

HPPR/2

- for AVANCE NEO Systems
User Manual
Version 001



Copyright © by Bruker Corporation

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form, or by any means without the prior consent of the publisher. Product names used are trademarks or registered trademarks of their respective holders.

© December 19, 2018 Bruker Corporation

Document Number: 1000061380

P/N: H172204

Contents

1	About This Manual	7
1.1	Symbols and Conventions	7
2	Introduction	9
2.1	Intended Use.....	9
2.2	Installation and Initial Commissioning.....	9
2.3	Limitation of Liability.....	9
2.4	Warranty Terms	10
2.5	Customer Service	10
2.6	Product Safety and Electromagnetic Compatibility	10
3	Safety	11
3.1	General	11
3.2	System Owner's Responsibility.....	11
3.3	Personnel Requirements	12
3.3.1	Qualifications	13
3.3.2	Unauthorized Persons	13
3.3.3	Instruction	13
3.4	Personal Protective Equipment.....	14
3.5	Location of the Safety Label	14
3.6	Basic Dangers.....	14
3.6.1	General Workplace Dangers.....	14
3.6.2	Dangers from Electric Power	15
3.6.3	Danger from Magnetic Fields.....	16
3.7	Environmental Protection.....	16
3.8	Signs and Labels	17
4	Transport, Packaging and Storage	19
4.1	Symbols on the Packaging	19
4.2	Inspection at Delivery.....	20
4.3	Packaging	21
4.4	Storage	21
5	HPPR/2	23
5.1	Overview	23
5.2	Features.....	24
5.3	HPPR/2 RF Power Supervision	24
5.3.1	FAQs.....	26
5.4	HPPR/2 Wiring.....	27
5.4.1	Supply and Pulse Wiring (up to 4 RF Channels)	28
5.4.2	Supply and Pulse Wiring (5 to 8 RF Channels)	29
5.5	Wobble.....	30
5.6	Abbreviations	30
6	Cover2 Module	33
6.1	Front View.....	33

6.1.1	Cover2 and Display Versions.....	34
6.1.2	LED Description	34
6.1.3	LCD and Touch Screen Description	35
6.1.4	Service Tab.....	35
6.1.5	Modules Tab	36
6.1.6	Devices Tab.....	37
6.1.7	Wobble Tab.....	37
6.2	Rear View	38
6.2.1	Rear Side Connectors.....	39
6.2.2	Left Side Connectors	40
6.3	Functionality.....	40
6.3.1	Power Supply and Monitoring	40
6.3.2	Real Time Pulse.....	40
6.3.3	BIS	40
7	HPPR/2 Preamplifier Modules for AVANCE NEO	41
7.1	HPPR/2 Preamplifier Variants.....	41
7.2	HPPR/2 Preamplifier Part Numbers.....	41
7.3	HPPR/2 Preamplifier Overview.....	42
7.4	HPPR/2 Operating Modes	43
7.4.1	Operating Modes of HPPR/2 XBB, 31P, 13C, 15N Modules	43
7.4.2	Operating Modes of HPPR/2 2H Module	44
7.4.3	Operating Modes of AQS 1H2H Preamp.....	45
7.4.4	Operating Modes of HPLNA 1H Module (ECL >=06, with Lock Capability).....	47
7.5	Technical Specifications	48
7.5.1	Technical Data AQS 1H2H Preamp (ECL>=03).....	48
7.5.2	Technical Data AQS XBB19F 2HS MODULE (ECL>=07)	49
7.5.3	Technical Data HPPR/2 1H HPLNA MODULE (19F-1H).....	49
7.5.4	Technical Data HPPR/2 3H HPLNA MODULE	50
7.5.5	Technical Data HPPR/2 31P MODULE (ECL>=07).....	50
7.5.6	Technical Data HPPR/2 13C MODULE (ECL>=08, 79Br-13C).....	50
7.5.7	Technical Data HPPR/2 2H MODULE (ECL>=07)	51
7.5.8	Technical Data HPPR/2 15N MODULE (ECL>=07)	51
7.5.9	Technical Data HPPR/2 XBB19F 2HP MODULE (ECL>=07).....	52
7.5.10	Technical Data HPPR/2 XBB31P 2HP HPLNA MODULE	52
7.6	RF Pulse Power Capability Overview	53
8	HPPR/2 Baseplate AV4.....	55
8.1	Overview	55
8.2	Description	56
8.2.1	Part Numbers.....	56
8.2.2	Technical Data	56
8.3	Troubleshooting	56
9	CRP RF-Electronics.....	57
9.1	General	57
9.2	Power Consumption.....	57
9.3	Transmit-/Receive Bias Currents	58
10	MRI Active Detuning Module	59

10.1	Overview	59
10.2	Description	60
10.2.1	Input Pulses	60
10.2.2	PIN Driver Function.....	61
10.2.3	Tune/Match Driver Function.....	61
10.2.4	RGP Output Pulse	61
10.2.5	Connectors.....	62
10.2.6	Part Numbers.....	62
10.3	Technical Data	62
10.3.1	Coil Control Section	63
10.3.2	RF-Section	64
10.4	Troubleshooting	64
10.4.1	Diagnostics	64
11	HPPR/2 MRI ADM-CRP Module	65
11.1	Overview	65
11.2	Description	65
11.2.1	Tuning/Matching Driver.....	66
11.2.2	Operating Modes	66
11.2.3	Connectors.....	67
11.2.4	Part Numbers.....	67
11.2.5	Technical Data	68
11.3	Troubleshooting	68
11.3.1	Diagnostics	68
12	HPPR/2 MRI Baseplate AV4	69
12.1	Overview	69
12.2	Description	70
12.2.1	Connectors.....	71
12.2.2	Part Numbers.....	71
12.2.3	Technical Data	71
12.3	Troubleshooting	72
13	Maintenance.....	73
13.1	Cleaning.....	73
13.1.1	Before Cleaning	73
13.1.2	Cleaning the Outer Shell of the Device.....	73
13.1.3	Other Cleaning Operations	73
13.2	Preventative Maintenance	74
13.3	Bruker Service Maintenance.....	74
13.3.1	Device Report File	74
13.3.2	Firmware Update	74
14	Troubleshooting	75
14.1	Operation Failure	75
14.2	Hardware Warnings or Errors	75
14.3	Troubleshooting Hardware Problems	76
14.3.1	Service Web.....	76
14.3.2	Savelogs	76
14.3.3	AqRackServer Log.....	76

14.4	How to Report a System Error	77
15	Dismantling and Disposal.....	79
15.1	Dismantling	79
15.2	Disposal Europe.....	79
15.3	Disposal USA and Other Countries	80
16	Technical Data	81
16.1	General Information	81
16.2	Connection Values	81
16.3	Operating Conditions	82
16.4	Rating Plate	82
17	Contact	83
	List of Figures	85
	List of Tables	87
	Index	89

1 About This Manual

This manual enables safe and efficient handling of the device.

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

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

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

1.1 Symbols and Conventions

Safety instructions in this manual and labels of devices are marked with symbols.

The safety instructions are introduced using indicative words which express the extent of the hazard.

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

DANGER



DANGER: Indicates a hazardous situation that, if not avoided, will result in death or serious injury. This signal word is limited to the most extreme situations.

This is the consequence of not following the warning.

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

WARNING



WARNING: Indicates a hazardous situation that, if not avoided, could result in death or serious injury.

This is the consequence of not following the warning.

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



CAUTION

CAUTION: Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.

This is the consequence of not following the warning.

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

NOTICE

NOTICE: Indicates information considered important, but not hazard-related (e.g. messages relating to property damage).

This is the consequence of not following the notice.

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

SAFETY INSTRUCTIONS

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

This is the consequence of not following the safety instructions.

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



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

2 Introduction

This manual is intended to be used by trained device users. This user manual contains information and safety information that are necessary for the safe operation of the device.

Any user maintenance and repairs are to be accomplished using the information in this manual.

Consider all safety references!

2.1 Intended Use

The device has been designed and constructed solely for the intended use described here.

The HPPR/2 units must only be used for the limited purpose of transmitting, switching and amplifying of dedicated RF signals in Bruker AVANCE spectrometers.

Intended use also includes compliance with all specifications in this manual.

Any use which exceeds or differs from the intended use shall be considered improper use.

No claims of any kind for damage will be entertained if such claims result from improper use.

2.2 Installation and Initial Commissioning



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

2.3 Limitation of Liability

All specifications and instructions in this manual have been compiled taking account of applicable standards and regulations, the current state of technology and the experience and insights we have gained over the years.

The manufacturer accepts no liability for damage due to:

- Failure to observe this manual
- Improper use
- Deployment of untrained personnel
- Unauthorized modifications
- Technical modifications
- Use of unauthorized spare parts

The actual scope of supply may differ from the explanations and depictions in this manual in the case of special designs, take-up of additional ordering options, or as a result of the latest technical modifications.

The undertakings agreed in the supply contract as well as the manufacturer's Terms and Conditions and Terms of Delivery and the legal regulations applicable at the time of conclusion of the contract shall apply.

2.4 Warranty Terms

The warranty terms are included in the manufacturer's Terms and Conditions.

2.5 Customer Service

Our customer service division is available to provide technical information. See the chapter Contact for contact information.

In addition, our employees are always interested in acquiring new information and experience gained from practical application; such information and experience may help improve our products.

2.6 Product Safety and Electromagnetic Compatibility

The device complies with the following safety requirements:

- IEC 61010-1:2010+AMD1:2016
- EN 61010-1:2010
- UL 61010-1 3rd edition (2012-05-11)
- CAN/CSA-C22.2 NO. 61010-1-12 (R2017)

3 Safety

This section provides an overview of all the main safety aspects involved in ensuring optimal personnel protection and safe and smooth operation.

Non-compliance with the action guidelines and safety instructions contained in this manual may result in serious hazards.

3.1 General

Before you start any repair inside of the device, be aware of the high 230/115V voltages. Even if these voltages are protected by security features to avoid any physical contact, it is still possible that the voltage sources can be unintentionally touched with a tool, object, etc.

Therefore, always check if you really need the power supply to be switched on during your work. Otherwise turn the device off and disconnect the power cable from the wall socket to the device. Safeguard that no one is able to re-power the system without your approval.

3.2 System Owner's Responsibility

System Owner

The term *system owner* refers to the person who operates the device for trade or commercial purposes, or who surrenders the device to a third party for use/application, and who bears the legal product liability for protecting the user, the personnel or third parties during the operation.

System Owner's Obligations

The device is used in the industrial sector, universities and research laboratories. The system owner of the device must therefore comply with statutory occupational safety requirements.

In addition to the safety instructions in this manual, the safety, accident prevention and environmental protection regulations governing the operating area of the device must be observed.

In this regard, the following requirements should be particularly observed:

- The system owner must obtain information about the applicable occupational safety regulations, and - in the context of a risk assessment - must determine any additional dangers resulting from the specific working conditions at the usage location of the device. The system owner must then implement this information in a set of operating instructions governing operation of the device.
- During the complete operating time of the device, the system owner must assess whether the operating instructions issued comply with the current status of regulations, and must update the operating instructions if necessary.
- The system owner must clearly lay down and specify responsibilities with respect to installation, operation, troubleshooting, maintenance and cleaning.
- The system owner must ensure that all personnel dealing with the device have read and understood this manual. In addition, the system owner must provide personnel with training and hazards information at regular intervals.
- The system owner must provide the personnel with the necessary protective equipment.

- The system owner must warrant that the device is operated by trained and authorized personnel as well as all other work, such as transportation, mounting, start-up, the installation, maintenance, cleaning, service, repair and shutdown, that is carried out on the device.
- All personnel who work with, or in the close proximity of the device, need to be informed of all safety issues and emergency procedures as outlined in this user manual.
- The system owner must document the information about all safety issues and emergency procedures in a laboratory SOP (Standard Operating Procedure). Routine briefings and briefings for new personnel must take place.
- The system owner must ensure that new personnel are supervised by experienced personnel. It is highly recommended to implement a company training program for new personnel on all aspects of product safety and operation.
- The system owner must ensure that personnel are regularly informed of the potential hazards within the laboratory. This is all personnel that work in the area, but in particular laboratory personnel and external personnel such as cleaning and service personnel.
- The system owner is responsible for taking measures to avoid inherent risks in the handling of dangerous substances, preventing industrial disease, and providing medical first aid in emergencies.
- The system owner is responsible for providing facilities according to the local regulations for the prevention of industrial accidents and generally accepted safety regulations according to the rules of occupational medicine.
- All substances needed for operating and cleaning the device samples, solvents, cleaning agents, gases, etc. have to be handled with care and disposed of appropriately. All hints and warnings on storage containers must be read and adhered to.
- The system owner must ensure that the work area is sufficiently illuminated to avoid reading errors and faulty operation.
- The system owner must ensure that the laboratory is equipped with an oxygen warning device, in case the device is operated with nitrogen.

Furthermore, the system owner is responsible for ensuring that the device is always in a technically faultless condition. Therefore, the following applies:

- The system owner must ensure that the maintenance intervals described in this manual are observed.
- The system owner must ensure that all (electrical, mechanical, etc.) safety devices are regularly checked to ensure full safety functionality and completeness.

3.3 Personnel Requirements



Only trained Bruker personnel are allowed to install, mount, retrofit, repair, adjust and dismantle the unit!

3.3.1 Qualifications

This manual specifies the personnel qualifications required for the different areas of work, listed below:

Laboratory Personnel

Laboratory personnel are health care professionals, technicians, and assistants staffing a research or health care facility where specimens are grown, tested, or evaluated and the results of such measurements are recorded. Laboratory personnel are able to carry out assigned work and to recognize and prevent possible dangers self-reliant due to their professional training, knowledge and experience as well as profound knowledge of applicable regulations.

The workforce must only consist of persons who can be expected to carry out their work reliably. Persons with impaired reactions due to, for example, the consumption of drugs, alcohol, or medication are prohibited from carrying out work on the device.

When selecting personnel, the age-related and occupation-related regulations governing the usage location must be observed.

3.3.2 Unauthorized Persons

 **WARNING**



Risk to life for unauthorized personnel due to hazards in the danger and working zone!

Unauthorized personnel who do not meet the requirements described in this manual will not be familiar with the dangers in the working zone. Therefore, unauthorized persons face the risk of serious injury or death.

- ▶ Unauthorized persons must be kept away from the danger and working zone.
- ▶ If in doubt, address the persons in question and ask them to leave the danger and working zone.
- ▶ Cease work while unauthorized persons are in the danger and working zone.

3.3.3 Instruction

Personnel must receive regular instruction from the owner. The instruction must be documented to facilitate improved verification.

Date	Name	Type of Instruction	Instruction Provided By	Signature

3.4 Personal Protective Equipment

Personal protective equipment is used to protect the personnel from dangers which could affect their safety or health while working.

Personnel must wear personal protective equipment while carrying out the different operations at and with the device.

This equipment will be defined by the head of the laboratory. Always comply with the instructions governing personal protective equipment posted in the work area.

3.5 Location of the Safety Label



The laboratory supervisor is responsible for ensuring that all the warning labels are maintained in their proper place any time that the device is used.

3.6 Basic Dangers

The following section specifies residual risks which may result from using the device and have been established by means of a risk assessment.

In order to minimize health hazards and avoid dangerous situations, follow the safety instructions specified here as well as in the following chapters of this manual.

3.6.1 General Workplace Dangers

CAUTION



Risk of injury from tripping over dirt and scattered objects!

Dirt and scattered objects may cause people to slip or trip, resulting in personal injuries.

- ▶ Always keep the work area clean.
- ▶ Remove objects which are no longer required from the work area and particularly from the floor.
- ▶ Indicate unavoidable hazards using marking tape.

NOTICE

Material damage hazard due to impacting the magnet!

Impacting the magnet may result in a quench.

- ▶ Mount the device carefully on the magnet.
- ▶ Avoid banging the magnet during installation and operation, e.g. when replacing the sample carousel.

3.6.2 Dangers from Electric Power

WARNING



Risk to life from stored charges!

Electric charges may be stored in electrical components even after the system has been switched off and disconnected from the power supply. Contact with these components may result in serious or fatal injury.

- ▶ Before working on the specified components, ensure that they have been completely disconnected from the power supply.
- ▶ Allow 10 minutes to elapse in order to ensure that the internal capacitors have been fully discharged.

WARNING



Risk to life from electrical shock

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

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

WARNING



Risk to life from residual electrostatic potentials!

Friction between material being conveyed may result in significant development of electrostatic potential. Therefore, contact with parts immediately following the conveying operation may be life-threatening.

- ▶ Potential equalisation must be ensured before making contact with parts, unless such equalisation is provided by the customer.



Electrostatic discharge from friction may occur, resulting in an electric spark and loud bang. Use ESD flooring and wear ESD shoes.

WARNING



Risk to life from contact voltage!

Absent or faulty protective earth conductor may result in contact voltage. This may pose a risk of injury or death.

- ▶ Before the initial commissioning of the device, connect the main power supply to the socket and verify the complete functionality of the protective earth conductor.

3.6.3 Danger from Magnetic Fields

WARNING

Risk to life due to high magnetic fields

A magnetic field of more than 0.5 mT (5 Gauss) is life-threatening for people with pacemakers or active metal implants. Exposure to more than 8 T can cause damage to health. Duration of exposure (8 h/day) above the limit of 200 mT can cause damage to health. Ferromagnetic tools in the magnetic field are significantly hazardous. Disks and electronic devices may be damaged.

