



Bruker BioSpin

# BLAH500 E •

Amplifier 700-900 MHz  
Operating & Service Manual

Version 001

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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

	<b>Contents .....</b>	<b>iii</b>
<b>1</b>	<b>General Information .....</b>	<b>5</b>
1.1	Introduction .....	5
<b>2</b>	<b>Safety .....</b>	<b>7</b>
2.1	Labels .....	7
	Identifying plate .....	7
	Manufacturer's nameplate .....	8
2.2	Safety labels and symbols .....	9
	Warning signs .....	9
<b>3</b>	<b>Installation .....</b>	<b>11</b>
3.1	Initial inspection .....	11
	Mechanical check .....	11
	Claim for damage .....	11
	Reshipment and repackaging requirements .....	11
	Environment requirements .....	12
3.2	Installation requirements .....	12
	Bench operation .....	12
3.3	System check .....	12
3.4	Initial turn on procedure .....	12
<b>4</b>	<b>Operation .....</b>	<b>13</b>
4.1	Front Panel .....	13
	Indicators .....	13
	Coaxial Connectors .....	14
	Interface Connector Ethernet 10/100 .....	14
	Device design .....	15
4.2	Rear Panel .....	16
<b>5</b>	<b>Technical description .....</b>	<b>17</b>
5.1	System Overview .....	17
5.2	Theory of Operation .....	21
	RF Path .....	21
	BLA Control Board .....	23
	Status Led Board .....	25
	BLA Extension Board .....	25
	BIS Board .....	25

<b>6</b>	<b><i>Servicing the BLA</i></b> .....	<b>27</b>
6.1	Accessing the BLA amplifier .....	27
	Amplifier status .....	29
	Amplifier limitations .....	30
	Routing information .....	32
	Self-test & software reset .....	33
	BIS content .....	35
	Firmware update .....	36
<b>7</b>	<b><i>Specifications</i></b> .....	<b>37</b>
7.1	Common Characteristics .....	37
7.2	General specifications Solid output H500 .....	38
7.3	General specifications High Resolution output H50 .....	39
<b>8</b>	<b><i>Service information and maintenance</i></b> .....	<b>41</b>
8.1	Preventive maintenance of the RF module on BLA-type Amplifiers .....	41
	Operation .....	41
	<b><i>Figures</i></b> .....	<b>43</b>
	<b><i>Tables</i></b> .....	<b>45</b>

# General Information

# 1

## Introduction

## 1.1

The BLAH500 E amplifier is a broadband linear pulse power amplifier specifically designed for Nuclear Magnetic Resonance and Magnetic Resonance Imaging (NMR/MRI) applications from 16 to 21 Tesla Systems. It is commercialized under the BRUKER part number W1345505.

Operating linear class AB, it provides 500W and more peak RF power over the frequency range 650-900MHz on the H500 output for the Solid applications and 50W and more peak RF power on the H50 output for the High Resolution applications.

The amplifier is equipped with N-CHANNEL LDMOSFET transistors of the latest generation. The unit can provide full power for any combination of pulse width and duty cycle up to 100ms and 20% (10% for the H500 output).

Its built-in protection circuitry will allow lower power pulses for longer pulse widths and duty-cycles, maintaining a 50W average power on the H500 output and 10W average power on the H50 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 entire unit is housed in a 19" ,3U, 520mm rack cabinet

**General Information**



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The BLAH500 E Amplifier 700-900MHz is in accordance with the standard 61010-1 safety Requirements for Electrical Equipments.

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## Labels

## 2.1

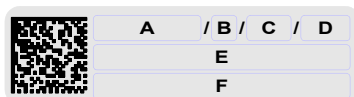
Labels are provided to alert operating and service personnel to conditions that may cause personal injury or damage to the equipment from misuse or abuse. Please read the labels and understand their meaning.

### Identifying plate

### 2.1.1

The BLAH500 E 700-900MHz can be identified by an identifying plate at the front panel of the unit that has following information.

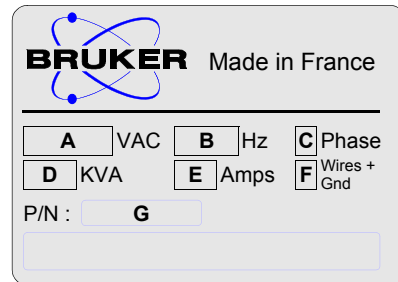
Figure 2.1. Identifying plate



- **(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.

The BLAH500 E 700-900MHz 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 signs

2.2.1



**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 with 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. 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."**

# Installation

## **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.

## **System check**

**3.3**

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

- The AC input voltage 220-230 VAC  $\pm$  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 BLAH500 E has a nominal input level of +4dBm. Ensure that the system drivers are operating at these levels.

## **Initial turn on procedure**

**3.4**

The following list describes how to turn on the BLAH500 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**".

1. Connect the amplifier to the AC line and turn the circuit breaker 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

4.1

The BLAH500 E front panel is provided with 12 indicators for status monitoring, 7 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 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 acceptable 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.
H500	Indicates when the RF Power is present on the Solid output.
H50	Indicates when the RF Power is present on the High Resolution output.

Table 4.2. Coaxial Connectors assignment

IN1, IN2, IN3	RF inputs of the embedded router, SMA type connector (female). Default entry is IN1 and allows to the BLAH500 E to deliver full power at nominal +4dBm drive.
H500	RF OUT H500 (Solid output) N type connector (female).
H50	RF OUT H50 (High Resolution) N type connector (female).
BLNK	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 H500/H50	BNC type connector (female). When the SELH500/H50 signal is at TTL level low (0V), the Solid output H500 is selected. When the SELH500/H50 signal is at TTL level high (5V), the High Resolution output H50 is selected.

