SamplePro hr-MAS

SamplePro hr-MAS

Service Manual

Version 002

NMR Spectroscopy

Innovation with Integrity

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This manual was written by

Stanley J. Niles and Gilbert Cyppel

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Rheinstetten, Germany

P/N: Z31946

DWG-Nr.: Z4D11366A

For further technical assistance on the SamplePro hr-Mas unit, please do not hesitate to contact your nearest BRUKER dealer or contact us directly at:

BRUKER BioSpin GMBH
am Silberstreifen
D-76287 Rheinstetten
Germany

Phone:+ 49 721 5161 0
FAX:+ 49 721 5171 01
E-mail:service@bruker.de
Internet:www.bruker.com

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1 About

1.1 This Manual

This manual is intended to be a reference guide for Bruker certified service engineers who have already completed a Bruker designated training course. It provides detailed information about the installation, maintenance and service and overall use of the Bruker device.

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

Read carefully all relevant chapters before working on the device!

This manual describes parts and procedures relevant to the device version it is delivered with. For older hardware, please refer to the manual supplied at the time.

1.2 Policy Statement

It is the policy of Bruker 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. Support engineers are advised to regularly check with Bruker for updated information.

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

1.3 Symbols and Conventions

Safety instructions in this manual 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

This combination of symbol and signal word indicates an immediately hazardous situation which could result in death or serious injury unless avoided.

⚠ WARNING

This combination of symbol and signal word indicates a potentially hazardous situation which could result in death or serious injury unless avoided.

⚠ CAUTION

This combination of symbol and signal word indicates a possibly hazardous situation which could result in minor or slight injury unless avoided.

NOTICE

This combination of symbol and signal word indicates a possibly hazardous situation which could result in damage to property or the environment unless avoided.

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

2 Introduction

The SamplePro hr-MAS is a sample changer that was developed for high throughput, high resolution, magic angle spinning (hr-MAS) applications, such as the measurement of biological samples.

The new sample changer is part of a Bruker NMR system for standard NMR MAS applications and is used to transfer prepared MAS samples to and from Bruker NMR devices to ensure they stay in continuous operation.

2.1 Concept

The sample changer consists of a laboratory robot (SamplePro) and a transfer system connecting the laboratory robot to the probe inside the NMR magnet.

The sample changer provides a Bruker standard interface, through which the changer can be controlled from TopSpin and IconNMR software.

Refer to the user manual Z31914 for a complete description of the design and function of SamplePro hr-MAS.

2.2 Before you begin

This service manual contains information and safety information that are necessary for the installation and service of the SamplePro hr-MAS.

All maintenance and repairs are to be accomplished using the information in this manual. At the same time references over general maintenance and care from the User Manual are also to be followed.

Consider all safety references!

Information for ordering spare parts is available in the spare parts section for from the Bruker Service Center (see "Contact" on page 249).

2.3 Minimum Qualifications for Service Personnel

Type of Task	Personnel	Training and Experience
Transportation	No special requirements.	No special.
Installation	Bruker certified personnel only.	Technically skilled, with a good knowledge of the application field.
Routine Use Daily Maintenance	Appropriately certified and experienced personnel, familiar with use of computers and automation in general	Laboratory technicians or equivalent. Training is usually done in-house. Familiar with Microsoft® Windows® environment.
Setup and optimization of program	Bruker certified personnel only.	Experienced laboratory technician. High degree of knowledge of the relevant application field.
Preventive Maintenance	Bruker certified personnel only.	Technically skilled with a basic understanding of the application.
Servicing	Bruker certified personnel only.	Background and experience in electronics/mechanics with computer knowledge.

Table 2.1 Overview Installation and Operation Requirements for Personnel

2.4 The Bruker Service

See "Contact" on page 249.

2.5 Transport to Manufacturer

When the SamplePro hr-Mas must be returned to the manufacturer for a major repair, use the original packaging for transportation.

- ▶ See "Exchange Unit Malfunctions" on page 147.

Include a good description of the problem.

3 Safety Information

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

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

3.1 Intended Use

The SamplePro hr-MAS sample changer has been designed and constructed to transfer prepared MAS samples to and from Bruker NMR devices to ensure it stays in continuous operation.

The sample changer must only be used for keeping MAS samples in a specially designed well plate, inserting them into the NMR spectroscopy magnet and ejecting them after measurement back into the well plate.

Since samples may undergo degradation at room temperature, the SamplePro hr-MAS device provides cooling to -16°C and +4°C.

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

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

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

3.2 Owner‘s Responsibility

Owner

The term owners refers to the person who themselves operates the unit for trade or commercial purposes, or who surrenders the unit 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.

Owner‘s Obligations

The unit is used in the industrial sector. The owner of the unit 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 unit must be observed.

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

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

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

- The owner must ensure that the maintenance intervals described in this manual are observed.
- The owner must ensure that all safety devices are regularly checked to ensure full functionality and completeness.

3.3 Personnel Requirements

3.3.1 Qualifications

⚠ WARNING

Danger of injury if personnel are insufficiently qualified.

If unqualified personnel perform work on the unit or are in the unit‘s danger zone, hazards may arise which can cause serious injury and substantial damage to property.

- ► Therefore, all work must be carried out by appropriately qualified personnel.
- ► Unqualified personnel must be kept away from the danger zones.

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

Qualified Personnel

Qualified personnel are able to carry out assigned work and to recognize and prevent possible dangers self-reliantly 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.

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

3.3.2 Unauthorized Persons

⚠ WARNING

Risk to life for unauthorized persons due to hazards in the danger and working areas.

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

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

3.3.3 Instruction

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

3.4 Personal Protective Equipment

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

The personnel must wear personal protective equipment, as prescribed in the laboratories standard operating procedures, while carrying out the different operations at and with the unit.

3.5 Basic Dangers

NOTICE

Material damage hazard from overflow of cryogens.

Material damage may result from the overflow of cryogens.

- Turn off the unit during magnet servicing.
- Cover the unit with a protective cover to avoid contact with cold gases.
- Be sure to use sufficient transfer line and Teflon evacuation hose for nitrogen and helium refills based on recommendations in the magnet manual.
- After refilling cryogens some parts of the magnet may be icy. Be sure to remove the ice to avoid its melting onto the unit.

⚠ CAUTION

Accident hazard from contact with hot or cold surfaces on the unit.

Contact with the hot or cold surfaces of the unit may result in serious burns.

- Do not touch unit parts of cooled or heated units.
- Do not use damaged units.
- After removing any part of the unit, allow it to cool or thaw before coming in contact.

⚠ WARNING

Accident hazard from asphyxiation.

A break in a tube or hose may result in the uncontrolled exit of nitrogen into the laboratory.

- An oxygen warning device must be present in the laboratory if the device is operated with nitrogen.
- Proper air ventilation must be planned and implemented in the laboratory.

⚠ CAUTION

Accident hazard from breaking or spilled samples.

Samples may break or be spilled due to improper adjustment or cap loss. This may result in personal injury or equipment contamination.

- ▶ Follow the mounting, installation and adjustment instructions in the manual.
- ▶ Confirm the correct installation at the customer site through use of acceptance protocol.
- ▶ Standard operating procedures for sample preparation and usage must be implemented.
- ▶ During installation and maintenance use only rotors with dummy samples. Remove all MAS rotors (also from the magnet) before the installation and maintenance!

⚠ WARNING

Biological, chemical hazard.

Infection, contamination, or other health endangerment as a result of contact with biological or chemical substances, e.g. from broken samples.

- ▶ Clean the unit before maintenance work and/or returning to Bruker for repair.
- ▶ Prepare a list of materials in which the unit came into contact with or measured.
- ▶ A signed confirmation of correctly carrying out cleaning/disinfection is required from the customer. Without this confirmation the parts delivered for repair will be rejected and returned to the customer.

DANGER

Accident and/or material damage hazard from sample breakage.

Contact with hazardous substances contained in sample rotors that break may result in a life threatening situation or material damage. The contents of the sample rotors are the responsibility of the laboratory supervisor. The laboratory supervisor is responsible for:

- Defining disinfectant and cleaning procedures.
- Establishing and enforcing the use of protective clothing (gloves, eye protection, mask etc.).
- Preparing laboratory instructions for handling this type of accident.
- Preparing an emergency plan.
- Enforcing standard sample handling procedures, e.g. removing all samples from the rotor container and using sample rotors with dummy contents before maintenance work etc.
- Training laboratory personnel.

NOTICE

Material damage hazard due to improper restart.

Device deadlock may occur as a result of restarting the unit when an equipment failure has occurred.

- When an error has occurred, do not try to restart the unit until the cause of the error has been corrected.
- Only trained personnel should carry out maintenance work.

i Note: Reference measurements should be made at regular intervals to help detect possible vibration and/or electromagnetic interference.

NOTICE

Material damage hazard from icing due to lack of nitrogen.

Material damage may result from icing caused by a lack of nitrogen flow.

- ▶ The nitrogen fill level must be controlled regularly.
- ▶ When icing occurs, the rotors must be defrosted according to established laboratory procedures.

NOTICE

Material damage hazard software error.

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

- ▶ Sample rotors with dummy contents must be used during installation and service.
- ▶ Personal should be alerted to unexpected malfunctions.

i To avoid mix-up of the contents in rotors, proper standard laboratory operating procedures must be followed.

3.6 Environmental Protection

⚠ CAUTION

Danger to the environment from incorrect handling of pollutants!

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

- ▶ Always observe the instructions below 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.

Helium Inert Gas

Helium inert gas may cause suffocation at high concentrations. Disposal of the empty gas cylinders must be performed by a specialist disposal company.

Coolants

When released, coolants develop decomposition products which are hazardous to the environment. Maximum care and caution are required when handling coolants. Always observe the safety data sheet issued by the manufacturer. Ensure that personnel handling coolants are regularly informed about potential dangers and are instructed in the safe handling of coolants.

Cleaning Liquids

Cleaning liquids incorporating solvents contain toxic substances. They must not be allowed to escape into the environment. Disposal must be carried out by a specialist disposal company.

3.7 Signage

3.7.1 Warning Signs

Warning indicating a danger zone in work rooms.

Warning indicating a biological hazard.

Warning indicating severe hand injury.

4 Tool List

4.1 Required for Exchange Unit

- Allen bit SW 1,5 - 8
- Spanner wrench SW8

4.2 Required for SamplePro hr-MAS

- Ratchet tool + extension
- Torx bit # 6 to # 25
- Torx screwdriver # 6 and 8.
- Allen bit # 2,3,4,5,and 8
- Pozidrive screwdriver # 1
- Phillips # 1
- Slotted screwdriver # 2
- Open wrench 5.5 mm (Z-gear play adjustment)
- Space gauge set 0.01 mm - 0.5 mm
- Set square
- Spirit level
- 20 cm metal precision ruler
- Adjustable spring loaded scale (2.5 kg)
- Glue Loctite 222
- Glue Loctite 243 (X-Motor gear screw)
- Transparent tape
- White insulating tape
- Sharp blade or tubing cutter
- Multi-meter
- Marker
- Safety door screw tool
- Nylon tie raps
- Solvent to clean threads

4.3 Required tools that can be ordered from Sias

- Special hexagonal socket wrench # 6 thin walls (Sias reference # 150008)
- Sias screw set (Sias reference # 150000)
- Sias Handler Gripper oil (Sias reference # M0266)
- Rubber pad (Sias reference # M0488)

4.4 Optional

- Wise wrench
- Slotted screwdriver # 1
- Adjustable parallel wrench
- Wire cutting pliers
- Pocket lamp
- Caliper
- Pliers

4.5 Figures

Figure 4.1 Allen Wrench for YZ Assembly Axis

Figure 4.2 Gripper Oil

Figure 4.3 Pip. Arm 5.5 Wrench

Figure 4.4 Ratchet Extension

Figure 4.5 Torx Bits

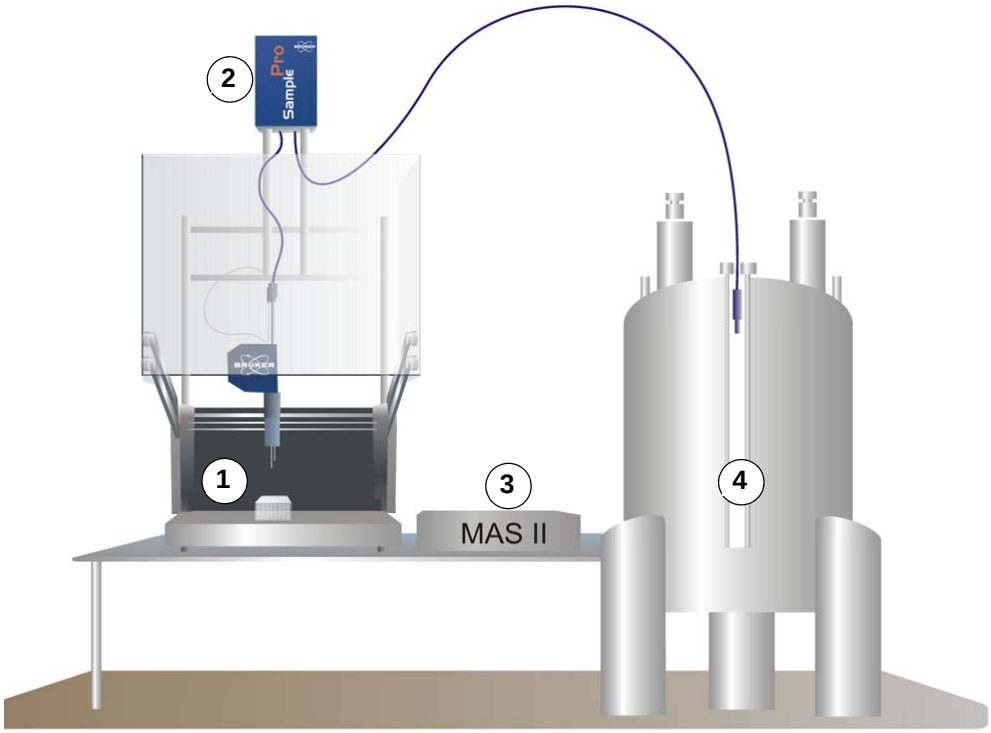
Figure 4.6 X-belt Scale Ruler

Figure 4.7 Tools

5 Principles of Operation

5.1 Main Components

The principal components of the SamplePro hr-MAS are:



1. Robotic System
2. Exchange Unit
3. MAS II Unit (not included in scope of supply)
4. MAS Probe (not included in scope of supply)

Figure 5.1 Main Components

SamplePro hr-MAS part number:

- H121100

System Main Part Numbers:

- O10547 - Robot
- H121905 - Cooling rack -16°C
- H120785 - Status light frame for mounting the exchange unit.

- H116431 - Exchange unit
- H121892 - Exchange unit accessories set
- H122275 - PC, monitor & cable set
- HZ16147 - Rotor container (tray for 48 rotors)
- H123449 - Rotor container adapter plate for room temperature
- HZ16892 - Rotor handling tool

See also "Robotic System Parts" on page 205 and "Exchange Unit Spare Parts" on page 213 for more information.

System Communication

For the system communication connections see also "Electronic Installation" on page 52.

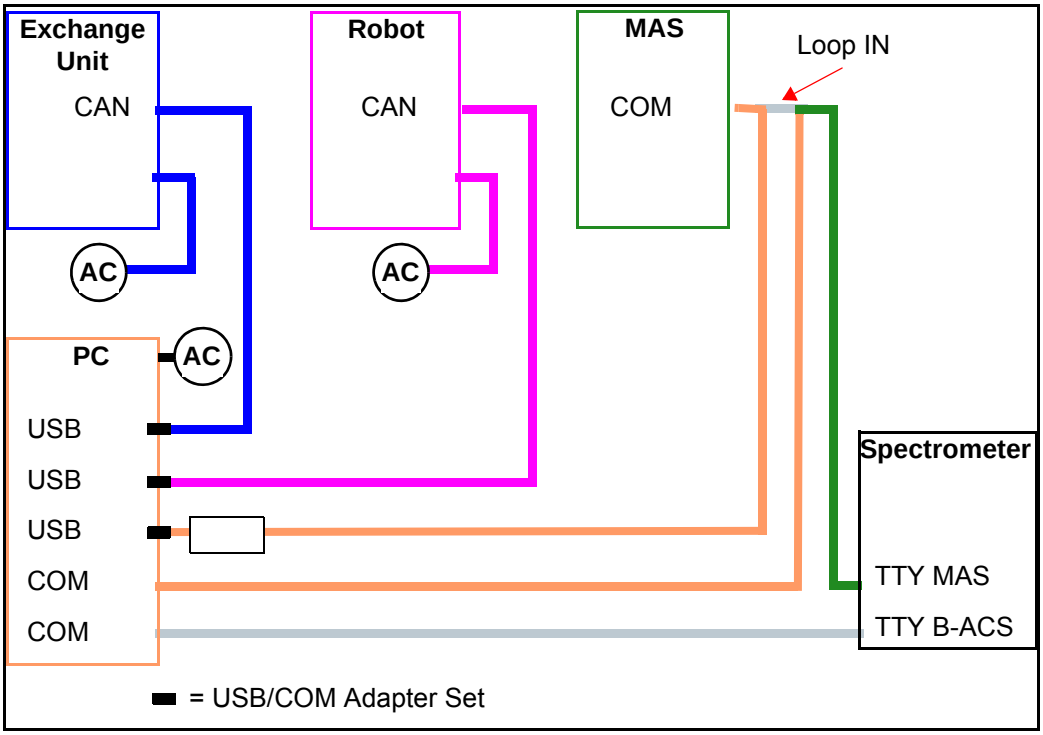


Figure 5.2 Communication Connections

Pneumatic Connections

The pneumatic connections in operation mode vary based on which cryogens are used:

- Only N2 or dry air AND compressed air
- Only N2 or dry air

Refer to the section "Pneumatics Installation" on page 58.

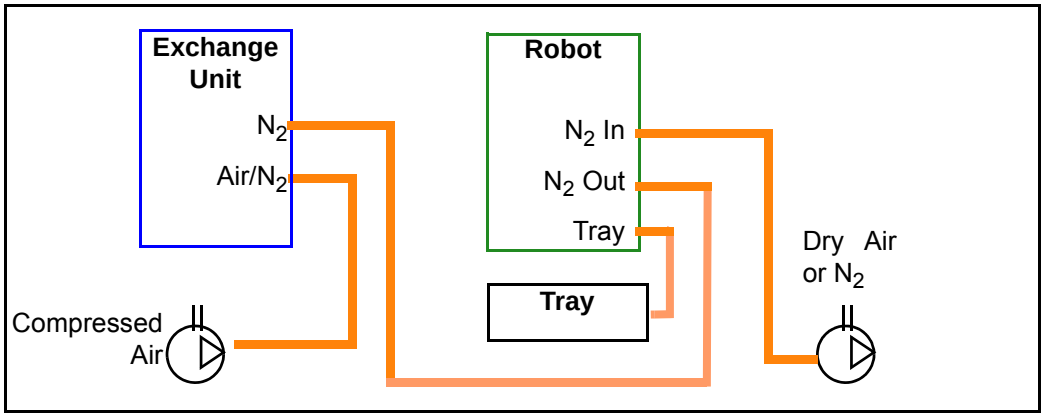


Figure 5.3 Connections in Operation Mode **Only N_2 or Dry Air, and Compressed Air**.

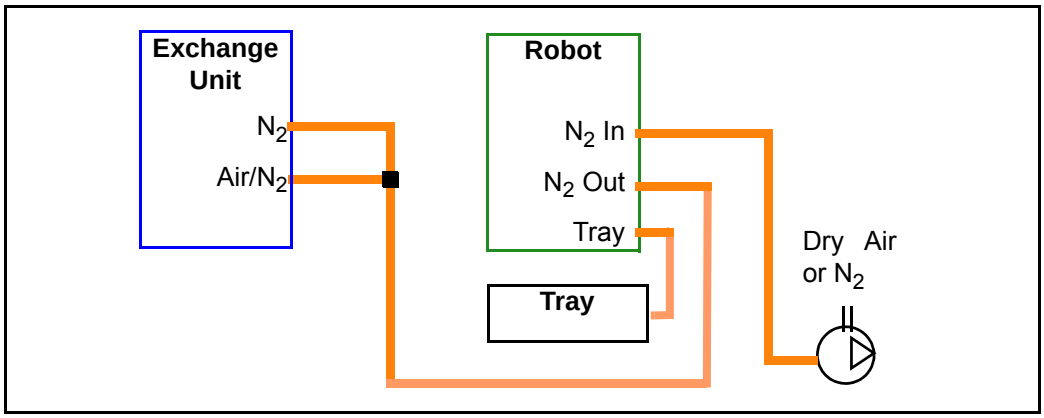
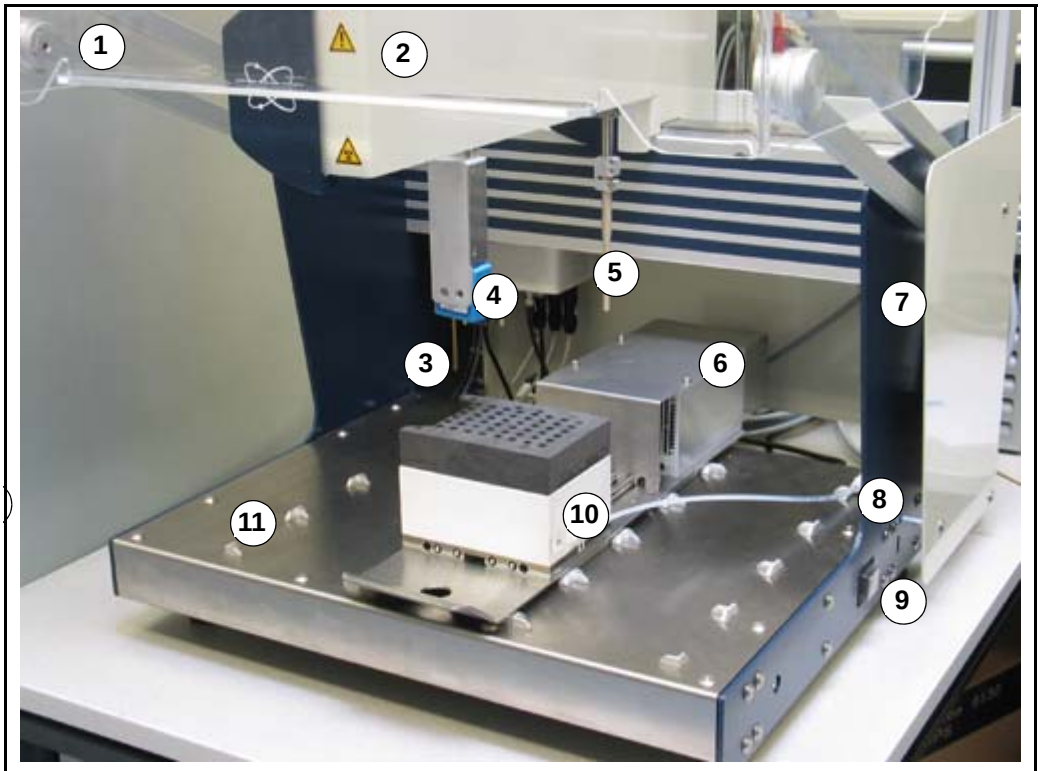


Figure 5.4 Connections in Operation Mode **Only N_2 or Dry Air**.

5.2 Description of the Robotic System

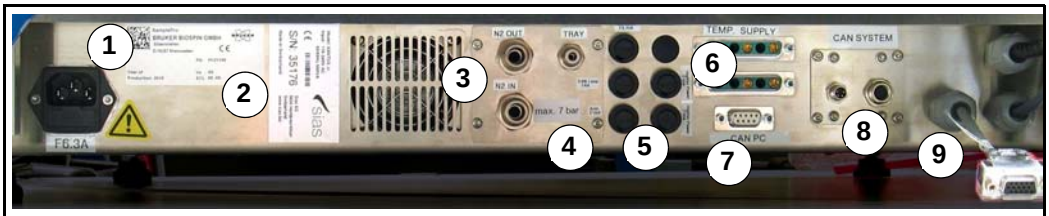
The robotic system consists of the following parts:



1. "Safety Door"
2. "The Frame"
3. "Barcode Reader"
4. "Barcode Reader" (for rotor containers).
5. "Pickup Adapter"
6. "Control Unit for the Cooling Device"
7. "Safety Door Lock"
8. "Control Wheel"
9. ON/OFF switch
10. The cooling rack for temperatures to + 4° C or to -16° C.
11. "The Deck Tray" (gas flow sensors are underneath).

Figure 5.5 The SamplePro Robotic System

The Robot Back Panel



1. Power Supply and Main Fuse, see "Mains Fuse (Input)" on page 100.
2. Rating Plates, see "Rating Plate System" on page 243.
3. N2 OUT, N2 IN, see also "Pneumatics Installation" on page 58.
4. Tray, see "Pneumatics Installation" on page 58.
5. Output Fuses, see "Output Fuses" on page 101.
6. Supply for external temperature units, for future versions.
7. CAN Interface to PC, see "Electronic Installation" on page 52.
8. CAN Interface for temperature unit, see "Cooling Rack" on page 137.
9. Status light connection, see "Mechanical Installation" on page 50.

5.2.1 Safety Door

⚠ WARNING

Severe hand injury.

When accessing the work area of the robot, movements of the robot may cause personal injury.

- ▶ Always open the safety door before accessing the working area of the robot.
- ▶ If the safety door cannot be opened, stop the automation using the control software (IconNMR).
- ▶ Do not reach over the safety door to access the work area.

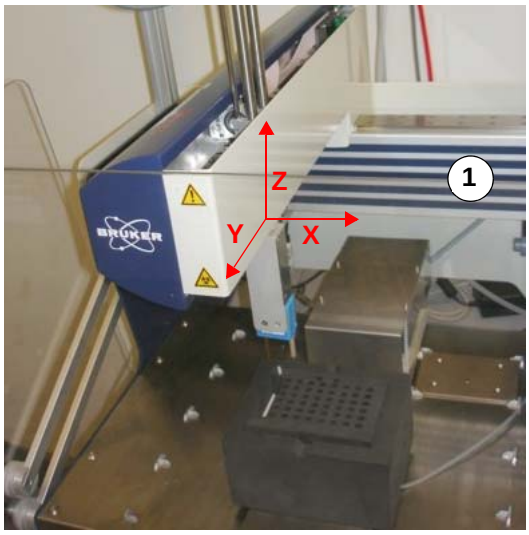
The safety door provides operator safety when the robot is in operation. There are four possible status for the safety door:

- **OPEN**: The safety door is open.
- **CLOSED**: The safety door is closed.
- **LOCKED**: The safety door is locked.
- **UNLOCKED**: The safety door is unlocked.

5.2.2 The Frame

The X-rail supports the tool arm. The tool arm is mounted on the X-rail located at the back of the device frame and moves in the X-direction (left and right). High precision DC motors with encoders drive all the module movements of the robot.

The frame supports the deck and provides a base for the X-rail.

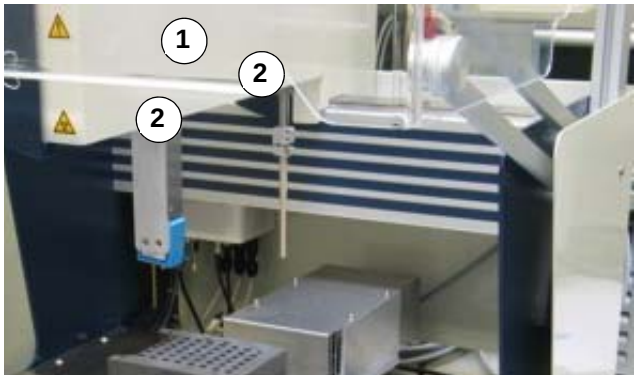


1. The X-rail supports the tool arm. The frame supports the deck.

Figure 5.6 The X-rail

5.2.2.1 Y-Arm

The tool arm supports different tool modules, the transport adapter, the object detection sensor and the barcode reader. Two YZ devices are mounted on the tool arm: the first for the pickup adapter and the second for the object detection sensor and the barcode reader.



1. The Y-Arm.
2. YZ-Devices.

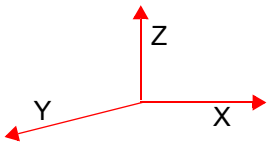


Figure 5.7 The Y-Arm

5.2.3 Object Detector

The object detector is used to detect the rotor container or single rotors in the rotor container. See also "Object Detector" on page 207.

5.2.4 Barcode Reader

The barcode reader is used to read the ID barcode and the type barcode of the rotor container. See also "Barcode Reader for Rotor Container" on page 208.

5.2.5 Pickup Adapter

The pickup adapter is used to transport rotors between the rotor container and the exchange unit. The pickup adapter movements are controlled by the X-motor of the arm and its own Y-motors and Z-motors. See also "Pickup Adapter" on page 207.

5.2.6 Control Unit for the Cooling Device

The control unit controls the temperature of the rotor container.

5.2.7 Control Wheel

The control wheel is used for the nitrogen flow to prevent the formation of condensed water.

5.2.8 Safety Door Lock

The SamplePro robotic system provides a door lock for safety.

The door locks when:

- The door is closed and the barcode scanner scans the well plates for barcodes. After the scan the door is automatically unlocked.
- A transfer to the MAS probe or a transfer back has been started within the control software SamplePro hr-MAS. After a transfer the door is automatically unlocked.

The door remains unlocked when:

- The sample changer is not active.

See also "Door Lock Actor" on page 208 and "Door Open Sensor" on page 208.

5.2.9 The Cooling Rack

The cooling rack allows temperatures from + 4° C to -16° C to be maintained.

5.2.10 The Deck Tray

The deck tray can accommodate one cooling rack with one rotor container or a rotor container without cooling.

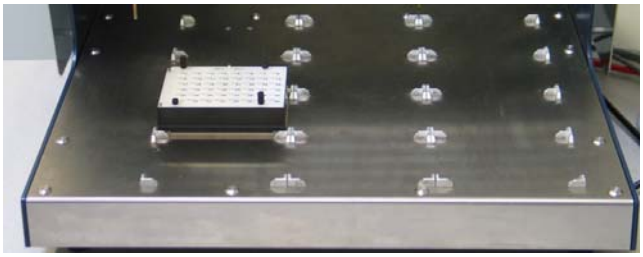


Figure 5.8 Deck Tray Layout with Rotor Container at Ambient Temperature

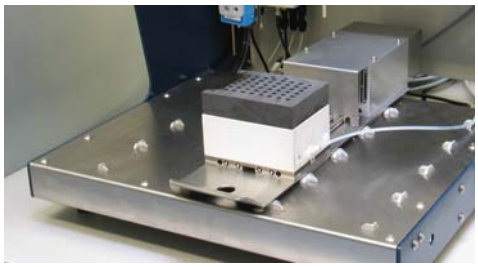


Figure 5.9 Deck Tray with Cooling Rack

5.2.11 Other Components

5.2.11.1 HR-MAS Software

The hr-MAS software allows day-to-day operation of pre-programmed applications, as well as system setup and applications optimization.

See also "MAS Unit Configuration" on page 49

5.2.11.2 The SamplePro LED Status Light

The robotic system also has an LED status lamp located on the upper frame of the unit.

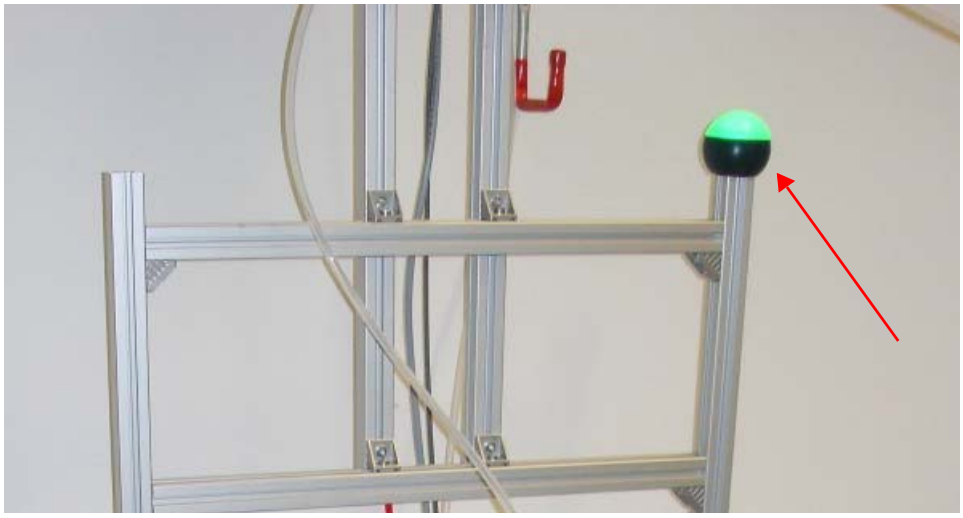


Figure 5.10: The SamplePro LED Status Light

The LED light utilizes different colors, whereas each light symbolizes a different system status:

Blue	A user interaction is required.
White	The system is initializing or running tasks.
Green	The SamplePro robotic system is ready and waiting for requests.
Red	A SamplePro hr-MAS device error has occurred. Further tasks cannot be performed.
Orange	The system is running in service mode.

See also "Status Light Board" on page 210.

5.3 The SamplePro Exchange Unit

The SamplePro Exchange Unit (EU) was designed to transfer 4 mm MAS rotors from one end of a flexible hose to the other. An optional barcode reader can be supplied for reading barcodes on the rotors. In the future the EU will possibly operate as a stand alone unit for fast sample transfers like the SampleMail, but with different sample geometries.

The exchange unit can easily be mounted above the robot using the frame part number H120785. The frame also contains the status light for the SamplePro system.

5.3.1 Exchange Unit Back Panel

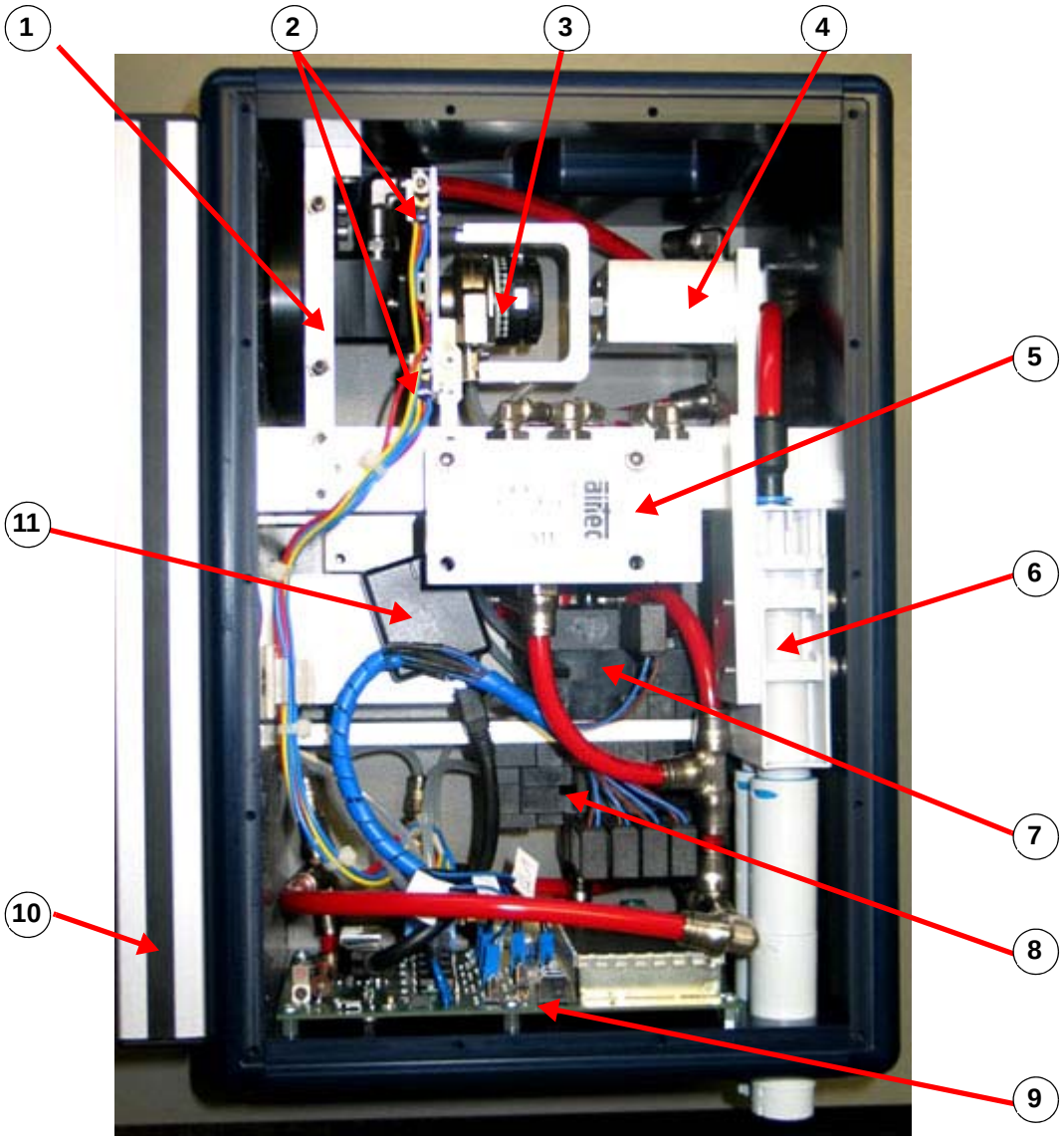
1. Vacuum Generator Exhaust
2. Ventilation Valve
3. Type Label
4. Transfer Pressure Adjustment
5. Gas Inlet 1 max. 7 bar
6. Gas Inlet 2 max. 7 bar
7. CAN Connector
8. Power Supply Connector

Figure 5.11 Exchange Unit Back Panel

Name	Notes
Vacuum Generator Exhaust	Used for the exhaust of the vacuum generator. Ensure that the outlet channels are not covered or congested.
Ventilation Valve	Used for the ventilation of the valves, supplied from gas inlet 1. The ventilation provides a protective atmosphere for the EU. All valves that are not supplied by a protective gas (e.g. nitrogen) have to ventilate through outlet 2. P/N: of the silencer: 85947
Type Label	The type label displays the basic information for the unit, e.g. the part and serial number.
Transfer Pressure Adjustment	The transfer pressure can be adjusted using this set screw. Typical is a value of about 1400 mbar.
Gas Inlet 1	This inlet supplies the vacuum pickup adapter and all valves that don't have contact with the transfer pneumatic. Thus, there is no need to use dry air or nitrogen. Pressure range: 6-8 bar, Gas flow: above 120 NL
Gas Inlet 2	This inlet supplies only the transfer pneumatic. Only dry air or nitrogen must be used. This gas is usually taken from the outlet on the robot. Pressure range: 6-8 bar, Gas flow: above 60 NL
CAN Connector	This connector provides the CAN connection to the control unit. This end is with 120 Ohms terminated. Pinout at this connector: 1 - Shield 2 - VCC CAN (not used) 3 - GND 4 - CAN High 5 - CAN Low Part number for the CAN cable (with 9 pol. D-Sub on the other side): HZ16758.
Power Supply Connector	This connector supplies the EU with 5V/0,4A for the electronics and 24V/0,3A for the pneumatic valves. Pinout at this connector: 1 - 5V 2 - 24V 3 - n.c. 4 - GND 5 - GND Part number for the mains adaptor: 1801718 Part number for the power supply cable: HZ16759

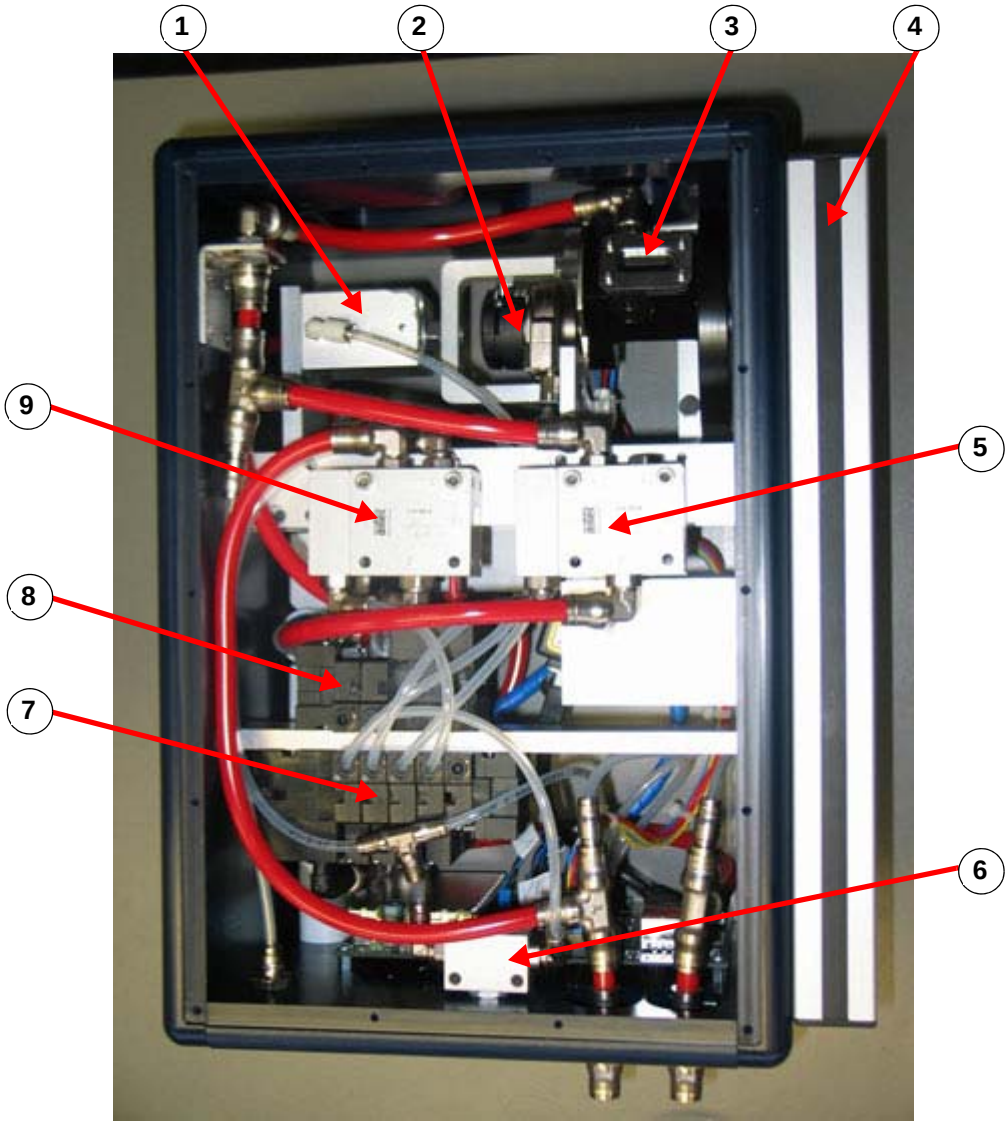
Table 5.1 Exchange Unit Back Panel

5.3.2 Exchange Unit Internal Components



1. Drum Stopper
2. Drum End Position Switches
3. Rotational Cylinder
4. Vertical Cylinder
5. Valve for Drum Rotation
6. Vacuum Generator (suction nozzle)
7. Valve block 1
8. Valve block 2
9. EU Main board
10. Barcode Reader (optional)
11. Mounting Rods

Figure 5.12 Exchange Unit Inside (right view)



1. Vertical Cylinder
2. Rotational Cylinder
3. Rotational Drum
4. Mounting Rods
5. Release Valve for Vacuum
6. Needle Valve for Transfer Pressure Adjustment
7. Valve block 2
8. Valve block 1
9. Valve for Vacuum Generator

Figure 5.13 Exchange Unit Inside (left view)

Notes on Figure 5.12 and Figure 5.13:

- The vertical cylinder lowers the drum at both end positions.
- The valve block 1 contains the transfer pressure valve.
- The valve block 2 consists of a valve for the vertical cylinder and separate pilot valves for the drum rotational cylinder, vacuum generator and the release valve.

For the complete board layout and the pneumatic drawings see "Exchange Unit Electrical Data" on page 221 and "Exchange Unit Pneumatic Data" on page 218.

5.3.2.1 Mechanics

Special feature

A special mechanical feature inside the EU moves the rotational drum between the source and destination position. Two pneumatic cylinders are used (Figure 5.12), one for the rotational movement, and the other for sealing the transfer channel in the drum with the transfer hose.

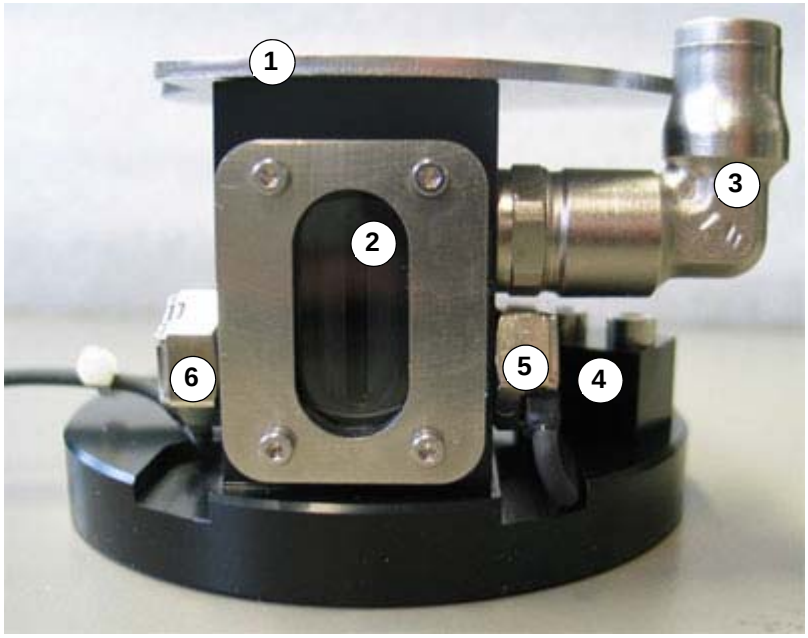
While the vertical cylinder lowers, the drum is pressed against a gasket inside the base-plate. If the rotational cylinder moves, the drum will rise assisted by a spring.

Rotational drum

This drum draws up the rotor from the source side hose, blows the rotor through the destination side hose and vice versa. The barcode on the rotors can be read through the drum window.

The receiver light barrier has two LED‘s that indicate the following:

- Green ON: Stable state.
- Red ON: No rotor detected.



1. Activation Disc
2. Window for Reading Barcodes
3. Gas Transfer Connection
4. Transmitter Light Barrier
5. Receiver Light Barrier
6. End Position Block

Figure 5.14 Exchange Unit Drum

5.3.2.2 Pneumatics

All exchange unit pneumatic connections are made using Super Rapid fittings for easy assembly and service.

The nitrogen supply is typically taken from the robot gas outlet. This gas is monitored by a flow meter inside the robot.

The pressure range for both exchange unit gas inlets should be between 6 and 8 bar. The exchange unit has no pressure regulator on the inlets, as some laboratories have a gas supply pressure of almost 6 bar. When a pressure regulator is used, the input pressure must be about one bar higher then the maximum output pressure of most pressure regulators.

The gas supply on Inlet 1 must provide a gas flow of above 120 l/min. This value depends on the geometry (especially the weight of the rotor), the delivery height, and the length of the transfer hose.

For Inlet 2, the nitrogen or dry air flow should provide about 60 l/min.

For the pneumatic drawings see "Exchange Unit Pneumatic Data" on page 218.

5.4 Description of the MAS Unit - COM Mode

The SamplePro hr-MAS uses the MAS/MAS II Pneumatic Control Unit to control the spinning rate of the samples. The MAS/MAS II units also are used to control the drive gas pressure in an NMR system.

If you are using the RS232 connection you can select whether the MAS II unit should use a mode compatible to the old MAS unit (P/N: H2620) for communication to the spectrometer.

Note: This setting is necessary if you want to use a Topspin prior to version 3.0. When using Topspin version 3.0 or newer, the old COM mode should not be used! For the settings see "MAS Unit Configuration" on page 49.

5.5 Description of the hr-MAS Probe

Probes are the interface between a sample and the spectrometer. High Resolution Magic Angle Spinning (hr-MAS) probes are configured with a Z-gradient aligned along the magic angle enabling the researcher to access a wide variety of NMR experimental techniques including gradient enhanced solvent suppression and artifact free 2D homo-nuclear and hetero-nuclear experiments.

The hr-MAS probes are controlled by the MAS (II) control unit. For cooled samples a cooling unit is used to control the gas flow temperature.

Refer to the corresponding user manual for more information over the probe(s) you are using.

6 Installation

6.1 Before You Begin

1. Before beginning the installation verify that the Site Planning Considerations described in the section below have been met.
2. Read and understand the "Safety Information" on page 15.

6.1.1 Site Planning

Robot

The SamplePro hr-MAS with a total weight of 60 kg (robot, frame and exchange unit) should be placed on a sturdy workbench and should not be located near a heat source or exposed to direct sunlight. The device must be close to an AC power outlet. The electrical supply for the equipment should be voltage regulated, properly grounded, and surge protected.

The site planning guidelines for the Bruker spectrometer must also be observed.

Exchange Unit

The exchange unit utilizes a hose that is more than 10 meters in length. Avoid bending the hose, the minimum bend radius is about 100 mm.

6.1.1.1 Gas Support

The gas pressure must be between 6 and 8 bar. The compressed air and nitrogen level is 200 l/min. A hose with a diameter of the 8 mm should be used.

Use only dry air or nitrogen.

➨ Exception: When both air and nitrogen are used, the air must not be dry.

See also "Exchange Unit Back Panel" on page 36.

6.2 Installation Procedure Overview

The installation must be carried out in accordance with the specifications and instructions in this manual.

Installation Procedure

The installation procedure consists of the following major steps:

1. "Robot System Installation"
2. "Exchange Unit Installation"
3. "MAS Unit Configuration"
4. Entering the system settings in the SamplePro hr-MAS application software (see "Configuring the Device Settings" on page 72).
5. Perform the robotic system teaching (see "Robotic System Teaching" on page 83).
6. Perform the exchange unit device test (see "Exchange Unit Service Dialog" on page 95).
7. Perform the robot system device test (see "Robot System Device Test" on page 91).
8. Save the settings as described in "Installation Restore Point" on page 79.

6.3 Robot System Installation

The robotic system is produced as an OEM product for Bruker by the SIAS company. The system is delivered with a pickup adapter, object detector, barcode reader, nitrogen flow sensor and optionally with one cooling rack.

