MRI CryoCooling Unit /5

User Manual

Version 001

Innovation with Integrity

Preclinical Imaging

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1 About This Manual

1.1 Policy Statement

It is Bruker's policy to improve products as new techniques and components become available. Bruker reserves the right to change specifications at any time.

Every effort has been made to avoid errors in text and figure presentation in this publication. In order to produce useful and appropriate documentation, we welcome your comments on this publication. Field Service Engineers are advised to check regularly with Bruker for updated information.

Bruker is committed to providing customers with inventive, high-quality, environmentally-sound products and services.

1.2 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

2.1 Overview

The *CryoPlatform*'s main purpose is to provide the cooling infrastructure needed for the operation of cryogenic probes for *NMR* and *MRI* applications. The CryoPlatform consists of the CryoCooling Unit adapted to the application and the *Helium* (He) compressor.

The *CryoCooling Unit* has dedicated electronics to control and monitor the He cycle, the cooling of the CryoProbes, and it features a vacuum system to insulate the cryogenic temperatures within the CryoPlatform and CryoProbe.

The He compressor is remotely controlled from the CryoController, therefore may be installed outside of the NMR or MRI lab. Several He compressor options are available including water or air-cooled versions and indoor and outdoor models.

The actual cooling device is a Gifford McMahon Coldhead inside the CryoCooling Unit. It is driven by pressurized He supplied by the He compressor. Cooling CryoProbes is accomplished with a closed-loop He gas flow cycle via a flexible *Transferline*. He gas consumption is minimal and used only for system purging and to compensate possible small He gas losses.

Figure 2.1: CryoCooling Unit

Ease of use

- Touch screen interface
- Continuous, unattended operation
- Integrated in AVANCE Spectrometer network
- Standard CryoCoupler™ connects to all Bruker BioSpin CryoProbes™ and MRI CryoProbes™

Compatibility

The CryoCooling Unit is compatible to an AVANCE Spectrometer network of :

- min AV II

2.2 Scope of the Manual

This manual explains how to use the CryoCooling Unit in an MRI application. It describes the setup and the procedures for one of the following systems (*Table 2.1 [▶ 8]*).

Material number	Name
Z159090	CryoCooling Unit 5 MRI with 3 m Transferline
Z159091	CryoCooling Unit 5 MRI with 4 m Transferline
Z159092	CryoCooling Unit 5 MRI with 5 m Transferline
Z159093	CryoCooling Unit 5 MRI with 6 m Transferline

Table 2.1: CryoCooling Unit 5 Types

For other aspects of the MRI system setup please refer to:

- CD MRI RF Coils
- Technical Manuals for He compressors
- Technical Manual for He pressure regulator
- Instruction Sheet for the Replacement of the He Gas Cylinder (Z31913)

2.3 Intended Use

The intended use of the MRI CryoCooling Unit is to cool the MRI CryoProbe™ which can be only used in combination with the corresponding Bruker BioSpec MR instrument and its intended use. Only trained personal is allowed to operate the MRI CryoProbe™.

Intended use also includes compliance with all specifications within 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.

2.4 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.

2.5 Limitation of Liability

All specifications and instructions in this manual have been compiled taking into account 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 inadmissible 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 the conclusion of the contract shall apply.

2.6 Warranty Terms

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

2.7 Customer Service

Our customer service division is available to provide technical information. See the *Contact [▷ 79]* 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.

2.8 Product Safety and Electromagnetic Compatibility

The device complies with the standard

- IEC 61010-1 and with UL 61010-1 / CSA C22.2 No. 61010-1-04 Safety Requirements for Electrical Equipment.
- IEC 61326-1 for Electromagnetic Compatibility (EMC)

Introduction

3 Safety

3.1 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 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 hazard 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 e.g. nitrogen or helium.

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.

3.2 Personnel Requirements

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

3.2.1 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.

3.2.2 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.

3.2.3 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

3.3 Personal Protective Equipment

Personal protective equipment is used to protect the personnel from hazards 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 as described in this manual.

Depending on the operation, these are

- Protective Goggles (DIN EN 166, 170 & 172)
  - Protect the eyes from injury due to flying cold gases, liquids and parts.
- Protective Gloves (DIN EN 388, 420 & 511)
  - Protect the hands from injury caused by contact with extremely cold gases, liquids or surfaces.

Additional protective equipment may be defined by the head of the laboratory to protect against hazards that are specific to the working area.

3.4 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.

3.4.1 General Workplace Dangers

⚠ WARNING

Risk to life from nonfunctional or insufficient safety devices!

If safety devices are not functioning or are disabled, there is a danger of serious injury or death.

- ▶ Check that all safety devices are fully functional and correctly installed before starting work.
- ▶ Never disable or bypass safety devices.
- ▶ Ensure that all safety devices are always accessible.

⚠ 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.
- ▶ Do not climb or stand on the CryoCooling Unit.
- ▶ Do not climb on the Transferline Support.

NOTICE

Material damage due to a software error!

Samples or the device may be damaged due to a software error causing malfunction of the control system. Users may also be shocked by abrupt malfunction or unexpected system start.

- ▶ Dummy samples must be used during installation and service.
- ▶ Personnel should be alerted to unexpected malfunctions.

3.4.2 Danger from Chemical Substances

⚠ WARNING

Exposure and other health hazards to maintenance personnel.

If contaminated, the device must be cleaned before any maintenance work can be performed.

- ▶ Register all substances with which the device has come into contact.
- ▶ Sign a certification form verifying that the device has been properly cleaned if contaminated to protect maintenance personnel.
- ▶ Obviously contaminated, insufficiently cleaned units, as well as units without a signed cleaning certification will not be repaired and will be returned to the sender.

⚠ CAUTION

Use and Accidental Spreading of Toxic Sample Substances

Sample tubes and the CryoProbe vacuum insulation are made of fragile glassware.

If a sample tube breaks, the CryoProbe will be contaminated.

If both a sample and the CryoProbe vacuum insulation break, the vacuum pumps will suck in the sample substance through the CryoProbe and spread it inside and outside the CryoCooling Unit.

- ▶ When using toxic samples: Include the CryoCooling Unit and the surrounding air in your safety considerations.
- ▶ The User is responsible that there is no contamination in the lab and in the CryoCooling Unit before any work is started by Bruker Service.
- ▶ All material returned to Bruker has to be accompanied by an RMA sheet and signed Equipment Clearance Form.

3.4.3 Dangers from Electric Power

⚠ WARNING

Hazard from electrical shock due to liquids or cooling water on electrical equipment

- ▶ If liquids reach the inside of the CryoCooling Unit or He compressor, disconnect the CryoCooling Unit Mains Power cable, the CryoCooling Unit ColdHead Power cable and turn off the power supply to the He compressor, without touching any wet surface.
- ▶ Do not repower the units until the liquids are completely removed by Bruker service.

⚠ 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.

⚠ WARNING

Hazard from electrical shock

The CryoCooling Unit is connected to two power sources, the alternating current Mains Power and to the three-phase Mains Power through the compressor.

- ▶ In an emergency case unplug both the Coldhead Power Cable and the Mains Power Cable. The Main Switch of the CryoCooling Unit only controls the electronics of the unit.
- ▶ Be sure that the power supply cannot be reconnected without notice.
- ▶ Only qualified personnel should open the housing.

3.4.4 Dangers from Gases Under Pressure

⚠ DANGER

Danger of asphyxiation due to displacement of air by Helium gas and Nitrogen gas

If more than 20% of the breathable air are displaced, loss of consciousness and death are possible. The CryoCooling Unit has up to 3 gas sources that can displace air if an unintended leak occurs:

- Helium Gas Cylinder
- Main N2/Air Supply *
- Backup N2/Air Supply *

* These sources are only a danger, if the source is N2 that is guided into the room from outside. There is no danger from a source that is air, or N2 produced by an N2 separator within the same room.

- ▶ Follow all local guidelines related to the use, transport and storage of Nitrogen and Helium gas in an enclosed area.
- ▶ The minimum free room volume (room volume – furniture volume) must be observed (*Calculation of Minimum Free Room Volume required for Gas Sources that can Instantly Displace Air (Such as an Air Compressor with an N2 Separator) [▷ 73]*).
- ▶ The minimum steady fresh air supply must be observed (*Calculation of Minimum Fresh Air Supply required for Gas Sources that can Continuously Displace Air (Such as an Air Compressor with an N2 Separator): [▷ 73]*).
- ▶ The lab must be equipped with oxygen monitors to detect a possible drop in the oxygen level. One oxygen monitor must be above the magnet and one oxygen monitor approx.30 cm off the floor of the magnet room to detect low oxygen levels. Where the magnet is located inside a pit, an additional oxygen monitor located approx. 30 cm from the bottom of the pit must be fitted. All detectors must be located outside the 0.5 mT (5 G) line.
- ▶ If the Helium and/or Nitrogen pressure hose runs through several rooms, all rules above must be fulfilled for all these rooms.
- ▶ Persons must not accompany a pressurized He gas cylinder inside an elevator (observe local regulations).

⚠ DANGER

Danger to life due to pressurized air / N2

1. Risk to life due to compressed air / N2 entering the body and the venous blood circulation through small skin injuries which can lead to an emboli and therefore dead.
2. Pressurized air / N2 can enter the body and lead to swellings of body parts.
3. Pressurized air / N2 can cause eye injury or tinnitus.

- ▶ Never cover gas outlets or gas leaks with your cloths or skin.
- ▶ Wear protective googles and ear protection.

⚠ WARNING

Risk of injury due to movements caused by stored pressurized Helium

To ensure the Helium (He) purity, the He is never completely dumped. Most of the He system is permanently under pressure.

- ▶ Only decouple the Transferline from the CryoProbe when the Unplug LED is lit.
- ▶ Any further work on the He system must only be carried out by Bruker service engineer.
- ▶ Before disposal, the stored He must be released by a Bruker service engineer.

⚠ WARNING

Risk of injury due to gas under pressure

- ▶ Wear protective goggles and ear protectors when working with pressurized systems.
- ▶ Do not stand in the direction of an outlet of the nozzle orifice of the He 6.0 gas cylinder.
- ▶ In case of a leak in the pressurized gas system, close the main valve of the He 6.0 gas cylinder and contact Bruker service for repair.
- ▶ Secure the He 6.0 gas cylinder to a wall at the intended position in the lab.
- ▶ Only use the original Bruker pressure reducer, which has a 30 bar limited output pressure and a discharge valve at 35 - 37 bar.
- ▶ Do not manipulate or obstruct the discharge valve.
- ▶ If the He pressure hose is not fixed it can whip around in case of a rupture. The He pressure hose between the He 6.0 gas cylinder and the CryoCooling Unit is strengthened with a steel wire that must be fixed to the units at its ends.
- ▶ The He pressure hose must be fixed to a wall or to the floor once every meter. If crossing of walkways cannot be avoided, the He pressure hose must be covered or buried.
- ▶ All local safety regulations for the installation of pressurized gas systems and transport of the He 6.0 gas cylinders must be obeyed.

Overpressure Valves and Drop-Off Plates

The system includes several overpressure valves and drop off plates which safely reduce excess pressure that may be caused by faulty operation, component failure or other irregular events. Do not block or manipulate the overpressure valves and drop-off plates.

3.4.5 Dangers from Magnetic Fields

⚠ WARNING

Risk to life due to strong magnetic fields of the NMR/MRI magnet

The He gas cylinder, He compressor, the CryoCooling Unit or ferromagnetic tools and equipment can be fiercely attracted by the magnetic field.

The function of the CryoCooling Unit and the He compressor can be impaired by the magnetic field.

- ▶ Mark the magnetic field of more than 0.5 mT (5 Gauss).
- ▶ Only use non-ferromagnetic ladders or steps.
- ▶ The He gas cylinder and its entire transport path must always be outside the marked 0.5 mT range of the magnet.
- ▶ The He compressor and its entire transport path must always be outside the marked 0.5 mT range of the magnet.
- ▶ The CryoCooling Unit and its entire transport path must always be outside the 5 mT range of the magnet.
- ▶ Do not use ferromagnetic tools or items within the marked 0.5 mT range of the magnet.

3.4.6 Dangers Due to High or Low Temperatures

⚠ CAUTION

Risk of injury due to low temperatures of cold Helium gas (-253°C) and cold metal parts.

Contact with the skin may cause cold burns.

Contact with the eyes may cause blindness.

1. Pressurized cryogenic He gas is circulated between CryoProbe and CryoCooling Unit through the Transferline.

- ▶ Do not disconnect the Transferline (or any other tube or cable) unless UNPLUG lights up.
- ▶ Never look directly in the openings of the Transferline without eye protection because cold He can flow out suddenly.
- ▶ Do not move a cold CryoProbe.
- ▶ Never over bend the Transferline (minimal bending radius = 400 mm).
- ▶ Protect temperature sensitive components such as O-rings from contact with liquid cryogenic agents.

⚠ CAUTION

Accident hazard from contact with cold surfaces

In case the insulation vacuum fails, or a component inside the Transferline breaks, the surfaces of CryoProbe body and /or CryoProbe interconnection may become dangerously cold (down to -253 °C).

- ▶ If any surface shows visible ice or snow, do not touch it.
- ▶ Press Warmup on the CryoCooling Unit.

3.5 Environmental Protection

NOTICE

Potential environmental damage 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.
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.
Compressor oil	Compressor oil may cause environmental pollution. It must not be allowed to escape into the environment. Disposal must be carried out by a specialist disposal company.
Glycol-cooling water mixture	Glycol-cooling water mixture within the compressor may cause environmental pollution. It must not be allowed to escape into the environment. Disposal must be carried out by a specialist disposal company.

3.6 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

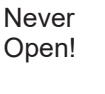
Warning indicating a cold spot in work rooms.

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

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

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.

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.

