Multimodal Animal Cassettes

Instructions for Use

Version 007

Innovation with Integrity

Preclinical Imaging

This manual was written by

Bruker

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1 About This Manual

This manual provides the instructions for use for users working with the device. It is an integral part of the device, and must be kept in close proximity to the device where it is permanently accessible to personnel.

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

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

1.1 Symbols and Conventions

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

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

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

General Hazard

Sign indicating a general hazard.

Read the manual for safety instructions or action guidelines. Noncompliance with the information provided in the manual may result in hazards or incorrect operation.

Hazardous Electrical Voltage

Sign indicating hazardous electrical voltage.

Noncompliance with the safety instructions provided in the manual may result in serious hazards.

Radioactive Material or Ionizing Radiation

Sign indicating radioactive material or ionizing radiation.

Noncompliance with the safety instructions provided in the manual may result in serious hazards.

⚠ DANGER

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

This is the consequence of not following the warning.

1. This is the safety condition.

▶ This is the safety instruction.

⚠ WARNING

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

This is the consequence of not following the warning.

1. This is the safety condition.

▶ This is the safety instruction.

⚠ CAUTION

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

This is the consequence of not following the warning.

1. This is the safety condition.

▶ This is the safety instruction.

NOTICE

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

This is the consequence of not following the notice.

1. This is a safety condition.

▶ This is a safety instruction.

SAFETY INSTRUCTIONS
SAFETY INSTRUCTIONS are used for control flow and shutdowns in the event of an error or emergency. This is the consequence of not following the safety instructions. 1. This is a safety condition. ▶ This is a safety instruction.

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

About This Manual

2 Introduction

2.1 Overview

Multimodal Animal Cassettes (MMACs) are dedicated cassettes to support mice or rats during imaging in one of the imaging modalities manufactured by Bruker. MMACs are designed for use in the following instruments:

- BioSpec and ICON MR instruments
- Albira I, II, and Si PET/SPECT/CT instruments
- SkyScan 1176 and 1278 µCT instruments
- Xtreme I and II Optical Imaging / X-ray instruments
- MPI instruments

Figure 2.1: Multimodal Animal Cassettes. From left: Small Mouse, Large Mouse, Small Rat, Rat, Large Rat Cassette

MMACs are available in different sizes. Please note that the diameter given in the table below is for an overview and indicates the space maximum required by the animal chamber. The available space for the animal inside the cassette is just below.

With optional devices, MMACs support application of anesthesia gas, warm air temperature supply, and supervision of vital parameters (ECG and respiratory) based on the sensors supplied by Small Animals Instruments, Inc. (*www.i4sa.com*).

Mouse				
Cassette	**Diameter animal chamber**	**Maximum Animal Weight**	**Part Number**	
Small Mouse	30 mm	30 g	T151509	
Large mouse	40 mm	50 g	T147105	
Small Mouse (MPI)	30 mm	30 g	T154324	only for MPI
Large mouse (MPI)	40 mm	50 g	T154325	only for MPI

Rat				
Cassette	**Diameter**	**Maximum Animal Weight**	**Part Number**	
Small Rat	60 mm	300 g	T147104	not for Skyscan
Large Rat	80 mm	500 g	T150742	not for Skyscan
Rat	70 mm	400 g	T151629	only for Skyscan
Small Rat (MPI)	60 mm	300 g	T152981	only for MPI, not for Skyscan
Large Rat (MPI)	80 mm	500 g	T154326	only for MPI, not for Skyscan
Rat (MPI)	70 mm	400 g	T154327	only for MPI and Skyscan

Adapter			
Instrument	**Part Number**		
BioSpec	T150743		
ICON	T145681		
Albira I and II	T156449		
Skyscan 1176 and 1278	T152980		
Xtreme I and II	T145679		
MPI	T150741		
Preparation Support	T151490		

A Preparation Support is available to support the animal cassette during the preparation phase on the preparation table:

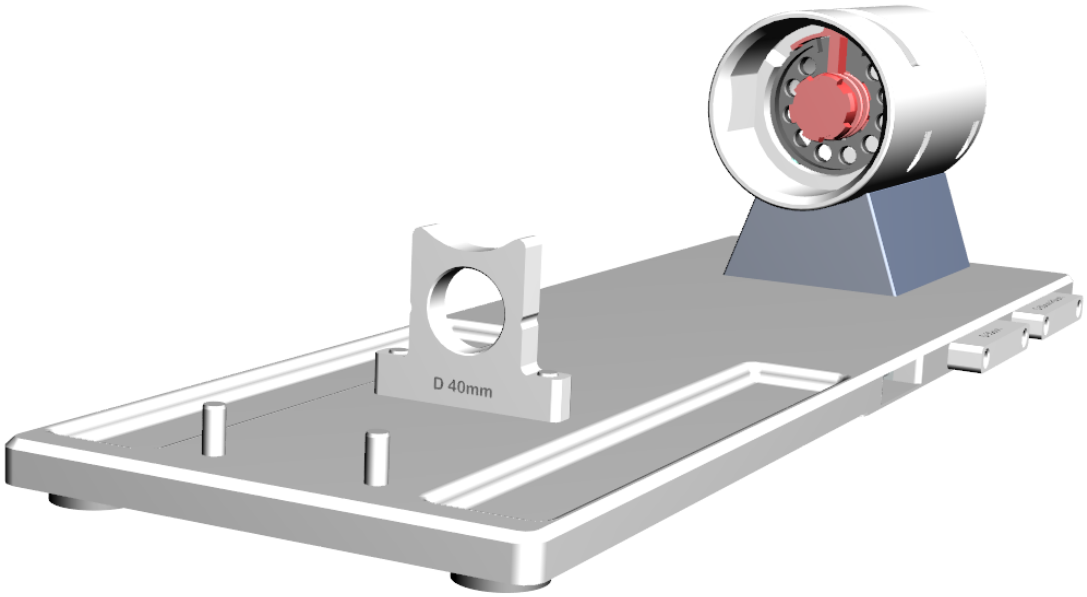


Figure 2.2: Preparation Support for Multimodal Animal Cassettes.

2.2 Intended Use

Multimodal Animal Cassettes (MMACs) are cassettes to position and support (for example mechanically, thermally, …) small rodents (mice and rats) while being imaged in instruments that use different techniques to generate the images. MMACs are designed for the following imaging instruments manufactured by Bruker:

- BioSpec and ICON MR instruments
- Albira I and II PET/SPECT/CT instruments
- SkyScan 1176 and 1278 µCT instruments
- Xtreme I and II Optical Imaging / X-ray instruments
- MPI instruments.

Specific adapters are available to attach the MMACs to the corresponding imaging instruments.

If adequately prepared for, the rodents can remain in the MMAC while being carried from one to the other imaging instrument.

MMACs are not intended to be used in laboratories at Biosafety Level larger than two and in specific-pathogen-free (SFP) environments.

The MMACs have been designed and constructed solely for the intended use described here. Intended use also includes compliance with all specifications within this manual.

Any use which exceeds or differs from the intended use shall be considered improper use. No claims of any kind for damage will be entertained if such claims result from improper use.

2.3 Limitation of Liability

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

The manufacturer accepts no liability for damage due to:

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

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

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

2.4 Copyright

2.5 Warranty Terms

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

3 Safety

This section provides an overview on all the safety aspects involved in ensuring optimal personnel protection and safe operation. The residual risks which may result from using the device have been established by means of a risk assessment.

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

The safety instructions and warnings in this document are provided in all official European Union member states languages in the Appendix called Safety Instructions.

⚠ WARNING

Biohazard

Depending on substances used, health hazard may arise. Only qualified personnel should carry out work following local biohazard regulatory.

