Bruker BioSpin

BLAH2000-I E

Amplifier 300MHz
Operating & Service Manual

Version 001

think forward

MR Imaging

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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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Contents

General Information

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Introduction 1.1

The BLAH2000-I E Amplifier 300MHz is a narrowband linear pulse power amplifier specifically designed for Nuclear Magnetic Resonance (NMR) and Magnetic Resonance Imaging (MRI) applications from 0.5 to 17 Tesla systems.
It is commercialized under the BRUKER BIOSPIN part number W1345543.

It is operated in AB linear class and provides 2000W and more peak RF power at 300MHz frequency on the 2000W output for Solid applications and 300W or more peak RF power on the 300W output connector for High Resolution applications.

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 100ms and 3% for 2000W RF output Power.

Its built-in protection circuitry will allow lower power pulses for longer pulse widths and duty-cycles, maintaining a 60W average power on the 2000W output and a 45W 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 when VSWR $\geq$ 6)
- Thermal protection (overheat)

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

The supply is self protected for overcurrent and overvoltage.

The amplifier is housed in a 19", 4U, 520mm deep rack cabinet.

Safety

2

The BLAH2000-I E 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 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 BLAH2000-I E can be identified by an identifying plate at the front panel of the unit that contains the following information :

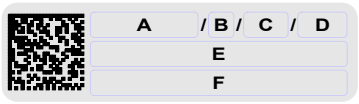

Figure 2.1. Identifying Plate

- **(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 Name Plate *2.1.2*

The BLAH2000-I E can be identified by a manufacturer's name plate at the back panel of the unit that contains the following information :

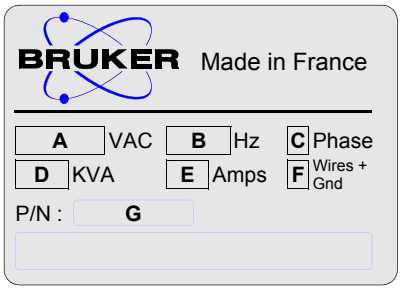

Figure 2.2. Manufacturer's Name Plate

- **(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 Signs 2.2.1

Risk of Danger

DANGER! Risk of electrical shocks

Throughout this manual, this symbol indicates the possibility of severe personal injury, loss of life or equipment damage if the instructions are not followed.

On the equipment, the symbol also implies a danger and alerts the user.

Operating Instruction

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

Please disconnect the mains supply before opening to prevent potential hazard such as :

- Electrical shock from power supply
- Contact burns from the RF module and 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.

BRUKER BIOSPIN assumes no liability for the customer's failure to comply with these requirements and is therefore not responsible or liable for any injury or damage that occurs as a consequence of non-approved installation.

Initial Inspection 3.1

Mechanical Check 3.1.1

If damage of the shipping cardboard 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 cardboard 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 cardboard 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 cardboard. Make sure that the instrument cannot move in the container during shipping. Seal the cardboard box with a good grade of shipping tape and mark the container :

"FRAGILE ELECTRONIC INSTRUMENT"

Environment Requirements *3.1.4*

This amplifier is built for inside use only on a maximum elevation of 2000m above sea level (6600 feet).

No specific cooling or ventilation is required.

Be sure that the amplifier has enough area around it so that the free airs flow into and out of the amplifier is not obstructed.

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 two (means a normal 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 has a class II installation category.

Bench Operation *3.2.1*

The unit can be placed onto a secure flat surface.

Power Requirements *3.3*

The BLAH2000-I E Amplifier 300MHz has a build-in switched power supply.
The mains line connector on the rear panel is a CEI 10A.

One Phase Line requirements :

AC input voltage :	208-230VAC
Input current max :	5A
Frequency :	50/60Hz

System Check *3.4*

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

- The AC input voltage 208-230 VAC ± 10% 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.
- The BLAH2000-I E Amplifier 300MHz 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 BLAH2000-I E Amplifier 300MHz and what should be seen as this occurs.

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

1. Connect the amplifier to the AC line and turn the line switch to ON.
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. System is now fully operational.

Operation 4

Front Panel Description 4.1

The BLAH2000-I E Amplifier 300MHz front panel is provided with 12 indicators for status monitoring, 6 RF connectors, 1 interface connector and 1 line switch.

Indicators 4.1.1

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

Table 4.1. Indicators Assignment

+32V	Indicates that the +32V supply is 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.
2000	Indicates when the RF Power is present on the 2000W output.
300	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). Allows to the BLAH2000-I E to deliver full power at nominal +4dBm drive.
2000W	RF output, N type connector (female). Power output 2000W @ 300MHz.
300W	RF output, N type connector (female). Power output 300W @ 300MHz.
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 2000/300	Select input, BNC type connector (female). When the SEL 2000/300 signal is at TTL level low (0V), the 2000W output is selected. When the SEL 2000/300 signal is at TTL level high (+5V), the 300W output is selected.
AMPLIFIER ERROR	Error output, BNC type connector (female). When the AMPLIFIER ERROR signal is at TTL level low (0V), the amplifier is at fault. When the AMPLIFIER ERROR signal is at TTL level high (+5V), the amplifier is running well.

Ethernet 10/100 Interface Connector *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 Front View *4.1.4*

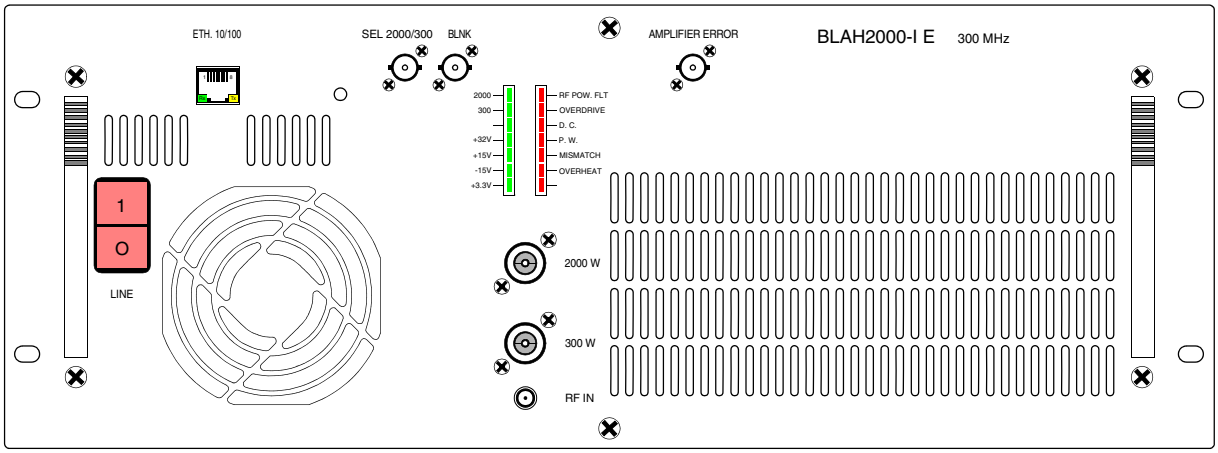

Figure 4.1. BLAH2000-I E Amplifier 300MHz Front Panel Design

BLAH2000-I E Amplifier 300MHz *Front Panel View*

Rear Panel Description 4.2

The BLAH2000-I E Amplifier 300MHz rear panel is free of elements in exception of the 3 poles (2P+E) line filter socket.

