MAGNETOM Family

Operator Manual – MR System and Coils
syngo MR XA60

Người đại diện hợp pháp của cơ sở
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Legend

	Indicates a hint Provides information on how to avoid operating errors or information emphasizing important details
	Indicates the solution to a problem Provides troubleshooting information or answers to frequently asked questions
■	Indicates a list item
✓	Indicates a prerequisite A condition that has to be fulfilled before starting a particular operation
◆	Indicates a single-step operation
1 2 3	Indicates steps within operating sequences
Italic	Used for references and for table or figure titles
➔	Used to identify a link to related information as well as previous or next steps
Bold	Used to identify window titles, menu items, function names, buttons, and keys, for example, the Save button Used for on-screen output of the system including code-related elements or commands
Orange	Used to emphasize **particularly** important sections of the text
`Courier`	Identifies inputs you need to provide
Menu > Menu Item	Used for the navigation to a certain submenu entry
<variable>	Identifies variables or parameters, for example, within a string

⚠ CAUTION	CAUTION Used with the safety alert symbol, indicates a hazardous situation which, if not avoided, could result in minor or moderate injury or material damage. CAUTION consists of the following elements: • Information about the nature of a hazardous situation • Consequences of not avoiding a hazardous situation • Methods of avoiding a hazardous situation
⚠ WARNING	WARNING Indicates a hazardous situation which, if not avoided, could result in death or serious injury. WARNING consists of the following elements: • Information about the nature of a hazardous situation • Consequences of not avoiding a hazardous situation • Methods of avoiding a hazardous situation

1 Introduction

In order to operate the MR system accurately and safely, the operating personnel must have the necessary expertise as well as knowledge of the complete operator manual. The operator manual must be read carefully prior to using the MR system.

1.1 Valid systems

This manual is valid for the following systems:

- MAGNETOM Vida, 3T
- MAGNETOM Lumina, 3T

1.2 Documentation overview

To improve readability, the Instructions for Use are split up into a number of individual operator manuals. Each of these individual operator manuals covers a specific topic or addresses a specific user group:

- Hardware components (system, coils, etc.)
- Software (measurement, evaluation, etc.)
- System owner manual

The scope of the respective operator manual depends on the system configuration and may vary.

All components of the complete operator manual may include safety information that must be adhered to. The intended use of the system is stated in the operator manual “MR System and Coils”.

1.2.1 Availability

The Instructions for Use are made available mainly in electronic form.

Internet

All operator manuals for your system are available online as PDF files in the **Document Library**:

- doclib.siemens-healthineers.com

For detailed information, see: (➔ Page 15 *Accessing the operator manuals on the Internet*)

Other media

Additionally, the software-related operator manuals are provided on a digital medium, for example, CD-ROM or USB flash drive.

The hardware-related operator manuals for your system are provided in printed form.

Online Help

Information on frequently-used software functions are also available context-sensitive in the Online Help. As the Online Help is part of the software user interface, the language of the Online Help is the same as the language of the software user interface.

Customer voucher (European Union)

EU Regulations stipulate that every European customer shall be provided with the option to receive a paper copy of the Instructions for Use. To comply with this regulation, a voucher is included in the delivery.

To obtain a printed copy of your Instructions for Use, follow the instructions on the voucher.

1.2.2 Contents

The operator manuals include information on frequently used functions for safe and proper use. They may include descriptions covering standard as well as optional hardware and software. The description of an option does not infer a legal requirement to provide it. To find out what hardware and software is available for your system, contact your Siemens Sales Organization.

The graphics, figures, and medical images used in this documentation are examples only. Their actual display and design may be different on your system. In particular, the screenshots may show the color design of an older user interface.

The operator manuals for hardware and software address the authorized user. Basic knowledge in operating PCs and software is a prerequisite.

Gender inclusivity

At Siemens Healthineers, we want to address all genders equally in our Instructions for Use. It is not our intention to exclude anyone. We continue to update our documentation with this in mind.

1.3 Accessing the operator manuals

The operator manuals for your system are available electronically in the **Help** portal of your application.

✓ Software application is open.

◆ To quickly access the **Online Help**:

Follow the link in an extended tooltip, or press the **F1** key, or click the icon in the upper right access bar (: icon or ? icon depending on the available space).

– or –

To view **online PDF** files, if available:

Open the **Help** portal as described above. Then click the **Library** button to go to the available documents.

In the **Library** section of the **Help** portal, you can choose the required document. If necessary, you can apply filters to optimize the display of the documents.

For detailed information about using the **Help** portal, see: Operator Manual MR Examination and Review.

1.3.1 Accessing the operator manuals on the Internet

The operator manuals for your system are available electronically on the Internet.

✓ You have the correct name and version of your system (medical device) at hand.

1 In a browser window, enter the following URL:

doclib.siemens-healthineers.com

If you are visiting this site for the first time, you will need to register and apply for an account.

2 Follow the instructions given on the website. After logging on, you will find further support in the **Medical Imaging & Healthcare IT** document category.

3 Search and filter for the required document.

The Basic UDI-DI for your MR system is: 0405686900125UQ

1.4 Intended purpose

Intended Purpose Statement under the European Medical Device Regulation 2017/745: Magnetic Resonance Imaging Systems

1.4.1 Intended use

The MAGNETOM system is indicated for use as a magnetic resonance diagnostic device (MRDD) that produces transverse, sagittal, coronal and oblique cross sectional images, spectroscopic images and/or spectra, and that displays the internal structure and/or function of the head, body, or extremities. Other physical parameters derived from the images and/or spectra may also be produced. Depending on the region of interest, contrast agents may be used. These images and/or spectra and the physical parameters derived from the images and/or spectra when interpreted by a trained physician yield information that may assist in diagnosis.

The MAGNETOM system may also be used for imaging during interventional procedures when performed with MR compatible devices such as in-room displays and MR Safe biopsy needles.

The MAGNETOM system is not a device with measuring function as defined in the EU directive 93/42/EWG (MDD) / EU regulation 2017/745 (MDR). Quantitative measured values obtained are for informational purposes and cannot be used as the only basis for diagnosis.

For the USA only: Federal law restricts this device to sale, distribution and use by or on the order of a physician.

Your MR system is a medical device for human use only!

1.4.2 Intended target population

As MR imaging is a general-purpose imaging modality, the system is intended for use for all humans that do not fall under the contraindications mentioned in the safety chapter, section “Common/Permanent existing hazards > Contraindications”.

In principle, a qualified physician must evaluate the risk/benefit ratio of the MR examination for every patient.

To date, there is no scientific proof that MR examinations are harmless for pregnant women, the unborn (embryos or fetuses) and children under two years of age. An embryo or a fetus is especially sensitive to potential thermal events during the first three months of pregnancy. Therefore, avoid scanning pregnant patients especially in the first three months of pregnancy and avoid scanning patients with unknown pregnancy status.

Additionally, the weight of the patient is limited by a technical limit of the patient table. For details, refer to the System Owner Manual, technical data. There may also be a weight limit for certain coils. For details, refer to the respective manuals of the coils.

1.4.3 Indications

Magnetic Resonance Imaging (MRI) is a noninvasive technique used for diagnostic imaging. MRI with its soft tissue contrast capability enables the trained user to differentiate between various soft tissues, for example, fat, water, and muscle, but can also discriminate between the different bone structures. This allows for visualization of anatomic details and can offer more sensitivity and specificity in the detection of certain abnormalities than other imaging modalities, when read and interpreted by trained personnel. In general, it is the health care provider who decides on the appropriate diagnostic procedure based on, for example, the patient's physical examination and medical history.

1.4.4 Contraindications

You can find a complete list and details about contraindications in the safety chapter, section "Common/Permanent existing hazards > Contraindications".

1.4.5 Intended users/Authorized operating personnel

The MR system must be operated according to the intended use and only by qualified persons with the necessary knowledge in accordance with country-specific regulations, for example, physicians, trained radiological technicians or technologists, having received the necessary user training.

This user training must include basics in MR technology as well as safe handling of MR systems. The user must be familiar with potential hazard and safety guidelines and emergency and rescue scenarios. In addition, the user has to have read and understood the contents of the operator manual.

The user must be fluent in the language used in the software user interface and in the Instructions for Use. The software user interface is available in less languages than the Instructions for Use.

Please contact Siemens Service for more information on available training options and suggested duration and frequency of such training.

Definitions of different persons

Term used	Explanation
User/Operator/ Operating personnel	Person who operates the system or software, takes care of the patient or reads images Typically physicians, trained radiological technicians, or technologists
System owner	Person who is responsible for the MR environment. This includes legal requirements, emergency plans, employee information and qualifications, as well as maintenance/repair.
MR worker	Person who works within the controlled access area or MR environment User/Operator as well as further personnel (for example, cleaning staff, facility manager, service personnel)
Siemens Healthineers Service/service personnel	Group of specially trained persons who are authorized by Siemens Healthineers to perform certain maintenance activities References to “Siemens Service”, “Siemens Healthineers Service”, or “Siemens Healthineers Customer Service” include service personnel authorized by Siemens Healthineers.

1.5 Clinical benefits

MRI can be used for imaging anatomies such as the brain, spinal cord, heart, breast, liver, prostate, and the musculoskeletal system. It can also help to visualize the blood flow through blood vessels and arteries (angiography imaging) and can give more information about the chemical composition of tissues (spectroscopy) or areas of activation within the brain (functional MRI or fMRI). The use of MRI can help health care providers to gain useful information about a variety of patient conditions and therefore may assist and support in diagnosis when being interpreted by trained personnel. In addition to the usage of MRI in diagnostic imaging, MRI may also be used to assist in dedicated interventional procedures.

1.6 Using the PEPconnect platform

PEPconnect is part of the Personalized Education Plan (PEP) Solution. It is a platform for healthcare professionals to access and share education and performance experiences, anytime, anywhere, on any device. The broad portfolio of medical imaging and therapy, laboratory diagnostics, and other healthcare-related topics is available via e-learning, competency-based training, webinars, job aids, and more. You can find more detailled information on the webpage.

1 In a browser window, enter the following URL:

   pep.siemens-info.com

   If you are visiting this site for the first time, you will need to register and apply for an account in the upper right area.

2 Follow the instructions given on the website.

   After logging in, you will find the material of interest by using the **Search** bar or the **Explore** function following the path: **Explore > Medical Imaging and Therapy > Magnetic Resonance Imaging**

2 Safety

2.1 Preface about safety

2.1.1 Hazards and risks

An MR system may present various hazards. Some occur only during the examination, while others exist permanently and thus are also relevant to non-users (e.g. cleaning personnel).

The various hazards and the corresponding safety instructions are explained in the safety chapter of this operator manual.

According to EU regulation 2017/745 (MDR), any serious incident that has occurred in relation to the device must be reported to the manufacturer and the competent authority of the EU Member State in which the user and/or patient is established.

2.1.2 Common causes of accidents

Despite safety instructions, some hazards lead to accidents time and again. In particular, this includes magnet accidents and RF burns/loop formation, as well as the use of incompatible devices and the wearing of clothing with electrically conductive materials. A detailed patient screening ensures that the patient is free of metallic objects and clothing with metallic yarns or appliqués.

The following sections provide information on how to avoid the most common mistakes and the resulting safety risks. These sections were prepared based on the long-time experience of Siemens.

2.1.3 Responsibility

Siemens accepts no responsibility for the safety, reliability, and performance of the MR system, if the MR system is not used in accordance with the instructions for use (Operator Manual, System Owner Manual). Siemens is also not responsible for any direct or indirect damages caused by incorrect operation. This includes, but is not limited to, accidents with ferromagnetic objects. This applies even if the consequences only become obvious at a later point in time.

2.2 Common/permanently existing hazards

The frequency at which the potential hazards mentioned in this section lead to accidents is still too high. Therefore, it is especially important to observe the instructions on how to avoid these dangerous situations.

The most significant hazards include:

- Electromagnetic fields
- Contraindications
- Mechanical hazards
- Incompatible devices

2.2.1 Electromagnetic fields

In the examination room, there are different kinds of electro-magnetic fields and the resulting risks.

Fields	Most serious hazards
Static magnetic field	Movement by implants and prostheses in the body Attraction, alignment, and projectile-like acceleration of magnetizable objects (➔ Page 22 *Static magnetic field/controlled access area*)
Gradient fields	Peripheral nerve stimulation (➔ Page 22 *Gradient fields*)

Fields	Most serious hazards
RF fields	Warming of body tissue (➔ Page 22 *RF fields*)

All persons (e.g. patients, physicians, operating and cleaning personnel, accompanying persons, and rescue personnel/fire fighters) are exposed to these fields in the examination room. Therefore, all limits and safety measures regarding electromagnetic fields equally apply to patients and MR workers.

- Observe prohibition signs in the area near the entrances to the MR system and the controlled access area.

Static magnetic field/controlled access area

The static basic field is generated by a superconductive magnet and may extend beyond the examination room (walls, ceilings).

In order to minimize the hazards mentioned, the controlled access area of the basic field is identified on the floor (0.5 mT line). Outside the controlled access area, the magnetic flux density is less than 0.5 mT. See: **System owner manual**

Gradient fields

Linearly rising additional fields of variable strength - gradient fields - are superimposed on the static main magnetic field in three different orientations. They may cause shifts in charge in the patient's tissue and lead to peripheral nerve stimulation.

RF fields

The nuclear spins of the body tissue are stimulated via pulsed electromagnetic RF fields. These RF pulses are generated by an RF transmit amplifier and transferred via RF coils to the object to be measured.

RF fields lead to warming of the body tissue. In this context, an important value per body weight is the specific absorption rate or SAR.
(→ Page 140 *Physiological effects*)

Side effects

Possible undesirable side effects for MR are dizziness, heating, claustrophobia and nerve stimulation.

2.2.2 Safety instructions on the static magnetic field

The list of objects in this chapter is not exhaustive. It only serves as an illustration of objects that present hazards in the presence of magnetic forces.

- Only use equipment specified or recommended for use in the controlled access area.

⚠ WARNING

Movement and/or alignment of implants and prostheses in the body, as well as attraction, alignment, and projectile-like acceleration of magnetizable objects may result in very serious hazards!

Injury to patient and operating personnel

- Do not use resuscitation devices - for example, defibrillators or oxygen bottles - in the examination room.
- Do not use transport trolleys, movable beds, stretchers, etc. that consist of magnetizable parts.
- Do not wear or carry any magnetizable objects on your person - for example, watches, pens, scissors, etc..
- Use only proven MR Safe or MR Conditional accessories, parts subject to wear and tear, and disposable articles with the MR system.
- Use only MR Safe or MR Conditional tools and devices.
- Service work on the MR system may only be performed by Siemens Service.
- Ensure that only authorized personnel enter the controlled access area (0.5 mT exclusion zone), for example, electricians or cleaning personnel trained in MR safety.

- Keep the door to the examination room closed.

For China only: Regarding the static magnetic field, your MR system is continuously operated in the first level controlled operating mode for static magnetic fields > 2T and <4T (according to IEC 60601-2-33 (2nd edition)). Therefore, in 3T systems medical supervision is mandatory for all patients.

Dizziness during exposure

When persons (e.g. MR workers or patients) are exposed to the static magnetic field, possible effects are dizziness, light-headedness, or metallic taste, especially in 3-Tesla magnetic fields.

1 Ask the patient to lie still during the measurement.

2 Keep a sufficient distance to the magnet and avoid rapid movements of the head.

CAUTION

Dizziness, light-headedness or metallic taste in the patient's mouth during measurements and/or table movements in a 3-Tesla magnetic field!

Reaction of fear by the patient

- Prior to the examination, inform the patient about the possible occurrence of these symptoms.

Device malfunctions

Magnetic flux densities exceeding 0.5 mT can interfere with electronic implants or other devices. The main magnetic field may either affect or destroy electronic data carriers such as check or credit cards, hard disks, ID cards with magnetic strips and/or magnetic tapes, diskettes or pocket calculators, as well as RFID chips (Radio Frequency Identification).

2.2.3 Safety instructions on RF and gradient fields

Patients at risk

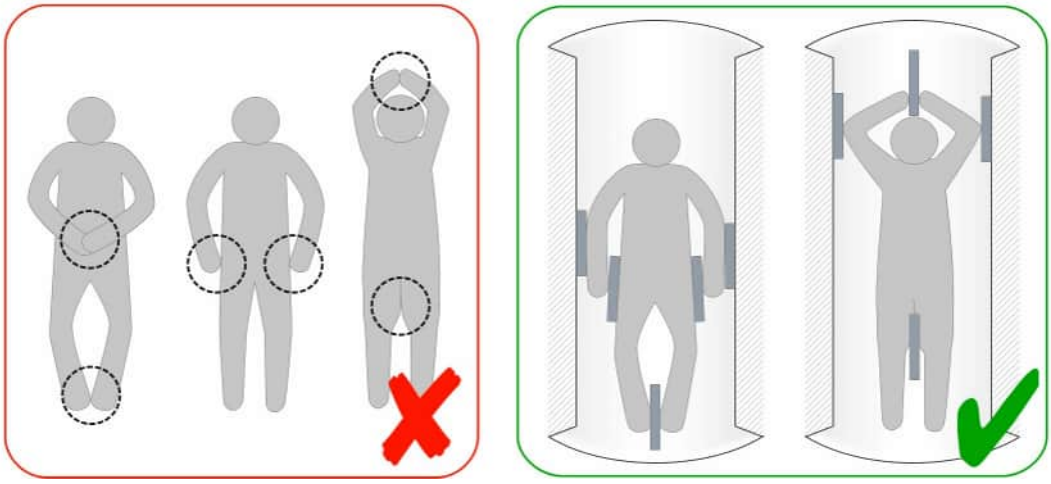
Some patients may be unable to communicate potential overheating effects (for example, small children, seriously ill, paralyzed, unconscious, sedated, or handicapped patients).