- ▶ Mark the magnetic field of more than 0.5 mT (5 Gauss) before start up.
- ▶ Keep people with active medical implants or heart pacemakers away from the 0.5 mT (5 Gauss) area.
- ▶ The permanent workplace of employees must be outside the 0.5 mT (5 Gauss) area.
- ▶ Do not stay or work at magnetic fields of more than 8 T.
- ▶ Prevent exposure of more than 200 mT for more than 8 h/day.
- ▶ Keep disks, credit cards and electronic devices away from the identified area.
- ▶ Do not use ferromagnetic tools or items within the identified area.
- ▶ Only use non-ferromagnetic transportation dewars or pressure cylinders for the cryogenic agents.
- ▶ Only use non-ferromagnetic ladders or steps.
- ▶ Remove magnetic items (jewelry, watches, pens etc.) before carrying out maintenance work.



3.7 Environmental Protection

NOTICE

Danger to the environment from incorrect handling of pollutants!

Incorrect handling of pollutants, particularly incorrect waste disposal, may cause serious damage to the environment.

- ▶ Always observe local environmental regulations regarding handling and disposal of pollutants.
- ▶ Take the appropriate actions immediately if pollutants escape accidentally into the environment. If in doubt, inform the responsible municipal authorities about the damage and ask about the appropriate actions to be taken.

The following pollutants are used:

Nitrogen gas	Nitrogen gas may cause suffocation at high concentrations. Disposal of the empty gas cylinders must be performed by a specialist disposal company.
Helium gas	Helium gas may cause suffocation at high concentrations. Disposal of the empty gas cylinders must be performed by a specialist disposal company.
Coolants	When released, coolants develop decomposition products which are hazardous to the environment. Maximum care and caution are required when handling coolants. Always observe the safety data sheet issued by the manufacturer. Ensure that personnel handling coolants are regularly informed about potential dangers and are instructed in the safe handling of coolants.
Cleaning liquids	Cleaning liquids incorporating solvents contain toxic substances. They must not be allowed to escape into the environment. Disposal must be carried out by a specialist disposal company.

3.8 Signs and Labels



The identification and placement of warning labels are included in the manual. The laboratory supervisor is responsible for ensuring that all the warning labels are maintained in their proper place any time that the device is used. New signs and labels can be obtained from Bruker Service.

The following symbols and information signs can be found in the work area. They refer to their immediate surroundings.

Electrical Voltage



Only qualified electricians are permitted to work in a work room marked by this sign. Unauthorized persons must not enter the workplaces thus marked and must not open the marked cabinet. The warning label may be ordered using Bruker Part Number 23948.

Danger Spot



Warning indicating a danger spot in work rooms.
The warning label may be ordered using Bruker Part Number 23944.

Cold spot



Warning indicating a cold spot in work rooms.
The warning label may be ordered using Bruker Part Number 23943.

Hot spot



Warning indicating a hot spot in work rooms.

The warning label may be ordered using Bruker Part Number 23945.

Protection

Never Open!

Warning indicating.

The warning label may be ordered using Bruker Part Number Z129088.

Personal Protective Equipment



Protective Goggles (DIN EN 166, 170 & 172)

Protect the eyes from injury due to flying cold gases, liquids and parts. The safety label may be ordered using Bruker Part Number 23946.



Protective Gloves (DIN EN 388, 420 & 511)

Protect the hands from injury caused by contact with extremely cold gases, liquids or surfaces and for protection from injury caused by rough edges. The safety label may be ordered using Bruker Part Number 23947.







4 Transport, Packaging and Storage



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

4.1 Symbols on the Packaging

The following symbols are affixed to the packaging material. Always observe the symbols during transport and handling.

Top		The arrow tips on the sign mark the top of the package. They must always point upwards; otherwise the content may be damaged.
Fragile		Marks packages with fragile or sensitive contents. Handle the package with care; do not allow the package to fall and do not allow it to be impacted.
Protect Against Moisture		Protect packages against moisture and keep dry.
Attach Here		Lifting gear (lifting chain, lifting strap) must only be attached to points bearing this symbol.
Center of Gravity		Marks the center of gravity of packages. Note the location of the center of gravity when lifting and transporting.
Weight, Attached Load		Indicates the weight of packages. Handle the marked package in accordance with its weight.






Permitted Stacking Load		<p>Indicates packages which are partially stackable.</p> <p>Do not exceed the maximum load-bearing capacity specified on the symbol in order to avoid damaging or destroying the content.</p>
Do not Damage Air-tight Packaging		<p>The packaging is air-tight. Damage to the barrier layer may render the contents unusable.</p> <p>Do not pierce.</p> <p>Do not use sharp objects to open.</p>
Component Sensitive to Electrostatic Discharge		<p>The packaging contains components which are sensitive to an electrostatic discharge.</p> <p>Only allow packaging to be opened by trained personnel.</p> <p>Establish potential equalization before opening.</p>
Protect from Heat		<p>Protect packages against heat and direct sunlight.</p>
Protect from Radioactive Sources		<p>Protect packages against radioactive sources.</p>

Table 4.1: Symbols on the Packaging

4.2 Inspection at Delivery

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

Proceed as follows in the event of externally apparent transport damage:

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



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

4.3 Packaging

About Packaging

The individual packages are packaged in accordance with anticipated transport conditions. Only environmentally friendly materials have been used in the packaging.

The packaging is intended to protect the individual components from transport damage, corrosion and other damage prior to assembly. Therefore do not destroy the packaging and only remove it shortly before assembly.

Handling Packaging Materials

Keep the original container and packing assembly, at least as long as the warranty is valid, in case the unit has to be returned to the factory. When the packaging material is no longer needed dispose of it in accordance with the relevant applicable legal requirements and local regulations.

4.4 Storage

Storage of the Packages

Store the packages under the following conditions:

- Do not store outdoors.
- Store in dry and dust-free conditions.
- Do not expose to aggressive media.
- Protect against direct sunlight.
- Avoid mechanical shocks.
- Storage temperature: 15 to 35 °C.
- Relative humidity: max. 60%.
- If stored for longer than 3 months, regularly check the general condition of all parts and the packaging. If necessary, top-up or replace preservatives.



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

5 HPPR/2

5.1 Overview



Figure 5.1: HPPR/2 Standard Configuration

The High Performance Preamplifier version 2 (hereafter referred as HPPR/2) consists, in the basic configuration, of a 1H module, a XBB module, a 2H module, a cover module (hereafter referred as Cover2) and a baseplate (HPPR/2 BASEPLATE AV4 4CH or 8CH). The basic configuration may be updated later to a maximum of nine modules (including cover).

The preamplifier modules contain a Transmitter/Receiver switch including necessary high performance filters in the transmitter and probe paths, a RF preamplifier and an interface logic including a power supply and BIS (Bruker Information System). All preamplifier modules are 'Fourier capable'.

The LCD-display indicates the operation status and configuration of the HPPR/2, e.g. what kind of modules are connected, what are their operating modes (observe, lock, wobble, decouple) and other information.

The status LEDs ERROR and READY indicate the current state of the Cover2's host. In AVANCE NEO systems the host firmware is located in the EPU.

The LCD's wobble tab shows the reflection coefficient of the probe during wobbling.

The individual modules, the power transmitter and the probe are connected with N-plugs and shielded cables. The BNC cable for the receiver signal leads from the rear HPPR/2 BASEPLATE AV4 unit to the FT and lock receivers in the console. The connected multi-core cable supplies all DC voltages for the preamplifier modules. The cable also contains the required real time pulses (LOCK_PP, RCP_HPPR_Mode) and a BFB-Bus for command and data transfer between the console and the HPPR/2. Tune and RGPs are transferred via a special cable from the console to the HPPR/2.

5.2 Features

- Same RF technology as the classic HPPR.
- Ease of operation.
- Self configuration.
- Modular arrangement, up to 8 preamplifier modules per HPPR/2, even identical ones.
- Enhanced noise immunity (also Cover Module).
- Enhanced display information.
- Integration of external functional modules as ATMA and Cryoprobe.

5.3 HPPR/2 RF Power Supervision

Introduction

Some of the HPPR/2 modules (AQS 1H2H modules and HPLNA 1H) have a built in, calibrated RF power limit detection capability. This power limit detection capability is used to supervise the power applied to the probe (calibrated and referenced at the probe connector of the HPPR/2 module), but also to protect the appropriate HPPR/2 module from too much power applied.

The transmission of RF power through the HPPR/2 module is being monitored autonomously (supervision is enabled after power up) and in case of exceeding power, the emergency stop signal will be activated. After a latency of about 2-3us all RF pulses and RF sources will be stopped.

RF Power

In order to avoid too much power to be applied to the probe, the power limit detection thresholds of the HPPR/2 modules for continuous (CW) and peak (PK) power are set according to the probe connected to the HPPR/2.

For each probe connected to the HPPR/2 COVER2 MODULE the PICS entries of that probe are read out by the firmware of the HPPR/2. The values for continuous but also peak power are extracted from the **\$PChan** group for each nucleus. Afterwards, the threshold values for the power limit detection are set for each nucleus (if power limit detection is available) according to the probe power values.

To avoid an emergency stop too close at the probe power limits, a 2 dB for peak power respectively a 3 dB for continuous power margin is added for the power limit detection thresholds.

The following diagram shows the characteristics (and the pulse length dependency) of the RF power detection.

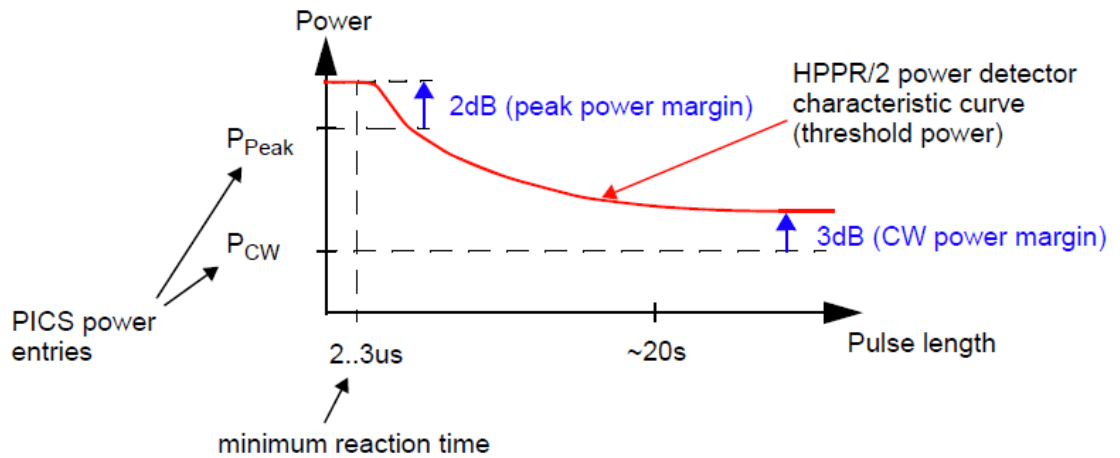


Figure 5.2: Threshold for RF Power Versus Pulse Length

The threshold value for CW pulses can be understood as the RF power of pulses of about 20s. The power limit threshold value for pulses between a few microseconds (peak power) and the very long pulses (CW power) behaves like described above (red curve).

Cover2 Display

The setting of the threshold values can be monitored on the HPPR/2 COVER2 module display (see following figures).

If no power limit detection capability is implemented for a certain HPPR/2 module, a '--' is shown on the corresponding display line instead of the threshold power value.

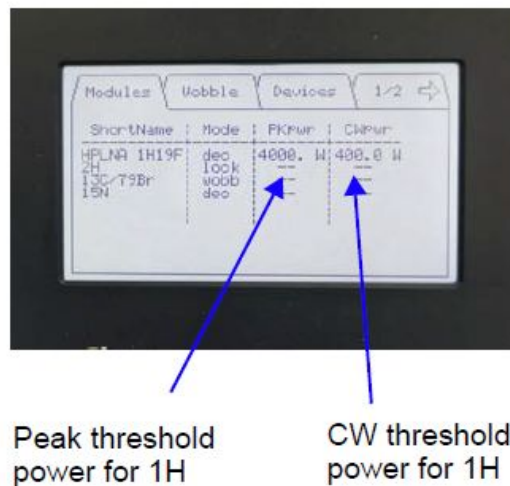


Figure 5.3: Cover2: Threshold Power Display

5.3.1 FAQs

Which HPPR/2 modules are equipped with a power limit detection?

As of January 2008, the following modules are equipped with a power limit detection:

- Z003950 AQS 1H2H PREAMP 300
- Z128274 AQS 1H2H PREAMP 400 CRP
- All frequencies HPPR/2 1H HPLNA MODULE

Additional modules will be published by EC only.

How can I see if the supervision is activated?

Cover2: The supervision can be disabled via the **Hosted Devices | Cover2 Overview | Module Settings | Overload Detect** website. After power up the supervision is always enabled automatically (default).

What happens in case of missing power entries in the PICS?

If a value is missing in the *\$PChan* group of the PICS, the maximum power rating of the corresponding HPPR/2 module will be set.

What happens in case of „incorrect“ or „corrupt“ (non numerical) power entries of the probe PICS?

The maximum power rating of the corresponding HPPR/2 module will be set.

What happens in case of higher rating of the probe than the HPPR/2 module?

The maximum power rating of the corresponding HPPR/2 module will be set.

What happens if the probe contains no PICS?

All limits of the HPPR/2 modules will be set to its corresponding maximum power ratings.

How can I check whether the supervision is available for a certain HPPR/2 module?

Check on the HPPR/2 COVER2 display as described in [HPPR/2 RF Power Supervision \[▶ 24\]](#).

How can I check whether the supervision is available for a certain nucleus by using the AQS integrated preamplifiers?

Check the *\$HpprFunc* group of the module BIS. The version of the group must be at least 2.3 and the sixth entry must be set to 1.

\$HpprFunc, 2.3, FreqRange, Shortname, RefType, LowGain, RefMeter, AutoPowDet#

↑
Version of the *\$HpprFunc*
group must be at least 2.3

↑
0: has no automatic power detection
1: has an automatic power detection

The *\$HpprFunc* group is valid for all HPPR/2 modules and not only for the AQS integrated preamplifiers.

When are the power limit detection threshold values set?

All threshold values are set after power up and in addition by plugging/unplugging a CRP/ ATMA/PICS device.

How can the supervision be deactivated?

The supervision can be disabled via the **Hosted Devices | Cover2 Overview | Module Settings | Overload Detect** website. This can be done for any module having the power limit detection feature.

5.4 HPPR/2 Wiring

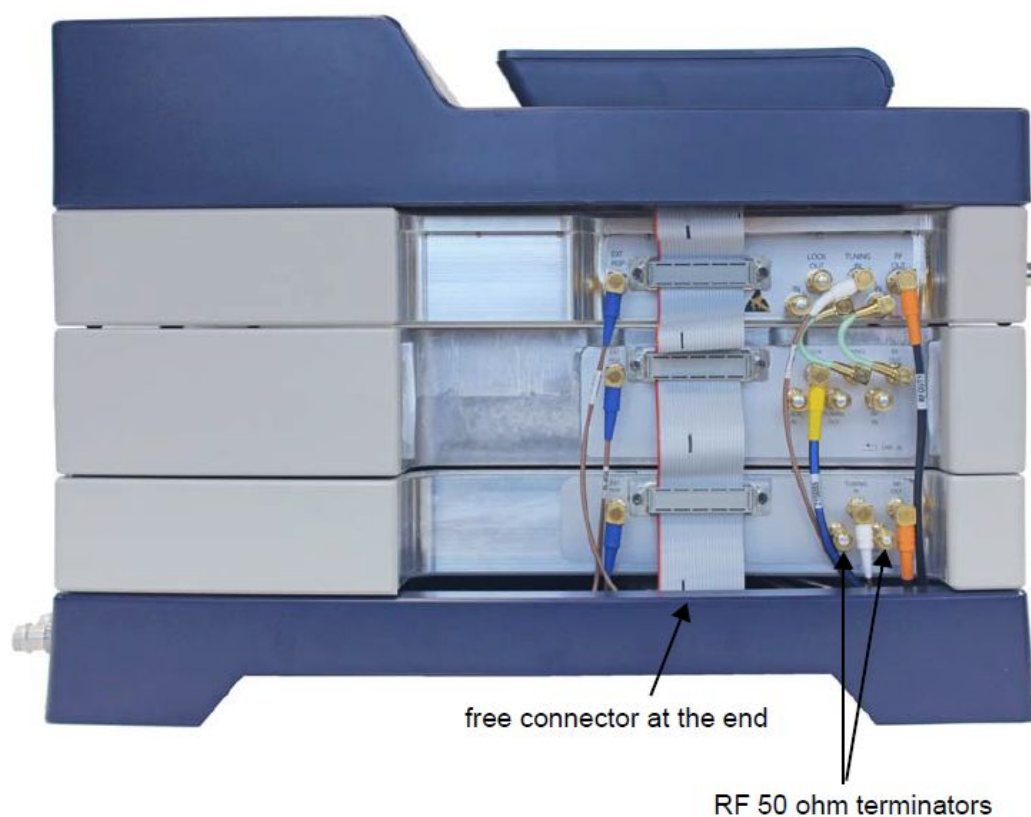


Figure 5.4: Module Connection

5.4.1 Supply and Pulse Wiring (up to 4 RF Channels)

The following diagram shows an exemplary wiring (power supply, pulses and tuning signals) for an HPPR/2 (up to maximal 4 RF channels).