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

Figure 4.1. BLAH500 E Front Panel Design

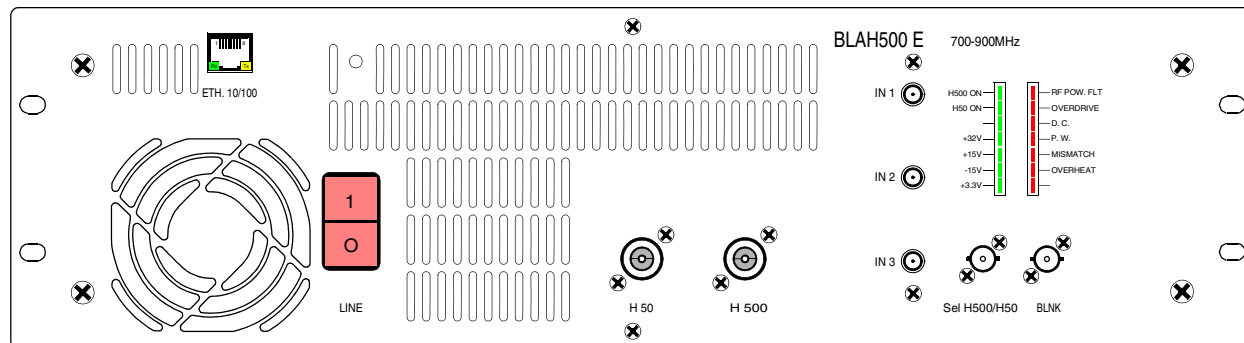
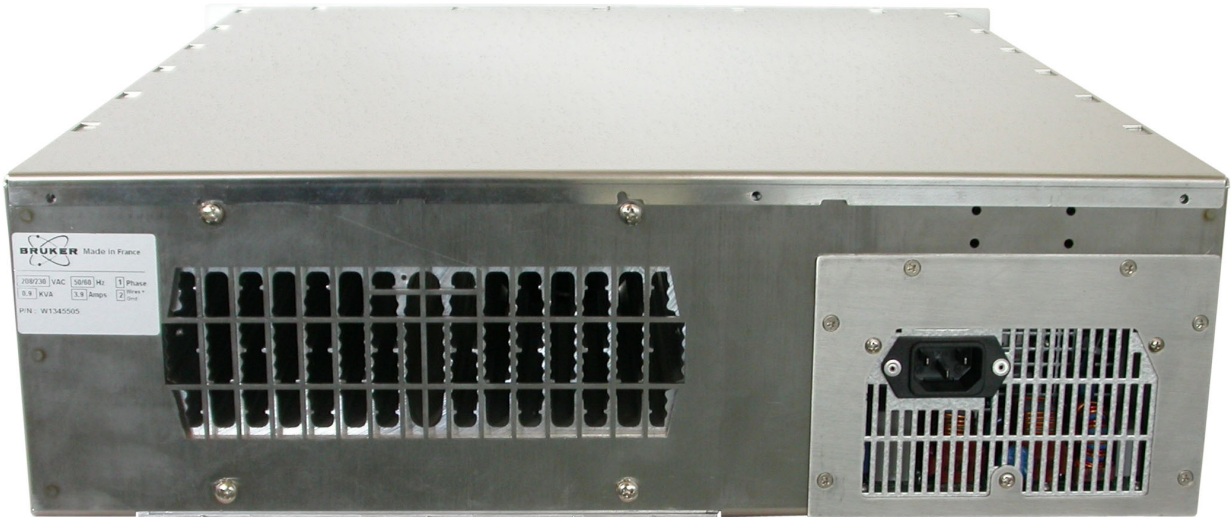


Figure 4.2. BLAH500 E Front Panel View



The rear Panel of the BLAH500 E Amplifier is free of elements in exception of the 3 poles (2P+E) line filter socket.

Figure 4.3. BLAH500 E Rear View





The BLAH500 E amplifier provides :

- A RF Output of 500W and more on the Solid Output H500, over the full frequency range 650 to 900MHz, when selected for Solid operation with SELH500/H50 command controlled at TTL level low.
- A RF Output of 50W and more on the High Resolution Output H50, over the full frequency range 650 to 900MHz, when selected for High Resolution operation with SELH300/H50 command controlled at TTL level High.

The RF section of the system consists of an embedded router fixed on the front panel and a linear module BLMH500/H50-E mounted around a single, self-contained Push fan assembly, heatsink.

The embedded router has three RF inputs and one RF output feeded to the driver amplifier located on the BLMH500/50-E module.

A linear class A / AB driver using switches and bias voltage gatings, delivers the RF input power to the Power Amplifier.

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

The class AB power amplifier is located on the bottom of the heatsink assembly.

The output of the power amplifier is connected to a bi-directional high dynamic coupler mounted on the front panel of the amplifier. This output will be the Solid H500 Output when the amplifier is controlled for Solid applications.

When controlled for High Resolution applications, the output of the driver is switched to the front panel H50 output via a RF relay and a bi-directional high dynamic coupler.

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 identification information of the amplifier (BIS).