- Pay special attention when you examine patients at risk, for example, monitor vital parameters.

Current loops and bore wall contact

Dangerous current loops may be generated when parts of the patient's body touch. These loops may lead to burns or increase the probability of stimulation.

Current loops are also generated when the patient's skin contacts the tunnel lining or RF coil cables.



Ensure to prevent potential current loops as shown in the red labeled illustration.

Ensure the patient is positioned with proper distance (5 mm) to magnet tunnel as well as proper distance between parts of the body as shown in the green labeled illustration.

- To lower the effects of gradient fields or RF fields, keep a sufficient distance from the RF coils and the magnet tunnel (gradient coils), and reduce the time of exposure during measurements.

WARNING

The patient is wearing electrically conductive material! Incorrect patient positioning!

Serious patient burns due to electric current loops

Peripheral nerve stimulation of the patient

- Ensure that the patient does not wear clothing that is wet or dampened by perspiration.
- Ensure that the patient is free of metallic rings, chains, or electrically conductive materials worked into items of clothing (for example, brassiere support wires, metallic appliqués or woven metallic yarns).
- Always position the patient so that the patient's arms are aligned with the torso and ensure that hands, arms, and legs do not touch (minimum distance: 5 mm).
- Ensure that the minimum distance of 5 mm is maintained between patient and tunnel covering.
- To ensure this distance, use positioning aids, e.g. blankets made of linen, cotton, or paper, or dry material that is permeable to air.
- Ensure sufficient ventilation.

CAUTION

RF field may heat up or ignite synthetic blankets and covers containing metallic threads during the measurement!

Patient burns

- Use only covers made of paper, cotton or linen.

CAUTION

Heating up of RF blankets or other conductive sheets!

Patient burns

- Never use RF blankets or other conductive sheets within the magnet bore.

2.2.4 Contraindications

Typical contraindications for MR examinations are:

- Electronic implants, for example, dedicated pacemakers, stimulators, insulin pumps
- Electrically conductive implants and protheses
- Artificial heart valves, aneurysm clips
- Artificial anus (anus praeter) with magnetic closure
- Transdermal drug patches with metallic backings
- Metallic spirals for contraception (IUDs = intrauterine devices)
- Metal splinter, especially in the eye (danger of retinal detachment)
- Metals especially those containing ferromagnetic foreign matter
- Transdermal or other similar implants (for example, body piercings, tattoos containing ferromagnetic material as well as magnetic piercings)

Exceptions for implants, heart valves and aneurysm clips as listed above:

- If these are classified as “MR Safe”, then they are not contraindicated.
- If these are classified as “MR Conditional”, then special conditions apply, which are listed under exceptions below. The adherence to them is in the responsibility of the MR operator and the qualified physician.

In general, MR examinations performed despite these contraindications are the responsibility of the physician.

WARNING

Electronic and/or electrically conductive implants and magnetizable inclusions in static and low-frequency magnetic fields and RF fields!

Risk of patient death/patient injury

- Ask the patient about implants and inclusions.
- Do not perform MR examinations on patients with electronic or electrically conductive implants and magnetizable inclusions.
- Ensure that patients wearing such implants and/or inclusions remain outside the exclusion zone (0.5 mT line).

Exceptions: Certain implantable medical devices have been cleared, approved and/or licensed by the Competent Governmental Authorities and/or labeled by the device manufacturer as “MR Conditional”. For such implantable medical devices, the previously mentioned list of general contraindications and the warning may not be applicable in its entirety.

It is the responsibility of the device manufacturer to declare an implantable medical device as MR Conditional if appropriate and to define the conditions (constraints) for safe MR scanning. The MR operator must be aware of any such conditions for MR scanning. It is the obligation of the MR operator to assure that these conditions are strictly adhered to. To obtain these specific conditions the MR operator may refer to the labeling of the implantable medical device or contact the device manufacturer. Siemens Healthineers does not assume responsibility or liability for the operation of the MR system with any implantable medical device. Especially, Siemens Healthineers is not responsible for controlling technical parameters of the MR system other than those defined by the normal operating mode, the first level controlled operating mode and the data provided in the system owner manual, such as spatial gradient field plots.

CAUTION

Eddy currents induced by low-frequency magnetic fields!

Patient burns

- Do not examine patients with electrically conducting implants or prostheses.

CAUTION

Electrically conducting objects!

Injury to patient due to warming

Incorrect diagnosis due to artifacts

- Request that the patient removes all electrically conducting objects, e.g. necklaces, rings, braces, rubber bands for long hair, piercings as well as jewelry.
- Request that the patient removes all clothing including electrically conducting material, for example, bras, metallic appliqués or woven metallic yarns.
- Inform patients that eyeliners and tattoos may contain ingredients causing artifacts or skin irritations during MR examinations. In some cases, patients have been burned.
- To prevent injuries, instruct patients to remove makeup prior to the examination.
- Instruct patients to seek medical attention in case of discomfort during or following the MR examination.

2.2.5 Mechanical hazards

Collision and points of injury

Collisions and injuries are more prevalent when using the dockable patient table or when performing maintenance activities.

- Observe the warning and prohibition signs as well as the safety information.

CAUTION

Accidental patient table movement!

Injury to the patient

- If you plan an intervention outside the magnet, activate the **Table Lock** function at the Select&GO display to avoid accidental patient table movement, or injury to the patient. After completing the intervention, the table can be unlocked.

WARNING

Cover of the table lifting column is defective; access to moving parts is possible!

Risk of severe contusion during vertical movement

- Complete the current examination.
- Move the patient table completely out of the tunnel and proceed carefully until the table has been fully lowered.
- Shut down the system.
- Notify Siemens Service.

WARNING

Vertical and horizontal movement of the patient table!

Injury to patient and other persons

Damage to the patient table

- Ensure that there are no obstacles (e.g. extending or overhanging body parts, hair, clothing, straps) between table and the magnet, or that the additional equipment (e.g. IV tube, respirator or ECG) does not get caught and remains in and on the patient when moving the tabletop.
- Secure the patient's arms and legs with straps so that the patient is not caught between the tabletop and the magnet cover. Remain in the MR examination room with helpless patients (e.g. children and patients who are either seriously ill, paralyzed, unconscious, sedated, handicapped or medicated), even if the patients are secured during the examination.
- Ensure that the sensor for height detection is not obstructed by clothing, sheets, or accessories, etc.
- Keep the patient under visual or acoustic control.
- In case of hazardous conditions, press the **Table Stop** button.
- Explain the significance of protocol-controlled table movements to the patient.

CAUTION

Risk of collision and crushing when moving the table automatically with helpless patients (for example, children, adipose, sedated, or anxious patients)!

Injury to the patient

- Pay special attention to collision and crushing hazards and avoid them.
- Do not use automatic table movements.
- Turn the jogwheel to move the table slowly and carefully and keep the patient under visual control.

CAUTION

Improper patient transport with the dockable patient table!

Injury to the patient

Damage to the patient table

- Carefully transport the patient on the dockable patient table. Secure the patient if necessary.
- Do not pull/push the tabletop or use the emergency release to avoid any unintended horizontal movement.

2.2.6 Compatibility

Combinations with other systems, accessories

Among other things, the following hazards or complications may occur through the use of third-party products during MR examinations:

- Heating of system cables or connection cables
- Interference with MR image quality
- Malfunctioning of third-party products

Auxiliary equipment, which has not been specifically tested and approved for use in the environment of the MR equipment, may result in burns or other injuries to the patient.

If the MR system is combined with other systems or components, it must be ensured that the planned combination and cable routing do not affect the safety of patients, personnel, or the environment.

Ensure that the devices used in the examination room are compatible with the field strength of the MR system. For example, devices compatible with 1.5T systems may be unsuitable for 3T systems (or even 7T systems) and vice versa. See also MR Conditional: (➔ Page 33 *Labeling*)

- Contact Siemens Service prior to combining the MR system with other devices.

Interferences

Peripheral equipment (e.g. patient monitoring, life support or emergency care equipment) which is not specified or recommended for use in the MRI environment, including the controlled access area, may be disturbed by the RF field or the magnetic fringe field of the MR system. This equipment may also disturb the proper function of the MR system.

Labeling

ASTM International developed a new classification system for implants and ancillary clinical devices. The following definitions apply:

MR Safe 	An item that poses no known hazards in all MR environments. MR Safe items include nonconducting, nonmagnetic items such as a plastic petri dish. An item may be determined to be MR Safe by providing a scientifically based rationale rather than test data.
MR Conditional 	An item that has been demonstrated to pose no known hazards in a specified MR environment with specified conditions of use. Field conditions that define the specified MR environment include field strength, spatial gradient, dB/dt (time rate of change of the magnetic field), RF fields, and SAR. Additional conditions, including specific configurations of the item, may be required. MR Conditional devices (for example, RF communications equipment) may present hazards as well. Observe the manufacturer's operator manual to avoid potential hazards and injuries.
MR Unsafe 	An item that is known to pose hazards in all MR environments. MR Unsafe items include magnetic items such as a pair of ferromagnetic scissors.

Technical data

Detailed information on B_0 values, gradient and RF data, as well as graphic representations of the spatial distributions are included in the MR compatibility data sheet. See: **System Owner Manual**

2.3 What else must be observed?

2.3.1 Ambient conditions

As the ambient conditions and SAR have a considerable effect on the patient's body temperature, you must regularly check the ambient conditions.

Regulating the room temperature

The patient's ability to dissipate surplus heat is increasingly affected as the room temperature and relative humidity increase.

- Ensure that the room temperature is at or below 22 °C and the relative humidity does not exceed 60%.

2.3.2 Access to the examination room

Free access to and exit from the examination room must be ensured at all times.

1. Regularly check the correct functioning of the door to the examination room.
2. Ensure that the door to the examination room opens and closes correctly.

2.3.3 Noise development

By switching the currents in the gradient coils for imaging purposes, the mechanical forces lead to noise development (humming, knocking noises) during the MR examination which can exceed 99 dB(A) in the bore.

WARNING

Noise development during the MR examination!

Injury to patient and people in the examination room (hearing impairment up to permanent hearing loss)

- Provide the patient with appropriate hearing protection that lowers noise to at least 99 dB(A).
- Mandatory provide anesthetized or unconscious patients with hearing protection. Ear protection for these patients should not be omitted even at moderate sound levels.
- Ensure that personnel and accompanying persons in the examination room wear hearing protection during the examination that lowers noise to at least 85 dB(A).

- For required level of hearing protection, see: **System Owner Manual, Technical data: Hearing protection data**. All hearing protection devices must provide the required level of sound attenuation.

Adequate attenuation levels can be achieved by using, for example, ear plugs. Ear plugs offering sufficient hearing protection can be found in the Siemens Accessories catalog.

The standard Siemens headphones are intended for communication with the patient and can be used in combination with ear plugs.

- For appropriate sound attenuation, the proper use of hearing protection is important. All personnel should be trained to correctly apply the hearing protection.
- Special attention and training of the operator is required for proper positioning of the hearing protection for neonates and infants. In addition this applies to any other condition where an alternative form of hearing protection might be necessary.
- For MR examinations of infants special hearing protection may be required.
- Due to increased anxiety the permissible sound pressure level may be a reason for concern for pregnant women and their unborn, for newborns, infants and small children as well as older persons.

2.3.4 Patient care

Patient information

Patients must be informed about the hazards and safety measures during MR examinations. Before doing so, it must be confirmed that an MR examination is permissible and/or checked if increased precautions are necessary.

WARNING

Patient received insufficient information!

Injury to patient

- Explain to the patient how to behave during the procedure and what to expect, as well as the risks involved.
- Inform the patient about the monitoring and communication equipment e.g. squeeze ball, intercom.
- Instruct the patient regarding possible heat development during the MR examination.
- Inform the patient about the risks associated with wearing metal objects (jewelry, conductive makeup, tattoos) and about possible consequences of contact with the tunnel wall or unfavorable contact between extremities.
- Inform the patient about noise developing during the MR examination.
- Prior to the MR examination, instruct patients of possible stimulations during the examination i.e. twitching muscles, tingling sensation.

Patient monitoring

Patients may be acoustically as well as visually and physiologically monitored in the MR system.

- The viewing window or a patient video monitoring system is used for visual monitoring.
- The intercom can be used to acoustically contact the patient. (→ Page 87 *Intercom*)
- Medical supervision: MR Conditional monitoring devices are used to monitor the patient's vital parameters, provided the conditions for safe operation are observed.

Medical supervision means adequate medical management of patients who can be at risk from some parameters of exposure to the MR equipment, either because of the medical condition of the patient, the levels of exposure or a combination.

All patients should receive at least routine monitoring. For some (e.g. sedated, physically unstable) patients, monitoring of the vital parameters is mandatory. In the First Level Controlled Operating Mode medical supervision is also mandatory.

CAUTION

Incompatible monitoring devices!

Patient burns

- Use only monitoring devices, for example, ECG electrodes and pulse sensors, that meet the conditions for safe use (MR Safe or MR Conditional).

2.3.5 Interventional procedures

CAUTION

No or incorrect visual feedback during interventional procedures!

Risk of patient injury; incorrect diagnosis

- Always plan appropriate emergency measures prior to starting an MR-guided or MR-monitored interventional procedure.
- Do not use the in-room monitor for diagnostic purposes.

During an intervention, body fluids or infusion liquid may escape and penetrate the coil.

CAUTION

Body fluids may escape during interventions!

Potential contamination

- Protect the Siemens local coils and cables, if possible.

Risk of stumbling

The risk of stumbling is related in particular to the unfavorable routing of cables/hoses of interventional components.

CAUTION

Cable/hoses of interventional components!

Injury to patient and operating personnel

- Route cables/hoses of interventional components so that it is not possible to trip over them.

2.3.6 Artifacts and imaging errors

Due to their magnetizability, foreign objects in the area of the magnet bore cause strong local distortions of the basic field and lead to considerable image artifacts. Depending on the level of distortion, diagnosis may be difficult, impaired or completely impossible.

Causes: Artifacts and imaging errors are listed according to their source for error:

- System-related artifacts/imaging errors
- Patient-related artifacts/imaging errors
- User-related artifacts/imaging errors, see: **Software operator manual**

User-related and patient-related artifacts/imaging errors can be largely avoided through patient instructions and proper conduct of patient and personnel.

Accessories, for example, markers must be “MR Safe”. But even if accessories are MR Safe, they can cause artifacts. For example, markers on a stereotactic frame can produce ghosting artifacts. In general, the use of accessories is the responsibility of the physician.

System-related artifacts/imaging errors

The MR image may show system-related artifacts/imaging errors despite careful preparation.

◆ If the same artifact/imaging error appears repeatedly, document and submit it to Siemens Service.

Stripe artifacts

CAUTION

RF-signal interference caused by incompatible accessories e.g. patient monitoring devices, also from the outside if the door is open!

Streaks and bright spots in the MR image

- Use only accessories tested and approved for the MR system.
- Keep the door to the examination room closed.
- Vary the bandwidth of the MR sequence.
- Whenever possible, use local coils for the MR examination.

Variations in brightness

CAUTION

Local variation in the sensitivity of local coils!

Continuous fluctuations in MR image brightness

- Whenever possible, use a local coil with transmit characteristics that are more suitable for the field of view desired.
- Use the normalization filter.

CAUTION

Static and/or stationary brightness errors on the LCD monitor due to aging!

Incorrect diagnosis

- Scroll through the images to ensure that the MR image does not show differences in brightness, spots, or cloudiness and check bright objects for afterglow.
- Keep your eyes always in central monitor position with a vertical view angle towards the screen surface for best image quality.

Variations in signal and contrast

CAUTION

Inhomogeneous RF field!

Asymmetry of contrast in the MR image

- Whenever possible, use a local coil with transmit characteristics that are more suitable for the desired field of view.

Distortions/signal obliteration along the edges

WARNING

Spatial non-linearity of the gradient field and inhomogeneity of the static magnetic field!

Pin-cushion and barrel-shaped distortions and/or loss of signal in the margins of the MR image

- Go through a distortion correction.
- Position the region to be examined as close to the magnet isocenter as possible.
- Use phantoms for the control measurements.

Localization errors due to distortion

CAUTION

Incorrect localization data due to spatial non-linearity of the gradient field and inhomogeneity of the static magnetic field!

Incorrect diagnosis

- Take localization errors into account while planning interventions or biopsies.

Potato chip artifact

CAUTION

Distorted slice edges in the margin due to spatial non-linearity of the gradient field and inhomogeneity of the static magnetic field!

Incorrect diagnosis

- Take into account slice distortion at the margins of the MR image. This applies in particular to graphic slice positioning (GSP) as well as other graphic slice displays and slice positioning data independent of the possible use of distortion correction.

DIXON swapping

CAUTION

When using the DIXON method, water and fat swaps might occur!

Incorrect diagnosis

- Diagnosis should be confirmed by a second contrast and/or a different orientation.

Patient-related artifacts/imaging errors

CAUTION

Poor image quality! Wrong image position!

Incorrect diagnosis

- Prior to the examination, inform patients about movements and their negative effects on the measurement.
- Ensure that the patient does not move during the measurement.
- Monitor the patient during the MR examination.

CAUTION

Imprecise localization due to patient movement during functional MR imaging (fMRI)!

Incorrect diagnosis

Incorrect assignment of active brain areas

- Prior to the examination, inform patients about movements and their negative effects on the measurement.
- Use Siemens scan protocols with motion correction.
- Monitor the patient to ensure that the task is performed correctly.

