BLA1000-I E

Amplifier 15-400MHz
Operating & Service Manual

Version 001

The information in this manual may be altered without notice.

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This manual describes the units as they are at the date of printing. On request, the manufacturer shall supply circuit diagrams, lists of components, descriptions, calibrating instructions and any other information for use by qualified personnel of the user, in charge of repairing the parts of the unit which have been stated by the manufacturer to be "repairable". Such supply shall in no event constitute permission to modify or repair the units or approval of the same.

This unit is not designed for any type of use which is not specifically described in this manual. Such use may be hazardous.

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General information 1

Introduction 1.1

The BLA1000-I E Amplifier is a broadband linear pulse power amplifier specifically designed for Nuclear Magnetic Resonance and Magnetic Resonance Imaging (NMR/MRI) applications from 0,5 to 17 Tesla Systems.

The class AB linear amplifier provides 1000W peak power over the frequency range 15-400MHz on the 1000W output for the Solid applications and 300W peak power on the 300W output for the High Resolution applications.

The amplifier is equipped with N-CHANNEL BROADBAND RF POWER MOS FETs of the latest generation. The unit can provide full power for any combination of pulse width and duty cycle up to 100ms and 5%.

Its built-in protection circuitry will allow lower power pulses for longer pulse widths and duty-cycles, maintaining a 50W average power on the 1000W output and 15W average power on the 300W 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 $\geq$ 6)
- Thermal protection (overheat)

The amplifier is powered by an internal switched power supply assembly and it is housed in a 19", 4U, 520mm deep rack cabinet.

Safety 2

The BLA1000-I E Amplifier 15-400MHz is in accordance with the standard 61010-1 safety Requirements for Electrical Equipments.

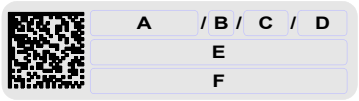
Labels 2.1

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.

Identifying plate 2.1.1

The BLA1000-I E Amplifier 15-400MHz can be identified by an identifying plate at the front panel of the unit that has following information.

Figure 2.1. Identifying plate

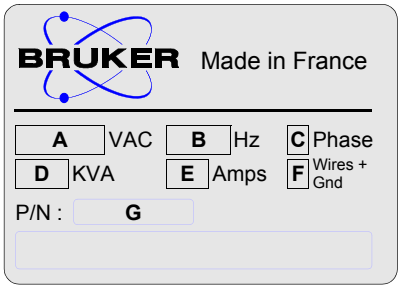


- **(A) Part Number**
  This field indicates the part number of the product.
- **(B) Variant**
  This field indicates the variant number that identifies the production category of the product. The default variant is 00.
- **(C) ECL**
  This field indicates the revision number that identifies the product 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.

Manufacturer's nameplate *2.1.2*

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

Figure 2.2. 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.

Safety labels and symbols 2.2

WARNING! *Risk of electrical shocks*

Figure 2.3. General hazard symbol

Operating personal should not remove RF output cables without turn off the power supply because the RF output power can cause serious burns before the "Mismatch" protection is active.

Please disconnect line cord before opening or prevent potential hazards such as:

- Electric shock on power supply.
- Contact burn on the RF module heatsink.
- Finger scratch due to the fan assembly on the RF module.

Installation 3

The installation of the device must be done only by an authorized and qualified technician, in total accordance with the running standards. Every breakdown due to a non-respect of the following instructions will not be attributable to Bruker and will not be covered by the guarantee clauses.

Initial inspection 3.1

Mechanical check 3.1.1

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.

Claim for damage 3.1.2

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.

Reshipment and repackaging requirements 3.1.3

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 a 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 from movements 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."

Environment requirements *3.1.4*

This amplifier is build for inside use only on a maximum high level of 2000m above sea level (6600 feet).
No specific cooling or ventilation is required.
Be sure that the amplifier has enough area around so that the free air flow into and out of the amplifier is not obstruct.
It should, however, be 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 2 (means a normal only non conductive contamination, temporary conductivity due to condensation is possible).

Installation requirements *3.2*

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 is a class II of installation category.

Bench operation *3.2.1*

The unit can be placed onto a secure flat surface.

Power requirements *3.3*

The BLA1000-I E is designed with a built-in switched power supply. The main line connector is a CEI 10A.

One Phase Line requirements :

AC input voltage :	220-230VAC	± 15%
Input current max :	7A	
Inrush current max :	30A	
Frequency :	50/60Hz	± 5Hz

System check *3.4*

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

- The AC input voltage 220-230VAC ± 15% range must be compatible with the power supply.
- An external blanking (gating) pulse must be supplied to the amplifier in order the unit to function. Ensure that this pulse has a proper level and logic polarity.
- The BLA1000-I E has a nominal input level of +4dBm. Ensure that the system drivers are operating at these levels.
- Output RF loads are connected.

Initial turn on procedure *3.5*

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

Before starting this procedure, make sure that you have properly followed instructions in the section ***"System check" on page 12***.

1. Connect the AC line to the power supply and set the power switch to the ON position.
2. Observe the indicators on the front panel of the amplifier :
   - The +32V ON LED's will illuminate,
   - The +15V, -15V and +3,3V ON LED's will illuminate.
3. The output "Amplifier default" is high (3.3V) if no problem at initialisation
4. System is now fully operational.

Operation 4

Front Panel 4.1

The BLA1000-I E front panel is provided with 12 indicators for status monitoring, 5 RF connectors, and 1 interface connector.

Indicators 4.1.1

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

Table 4.1. Indicators assignment

+32V	Indicates that the +32V supplies are applied.
+15V	Indicates that the +15V supply is applied.
-15V	Indicates that the -15V supply is applied.
+3,3V	Indicates that the +3,3V supply is applied.
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 max. reflected power limit has been reached.
RF POW. FLT	Indicates when one of the above limits has been reached.
Overheat	Indicates that the thermistor located on the RF module heatsink has sensed excessive heatsink temperature. The amplifier is blanked until an accepable temperature is reached. The function is self-resetting and no maintenance is needed. Indicates also that a fan on the assembly stops turning. The amplifier is blanked until fans are changed.
1000W	Indicates when the RF Power is present on the 1000W output.
300W	Indicates when the RF Power is present on the 300W output.

Coaxial Connectors *4.1.2*

Table 4.2. Coaxial Connectors assignment

RF IN	RF input, SMA type connector (female). Nominal input +4dBm.
1000W	RF output, N type connector (female). Pnominal 1000W (15-400MHz)
300W	RF output, N type connector (female). Pnominal 300W (15-400MHz)
BLNK	Blanking input, BNC type connector (female). TTL logic, 5V = blanking on, 0V = blanking off. When BLANKING signal is at TTL level high (+5V), no gating is applied to the amplifier stages, and no RF Power is possible. When BLANKING signal is at TTL level low (0V), the amplifier stages are gated and RF Power is possible.
SEL 1000/300	Selection input, BNC type connector (female). TTL logic, 5V = SEL 300W, 0V = SEL 1000W. When the SEL 1000/300 signal is at TTL level high (5V) or not connected, the output 300W is selected. When the SEL 1000/300 signal is at TTL level low (0V), the output 1000W is selected.
AMP DEFAULT	Default signal output, BNC type connector (female). TTL logic, 5V = amplifier ready, 0V = amplifier default. When the default signal is at TTL level high (5V), the amplifier is ready. When the default signal is at TTL level low (0V), the amplifier is fail.