Device Rear View 4.2.1

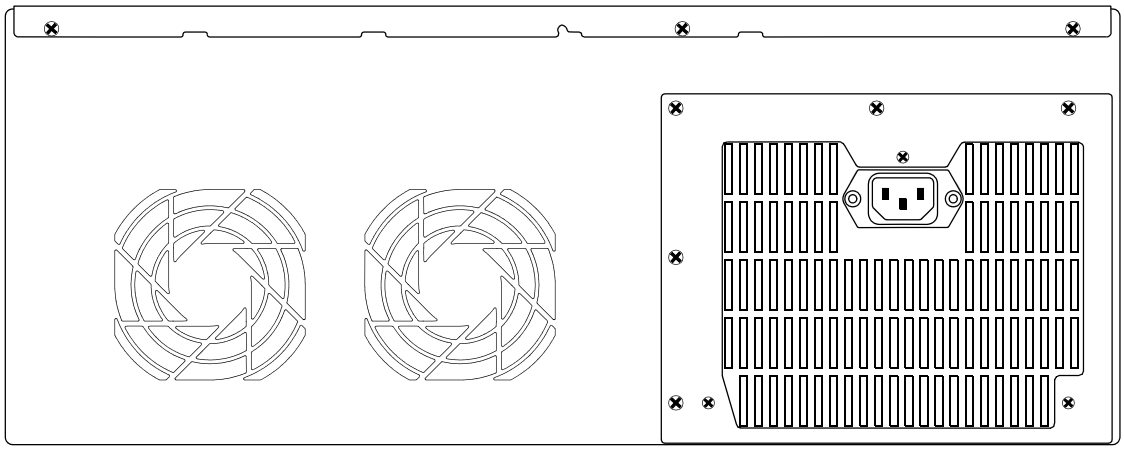

Figure 4.2. BLAH2000-I E Amplifier 300MHz Rear Panel Design

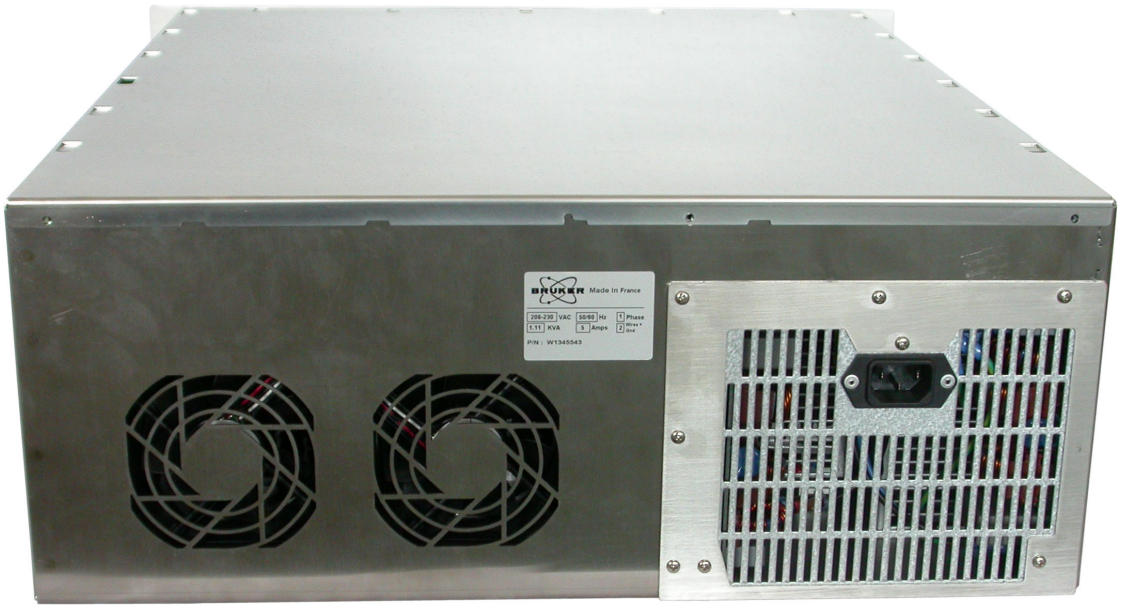

Figure 4.3. BLAH2000-I E Amplifier 300MHz Rear Panel View

Technical Description

5

System Overview 5.1

The BLAH2000-I E Amplifier 300MHz provides :

- A RF Output of 2000W and more on the 2000W output at 300MHz frequency when selected with SEL 2000/300 command controlled at TTL level low.
- A RF Output of 300W and more on the 300W output at 300MHz frequency when selected with SEL 2000/300 command controlled at TTL level High.

The RF section of the system consists of a linear module BLMH2000-E mounted around a single self-contained Push and Pull fan assembly heatsink.

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

The four class AB power amplifiers are located on the top of the heatsink assembly and are combined by the means of 4 ways in-phase combiner.

The output of the combiner is connected to a bi-directional high dynamic coupler mounted in the BLMH2000-E module. The coupler output is switched via a failsafe RF relay to the 2000W or 300W on the front panel connectors 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 the indentification information of the amplifier (BIS).

Monitoring of fan status, supply status and LED's status is also performed by the control board.

Circuits such as BLAC6 Extension Board 1 Channel and Status LED's board, complete the amplifier assembly.

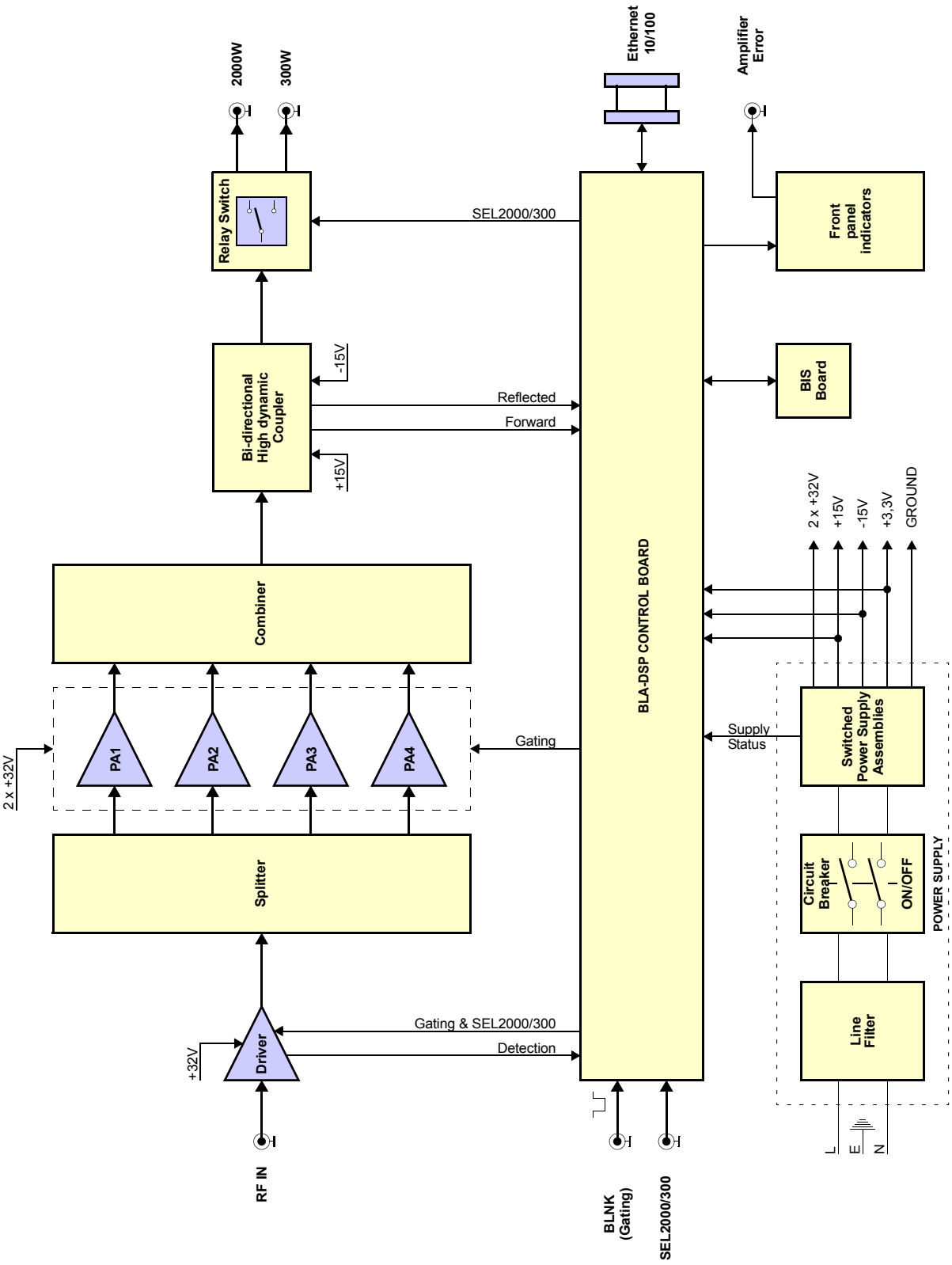

Figure 5.1. BLAH2000-I E System Block Diagram

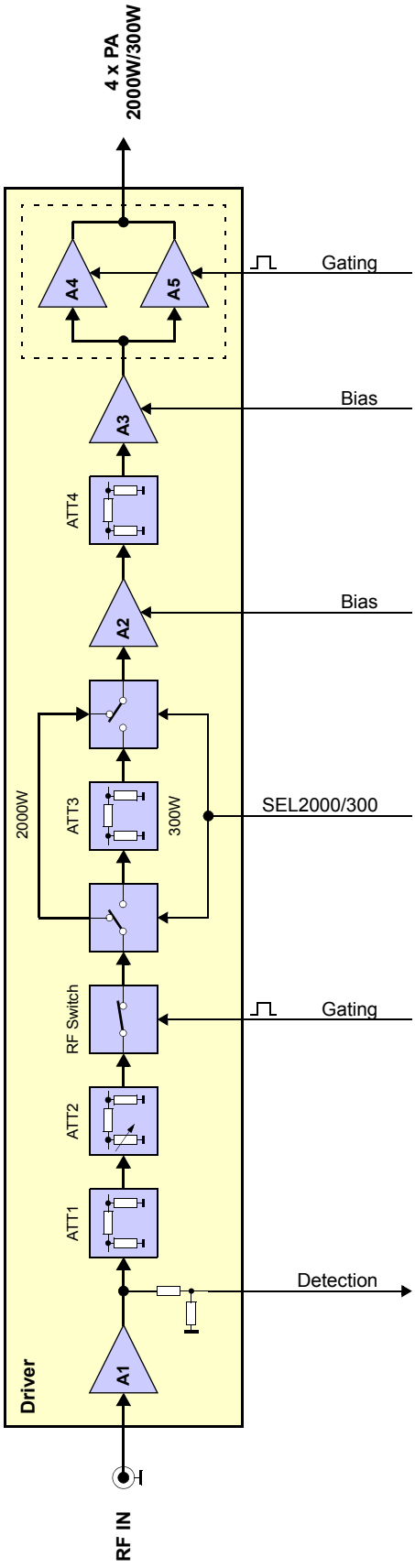

Figure 5.2. Driver Block Diagram

Theory of Operation *5.2*

RF Path *5.2.1*

The BLAH2000-I E Amplifier 300MHz (P/N: W1345543) consists of a class A / AB driver amplifier and a class AB power amplifier.