MR images can also show typical MRI artifacts such as aliasing and ghosting:

- **Ghosting artifacts** are typically caused by environmental factors or human body movements (such as respiratory motion, blood flow, heartbeat, implants, or hyperintense markers) and appear in the phase-encoding direction. Ghosting artifacts can be reduced by respiratory and cardiac triggering, the use of breath-holding pulse sequences, flow compensation or presaturation pulses, depending on their origin. To reduce bowel motion also pharmaceuticals can be useful.
- **Aliasing artifacts**, also known as wrap-around artifacts, occur when the field of view (FOV) is smaller than the body part being imaged. The part of the body that lies beyond the edge of the FOV is projected onto the other side of the image. Aliasing artifacts can be reduced by a larger FOV or an adjusted FOV position. Oversampling and adjustment of individual measurement parameters can also help to reduce aliasing artifacts. For details about measurement parameters, see: **Operator Manual - MR Examination and Review**

2.3.7 Maintenance/repair

WARNING

High voltage and currents inside the electronics cabinets!

Risk of death by electrocution

- Electronics cabinets should only be opened by Siemens Service.

Daily checks

Windows, doors, and emergency flaps must not be blocked.

Safety-relevant accessories

The following safety-relevant accessories should be checked:

- All RF coils for the transmitting and receiving system
- ECG and respiratory sensor
- Disposable electrodes
- Pulse sensor

Maintenance

For detailed information about maintenance of the MR system, see: **System owner manual**

Serious malfunctions

In case of serious malfunctions, shut down the MR system immediately and notify Siemens Service.

2.3.8 Signs and symbols

Warning signs

 Magnetic field	 RF field	 Observe operator manual
 Potential injury to persons	 Risk of injury	 Maximum load side rails
 Risk of breaking	 Refilling with liquid nitrogen and helium	

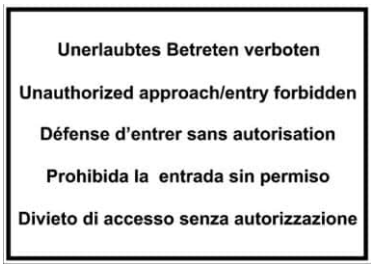
Prohibition signs

 Implants susceptible to electromagnetic effects	 Open flames, no smoking	 Metallic implants and other metallic objects inside the body	 Mechanical watches and electronic data carriers

Fire extinguishers with magnetizable metal housing

Metal parts, e.g. tools

Electronic data carriers



Unauthorized access

Implants susceptible to electromagnetic effects

Further symbols

Sign requiring mandatory hearing protection

Non-ionizing radiation

Protective class symbol B for application parts

Protective class symbol BF for application parts

2.3.9 System owner-related advices

Some safety instructions address the system owner. They are included as "Safety information" in a separate operator manual, see: **System owner manual**. This manual also contains the technical description of the system.

2.3.10 Coils

CAUTION

Damaged RF coils/coil cables! Warming!

Patient burns

- Never run coil cables over the patient's head.
- Avoid direct contact between the coil cables and the patient.
- Use only operationally satisfactory RF coils/coil cables.
- In case of damage, contact Siemens Service.

CAUTION

Exposure to RF electromagnetic fields!

Burns to infants/small children

- Do not examine small children in local TxRx coils while ECG leads or ECG electrodes are attached.

Dangerous current loops may be generated if parts of the patient's body touch. These loops may lead to burns or increase the probability of stimulation. To avoid such loops, always use appropriate cushions when positioning the patient. See chapter: **Accessories > Standard accessories > Set of positioning aids**

Effect of antenna

Cables (for example, from RF coils, ECG cables) that are run together and form loops can absorb RF energy and can cause patient heating.

CAUTION

Cable loops may absorb RF energy!

Patient burns

- Avoid coil cable loops.

RF coils that are not connected

To avoid electrical coupling between the RF coils and the Body coil, the coils must be connected correctly.

WARNING

Coil cables/plugs not connected!

Patient burns

Irreparable damage to RF coil

- Ensure that all RF coils used are connected.
- Remove disconnected RF coils from the patient table.

2.3.11 Quality assurance/phantom handling

CAUTION

Deactivated RF transmitters (SAR) and gradient (dB/dt) monitoring during quality measurement!

Injury to patient

- Ensure that the patient is not located in the magnet bore.

When measurement phantoms are used as intended within the scope of quality assurance for RF coils, there is no physical contact with measurement phantom fluids. The fluids are sealed inside the measurement phantoms.

Risk due to aerosol formation

If phantom fluid has escaped, inhalable droplets (aerosols) may form in the event of a fire or atomization caused by strong air currents. Carcinogenic effects cannot be ruled out if these aerosols are absorbed by the body.

Handling and storing

WARNING

Improper handling of measurement phantoms may lead to phantom leakage or overheating!

Skin irritation

Risk of fire due to lens effect

- Store the phantoms at room temperature, around 18 °C–22 °C (64 °F–72 °F) in a protected location.
- Do not drop measurement phantoms.
- Do not change measurement phantoms.
- Do not store measurement phantoms in direct sunlight.

Phantom fluid spills

The measurement phantoms contain various fluids (for example, nickel sulfate solution, manganese chloride, or white oil). Some fluids may require special measures to avoid health risks. The EC safety data sheets and legal regulations explicitly mention possible hazards relating to phantom fluids.

Always observe the information on the phantom and in the corresponding safety data sheet and follow the specific measures relevant to each phantom fluid.

WARNING

Contact with spilled phantom fluid!

Personal injury

- Wear protective clothing (gloves, work coat, and goggles).
- Wear a mask with a filter for inorganic vapors if aerosols (inhalable droplets) are formed.
- Avoid skin contact with phantom fluids.
- Do not swallow phantom fluids.
- Do not use damaged phantoms.
- Ensure that fluids from phantoms are disposed of properly.

1 Absorb the fluid immediately using absorbent material such as sand, sawdust, etc.

2 Collect the fluid in a plastic bucket.

3 Prevent phantom fluid from entering the waste water system.

4 Change contaminated clothing.

5 Clean your hands thoroughly using soap and water.

First aid in case of contact with phantom fluid

- Always consult a physician immediately.
  - **Skin contamination:**
    - Immediately remove the clothing covering the contaminated area.
    - Immediately wash the skin using soap and water.
  - **Eye contamination:** Immediately consult an ophthalmologist.
  - **Swallowing:** Drink plenty of water and induce vomiting immediately.
  - **Swallowing oil:**
    - Do NOT induce vomiting.
    - Ensure that the person lies still.
  - **Inhalation:** Apply fresh air.

Mandatory reporting in case of fire

1. Inform the fire department about the contents of the measurement phantoms.
2. Inform your local fire department that phantom fluids may produce nickelous aerosols.

Disposal of phantom fluids as special waste

1. Label the container accordingly.
2. Hire an authorized special waste company for disposal.
3. It is recommended that you contact the local Siemens Service office as well as the environmental protection officer or the responsible local authorities.
4. If you have additional questions, contact Siemens Service.

2.4 In case of emergency

1. Before working with the system, familiarize yourself with the location and functionality of the emergency switches installed.
2. Report all accidents resulting in personal injury immediately to the appropriate authorities.
3. Observe the established emergency plans (e.g. emergency plan in case of coolant accidents, emergency plan for fire fighting).

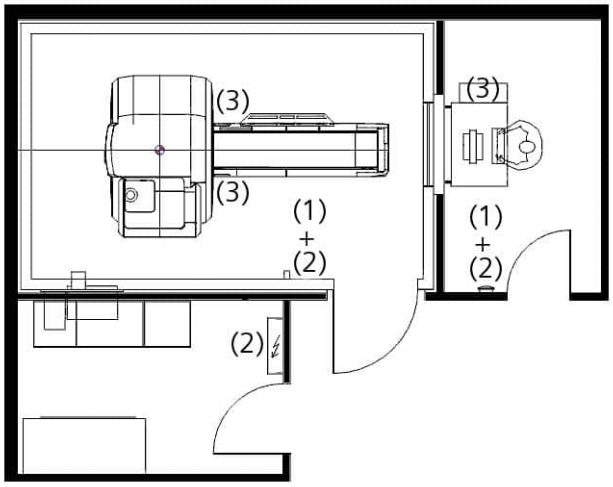
2.4.1 Emergency switches

The MR system has different types of emergency switches.

Switch	Effect	Emergency
Magnet Stop	Shutting down the static magnetic field (quenching)	E.g. in case of accidents with attracted metal parts or in case of fire
Emergency Shut-down	Electric power of the entire MR system is switched off, but magnet remains at field	E.g. in case of fire
Table Stop	Motorized table movement is stopped	E.g. in case of accidents or injury due to table movement

In case of emergency, the relevant switch should be pressed.

Follow the instructions in the different subchapters, in particular regarding when which switch should be used. Especially the **Magnet Stop** and the **Emergency Shut-down** switches are often confused. Sometimes the **Magnet Stop** switch is pressed accidentally and the magnet quenches with all its consequences.



(1) **Magnet Stop** switch
(2) **Emergency Shut-down** switch
(3) **Table Stop** button

Magnet Stop switch

The **Magnet Stop** switch triggers a controlled magnet quench (shutting down the magnetic field). The MR system is not disconnected from the power.

The quench process, that you trigger by the **Magnet Stop**, is irreversible and has several consequences. As one rule, Siemens Service must be called following a quench. The magnet must only be put back into operation by Siemens Service personnel.

There are two different versions of the **Magnet Stop** switch on the MR system: as an individual switch or as an integral part of the alarm box. The switches may also be installed in other places of the MR system.

(1) **Magnet Stop**, example individual switch: "Press to remove field. Emergency use only."
(2) **Magnet Stop** on the alarm box: "Press to remove field. Emergency use only."

Only operate the **Magnet Stop** in emergency situations in which persons are at risk and in which the magnetic field must be switched off. In other situations, for example, attraction of a metal object to the magnet without any risk to persons, please contact Siemens Service.

Note that in some emergency situations it may be sufficient to switch off the electric power of the entire MR system. In this case, you should use the **Emergency Shut-down**.

Examples where switching off the magnet may be required:

- Accidents with attracted metal parts
- Fire

After the **Magnet Stop** switch has been pressed, an alarm is triggered at the alarm box. The **WARNING** LED will light up and an alarm signal will sound.

CAUTION

Formation of droplets due to condensation during quenching!

Personal injury (for example, frostbite)

- Do not touch the exhaust line / quench pipe.
- Do not stand under the exhaust line.

WARNING

System indicates **Magnet Stop** error!

Hazardous conditions because the magnet cannot be quenched in case of emergency

- Immediately remove the patient from the magnet.
- Restrict the access to the examination room.
- Notify Siemens Service.

Emergency Shut-down switch

Typically there are two **Emergency Shut-down** switches installed: one near the alarmbox and another one in the examination room. The switch is used to switch off the electric power of the entire MR system.

Examples where switching off the electric power may be required:

- Voltage accidents
- Fire

WARNING

Fire or electrical accidents!

Smoke inhalation, electrical shock, and burns

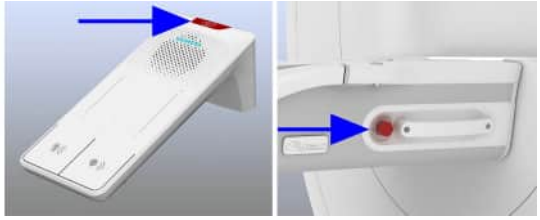
- Press the **Emergency Shutdown** switch immediately.
- Make an emergency call (e.g. fire department).

If your system is equipped with a UPS (uninterruptible power supply), make sure that you switch on the UPS manually after you have released the **Emergency Shut-down** switch. See: (➔ Page 100 *UPS (uninterruptible power supply)*)

Table Stop button

A button to stop table movement is located on the intercom and on the patient table (red button, indicated by the stop symbol). As soon as the button is activated, table movement and the current measurement are stopped immediately. Additionally, a message is displayed on the Select&GO display and LEDs on the intercom flash.

The **Table Stop** button must always be reset on the component on which it was activated.



An additional **Table Stop** button is located on the dockable patient table, on the back of the control panel. This button is intended to stop the table movement, if the table in undocked from the system.

2.4.2 Medical emergency

WARNING

Medical emergency during MR measurements!

Risk of death to patients

- Terminate the measurement immediately.
- Remove patients from the examination room for treatment unless it is certain that the medical equipment required is appropriate for use inside an MR room.
- Do not store or operate oxygen bottles, defibrillators, or other auxiliary tools for resuscitation in the examination room.

CAUTION

Squeeze bulb is defective!

Risk of injury to patient because emergencies cannot be communicated

- Check the functionality of the squeeze bulb daily.

2.4.3 Coolant accidents

First aid in case of shortness of breath

During a quench, a person might become unconscious due to severe shortness of breath:

1 Remove unconscious persons immediately from the examination room.

2 Start adequate first aid measures and contact a physician immediately.

First aid in case of frostbite

Direct contact with subzero liquids, gases, and surfaces (e.g. pipes) may lead to frostbite. The eyes and mucous membranes are especially vulnerable.

WARNING

Improper handling of liquid helium!

Skin damage caused by frostbite

◆ Do not rub frostbitten skin areas.

1 Remove clothing carefully from the locations involved.

2 Rinse frostbitten skin with lukewarm water.

3 Cover frostbitten skin with sterile bandages.

4 Do not apply powder or creams.

5 Contact a physician immediately.

2.4.4 Fire/Fire fighting

The following devices/materials may be used for fire fighting:

- Non-magnetic CO_2 extinguisher
- Self-contained, anti-magnetic compressed-air breathing apparatus (or hose connection)
- Airtight chemical protective suit

3 MR system components

3.1 Overview system

3.1.1 About function

A detailed specification of the system hardware and software is provided in the **System Info** dialog box. To access this dialog box, open the **About** dialog box: Click the menu icon on the upper right access bar and choose **Help > About**. Then click the **System Info** button.

The **Hardware** tab of the **System Info** dialog box can be used in combination with the information provided in the System Owner Manual (MR compatibility data sheet) to determine the specification of the static magnetic field, the gradients and the RF.

3.1.2 Super-conducting magnet

Magnetic field

The super-conducting magnet generates a strong homogeneous magnetic field with a field strength of 1.5T, 3T, or even 7T.

The magnet field strength of your system is specified in the introduction.

Cooling system

The magnet is filled with liquid helium as a coolant. Following installation, it is adjusted to the desired operating field strength. The ramped-up magnet does not require additional electric power to maintain the magnetic field. Under normal operating conditions, there is no helium boil-off.

Shielding

To minimize the effects of the magnetic fringe field on the environment, the magnet of the MR system is equipped with active super-conducting shielding.

Gradient system

The gradient system provides precise localizing slice positions.

For details on the gradient system, please refer to the **System owner manual**.

3.1.3 Electronics cabinets

The electronics cabinets are located in the equipment room or the control room.

Example of electronics cabinets (actual configuration may be different on your system)

Depending on the MR system, the electronics cabinets may contain one or more of the following components:

- Gradient cabinet

  The gradient cabinet contains the power electronics for generating the magnetic field gradients.

- Control cabinet

  The control cabinet includes different electronics components for operating the MR system, for example, the MARS (measurement and reconstruction system).

  The control cabinet includes a sequence-programmable, optical trigger signal output which can be made externally accessible by Siemens Service via installation of a fiber optic cable.

Please note that Siemens provides customers with the optical trigger signal output for research purposes only. No devices connected to this output have been tested by Siemens. Before connecting devices to the MR suite using the optical trigger signal output, they must be tested for safety by trained personnel.

Before using devices in the proximity of the magnet, their non-magnetic properties and clinical operation in the magnetic field have to be confirmed.

The use of devices connected to the optical trigger signal output has to comply with any applicable governmental or local hospital Institutional Review Boards (IRBS).

Siemens will not be held responsible for the use of any device and resulting consequences in connection with the optical trigger signal output.

- System separator

  The system separator contains electronics components and cooling-equipment to deliver an adequate cooling power for the system. If a special cooling system (chiller) is installed, the system separator is not necessary. The chiller option is not available for all systems.

3.2 *syngo* Acquisition Workplace

The workplace (desk) in the control room is known as the *syngo* Acquisition Workplace (*syngo* Acq WP) and is used to operate the software. It includes the host processor with the operating elements monitors, keyboard, and mouse.

An additional component of the *syngo* Acquisition Workplace is the intercom.

For details about software operation, please refer to the other software-related operator manuals.

3.2.1 Host

Among other things, the host processor includes the following functions:

- Patient management
- Image selection and storage
- Measurement sequence management

Measured MR images may be transferred to other systems or computers via the network connection (for example, PACS or RIS systems). MR images from other systems or computers can be received via the network as well.

Processes that require substantial computing power (for example, image reconstruction) are performed on the separate MARS (measurement and reconstruction system), which is connected to the host computer. The MARS is installed in the electronics cabinets and is located in the equipment room.

3.2.2 Data recording

The host computer provides several USB ports. These USB ports allow you to connect an external CD/DVD drive for data recording. The external CD/DVD drive must be Windows 10 compliant.

The burn and read process is started via the software.

Please take into account the handling, care, storage of CDs/DVDs and CD-Rs/DVD-Rs as specified by the respective manufacturers.

You can also use the USB ports to connect a paper printer.

3.2.3 Monitors

Monitors are used to display both MR images and user dialogs. If your *syngo*.Acquisition Workplace is equipped with two monitors, one console monitor displays scan-related contents, while the other monitor displays images for viewing and post-processing. The monitors are switched on or off as part of the overall MR system.

Do not touch the surface of the screen using sharp, pointed objects.

Follow the cleaning instructions.

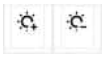
As the monitors are optimally configured by Siemens Service, all monitor adjustments are blocked.