Interface Connector Ethernet 10/100 *4.1.3*

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

Table 4.3. RJ45 Pin assignment

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

Device design 4.1.4

Figure 4.1. BLA1000-I E Front Panel Design

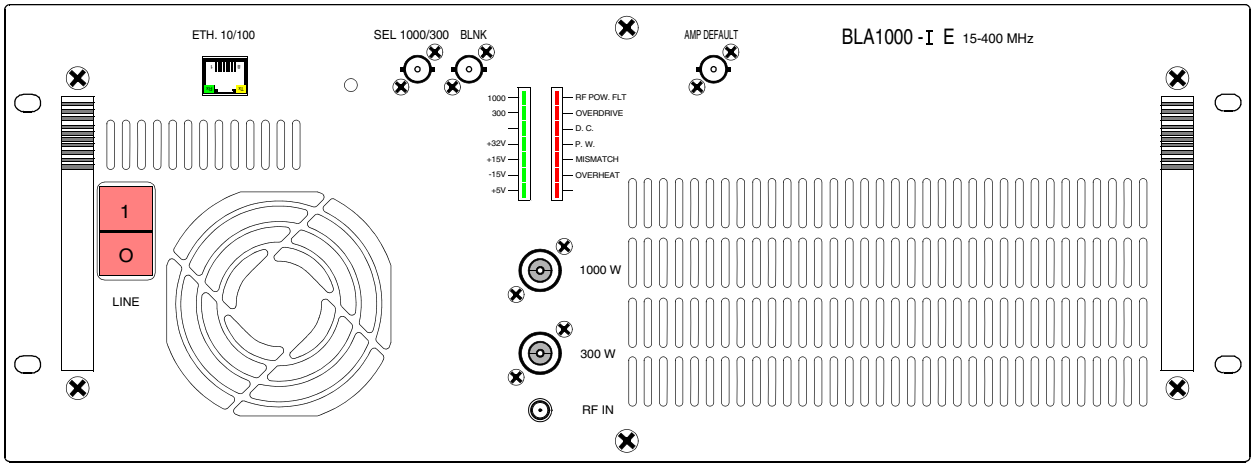
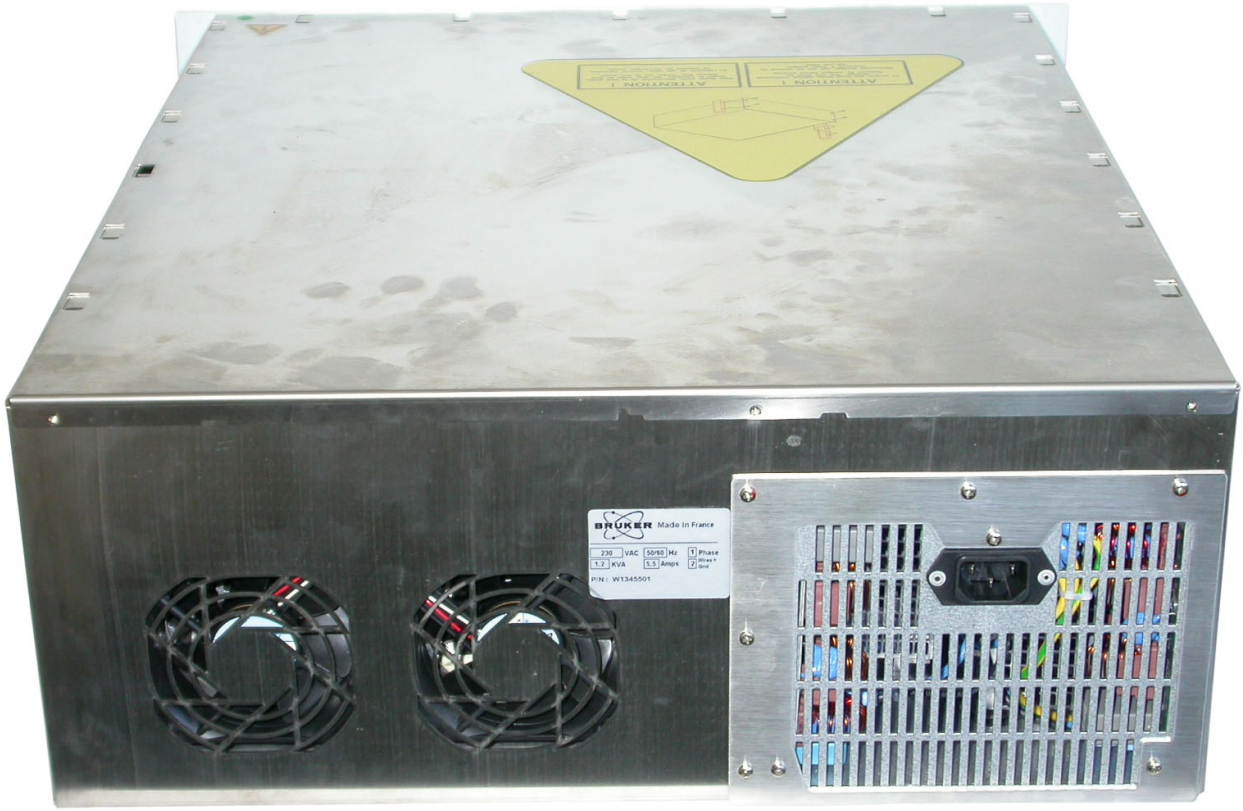


Figure 4.2. BLA1000-I E Front Panel View

Rear Panel *4.2*

The rear Panel of the BLA1000-I E Amplifier has only a line connector CEI 10A.

Figure 4.3. BLA1000-I E Rear View



Technical description

5

System Overview 5.1

The BLA1000-I E amplifier provides :

- A RF Output of 1000W and more on the Output 1000W over the full frequency range 15 to 400MHz when selected with SEL 1000/300 command controlled at TTL level low.
- A RF Output of 300W and more on the Output 300W over the full frequency range 15 to 400MHz when selected with SEL 1000/300 command controlled at TTL level High.

The RF section of the system consists of a linear module BLM1000-IE mounted on to a single heatsink, self-contained Push and Pull fan assemblies.

A linear class A / AB driver using switches and bias voltage gatings, delivers the RF input power to the four Power Amplifiers, through a 4 ways in-phase splitter.

The driver is located on the bottom of the heatsink assembly.

Four class AB power amplifiers, located on the top of the heatsink are combined by mean of a 4 ways in-phase combiner.

The output of the combiner is connected to a bi-directional high dynamic coupler mounted on the front panel of the amplifier. This output is switched with a failsafe RF relay to the 1000W Output or 300W Output to avoid higher power on the 300W 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 indentification information of the amplifier (BIS).

Circuits such, Fan Status board, Supply Status board and LED's Status board, complete the amplifier assembly.