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

- 300W peak power and more for 15% duty cycle at 100ms pulse width maximum on the 300W front panel output connector. The unit is also capable of longer pulses for lower average power, up to 45W CW power on on the 300W output.
- 2000W peak power and more for 3% duty cycle at 100ms pulse width maximum on the 2000W front panel output connector. The unit is also capable of longer pulses for lower average power, up to 60W CW power on on the 2000W output.

RF Driver

In the first section of the driver, the RF input signal is preamplified with a low noise stage amplifier and followed by a thermal PAD attenuator and a variable attenuator.

Then, the RF signal get through a gating GaAs RF switch and a switchable attenuator to get the right gain in the two modes 2000W and 300W. This attenuator is built of two GaAs RF switches, commutated by a control board conditioned signal SEL 2000/300 and an attenuator to minimize gain of about 9dB when the amplifier is operating in 300W mode or provides full gain in 2000W mode.

Next, there is a two stage class A amplifier to build a nominal 40dB gain block.

The second section of the driver includes two power MOSFET transistors. The circuits around the transistors consist of complementary input and output transformers and baluns which operate the devices in push-pull mode.

This section requires a control board conditioned gating signal to control the bias voltage on the gates of the FETs. The gain of this section is around 13dB.

The entire RF driver has around 53dB nominal gain, operates at +32VDC and able to provide more than 250W linear power.

RF 4 ways Splitter

The RF in-phase splitter distributes with minimal power losses the RF output from the driver towards the four power amplifier circuits.

RF Power Amplifier

The power amplifier is divided in four identical cells constituted by two RF MOSFET transistors each. The circuits around the transistors consist of complementary transformers and baluns which operate the devices in push-pull mode. Each amplifier cell requires a control board conditioned gating signal to control the bias voltage on the gates of the FETs.

The entire RF power amplifier operates at +32V DC and increases the nominal driver gain to provide more than 2000W power output.

RF 4 ways Combiner

The RF in-phase combiner is the same structure that the 4 ways splitter. It combines the outputs from the four power amplifier cells in one output which feed a bi-directional coupler.

RF Coupler

The bi-directional high dynamic coupler provides an approximate 1V peak DC signal for full 2000W forward power and also a peak DC signal for reflected power level. The same coupler is used for the 2000W and 300W ways.

Forward and reflected signals are analyzed by the BLA control board for monitoring and protection of the both RF power outputs.

RF Relay 2000/300

The coaxial RF relay switches the RF power after the bi-directional high dynamic coupler to one of the both front panel connectors 2000W or 300W.

When the SEL 2000/300 is controlled to TTL level high or not connected, the relay switches the RF power to the 300W output.

When the SEL 2000/300 is controlled to TTL level low, the relay switches the RF power to the 2000W output.

A failsafe function in the relay protects the 300W output from overload like 2000W RF power on 300W way.

BLA Control Board *5.2.2*

The BLA Control Board has 3 main functions:

1. Conditions the input blanking (BLNK) signal and delivers it to the above mentioned RF Paths.
2. Allows Ethernet communication with the workstation.
3. Monitor the output characteristics of the amplifier thanks to the DC peak detection of the bi-directional coupler.
   Electronic circuitry processes the detection information and protect the amplifier from overstress like :

- Forward and reflected peak power

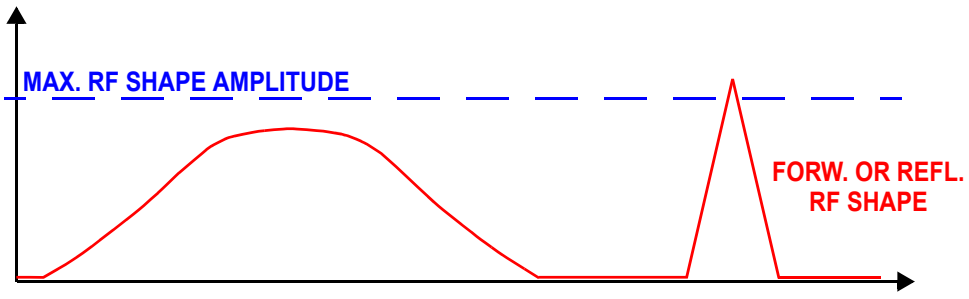

Figure 5.3. Peak Power Limitation

The peak power limitation is the maximum RF forward shape amplitude allowed 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).

- Forward pulse width

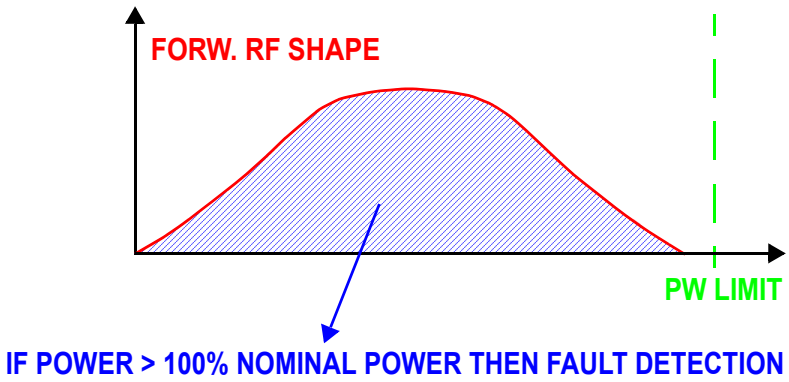

Figure 5.4. Forward Pulse Width Limitation

The pulse width is the lapse of time during which the nominal power can be applied.

Limitation range : from 0.1ms to 512ms.

The pulse width value is updated every 100µs.

- Forward pulse duty cycle

The duty cycle value is the ratio between measured input power during pulse width limitation value divided by duty cycle limitation value and the nominal power during the same time.

For example, if the pulse width limitation is set to 3ms and duty cycle is limited to 10%, then duty cycle value equals the measured input power during 30ms (3ms / 0.1) divided by the nominal power during 30ms.

Limitation range : from 1% to 100%.

The duty cycle value is updated every 100µs.

- 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 100µs.

- 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 timings

Table 5.1. Fault Detection Timings

Fault	Detection delay (max)
Peak power	500 ns
Duty cycle	100 µs
Pulse Width	100 µs
Mismatch	100 µs
Power Supply, Fan	200 ns
Heat sink temperature	500 ms

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

- 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).

BLA Extension Board *5.2.3*

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

Status Led Board *5.2.4*

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" on page 23***.

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

The BLAH2000-I E Amplifier 300MHz provides diagnosis and servicing web pages relies on HTTP, allowing service access with any web browser.

Accessing the BLA Amplifier 6.1

The BLAH2000-I E Amplifier 300MHz is accessible via the BLA control board with its IP address.

The IP address is given during "**cf**" by using TOPSPIN 2.xx software 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 BLAH2000-I E Amplifier 300MHz, type "**ha**" in TOPSPIN 2.xx or better and choose the BLA that should be accessed or start your favourite web browser and type the given IP address as URL.

NOTE : That the different information and parameters displayed will depend on the state of the selection SEL 2000/300 connector on front panel.

Sub Toolbar Information 6.2

Device Information (default) 6.2.1

You should get the following start screen.