Installation Requirements

- A separate host computer (PC) for installation and operation.
- An Uninterruptible Power Supply (UPS) is highly recommended.

The PC or UPS can be ordered with the device from Bruker as an option.

6.3.1 Receiving the Product

Upon receiving the SIAS robot the „AS002 Shipping / Installation Report Form“ enclosed with the product must be completed and returned to Bruker within two weeks after delivery.

When the system is installed past the two week deadline, the report should be filled out and returned to Bruker twice as follows:

- Immediately after the shipment is received.
- Immediately after the installation.

6.3.1.1 Unpacking

⚠ CAUTION

Risk of personal injury from lifting heavy objects!

The robot system is heavy and may cause personal injury if handled incorrectly.

- ▶ Keep your back straight and bend the knees, never bend the back. At least two people should lift the device, preferably four.
- ▶ Carry the device by holding the base frame as shown in the following diagram:

Figure 6.1 Carrying the SamplePro hr-MAS

1. Inspect the packaging for any damage that may have occurred during shipping. Check the shock indicators attached to the crate.

➨ If any shock indicators are red, broken or missing, or if the shipment is damaged, please file a claim with the transport carrier immediately and contact Bruker for advice.

2. Remove the plastic straps and lift off the cardboard box.
3. Unpack all items in the shipping container and check against the packing list.

➨ If the items received do not match the packing list, or if any items are missing, immediately contact the transport carrier and Bruker for advice.

4. All device parts were thoroughly inspected and tested before the unit was shipped. Carefully inspect the device and its accessories for any physical damage sustained in transit.

➨ If any damage is found file a claim with the transport carrier immediately and contact Bruker.

6.3.2 Hardware Installation

To avoid problems due to condensation, do not start installing the robot until it has equilibrated to room temperature (up to 2 hours).

1. Place the robot in its designated position on a sturdy table or work station.
2. Use a leveling device to make sure that device is level.
3. Check the arm alignment as follows:
   - Move the arm manually to the left side (home position) of the device and carefully slide the object detector to its upper-most position in the back.
   - Lower the front object detector until its end nearly touches the deck. Measure the distance between the object detector end and deck surface.
   - Slide the object detector assembly slowly towards the front of the device and check the distance between the object detector end and deck surface, it should be within a tolerance of 0.5 mm.
   - Repeat the alignment check on the right side of the device.

➨ When the distance is outside the acceptable tolerance, refer to "Arm Alignment" on page 171.

4. When the optional cooling rack available proceed to the procedure "Installing the Optional Cooling Rack" below.

➨ If a cooling rack is not installed, the CAN-bus connectors must be looped with the loop cable provided.

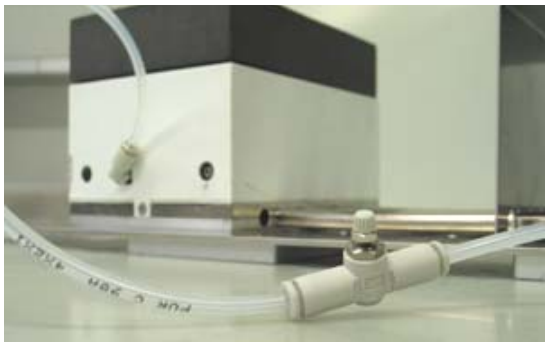
Figure 6.2 CAN-Bus Loop Cable

Figure 6.3 CAN-Bus Looped

6.3.3 Installing the Optional Cooling Rack

The system can be delivered with or without the cooling option.

1. In the application service settings, ("Configuring the Device Settings" on page 72), select the appropriate setting:
   - 48 Rotors no cooling device, or,
   - 48 Rotors in one cooling device - 20 degrees



2. Remove the expanded rubber and the socket screw from the cooling rack.
3. Place the cooling rack on the deck tray.
4. Connect the nitrogen flow hose to the cooling rack.

5. Connect the 3 cable connectors from the cooling rack to the control unit box. The cable connectors are labeled with R1, R2, and FAN.
6. Connect the 2 CAN bus loop connectors to the control unit box.

Notice: When working in the mode **48 Rotors no cooling device**, use a non-cooled rotor container. The container must be set in the last position to the right, see the next figure. Do not forget to use the adapter plate to fix the rotor container, see "Adapter Plate for Cooling Unit" on page 209.

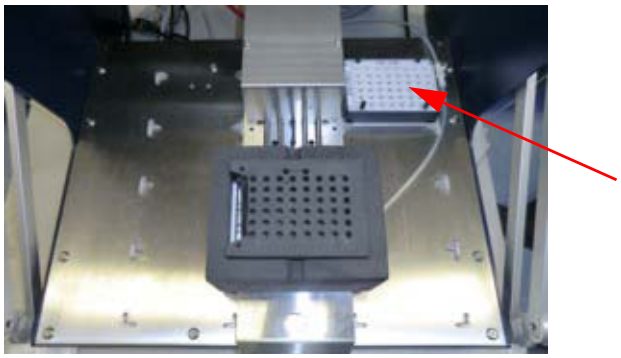
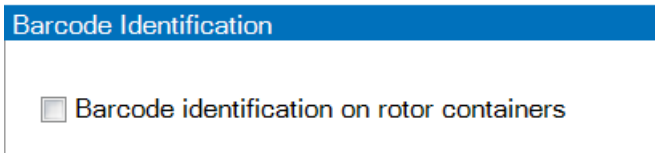


Figure 6.4 Container Position When Using an Non-cooled Rotor Container When a Cooling Device is Available

6.3.4 Barcode Identification Option for the Rotor Container

The system can be used with or without a rotor container barcode identification. When using rotor containers with barcodes the **Barcode Identification** option must be checked in the Robot Settings:



See also"Configuring the Device Settings" on page 72.

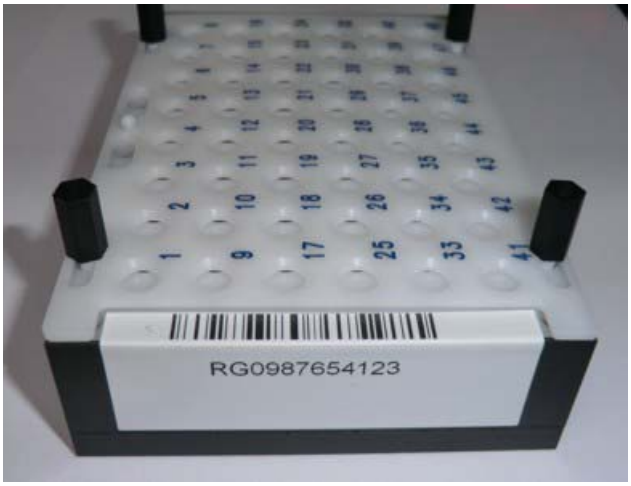


Figure 6.5 Rotor Container with Barcode, Type RG0

6.3.5 Connecting the Power Cable

Connect the power cable to the mains socket located at the rear of the device, under the deck on the left hand side of the power supply.

6.4 MAS Unit Configuration

The SamplePro hr-MAS uses the MAS/MAS II Pneumatic Control Unit to control the spinning rate of the samples. The MAS/MAS II units also are used to control the drive gas pressure in an NMR system.

Com Mode old MAS

If you are using the RS232 connection you can select whether the MAS II unit should use a compatible mode to the old MAS unit (P/N: H2620) for communication with the spectrometer.

This setting is necessary if you want to use a Topspin prior to version 3.0. When using Topspin version 3.0 or newer, the old COM mode should not be used!

1. Press the key **Unit Setup** from the main selection menu.

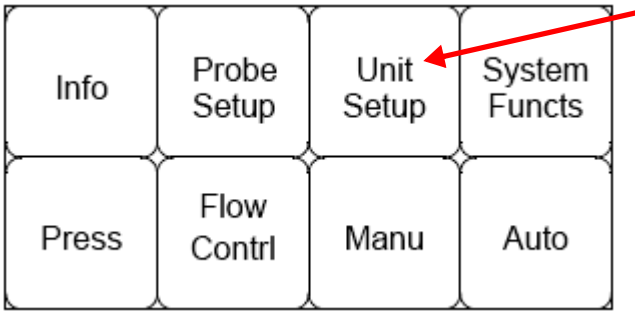


Figure 6.6 MAS Unit Setup

➨ The submenu MAS II Unit Setup will appear.

2. Press the Change Setup button.

➨ The Setup Window will appear:

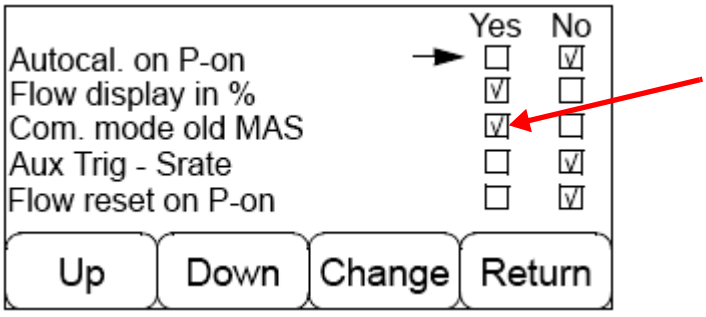


Figure 6.7 Selecting the Old MAS Communication Mode

3. Use the **Up** and **Down** buttons to move to the checkboxes for **Com. mode old MAS**.
4. Use the **Change** button to select **YES**.
5. Press the **Return** button.

➨ The Storing MAS Setup Changes window will appear:

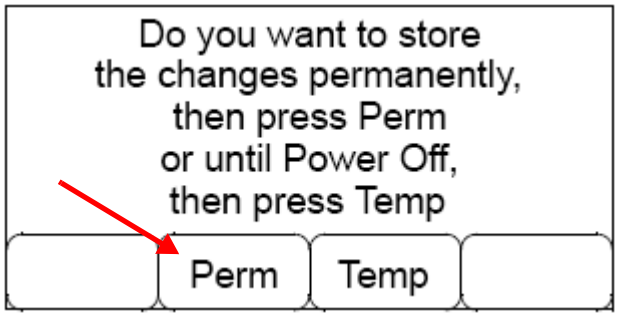


Figure 6.8 Storing MAS Setup Changes

6. Store the changes by pressing the **Perm** button.

For more information on the MAS unit configuration refer to the installation chapter in the Bruker **MAS II User Manual**, P/N: Z31701E.

6.5 Exchange Unit Installation

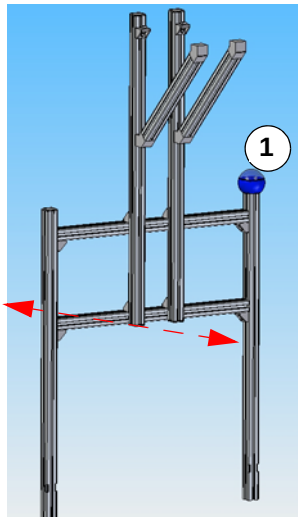
The installation of the exchange unit consists of five parts:

- The "Mechanical Installation"
- The "Electronic Installation"
- The "Transfer Hose Installation"
- The "Pneumatics Installation"

After the installation the application settings should be adjusted as described in "Exchange Unit Settings" on page 75.

6.5.1 Mechanical Installation

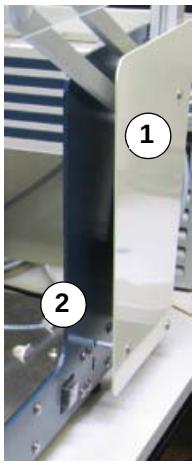
1. Assemble the pre-mounted frame (P/N: H120785) in line as shown in the figure below:



1. Status Light

Figure 6.9 Exchange Unit Frame

2. Attach the status light on the left or right hand side of the frame.
3. Remove the left and right guard plates from the robot.



1. Guard Plates
2. Support Panel

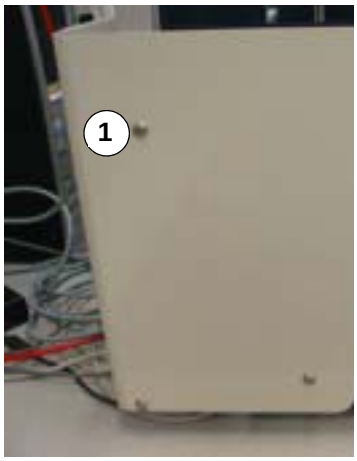


Figure 6.10 Support Panel and Guard Plate with 3 Screws

3. Fasten the screws for the frame to the robot case as shown below:

Figure 6.11 Status Light Frame, View from the Left and from the Right

4. Mount the exchange unit to the upper part of the exchange unit frame. The figure below shows the exchange unit after the installation.

Figure 6.12 Exchange Unit After Mounting

6.5.2 Electronic Installation

1. Connect the 15 pin, 3 row, D-sub connector from the robot to the status light.

2. Connect the EU/CAN cable with the USB/CAN adapter (P/N: O10375, HZ16758) to the host computer.
3. Connect the exchange unit power supply cable (P/N: HZ16759) to the exchange unit and the mains adapter (P/N: 1801718).

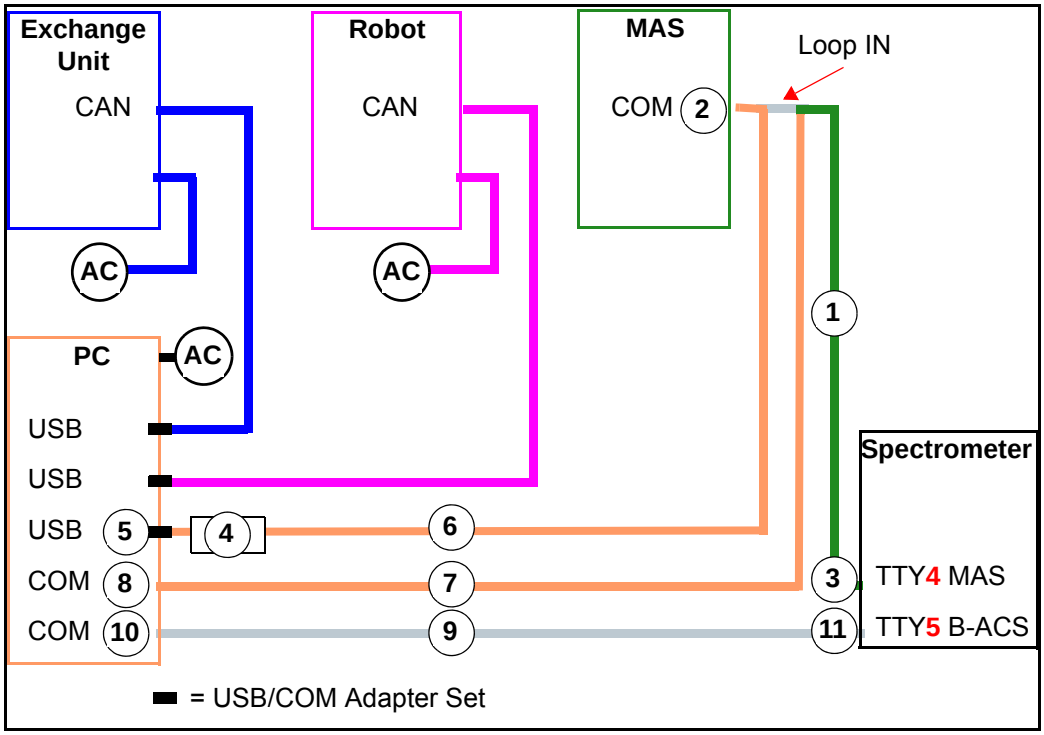


Figure 6.13 Communication Connections

For an error-free communication between the spectrometer, MAS/2, robot, exchange unit and the SamplePro host computer a proxy on the control PC must be installed. Refer to Figure 6.13 for the location of the parts.

1. Unplug the original cable (1) leading from the MAS/2 front panel (2) to the spectrometer TTY4 MAS interface (3).
2. Connect the USB adapter set P/N 1802533 (4) to the controlling computer USB port (5).
3. Connect the serial cable P/N HZ16761 (6) from the USB adapter (4) to the MAS2 front panel connector (2).
4. Connect the serial cable P/N HZ16762 (7) from the PC COM Port (8) to the cable which is connected to the spectrometer TTY4 MAS interface (1).

When TopSpin is used to control the SamplePro hr-MAS system, a further serial connec-

tion is needed between the controlling computer and the spectrometer:

5. Connect the serial cable P/N Z10034 (9) from the COM port of the PC (10) to the TTY**5** B-ACS port of the spectrometer (11).

Note: To avoid errors with the IPSO, connect the MAS to TTY4.

For the TopSpin configuration see also "TopSpin Configuration" on page 80.

6.5.3 Transfer Hose Installation

The transfer hose installation consists of two parts:

- "Transfer Hose from the Exchange Unit to the Robot"
- "Transfer Hose from the Exchange Unit to the Probe"

Transfer Hose from the Exchange Unit to the Robot

1. Cut the end of the hose using a hose cutter tool ("Exchange Unit Spare Parts" on page 213) to ensure the end has a clean, even cut.
2. Measure a 1450 mm long section of hose using the cutter tool.
3. Make a cone on both ends of the hose using the countersink delivered in the tool kit ("Exchange Unit Spare Parts" on page 213).
4. Inspect the hose and remove any dust or foreign particles.
5. Remove the pickup adapter from the robot ("Pickup Adapter" on page 132).
6. Connect one end of the hose to the robot connector.
7. In the Service and Settings window of the application software, select **Service** - **Device Settings** - **Exchange Unit Settings** and press the **Open Exchange Unit Service Dialog** button.

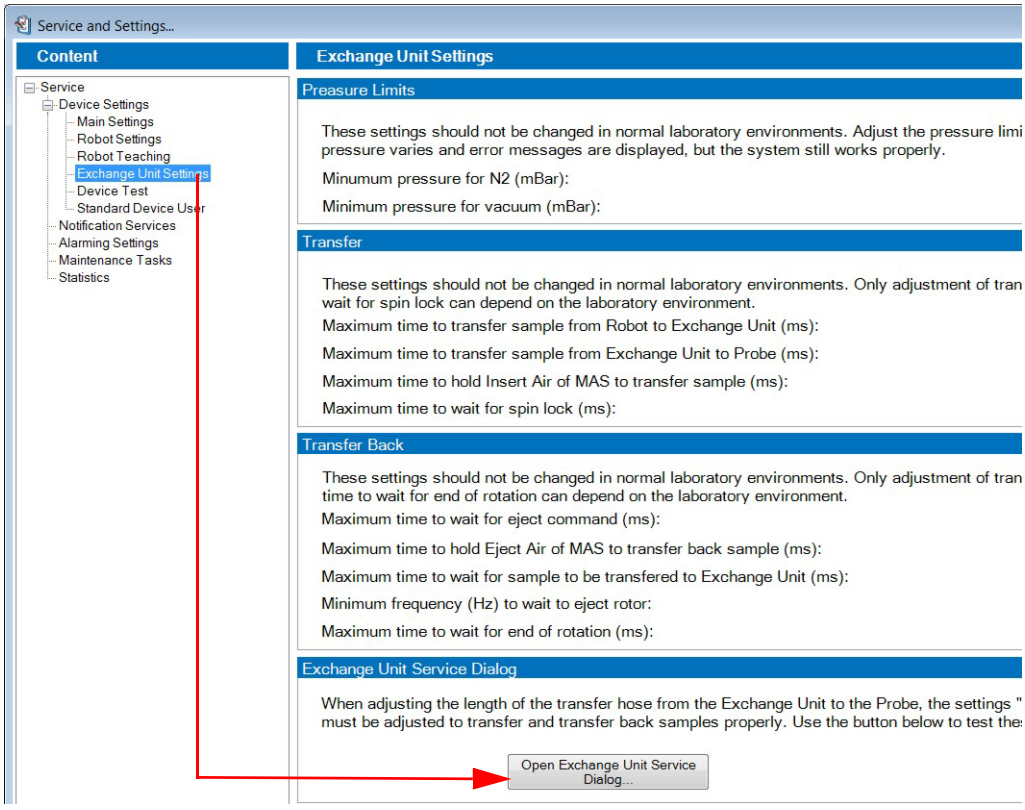


Figure 6.14 Service and Settings- Exchange Unit Settings

8. Open the “Lower” valve by checking the checkbox field “Lower” in the **Exchange Unit - Service Dialog**, as shown in next figure:

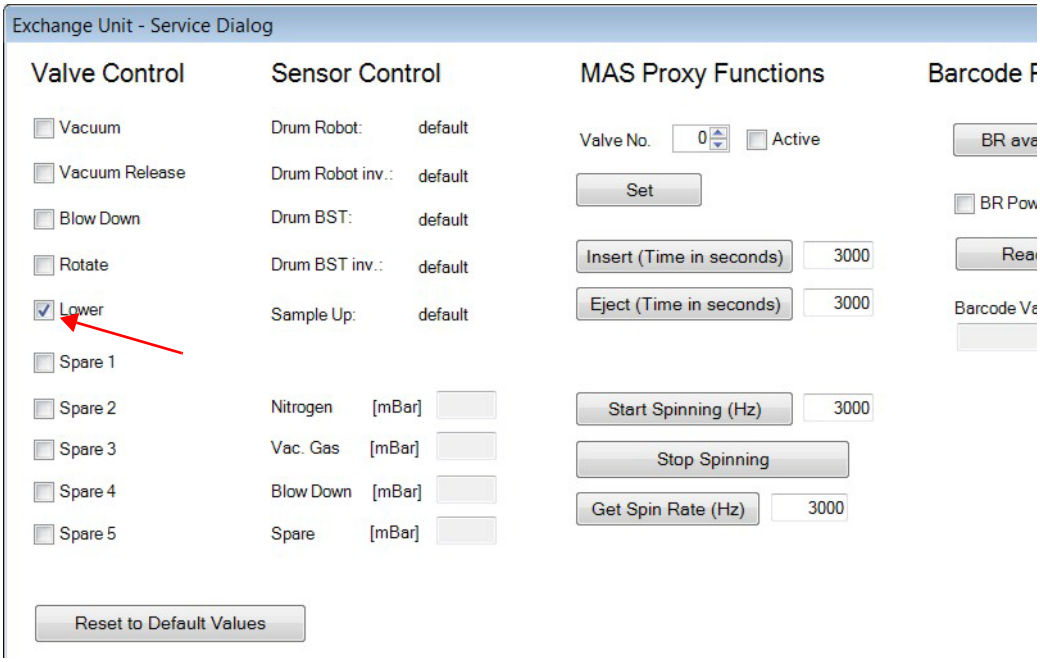
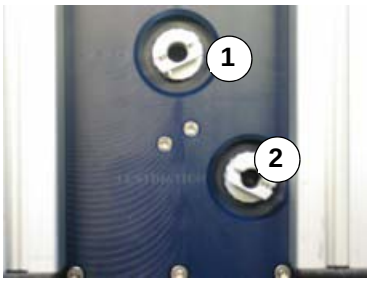


Figure 6.15 Exchange Unit - Service Dialog

9. Insert the other side of the hose into the exchange unit clamp marked as “Source” on the bottom of the EU unit, until a slight resistance is felt. Do not force it!
10. Tighten the screws on the clamp.



1. Source
2. Destination

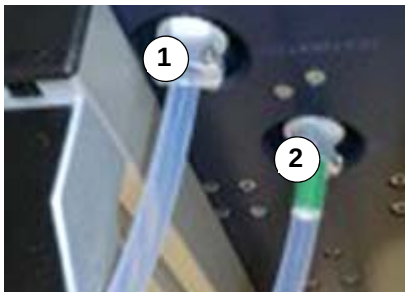


Figure 6.16 Exchange Unit - Source and destination

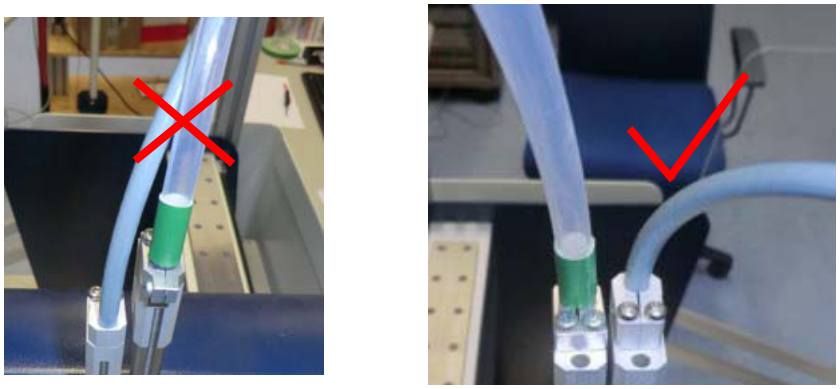
3. In the **Exchange Unit - Service Dialog**, uncheck the “Lower” valve and check the “Rotate” valve checkbox to reopen the “Lower” valve.

NOTICE

Material damage hazard due to incorrect cable placement.

Device deadlock may occur as a result of a incorrect cable placement.

► Keep the transfer hose away from object detector cable.



Transfer Hose from the Exchange Unit to the Probe

1. Cut the end of the hose using a hose cutter tool ("Exchange Unit Spare Parts" on page 213) to ensure the end has a clean, even cut.
2. Make a cone on one end of the hose using the countersink.
3. Inspect the hose and remove any dust or foreign particles.
4. Place the coned end of the hose into the probe adapter and fasten it with the pre-mounted screws.

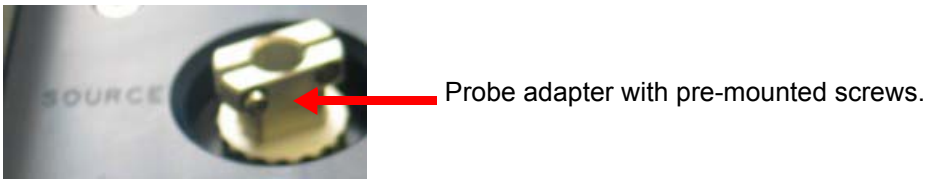


Figure 6.17 Exchange Unit Probe Adapter

5. Insert the hose with the probe adapter in an MAS probe and insert the probe into the magnet until you feel resistance.
6. Attach the hose to one of the towers of the magnet using a cable tie.
7. Run the hose along the ceiling of the room to the exchange unit. Attach the hose to the ceiling using adhesive clips or cable ties. The hose should not be in the way of normal laboratory traffic. Do not fold or crimp the hose!
8. Run the hose to the clamp marked as “Destination” on the bottom of the EU unit.
9. Cut away any excess hose using the hose cutter tool.

10. Make a cone on one end of the hose using the countersink.
11. Insert the coned hose into the clamp, which is marked as „Destination“, and tighten the pre-mounted screws.

6.5.4 Pneumatics Installation

The pneumatic connections between the exchange unit, robot and the source depend on one of the following scenarios, determine which is appropriate and follow the instructions accordingly.

Case 1: The laboratory provides nitrogen or dry air AND normal (almost oil free) compressed air:

1. Connect the nitrogen or dry air supply to the robot gas inlet.
2. Connect the exchange unit nitrogen inlet Figure 5.11/(6) to the robot gas outlet.
3. Connect the second inlet from the EU Figure 5.11/(5) directly to the compressed air wall plug.

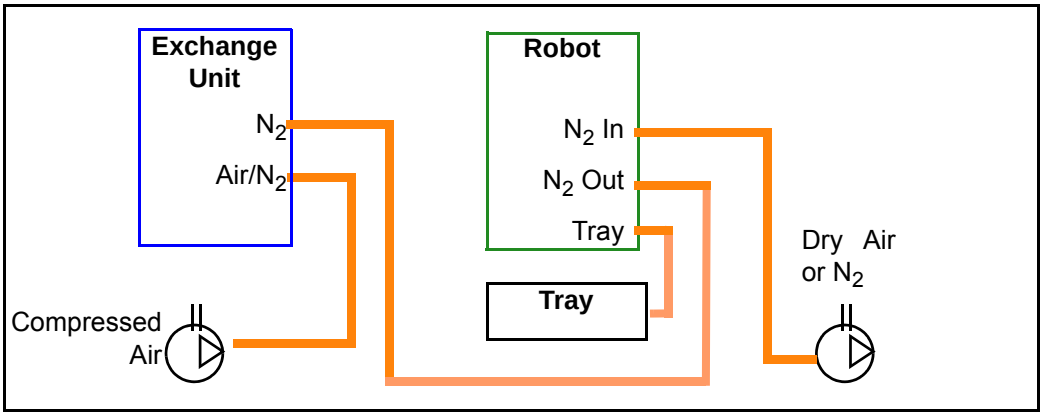


Figure 6.18 Connections in operation mode **Only N_2 or Dry Air AND Compressed Air**.

Case 2: The lab provides only nitrogen or dry air:

1. Connect the nitrogen or dry air supply to the robot gas inlet.
2. Connect the robot gas outlet to both inlets of the EU Figure 5.11/(5)/(6) using the enclosed Y-fitting.

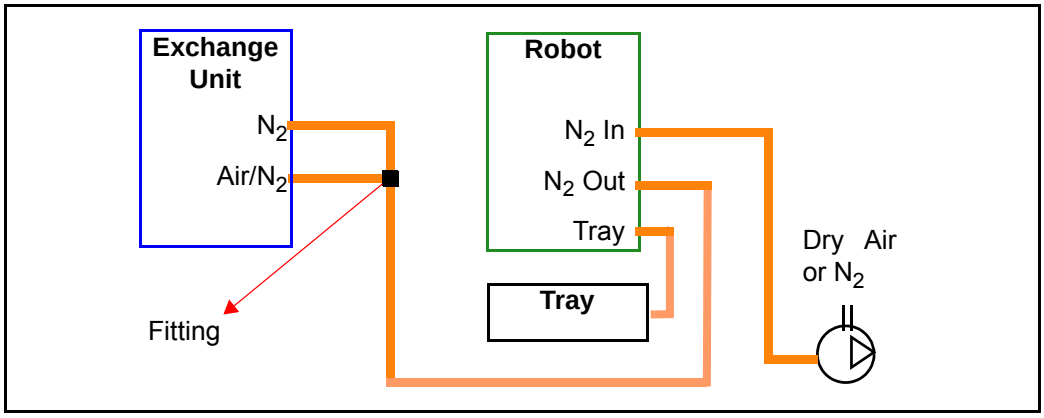
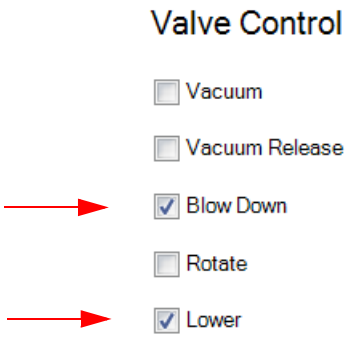


Figure 6.19 Connections in operation mode **Only N_2 or Dry Air**.

6.5.4.1 Transfer Pressure Setup

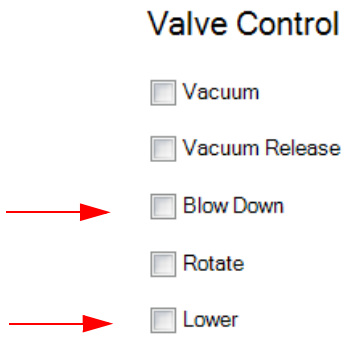
The transfer pressure setup controls the robot transfer pressure between the exchange unit (source) and the probe (destination).

1. In the Service and Settings window of the application software, select **Service** - **Device Settings** - **Exchange Unit Settings**, open the **Exchange Unit - Service Dialog**.
2. Open the **Lower** valve by selecting the **Lower** checkbox.
3. Open the **Blow Down** valve by selecting the **Blow Down** checkbox.



4. Adjust the valve described as **Transfer pressure** on the back panel of the EU Figure 5.11/(4) until the **Blow Down** sensor value in the Exchange Unit - Service Dialog displays about **1400** mBar.

5. Close all open valves by unchecking the checkboxes **Blow Down** and **Lower**.



For more information on accessing the settings windows refer to the chapter "System Configuration" on page 71 for opening the **Service Settings** window and for opening the Exchange Unit Service Dialog see the chapter **Verification and Validation** "Exchange Unit Service Dialog" on page 95.

6.6 Software Installation (Optional)

This section describes the installation of the SamplePro hr-MAS software and drivers. The software and drivers that need to be installed are contained on the Bruker software CD P/N: H118403.

The installation consists of three major steps:

- Installation of the CAN drivers for the SamplePro hr-MAS robot.
- Installation of the CAN drivers for the exchange unit.
- Installation of the software program for the **SamplePro hr-MAS Application**.

Prerequisites

To achieve optimal hr-MAS performance the host computer virus software should be configured to exclude scanning the LOG directory.

Required Parts

1 x P/N: O10375 - USB CAN interface controls the robot.

1 x P/N: O10375 - USB CAN interface controls the exchange unit.

6.6.1 CAN Driver for the Robot and Exchange Unit

This section describes the installation of the SamplePro hr-MAS software and drivers. The figure below provides an overview of the interfaces used for communication.

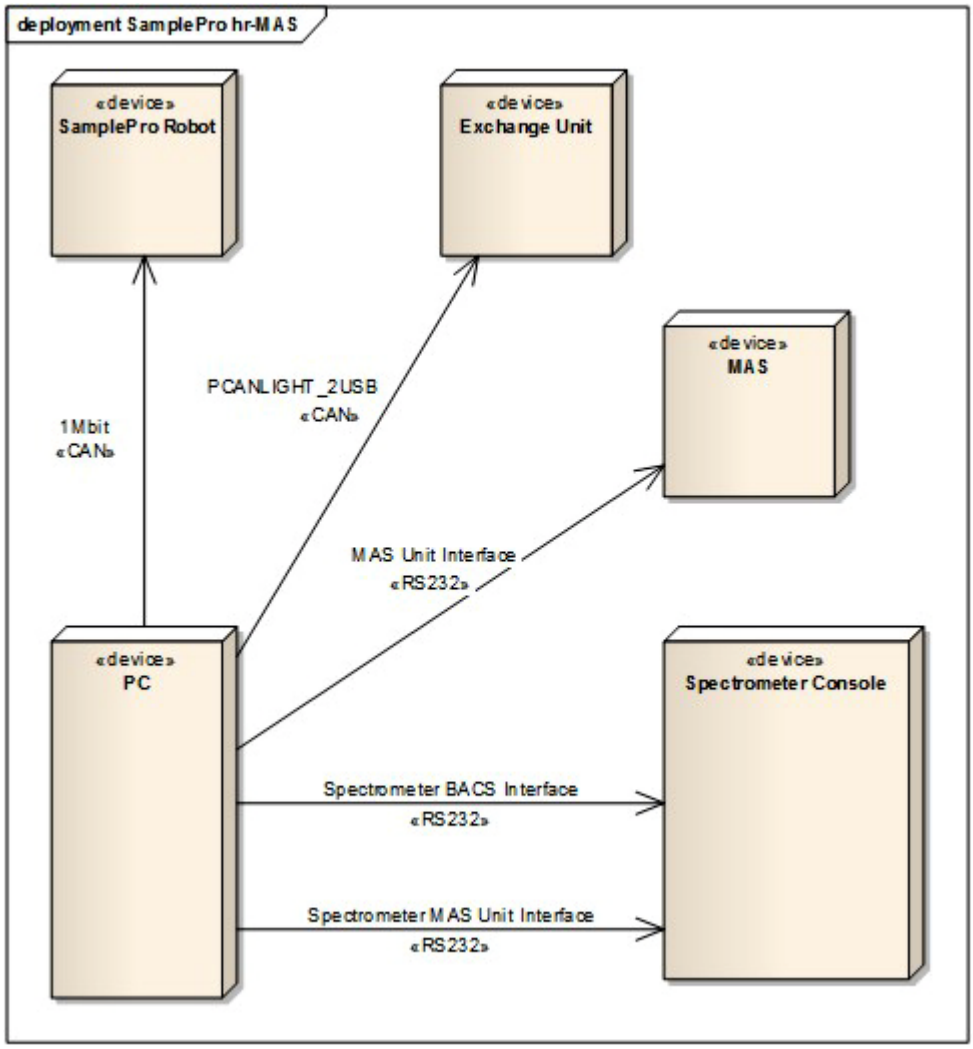


Figure 6.20 Interface Overview

6.6.1.1 Installing the Robot CAN Interface Driver

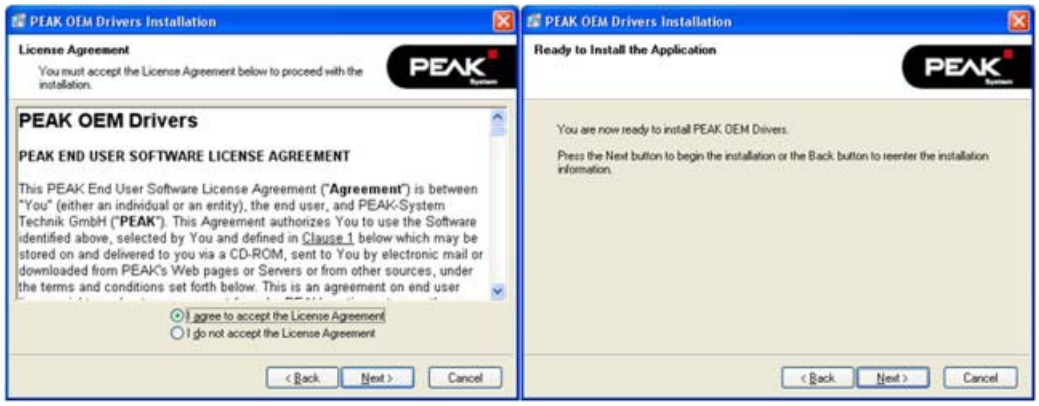
1. Select and execute the command **PcanOemDrv.exe** from the installation CD-ROM.

➨ The Select Language window will appear.

2. Select the desired installation language and press **OK**.
3. A welcome window will appear, follow the instructions provided and press **Next**.

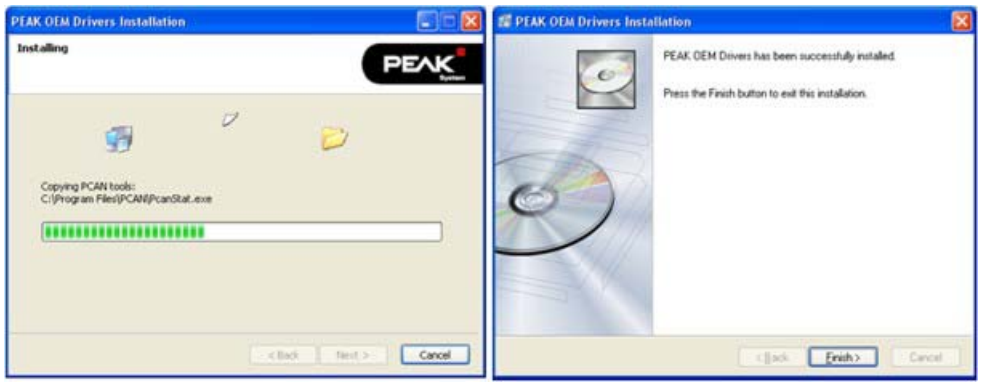
➨ A License Agreement window will appear.

4. Read the license agreement and select the appropriate check button.
5. Press **Next** to continue.



➨ The drivers will be installed. When the process is finished a confirmation window will appear.

6. Press the **Finish** button to exit the installation.

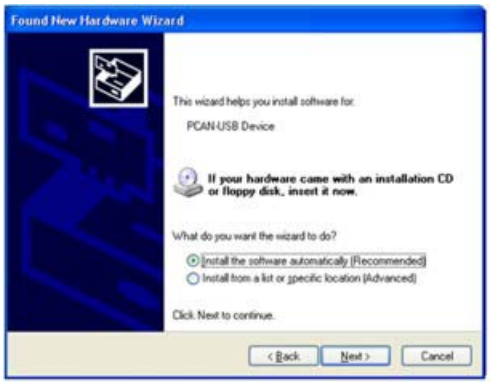


7. Plug the first USB CAN interface into the SamplePro controller PC.

➨ The Windows® **Found New Hardware Wizard** will start.

8. Check the box **No, not this time**.
9. Click **Next** to continue.

➨ A new wizard window will appear.



10. Select Install the Software Automatically.
11. Click **Next** to continue.

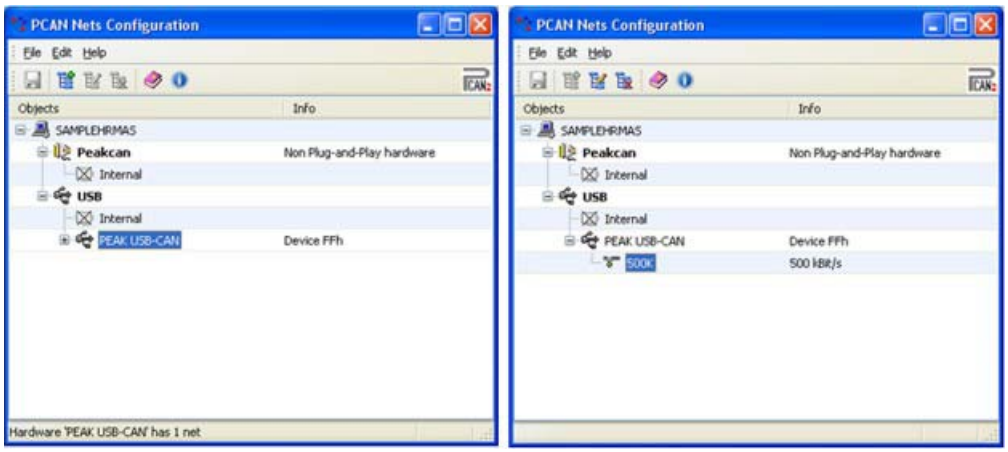
➨ The appropriate software will be installed.

12. Click **Finish** to close the wizard.

13. Select **Start** - **All Programs** - **PCAN TOOLS** - **PCAN Nets Configuration** from the Windows Start menu.

➨ The PCAN Nets Configuration window will appear.

14. Expand the **USB** - **PEAK USB-CAN** tree.



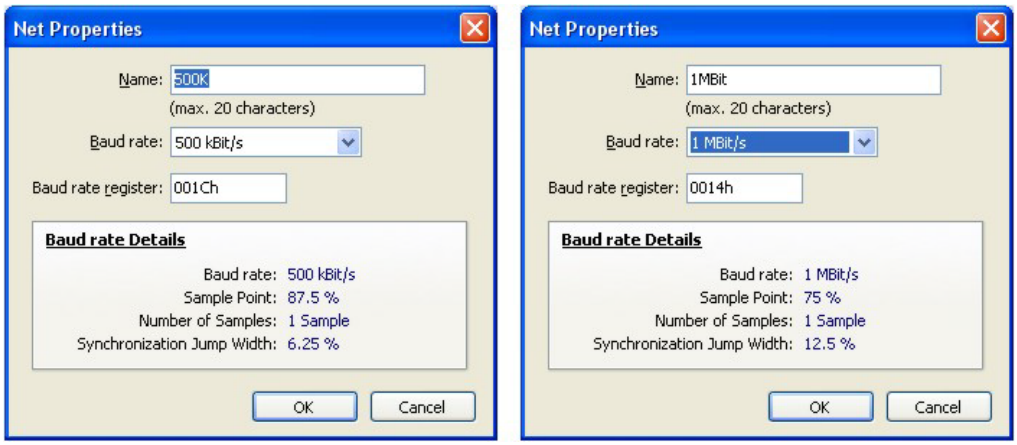
15. Double click **500K**.
16. Select **Start** - **All Programs** - **PCAN TOOLS** - **PCAN Nets Configuration** from the Windows Start menu.

➨ A Net Properties window will appear.

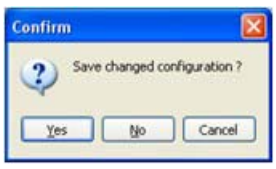
17. Change the field properties as follows:

    NAME = 1MBit,

    BAUD RATE = 1MBits/s



18. Click **OK** and confirm with **Yes**.



6.6.1.2 Installing the Exchange Unit CAN Interface Driver

1. Plug in the second USB to the SamplePro controller PC.

➥ The New Hardware Wizard starts.

2. Select **No, not this time**.
3. Click **Next** to continue.

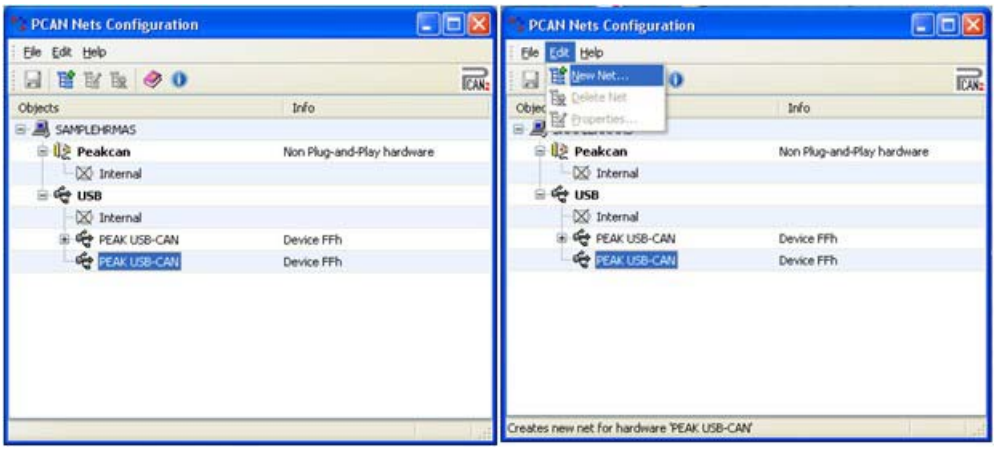
➥ A new wizard window will appear.

4. Select Install the Software Automatically.
5. Click **Next** to continue.

➥ The appropriate software will be installed.

6. Click **Finish** to close the wizard.
7. Select **Start** - **All Programs** - **PCAN TOOLS** - **PCAN Nets Configuration** from the Windows® Start menu.

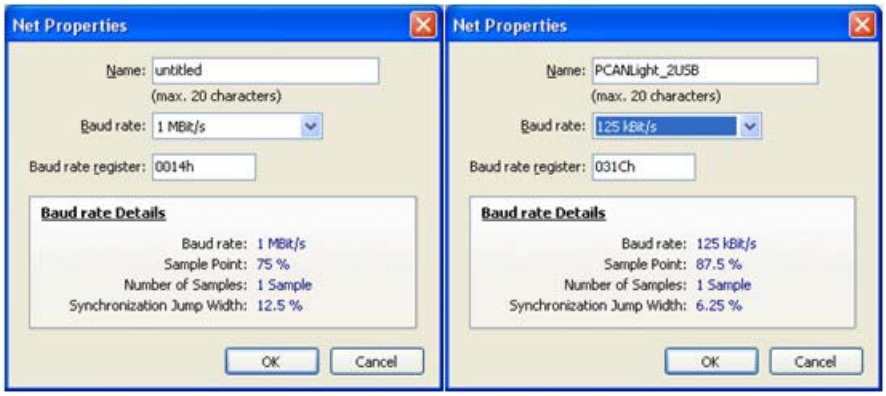
➥ The PCAN Nets Configuration window will appear.



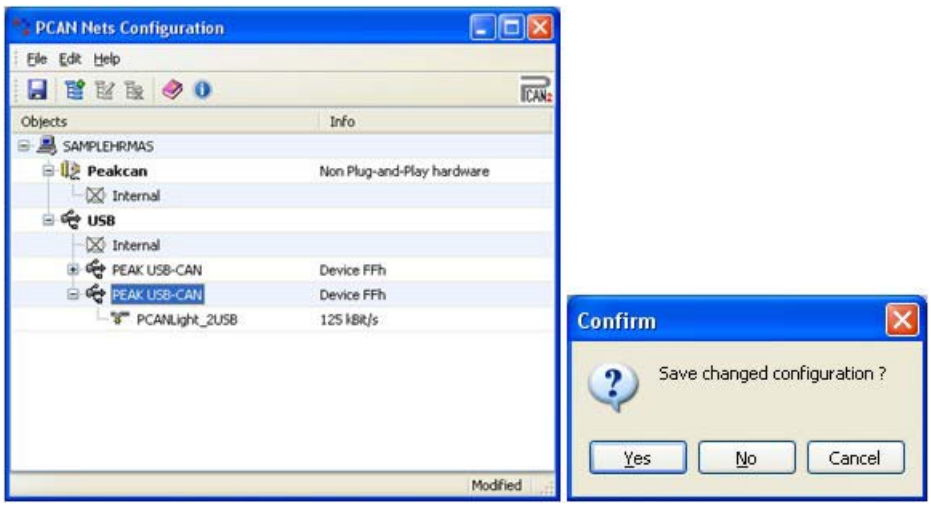
8. Change the field properties as follows:

   NAME = PCANLight_2USB,

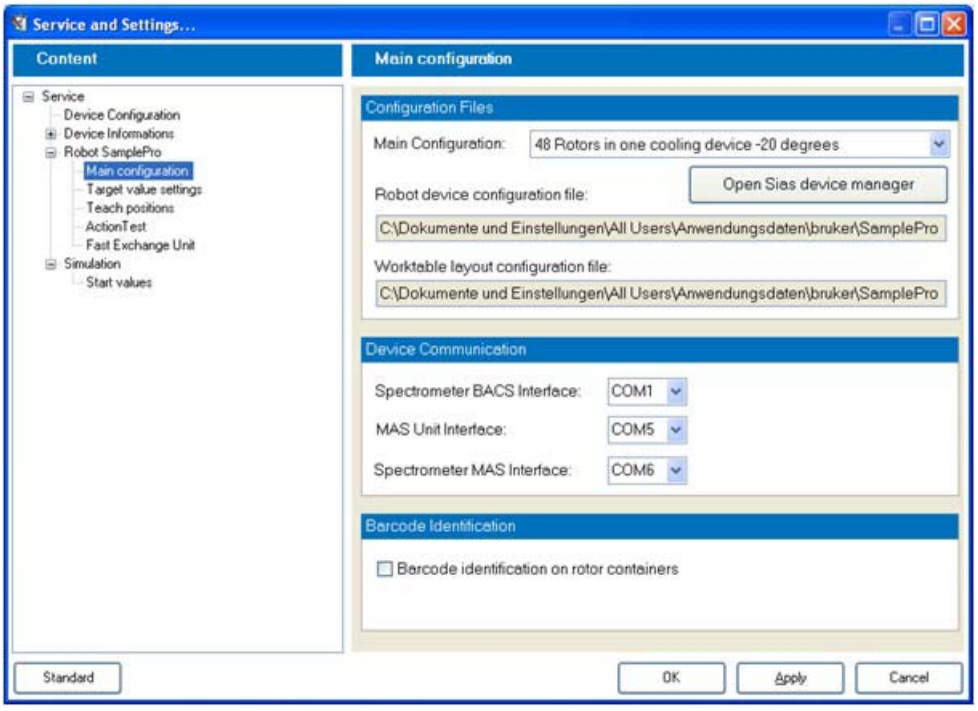
   BAUD RATE = 125kBits/s



9. Click **OK** and confirm **Save changed configuration?** with **Yes**.



6.6.1.3 Communication Settings



6.6.2 SamplePro hr-MAS Application Software

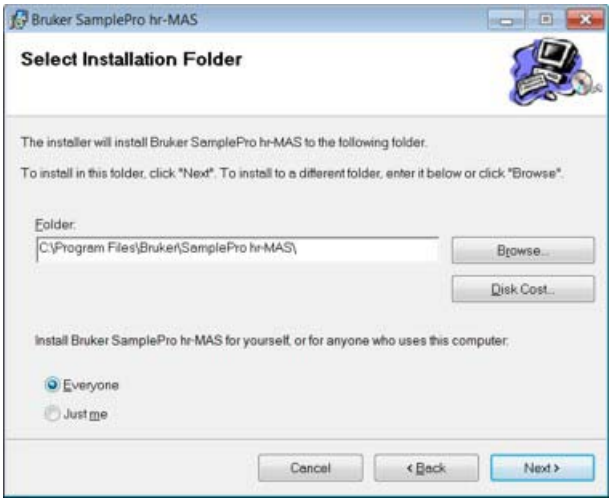
The software installation program for the **SamplePro hr-MAS Application** is also delivered with the Bruker CD, P/N H118403. The CD contains the HRMASSetup.msi and the setup.exe files. The Setup.exe program checks if the Dot Net is installed, and installs it if necessary. The Setup program then calls HRMASSetup.msi.