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

Figure 5.1. BLAH500 E System Block Diagram

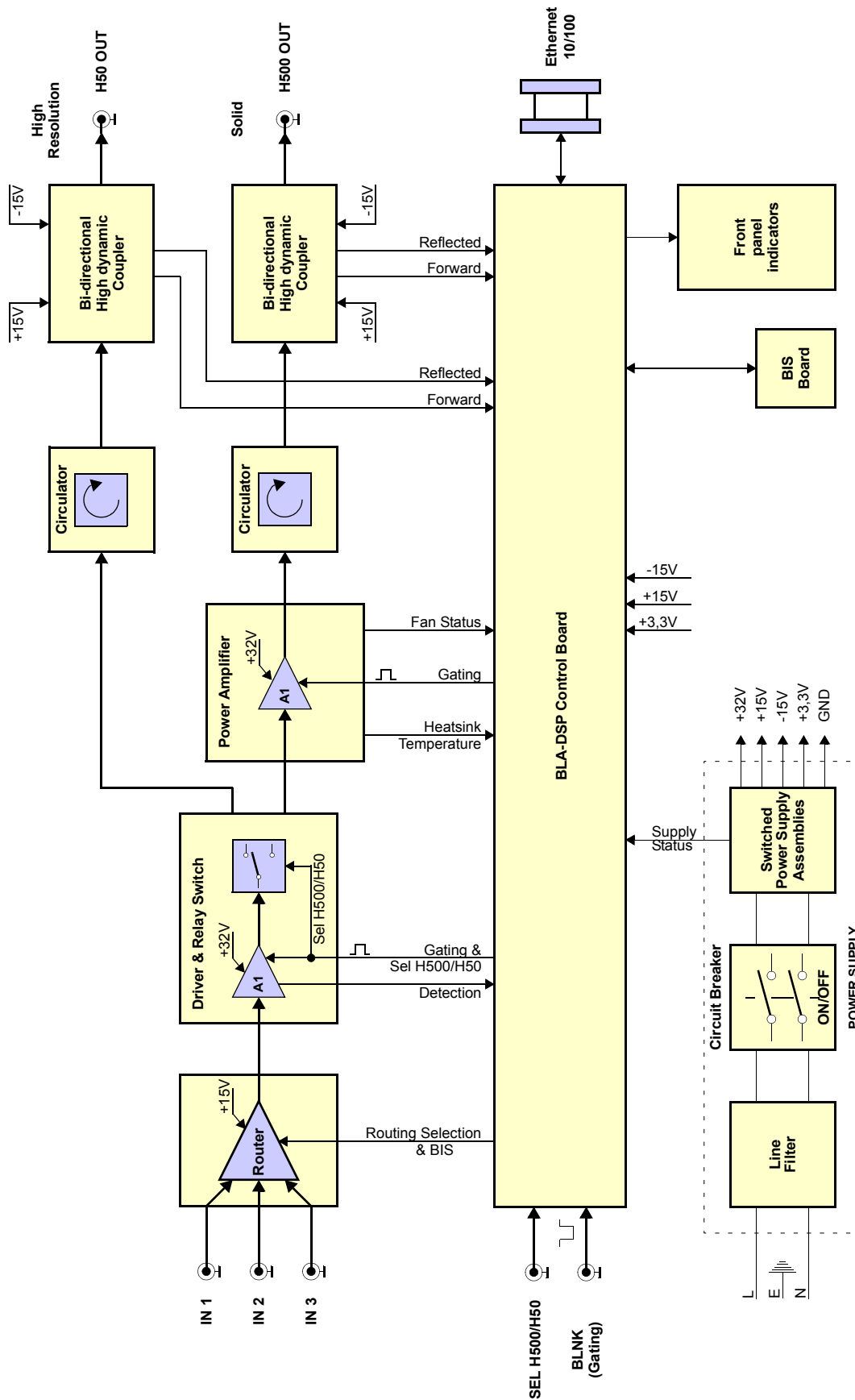


Figure 5.2. Embedded router Block Diagram

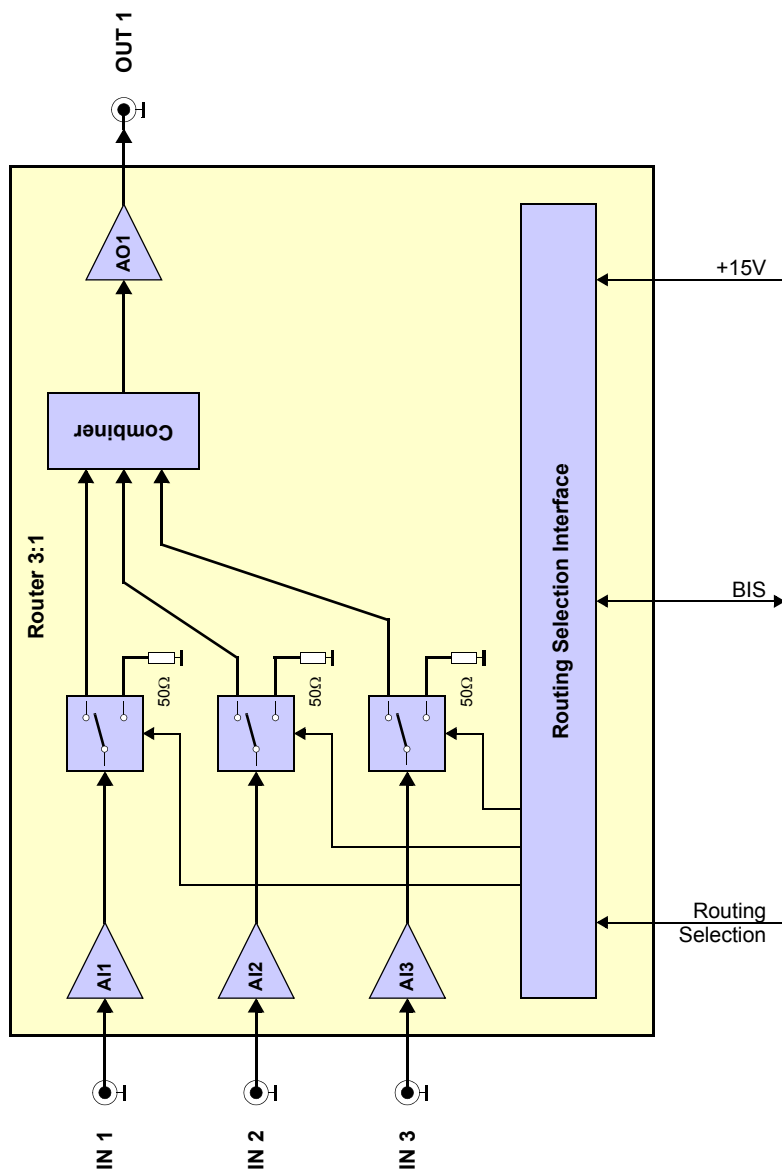
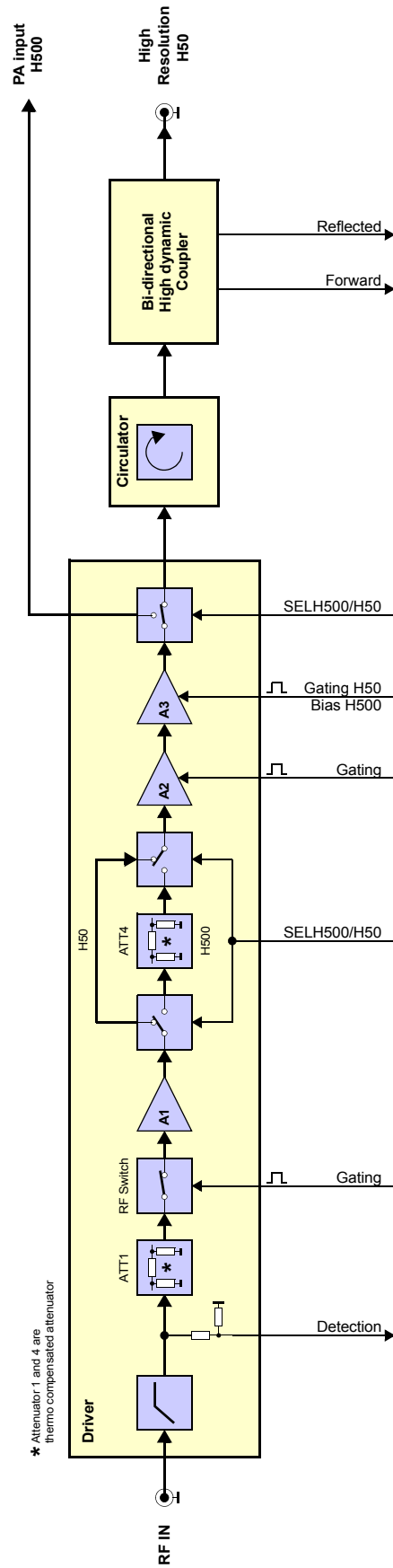


Figure 5.3. Driver Block Diagram



**Theory of Operation****5.2****RF Path****5.2.1**

The BLAH500 E (P/N : W1345505) amplifier consists of a 3 input embedded Router, 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 :

- 50W peak for 20% duty cycle at 100ms pulse width maximum on the High Resolution output H50, when selected as an High Resolution amplifier.  
In this case the 50W driver is directly switched to the front panel via a mechanical relay, a circulator and a bi-directional high dynamic coupler.
- 500W peak for 10% duty-cycle at 100ms pulse width maximum on the Solid output H500, when selected as a Solid amplifier.  
In this case the output of the 50W driver is switched to the input of the power amplifier via the mechanical switch.

The unit is also capable of longer pulses for lower average power, up to 50W CW Power on the Solid output H500 (10W CW on the High Resolution output H50).

**Embedded Router**

The embedded Router consists of a Class A RF amplifier IC's and RF switches, manufactured on a Gallium Arsenide process.

It is built on a four independent cells architecture with three RF input cells and one RF output cell. The RF input cell ensures function of amplification and routing, the output cell ensures the function of combining, RF amplitude thermo-stability and amplification.

The three RF inputs could be routed alone or combined each other to the RF output by selecting the wished RF path through the BLA controller board. Each entire RF path has a nominal 15dB of gain and operates at +15V DC.

Also, the router is equipped with a EEPROM for BIS information.

**RF Driver**

In the first section of the driver, the RF input signal is fed through a 5 poles High Pass filter and the RF detection path. Then, via a thermal PAD attenuator and a GaAs RF switch, the RF signal is conveyed to a hybrid amplifier.

In this section, the GaAs RF switch requires a control board conditioned gating signal to control the operation of the switching element.