- ▶ Do not use devices described in this manual in laboratories with biosafety level larger than 2.
- ▶ Always clean and disinfect devices appropriately.
- ▶ Prevent successive users from access to and use of the devices prior to cleaning/ disinfection.

⚠ CAUTION

Health hazard by anesthesia gas above regulatory limits (worker protection)

Compliance with occupational safety and health regulations are in the responsibility of the System Owner (responsible body). Acute exposure to Isoflurane as well as chronic exposure can cause health hazard.

1. Anesthesia gas delivered into the instrument can escape.

- ▶ Use corresponding air suction in the surrounding enclosure.
- ▶ To ensure safe and adequate handling of anesthesia, only trained and authorized users may work with anesthesia gas. Repeat training on a regular base.
- ▶ Check residual anesthesia gas concentration to stay within worker protection regulatory limits (for example using regularly gas personal monitors suitable for Isoflurane detection).

⚠ WARNING

Danger of injury from electrical shock.

1. Defective devices or devices having insufficient safety standard bear the risk of electrical hazard.

▶ Use only devices with approval by nationally recognized testing laboratories (NRTL).

▶ Do not use defective devices or devices showing safety relevant signs of wear and tear.

▶ Check the water hoses and connections before using them in the imaging instrument (where applicable).

▶ Do not use leaking devices in the imaging instruments.

⚠ CAUTION

Death of or harm to the animal

1. The Bruker instrument is often used in combination with anesthesia devices (Trade Products) that deliver anesthesia gas. Overdose of anesthesia gas might cause the death of the animal. It is in the operators responsibility to monitor vital signs of the animal.

▶ We recommend to use an animal monitoring system to monitor vital signs (for example heart rate, respiratory rate, body temperature, …).

▶ Follow the instructions for use of all device suppliers such as for example the anesthesia device or animal monitoring trade product supplier.

▶ Ensure operation of vital signs when preparing the experimental setup. For example check ECG wires and hoses of respiratory air pressure pad for blockade.

⚠ CAUTION

Death of or harm to the animal

1. During anesthesia, animal body temperature stabilization needs to be fulfilled. We recommend to use a heating device supplying warm air to the air diffusor in the MMAC to support the body temperature.

▶ As warm air supply, we recommend the temperatures and the air flow rates given in the text.

▶ Select a device that supports the recommendation.

▶ Follow the instructions for use of the heating device supplier.

NOTICE

Harm to the animal

1. Acoustic noise caused by the air stream of the warm air supply/suction or caused by the imaging instrument (for example MR instrument) can harm the animal. In addition, warm air supply and/or anesthesia might cause dehydration.

▶ We recommend to use hearing protection for the animal

▶ We recommend eye protection salve or gel to protect the animal from dehydration.

▶ Reduce warm air stream to the minimum while still achieving body temperature stabilization.

▶ Minimize scan time.

⚠ CAUTION

Blade injury, laceration

Blade injury might occur at sharp edges when mounting the items.

- ▶ Work carefully and focus on mechanical parts and sharp edges to avoid blade injury.
- ▶ Wear protective gloves.

4 Installation and Operation

4.1 Setup

Animal Position and Fixation

The animal can be positioned in the cassette head first (respiration mask according to the first figure below) or tail first (respiration mask according to the second figure below). Depending on the animal size, additional fixation of the animal can be done using tape to avoid displacement of the animal during measurement or transfer of the cassette from one imaging modality to another.

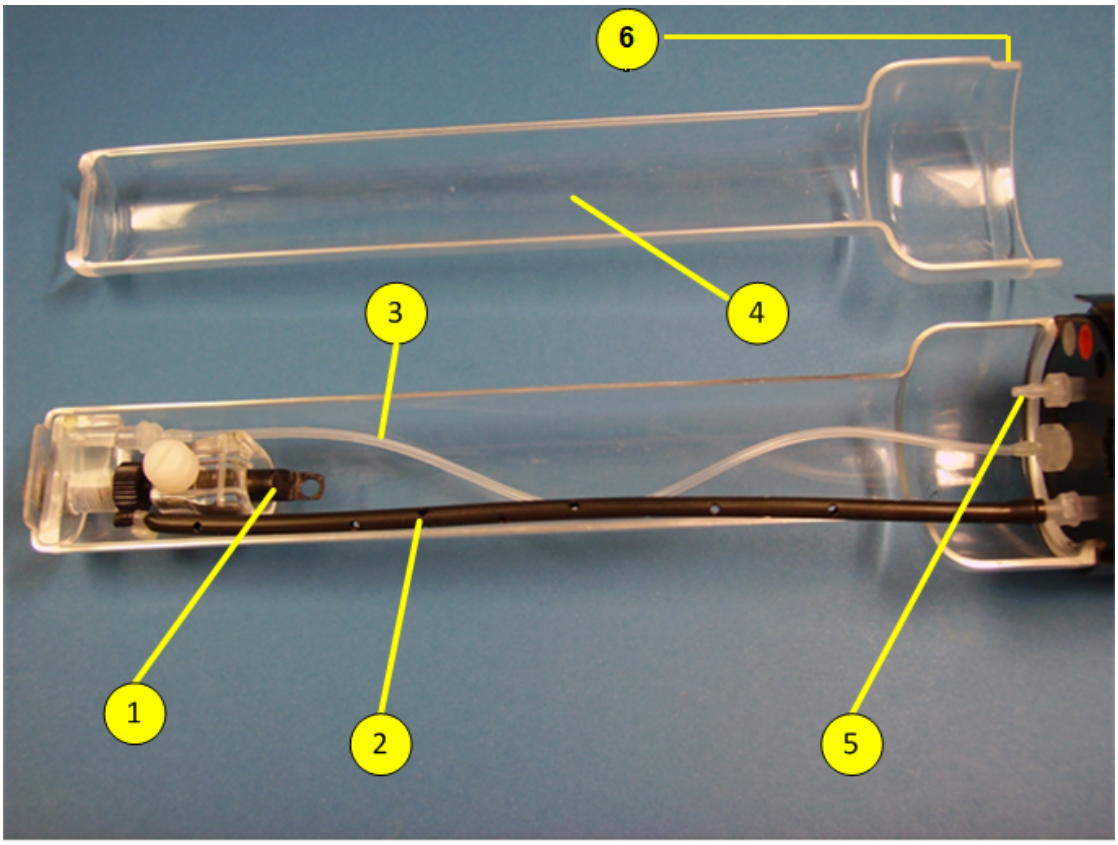


Figure 4.1: Small Mouse Cassette: Tooth bar and respiration mask mounted in head first position. In this setup, the anesthesia gas is supplied to the nose cone via the silicon tube (3).

1	Tooth bar and respiration mask in head first position Nose cone includes anesthesia gas supply.
2	Diffusor for warm air supply.
3	Silicon tube with connectors for anesthesia gas supply in head first setup.
4	Cassette cover.
5	Connector for respiration pad for respiration supervision.
6	Opening for catheter hose

Respiration Mask, Anesthetic Gas Supply and Extraction

The respiration mask in head first position (see figure above) is supported via a silicon tube (3) to supply the anesthesia gas through the tooth bar. In tail first position, the silicon tube is removed, the tooth, bar and the respiration mask are unscrewed and attached on the opposite site of the cassette where initially the silicon tube was located (see figure below).

In both setup, the anesthesia gas exits the nose cone of the respiration mask and distributes into the cassette. From there, is extracted through suction hole (8).