Figure 5.1. BLA1000-I E System Block Diagram

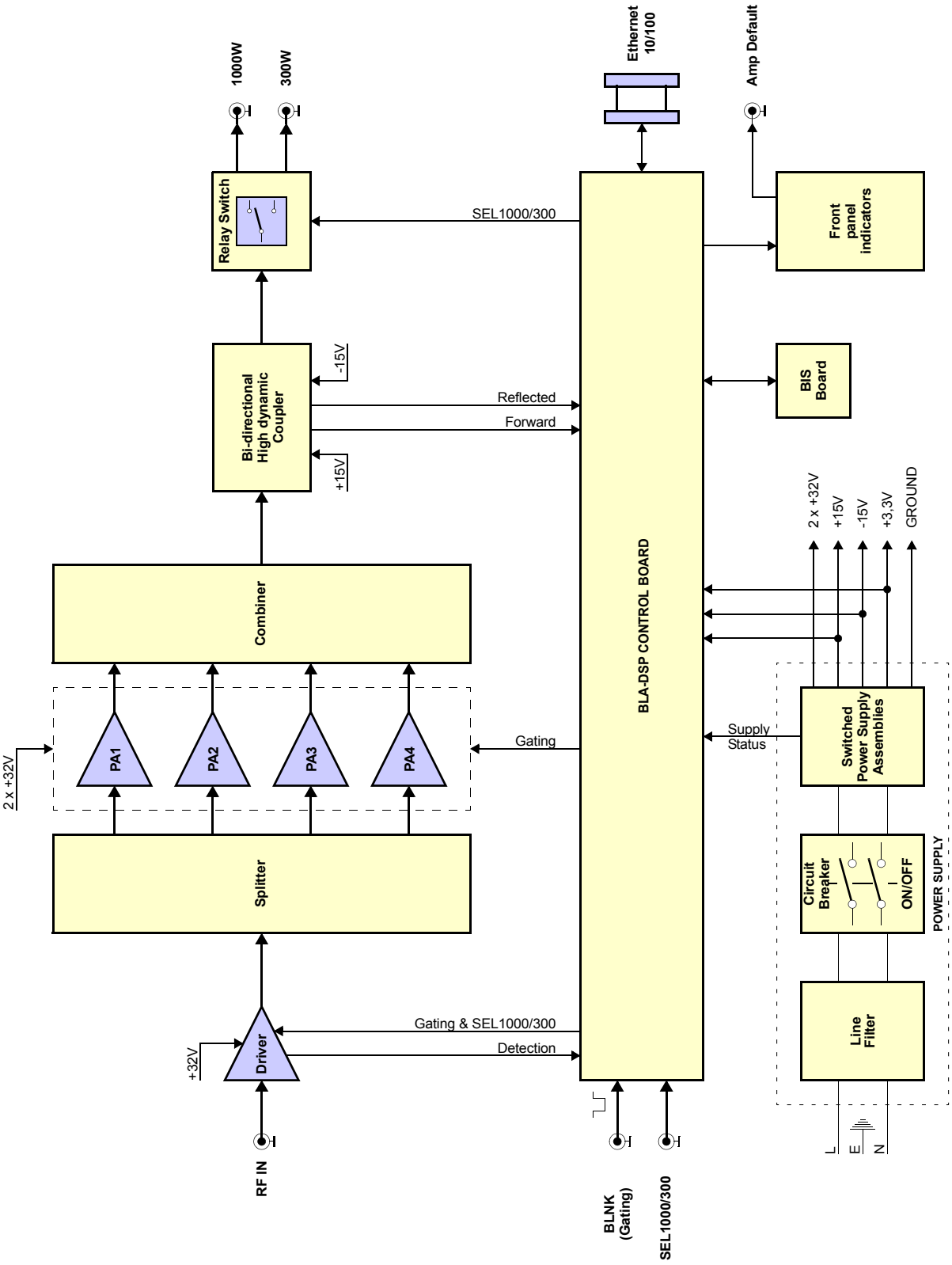
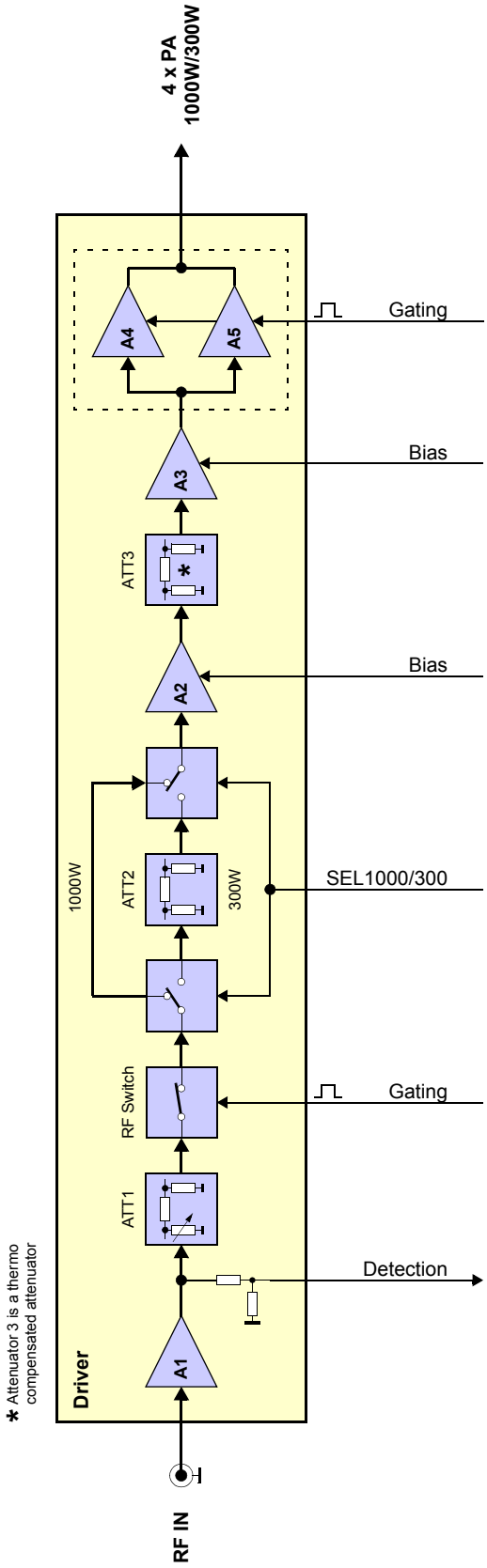


Figure 5.2. Driver Block Diagram



Theory of Operation 5.2

RF Path 5.2.1

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

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

- 300W peak for 5% duty cycle at 100ms pulse width maximum on the High Resolution output 300W, when selected as High Resolution amplifier.
  In this case, the 300W 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 output 300W.
- 1000W peak for 5% duty-cycle at 100ms pulse width maximum on the output 1000W.
  The unit is also capable of longer pulses for lower average power, up to 50W CW Power on the output 1000W.

RF Driver

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

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

Next is a two stage class A amplifier to built a nominal 40dB 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 13dB.

The entire RF driver has a nominal 53dB gain, able to develop more than 250W linear power and operates at +32V 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 PA includes 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 requires a control board conditioned gating signal in order to control the bias gate voltage on the gates of the FETs.

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

RF Combiner

The RF Combiner acts as an 4 ways in-phase combiner between the outputs of the four PA and the input of the bi-directional high dynamic coupler.

RF Coupler 1000W/300W

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

Both signals, forward and reflected, are analyzed by the BLA control board for monitoring and protection setting on the 1000W output and 300W output.

RF Relay 1000W/300W

The coaxial RF relay switches the RF Power from the bi-directional high dynamic coupler to the 300W output on the front panel, when the SEL1000/300 signal is controlled to TTL level high or not connected.

When controlled by SEL1000/300 signal at TTL low, the relay switches the RF Power to the 1000W output.

A failsafe function in the relay protects the 300W output from power overload. (1000W on output)

BLA Control Board *5.2.2*

The BLA Control Board has 3 functions:

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

The monitoring circuitry is also useful to process the detection information and protect the amplifier from overstress in peak power, average power versus duty cycle and pulse width, so as excess of reflected power.

The control board also monitors the RF Path heatsink temperature to protect against thermal overstress.

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

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

Status Led Board *5.2.3*

The Status Led Board, on the front panel of the amplifier, displays overstress functions, supplies status, and so on, as described in "***"Indicators" on page 15*** and ***"BLA Control Board"***.