3.2.4 Keyboard

The *syngo* Acquisition Workplace is equipped with a specially labeled Siemens keyboard. This keyboard is a modified Windows keyboard on which some of the numeric keys have been replaced with symbol keys.

The symbol and navigation keys are used to access frequently used functions. **+** or **-** means an increase or a decrease or navigate back and forth in a given order.

Symbol keys on the keyboard

	Adjusts brightness		Opens the Patient Browser
	Adjusts contrast		Opens patient registration
	Copies to film sheet		Sends data to configured DICOM node

The functions of the navigation keys in the following table differ depending on the active display mode (stack or stripe display mode).

Navigation keys on the keyboard

	Stack display mode: Scrolls to the next/previous slice in space. Stripe display mode: Moves one segment up/down.
	Stack display mode: Moves a predefined number of images forward/backward (for calculated 2D images, the slice spacing is taken into account). Stripe display mode: Goes to the next/previous page.
	Stack display mode: Navigates in time points or data sets, if applicable. Stripe display mode: Moves one segment left/right.

3.2.5 Mouse

The system is equipped with a wheel mouse.

- Left mouse button:
  - Selecting or moving objects
  - Starting applications
  - Executing commands

- Center mouse button/wheel:
  - Changing the window values of patient images
  - Scrolling (for example, through the Patient list)
- Right mouse button:
  - Opening the context menu (depending on the position of the mouse pointer)

3.2.6 *syngo* MR Workplace (optional)

The *syngo* MR Workplace allows for evaluation, documentation and post-processing of previously measured images while acquiring images at the *syngo* Acquisition Workplace. It accesses the database of the host processor.

You cannot perform measurements at the *syngo* MR Workplace. It is not connected to the MARS (measurement and reconstruction system).

3.3 System control

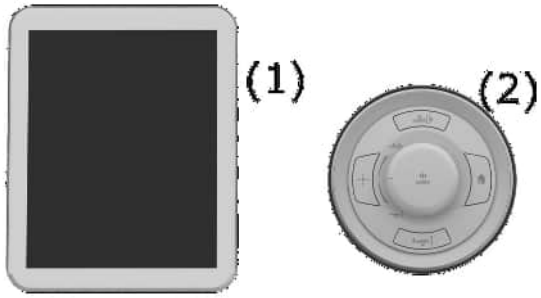
3.3.1 Description

You can use the system control units to operate the system and the patient table.

Control units

Depending on your system configuration, the control units might be located at the right and the left side of the patient table at the front of the magnet cover and additionally at the rear side of the magnet.

Each control unit consists of a display with a touchscreen (Select&GO display) and a control panel with a jogwheel and several buttons.



(1) Select&GO display: touchscreen providing several features
(2) Control panel with jogwheel and buttons for table positioning

The optional control unit at the back of the magnet additionally comprises a **Table Stop** button.

For better user guidance, the jogwheel and the buttons are backlit.

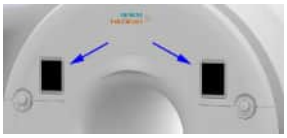
(➔ Page 71 *Operating the patient table*)

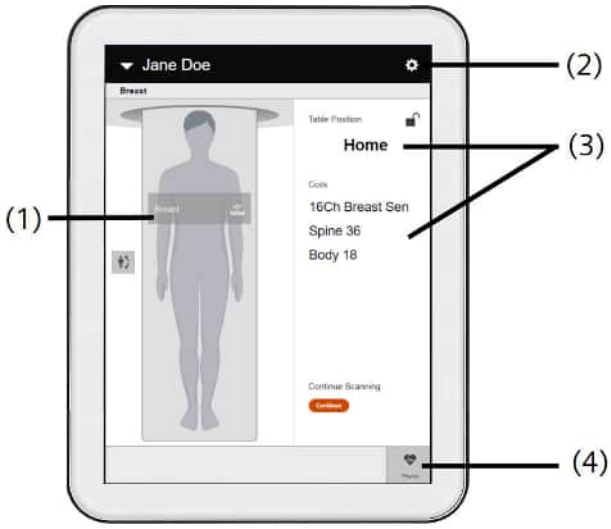
(➔ Page 67 *Operating the control units*)

(➔ Page 135 *Preparing the MR system*)

Select&GO display with touchscreen

The Select&GO display provides status information as well as several tools. The display is located at the right and the left side of the patient table at the front of the magnet cover.





(1) Button for automatic table positioning
(2) Access to **Comfort** and **Settings** menus
(3) Current table position and connected coils
(4) Tool bar

Information service

The display shows several pieces of information:

- Information concerning patient positioning (for example, patient orientation, current table position, auto-positioning)
- Information about the connected coils
- Several guidances, for example, for attaching ECG electrodes, using the Beat Sensor, docking the table, and emergency evacuation
- General patient information submitted from the software
- Information concerning troubleshooting

Automatic table positioning

You can use the display to automatically move the table to the isocenter position of the selected body region.

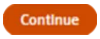
As soon as at least one coil is connected to the system, one or more overlay buttons are offered on the pictogram of the patient body. Each button represents a possible examination region. The position of the button on the patient body depends on which coils are connected.

The isocenter position depends on the patient registration.

- If the patient is already registered, the isocenter position is determined depending on the patient's height and gender.
- If the patient is not yet registered, an isocenter position based on default values is used. The isocenter position is then recalculated after registration. If necessary, the table position is automatically adjusted before the first measurement.

Tools and menus

	**Comfort** menu, offers settings for patient comfort:  **Ventilation**, **Speakers**, **Headphones**, and **Bore light**
	Settings menu, offers **Cleaning Mode** and various **Brightness** settings:  **Brightness** (of the touch display), optional: **Funnel Light**, **Ring Light** or **Ambient Light** The ambient light is not available for all systems.
	**Physio** menu Displays the physiological data of the patient and provides access to the Beat Sensor guidance

	**Breast Biopsy** Displays target settings for the biopsy device (only with advanced application MR Breast Biopsy)
	**Continue** scanning Restarts a paused measurement step when the table reaches the center position.
	**Info** Displays further information (for example, undocking of the dockable patient table)
	Table lock/Table unlock (toggle icon) Activates/deactivates the table lock function for interventional examinations If the table lock is active, the control functions for the patient table are locked but it is still possible to move the table mechanically.
	Automatic table positioning The overlay button on the pictogram of the patient body moves the table to the isocenter position of the selected body region.
	Swap button Changes the patient orientation before the patient is registered and the table is in the home position

3.3.2 Operating the control units

For details about operation of the jogwheel and the buttons, see:
(➔ Page 71 *Operating the patient table*)

To operate the Select&GO display, proceed as follows.

1 Tap one of the icons in the lower menu bar or tap the gearwheel icon in the upper-right corner to choose a menu or to perform an action.

2 To adjust an intensity (for example, the volume of the headphones), tap the corresponding position on the slider.

3 To move the table to the isocenter position automatically, tap the button of the corresponding body region.

4 To reset the patient alert (alarm message on the display), tap the corresponding button in the message.

Alternatively, you can reset the patient alert on the intercom at the *syngo* Acquisition Workplace.

Cleaning Mode can be used to freeze the touch display for cleaning.

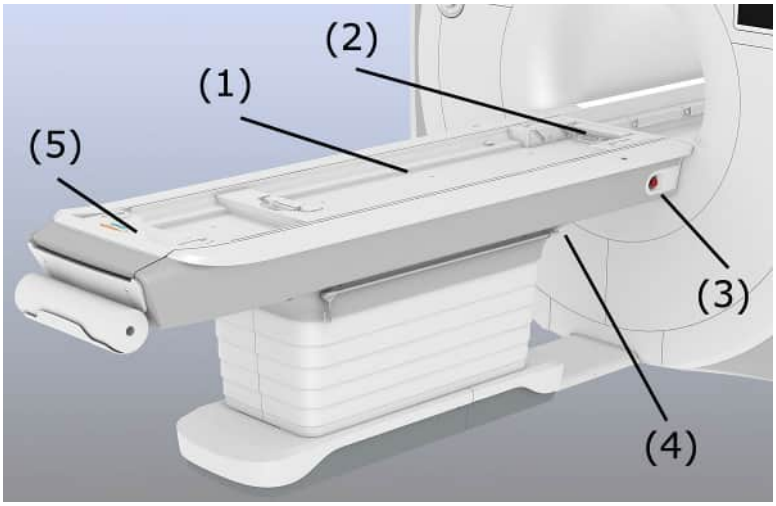
5 If you want to clean the touch display, choose the **Settings** menu and tap on the **Cleaning Mode** switch.

The display remains dark until you tap the **Cleaning Mode** switch again.

3.4 Patient table

3.4.1 Description

The patient table is used for positioning the patient and the coils. The table comprises several sockets and connections.



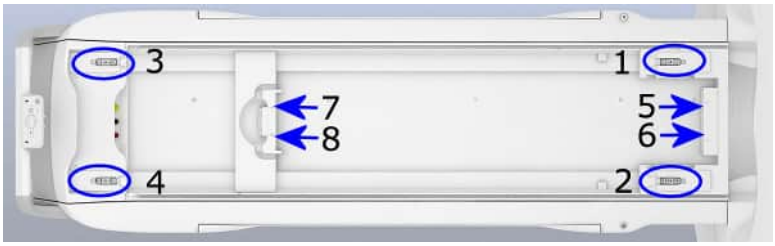
(1) Tabletop
(2) Head end
(3) **Table Stop** button
(4) Emergency release
(5) Handle to pull out the tabletop in case of emergency

The tabletop can be moved horizontally into the magnet bore. When moved completely out of the magnet, the tabletop may be moved vertically as well.

You can use the MR system with the table for interventions, for example, to perform biopsies. But consider that the table is *not* an operating table (according to IEC 60601-2-46) for surgical procedures!

Max. load: This label is located on the patient table.

Coil sockets



The coil sockets are located at the head or foot end of the patient table.

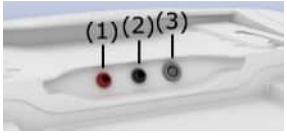
Depending on your system configuration, coil socket 4 may not be available.

Make sure that no liquids such as contrast medium, blood, or cleaning agents get into the table connections.

When cleaning the table use the protective cover for coil sockets 5 and 6.

Connections

The following connections are located at the foot end of the patient table:

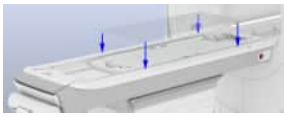


(1) Squeeze bulb
(2) Vacuum cushion
(3) Headphones

Paper roll holder

The paper roll holder is located at the foot end of the table frame. Its design makes it suitable for different paper roll sizes.

Protective film for tabletop



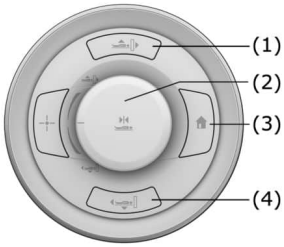
You can use the protective film on the tabletop to protect the tabletop (including spine coil) against soiling.

Holder for infusion bottles

To use the holder for infusion bottles, position the rod on both sides at the head end of the patient table. When the holder is not in use, it can be clamped in the attachments at the side of the table.

3.4.2 Operating the patient table

The patient table can be controlled via the movement buttons and the jogwheel on the control unit. (➔ Page 63 *System control*)



(1) **Table Up/Inward** button
(2) Jogwheel, **Center Position** button
(3) **Home Position** button
(4) **Table Down/Outward** button

To operate the patient table safely and efficiently, operating personnel must be familiar with its most important positions.

Home position	Table is at the height of moving into the magnet bore, tabletop is moved completely out of the magnet
Last scan position	If the tabletop was moved only in the horizontal direction, the tabletop can be returned into the position of the last measurement
Default position	The center of the Head/Neck 20 is in the magnet isocenter
Center position	The body region to be measured is in the magnet isocenter
Relative position	Distance between the slice marked with the light localizer and the magnet isocenter

For interventional examinations, a table lock function is available via the Select&GO display. (➔ Page 63 *System control*)

For some measurements, the tabletop is moved automatically.

Moving the table with the control unit

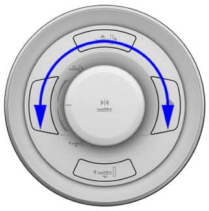
You can only control table movements from one of the control units at any one time. If actions are simultaneously performed at another control unit, all movements will be stopped immediately.

1 Press the corresponding button to move the patient table into the required position.

The **Table Up/Inward** and the **Table Down/Outward** button can be pressed in two stages for horizontal movements. Pressing the button softly moves the table slowly. Pressing the button forcefully moves the table more quickly.

– or –

Keep the jogwheel turned to move the patient table up/into or down/out of the magnet bore.



The horizontal speed is higher, the further the jogwheel is turned. The speed of the vertical table movement remains constant. The table movement stops immediately once you release the jogwheel.

2 Press the jogwheel for one second to move the patient table (at maximum speed) into the *center position*.

Depending on the situation, you can also move the table horizontally into the *last scan position* or the *default position* by pressing this jogwheel.

As soon as you press a motion button or use the jogwheel during an automatic table movement (for example, to the home position), the table stops immediately.

Stopping table movement

1 Press the **Table Stop** button to stop the table movement.

2 To reset the table stop, pull out the **Table Stop** button until it releases mechanically. Then simultaneously press the **Table Up/Inward** and the **Table Down/Outward** button fully.

Rescuing the patient in an emergency

In case of accidents, for example, patient emergency situation (for example, heart attack), the tabletop and patient must be moved out of the magnet bore.

The fastest method for moving the tabletop out of the magnet bore is to press the **Home Position** button. Select this method whenever the power supply and/or motorized drive are intact.

1 On the control panel with jogwheel, press the **Home Position** button.

The tabletop moves completely out of the magnet.

2 Rescue the patient.

Rescuing the patient manually

In case of power failure and/or defective motorized drive, pull the tabletop manually out of the magnet bore.

WARNING

Patient rescue during emergency situations, e.g. quench with failing quench pipe, fire with strong smoke development, emergency situation involving patient (for example, heart attack) and simultaneous power failure!

Personal injury

- After releasing the emergency release, manually pull the tabletop with the patient out of the magnet.

1 Activate the emergency release (location is indicated by a label):

From the right side of the table: pull the lever.

From the left side of the table: push the lever.

The MR measurement is terminated.

2 Grip the recess handle and pull the tabletop out of the magnet into the home position.

3 Rescue the patient.

Resetting the emergency release

1 Ensure that the power supply fault and/or motorized drive fault has been eliminated.

2 Pull the tabletop into the home position until you hear a click sound.

3 To reset the table, simultaneously press the **Table Up/Inward** button and the **Table Down/Outward** button fully.

After reaching the home position, the patient table is ready for operation again.

3.5 Dockable patient table

3.5.1 Description

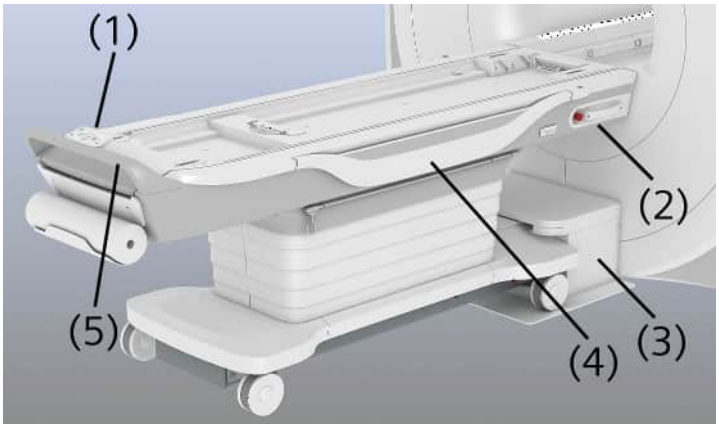
The dockable patient table is an optional table that can be completely removed from the magnet system. This enables the transport of immobile patients.

The dockable patient table is available in two different versions:

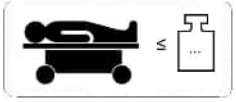
- The standard dockable patient table is equipped with a guiding wheel (5th wheel in the middle underneath the table). This wheel stabilizes the table when it is moved back and forth and allows for easy rotation around the center.
- As an option, the 5th wheel is available with motorized support and is called eDrive. Depending on your system configuration, the eDrive option may not be available.

Both versions of the dockable patient table are equipped with a battery to allow for motorized movements.

The configuration of the dockable patient table is similar to the standard table. This section only mentions the differences. For the standard patient table, please refer to: (➔ Page 68 *Patient table*)



(1) Table user interface
(2) Handle at the head end and **Table Stop** button (on both sides of the table)
(3) Docking station
(4) Side rails
(5) Handle at the foot end



Max. total weight (patient + patient table): This label is located on the dockable patient table.

Table user interface

The table user interface is used to operate the dockable patient table if the table is not docked to the MR system. It also shows the battery charge level of the table.

(➔ Page 77 *Operating the dockable patient table*)

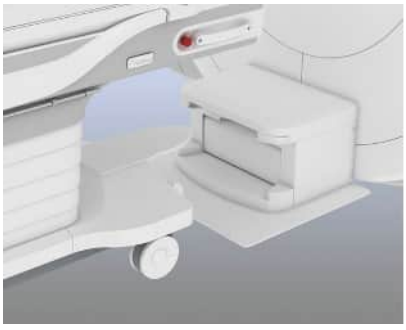
Battery charge level

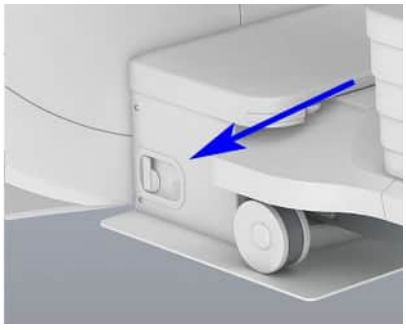
The dockable patient table is supplied with power via a rechargeable battery. As soon as the table is docked to the system, the battery is recharged by the system.