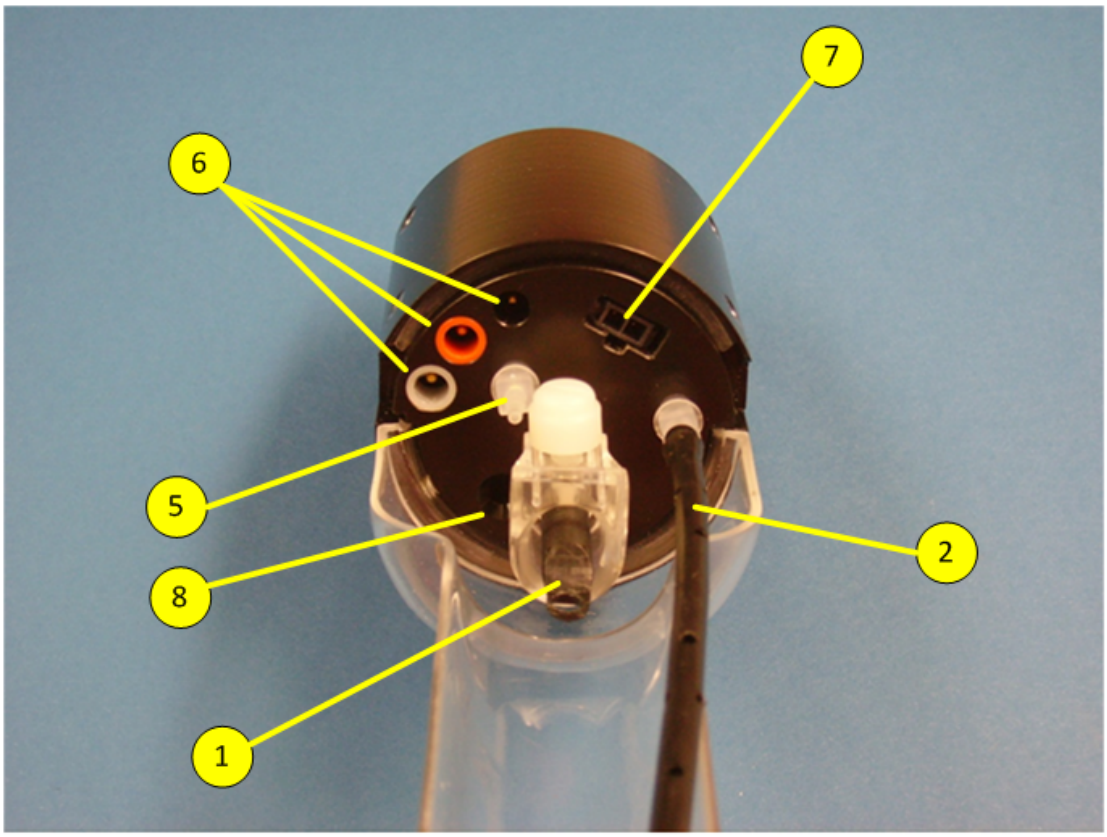


Figure 4.2: Small Mouse Cassette Interface: Tooth bar and respiration mask mounted in tail first position. In this setup, the anesthesia gas is supplied to the nose cone directly through the interface.

1	Tooth bar and respiration mask mounted in tail first position.
2	Diffusor for warm air supply.
5	Connector for respiration pad for respiration monitoring.
6	Connectors for ECG.
7	Connector for temperature monitoring.
8	Air suction from the cassette.

Animal Respiration, Temperature Control and ECG

The cassette has connectors for respiratory monitoring (5), ECG (6), and temperature monitoring (7). The connectors are compatible with the monitoring system of SA Instruments Inc. (*www.i4sa.com*).

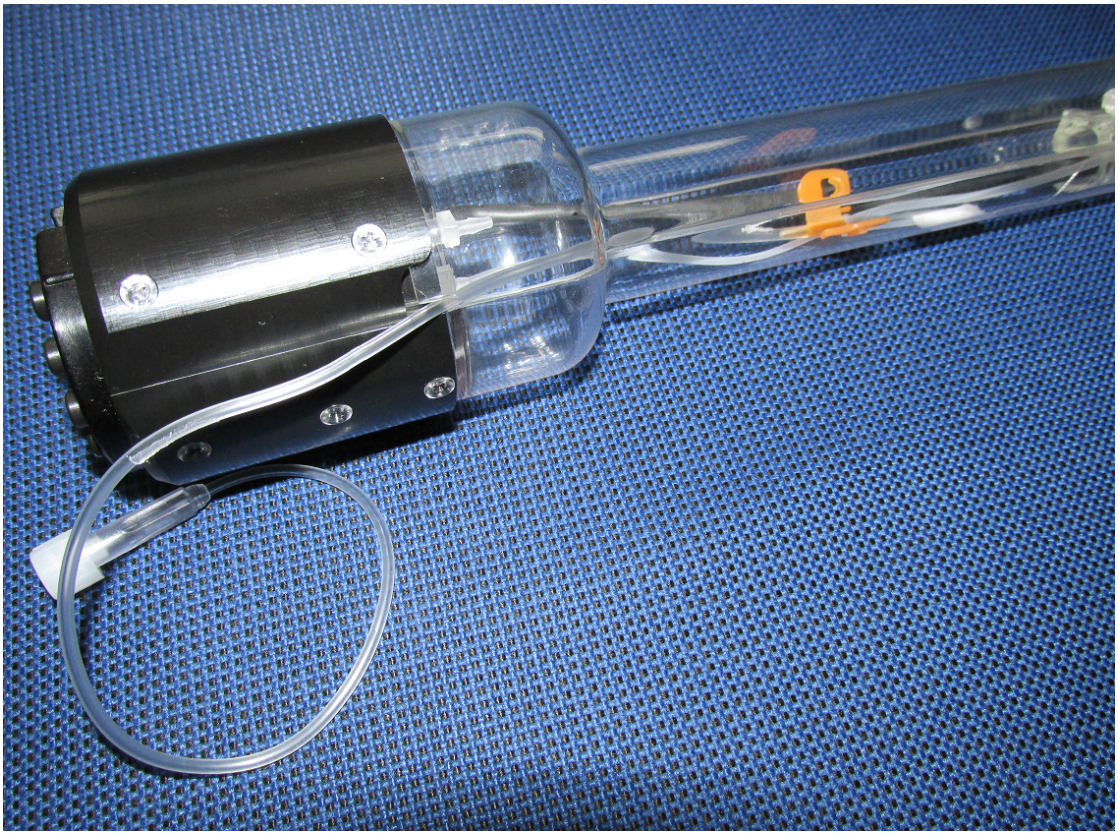
Warm Air Supply

Warm air is supplied via a diffusor tube (2) positioned along the cassette to stabilize the body temperature of the animals during investigation after the cassette cover (4) is closed.

Depending on the modality used, the air supply has to be connected to the corresponding heating system.

Catheter Port

Use the opening at the end of the cassette cover as port for a catheter hose.



4.2 Installation and Operation in different Modalities

4.2.1 ICON

4.2.1.1 Adapter

In order to use the Multimodal Animal Cassettes (MMAC) in the MR Instrument ICON, an adapter P/N T145681 is required. Establish connections to the instrument as labelled and applicable.

Figure 4.3: ICON Adapter for Multimodal Animal Cassettes with 60 mm diameter cassette mounted.