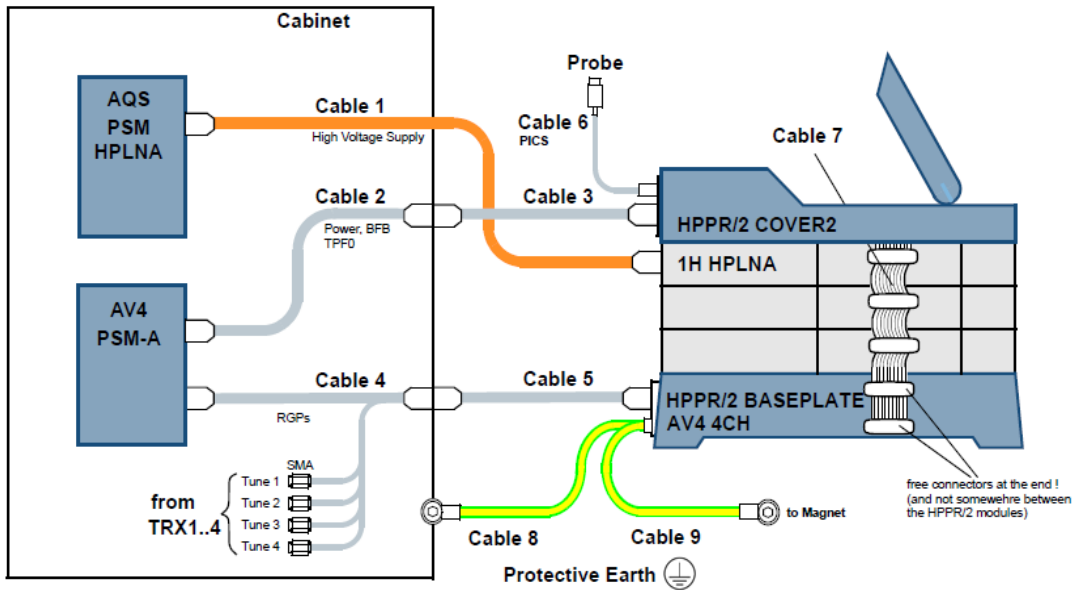


Figure 5.5: Standard Wiring HPPR/2

Id	P/N	Length	Description
Cable 1	Z104842	8m	CABLE RD 8P 8M HPLNA HV-SUPPLY
Cable 2	Z157942	2 m	CABLE RD 37P2000 D-SUB M/F PSM-A/BP
Cable 3	Z134361	7 m	CABLE RD 37P7000 D-SUB SFT/BU BP/COVER2
Cable 4	Z156002	2 m	CABLE RD 8P2000 D-SUB M/F PSM-A/BP CH1-4
Cable 5	Z156003	7 m	CABLE RD 8P7000 D-SUB M/F BP/HPPR2
Cable 6	Z14361	2.2 m	CABLE RD 5P HPPR/2<->ATMA/PICS
Cable 7	Z14091	0.29 m	CABLE FLK 25P 29CM PREAMP-BUS (for more than five HPPR/2 modules an additional cable Z14091 and a gender changer 47020 is needed)
Cable 8	W5200127	9 m	CBL GROUND TERMINAL D5-D8 L=9M
Cable 9	HZ15641	3 m	CABLE GROUND 3000 LUG RING M8/6

Table 5.1: Part List HPPR/2 Wiring

5.4.2 Supply and Pulse Wiring (5 to 8 RF Channels)

The following diagram shows an exemplary wiring (power supply, pulses and tuning signals) for an HPPR/2 (5 to maximal 8 RF channels).

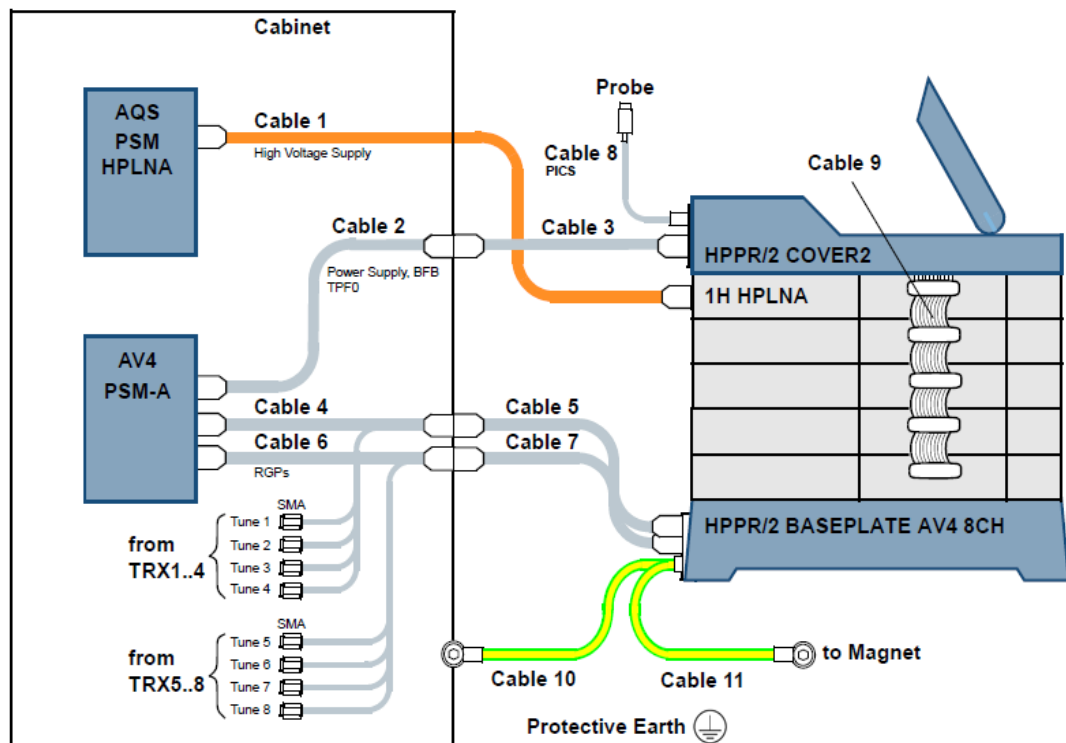


Figure 5.6: Standard Wiring: HPPR/2

Id	P/N	Length	Description
Cable 1	Z104842	8 m	CABLE RD 8P 8M HPLNA HV-SUPPLY
Cable 2	Z157942	2 m	CABLE RD 37P2000 D-SUB M/F PSM-A/BP
Cable 3	Z134361	7 m	CABLE RD 37P7000 D-SUB SFT/BU BP/COVER2
Cable 4	Z156002	2 m	CABLE RD 8P2000 D-SUB M/F PSM-A/BP CH1-4
Cable 5	Z156003	7 m	CABLE RD 8P7000 D-SUB M/F BP/HPPR2
Cable 6	Z156892	2 m	CABLE RD 8P2000 D-SUB M/F PSM-A/BP CH5-8
Cable 7	Z156003	7 m	CABLE RD 8P7000 D-SUB M/F BP/HPPR2
Cable 8	Z14361	2.2 m	CABLE RD 5P HPPR/2<->ATMA/PICS
Cable 9	Z14091	0.29 m	CABLE FLK 25P 29CM PREAMP-BUS (for more than five HPPR/2 modules an additional cable Z14091 and a gender changer 47020 is needed)
Cable 10	W5200127	9 m	CBL GROUND TERMINAL D5-D8 L=9 M
Cable 11	HZ15641	3 m	CABLE GROUND 3000 LUG RING M8/6

Table 5.2: Part List HPPR/2 Wiring

5.5 Wobble

The recently introduced **wobb reflection** has the following features:

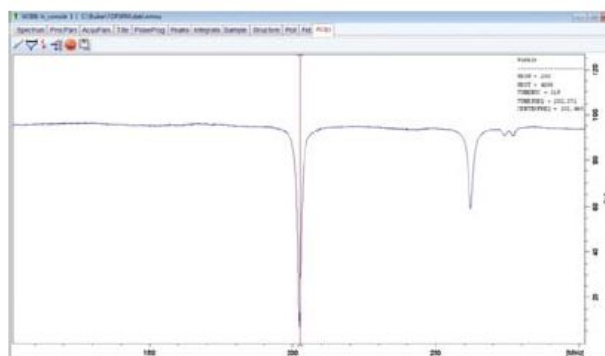
- The wobble display represents the amount of the reflection coefficient at the probe connector of the corresponding HPPR/2 module.
- A quantitative statement on the reflected power and of the probe Q can be made.
- The HPPR/2 acts as a network analyzers s11 measurement.

TS4.0 (or later) uses the individual calibration data of the appropriate preamplifier unit to calculate the exact reflection coefficient at the HPPR **Probe** port in direction to the probe (same as the s11 measurement of a network analyzer).

To do this, the calibration data file of the individual HPPR/2 module must be loaded to the spectrometer. The calibration data files are available from the Bruker-CH FTP server (<ftp://ftp.bruker.ch/NMR/download/preamplifier/>). Folder- and filenames are according part number and serial number of your individual HPPR/2 module. The calibration file is available for all HPPR/2 modules with a production date after 1.1.2012.

Copy the file into the appropriate spectrometer directory (conf/instr/<spect>/preamp/) and start **wobb reflection**.

New ,calibrated
wobble curve



5.6 Abbreviations

Cover2	Z124567 HPPR/2 COVER2 MODULE Z144595 HPPR/2 MRI COVER2 MODULE
ADM	Active Detuning Module
ATMA	Automatic Tuning and Matching Accessory
BIS	Bruker Information System
CRP	Cryo Probe
PK	Peak (peak power)
CW	Continuous Wave (CW power)
HPPR/2	High Performance Preamplifier Version 2
HPLNA	High Power Low Noise Amplifier
IFB	HPPR/2 Interface Board (interface from the module to the Preamp-Bus)
INCR_AQ	see INTERLEAVE_INCR
INTERLEAVE_INCR	Interleave Increment Pulse

I2C	I2C bus (two wire single master bus)
PLD	Programmable Logic Device
LCD, LC-Display	Liquid Crystal Display
LOCK_PP	Lock Protection Pulse
MDR	Mini Delta Ribbon connector (e.g. from 3M)
PICS	Probehead Identification System
QNP	Quadro Nucleus Probe
RGP_HPPR	Receiver Gating Pulse for HPPR
RGP_PA	see RGP_HPPR
SBSB	Serial Bruker Spectrospin Bus (RS485 Bus)
TP_F0	see LOCK_PP

Table 5.3: Abbreviations

6 Cover2 Module

6.1 Front View



Figure 6.1: Cover Module Front View

6.1.1 Cover2 and Display Versions

The HPPR/2 Cover2 module is available in several versions.

Bruker Part No.	Name	Description
Z124567	HPPR/2 COVER2 MODULE	Standard, as shown above
Z144595	HPPR/2 MRI COVER2 MODULE	Without display for MRI
Z144596	HPPR/2 MRI COVER2 LCD	Separate display for MRI
Z162703	HPPR/2 MRI COVER2 LCD/2	Separate display for MRI, version 2

Table 6.1: Part Numbers: HPPR/2 Cover2

6.1.2 LED Description

The LEDs indicate the current state of the HPPR/2 host. In AV NEO systems EPU is host. The LEDs do not state anything about the MRI-HWIDS interface.









ERROR	READY	Description
 off	 off	Power supply is off
 red	 off	After power-on: - Cover2 is waiting for a host.
 red	 green	After power-on: - Host is downloading Cover2 firmware. - Host is initializing HPPR/2 modules and connected devices. After initialization: - Host is in an error state.
 off	 green	After initialization: - Host is in normal operation, no error(s) from host side.

Table 6.2: LED States

6.1.3 LCD and Touch Screen Description

Label	Description
LCD	The LC-Display is used to show tabs with useful information - Module list. - Tuning/matching channel. - Sockets and its corresponding connected devices. - Cover2 info and an error message.
Tabs on LCD	Four tabs can be selected by tipping the Touch Screen. Tab description see below.
Touch Screen	The resistive Touch Screen allows to tip on it with one finger or a soft pen.

Table 6.3: LCD and Touch Screen Description

6.1.4 Service Tab

After power-on the Service tab is shown by Cover2. The red Error LED is ON.

If downloading is necessary, the host does an upgrade respectively a downgrade. While downloading both LEDs are ON. A Cover2 download lasts about one minute.

While initializing both LEDs are ON.

If after initializing, there is an error to display on the host both LEDs stay ON.

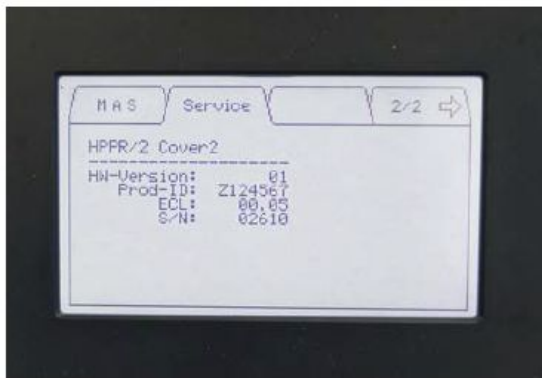


Figure 6.2: Service Tab

On the Service tab you are shown the:

- HW-Version: e.g. '1'
- Prod-ID: e.g. 'Z124567'
- ECL: <nn.mm>
- S/N: <Serial Number>
- If any error is queueing on the host, the error number, error message and the **Quit Error** button is shown on Service tab. The red Error LED is ON.

If there are no errors to display after initialization the host changes to the Modules tab. At this time, only the green Ready LED is ON.

6.1.5 Modules Tab

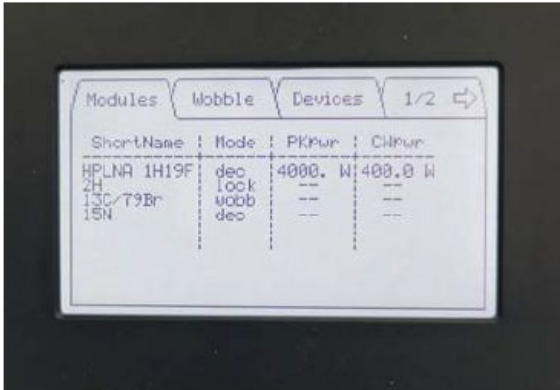


Figure 6.3: Modules Tab

The following module modes are possible depending on the module type:

Module Mode	Description
'dec'	Decouple mode (default), module is not used for observe or lock and is therefore always protected from transmit pulses.
'obs'	Observe mode, this module is used as observe channel. The protection of the module depends on the real time pulse "RGP_HPPR".
'lock'	Lock mode, this module is used as lock channel. The protection of the module depends on the real time pulse "LOCK_PP".
'wobb'	Tuning/Matching mode: This channel can be tuned and matched.
'crp ...'	Cryo probe modes: Can be combined with all modes described above (crp dec, crp obs, crp lock, crp wobb).
'fwd pwr'	The forward power from the reflectometer is routed to the RF out of the HPPR/2 (implemented in HPLNA modules only).
'refl pwr'	The reflected power from the reflectometer is routed to the RF out of the HPPR/2 (implemented in HPLNA modules only).
'PwrErr'	Power error, a power error has occurred on this module. Check the connection to the module and the preamplifier module itself.
'EmStop'	Emergency stop, an emergency stop signal has occurred and is queueing on this module.

Table 6.4: Modules Modes

The red Error LED shows a possible error on the host.

6.1.6 Devices Tab

The Devices tab shows all the so called 'connected devices' which can be connected at the rear side of Cover2.

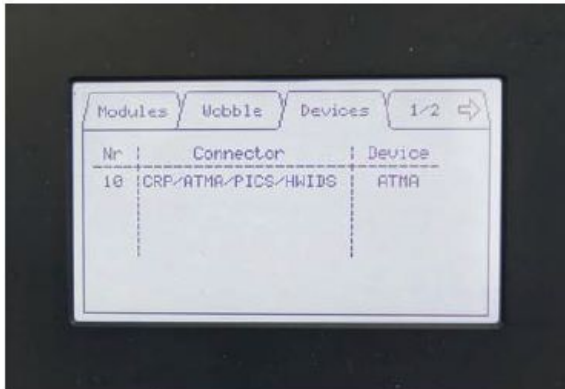


Figure 6.4: Devices Tab

The rear side from left to right is shown on the LCD from top to bottom.

The following devices can be shown:

'--'	Disconnected / empty socket
'CRP'	Cryoprobe
'ATMA'	ATMA resp. CRP-ATMA probe
'PICS'	Probe Identification System
'HWIDS'	Hardware Identification System

By connecting or disconnecting a connected device the host changes to the Device tab.

The red Error LED shows a possible error on the host.

6.1.7 Wobble Tab

The Wobble tab shows the modules short name and the corresponding wobble curve if any module is configured to wobble.

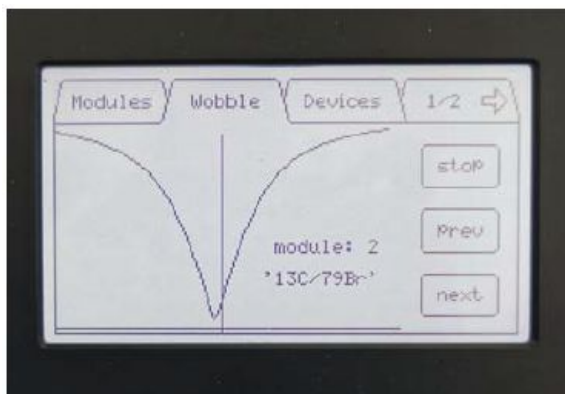


Figure 6.5: Wobble Tab

If wobble is active, wobble can either be:

- Stopped with the **stop** button.
- Switched to the next (**next** button) or previous (<**prev** button) channel if more than one channel is available.

TopSpin is able to change to the Wobble tab via the host.

The red Error LED shows a possible error on the host.

6.2 Rear View



Figure 6.6: Cover2 Module Rear View

6.2.1 Rear Side Connectors

NOTICE

Material damage hazard

Never plug in anything else other than the below mentioned connected devices to any of the RJ-45 connectors on the Cover2 rear side.