The battery charge level of the dockable patient table is indicated on the table user interface. The time for which the battery will remain charged depends on how you operate the table. Before an LED goes out it flashes at regular intervals for a while.

- When all 5 LEDs are lit, the battery is fully charged.
- When 4 of 5 LEDs are lit, the battery is 4/5 fully charged.
- When 3 of 5 LEDs are lit, the battery is 3/5 fully charged, and so on.

Docking station



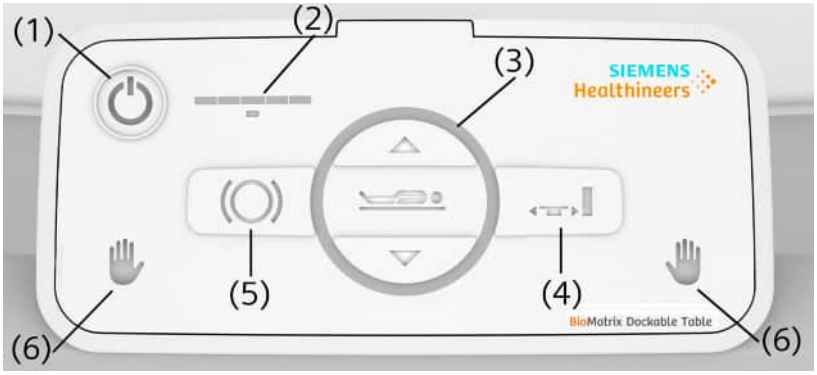


The docking station is located at the lower front of the magnet. Docking and undocking is performed electronically by pressing a button on the table user interface. If the battery is completely discharged or if a table error has occurred, you can use the button on the left side of the docking station to dock the table.

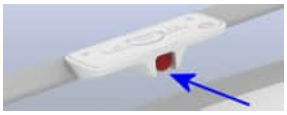
3.5.2 Operating the dockable patient table

If the table is docked to the system, you use the same controls as for the standard table to operate the table. (→ Page 71 *Operating the patient table*)

If the table is undocked from the system, you use the table user interface at the foot end to control the table movements.



(1) **Table On/Off** button
(2) Battery charge level LEDs
(3) **Table up/down** button
(4) **Docking/Undocking** button
(5) **Brake** button, used to apply or release the parking brake
(6) **Hand** symbols, to check the eDrive (option)



To avoid injuries, an additional **Table Stop** button is provided at the table user interface. You can use this button to stop horizontal and vertical table movements and the electronic docking procedure.

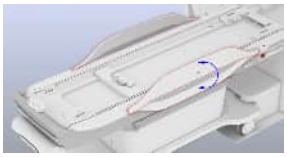
Basic operations and safety advice

The table user interface is ready for operation as soon as the controls are backlit. If a button is not backlit, the corresponding function is not available.

1 Use the **Table On/Off** button to switch the table on and off when the table is undocked from the system. Switch the table on before you move the table.

When the battery charge level LED is lit, the table is ready for use.

If the table is parked and no longer in use, switch the table off. If the table has not been moved for 30 minutes, it is switched off automatically.



2 If the side rails are not in use, fold them down and secure them at the frame of the table.

To secure the patient if the table is undocked, raise the side rails into the vertical position: pull the side rails out of the fixed position at the frame and turn them up into the vertical position. When they are in the vertical position, let the side rails drop to engage.

CAUTION

Improper use of the side rails!

Injury to the patient; damage to the equipment

- Raise the side rails to secure the patient. Ensure that nothing gets caught or clamped.
- Ensure that the side rails are fully engaged.

You can also use the side rails to steer the table.

3 Move the table using the handle at the foot end of the table.

Rotate the table around the center.

CAUTION

Dockable patient table may move against the wall or the door!

Possible injuries (for example, squashed fingers)

- To move the table, always grip the middle area of the handle (not the outside edges).

If your table is equipped with the eDrive option, you can control the 5th wheel and its motorized support by gripping the handle.

4 If you grip the handle with at least one hand, the 5th wheel will be activated (lowered). Use this wheel to move the table back and forth or to rotate the table around the center.

Grip the handle with both hands to activate the motorized support (eDrive). Now you can assist movement back and forth by pushing or pulling the handle. The more you push or pull, the more support you will get.

The motorized drive only provides assisted movement. The table cannot move by itself.

Always move the table with cautious speed. There is no brake to reduce the speed of the table. Ensure that you can slow down or stop the table early enough.

Let go of the handle to deactivate the 5th wheel.

5 If the table is undocked and does not move, you can apply the parking brake (**Brake** button is lit).

Always apply the parking brake if you do not intend to move the table. Use the **Brake** button to apply or release the parking brake.

If you apply the brake, the **Brake** button flashes at regular intervals. If the brake if fully applied, the **Brake** button lights up red.

CAUTION

Brake not properly applied. Unintended table movement!

Injury to the patient

- Park the table only on flat, level surfaces, not on ramps or uneven floors.
- Switch on the table and apply the brakes before you position a patient on the table.

6 Press the **Table up/down** button to raise or lower the table if the table is undocked.

7 If the table is undocked from the system, pay attention to the battery charge level LEDs. If only one LED is lit red (the leftmost), the battery is almost empty. In that case, dock the table to the system to charge the battery.

If the dockable patient table is not in use, make sure not to move it to the back of the magnet.

Docking and undocking the table

CAUTION

Risk of injury when docking and undocking of the table!

Injury to the patient; damage to the system

- Ensure that the patient's hair, parts of the body, or items of clothing do not get caught between the table and the system.

1 To undock the table from the system, press the **Docking/ Undocking** button.

Automatic undocking starts. The table is released from the docking station. The Select&GO display shows a message as soon as the table is undocked.

2 To dock the table to the system, move the table with the docking nose into the docking station. Align the table with the magnet bore so that it can reach the end stop position of the docking station.

The Select&GO display indicates whether the table is positioned correctly and completely in the docking station.

3 Press the **Docking/Undocking** button to start electronic docking.

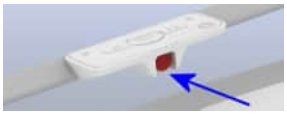
The table is connected to the docking station. The Select&GO display outputs a message as soon as the table is completely docked.

4 To lower the side rails, raise the side rails and turn them downward.

Table cannot be docked to the system?

- Position the table again so that the docking nose is positioned correctly and completely in the docking station. Press the **Docking/Undocking** button again.

In case of emergency



- In case of error or emergency, press the **Table Stop** button to stop the table moving.

  The functionality of all table stop buttons on the dockable table are available regardless of whether the table is docked or undocked.

  To reset the **Table Stop** button on the table user interface, pull the button out again.

Undocking in case of emergency

If undocking with the **Docking/Undocking** button on the table user interface does not work (for example, if a docking error has occurred), the table can be docked or undocked using the controls at the left side of the docking station.

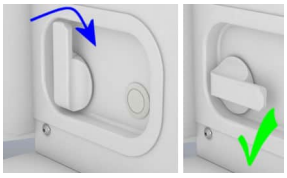
WARNING

Wrong tabletop position for emergency undocking!

Uncontrolled table movement, tabletop crashes

- Use the emergency undocking handle only when the tabletop is in the outermost position (home position).

✓ Tabletop is in the home position.



1 At the left side of the docking station, turn the lever clockwise (into horizontal position).

  The table is released from the docking station.

2 If the table is undocked, turn the lever back into the vertical position.

3 Remove the table completely from the docking station and press the button on the docking station to reset the docking mechanism.

Docking the completely-discharged table

You can also dock the table to the system if the table battery is completely discharged. In this case, you use the button at the docking station to dock the table.

1 Ensure that the lever on the left side of the docking station is in the vertical position.

2 Position the table with the docking nose in the docking station (as for automatic docking). Press and hold the button on the side of the docking station until the docking process is complete.

   The table is connected to the docking station.

Releasing the parking brake manually

If the battery completely discharges while the table is parked, you can release the parking brake manually. As this may impact proper functioning of the parking brake, you must always reset the brake after you have released it manually.

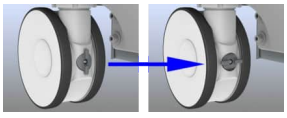
CAUTION

Releasing the parking brakes manually results in improper functioning of the brakes!

Unintended table movement, injury to the patient

- After releasing the parking brake manually, always reset the brake to ensure proper functioning of the brakes.
- Follow the instructions to reset the parking brake.

There is a small locking knob on each wheel of the table.



1 Turn the small locking knob counterclockwise into the horizontal position to release the parking brake. Turn the knob on all four wheels of the table.

   The parking brake is released. You can now move the table to the MR system.

2 Move the table toward the MR system and engage the docking nose into the docking station. Use the button on the docking station and dock the table manually to the system. See: (→ Page 83 *Docking the completely-discharged table*)

3 Wait until the battery of the table has recharged (approx. 30 minutes).

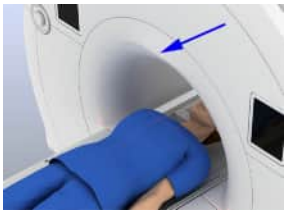
4 Undock the table by pressing the **Docking/Undocking** button on the table user interface.

5 Press and hold the **Table up/down** button on the table user interface for 5 seconds.

The process of resetting the parking brake starts. The **Brake** button flashes. When the resetting process has been successfully completed, the **Brake** button stops flashing and is lit red.

6 Use the **Brake** button to release the brake.

3.6 Laser-light localizer



The laser-light localizer facilitates correct patient positioning. The laser-light localizer is located on top at the entrance to the magnet bore (blue arrow in the picture).

Laser radiation
Class 1M laser product
Do not view directly with optical instruments.

The laser of the laser-light localizer is classified as Class 1M according to IEC 60825-1:2007 and IEC 60825-1:2014 (for China: GB 7247-1:2012). Therefore, warning labels are not required. FDA standards regarding classification and labeling are assured by applying Laser Notice No. 56, dated May 8, 2019.

Technical data

Laser class	1M
Laser wavelength	640 nm
Maximum output of laser radiation (accessible emission level, AEL)	1.41 mW

3.6.1 Using the laser-light localizer

✓ The patient is positioned on the tabletop.

✓ The patient table is in the home position.

CAUTION

Glasses and other optical instruments may focus the laser beam of the laser-light localizer!

Eye injury caused by laser beam

- Instruct the patient not to look directly into the laser beam. Do not use optical instruments that may focus the laser beam (for example, glasses or microscopes).

1 Press the **Laser-Light Localizer** button on the control unit.

The laser-light localizer is switched on. A crosshair is visible.

2 Move the tabletop so that the crosshairs point precisely to the region of interest.

The slice for measurement is marked. The display shows the relative tabletop position of the marked slice.

3 If the laser is correctly positioned, press the **Center Position** button for one second to move the table into the magnet isocenter.

The tabletop moves to the selected position and the laser shuts off automatically.

When the table is not moving, the laser-light localizer shuts off automatically after 60 seconds.

3.7 Alarm box

3.7.1 Description

The alarm box has the following functions:

- Displays alarm signals
- Switches the MR system on and off
- Magnet Stop / Magnet Quench

The alarm box is installed near the *syngo* Acquisition Workplace.

3.7.2 Checks

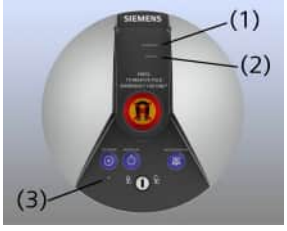
WARNING

MR system malfunction! Required quench cannot be executed!

Hazardous conditions for patients

- Note the sounding alarm and signal.
- Rescue the patient. Do not perform any further MR examinations.
- Prevent further access to the examination room.
- Notify Siemens Service.

Checking the LEDs



(1) **WARNING** LED
(2) **POWER** LED
(3) **SYSTEM ON** LED

LED	LEDs light up to indicate
WARNING	Error message, e.g. helium fill level is too low
POWER	Voltage supply of MR system is satisfactory
SYSTEM ON	The MR system is switched on

1 Check the **WARNING** LED for alarm messages.

   An alarm is present when a yellow LED lights up and/or an alarm sounds.

2 In case of an alarm: Check the host computer for error messages. Press the **Audio Alarm Off** button to silence the alarm, and notify Siemens Service.

3 Verify that the **POWER** LED is green.

4 If the **POWER** LED is not on: Check the power supply of the MR system.

The **POWER** LED is off, even though the power supply is functioning properly?

- Notify Siemens Service.

After a power failure, the battery powers the circuit of the magnet emergency shutdown for another 14 days. During this time, the magnet can still be quenched i.e. the magnetic field can be shut down by pressing the **Magnet Stop** switch in case of emergency.

Remote monitoring

After installing remote monitoring, various error messages can be output centrally (e.g. to the front door or gate):

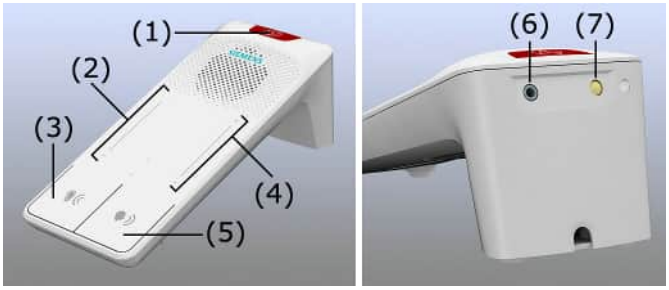
- Please contact Siemens Service regarding questions about remote monitoring.

3.8 Intercom

3.8.1 Description

The intercom allows personnel and patients to communicate during the examination. In addition, some important operations like stopping the patient table can be managed from the intercom. Optionally, music or automatic voice outputs can be played in the examination room via the loudspeaker or the headphones.

The operating unit of the intercom is located at the *syngo* Acquisition Workplace.



(1) **Table Stop** button
(2) Touch slider to set the volume for listening
(3) **Listen** button
(4) Touch slider to set the volume for speaking
(5) **Speak** button
(6) Audio connection (music in)
(7) **Reset Table Stop** button

LEDs (indicating table stop)

The following LEDs are provided on the intercom:

- Two LEDs on the front side of the intercom, below the **Table Stop** button

  These LEDs always flash simultaneously as long as table stop is activated and no matter where the table stop was activated. They go out as soon as the table stop is reset.

- One LED on the rear of the intercom, on the right of the **Reset Table Stop** button

  This LED only flashes if the table stop was activated using the **Table Stop** button on the intercom. The LED alternates with the other LEDs and goes out as soon as the **Reset Table Stop** button on the intercom is pressed.

Patient alert

Patients may use the squeeze bulb to alert the operating personnel (patient alert). You will recognize the patient alert as follows:

- Acoustically:
  - In the examination room: audio signal through the patient's headphones (only as long as the patient squeezes the bulb) and through the system's loudspeakers (only as long as the patient squeezes the bulb + 5 sec.)
  - In the control room: continuous tone over the intercom (until the alert is reset)
- Visually:
  - **Speak** button and **Listen** button on the intercom light up red
  - Message on the Select&GO display in the examination room

You can reset the patient alert by pressing the **Speak** button or the **Listen** button on the intercom. Alternatively, you can reset the patient alert on the Select&GO display in the examination room.

Patients, for example, sedated patients, who may not be able to alert the personnel must be monitored by a person present in the examination room.

3.8.2 Operating the intercom

Intercom operation is partially software based. The **Scan Application** tab on the **Configuration Panel** allows several settings, for example, volume settings. For detailed information regarding the operation of the software, please refer to the other software-related operator manuals.

As the intercom is the "terminal device", always ensure that the necessary function is activated in the software. For example, adjusting the volume at the intercom does not work if the loudspeakers are switched off in the software.

Button	Function
Listen	Allows you to listen to the patient in the examination room; resets the patient alert

Button	Function
Speak	Allows you to speak to the patient (as long as the button is pressed); resets the patient alert
Table Stop	Stops table movement and measurement immediately
Reset Table Stop (on the rear of the intercom)	Resets the table stop, if it was activated at the intercom. Additionally, you need to reset the table stop at the control unit by simultaneously pressing the **Table Up/ Inward** and the **Table Down/Outward** button.
+ / -	Touch sliders to control the volume for listening or speaking to the patient.

1 Press one of these buttons to perform an action.

2 If necessary, adjust the volume using the touch sliders.

Transmitting automatic voice output

Automatic voice output can be used for transmission of commands, for example, breath hold commands.

- Use the **Scan Application** tab on the **Configuration Panel** in the software to initiate automatic voice output.

Transmitting music

To play music in the examination room, an audio device can be connected to the intercom.

1 Connect a suitable cable to the audio device and to the connection at the back of the intercom.

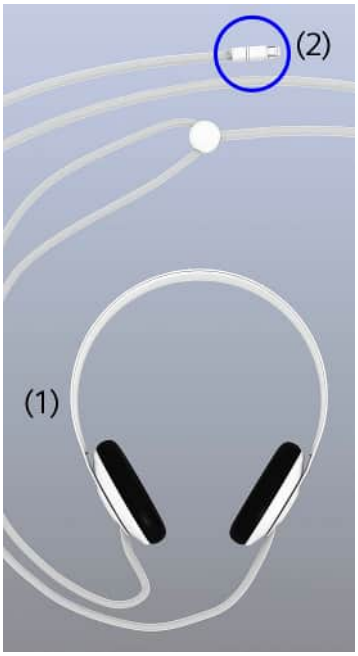
2 Adjust the final volume to the desired level using the Select&GO display on the magnet cover or the **Scan Application** tab on the **Configuration Panel** in the software.