A commutable H500/H50 attenuator follows the hybrid amplifier.

This attenuator is built of two GaAs RF switches, commutated by a control board conditioned signal SELH500/H50 and a thermo-compensated attenuator for compensation of the output power drift with temperature of the amplifier when channel H500 is selected.

This commutable attenuator is needed to minimize gain of about 5dB when the amplifier is operating in Solid mode H500 and full gain in HR mode H50. It is divided in variable resistive attenuator to adjust output power and the Thermal-PAD.

The second section of the driver includes a Class AB MOSFET transistor followed by a Class AB LDMOSFET transistor.

The polarisations of these transistors require a control board conditioned gating signal to control the bias voltage on the gate of the FET.

The polarisation of the LDMOSFET power transistor depends of the selection H500/H50 to prevent the increasing of anti-droop behaviour. If H500 is selected then gating signal is unblanked else if H50 is selected it is blanked. The circuitry around the transistors consists of complementary input and output transformers and baluns and operates the devices in Push-Pull.

The RF driver has a nominal 25 to 30dB gain and operates at +32VDC.

With the embedded router gain, the entire path has a nominal 45dB gain in H50 mode to get the HR output power else 40dB to deliver power to the power amplifier to get the Solid output power.

### ***RF Relay H500/H50***

The coaxial RF relay switches the RF power from the driver via a circulator and bi-directional high dynamic coupler to the High Resolution output H50 on the front panel, when the SELH500/H50 signal is controlled to TTL level high or not connected.

When controlled by SELH500/H50 signal at TTL low, the relay switches the output of the driver to the power amplifier to built the Solid output H500.

### ***RF Coupler H50***

The H50 bi-directional high dynamic coupler provides an approximate 1V peak DC signal for full 50W and also a peak DC signal for reflected power on the High Resolution output H50.

Both signals, forward and reflected, are analyzed by the BLA control board for monitoring and protection setting on the H50 output.

### ***RF Power Amplifier***

The power amplifier includes four Class AB LDMOSFET transistors mounted on a single flange. They are coupled with -6dB 4way splitter/combiner to build a nominal 16dB gain and operates at +32VDC. The power amplifier requires a control board conditioned gating signal to control the bias voltage on the gate of the FETs.

### ***RF Coupler H500***

The H500 bi-directional high dynamic coupler on the front panel provides an approximate 1V peak DC signal for full 500W and also a peak DC signal for reflected power on the Solid output H500.

Both signals, forward and reflected, are analyzed by the BLA Control board for monitoring and protection setting on the H500 output.

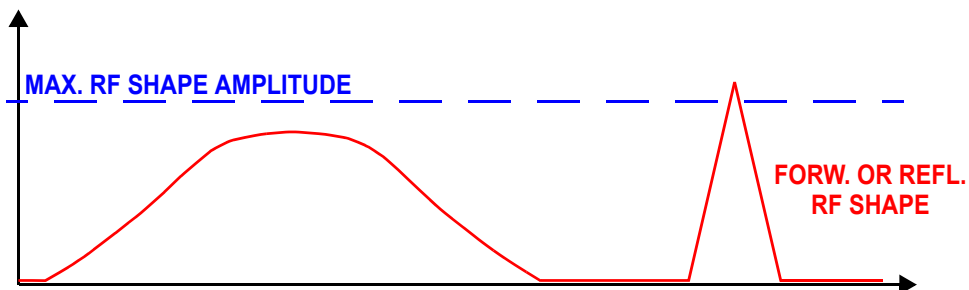
### ***Circulators***

The RF circulator is a three-port passive device made of magnets and ferrite material used to control the direction of signal flow in a circuit. In our case, the circulator is used as an isolator to protect the output power transistor from excessive signal reflection. There is a circulator incorporated between each power output and RF coupler.

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 high dynamic coupler.  
Electronic circuitry processes the detection information and protect the amplifier from overstress like :
  - Forward and reflected peak power.

Figure 5.4. Peak power limitation



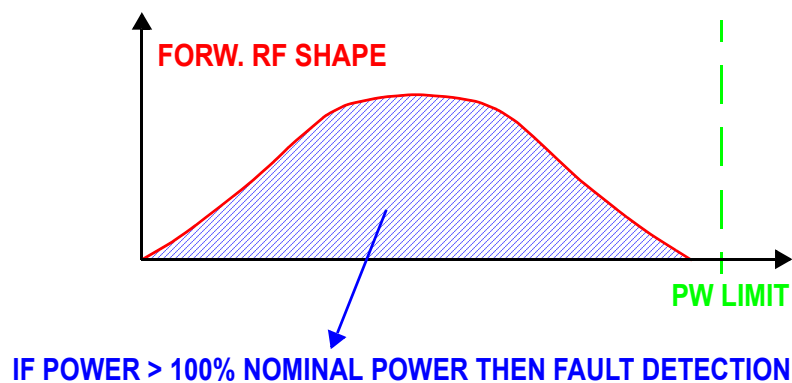
The peak power limitation is the maximum RF forward shape amplitude allowed at the amplifier output.

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 5.5. Forward pulse width limitation



## Technical description

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

Limitation range : from 0.1 ms to 512 ms.

The pulse width value is updated every 100  $\mu$ s.

- 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 100  $\mu$ s.

- 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  $\mu$ 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 timings

Table 5.1. *Fault detection timings*

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

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



- Fault protection reset

If one of these over stresses 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).

### **Status Led Board**

**5.2.3**

---

The Status Led Board, on the front panel of the amplifier, displays over stress functions, supplies status, and so on, as described in "**Indicators**" on page 13 and "**BLA Control Board**" on page 23.

### **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 BLAH500 E Amplifier 700-900MHz 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 BLAH500 E Amplifier 700-900MHz, 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.

# Servicing the BLA

Figure 6.1. Device Information

**BRUKER** BLA Service Web

**Bruker Linear Amplifier**  
Device Information

**Amplifier information**

- Amplifier status
- Amplifier limitations
- Routing information
- Self test & Software reset
- BIS content
- Firmware update

Name: BLAH500 E 700-900MHZ  
 Part number: W1345505  
 Serial number: 0001  
 Ecl: 0  
 Manufacturing location: BFR  
 Manufacturing date: 5/22/07  
 BIS type: BLA

**Software versions**

Boot version: 20051018  
 Kernel version: Windows CE 5.0  
 Application version: 20060727

**Channel Information**

Ch.	Type	Nom. power	Min freq.	Max freq.	Limits				Output num.	Input num.
					Duty cycle	Pulse width	Mismatch	Forw. peak		
1	H	500 W	650 MHz	900 MHz	10 %	100 ms	250 W (50 %)	1000 W (200 %)	1	Via router

**High Resolution Option Information**

Ch.	Nom. power	Limits			Output num.
		Duty cycle	Pulse width	Mismatch	
1	50 W	20 %	100 ms	25 W (50 %)	2

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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 Solid)

