a navigation menu with 'Information', 'Amplifier information', and 'Amplifier status'. The main content area is titled 'Device Information' and contains three sections: 'Device Information' (Name: BLA2000-I E 15-400MHZ, Part number: W1346839, Serial number: 0002, Ecl: 0, Manufacturing location: BFR, Manufacturing date: 9/3/14, BIS type: BLA), 'Software Versions' (Boot version: 20110801, Kernel version: Windows CE 5.0, Application version: BLAC6_20120627), and 'Channel Information' (a table with columns: Ch., Type, Nom. power, Min freq., Max freq., Duty cycle, Pulse width, Limits, Mismatch, Forw. peak, Output num., Input num.). The 'Limits' section is expanded to show a table with one row: Ch. 1, Type H, Nom. power 2000 W, Min freq. 15 MHz, Max freq. 400 MHz, Duty cycle 5 %, Pulse width 100 ms, Mismatch 1000 W (50 %), Forw. peak 4000 W (200 %), Output num. Via router, Input num. 1.

Figure 7.1: Device Information

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.



Bruker Linear Amplifiers

BLA

Information | Advanced Operations | Maintenance

Amplifier status

Name: BLA2000-I E 15-400MHZ
 Part number: W1346839
 Serial number: 0002
 Ed: 0

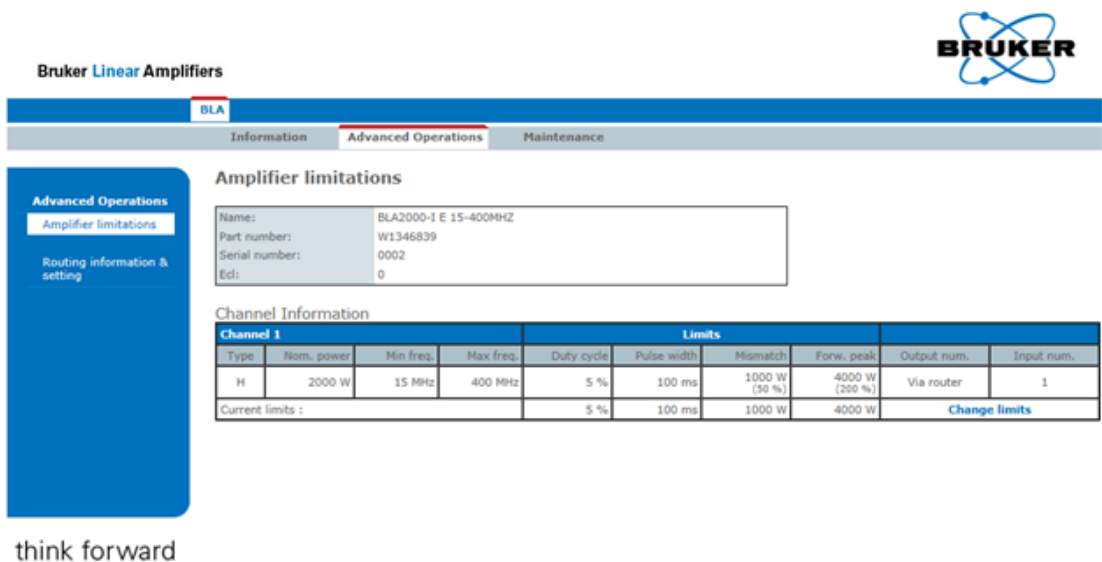
	Channel 1
Type:	H
Nominal power:	2000 W
Forward peak power:	0.00 %
Forward average power:	0.00 %
Reflected power:	0 %
Overdrive:	OK
Pulse width:	OK
Duty cycle:	OK
Mismatch:	OK
General gating fault:	OK
Supply:	OK
Thermal:	OK
Blanking signal state:	inactive
Input power:	none
Output power:	none
High resolution state:	inactive
Switchbox position:	Off

This page is automatically refreshed every 10 seconds

Figure 7.2: Amplifier Status

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**.



Bruker Linear Amplifiers

BLA

Information | Advanced Operations | Maintenance

Amplifier limitations

Name: BLA2000-I E 15-400MHZ
 Part number: W1346839
 Serial number: 0002
 Ed: 0

Channel Information

Channel 1				Limits				Output num.	Input num.
Type	Nom. power	Min freq.	Max freq.	Duty cycle	Pulse width	Mismatch	Forw. peak		
H	2000 W	15 MHz	400 MHz	5 %	100 ms	1000 W (50 %)	4000 W (200 %)	Via router	1
Current limits :				5 %	100 ms	1000 W	4000 W	Change limits	

Figure 7.3: Amplifier Limitations

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

Channel limitations

Name: BLA2000-I E 15-400MHZ
 Part number: W1346839
 Serial number: 0002
 Ecl: 0

Channel 1 limitations

⚠ Changing these settings will overwrite the limitations defined with the spectrometer software. Please use this page for test purposes only.