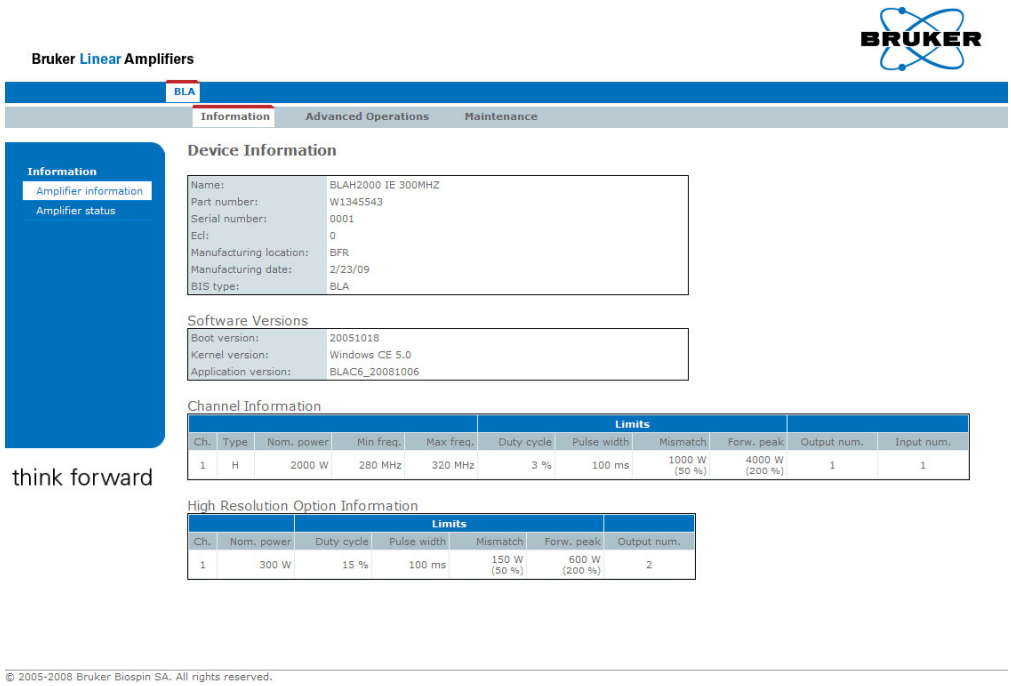

Figure 6.1. Device Information

This page gives you general information about the amplifier (default page).

In the main toolbar, we can see that a BLA is displayed.

The left panel is the navigation menu. It can be used to navigate through the service pages or choose another tab in the sub toolbar.

Amplifier Status *6.2.2*

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

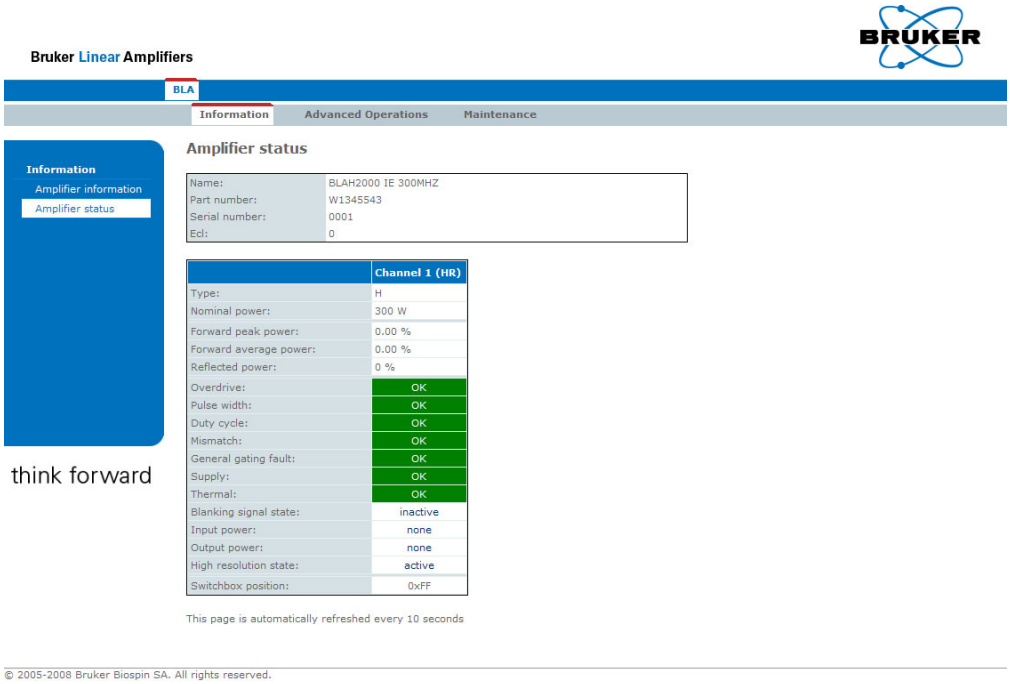

Figure 6.2. Amplifier Status (300W)

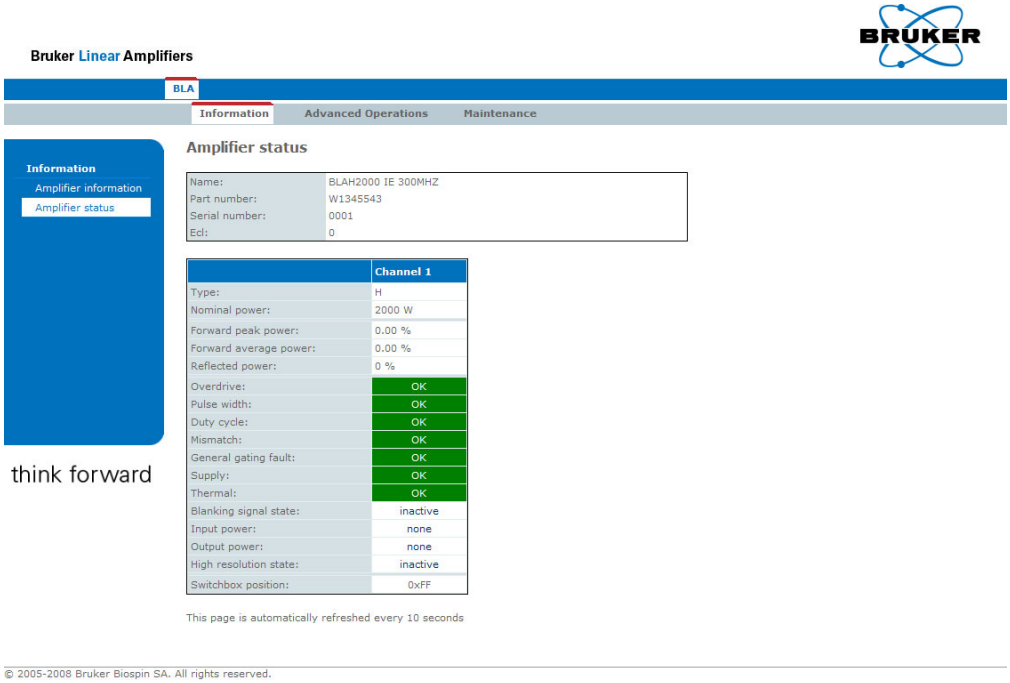

Figure 6.3. Amplifier Status (2000W)

Sub Toolbar Advanced Operations 6.3

Device Information (advanced) 6.3.1

You should get the following start screen.

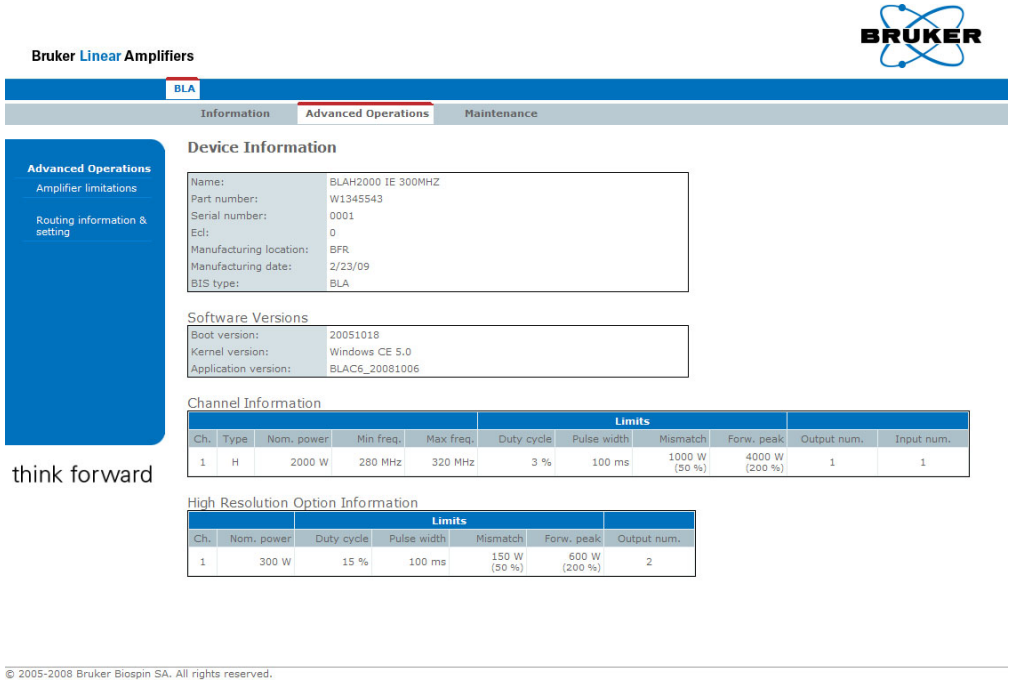

Figure 6.4. Device Information

This page gives you general information about the amplifier.