BLA Extension Board 5.2.4

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

BIS Board 5.2.5

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

Technical help : please contact your local representative.

Servicing the BLA 6

Diagnosis and servicing access to the BLA amplifier relies on HTTP, allowing service access with any web browser.

Accessing the BLA amplifier 6.1

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

The IP address is given during "cf" by using TOPSPIN 2.xx software under PARAVISION 5 on the workstation.

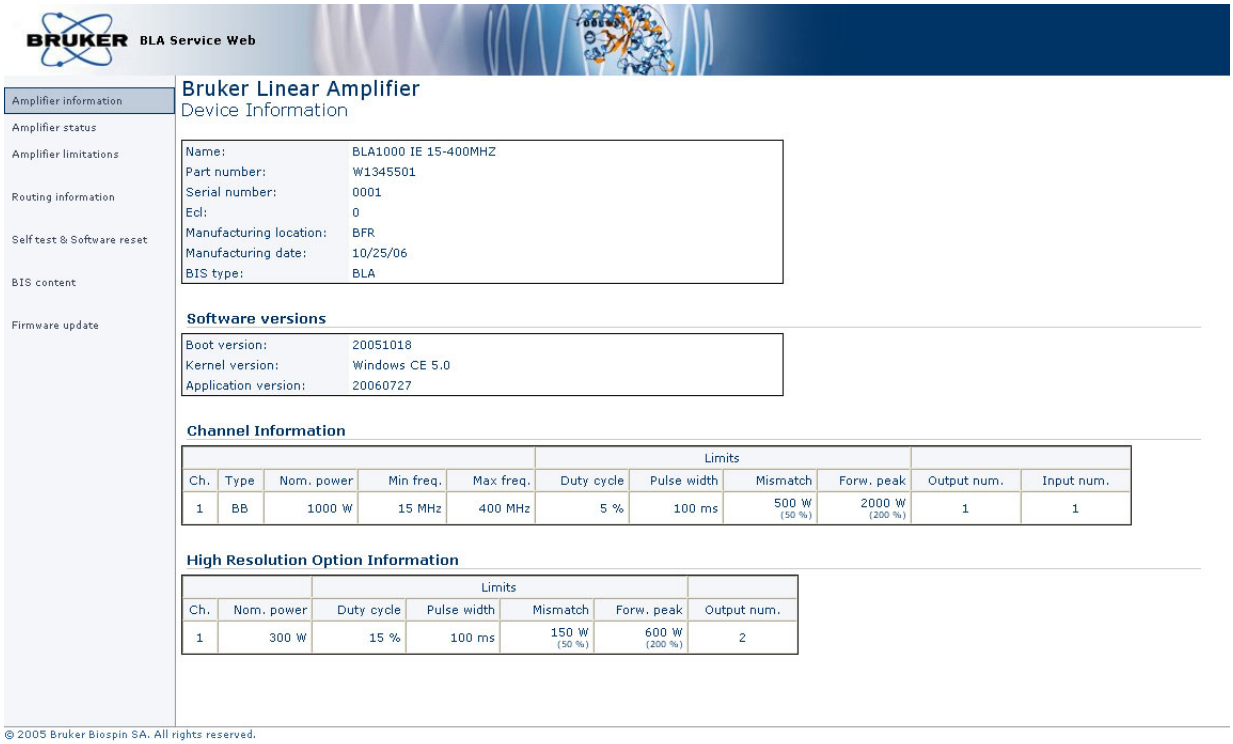
In case of problems :

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

To access the BLA1000-I E Amplifier 15-400MHz, type "ha" in TOPSPIN 2.xx and choose the BLA that should be accessed or start your favourite web browser and type the given IP address as URL.

You should get the following start screen.

Figure 6.1. Device Information



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

Amplifier status *6.1.1*

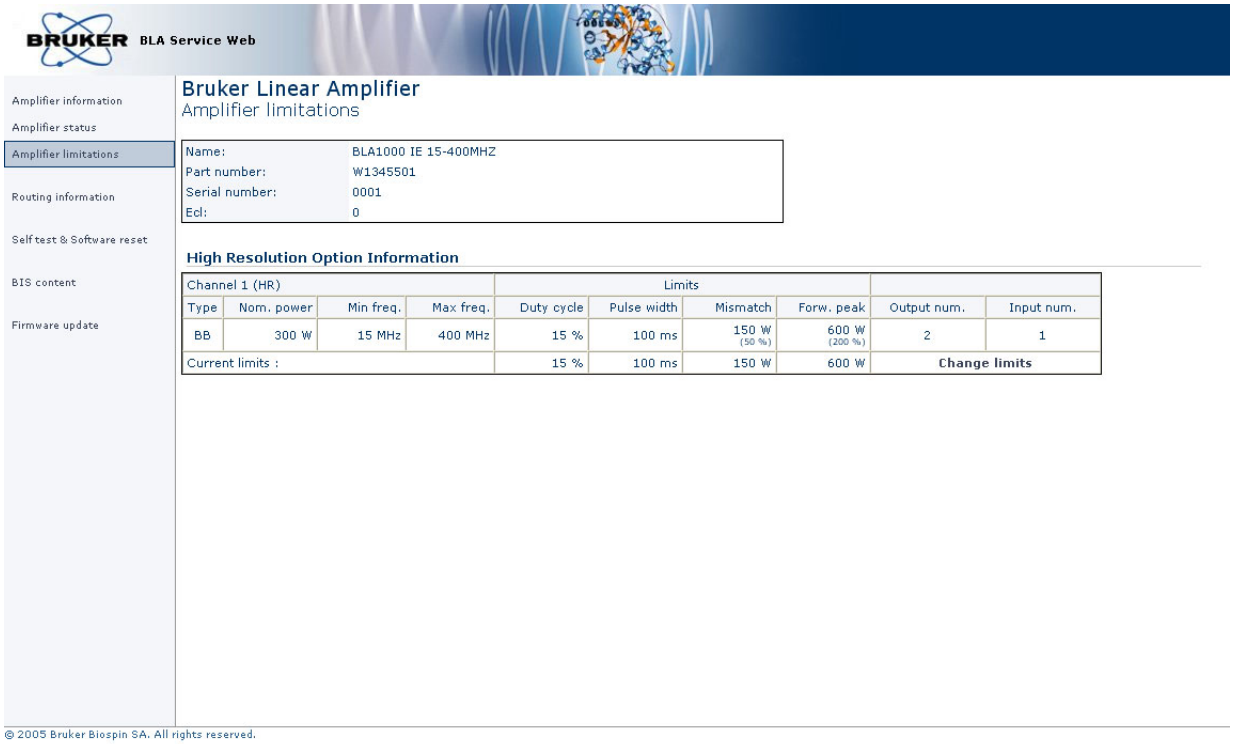
Leads you to a page giving information about the current status from the selected channel of the amplifier.