3.7 Spare Parts

Loss of Warranty

The use of non-approved spare parts will invalidate the manufacturer‘s warranty.

Purchase spare parts from authorized dealers or directly from the manufacturer. See Contact for manufacturer's address.

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.

Table 4.1: Symbols on the Packaging

4.2 Inspection at Delivery

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

Therefore check Tilt and Shock watches on the package of the CryoCooling Unit. In case one of the sensors or both have been activated according to the description on the labels follow the procedure below.

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 were used in the packaging. All wooden packages are marked with an ISPM 15 compliant stamp.

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 in case the unit has to be returned to the factory.

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 Design and Function of the CryoPlatform

5.1 Overview MRI Application

Only one CryoPlatform™ is required per spectrometer (*Figure 5.1 [▶ 26]*). It supplies the entire infrastructure for the operation of CryoProbes, i.e. all cooling and all control functions. It is a push-button system which performs all operations needed for a fully automated cool-down, cold operation, and warm-up of the probe. Although capable of stand-alone operation, the CryoPlatform is fully integrated into the AVANCE spectrometer system.

A CryoPlatform consists of CryoProbe Mounting Hardware at the CCM box or a MRI mounting plate to mount directly to the magnet. Furthermore, a CryoCooling Unit with an integrated He Transferline to the MRI CryoProbe, a separate He Compressor with water- or air-cooling, Flexlines between He Compressor and CryoCooling Unit, a He Regulator on a He gas cylinder. Furthermore, the RF Window Heater Display allows the control of the RF Window temperature of the CryoProbe.

The CryoProbe, the cryo-compatible HPPR, the He gas cylinder and an optional water chiller are not considered as part of the CryoPlatform.

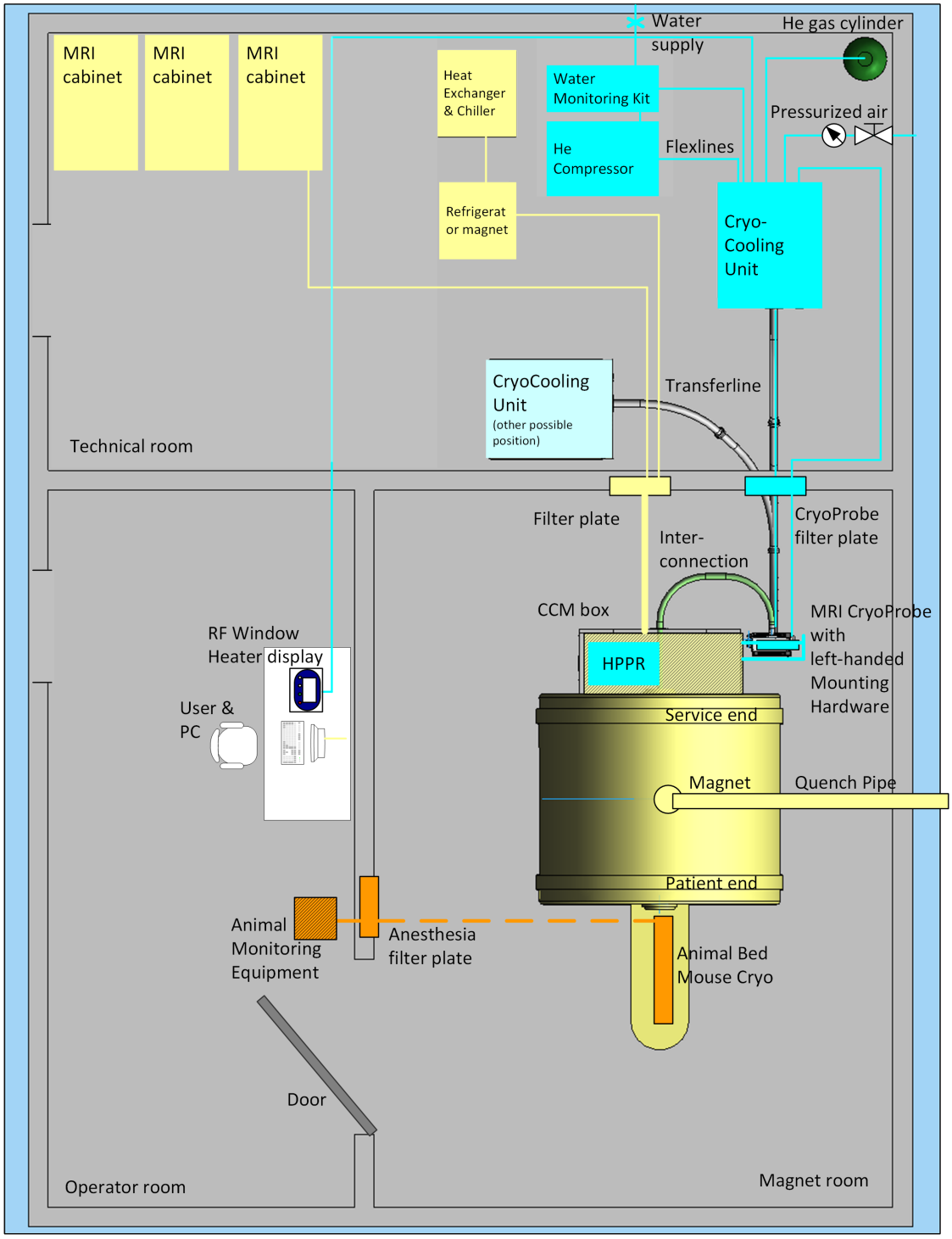


Figure 5.1: CryoPlatform installation within an MRI setup.

5.2 MRI System with CryoPlatform

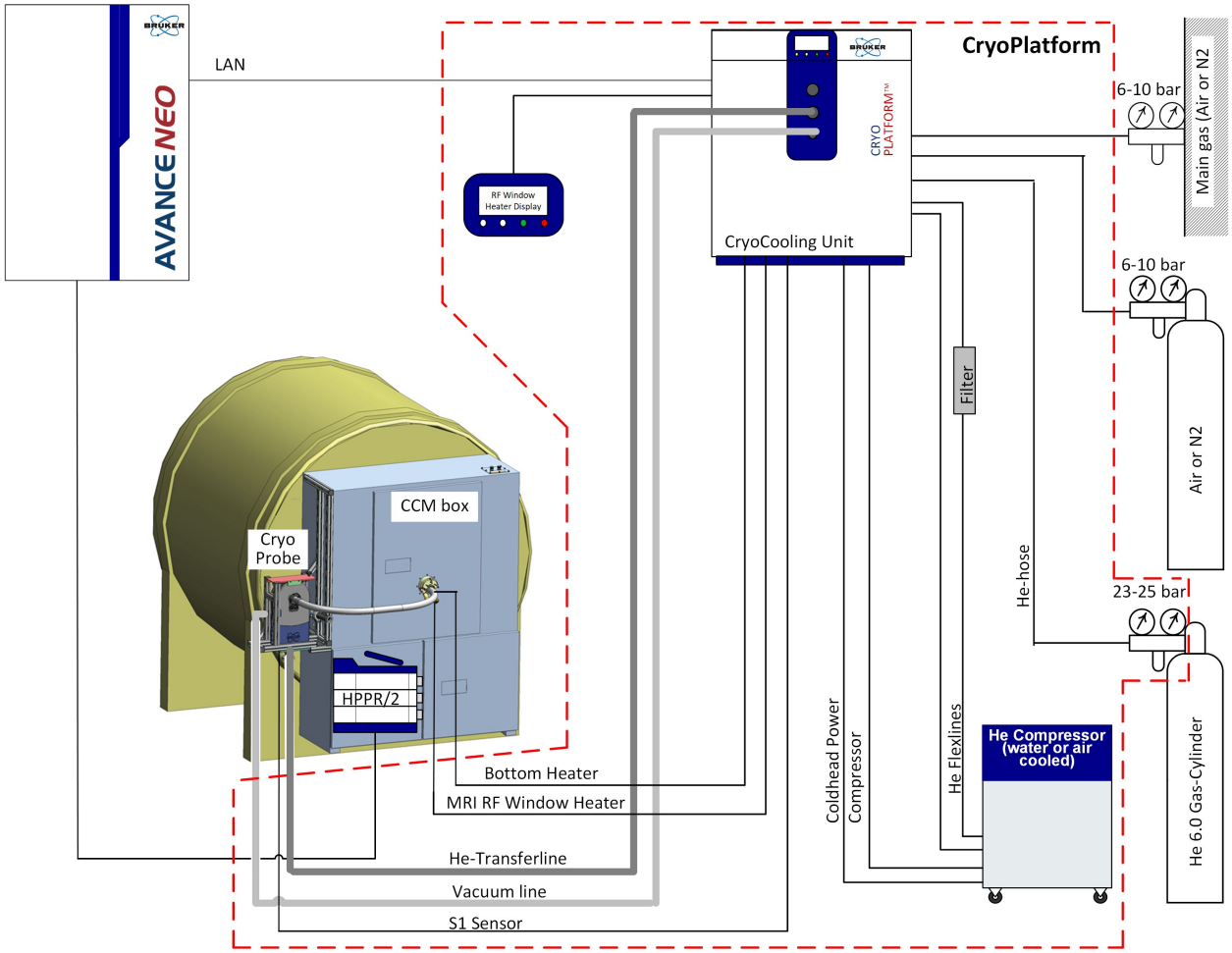


Figure 5.2: Schematic of MRI CryoProbe Installation

5.3 CryoCooling Unit Software

Cryo Display

Available from TopSpin 3.6 and newer.

Start the Cryo Display by typing **cryodisp** in the TopSpin command line.

A simple user interface opens that allows hassle-free basic operation of the CryoCooling Unit.

It features basic user settings, simple logfile export and easy startup of the Service GUI (without the need of software installation)

The operation of the cryodisp software is described in the TopSpin manual.

Service Web

The Service Web of the CryoCooling Unit can be accessed through the TopSpin **HA** command.

It is used by Bruker Service to upload a new firmware onto the CryoCooling Unit.

Also, the Service GUI can be downloaded from here if a stand-alone installation is needed instead of the easy startup function offered by Cryo Display.

Service GUI

A User interface that allows control of the CryoCooling Unit. A service password will be required to access some specific functions. A temporary Service password can be obtained from Bruker.

6 Connections of the Cryo Platform

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.

6.1 Overview

The CryoCooling Unit has an integrated touch screen and 4 status LEDs for state display and messages. On the back of the CryoCooling Unit there are the He gas connectors, the electric connectors, power supply and the pneumatic connectors. A schematic of all cables and tube connections can be found in *MRI System with CryoPlatform [▶ 27]*.

Figure 6.1: Front view of the CryoCooling Unit

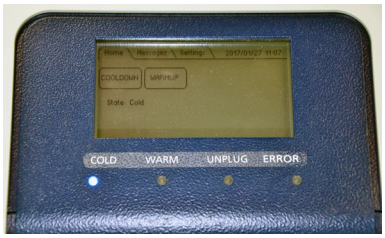


Figure 6.2: CryoCooling Unit touch screen interface and LED display

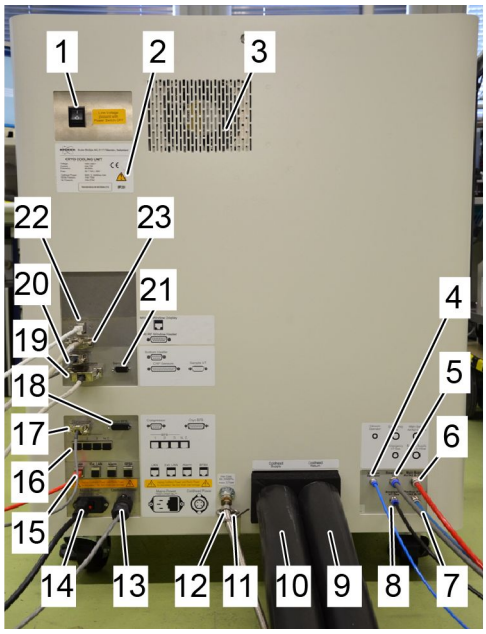


Figure 6.3: Back of MRI CryoCooling Unit

1	Power switch	13	Coldhead power
2	Rating plate	14	Mains power
3	Cooling fan	15	LAN, Ext. LAN, Alarm and BFB4
4	Vacuum operator	16	BFB (1, 2, 3, N.C.)
5	Emergency lift (not used)	17	Compressor
6	Main supply Air/N2 (6-10 bar)	18	Cryo BFB
7	Backup supply Air/N2 (6-10 bar)	19	CRP sensor
8	Emergency VT gas (not used)	20	Bottom heater
9	Coldhead return	21	Sample VT (not used)
10	Coldhead supply	22	MRI RF Window Display
11	Security lock for He gas line	23	MRI RF Window Heater
12	He gas 99.9999% (max 27 bar)		

Figure 6.4: Filter holder below the CryoCooling Unit

6.2 Secure Position the CryoCooling Unit

⚠ WARNING

Risk of personal injury from moving heavy objects.

The CryoCooling Unit weighs ~250 kg and has no brakes. The wheels of the CryoCooling unit are designed to carry the unit over small distances on an even surface. When in defined position in the working space it must be secured to the place by lowering the three supports to the ground.

- ▶ The support stands must be loosened before the unit can be moved.
- ▶ On inclined floors such as a ramp, use a transport vehicle that is designed to handle the weight of the CryoCooling Unit with sufficient fixation, suspension, steering and braking capability.
- ▶ During the transport, be sure that any inclined floor or ramp on which the unit is temporarily or permanently placed can support the weight and will not allow the unit to tip or slide off.
- ▶ In the determined position of the unit, the three supports need to be lowered such that the unit rests on the three supports and the wheels have free play.
- ▶ Only lower the supports so far that the wheels are ≤ 1 cm above the floor.
- ▶ Never climb on the unit itself or place heavy devices on it.