1. Select and execute the command **Setup.exe** from the installation CD-ROM.

➨ The welcome window appears.

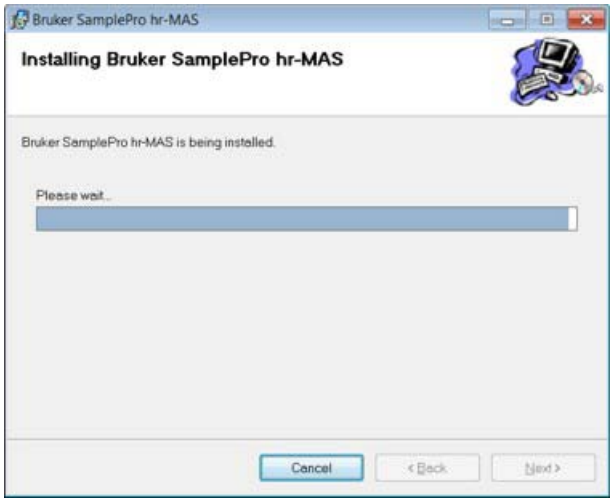
2. Click **Next** to continue.

➨ A Select Installation Folder window will appear.

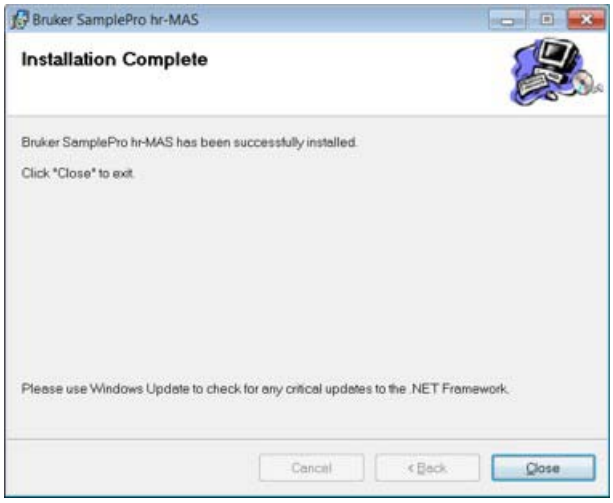


3. Select the location where the program should be installed.
4. Click **Next** to continue.

➨ A new window will appear and the appropriate software will be installed.



➨ An Installation Complete window will appear.



5. Click **Close** to exit.

7 System Configuration

7.1 Overview

The Service and Settings area is used for the system configuration and is intended for trained Bruker service personnel only!

⚠ WARNING

Danger of injury if personnel are insufficiently qualified.

If unqualified personnel perform work in the software service area, hazards may arise which can cause serious injury and substantial damage to the robot.

- ▶ All work must be carried out by qualified personnel.
- ▶ Unqualified personnel must not be given the service password.

The Service and Settings area menu of the application software is made of the following components:

Menu Option	Submenu Option	Description
Device Settings		
	Main Settings	Used to set device communication settings.
	Robot Settings	Used to set the robot configuration, set the target values for nitrogen, air flow and cooling rack temperature, and to select barcode identification.
	Robot Teaching	Used to check and teach the pickup adapter, object sensor and the barcode reader.
	Exchange Unit Settings	Used to set the pressure limits, transfer times, and open the EU service dialog.
	Device Test	Used to perform test steps and test loops.
	Standard Device User	Used to select the user level.
Notification Services		Used to view and add device services.
Alarm Settings		Used to add/delete notification rules.
Maintenance Tasks		Provides a list of current maintenance tasks to be performed and a task history.
Statistics		Used to display device statistics.

Table 7.1 Overview of the Service and Settings Area

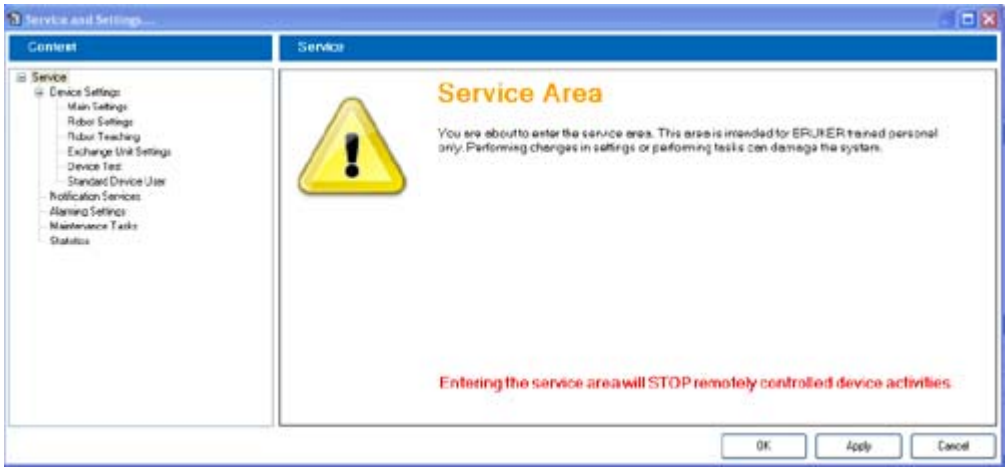
7.2 Configuring the Device Settings

1. Select **File - Service and Settings** from the application software.

2. Log in to the service area by:
   - Selecting **Service Mode**.
   - Entering the service password (Password: **service**).
   - Pressing the **Enter Service Area** button.

➥ A confirmation window will appear.

3. Confirm by pressing **OK**.



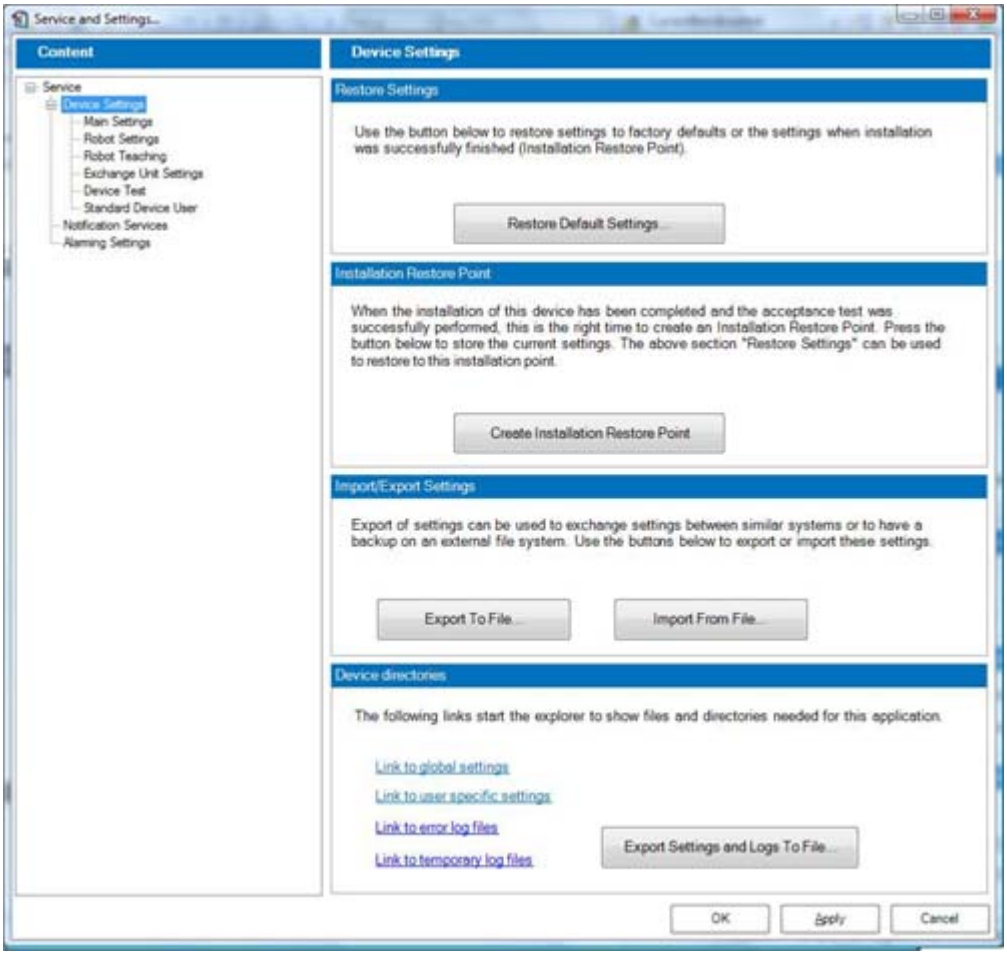


Figure 7.1 Service and Settings Window

7.2.1 Initial Settings

After the device has been installed as described in "Installation" on page 43, the software must be configured as described in this section.

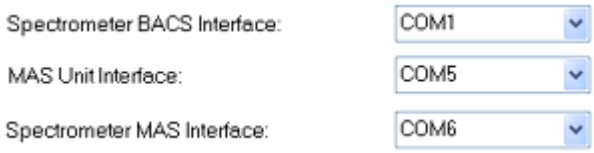
The initial device settings must be set in the following sequential order:

- "Main Settings"
- "Robot Settings"
- "Robot Teaching"
- "Exchange Unit Settings"
- "Device Test"
- "Standard Device User"

7.2.1.1 Main Settings

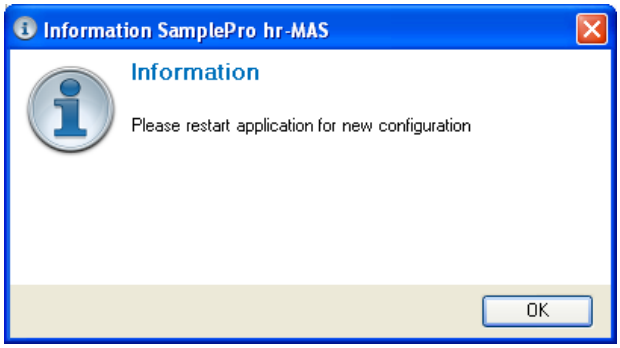
The CAN drivers must be installed as described in "Installing the Robot CAN Interface Driver" on page 62 and "Installing the Exchange Unit CAN Interface Driver" on page 66.

1. Set the RS-232 serial interfaces for the spectrometer B-ACS, MAS unit and the spectrometer MAS interface. The COM ports used are dependent on the system configuration.



7.2.1.2 Robot Settings

Note: When the settings have been changed a warning message appears. The application must be restarted.



The system can be delivered with or without the cooling option.

1. When working **without** the cooling device select:
   - 48 Rotors no cooling device

   When working **with** the cooling device select:
   - 48 Rotors in one cooling device - 20 degrees.

Note: When working in the mode **48 Rotors in one cooling device - 20 degrees**, it is also possible to use an non-cooled rotor container. The container must be set in the last position to the right, see the next figure. Do not forget to use the adapter plate to stabilize the rotor container, see "Adapter Plate for Cooling Unit" on page 209.

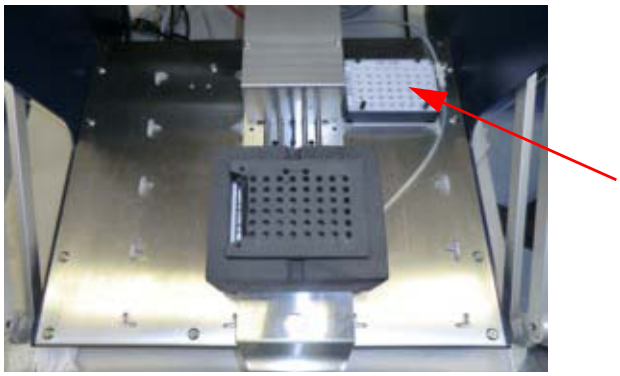


Figure 7.2 Container Set in Last Position to the Right for Robot Settings

2. Enter the **Nitrogen/Air Flow** target value and difference for error. For containers at room temperature, the target value can be set to zero.
3. Enter the **Cooling Rack** target temperature based on the selected application in the Robot Configuration.
4. Enter the cooling rack temperature difference for warning and error.
5. When the barcode option is available check the **Barcode identification on rotor containers box**.

7.2.1.3 Robot Teaching

This section is used to check and teach the main robot positions. Perform the tasks in the order listed here:

1. Select the teaching position (see "Select the rotor position or container where the teaching will be performed." on page 84**)**.
2. Perform "Teaching the Pickup Adapter" on page 84.
3. Perform "Teaching the Rotor Detection Position" on page 85.
4. Perform "Teaching the Barcode Reader Position" on page 87.
5. Perform "Teaching the Rotor Container Detection Position" on page 88.
6. Perform "Teaching the Security Eject Position" on page 89.

7.2.1.4 Exchange Unit Settings

The Exchange Unit settings are separated into four areas:

- Pressure Limits
- Transfer
- Transfer Back
- Exchange Unit Service Dialog

Before the system is delivered to the customer, default values for these settings are entered in the factory. However optimal settings depend on the laboratory environment, including the length and height of the transfer hose. Thus, the values need to be adjusted after the unit is installed and whenever the transfer hose is changed.

1. In the Service and Settings window of the application software, select **Service** - **Device Settings** - **Exchange Unit Settings**.

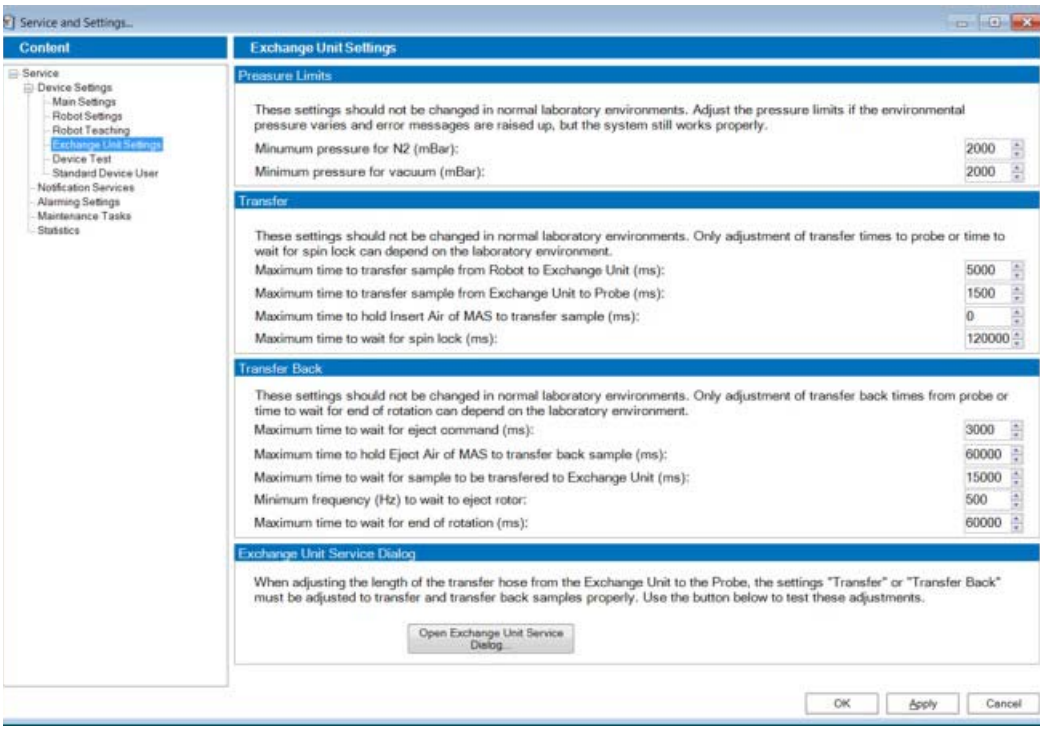


Figure 7.3 Exchange Unit Settings

2. Use the **Exchange Unit Service Dialog** to test the default values. When the values are inadequate for the laboratory environment, adjust them as described below and retest the new values.
3. Adjust the pressure limits if the environmental pressure varies and error messages are displayed, even when the system is working properly.
4. Adjust the „Transfer“ values. The maximum time to transfer the sample from the robot to the exchange unit, or from the exchange unit to the probe, depends on the length of the transfer hose and the level differences.

   The other time settings under „Transfer“ depend on several factors, including the probe, the pressure in the laboratory, the environmental conditions, the difference in height, and the bending radius.
5. Adjust the „Transfer Back“ values. These values also depend on the laboratory environment, as indicated in the previous step.
6. If not already done, use the Exchange Unit Service Dialog to test the values entered.

7.2.1.5 Device Test

After teaching the robot system a test of the main actions can be performed. This procedure is described in detail in the section "Robot System Device Test" on page 91.

7.2.1.6 Standard Device User

Depending on the laboratory environment, different user modes may be desirable. Three user modes are currently available:

Standard Mode. The standard user.

Service Mode: Used by Bruker Service personnel.

Super User Mode: For advanced users, this mode is currently still under development.

Select the user mode that should be used when the application is started.

7.3 Notification Service

The notification service window is used to add or maintain contacts that should be notified when an alarm is activated (see "Alarm Settings" on page 78). This is an optional feature and the list members can be enabled or disabled as needed.

Figure 7.4 Notification Service

1. Fill out all the information fields.
2. Press **Apply** to save the values.

7.4 Alarm Settings

The alarm settings window is used to set the notification type, filter the error messages that should be sent and enter the name and address (or telephone number) of the recipient.

Figure 7.5 Alarm Settings

1. Fill out all the information fields.
2. Press **Apply** to save the values.

7.5 Maintenance Tasks

The maintenance task window displays a list of maintenance task that need to be performed, as well as provides a history of tasks that have already been performed.

During initialization of the system these should be blank.

7.6 Statistics

The statistics overview displays system statistics collected during operation of the device. This information is used for troubleshooting purposes and does not need to be initialized.

7.7 Backing up the Settings Configuration

Before making any setting changes and after making the changes, always use the **Export To File** button to back up the settings. The exported settings can be restored at any time using the **Import From File** button (see "Import/Export Settings" on page 79).

7.8 Importing, Exporting and Restoring Device Settings

In the device settings area, it is possible to export, import or restore the device settings. The device configuration files can be found in the following directories:

- C:\ProgramData\bruker\SamplePro hr-MAS\hrMasGui\config
- C:\Users\AppData\Local\bruker\SamplePro hr-MAS\hrMasGui\config
- C:\ProgramData\bruker\SamplePro hr-MAS\hrMasGui\logs
- C:\Users\AppData\Local\Temp\bruker\SamplePro hr-MAS\hrMasGui\logs

Restore Settings

The **Restore Default Settings** button is used when the system is already installed to either:

- Restore the factory defaults.
- Restore the installation settings, that were saved with the **Create Installation Restore Point** button.

Installation Restore Point

When the installation of the device is complete and the acceptance test was successfully performed, an installation restore point should be established.

To do this, press the **Create Installation Restore Point** button.

Import/Export Settings

The Import/Export Settings buttons can be used to exchange settings between similar systems or to have a backup of an external file system.

After a successful installation, or before testing or changing the device settings, the settings should be stored using the **Export To File** button.

The settings that were saved can be restored using the **Import From File** button.

If necessary, the zipped export file can also be sent to Bruker for troubleshooting purposes.

See the sections "Troubleshooting" on page 175 and "History Files and Log Files" on page 175 for more information.

7.9 The Robot Device Manager

The robot device manager settings are used only by the program developers and therefore are not explained in this manual.

7.10 TopSpin Configuration

To configure the SamplePro hr-MAS enter the Command cf in TopSpin. When the Settings window for the device communication is display, verify the settings for the Bruker Automatic Changer and the MAS Pneumatic Control Unit. Use the settings displayed in the following figures.

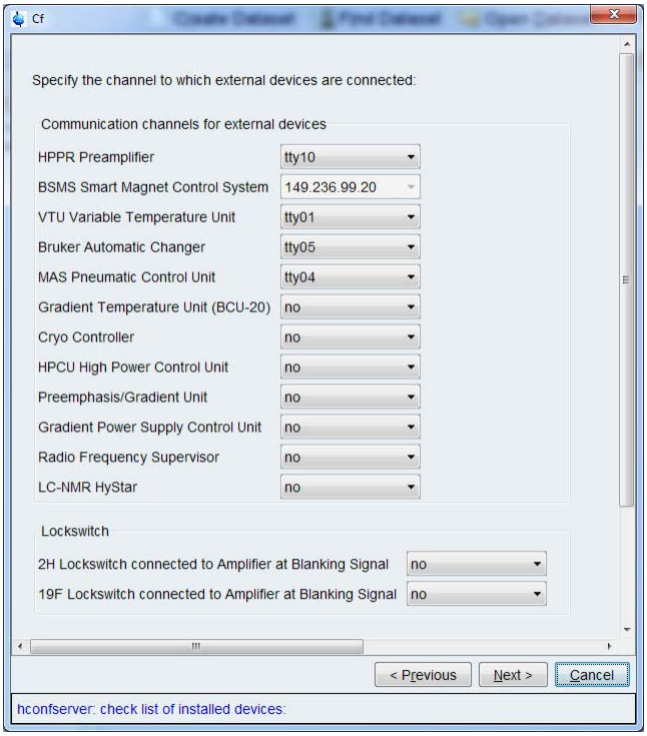


Figure 7.6 TopSpin List of Installed Devices

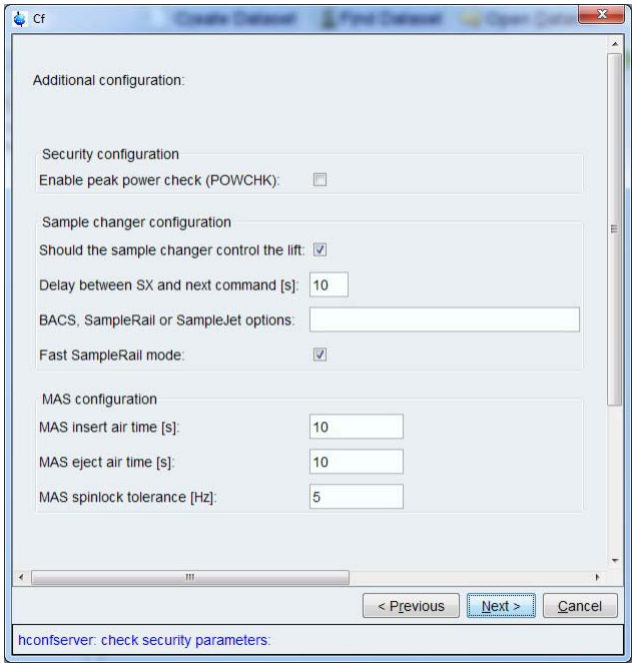


Figure 7.7 TopSpin Security Parameters

For the cable connections refer to "Electronic Installation" on page 52

8 Verification and Calibration

8.1 Pre-test Checklist

- The installation must be completed as described in "Installation" on page 43.
- The system must be configured as described in "System Configuration" on page 71.
- The check the parallelism of the arm alignment must be checked as described in "Arm Alignment Check" on page 131.

8.2 Robotic System Teaching

After installation, and after changing components like the cooling rack, the pickup adapter or the object detector, a teaching of the robot system positions should be performed. At a minimum, check if the pickup adapter position and rotor detection position are correct.

1. Select **File - Service and Settings** - **Device Settings** and **Robot Teaching** from the application software.

➨ The Robot Teaching window will appear.

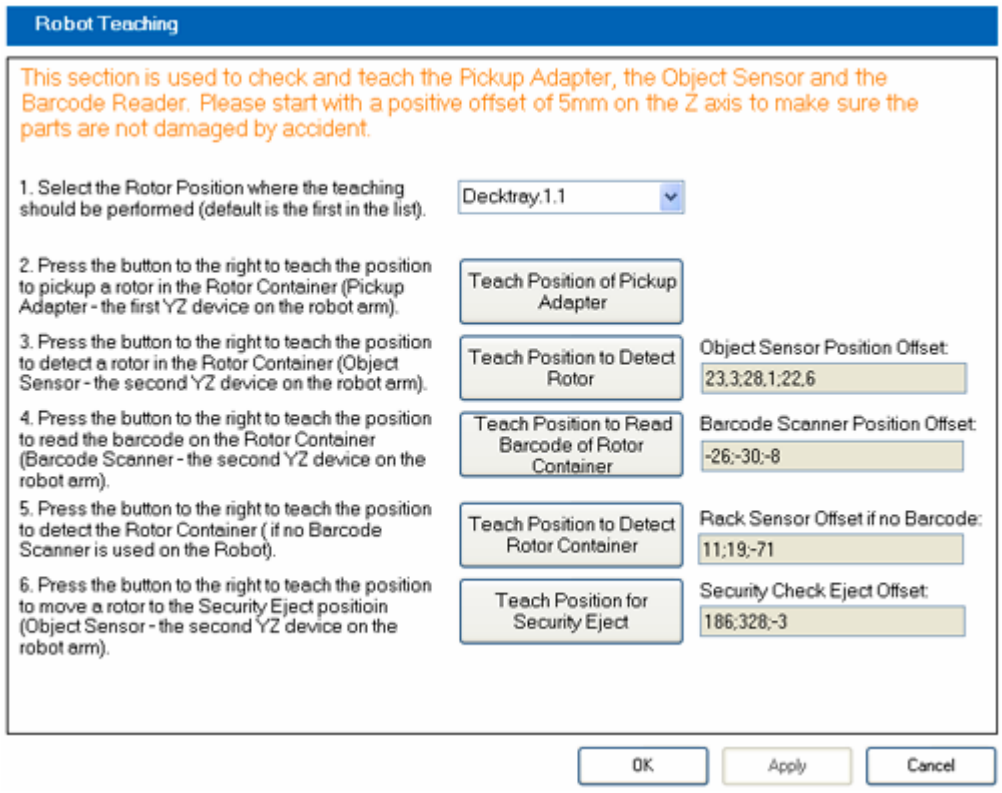


Figure 8.1 The Robot Teaching Window

Any time the teaching on the pickup adapter is performed, teaching on all the other positions must also be made!

2. Select the rotor position or container where the teaching will be performed.
   - For teaching the pickup adapter or the rotor detection, use position 1 of the rotor container (this is the first entry in the list).
   - For checking the accuracy use all other positions (usually position 8 and 48).
   - For teaching the barcode reader position or the rotor container detection, any position on the rotor container can be used.
   - For teaching the security eject position the selected position will not be used.

Note: In the following sections the **Step Size** for the **X**, **Y**, and **Z** buttons can be modified in the text field on the left side of the buttons.

8.2.1 Teaching the Pickup Adapter

1. Press the **Teach Position of Pickup Adapter** button.

➨ The teaching window will appear:

2. Verify that the **Position ID** is position 1 of the rotor container.
3. Open the moveable cover plate of the rotor container.

4. Enter 5 mm in the **Test offset Z** field.

   Note: After changing components like the cooling rack or the pickup adapter, it is recommended to start with a test offset of 20 or 50 mm.

5. Press the **Move XY** and **Move Z** buttons to move the pickup adapter to the rotor position.

6. Check the Z height over the rotor position: With a Test Offset Z value of 5 mm the bottom of the pickup adapter must be the same height as the surface of the moveable cover plate of the rotor container.

   If necessary, press the **Z** up and down buttons until the correct height has been adjusted.

7. Check the XY position over the rotor position: the bottom of the pickup adapter must be in the center of the hole in the cover plate.

   If necessary, press the **X** or **Y** buttons until the correct XY position has been adjusted.

➨ The total offset of the teaching procedure will be shown in the text fields on the left side.

8. At the end of the teaching procedure save the results by pressing the **OK** button.

9. Confirm the changes to the device configuration file by pressing the **Overwrite** button.

8.2.2 Teaching the Rotor Detection Position

1. Press the **Teach Position to Detect Rotor** button.

➨ The teaching window will appear:

2. Verify that the **Position ID** is position 1 of the rotor container.
3. Open the moveable cover plate of the rotor container.
4. Check if a rotor is inserted in the teaching position.
5. Enter 0 mm in the **Test offset Z** field.

   After changing components like the cooling rack or the object detector, it is recommended to start with a test offset of 20 or 50 mm.
6. Press the **Move XY** and **Move Z** buttons to move the pickup adapter to the rotor position.
7. Check the Z height over the rotor position: With a Test Offset Z value of 0 mm the bottom of the detector must be less than 1mm over the rotor in the rotor container.

   If necessary, press the **Z** up and down buttons until the correct height has been adjusted (the step size for the **Z** buttons can be modified in the text field on the left side of the button).
8. Check the XY position over the rotor position: the bottom of the object detector must be in the center of the rotor position hole.

Figure 8.2 Checking the XY position over the rotor position

   If necessary, press the **X** or **Y** buttons until the correct XY position has been adjusted (the step size for the **X**, **Y**, and **Z** buttons can be modified in the text field on the left side of the buttons).

➨ The total offset of the teaching procedure will be shown in the text fields on the left side.

9. At the end of the teaching procedure save the results by pressing the **OK** button.

8.2.3 Teaching the Barcode Reader Position

1. Press the **Teach Position to Read Barcode of Rotor Container** button.

➨ The teaching window will appear:

2. Verify that the **Position ID** is the correct position. Any rotor container position may be used.

3. Enter 0 mm in the **Test offset Z** field.

   After changing components like the cooling rack or the object detector, it is recommended to start with a test offset of 20 or 50 mm.

4. Press the **Move XY** and **Move Z** buttons to move the barcode reader over the barcode position of the rotor container.

5. Check the Z height over the barcode: The bottom of the barcode reader should be about 130 mm over the barcode.

6. Check the Y position of the barcode reader: The center of the barcode reader should be about 20 mm to the right side over the barcode.

7. If necessary, press the **X**, **Y**, or **Z** buttons until the barcode is read and displayed in the Detected Barcode field.

➨ The total offset of the teaching procedure will be shown in the text fields on the left side.

8. At the end of the teaching procedure save the results by pressing the **OK** button.

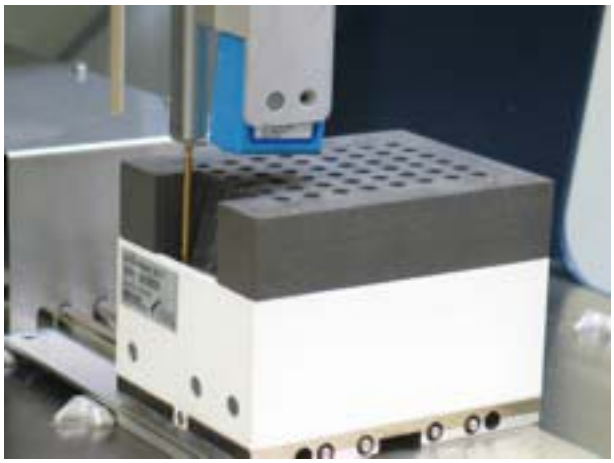
8.2.4 Teaching the Rotor Container Detection Position

1. Press the **Teach Position to Detect Rotor Container** button.

➥ The teaching window will appear:

2. Verify that the **Position ID** is the correct position. Any rotor container position may be used.
3. When the cooling rack is used, place the isolation cover on the rotor container.
4. Close the moveable cover of the rotor container.
5. Enter 0 mm in the **Test offset Z** field.

   After changing components like the cooling rack or the object detector, it is recommended to start with a test offset of 20 or 50 mm.
6. Press the **Move XY** and **Move Z** buttons to move the object detector over the rotor container surface.



7. Check the XY position of the object detector: The object detector finger should be over the *fixed* cover plate.

   If necessary, press the **X** or **Y** buttons until the correct position is reached.

8. Check the Z height over the fixed cover plate: With an Test Offset Z of 0 mm the bottom of the object detector finger must be less than 1 mm over the fixed cover plate of the rotor container.

   If necessary, press the **Z** buttons up and down until the correct height has been adjusted.

➨ The total offset of the teaching procedure will be shown in the text fields on the left side.

9. At the end of the teaching procedure save the results by pressing the **OK** button.

8.2.5 Teaching the Security Eject Position

1. Press the **Teach Position for Security Eject** button.

➨ The teaching window will appear:

2. When the cooling rack is used, place the isolation cover on the rotor container.
3. Enter 0 mm in the **Test offset Z** field.

   After changing components like the cooling rack or the object detector, it is recommended to start with a test offset of 20 or 50 mm.
4. Press the **Move XY** and **Move Z** buttons to move the pickup adapter over the last security eject position.

   When using the cooling rack an additional 8 mm hole in the isolation cover near the barcode can be used as the security eject position.

   When working without a cooling rack the user can put an additional flat container in any position that can be reached by the pickup adapter, e.g. an empty well plate with a height of 10 mm.
5. Check the Z height over the eject position: With a Test Offset Z of 0 mm the bottom of the object detector finger must be less than 10 mm over the eject position.

   If necessary, press the **Z** buttons up and down until the correct height has been adjusted.
6. Check the XY position of the pickup adapter: The bottom of the pickup adapter should be in the center over the eject position.

   If necessary, press the **X** or **Y** buttons until the correct position is reached.

➨ The total offset of the teaching procedure will be shown in the text fields on the left side.

7. At the end of the teaching procedure save the results by pressing the **OK** button.

8.3 Robot System Device Test

After teaching the robot system a test of the main actions should be performed.

1. Select **File - Service and Settings** - **Device Settings** and **Device Test** from the application software.

➨ The Device Test window will appear.

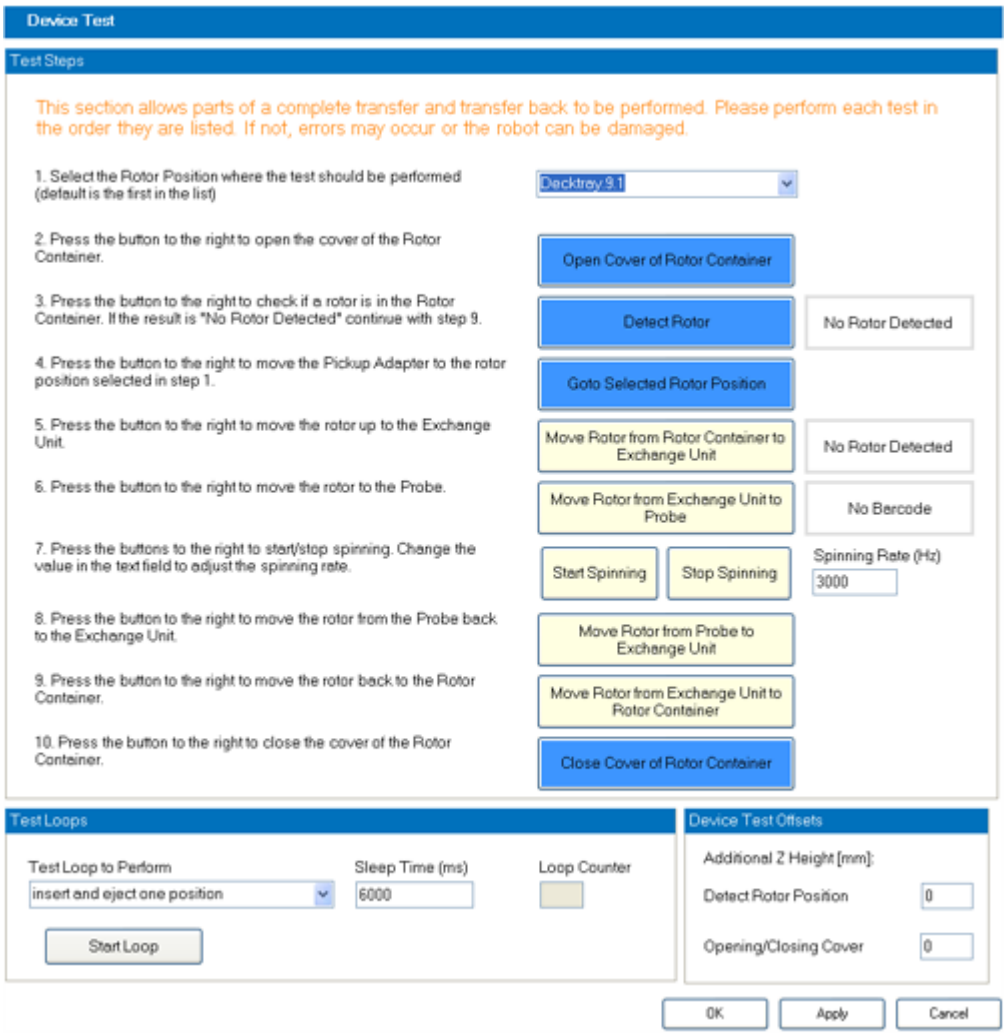


Figure 8.3 The Device Test Window

The **Test Steps** section is used to test the 10 steps required to pick up a rotor from the rotor container, insert it into the MAS probe, and then transfer it back to the rotor container.

- The steps using the robot system have a blue button.
- The steps using the exchange unit have a light yellow button.

The **Test Loops** section is used to start different loop tests that check the single actions and the cooling rack over a longer period of time.

The **Device Test Offsets** section is used to perform single tests with an additional Z offset, e.g. for error troubleshooting. The offset values normally are 0, but when an error occurs, the errors have to be corrected with an additional teaching of the pickup adapter or the rotor detector position.

8.3.1 Performing the Individual Test Steps

8.3.1.1 Step 1: Select the Rotor Position

Check if there is a rotor in the selected position or select another position where a rotor is placed.

8.3.1.2 Step 2: Open Cover of Rotor Container

The object detector finger is used to open the moveable cover of the rotor container.

If there is no cooling isolation cover placed on the container it is possible to check if the rotor position hole is fully opened. If not, the next steps will show the error 154.010.025 and the rotor detection position must be taught again.

When using the cooling rack with the isolation cover, check that the object detector and the barcode reader are not moving too much downwards and are not blocked by the isolation cover. Remove the isolation cover temporarily after this step to check if the rotor position hole is fully opened.

8.3.1.3 Step 3: Detect Rotor

The object detector finger is used to check the presence of the rotor container.

Before detecting the rotor, the object detector will first check if there is another object above the rotor, e.g. the movable cover plate (not opened correctly) or a rotor on the cover.

If another object was detected the error 154.010.025 will be displayed.

The result of the detection, the presence or absence of the rotor will be shown in the text field on the right.

8.3.1.4 Step 4: Goto Selected Rotor Position

The pickup adapter moves to the selected rotor position 5 mm downwards into the hole of the open cover. Small XY tolerances up to 1 mm should not be a problem, because the adapter is bending when moving into the cone of the cover plate.

8.3.1.5 Step 5: Move Rotor from Rotor Container to Exchange Unit

This action checks the exchange unit, but the correct pickup adapter position is checked indirectly when moving the rotor up to the exchange unit successfully.

The result of the rotor detection and rotor barcode reading in the exchange unit will be shown in the text fields on the right.

The air flow to move the rotor up will not stop after this action, so step 6 should follow immediately. If not, after a time-out of approximately 10 seconds the air flow stops and the rotor is falling back to the rotor container.

Attention: If the cooling rack is used, step 6 must be started immediately after the end of step 5. Otherwise too much humid ambient air will flow through the rotor container and ice could block the rotors in its positions!

See the chapter Troubleshooting "Problem: Light barrier always detects a rotor, even there is no rotor in the EU." on page 182 if experiencing the following problems with the exchange unit:

- Rotor transfer,
- Rotor sensor light barrier,
- Transfer pressure,
- Drum adjustment,
- Barcode reader.

Note: If the pickup adapter is too low, the samples cannot be sucked up!

8.3.1.6 Step 6: Move Rotor from Exchange Unit to MAS Probe

This action checks the exchange unit and the MAS unit. This step can be omitted when testing the robot system (when skipping steps 6, 7 and 8 continue with step 9).

8.3.1.7 Step 7: Start and Stop Spinning

This step can be omitted when checking the robot system. This step must be skipped if step 6 was skipped.

8.3.1.8 Step 8: Move Rotor from MAS Probe to Exchange Unit

This action check the exchange unit and the MAS unit. This step must be skipped if step 6 was skipped. The result of the rotor detection and rotor barcode reading in the exchange unit will be shown in the text fields on the right of step 5 and step 6.

Attention: If the cooling rack is used step 9 must be started immediately after the end of step 8. Otherwise too much humid ambient air will flow through the rotor container and ice could block the rotors in its positions!

8.3.1.9 Step 9: Move Rotor from Exchange Unit to Rotor Container

This action checks the exchange unit, but the correct pickup adapter position is checked indirectly when moving the rotor back to the rotor container successfully.

8.3.1.10 Step 10: Close Cover of Rotor Container

The object detector finger is used to close the moveable cover of the rotor container.

If the cooling isolation cover is not placed on the container it is possible to check if the rotor position hole is fully closed.

8.3.2 Actions Test in a Test Loop

In the drop down list of this window section different loop tests can be selected. Two loop tests are used for service tests:

- Insert and eject one position
- Insert/eject one position read barcode

With the buttons **Start Loop/Stop Loop** the test loop can be started and stopped.

The number of performed cycles is shown in the text field on the right.

One cycle performs the all steps from step 2 until step 10, only skipping step 7.

After step 6 and at the end of one cycle a sleep time is inserted that can be changed in the Sleep Time field (default 6000 milliseconds).

8.4 Exchange Unit Service Dialog

Select **Exchange Unit Settings** in the left panel tree view of the service area. See also "Exchange Unit Settings" on page 75.

To open the Exchange Unit Service Dialog press the **Open Exchange Unit Service Dialog** button.

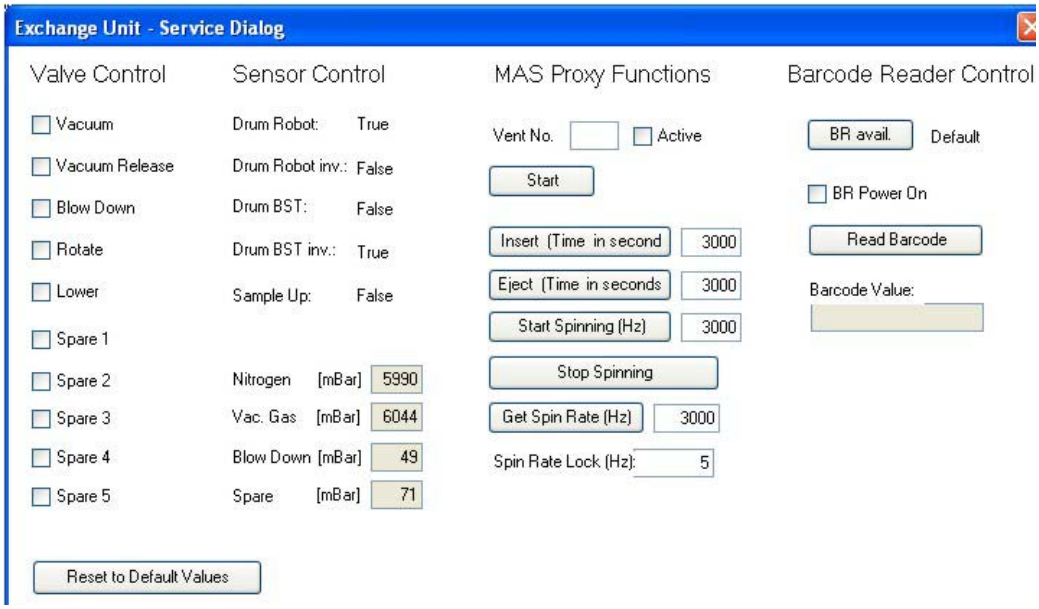


Figure 8.4 Exchange Unit Service Dialog

See the chapter Troubleshooting "Problem: Light barrier always detects a rotor, even there is no rotor in the EU." on page 182 if experiencing the following problems with the Exchange Unit:

- Rotor transfer,
- Rotor sensor light barrier,
- Transfer pressure,
- Drum adjustment,
- Barcode reader.

8.4.1 Valve Control

The Valve Control fields are used to open or close the corresponding valve by checking or unchecking the corresponding checkbox.

Vacuum - Turns the vacuum generator on.

Vacuum Release - This valve releases the vacuum into the transfer hose.

Blow Down - Opens the gas flow into the transfer hose, adjusted by the needle valve

Rotate - Rotates the drum

Lower - Lowers the drum over the source (robot) or destination (probe) position

Note: All spare valves are not implemented yet.

The **Reset to Default Values** button closes all valves.

8.4.2 Sensor Control

The first four fields of the Sensor Control display the state of the end position switches of the drum.

The field **Sample Up** displays the value of the light barrier inside the drum.

The fields **Nitrogen** and **Vac. Gas** display the two gas supply pressures.

The **Blow Down** field displays the pressure which is adjusted with the needle valve on the back of the EU. Adjustment of this pressure is described in the section "Exchange Unit Settings" on page 75.

The **Spare** field is currently not used.

8.4.3 MAS Proxy Functions

The MAS Proxy Functions display the current status of the MAS proxy.

In the **Valve No.** list of value field select the valve ID:

0 - Insert Valve

1 - Eject Valve

2 - Frame Cooling Valve

3 - Drive Valve

4 - Spare2 Valve

5 - Spare1 Valve

6 - Magic Angle Valve

7 - Vertical Valve

8 - Bearing Valve

If the **Active** checkbox field is checked, the valve state can be set. Checked means the valve is open/active. The function executed by pressing the **Set** button.

Press the **Insert** or **Eject** button to start the corresponding function on the MAS device. The text fields to the right of the buttons indicate the number of seconds that the **Insert** and **Eject** functions have to be active.

Press the **Start Spinning** button to start the MAS rotation up to the required spinning rate, which is set in the text box right to the button.

Press the **Stop Spinning** button to stop the rotation.

If the **Get Spinrate** button is pressed, the actual spinning rate will be displayed in the text box to the right.

8.4.4 Barcode Reader Control

To check if a barcode reader is available in the EU, press the button **BR avail**. The result will be displayed to the right of the button.

The checkbox **BR Power On** activates and deactivates the barcode reader (sleep mode/ wake-up).

The barcode value is displayed in the **Barcode Value** field, when the **Read Barcode** button is pressed.

9 Service - Minor Corrective Actions

9.1 Introduction

The modular design of the SamplePro hr-MAS allows the removal of individual modules by certified Bruker service engineers. Unauthorized personnel should never attempt major service and maintenance actions.

Minor service and maintenance actions can be performed by a certified operator. A trained operator can usually perform minor corrective actions. After completing any actions, it is important to perform the corresponding verification (see chapter "Verification and Calibration" on page 83) before running a significant test run with X-Util or another application. Only then can the device put into operation again.

If there is any doubt, please contact Bruker for advice or assistance.

NOTICE

Material damage hazard due to improper maintenance.

Device deadlock may occur as a result of failures due to a lack of proper maintenance.

- ▶ Maintenance intervals must be properly followed.
- ▶ Use appropriate tools to avoid damaging parts or modules.
- ▶ Only trained personnel should carry out maintenance work.

9.2 Robotic System Maintenance

⚠ CAUTION

Before Starting any Service and Maintenance

- ▶ Before starting any service and maintenance action, Ensure that the device is switched off and the power cable is unplugged.
- ▶ Remove all racks and accessories from the work surface.Do not touch unit parts of cooled or heated units.
- ▶ Make sure the device is clean and free from any contamination.
- ▶ Use appropriate tools to avoid damaging parts or modules.

9.2.1 Securing Screws

Whenever screws have been loosened or removed for corrective actions, they must be cleaned and fastened again using a small amount of Loctite® 222 unless otherwise stated. For correct application please refer to the instruction manual provided with the glue. The following screws must never be fastened with thread locking adhesives:

- Adjusting screws
- Screws mounted with spring lock washers
- Grounding screws

9.2.1.1 Securing Gear Screws

The following assembly procedure is mandatory to avoid thread locking adhesive from coming in contact with the motor shaft when a gear is mounted.

1. Turn the grub screw into the threaded hole of the gear until the screw nearly touches the side of the shaft bore. Do not apply force!
2. Apply Loctite® into the threaded hole.
   - X-gear screws must be fastened with Loctite® 243.
   - For all other gear screws use Loctite® 222.
3. Loosen the screw until the shaft bore is completely open.
4. Put the gear on the motor shaft making sure that the threaded hole faces the notch or the flattened side of the shaft (depending on the motor type).
5. Tighten the screw.

9.2.2 Mains Fuse (Input)

Before replacing any fuses, ensure that the device is switched off and the power cable is unplugged.

The mains fuse compartment is located in the mains socket on the rear of the device. Check the voltage on the type label to verify that the device is compatible with the AC voltage available at the installation site.

Replace a fuse only with one of the same value (refer to the label next to the fuse compartment):

Figure 9.1 Fuse Compartment

Fuse replacement

1. Ensure that the device is switched off and the power cable is unplugged.
2. Pull the fuse compartment out and replace the fuse(s).
3. Insert the fuse compartment.
4. Plug the power cable in and switch the device on.

9.2.3 Output Fuses

The output fuses are located on the rear of the PSU. Replace a fuse only with one of the same value (refer to the label above the fuse holder).