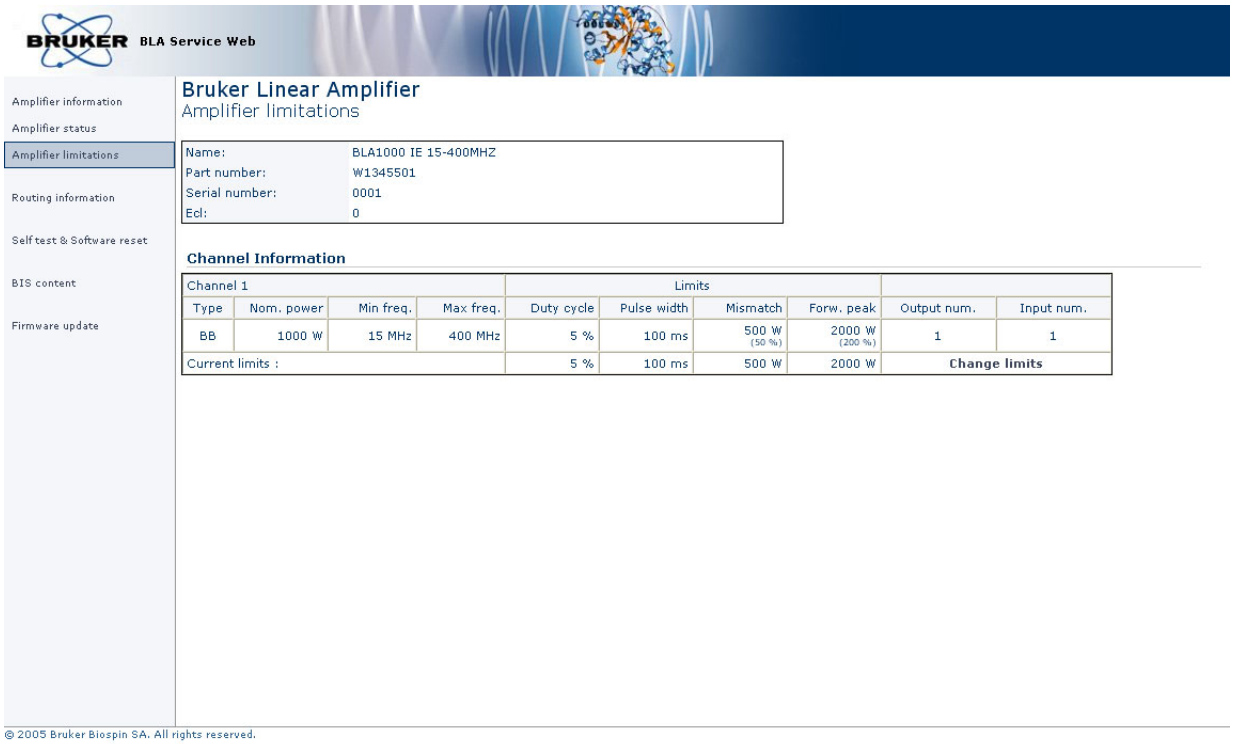
Figure 6.2. Amplifier status (High Resolution and 1000W)

Amplifier limitations *6.1.2*

Leads you to a page giving several, default and current limits, from the selected channel of the amplifier.

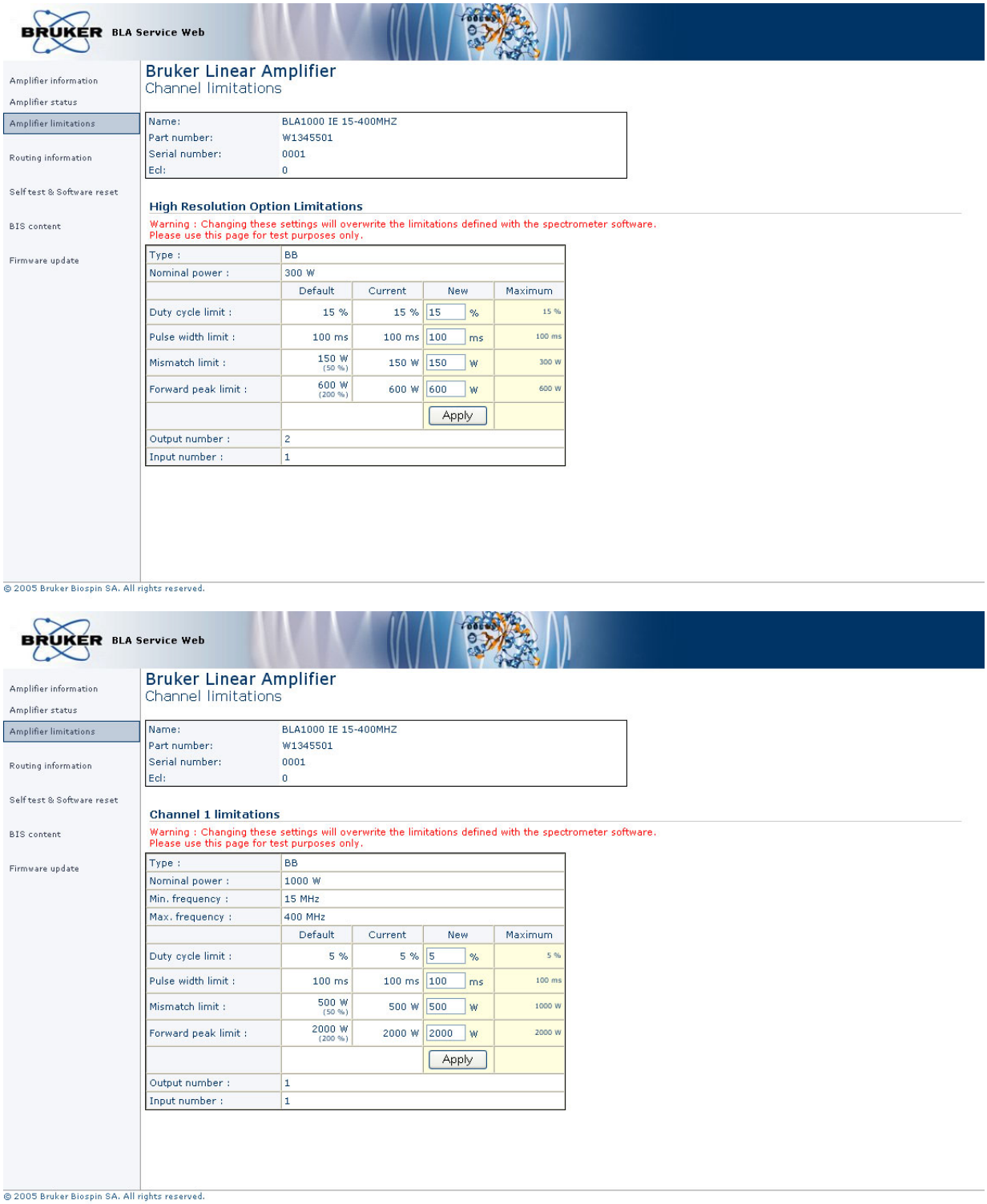
Figure 6.3. Amplifier limitations (High Resolution and 1000W)





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

Figure 6.4. Change limits (High Resolution and 1000W)