The CryoCooling Unit has been placed by the Bruker service engineer as has been agreed within the SitePlanning.

The service engineer has lowered the three fixation stands under the CryoCooling Unit to prevent it from rolling off and to reduce vibrations on Transferline and CryoProbe.

6.3 Overview of Cable and Gas Tube Connections

The schematic shows the cable connections between the two main system components of the MRI setup with the CryoCooling unit and the console marked in black.

The gas tube connection between the He gas cylinder and the CryoCooling unit is highlighted in orange. The Main N2 gas tube is marked in red, while the Vacuum Operator and Backup N2 gas tubes are shown in blue. Details about the relevant connectors and their position at the CryoCooling Unit are given in the following sections.

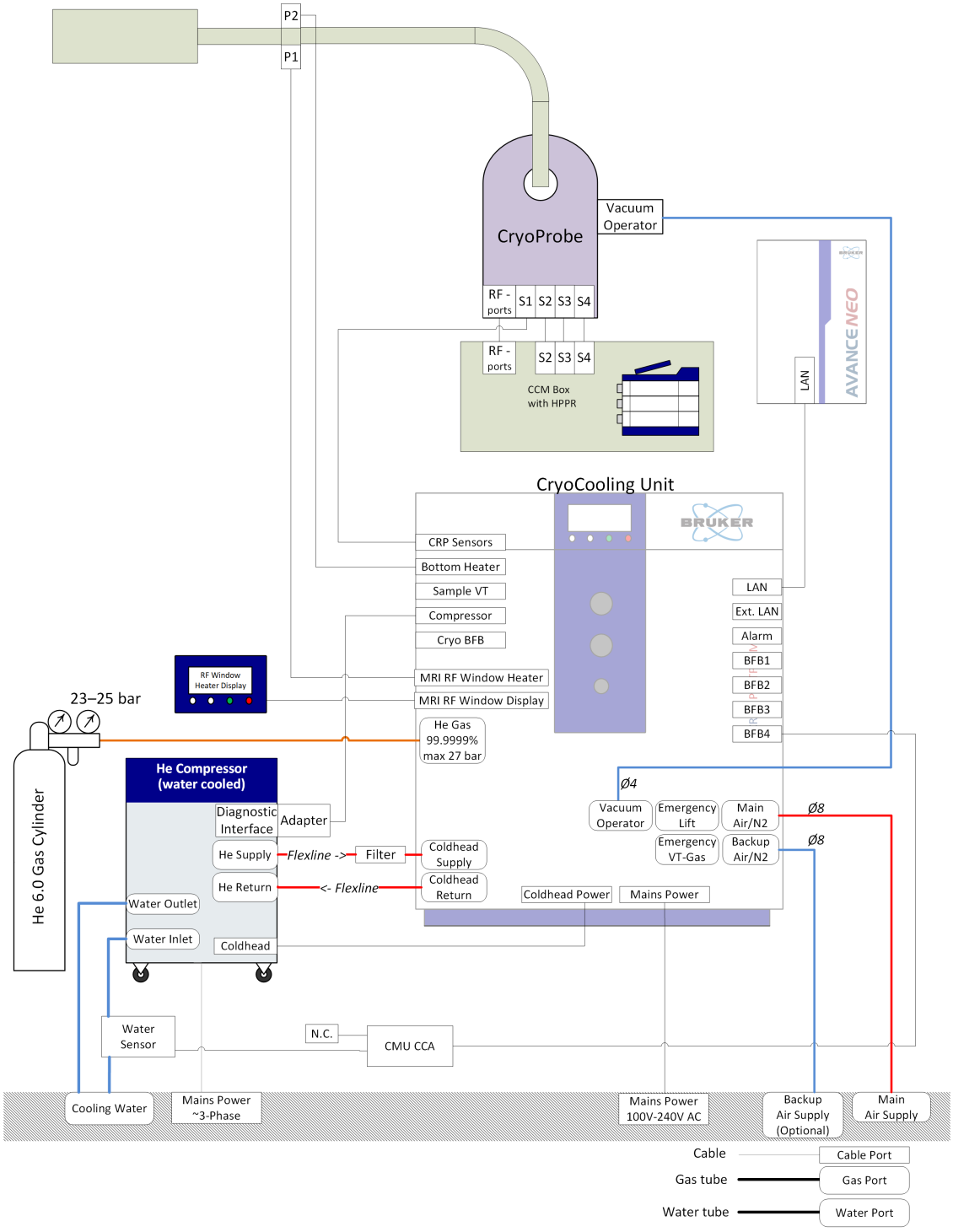


Figure 6.5: Cable and gas tube connections of the MRI CryoProbe system with the CryoCooling Unit

6.4 Connections of the MRI CryoCooling Unit

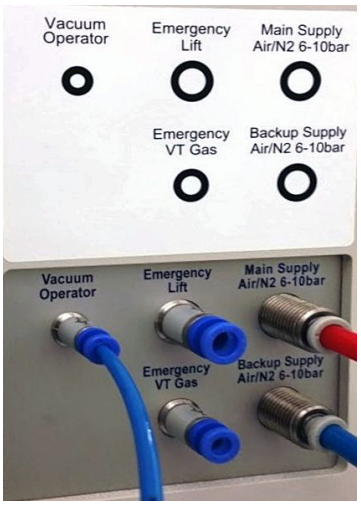
Gas Tube Connections

⚠ CAUTION

Risk of injury due to moving gas tubes

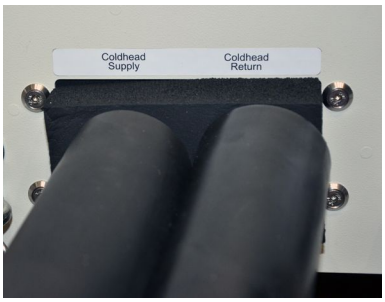
Improper installation of the pneumatic tubes on the device can lead to the situation that gas connections become loose when the device is switched on and is set under pressure. A slashing pneumatic tube can hit somebody in the e.g. face

- ▶ Check that the pneumatic connections are correctly made, before switching the device on.
- ▶ In case a pneumatic tube becomes loose, snatch the pneumatic tube near the next fixation point in the lab or near the connectors of the CryoCooling Unit and bend it. Stabilize the bended pneumatic tube with tape. Then reconnect the pneumatic tube to the connector again.



- Check that the gas tube connections for vacuum operator, Main supply Air / N2 and Backup Supply Air / N2 are made according to the schema on the label above the connectors.
- The Emergency Lift and Emergency VT Gas connections are not used with the MRI CryoCooling Unit. They remain unconnected.
- The use of Backup Supply Air / N2 is optional and depends on the chosen MRI CryoCooling Unit setup.

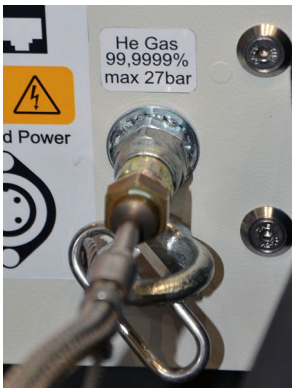
He Flexlines to the He Compressor



- The Flexlines to the He compressor are permanently pressurized and may only be installed by Bruker Service. Do not manipulate.

Connections of the Cryo Platform

Helium Connection



- The He Flexline to the He gas cylinder is permanently pressurized and may only be installed by Bruker Service. Therefore, the He Flexline is secured to the hook.
- ⚠ **WARNING! Do not manipulate.**

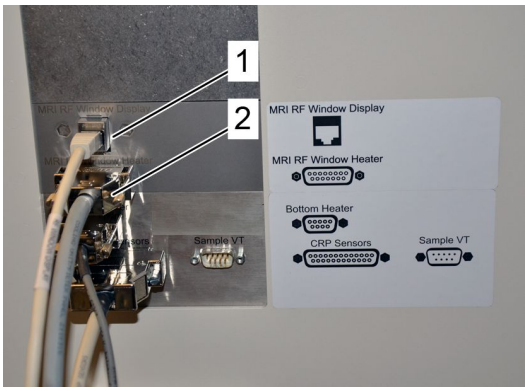
Main Connector Board

Plug in the following cables according to the label on the side:

- Bottom Heater to the CryoProbe P2
- CRP Sensors to the CryoProbe S1
- Compressor to the He Compressor
- BFB1 to the water flow sensor (only, if a water cooled He-Compressor is used)
- LAN to the Console
- Mains Power to the Power Mains
- Coldhead Power to the He Compressor

6.4.1 Connections of the MRI RF Window Heater Display

Connections at the CryoCooling Unit



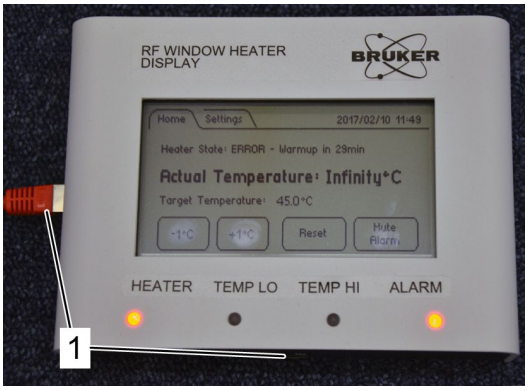
MRI RF Window display:

- Connect the cable to the MRI RF Window display.

MRI RF Window heater:

- Connect the cable to the MRI RF Window heater of the CryoProbe.

RF Window Heater Display Connections



- Connect the cable from the CryoCooling Unit in one of the two RF Window Heater display sockets. Chose the socket that is more suitable for the setup.

6.4.2 Connections of the CryoCooling Unit to the He Compressor

⚠ WARNING

Risk of injury due to movements caused by stored pressurized Helium

To ensure the Helium (He) purity, the He is never completely dumped. Most of the He system is permanently under pressure.

- ▶ Only decouple the Transferline from the CryoProbe when the Unplug LED is lit.
- ▶ Any further work on the He system must only be carried out by Bruker service engineer.
- ▶ Before disposal, the stored He must be released by a Bruker service engineer.

⚠ WARNING

Hazard from electrical shock

The He compressor is connected to the three-phase power mains (up to 400 V).

Any work on the three-phase power must be done by qualified electrician.

- ▶ Do not open the He compressor.
- ▶ Do not manipulate the connection of the He compressor to the three-phase power mains.
- ▶ Do not open the He compressor Indoor Unit or Outdoor Unit (for outdoor air cooled He compressors).
- ▶ Do not manipulate cable 1-1, cable 1-2 or cable 1-3 (for outdoor air cooled He compressors).

⚠ CAUTION

Accident and material damage hazard from electrical shock

The Coldhead power cable contains three-phase power (200V). It is safe to disconnect the Coldhead power cable.

> To exclude hazards due to live parts do not try to touch the pins of the Coldhead power cable using any kind of conductive tool.

⚠ CAUTION

Risk of damage due to leaking water connections

Large quantities of water may spill out through leaky connections.

- ▶ Any work on the cooling water tubing must be done by qualified personnel.
- ▶ Do not manipulate the cooling water tubes.

The following schematics show how the 3 available He compressors are connected to the CryoCooling Unit.

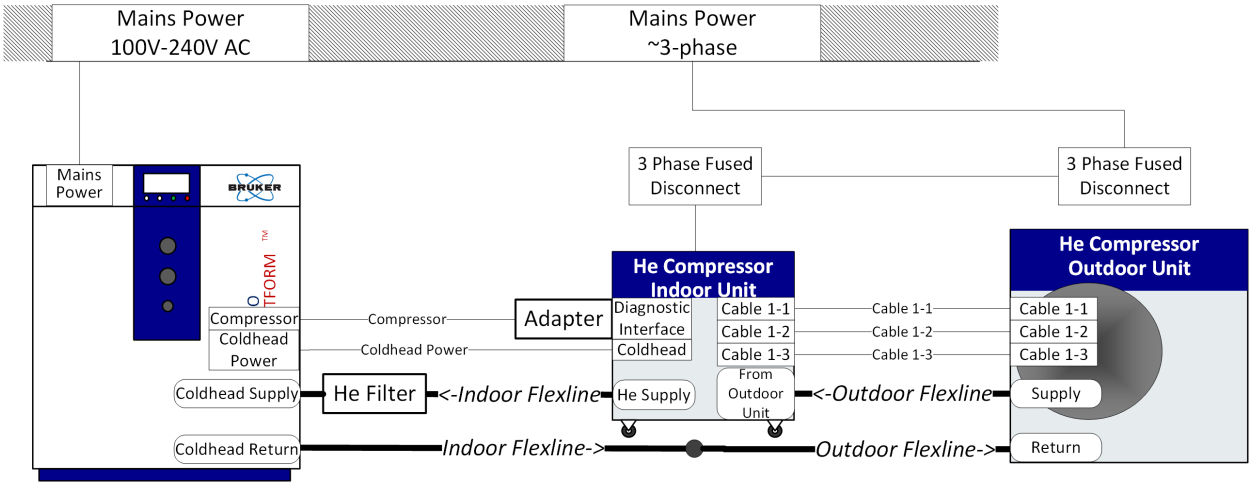


Figure 6.6: Connections of the CryoCooling Unit to the outdoor air cooled He compressor.