**BRUKER BLA Service Web**

**Bruker Linear Amplifier**  
Amplifier status

Amplifier information	Name: BLAH500 E 700-900MHZ Part number: W1345505 Serial number: 0001 Ecl: 0	
Amplifier status		
Amplifier limitations		
Routing information		
Self test & Software reset	Channel 1 (HR) Type : H Nominal power : 50 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 : active Switchbox position : 0xFF	
BIS content		
Firmware update		
This page is automatically refreshed every 10 seconds		

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**BRUKER BLA Service Web**

**Bruker Linear Amplifier**  
Amplifier status

Amplifier information	Name: BLAH500 E 700-900MHZ Part number: W1345505 Serial number: 0001 Ecl: 0	
Amplifier status		
Amplifier limitations		
Routing information		
Self test & Software reset	Channel 1 Type : H Nominal power : 500 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 : 0xFF	
BIS content		
Firmware update		
This page is automatically refreshed every 10 seconds		

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# Servicing the BLA

## 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 Solid)

**Amplifier information**  
Bruker Linear Amplifier  
Amplifier limitations

**Amplifier status**

**Amplifier limitations**  
Name: BLAH500 E 700-900MHZ  
Part number: W1345505  
Serial number: 0001  
Ecl: 0

**Routing information**

**Self test & Software reset**

**BIS content**

**Firmware update**

**High Resolution Option Information**

Channel 1 (HR)				Limits					
Type	Nom. power	Min freq.	Max freq.	Duty cycle	Pulse width	Mismatch	Forw. peak	Output num.	Input num.
H	50 W	650 MHz	900 MHz	20 %	100 ms	25 W (50 %)	100 W (200 %)	2	Via router
Current limits :				20 %	100 ms	25 W	100 W	<b>Change limits</b>	

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**Amplifier information**  
Bruker Linear Amplifier  
Amplifier limitations

**Amplifier status**

**Amplifier limitations**  
Name: BLAH500 E 700-900MHZ  
Part number: W1345505  
Serial number: 0001  
Ecl: 0

**Routing information**

**Self test & Software reset**

**BIS content**

**Firmware update**

**Channel Information**

Channel 1				Limits					
Type	Nom. power	Min freq.	Max freq.	Duty cycle	Pulse width	Mismatch	Forw. peak	Output num.	Input num.
H	500 W	650 MHz	900 MHz	10 %	100 ms	250 W (50 %)	1000 W (200 %)	1	Via router
Current limits :				10 %	100 ms	250 W	1000 W	<b>Change limits</b>	

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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 Solid)

**BRUKER BLA Service Web**

**Bruker Linear Amplifier**  
Channel limitations

Amplifier information  
Amplifier status  
**Amplifier limitations**  
Routing information  
Self test & Software reset  
BIS content  
Firmware update

Name: BLAH500 E 700-900MHZ  
Part number: W1345505  
Serial number: 0001  
Ecl: 0

**High Resolution Option Limitations**  
*Warning : Changing these settings will overwrite the limitations defined with the spectrometer software. Please use this page for test purposes only.*

Type :	H			
Nominal power :	50 W			
	Default	Current	New	Maximum
Duty cycle limit :	20 %	20 %	<input type="text" value="20"/> %	20 %
Pulse width limit :	100 ms	100 ms	<input type="text" value="100"/> ms	100 ms
Mismatch limit :	25 W (50 %)	25 W	<input type="text" value="25"/> W	50 W
Forward peak limit :	100 W (200 %)	100 W	<input type="text" value="100"/> W	100 W
			<input type="button" value="Apply"/>	
Output number :	2			
Input number :	Via router			

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**BRUKER BLA Service Web**

**Bruker Linear Amplifier**  
Channel limitations

Amplifier information  
Amplifier status  
**Amplifier limitations**  
Routing information  
Self test & Software reset  
BIS content  
Firmware update

Name: BLAH500 E 700-900MHZ  
Part number: W1345505  
Serial number: 0001  
Ecl: 0

**Channel 1 limitations**  
*Warning : Changing these settings will overwrite the limitations defined with the spectrometer software. Please use this page for test purposes only.*

Type :	H			
Nominal power :	500 W			
Min. frequency :	650 MHz			
Max. frequency :	900 MHz			
	Default	Current	New	Maximum
Duty cycle limit :	10 %	10 %	<input type="text" value="10"/> %	10 %
Pulse width limit :	100 ms	100 ms	<input type="text" value="100"/> ms	100 ms
Mismatch limit :	250 W (50 %)	250 W	<input type="text" value="250"/> W	500 W
Forward peak limit :	1000 W (200 %)	1000 W	<input type="text" value="1000"/> W	1000 W
			<input type="button" value="Apply"/>	
Output number :	1			
Input number :	Via router			

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

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

Default RF path is INPUT 1 to CHANNEL1

Figure 6.5. Routing information

The screenshot shows the Bruker BLA Service Web interface. The main content area is titled "Bruker Linear Amplifier Routing Information & Setting". It displays the following information:

- Name: BLAH500 E 700-900MHZ
- Part number: W1345505
- Serial number: 0001
- Ecl: 0

A warning message is displayed: "Warning : Changing these settings will overwrite the routes defined with the spectrometer software. Please use this page for test purposes only."

Below the warning is a table with the following columns: Input number, Current channel, Possible channels, and New route.

Input number	Current channel	Possible channels	New route
1	1	1	Channel 1 <input type="button" value="set new route"/>
2	0	1	no route <input type="button" value="set new route"/>
3	0	1	no route <input type="button" value="set new route"/>

At the bottom left of the page, there is a copyright notice: "© 2005 Bruker Biospin SA. All rights reserved."