3 Start the music at the audio device.

3.9 Other components and accessories

3.9.1 Standard Siemens headphones

The standard Siemens headphones reduce noise and can be used to communicate with the patient.

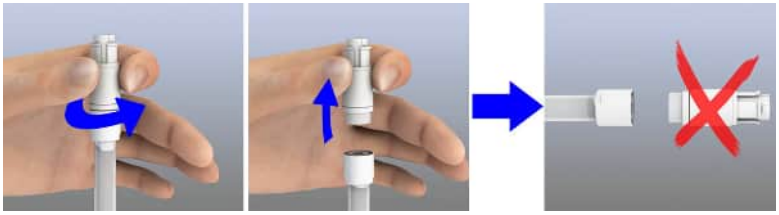


(1) Standard Siemens headphones
(2) Adapter

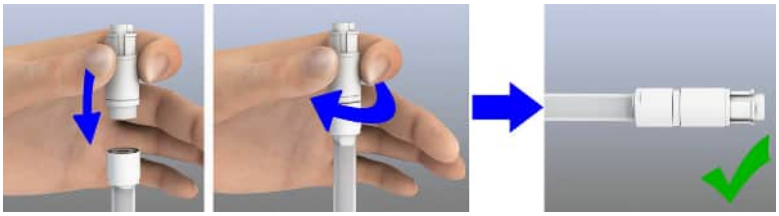
Replacing the adapter

You can replace the adapter if it is defective.

1 Remove the old adapter.



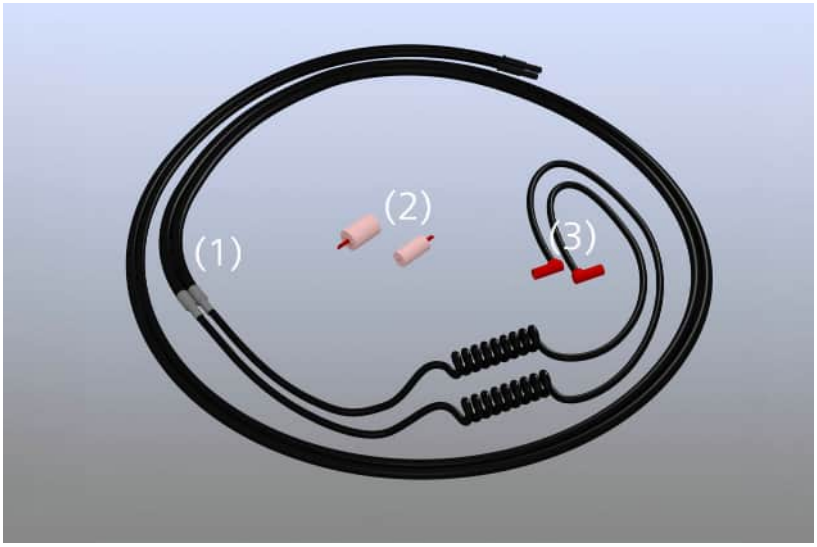
2 Attach the new adapter.



3.9.2 MagnaCoil™ Headset System

Overview

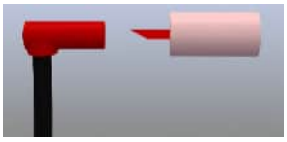
Your system can be equipped with the optional/additional MagnaCoil Headset System. The MagnaCoil Headset System is an MR Conditional headphone. You can use it as an alternative headphone (for example, in head coils). The headset reduces the noise and can be used for communicating with the patient.



(1) MagnaCoil Headset System incl. table plug and MagnaCoil Coupler for MagnaPlugs
(2) MagnaPlugs (two sizes available: standard and mini)
(3) MagnaCoil Coupler for MagnaPlugs

The MagnaPlugs are for single-use only. Dispose of the MagnaPlugs after use.

Applying the headset



1 Connect the headphone to the corresponding connector at the foot end of the patient table.
2 Attach the plug to the coupler and check that the plug is firmly inserted. Holding the coupler, roll the plug into a tight cylinder between your fingers.
3 Apply the plugs to the patient's ears.

Assist patients that may need help, for example, children.

CAUTION

Wrong operation and insufficient hearing protection!

Injury to the patient

- Apply the MagnaPlugs carefully.
- Check your system owner manual for the hearing protection data and decide whether the noise reduction of about 36.7 dB Single Number Rating is sufficient.

4 Route the cable over and behind the patient's ear.

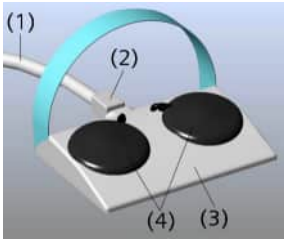
5 Use wedge cushions to position the patient's head in the head coil. Ensure that the red MagnaCoil Coupler does not touch the coil wall as this may increase the noise level.

Now you can communicate with the patient as usual via the intercom.

When using a short echo time (TE < 2 ms), parts of the PVC tubes of the MagnaCoil Headset System may be visible in the MR image! In this case ambiguity artifacts in the MR image may occur due to aliasing and folding back. The position of the artifact in the MR image may deviate from its actual location!

3.9.3 Footswitch

The footswitch is used to start and stop the MR measurement in the examination room.



(1) Hose
(2) Hose connector
(3) Pushbutton unit
(4) Footswitch Start/Stop

MR measurements with the footswitch are only possible for protocols that were configured for manual start-up. This is the case e.g. for protocols with MR measurements after administering contrast medium.

If the protocol is configured for repeated measurements, the next measurement can be started with the footswitch after completing the preceding measurement.

Labels for start and stop should be attached to the relevant footswitches to identify their function.

Starting/stopping a measurement with the footswitch

1 Push the hose plug into the retaining rings of the pushbutton unit.

2 Load a suitable protocol and start it at the *syngo* Acq WP.

The MR system is waiting for the manual start of the protocol.

3 Press the **Start** footswitch to begin the measurement.

As an alternative, you can start and end the measurement on the *syngo* Acq WP.

4 Press the **Stop** footswitch to end the measurement.

3.9.4 Gradient supervision

To prevent damage to the MR system by a malfunction of the gradient system, a specially designed supervision is installed at your system.

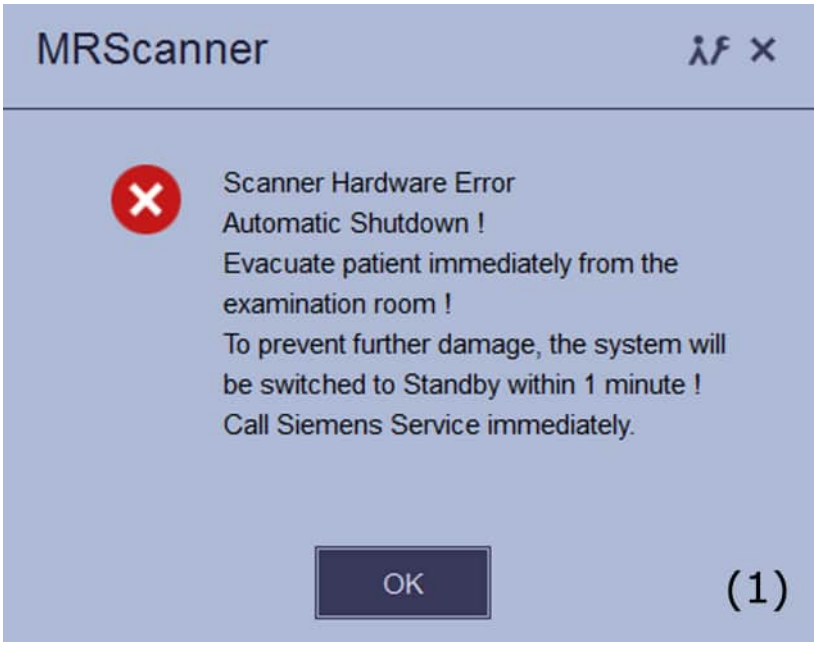
This supervision monitors that cables, connections, or other components of the gradient system do not show excessive heating. In case of a malfunction, the measurement is stopped and an alarm message is issued.

After 1 minute the system will be automatically switched to Standby.

Acting in case of an alarm

✓ Gradient malfunction is detected.

✓ An alarm message appears at the *syngo* Acquisition Workplace.



Dialog box at the *syngo* Acquisition Workplace

(1) Scanner hardware error
Automatic shutdown! Evacuate patient immediately from the examination room! To prevent further damage, the system will be switched to Standby within 1 minute! Call Siemens Service immediately.

1 Immediately move the patient out of the magnet bore by pressing the **Home Position** button.

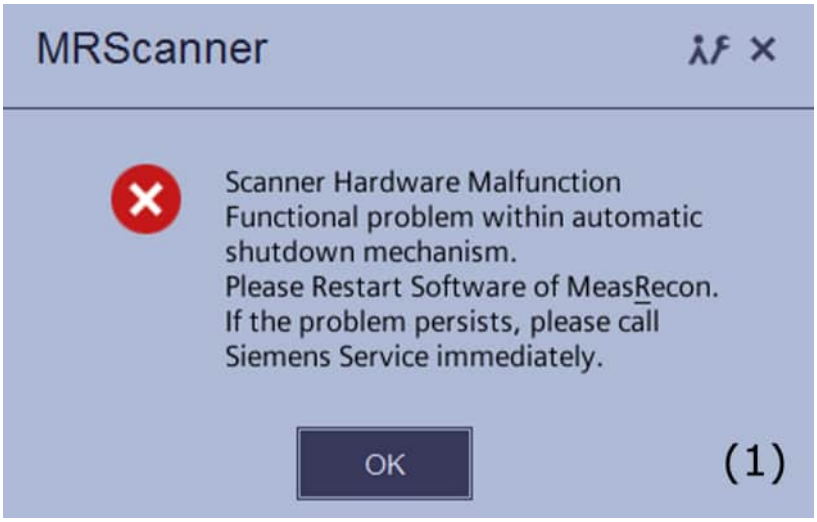
Within the next 60 seconds, the system will be switched to Standby automatically. Then, the patient table motors can not be operated any longer.

2 Call Siemens Service.

Acting in case of a supervision malfunction

✓ A malfunction within the supervision system is detected.

✓ A corresponding error message appears at the *syngo* Acquisition Workplace.



Dialog box at the *syngo* Acquisition Workplace

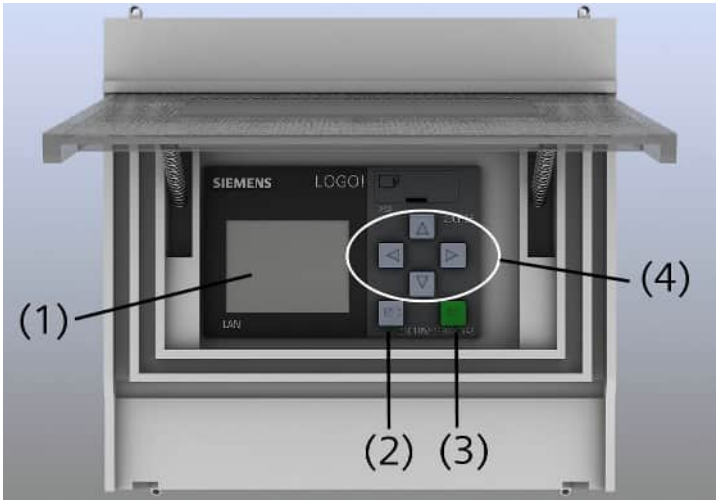
(1) Scanner hardware malfunction
Functional problem within automatic shutdown mechanism. Please restart software of MeasRecon. If the problem persists, please call Siemens Service immediately.

◆ Call Siemens Service.

The supervision sensitivity is potentially affected, but the operation of your MR scanner is still possible.

3.9.5 Time switch

You can use the time switch to start up the MR system automatically at a predefined time. Typically, the time switch is installed in a box near the alarm box.

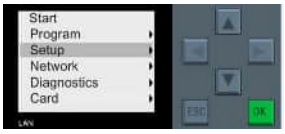


(1) Display
(2) **ESC** key
(3) **OK** key
(4) Keys for menu navigation

The keys of the time switch are very sensitive. Press a key only gently to avoid that you accidentally press it several times.

Setting the current time

Before you set the time switch, ensure that the current time is set correctly.



1 Press the **Up**/**Down** keys to navigate in the menu:
   - Choose the **Setup** menu. Confirm with **OK**.
   - Choose the **Clock** menu. Confirm with **OK**.
   - Choose the **Set Clock** menu. Confirm with **OK**.
2 Press the **Right**/**Left** keys to move the cursor to the desired position.
3 To set the date and time, press the **Up**/**Down** keys. Confirm with **OK**.

4 To return to the menu, press **ESC**. Press **ESC** three times to go back to the main menu.

Setting the startup time

The time switch can be programmed one year in advance. A programmed weekly schedule is repeated unless it is modified or suspended.

✓ The current time is set correctly.

1 Choose **Start** and confirm with **OK**.

An additional question about starting the program is displayed.

2 Select **Yes** and confirm with **OK**.

Three items (consisting of a Day and a Time entry) are displayed.

- **Day**: Shows 7 digits, one for each day of a week. If a day is selected, the first letter of the weekday is displayed (for example, M for Monday).
- **Time**: Shows the startup time

Example for a **Day** selection: M - W - - S S. This means, the system starts automatically (at the programmed startup time) on Mondays, Wednesdays, Saturdays, and Sundays. On the remaining days, the system will not start automatically.

3 Press **ESC** for three seconds to enable editing.

The first line is inverted.

4 To change the settings, select a line with the **Up**/**Down** keys and confirm with **OK**.

5 Use the **Right**/**Left** keys to select the required position within a line. Change the setting with the **Up**/**Down** keys.

Repeat this for every weekday you wish to change.

6 Confirm this weekday setting with **OK**.

7 Change the **Time** settings as you did for the **Day** settings.

The selected startup time applies for the corresponding Day entry with the selected weekdays.

If necessary, you can set other startup times for different weekdays.

8 Leave the menu with **ESC**.

The time switch starts the MR system at the programmed date and time.

Stopping the time switch

If your institution is closing, for example, due to holidays, manually stop the time switch program to avoid unintended system starts.

1 Choose **Start** and confirm with **OK**.

An additional question about starting the program is displayed.

2 Select **Yes** and confirm with **OK**.

3 To stop the displayed schedule program, press the **Down** key.

4 Press **ESC** to go to the main menu.

5 Choose **Stop** and confirm with **Yes**.

You can restart the timer by choosing **Start** from the main menu.

3.9.6 UPS (uninterruptible power supply)

Your system may be equipped with an optional UPS (uninterruptible power supply).

The UPS can stabilize the power supply to your *syngo* Acquisition Workplace if the main power supply is unstable. If the main power fails, the UPS powers your *syngo* Acquisition Workplace and system control for about five minutes. This time can be extended by using the additional battery module.

The UPS is usually installed in the equipment room. Once it is installed, you do not need to operate the UPS during normal operation. If you have released the **Emergency Shut-down** switch due to an emergency, you must switch on the UPS output power once manually to ensure proper power supply to the system and the magnet cooling. The UPS output power is indicated on the display of the UPS as **O/P**.

✓ The **Emergency Shut-down** switch has been released.

- Switch on the UPS output power (**O/P**) manually:
  - Use the up/down keys to navigate in the UPS display menu and select the **O/P** output power entry.
  - Press the Enter key to confirm your selection.
  - Choose **3_CONTROL** and confirm with Enter.
  - Choose **1_TURN ON & OFF** and confirm with Enter.
  - Choose **TURN ON UPS** and confirm with Enter.
  - **Do you want to turn on UPS** is displayed. Select **Yes** and confirm with Enter.

3.9.7 Injector

To synchronize contrast agent administration and measurement, you can couple an injector to the MR scanner.

Only use injectors that are released for your MR system.

If an injector is plugged into the MR scanner, a connection to the MR system can only be established if a valid license is available.

✓ The injector is switched off.

1 Plug the cable of the injector into the MR scanner.

2 Switch on the injector.

See the injector operator manual for details regarding the control and the safety precautions to be observed when handling the injector device.

The injector is automatically recognized by the MR scanner.

For details about the operation in the software, please refer to the **Operator Manual - MR Examination and Review**.

3.9.8 Patient video monitoring system

A video system can be installed for visual patient monitoring. The patient video monitoring system consists of a camera and a video display. Optionally, up to four cameras can be connected (not available for all MAGNETOM systems). If two or more cameras are used, an additional camera supervision controller is necessary.

Depending on the MR system, the video camera may be attached at the back of the magnet or, preferably, on the wall facing the MR system.

This chapter describes the latest version of the patient video monitoring system. The description of the previous models can be found in a separate addendum available in the Document Library.

General display settings

Buttons for adjusting the video display settings and a LED to indicate the operating mode are located at the back of the display. With the keys on the optional camera supervision controller, the corresponding camera view (1-4) or the camera views of all four cameras can be displayed.

Button	Function
⏻	Switches the video display on or to standby
M	Opens the main menu of the OSD (On-Screen Display) Closes the submenu or the OSD main menu
S	Navigates between the menu items in the OSD main menu or in the submenus Selects a setting/function
↑	Opens a submenu Activates a setting/function for adjustments Increases the menu item values
↓	Decreases the menu item values

In the OSD main menu, different parameters can be changed in each of the submenus. The menu looks different depending on the video display version.

OSD main menu of video display 6.1

Essential settings are entered in the PICTURE (**PIC**) and in the FUNCTION (**FUN**) menu.