Case Label	Connector Type	Description
RF-OUT	BNC	Not used for AVANCE NEO.
LOCK-OUT	BNC	Not used for AVANCE NEO.
TUNING-IN	BNC	Not used for AVANCE NEO.
HPPR CONTROL	D-Sub 37	Control signals (BFB, real time pulses, emergency stop) and power supply for preamplifier modules, QNP, ADM, ADM-CRP.
CRP/ATMA/PICS/ HWIDS	RJ-45	Socket number 9 ... 10: - Connection either to CRP, ATMA, PICS or HWIDS.
HWIDS	RJ-45	Socket number 1 ... 8: - Connection to HWIDS only.

Table 6.5: Connectors on the rear side

NOTICE

Cover2 damage hazard

To connect the CRP / ATMA / PICS / HWIDS devices use exclusively the following cable:

Connected Device	Cable (Material Number)
CRP	Z14362
ATMA	Z14361
PICS	Z14361
HWIDS	H135248

Table 6.6: Appropriate Cable for Connected Devices

6.2.2 Left Side Connectors

Case Label	Connector Type	Description
Not labelled	D-Sub 25	PREAMP BUS connector (flat cable is already mounted)
Not labelled	D-Sub 9	Connector to MRI's HWIDS interface

Table 6.7: Connectors on the Left Side

6.3 Functionality

6.3.1 Power Supply and Monitoring

All voltages supplied from the console are filtered on the HPPR/2 Cover2 Module.

The HPPR/2 Cover2 Module is monitoring the +19V, +9V and -19V. Cover2 has the following voltage threshold to inform the host:

Error Cause	Description
+9V falls below 7.15 ... 7.55 V	The power supply +9V is too low. Check the power supply in the AQS-console.
+19V falls below 16.9 ... 17.25 V	The power supply +19V is too low. Check the power supply in the AQS-console.
-19V falls below -17.25 ... -16.9 V	The power supply -19V is too low. Check the power supply in the AQS-console.

Table 6.8: Power Supply Error Cause

6.3.2 Real Time Pulse

All pulses are driven to the preamplifier modules by a RS422 driver. The pulse delay from the pulse driver and transmission line to the preamplifier module is less than 300 ns.

There are following three real time pulses:

- RGP_HPPR, Receiver Gating Pulse HPPR (also known as RGP_PA).
- LOCK_PP, Lock Protection Pulse (also known as TP_F0).
- INTERLEAVE_INCR, Interleave Increment (also known as INCR_AQ or as RCP_HPPR_MODE).

6.3.3 BIS

The HPPR/2 Cover2 Module BIS data contains information about production data, ECL, hardware type, display type, calibration and sockets for connected devices.

BIS information is provided by the internal MCU (Micro Controller Unit) and can be read via the website respectively via the host.

7 HPPR/2 Preamp Modules for AVANCE NEO

7.1 HPPR/2 Preamp Variants

The following preamp modules are used for AVANCE NEO:

- AQS 1H2H PREAMP 300
- AQS 1H2H PREAMP 400 CRP
- AQS XBB19F 2HS PREAMP 300
- AQS XBB19F 2HS PREAMP CRP 400

- HPPR/2 1H HPLNA Module
- HPPR/2 3H HPLNA Module
- HPPR/2 31P Module
- HPPR/2 13C Module
- HPPR/2 2H Module
- HPPR/2 15N Module
- HPPR/2 XBB19F 2HP Module
- HPPR/2 XBB31P 2HP HPLNA Module

(Refer to HPPR/2 manual Z31559 version 007 for other HPPR/2 preamp modules used in previous spectrometers)

7.2 HPPR/2 Preamp Part Numbers

System Frequency (MHz)	HPLNA 1H	HPLNA 3H	31P	13C	2H	15N	XBB19F 2HP	HPLNA XBB31P
300	Z103202	Z108973			Z003469		Z105925	Z111088
400	Z103203	Z108974	Z103580	Z103574	Z003471	Z103577	Z106984	Z111091
500	Z103204	Z106669	Z102448	Z003523	Z003472	Z003529	Z102026	Z111092
600	Z103205	Z108975	Z102449	Z003524	Z003473	Z003530	Z105186	Z111093
700	Z103206	Z108976	Z102450	Z003525	Z003474	Z003531		Z111094
750	Z103207	Z108977	Z102451	Z003526	Z003475	Z003532		Z111095
800	Z103208	Z108978	Z102452	Z003527	Z003476	Z003533		Z111096
850	Z105203		Z107395	Z107393	Z104078	Z107394		Z111097
900	Z103209		Z102453	Z003528	Z003477	Z003534		Z111098
950	Z106278		Z106277	Z106275	Z106273	Z106276		Z111099
1000	Z103210		Z109359	Z109357	Z109356	Z109358		Z111100

Table 7.1: HPPR/2 Modules for HR NMR, Solids and Imaging

HPPR/2 Preamplifier Modules for AVANCE NEO

System Frequency (MHz)	AQS 1H2H	AQS 1H2H CRP	AQS XBB19F 2HS	AQS XBB19F 2HS CRP
300	Z003950		Z003954	
400		Z128274		Z128143

Table 7.2: AQS Preamplifier for HR NMR (NanoBay)

System Frequency (MHz)	HPLNA 1H	HPLNA XBB31P	BB HPLNA 20-200MHZ	BB HPLNA 40-400MHZ
128 (3T)	Z153915			
200	Z103201	Z125300		
300	Z103202	Z111088		
400	Z103203	Z111091		
500	Z103204	Z111092		
600	Z103205	Z111093		
650	Z125008	Z125301		
Special			Z137069	Z145642

Table 7.3: HPPR/2 Modules for MRI

7.3 HPPR/2 Preamplifier Overview

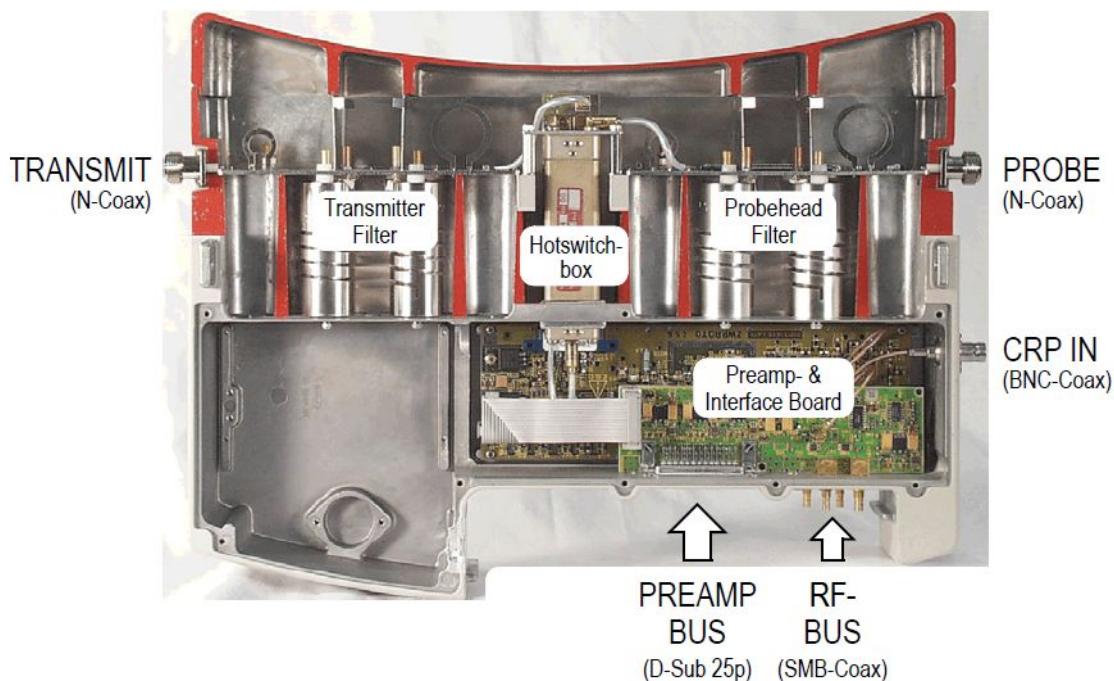


Figure 7.1: Preamp Module (open example)