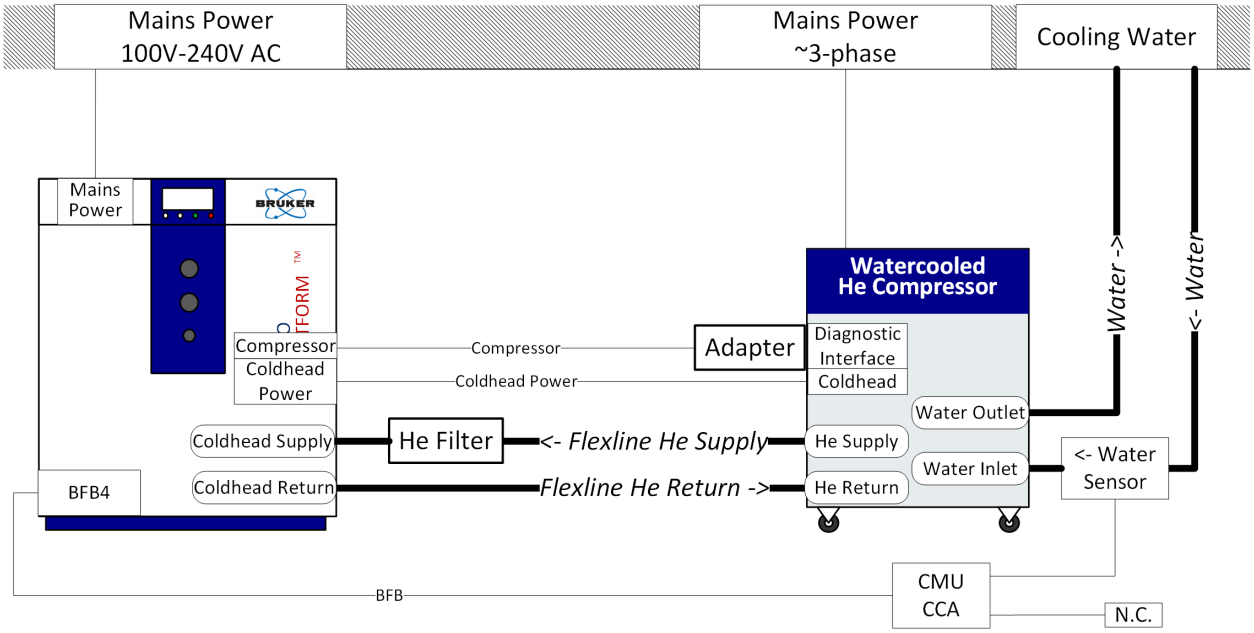


Figure 6.7: Connections of the CryoCooling Unit to the water cooled He compressor.

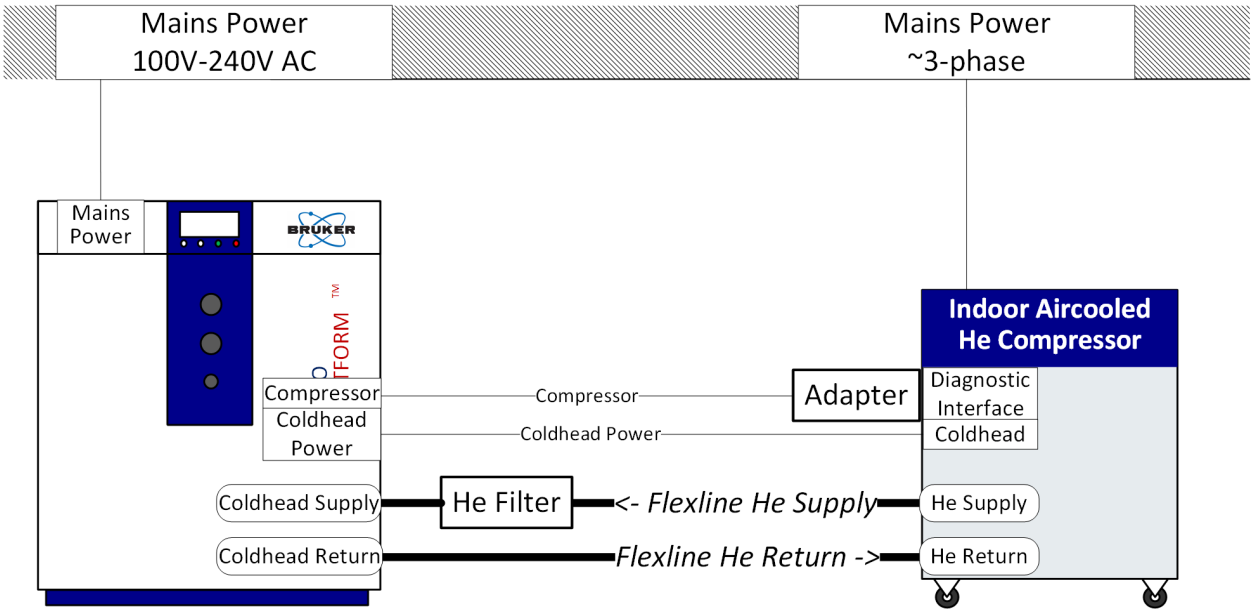


Figure 6.8: Connections of the CryoCooling Unit to the indoor air cooled He compressor.

6.5 Setting Up the MRI RF Window Heater

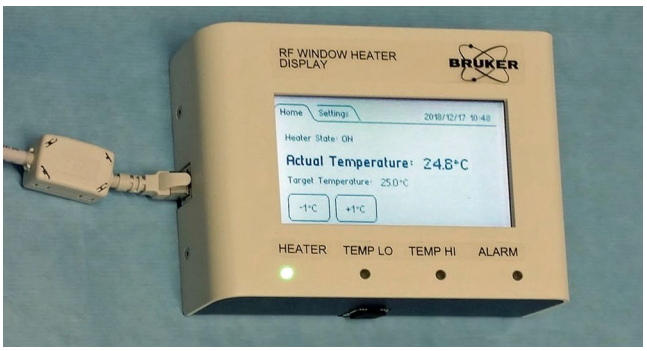


Figure 6.9: MRI RF Window heater display

The MRI RF Window Heater has two functions:

The MRI RF Window heater heats the surface of the cryo cooled RF Window and therefore protects the hardware from corrosion damages due to water condensation. Therefore, the MRI RF Window Heater cannot be disabled while the CryoProbe is cold.

Also, and more important, it protects the animal's head from the cryo cooled RF Window. Select a temperature that is suitable for the animal's comfort.

Setting Up the MRI RF Window Heater within an MRI Installation

The user must constantly supervise the correct RF Window Heater function when an animal is inside the CryoProbe. Therefore position the RF Window Heater Display in a location where it is always visible, and its warning beeper can be heard, as shown under *Figure 5.1 [▷ 26]*.

The RF Window Heater display has two sockets for the cable from the MRI CryoCooling Unit. Choose the socket that is more suitable for the setup.

7 Operating the CryoCooling Unit with MRI CryoProbe

The following sequence describes the complete procedure on how to use the CryoCooling Unit:

Cooldown the MRI CryoProbe for Measurement Operation

- According to the **MRI CryoProbe User Manual Z33142**
  - Mount the MRI CryoProbe to the magnet
  - Connect all cables and tubes to the MRI CryoProbe
- Connect the CryoCooling Unit to the MRI CryoProbe
  - Join the CryoCoupler, see *CryoCoupler [▶ 41]*
  - Join the Vacuum Adapter, see *Vacuum Operator [▶ 42]*
- Reactivate the CryoCooling Unit from Hibernation
  - Turn on the Power, see *Power-on [▶ 47]*
  - Turn on the He Gas Supply, see *Turning on the He Gas Supply [▶ 49]*
  - Turn on the Main and Backup Gas Supply
- Cooldown the MRI CryoProbe see *Cooldown the CryoProbe System [▶ 50]*

During Measurement Operation

Continuously monitor the MRI RF Window Heater Display when an animal is in the MRI CryoProbe measurement setup, see *Operating the MRI RF Window Heater [▶ 52]*.

Warmup the MRI CryoProbe after Measurement Operation

- Warmup the MRI CryoProbe see *Warmup of the CryoProbe System [▶ 53]*
- Disconnect the MRI CryoProbe from the CryoCooling Unit
  - Separate the CryoCoupler, see *CryoCoupler [▶ 41]*
  - Unmount the Vacuum Adapter, see *Vacuum Operator [▶ 42]*
- Prepare the CryoCooling Unit for Hiberation
  - Turn off the system, see *Power-off [▶ 54]*
  - Turn off the He Gas Supply, see *Turning off the He Gas Supply [▶ 55]*
  - Turn off the Main and Backup Gas Supply
- According to the **MRI CryoProbe User Manual Z33142**:
  - Disconnect all cables and tubes from the MRI CryoProbe
  - Unmount the MRI CryoProbe from the magnet

In most situations, only a part of the complete procedure is needed:

If no measurement for less than 1 month

- Leave the MRI CryoProbe cold to avoid thermal stress of a Warmup and Cooldown
- For measurement with a different Probe, place the cold interconnection into the park position.

Prepare for Planned Maintenance

- Warm up the MRI CryoProbe.
- Do not disconnect or unmount the MRI CryoProbe and do not hibernate the CryoCooling Unit.

If no measurement for more than 1 month

- Warmup the MRI CryoProbe to reduce ageing of ColdHead and He Compressor Power consumption.
- Prepare the CryoCooling Unit for Hibernation (Turn off Power and Gas Supply) to reduce potential safety hazards
- Leave the MRI CryoProbe mounted to the magnet and fully connected unless the magnet is needed for a measurement with a different MRI CryoProbe.

⚠ WARNING

Risk of slipping, tripping or falling

In accordance with the site planning the installation of CryoProbe and CryoCooling Unit has taken place. But the system equipment is strongly interconnected with Transferline, cables, hoses and He Flexlines.

▶ Take care that interconnections do not block frequently used passages in the setup.

▶ Keep the arrangement of components tidy to reduce tripping hazards to a minimum.

▶ Mark remaining tripping hazards and fence in the installation.

⚠ CAUTION

Risk of injury due to sudden loud noise

The He system is protected with several overpressure valves. Inside the CryoCooling Unit, inside the He compressor and at the He bottle adapter. He overpressure will trigger these valves, resulting in one or a series of sudden loud banging noises. Such noises indicate a defect.

▶ Have the setup checked by Bruker Service.

7.1 CryoCoupler

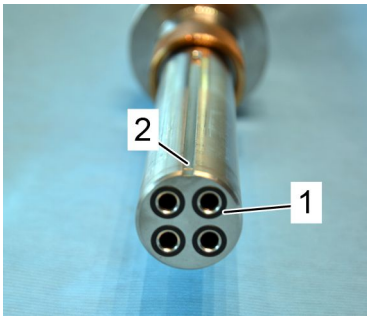
NOTICE

Risk of material damage due to improper handling

- ▶ If the CryoCoupler gets stuck, do not force it into position.
- ▶ Do not bend the He Transferline to an extreme shape to make it fit. This could result in permanent damage to the CryoProbe or the He Transferline.

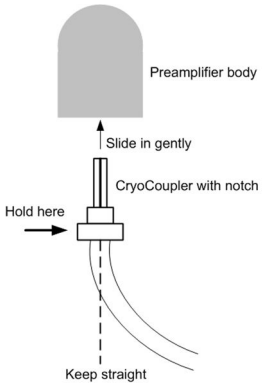
7.1.1 Joining the CryoCoupler

- Unscrew the protective cap to the left and remove it from the CryoCoupler on He Transferline.
- Also remove the protective cover of the CryoProbe's Transferline receptible (not shown here).



- Check that the four O-rings (1) on the He Transferline CryoCoupler are in place, clean and undamaged. If not, replace with the O-rings found in the spare parts box delivered with each CryoProbe system. The O-rings are Viton, size 7.1 x 1.6 mm (P/N 23193).
- Check that the notch (2) is clean.

- The bolt (1) inside CryoProbe's receptible is towards the magnet.



- Slide the CryoCoupler into the MRI CryoProbe. It should fit smoothly without any significant movement of the suspended magnet.
- Use the special open-end 36 mm aluminum wrench to tighten the CryoCoupler gently to the CryoProbe. Take care not to damage any connectors on the CryoProbe front.

7.1.2 Separating the CryoCoupler

NOTICE

Separating the vacuum operator

Make sure the green WARM and white UNPLUG lights are on.

- Verify the green WARM and white UNPLUG lights are on.
- Follow chapter *Joining the CryoCoupler [▶ 41]* in reverse order.

7.2 Vacuum Operator

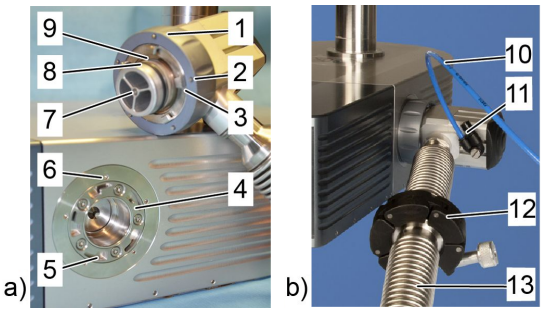


Figure 7.1: Vacuum Operator a) Interface of both connection sides b) Plugged in Vacuum Operator at the CryoProbe

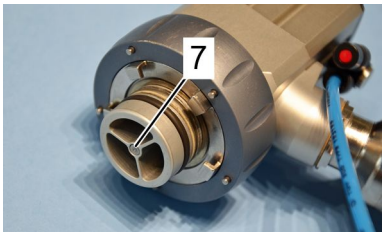
1	Rotable mounting ring	8	Vacuum sealing O-ring
2	Positioning pins	9	RF sealing ring
3	Hook	10	Blue gas tube of the Vacuum Operator
4	Bayonet plate	11	Pneumatic fitting with indicator
5	Notch	12	Non-magnetic plastic KF-25 clamp
6	Positioning holes	13	Vacuum hose (leading to CryoCooling Unit)
7	Central pin		

In the following procedures for Mounting and Unmounting of the Vacuum Operator the numbering from *Figure 7.1 [▶ 42]* has been used.

7.2.1 Mounting Procedure of the Vacuum Operator

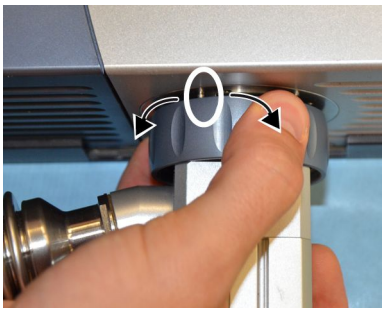
NOTICE! Do not damage the sealing rings of the Vacuum Operator. If the sealing rings are damaged, replace them by new rings delivered as spare parts together with the CryoProbe. Furthermore, check that the red pin of the Vacuum Operator does not pop out, otherwise the CryoProbe could be damaged.