The following image parameters are set in the **PIC** menu:

- Contrast
- Brightness
- Color
- Tint
- Sharpness
- Color Tone
- Scan Mode
- Noise Reduction

The following image parameters are set in the **FUN** menu:

- Language
- OSD Time
- Button Lock
- Reset

OSD main menu of video display 6.2

Essential settings are entered in the **PICTURE** menu, the **FUNCTION** menu and in the **OPTION** menu.

The following image parameters are set in the **PICTURE** menu:

- Picture Mode
- Contrast
- Brightness
- Color
- Sharpness
- Tint
- Color Temperature
- Backlight

The following function parameters are set in the **FUNCTION** menu:

- Power Save
- Zoom Mode
- Aspect
- Image Flip
- Image Mirror

The following additional option parameters are set in the **OPTION** menu:

- Menu Language
- Transparency
- OSD Time Out
- OSD Info
- Restore Default

Changing the menu settings

1 Press the **M** button.

2 Press the **S** button to select the corresponding menu.

3 Press the ↑ button to open the menu.

4 Press the **S** button to select the requested parameter.

5 Use the buttons ↑/↓ to change the value.

6 Press the **M** button to close the menu.

7 To close the OSD main menu, press also the **M** button.

4 Physiological imaging

4.1 General information about physiological imaging

You can use the physiological signals of a patient (ECG, respiration, and pulse) to control MR measurement sequences. The physiological signals are acquired with sensors. You can view the measured data on the Select&GO display in the examination room and at the *syngo* Acquisition Workplace in the **Physio Display**.

The following components enable physiological imaging:

- Spine coil that is equipped with respiratory sensors (for example, BM Spine 24)
- Body coil that is equipped with the Beat Sensor (for example, BM Body 12)
- PERU (physiological ECG and respiratory unit): ECG and respiratory sensor
- PPU (peripheral pulse unit): pulse sensor

For details about the coils with sensors, refer to the individual coil chapters.

All components of the MR system mentioned here must only be used to control MR measurement sequences. They are not approved as a patient monitoring system!

4.1.1 Physio display

The physiological signals are shown on the Select&GO display in the examination room and at the *syngo* Acquisition Workplace. As soon as the system receives a physiological signal, its curve is displayed.

Physio display (on the Select&GO display)

Additionally, the battery charge level and electrode/application faults are displayed.

WARNING

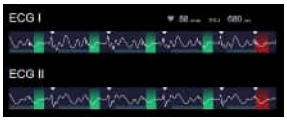
Physiological displays are not approved to monitor vital parameters!

Anomalies of the vital parameters may not be recognized or recognized too late

- Never use the physiological displays (either at the system or at the computer) to monitor the vital parameters of a patient.
- Only use suitable patient monitoring systems for monitoring vital parameters (MR Safe or MR Conditional).

For details about the operation of the Select&GO display, see:
(➔ Page 63 *System control*)

Physio Display (at the Acquisition Workplace)



On the **Physio Display** at the *syngo* Acquisition Workplace you can view the patient's physiological signals. For details about software operation, please refer to the other software-related operator manuals.

4.1.2 Triggering methods

MR imaging procedures are sensitive to patient movement. Images may exhibit artifacts in the form of smears when motion times - for instance, during respiration or heartbeat - are short compared to measurement times. In particular, this problem occurs as a result of the patient's heartbeat during cardiac examinations or as a result of the patient's breathing during abdominal examinations.

Two different procedures are used to avoid motion artifacts in images: prospective triggering and retrospective gating. Both procedures are based on the correlation between measurement and physiological signal (ECG signal, respiratory signal, pulse signal).

Prospective triggering

During prospective triggering (or antegrade triggering), a measurement is triggered by using a so-called trigger signal derived from the patient's physiological signal. This signal is usually defined based on the time period during which organ movement is as low as possible. The trigger delay is, for example, set to the end of the systole for certain cardiac examinations so that the measurement is running during the akinetic diastole. For respiratory triggering during abdominal examinations, it is recommended to start the measurement at the end of the respiratory period.

To determine the start time for the measurement, an acquisition window is defined based on the signal form (e.g. R-wave in ECG, minimum of respiratory curve). For example, the size of the acquisition window is approx. 80 % of the RR interval for ECG measurements. The acquisition window defines the range in which the measurement can be triggered. The trigger time is defined by the trigger delay.

Prospective triggering can be used for ECG, pulse, or respiratory signal curves as well as for external trigger signal curves.

Retrospective gating

Retrospective gating fundamentally differs from prospective triggering. No actual triggering is taking place. The physiological signal and data acquisition times are recorded simultaneously. The measurement is performed completely independently of the patient's heartbeat or pulse. A temporal assignment of images to the corresponding phase (e.g. heart stimulation) is performed after the measurement (retrospectively).

In particular, retrospective gating is used to acquire images of the beating heart. As compared to measurements using prospective triggering, this technique is especially useful for displaying the late diastole. Temporal resolution is freely selectable and may be higher or lower than selected for the measurement.

Retrospective gating can be used for ECG, pulse, or external trigger signal curves.

4.2 Physiological Measurement Unit (PMU)

4.2.1 Description

You can use the Physiological Measurement Unit (PMU) for physiological imaging.

The PMU consists of the following components:

- PERU (physiological ECG and respiratory unit): ECG and respiratory sensor
- PPU (peripheral pulse unit): pulse sensor
- External trigger input

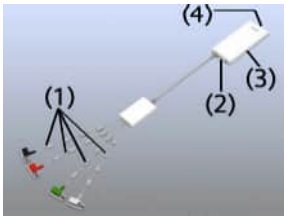
The physiological signals are acquired with receptors - ECG electrodes, respiratory cushion and pulse sensor - directly at the patient via the PERU (ECG, respiration) and PPU (pulse).

Only *one* PERU or PPU can be located in the examination room!

Two ECG and respiratory sensors in the examination room interfere with one another in signal transmission. It is not possible to determine the results.

ECG and respiratory sensor (PERU)

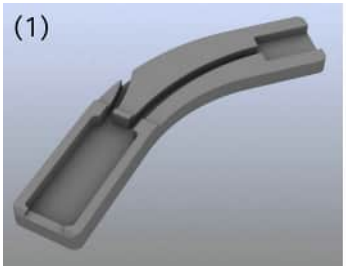
The wireless PERU simultaneously acquires three ECG channels as well as the respiratory channel of the patient.

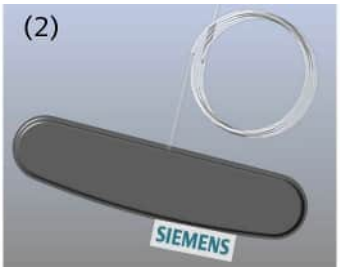


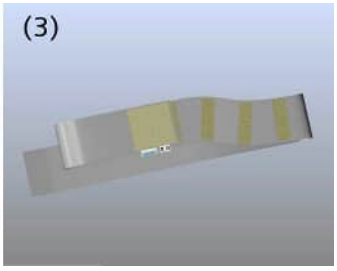
(1) ECG leads with clips
(2) Plug for respiration cushion
(3) Transmitter unit
(4) Control LEDs

The ECG electrodes and respiratory cushion are connected to the PERU.

To prevent skin irritations, the PERU has to be located in the application cushion during the examination.





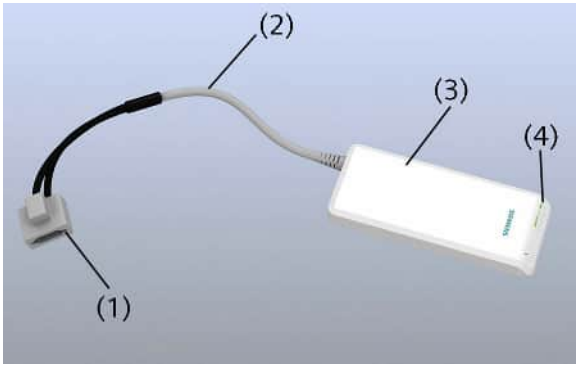


(1) Application cushion
(2) Respiratory cushion with pressure hose
(3) Respiratory belt

The respiratory cushion is attached to the patient using the respiratory belt.

Wireless pulse sensor (PPU)

The PPU acquires the patient's peripheral pulse. It consists of a transmitter unit, a fiber-optic sensor and a removable finger adapter (available in different sizes).



(1) Finger adapter
(2) Fiber optic cable
(3) Transmitter unit
(4) Control LEDs

External trigger input

Example of an external trigger input (actual design may be different on your system)

External trigger sources (e.g. patient monitoring system) may be connected with the help of the trigger input to drive MR sequences.

The connection for the trigger input is located on the cover of the MR system. Trigger input is galvanically isolated with respect to the MR system.

Charging station

Both the PERU and the PPU are supplied with power via rechargeable batteries. All other components of the PMU are supplied by system-internal voltage sources. The charging station is installed separately near the *syngo* Acquisition Workplace and is used for storing both units.

The batteries should not be fully discharged before recharging them. If only one green LED flashes, you should charge the battery for the next patient. The maximum charging time is approx. 3 hours. After being fully charged, the operating hours for the units cover approximately 24 hours.

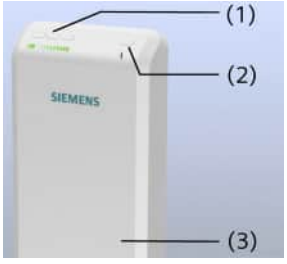
To charge a unit, it has to be placed firmly in the charging station. The PERU and PPU can be charged together or separately in the charging station.

Use only the charger included with delivery. Charging the units with non-Siemens equipment may destroy the PERU and PPU.

If the rechargeable batteries can no longer be properly charged, please contact Siemens Service, as the rechargeable batteries can only be replaced by Siemens.

Control LEDs

The transmitter unit includes three green LEDs for indicating the battery charge level and one red LED as a fault indicator (for example, insufficient skin contact of the ECG electrodes).



(1) 3 Green LEDs (battery charge level)
(2) 1 Red LED (fault)
(3) Transmitter unit

Battery charge level and faults are also indicated on the system display and the **Physiological Display** dialog window.

If the battery is not in the charging station, the green LEDs flash regularly and simultaneously.

3 Green LEDs flash	Fully or nearly fully (2/3) charged battery
2 Green LEDs flash	1/3 to 2/3 fully charged battery
1 Green LED flashes	Nearly discharged battery; remaining operating duration is 1 hour

Red LED flashes (as regular as the green LEDs)	Transmit function deactivated, unit is positioned outside the static magnetic field; no electrode/application fault detected
Red LED is off	Transmit function activated; unit is positioned on the patient table in the static magnetic field; no electrode/application fault detected
Red LED flashes rapidly	PERU: electrode fault - one or more ECG electrodes are not applied correctly or fell off PPU: application fault - pulse sensor is not applied correctly at the finger

A second set of sensors with charging station may be useful in hospitals or radiology facilities because *one* PPU and PERU can be permanently ready for operation, while a *second* PPU and PERU are being charged.

LEDs during charging The red LED goes out when the unit is positioned correctly in the charging station. While charging, the green LEDs flash alternately as moving light. If the battery is nearly discharged, only one LED flashes at the beginning. With increasing charging level, a second green LED flashes and then also the third LED. If the battery is fully charged, the 3 green LEDs are on and stop flashing.

4.2.2 Preparing the measurement

Informing the patient

1 Ask the patient to lie still during the measurement.

2 Inform the patient that the knocking sounds during the measurement are caused by switching the gradients on and off. The PERU may also vibrate slightly.

Knocking sounds may affect the heart rate of patients, either consciously or subconsciously. The resulting irregular cardiac cycles adversely affect image quality.

Attaching the PERU

The PERU is used together with ECG and respiratory triggering.

✓ ECG electrodes are attached.

✓ The patient table is in the home position.

CAUTION

Hot ECG cables!

Patient burns

◆ Place absorbent natural material between the ECG cables/leads of the PERU and the patient's skin.

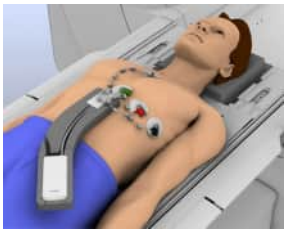
1 Position the patient on the patient table with the head toward the magnet bore.

2 Position the PERU in the application cushion.

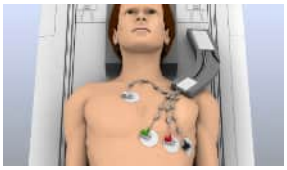
Especially with respect to whole-body examinations, it should be noted that artifacts (homogeneity distortions) may occur in the direct vicinity of the PERU transmitter unit.

3 Use the application cushion and position it together with the PERU on the patient.

Ensure that a minimum distance of 10 cm is maintained between PERU and tunnel covering to avoid damage to the PERU.



4 Align the PERU on the patient in the direction of the patient's feet.



5 Finding the best position for the PERU and electrode positions for flow measurements is a matter of trial and error. As a general rule of thumb, the electrode leads should be routed as close as possible to each other to minimize the effective area spanned by the electrode leads and consequently minimize gradient interference. It might be helpful to position the PERU next to the patient's head (as shown in the picture).

Position and connect the PERU and electrodes as usual. Then use the electrodes as a pivot point and turn the PERU with the application cushion counterclockwise until the cushion is lying next to the patient's head. Now turn the clips counterclockwise, so that the cable outlet of the clips is positioned in the direction of the patient's head.

– or –

As an alternative (for example, if the patient is wearing a shirt), first position the PERU with the application cushion next to the patient's head and then run the cables through the neckline of the patient's shirt to attach the electrodes. Try to avoid cable loops.

Depending on the sequence and slice orientation, it may also be advantageous to position the PERU in the usual way and place the electrodes and cables so that the smallest possible area is spanned.

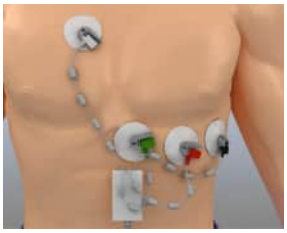
4.3 ECG triggering

4.3.1 Description

ECG triggering is a method for measuring heart sequences including dynamic studies. It is also suitable for studies where pulse flow causes artifacts. Provided that special sequences are in use, ECG triggering can be applied in combination with respiratory-controlled methods.

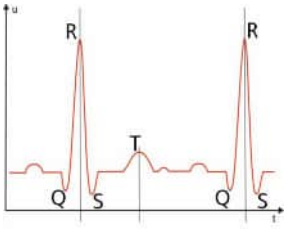
A number of special sequences support retrospective gating.

ECG leads



The ECG leads are selected according to the potential difference between the connected electrodes.

The three leads I, II and III are used and acquired in parallel via the ECG channels. All curves display a prominent R wave when the ECG electrodes and leads are correctly attached.



The characteristic QRS complex of the ECG signal is used as a trigger signal. Simultaneous acquisition and overlaying of the orthogonal leads (vector cardiography) is used to minimize triggering errors due to gradient switching and the magneto-hydrodynamic effect (i.e. excess T-wave amplitude).

Trigger methods

In the **Physio Display** several trigger methods are available:

- **VCG standard**: VCG activated
- **ECG I**: VCG inactive
- **ECG II**: VCG inactive
- **ECG III**: VCG inactive
- **Auto:** Improved trigger algorithm; VCG activated; default trigger method

If **Auto** is used, the signal characteristics can be relearned by selecting **Relearn** in the context menu of the **Physio Display**.

If triggering with **Auto** fails, preferably **VCG standard** should be used.

Disposable electrodes

For ECG triggering, special MR Conditional and disposable electrodes are used (the recommended ones are available through the Accessories catalog).

4.3.2 Performing

Image quality

The quality of the ECG signal for triggered measurements is enhanced by:

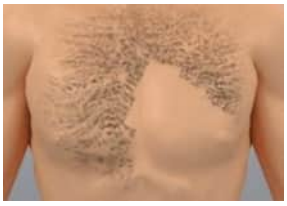
- Proper placement of the electrodes
- Good skin contact of the electrodes
- Reduction of interference signals caused by electromagnetic induction.
  - Due to cable loops
  - Interferences from electrical potentials caused by muscle movement

Attach the electrodes so that interferences from electrical potentials caused by muscle movement and baseline drifts are minimized. Suitable contact points are therefore areas that show very little muscle or fatty tissue.

Preparing the patient

1 Prepare the patient for the examination as early as outside the examination room.

2 On the chest of the patient, select locations with minimal muscle and fat tissue for attaching the electrodes.



3 In case of hairy skin: shave the points where you intend to attach the electrodes.

Shave the patient outside the examination room to prevent accidents.

4 Thoroughly clean the patient's skin at the locations involved. However, do not use solutions containing alcohol.

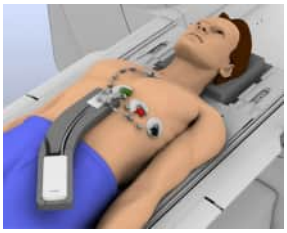
5 Then dry the skin with a paper towel.

6 Use a suitable gel to prepare the skin for better signal transmission.

Applying ECG electrodes

Finding the best position for the electrodes is a matter of trial and error. (➔ Page 116 *ECG leads*)

Patients with an offset heart axis (e.g. dilatative cardiomyopathy) may require a different orientation than parallel to the spine.



1 Check the expiration date of disposable electrodes and order new ones if necessary.

2 Pull the protective foil off the electrodes and attach them.

3 Use the application cushion and position it together with the PERU on the patient. (➔ Page 113 *Preparing the measurement*)

4 Connect the electrode clips of PERU to the ECG electrodes.

Evaluating the signal quality

1 Check to see if the leads show a preferably pronounced R-wave on the system display.

2 If you are using a body coil (for example, Body 12), position it over the heart. Connect the coil and secure it with the belts.