7.4 HPPR/2 Operating Modes

7.4.1 Operating Modes of HPPR/2 XBB, 31P, 13C, 15N Modules

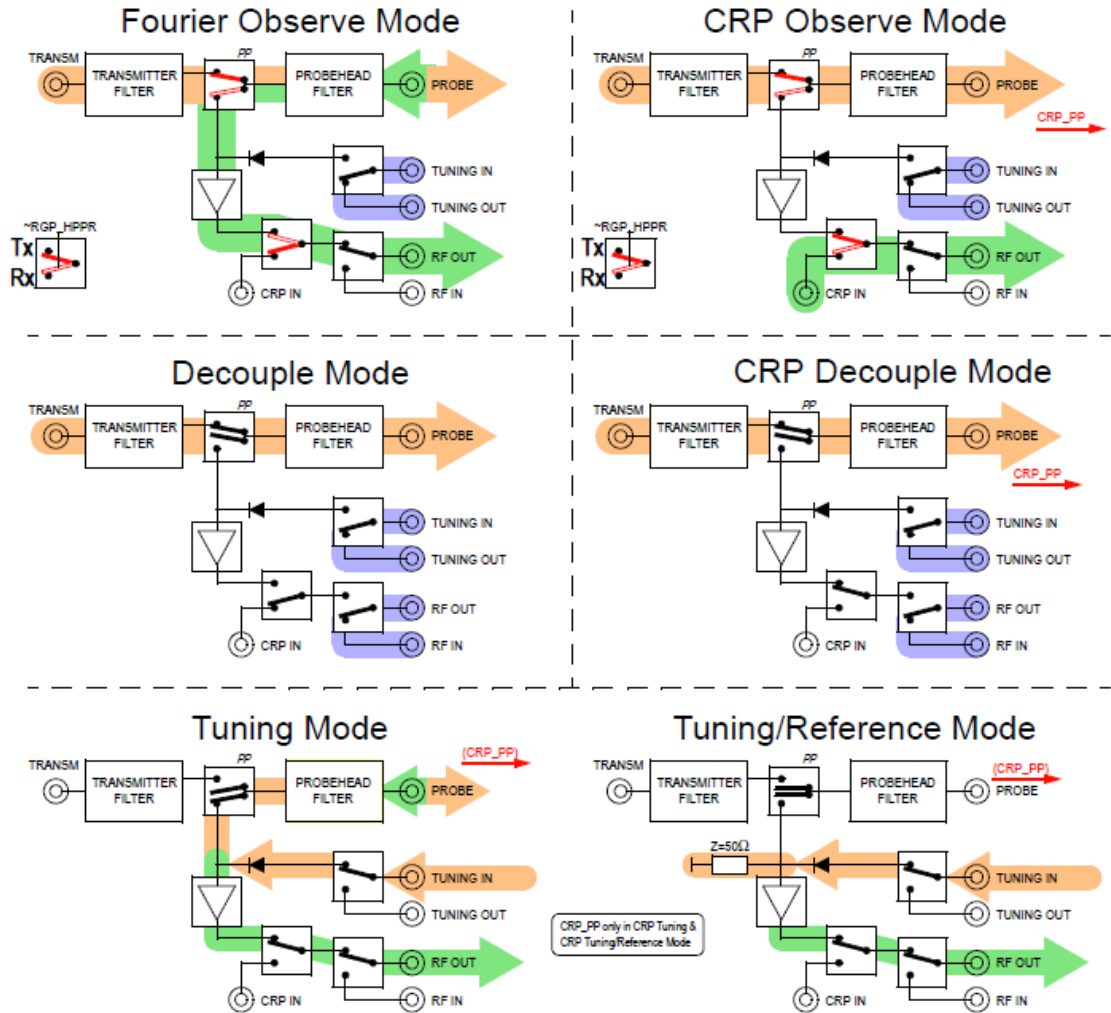


Figure 7.2: Operating Modes of HPPR/2 XBB19F, 31P, 13C, 15N Modules

7.4.2 Operating Modes of HPPR/2 2H Module

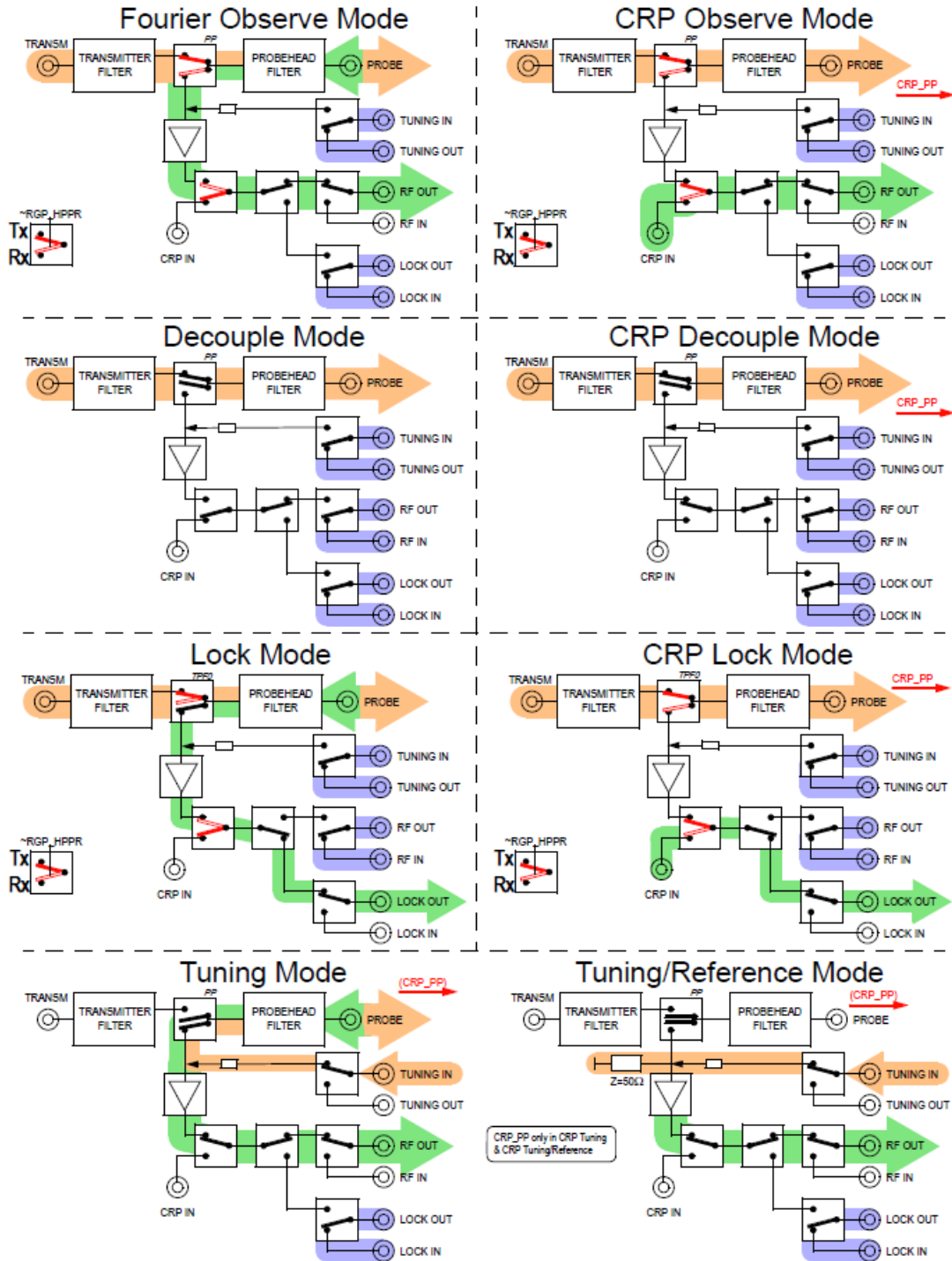


Figure 7.3: Operating Modes of HPPR/2 2H Modules

7.4.3 Operating Modes of AQS 1H2H Preamp

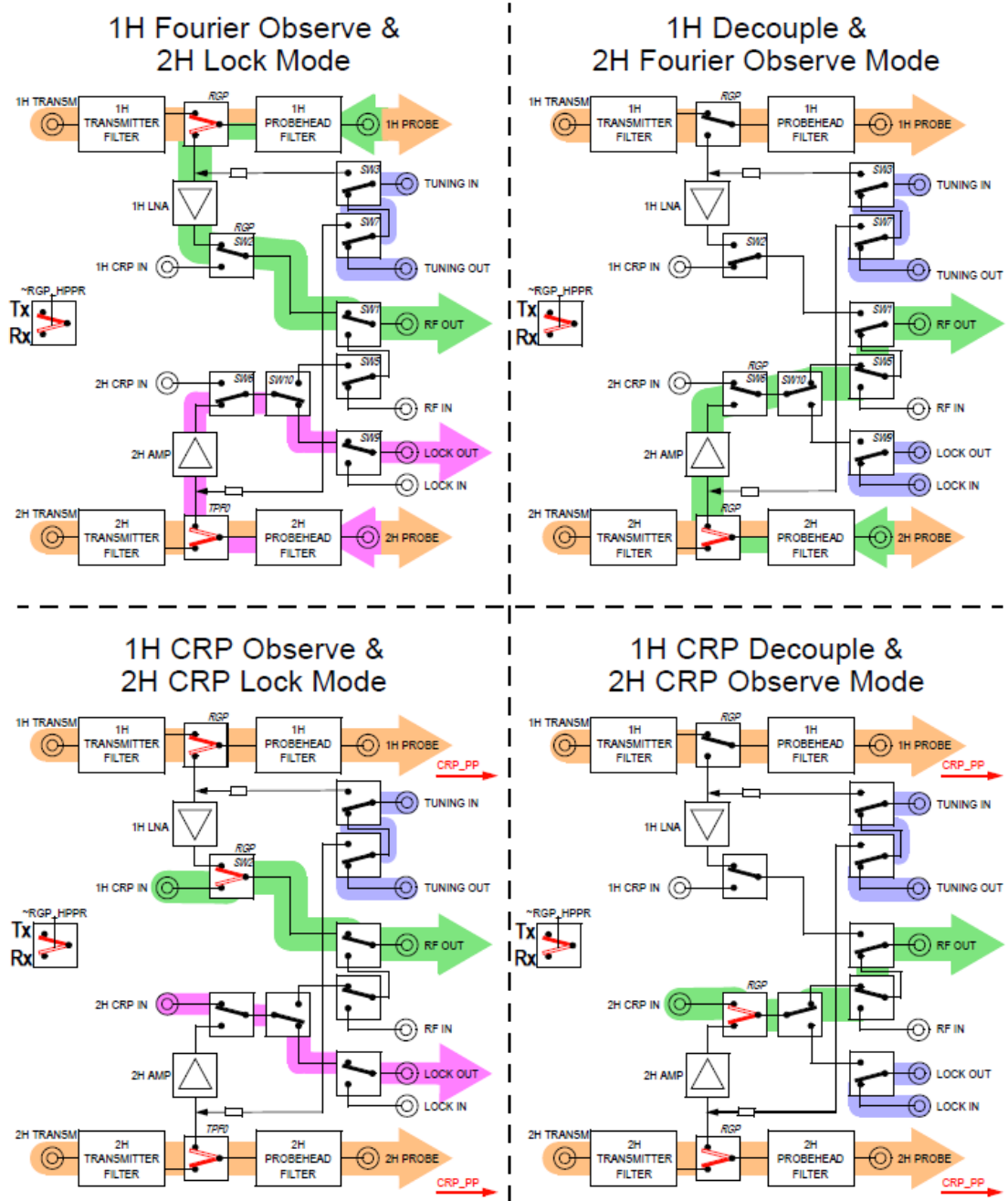


Figure 7.4: Operating Modes of AQS 1H2H Preamp

7.4.4 Operating Modes of HPLNA 1H Module (ECL >=06, with Lock Capability)

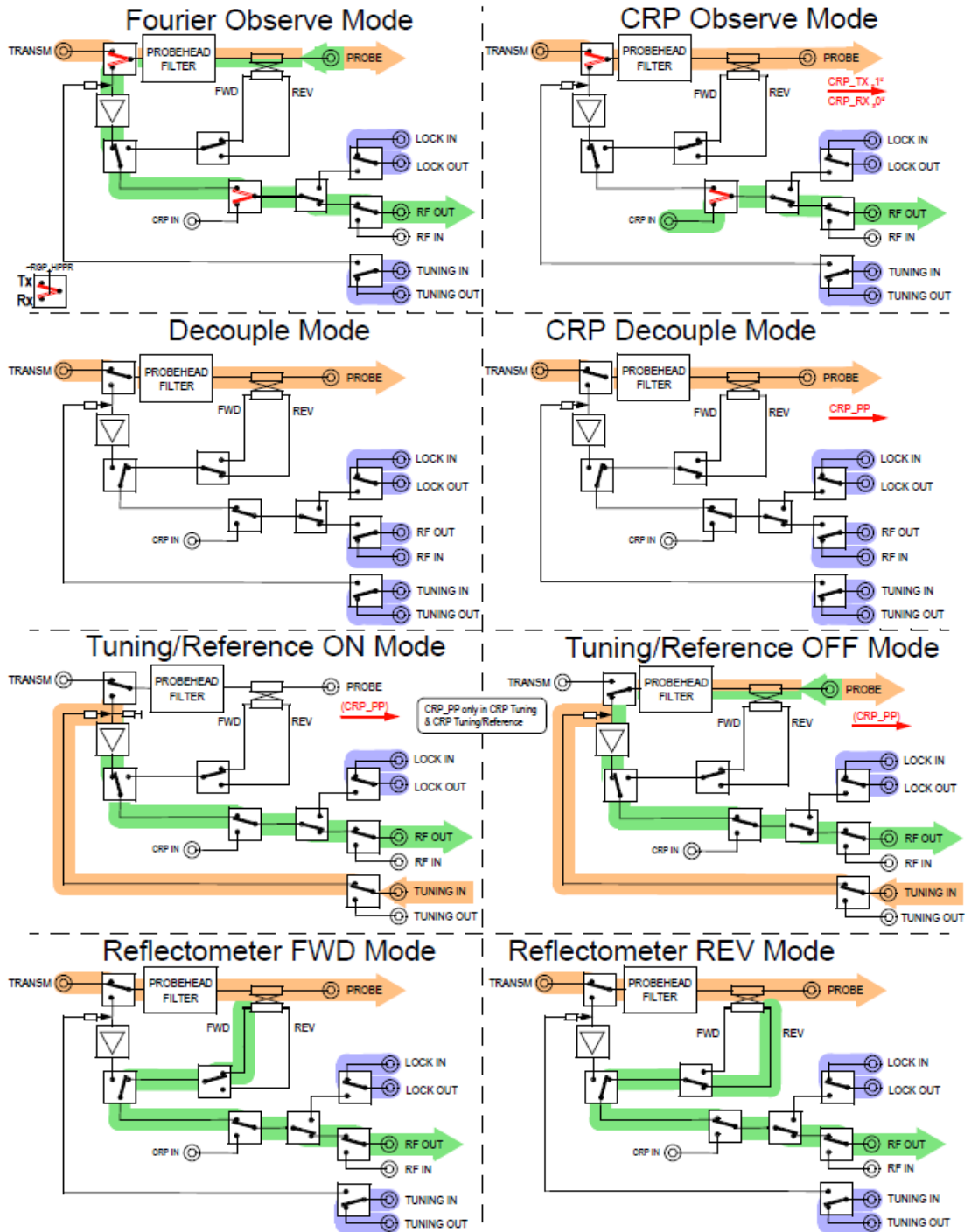


Figure 7.6: Operating Modes 1H HPLNA Module

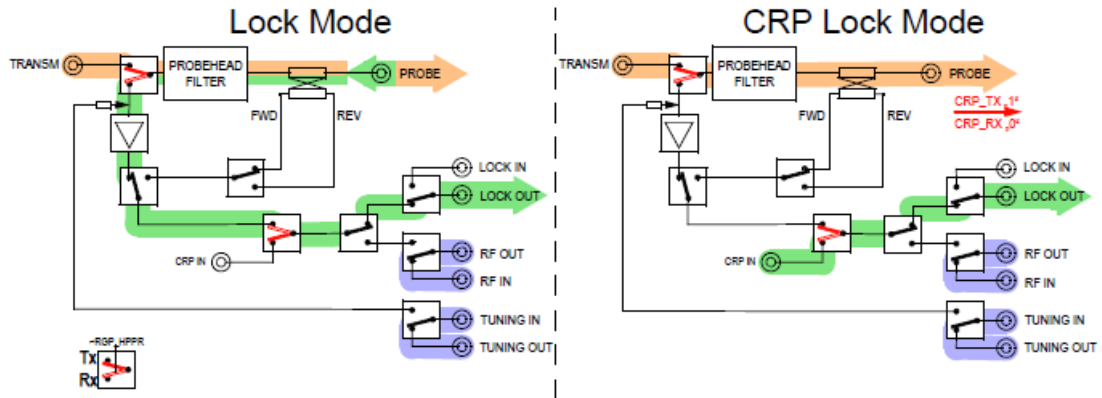


Figure 7.7: Operating Modes 1H HPLNA Module

7.5 Technical Specifications

Important technical specifications of AV NEO HPPR/2 modules will be given in the following section.

All given parameters are valid for the entire module. Specially the noise figure specification is valid for the entire HPPR/2 module including all implemented filters.

Only the typical values are given for the noise figures. The unit to unit variation is less than ± 0.2 dB.

For technical specifications of previous or other module types, please check the previous HPPR/2 manual version: Z31559 Version 007.

7.5.1 Technical Data AQS 1H2H Preamp (ECL>=03)

	300	400
1H Receive Path Performance		
Gain (typ)	30 dB	30 dB
Noise Figure (typ)	1.8 dB	1.6 dB
1H Transmit Path Performance		
Max. Power Rating, 2% Duty Cycle	150 W / 20 μ s,	150 W / 20 μ s,
Insertion Loss	≤ 2.8 dB	≤ 2.8 dB
2H Receive Path Performance		
Gain (typ)	48 dB	48 dB
Noise Figure (typ)	1.5 dB	1.5 dB
2H Transmit Path Performance		
Max. Power Rating, 2% Duty Cycle	300 W (20 μ s)	300 W (20 μ s)
Insertion Loss	≤ 2.0 dB	≤ 2.0 dB

Table 7.4: Technical Data AQS 1H2H Preamp

7.5.2 Technical Data AQS XBB19F 2HS MODULE (ECL>=07)

	300 - 400
Receive Path Performance	
Gain (typ)	28 dB
Noise Figure 13C (typ)	1.2 dB
Transmit Path Performance	
Max. Power Rating, 2% Duty Cycle	500 W (0.1 ms) 400 W (1 ms) 300 W (10 ms)
Insertion Loss 13C	≤ 0.7 dB

Table 7.5: Technical Data AQS XBB19F 2HS Preamp

7.5.3 Technical Data HPPR/2 1H HPLNA MODULE (19F-1H)

	200 - 600	650- 900	950 - 1000
Receive Path Performance			
Gain (typ)	28 dB	28 dB	28 dB
Noise Figure 1H (typ)	0.9 dB	1.0 dB	1.1 dB
1dB Compression Point	≥ -12 dBm (Input Power)	≥ -12 dBm (Input Power)	≥ -12 dBm (Input Power)
Transmit Path Performance			
Max. Power Rating, 2% Duty Cycle	4 kW (0.1 ms) 4 kW (1 ms) 4 kW (10 ms)	4 kW (0.1ms) 4 kW (1 ms) 4 kW (10 ms)	4 kW (0.1 ms) 4 kW (1 ms) 4 kW (10 ms)
Insertion Loss 1H	≤ 0.9 dB	≤ 0.9 dB	≤ 0.9 dB

Table 7.6: Technical Data HPPR/2 1H HPLNA Module

7.5.4 Technical Data HPPR/2 3H HPLNA MODULE

	300 - 600	700 - 800
Receive Path Performance		
Gain (typ)	28 dB	28 dB
Noise Figure (typ)	0.9 dB	1.0 dB
1 dB Compression Point	≥ -12 dBm (Input Power)	≥ -12 dBm (Input Power)
Transmit Path Performance		
Max. Power Rating, 2% Duty Cycle	4 kW (0.1 ms) 4 kW (1 ms) 4 kW (10 ms)	4k W (0.1 ms) 4 kW (1 ms) 4 kW (10 ms)
Insertion Loss	≤ 0.9 dB	≤ 0.9 dB

Table 7.7: Technical Data HPPR/2 3H HPLNA Module

7.5.5 Technical Data HPPR/2 31P MODULE (ECL≥=07)

	400 - 1000
Receive Path Performance	
Gain (typ)	28 dB
Noise Figure (typ)	1.5 dB
Transmit Path Performance	
Max. Power Rating, 2% Duty Cycle	500 W (0.1 ms) 400 W (1 ms) 300 W(10 ms)
Insertion Loss	≤ 1.6 dB

Table 7.8: Technical Data HPPR/2 31P Module

7.5.6 Technical Data HPPR/2 13C MODULE (ECL≥=08, 79Br-13C)

	400 - 900	950 - 1000
Receive Path Performance		
Gain (typ)	28 dB	28 dB
Noise Figure 13C (typ)	1.5 dB	1.6 dB
Transmit Path Performance		
Max. Power Rating, 2% Duty Cycle	500 W (0.1 ms) 400 W (1 ms) 300 W (10 ms)	500 W (0.1 ms) 400 W (1 ms) 300 W (10 ms)
Insertion Loss 13C	≤ 1.6 dB	≤ 1.6 dB

Table 7.9: Technical Data HPPR/2 13C Module

7.5.7 Technical Data HPPR/2 2H MODULE (ECL \geq 07)

	300 - 900	950 - 1000
Receive Path Performance		
Gain (typ)	28 dB (42 dB in Lock Mode)	28 dB (42 dB in Lock Mode)
Noise Figure (typ)	1.3 dB	1.2 dB
Transmit Path Performance		
Max. Power Rating, 2% Duty Cycle	500 W (0.1 ms) 400 W (1 ms) 300 W (10 ms)	500 W (0.1 ms) 400 W (1 ms) 300 W (10 ms)
Insertion Loss	≤ 1.6 dB	≤ 1.6 dB

Table 7.10: Technical Data HPPR/2 2H Module

7.5.8 Technical Data HPPR/2 15N MODULE (ECL \geq 07)

	400 - 600	700 - 900	950-1000
Receive Path Performance			
Gain (typ)	28 dB	28 dB	28 dB
Noise Figure (typ)	1.5 dB	1.2 dB	1.3 dB
Transmit Path Performance			
Max. Power Rating, 2% Duty Cycle	500 W (0.1 ms) 400 W (1 ms) 300 W (10 ms)	500 W (0.1 ms) 400 W (1 ms) 300 W (10 ms)	500 W (0.1 ms) 400 W (1 ms) 300 W (10 ms)
Insertion Loss	≤ 1.6 dB	≤ 1.0 dB	≤ 1.0 dB

Table 7.11: Technical Data HPPR/2 15N Module

7.5.9 Technical Data HPPR/2 XBB19F 2HP MODULE (ECL>=07)

	300 - 700
Receive Path Performance	
Gain (typ)	28 dB
Noise Figure 13C (typ)	1.0 dB
Transmit Path Performance	
Max. Power Rating, 2% Duty Cycle	500 W (0.1 ms)
	400 W (1 ms)
	300 W (10 ms)
Insertion Loss 13C	≤ 0.7 dB

Table 7.12: Technical Data HPPR/2 XBB19F 2HP Module

7.5.10 Technical Data HPPR/2 XBB31P 2HP HPLNA MODULE

	200 - 600	650- 1000
Receive Path Performance		
Gain (typ)	28 dB	28 dB
Noise Figure 13C (typ)	1.0 dB	1.1 dB
1dB Compression Point	≥ -11 dBm (Input Power)	≥ -11 dBm (Input Power)
Transmit Path Performance		
Max. Power Rating, 2% Duty Cycle	2 kW (0.1 ms)	2 kW (0.1 ms)
	700 W (1 ms)	700 W (1 ms)
	550 W (10 ms)	550 W (10 ms)
Insertion Loss 13C	≤ 0.6 dB	≤ 0.6 dB

Table 7.13: Technical Data HPPR/2 XBB31P 2HP HPLNA Module

7.6 RF Pulse Power Capability Overview

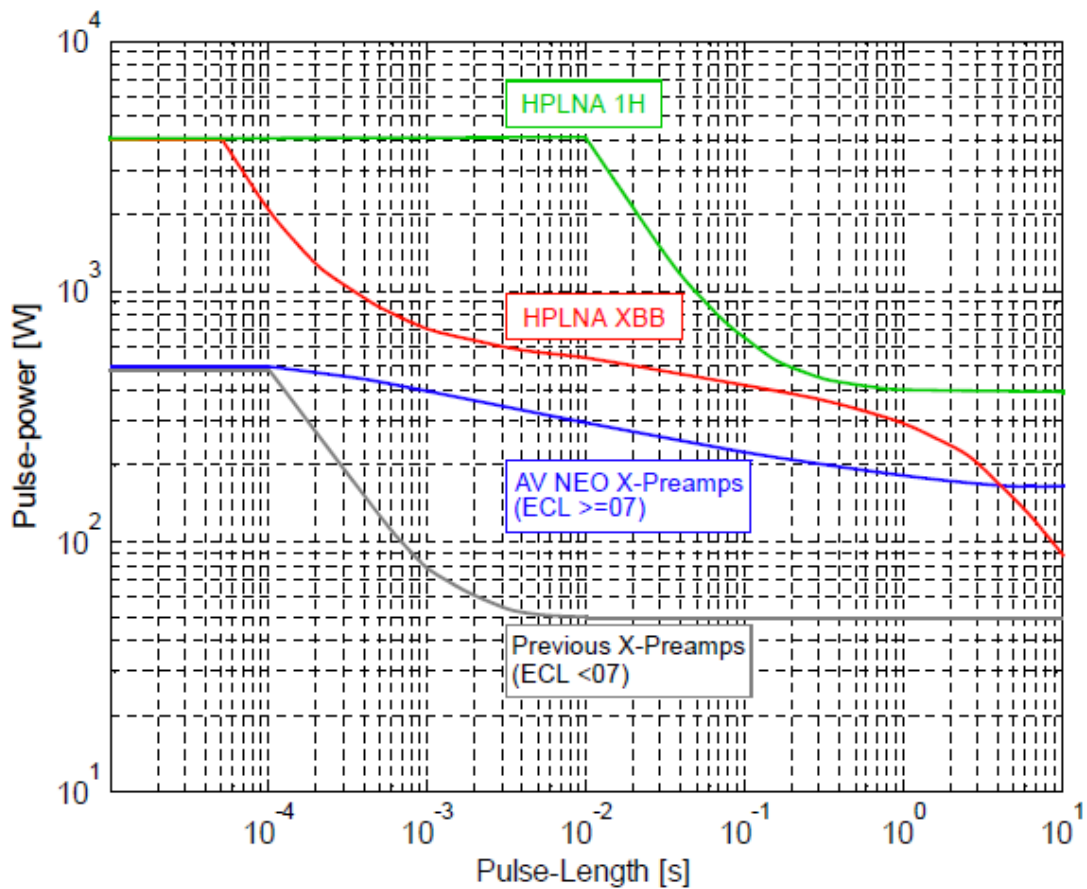
The following graph shows the maximum single RF pulse power capability for all AV NEO compatible HPPR/2 preamplifier modules. The graph is also valid for repetitive RF-pulses with a low duty cycle ($\leq 2\%$).