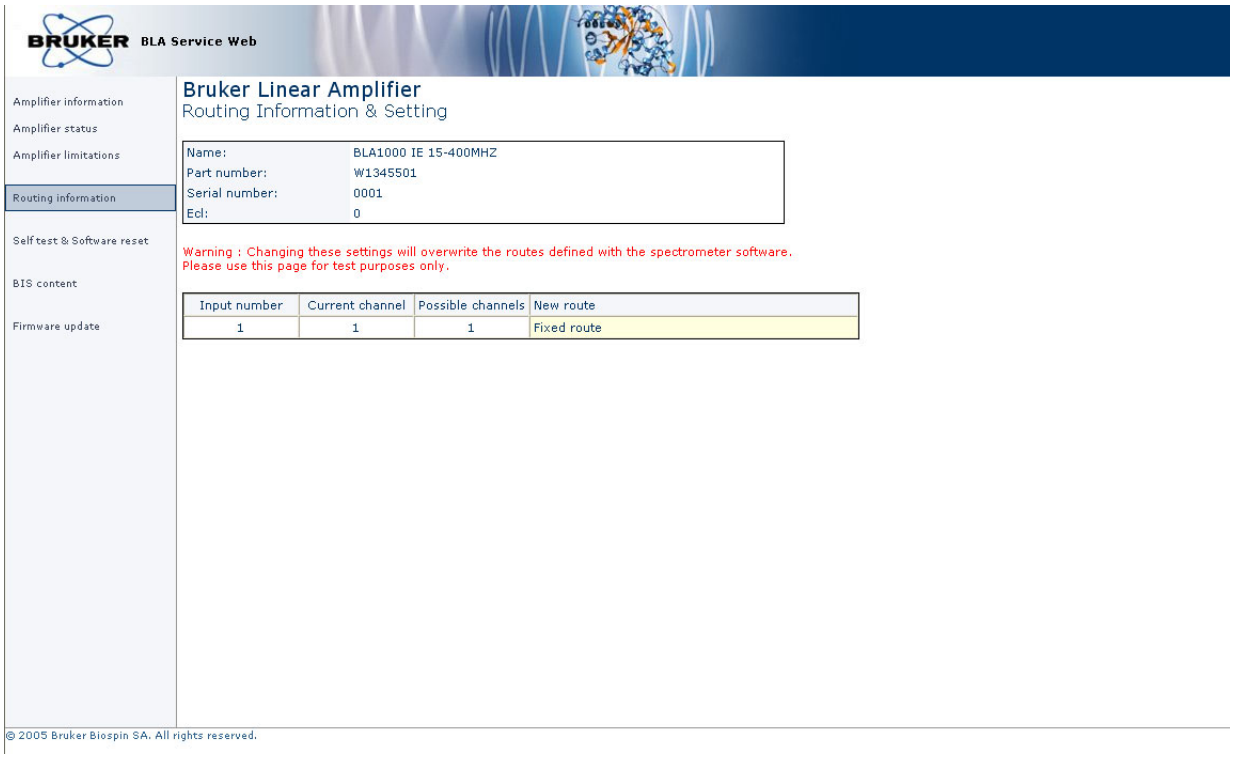
Read the warnings, change limit parameters and press **Apply** if you are sure of that.

Routing information *6.1.3*

Leads you to a page giving information about the current routed RF path at the amplifier inputs.

The RF Router isn't included, thus the RF path is fixed.

Figure 6.5. Routing information

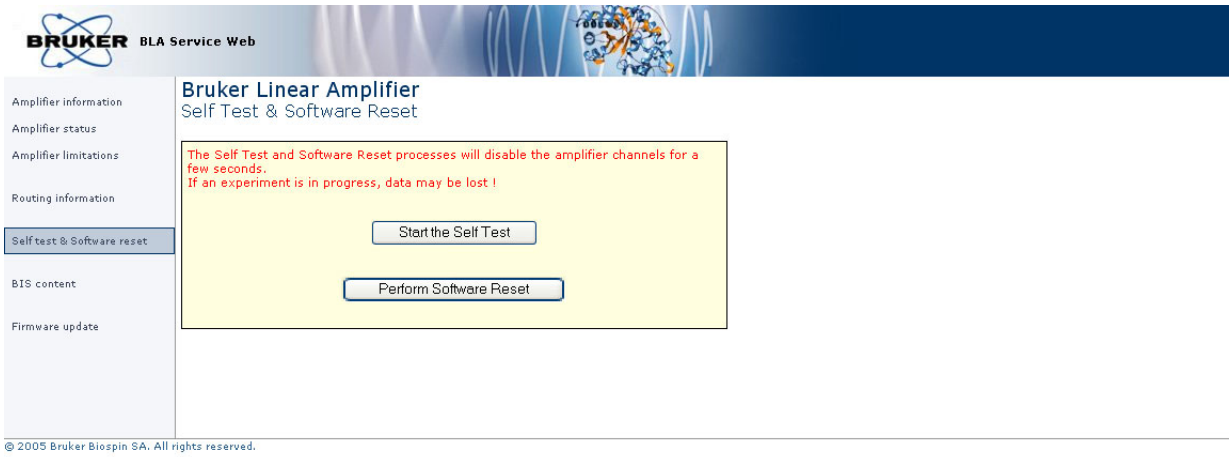


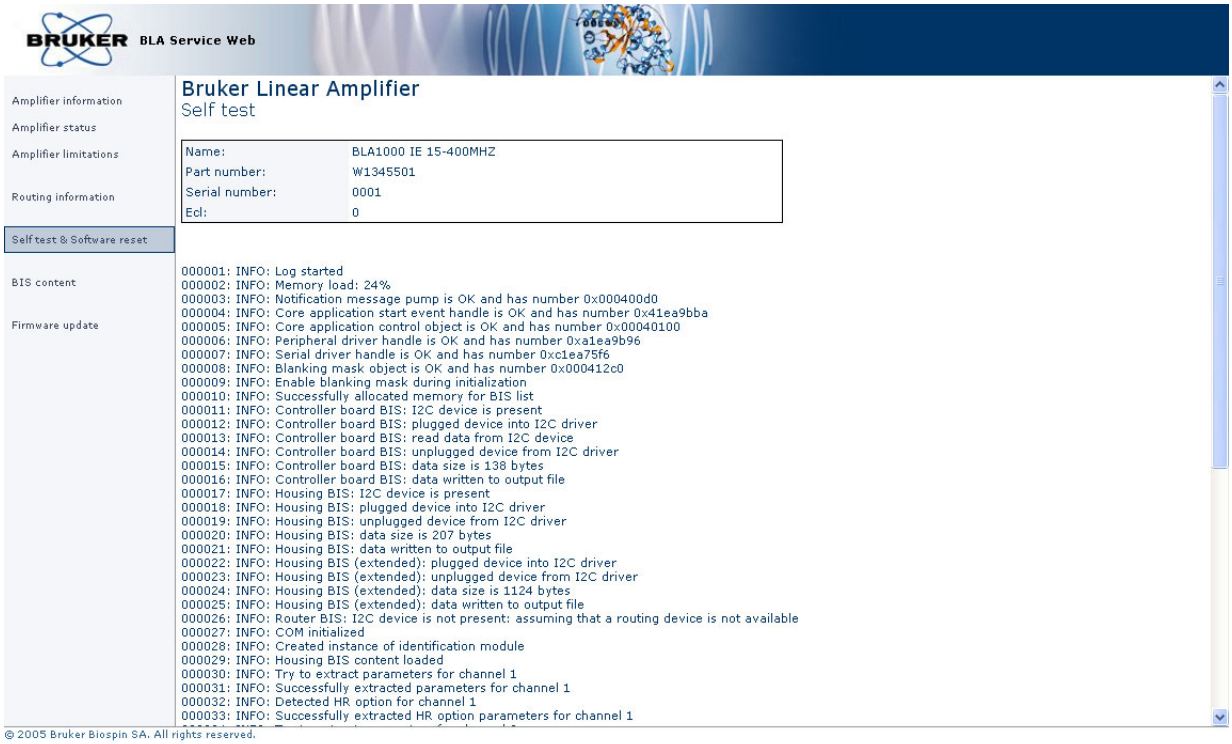
Self-test & software reset *6.1.4*

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 doesn't work correctly.