The left panel is the navigation menu. It can be used to navigate through the service pages or choose another tab in the sub toolbar.

Amplifier Limitations *6.3.2*

Leads you to a page giving several default and current limits of the amplifier.

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

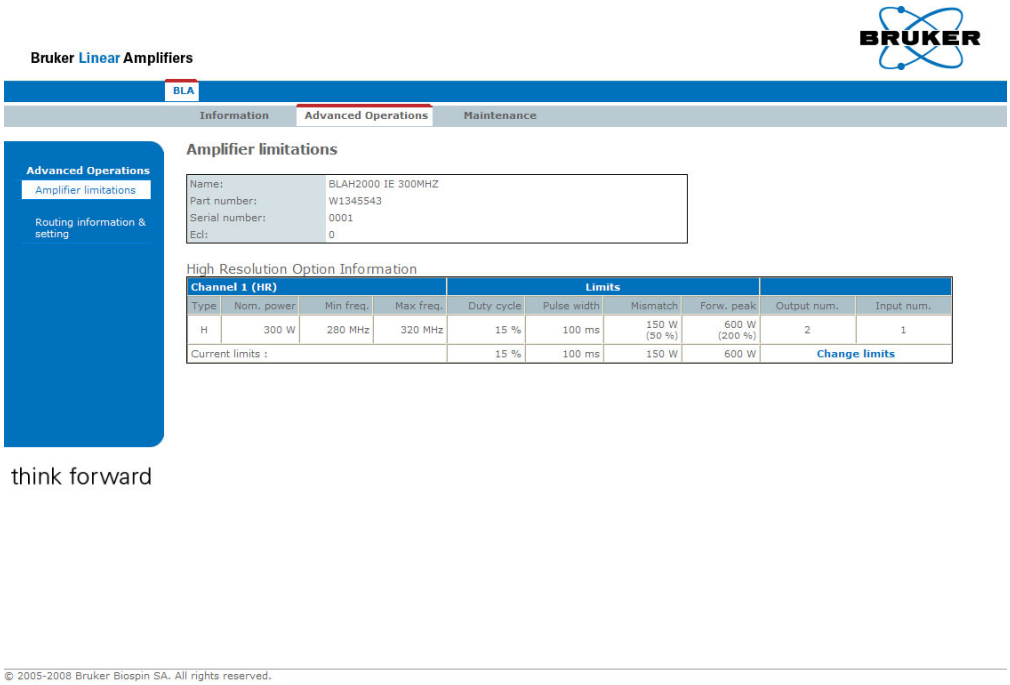

Figure 6.5. Amplifier Limitations (300W)

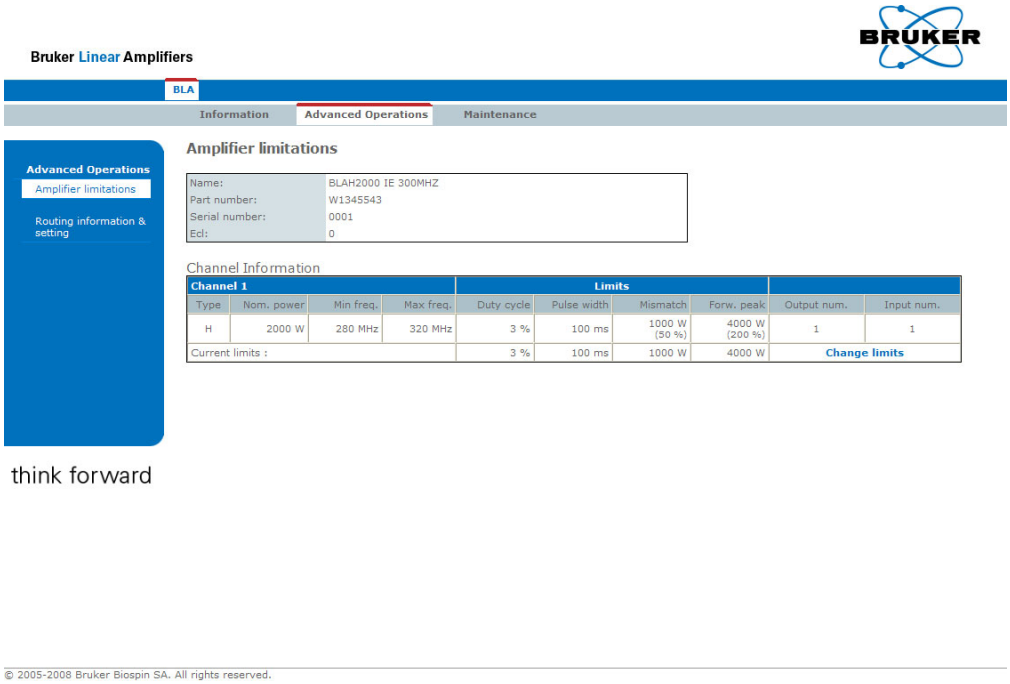

Figure 6.6. Amplifier Limitations (2000W)

Change Limits *6.3.3*

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

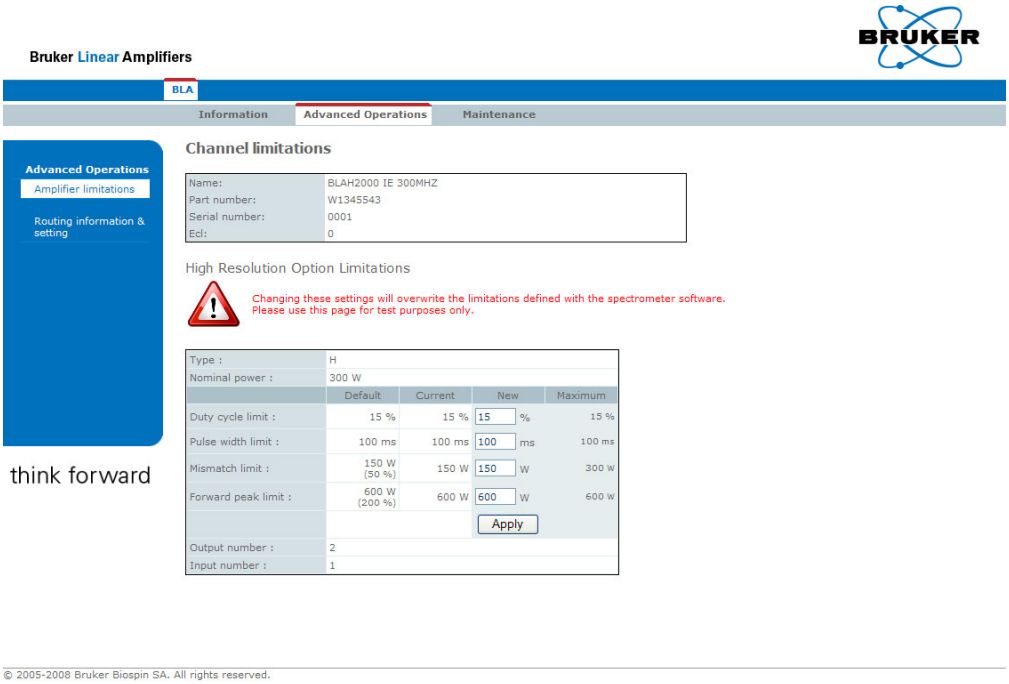

Figure 6.7. Change Limits (300W)

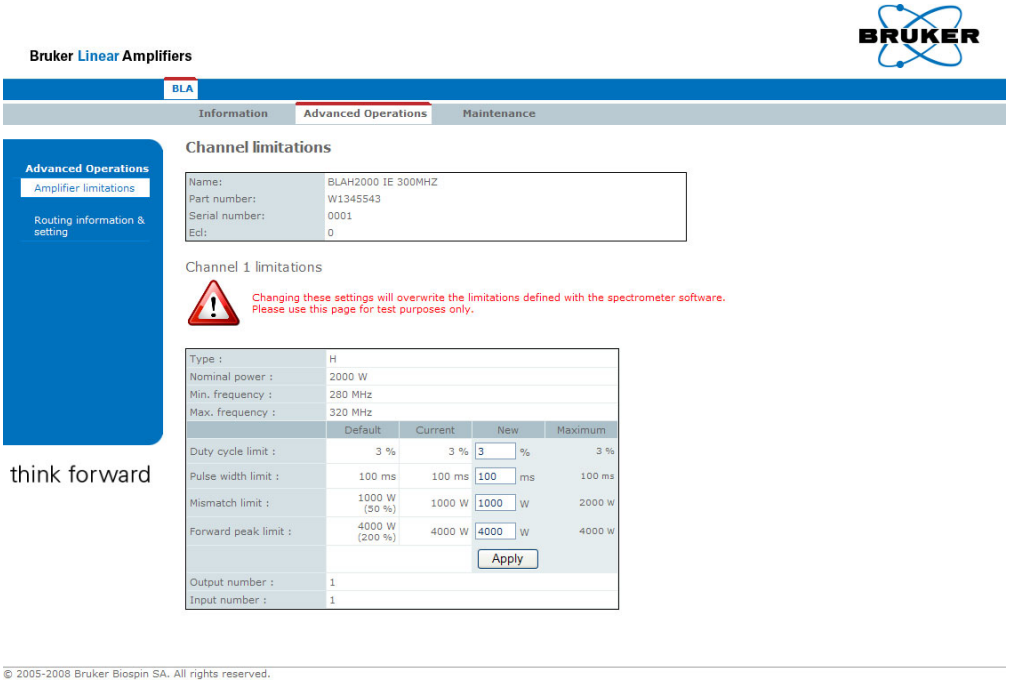

Figure 6.8. Change Limits (2000W)

Routing Information and Setting *6.3.4*

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

Default RF path is INPUT 1 to CHANNEL 1.