4.2.1.2 RF Coils

RF Coils compatible with Multimodal Animal Cassettes

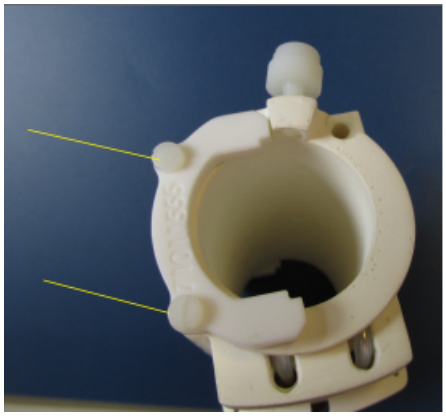
RF Coil	P/N	compatible with	Multimodal Animal Cassette, Diameter	P/N
Rat Body 60 mm [1)]	T155166		60 mm	T147104
Large Mouse 40 mm [1)]	T155167		40 mm	T147105
Small Mouse 30 mm (length 50 mm) [2)]	1806761		30 mm	T151509

RF Coil	P/N	compatible with	Multimodal Animal Cassette, Diameter	P/N
Small Mouse 30 mm (length 80 mm) [2)]	1806762		30 mm	T151509

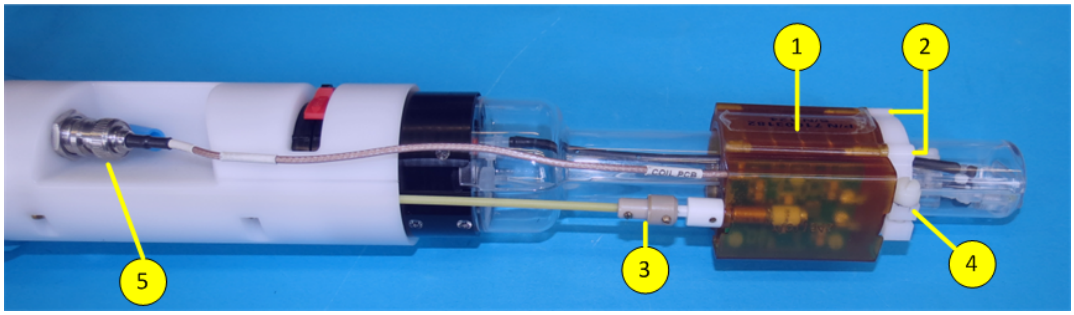
[1)] Prerequisite for the usage of these RF Coils is the modification of the ICON to enable RF Coils mounted from the rear (Uprade Kit P/N T157583). The Cassette is inserted from the front whereas the RF coil is mounted in magnet from the rear.

[2)] The RF Coil is to be mounted directly on the cassette:

- Remove the sledges on both sides of the coil. Keep the screws at the sledges.



- Attach the clamp (4) with the corresponding two screws (2) at the coil (see figure below).
- Positioning the animal in the cassette and close the cassette.
- Connect the Tuning Rod (3) and fix the coil using the clamp screw (4).



Small Mouse 30 mm RF Coil (length 50 mm) mounted on 30 mm diameter MMAC. Similar for the 80 mm long RF Coil.

4.2.1.3 Air Circulation System

MMACs in combination with the instrument adapter provide hose connections to be used as warm air in- and outlet. This allows on one side to regulate the temperature in the animal chamber but also serves to extract air potentially enriched with anesthesia gas (WAG waste anesthetic gas).

For Bruker BioSpin MR Instruments, we recommended a closed Air Circulation System (Option Air Supply & Gas Removal Pump, Bruker P/N T155907 (230V) or T157336 (110V)) with anesthesia extraction to an activated charcoal adsorber (* not part of the delivery). Air flow to the animal chamber as well as the amount of air removed to the WAG adsorber can be regulated.

Figure 4.4: Air Circulation System (Option Air Supply & Gas Removal Pump).

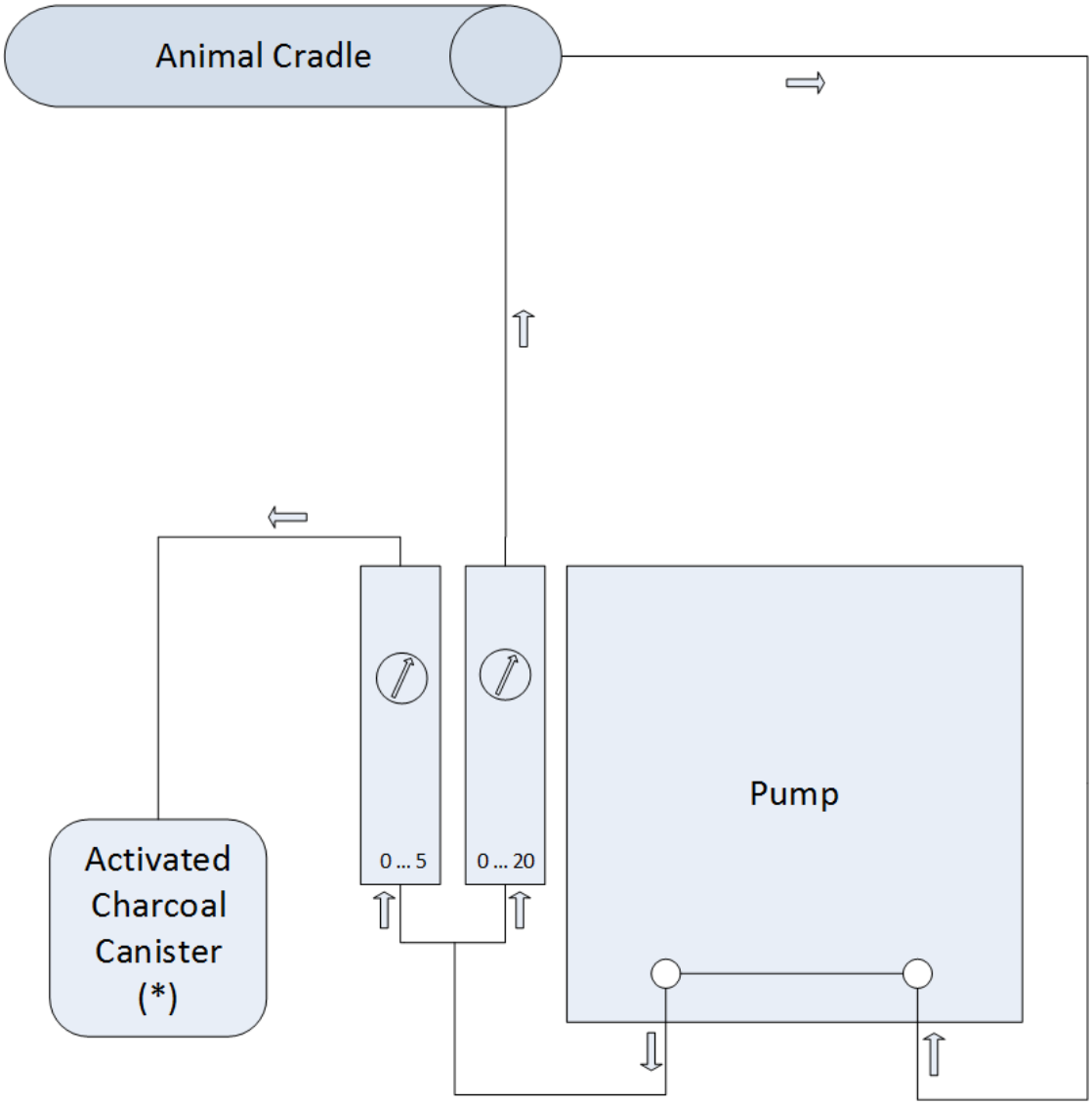


*Figure 4.5: Sketch showing the Air Circulation System (Option Air Supply & Gas Removal Pump). It consists of a diaphragm pump, corresponding hoses, adjustable flow valves with meters for both, the closed air flow circuit to the animal chamber and the extraction pathway to an activated charcoal container *. The air flow to the MMAC can be regulated from 0 to 20 lpm and the flow to the activated charcoal canister from 0 to 5 lpm.*

Animal Temperature Stabilization

The hoses of the water based heating unit called Body Temperature Conditioning System (Option) can be connected to the ICON and BioSpec Adapter. In combination with the Air Circulation System (Option), the water/air heat exchanger located within the ICON and BioSpec Adapter allows temperature stabilization of the animal in the cassette.