The number and value of the fuses depends on the version of the PSU.

Required tools

- Flat-head screwdriver #3

Fuse replacement

1. Ensure that the device is switched off and the power cable is unplugged.
2. Open the fuse holder by turning its cap (bayonet socket) counter-clockwise and replace the fuse.
3. Close the fuse holder by turning its cap clockwise.
4. Plug the power cable in and switch the device on.

Power supply with single output (24 V)

Table 9.1 Fuses (PSU with Single Output)

Ordering Information

Part Number	Description
150002	Replacement fuse set for 24 V PSU (4 x F10 A, 2 x F6.3 A. Dimension 5 x 20 mm).
150009	Replacement fuse set for 24 V PSU (4 x F10 A, 2 x F6.3 A. Dimension 5 x 20 mm). Fuse cap (for the use of 5 x 20 mm fuses in a 6 x 32 mm fuse holder.

Table 9.2 Fuse Ordering Information

9.2.4 CAN-Bus and Extensions (loop)

The CAN-bus connectors must be plugged in properly and securely locked with the screw coupling (see "Hardware Installation" on page 45„).

9.2.5 Deck

The deck must be level within a small tolerance. The horizontal alignment is checked with a spirit level.

Required tools

- Spirit level
- Open-end wrench 13 mm and 14 mm (or adjustable wrench)

Check

Check the horizontal alignment of the deck by positioning the spirit level along the deck width and depth.

Adjustment

1. Evaluate which feet need to be adjusted to level the deck.
2. Loosen the counter nut by turning it counterclockwise.
3. Adjust the foot. Turning the foot nut counterclockwise moves the deck upward, turning the food nut clockwise moves the deck downward. Check the level using the spirit-level while adjusting the feet.
4. Adjust the other feet if required.
5. Ensure that the device is not shaky and stands solid on the workbench.
6. Lock all counter nuts by turning them clockwise.

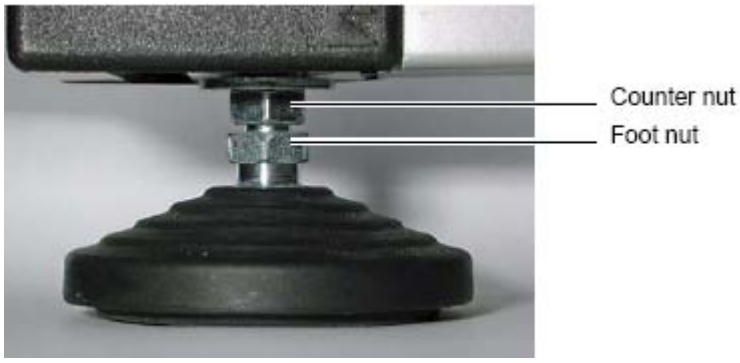


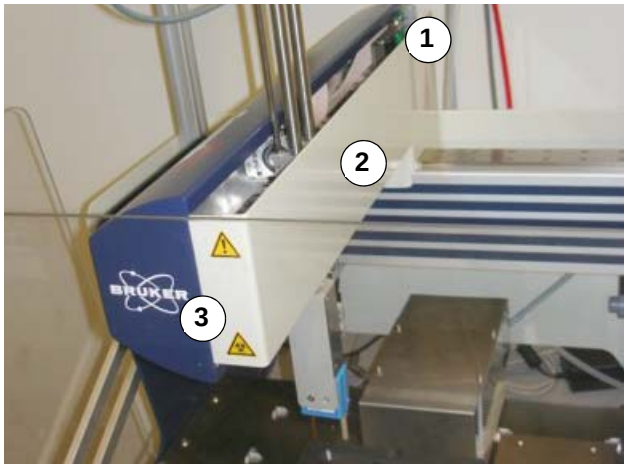
Figure 9.2 Adjusting Device Foot

9.2.6 Arm Housing

The arm housing consists of three different parts:

- Arm cover.
- Arm side cover plate.
- Arm rear cover plate.

For service and maintenance some or all of the covers/plates must be dismounted.



1. Arm Rear Cover (not visible)
2. Arm Side Cover
3. Arm Cover

Figure 9.3 Arm Housing

9.2.6.1 Arm Cover

Required tools

- Torx screwdriver T20

Disassembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Move the arm to the home position.
3. Remove the two screws at the rear and the one on the bottom side of the front.

Figure 9.4 Screw at the Front Bottom Side

Figure 9.5 Screws at the Rear Side

4. Slide the arm cover carefully towards the X-rail until the mounting tappet is released from the cut-out on the side or front cover plate. Then take the arm cover off by moving it to the side.

Assembly

To mount the arm cover, the side/front cover plate and the rear cover plate must be already mounted. If not refer to „Installation“ and „Installation“.

1. Ensure that the device is switched off and the power cable is unplugged.
2. Move the arm manually to its home position.
3. Carefully push the arm cover from the side towards the arm, making sure that the flat band cables are not pinched between arm cover and arm.
4. Slide the arm cover slowly towards the side, and the front cover plate until the mounting tappet is firmly inserted into the cut-out.

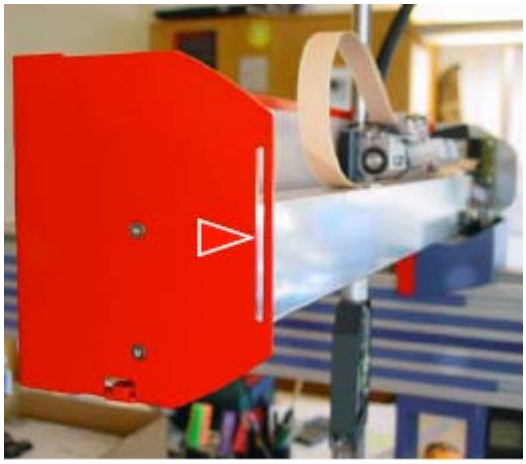


Figure 9.6 Cut-out on the Side Cover Plate

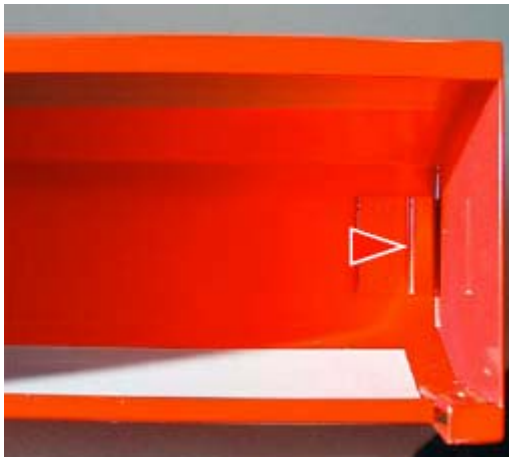


Figure 9.7 Mounting Tappet Inside the Arm Cover

5. Check that the arm cover is not tilted in any direction and is parallel to the deck.
6. Tighten the two screws at the rear of the arm cover and the screw (including washer) on the bottom side of the front.

9.2.6.2 Side and Front Cover Plate

Required Tools

- Torx screwdriver T10

Disassembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Remove the arm cover (see "Arm Cover" on page 104).
3. Remove the two screws at the rear of the plate.
4. Remove the screw underneath the arm.
5. Remove the two screws at the front of the plate.
6. Remove the side cover plate.

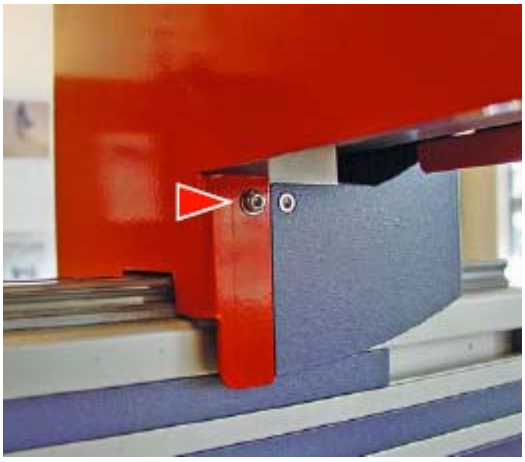


Figure 9.8 Screw in the Back Underneath the Arm

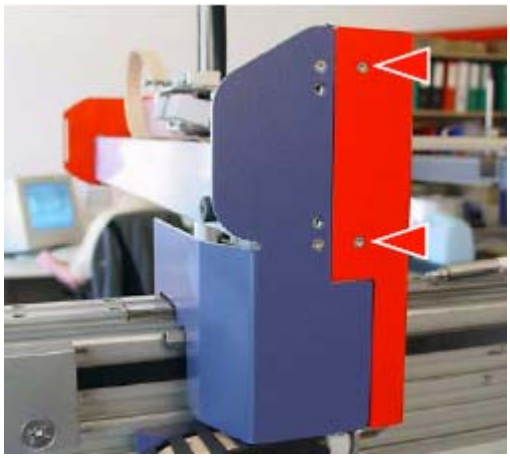


Figure 9.9 Screws on the Rear Cover Plate

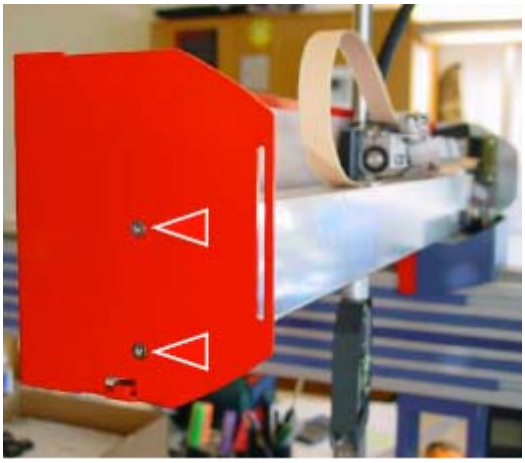


Figure 9.10 Screws at the Front Cover Plate

Assembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Mount the side cover plate.
3. Tighten the screws at the front.
4. Tighten the screw underneath the arm.
5. Tighten the two screws at the rear of the side cover plate.
6. Check that the side cover plate is not touched when the object detector is moved manually along the arm. Otherwise adjust the cover.

9.2.6.3 Rear Cover Plate

Required tools

– Torx screwdriver T10

Disassembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Remove the cover (see "Arm Cover" on page 104).
3. Remove the screw underneath the arm.
4. Remove the two screws at the rear of the plate.
5. Remove the rear cover plate.

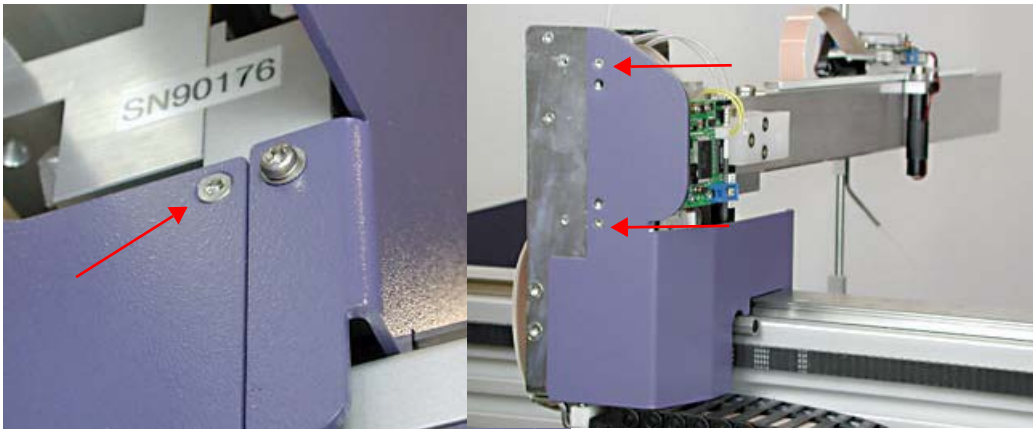


Figure 9.11 Screw on the Back Underneath the Arm and on the Rear Cover Plate

Assembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Mount the rear cover plate.
3. Tighten the screw underneath the arm.
4. Tighten the two screws at the rear.

9.2.7 X-Axis Components

9.2.7.1 MCB X-Motor Board

⚠ CAUTION

X-Util must be run to download boot loader.

- Whenever an MCB X-motor board has been exchanged, X-Util must be run to download boot loader, firmware and parameters (see "Exchanging Controller Boards" on page 158).

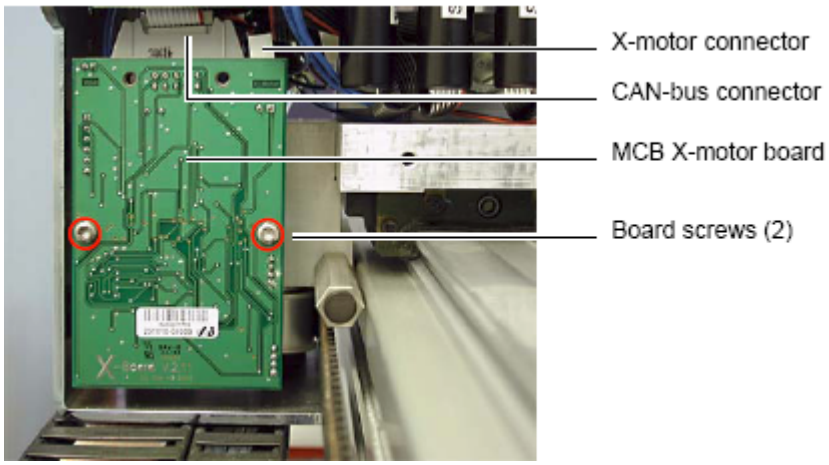


Figure 9.12 MCB X-motor board (arm)

Required tools

- Torx screwdriver T10

Check

1. Ensure that the device is switched off and the power cable is unplugged.
2. Remove the relevant parts of the arm housing (see "Arm Housing" on page 103).
3. Check that all connectors are fully inserted in their sockets on the MCB X-motor board.
4. Install the arm housing (see "Arm Housing" on page 103).

Disassembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Remove the relevant parts of the arm housing (see "Arm Housing" on page 103).
3. Remove the two board screws.
4. Carefully pull the board out and mark the plugs/sockets on the MCB X-motor board to ease the reconnection.
5. Disconnect the cables.
6. Remove the board.

Assembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Connect the cables.
3. Mount the MCB X-motor board with the two screws and the spring rings.
4. Install the arm housing (see "Arm Housing" on page 103).

9.2.7.2 X-Gear

NOTICE

Damage to device due to incorrect belt tension

To check the X-gear, the X-belt must be released. Be aware that this procedure might affect the belt tension.

It is recommended to check the tension afterwards (see "Adjusting the X-Belt Tension" on page 154).

Required Tools

- Torx screwdrivers T10, T20

Check

1. Ensure that the device is switched off and the power cable is unplugged.
2. Remove the relevant parts of the arm housing (see "Arm Housing" on page 103).
3. Release the belt tension by removing the belt clamp screw on the X1-stopper.

Never loosen the two blocking screws!

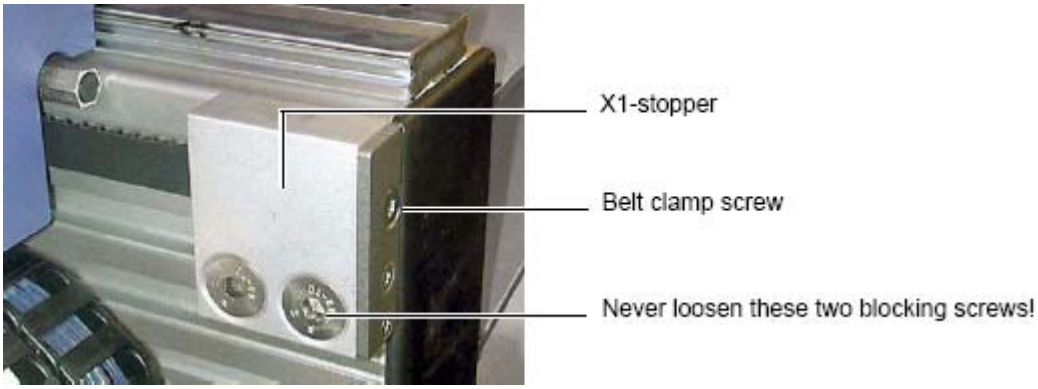


Figure 9.13 Loosening the Belt Clamp

4. Carefully pull the X-belt out away from the X-gear until it can be moved freely.
5. Turn it until you can access the two gear screws.

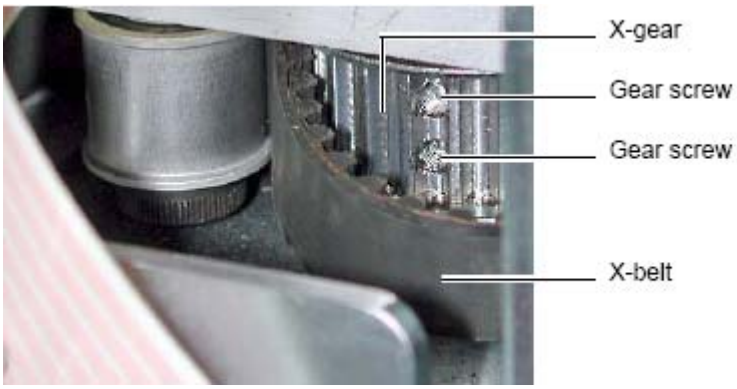


Figure 9.14 X-Gear and Pulley

6. Check if the screws are tightened. If they are loose or can be screwed out easily, proceed with the following corrective action:

a) Turn the gear screw in as far as possible. However, do not apply too much force.

b) Apply Loctite® 243 into the threaded hole.

c) Turn out the screw until its end is well out of the threaded hole.

7. Turn in the screw again and tighten. Repeat with the second screw.

---

i Let it dry for at least 2 hours before applying torque on the X-gear (initializing the device)!

---

8. Guide the X-belt around the pulley.
9. Insert the belt clamp in the X1-stopper and attach it firmly by tightening the belt

clamp screw.

10. Slide the arm carefully to and fro to check that the X-belt moves smoothly around the X-drive.
11. Install the arm housing. See "Arm Housing" on page 103).

9.2.7.3 X-Motor

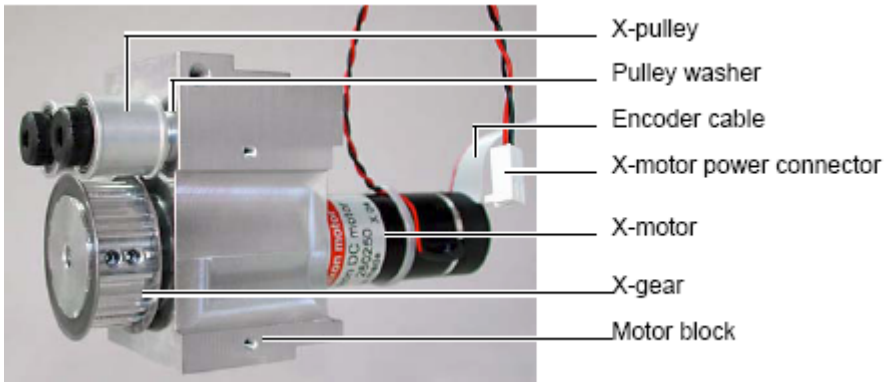


Figure 9.15 X-Motor Assembly

Required tools

- Torx screwdrivers T10, T20, T25
- Allen wrench 4 mm („L“-shape)
- Adjustable torque wrench, Allen bit 4 mm

Disassembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Remove the relevant parts of the arm housing (see "Arm Housing" on page 103„).
3. Disassemble the MCB X-board (see "MCB X-Motor Board" on page 108„).

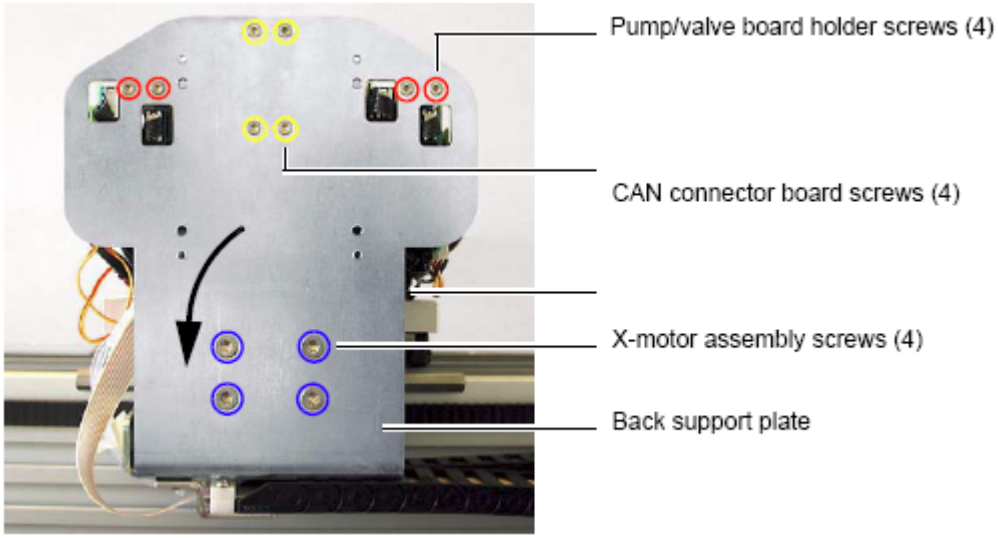


Figure 9.16 Back Support Plate

4. Remove the screws from the CAN connector board(s).
5. Remove the screws from the pump/valve board holder(s) (arm only).
6. Remove the screws from the X-motor assembly and swivel the back support plate downwards in order to get access to the motor block screws.

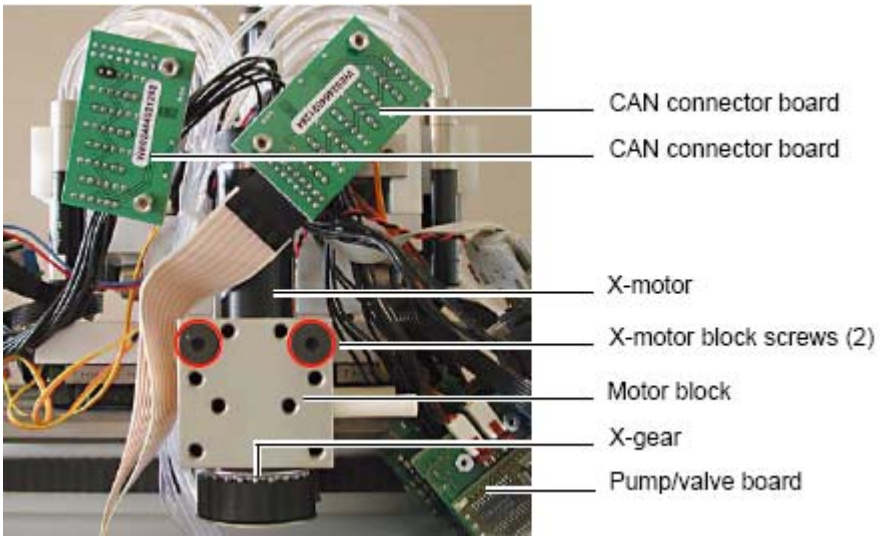


Figure 9.17 Removed Back Support Plate

Note: The caterpillar drive chain remains mounted on the back support plate.

7. Release the belt tension by removing the belt clamp screw on the X1-stopper.

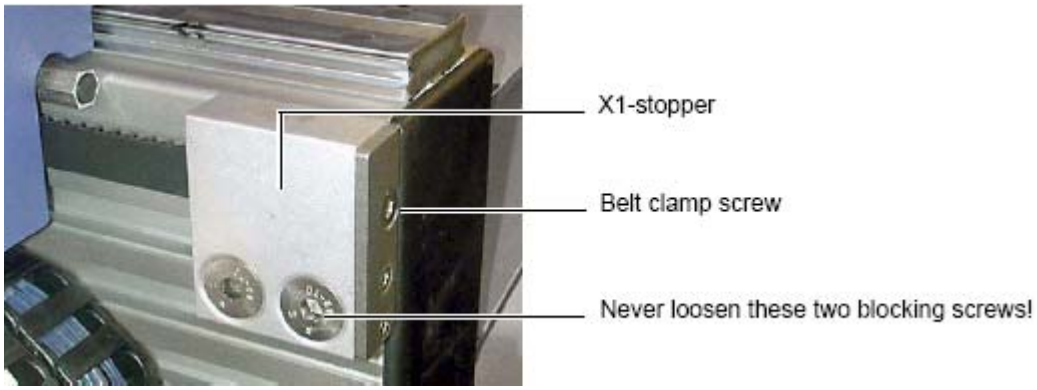


Figure 9.18 Removing the Belt Clamp Screw

8. Dismount the two X-pulleys and the washers from the motor block (see Figure 9.15 „X-motor assembly“.
9. Release the belt from the X-gear.
10. Remove the two motor block screws and remove the X-motor assembly.
11. Loosen the two grub screws on the X-gear and remove it.
12. Dismount the X-motor by removing the two screws.

Assembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Mount the X-motor on the motor block with the two screws. Make sure that the flat ribbon cable points towards the X-pulley bores (see Figure 9.15 „X-motor assembly“).
3. Put the X-gear on the motor shaft. Align the gear so that its threaded holes face the flattened side of the motor shaft. Insert the grub screws and tighten them.
4. Mount the motor block on the X-module with the two screws. Make sure that block and module are perfectly aligned before tightening the screws with a torque of 9 Nm.

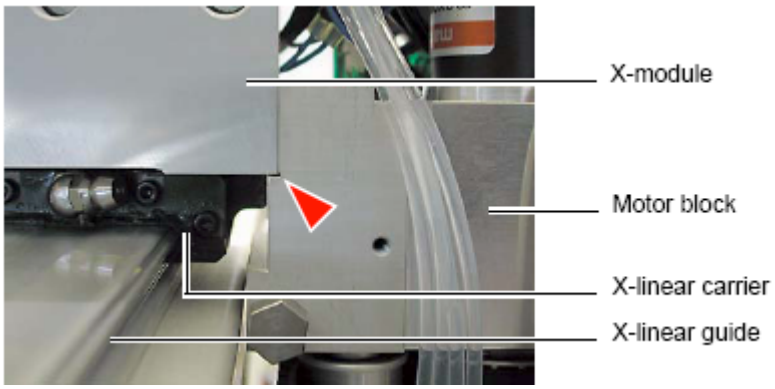


Figure 9.19 Alignment Between Motor Block and X-Module

5. Guide the X-belt around the X-gear.
6. Mount the two pulleys and the washers. Insert the screws and tighten with a torque of 9 Nm. Make sure that the washer aligns perfectly with the screw axis.
7. Insert the belt clamp in the X1-stopper and tense the X-belt by tightening the screw. Check the tension (see "Adjusting the X-Belt Tension" on page 154).
8. Mount the back support plate on the motor block with the four X-motor assembly screws.
9. Mount the pump/valve board holder(s) (arm only).
10. Mount the CAN connector board(s).
11. Assemble the MCB X-motor board (see "MCB X-Motor Board" on page 108).
12. Slide the arm carefully to and fro to check that the X-belt smoothly moves around the X-drive. Ensure that the belt is horizontal.
13. Install the arm housing (see "Arm Housing" on page 103„).

9.2.8 CAN Connector Board

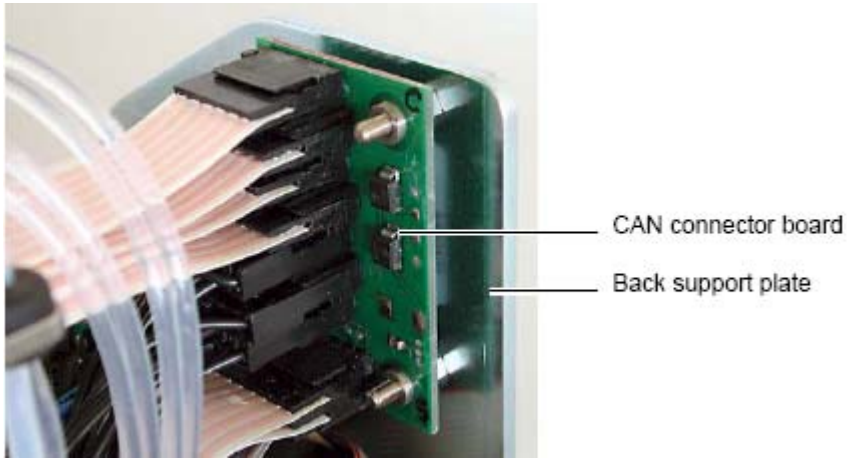


Figure 9.20 CAN Connector Board (arm)

A 4- arm houses one CAN connector board. There is one CAN connector board in the tool arm.

Required Tools

- Torx screwdriver T10

Disassembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Remove the relevant parts of the arm housing (see "Arm Housing" on page 103„).
3. Loosen the two screws on the back support plate and remove the board.
4. Disconnect the cables.

Assembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Connect the cables (the order is not important, but the orientation is).

Note: Always fully insert the cables. Ensure that the cables do not touch the moving parts of the arm.

3. Mount the board on the back support plate with the two screws.
4. Install the arm housing (see "Arm Housing" on page 103).

9.2.9 Device X-Rail

9.2.9.1 X-Belt

There is an easy way to check the tension of the X-belt. However, adjusting the belt is a major corrective action and should be done by Bruker certified personnel only (see "Adjusting the X-Belt Tension" on page 154.

9.2.9.2 X-Spacers

X-spacers (2 on each side on each arm) must be firmly tightened. A rubber pad must be attached at the front end of each spacer, facing the X-stopper.

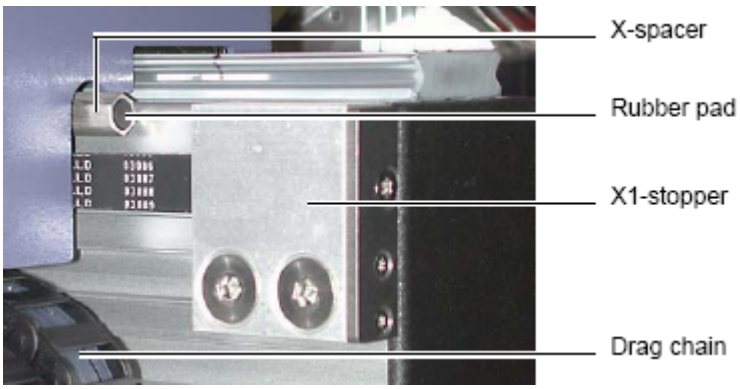


Figure 9.21 The X-Spacer and X1-Stopper

9.2.9.3 Caterpillar Drive Chain

The shape of the caterpillar drive chain must form a smooth loop without any buckles.

Figure 9.22 Caterpillar Drive Chain Perfectly Shaped

Figure 9.23 Buckled Caterpillar Drive Chain

9.2.9.4 CAN-Bus Wiring

CAN-bus wiring must be checked to ensure each wire is still securely connected.

Required tools

- Torx screwdriver T10
- Slotted screwdriver #1

Check and Corrective Action

1. Ensure that the device is switched off and the power cable is unplugged.
2. Remove the four screws of the CAN-bus cover and lift it off.
3. Check the tightness of the connection by pulling slightly at the wires. Tighten the connector screws if necessary.
4. If the module scan failed under X-Util, check the tracks on the PCB next to the black 16-pin connectors and exchange the X-rail CAN-bus connector if the tracks are damaged.

Figure 9.24 X-Rail CAN Bus Cover

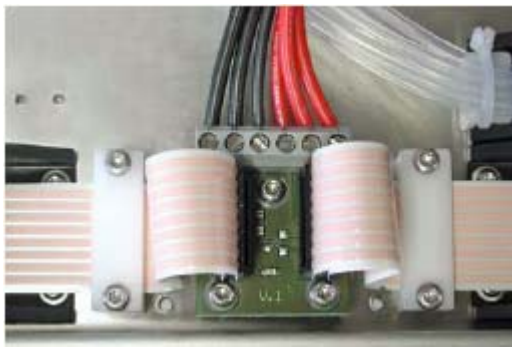


Figure 9.25 X-Rail CAN-bus Connector

5. Remount the CAN-bus cover.

9.2.9.5 Safety Door

The safety door prevents accidental contact with moving components. It must be installed whenever the device is in use. However for maintenance purposes it can be removed to access the arms and other components.

Do not forget to reinstall the safety door after maintenance has been executed!

Required tools

- Adjustable face spanner wrench (safety door tool)

Assembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Take the safety door in both hands and fasten it in position.
3. Tighten the fixing screws using the special tool supplied.

Disassembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Fasten the safety door by supporting it with an appropriate HD foam block.
3. Remove the two safety door screws using the special tool supplied.
4. Take the safety door in both hands and remove it.

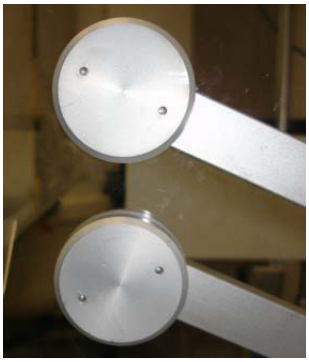


Figure 9.26 Safety door screw

Figure 9.27 Adjustable face spanner wrench

9.2.10 Y-Axis Components

9.2.10.1 YZ-Board

i Whenever an YZ-board has been exchanged, X-Util must be run to download boot loader, firmware and parameters (see "Exchanging Controller Boards" on page 158„)

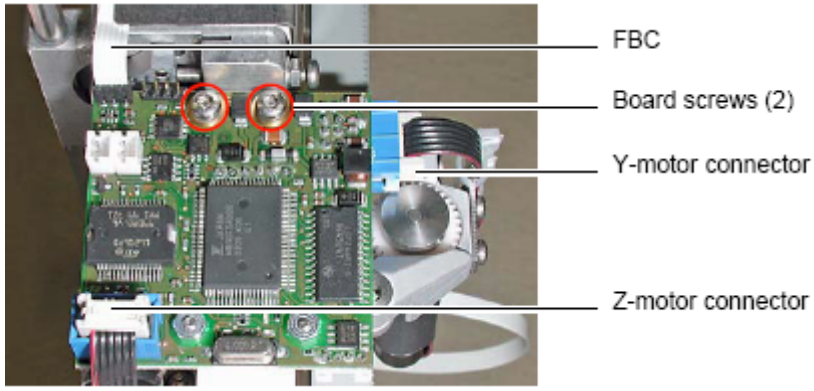


Figure 9.28 YZ-board (BB2)

Required tools

- Torx screwdrivers T8, T10, T20

Check

1. Ensure that the device is switched off and the power cable is unplugged.
2. Remove the relevant parts of the arm housing (see "Arm Housing" on page 103„).
3. Check that all connectors are fully inserted in their sockets on the YZ-board.
4. Install the arm housing (see "Arm Housing" on page 103).

Disassembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Remove the relevant parts of the arm housing (see "Arm Housing" on page 103).
3. Remove the two board screws.
4. Lift the board at the corner which is closest to the FBC connector.
5. Unplug the Z-motor connector.
6. Unplug the Y-motor connector whenever possible without removing the cable tie.
7. Turn the board over and remove the two screws of the FBC strain relief clip.
8. Unplug the CAN-bus FBC connector.

Assembly

MCB BB1 and MCB BB2 boards are different! Make sure you use the correct one!

Depending on the type of the Y-motor support used (see "Y-Motor Support" on page 206„) the channel/board allocation is different! Please refer to the two tables below.

Board MCB BBx		BB1	BB2	BB2	BB1	BB2	BB1	BB1	BB2
1-Tip Arm	Channel #	-	-	-	-	1	-	-	-
2-Tip Arm	Channel #	-	-	-	-	1	3	-	-
4-Tip Arm	Channel #	-	-	-	-	1	2	3	4
8-Tip Arm	Channel #	1	2	3	4	5	6	7	8

Table 9.3 Channel/board allocation in devices using fixed Y-motor supports

Board MCB BBx		BB2	BB1	BB1	BB2	BB2	BB1	BB1	BB2
1-Tip Arm	Channel #	1	-	-	-	-	-	-	-
2-Tip Arm	Channel #	1	2	-	-	-	-	-	-
4-Tip Arm	Channel #	1	2	3	4	-	-	-	-
8-Tip Arm	Channel #	1	2	3	4	5	6	7	8

Table 9.4 Channel/board allocation in devices using spring-loaded Y-motor supports

1. Ensure that the device is switched off and the power cable is unplugged.
2. Plug the CAN-bus FBC connector in.
3. Mount the strain-relief with the two screws and turn the board over.
4. Plug the Y-motor connector in, mount a cable tie if it has been previously removed. Do not over tighten the cable tie.

Note: Ensure that the Y-gear does not touch the Y-motor connector or the ribbon cable!

5. Plug the Z-motor connector in.
6. Install the board with the two screws and the spring rings.
7. Plug the power cable in and switch the device on.
8. Check for holding torque.
9. Start X-Util.

➨ The „Module Setup“ window will be displayed.

10. Assign board to correct module (refer to the module identification in the firmware setup).
11. Switch the device off.
12. Install the arm housing (see "Arm Housing" on page 103).

9.2.10.2 Y-Motor Assembly (spring-loaded Y-motor support)

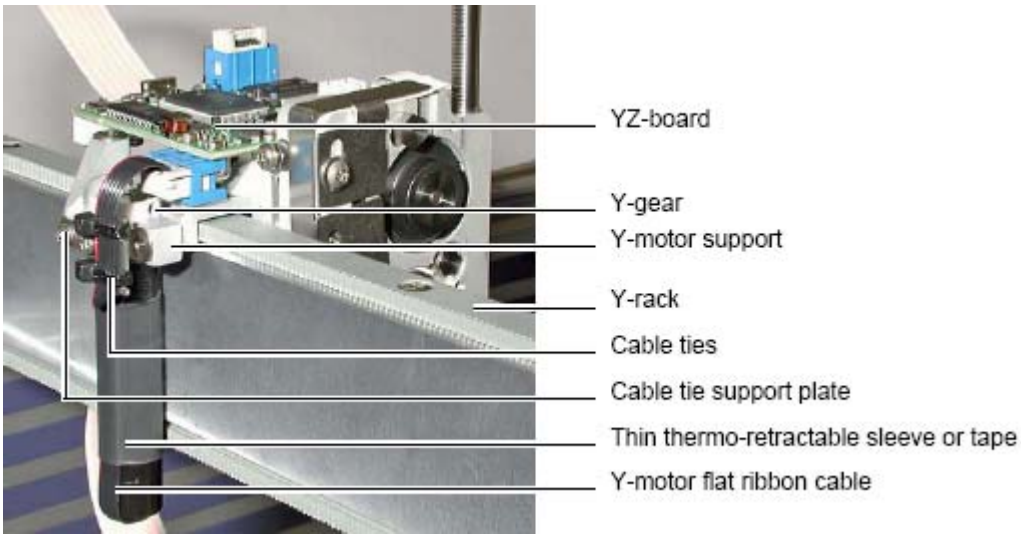


Figure 9.29 Y-motor assembly with spring-loaded Y-motor support

There are two versions of the Y-motor assembly: One using a fixed Y-motor support and another one using a spring-loaded Y-motor support (see "Y-Motor Assembly (spring-loaded Y-motor support)" on page 121 and "Y-Motor Support" on page 206„). They require appropriate slotted racks and Y-gears. Never replace a fixed Y-motor assembly with a spring-loaded one or vice versa!

Required tools

- Torx screwdriver T10

Check

1. Ensure that the device is switched off and the power cable is unplugged.
2. Remove the relevant parts of the arm housing (see "Arm Housing" on page 103).
3. Move the Y-motor slowly to and fro. Check that the movement is smooth and does not stick or grind at any points. It is normal that the gear moves very slightly while moving to and fro.
4. Check that the Y-gear and Y-rack are aligned against each other. The slotted wheel should not overhang the slotted rack or vice versa.

Corrective action

1. Disassemble the YZ-board (see "YZ-Board" on page 119.

Figure 9.30 YZ-board connectors and screws

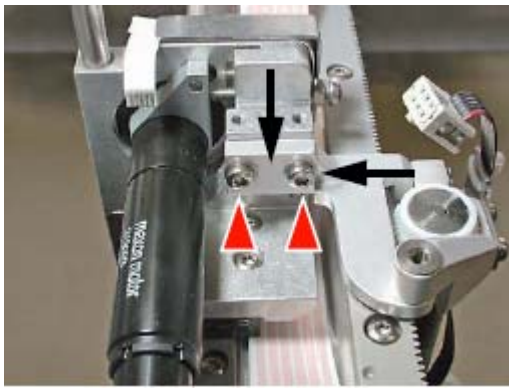


Figure 9.31 Y-motor support with mounting screws

2. Loosen the Y-motor support screws.
3. Push the Y-motor support towards the Z-motor and Y-linear guide while tightening the screws.
4. Recheck for smooth movement. If the problem still occurs, the Y-motor (or gear) may be defective, see "Y-Motor Assembly (spring-loaded Y-motor support)" on page 121„.

5. Reassemble the YZ-board, see "YZ-Board" on page 126 assembly.
6. Remove the relevant parts from the arm housing (see "Arm Housing" on page 103).

9.2.10.3 Y-Motor (spring-loaded Y-motor support)

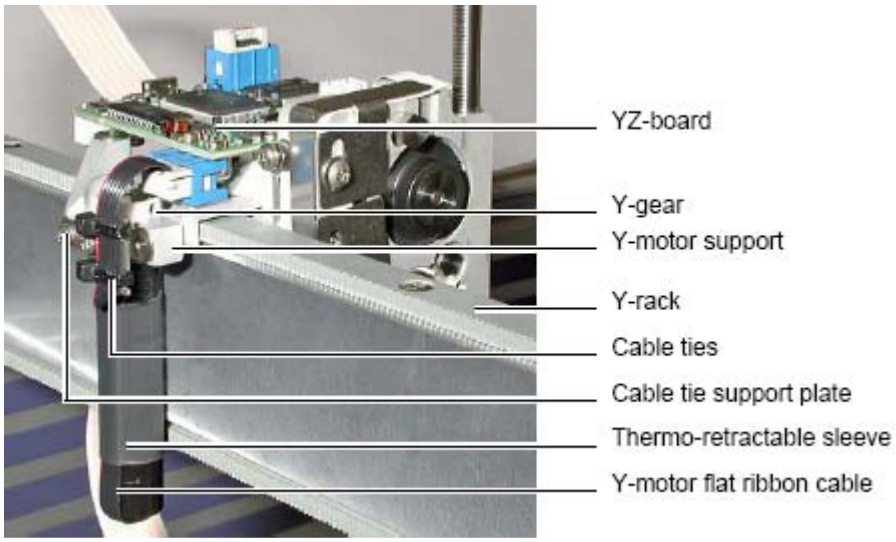


Figure 9.32 Y-motor Assembly with Spring-loaded Y-motor Support

NOTICE

Material damage due to mix-up of two versions of the Y-motor assembly

There are two versions of the Y-motor assembly available, one using a fixed Y-motor support and another one using a spring-loaded Y-motor support (see "Y-Motor Assembly (spring-loaded Y-motor support)" on page 121), mixing the versions may result in material damage.

- ▶ They require appropriate slotted racks and Y-gears.
- ▶ Never replace a fixed Y-motor assembly with a spring-loaded one or vice versa!

Required tools

- Torx screwdrivers T6, T10
- Allen wrench 1.5 mm

Disassembly

1. Ensure that the device is switched off and the power cable is unplugged.

2. Remove the relevant parts of the arm housing (see "Arm Housing" on page 103).
3. Remove the cable ties.
4. Disconnect the motor from the YZ-board.
5. Move the YZ-module to get access to the Y-gear grub screw.

Note: If the YZ-module can not be moved because of a seized Y-motor, the Y-motor support must be removed to exchange the Y-motor (see "Y-Motor (spring-loaded Y-motor support)" on page 123 - „Disassembly“).

6. Loosen the gear grub screw and remove the Y-gear from the motor shaft.
7. Remove the two screws and dismount the Y-motor.

Assembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Mount the Y-motor on its support. Make sure that the flat ribbon cable is parallel to the arm.
3. Mount the Y-gear.
4. Fasten the flat ribbon cable to the support plate with the cable ties. Do not over tighten the cable tie.
5. Connect the motor to the YZ-board.
6. Check that the Y-motor assembly can be moved smoothly along the entire Y-rack.
7. Remove the relevant parts of the arm housing (see "Arm Housing" on page 103).

9.2.10.4 Spring-Loaded Y-Motor Support

Do not dismount components of the spring-loaded Y-motor support!

Required Tools

Torx screwdrivers T6, T10

Disassembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Remove the relevant parts of the arm housing (see "Arm Housing" on page 103).
3. Disassemble the YZ-board (see "YZ-Board" on page 126 - „Disassembly“).

Figure 9.33 YZ-board connectors and screws

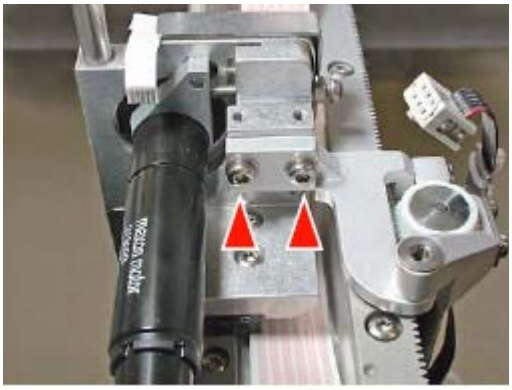


Figure 9.34 Y-motor support with mounting screws

4. Loosen the Y-motor support screws.
5. Remove the Y-motor support.

Assembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Mount the Y-motor support. Insert the two screws but do not tighten them yet.
3. Press the Y-motor assembly against the Z-hub-module in the direction indicated by the arrows.
   - Keep the vertical and horizontal gaps between Y-motor support and Z-hub module as small as possible:

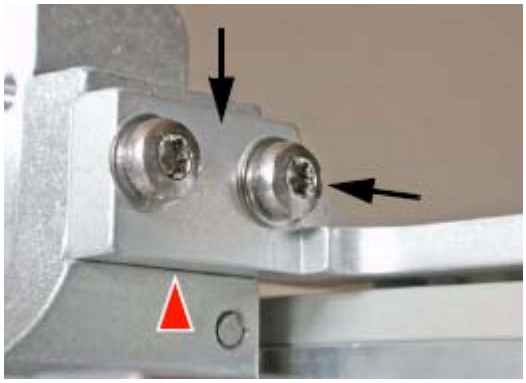


Figure 9.35 Vertical gap between Y-motor support and Z-hub-module

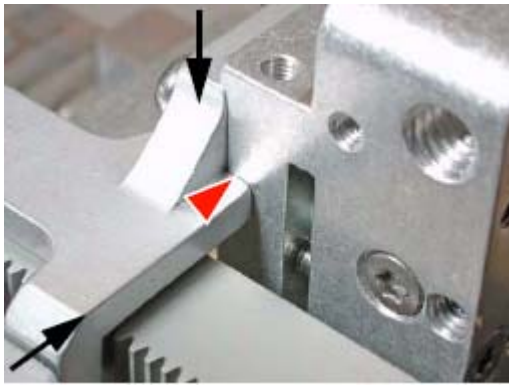


Figure 9.36 Horizontal gap between Y-motor support and Z-hub-module

4. Tighten the screws.
5. Assemble the YZ-board (see "YZ-Board" on page 119).
6. Install the arm housing (see "Arm Housing" on page 103).

9.2.10.5 YZ-Module

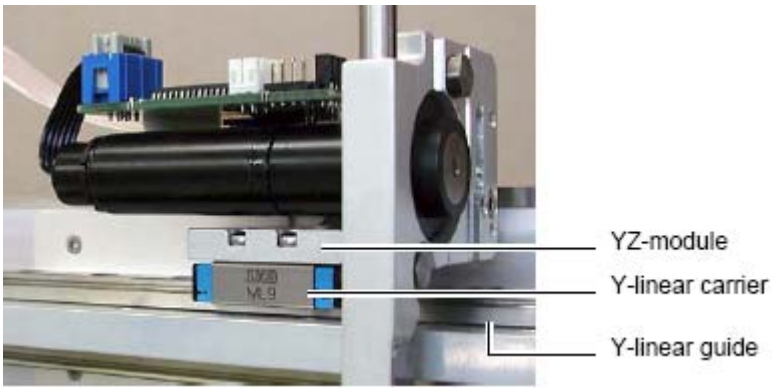


Figure 9.37 YZ-Module

Disassembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Remove the relevant parts of the arm housing (see "Arm Housing" on page 103).
3. Disassemble the YZ-board (see "YZ-Board" on page 119).
4. Disassemble the Z-motor (see "Z-Motor" on page 129).
5. Remove the screws, securing the YZ-module on the Y-linear carrier.

i Never remove the Y-linear carrier from the linear guide!

Assembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Mount the screws to fasten the YZ-module on the Y-linear carrier.
3. Assemble the Z-motor (see "Z-Motor" on page 129).
4. Assemble the YZ-board (see "YZ-Board" on page 126).
5. Install the arm housing (see "Arm Housing" on page 103).

9.2.11 Z-Axis Components

9.2.11.1 YZ-Board

This component is described in "YZ-Board" on page 119.