	Default	Current	New	Maximum
Type :	H			
Nominal power :	2000 W			
Min. frequency :	15 MHz			
Max. frequency :	400 MHz			
Duty cycle limit :	5 %	5 %	<input type="text" value="5"/> %	5 %
Pulse width limit :	100 ms	100 ms	<input type="text" value="100"/> ms	100 ms
Mismatch limit :	1000 W (50 %)	1000 W	<input type="text" value="1000"/> W	2000 W
Forward peak limit :	4000 W (200 %)	4000 W	<input type="text" value="4000"/> W	4000 W
Output number :	Via router			
Input number :	1			

Apply

Figure 7.4: 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

Selecting **Routing Information & Setting** leads you to a page providing information about the current RF routing path for the 1000 W combiner outputs.

Routing Information & Setting

Name: BLA2000-I E 15-400MHZ
 Part number: W1346839
 Serial number: 0002
 Ecl: 0

⚠ Changing these settings will overwrite the routes defined with the spectrometer software. Please use this page for test purposes only.

Input routing

Input number	Current channel	Possible channels	New route
1	1	1	Fixed route

Output routing

Output number	Current channel	Possible channels	New route
1	1	1	<input type="text" value="Channel 1"/> <input type="button" value="set new route"/>
2	-	1	<input type="text" value="Channel 1"/> <input type="button" value="set new route"/>

Figure 7.5: Routing Information

When powering up, by default the channel “**2000W MAIN**” is selected.

To activate the channel for “2000W AUX”, select the new route channel from *Output Number 2* and press the button **set new route**.

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.

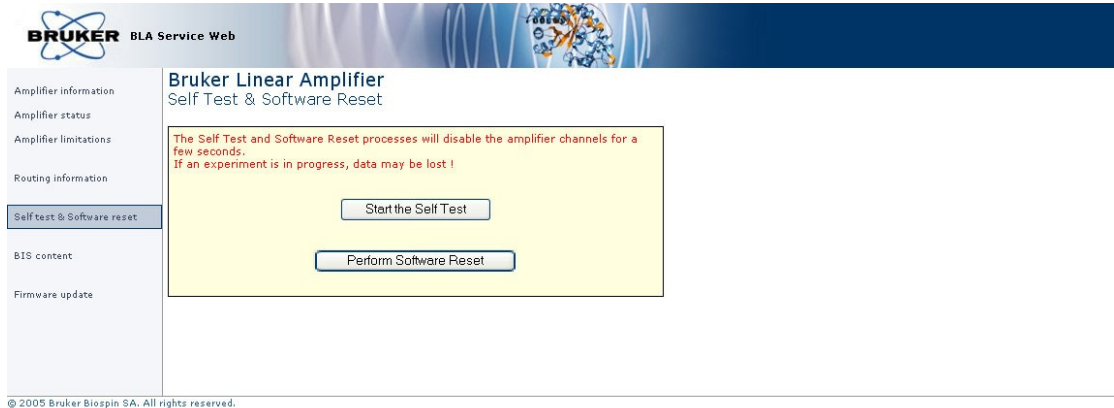
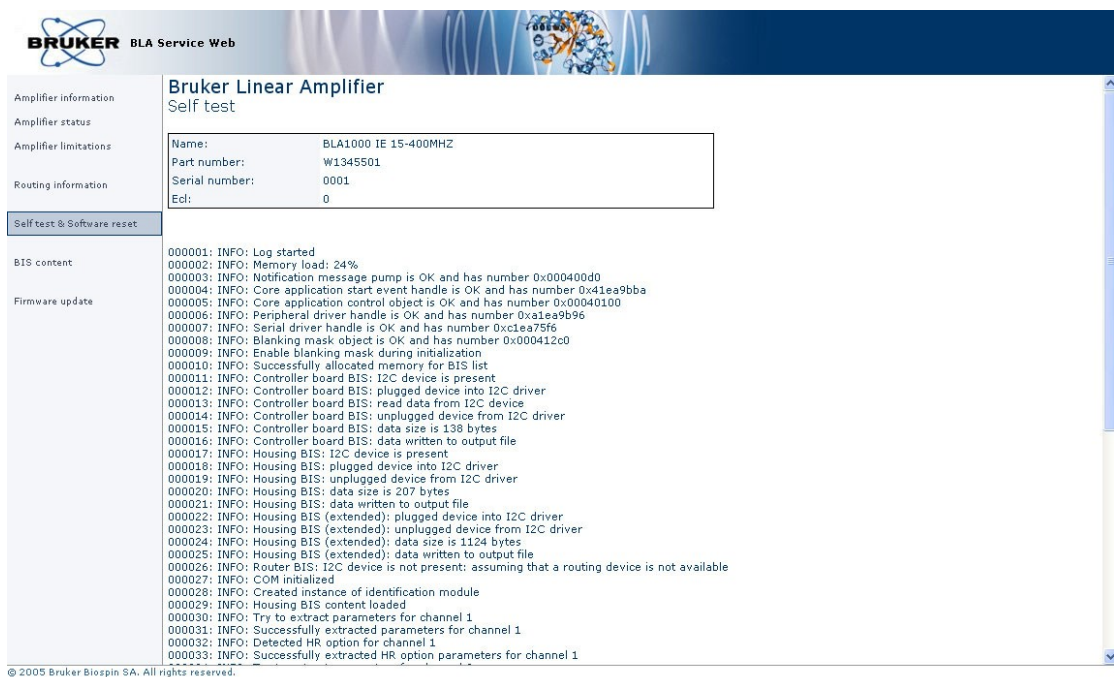


Figure 7.6: Self-test, Software Reset and Reports



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.