Recommendation:

A typical installation of the Body Temperature Conditioning System consists of 2x 6 meter water hoses and 2x 10 m air hoses between the water bath and ICON/BioSpec adapter.

A water bath temperature of 52 – 58 degree Celsius in combination with 8 liter/min. air flow to the water/air heat exchanger in the adapter is recommended for adequate animal body temperature stabilization.

Extraction of 2 liter/min. air from the closed air circuit to the activated charcoal container is recommended when anesthesia gas is supplied to the cassette.

⚠ CAUTION

Health hazard by anesthesia gas above regulatory limits (worker protection)

Compliance with occupational safety and health regulations are in the responsibility of the System Owner (responsible body). Acute exposure to Isoflurane as well as chronic exposure can cause health hazard.

1. Anesthesia gas delivered into the instrument can escape.

▶ Use corresponding air suction in the surrounding enclosure.

▶ To ensure safe and adequate handling of anesthesia, only trained and authorized users may work with anesthesia gas. Repeat training on a regular base.

▶ Check residual anesthesia gas concentration to stay within worker protection regulatory limits (for example using regularly gas personal monitors suitable for Isoflurane detection).

NOTICE

Death of or harm to the animal

1. The Bruker instrument is often used in combination with anesthesia devices (Trade Products) that deliver anesthesia gas. Overdose of anesthesia gas might cause the death of the animal. It is in the operators responsibility to monitor vital signs of the animal.

▶ We recommend to use an animal monitoring system to monitor vital signs (for example heart rate, respiratory rate, body temperature, …).

▶ Follow the instructions for use of all device suppliers such as for example the anesthesia device or animal monitoring trade product supplier.

▶ Ensure operation of vital signs when preparing the experimental setup. For example check ECG wires and hoses of respiratory air pressure pad for blockade.

NOTICE

Death of or harm to the animal

1. During anesthesia, animal body temperature stabilization needs to be fulfilled. We recommend to use a heating device supplying warm air to the air diffusor in the MMAC to support the body temperature.

▶ As warm air supply, we recommend the temperatures and the air flow rates given in the text.

▶ Select a device that supports the recommendation.

▶ Follow the instructions for use of the heating device supplier.

4.2.1.4 First Time Use

The Icon and BioSpec adapters contain a water/air heat exchanger. When connected the first time to the *Air Circulation System [▶ 22]* in combination with the water (options), air bubbles in the heat exchanger of the adapter might prevent water flow. Prior to mounting the adapter to the animal preparation table, connect it to the warm water circulation, switch the pump on, and hold the adapter vertically.

Turn it around a couple of times from vertically upward to downward and vice versa until you feel warm water flowing at the output hoses and no air bubbles are to be seen in the transparent water hoses.

4.2.2 BioSpec and PET/MR

4.2.2.1 Adapters

Adapters for BioSpec

Depending on animal transport system installed at the BioSpec, different adapters/interfaces apply in order to use the Multimodal Animal Cassettes (MMAC):

- for AutoPac, the adapter P/N T150743 is required. Establish connections to the instrument as labelled and applicable.

BioSpec AutoPac adapter with 60 mm Rat Cassette mounted.

- for ATS, the interface is mounted to the ATS and the MMAC can be attached directly.

4.2.2.2 RF Coils

RF Coils compatible with Multimodal Animal Cassettes

All MRI RF Volume Coils with inner diameter larger than the cassettes are compatible.

4.2.2.3 Air Circulation System

For BioSpec, the same as for ICON applies. See the *Air Circulation System [22]*.

4.2.2.4 PET/MR

The Multimodal Animal Cassettes are compatible with BioSpec instruments equipped with PET Inline or PET Insert. Using ParaVision 360 software for the instrument, attenuation maps for the corresponding animal cassettes can be selected during study registration in ParaVision in order to correct the 511 keV gamma ray attenuation during PET image reconstruction.

4.2.3 Xtreme I and II

The following sections are Work-In-Progress (WIP) and subject to change without notice.

Please contact the hotline for information.

4.2.3.1 Adapter

In order to use the Multimodal Animal Cassettes (MMACs) in the Xtreme I and II, an adapter P/N T145679 is required. Establish connections to the instrument as labelled and applicable.

Figure 4.6: Adapter for Xtreme to support 3 Multimodal Animal Cassettes. 2 of 3 mounted.

4.2.3.2 Air Circulation System

The warm air supply from the heater can be attached to the adapter.

4.2.3.3 First Time Use

The handle of the radiographic screen has to be dismounted when using the MMAC Adapter. After removing the handle, the radiographic screen can be moved freely again.

4.2.4 Skyscan 1176 and 1278

The following sections are Work-In-Progress (WIP) and subject to change without notice.

Please contact the hotline for information.

4.2.4.1 Adapter

In order to use the Multimodal Animal Cassettes (MMACs) in the SkyScan 1176 instrument, an adapter P/N T152980 is required. This adapter is not needed for SkyScan 1278 µCT.

Figure 4.7: Adapter for SkyScan 1176 with Animal Cassette mounted.

4.2.5 Albira II and Si

4.2.5.1 Prerequisite and Adapter

In order to use the Multimodal Animal Cassettes (MMACs) in the Albira II and Albira Si delivered before July 2017, a modification of the instrument is prerequisite: install modification kit P/N T157432.

In addition, the adapter P/N T156449 is required to interface the MMACs.

Figure 4.8: Adapter for Albira Si with Multimodal Animal Cassette mounted.

Albira Si delivered July 2017 onward do not require the modification kit anymore and the adapter is part of the delivery.

4.2.5.2 Air Circulation and Heating System

The adapter to connect MMACs contains an electrical heating element and supports warm air in- and outlet. This allows on one side to regulate the temperature in the animal chamber but also serves to extract air potentially enriched with anesthesia gas (WAG waste anesthetic gas).

In order to use this, the following 2 options are required:

1. The closed Air Circulation System
2. Heating System

Air Circulation System (Option Air Supply & Gas Removal Pump**)**

Bruker P/N T155907 (230V) or T157336 (110V).

Air flow to the animal chamber as well as the amount of air removed to the WAG adsorber can be regulated. When extracting anesthesia gases, additionally an activated charcoal adsorber (* not part of the delivery) is required.

Figure 4.9: Air Circulation System (Option Air Supply & Gas Removal Pump).