9.2.11.2 Z-Motor Assembly

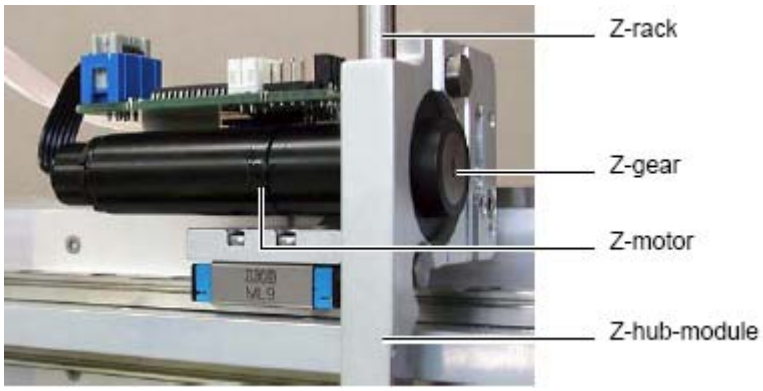


Figure 9.38 Z-Motor Assembly Side View

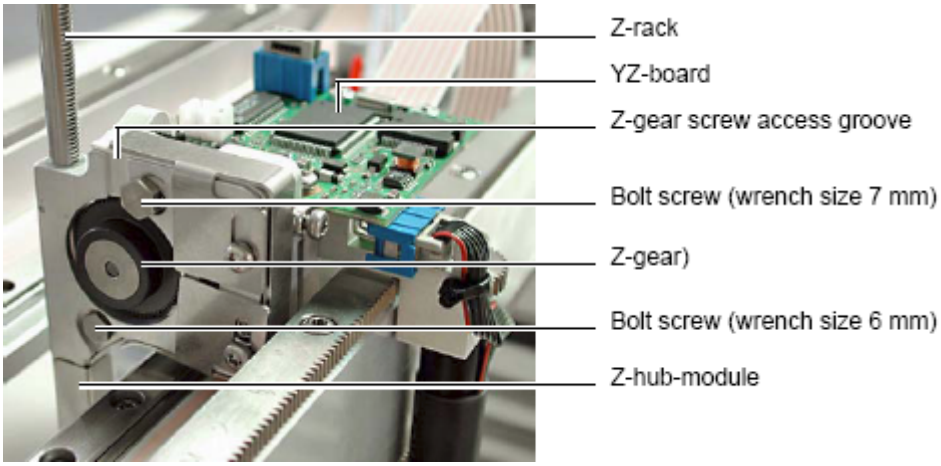


Figure 9.39 Z-Motor Assembly Overview

Required Tools

- Torx screwdriver T8
- Socket wrench 6 mm (thin wall) and 7 mm

Disassembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Remove the relevant parts of the arm housing (see "Arm Housing" on page 103).
3. Remove the object detector, tubing, liquid level detector assembly and Z-rack.
4. Disassemble the YZ-board (see "YZ-Board" on page 119).

5. Remove the two bolt screws. Use a socket wrench with extension and hold it parallel to the Y-axis.
6. Remove the Z-motor assembly by swinging it horizontally towards the center of the arm while pulling it either up or down depending on the arm configuration.

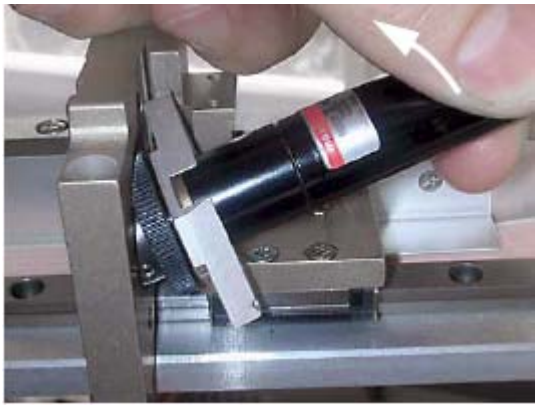


Figure 9.40 Removing the Z-Motor Assembly

Assembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Install the Z-motor assembly by swinging it horizontally from the center of the arm, while moving it either up or down, depending on the arm configuration.
3. Insert the smaller of the bolt screws (wrench size 6 mm thin wall) and tighten it slightly.
4. In the bore of the larger bolt screw (wrench size 7 mm) there is a spring-loaded pin which generates the contact pressure of the Z-gear against the Z-rack. Push the pin back using a tiny screwdriver while inserting the bolt screw.

Note: The larger bolt screw is located close to the groove of the Z-hub-module.

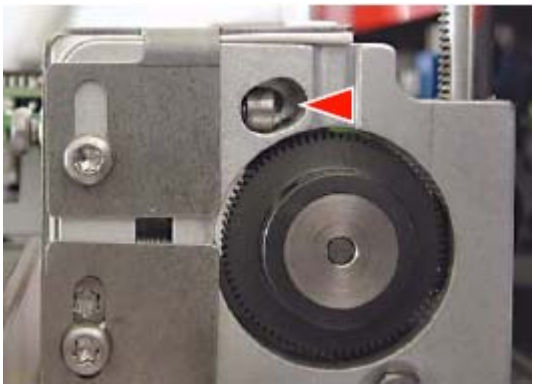


Figure 9.41 Spring-loaded Pin

5. Tighten the bolt screws.
6. Reassemble the YZ-board (see "YZ-Board" on page 126).
7. Install the Z-rack, liquid level detector assembly, tubing and object detector.
8. Install the arm housing (see "Arm Housing" on page 103).

9.2.11.3 Z-Motor

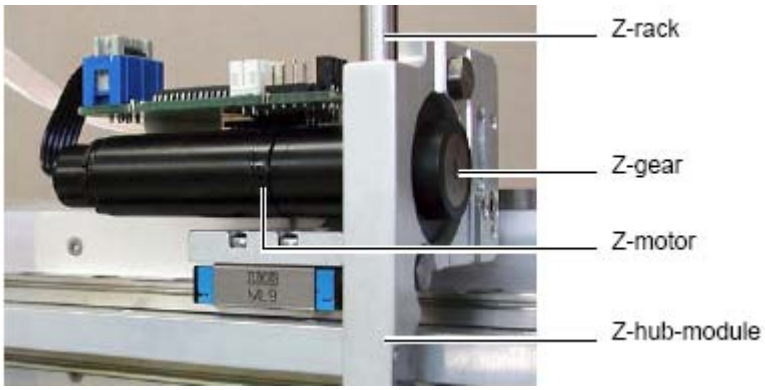


Figure 9.42 Z-motor Assembly Side View

Dismounting a blocked motor on the basis of the following description is possible only when the Z-gear screw is facing the Z-hub-module groove. Otherwise the complete Z-motor assembly must be removed (see "Z-Motor Assembly" on page 127„) to dismount the Z-motor.

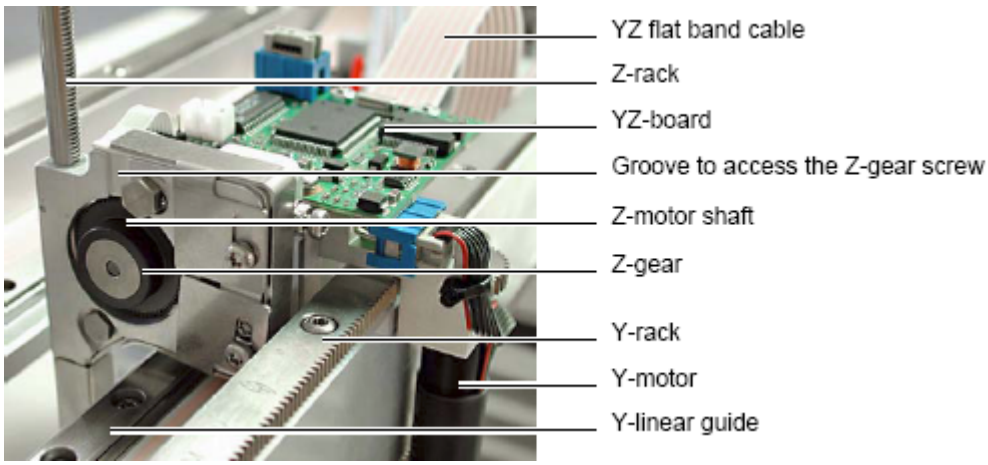


Figure 9.43 YZ-Assembly Overview

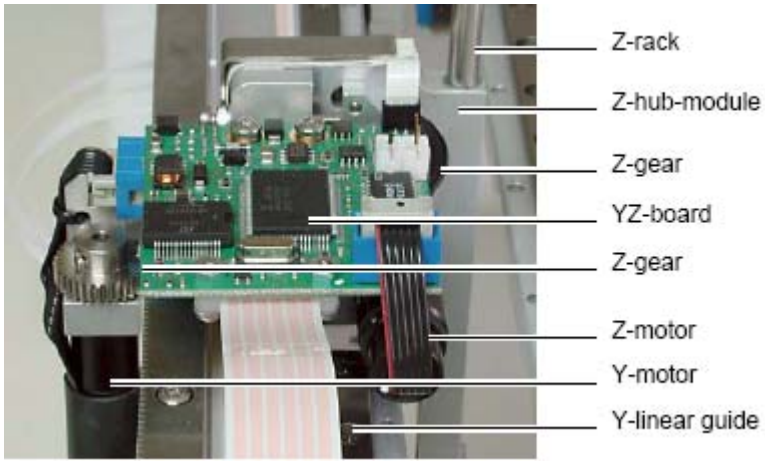


Figure 9.44 YZ-Assembly Overview

Required tools

- Torx screwdrivers T6, T8, T10, T20
- Flat pliers

Disassembly

1. Back flush the pipetting tubing.
2. Ensure that the device is switched off and the power cable is unplugged.
3. Remove the relevant parts of the arm housing (see "Arm Housing" on page 103).
4. Disconnect the Z-motor from the YZ-board.
5. Remove the object detector and pull the tubing out the Z-rack.
6. Carefully move the Z-rack up or down until the Z-gear screw is facing the groove of the Z-hub module.
7. Loosen the screw and remove the Z-gear while holding the Z-rack to prevent that it glides through the Z-hub module (putting stress on the flat band cable).
8. Pull out the Z-rack with the liquid level detector assembly.
9. Dismount the motor from the Z-motor support plate.

Assembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Insert the motor into the Z-motor support plate.
3. Position the motor so that the socket side of the connector faces the corresponding YZ-board.
4. Fasten the motor with the two screws.

5. Connect the Z-motor to the YZ-board.
6. Carefully turn the motor shaft with flat pliers until the bore is facing the groove of the Z-hub-module.
7. Put the gear on the motor shaft.
8. Position the gear so that its threaded hole faces the notch in the motor shaft.
9. Insert the screw into the Z-gear and tighten.
10. Carefully insert the Z-rack with the liquid level detector assembly.
11. Insert the tubing in the Z-rack and install the object detector, see "Object Detector" on page 134.
12. Install the arm housing (see "Arm Housing" on page 103).
13. Plug in the power cable and switch the device on.
14. Flush the system.

9.2.12 Arm Alignment Check

The arm glides on the X-rail located at the top rear of the device. It supports the Z-axes and integrates all the necessary components Y and Z motors and their electronics.

Manufacturing and assembly of the robot frame and arms are performed according to very strict procedures and tolerances. Before delivery all devices must pass the quality control where the perfect arm alignment is checked. The arm must be adjusted within a tolerance of +/- 0.5 mm over the whole of the deck working area.

The packing procedure provides sufficient protection to the device under normal transport conditions. However, Bruker strongly advises checking the parallelism after transportation before proceeding with the installation. The arm alignment can be easily checked by moving an object detector manually to and fro, checking the distance between object detector end and top side of the deck.

Check

1. Ensure that the device is switched off and the power cable is unplugged.
2. Remove all racks.
3. Move the arm manually to the left hand side (home position) of the device and carefully slide the object detector to its upper-most position in the back.
4. Lower the object detector until it‘s end nearly touches the deck. Measure the distance between object detector end and deck surface.
5. Slide the object detector slowly towards the front of the device and check the distance between object detector end and deck surface, it should be within a tolerance of 0.5 mm.

➨ When the distance is outside the acceptable tolerance, refer to "Arm Alignment" on page 171.

6. Repeat the alignment check at the right hand side of the device.

9.2.13 Pickup Adapter

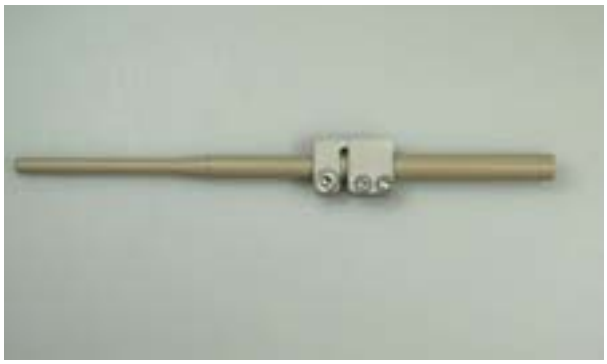


Figure 9.45 Pickup Adapter Assembly: PEEK Tube with Clamp Part

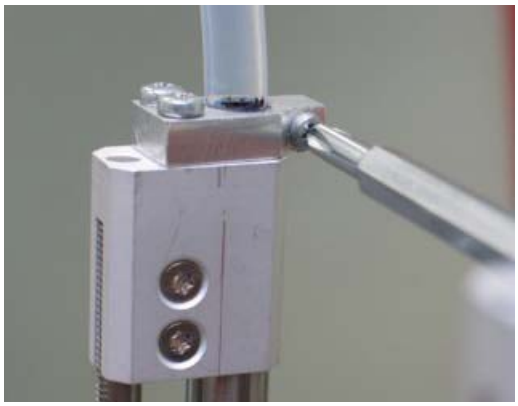
Required Tools

- Torx screwdriver T10 an T15

Disassembly

1. Loosen the two Torx screws T10, that fasten the pickup adapter on the Z device tube.

Figure 9.46 Disassembly of the Pickup Adapter



2. Loosen the hose fixation screw on the top of the YZ device.

Figure 9.47 Hose Fixation

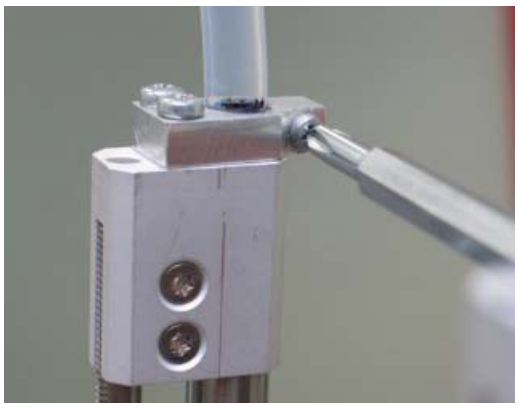
3. Move the pickup adapter together with the hose down to the deck plate. Remove the hose from the pickup adapter.

Assembly

1. Check that the clamp part is fixed on the pickup adapter. Otherwise move the clamp part until the edge on the pickup adapter and fasten it with the Torx screw T15

Figure 9.48 Fasten the Clamp Part on the PEEK Adapter

2. Loosen the hose fixation screw on the top of the YZ device.
3. Move the robot transfer hose from the top down through the holder tube approximately 300 mm.
4. Insert the lower part of the hose into the pickup adapter until you feel the resistance on the edge inside the adapter.
5. Move the pickup adapter together with the robot transfer hose upwards by gripping only the pickup adapter.
6. Move the pickup adapter up into the holder tube until the end stop at the clamp between the upper two screws and the lower screw.
7. Fasten the pickup adapter with the two Torx T10 screws on the Z device tube. The clamp must be parallel to the barcode reader device so that there is never a contact between the two YZ devices when moving them up and down.



8. Fasten the robot transfer hose with the screw on the top of the YZ device.

9. Perform a teaching of the pickup adapter (see also "Teaching the Pickup Adapter" on page 84) and perform action tests (see also "Robot System Device Test" on page 91) to check correct transportation of the rotor.

9.2.14 Object Detector

The object detector is used to detect the presence of a rotor or of a rotor container and to open or close the rotor container. See also the drawing HZ16890_C "Object Detector HZ16890_C" on page 217.

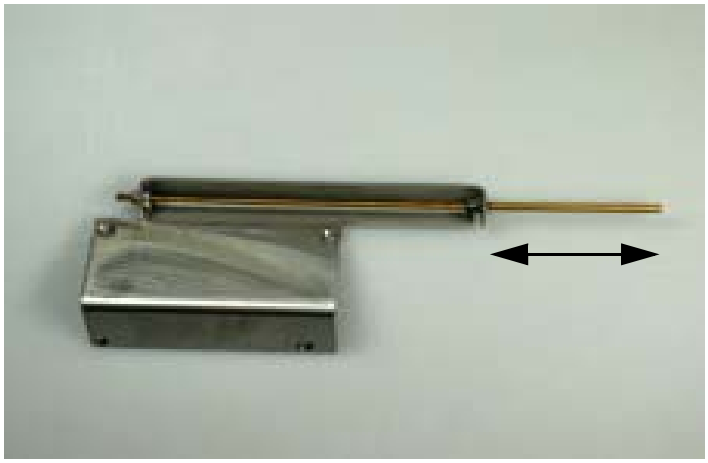


Figure 9.49 Length of the Detection Finger on the Right Side of the Object Detector

Required Tools

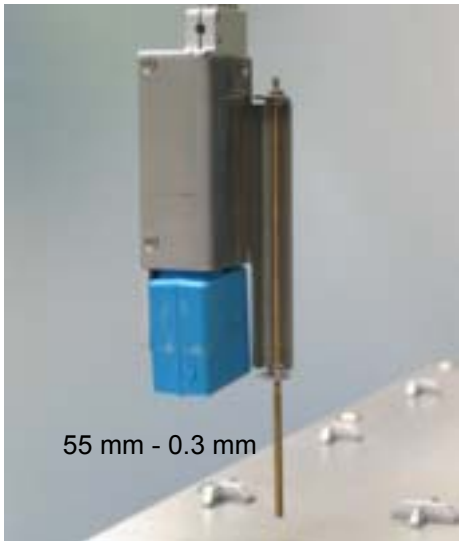
- Torx screwdriver T 8
- Wrench 5.5 mm
- Open end wrench 5.5 mm

Disassembly

1. Loosen the four Torx screws T 8 of the cover plate above the barcode reader and remove the object detector.

2. When only the detection finger is changed, take care that all four screw nuts for fixation are placed exactly at the same position!

Assembly



1. Check the length of the detection finger on the bottom side, it should be 55 mm - 0.3 mm.
2. Check that both nuts that fasten the finger at the top of the cover plate are tight.
3. Mount the cover plate with the object detector above the barcode reader using the four Torx screws T 8.

4. Perform a teaching of the pickup adapter (see "Teaching the Pickup Adapter" on page 84) and perform action tests (see "Teaching the Rotor Detection Position" on page 85) to check correct detection of the rotor and movement of the cover plate to open and close the rotor container.

9.2.15 Barcode Reader

The barcode reader can optionally be used to read the type and ID of the rotor container.

Required Tools

- Torx screwdriver T 8

Disassembly

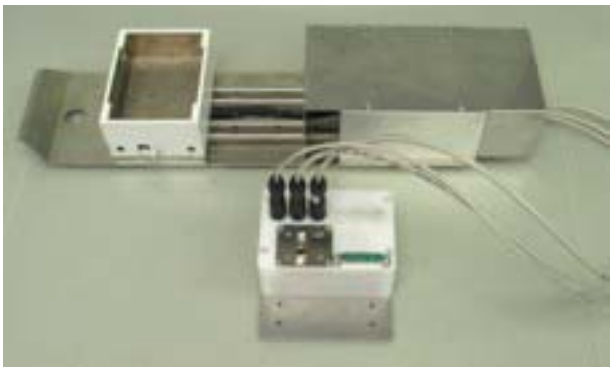
1. Remove the two Torx screws T 8 to remove the barcode reader. In the picture the cover plate with the object detector is removed, but this is not obligatory if the barcode cable is long enough to remove it even if the cover plate is mounted.

2. Remove the cable from the barcode reader.

Assembly

1. Perform the disassembly procedure in the opposite order.
2. Perform a teaching of the barcode reader position (see "Teaching the Barcode Reader Position" on page 87).
3. Perform action tests (see "Teaching the Rotor Detection Position" on page 85) to check for the correct reading of the rotor container barcode (when using the cooling rack the isolation cover must be placed on the container for testing.

9.2.16 Cooling Rack



Required Tools

- Torx screwdriver T 15

Disassembly

1. Switch OFF the main power of the SamplePro hr-MAS device.

2. Remove the 3 cable connectors for the cooling rack from the control unit box.

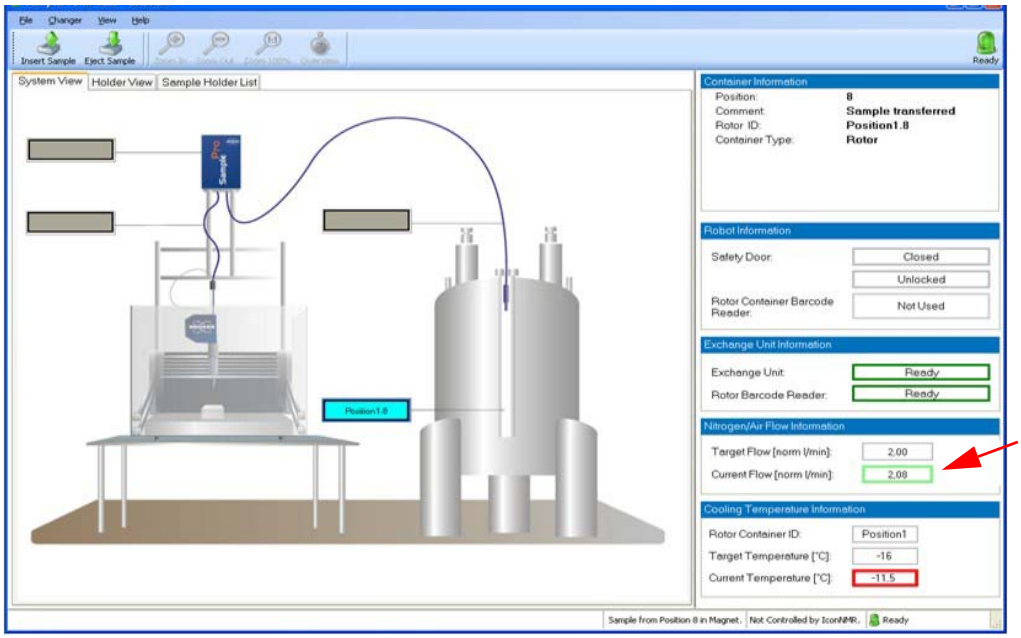
   The cable connectors are labeled with R1, R2, FAN.
3. Remove the 2 CAN bus loop connectors from the control unit box.

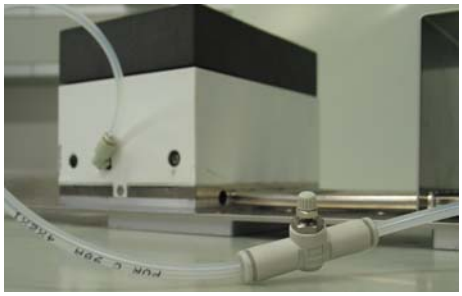
4. Remove the nitrogen flow hose on the cooling rack (push the metallic ring on the hose into the adapter before removing the hose).

5. Remove the cooling rack from the deck tray.

Assembly

1. Perform the disassembly procedure in the opposite order.
2. Open the application program and check the current nitrogen flow on the right side of the main window.





3. If the current flow is not near the target flow (frame of the value field is not green) adjust the flow at the flow control valve.

4. Check if the cooling temperature value in the main window is changing into the direction of the target temperature value. It may take several hours until the tolerance range of a very low target temperature is reached.
5. Perform an overnight long time action loop test (see "Robot System Device Test" on page 91) to check a stable cooling temperature of the rotor container even when rotors are transferred (the sleeping time of the loop test should correspond with the spectrometer experiment measurement time).

9.2.17 Nitrogen Flow Sensor

The nitrogen flow sensor measures the current nitrogen flow and reports the analog value to the I/O board under the deck tray.

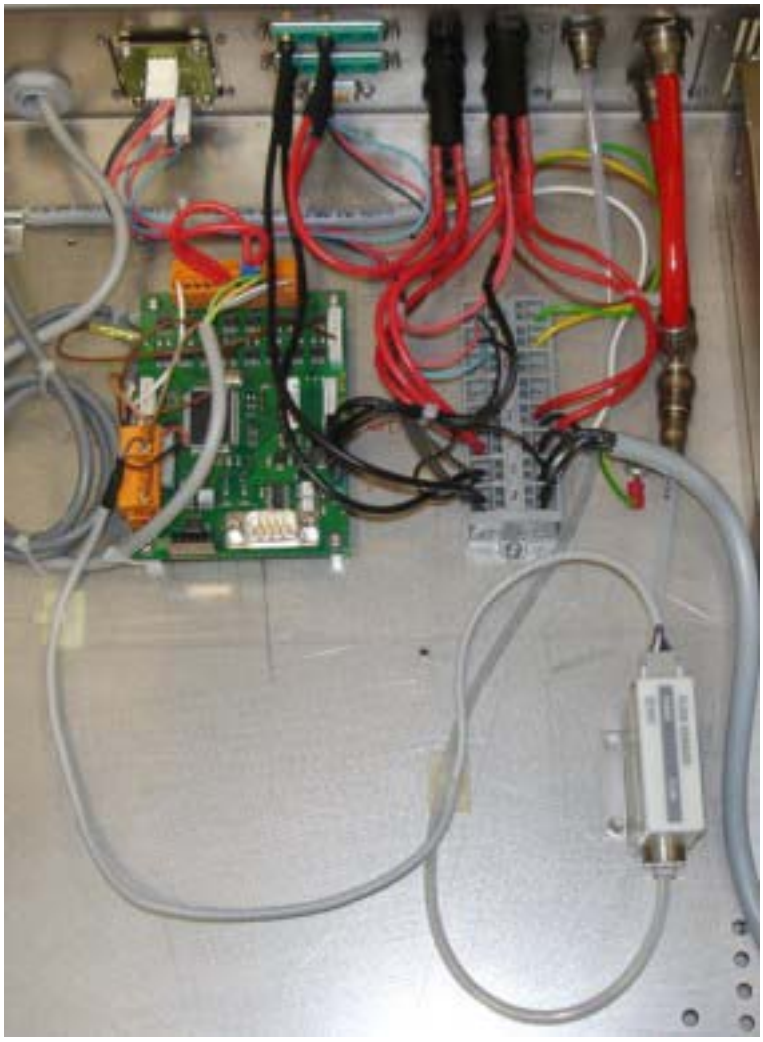
Figure 9.50 Nitrogen Flow Sensor

Required Tools

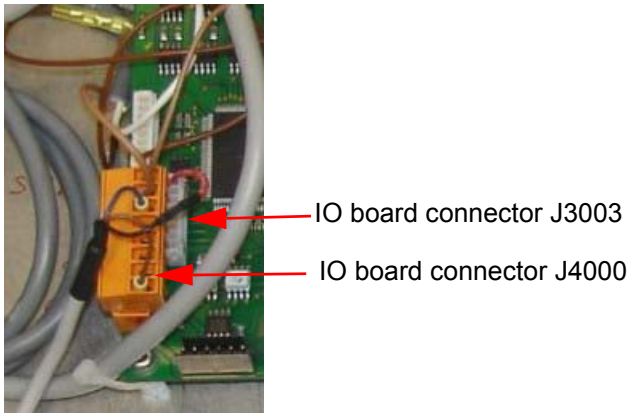
- Torx screwdriver T 20 and T 15

Disassembly

1. Switch OFF the main power of the HR MAS SamplePro device.
2. Remove the nitrogen flow hose on the cooling rack.
3. Remove the cooling rack from the deck tray (see "Cooling Rack" on page 137).
4. Remove the 16 Torx screws T 20 from the deck tray plate and remove the plate.



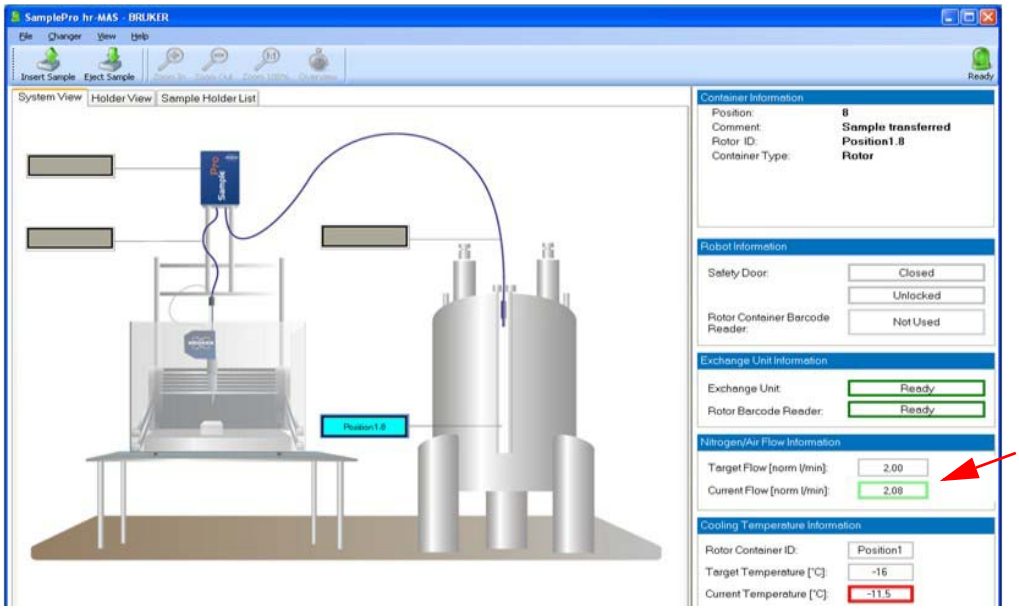
5. Remove the screws T 15 that fasten the nitrogen gas flow sensor on the bottom plate.
6. Remove the nitrogen flow hose at the sensor.
7. Remove the 3 sensor cable connectors from the IO board.

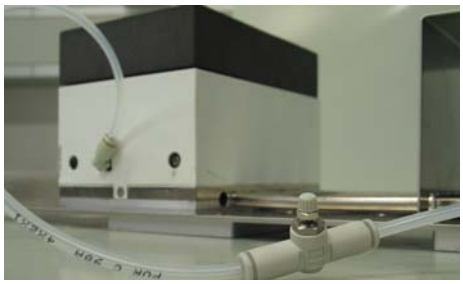


8. Remove the sensor.

Assembly

1. Perform the disassembly procedure in the opposite order connecting the 3 sensor cables to the IO board in the following way:
   - Sensor cable brown to IO board connector J4000, Pin 1 (24V)
   - Sensor cable blue to IO board connector J4000, Pin 6 (GND)
   - Sensor cable black to IO board connector J3003, Pin 1 (analog signal)
2. Open the application program and check the current nitrogen flow on the right side of the main window.





3. If the current flow is not near the target flow (frame of the value field is not green) adjust the flow at the flow control valve.

9.2.18 Checking the Nitrogen Flow Sensor Connection and Settings

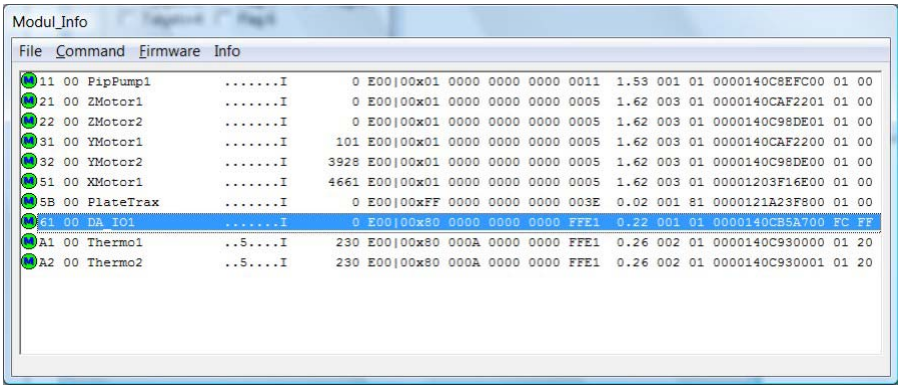
When the target flow can not be adjusted, this is an indication that the Flow Sensor Module is not correctly configured. Follow the steps in this section to correct this problem.

Important Note: **Stop the SamplePro hr-MAS Software** before you check the flow sensor connection settings!

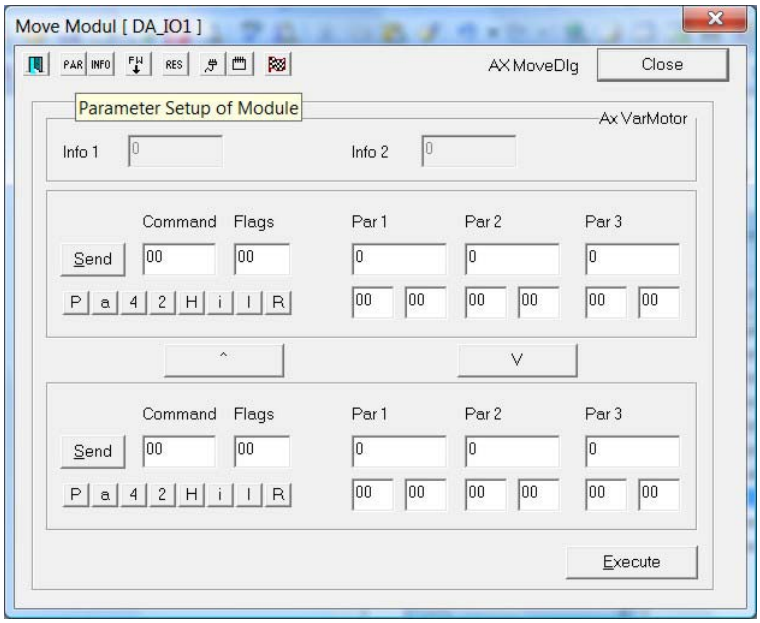
1. Cable connections on IO board

Sensor	**I/O board „61“**		
brown	**J4000 pin 1**	**24V**	
blue	**J4000 pin 6**	**GND**	
black	**J3003 pin 1**	**analog input**	**= Port60**

2. Start the program Sias XUtil.exe from the Desktop
3. Select Module DA_IO1



4. Select Toolbar Button „PAR“



5. Check the parameter settings in section „DA_IO1.03“.

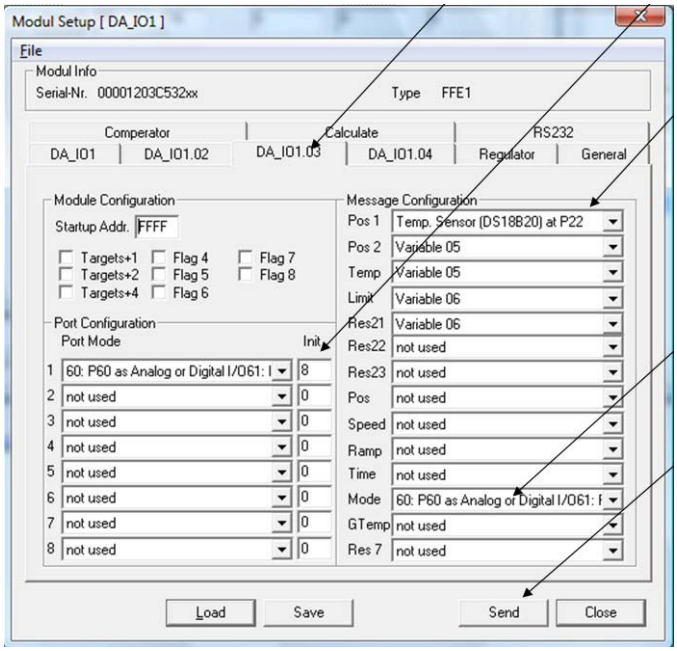


Figure 9.51 Module Settings in DA_IO1.03: Init= 8 (setting as analog input)

6. Press the „Send“ button after modifications!

9.2.19 Door Lock Actor

The door lock actor is blocking the closed safety door during movements of the robot.

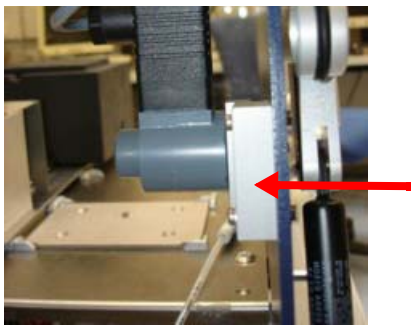
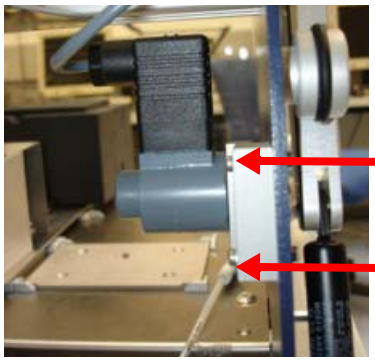


Figure 9.52 The Door Lock Actor

Required Tools

- Torx screwdriver T 20 and T10
- Flat wrench 5.5 mm

Disassembly:



1. Remove the rear cover plate.
2. Remove the two Torx screws T 10 using the flat wrench 5.5 mm to remove the door lock actor and the door open sensor.
3. Remove the cable from the bottom of the back plate.

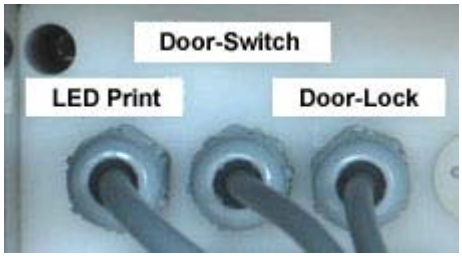


Figure 9.53 Back Plate Cables

Assembly

Perform the assembly procedure in the opposite order as the disassembly procedure above.

9.2.20 Door Open Sensor

The door open sensor is a switch to tell the software if the door is opened or closed.

Figure 9.54 Door Open Sensor

Required Tools

- Torx screwdriver T 20 and T10
- Wrench 5.5 mm

Disassembly:

1. Remove the rear cover plate.
2. Remove the two Torx screws T 10 using the wrench 5.5 mm to remove the door lock actor and the door open sensor (see Figure 9.54).
3. Remove the cable from the back plate at the bottom (see Figure 9.53).

Assembly

1. Perform the assembly procedure in the opposite order as the disassembly procedure above.
2. Check the sensor status in the main view when starting the program.

9.2.21 Status Light Board

The status light shows the current status of the software.

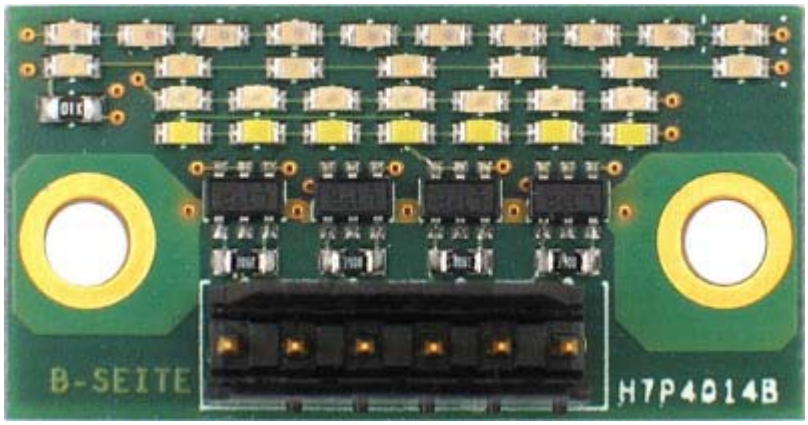
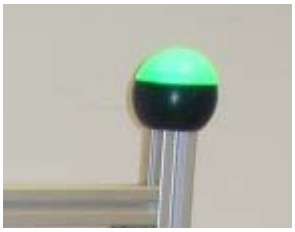


Figure 9.55 Status Light Board

Required Tools

- Cross-tip screwdriver

Disassembly:



1. Remove the upper plastic part of the status lamp by stripping it upwards to the top (use a screwdriver to loosen it from the lower plastic part).
2. Remove the two screws using the cross-tip screwdriver to remove the board.
3. Remove the cable from the board.

9.3 Exchange Unit Malfunctions

In case of malfunction, especially with the sensors and valves, first check the connections to the main board. This type of error is not typical but quite possible on a unit with moving elements.

9.3.1 Light Barrier

Light Barrier Failure: Light Barrier always Detects a Rotor.

Cause: Dust or dirt coming from the atmosphere.

1. Remove the transfer hose on the source side.
2. Open the FEU test dialog and switch on the BlowDown and the lower valve.
3. Use a Q-Tip swab and drill up and down into the hose connection until the service application software shows you that the sensor changes its state.

10 Service - Major Corrective Actions

The modular design of the robotic system allows the removal of individual modules for factory service by Bruker service engineers. Unauthorized personnel should never attempt major corrective action.

After completing any action, it is important to perform the corresponding verification (see "Verification and Calibration" on page 83) before running a significant test run with X-Util or another application. Only then the device can put into operation again. If there is any doubt, please contact Bruker for advice or assistance.

NOTICE

Material damage hazard due to improper maintenance.

Device deadlock may occur as a result of failures due to a lack of proper maintenance.

- ▶ Maintenance intervals must be properly followed.
- ▶ Use appropriate tools to avoid damaging parts or modules.
- ▶ Only trained personnel should carry out maintenance work.

⚠ WARNING

Danger to life from electrical shock!

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

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

⚠ CAUTION

Accident hazard from contact with hot or cold surfaces on the unit.

Contact with the hot or cold surfaces of the unit may result in serious burns.

- ▶ Do not touch device parts of cooled or heated units.
- ▶ Do not use damaged samples.
- ▶ Remove tips and all racks and accessories from the work surface before coming in contact.

Whenever screws have been loosened or removed for corrective action, they must be cleaned and locked again with Loctite® 243 (liquid) or Loctite® 248 (gel stick) unless otherwise stated (see "Securing Screws" on page 100).

The safety door and arm covers must be removed before any maintenance or service on components in the arm can be performed. Detailed descriptions can be found in the section "Arm Cover" on page 104 and "Safety Door" on page 118.

10.1 Replacing the Power Supply Unit

The power supply unit (PSU) is situated under the deck cover plate.

⚠ 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.

Required tools

- Torx screwdriver T10, T20
- Slotted screwdriver #2
- Soft mat or blanket

Disassembly

Depending on the version, the deck cover plate is mounted either with:

- screws and separate countersink washers, or,
- with screws with integrated washers (ecofix® screws).

1. Ensure that the device is switched off and the power cable is unplugged.
2. Remove all racks, plates, modules, etc. located on the deck.
3. Remove all screws (14) from the deck cover plate.

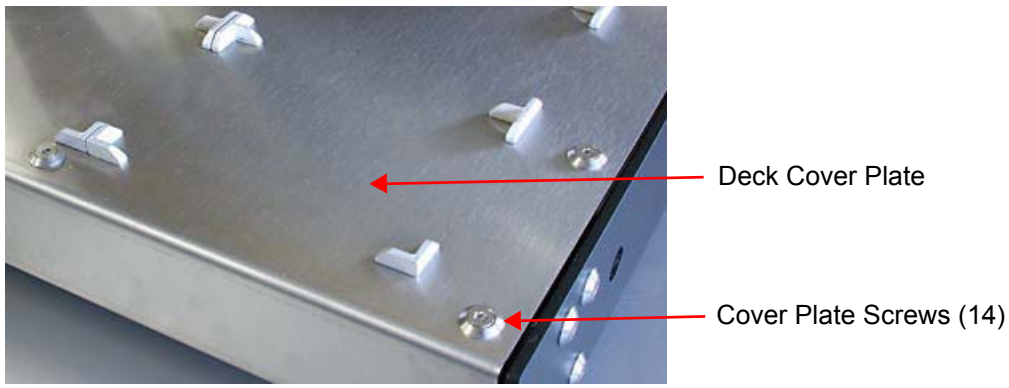


Figure 10.1 Cover Plate Screws

4. Remove the deck cover plate.

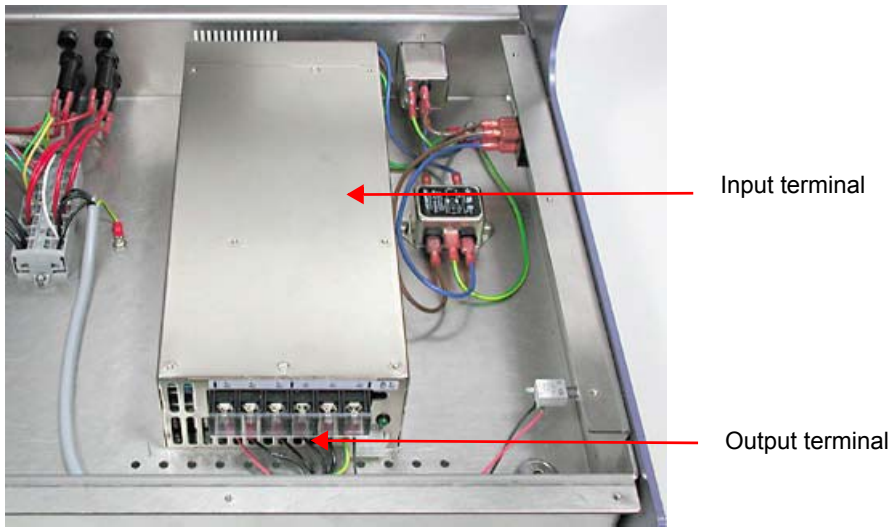


Figure 10.2 PSU Input and oUtput Terminals

5. Note the PSU pin assignment of the input and output terminals prior to disconnecting
6. Ensure that there is ample of free space behind the robot. Place a soft mat or a blanket behind the device. Move the arm to the center of the X-rail.

Note: The following steps require 2 people!

---

7. Grab the robot on both sides of the support panels underneath the deck, tilt it gently backwards and place the rear side of the unit on the soft mat. Don‘t jar the unit!

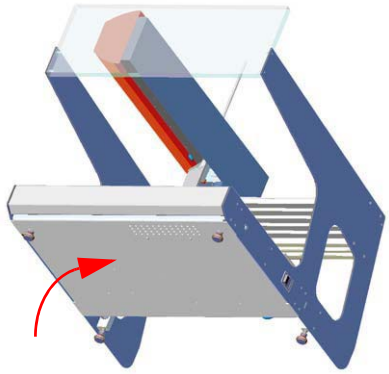


Figure 10.3 Tilting the Robot

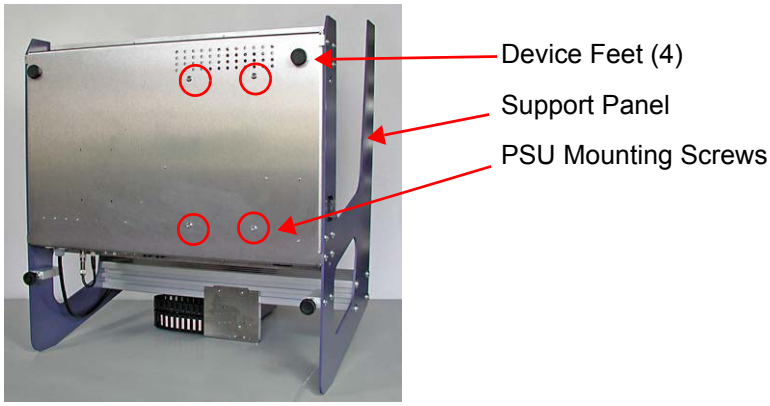


Figure 10.4 Location of the PSU Mounting Screws

8. Remove the four PSU mounting screws on the bottom plate. Ensure that the PSU remains at its place (support the PSU manually if necessary).
9. Grab the robot on both sides of the support panels underneath the deck, tilt it gently forward onto its feet. Do not jar the unit!
10. Disconnect all wires from the input and output terminals.
11. Remove the PSU.

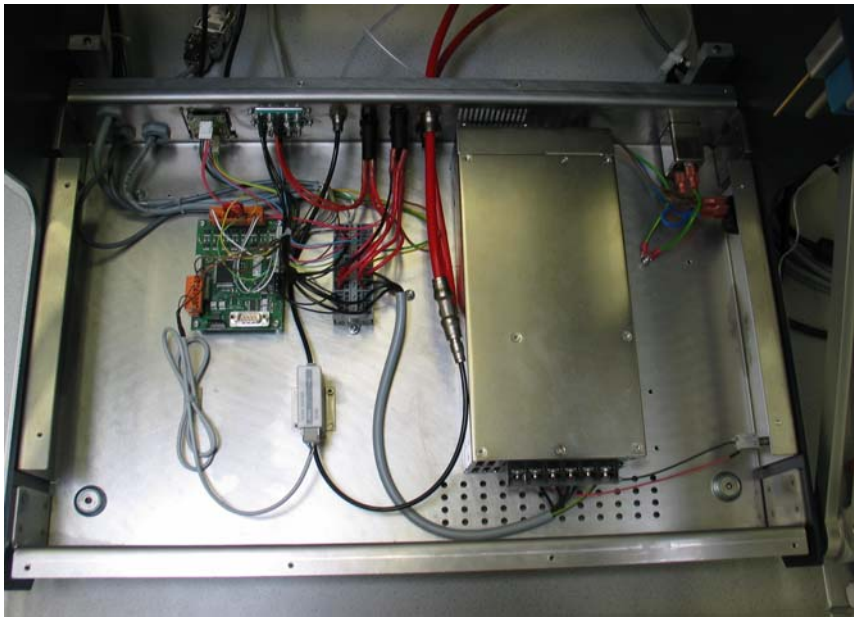


Figure 10.5 PSU on the Right Side

Assembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Position the PSU on the bottom plate.
3. Connect the wires to the input and output terminals according to the previously acquired pin assignment.
4. Ensure that there is ample of free space behind the robot. Place a soft mat or a blanket behind the device. Move the arm to the center of the X-rail.

---

i Note: The following steps require 2 people!

---

5. Grab the robot on both sides of the support panels underneath the deck, tilt it gently backwards and park its back side on the soft mat. Ensure that the PSU remains at its place (support PSU manually if necessary). Do not jar the unit!
6. Fasten the PSU on the bottom plate with four screws.
7. Grab the robot on both sides of the support panels underneath the deck, tilt it gently back on its feet. Do not jar the unit!
8. Mount the deck cover plate with the fourteen screws.

10.2 Adjusting the X-Belt Tension

The X-belt is a slotted belt along the X-rail, used by the X-drive to move the arm to and fro. Whenever the belt is dismounted (e.g. for the inspection of the X-gear) the tension of the belt should be rechecked.

i Note: Incorrect belt tension results in inaccurate X-positioning. With insufficient belt tension, the system might vibrate when idle or make a high pitch noise during initialization. With too much tension, the X-motor bearing assembly could be damaged.

10.2.1 Mechanical Principle of the X-Drive

The X-motor runs along the slotted belt (X-belt), which is held around the motor gear by two counter pulleys, giving the belt an Omega (Ω) shape.