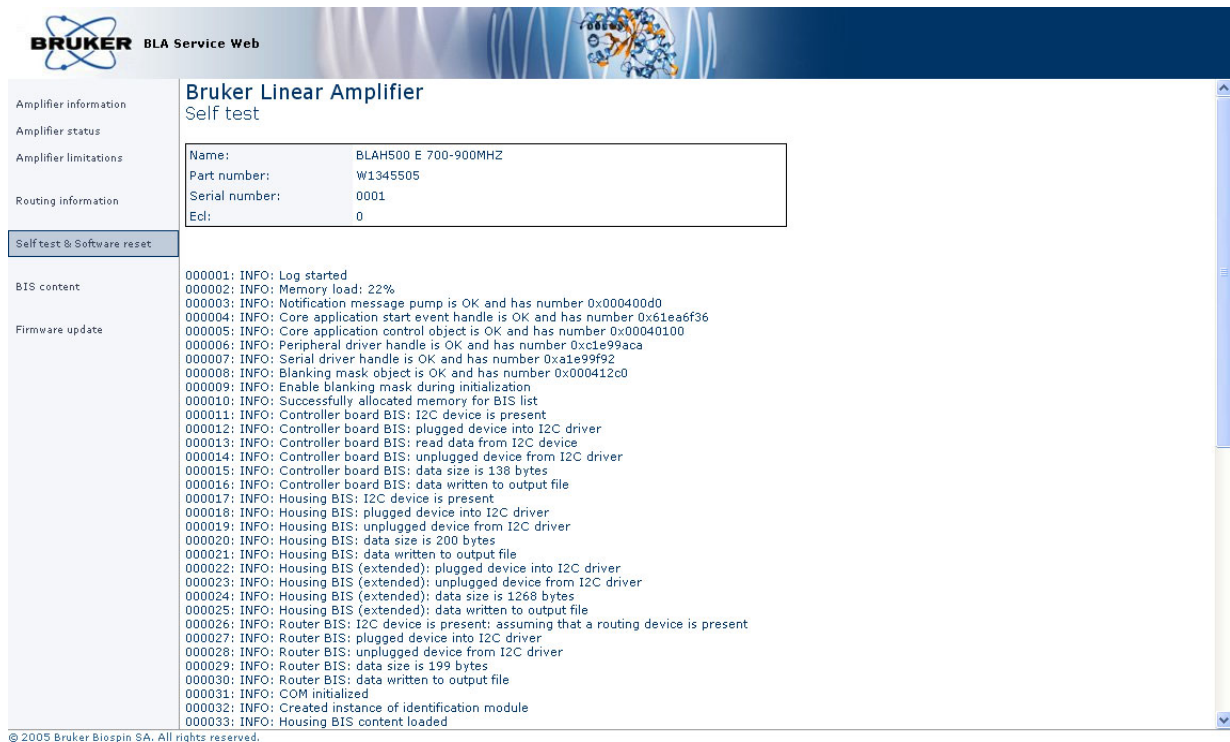
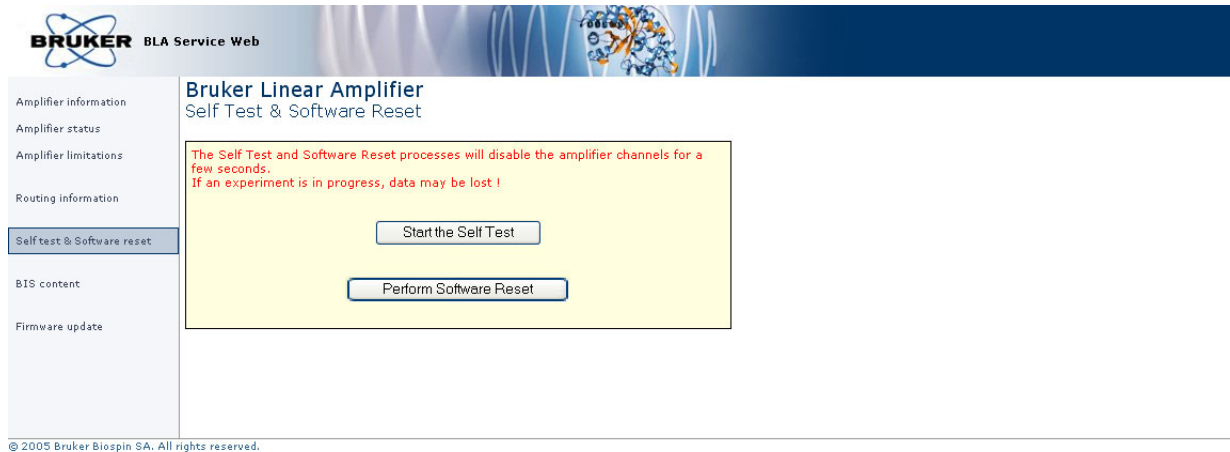
Read the warnings, it is allowed to change routing configuration (ex: new route INPUT 2 to CHANNEL1), press **Set new route** if you are sure of that.



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.

# Servicing the BLA

Figure 6.7. Perform software reset and report

The screenshot shows the 'Bruker Linear Amplifier Self Test & Software Reset' page. On the left is a navigation menu with options: Amplifier information, Amplifier status, Amplifier limitations, Routing information, Self test & Software reset (highlighted), BIS content, and Firmware update. The main content area has a yellow background with a red warning box: 'The Self Test and Software Reset processes will disable the amplifier channels for a few seconds. If an experiment is in progress, data may be lost !'. Below the warning are two buttons: 'Start the Self Test' and 'Perform Software Reset'. The footer contains the text '© 2005 Bruker Biospin SA. All rights reserved.'

The screenshot shows the 'Bruker Linear Amplifier Software Reset' page. The navigation menu is the same as in the previous screenshot. The main content area displays a table with device information:

Name:	BLAH500 E 700-900MHZ
Part number:	W1345505
Serial number:	0001
Ecd:	0

Below the table, the text reads: 'Software Reset in progress. The device will now restart.' The footer contains the text '© 2005 Bruker Biospin SA. All rights reserved.'

Read the warnings, press **Perform software reset**.  
You should have the following screen.

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

Figure 6.8. BIS content

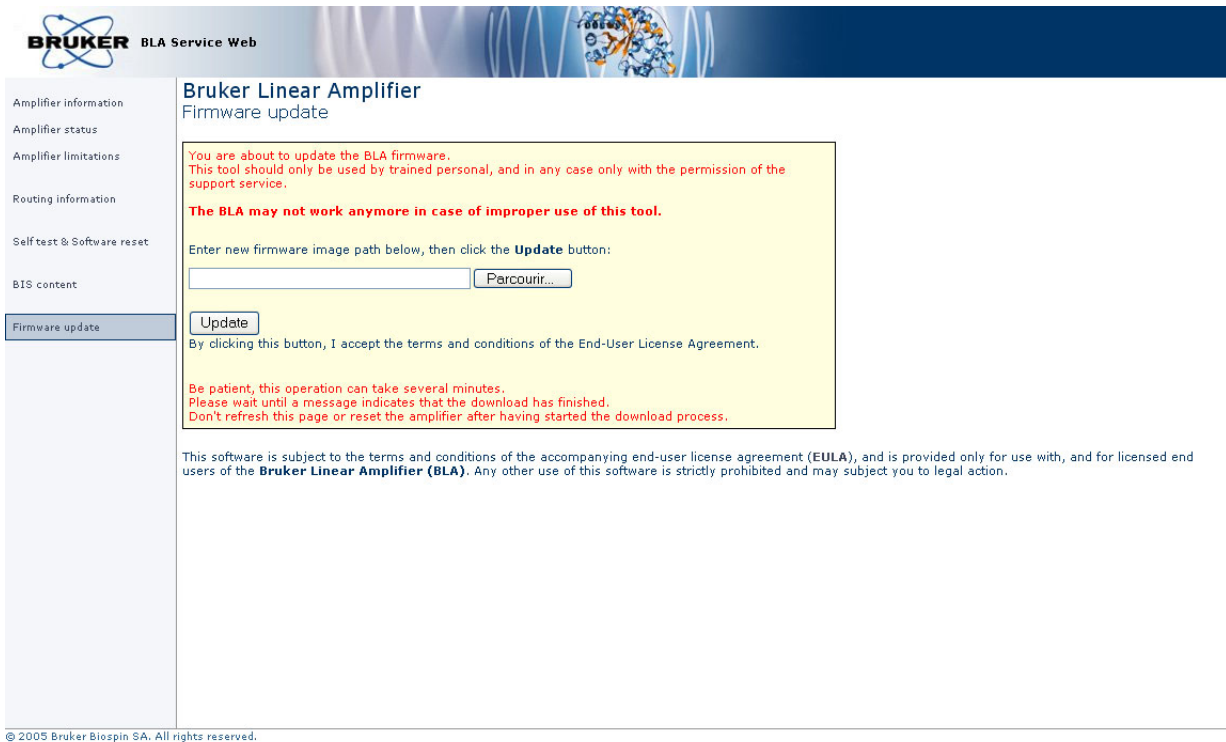
The screenshot shows the Bruker BLA Service Web interface. The main heading is "Bruker Linear Amplifier BIS Content". On the left, there is a navigation menu with options: Amplifier information, Amplifier status, Amplifier limitations, Routing information, Self test & Software reset, BIS content (highlighted), and Firmware update. The main content area displays three BIS configurations:

BIS Id:	Description	Type	Content
1	BLA Controller	BLAC	\$Bis,1,20070228,2048,BLAC,1# \$Prd,W1522050,0053,1,,BDE,20070228# \$Nam,BLA CONTROL BOARD 6 2V H-USB# \$CtrlVers,1.0,6.0# \$EndBis,b0, 38#
2	BLA Housing	BLA	\$Bis,1,20070522,2048,BLA,3# \$Prd,W1345505,0001,0,,BFR,20070522# \$Nam,BLAH500 E 700-900MHZ# \$Amp,1.1,1,H,,500,F8,10,100,650,900,1,0,50,200,200,# \$HROpt,1.0,1,,50,20,100,650,900,2,50,200,200# \$EndBis,Sb, 34#
3	Mini-Router	BLAROUTER	\$Bis,1,20070522,2048,BLAROUTER,1# \$Prd,W1345212,0270,0,,BFR,20070522# \$Nam,BLMMR31 RF AMPLIFIER MODULE# \$RtInChar,1.0,10,1000,15# \$RtInPath,1.0,1,1,1# \$RtInPath,1.0,2,1,# \$RtInPath,1.0,3,1,# \$EndBis,e8, 76#

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

Figure 6.9. 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

## Common Characteristics

## 7.1

Table 7.1. BLAH500 E Common Characteristics

<b>Constant Internal Protection</b>	Supplies & fans faults & Overtemperature Forward Power : peak & CW power pulse width duty cycle Reflected Power : peak & CW power
<b>Front Panel Indicators</b>	Amplifier Status Led Board
<b>Front Panel Interfaces</b>	1 x I/O 8 pins RJ45 connector
<b>Front Panel controls</b>	1 x SELH500/H50 control signal, 1 AC line ON/OFF switch
<b>Front Panel connectors</b>	3 x RF input, 2 x RF output, 1 x blanking input
<b>Rear Panel Interface</b>	AC line in socket
<b>Cooling System</b>	Forced-air cooling (from front to rear)
<b>Size</b>	19" rack cabinet x 3U height x 520mm depth
<b>Weight</b>	19kg
<b>Power requirements</b>	220-230 VAC $\pm$ 15% single phase 50-60Hz, Bruker part number W1304005. Consumption max. 0,9kVA

Table 7.2. BLAH500 E Solid Output H500 Specifications

<b>Frequency range</b>	650 to 900MHz
<b>Linear Gain</b>	56dB ± 1dB typical
<b>Gain Flatness</b>	± 2dB max.
<b>Minimum Pulsed Output Power</b>	500W min. full range (@ nominal input +4dBm)
<b>CW Output Power</b> (internal limitation)	50W max.
<b>Linear Output Power</b>	550W typical @ 1dB Compression
<b>Linearity</b>	+2/-1dB to 550W typical
<b>Amplifier Biasing</b>	Class AB Operation
<b>Blanking Delay Time</b>	1µs min.
<b>RF Rise Time</b>	< 100ns
<b>RF Fall Time</b>	< 50ns
<b>DC Ringing</b>	± 100mV typical (due to blanking signal)
<b>Input Noise Figure</b>	8dB typical
<b>Output Noise Power</b> (Unblanked)	-108dBm @ 1Hz
<b>Output Noise Power</b> (Blanked)	Thermal Noise
<b>Input/output Impedance</b>	50Ω
<b>Input V.S.W.R. Route OFF</b>	1.6 max.
<b>Input V.S.W.R. Route ON</b>	1.5 max.
<b>Output Harmonics</b> (2fc ; 3fc)	-40dBc ; -65dBc max. @ 500W
<b>Pulse Width</b> (internal limitation)	100ms @ 500W (up to CW @ 50W)
<b>Duty Cycle</b> (internal limitation)	10% @ 500W (up to 100% @ 50W)
<b>Droop &amp; Pulse Flatness</b>	± 4% typical @ 500W for 100ms Pulse Width
<b>Amplitude Stability vs. Temperature</b>	± 0.1% / °C max.

**General specifications High Resolution output H50**

**7.3**

Table 7.3. *BLAH500 E High Resolution Output H50 Specifications*

<b>Frequency range</b>	650 to 900MHz
<b>Linear Gain</b>	45dB ± 1dB typical
<b>Gain Flatness</b>	± 1.5dB max.
<b>Minimum Pulsed Output Power</b>	50W min. full range (@ nominal input +4dBm)
<b>CW Output Power</b> (internal limitation)	10W max.
<b>Linear Output Power</b>	35W typical @ 1dB Compression
<b>Linearity</b>	± 1dB to 35W typical
<b>Amplifier Biasing</b>	Class AB Operation
<b>Blanking Delay Time</b>	1µs min.
<b>RF Rise Time</b>	< 100ns
<b>RF Fall Time</b>	< 50ns
<b>DC Ringing</b>	± 100mV typical (due to blanking signal)
<b>Input Noise Figure</b>	8dB typical
<b>Output Noise Power</b> (Unblanked)	-119dBm @ 1Hz
<b>Output Noise Power</b> (Blanked)	Thermal Noise
<b>Input/output Impedance</b>	50Ω
<b>Input V.S.W.R. Route OFF</b>	1.6 max.
<b>Input V.S.W.R. Route ON</b>	1.5 max.
<b>Output Harmonics</b> (2fc ; 3fc)	-45dBc ; -70dBc max. @ 50W
<b>Pulse Width</b> (internal limitation)	100ms @ 50W (up to CW @ 10W)
<b>Duty Cycle</b> (internal limitation)	20% @ 50W (up to 100% @ 10W)
<b>Droop &amp; Pulse Flatness</b>	± 2% typical @ 50W for 100ms Pulse Width
<b>Amplitude Stability vs. Temperature</b>	± 0.1% / °C max.





# 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 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 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.

This assembly can be ordered on the manufactory BBIO-FR by P/N:

- **W1346523** «PUSH FAN ASSEMBLY 6».