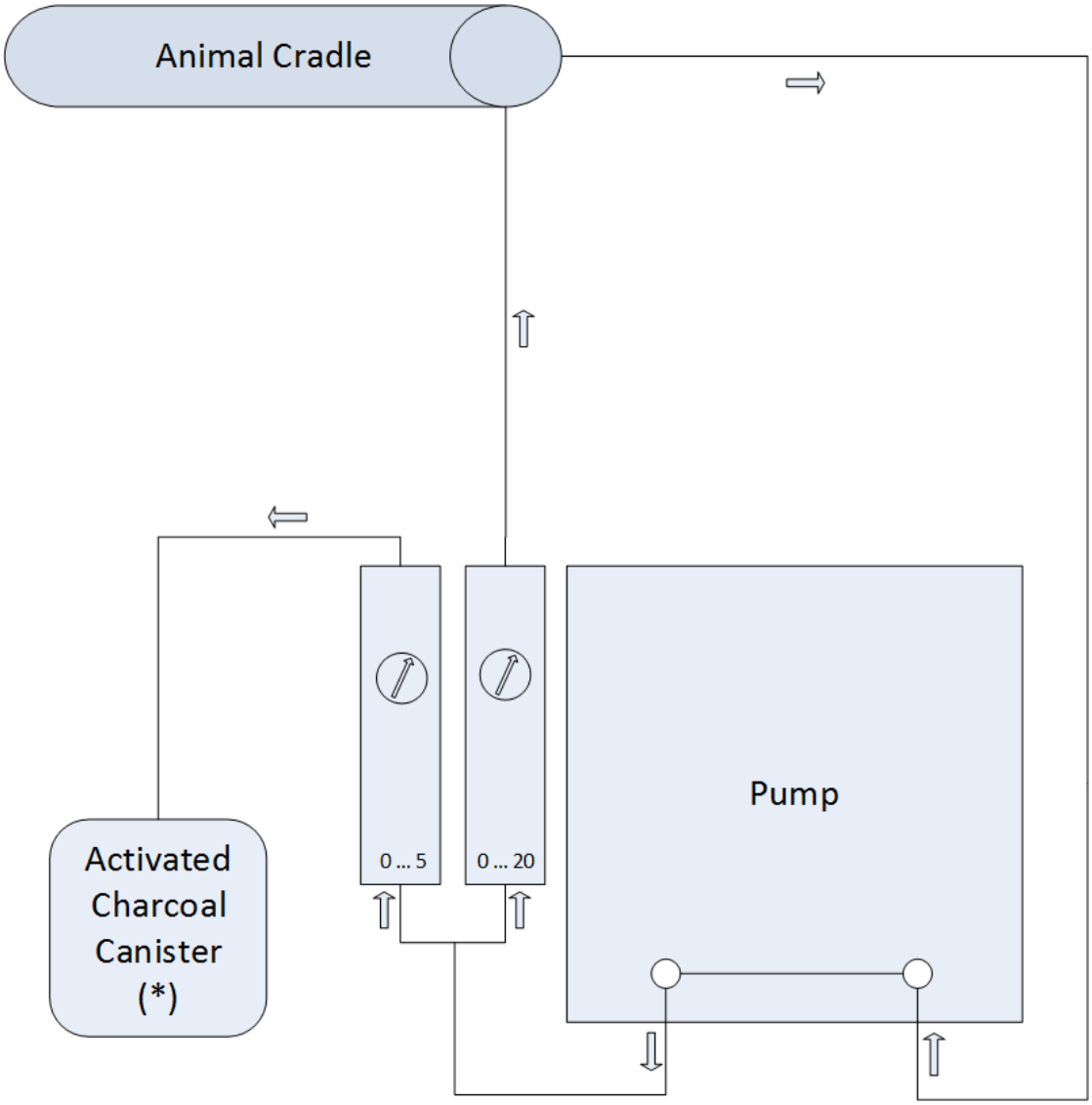


*Figure 4.10: Sketch showing the Air Circulation System (Option). It consists of a vacuum pump, adjustable flow valves with meters, and the hoses for the closed air flow circuit together with and the extraction pathway to an activated charcoal container *. The air flow to the MMAC as well as the flow to the activated charcoal can be regulated.*

Heating System (Option)

To enable and control the electrical heating element, the Temperature Controller of the Heating System is required.

Figure 4.11: Temperature Controller of the Heating System.

This in combination with the Air Circulation System allows the temperature stabilization of the animal in the cassette. The Temperature Control connector needs to be connected to the correspondingly labelled socket at the Albira Si interface plate. Within the Albira, the MMAC Adapter (*Prerequisite and Adapter [28]*) needs to be connected to the 4 pin MINI DIN type connector.

All settings at the Temperature Controller are to be set according to the User Manual of the Heating System.

Recommendation:

A temperature setting of at least 36 degree Celsius at the Temperature Controller of the Heating System in combination with 8 liter/min. air flow to the heater/air heat exchanger in the adapter is recommended for adequate animal body temperature stabilization.

Extraction of 2 liter/min. air from the closed air circuit to the activated charcoal container is recommended when anesthesia gas is supplied to the cassette.

⚠ CAUTION

Death of or harm to the animal

1. The Bruker instrument is often used in combination with anesthesia devices (Trade Products) that deliver anesthesia gas. Overdose of anesthesia gas might cause the death of the animal. It is in the operators responsibility to monitor vital signs of the animal.

▶ We recommend to use an animal monitoring system to monitor vital signs (for example heart rate, respiratory rate, body temperature, …).

▶ Follow the instructions for use of all device suppliers such as for example the anesthesia device or animal monitoring trade product supplier.

▶ Ensure operation of vital signs when preparing the experimental setup. For example check ECG wires and hoses of respiratory air pressure pad for blockade.

⚠ CAUTION

Death of or harm to the animal

1. During anesthesia, animal body temperature stabilization needs to be fulfilled. We recommend to use a heating device supplying warm air to the air diffusor in the MMAC to support the body temperature.

▶ As warm air supply, we recommend the temperatures and the air flow rates given in the text.

▶ Select a device that supports the recommendation.

▶ Follow the instructions for use of the heating device supplier.

⚠ CAUTION

Health hazard by anesthesia gas above regulatory limits (worker protection)

Compliance with occupational safety and health regulations are in the responsibility of the System Owner (responsible body). Acute exposure to Isoflurane as well as chronic exposure can cause health hazard.

1. Anesthesia gas delivered into the instrument can escape.

▶ Use corresponding air suction in the surrounding enclosure.

▶ To ensure safe and adequate handling of anesthesia, only trained and authorized users may work with anesthesia gas. Repeat training on a regular base.

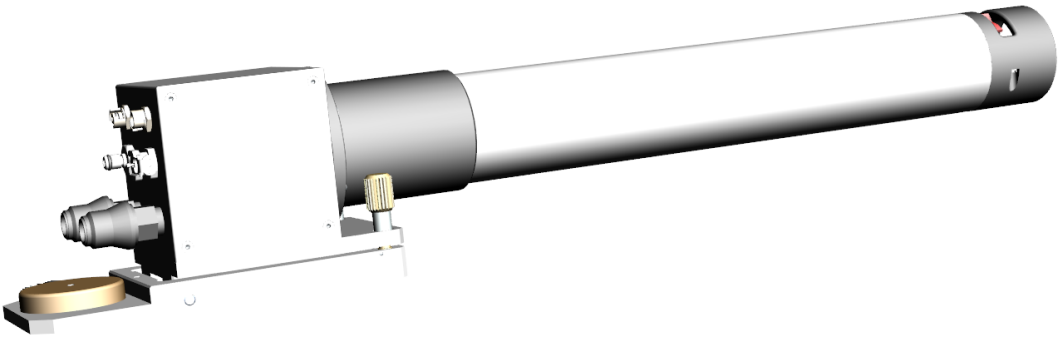
▶ Check residual anesthesia gas concentration to stay within worker protection regulatory limits (for example using regularly gas personal monitors suitable for Isoflurane detection).

4.2.6 MPI

For MPI instruments, dedicated cassettes exist where all metallic parts have been eliminated (for P/N, see *Overview [▶ 9]*. Please note that these dedicated cassettes are not prepared for ECG gating and animal temperature monitoring.

4.2.6.1 Adapter

In order to use the Multimodal Animal Cassettes (MMACs) in the MPI Instrument, an adapter P/N T150741 is required.



Fixation

Use the circular golden plate and turn clockwise to lock the sliding of the adapter on the rail. Turn anticlockwise to release. Do not lock too tight to avoid damage of the sliding rail.