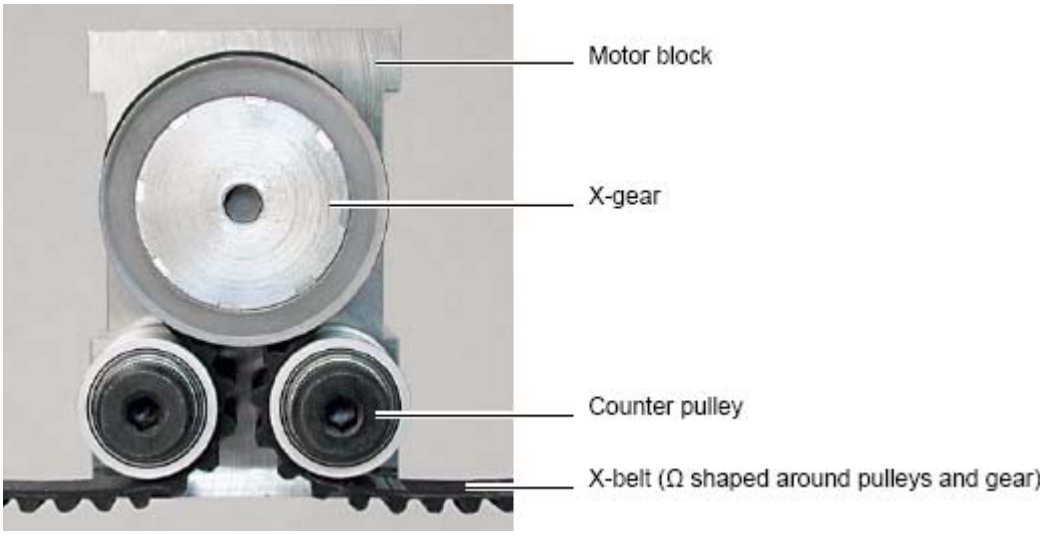


Figure 10.6 X-Spacer and X1-Stopper

The correct setting of the X-belt tension ensures that no drift or tooth skip occurs. It also affects the positioning precision of the arms.

i Note: If you check the tension after the device has been idle for a couple of days, the X-belt keeps the Ω shape caused by the X-motor gear and counter pulleys (memory effect). This phenomenon temporarily increases the belt tension. In order to eliminate this effect, first manually move the arms along the X-rail several times.

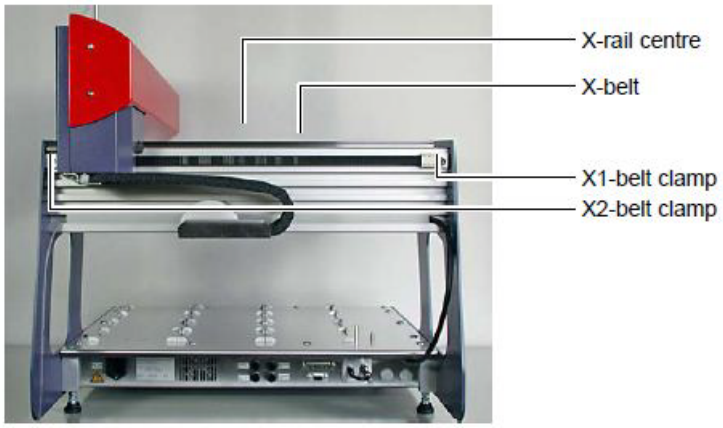
10.2.2 Checking the Tension of the X-Belt

Required Tools

- 2.5 kg precision spring-loaded scale
- 20 cm precision metal rule
- Torx screwdriver T20
- Allen wrench 5 mm

Procedure

1. Ensure that the device is switched off and the power cable is unplugged.
2. Move the arm opposite of its home position.



3. Hook the spring-loaded scale to the center of the X-belt.

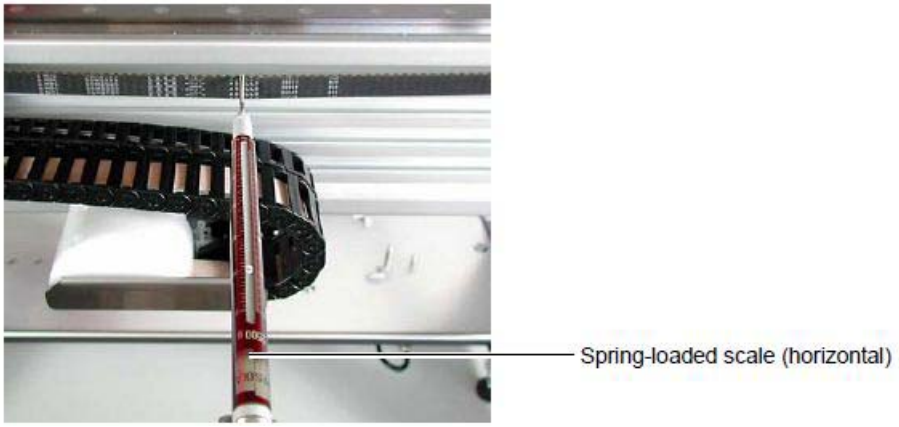


Figure 10.7 X-Belt Measurement Setup

4. Pull the spring loaded scale horizontally applying a load of 500 grams.

Figure 10.8 Spring-Loaded Scale Indicator

5. Measure the deflection of the X-belt with a metal ruler, while pulling on the spring-loaded scale.

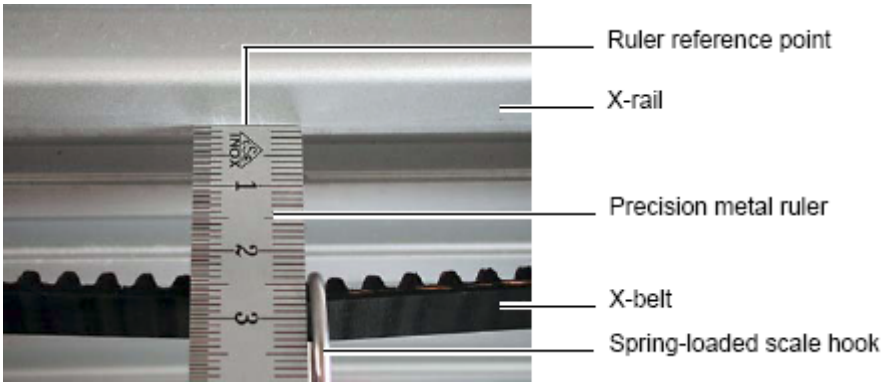


Figure 10.9 Measuring the X-Belt Tension

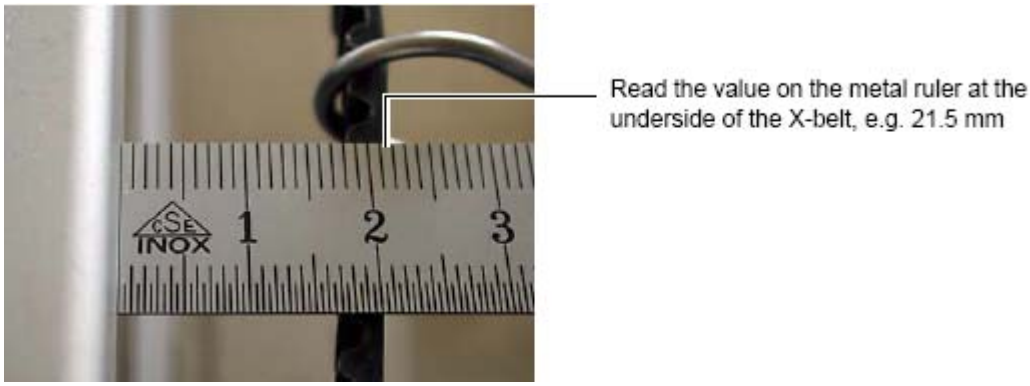


Figure 10.10 Reading the Value on the Metal Ruler

6. Read the value on the metal ruler on the underside of the X-Belt.
7. The resulting value must be between 20 – 21 mm. If the value is not within the range, the tension needs to be adjusted.

10.2.3 Adjusting the Tension of the X-Belt

1. Ensure that the device is switched off and the power cable is unplugged.
2. Ensure that the arm is opposite from its home position.
3. Mark precisely the current position of the X1-belt clamp on the X-rail with a pen.

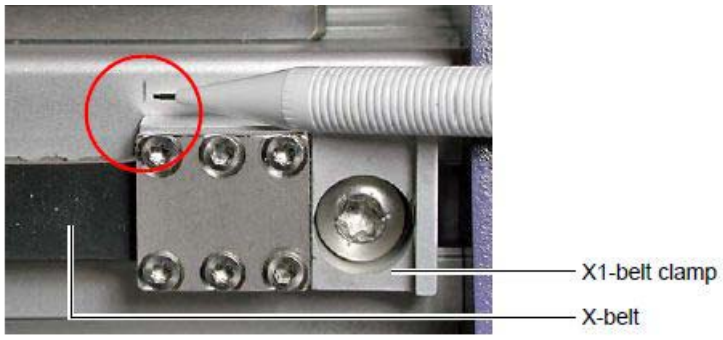


Figure 10.11 Marking the Position of the X1-Belt Clamp

4. Loosen the belt clamp screw on the X1-belt clamp.
5. Slide the belt clamp either towards the X-rail center to reduce, or in the opposite direction to increase, the tension.

Note: Shifting the X1-belt clamp by 1 mm affects the deflection of the x-belt by several mm!

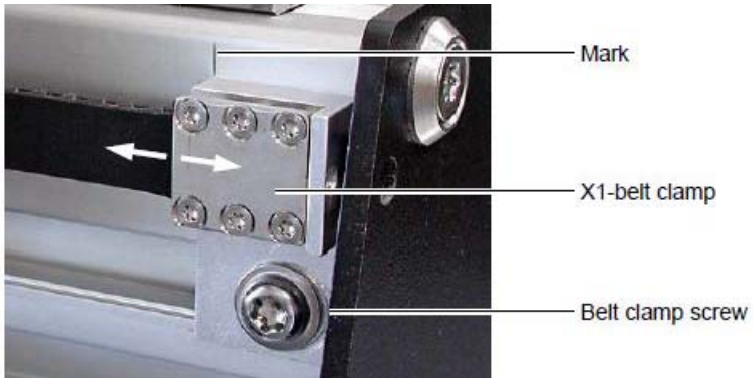


Figure 10.12 Adjusting the X-Belt Tension by Shifting the X1-Belt Clamp

6. Tighten the belt clamp screw.
7. Measure the tension again by measuring the belt deflection. The resulting value must be between 20 – 21 mm. Otherwise repeat the adjustment procedure.

Note: If the belt is too loose a squeaking noise might be heard while initializing the arm.

10.3 Exchanging Boards and Motors

10.3.1 Introduction

To ease reassembly when exchanging boards and motors, and to avoid incorrect connection, plugs should be marked before they are disconnected. This is especially important when the same connector type is used more than once on a board.

10.3.1.1 Exchanging Controller Boards

After a controller board, e.g. X-board or Y/Z-board, has been exchanged, the X-Util must be run to download the boot loader, firmware and parameters. Before starting the procedure, the arm should be moved away from its home positions and the object detector should be positioned in the center of the arm.

1. Switch the device on.
2. Start X-Util -> window pops up „New hardware“
3. Click „Identify“ ->corresponding motor or pump is moving.
4. Select module.
5. Set flag „Save on module“.
6. Press „Save“.
7. Load firmware and parameters.

10.3.2 Replacing the X-Board

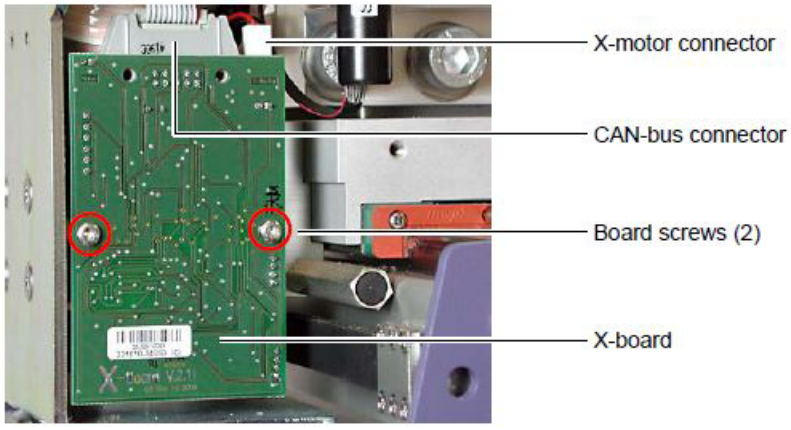


Figure 10.13 X-Board (arm)

Required tools

- Torx screwdriver T10

Disassembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Remove the arm covers (see "Arm Cover" on page 104).
3. Remove the two board screws.
4. Carefully pull the board out and mark plugs/sockets on the X-board to ease the reconnection later on.
5. Disconnect the cables.
6. Remove the board.

Assembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Connect the cables.
3. Mount the board with the two screws.
4. Install the arm covers (see "Arm Cover" on page 104 - Installation).
5. Download the boot loader, firmware and parameters as described in "Exchanging Controller Boards" on page 158.

10.3.3 Replacing the X-Motor

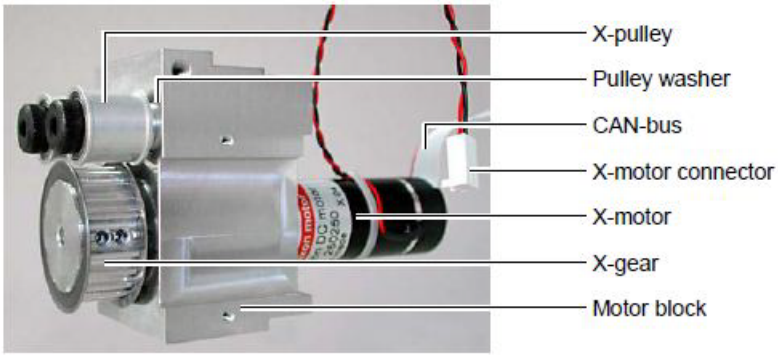


Figure 10.14 X-Motor Assembly

Required tools

- Torx screwdriver T10, T20, T25
- Allen wrench 4 mm („L“-shape)
- Adjustable torque wrench, Allen bit 4 mm

Disassembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Remove the arm covers (see "Arm Cover" on page 104).
3. Disassemble the X-board (see "Disassembly" on page 159).

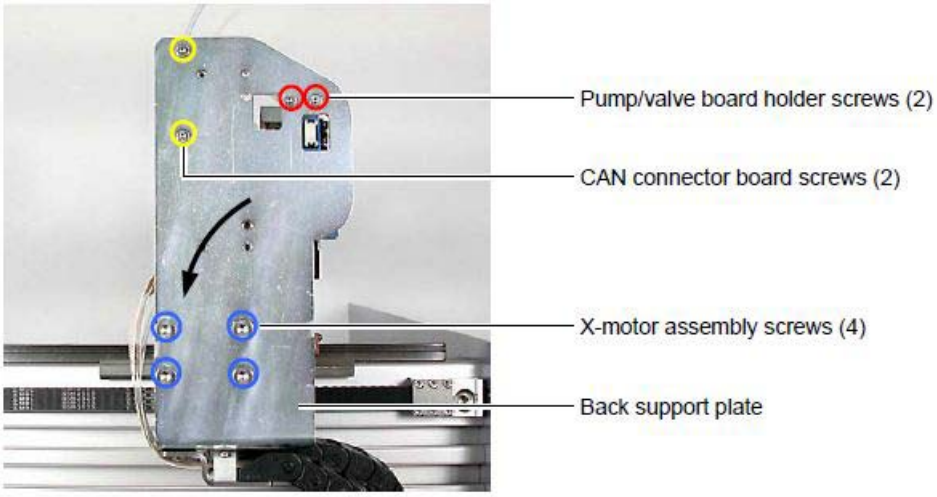


Figure 10.15 Back Support Plate

4. Remove the CAN connector board screws.
5. Remove the pump/valve board holder screws.
6. Remove the X-motor assembly screws.
7. Swivel the back support plate downwards in order to get access to the motor block screws.

Note: The caterpillar chain drive remains mounted on the back support plate.

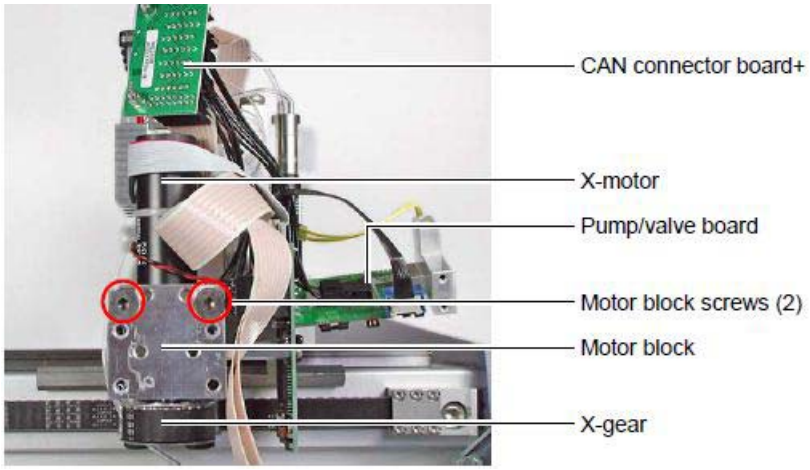


Figure 10.16 The Back Support Plate

8. Release the belt tension by loosening the belt clamp screw and sliding the X2-belt clamp towards the X-rail center.

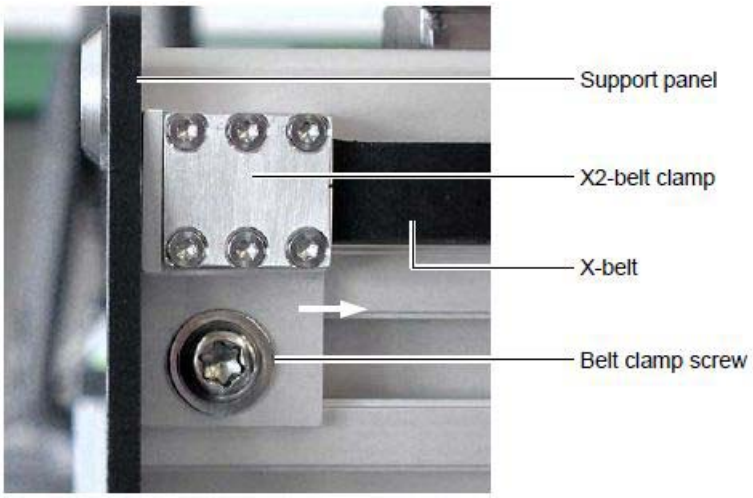


Figure 10.17 Screws for Releasing the X-Belt Tension

9. Dismount the two X-pulleys and the washers from the motor block.
10. Release the belt from the X-gear.
11. Remove the two motor block screws and the X-motor assembly.
12. Loosen the two grub screws on the X-gear and remove the X-gear.
13. Dismount the X-motor by removing the two screws.

Assembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Mount the X-motor on the motor block with the two screws. Make sure that the flat ribbon cable points towards the X-pulley bores (see Figure 10.14).
3. Put the X-gear on the motor shaft. Align the gear so that its threaded holes face the flattened side of the motor shaft. Insert the grub screws and tighten them.
4. Mount the motor block on the X-module with the two screws. Make sure that block and module are perfectly aligned before tightening the screws with a torque of 9 Nm.

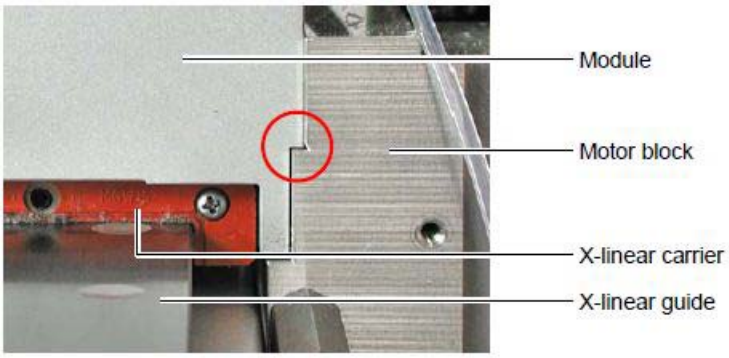


Figure 10.18 Alignment Between Motor Block and X-module

5. Guide the X-belt around the X-gear.
6. Mount the two pulleys and the washers. Insert the screws and tighten with a torque of 9 Nm. Make sure that the washer aligns perfectly with the screw axis.
7. Firmly push the X2-belt clamp against the support panel while tightening the belt clamp screw.
8. Mount the back support plate on the motor block with the four X-motor assembly screws.
9. Mount the pump/valve board holder.
10. Mount the CAN connector board.
11. Assemble the X-board (see "Assembly" on page 159).
12. Slide the arm carefully to and fro to check that the X-belt smoothly moves around the X-drive.
13. Install the arm covers (see "Arm Cover" on page 104 - Installation).

10.3.4 Replacing the YZ-Module

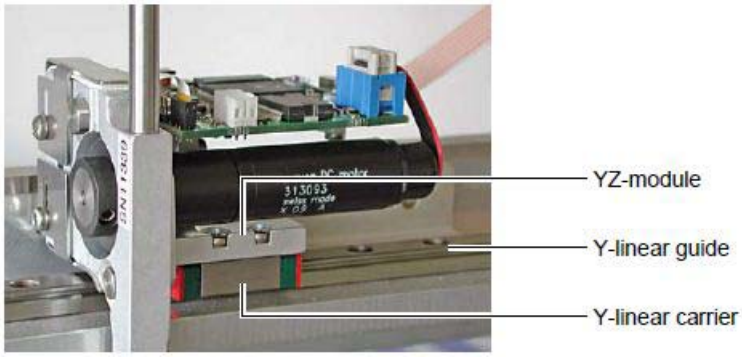


Figure 10.19 YZ-Module

Required tools

- Torx screwdrivers T10

Disassembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Remove the arm covers (see "Arm Cover" on page 104 - Removal).
3. Disassemble the YZ-board (see "Disassembly" on page 164).
4. Disassemble the Z-motor (see "Assembly" on page 168).
5. Remove the screws, securing the YZ-module on the Y-linear carrier. Never remove the Y-linear carrier from the linear guide!

Assembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Mount the screws to fasten the YZ-module on the Y-linear carrier.
3. Assemble the Z-motor (see "Assembly" on page 168).
4. Assemble the YZ-board (see "Assembly" on page 164).
5. Install the arm covers (see "Arm Cover" on page 104).

10.3.5 Replacing the YZ-Board

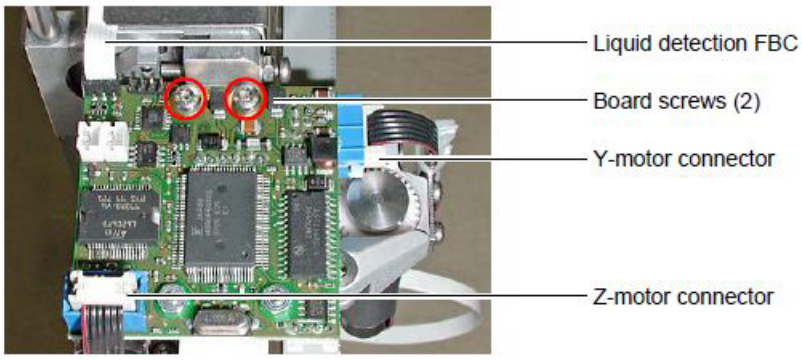


Figure 10.20 YZ-board (BB2)

Required tools

- Torx screwdrivers T8, T10, T20

Disassembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Remove the arm covers (see "Arm Cover" on page 104).
3. Carefully pull the liquid detection flat band cable (FBC) out.
4. Remove the two board screws.
5. Lift the board at the corner which is closest to the liquid detection FBC connector.
6. Unplug the Z-motor connector.
7. Unplug the Y-motor connector whenever possible without removing the cable tie.
8. Turn the board over and remove the two screws of the strain-relief.
9. Unplug the CAN-bus FBC connector.

Assembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Plug the CAN-bus FBC connector in.
3. Mount the strain-relief with the two screws and turn the board over.
4. Plug the Y-motor connector in, mount a cable tie if it was previously removed. Do not over tighten the cable tie.
5. Plug the Z-motor connector in.
6. Install the board with the two screws.
7. Carefully insert the liquid detection FBC.

8. Plug the power cable in and switch the device on.
9. Check for holding torque.
10. Start X-Util. The „Module Setup“ window will be displayed.
11. Assign board to correct module (refer to the module identification in the firmware setup).
12. Switch the device off.
13. Install the arm covers (see "Arm Cover" on page 104).

10.3.6 Replacing the Y-Motor (with fixed support)

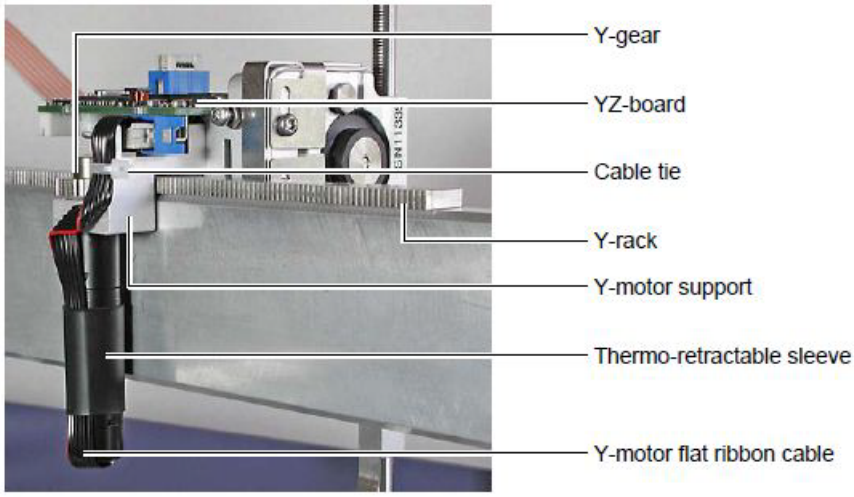


Figure 10.21 Y-Motor Assembly with Fixed Y-Motor Support

Required tools

- Torx screwdriver T6, T10
- Allen wrench 1.5 mm

Disassembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Remove the arm covers (see "Arm Cover" on page 104).
3. Disassemble the YZ-board (see "Disassembly" on page 164).
4. Loosen the two Y-motor support screws and remove the Y-motor assembly.
5. Remove the cable tie.
6. Loosen the gear grub screw and remove the Y-gear from the motor shaft.
7. Remove the two screws and dismount the Y-motor.

Assembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Mount the Y-motor on its support. Make sure that the flat ribbon cable is as parallel as possible to the arm.
3. Mount the Y-gear.
4. Fasten the flat ribbon cable to the support with the cable tie. Do not over tighten the cable tie.
5. Push the support gently against the Y-rack to prevent play. Ensure that the Y-gear is aligned with the Y-rack Then tightened the screws. Check that the Y-motor assembly can be moved smoothly along the Y-rack.
6. Assemble the YZ-board (see "Assembly" on page 164).
7. Install the arm covers (see "Arm Cover" on page 104 - Installation).

10.3.7 Replacing the Y-Motor (with spring-loaded support)

Note: Do not dismount the Y-motor support components!

Disassembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Remove the arm covers (see "Arm Cover" on page 104 - Removal).
3. Disassemble the YZ-board (see "Disassembly" on page 164).

Figure 10.22 YZ-Board Connectors and Screws (left) and Y-Motor Support with Mounting Screws (right)

4. Loosen the Y-motor support screws.
5. Remove the Y-motor support.

Assembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Mount the Y-motor support. Insert the two screws but do not tighten yet.
3. Press the Y-motor assembly against the Z-hub module in the direction indicated by the arrows. Keeping the horizontal and vertical gaps between the Y-motor support and Z-hub module as small as possible

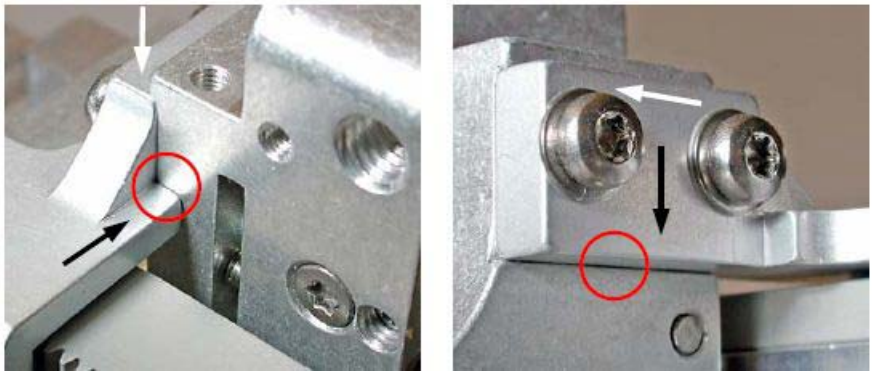


Figure 10.23 Gaps Between Y-Motor Support and the Z-Hub Module

4. Tighten the screws.
5. Assemble the YZ-board (see "Assembly" on page 164).
6. Install the arm covers (see "Arm Cover" on page 104).

10.3.8 Replacing the Z-Motor

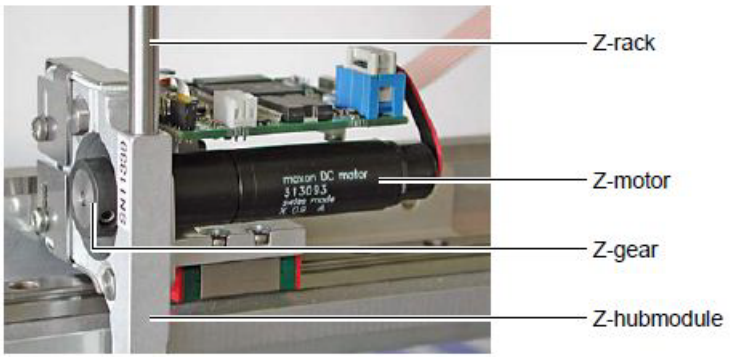


Figure 10.24 Z-Motor Assembly

Required tools

- Torx screwdriver T6, T8

Disassembly

1. Flush back pipetting tubing.
2. Ensure that the device is switched off and the power cable is unplugged.
3. Disassemble the Z-motor assembly (see Figure 10.24).
4. Dismount the Z-gear.
5. Dismount the motor from the Z-support plate.

Assembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Insert the motor into the Z-support plate. Position the motor so that its flat ribbon cable points towards the smaller threaded hole in the Z-support plate.

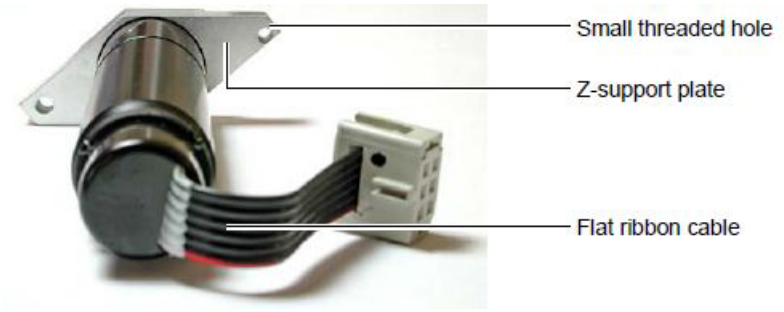


Figure 10.25 Correct position of Z-motor in Z-support plate

3. Fasten the motor with the two screws.
4. Put the gear on the motor shaft. Position the gear so that its threaded hole faces the notch in the motor shaft.
5. Insert the screw into the Z-gear and tighten.
6. Install the Z-motor assembly (see "Assembly" on page 168).
7. Plug in the power cable and switch the device on.
8. Flush the system.

10.3.8.1 Z-Motor Check

If the Z-axis fails during operation, check whether the Z-motor channel is recognized and can be initialized in X-Util/Modul_info.

If not, check the motor first with the Sias encoder tester.

Required tools

- Encoder tester (P/N: 150104 - not delivered by Bruker).

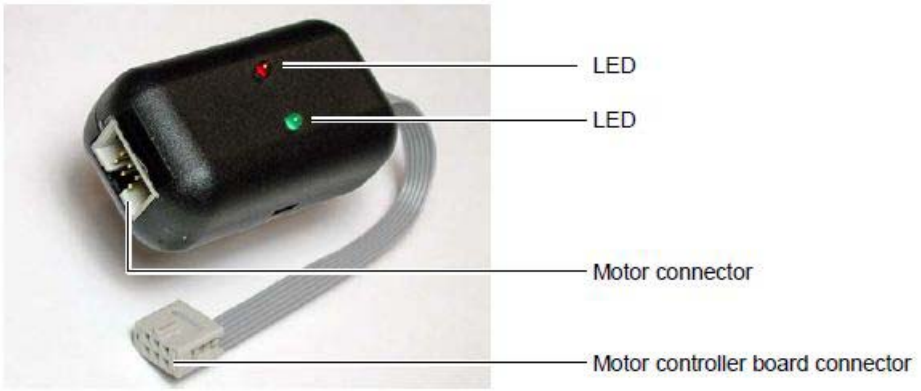


Figure 10.26 Encoder Tester

1. Ensure that the device is switched off and the power cable is unplugged.
2. Remove the arm covers (see "Arm Cover" on page 104).
3. Loop the encoder tester between motor and motor controller board (MCB).
4. Plug the power cable in and switch the device on.
5. Start X-Util, select the appropriate motor and note the current scaling factor and speed (to restore later).
6. Set scaling factor 1 >> 0.
7. Set speed to 1.
8. Set „new Position“ to 100
9. Click „Move“.
10. Carefully check the LED's repetitive flashing sequence:
    - The first LED lights up (it is not relevant which one).
    - The second LED lights up (both are lit).
    - The first LED switches off.
    - The second LED switches off.
11. Repeat check if necessary by clicking the **Move** button. Any other flash sequence pattern indicates that the encoder is defective.
12. Reset the scaling factor and speed to the previous noted values.
13. Ensure that the device is switched off and the power cable is unplugged.
14. Disconnect the encoder tester.
15. Depending on the test result, replace the motor or proceed with the coil resistance test.

10.3.8.2 Coil Resistance Check

If the encoder check did not result in failure, check the coil resistance of the motor with an ohmmeter. This quick check helps determine if the faulty part is the motor or the motor control board.

Required tools

- 6-pin header
- Ohmmeter

Procedure

1. Ensure that the device is switched off and the power cable is unplugged.
2. Remove the arm cover (see "Arm Cover" on page 104).
3. Unplug the Z-motor connector.
4. Plug a 6-pin header into the Z-motor connector.

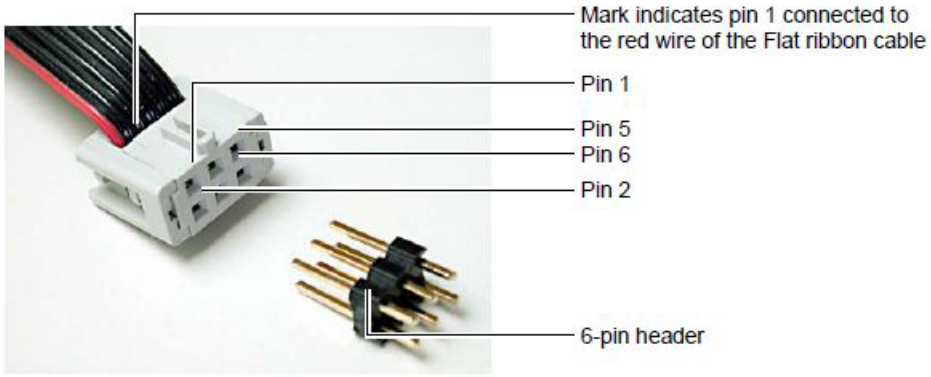


Figure 10.27 Z-motor connector and header

5. Check the coil resistance of the motor between pin 1 and 6. It must be 5 - 20 Md. If the result is not within this range, the motor is faulty.
6. Check the resistance of the encoder between pin 2 and pin 5. It must be 4 - 20 Md. If the result is not within this range, the motor is faulty.

Figure 10.28 Measuring the Inner Coil (left) and Encoder Resistance (right)

7. If the results are within the tolerance, the board might be defective. Otherwise dismount the motor (see "Disassembly" on page 168) and replace it.

Note: A new motor may have a higher coil resistance for a short period but should come back within the range described above.

10.4 Arm Alignment

Before the arm alignment is performed, the parallelism of the arm should be checked. See "Arm Alignment Check" on page 131.

Note: The precision of this adjustment has a direct impact on the positioning precision of the arm across the whole deck area. For safety reasons place a foam spacer underneath the arm. You may need to use force to loosen the blocking screws. Never remove them completely

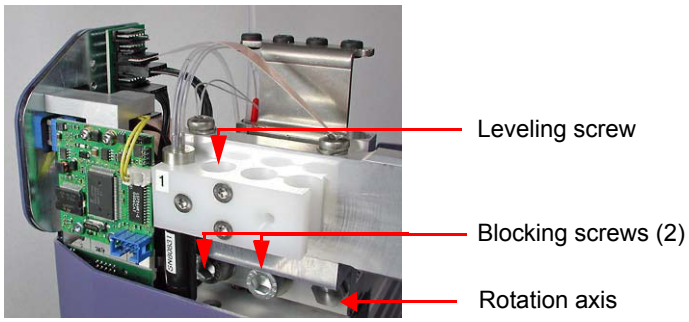


Figure 10.29 Arm Fixation and Adjustment

Required tools

- Allen wrench 4 and 8 mm
- Adjustable torque wrench (20 - 80 Nm; Allen bit 8 mm)
- Torx screwdrivers T10, T20, T30

Disassembly

1. Ensure that the device is switched off and the power cable is unplugged.
2. Remove the arm covers ("Arm Housing" on page 103).
3. Remove the upper and the lower center screws of the pump holder and lift it up to get access to the blocking screws. Do not remove the screw on the left hand side of the holder!
4. Disconnect the CAN-bus flat band cable (FBC) from the CAN connector board and push the FBC aside to provide access to the leveling screw.

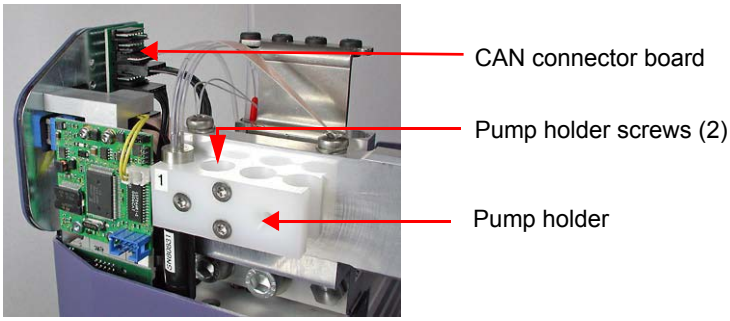


Figure 10.30 The CAN Bus FBC and Pump Holder

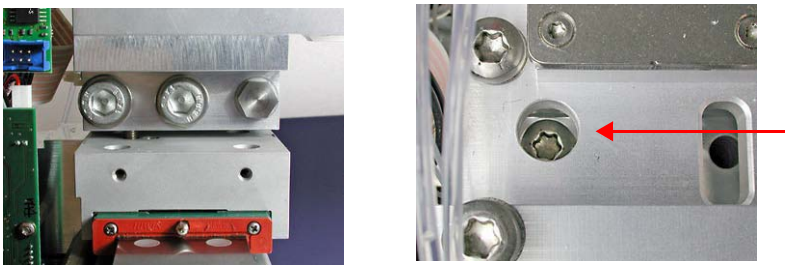


Figure 10.31 Arm Blocking Screws and Rotating Axis (left) and Arm Leveling Screw (right)

10.4.1 Arm Adjustment

1. Loosen the blocking screws with an Allen wrench. Never remove the blocking screws!
2. Adjust the arm alignment by turning the leveling screw. Turning the screw anti-clockwise lowers the front of the arm and decreases the distance to the deck. Turning the screw clockwise lifts the front of the arm and increases the distance to the deck.

Note: Turning the leveling screw a quarter turn lifts or lowers the front of the arm by about 2.25 mm!

3. Tighten the blocking screws a little and check the parallelism of the arm as described in "Arm Alignment Check" on page 131. Repeat the adjustment procedure if necessary.
4. Tighten the blocking screws with an adjustable torque wrench applying a torque of 60 Nm.

10.4.2 Arm Assembly and Testing

1. Connect the CAN-bus FBC to the CAN connector board (the order is not important, but the orientation is).
2. Mount the pump holder.
3. Install the arm cover (see "Arm Cover" on page 104.
4. Check at least one robot application layout to evaluate the Z-parameters of the slots and racks.

To check these positions see "Teaching the Pickup Adapter" on page 84.

11 Troubleshooting

11.1 Error Reporting Checklist

Before reporting an error to Bruker, the following steps must be taken:

1. Specify on which device (type, name and serial number) the error occurred.
2. Indicate which software type and version is used.
3. Write down the error code.
4. Be ready to e-mail the compressed file containing current settings and logs (see "History Files and Log Files" on page 175).
5. Describe the error (behavior of the device when the error occurred).
6. Report which action has been taken.
7. Contact Bruker support by mail.

11.2 History Files and Log Files

SamplePro assembles data, error messages and settings information in various history and/or log files that are invaluable for troubleshooting purposes.

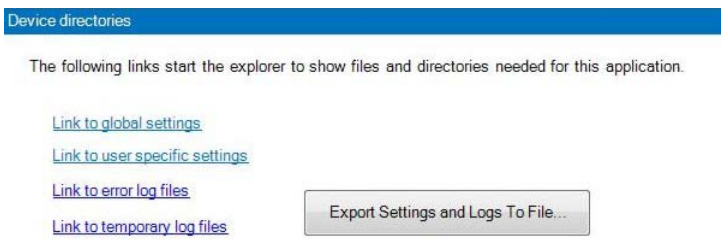
The settings and log files can be exported and viewed or sent to Bruker for troubleshooting purposes.

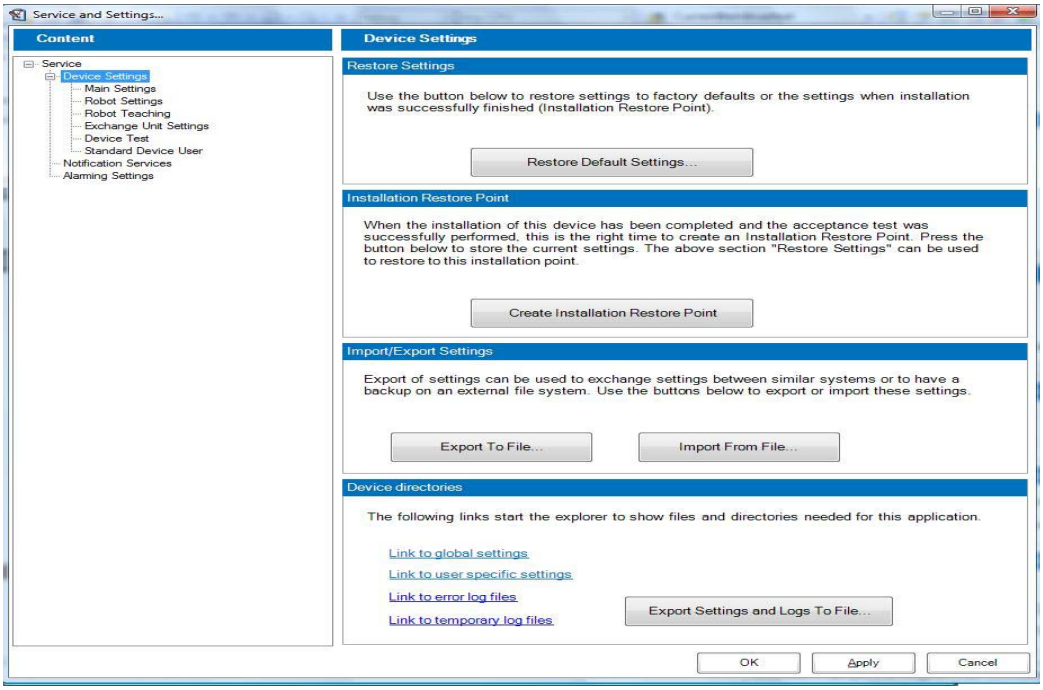
To export log files:

1. Open the **File** menu **Service and Settings**
2. Login with service user rights.
3. Open the page **Device Settings** in the left tree view.

At the bottom of the page there are links to the error main log file „hrMasGui.critical.log" and the temporary main log file „hrMasGui.log" that can be used to show the current log files.

The **Export Settings and Logs To File..** button can be used to copy all interesting data (configuration/settings files and log files) into a *.ZIP file to send them to Bruker.





The robotic system software modules from SIAS are creating additional sub-device log files, that will be used to find error details if the error cause cannot be located with the main log files (see "Robot System Sub-device Log Files" on page 176).

11.2.1 History files

For displaying the history data of all actions:

1. Select in the menu **View** and sub menu **Activity History...**

➥ The data are written in several files in the folder „**ActivityHistories**”. This folder is located the folder „logs”, where the current main log file is saved.

11.2.2 Robot System Sub-device Log Files

The robotic system sub-device log files are automatically generated and stored in the sub folder **„**Robot” of the temporary log file folder.

The first 99 logs are stored sequentially, numbered from „SCan_IO01“ to „SCan_IO99“. After the 99th log, the system loops and overwrites the first file in the loop.

When the robotic system runs service tests under X-Util, log files are automatically generated and stored in the sub folder **„**\log” of the X-Util folder.

The size of the log file depends on the length of the run, but may be several megabytes! Opening such a file to investigate module errors or flags is more convenient at Bruker or SIAS site using a special tool, which generates useful information for systematic support.

Bruker may request these additional sub-device log files, if the cause of the error cannot be located using the main log files.

11.3 Error Information Dialogs

The SamplePro hr-MAS program displays errors and warnings in different ways depending on the error type. Typically the error dialog shows an error information description and also displays hints on how to remove the error cause. The operator can continue or abort the application.

11.3.1 Initialization Warning Dialog

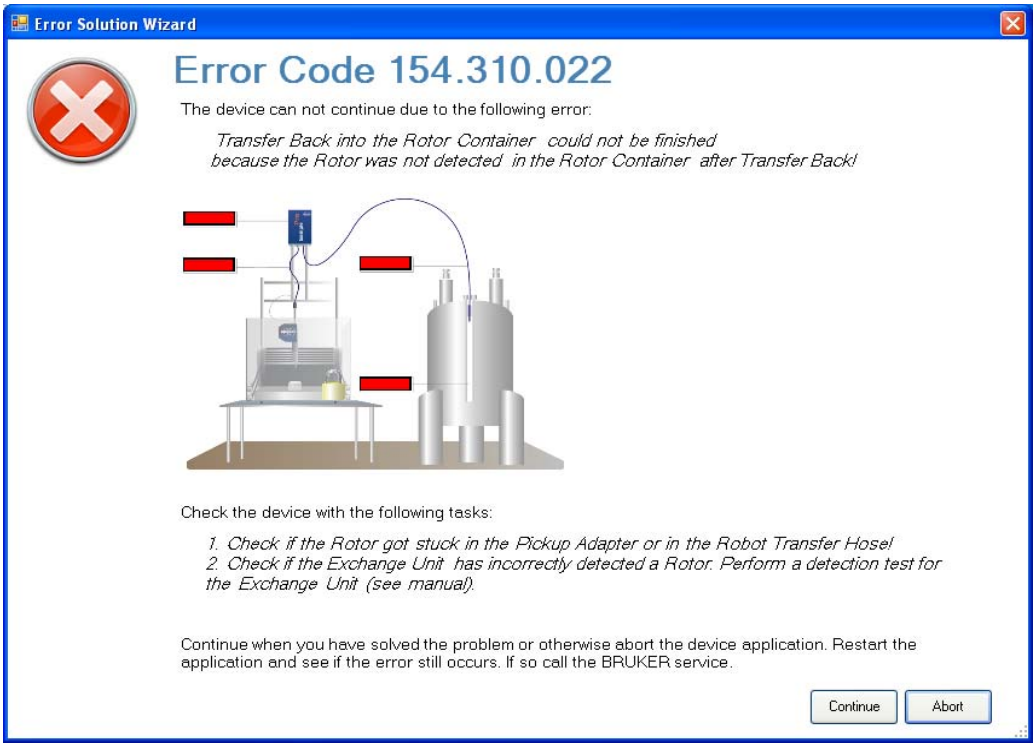
When starting the application at initialization time the following warning may occur:

After checking the device the operator should retry the initialization.

Service personnel can fix the problem in the service area and then retry the initialization.

11.3.2 Standard Error Dialog at Run Time

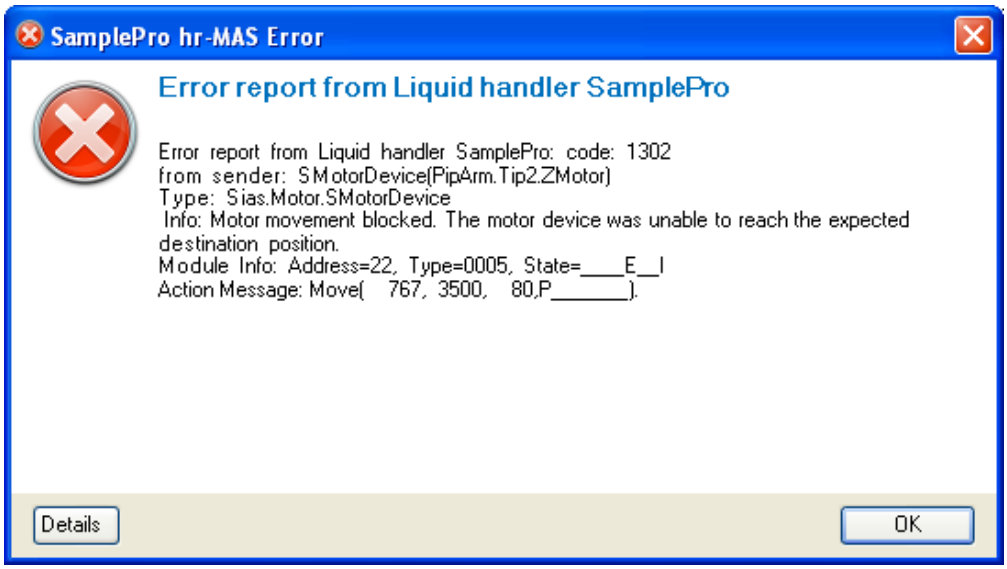
After initialization, most of the error messages at run time will display the following error or warning dialog:



Most error messages will display the following information in the dialog:

- A detailed failure description will be shown at the top of the dialog.
- The probable location of the failure is displayed as a red rectangle in the system view.
- Finally advice on how to check the device to locate and remove the failure will be displayed. Additional information may also be provided for special error handling, in this case see "Special Error Handling" on page 185).

11.3.3 Robot System Sub-device Error Window



The causes of many operating problems can be identified and corrected by the user. Failures are displayed on the computer screen as error codes and messages, which are described in this chapter.

If an error of the robot system sub-device occurs during the run time of the device, error codes are displayed in the first line of the error description.

Errors originating from the malfunction of individual modules in the robot system are displayed in the description line „from sender“, together with the name of the module that generated the error.