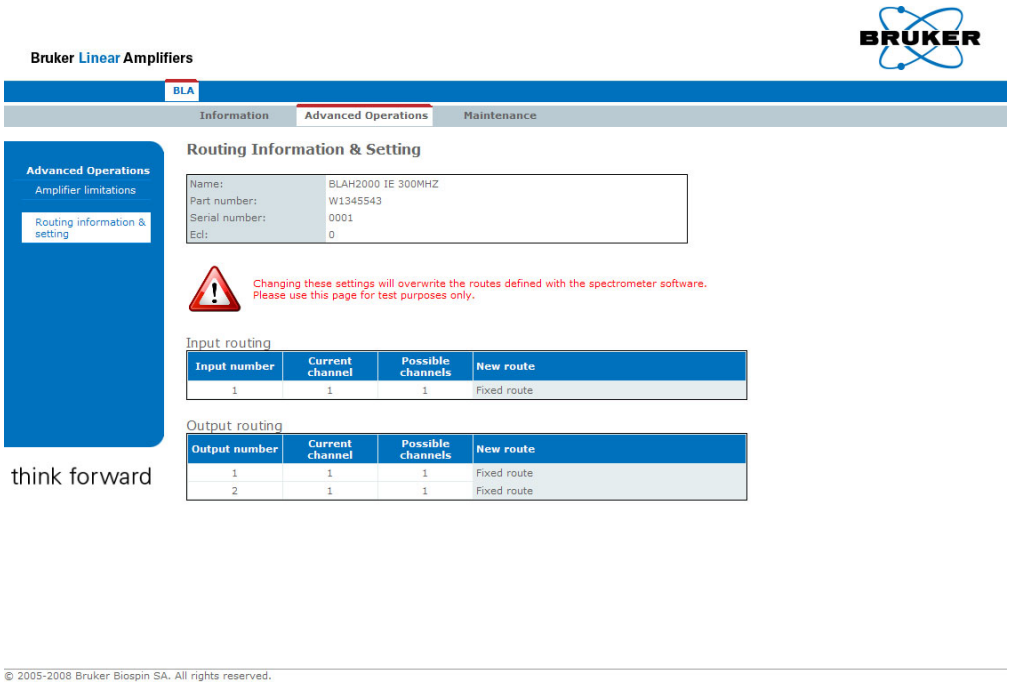

Figure 6.9. Routing Information and Setting

Because of fixed route, it is not possible to change anything.

Sub Toolbar Maintenance 6.4

Device Information (maintenance) 6.4.1

You should get the following start screen.

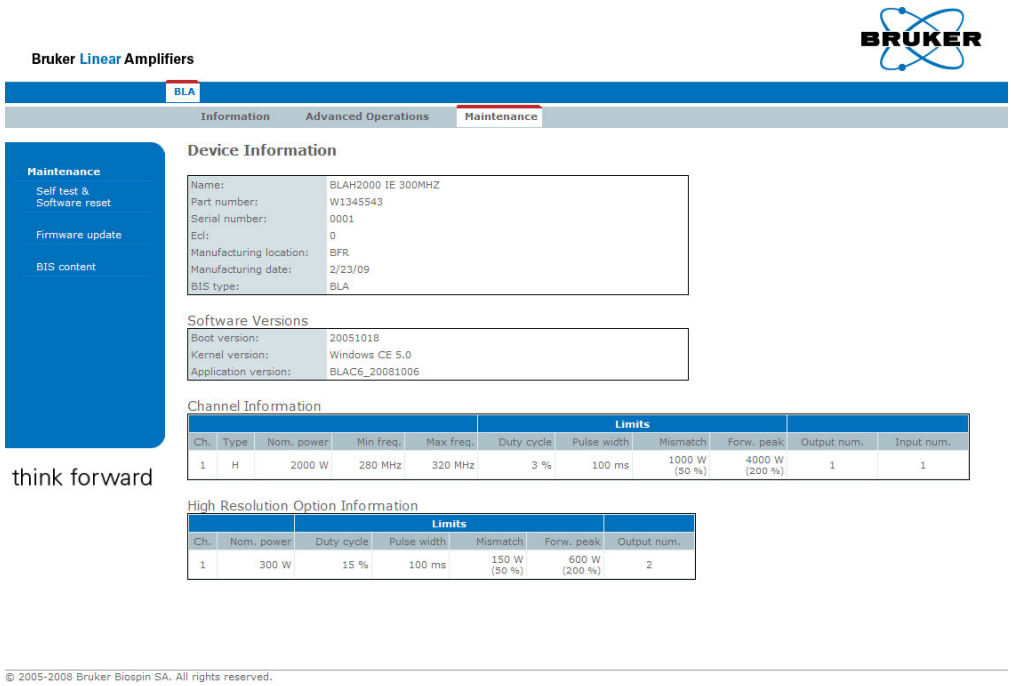

Figure 6.10. Device Information

This page gives you general information about the amplifier.

The left panel is the navigation menu. It can be used to navigate through the service pages or choose another tab in the sub toolbar.

Self-Test & Software Reset *6.4.2*

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.

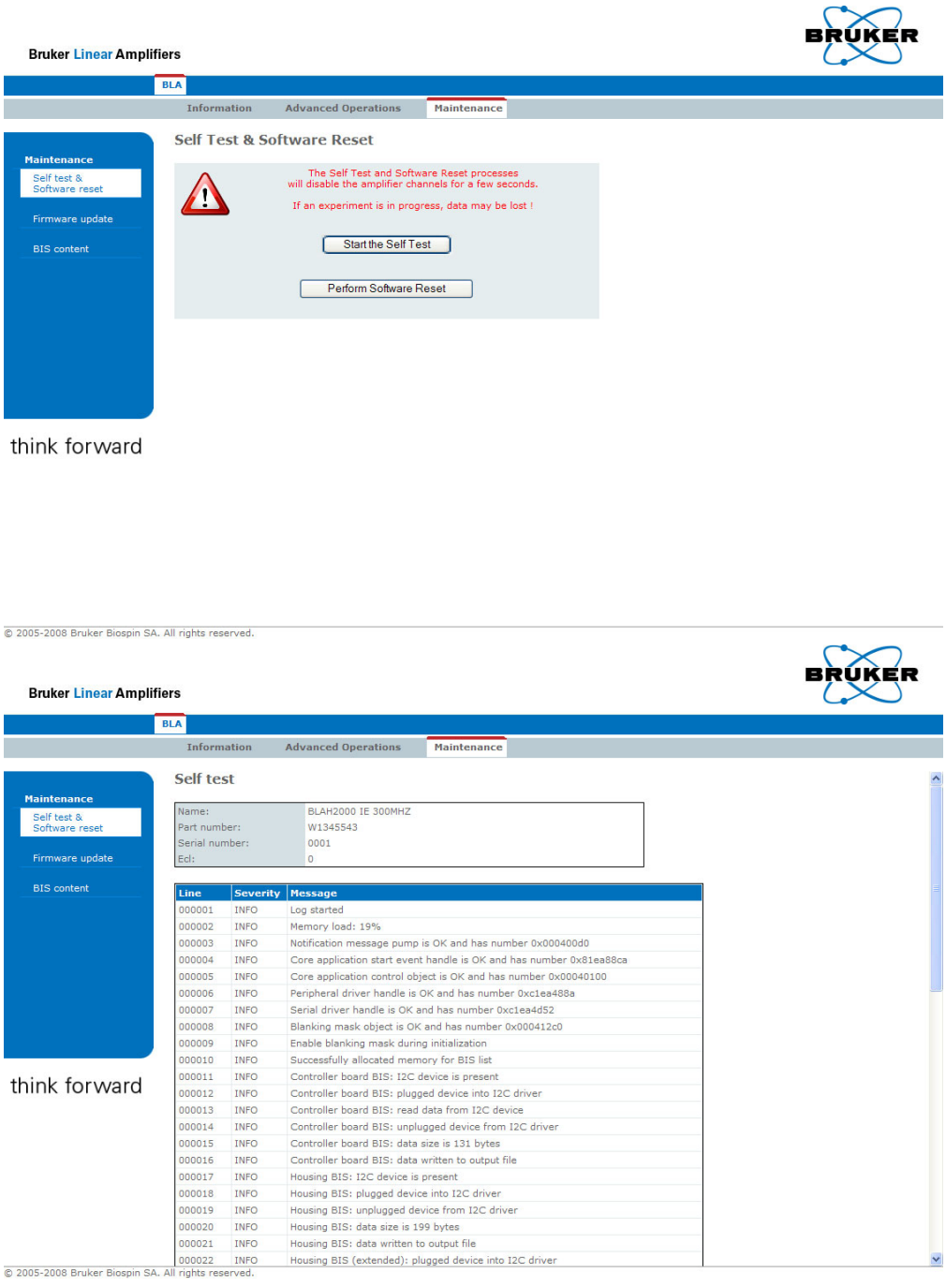

Figure 6.11. Perform Self Test and Report

Read the warnings, press ***Start the Self Test***.