Connections

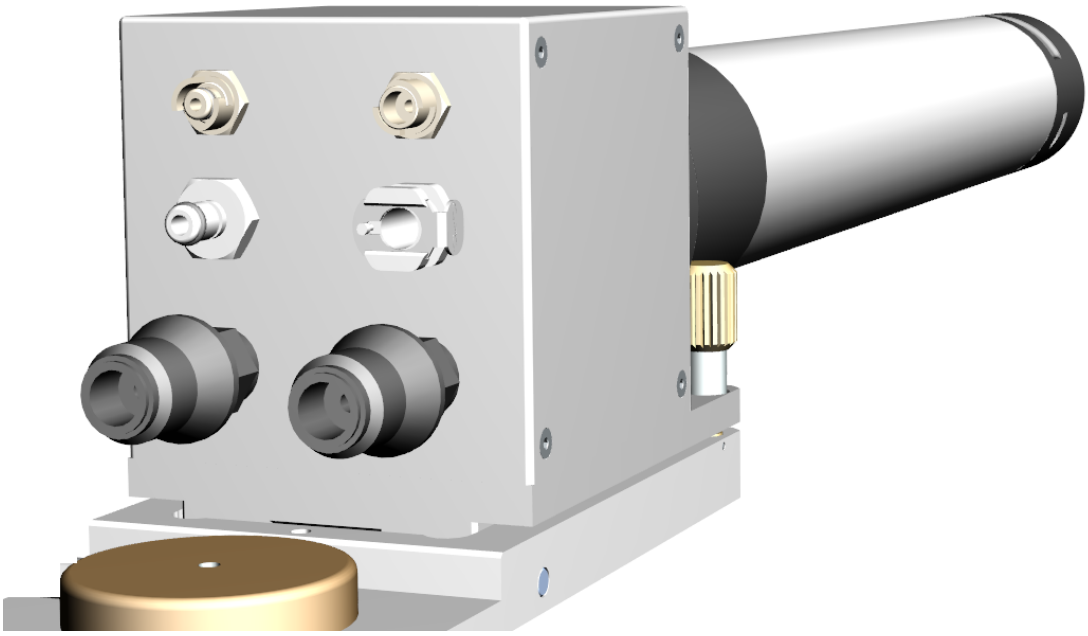


Figure 4.12:

Anesthesia IN (Use hose with 1.6 mm inner diameter and 3.2 mm outer diameter; for example Bruker P/N 69533)		Respiratory Pad (Use enforced shore-A hose)
Air IN (Use hose with 4.8 mm inner diameter and 6.4 mm outer diameter; for example Bruker P/N 183628)		Air suction OUT (Use hose with 4.8 mm inner diameter and 6.4 mm outer diameter; for example Bruker P/N 183628)
Water IN (in/out can be swapped; no preferred direction)		Water OUT

Vertical Adjustment

- Use the left golden screw to adjust the adapter vertically while keeping the right golden screw untightened.
- After reaching the desired height: Turn the right golden screw anticlockwise to lock the vertical adjustment.
- For readjustments, release the right golden screw first before adjusting with the left screw the height again.

5 Maintenance

5.1 Cleaning and Disinfection

Cleaning

The Animal Cradles, Cassettes, and adapters for the different imaging instruments are not watertight. Use dry cleaning whenever possible or dampen a soft, lint-free cloth with water or a diluted cleaning solution of an all-purpose cleaner and wipe the surface carefully. Do not immerse.

Disinfection

We recommend to use surface disinfection using for example Microbac® forte.

Disinfection with VHP, a vapor form of hydrogen peroxide (H_2O_2), is under investigation. Please ask the hotline for available results.

NOTICE

Material damage of the device

Cleaning of the device with the following chemicals will damage the device.

- ▶ Do not use acetone, ketones, hexanes, acids and alkalis.
- ▶ Do not use alcohols such as for example ethanol, propanol, or isopropyl alcohol (isopropanol) or products, containing alcohols such as Bacillol®.
- ▶ Do not use volatile cleaners like thinner or benzine.

NOTICE

Damage of the Device

Sterilization using an Autoclave is not possible. The material of the device will become damaged.

- ▶ Do not insert the device into an Autoclave for sterilization.

6 Troubleshooting

Status / Indication	Problem / Possible cause	Check / Remedy / Corrective Action
	Bubbles in the water circulation (BioSpec, ICON Adapter)	Tilt the adapter a few times up and down while the water circulation is on.
	Bad ECG signal	Check the connections inside the cassette and at the SAI module.
		Twist the cables (BioSpec, ICON).
	Bad respiration signal	Check position of respiration pad and tightness of Luer connections.
	Unusually high amount of anesthesia gas necessary	Check cassette cover and all connections for tightness.
		Reduce at the Air Circulation System air flow to activated charcoal container (BioSpec, ICON)
	Accumulation of anesthesia gas in the cassette	Increase at the Air Circulation System air flow to activated charcoal container (BioSpec, ICON)
	Anesthesia mask and tooth bar in mice cassettes are difficult to connect at the rear end	Remove the rear plate first, connect everything, attach the rear plate again to the cassette.
	Temperature instable (Xtreme)	Possibly interchanged Air In and Air Out hoses.
	Animal not correctly positioned in field of view (Albira)	Adjust the telescopic arm of the adapter to correct the position for the animal cassette in use.
	No reception of ECG and temperature signal (Albira)	Check if the correct (labeled "ECG sensor") D-Sub receptacle was used on the Albira interface panel.

Table 6.1: Troubleshooting

Troubleshooting

7 Replacement of Parts

7.1 Field Replaceable Units

The MMACs have the following Field Replaceable Units (FRU) that can be ordered using the part numbers given below.

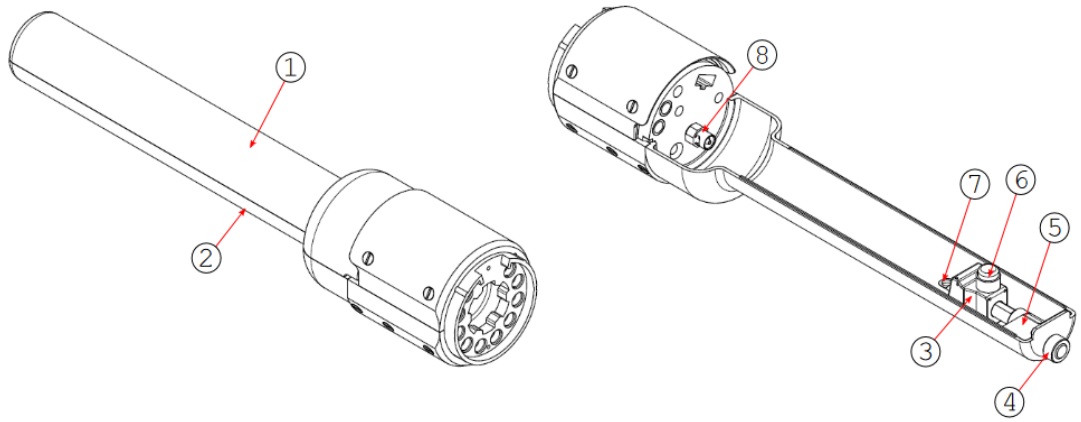


Figure 7.1: Field Replaceable Units. Drawing shows mouse cassette as an example.

ID	P/N	Description	mouse 30 mm	mouse 40 mm	rat 60 mm	rat 72 mm	rat 80 mm
5	H153778	PCI MMAB M. CASSETTE REAR PLATE	x	x			
7	H151467	PCI MMAB M. CASSETTE TOOTH BAR L53	x EC00	x			
7	H164911	PCI MMAB M. CASSETTE TOOTH BAR L39	x EC01				
3	H146009	PCI MMAB M. CASSETTE ANESTHESIA MASK	x	x			
5	H152637	PCI MMAB R. CASSETTE REAR PLATE			x	x	x
	H149939	PCI MMAB R. CASSETTE TOOTH BAR L60			x	x	x
	H152636	PCI MMAB R. CASSETTE ANESTHESIA MASK			x	x	x
1	H153788	PCI MMAB SM. CASSETTE COVER OT	x				
2	H153787	PCI MMAB SM. CASSETTE COVER UT	x				
	H153918	PCI MMAB LM. CASSETTE COVER OT		x			
	H153917	PCI MMAB LM. CASSETTE COVER UT		x			
	H152634	PCI MMAB SR. CASSETTE COVER OT			x		
	H152635	PCI MMAB SR. CASSETTE COVER UT			x		
	H153932	PCI MMAB SKYSCAN R. CASSETTE COVER OT				x	
	H153931	PCI MMAB SKYSCAN R. CASSETTE COVER UT				x	
	H149937	PCI MMAB R. CASSETTE COVER OT					x
	H149935	PCI MMAB R. CASSETTE COVER UT					x
4,6,8	T157730	PCI M.-MODAL AHS Spare Parts Kit MMAC	x	x	x	x	x

Figure 7.2: Field Replaceable Units of MMACs.