Typically there is no detailed information available. The user should close the error dialog with „OK” and restart the application if the cause of the error is found.

---

i Note: When reporting a malfunction or asking Bruker for assistance, a precise description of the problem should already be provided, including the exact error code, module information, software version and build, as well as the attempted corrective action and the serial number of the device (for robot system sub-device log files see "Robot System Sub-device Log Files" on page 176).

Error codes and messages are displayed during run-time.

The following sections describe the errors and give some assistance in locating the cause and possible remedy. Although this information is comprehensive, it is impossible to list every potential cause and remedy for each error. In this case, Bruker relies on the judgment and professionalism of the certified service engineer.

Module Error Groups

Type of Error	Value hexa-decimal	Description	Cause
Syntax error at module	Missing	The telegram is not correct	• Software error Wrong configuration
Module error at module	0100	Initialization failed (no block found). The module has not been initialized	• Mechanical problem (loose gear) • Sensor not found • Electronics error • Wrong motor range • Time-out
	0200	Movement blocked	• Mechanical obstruction
	0300	Initialization failed (movement blocked during the **init** offset step)	• Mechanical obstruction

Table 11.1 Module Errors

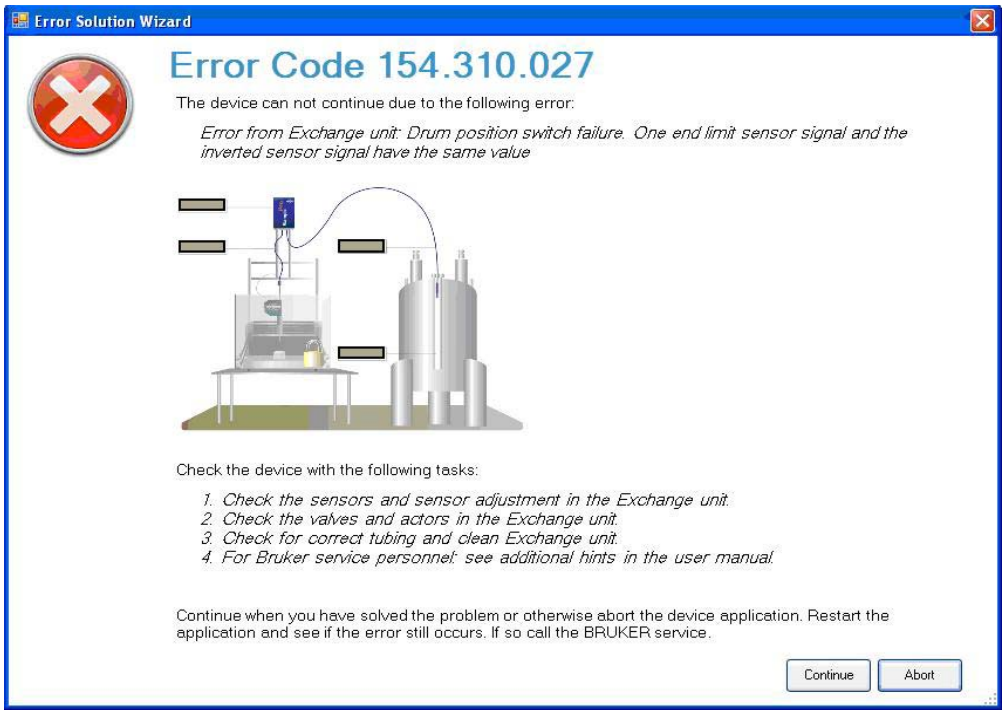
Communication Errors

Type of Error	Description	Cause
Unknown module error	An unknown error has occurred	• Translate error code in decimal and see if it matches a known code
Error addressing module	The module can not be addressed	• Faulty electronics • Module firmware error • Wrong firmware identification • Wrong configuration in „siascfg.ini“ • Cables not properly connected
Error sending to module	The telegram can not be sent to the module	• Faulty electronics • Module firmware error • Cables not properly connected device is switched off
Illegal message from module	The module sends incorrect telegram	• Firmware error
Active time-out at module	The module does not complete the action in a given time	• Time-out time too short • Speed of the module too slow • Software error • Wrong configuration in „siascfg.ini“ • Electronics error • device is switched off
CAN error	CAN-bus does not work properly	• CAN dongle not installed properly • Driver for the CAN-bus faulty • Software error - reboot computer • USB port power failure
Unable to create CAN thread	Software can not create a CAN thread	• Software error
Message answer time-out at module	The module does not answer in the given time	• Faulty electronics • Firmware error • device disconnected from the PC or device is switched off. • Wrong connection cable configuration

Table 11.2 Communication Errors

11.3.4 Exchange Unit Sub-device Errors

When an exchange unit error occurs, especially with the sensors and valves, first check the connections to the main board. This type of error is not typical, but quite possible on a unit with moving parts.



Problem: Light barrier always detects a rotor, even there is no rotor in the EU.

Cause: Dust or dirt.

Solution:

1. Remove the transfer hose on the source side and switch on the Blowdown and lower valve on the service application software.
2. Use a cotton swab, like a Q-tip, and drill up and down until the service application software shows you that the sensor changes its state.

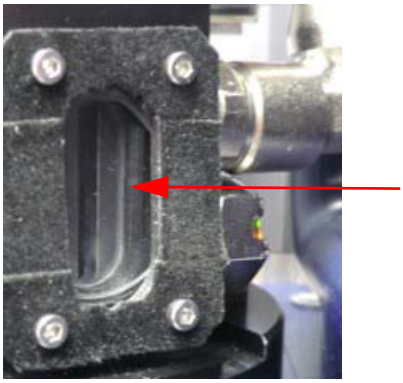
Sample Up: default

Problem: The rotor has moved from the rotor container to the exchange unit, but the barcode could not be read.

Cause: Dust or dirt on the glass panel.

Solution:

1. Clean the glass panel with a lint free tissue.



Cause: The rotor barcode is inaccurate or missing.

Solution:

1. Check the rotor barcode with a handheld scanner.

Problem: The rotor is not transferred, because the drum is not adjusted correctly.

Solution:

1. Disconnect the hose from the exchange unit and insert the adjustment rod.

2. If there is resistance, or too much space, adjust the drum by loosening the screws (robot and robe).
3. Insert the adjustment rod and tighten the screw until resistance is felt.

Problem: The sensor control displays wrong values.

Cause: The sensor control displays the drum positions, either to the robot or to the probe. For each direction there are two signals, either true or false. An incorrect signal will be displayed as an error message.

Solution:

1. Adjust the drum, see "Problem: The rotor is not transferred, because the drum is not adjusted correctly." on page 183.

Problem: The rotor is not transferred correctly to the probe or back.

Cause: The transfer pressure is not correctly adjusted.

Solution:

1. Follow the instructions explained in "Transfer Pressure Setup" on page 59 and change the mBar value.

11.3.5 Special Error Handling

Error Number	Information
154.310.014	Check the drum rotation position sensors (see "Sensor Control" on page 96).
154.310.015	Check the drum rotation position sensors (see "Sensor Control" on page 96).
154.310.019	If the rotor could not be found in the transfer hose it is probably still in the MAS probe. Check if the rotor could be ejected using commands on the MAS display, then execute the test command „Move Rotor from Probe to Exchange Unit” on the service page (see "Robot System Device Test" on page 91). If the rotor remains in the probe, check if the rotor is correctly turning into the magic angle position and back into the vertical position. Remove the Probe from the Magnet if necessary. Check the drum rotation position sensors. Check the drum rotation position mechanical adjustment (see "Sensor Control" on page 96).
154.310.027	All errors from the exchange unit have this code number. The hints are a summary of all exchange unit checks. The error description indicates which part of checks has to be done.

Table 11.3 Special Error Handling

11.4 Start Problems Due to Virus Scanner Setup

In some cases the application program can slow down or even crash when virus scanner software activates and checks all files by default. This annoying behavior is caused by the virus scanner verifying the file whenever the control software writes data in the „log“ file.

Verifying the error cause

To confirm the assumption, rename the „LOG“ directory so the virus scanner software can no longer access the corresponding file. If the program starts immediately or no crash occurs, it's likely that the failure was caused by the virus scanner setting.

Solution

The virus scanner should be configured to exclude the „LOG“ directory from scanning.

11.5 Firmware

Note: Screen shots in this section refer to „sias_io.dll“ version 0.1.7.7; X-Util version 0.1.7.5 and older, firmware version 0.21b2.

Incorrect sequence of action while updating or changing firmware parameters

An incorrect sequence of actions while updating or changing firmware parameters may result in an unstable firmware configuration and, worst case, can lead to an unusable device.

Firmware parameters are vital information for the device. Only Bruker certified engineers are authorized to modify these values and even then only when instructed to do so by Bruker.

Unauthorized changes by customers will invalidate the warranty!

11.5.1 Validating Firmware Parameters

The valid firmware parameter set for each device is produced at the time the device was built and is recorded on the CD delivered with the device.

The „AllPar.dat“ file containing all the parameter settings is located in the FW subdirectory by default. Sias suggests renaming this file to „AllPar_Original.dat“.

Whenever a backup of the device parameters is necessary, e.g. in case of a module replacement, the default name „AllPar.dat“ should be used. This file will always be the current one. When module is changed, first backup the old file as „AllPar_yymmdd.dat“ to provide a log history of the service actions done on the robot.

A PDF file containing screen shots of firmware parameters is usually handed out during hardware training courses.

i Note: This file should never be used as reference but it can be helpful when used as example! If in doubt, always contact Sias for the latest valid firmware and parameters.

11.5.1.1 Correct Configuration (display)

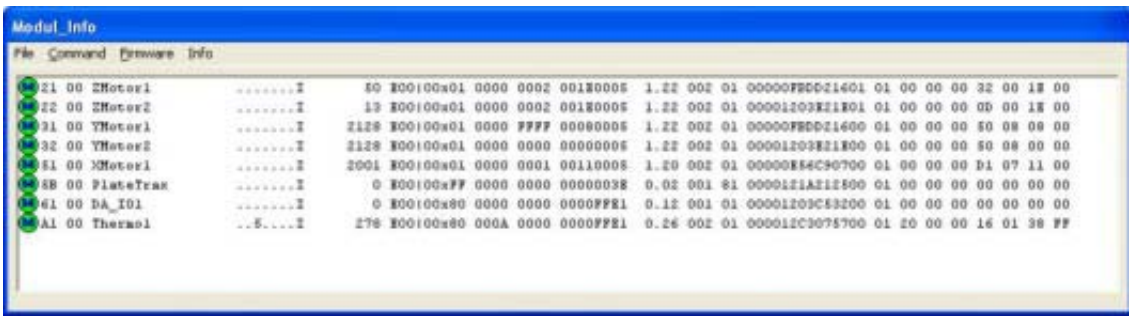


Figure 11.1 Module Info Window (example SamplePro hr-MAS with Cooling Rack)

Number	Description
1	First Start address
2	Module name
3	Module status flag: D = detected; I = initialized; P = prepared; A = active; W = warning; E = error; other codes = module specific
4	Module position in units 1/10 (i.e. 0.1 mm, 0.1 degree, 0.1° C, 0.1 µl)
5	Firmware type (last 4 digits): 0004= DC motor; (BB1 V1.0, BB2 V1.0, X-board V 1.0) 0010= pump; (BB1 V1.0, BB2 V1.0, X-board V 1.0) 0005= DC motor; (MCB BB1 V2.0, MCB BB2 V2.0, X-board V 2.11) 0011= pump; (MCB BB1 V2.0, MCB BB2 V2.0, X-board V 2.11) FFE1= IO board base 540 other codes = module specific
6	Firmware version
7	Build
8	Module serial number of the CPU chip (first 12 digits)
9	PCB channel number for sub modules (last 2 digits): 00–03

Table 11.4 Module Information

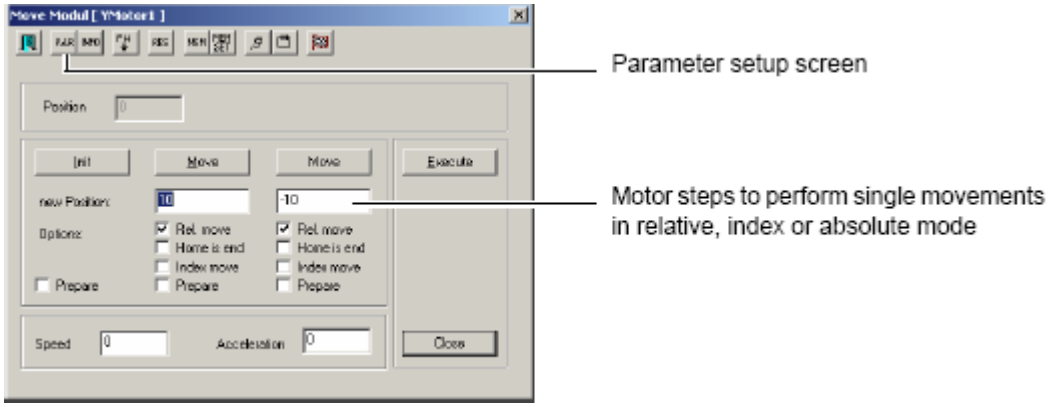


Figure 11.2 Move Module [YMotor1] Window

11.5.1.2 Incorrect Configuration (Display)

If the device is switched off and on while X-Util is starting up, corrupt information may be displayed with an incomplete module list and missing module type information.

Firmware parameters will be displayed as FFFF and/or 65535, meaning that default values were displayed.

Note: Never save an incorrect configuration parameter screen!

In the example below, the module type information for address 31 is missing, resulting in a corrupted „Modul_Info“ list!

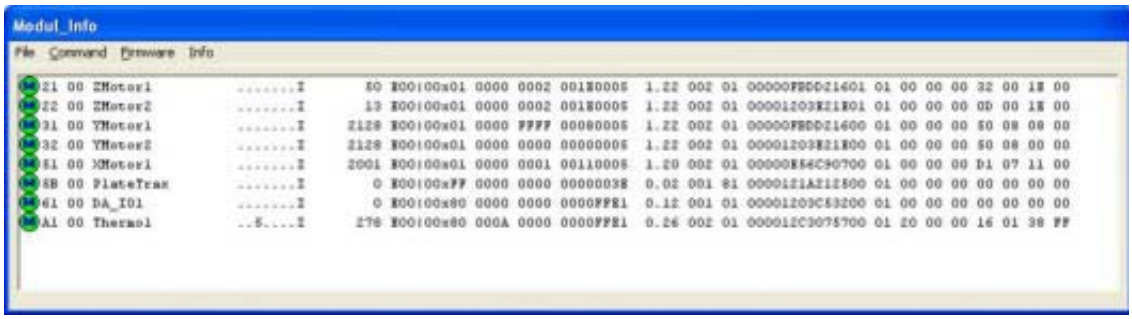


Figure 11.3 Modul_Info Window (example with cooling rack)

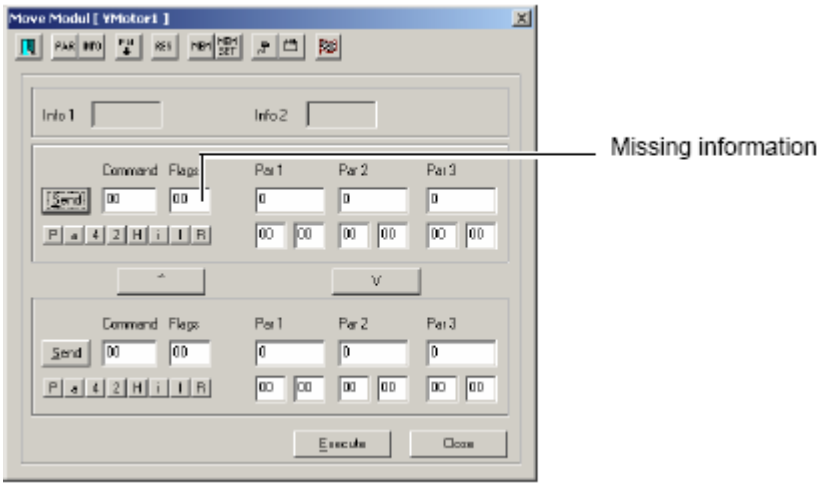


Figure 11.4 Display of an Incorrect Y-motor Move Module Window

Note: Such firmware parameter windows may also appear when the corresponding ocx-file is missing or not registered.

11.5.2 Firmware and Parameters

Note: This section describes firmware **parameters**, not firmware versions. Do not confuse firmware download and parameter setup!

11.5.2.1 Firmware Download

A firmware download allows you to upgrade the current firmware version without changing the firmware parameters. As the same firmware type goes in different modules, e.g. DC motors, it makes sense to use the multi-download option of the firmware menu. Make sure that the firmware file version selected is the correct one!

„Firmware info from file“ or „Firmware info from module“ can be used to display information in clear text to make sure that the selection is correct.

11.5.2.2 Firmware Parameter Setup

A firmware parameter setup changes the current setting of a module independently of the firmware version. The setup contains the address of the modules and the specific values, which make the difference between a Z-motor and a Y-motor; e.g. liquid detection, default direction of the motor, error limits, home offsets. For pumps, it contains the scaling factor which is different for each pump.

Note: The parameter „MultiSend“ button should never be used in the field, as it would send the complete content of the current window to all other selected modules!

11.5.3 Troubleshooting Corrupted Firmware Configuration

The following list is a reference for the correct addresses and module names for robot systems.

Address Number		Module Name	Arm
HEX	DEC		
11-18	17-24	Micro-pump device	Arm
21-28	33-40	Z-motor	Arm
31-38	49-56	Y-motor	Arm
51	81	X-motor	Arm
5B	91	Plate-trax	
5C	92	ID-trax	
61-64	97-100	I/O Board	
72-73	114-115	Shaker 1 and 2	
79	121	Ixion centrifuge	
A1-A5	161-165	Thermo block	

Table 11.5 Robot System

Address Number		Module Name	Arm
HEX	DEC		
11	17	Micro-pump device	Arm
21	33	Z-motor	Arm
31	49	Y-motor	Arm
51	81	X-motor	Arm

Table 11.6 Robot Based System

Note: X-Util and „device.dat“ file, the addresses are displayed in hexadecimal; in siascfg.ini file in decimal!

11.5.3.1 Configuration Conflict after Module Identification

Whenever a defective board has been replaced with a Sias service part, it comes with the default service address E1 for sub module #1 and F1 for sub module #2. X-Util recognizes that there is a new component installed and displays the identification screen.

Note: It is not possible to skip the automatic identification step. Only the manual identification steps illustrated below have a close window button.

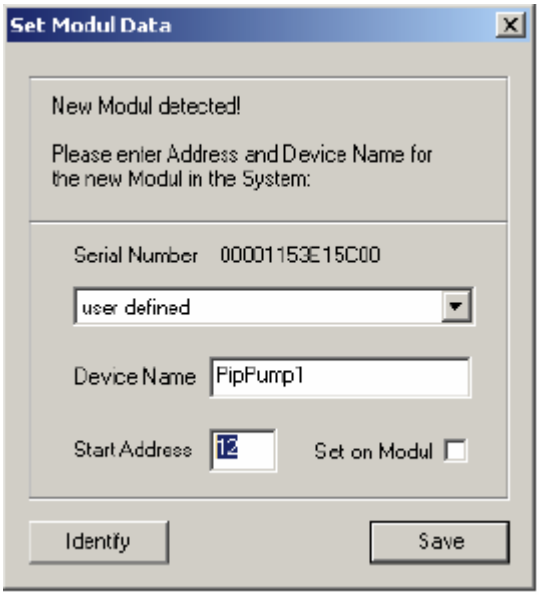


Figure 11.5 Set Module Data Window

Use the „Identify“ function for motors and pumps. It does not work with modules without motor or modules driven by IO firmware! Respect Sias rules when selecting „Device Name“ and „Start Address“.

Check the „Set on Module“ box when you are sure of the identification.

„Save“ stores the start address in the module EEPROM and CPU serial number, name and address in the „device.dat“ file. If the flag is unchecked, only the „device.dat“ file is updated!

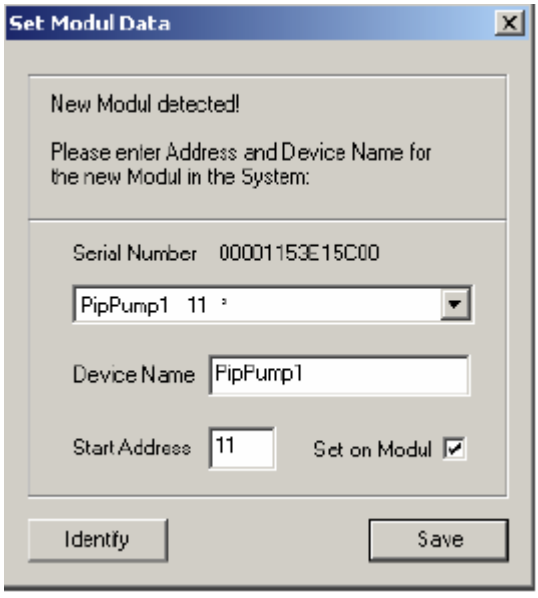


Figure 11.6 Set Module Data Window

1. Modify the above window using the start address 12.

➨ If the identification procedure fails and the configuration in the EEPROM does not match the configuration in the „device.dat“ file, X-Util will prompt for configuration troubleshooting with following message:

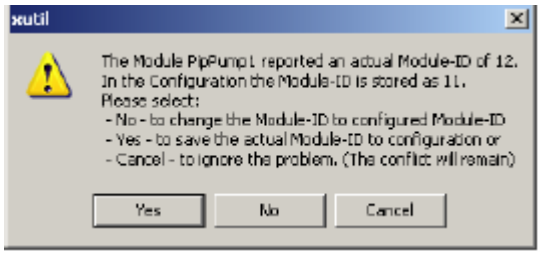


Figure 11.7 Set Module Data Window

In the example above the „Actual Module-ID“ stands for information stored in the CPU EEPROM, and „Configured Module-ID“ stands for the information stored in the device.dat file.

---

i Note: The button labels are not significant, but the explanations to select the appropriate option are. If the problem is not solved, the same prompt will pop up with the next start.

In the example above, the start address of module PipPump1 was set incorrectly to 12 instead of 11. Therefore the ”No” button must be selected to save the module ID (EEPROM) to the configured module ID (device.dat): 00001153E15C00,011,PipPump1

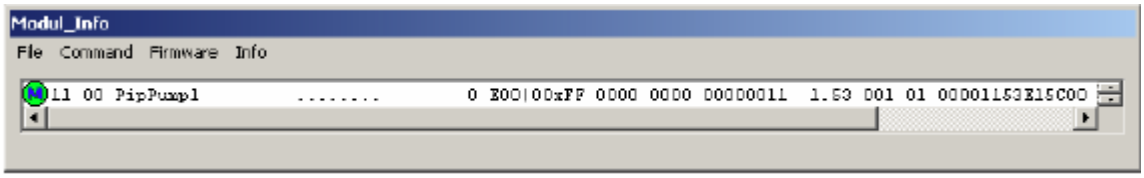


Figure 11.8 Modul_Info Window

11.5.4 Procedure to Restore a Correct FW Parameter Configuration

Restoring FW parameters should be done by Bruker certified engineers only!

11.5.4.1 Software Procedure

1. Switch the device on.
2. Start X-Util and check which modules are displayed or not.
3. Select one of the displayed modules.
4. Initialize it to get a visual confirmation of the selection.
5. Compare the address with the one in the „Module Name“ list verifying that it matches with the print module number (…00).
6. Correct the address if necessary in the parameter window.
7. Click „Send“.
8. Compare the „Reverse“ flag parameter with the one provided by Sias. Modify it if necessary.
9. Click „Send“.
10. Click „Close“.
11. Click „Reset“.
12. Re-initialize the module to check if the motor polarity is correct.
13. Exit X-Util.
14. Switch the device off.
15. Repeat these steps for all listed modules. In case some modules are not listed initially, they will be displayed after the first ones have been properly setup.
16. Open „File“ menu from the „Modul_Info“ screen.
17. Click on „Load parameter of all modules from file“.
18. Select the „AllPar.dat“ file located in the.\few directory.
19. Click on „Download“.
20. Make a final check to be sure that each module (including pumps) can be addressed (unit, move, pick, disp, …).
21. If a pump was changed, enter the new volume scaling factors delivered by Sias with the spare part in the „PipPump1.Vol“ firmware parameter page.
22. Click on „Send“ and after a few seconds, click on „Close“.
23. Create a new „AllPar.dat“ file from the file menu of the „Modul_info“ screen in the. directory **.\fw** of X-AP.
24. Make a copy of this file under „yymmdd_hhmm_AllPar.dat“ for archive.

11.5.4.2 Emergency Procedure

If identification problems persist, all modules can physically be disconnected except one. Then the only remaining module connected can be identified by **init/move** and set the right address and parameters.

1. Click „Send“.
2. Click „Exit“.
3. Switch the device off.
4. Connect next module.
5. Switch the device on.
6. Repeat the procedure until all modules are setup correctly.

11.5.5 Communication Error While Reading X-Util FW Parameters

Note: The following error does not indicate defective hardware.

Problems

The following error windows might appear after the device has been switched off while X-Util was executing a firmware maintenance process.

1. Switch the device on again.
2. Start X-Util
3. Select the module by double clicking in the „Modul_Info“ window.

First error message:

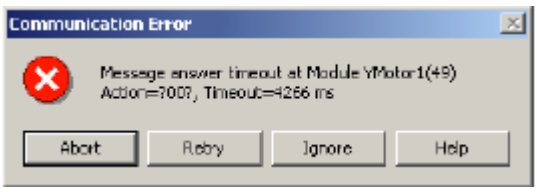


Figure 11.9 Communication Error Window

4. Click „Abort“.

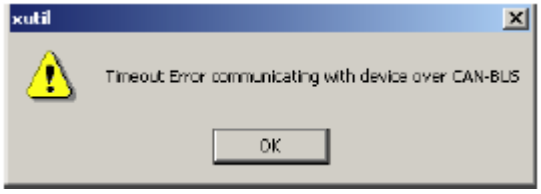


Figure 11.10 X-Util Window

5. Accept this error message as many times as you have installed modules on the robot.

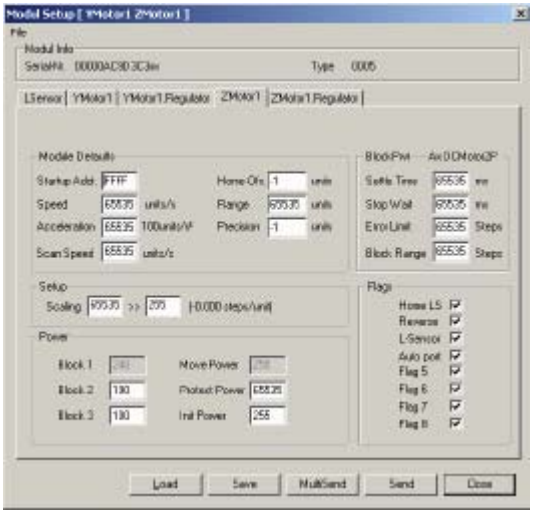


Figure 11.11 Module Setup – Zmotor1 Window

Diagnosis

The software could not read the firmware parameter configuration from the module. All fields which could not be filled in by the values of the „ini“ file are set to „FFFF“ (hexadecimal value „65535“ decimal).

Solution

1. Click „Close“.

➨ The following window appears.

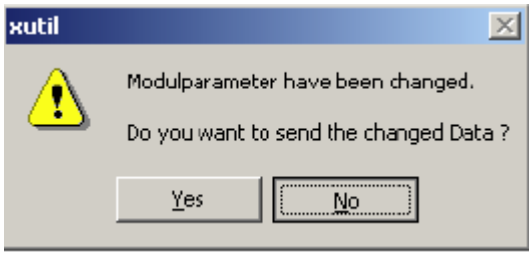


Figure 11.12 X-Util Save module parameter

2. Click „No“.

Do not send the changes to the module yet!

- It is extremely important not to send the changes to the module yet!
- Normal window appearance will be restored as soon as you exit X-Util.

3. Make sure the device is switched on, then restart X-Util to scan the current modules.

11.6 Y- and Z-Motor and Controller Board

11.6.1 Motor does not Initialize

Problem

The motor is not responding to initialization and there is no resistance when manually moving the pickup adapter up and down or back and forth.

- Check: Is the power switched on?
- Are power and CAN-bus cables/connectors correctly installed?
- Is the CAN-bus looped?
- Are software settings („siascfg.ini“), firmware, addresses and parameters correct?

Solution

Does a swap of the controller board affect another motor?

No

Go to section "Motor Check" on page 197.

Yes

Go to section "Controller Board Check" on page 199.

11.6.2 Motor Moves in Negative Direction with Positive Values

Problem

According to the firmware „reverse“ flag status, the motor moves in the correct direction while initializing. But other movements are executed in the opposite direction.

Diagnosis

As the initializing has been executed properly, the controller board and motors are working well. The problem is related to the parameters although the reverse flag has not been set and the initializing move was carried out in the correct direction.

Cause

If the motor range is set too high, the firmware can not process the calculated data properly, which results in a negative value for the move direction.

Solution

The motor range must be set according to the value provided in „siascfg.ini“ file on the installation CD.

11.6.3 Motor Check

If a controller board exchange does not bring any improvements, the fault must be in the motor. To detect a possible short circuit, the inner resistance of the motor must be tested:

1. Ensure that the device is switched off and the power cable is unplugged.
2. Disconnect the motor from the controller board and measure the resistance with an ohmmeter as follows:

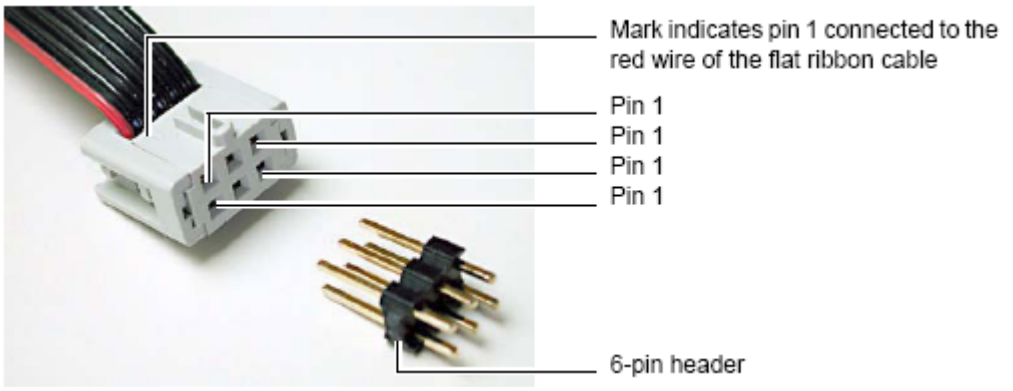


Figure 11.13 Motor connector and 6-pin header

3. Plug a 6-pin header into the motor connector.
4. Check the coil resistance of the motor between pin 1 and 6. It never must be 0 Ω or greater than 50 Ω.
5. Check the resistance of the encoder between pin 2 and pin 5. It must be 3–4 MΩ.

11.6.4 Z-motor shakes when sensing for liquid

1. Switch the device off.
2. Remove arm cover, see "Arm Cover" on page 104.
3. Disconnect the liquid level detector FBC from the motor board.
4. Switch the device on again.
5. Start X-Util: “E” flag should appear on ZMotor1.
6. Initialize the Z-motor.
7. Send low level commands in X-Util to move in Z-axis. Does it work?
8. If yes, the FBC is defective (shortcut due to damaged insulation or cable break).
9. Replace the FBC.

Note: The FBC is very sensitive and can only be folded once. Copy the folding of the defective cable and place insulation tape in exactly the same way.

11.6.5 Controller Board Check

If a motor exchange does not bring any improvements, the fault must be on the controller board.

11.6.5.1 Controller Board Troubleshooting

1. Switch the device off and then on again.
2. Start X-Util.
3. Check the LED on the controller board. At power on and during operation it flashes slowly (1 Hz).
4. Check if the board is listed with its name during the module scan ("Validating Firmware Parameters" on page 186).
5. Exit X-Util.
6. Open Windows® Explorer® and backup the „device.dat“ file located in the „X-Pdata“ subdirectory.
7. Start a text editor and open the „device.dat“ file located in the „X-AP\Data“ subdirectory.
8. Delete the line(s) which are related to the appropriate modules; e.g. ZMotor1, address 21 and YMotor1, address 31.
9. Save the file and exit text editor.
10. Start X-Util.
11. Enter XUtil/Module Info.

➨ This displays a dialog box to identify new hardware.

12. Ensure the corresponding motor is connected and click „Identify“ button.

➨ The motor will move to and fro a few steps, like a shake movement.

13. Select the correct module name (e.g. ZMotor1) and address (e.g. 21) from the pop down menu in the „user defined field“.

i Note: Service controller boards come with service start address E1 and F1.

➨ The module name (ZMotor1) and address (21) will automatically be displayed. This means that the controller board has been recognized and that communication is established.

14. Check the „Set on Module“ box.
15. Repeat this procedure for the Ymotor1 which is driven by the same controller board.

11.7 USB / CAN-Bus

11.7.1 Communication Problems Linked to USB Devices

Note: After a PC reboot the PCAN USB dongle flashes its red LED once, indicating that the dongle has been recognized by the PC BIOS. After proper setup the red LED should light consistently when no Sias applications are in use.

Some PCs may encounter communication problems linked to Universal Serial Bus (USB) devices. Listed below are some of the common errors:

- USB devices are not detected when you restart the computer.
- USB devices are not detected after you resume the computer from hibernation or standby.
- The computer uses 100% of the CPU time when you move the USB mouse.
- The computer hangs when resumed from standby mode when a USB mouse is connected.
- The computer takes a long time to start or resume when a USB device is connected.
- A yellow exclamation mark with code 28 or 31 is shown on a USB device in device manager.
- USB 2.0 Hi-speed devices are detected as USB 1.1 devices when your computer resumes from hibernation, even though they are plugged into a USB 2.0 capable port.

If any of these problems occur, it may not indicate that the PCAN USB dongle is faulty. But some settings and versions must be checked first.

Checking the OS and the SP version

Operating system (OS) and service pack (SP) version can be checked in „Start/Settings/ Configuration Panel/System/General.

Minimal configuration:

- Microsoft Windows 2000 with SP 4
- Microsoft Windows XP with SP 2
- Microsoft Windows Vista SP2
- Microsoft Windows 7

Note: Get in touch with Bruker if you encounter problem with Microsoft Windows XP-SP 3.

Checking the USB port version

The USB port version can be checked in „Start/Settings/Control Panel/System/Hardware/Device Manager/USB Bus Controllers“.

1. Right click „USB Root Hub“.
2. Click „Properties“.

If each USB output provides a current of 500 mA it is an USB V2.0 Hi-speed port, otherwise it is an USB 1.1 port. Dongle current consumption is around 380 mA.

Note: After a PC reboot the PCAN USB dongle flashes its red LED once, indicating that the dongle has been recognized by the PC BIOS.

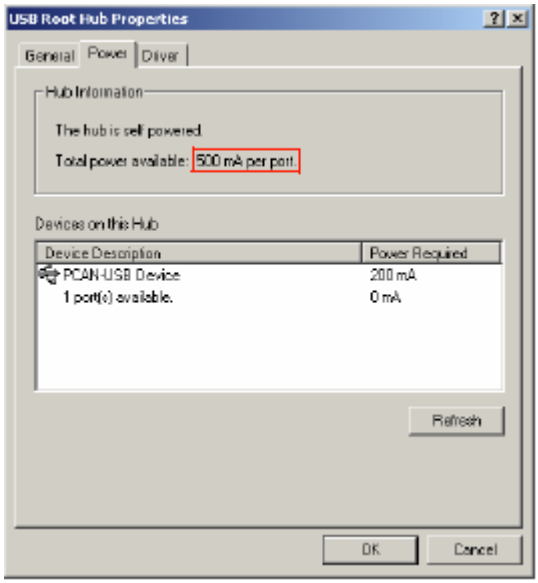


Figure 11.14 USB Root Hub Properties Window

Checking the dongle firmware version

The firmware version can be checked in „Start/Settings/Control Panel/PCAN Hardware“.

1. Right click „PCAN Hardware icon“.
2. Click „Properties“.

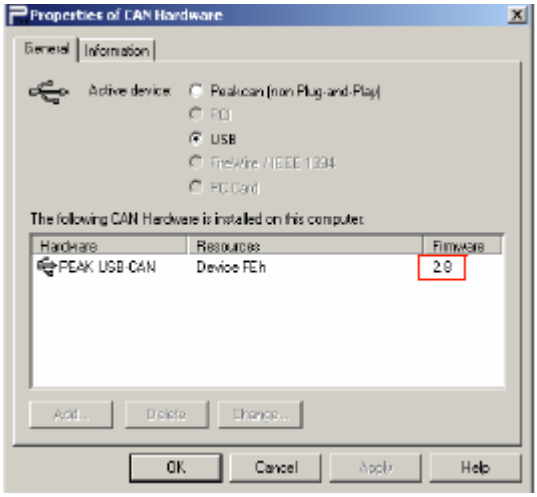


Figure 11.15 Checking the Firmware Version

Note: A dongle upgrade will not be charged as long as the old one is returned to Sias support within one week. Please contact Sias for further support and latest firmware version and driver.

11.7.2 Mixup of USB CAN Adapters

When the computer is rebooted or started it can occur that the SamplePro hr-MAS software does not start correctly and stops with the following error message:

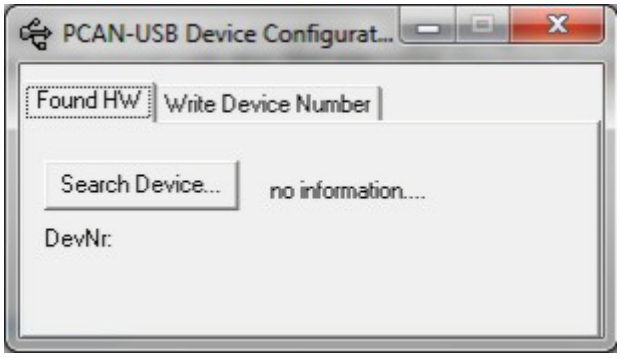
Figure 11.16 Device Failure

Cause: The operating system detects the connected USB adapters in a random scan progress and the CAN Adapter list is sorted depending on which adapter has been

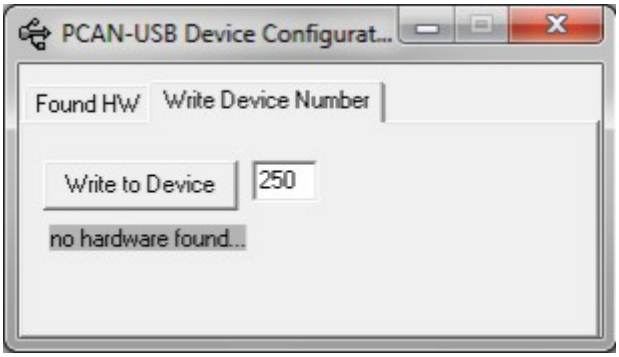
detected first.

To force a fixed CAN adapter list and to assign a permanent address ID,

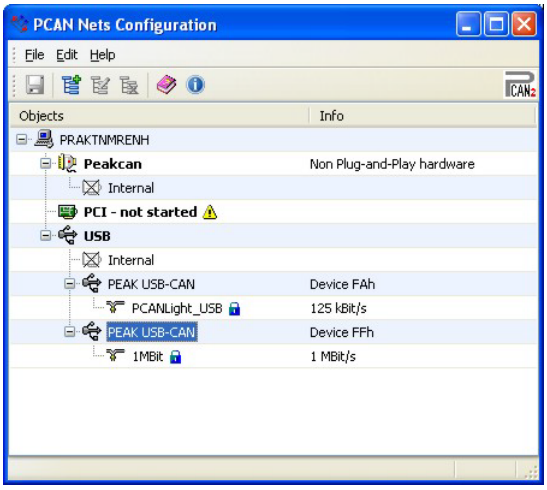
1. Open the **PCAN USB Device Configurator** program.



2. Plug off the device that is attached to the robot system. Press the **Search Device…** button to detect the USB adapter of the FEU.
3. Write the address 250 to the adapter.



4. Plug in the device that is attached to the robot system.
5. Reboot the system.
6. Check the PCAN Net settings.


PCAN Nets Configuration
File Edit Help
Objects
Info
PRAKTNMRENH
Peakcan
Non Plug-and-Play hardware
Internal
PCI - not started
USB
Internal
PEAK USB-CAN
Device FAh
PCANLight_USB
125 kBit/s
PEAK USB-CAN
Device FFh
1MBit
1 MBit/s

12 Spare Parts

12.1 Robotic System Parts

Arm Cover

Visual Identification	Description/Part #/Revision	Specifications/Release Info.
	Arm left	Additional bottom screw (including washer) on the front side. Serial No. 1290 and above.
		

Table 12.1 Arm Cover

Side and Front Cover Plate

Visual Identification	Description/Part #/Revision	Specifications/Release Info.
	Arm (inside right)	Additional thread on the bottom side of the front for cover mounting. Serial No. 1290 and above.
	Arm (front)	Two additional threads on the bottom side of the front. Serial No. 1290 and above.

Table 12.2 Side and Front Cover Plate

Y-Motor Support

Visual Identification	Description/Part #/Revision	Specifications/Release Info.
	P/N: 200574-R revision F P/N: 200574-L revision F (pictured)	Vertical part broaden and 45° facet replaced by a radius to optimize ribbon cable guidance. Serial No. up to 1765
	P/N: 101177 revision A, B, C	Spring loaded support. Serial No. 1766 and above

Table 12.3 Y-Motor Support

Y-Gear

Visual Identification	Description/Part #/Revision	Specifications/Release Info.
	Y-Gear (metal) P/N: 200292 revision B Grub Screw P/N: 201175	Serial No. up to 1752 Serial No. from 1754 to 1761 Serial No. from 1763 to 1768
	Y-Gear (POM) P/N: 202262 revision A Grub Screw P/N: 201175	For Y-motors mounted on the spring-loaded support only, requires the appropriate slotted rack. Serial No. 1753, 1762 Serial No. 1769 and above

Table 12.4 Y-Gear

Z-Motor and Z-Gear

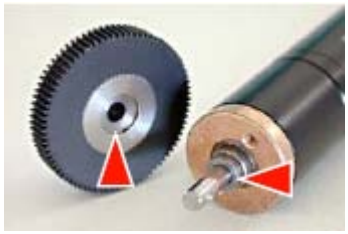
Visual Identification	Description/Part #/Revision	Specifications/Release Info.
	Z-Motor P/N: 131008 Maxon reference # M040304 and 313093 Z-Gear P/N: 202271 revision A	Z-Motor Sintered steel bearing Z-Gear Additional cut-in Serial No. 1349 and above

Table 12.5 Z-Motor and Z-Gear

Pickup Adapter

Visual Identification	Description/Part #/Revision	Specifications/Release Info.
	PEEK Pickup Adapter P/N: HZ16944	

Table 12.6 Pickup Adapter and Clamp

Object Detector

Visual Identification	Description/Part #/Revision	Specifications/Release Info.
	Object Detector P/N: HZ16890	

Table 12.7 Object Detector with Barcode Cover

Barcode Reader for Rotor Container

Visual Identification	Description/Part #/Revision	Specifications/Release Info.
	Barcode SICK ICR803 B 0271 SIAS P/N: E0188 Barcode Reader Print: SIAS P/N: 130110	

Table 12.8 Barcode reader for rotor container

Door Lock Actor

Visual Identification	Description/Part #/Revision	Specifications/Release Info.
	Door Lock Actor SIAS P/N: E0240	

Table 12.9 Door lock actor

Door Open Sensor

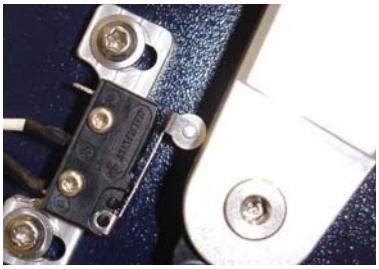
Visual Identification	Description/Part #/Revision	Specifications/Release Info.
	Door Open Sensor SIAS P/N: E0026	

Table 12.10 Door open sensor

Cooling Rack

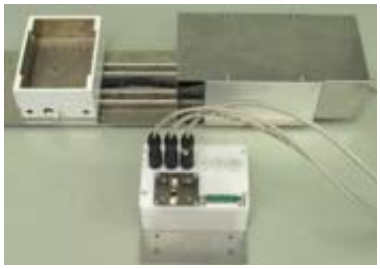
Visual Identification	Description/Part #/Revision	Specifications/Release Info.
	Cooling Rack -16 degrees Celsius with 48 positions P/N: H121905	Including: Cooling Unit P/N: O10548 Adapter plate for rotor trays, P/N: 1803904 Power supply, P/N: 1803903

Table 12.11 Cooling Unit -16°C

Adapter Plate for Cooling Unit

Visual Identification	Description/Part #/Revision	Specifications/Release Info.
	Adapter plate for cooling unit P/N: 1803904	

Table 12.12 Adapter Plate for Cooling Unit

Rotor Container Adapter Plate for Room Temperature

Visual Identification	Description/Part #/Revision	Specifications/Release Info.
	Rotor container adapter plate for room temperature P/N: H123449	

Table 12.13 Adapter Plate for Rotor Container

Nitrogen Flow Sensor

Visual Identification	Description/Part #/Revision	Specifications/Release Info.
	Gas Flow Meter P/N: 1801110	SMC #PF510-C4-1-NA-R

Table 12.14 Gas Flow Meter

Status Light Board

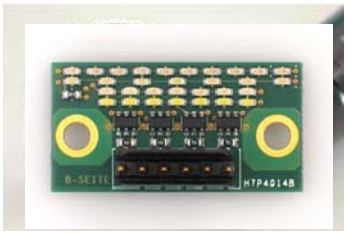
Visual Identification	Description/Part #/Revision	Specifications/Release Info.
	P/N H14216	

Table 12.15 Status Light Board

Rotor Container

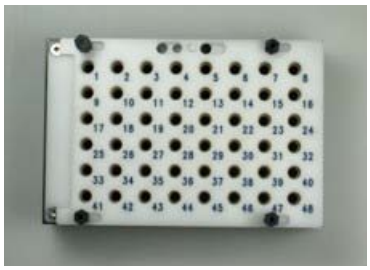
Visual Identification	Description/Part #/Revision	Specifications/Release Info.
	Rotor Container with 48 positions P/N: HZ16147	

Table 12.16 Rotor Container

Power Supply for Cooling Rack

Visual Identification	Description/Part #/Revision	Specifications/Release Info.
	Power supply P/N: 1803903	

Table 12.17 Power Supply for Cooling Rack

Tray Isolation Lid for Rotor Container

Visual Identification	Description/Part #/Revision	Specifications/Release Info.
	Isolation Lid P/N: HZ 16533	

Table 12.18 Isolation Lid

Tray Isolation Collar for Rotor Container

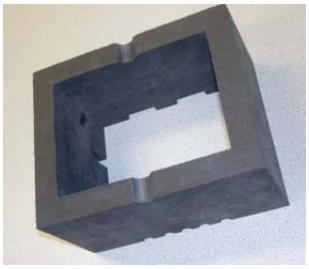
Visual Identification	Description/Part #/Revision	Specifications/Release Info.
	Isolation Collar P/N H121856	

Table 12.19 Tray Isolation Collar

Rotor 5 mm for MAS

Visual Identification	Description/Part #/Revision	Specifications/Release Info.
	HR-MAS Rotors with Barcode	

Table 12.20 HR-MAS Rotor with Barcode

Rotor Handling Tool

Visual Identification	Description/Part #/Revision	Specifications/Release Info.
	Rotor Handling Tool P/N: HZ16892	

Table 12.21 Rotor Handling Tool

Lead Tube for Pickup Adapter

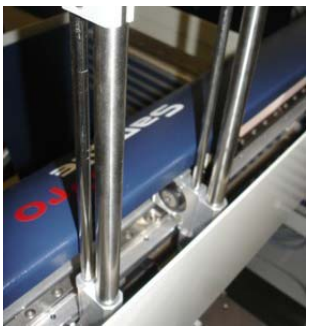
Visual Identification	Description/Part #/Revision	Specifications/Release Info.
	Lead Tube for Pickup Adapter SIAS P/N 101182 (Hubmodule adapter for tube guide)	

Table 12.22 Lead Tube for Pickup Adapter

12.2 Exchange Unit Spare Parts

Visual Identification	Description/Part #/Revision	Specifications/Release Info.
	Transfer Hose P/N: 1802382	
	Pipe Cutter Plastic P/N: 1804584	
	Manual Deflasher P/N: 1804590	

Table 12.23 Exchange Unit Spare Parts

Spare Parts

13 Electrical and Pneumatic Data

13.1 Robotic System PCB Pinout

13.1.1 MCB X-Motor Board V2.11

This board controls the X-motor.

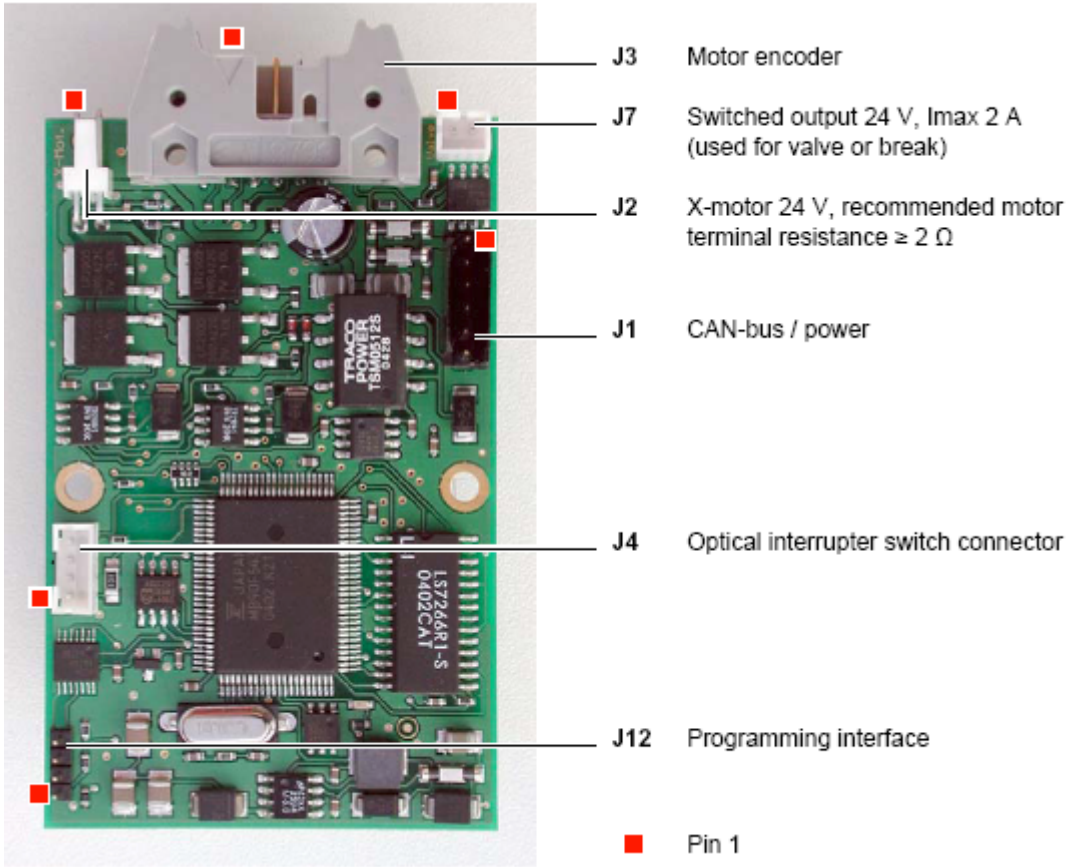


Figure 13.1 MCB X-Motor Board V 2.11

13.1.2 MCB BB1 V2.0

This board controls the Y- and Z-motors, pumps and valves.