You should have only gray lines in the report.

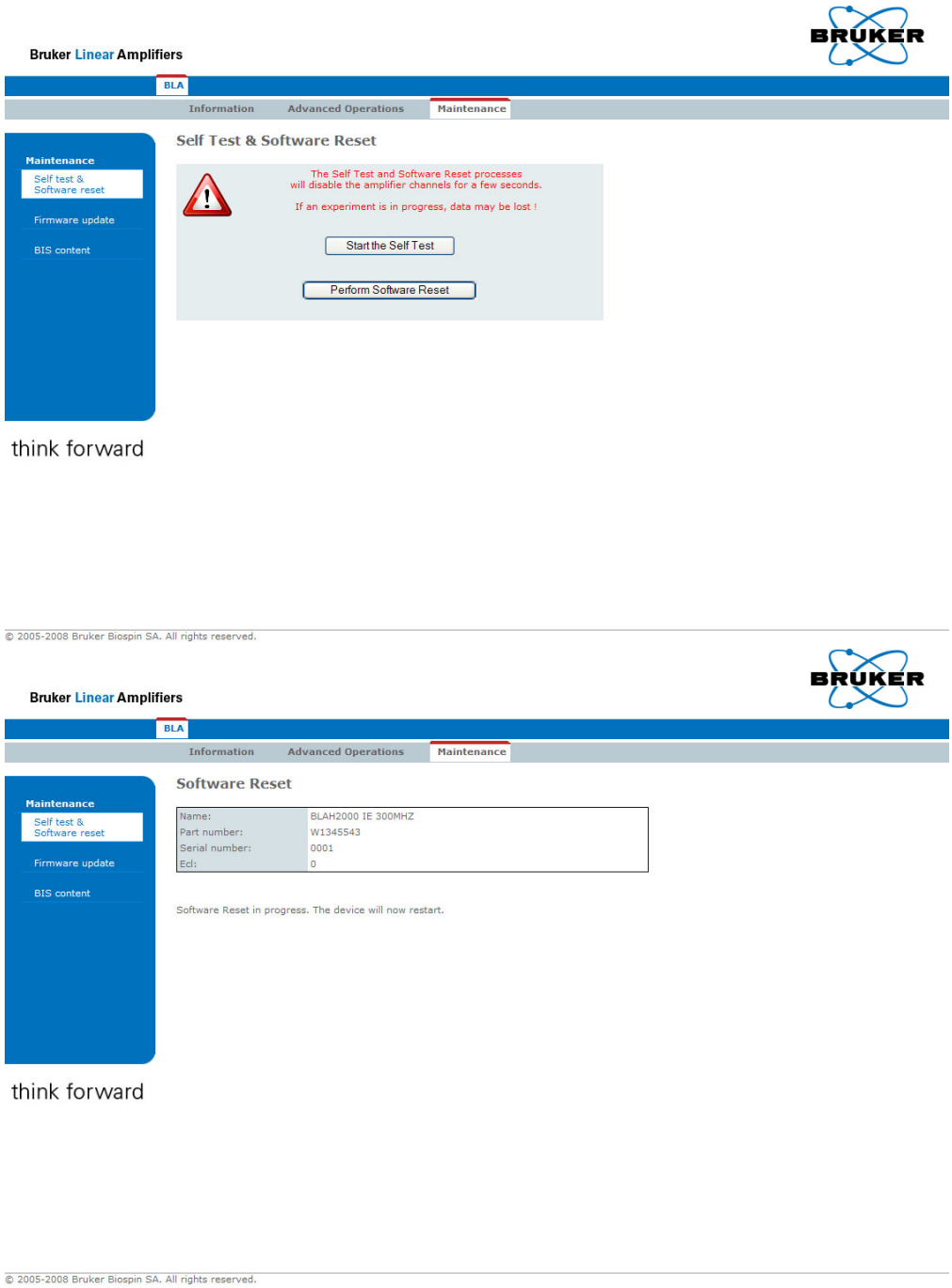

Figure 6.12. Perform Software Reset and Report

Read the warnings, press ***Perform Software Reset***.

You should have the following screen.

Firmware Update *6.4.3*

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

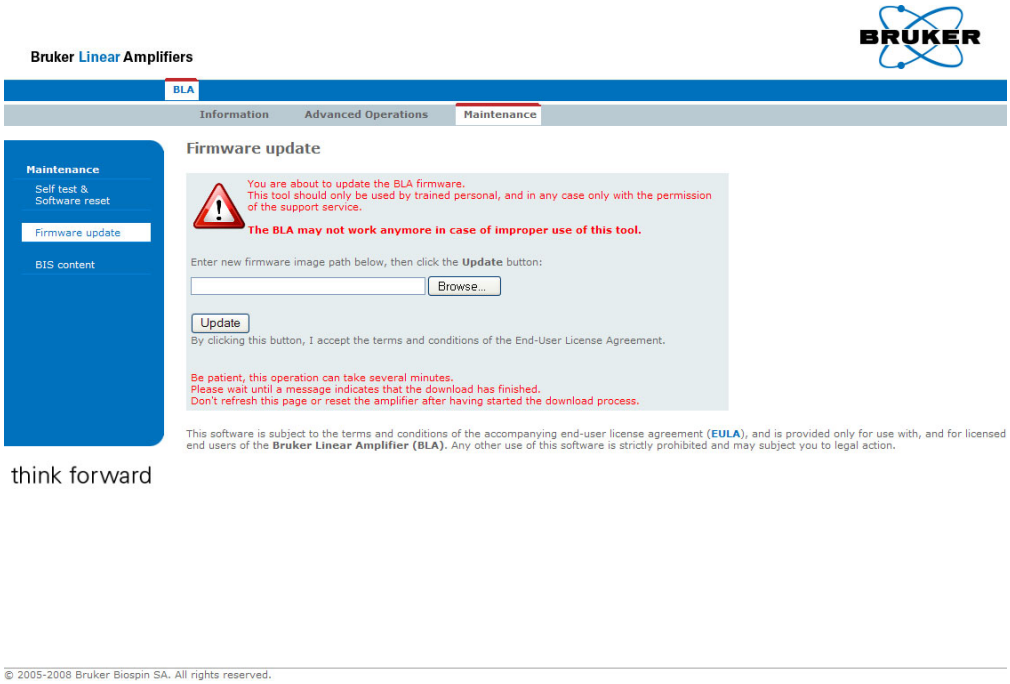

Figure 6.13. Firmware Update

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.