All x-nuclei preamplifier (e.g. selective preamps as 15N, 13C, 31P, 2H and also broadband preamps as XBB19F 2HP) are summarized and labeled as *X-Preamps*.

Previous preamplifiers are also shown (gray line).

The RF pulse power capability is limited by maximal dielectric strength or thermal hotspots in certain electronic components (whichever is earlier).

The graph is only valid for matched conditions. In an unmatched environment, the power capability will be lowered.



8 HPPR/2 Baseplate AV4

8.1 Overview

The HPPR/2 BASEPLATE AV4 serves as an interconnect for the RF- and RGP wiring between the electronics console and the HPPR/2 preamplifiers. It also has the main protective earth connection for the HPPR/2 preamplifier stack.

There are several versions for NMR systems:

- Z155568 HPPR/2 BASEPLATE AV4 4CH
- Z155569 HPPR/2 BASEPLATE AV4 8CH
- Z165937 HPPR/2 MAS3 BASEPLATE AV4 8CH



Figure 8.1: View BASEPLATE AV4 4CH



Figure 8.2: View BASEPLATE AV4 8CH

8.2 Description

The standard baseplates have BNC connectors for RF-OUT and LOCK-OUT signals to the TRANSCEIVER (TRX) in the AQS chassis of the console. The TUNE and RGP-HPPR signals from the TRX and PSM-A are bundled in cables (4 channels each) and linked via d-sub connectors to the baseplate. Inside the baseplate some RGPs are split with resistive splitters. All cables to the preamplifiers have SMB connectors.

The MAS3 baseplate is functionally the same as the 8CH baseplate. But because it is mounted on top of the MAS3 UNIT it has a standard preamplifier housing.

8.2.1 Part Numbers

Bruker Part No.	Description
Z155568	HPPR/2 BASEPLATE AV4 4CH
Z155569	HPPR/2 BASEPLATE AV4 8CH
Z165937	HPPR/2 MAS3 BASEPLATE AV4 8CH

Table 8.1: Part Numbers: BASEPLATE AV4

8.2.2 Technical Data

Frequency range

- all RF signals 0.005 .. 1.5 GHz

Insertion loss @ 1 GHz

- RF-IN, RF-OUT, LOCK-OUT: 0.3 dB (connector) + 1.0 dB/m
(BNC > SMB)

- TUNE IN: (D-SUB > SMB) 0.5 dB (connector) + 1.7 dB/m

RGP splitter

Resistive 2 or 3-way splitter, 1 resistor per output 330 Ω

8.3 Troubleshooting

The BASEPLATE can only be replaced as a whole unit (FEU). There are no serviceable parts.

If an FRU needs to be replaced, contact your Bruker Service Representative.

9 CRP RF-Electronics

9.1 General

The HPPR/2 plays an important role of being the provider of the Cryoprobe in terms of DC-power supply and transmit-/receive switch bias current for every active ¹ CRP channel.

Following a short overview shall be given on the typical power consumption of different CRP RF-electronics types and the transmit-/receive bias currents.

9.2 Power Consumption

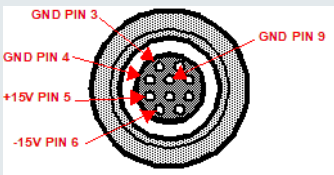
Cryoprobe	I_{typ} [A]	I_{typ} [A]
 <p>View: Connector Side</p>	+15V (LEMO Power Conn. Pin 5)	-15V (LEMO Power Conn. Pin 6)
CRP PRCONT 1H2H	.13	.02
CRP PRCONT 13C(1H31P2H15N)	.10	.01
CRP PRCONT 15N (2H13C31P1H)	.10	.01
CRP PRCONT BB15N,29SI-31P(2H,19F-1H)	.14	.01
CRP PRCONT BB15N,29SI-31P,19F(2H1H)	.14	.01
CRP PRCONT 1H(15N-31P,19F) ^a	.17	.01
CRP PRCONT 2H(15N13C31P1H) ^a	.05	.01
CRP PRCONT 1H2H(15-31P,19F)	.21	.02
CRP PRCONT 19F(15N-31P,1H)	.16	.01
CRP PRCONT 1H1H	.17	.02
CRP T/R-SWITCH CONTROL	.08	.01
CRP POWER SUPPLY BBIS/PICS	.11	.03
^a Obsolete		

Table 9.1: CRP RF-Electronics Power Consumption

¹ An active CRP channel (cold preamplifier) is marked in the CRP PICS with a „PRCONT“ entry. Compared to a passive channel (cold filters only) which is marked with a „CONT“ entry.

9.3 Transmit-/Receive Bias Currents

The following transmit-/receive bias currents may be measured on the transmitter coaxial line between the HPPR/2 module and the corresponding Cryoprobe input:

MODULE	Typical Bias Current @ 77K	
	For System Frequencies (1H) up to 1000 MHz	For System Frequencies (1H) 1100 and 1200 MHz
HPPR/2 15N MODULE	95 mA	140 mA
HPPR/2 2H MODULE	95 mA (observe mode)19 mA (lock mode)	140 mA (observe mode)19 mA (lock mode)
HPPR/2 13C MODULE	95 mA	140 mA
HPPR/2 31P MODULE	95 mA	140 mA
AQS XBB19F 2HS MODULE	95 mA	140 mA
HPPR/2 XBB19F 2HP MODULE	95 mA	140 mA
HPPR/2 XBB31P 2HP HPLNA MODULE	95 mA	140 mA
HPPR/2 19F MODULE	45 mA (observe mode) 17 mA (lock mode)	not available
HPPR/2 1H HPLNA MODULE	45 mA (observe mode) 17 mA (lock mode, ECL >= 06)	
AQS 1H2H MODULE	1H: 36 mA	not available
	2H: 36 mA (observe mode) 15 mA (lock mode)	not available

Table 9.2: Cryoprobe T/R-Switch Bias Currents for the HPPR/2 Family

10 MRI Active Detuning Module

10.1 Overview

The HPPR/2 MRI ACTIVE DETUNING Module (ADM) belongs to the group of MRI interface modules. It combines the functionality of the former BIO ACT DEC/COIL CONTROL UNIT (T5051) and the HPPR/2 MRI-INTERFACE MODULE RF1-4 (Z106268).

The ADM has four coil control channels. Each has four PIN diode drivers, four tuning/matching varicap diode drivers and additional control signals. They are used to tune or detune individual coils in the receiver array.

RF connections provide interconnects between the coil array (incl. array preamps), the preamplifier modules and the receiver boards in the AQS chassis. In AV4 systems some of these connections have been moved to the HPPR/2 MRI BASEPLATE.



Figure 10.1: View HPPR/2 MRI ACTIVE DETUNING Module

10.2 Description

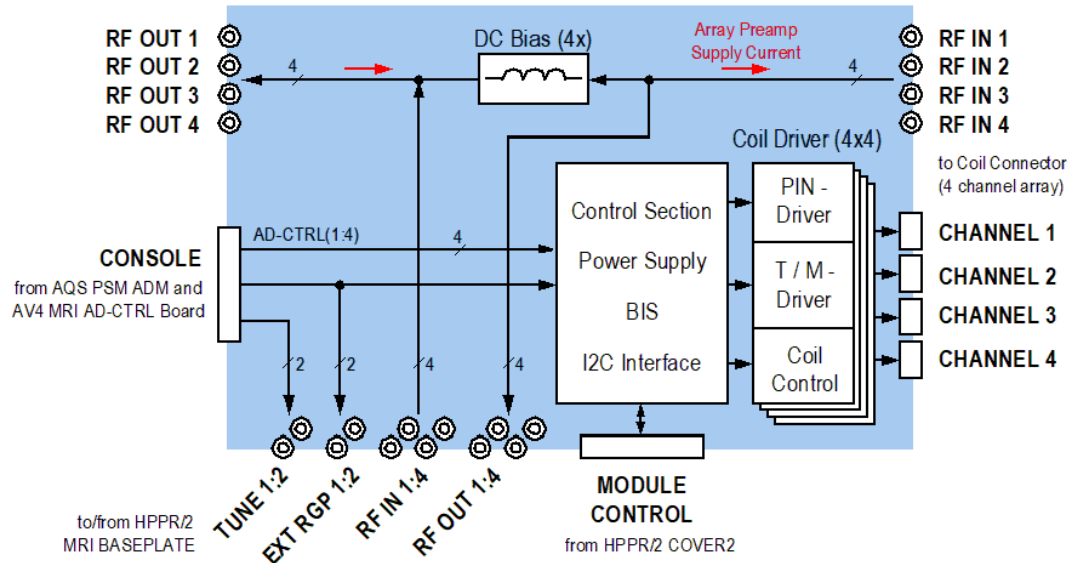


Figure 10.2: Block Diagram: MRI ADM-CRP Module (ECL > 03)

10.2.1 Input Pulses

The ADM module uses seven input pulses used for PIN driver, tune/match driver and RGP output pulse control:

- RGP_HPPR: common RGP for all preamplifier modules.
- EXT_RGP(1:2)~: discrete RGP from AV4 TRX.
- AD-CTRL(1:4)~²: discrete transmitter blanking pulse from AV4 AD-CTRL Board.

² Formerly BLNKTR(1:4)~

10.2.2 PIN Driver Function

Each driver can be controlled independently either in static mode or by the input pulses, which can be OR combined via software setting. The pulse polarity is either set via the LOGIC_SEL input from the coil connector or via software.

The positive (forward) output voltage level is about +5 V, depending on the load current. In voltage mode the maximum load current is 0.5 A per driver. In current mode the load current is limited to 100 mA per driver. The negative (reverse) output voltage level can be set either to -36 V or -60 V.

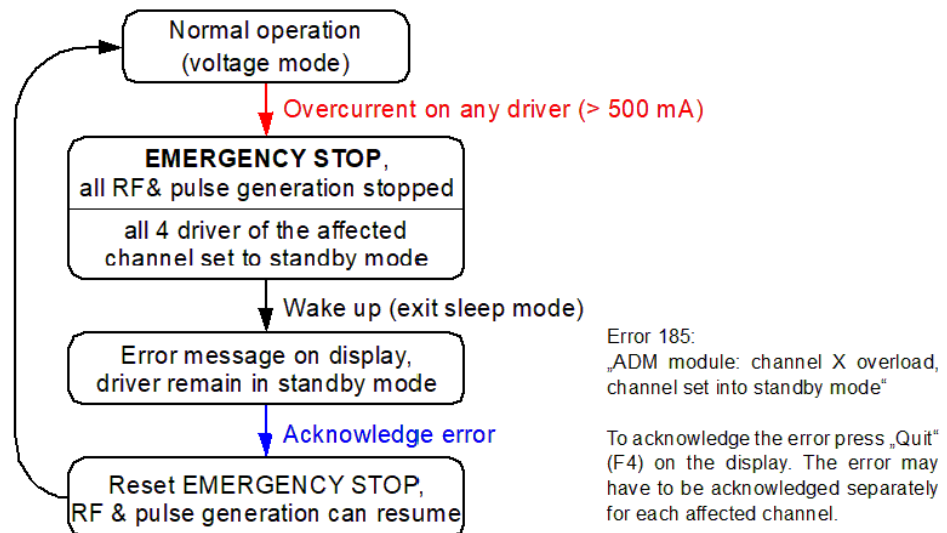


Figure 10.3: PIN-Driver Overcurrent Error Handling

10.2.3 Tune/Match Driver Function

Each coil channel has four DAC controlled tuning drivers for varicap diodes: Tune 0°, Match 0°, Tune 90° and Match 90°. The output voltage level is between 0 and -30 V.

Each DAC has two data registers A and B. This allows fast switching between two preset output voltages. To toggle between these, any OR-combination of the input pulses can be used.

10.2.4 RGP Output Pulse

Each coil channel has one RGP output pulse. The pulse can be selected from the three input pulses RGP_HPPR, EXT_RGP(1)~ or EXT_RGP(2)~ individually for each channel.

10.2.5 Connectors

Position	Label	Connector Type	Description
PROBE	CHANNEL	MDR (mini-delta ribbon female)	Detuning output signals to coil connector
	RF IN	SMA (coax female)	RF input signal from coil or array preamp
TRANSM	RF OUT	N (coax female)	RF output signal to AQS RXAD
	CONSOLE	UT0 19pol. (multiple coax and DC contacts)	Receiver gating pulses from AQS RXAD Blanking pulses and tuning signals from AQS PSD Power supply from AQS PSM ADM
PREAMP	RF IN RF OUT EXT_RGP~ TUNE	SMB (coax male)	RF input from preamplifier module RF output to preamplifier module Receiver gating pulse output to preamplifier module Tuning signal output to preamplifier module

Table 10.1: Connector Description

10.2.6 Part Numbers

Bruker Part No.	Description
Z107408	HPPR/2 MRI ACTIVE DETUNING MODULE

Table 10.2: Part Number: ADM

10.3 Technical Data

10.3.1 Coil Control Section

Input Signals:

RGP_HPPR:	RS-422 differential	--
EXT_RGP(1:2)~:	+5V TTL	--
AD-CTRL(1:4)~:	+5V TTL	--
LOGIC_SEL: (from coil connector)	open/1k Ω pull-down or +5V TTL	--

PIN Driver:

Positive (forward) output voltage: (voltage mode)	+4 .. 5.5	Vdc
Positive (forward) output current: (voltage mode)	max. 500	mA
Positive (forward) output current: (current mode)	limited to 100 ³	mA
Negative (reverse) output voltage: (-36 V mode)	-36 +3/-10%	Vdc
Negative (reverse) output voltage: (-60 V mode)	-60 +3/-10%	Vdc
Negative (reverse) output current: (-60 V mode)	max. -50	mA
Transition time: (50% input pulse \rightarrow 90% output voltage)	max. 3	μ s

Tuning/Matching Driver:

Output voltage: (DAC 0..4095, register A or B)	0..-30 ⁴	Vdc
Trans. time reg. A to B: (50% input pulse \rightarrow 90% output voltage)	max. 30	μ s
Tune control output signals:	+5V TTL	--

Coil Control Signals:

RGP output voltage:	+5V TTL	--
+9V output voltage: ($I_{Lmax} = 200$ mA)	+9.0 \pm 0.5	Vdc
-30V output voltage: ($I_{Lmax} = 20$ mA)	-30.0 \pm 0.5	Vdc
+5V output voltage: ($I_{Lmax} = 50$ mA)	+5.0 \pm 0.5	Vdc

³ECL02: max. current = 108 .. 124 mA ; ECL03: max. current = 104 .. 110 mA

⁴Transition time corrected (old value = max. 6 μ s)

10.3.2 RF-Section

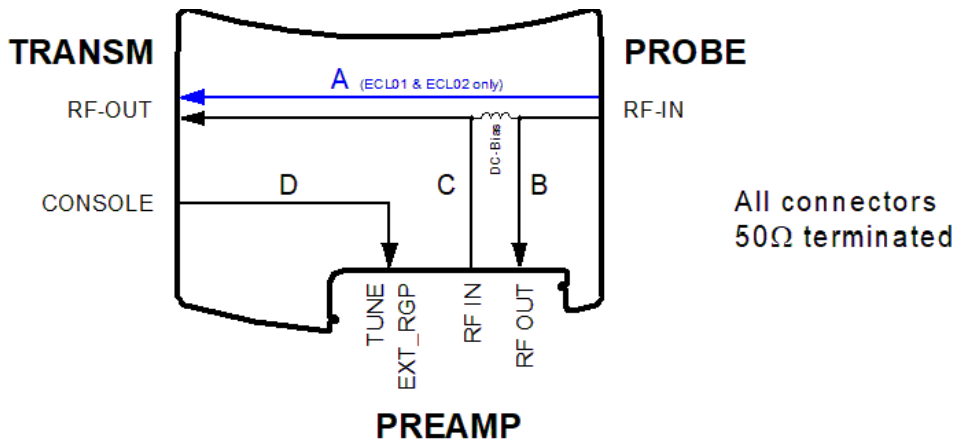


Figure 10.4: RF Measurement Paths

Measurement range insertion loss (S21):	0.02 - 0.4GHz / 0.4 - 1GHz	
Insertion loss path A:	max. 0.5 / 1.0	dB
Insertion loss path B:	max. 0.4 / 0.8	dB
Insertion loss path C:	max. 0.6 / 1.2	dB
Insertion loss path D:	max. 0.5 / 1.0	dB
Measurement range VSWR (S11) and Isolation (21):	0.005 - 1GHz	
VSWR path A, B and C : all connectors	max. 1.2:1	-
VSWR path D : all connectors	max. 1.4:1	-
Isolation path B → C:	min. 40	dB

10.4 Troubleshooting

The ADM-CRP can only be replaced as a whole unit (FEU). There are no serviceable parts.

If an FRU needs to be replaced, contact your Bruker Service Representative.

Detected failures are reported with event messages. Event messages are displayed on the TopSpin screen and can be viewed on the Service Web pages.

10.4.1 Diagnostics

ServiceWeb pages provide some low level access to the hardware that may help to diagnose hardware problems.

There are testpoints for all input pulses, all PIN and tune/match driver outputs and a selection of power supply voltages.