Bruker Linear Amplifiers

BLA

Information Advanced Operations Maintenance

Maintenance

- Self test & Software reset
- Firmware update
- BIS content

BIS Content

BIS Id:	1
BIS description:	BLA Controller
BIS type:	BLAC
BIS content:	\$Bis,1,20090716,2048,BLAC,1# \$Prd,W1522050,010252,50,,BDE,20140704# \$Nam,BLA CONTROL BOARD 6 2CH# \$CmVers,1,0,0,0# \$EndBis,35,C2#

BIS Id:	2
BIS description:	BLA Housing
BIS type:	BLA
BIS content:	\$Bis,1,20140903,2048,BLA,3# \$Prd,W1346839,0002,0,,BFR,20140903# \$Nam,BLA2000-1 E 15-400MHZ# \$Amp,1,1,1,H,,2000,FB,5,100,15,400,0,1,50,200,200,# \$RtOutChar,1,0,15,400,0# \$RtOutPath,1,0,1,1,1# \$EndBis,35,ed#

think forward

Figure 7.7: BIS Content

7.1.6 Firmware Update

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



Bruker Linear Amplifiers

BLA

Information Advanced Operations Maintenance

Maintenance

- Self test & Software reset
- Firmware update
- BIS content

Firmware update

You are about to update the BLA firmware. This tool should only be used by trained personal, and in any case only with the permission of the support service.

The BLA may not work anymore in case of improper use of this tool.

Enter new firmware image path below, then click the Update button:

By clicking this button, I accept the terms and conditions of the End-User License Agreement.

Be patient, this operation can take several minutes.
Please wait until a message indicates that the download has finished.
Don't refresh this page or reset the amplifier after having started the download process.

This software is subject to the terms and conditions of the accompanying end-user license agreement (EULA), and is provided only for use with, and for licensed end users of the Bruker Linear Amplifier (BLA). Any other use of this software is strictly prohibited and may subject you to legal action.

think forward

Figure 7.8: Firmware Updates

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 General Output Specifications 2000W

Frequency Range	15 to 400 MHz
Linear Gain	62 dB \pm 2 typical
Gain Flatness	\pm 3 dB maximum
Minimum Pulsed Output Power	2000 W min. full range
(@nominal Input +4 dBm)	2000 W typical 15 to 250 MHz
CW Output Power	100 W maximum (internal limitation)
Linear Output Power	2500 W typical @ 1dB compression 15 to 250 MHz
	1200 W typical @1 dB compression to 400 MHz
Linearity	\pm 1dB to 2500 W (1300 W to 400 MHz) typical
Amplifier Biasing	Class AB operation
Blanking Delay Time	1.5 μ s typical ON & OFF
RF Rise Time	< 100 ns
RF Fall Time	< 70 ns
DC Ringing	\pm 500 mV typical (due to blanking signal)
Input Noise Figure	9 dB typical
Output Noise Power (Unblanked)	-100 dBm @ 1 Hz
Output Noise Power (Blanked)	Thermal Noise
Input/output Impedance	50 Ω
Input V.S.W.R.	1.3 :1 maximum
Output Harmonics (2fc ; 3fc)	-35 dBc at 2000 W; -10 dBc to -65 dBc at 2000 W
Pulse Width (internal limitation)	100 ms @ 2000 W (up to CW @ 100 W)
Duty Cycle (internal limitation)	5% @ 2000 W (up to 100% @ 100 W)
Droop & Pulse Flatness	< 6% typical @ 2000 W for 10 ms PW (maximum 8%)
Amplitude Stability vs. Temperature	\pm 0.1% / $^{\circ}$ C maximum

Table 8.1: BLA2000-I E Output Specifications

8.2 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
------------------------------	---

Specifications

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	2 x RF input, 2 x RF output
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	10 kg

Table 8.2: 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 Preventive Maintenance

- The RF Combiner Unit is equipped with a fan. Fans have a high reliability and manufacturer gives an expected live time of 70000 hours (8 years) at 25 °C and 5 years at 60 °C. To prevent such a malfunction, preventive maintenance should be done every 4 years.
- When a malfunction of one of the amplifiers, the indicator **OVERHEAT** is illuminated.
- When a malfunction of the amplifier causes an error signal (**AMPLIFIER ERROR**) to be sent, investigate the cause of error, by looking at the front panel the amplifier.

For more information refer to the manual BLA1000-E I P/N Z31782.

9.2 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.

9.3 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.

For more information refer to the manual BLA1000-E I P/N Z31782.

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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