ID	P/N T157730	PCI M.-MODAL AHS Spare Parts Kit .... Contains:	Quant.	Unit
	1836874	SCHLAUCH SILIKON SCHWARZ 3.0X0.4MM	0.4	m
8	1827824	PNM FITTING GEW 1/4"-28 SCHLAUCH 1,6MM	1	piece
	80855	HOSE SILICON 1X0.4MM SIS00288	0.4	m
	72232	PNM PIPE COUPLING M D1.6MM	1	piece
	59066	HYD RACCORD MIN LUER M 3.1	1	piece
	17096	SCHLAUCH SILIKON DI=2.5 DA=3.3	0.07	m
6	1825331	BFEL RAENDELSCHR M4X6 PA	1	piece
	81423	MRI A. BEDS KNURLED SCREW M4X12 PA	1	piece
4	H146004	PCI MMAB CASSETTE NUT	1	piece

Figure 7.3: Bill of Material of Spare Part Kit P/N T157730.

Dedicated items for ICON

Clamp for 30 mm RF Coils (see *RF Coils [▶ 20]*):

- Clamp P/N T159315 with screw P/N 1830789
- 2x mounting screws P/N 4185 for clamp

Tuning rod connector (see *RF Coils [▶ 20]*):

- Tuning rod connector P/N H159557 with 2 connecting screws P/N 12587

7.2 Replacement Instructions

Tools

No dedicated tools are required for the replacement of parts.

Instruction

Replace defective parts piece by piece at their initial position.

Hoses are to be cut with a pair of scissors to the corresponding length.

8 Dismantling and Disposal

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

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

8.1 Dismantling

Before dismantling:

- Power off the device and secure to prevent restarting.
- Physically disconnect the power supply cable from the device.
- Clean assemblies and parts properly.

Dismantle in compliance with applicable local occupational safety and environmental protection regulations.

8.2 Disposal Europe

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

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

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

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

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

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

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

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

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

8.3 Disposal for USA

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

9 Contact

Manufacturer

Bruker BioSpin MRI GmbH
Rudolf-Plank-Str. 23
D-76275 Ettlingen
Germany
Phone: +49 721-5161-6531
www.bruker.com / *preclinical imaging*
WEEE DE92533205

MRI Hotlines

Service Hotline

Phone: +49 721-5161-6521
E-Mail: *mri-hardware-support@bruker.com*

Application Hotline

Phone: +49 721-5161-6621
E-Mail: *mri-application-support@bruker.com*

Software Hotline

Phone: +49 721-5161-6588
E-Mail: *mri-software-support@bruker.com*

MRI Service Centers

MRI Service Centers or general *Service Helpdesk*.

Please refer to the product label located typically at the outside of the main electronic cabinet and report Type, Model No., Serial No. and Internal Order where different to Serial No.:

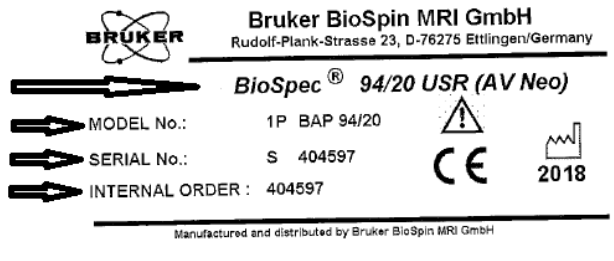
Product Label / Identification for Hotline		
	Type	
	Model No.	
	Serial No.	
	Internal Order	

Table 9.1: Example showing BioSpec 94/20 USR (AVANCE NEO).

Contact

10 Appendix Safety Instructions

This document provides the safety instructions and warnings in all official European Union member states languages.

Work-in-Progress:

Currently no translations are available. Please check for the latest revision of this document.

⚠ WARNING

Biohazard

Depending on substances used, health hazard may arise. Only qualified personnel should carry out work following local biohazard regulatory.

- ▶ Do not use devices described in this manual in laboratories with biosafety level larger than 2.
- ▶ Always clean and disinfect devices appropriately.
- ▶ Prevent successive users from access to and use of the devices prior to cleaning/ disinfection.

⚠ WARNING

Danger of injury from electrical shock.

1. Defective devices or devices having insufficient safety standard bear the risk of electrical hazard.

- ▶ Use only devices with approval by nationally recognized testing laboratories (NRTL).
- ▶ Do not use defective devices or devices showing safety relevant signs of wear and tear.
- ▶ Check the water hoses and connections before using them in the imaging instrument (where applicable).
- ▶ Do not use leaking devices in the imaging instruments.

⚠ CAUTION

Health hazard by anesthesia gas above regulatory limits (worker protection)

Compliance with occupational safety and health regulations are in the responsibility of the System Owner (responsible body). Acute exposure to Isoflurane as well as chronic exposure can cause health hazard.

1. Anesthesia gas delivered into the instrument can escape.

▶ Use corresponding air suction in the surrounding enclosure.

▶ To ensure safe and adequate handling of anesthesia, only trained and authorized users may work with anesthesia gas. Repeat training on a regular base.

▶ Check residual anesthesia gas concentration to stay within worker protection regulatory limits (for example using regularly gas personal monitors suitable for Isoflurane detection).

⚠ CAUTION

Blade injury, laceration

Blade injury might occur at sharp edges when mounting the items.

▶ Work carefully and focus on mechanical parts and sharp edges to avoid blade injury.

▶ Wear protective gloves.

NOTICE

Death of or harm to the animal

1. The Bruker instrument is often used in combination with anesthesia devices (Trade Products) that deliver anesthesia gas. Overdose of anesthesia gas might cause the death of the animal. It is in the operators responsibility to monitor vital signs of the animal.

▶ We recommend to use an animal monitoring system to monitor vital signs (for example heart rate, respiratory rate, body temperature, …).

▶ Follow the instructions for use of all device suppliers such as for example the anesthesia device or animal monitoring trade product supplier.

▶ Ensure operation of vital signs when preparing the experimental setup. For example check ECG wires and hoses of respiratory air pressure pad for blockade.

NOTICE

Death of or harm to the animal

1. During anesthesia, animal body temperature stabilization needs to be fulfilled. We recommend to use a heating device supplying warm air to the air diffusor in the MMAC to support the body temperature.

▶ As warm air supply, we recommend the temperatures and the air flow rates given in the text.

▶ Select a device that supports the recommendation.

▶ Follow the instructions for use of the heating device supplier.

NOTICE

Harm to the animal

1. Acoustic noise caused by the air stream of the warm air supply/suction or caused by the imaging instrument (for example MR instrument) can harm the animal. In addition, warm air supply and/or anesthesia might cause dehydration.

▶ We recommend to use hearing protection for the animal

▶ We recommend eye protection salve or gel to protect the animal from dehydration.

▶ Reduce warm air stream to the minimum while still achieving body temperature stabilization.

▶ Minimize scan time.

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