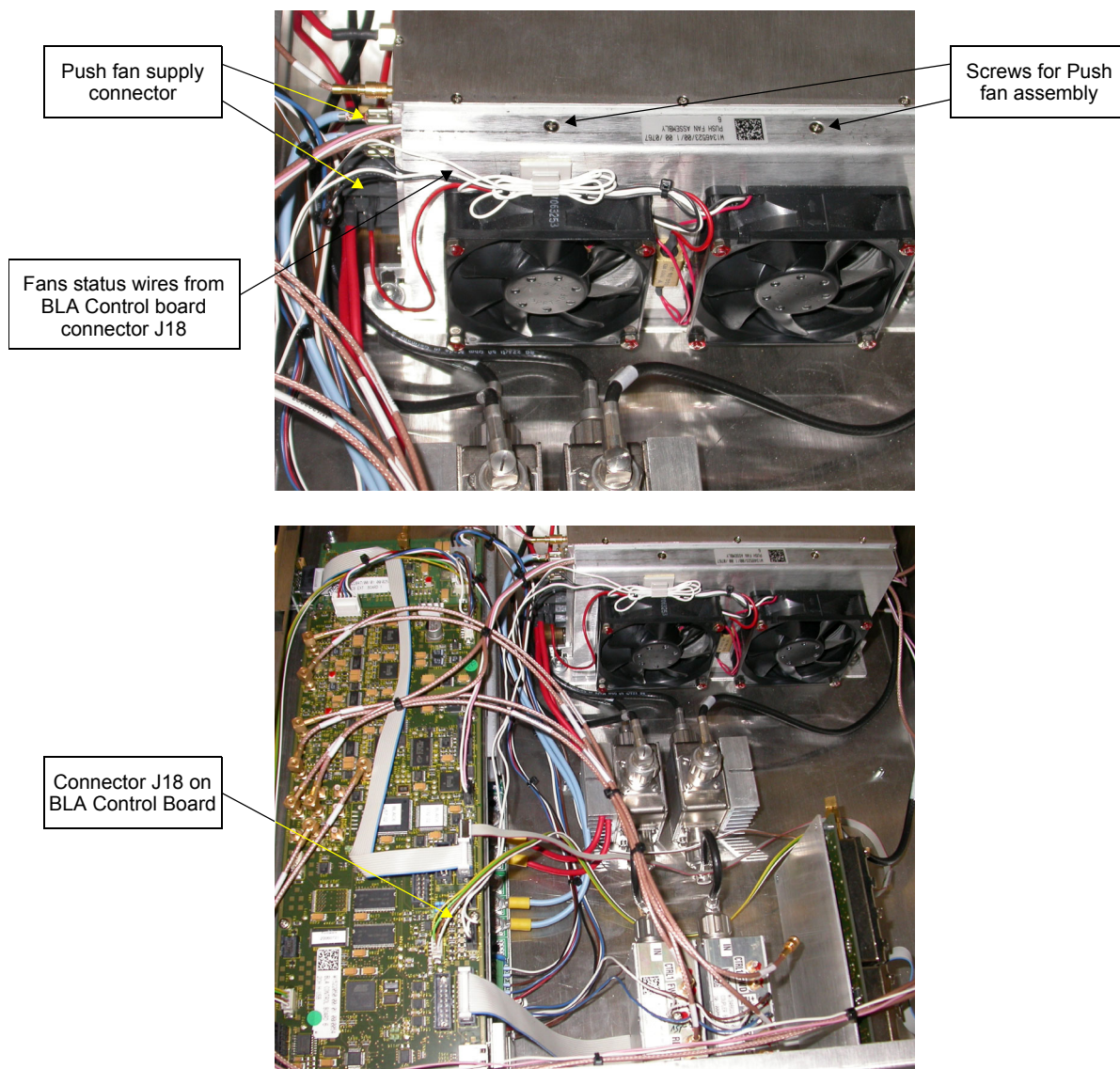
### ***Operation***

---

### **8.1.1**

1. Disconnect all cables from the front panel and the supply connector on the rear panel. Remove the amplifier from the NMR console and place it on a secure flat surface.
2. Unscrew and remove the coverage plate from the amplifier.
3. Disconnect the 2 wires (red +32V / black GND) being on the RF module dispatch supply connectors and coming from the Push fan assembly. Also disconnect the fan status wires (white) from BLA Control board connector J18.

Figure 8.1. Push Fan Assembly



4. Unscrew the 2 screws from the top of the Push fan assembly.
5. Remove the Push fan assembly.
6. Place correctly the new fan assembly in the bottom holes from the RF module and screw it.
7. Connect all wires (status and supply).
8. Connect line cord and turn on the BLA amplifier. Note that the fans are turning and no OVERHEAT status led appears on front panel.
9. Put the coverage plate on the BLA amplifier and screw it.
10. Put the amplifier in the NMR console, connect all cables on the front panel and the line cord on the rear panel.

# Figures

<b>1</b>	<b>General Information</b>	<b>5</b>
<b>2</b>	<b>Safety</b>	<b>7</b>
Figure 2.1.	Identifying plate .....	7
Figure 2.2.	Manufacturer's nameplate .....	8
Figure 2.3.	General hazard symbol .....	9
<b>3</b>	<b>Installation</b>	<b>11</b>
<b>4</b>	<b>Operation</b>	<b>13</b>
Figure 4.1.	BLAH500 E Front Panel Design .....	15
Figure 4.2.	BLAH500 E Front Panel View .....	15
Figure 4.3.	BLAH500 E Rear View .....	16
<b>5</b>	<b>Technical description</b>	<b>17</b>
Figure 5.1.	BLAH500 E System Block Diagram .....	18
Figure 5.2.	Embedded router Block Diagram .....	19
Figure 5.3.	Driver Block Diagram .....	20
Figure 5.4.	Peak power limitation .....	23
Figure 5.5.	Forward pulse width limitation .....	23
<b>6</b>	<b>Servicing the BLA</b>	<b>27</b>
Figure 6.1.	Device Information .....	28
Figure 6.2.	Amplifier status (High Resolution and Solid) .....	29
Figure 6.3.	Amplifier limitations (High Resolution and Solid) .....	30
Figure 6.4.	Change limits (High Resolution and Solid) .....	31
Figure 6.5.	Routing information .....	32
Figure 6.6.	Self-test, software reset and report .....	33
Figure 6.7.	Perform software reset and report .....	34
Figure 6.8.	BIS content .....	35
Figure 6.9.	Firmware update .....	36
<b>7</b>	<b>Specifications</b>	<b>37</b>
<b>8</b>	<b>Service information and maintenance</b>	<b>41</b>
Figure 8.1.	Push Fan Assembly .....	42

**Figures**

# Tables

<b>1</b>	<b>General Information</b>	<b>5</b>
<b>2</b>	<b>Safety</b>	<b>7</b>
<b>3</b>	<b>Installation</b>	<b>11</b>
<b>4</b>	<b>Operation</b>	<b>13</b>
Table 4.1.	Indicators assignment .....	13
Table 4.2.	Coaxial Connectors assignment .....	14
Table 4.3.	RJ45 Pin assignment .....	14
<b>5</b>	<b>Technical description</b>	<b>17</b>
Table 5.1.	Fault detection timings .....	24
<b>6</b>	<b>Servicing the BLA</b>	<b>27</b>
<b>7</b>	<b>Specifications</b>	<b>37</b>
Table 7.1.	BLAH500 E Common Characteristics .....	37
Table 7.2.	BLAH500 E Solid Output H500 Specifications .....	38
Table 7.3.	BLAH500 E High Resolution Output H50 Specifications ..	39
<b>8</b>	<b>Service information and maintenance</b>	<b>41</b>





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