- Precondition: The Vacuum Operator must already be connected to the Vacuum hose (13) and to the blue pressure tube (10)
- Verify that the Vacuum Operator is not pressurized, which is the case when the red pin does not stick out.
- Remove the white plastic cover from the nozzle of the Vacuum Operator.



- Verify that the central pin (7) of the Vacuum Operator does not stick out.

- Take the Vacuum Operator with one hand. Use the other hand to hold the CryoProbe.
- Insert the Vacuum Operator into the corresponding port of the CryoProbe. The Vacuum Operator might require some wiggling movement to overcome the friction of the sealing rings.



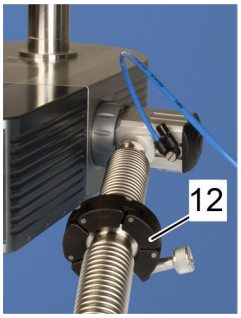
- Turn the mounting ring (1) to align the hooks (2) with the notches (5) on the bayonet plate (4).

NOTICE! The mounting ring (1) can be slightly pulled to make turning easier.

- Now push the Vacuum Operator all the way in until it touches the stop edge.

- Turn the mounting ring (1) clockwise until the positioning pins (2) click into the positioning holes (6).

- Release the mounting ring (1). The Vacuum Operator is now installed.

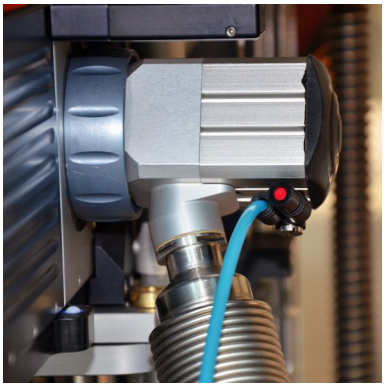


- Make sure that the Vacuum Operator does not exert too much torque on the CryoProbe. If so the clamp (12) should be loosened and the vacuum line vented for reorientation.

7.2.2 Unmounting Procedure of the Vacuum Operator

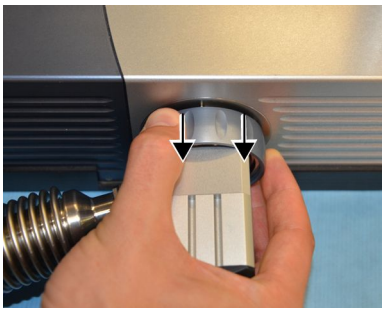
NOTICE

Make sure the Vacuum Operator is closed (the red pin at the pneumatic connector must be inside). Pulling out the Vacuum Operator requires a high force due to the low vacuum pressure in the CryoProbe. Make sure WARM and white UNPLUG lights are lit.

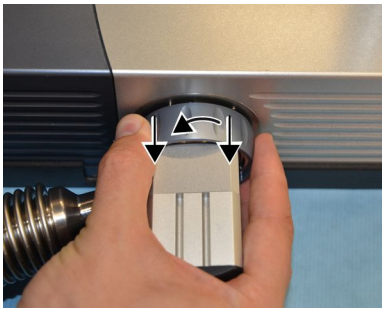


- Verify that the Vacuum operator is not pressurized, and the red pin does not stick out.

- Support the Vacuum Operator with the palm and grab the mounting ring (1).

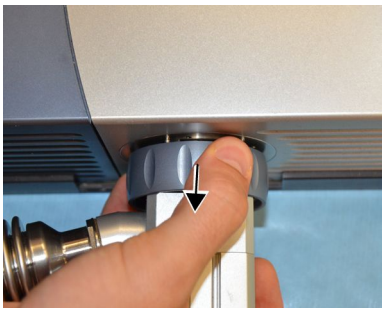


- Pull the mounting ring (1).



- Turn the mounting ring (1) counter-clockwise until there is a noticeable stop.

- The mounting ring (1) is now unlocked. Release the mounting ring.



- Carefully pull out the Vacuum Operator and remove it from the CryoProbe.

- Protect the Vacuum Operator with the white plastic cover.

7.3 Power-on

If the CryoProbe system has been turned OFF or has not been recently used, the following steps need to be completed to make sure all components are ON and ready.

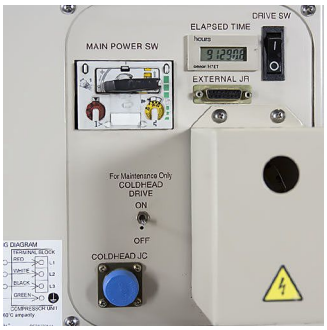
- All units of the CryoProbe system must be set up correctly as shown in *Overview of Cable and Gas Tube Connections [▷ 31]*.
- Activate the Main Pressure Supply and (if available) Backup Pressure Supply to the CryoCooling Unit.

Only for outdoor air cooled He compressors:

- Switch **ON** the He compressor MAIN POWER switch.
- If the outside temperature is below -5 °C, allow 4 hours for the He Compressor to warm up before starting a cooldown.

Only for water-cooled He compressors:

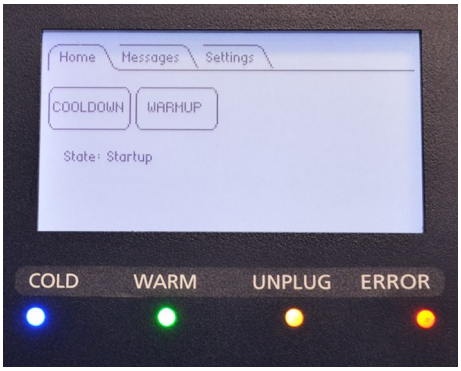
- Open the cooling water supply or switch **ON** the water chiller.
- Switch **ON** the He compressor MAIN POWER switch.



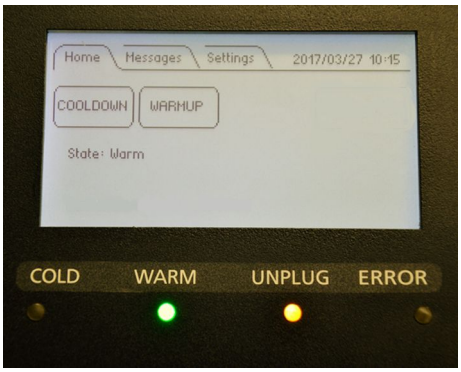
Only for indoor air cooled He compressors:

- Switch **ON** the He compressor MAIN POWER switch.

- Switch **ON** the CryoCooling Unit at its main switch at the back.



- During the booting of the CryoCooling Unit, the Error LED blinks green for about 1 min. When the booting is complete, all LEDs light up for 1 sec.



- Then the green WARM and the white UNPLUG LEDs light up.

7.4 Turning on the He Gas Supply

If the CryoProbe system has been turned OFF or has not been recently used, the following steps need to be completed to make sure all components are ON and ready.

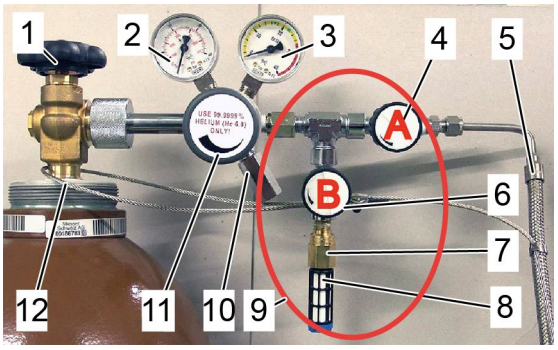


Figure 7.2: He-regulator on the He gas cylinder

1	He gas cylinder main valve	7	Dump port one-way valve
2	Primary gauge	8	Dump port silencer
3	Secondary gauge	9	Purging device (marked with red circle)
4	He hose valve	10	Relief valve (35 - 37 bar)
5	He hose to CryoCooling Unit	11	He regulator valve
6	Dump port valve	12	Safety cable

NOTICE

Material damage hazard due to sudden pressure increase

A sudden pressure increase may damage the regulator unless the regulator valve is completely closed.

> Always close the regulator valve completely in counter-clockwise direction before opening the main valve

- Turn the He regulator (11) counter-clockwise until it is closed completely.
- Open the He steel cylinder main valve (1). The primary pressure gauge (2) should read 30-300 bar.
- Adjust the He regulator valve until the secondary pressure gauge (3) reads 23-25 bar. Check the secondary pressure after about 20 min and readjust if needed.

7.5 Cooldown the CryoProbe System

⚠ CAUTION

Risk of injury due to low temperatures of cold Helium gas (-253°C) and cold metal parts.

Contact with the skin may cause cold burns.

Contact with the eyes may cause blindness.

1. Pressurized cryogenic He gas is circulated between CryoProbe and CryoCooling Unit through the Transferline.

▶ Do not disconnect the Transferline (or any other tube or cable) unless UNPLUG lights up.

▶ Never look directly in the openings of the Transferline without eye protection because cold He can flow out suddenly.

▶ Do not move a cold CryoProbe.

▶ Never over bend the Transferline (minimal bending radius = 400 mm).

▶ Protect temperature sensitive components such as O-rings from contact with liquid cryogenic agents.

⚠ CAUTION

Accident hazard from contact with cold surfaces

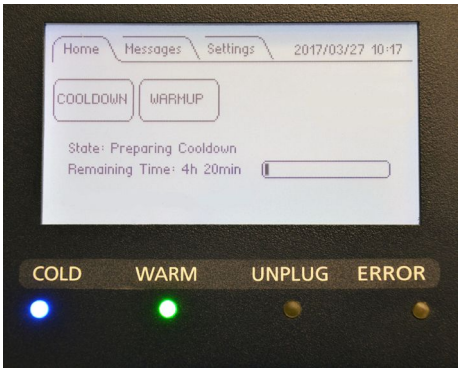
In case the insulation vacuum fails, or a component inside the Transferline breaks, the surfaces of CryoProbe body and /or CryoProbe interconnection may become dangerously cold (down to -253 °C).

▶ If any surface shows visible ice or snow, do not touch it.

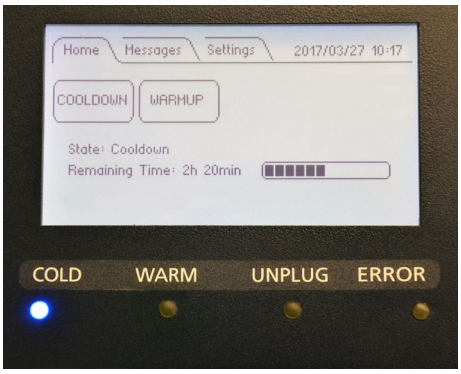
▶ Press Warmup on the CryoCooling Unit.

Check if the

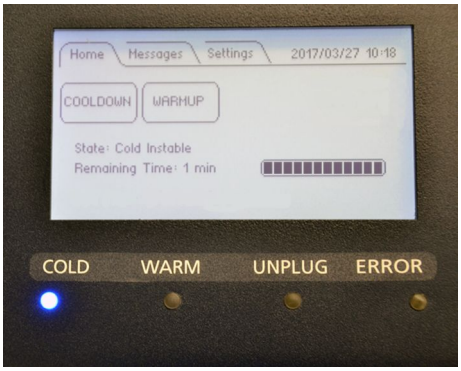
1. Cooling water supply to the He compressor is active (if applicable).
2. He gas cylinder is connected and open. Check the primary pressure:
   - Primary pressure 90 bar and less: Order a new He gas cylinder, to have a spare He gas cylinder ready when needed.
   - Primary pressure 30 bar and less: Replace the He gas cylinder according to *Replacement of He Gas Cylinder [▷ 62]*
3. CryoProbe is properly installed and connected.
4. CryoCooling Unit is ON and if WARM and UNPLUG LEDs indicate that the unit is ready.
5. He compressor MAIN POWER is ON and REMOTE DRIVE is EXT.
6. Verify that there is no animal in the magnet.



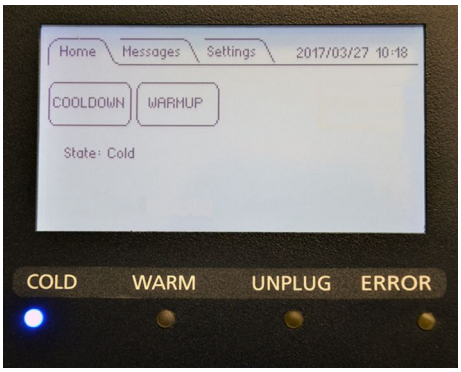
- Start the cooldown by pressing the COOLDOWN button on the CryoCooling Unit or in the CryoDisp.
- The COLD LED will start to blink, indicating that the system is preparing the Cooldown process.
- **Preparing Cooldown** is displayed while the CryoProbe is still warm. Charging the system with He, evacuation and the He flushing cycles take at least 30 min. It is possible to configure in the Service GUI a longer evacuation time, therefor go to *Improve vacuum duration (default 1 h).*



- **In Cooldown** state, the ColdHead and He compressor are activated, and the characteristic periodic hiss is audible.
- The actual Cooldown takes about 2 h.



- The **Cold Instable** takes about 30 min.



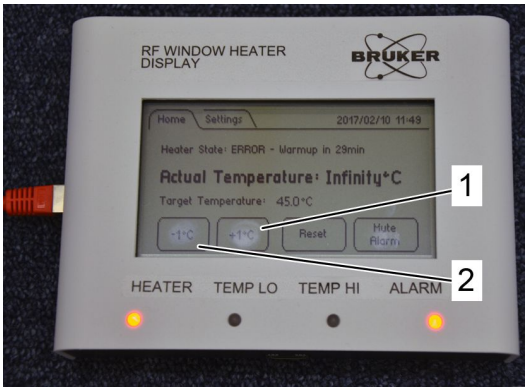
- The **Cold** state and the steady blue COLD LED indicate that the CryoProbe is ready for MRI measurement.