Figure 6.6. Self-test, software reset and report





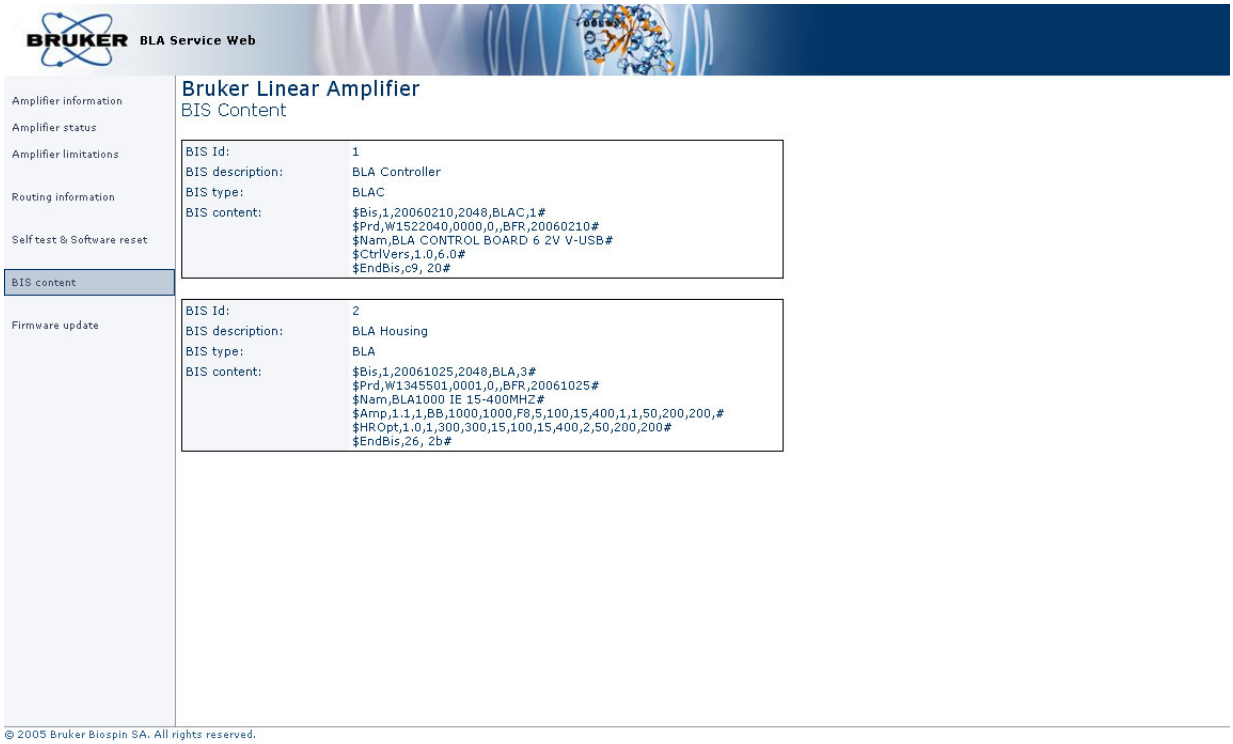
Read the warnings, press **Start the self-test**.

You should have only blue lines in the report .

BIS content *6.1.5*

Leads you to a page giving information about the current BIS programmed on the amplifier.

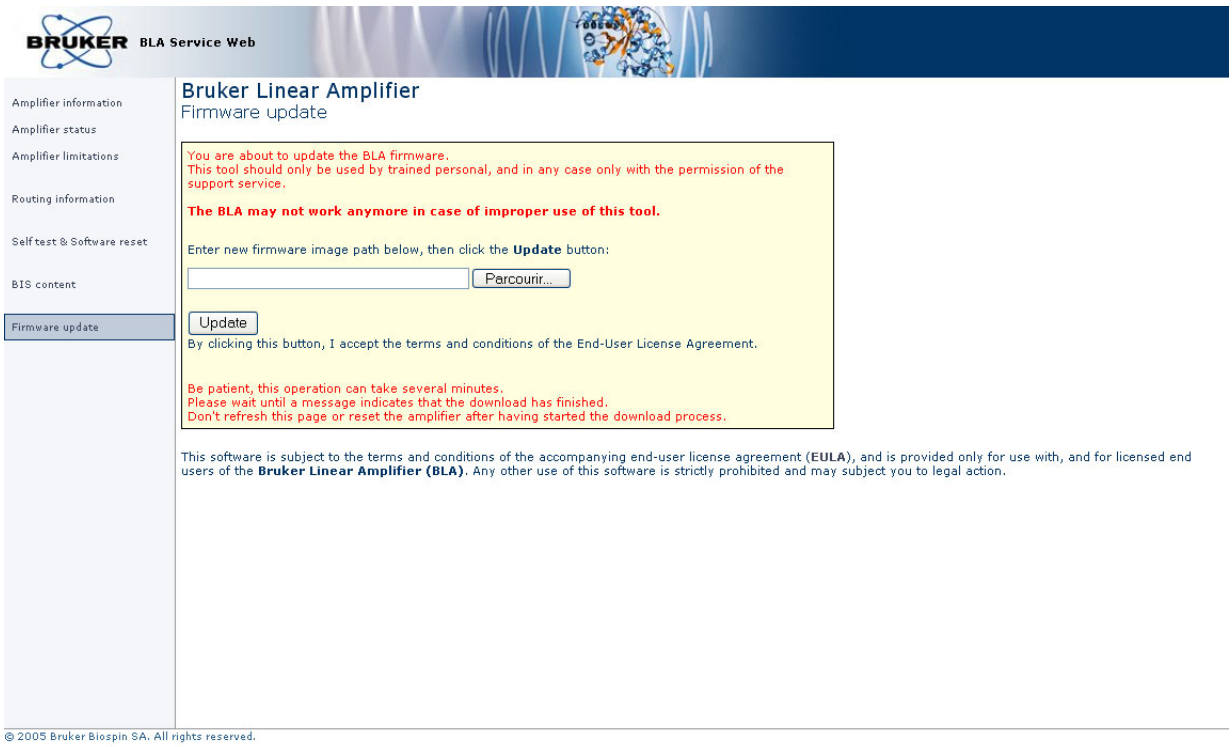
Figure 6.7. BIS content



Firmware update *6.1.6*

Leads you to a page allowing you to download new firmware.

Figure 6.8. Firmware update



Read the warnings, press the Browse button for selecting the new firmware file to download and press **Update**. Download the new firmware will take a few minutes.

NOTE : This button caption depends on your operating system language settings

Specifications 7

General specifications Output 1000W 7.1

Table 7.1. BLA1000-I E Output 1000W Specifications

Frequency range	15 to 400MHz
Linear Gain	59dB ± 1dB typical
Gain Flatness	± 2dB max.
Minimum Pulsed Output Power	1000W min. full range (@ nominal input +4dBm)
CW Output Power (internal limitation)	50W max.
Linear Output Power	1000W typical @ 1dB Compression to 365MHz 750W typical @ 1dB Compression to 405MHz
Linearity	± 1dB to 1000W typical (750W from 365MHz to 405MHz)
Amplifier Biasing	Class AB Operation
Blanking Delay Time	1.5µs min.
RF Rise Time	< 100ns
RF Fall Time	< 70ns
DC Ringing	± 500mV typical (due to blanking signal)
Input Noise Figure	5dB typical
Output Noise Power (Unblanked)	-110dBm @ 1Hz
Output Noise Power (Blanked)	Thermal Noise
Input/output Impedance	50Ω
Input V.S.W.R. Route OFF	1.2 max.
Input V.S.W.R. Route ON	1.3 max. (100MHz to 365MHz) Up to 1.9 max. @ 20MHz
Output Harmonics (2fc ; 3fc)	-30dBc @ 1000W ; -10dBc to -60dBc @ 1000W
Pulse Width (internal limitation)	100ms @ 1000W (up to CW @ 50W)
Duty Cycle (internal limitation)	5% @ 1000W (up to 100% @ 50W)
Droop & Pulse Flatness	± 3% typical @ 1000W for 10ms PW
Amplitude Stability vs. Temperature	± 0,1% / °C max.