11 HPPR/2 MRI ADM-CRP Module

11.1 Overview

The HPPR/2 MRI ADM-CRP MODULE 200-400 (ADM-CRP) belongs to the group of MRI interface modules. It has similar functions as the HPPR/2 MRI ACTIVE DETUNING MODULE (ADM) but is exclusively used for 1H MRI array cryo probe (RX only).

In addition to the ADM, the ADM-CRP contains a preamplifier with four channel tuning (wobble) capability. There are two frequency versions; 200-400 MHz and 500-750 MHz.



Figure 11.1: View HPPR/2 MRI ADM-CRP Module

11.2 Description

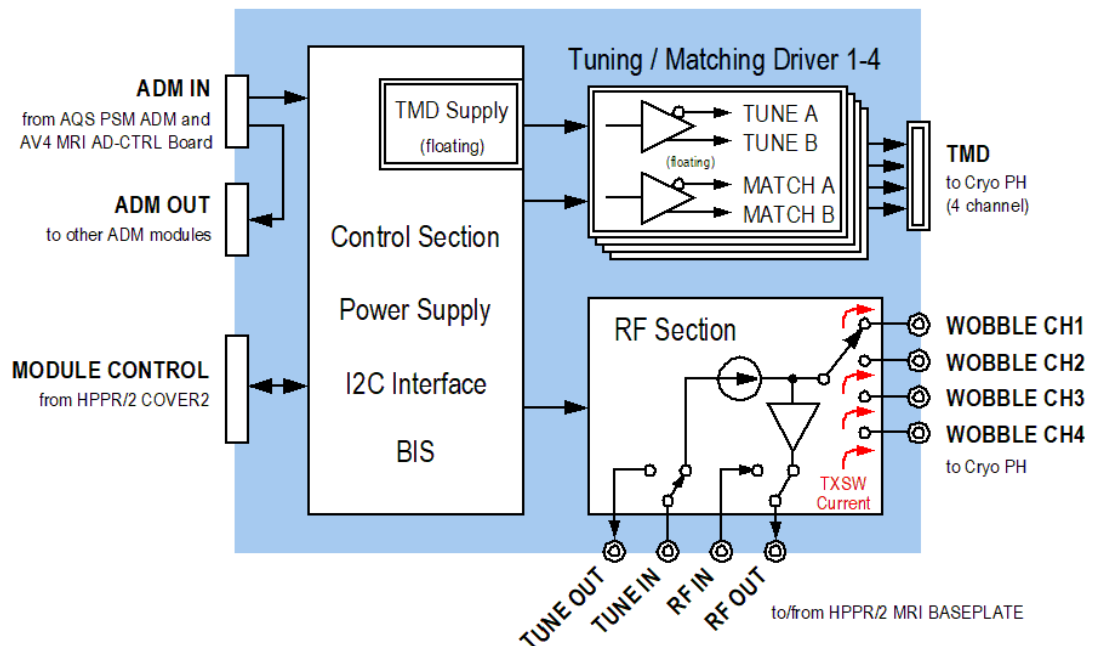


Figure 11.2: Block Diagram: MRI ADM-CRP Module

The control section incorporates an I2C interface, tuning/matching DAC controller, detune- and RF switch controller and many diagnostic functions. The TMD section has its own supply, isolated from the common HPPR (case) GND.

The RF sections contains a preamplifier with a selector for four wobble channels including TXSW bias current sources. The tuning RF-signal is coupled into the preamplifier via the tuning switch.

11.2.1 Tuning/Matching Driver

Each TMD channel has four tuning/matching drivers for varicap diodes combined with tune/detune switches. In tuning/matching mode the output voltage is controlled by DAC. In detune mode the output voltage polarity is inverted and the current limited.

The tune/detune switches are all switched synchronously with one single detune pulse per channel. The detune pulses are controlled by a combination of up to four AD-CTRL (formerly BLNKTR) pulses.

11.2.2 Operating Modes

The ADM-CRP uses internally two modes to set the operating mode. The HPPR/2 COVER software uses these to control the module functions. They are also available on the service web page.

- Module mode = channel independent settings.
- Channel mode = channel specific settings, one setting per channel.

Group	Operating Mode	Array Coils	Volume Resonator	CRP TXSW ^a	Module Mode	Channel Mode
CRP Obs	Passive (power up)	0V	na	RX ^b	0	0
	Observe Continuous	tuned	na	RX ^b	2	0
	Observe / Detune Pulsed	pulsed	TX	pulsed	2	1
	Detune Continuous	detuned	pulsed	TX	2	2
Tune	Tuning Reference ^c	tuned	na	TX	1	3
	Wobble ^d	tuned	na	TX	3	3
	Wobble Detuned	detuned	na	RX	3	4
	Wobble 50 Ω	tuned	na	TX	3	5
	Wobble Observe	tuned	na	RX	3	6
Other	Reset Interleave Increment Counter					15

^a Transmit/receive switch in cryo probe, controlled by bias current from ADM-CRP.

^b **Caution: No active probe protection against transmitter pulse, only transmit with low power!**

^c Internal 50 Ohm reference active.

^d Wobble mode only valid for one channel at a time. Other channels must be set to another wobble mode.

Table 11.1: Module Operating Modes

11.2.3 Connectors

Position	Label	Connector Type	Description
PROBE	TMD	D-SUB (delta ribbon)	TMD output signals to MRI cryo probe.
	WOBBLE CH 1-4	SMA (coax female)	Wobble signal to/from MRI cryo probe.
TRANSM	ADM IN	UT0 19pol (multiple coax and dc contacts)	Control pulses from MRI AD-CTRL board, Power supply from AQS PSM ADM.
	ADM OUT		
PREAMP	RF IN	SMB (coax male)	RF input from other HPPR/2 modules.
	RF OUT		RF output to AV4 TRX (AQS) ^a .
	TUNING IN		TUNE input from AV4 TRX (AQS) ^a .
	TUNING OUT		TUNE output to other HPPR/2 modules.
	MODULE CONTROL	D-SUB (delta ribbon)	I2C interface, control pulses, power supply from HPPR/2 COVER2.

^a Via HPPR/2 MRI BASEPLATE

Table 11.2: Connector Description

11.2.4 Part Numbers

Bruker Part No.	Description
Z130507	HPPR/2 MRI ADM-CRP MODULE 200-400
Z130508	HPPR/2 MRI ADM-CRP MODULE 500-750

Table 11.3: Part Numbers: ADM-CRP

11.2.5 Technical Data

Number of channels: 4

Input Signals:

RGP_HPPR, INTRLVE_INCR: RS-422 differential

AD-CTRL(1:4)~: +3.3V LVTTTL, +5V compatible

Wobble Preampfier:

RF frequency ranges: 200..400 and 500..750 MHz

Tuning Reference: internal, 50 Ohm

Tuning Gain: TUNING IN to RF OUT -20 dB

Input VSWR WOBBLE CH1-4: < 1.1

CRP TXSW bias current WOBBLE CH1-4 output: same as HPLNA 1H

TMD Driver:

Matching voltage range (symmetric): tune mode $\pm 0..15$ V

Matching current: detune mode ± 70 mA

Tuning voltage range (symmetric): tune mode $\pm 0..15$ V

Tuning voltage: detune mode ± 24 V

Detune switching time: (TMD driver and wobble selector) < 5 μ s

Number of detune control pulse: OR combinable for each channel 4

11.3 Troubleshooting

The ADM-CRP can only be replaced as a whole unit (FRU). There are no serviceable parts.

If an FRU needs to be replaced, contact your Bruker Service Representative.

Detected failures are reported with event messages. Event messages are displayed on the TopSpin screen and can be viewed on the Service Web pages

General information on trouble shooting, error handling and failure reporting is available in chapter [Troubleshooting \[75\]](#).

11.3.1 Diagnostics

Service Web pages provide some low level access to the hardware that may help to diagnose hardware problems.

12 HPPR/2 MRI Baseplate AV4

12.1 Overview

The HPPR/2 MRI BASEPLATE AV4 serve as interconnects for the RF- and RGP wiring between the electronics console, the HPPR/2 preamplifiers and the MRI probe (coils). It also has the main protective earth connection for the HPPR/2 preamplifier stack.

There are two versions for MRI systems:

- Z162168 HPPR/2 MRI BASEPLATE AV4 4CH
- Z162169 HPPR/2 MRI BASEPLATE AV4 8CH



Figure 12.1: View MRI BASEPLATE AV4 4CH



Figure 12.2: View MRI BASEPLATE AV4 8CH

12.2 Description

The MRI baseplates have SMA connectors for RF-IN and N connectors for RF-OUT signals to the TRANSCEIVER (TRX) in the AQS chassis of the console. The TUNE signals from the TRX are connected via QLA Adapters. The RGP-HPPR signals from the PSM-A are bundled in cables and linked via d-sub connectors to the baseplate. Inside the baseplate some RGPs are split with resistive splitters. All cables to the preamplifiers have SMB connectors. TUNE cables with QLA connectors are not included with the baseplate.

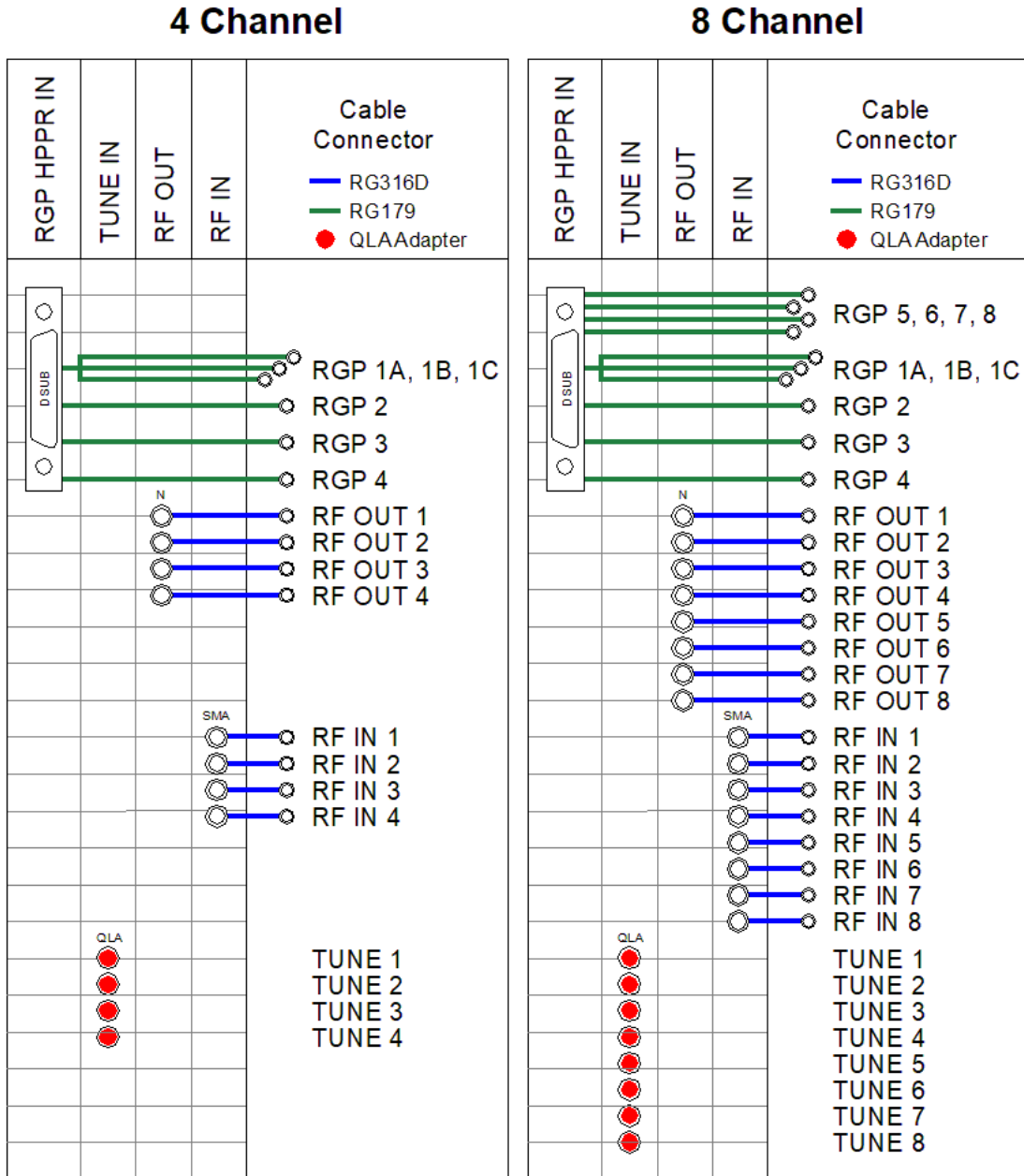


Figure 12.3: Internal Wiring: MRI BASEPLATE AV4 4CH & 8CH

12.2.1 Connectors

Pin	Signal	Pin	Signal
1	RGP HPPR IN (5)	2	GND
3	RGP HPPR IN (6)	3	GND
5	RGP HPPR IN (7)	6	GND
7	RGP HPPR IN (8)	8	GND
9	RGP HPPR IN (1)	10	GND
11	RGP HPPR IN (2)	12	GND
13	RGP HPPR IN (3)	14	GND
15	RGP HPPR IN (4)		

Table 12.1: Pinout RGP HPPR IN Connector

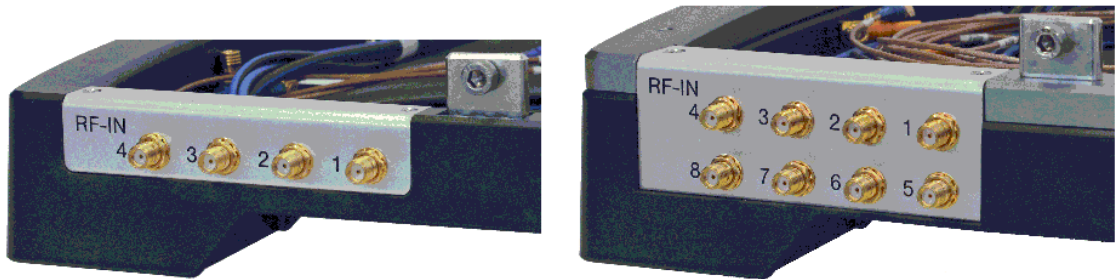


Figure 12.4: Rear View MRI BASEPLATE AV4 4CH and 8CH

12.2.2 Part Numbers

Bruker Part No.	Description
Z162168	HPPR/2 MRI BASEPLATE AV4 4CH
Z162169	HPPR/2 MRI BASEPLATE AV4 8CH

Table 12.2: Part numbers: MRI BASEPLATE AV4

12.2.3 Technical Data

Frequency range

- all RF signals: 0.005 .. 1.5 GHz

Insertion loss @ 1 GHz

- RF-IN: (SMA > SMB) 0.3 dB (connector) + 1.0 dB/m

- RF-OUT: (N > SMB) 0.3 dB (connector) + 1.0 dB/m

- TUNE IN: (QLA Adapter only) 0.5 dB (connector) + 1.7 dB/m

RGP splitter

Resistive 2 or 3-way splitter, 1 resistor per output: 330 Ohm

12.3 Troubleshooting

The BASEPLATE can only be replaced as a whole unit (FRU). There are no serviceable parts.

If an FRU needs to be replaced, contact your Bruker Service Representative.

General information on trouble shooting, error handling and failure reporting is available in chapter [Troubleshooting \[75\]](#).

13 Maintenance

The sections below describe the maintenance work required to ensure optimal and smooth operation of the device.

If increased wear is found during regular checks, the required maintenance intervals should be shortened in accordance with the actual wear occurrences. Contact Bruker in the event of questions regarding maintenance work and intervals (see [Contact ▶ 83](#)).

Interval	Maintenance Work	Reference
Daily	Clean the working area	Laboratory SOP
As needed	Clean outer shell of the device	
	Update firmware	

Table 13.1: Maintenance Schedule for Laboratory Personnel

13.1 Cleaning

13.1.1 Before Cleaning

1. Stop all experiments.
2. Power down the electronics cabinet.
3. Disconnect the mains power cable.

13.1.2 Cleaning the Outer Shell of the Device

Do not use any detergent or other cleaning solvents. Use only water or neutral cleaning fluids. Usage of volatile cleaners like thinner, benzine or acetone may damage the surface of the units.

- Do not disassembly the device for cleaning.
- Clean only the outer shell of the device with a lint-free cloth dampened in water.

13.1.3 Other Cleaning Operations

For all other cleaning operations contact Bruker service for advice and support. It may be necessary to send in the device for a cleaning service.

No special precautions have been taken in the device to avoid contamination from leaking samples. Bruker accepts no responsibility for any damage which may occur when samples are used containing radioactive or other hazardous materials.

In case of an accident with toxic, radioactive, explosive, or biologically active substances, the device and associated equipment must be cleaned in such a way that no danger emanates from the device and associated equipment, especially for all uninformed personnel. If a device has to be cleaned of all remains of a substance for safety reasons, contact Bruker service for advice and support.

Note that in serious cases it may be necessary for the owner to exchange the device with a new one, contact Bruker service for details.

13.2 Preventative Maintenance

All parts in the device have been designed to work reliably without preventative maintenance.

13.3 Bruker Service Maintenance

Bruker offers various maintenance options and packages. Contact Bruker customer service for more information.

13.3.1 Device Report File

The device logs all information in a file. With the help of this file Bruker customer service can diagnose the system. In case of troubleshooting as a result of an unknown error, Bruker customer service may ask you to send the log files and the system data. From these files the customer service can obtain additional debugging information. These files do not contain any information about your company, samples or spectra. Bruker will not give any information to a third party.