- Verify the correct MRI RF Window Heater temperature setting (*Operating the MRI RF Window Heater [▶ 52]*). Now an animal can be inserted.

7.6 Operating the MRI RF Window Heater

The MRI RF Window Heater is turned on automatically together with the CryoCooling Unit.

The user must constantly supervise the correct MRI RF Window Heater function when an animal is inside the MRI CryoProbe setup.



At the RF Window Heater display the temperature of the RF coil window temperature can be adjusted with two buttons.

1. Increase the Temperature by 1 °C.
2. Decrease the Temperature by 1 °C

7.6.1 Alarm Function

⚠ CAUTION

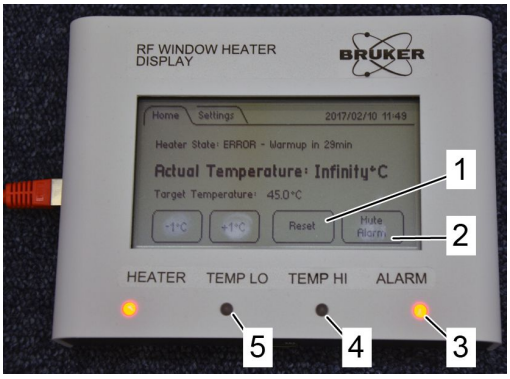
Accident and material damage due to low temperature

- ▶ Use gloves when working on the setup.
- ▶ If the RF Window Heater display shows an *error*, or does not display anything, remove the laboratory animal from the CryoProbe immediately to protected from freezing.

If the chosen temperature for the RF window of the MRI CryoProbe cannot be maintained, the RF Heater display will signal a warning by the ALARM LED and a built-in alarm sound.

For minor problems, the RF Window Heater will resume normal operation as soon as possible.

For major problems, a reset button appears on the display. Solve the problem, then press the reset button (5) to restart operation.



1. Press reset button to clear the Error LED and restart the operation.
2. Press Mute Alarm to mute the alarm sound.
3. The ALARM LED lights up if the actual temperature deviates from the chosen temperature, or if the temperature sensor readout is invalid. Also, the RF Window Heater Display will sound an alarm.
4. The TEMP HI LED lights up in orange if the actual temperature is above the chosen temperature.
5. The TEMP LO LED lights up in blue if the actual temperature is below the chosen temperature.

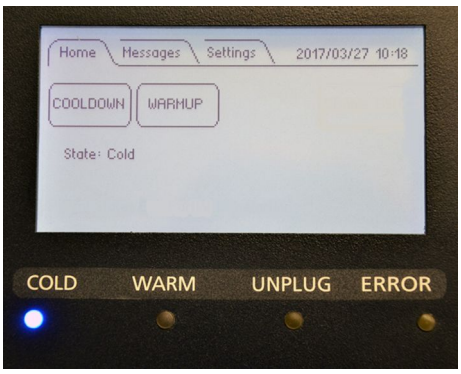
7.7 Warmup of the CryoProbe System

NOTICE

Hazardous situation due to cold temperature for an animal

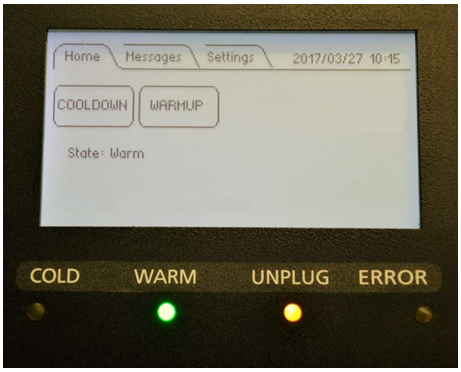
▶ Remove the animal from the magnet before the CryoProbe warmup or in case of an automatic warmup.

⚠ CAUTION! Keep the RF Window Heater and the Bottom Heater operating even when there is no animal in the CryoProbe.



- Initiate a warmup by pressing the **WARMUP** button on the CryoCooling Unit or the CryoDisp. The ColdHead stops after a short while.

- The WARM LED blinks in green and the remaining time until the system will be warm is shown on the display. This will typically take ~2.5 h.



- Wait until green WARM and white UNPLUG lights are lit.

7.8 Power-off

If the WARM and UNPLUG LEDs light up and the CryoCooling Unit may be switched off completely.

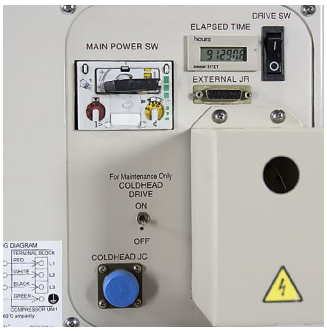
- Switch OFF the CryoCooling Unit at its back.

Only for outdoor air cooled He compressors:

- Switch OFF the He compressor MAIN POWER switch.

Only for water-cooled He compressors:

- Switch OFF the He compressor MAIN POWER switch.
- Close the cooling water supply or switch OFF the water chiller.



Only for indoor air cooled He compressors:

- Switch OFF the He compressor at its MAIN POWER switch at the back.

NOTICE! The He compressor and the Flexlines remain pressurized at all times to prevent contamination. When the CryoProbe System is shut down, it automatically vents some parts while others remain pressurized. Its seals are designed to hold the pressure over an extended period. Do not try to release this pressure by any means! Safety valves will prevent damage if excess pressure builds up accidentally. NOTICE! If the CryoProbe system should need to be relocated, a Bruker engineer should be contacted.

7.9 Turning off the He Gas Supply

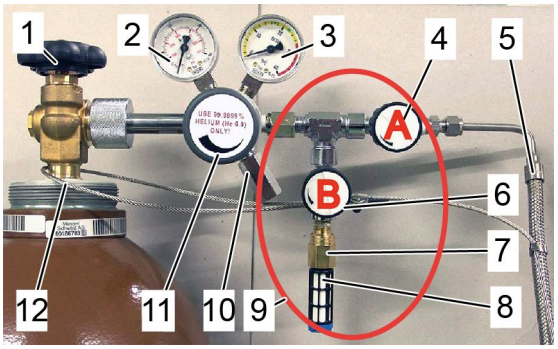


Figure 7.3: He-regulator on the He gas cylinder

1	He gas cylinder main valve	7	Dump port one-way valve
2	Primary gauge	8	Dump port silencer
3	Secondary gauge	9	Purging device (marked with red circle)
4	He hose valve	10	Relief valve (35 - 37 bar)
5	He hose to CryoCooling Unit	11	He regulator valve
6	Dump port valve	12	Safety cable

NOTICE

Material damage hazard due to sudden pressure increase

A sudden pressure increase may damage the regulator unless the regulator valve is completely closed.

> Always close the regulator valve completely in counter-clockwise direction before opening the main valve

- Close the He gas cylinder main valve (1).
- Turn the He regulator (11) counter-clockwise until it is closed completely.

8 Maintenance

Work	Interval	Device	Performed By
LabScape Planned Maintenance	Yearly	CryoCooling Unit	Bruker Service Engineer
Cleaning Dust Filter [▷ 59]	Every 6 Months*	CryoCooling Unit	Instructed User
Cleaning the Air Fins of an Air Cooled He-Compressor [▷ 60]	Every 6 Months*	Air Cooled He Compressor	Instructed User
Ensure Cooling Water Flow and Temperature of a Water Cooled He Compressor [▷ 61]	Check Daily or set Compressor water supervision to ON	Water Cooled He Compressor	Instructed User
Ensure Cooling Water Specifications of a Water Cooled He Compressor [▷ 61]	According to the water-cooling system instructions	Water Cooled He Compressor	Instructed User
Other Cleaning Operations	When needed	CryoCooling Unit	Instructed User
Replacement of He Gas Cylinder [▷ 62]	Check before every Cooldown	He Gas Cylinder	Instructed User

Table 8.1: Maintenance Work

* In many cases the cleaning performed during the LabScape Planned Maintenance is sufficient.

However, if the CryoCooling Unit is exposed to an extensive amount of dust, or the He compressor is exposed to tree leaves or similar, they need more frequent cleaning. Check your system every 6 months, until you can estimate how often cleaning is actually required.

Periodic Warm-Up

Periodic Warm-Up of the CryoProbe:

To release accumulated frozen particles and restore full cooling capacity, the CryoProbe must be warmed up after 3 - 12 months of permanent cold operation.

In due time, the message *warm-up needed soon* (I2302, blue LED blinks) indicates that the user should Warmup the CryoProbe within the next days.

After some days after the message without any user action the Cryo-temperatures become unstable and may reduce the measurement quality of the experiments (E2304, green LED blinks), and finally an automatic warm-up is initiated (E2301, red LED blinks).

- Therefore, check weekly for the message *warm-up needed soon* when the CryoProbe is in cold state.
- Plan to perform a warm-up soon when this message is shown.

8.1 LabScape Planned Maintenance

The CryoPlatform requires periodic maintenance to avoid preventable breakdowns with possible damage to the system, as well as to achieve optimum efficiency.

Our knowledgeable service engineers exchange wear parts, inspect the system and fix small problems that could otherwise lead to expensive repairs or reduced NMR/MRI performance.

Check *https://www.bruker.com/labscape-service-and-life-cycle-support* for long term and on demand LabScape maintenance agreements.

LabScape Planned Maintenance work include:

- Firmware update (yearly)
- System health check (yearly)
- Coldhead exchange (yearly)
- Cleaning of air cooled He compressors (yearly)
- Adsorber exchange (every two years)
- Vacuum Pump Module exchange (every two years)
- Replacing the dust filter (every two years)

Additional work, depending on your LabScape maintenance agreement:

- Exchange of the He 6.0 gas cylinder (yearly, if needed)
- Exchange of the optional Backup Air/N2 gas cylinder (yearly, if needed)

The planned maintenance interval is 12 months, meaning this maintenance must be completed annually to ensure continuous proper functionality.

Contact your local Bruker Service Department to schedule your next planned maintenance at *https://www.bruker.com/labscape-service-and-life-cycle-support/contact-support*.

8.2 Cleaning Dust Filter

Remove the dust filter mat from the filter drawer below the CryoCooling Unit.

Figure 8.1: Filter drawer with filter mat below the CryoCooling Unit

NOTICE! Vacuuming is necessary, if a visible dust imprint covers more than half of the bottom dust filter mat side.

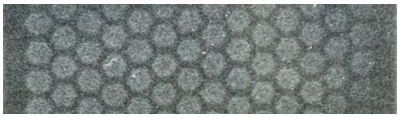
	Filter bottom covered with dust imprint. Cleaning is needed. • To clean the filter vacuum the bottom of the filter drawer. Do not clean the filter directly with the vacuum cleaner to prevent the filter from being sucked into the vacuum cleaner. **NOTICE! Note that vacuuming the top of the filter would only allow the dust to penetrate deeper into the filter.**
	Filter bottom without dust imprint. Cleaning is not needed.

Table 8.2: Filter State of CryoCooling Unit

8.3 Cleaning the Air Fins of an Air Cooled He-Compressor

NOTICE

Material damage hazard due to blocked He compressor air fins

Due to blocked air fins the He compressor can overheat and the He compressor oil can degrade and quickly contaminate the He. A He compressor with degraded compressor oil must be replaced.

The He Compressor can overheat if less than 50% of the free airflow is available. A thin layer of dust does not block the airflow completely.

- Therefore, cleaning of the He Compressor air fins is needed if more than 50% of the air fins are hidden by dust. Clean the air fins according to the procedure described in the He compressor manual.

	More than 50% of the Air Fins are hidden by dust. • Cleaning is needed.
	More than 50% of the Air Fins are free from dust. • At the moment cleaning is not needed but check regularly.
	Clean He Compressor Air Fins. • Cleaning is not needed but check regularly.

Table 8.3: He Compressor Air Fins

8.4 Ensure Cooling Water Flow and Temperature of a Water Cooled He Compressor

NOTICE

Material damage hazard when cooling water flow specifications in the He compressor manual are not met

- ▶ With a too low-water supply the He compressor can overheat, the He compressor oil can degrade and quickly contaminate the He. A He compressor with degraded compressor oil must be replaced.
- ▶ A too high-water flow causes turbulence and bubbles inside the heat exchanger, reducing the thermal conduction and as a result causes overheating and degradation of the He compressor oil. A He compressor with degraded compressor oil must be replaced.

To check the He compressor water temperature:

- **Read** within the Service GUI of the CryoCooling Unit the temperature profile of the sensors **S33 Compr. Water Flow** and **S32 Compr. Water Temperature**.
- If the temperature values have been or are actually outside the specified range given in the He Compressor Manual, even for short periods of time, adjust the cooling water system to prevent this in the future.
- **Set** the **compressor water supervision** to **ON** or **AUTO ON** in the Service GUI status tab. This will automatically provide warning messages if the water flow or the temperature slightly deviate from the specifications and initiate a **Warmup the CryoCooling Unit** for longer or more severe deviations from the specifications.

8.5 Ensure Cooling Water Specifications of a Water Cooled He Compressor

NOTICE

Material Damage Hazard when cooling water specifications are not met

If the cooling water specifications according to the He compressor specifications are not met the heat exchanger might corrode and begin to leak water. A He compressor with corroded heat exchanger must be replaced.

Maintain the cooling water system regularly to ensure that the cooling water specifications are met.

8.6 Other Cleaning Operations

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

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 must 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.