BIS Content *6.4.4*

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

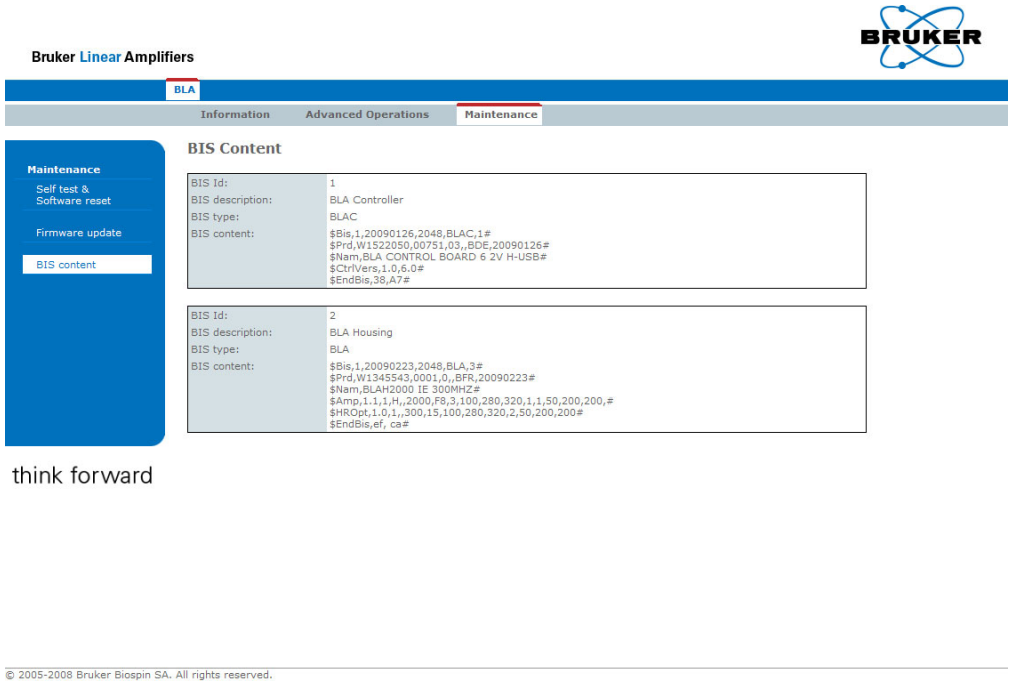

Figure 6.14. BIS Content

Specifications 7

Common Characteristics 7.1

Table 7.1. Amplifier Common Characteristics

Constant Internal Protection	Supplies, fans faults and over temperature. Forward Power : peak & CW power, pulse width and duty cycle. Reflected Power : peak & CW power, self resetting protection shuts the amplifier off if the load VSWR is excessive.
Front Panel Indicators	Amplifier Status Led Board.
Front Panel Interfaces	1 x I/O 8 pins RJ45 connector.
Front Panel Controls	1 x AC line ON/OFF switch, 1 x SEL 2000/300 control signal.
Front Panel Connectors	1 x RF input, 1 x RF output, 1 x blanking input (gating), 1 x amplifier error.
Rear Panel Connectors	1 x AC line in socket.
Cooling System	Forced-air cooling (from front to rear).
Size	19" rack cabinet x 4U height x 520mm depth.
Weight	30kg
Power Requirements	208-230 VAC ± 10% single phase 50-60Hz. Bruker Biospin part number 50776. Consumption max. 1.10kVA.

General Specifications 7.2

Channel 300W Output 7.2.1

Table 7.2. Channel 300W Output Specifications

Frequency Range	280 to 320MHz
Linear Gain	54dB ±1dB typical
Gain Flatness	±1dB max.
Minimum Pulsed Output Power (@ nominal Input +4dBm)	300W min. full range
CW Output Power (Internal Limitation)	45W max.
Linear Output Power	300W or better @ 1dB compression
Linearity	±1dB to 300W typical @ 300MHz
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	9dB typical
Output Noise Power (Unblanked)	-112dBm @ 1Hz
Output Noise Power (Blanked)	Thermal Noise
Input/Output Impedance	50Ω
Input V.S.W.R.	1.6 : 1 max.
Output Harmonics (2fc ; 3fc) @ 300MHz	-50dBc ; -55dBc max. @ 300W
Pulse Width (Internal Limitation)	100ms @ 300W (up to CW @ 45W)
Duty Cycle (Internal Limitation)	15% @ 300W (up to 100% @ 45W)
Droop & Pulse Flatness	±2% typical @ 300W for 10ms Pulse Width
Amplitude Stability vs. Temperature	±0.15% / °C max.

Channel 2000W Output *7.2.2*

Table 7.3. Channel 2000W Output Specifications

Frequency Range	280 to 320MHz
Linear Gain	62dB ±1dB typical
Gain Flatness	±1dB max.
Minimum Pulsed Output Power (@ nominal Input +4dBm)	2000W min. full range
CW Output Power (Internal Limitation)	60W max.
Linear Output Power	1600W typical @ 1dB compression
Linearity	±1dB to 1600W typical @ 300MHz
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	4dB typical
Output Noise Power (Unblanked)	-108dBm @ 1Hz
Output Noise Power (Blanked)	Thermal Noise
Input/Output Impedance	50Ω
Input V.S.W.R.	1.6 : 1 max.
Output Harmonics (2fc ; 3fc) @ 300MHz	-55dBc ; -50dBc min. @ 2000W
Pulse Width (Internal Limitation)	100ms @ 2000W (up to CW @ 60W)
Duty Cycle (Internal Limitation)	3% @ 2000W (up to 100% @ 60W)
Droop & Pulse Flatness	±3% typical @ 2000W for 10ms Pulse Width
Amplitude Stability vs. Temperature	±0.15% / °C max.

Service Information and Maintenance 8

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 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 Assemblies.

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 assembly 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 could be done every 4 years.

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

- **W1346530** «PUSH FAN ASSEMBLY BLA1000/300».
- **W1346531** «PULL FAN ASSEMBLY BLA1000/300».

Operation *8.1.1*

1. Disconnect all cables from the front panel and the supply connector on the rear panel. Remove the amplifier from the MRI 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 (two red/white wires) from the left side of the RF module.

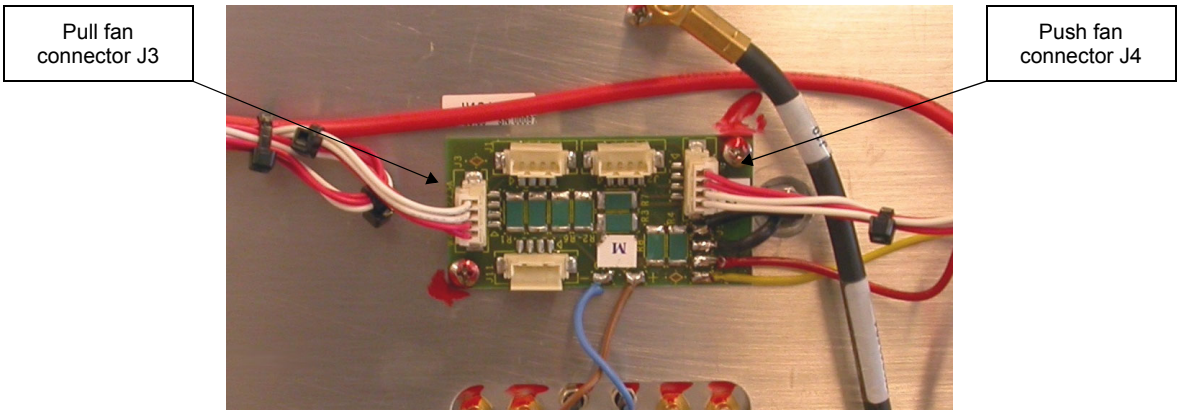

Figure 8.1. Fan Supplies and Status Connections

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

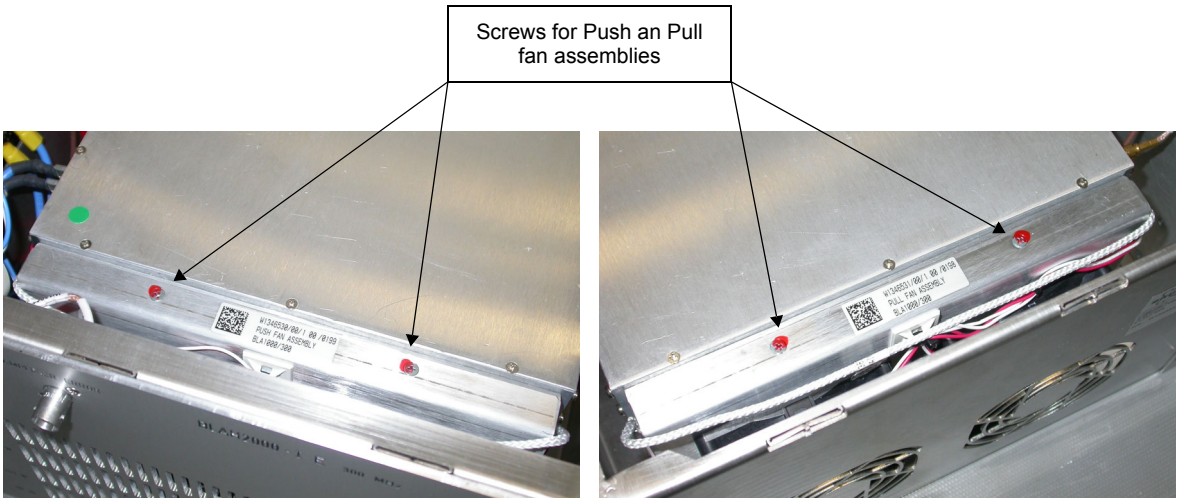

Figure 8.2. Push Fan Assembly

5. Remove the Push and Pull fan assemblies.
6. Place correctly the new fan assembly sets in the bottom holes of the RF module and screw it on the top.
7. Connect the 2 red/white wires on the left side of the RF module (J3 and J4).
8. Connect line cord and turn on the amplifier. Note that the fans are turning and no OVERHEAT status led appears on front panel.
9. Turn off the amplifier and disconnect the line cord.
10. Put the coverage plate on the amplifier and screw it.
11. Put the amplifier in the MRI console, connect all cables on the front panel and the line cord on the rear panel.

Figures

Figures

Tables

Tables

End of Document

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