For information on how to acquire the log files refer to [Troubleshooting \[75\]](#).

13.3.2 Firmware Update

In case of problems, check for the newest official firmware release for the HPPR/2 Cover and for the DRU on the CH FTP server.

14 Troubleshooting

The following chapter describes how failures are reported and what can be done to simplify the troubleshooting for customer service.

14.1 Operation Failure

When an error occurs during program execution, an exception will be displayed on the TopSpin screen. If the exception occurs in a low level AQS or HPPR configuration routine, the exception information may also be saved in the AqRackServer log.

14.2 Hardware Warnings or Errors

The hardware reports detected failures with event messages. Event messages are displayed on the TopSpin screen and can be viewed on the Service Web pages:

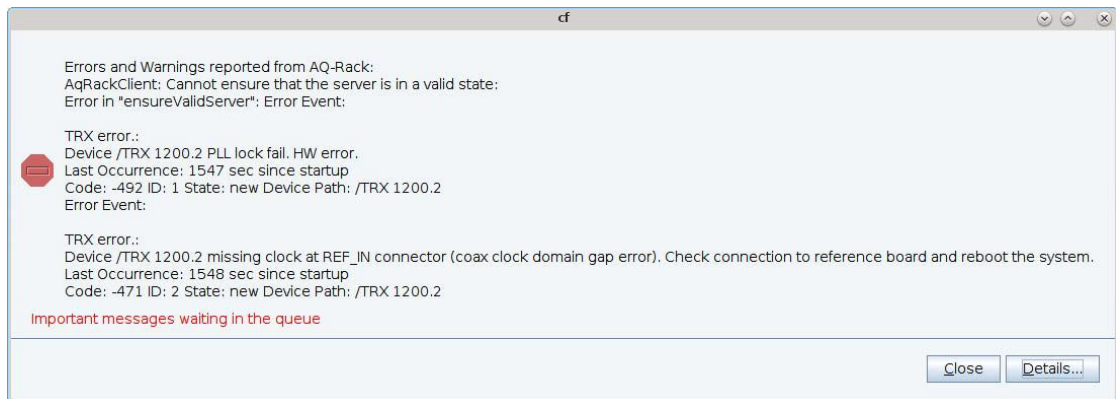


Figure 14.1: Troubleshooting: TopSpin Event Messages



Figure 14.2: Troubleshooting: Service Web Event Messages

Multiple events may be reported almost simultaneously. It is not guaranteed that the main cause for the hardware failure is reported in the first event message. Therefore, read carefully all event messages when troubleshooting.

A device that reports a hardware error event may also indicate that by changing the color of its status LED. For more information on LED colors, see the chapter on the corresponding unit.

14.3 Troubleshooting Hardware Problems

14.3.1 Service Web

Service Web pages on the EPU provide some low level access to the hardware that may help to track down a hardware problem. Service Web provides amongst other things:

- Overview of detected AQS and HPPR devices.
- Failure report generation for customer service.
- Ability to change some HPPR settings for debug purposes.
- Low level device diagnostic.

You can connect to the Service Web page on the EPU via **ha** (Hardware Access) command in TopSpin. Direct connection via a browser is also possible if the system IP is known (e.g. <http://149.236.99.9/serviceweb/>).

14.3.2 Savelogs

Savelogs is a TopSpin command that simplifies the collection of all information needed by the customer service.

Read the TopSpin User Manual chapter "Store Complete Log with => savelogs" for more information.

14.3.3 AqRackServer Log

The AqRackServer is responsible for low level AQS and HPPR device initialization and configuration. It also handles hardware event reporting. The log files of AqRackServer contain useful information for AQS and HPPR troubleshooting. They are located on the EPU and will be saved with **savelogs**.

AqRackServer log files on SpectrOs (EPU):

- /opt/topspin/prog/curdir/root/stdout.AqRackServer.log
- /opt/topspin/prog/curdir/root/stderr.AqRackServer.log

The verbosity of AqRackServer logs can be configured with the two parameter Log-Level and Log-Mask.

Log-Level

The Log-Level is a number. Larger values lead to more detailed log files. A reasonable Log-Level for hardware troubleshooting is 20. Values >99 are not recommended.

The Log-Level of a running system can be changed via ServiceWeb or by modifying the command line parameter (-d) of AqRackServer in the startup script.

AqRackServer startup script on SpectrOs (EPU):

- /opt/topspin/prog/mod/start_aqrackserver

Changing the Log-Level via startup script may only be necessary for failures that occur during device initialization. Remember to change the Log-Level back to its original value after troubleshooting.

Log-Mask

The Log-Mask determines what kind of information will be written to the log. Each device has its own Log-Mask that can be configured via Service Web. Changing the Log-Mask is only recommended when the default values lead to unreadable big log files, or when you are troubleshooting AqRackServer internals.

14.4 How to Report a System Error

When contacting the customer service to report a system error do provide a short description of the problem. Additionally, use the following tools or methods to get more information from your system.

When TopSpin is running.

- Use Savelogs to automatically compile necessary information from your system.
- Sometimes additional Service Web reports may be useful.

When TopSpin is not running.

- Use Service Web reports for additional information.

When TopSpin and Service Web are not running

- Get the AqRackServer log via SSH from the EPU, if possible with increased Log-Level for more detailed information.

When TopSpin, Service Web and EPU are not running.

Write a description of your hardware by hand. The description should contain:

- Spectrometer type (e.g. AV Neo 500) and order number.
- Part number and ECL (engineering change level) of all units.
- Position (slot number) of the units within the chassis (rack) or cabinet.
- Color and state of unit LEDs.
- Magnet type.

With this information contact the customer service. See [Contact \[▶ 83\]](#) for contact details.

15 Dismantling and Disposal

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



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

15.1 Dismantling

Before starting dismantling:

1. Shut down the device and secure to prevent restarting.
2. Disconnect the power supply from the device; discharge stored residual energy.
3. Remove consumables, auxiliary materials and other processing materials and dispose of them in accordance with the environmental regulations.
4. Clean assemblies and parts properly and dismantle in compliance with applicable local occupational safety and environmental protection regulations.

15.2 Disposal Europe

Environmental information for laboratory and industrial customers within the EU (European Union)



This laboratory product is developed and marketed for Business-to-Business (B2B), so does not fall under article 6 clause 3 of the German Act ElectroG. To meet the demands of the European Directive 2012/19/EU WEEE 2 (Waste of Electrical and Electronic Equipment) and the national Equipment Safety Act, electrical and electronic equipment that is marked with this symbol directly on or with the equipment and/or its packaging must not be disposed of together with unsorted municipal waste or at local municipal waste collecting points. The symbol indicates that the equipment should be disposed of separately from regular industrial/ domestic waste.

Correct disposal and recycling will help prevent potential negative consequences for the environment and risk to personal health. It is your responsibility to dispose of this equipment using only legally prescribed methods of disposal and at collection points defined by government or local authorities in your area.

The WEEE register number can be found on the product label of the equipment. If you need further information on the disposal of equipment or collection and recovery programs available, contact your local Bruker BioSpin sales representative. Local authorities or professional waste management companies may also provide information on specific waste disposal services available in your area.

Disposal - End of Life (EoL) information: the common procedure as defined in the sales contract with Bruker BioSpin

After the lifespan of an electrical and electronic product, Bruker BioSpin takes responsibility for final disassembly and correct disposal in accordance with the European directive 2012/19/EU WEEE 2.

Bruker BioSpin offers to take back the equipment (only for deliveries after 23.03.2006) after termination of use at the customer site upon request by the customer. This request must be affirmed when the equipment is ordered from Bruker BioSpin. Additional costs for dismantling and transport service will apply!

Only 100% pre-decontaminated equipment can and will be accepted by Bruker BioSpin. A release document for decontamination can be inquired from your nearest Bruker BioSpin contact site, also to be used when repairs, going back to Bruker sites, are requested.

In compliance with WEEE II directive: **2012/19/EU**

15.3 Disposal USA and Other Countries

Disposal of these materials may be regulated due to environmental considerations. For disposal or recycling information, please contact our local office or your local authorities, or in the U.S.A., contact the Electronics Industry Alliance web site at www.eiae.org.

16 Technical Data

The HPPR/2 System consists of a stack of several subunits (modules) with one cover module on top. This section contains only general data of the modules. For RF-performance data of a specific module please refer to the section [Technical Specifications \[48\]](#).

16.1 General Information

Data		Value	Unit
Cover module	Weight	2	kg
	Height	110	mm
Preamp module ^a	Weight	2..3	kg
	Height	40..55	mm
All modules	Length	350	mm
	Width	270	mm

^a Depending on module type.

Table 16.1: Technical Data: General Information

16.2 Connection Values

All HPPR/2 modules are supplied with dc voltages from the spectrometer console. There is no mains connection.

Standard Preamp modules are supplied via the Cover module. HPLNA and ADM-modules have an additional power supply connected directly to the console.

Electrical

Data		Value	Unit
Cover module	Voltages	+ 9	Vdc
		+ 19	Vdc
		- 19	Vdc
	power consumption, maximum	4	W
Preamp module standard supply	Voltages	from Cover module	
	power consumption, maximum ^a	4..20	W
HPLNA module additional supply	Voltages	+ 500	Vdc
		- 5	Vdc
		± 20	Vdc
	power consumption, maximum	23	W
ADM module additional supply	Voltages	+ 7.5	Vdc
		± 19	Vdc
		- 36	Vdc

Data		Value	Unit
		- 60	Vdc
	power consumption, maximum ^b	8.40	W

^a Depending on module type and measurement mode.
^b Depending on measurement mode and connected coil assembly.

Table 16.2: Electrical Connection Values

16.3 Operating Conditions

Environment

Data	Value	Unit
Ambient temperature range	5..40	°C
Relative humidity at 31 °C, maximum	80	%
Relative humidity linear decreasing till 40 °C, maximum	50	%
Permissible altitude above sea level	< 2000	m

Table 16.3: Operating Environment

16.4 Rating Plate

Only HPLNA Modules with additional high voltage supply have a rating plate.

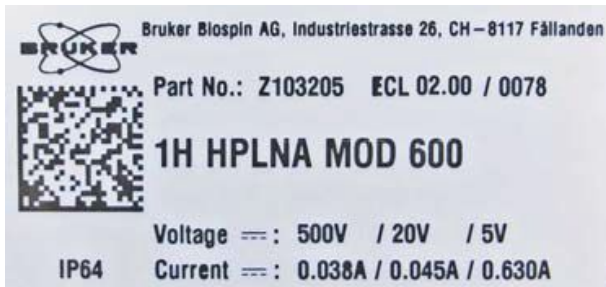


Figure 16.1: Rating Plate HPLNA 1H Module

17 Contact

Manufacturer

Bruker BioSpin GmbH
Silberstreifen 4
D-76287 Rheinstetten
Germany
<http://www.bruker.com>

WEEE DE43181702

NMR Hotlines

Contact our NMR service centers.

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

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

<https://www.bruker.com/service/information-communication/helpdesk.html>

Phone: +49 721-5161-6155

E-mail: nmr-support@bruker.com

List of Figures

Figure 5.1:	HPPR/2 Standard Configuration.....	23
Figure 5.2:	Threshold for RF Power Versus Pulse Length	25
Figure 5.3:	Cover2: Threshold Power Display	25
Figure 5.4:	Module Connection.....	27
Figure 5.5:	Standard Wiring HPPR/2	28
Figure 5.6:	Standard Wiring: HPPR/2	29
Figure 6.1:	Cover Module Front View	33
Figure 6.2:	Service Tab.....	35
Figure 6.3:	Modules Tab	36
Figure 6.4:	Devices Tab.....	37
Figure 6.5:	Wobble Tab	37
Figure 6.6:	Cover2 Module Rear View.....	38
Figure 7.1:	Preamp Module (open example)	42
Figure 7.2:	Operating Modes of HPPR/2 XBB19F, 31P, 13C, 15N Modules.....	43
Figure 7.3:	Operating Modes of HPPR/2 2H Modules	44
Figure 7.4:	Operating Modes of AQS 1H2H Preamp.....	45
Figure 7.5:	Operating Modes of AQS 1H2H Preamp.....	46
Figure 7.6:	Operating Modes 1H HPLNA Module.....	47
Figure 7.7:	Operating Modes 1H HPLNA Module.....	48
Figure 8.1:	View BASEPLATE AV4 4CH	55
Figure 8.2:	View BASEPLATE AV4 8CH	55
Figure 10.1:	View HPPR/2 MRI ACTIVE DETUNING Module.....	59
Figure 10.2:	Block Diagram: MRI ADM-CRP Module (ECL > 03).....	60
Figure 10.3:	PIN-Driver Overcurrent Error Handling.....	61
Figure 10.4:	RF Measurement Paths.....	64
Figure 11.1:	View HPPR/2 MRI ADM-CRP Module.....	65
Figure 11.2:	Block Diagram: MRI ADM-CRP Module	65
Figure 12.1:	View MRI BASEPLATE AV4 4CH	69
Figure 12.2:	View MRI BASEPLATE AV4 8CH	69
Figure 12.3:	Internal Wiring: MRI BASEPLATE AV4 4CH & 8CH	70
Figure 12.4:	Rear View MRI BASEPLATE AV4 4CH and 8CH	71
Figure 14.1:	Troubleshooting: TopSpin Event Messages	75
Figure 14.2:	Troubleshooting: Service Web Event Messages	75
Figure 16.1:	Rating Plate HPLNA 1H Module.....	82

List of Tables

Table 4.1:	Symbols on the Packaging	19
Table 5.1:	Part List HPPR/2 Wiring.....	28
Table 5.2:	Part List HPPR/2 Wiring.....	29
Table 5.3:	Abbreviations	30
Table 6.1:	Part Numbers: HPPR/2 Cover2	34
Table 6.2:	LED States.....	34
Table 6.3:	LCD and Touch Screen Description	35
Table 6.4:	Modules Modes	36
Table 6.5:	Connectors on the rear side	39
Table 6.6:	Appropriate Cable for Connected Devices	39
Table 6.7:	Connectors on the Left Side	40
Table 6.8:	Power Supply Error Cause	40
Table 7.1:	HPPR/2 Modules for HR NMR, Solids and Imaging	41
Table 7.2:	AQS Preamplifier for HR NMR (NanoBay)	42
Table 7.3:	HPPR/2 Modules for MRI.....	42
Table 7.4:	Technical Data AQS 1H2H Preamp	48
Table 7.5:	Technical Data AQS XBB19F 2HS Preamp	49
Table 7.6:	Technical Data HPPR/2 1H HPLNA Module	49
Table 7.7:	Technical Data HPPR/2 3H HPLNA Module	50
Table 7.8:	Technical Data HPPR/2 31P Module.....	50
Table 7.9:	Technical Data HPPR/2 13C Module	50
Table 7.10:	Technical Data HPPR/2 2H Module	51
Table 7.11:	Technical Data HPPR/2 15N Module	51
Table 7.12:	Technical Data HPPR/2 XBB19F 2HP Module.....	52
Table 7.13:	Technical Data HPPR/2 XBB31P 2HP HPLNA Module	52
Table 8.1:	Part Numbers: BASEPLATE AV4.....	56
Table 9.1:	CRP RF-Electronics Power Consumption	57
Table 9.2:	Cryoprobe T/R-Switch Bias Currents for the HPPR/2 Family.....	58
Table 10.1:	Connector Description	62
Table 10.2:	Part Number: ADM.....	62
Table 11.1:	Module Operating Modes	66
Table 11.2:	Connector Description	67
Table 11.3:	Part Numbers: ADM-CRP.....	67
Table 12.1:	Pinout RGP HPPR IN Connector.....	71
Table 12.2:	Part numbers: MRI BASEPLATE AV4.....	71
Table 13.1:	Maintenance Schedule for Laboratory Personnel.....	73
Table 16.1:	Technical Data: General Information	81
Table 16.2:	Electrical Connection Values	81
Table 16.3:	Operating Environment.....	82

Index

A

ADM.....	30, 59, 65
ATMA.....	30
ATMA/PICS	39

B

BIS.....	30, 40
----------	--------

C

Connector Rear Side	39
CONTROL	39
Cover Module	33
CRP	30, 39
crp	36
CW.....	30

D

DC-Wiring DMX with HRD-16.....	30
DC-Wiring with AQS	28
dec.....	36

E

Emergency stop	36
----------------------	----

F

FAQs	26
forward power.....	36
fwd pwr	36

H

HPLNA	30
HPPR/2	30
HPPR/2 MRI ADM Module	59, 65

I

I2C	31
IFB.....	30
INTERLEAVE_INCR	30, 40

L

Laboratory personnel	13
LCD	31
lock.....	36

LOCK_PP	31, 40
---------------	--------

M

MDR	31
MRI ACTIVE DETUNING MODULE	55, 59, 65, 69
MRI-INTERFACE MODULE	55, 59, 65, 69

O

obs.....	36
----------	----

P

Personal protective equipment	14
Personnel qualifications	13
PICS	31
PIN Driver	61
PLD	31
Power Supply and Monitoring	40
Product liability	11
pwr err	36

Q

QNP	31
-----------	----

R

refl pwr.....	36
reflected power	36
reflectometer	36
RGP Output.....	61, 66
RGP_HPPR.....	31, 40
RGP_PA.....	31
Risk assessment	11

S

SBSB	31
SOP	12
Standard Operating Procedure	12
stop.....	36
Symbols and Conventions	
Safety	7

T

TP_F.....	40
TP_F0.....	31
Tune/Match Driver	61

W

wobb.....	36
-----------	----





Bruker Corporation

info@bruker.com
www.bruker.com

Order No: H172204