8.7 Replacement of He Gas Cylinder

⚠ DANGER

Danger of asphyxiation due to displacement of air by Helium gas and Nitrogen gas

If more than 20% of the breathable air are displaced, loss of consciousness and death are possible. The CryoCooling Unit has up to 3 gas sources that can displace air if an unintended leak occurs:

- Helium Gas Cylinder
- Main N2/Air Supply *
- Backup N2/Air Supply *

* These sources are only a danger, if the source is N2 that is guided into the room from outside. There is no danger from a source that is air, or N2 produced by an N2 separator within the same room.

- ▶ Follow all local guidelines related to the use, transport and storage of Nitrogen and Helium gas in an enclosed area.
- ▶ The minimum free room volume (room volume – furniture volume) must be observed (*Calculation of Minimum Free Room Volume required for Gas Sources that can Instantly Displace Air (Such as an Air Compressor with an N2 Separator) [▷ 73]*).
- ▶ The minimum steady fresh air supply must be observed (*Calculation of Minimum Fresh Air Supply required for Gas Sources that can Continuously Displace Air (Such as an Air Compressor with an N2 Separator): [▷ 73]*).
- ▶ The lab must be equipped with oxygen monitors to detect a possible drop in the oxygen level. One oxygen monitor must be above the magnet and one oxygen monitor approx.30 cm off the floor of the magnet room to detect low oxygen levels. Where the magnet is located inside a pit, an additional oxygen monitor located approx. 30 cm from the bottom of the pit must be fitted. All detectors must be located outside the 0.5 mT (5 G) line.
- ▶ If the Helium and/or Nitrogen pressure hose runs through several rooms, all rules above must be fulfilled for all these rooms.
- ▶ Persons must not accompany a pressurized He gas cylinder inside an elevator (observe local regulations).

⚠ WARNING

Risk of injury due to gas under pressure

- ▶ Wear protective goggles and ear protectors when working with pressurized systems.
- ▶ Do not stand in the direction of an outlet of the nozzle orifice of the He 6.0 gas cylinder.
- ▶ In case of a leak in the pressurized gas system, close the main valve of the He 6.0 gas cylinder and contact Bruker service for repair.
- ▶ Secure the He 6.0 gas cylinder to a wall at the intended position in the lab.
- ▶ Only use the original Bruker pressure reducer, which has a 30 bar limited output pressure and a discharge valve at 35 - 37 bar.
- ▶ Do not manipulate or obstruct the discharge valve.
- ▶ If the He pressure hose is not fixed it can whip around in case of a rupture. The He pressure hose between the He 6.0 gas cylinder and the CryoCooling Unit is strengthened with a steel wire that must be fixed to the units at its ends.
- ▶ The He pressure hose must be fixed to a wall or to the floor once every meter. If crossing of walkways cannot be avoided, the He pressure hose must be covered or buried.
- ▶ All local safety regulations for the installation of pressurized gas systems and transport of the He 6.0 gas cylinders must be obeyed.

⚠ WARNING

Risk to life due to strong magnetic fields of the NMR/MRI magnet

The He gas cylinder, He compressor, the CryoCooling Unit or ferromagnetic tools and equipment can be fiercely attracted by the magnetic field.

The function of the CryoCooling Unit and the He compressor can be impaired by the magnetic field.

- ▶ Mark the magnetic field of more than 0.5 mT (5 Gauss).
- ▶ Only use non-ferromagnetic ladders or steps.
- ▶ The He gas cylinder and its entire transport path must always be outside the marked 0.5 mT range of the magnet.
- ▶ The He compressor and its entire transport path must always be outside the marked 0.5 mT range of the magnet.
- ▶ The CryoCooling Unit and its entire transport path must always be outside the 5 mT range of the magnet.
- ▶ Do not use ferromagnetic tools or items within the marked 0.5 mT range of the magnet.

NOTICE

Risk of material damage to the Coldhead

Impure Helium leads to knocking and irreversibly damages the Coldhead of the CryoCooling Unit and the He compressor.

- ▶ Exchange the He gas cylinder when its main pressure drops below 30 bar.
- ▶ Only use He gas of grade 6.0, with a total purity of 99.9999%.
- ▶ Grade 6.0 He is sometimes not immediately available. Order a new He gas cylinder early, e.g. when the pressure has dropped to 40 bar. With a standard size 50 l He gas cylinder, this reserve would last for another 2 – 3 warmup / cooldown cycles of the system.
- ▶ Do not use He gas cylinders with built-in purifier (BIP).

Replacing the He Gas Cylinder

Before every Cooldown, check the primary pressure gauge:

- Primary pressure 90 bar and less: Order a new He 6.0 gas cylinder, to have a spare He gas cylinder ready when needed.
- Primary pressure 30 bar and less: Replace the He 6.0 gas cylinder.

NOTICE! This procedure applies ONLY to He regulators that are equipped with the purging device shown here in the red circle.

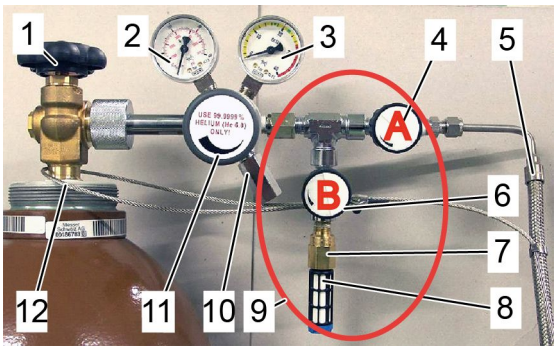
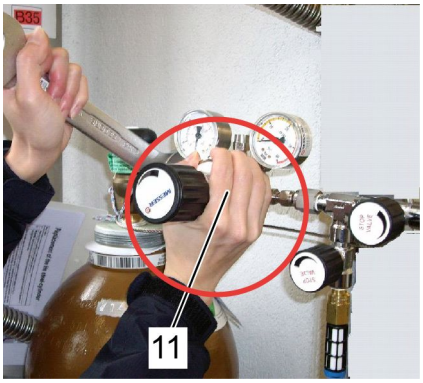


Figure 8.2: He-regulator on the He gas cylinder

1	He gas cylinder main valve	7	Dump port one-way valve
2	Primary gauge	8	Dump port silencer
3	Secondary gauge	9	Purging device
4	He hose stop valve	10	Relief valve (35 - 37 bar)
5	He hose to CryoCooling Unit	11	He regulator valve
6	Dump port stop valve	12	Safety cable

- Make sure the CryoProbe system is WARM and UNPLUG is lit.
- Close the main valve (1) of the He gas cylinder.
- Close valve A (4) completely to shut off the He hose.
- Open valve B (6) to release the remaining pressure from the He regulator. Verify that both the primary (2) and secondary (3) pressures have dropped to zero.



- Detach the He regulator assembly from the He gas cylinder: Only the regulator valve body (11) should be held to stabilize the assembly when unmounting (or mounting); **NOTICE! Do not hold the pressure gauges or any part of the purging device.**
- Put the protective cap onto the used He gas cylinder.
- Replace the He gas cylinder.
- Fix the new He gas cylinder securely to a wall. Attach the safety cable of the He hose to the He gas cylinder and mount the He regulator.

NOTICE! Always close counter-clockwise the regulator valve (11) completely before opening the main valve (1).

NOTICE! When opening the main valve in the following work sequence, do so only very briefly to avoid contamination of the He inside the cylinder with air.

Do the following five steps three times in a row:

- Close counter-clockwise the regulator valve (11) completely; the regulator valve is closed when you feel no resistance from turning it.
- Close valve B (6).
- Open the main valve (1) of the He gas cylinder by 1/8 – 1/4 turn and immediately close it again as soon as the primary gauge (2) shows the pressure inside the He gas cylinder.
- Open clockwise the regulator valve until the secondary pressure is about 6 - 10 bar.
- Open valve B (6) to release the pressure.

Afterwards:

- Close counter-clockwise the regulator valve (11) completely.
- Close valve B (6).
- Open the main valve (1) of the He gas cylinder.
- Open clockwise the regulator valve (11) until the pressure on the secondary gauge (3) reads between 23 and 25 bar.
- Open valve A (4).

He Leak Test

- Close the main valve (1) of the He gas cylinder and wait for ~1/2 hour.
- Read the secondary pressure (3).
- Wait for ~2 hours and read this pressure again. If the value has decreased, search for the leak(s) with a He detector or Snoop Liquid (found inside the toolbox for the CRP Spare Parts Set).
- If the secondary pressure (3) has not decreased, open the main valve (1) of the He gas cylinder.

9 Replacement of Parts

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

9.1 Returning the Unit for Repair

If the Bruker Hotline diagnoses an instrument failure that requires a part to be returned for repair, please follow the procedure listed here:

1. Contact your local Bruker office to start the repair process (see Contact). Repair is always handled by your local Bruker office. Their reply will contain all necessary information for the subsequent repair process steps.
2. They will provide you with details on the shipping address, and also in most cases a “Return Merchandise Authorization” number (RMA number) that allows references to the repair case. Always refer to this RMA number in case of questions.
3. Send the defective part to the local Bruker office and include the following documents:
   - RMA sheet (if RMA number was assigned).
   - Signed Equipment Clearance Form (BBIOF002/H152631). The Equipment Clearance Form will be sent to you as part of step 1 (see above) with information about the returned part (part number, serial number, your contact details) already filled in.
4. Attach the relevant papers to the *outside* of the packaging, for instance in a transparent polybag.

The unit should be returned using the original container and packing assembly. If this packaging is no longer available, contact your local Bruker office for further instructions.

10 Dismantling and Disposal

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

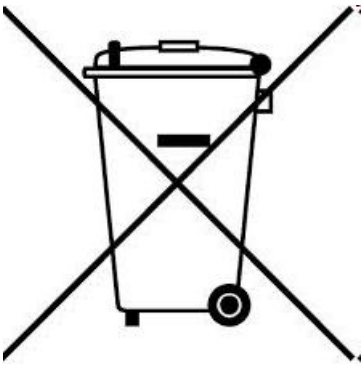
10.1 Dismantling

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.

10.2 Disposal in 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 requested 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**

10.3 Disposal in 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*.

11 Technical Data

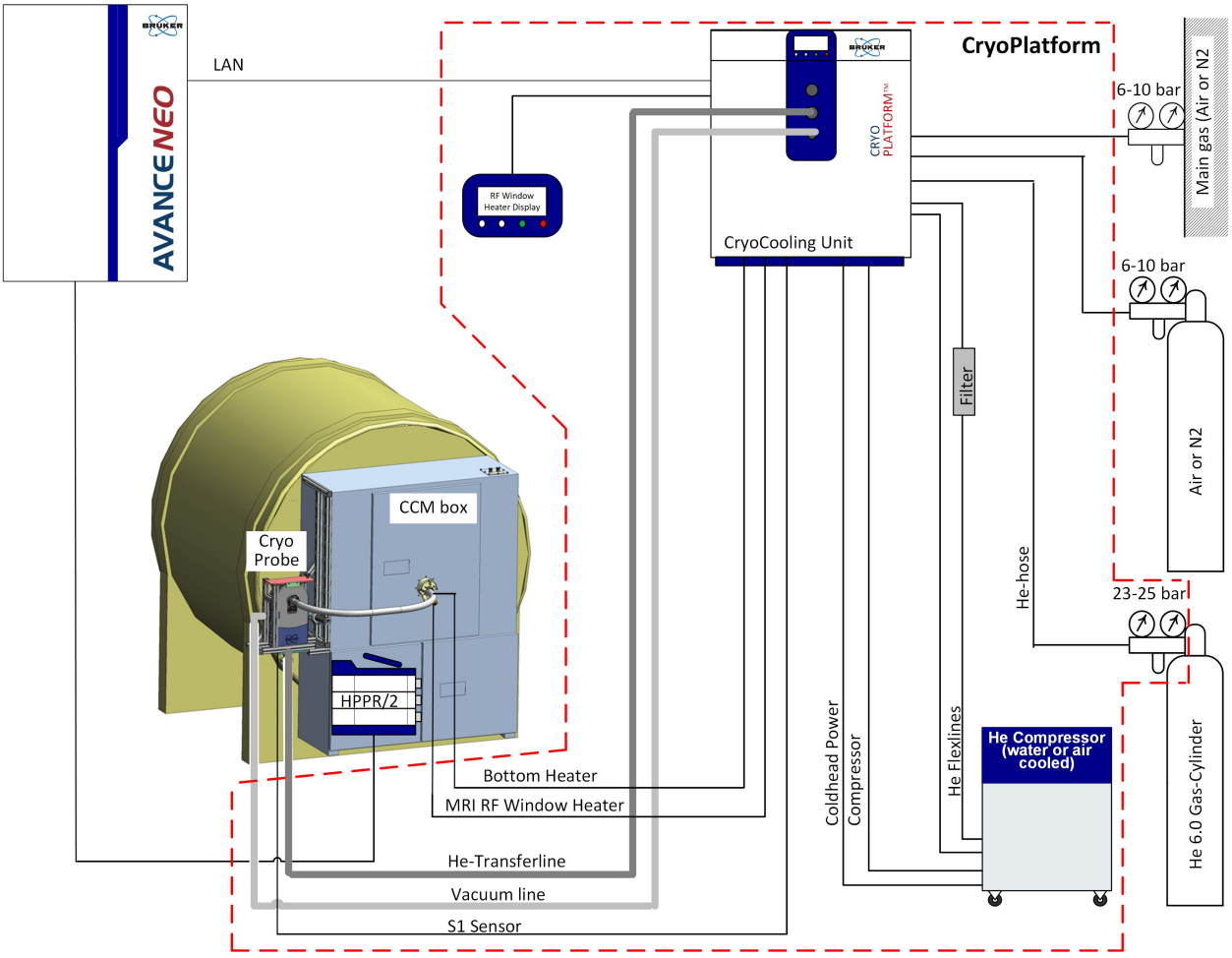


Figure 11.1: Diagram of MRI CryoProbe Installation

CryoCooling Unit 5	
Dimensions	73 x 74 x 98 cm^3 (W x D x H) Detailed space requirements in the Site planning. Weight 250 kg
Mains power	100 V – 240 V ~ 50 -60 Hz, max 10 A, max 1 kW Cold State typically ~ 300 W
Coldhead power	200 V 3 ~ 50 / 60 Hz 0.5 A Coldhead power is provided by He compressor.
Magnetic field	For operation and protection against a magnet quench: CryoCooling Unit needs to be outside of the 5 mT fringe field of the magnet.
Acoustic noise	Typically, < 46 dB(A) in 1 m distance.