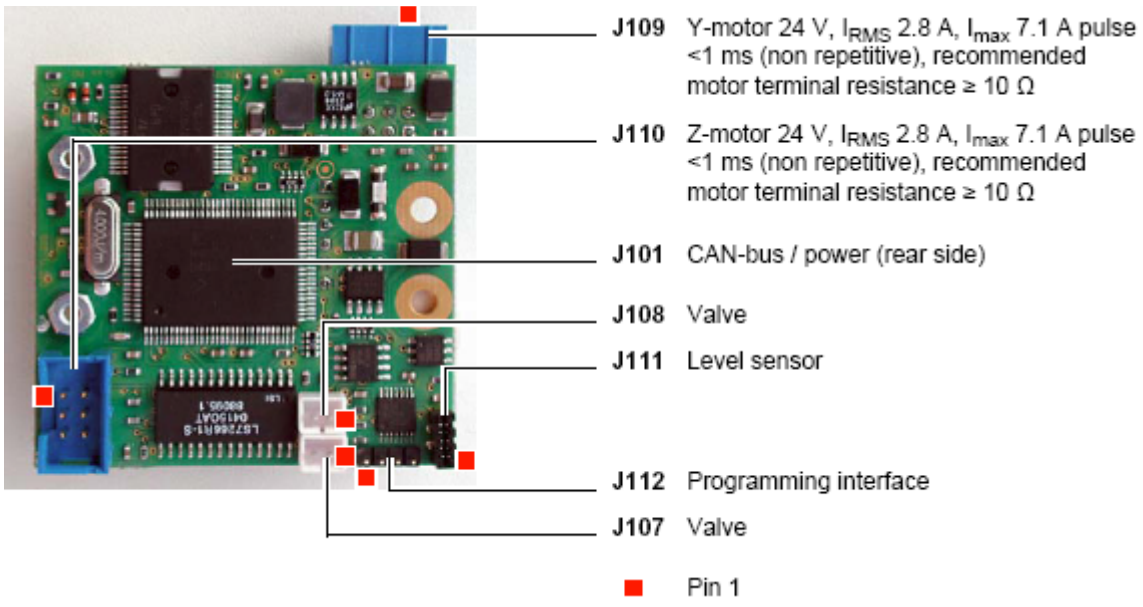


Figure 13.2 MCB BB1 V2.0

13.1.3 MCB BB2 V2.0

This board controls the Y- and Z-motors, pumps and valves.

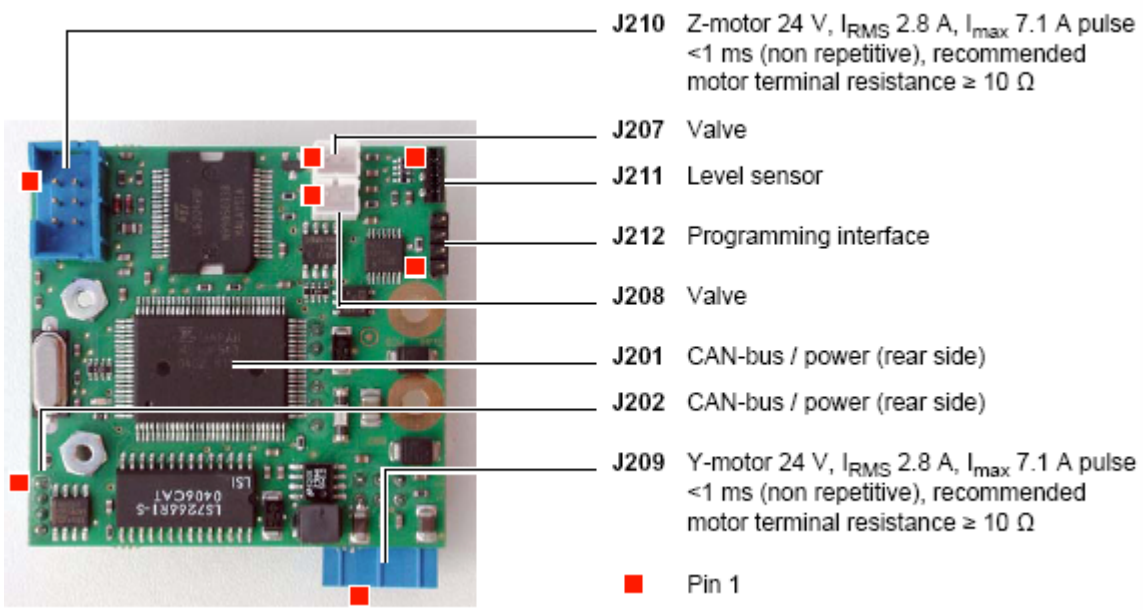


Figure 13.3 MCB BB2 V2.0

13.1.4 Object Detector HZ16890_C

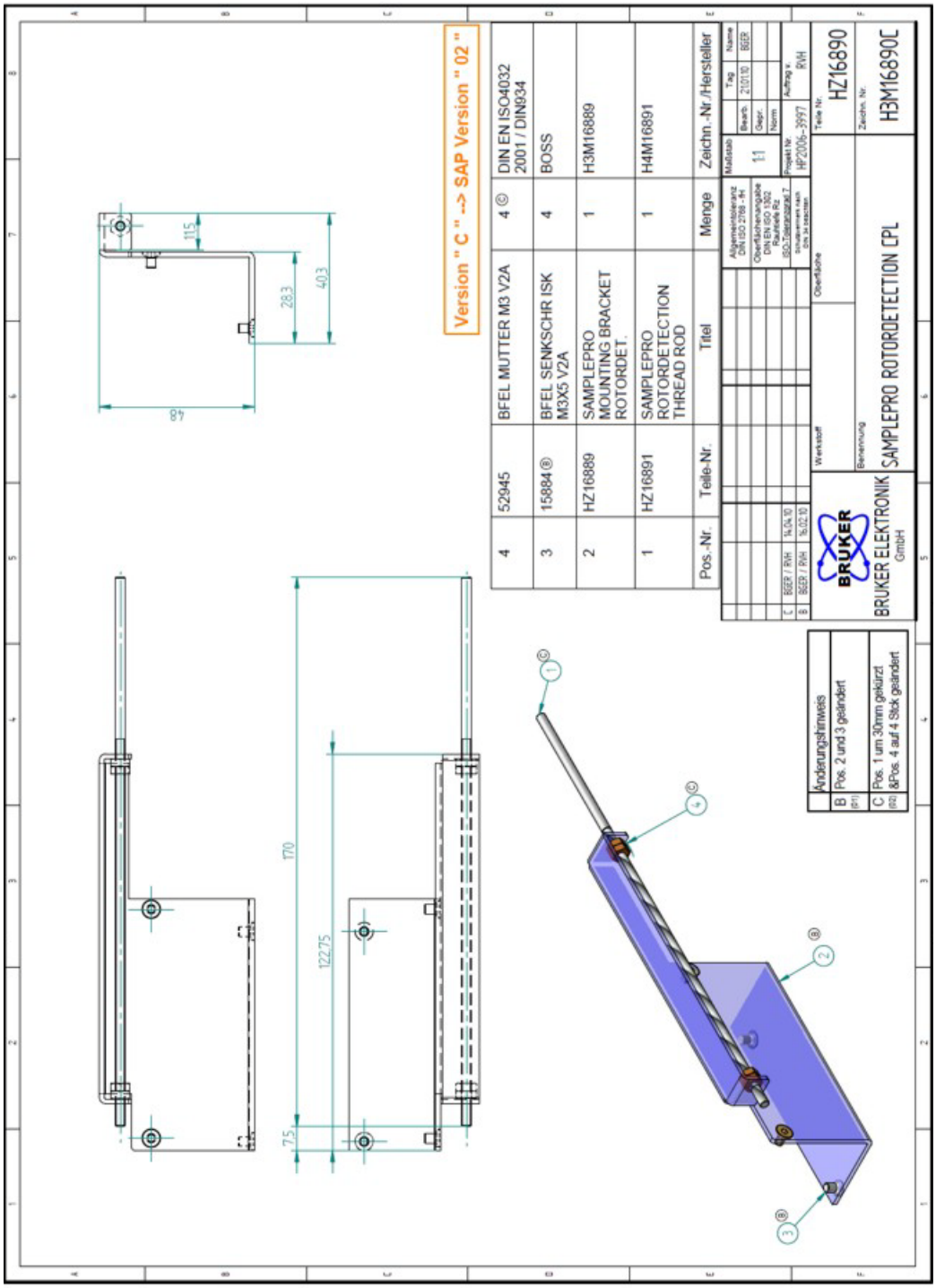


Figure 13.4 Object Detector - Drawing

13.2 Exchange Unit Pneumatic Data

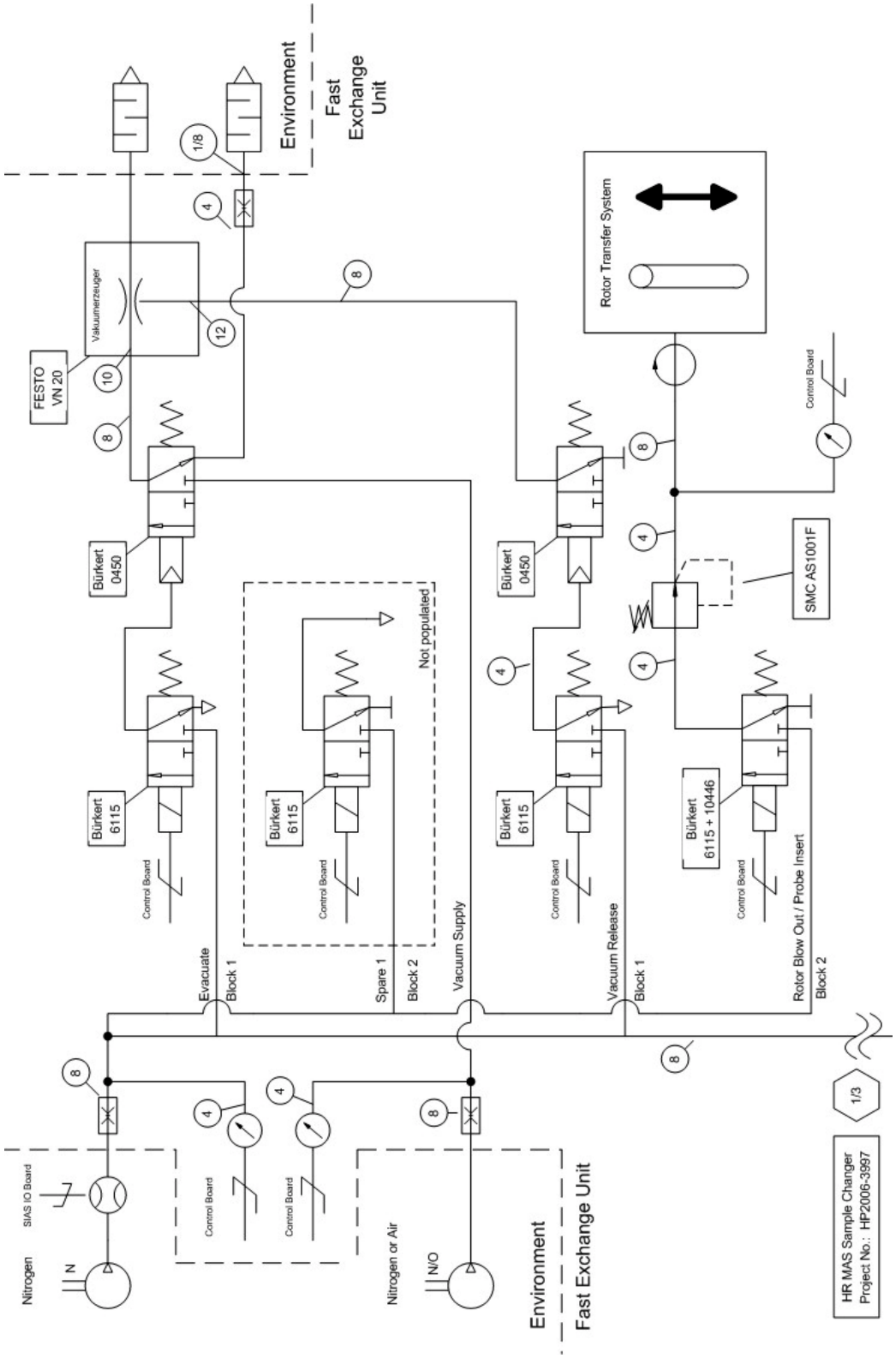


Figure 13.5 Pneumatic Drawing Page 1

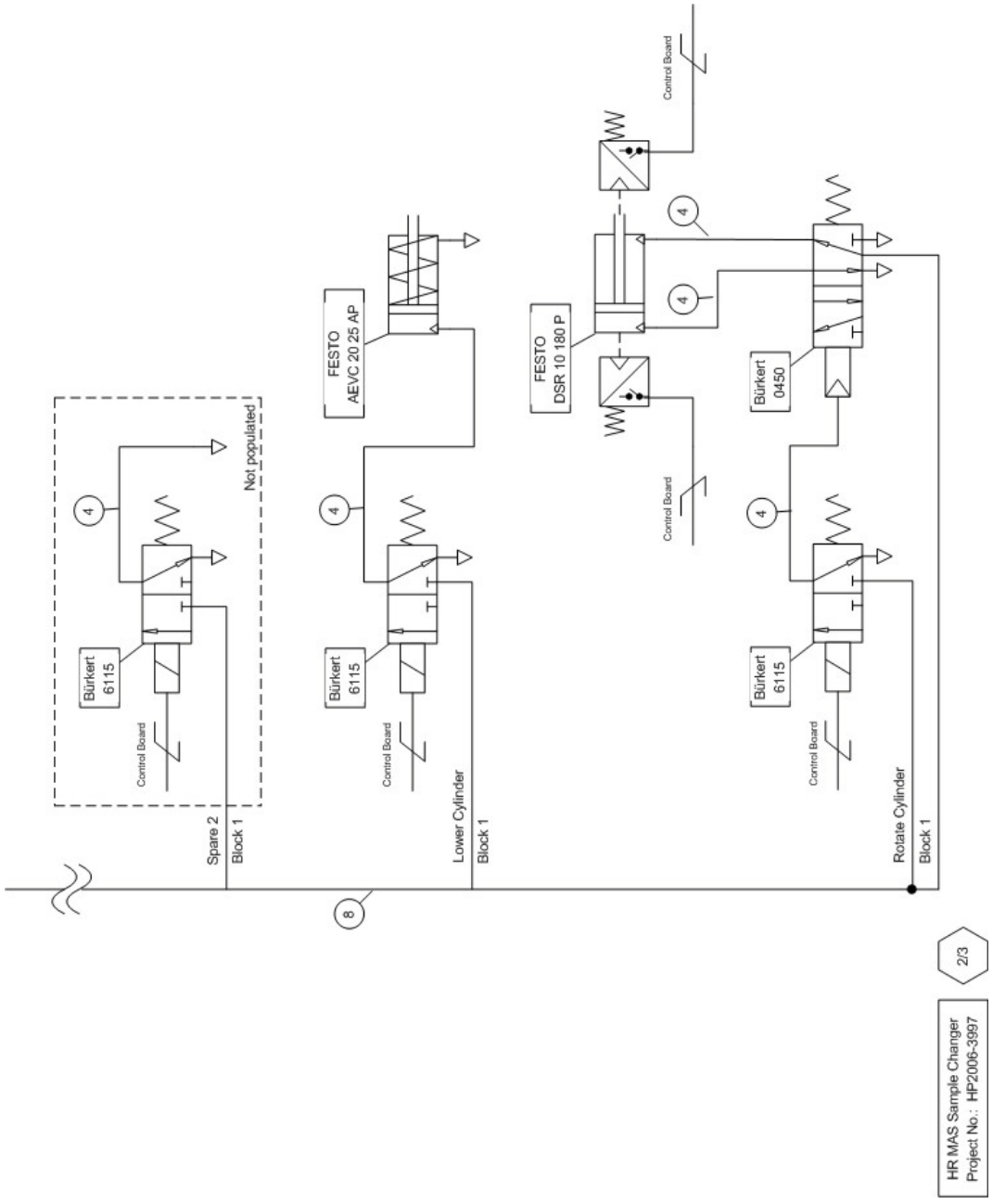


Figure 13.6 Pneumatic Drawing Page 2

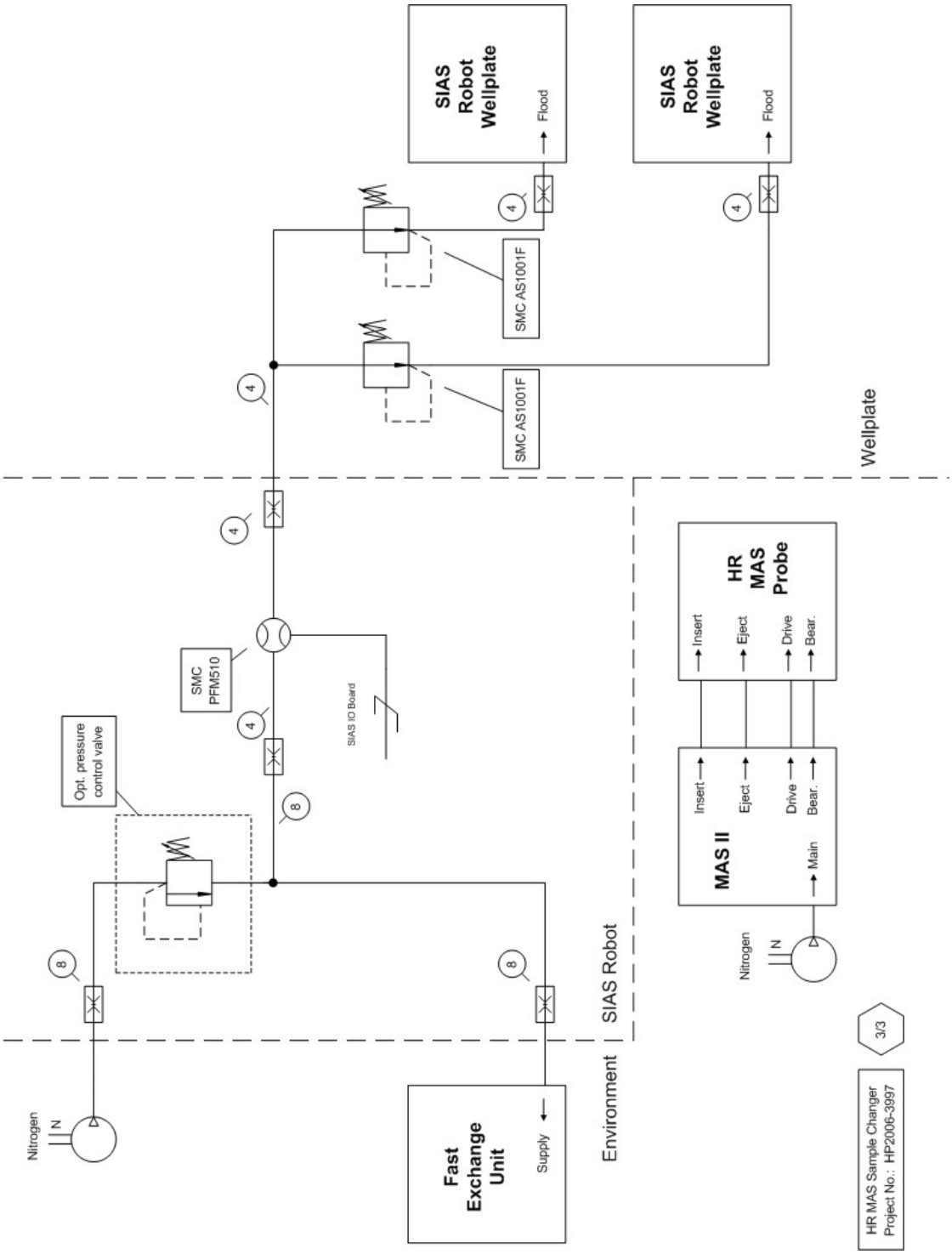


Figure 13.7 Pneumatic Drawing Page 3

13.3 Exchange Unit Electrical Data

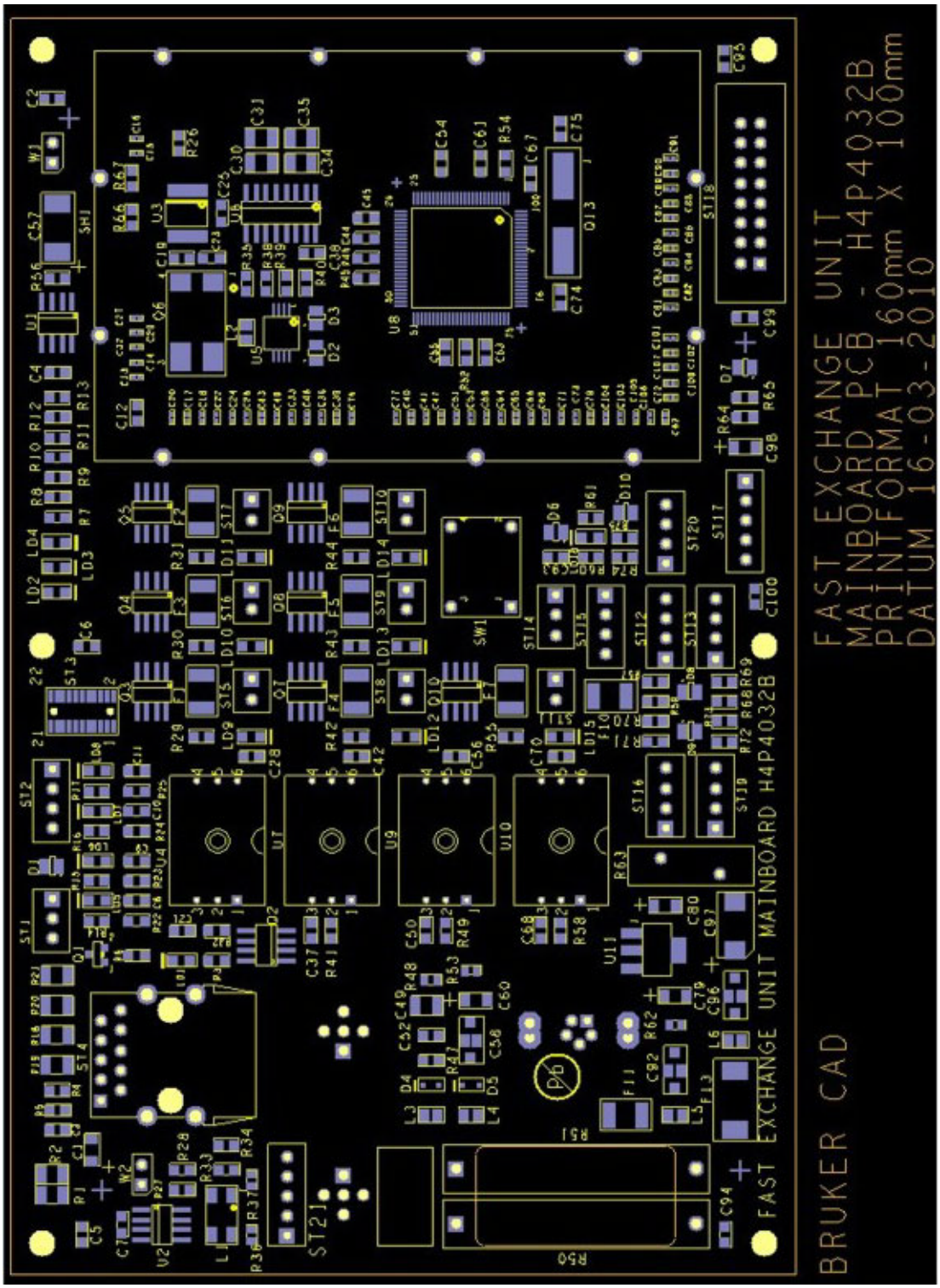


Figure 13.8 Board Layout

Connectors

STB3 - Power supply connector

This connector supplies the exchange unit with 5V/0.4A for the electronics and 24V/0.3A for the pneumatic valves.

Pinout at this connector:

1 - 5V

2 - 24V

3 - n.c.

4 - GND

5 - GND

P/N: for the mains adaptor: 1801718

P/N: for the power supply cable: HZ16759

STB1 - CAN BUS output

This connector is not populated.

Pinout at this connector:

1 - Shield

2 - VCC CAN (not used)

3 - GND

4 - CAN High

5 - CAN Low

STB2 - CAN BUS input

This connector provides the CAN connection to the control unit. This end is with 120 Ohms terminated.

Pinout at this connector:

1 - Shield

2 - VCC CAN (not used)

3 - GND

4 - CAN High

5 - CAN Low

P/N: of the CAN cable (with 9pol. D-Sub on the other side): HZ16758

ST21 - Internal CAN BUS connection

This connector is not populated.

Pinout at this connector:

1 - Shield

2 - VCC CAN (not used)

3 - GND

4 - CAN High

5 - CAN Low

ST18 - Debugger connector

This connector is not populated.

ST4 - Barcode reader connector

U4 - N2 supply pressure sensor

The N2 gas supply (Inlet 2) is connected to this sensor.

U9 - Vacuum supply pressure sensor

The vacuum supply (Inlet 1) is connected to this sensor.

U7 - Transfer pressure sensor

The transfer pressure valve is connected to this sensor.

U10 - Spare pressure sensor

This sensor is not populated.

ST7 - Valve output Lower

The valve for the vertical cylinder is connected to this connector.

ST8 - Valve output **Vacuum supply**

The vacuum supply valve is connected to this connector.

ST9 - Valve output **Release vacuum**

The release valve for the vacuum generator is connected to this connector.

ST10 - Valve output **Blow Down**

The valve for the downwards rotor transfer is connected to this connector.

ST11 - Valve output **Rotate Cylinder**

The drum rotation valve is connected to this connector.

ST3 - Runtime logger connector

This connector is not populated.

ST14 - Light barrier power supply

ST15 - Light barrier state input

ST17 - Programming interface

The board has to be flashed with the firmware by this connector.

ST1 - End position switch connector **source**

Source side end position switch, operated by the drum.

ST2 - End position switch connector **destination**

Destination side end position switch, operated by the drum.

State LED‘s

LD2 - Supply OK

This LED is ON if the board voltages are OK and the board is not in reset state.

LD3 - Application program running

This LED will blink very fast, when no CAN communication is possible.

It blinks slow, if the CAN connection is succeeded.

LD4 - Boot program running

This LED illuminates if the processor runs in the boot an not in the application program.

LD1 - Sleep Mode LED

If the board is in sleep mode, this LED is ON. In this state, the power supply to the bar-code reader is disabled.

LD11 - Valve output **Lower**

This LED is ON, if the valve is active.

LD12 - Valve output **Vacuum supply**

This LED is ON, if the valve is active.

LD13 - Valve output **Release vacuum**

This LED is ON, if the valve is active.

LD14 - Valve output **Blow Down**

This LED is ON, if the valve is active.

LD15 - Valve output **Rotate Cylinder**

This LED is ON, if the valve is active.

LD18 - Light barrier state

This LED is ON, if the beam of the light barrier is interrupted.

LD6 - End position switch LED **source**

Indicates if the switch is operated.

LD5 - End position switch LED no **source**

Indicates if the switch is not operated.

LD8 - End position switch LED **destination**

Indicates if the switch is operated.

LD7 - End position switch LED **no destination**

Indicates if the switch is not operated.

Jumper and Buttons

SW1 - Reset

This button resets the whole board.

W2 - CAN BUS termination

This jumper is not populated.

W1 - Boot program jumper

Closing this jumper will hold the processor in the boot program.

14 Preventive Maintenance

There is no service level preventative maintenance required. For user level maintenance information refer to the SamplePro hr-MAS User Manual P/N: Z31941.

15 Transport, Packaging and Storage

15.1 Symbols on the Packaging

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

Top

The arrow tips on the sign mark the top of the package. They must always point upwards; otherwise the content may be damaged.

Fragile

Marks packages with fragile or sensitive contents.

Handle the package with care; do not allow the package to fall and do not allow it to be impacted.

Protect Against Moisture

Protect packages against moisture and keep dry.

Attach Here

Lifting gear (lifting chain, lifting strap) must only be attached to points bearing this symbol.

Center of Gravity

Marks the center of gravity of packages.

Note the location of the center of gravity when lifting and transporting.

Weight, Attached Load

Indicates the weight of packages.

Handle the marked package in accordance with its weight.

Permitted Stacking Load

Indicates packages which are partially stackable.

Do not exceed the maximum load-bearing capacity specified on the symbol in order to avoid damaging or destroying the content.

Do not Damage Air-tight Packaging

The packaging is air-tight. Damage to the barrier layer may render the contents unusable.

Do not pierce.

Do not use sharp objects to open.

Component Sensitive to Electrostatic Charge

The packaging contains components which are sensitive to an electrostatic charge.

Only allow packaging to be opened by trained personnel.

Establish potential equalisation before opening.

Protect from Heat

Protect packages against heat and direct sunlight.

Protect from Heat and Radioactive Sources

Protect packages against heat, direct sunlight and radioactive sources.

15.2 Inspection at Delivery

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

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

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

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

15.3 Packaging

About Packaging

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

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

Handling Packaging Materials

Dispose of packaging material in accordance with the relevant applicable legal requirements and local regulations.

15.4 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.

15.5 Returning the Robotic System

Before delivery to the customer Bruker thoroughly checks all parts according to the order received and ensures that they are packed properly. Whenever a device or parts of a device need to be returned to the factory, the same precautions should be taken.

Bruker recommends keeping the packaging material in case of later shipment (at least the foam block used to stabilize the arms and ideally the wooden pallet). If the original packing is not available, contact Bruker to order a replacement.

15.5.1 Robot and Part Shipping Precautions

Before returning a device or parts to Bruker, the following actions must be completed:

1. Contact Bruker support to get a „Return Material Agreement (RMA) number“. This number must be entered on all correspondence.
2. If defective parts are returned, specify from which device (type and SN) they come from.
3. Indicate the circumstance of the problem, i.e. error code reported by software.
4. Complete the RMA document provided during service training (please contact Bruker support if you need a copy).
5. Summarize what service action and time was necessary to identify and to fix the problem. Write down your actions.
6. Clean and decontaminate parts and device as described in "Cleaning" on page 237.
7. Complete the „Certificate of Decontamination“. This document is available from Bruker upon request. The completed certificate must be sent with the parts.

15.5.2 Preparing the Robot System for Transport

15.5.2.1 Dismounting

1. Remove all unfixed modules, accessories, including racks.
2. Remove the object detector and pickup adapter.

15.5.3 Packing the Robot System for Transport

For packing the device Bruker recommends the use of the original foam blocks and box. Contact your supplier to order a replacement set if the originals are not available.

Note: The device and accessories mentioned below are general and may not be relevant to your specific equipment. However, make sure your device is packed in a comparable way.

15.5.3.1 Packing the arm

1. Slide the liquid level detector assemblies to the center area of the arm.
2. Stabilize the Z-racks by wrapping PE flat film around the Z-Modules and arm as shown in the following figure. Do not wrap too tightly, and this may cause tension on the liquid level detector assemblies!

Figure 15.1 Wrapping the Z-Modules

Figure 15.2 Wrapping

15.5.3.2 Packing the Tool Arm

1. Slide the tool module to the center area of the tool arm.
2. Fasten the module (e.g. handler) with an adequate foam block and attach it to the arm housing with PE flat film.
3. Stabilize the tool module by wrapping PE flat film around the tool module. Do not wrap too tightly, as this may cause tension on the module!

Figure 15.3 Wrapping the Tool Module

15.5.3.3 Packing the Deck Tray and Frame

1. Lift the deck tray and frame onto the wooden pallet using the handles (see "Carrying the SamplePro hr-MAS" on page 45).
2. Attach the bag containing the system liquid filters on the pallet.
3. Remove the handles and pack them in bubble wrap. Stow them in the accessory card box.

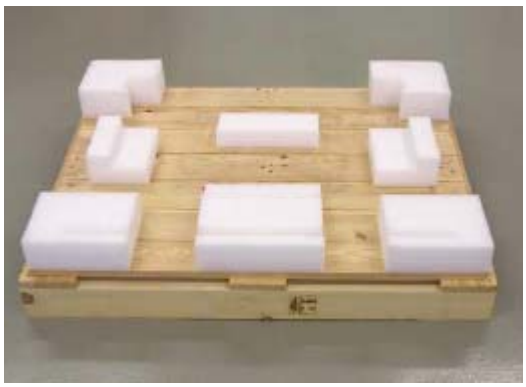


Figure 15.4 Wooden pallet

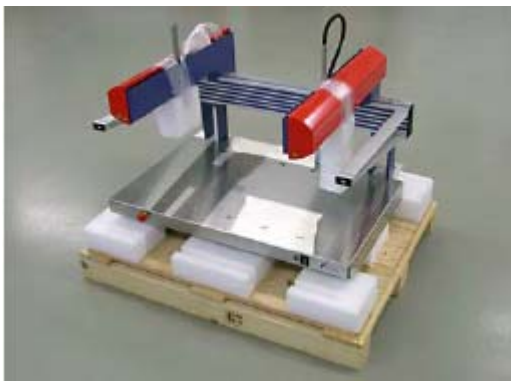


Figure 15.5 device on the wooden pallet

4. Stabilize the arms with a foam block put over the X-rail. Fasten the block with adhesive tape around the X-rail.
5. Cover the deck with bubble wrap. Protect the edges of the deck with cardboard, then strap down the device to the wooden pallet with two straps.
6. Support the arms with foam blocks.

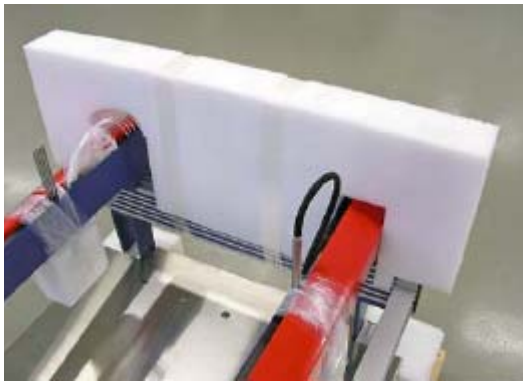


Figure 15.6 Stabilizing the arms and the X-rail with a foam block

Figure 15.7 Strapping down the device and supporting the arm with a foam block.

7. Wrap the safety door in bubble wrap and place it in the grove between foam blocks in front of the deck. Put the safety door tool in a plastic bag and put it in the accessories box.
8. Pack all accessories in a box. Make sure every item is adequately protected.
9. Put the accessories box on the deck between the arms and fasten it to the pallet with two straps.

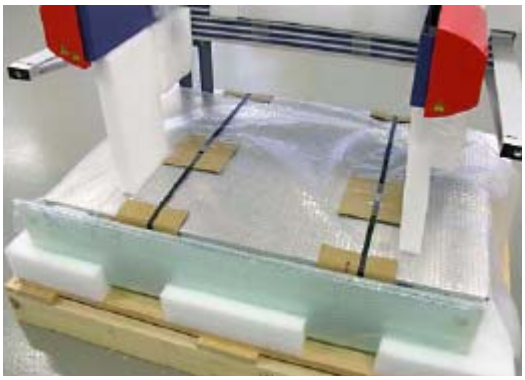


Figure 15.8 Safety door and accessories box

Figure 15.9 Accessories in the box

10. Cover the device with a card box and fasten it with plastic strapping. Protect the edges with strap guards.

Figure 15.10 Place the accessories box on the deck

Figure 15.11 Cover the device with a card box

11. Attach Shockwatch® indicators to the top of two opposite sidewalls. Make sure they are white, which means that they are still intact.

Figure 15.12 Attaching Shockwatch® indicators

12. Make sure all necessary documents are provided and required forms are completely filled in.

16 Cleaning and Disposal

16.1 Cleaning

⚠ CAUTION

Potential hazards may exist to personnel from the liquids being handled by the device.

Infectious clinical samples, toxic or corrosive chemicals, or radioactive substances may be present.

- ▶ Clean and decontaminate device and modules before packing and transporting!
- ▶ Wear protective clothing, gloves and glasses.
- ▶ Pour water into the wash station and drain the waste tubing. Pour 70% ethanol solution in the wash station and rinse thoroughly. Remove the wash station.
- ▶ Decontaminate the extremity of the waste tubing with a lint free tissue impregnated with 0.05% ProClin 950® solution. Use a clean tissue impregnated with 0.05% ProClin 950® solution to wrap the tubing in a plastic bag.
- ▶ Decontaminate all relevant modules and parts with 70% ethanol solution or 0.05% ProClin 950® solution in accordance with „Certificate of Decontamination“. This document is available on request
- ▶ Clean the deck with 70% ethanol solution.

For the cleaning and lubrication intervals refer to the SamplePro hr-MAS user manual.

For the chemical resistance specifications of the SamplePro hr-MAS robot see also "Material Chemical Resistance" on page 248.

16.2 Environmental Protection

NOTICE

Danger to the environment from incorrect handling of pollutants!

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

- Always observe the instructions below 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:

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

16.3 Decommissioning, Recycling and Disposal of the Robotic System

Bruker is committed to providing customers with innovative, high quality products and services that are environmentally sound.

If your SamplePro hr-MAS is no longer needed, please consider recycling it by transferring it to another lab, either directly or by contacting an device recycling organization. Otherwise it can be disassembled and some parts recycled.

When the SamplePro hr-MAS is permanently taken out of service, first thoroughly clean and decontaminate according to the instructions given in section „Cleaning“.

Prior to recycling, electrical and electronic components, such as power supply units (PSU), printed circuit boards (PCB), cables etc., should be removed and disposed of according to local regulations.

The remainder of the SamplePro hr-MAS can be recycled according to local regulations.

Key components of the SamplePro hr-MAS are made of:

Component	Material
Frame	Aluminum
X-rail	Aluminum
X-rail support	Aluminum
Deck	Stainless steel
Arm housing	Steel
Arm support	Aluminum
Arm frame	Aluminum
Safety door	Tempered or acrylic glass
Safety door rail	Aluminum

Table 16.1 Material Used for SamplePro hr-MAS Key Components.

Cleaning and Disposal

17 Technical Data

17.1 General

Weight

Data	Value	Unit
System	60	kg
Robot	40	kg
Exchange Unit	10	kg
Cooling Unit	4.5	kg
Accessories	5.5	kg

Table 17.1 Technical Data: Weight

Dimensions

Data	Height	Width	Depth	Unit
System	1800	566	650	mm
Robot	750	566	650	mm
Exchange Unit	300	150	350	mm

Table 17.2 Technical Data: Dimensions

Noise Level

Data	Value	Unit
The highest measured workstation accepted value, with consideration of a standard deviation of 1.5 dB from the measurement inaccuracy.	71.5	dB(A)
The highest value 1 meter from the vicinity of the neighboring workstation.	69.5	dB(A)

Table 17.3 Technical Data: Noise Level

Height

The SamplePro hr-Mas system can be operated in a height up to maximum 2000 m.

Cooling Range

Data	Value	Unit
Cooling device temperature range	-16 to room temperature	°C

Table 17.4 Cooling Device Temperature Range

Sample Usage

SamplePro hr-MAS can handle the following standard spinner geometry:

Standard MAS 4 mm rotors.

17.2 Electrical

System

System	Value	Unit
Voltage (automatic voltage regulation)	90 - 240	Volts
Maximum power consumption	1045	Watts

Table 17.5 Electrical Connection Values

Components

Components	Value	Unit
Robot	500	Watts
Exchange Unit	30	Watts
Cooling Unit	150	Watts
PC	320	Watts
Monitor	45	Watts

Table 17.6 Maximum Power Consumption

17.3 Operating Conditions

Environment

Data	Value	Unit
Temperature range	15 to 30	°C
Relative humidity at 30 °C, maximum, not condensing	10-85	%

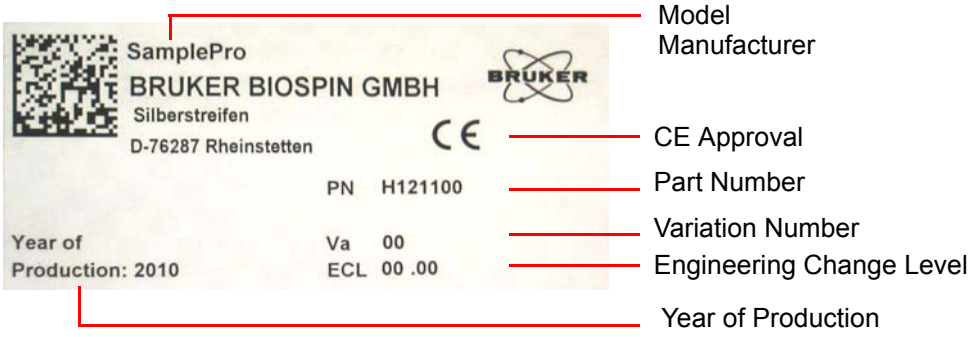
Table 17.7 Operating Environment

For the appropriate temperature see also the Bruker site planning guides on the BASH CD (Bruker Advanced Service Handbook):

Manual	Bruker Part Number
Site Planning for AVANCE Systems 300-700 MHz (UM)	Z31276
Site Planning for AVANCE Systems 750 -950 MHz (UM)	Z31686

Table 17.8 Bruker Site Planning Guides

17.4 Rating Plate System



17.5 Rating Plate Robot

Figure 17.1 Rating Plate Robot

17.6 Rating Plate Exchange Unit

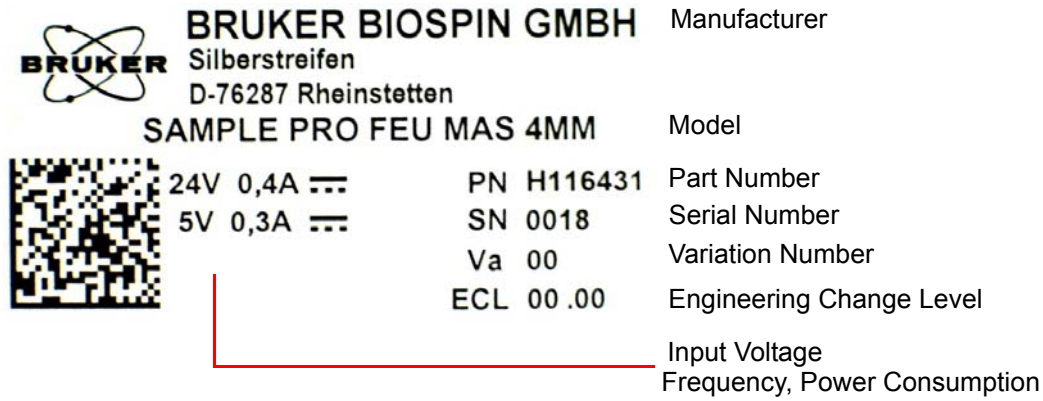


Figure 17.2 Rating Plate Exchange Unit

18 Specifications

18.1 Motion Speed

Feature		Speed	Ramp
Tool arm	X-motion	750 mm/sec	1000 mm/sec^2
	Y-motion	300 mm/sec	1500 mm/sec^2
	Z-motion	350 mm/sec	500 mm/sec^2

Table 18.1 Motion Speed

18.2 Electrical and Communication

Feature	Specification
Power	Self regulating power supply. 110–240 VAC nominal, 50/60 Hz, 500 VA
Mains fuses	Located at the rear of the device. 2x F6.3 A / 250 V (P and N), for devices with single output PSU 2x F10 A / 250 V (P and N), for devices with dual output PSU
Output fuses	Located at the rear of the device (below the CAN-bus extension). CAN-bus loop: F3.15 A / 250 V Arm and high power output: F10 A / 250 V Values depend on the power supply configuration. Please refer to the appropriate label.
Interface	CAN-bus.
Uninterruptible power supply	600 VA is recommended.

Table 18.2 Electrical and Communication

18.3 Safety and Security

Feature	Specification
Safety	Operator safety is ensured by the safety door or an optional cover. The SamplePro hr-MAS robot is designed for EN IEC 61010-1 compliance and bears the CE mark.
Security	Sophisticated software combined with real time bar code tracking can eliminate sample tracking errors. Processes and actions are monitored and logged.
Uninterruptible power supply	Refer to "Electrical and Communication" on page 245.

Table 18.3 Safety and Security

18.4 Physical Properties

18.4.1 Precision

Device	Positional Accuracy
Object Detector	+/-0.2 mm (Y, Z); +/-0.5 mm (X);
Handler	+/-0.2 mm (Y, Z); +/-0.5 mm (X);

Table 18.4 Precision

18.5 Computer and Software Requirements

Device	Requirement	
	Minimal	Recommended
Processor	Pentium III or IV	Intel dual/quad core
Operating system	Microsoft Windows® 2000 Pro SP4 or XP Pro SP2	Microsoft Windows® 2000 Pro SP4 or XP Pro SP3 / 32 Bit.
	Current X-AP 7 is executable additionally with Microsoft Windows® Vista® and Microsoft® Windows® 7 (32 Bit).	
RAM	1 GB	2 GB
Free disk space	200 MB	500 MB
Display	17" color screen (monitor resolution 1024 x 768).	
Mouse	optical (recommended)	
Drives	CD-ROM	
Ports	USB (current 500 mA)	

Table 18.5 Computer and Software Requirements

18.5.1 Recommended Options

Device
CD-writer for data backup.
Uninterruptible power supply 600 VA (sine wave).
Additional software: WinZip, MS Excel. MS Excel is mandatory to run the application „ScalingCalc“.

Table 18.6 Recommended Options

18.5.2 Material Chemical Resistance

The following table lists material compatibility for the SamplePro hr-MAS robot with specific chemicals. The source of compatibility data is material producers and was not cross tested by Sias.

Note: The SamplePro hr-MAS robot was developed for use with aqueous liquids only. We strongly recommend extensive testing prior to using the systems with other liquids.

Key EX= excellent GO= good PO= poor NR= not resistant		Aqueous Sol	Methanol	Ethanol	Acetonitrile	Chloroform	DMSO	Other
Components	**Material**							
System liquid container	Container	EX	EX	EX	---	---	---	
	Reservoir HDPE	EX	EX	EX	PO	PO	PO	
System liquid filter P/N: 120020	Sintered, SS	EX	EX	EX	EX	EX	EX	
System liquid filter P/N: 100706	PEEK mesh, SS	EX	EX	EX	NR	NR	GO	
Pump tubing	FEP	EX	EX	EX	EX	EX	EX	
Annular gear pump	ARCAP	EX	EX	EX	---	---	EX	Acid NR particles >10 µm
	SS 316L	EX	EX	EX	EX	EX	EX	
	Tungsten Carbide	EX	EX	EX	---	---	---	
	Fluorocarbon resin	EX	EX	EX	---	---	EX	
	Teflon®	EX	EX	EX	EX	EX	EX	
Motorized valve	Body: PCTFE	EX	EX	EX	EX	PO	EX	
	Fittings: PP	EX	EX	EX	NR	EX	EX	
Valve tubing	FEP	EX	EX	EX	EX	EX	EX	
Micro-valve * except cap	ETFE (Tefzel)	EX	EX	EX	EX	GO	GO *	
Tip tubing	PTFE	EX	EX	EX	EX	EX	EX	
SS tip	SS	EX	EX	EX	EX	EX	EX	
	Teflon®	EX	EX	EX	EX	EX	EX	
DT tip	PP	EX	EX	EX	PO	NR	EX	
Worktable	High quality SS	EX	EX	EX	EX	EX	EX	
DT drop station	SS	EX	EX	EX	EX	EX	EX	
	POM/ACL	EX	GO	GO	---	---	---	
Racks	HDPE	EX	EX	EX	PO	PO	PO	

Table 18.7 Material Chemical Resistance

19 Contact

Manufacturer:
Bruker BioSpin NMR
am Silberstreifen
D-76287 Rheinstetten
Germany
Phone: +49 721-5161-0
http://www.bruker-biospin.com

NMR Hotlines

Contact our NMR service centers.

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

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

http://www.bruker-biospin.com/hotlines_nmr.html

Contact

Appendix A

A.1 Warning Signs

Warning Signs

A.2 Figures

Figures

Figures

Figures

A.3 Tables

Tables

A.4 Glossary

CAN
Controller Area Network

EU
Exchange Unit

FBC
Flat Band Cable

Icon NMR
Bruker software package for automation.

MAS
Magic Angle Spinning

PSU
Power Supply Unit

Glossary

A.5 Index

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Bruker,
your solution partner

Bruker provides a world class, market leading range of analytical solutions for your molecular and material research needs. Our solutionbased approach enables us to work closely with you to identify your specific needs and determine the best solution package for you from our comprehensive range. Furthermore, we offer you the opportunity to collaborate with us on new developments.

Our ongoing efforts and considerable investment in research and development domonstrates our longterm commitment to technological innovation on behalf of our customers. With more than 50 years of experience in meeting the needs of the scientific community across a range of disciplines, Bruker has built a sound rapport with professionals from the community through understand ing their specific requirements.

This cooperative relationship with our customers allows us to provide them with effective solutions and a service of unmatched quality.

Bruker Corporation

info@bruker.com
www.bruker.com

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