General specifications Output 300W 7.2

Table 7.2. BLA1000-I E Output 300W Specifications

Frequency range	15 to 400MHz
Linear Gain	54dB ±2dB typical
Gain Flatness	± 2dB max.
Minimum Pulsed Output Power	300W min. full range (@ nominal input +4dBm)
CW Output Power (internal limitation)	50W max.
Linear Output Power	300W typical @ 1dB Compression
Linearity	± 1dB to 250W typical
Amplifier Biasing	Class AB Operation
Blanking Delay Time	1.5µs min.
RF Rise Time	< 100ns
RF Fall Time	< 70ns
DC Ringing	± 500mV typical (due to blanking signal)
Input Noise Figure	7dB typical
Output Noise Power (Unblanked)	-113dBm @ 1Hz
Output Noise Power (Blanked)	Thermal Noise
Input/output Impedance	50Ω
Input V.S.W.R. Route OFF	1.2 max.
Input V.S.W.R. Route ON	1.3 max. (100MHz to 365MHz) Up to 1.9 max. @ 20MHz
Output Harmonics (2fc ; 3fc)	-30dBc @ 300W ; -10dBc to -60dBc @ 300W
Pulse Width (internal limitation)	100ms @ 300W (up to CW @ 50W)
Duty Cycle (internal limitation)	15% @ 300W (up to 100% @ 50W)
Droop & Pulse Flatness	± 3% typical @ 300W for 10ms PW
Amplitude Stability vs. Temperature	± 0,1% / °C max.

Common Characteristics 7.3

Table 7.3. BLA1000-I E Common Characteristics

Constant Internal Protection	Supplies faults & Overtemperature Forward Power : 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 gating 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 520mm depth
Weight	30kg

Inside Power Supply Characteristics 7.4

Table 7.4. BLA1000-I E Power Supply Characteristics

Voltage	+32V
Current	50A DC
Pulsed current	200A pulse 100ms
Input voltage	230V ± 15% @ 50/60Hz ± 5Hz
Input current	Max @ 230V : 7A
Input power	Max @ 230V : 1600VA
In rush current	< 30A
Input Thermal protection	16A

Service information and maintenance 8

Every intervention on the device must be carried out by a 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.

Preventive maintenance of the RF module on BLA-type Amplifiers 8.1

The RF module inside BLA's Amplifiers is equipped with a easily extractible PUSH and PULL FAN Assembly.

Fan's on assembly have a high reliability and manufacturer gives a expected live time of 70000 hours (8 years) at 25°C and 5 years at 60°C.

Replacement of the assemblies could be done in the field when a misfonction of fans is detected by lightning from the OVERHEAT Status Led.

To prevent such a misfonction, a preventive maintenance should be done every 4 years.

These assemblies can be ordered on the manufactory BBIO-FR by P/N:

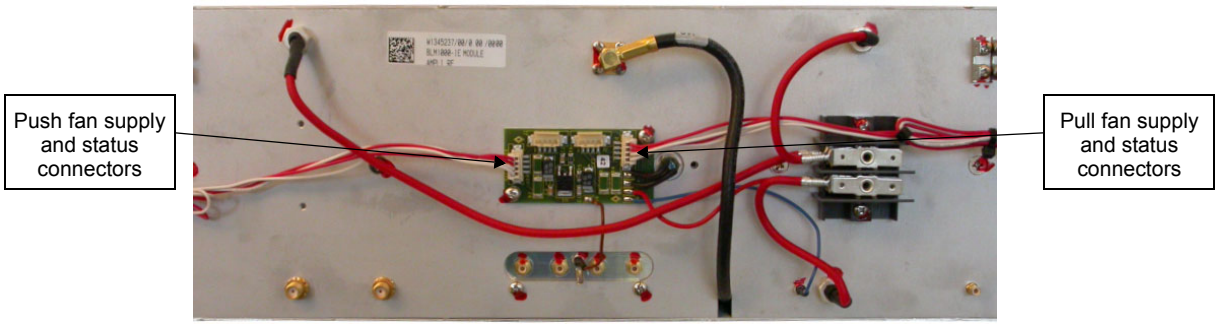
- **W1346530** «PUSH FAN ASSEMBLY H1000/300»,
- **W1346531** «PULL FAN ASSEMBLY H1000/300».

Operation 8.1.1

Read below or see SIH0292.

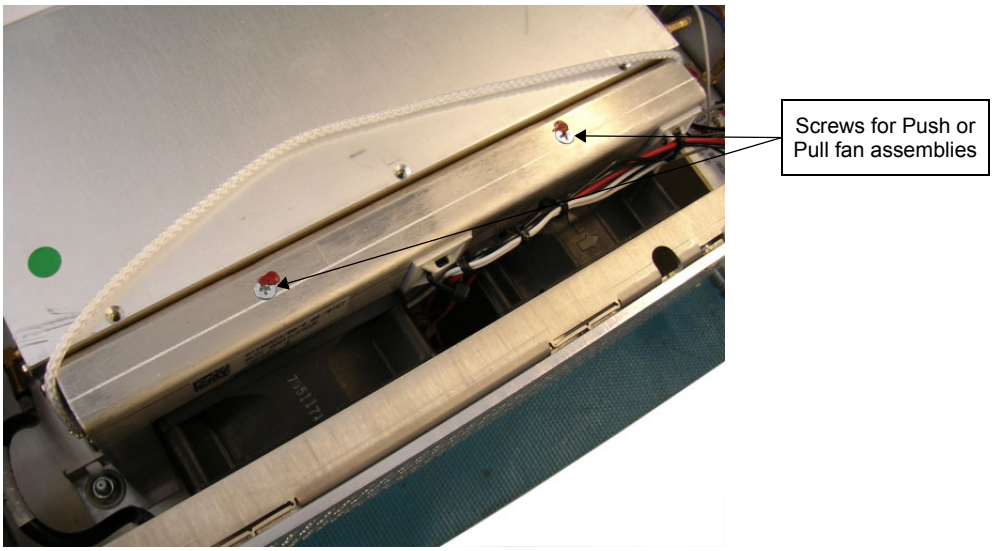
1. Disconnect all cables from the front panel and the supply connector on the rear panel. Remove the amplifier from the BIOSPEC / PHARMASCAN console and place it on a secure flat surface.
2. Unscrew and remove the coverage plate from the amplifier.
3. Disconnect the 2 connectors J3 and J4 from the Status Connections Board on the RF Amplifier Module.

Figure 8.1. Fans supplies and status Connections



4. Unscrew only the 2 screws from the top of the Push and Pull fan assemblies on both side of the RF module.

Figure 8.2. Push and Pull Fan Assembly



5. Remove the Push and the Pull fan assembly.
6. Place correctly the 2 new fan assemblies in the holes on the bottom of the RF module and screw it on the top.
7. Connect the 2 connectors J3 and J4 from the fans to the Status Connections Board .
8. Connect the supply cable from BLA1000-I E to the external power supply, turn on the amplifier. Note that the fans are turning and no OVERHEAT status led appears on front panel.
9. Put the coverage plate on the BLA1000-I E amplifier and screw it.
10. Put the amplifier in the BIOSPEC / PHARMASCAN console, connect all cables on the front panel and the supply connector on the rear panel.

Figures

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