CryoCooling Unit 5	
Installation altitude	Max. 2000 m above sea level.
Operating conditions	Ambient temperature: 10 °C to 28 °C Humidity: 5 % to 85 % (non-condensing)

Table 11.1: CryoCooling Unit 5 Technical Data

Further Information

For technical data of the He compressor, consult the He compressor manual by Sumitomo delivered with the compressor.

He 6.0 Gas Cylinder	
Minimum quality	He Gas 99.9999% (Grade 6.0) Use individually certified cylinders only. No built-in purifiers (BIP) are allowed.
Primary pressure before pressure reducer	30 - 300 bar
Maximal working pressure	25 bar
Magnetic field	For protection against an magnet quench: The He gas cylinder needs to be outside of the 0.5 mT fringe field of the magnet.

Table 11.2: Helium (He) Requirements

Air / N2 gas requirements	
Main Air / N2 gas supply	ISO 8573-1:2010 [2, 2, 2] Pressure: 6 - 10 bar Dew point: < -20°C @ 1 bar Solid impurities: 1-5 um (< 100 particles / m^3) Oil content: < 0.5 ppm (0.425 mg/ m3) Capacity for normal operation 1l / min
Backup Air / N2 gas supply (optional)	Independent Air / N2 gas source, e.g. a N2 gas cylinder fitted with a pressure reducing valve Air / N2. Specifications: See Main Air / N2 supply.

Table 11.3: Air / N_2 Gas Requirements

Minimum Free Room Volume	Instantly Displaced Air Volume	Safe Free Room Volume
Calculation	Gas Cylinder Volume * max. Gas Cylinder Pressure = Norm Gas Volume	Norm Gas Volume / 20 % = Safe free room volume
Example: He Gas Cylinder	50 l * 200 bar = 10’000 Nl = 10 Nm^3	10 m^3 / 0.2 = 50 m^3
Example: N2 Gas Cylinder for Backup Supply*	50 l * 200 bar = 10’000 Nl = 10 Nm^3	10 m^3 / 0.2 = 50 m^3

Table 11.4: Calculation of Minimum Free Room Volume required for Gas Sources that can Instantly Displace Air (Such as an Air Compressor with an N2 Separator)

Minimum Fresh Air Supply Rate	Continuously Displaced Air Volume	Safe Steady Fresh Air Supply
Calculation	Max. Supply Flow = Norm Gas Flow	Norm Gas Flow / 20 % = Safe steady fresh air supply
Example: N2 Main / Backup Supply	200 Nl / min = 12 Nm^3 / h	12 m^3 / h / 0.2 = 60 m^3 / h

Table 11.5: Calculation of Minimum Fresh Air Supply required for Gas Sources that can Continuously Displace Air (Such as an Air Compressor with an N2 Separator):

11.1 Rating Plate

The rating plate is located at the power input and includes the following information:

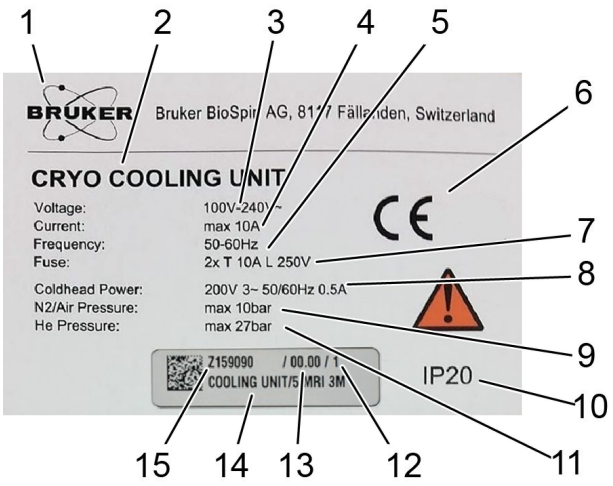


Figure 11.2: Rating plate of the MRI CryoCooling Unit

1	Manufacturer	9	N2 / Air Pressure
2	Type	10	IP Code, International Protection Marking, IEC standard 60529
3	Voltage	11	He Pressure
4	Current	12	Serial Number
5	Frequency	13	ECL: Engineering Change Level
6	CE Symbol	14	Part name
7	Fuse	15	Part Number
8	Coldhead Power		

12 Certificate of Compliance

The CryoCooling Unit 5 (CU/5) and CryoCooling Unit 5 MRI (MRI CU/5), are checked by external inspectors to satisfy the safety requirements of the 2014/35/EU (Low Voltage Directive LTD), EN 61010-1:2010 / IEC 61010-1 (3rd Edition) and 2014/30/EU (Electromagnetic Compatibility EMC), EN 61326-1:2013 / IEC 61326-1 (2nd Edition) and 2011/65/EU (RoHSII).

EU Konformitätserklärung
EU-Declaration of Conformity
Declaration de Conformité – UE
Bruker BioSpin Group

BRUKER

Der Unterzeichner, der den nachstehenden Hersteller vertritt:
The undersigned, representing the following manufacturer:
Le signataire, qui représente le producteur suivant:

Hersteller / Manufacturer / Producteur:
Anschrift / Address / Adresse:

Bruker BioSpin AG
Industriestraße 26, 8117 Fällanden, Switzerland

erklärt hiermit, dass die... / herewith declares that... / déclare par la présente que le ...

Produkt Serie / Product Series/ Série de Produit

Cryo Cooling Unit 5 (CU5) ;
Cryo Cooling Unit 5 MRI (MRI CU5) ;
BSNL N2-Liquefier

CE

...in Übereinstimmung mit den Bestimmungen der nachstehenden EU-Richtlinien (einschließlich aller zutreffenden Änderungen) ist.
...is in conformity with the provisions of the following EU directives (including all applicable amendments).
...est conforme aux dispositions des directives d'union européennes suivantes (y compris tous les amendements applicables).

2014/35/EU			
Europäische Richtlinie **Niederspannungsrichtlinie (NS-RL)** betreffend...	European Directive **Low Voltage Directive (LVD)** to...		Directive européen **Directive Basse Tension (DBT)** au...
Elektrische Betriebsmittel zur Verwendung innerhalb bestimmter Spannungsgrenzen Electrical equipment designed for use within certain voltage limits Matériel électrique destiné à être employé dans certaines limites de tension	(Neufassung) (recast) (refonte)		(früher 2006/95/EG) (former 2006/95/EC) (avant 2006/95/CE)
Angewandet harmonisierte Normen / Applied harmonized standards / Suite à des normes harmonisées applicables:			
EN 61010-1:2010 / **IEC 61010-1** (3rd Edition)			

2014/30/EU			
Europäische Richtlinie **Elektromagnetische Verträglichkeit (EMV)** betreffend...	European Directive **Electromagnetic Compatibility (EMC)** to...		Directive européen **Compatibilité Electromagnétique (CEM)** concernant...
...die elektromagnetische Verträglichkeit ...Electromagnetic compatibility ...la Compatibilité Électromagnétique	(Neufassung) (recast) (refonte)		(früher 2004/108/EG) (former 2004/108/EC) (avant 2004/108/CE)
Angewandte harmonisierte Normen / Applied harmonized standards / Suite à des normes harmonisées applicables:			
EN 61326-1:2013 / **IEC 61326-1** (2nd Edition)			

Hinweis: Verwendung dieser Baugruppe - nur in Verbindung mit den dafür vorgesehenen Bruker BioSpin Systemen.
Note: Operation of this component - only in conjunction with the appropriate Bruker BioSpin systems.
Note: Utilisation de ce module uniquement en rapport avec un system Bruker BioSpin appropriés.

Fällanden, 20.10.2017
Schweiz / Switzerland / Suisse

Dr. Daniel Guy Baumann
Komponenten Manager / Component Manager / Responsable de Composants
Cooling Units & BSNL Liquefiers / R&D Organisation – Bruker BioSpin Group

Figure 12.1: CE CryoCooling Unit CU/5 for NMR (with optional BSNL) and MRI

EU Konformitätserklärung
EU-Declaration of Conformity
Declaration de Conformité – UE
Bruker BioSpin Group

RoHS

Der Unterzeichner, der den nachstehenden Hersteller vertritt:
The undersigned, representing the following manufacturer:
Le signataire, qui représente le producteur suivant:

Hersteller / Manufacturer / Producteur:
Anschrift / Address / Adresse:

Bruker BioSpin AG
Industriestraße 26, 8117 Fällanden, Switzerland

erklärt hiermit, dass die... / herewith declares that... / déclare par la présente que le ...

Produkt Serie / Product Series/ Série de Produit

Cryo Cooling Unit 5 (CU5) ;
Cryo Cooling Unit 5 MRI (MRI CU5) ;
BSNL N2-Liquefier

...in Übereinstimmung mit den Bestimmungen der nachstehenden EU-Richtlinien (einschließlich aller zutreffenden Änderungen) ist.
...is in conformity with the provisions of the following EU directives (including all applicable amendments).
...est conforme aux dispositions des directives d'union européennes suivantes (y compris tous les amendements applicables).

2011/65/EU		
Europäische Richtlinie / European Directive / Directive européen **RoHS II** zur.../ on... / relative à...		
...Beschränkung der Verwendung bestimmter gefährlicher Stoffe in Elektro- und Elektronikgeräten ...the restriction of the use of certain hazardous substances in electrical and electronic equipment ...la limitation de l'utilisation de certaines substances dangereuses dans les équipements électriques et électroniques	(Neufassung) (recast) (refonte)	(früher 2002/95/EG) (former 2002/95/EC) (avant 2002/95/CE)
EEE-Produkte der Kategorie: **9. Überwachungs- und Kontrollinstrumente einschließlich Überwachungs- und Kontrollinstrumenten in der Industrie** EEE-Products of Category: **9. Monitoring and control instruments including industrial monitoring and control instruments** EEE-Produits de Catégories: **9. Instruments de contrôle et de surveillance, y compris instruments de contrôle et de surveillance industriels**		
...mit Verweis auf die folgenden delegierten Richtlinien als Erweiterung zu den Ausnahmen (Anhang III und IV) der RoHS II Richtlinie: ...with relation to the following delegated directives as addition to Exemptions (Annex III and IV) of RoHS II directive: ... en rapport avec les directives délégué suivantes en complément des applications exemptées (Annexe III et IV) de directive RoHS II :		
2014/6/EU	**2014/10/EU**	**2014/69/EU**	**2014/74/EU**
(EU) 2016/1028			

Hinweis: Verwendung dieser Baugruppe - nur in Verbindung mit den dafür vorgesehenen Bruker BioSpin Systemen.
Note: Operation of this component - only in conjunction with the appropriate Bruker BioSpin systems.
Note: Utilisation de ce module uniquement en rapport avec un system Bruker BioSpin appropriés.

Fällanden, 20.10.2017
Schweiz / Switzerland / Suisse

Dr. Daniel Guy Baumann
Komponenten Manager / Component Manager / Responsable de Composants
Cooling Units & BSNL Liquefiers / R&D Organisation – Bruker BioSpin Group

Figure 12.2: EU Doc ROHS CryoCooling Unit CU/5 for NMR (with optional BSNL) and MRI

Certificate of Compliance

13 Contact

NMR Hotlines

Bruker Corporation provides dedicated hotlines and service centers. 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

Contact our NMR service centers, so that our specialists can respond as quickly as possible to all your service requests, application questions, software or technical needs.

CryoProbe Sales

BRUKER BioSpin AG
Industriestrasse 26
CH-8117 Fällanden
Switzerland
phone: + 41 44 825 91 11

email: info.bbio.ch@bruker.com
email: sales.bbio.ch@bruker.com
http://www.bruker.com

BRUKER Instruments, Inc.
44 Manning Road
Billerica, MA 01821
U.S.A.
phone: ++1-978-667-9580
fax: ++1-978-667-0985

email: sales.bbio.us@bruker.com
http://www.bruker.com

CryoProbe Service

BRUKER BioSpin AG
Service Department
Industriestrasse 26
CH-8117 Fällanden
Switzerland
phone: + 41 44 825 97 97

email: cryoprobe.service.ch@bruker.com
http://www.bruker.com
WEEE DE43181702

BRUKER Instruments, Inc.

44 Manning Road
Billerica, MA 01821
U.S.A.
phone: ++1-978-667-9580
fax: ++1-978-667-0985

email: cryoprobe.service.us@bruker.com
http://www.bruker.com

Contact

Glossary

CryoCooling Unit

The CryoCooling Unit has dedicated electronics to control and monitor the He cycle, the cooling of the CryoProbes, and it features a vacuum system to insulate the cryogenic temperatures within the CryoPlatform and CryoProbe.

CryoPlatform

The CryoPlatform's main purpose is to provide the cooling infrastructure needed for the operation of CryoProbes for NMR and MRI applications. The CryoPlatform consists of the CryoCooling Unit adapted to the application and the Helium (He) compressor.

Helium

Light, colorless, odorless and tasteless gas with the chemical formula He. Liquid helium has a temperature of –269 °C / 4 K.

MRI

Magnetic Resonance Imaging

NMR

Nuclear Magnetic Resonance

Transferline

Vacuum insulated transfer pipe for cold Helium gas.

Glossary

Bruker Corporation

info@bruker.com
www.bruker.com

Order No: Z33142