The display shows the following message: **Initial Learningphase active. Don´t move table.**

3 Wait at least 10 heart beats (learning phase for triggering) before you move the patient table into the magnet.

The learning phase outside the bore is very important for obtaining a reliable trigger.

The patient must not move during this learning phase. The patient table is in the home position.

The red LED (fault) at the PERU is flashing rapidly?

No analyzable signal is available.

- Ensure that the ECG electrodes are attached correctly.

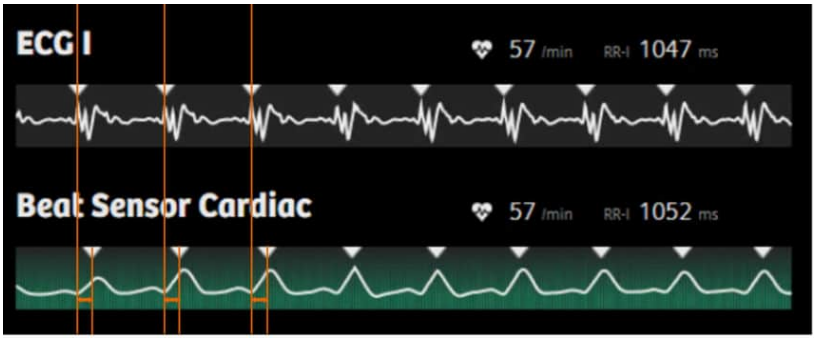
Performing the examination

- Perform the examination.

4.4 Beat Sensor triggering

You can use the Beat Sensor to trigger cardiac measurements. The sensor in the coil is sensitive to movements in the patient's chest. If you position the coil with the sensor placed over the patient's heart, you can use the sensor's signal to trigger measurements.

The Beat Sensor signal is shown on the Select&GO display in the examination room and at the *syngo* Acquisition Workplace.



The signal of the Beat Sensor shows the cardiac contraction. The trigger point corresponds to the beginning of the systole. This point is shown as high in the curve and is used as a reference point for triggering. The trigger point is later than the ECG trigger because the ECG triggers at the start of saltatory conduction.

Some sequences also support retrospective gating.

For details about the operation in the software, please refer to the **Operator Manual - Diagnostic MR Imaging**.

4.4.1 Evaluating the signal quality

1 Ensure that the body coil is positioned with the sensor placed over the patient's heart. Follow the instructions given in the individual coil chapters.

2 As soon as you have connected the coil, the **Relearn Signals** button on the system display in the lower right of the **Physio** display becomes active.

Click this button to start the learning phase.

The display shows a countdown. During the learning phase, the display will be turned off.

Wait at least 20 seconds (learning phase for triggering) before you move the patient table into the magnet.

The patient must not move during this learning phase.

The **Relearn Signals** button on the system display can only be used for Beat Sensor triggering.

3 Check the signal on the Select&GO display.

4 Use the same coil setup for the learning phase and measurement. If you need to change the coil position, repeat the learning phase.

5 Avoid movements in the examination room apart from the patient's breathing and heartbeat.

4.5 Pulse triggering

4.5.1 Description

Pulse triggering uses the patient's pulse to trigger the measurement. A pulse sensor is connected to the patient's toe or finger. The first pulse wave (“premature pulse wave”) is used for triggering. This wave corresponds to the systolic blood pressure.

A number of special sequences support retrospective gating.

4.5.2 Performing

Attaching the pulse sensor

✓ Suitable finger adapter is attached.

1 Ensure that the cable is not bent.

2 Attach the pulse sensor to a finger or on a toe.

3 Ensure that the pulse sensor is attached properly.

The red LED (fault) at the PPU is flashing rapidly?

No analyzable signal is available.

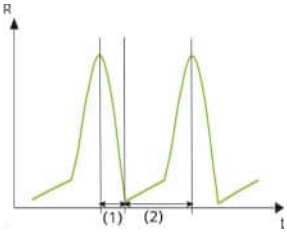
◆ Ensure that the pulse sensor is attached correctly.

Performing the examination

✓ The pulse sensor is attached.

◆ Perform the examination. See: Software operator manual

4.6 Respiratory triggering



To keep respiratory artifacts to a minimum, respiratory triggering is primarily used in abdominal imaging. Retrospective gating cannot be applied.

(1) Expiration
(2) Inspiration

Data acquisition for respiratory triggering begins when the respiratory signal reaches a predefined level (approx. 20 % of the maximum value). Respiratory movement is minimal in this range.

To acquire the respiratory signal you can use the following components:

- A Biomatrix spine coil (for example, BM Spine 24) that is equipped with respiratory sensors
- PERU with respiratory cushion, respiratory belt

The display shows only one respiratory signal, either the signal of the sensor in the spine coil or the signal of the PERU with respiratory cushion.

- By default, the display shows the signal of the spine coil, but only if a spine coil with respiratory sensor is positioned on the patient table.
- The display shows the signal of the PERU if the following applies:
  - The PERU is located in the magnetic field (approx. 1.5 - 2 m from the magnet) and is transmitting.

  AND

  - The respiratory cushion is connected to the PERU and recognizes pressure variations.

To make sure that the displayed signal is from the spine coil, take the PERU out of the magnetic field or disconnect the PERU from the respiratory cushion.

4.6.1 Using a spine coil with respiratory sensor

The Biomatrix spine coils (for example, BM Spine 24) are equipped with two respiratory sensors: one for head first positioning and one for feet first positioning.

As long as the patient is not registered, the display shows the mean value of both sensors. Any movement of the patient's legs during this time may affect the displayed signal. When the patient has been registered, the display only shows the signal of the sensor under the chest of the patient for the actual patient position (head first or feet first).

For detailed information about the spine coils and patient positioning on the respiratory sensor of the spine coil, please refer to the relevant coil chapters.

4.6.2 Using the PERU with the respiratory cushion

Informing the patient

1 Ask the patient to lie still during the measurement.

2 Inform the patient that the knocking sounds during the measurement are caused by switching the gradients on and off. The PERU may also vibrate slightly.

Attaching the respiratory cushion and belt

✓ The plug of the respiration cushion is NOT connected.

CAUTION

Incorrect MR image due to disconnected respiratory cushion!

Incorrect diagnosis

◆ As a last step, plug the connector of the respiratory cushion into the allocated jack.

1 Determine whether the patient is a thoracic or abdominal breather.

Women and athletes are usually thoracic breathers.

Men and obese patients are usually abdominal breathers.

2 If the patient is an abdominal breather, place the respiration belt around his abdomen.

– or –

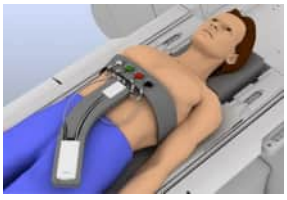
If the patient is a thoracic breather, place the respiration belt around his chest.

3 Slide the respiratory cushion underneath the respiratory belt.

Connecting the respiratory cushion

✓ The respiratory cushion is attached.

1 Use the application cushion and position it on the patient together with the PERU. (➔ Page 113 *Preparing the measurement*)



2 For respiratory triggering alone, position the electrode leads loosely on the respiratory belt.

3 Connect the plug for the respiratory cushion to the appropriate socket on the PERU.

4 Ensure that the pressure hose of the respiration cushion is not crimped or bent. Make sure the respiration cushion is not unduly compressed.

With quiet patients, a periodic signal will appear on-screen.

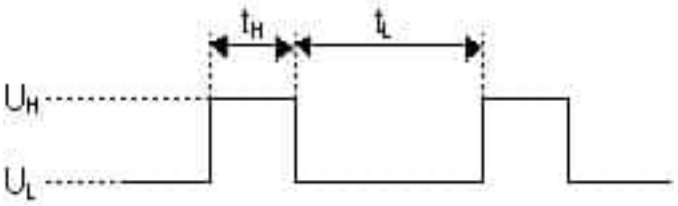
Performing the examination

◆ Perform the examination. See: **Software operator manual**

4.7 External triggering

4.7.1 Input for external trigger signal

The external trigger signal has to meet the following specifications:



Voltage-tim diagram for external triggering of the PMU

Name	Value
U_L	0 V ... 0.8 V
U_H	2.5 V ... 5 V
t_L(min.)	10 ms
t_H(min.)	10 ms
Input current	min. 5 mA
Input voltage	max. ± 5 V
Internal contact	+
External contact	-

The measurement sequence is triggered by the rising edge of the external signal.

The external trigger signal can be supplied via the connections in the magnet cover that are indicated by the trigger symbol.

4.7.2 Performing

Example of an external trigger input (actual design may be different on your system)

1 Connect the source of the external trigger signal to the cinch jack trigger input (magnet cover, left).

2 Perform external triggering. See: **Software operator manual**

5 MR system operation

5.1 Daily functionality checks

Before using the MR system, the functionality and/or cleanliness of the following parts and areas must be checked:

- Alarm box
- Warning signs
- Floor
- Magnetizable materials
- Exhaust vent
- Patient table
- Squeeze bulb

5.1.1 Checking the functionality and cleanliness

CAUTION

Large amount of liquid (for example, phantom fluid) spilled onto patient table and seeping into electrical connections!

Risk of electric shock

System malfunction due to electrical hazards

- Immediately stop the running examination.
- Shut down the computer system and power off the MR system (**SYSTEM OFF**).
- Notify Siemens Service.

1 Check the LEDs on the alarm box.

2 Check if all warning symbols and signs are present inside and outside the examination room.

3 Check the examination room, control room, and equipment room for liquid spills and puddles on the floor.

4 Ensure that no magnetizable materials or objects such as vacuum cleaners, carts, ladders, and tools are present in the examination room.

5 Ensure that the outlet of the exhaust vent line is not obstructed.

6 Ensure that any contrast medium residue has been cleaned off the patient table.

7 Check the functionality of the squeeze bulb. The patient must be able to trigger the patient alert using the squeeze bulb.

5.2 Efficient energy usage

Your system is designed for energy-efficient operation. To make full use of the implemented energy efficiency features, you should consider putting the system into standby mode or shut down the system depending on your operation plan. During standby mode, you can still perform patient evaluation, whereas the system shut down is ideal during non-productive times, for example, at night. For detailed information about standby and switching off, please refer to the chapter “Starting up and shutting down the system”.

Additionally, ensure that proper maintenance is regularly performed by qualified personnel to maintain clinical performance and environmental performance over a longer period of time.

Please contact your local Siemens Healthineers Customer Services to ensure that your scanner is configured for optimal performance and minimum energy consumption according to your real-use scenarios.

You will find energy measurement results according to COCIR SRI methodology in the data sheet of your system. For more details, please contact your local Siemens Healthineers sales organization.

COCIR is the European Coordination Committee of the Radiological, Electromedical and Healthcare IT Industry. SRI is a self-regulatory initiative (SRI) under an eco-design directive to reduce the environmental impact of medical imaging equipment.

For more details, including the energy measurement methodology for MRI, please visit https://www.cocir.org.

5.3 Starting up and shutting down the MR system

There are three operating modes:

- System On (full operation)

  All MR system components are switched on. Examinations may be performed.

- System Off (system is not working)

  All MR system components except magnet and cooling are switched off.

- Standby (standby operation)

  Only the host computer is switched on. Standby is useful for patient evaluations on the computer after performing an examination.

The operating modes can be selected by pressing the corresponding button on the alarm box or by using the software. For details about software operation, please refer to the other software-related operator manuals.

5.3.1 Starting the system (System On)

System start-up includes the following steps:

- Switching on the MR system at the alarm box
- Switching on the *syngo* MR Workplace
- Checking the MR system components

Do not perform preliminary examination steps (for example, moving the patient table, connecting coils) at the MR system while starting up the system.

After "system off" or Standby, wait at least 30 seconds before you switch on the system again.

Switching on the MR system at the alarm box

✓ The daily functionality checks have been completed.

✓ The coils used are fully connected to the coil sockets.

✓ Coils comprising several parts (for example, head coils) are closed.

1 Turn the keyswitch to the right.

2 Press the **SYSTEM ON** button.

The **SYSTEM ON** LED lights up. The MR system is switched on.

The software automatically starts at the *syngo* Acquisition Workplace.

Switching on the *syngo* MR Workplace

Since the *syngo* MR Workplace has its own voltage supply, it is switched on separately from the *syngo* Acquisition Workplace.

◆ Press the Power On switch at the computer of the *syngo* MR Workplace.

The software of the *syngo* MR Workplace starts.

After switching on the *syngo* Acquisition Workplace and the *syngo* MR Workplace, the system requires approx. 6 minutes to warm up and get ready for acquisition.

Checking the MR system components

1 Check whether the system is ready for operation by the **System Check** icon on the **Home Screen**.

For details about software operation and the MR system status, please refer to the other software-related operator manuals.

2 If a dialog box is displayed at the *syngo* Acquisition Workplace informing you that the helium fill level is too low: Close the dialog box and notify Siemens Service or have the magnet refilled.

3 Check all **Table Stop** buttons (at the intercom and at the patient table). Ensure that these buttons function properly and stop the table immediately.

4 Check if pressing the squeeze bulb triggers the patient alert.

5 Check if communication with the patient in the examination room works properly.

6 Check if image transmission of the patient video monitoring systems works properly.

7 Check if the contact spring connectors at the door frame and the door to the examination room are free of residues, such as cleaning agents, oil, grease, paint splatters, blood drops, etc.

5.3.2 Shutting down the system (System Off)

- To switch the MR system off, you shut down the computer system (software).
- If the MR system should be switched off completely for a lengthy period of time, you can switch the MR system off at the alarm box.

When shutting down the system, the software of the *syngo* MR Workplace is automatically ended as well.

To avoid possible data losses at the *syngo* MR Workplace, shut down the *syngo* MR Workplace before the *syngo* Acquisition Workplace.

Shutting down the computer system

If you switch off the computer system, the host computer and the MARS (measurement and reconstruction system) will also shut down.

You can only shut down the computer system when all jobs that use local resources have been completed. For example, if a scan is currently running, the **Shutdown** icon in the Home screen is dimmed.

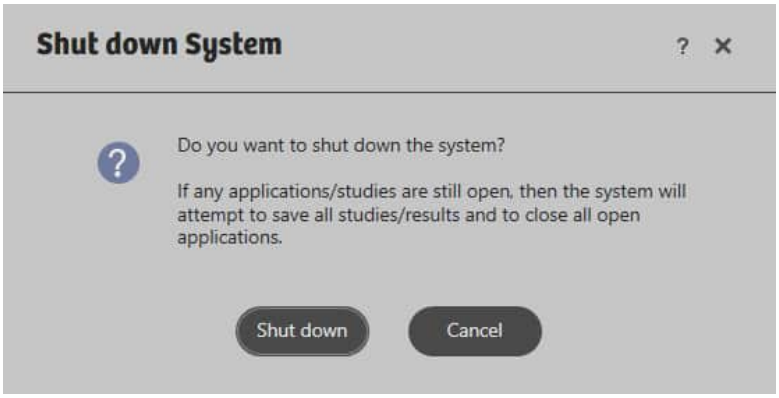
✓ All workflows, examinations, and applications are closed. All data have been saved, both at the *syngo* Acquisition Workplace and at the *syngo* MR Workplace.

1 If a secondary console is connected to your system, inform your colleague at the secondary console that the system is about to shut down.

2 On the access bar, click the **Home** icon to open the **Home** screen.

3 On the **Home** screen, click the **Shutdown** icon and choose **Shutdown System**.

The **Shut Down System** dialog box opens.



4 Click **Shut Down**.

The screen displays the progress of the shutdown process.

The computer system shuts down. This shutdown also turns on the power saving mode of the MR cooling system.

The *syngo* software does not respond?

- To force the shutdown at the risk of losing data, you can click the **Force Shutdown** button on the shutdown screen.

The *syngo* software does not respond?

You can shut down the *syngo* Acquisition Workplace via the Windows platform, which can cause data loss.

- Simultaneously press the **Ctrl**, **Alt**, and **Del** keys on the keyboard and choose the shutdown option.

syngo software and Windows do not respond?

- Switch off the *syngo* Acquisition Workplace.

Switching off the MR system at the alarm box

If the system should be switched off completely for a lengthy period of time, you can switch off the MR system at the alarm box.

Always shut down the computer system (software) before you switch off the MR system at the alarm box!

✓ The computer system has been shut down.

1 Press **SYSTEM OFF** at the alarm box.

2 Turn the keyswitch to the left.

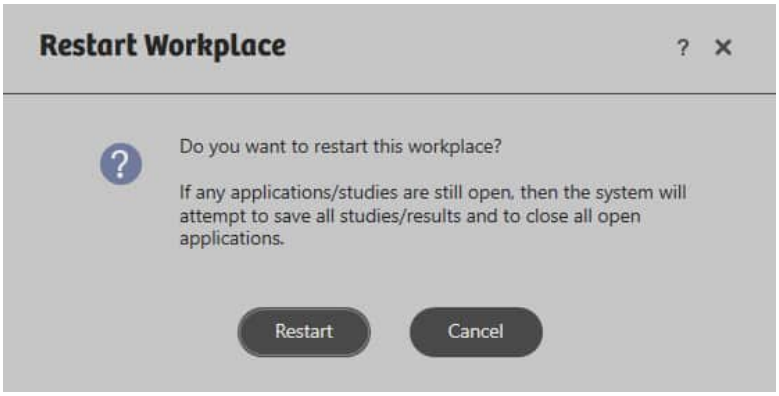
5.3.3 Restarting the *syngo* MR Workplace

In System On mode, you can only restart the *syngo* MR Workplace.

✓ The **Home** screen is open.

1 Save your data.

2 At the *syngo* MR Workplace, on the **Home** screen, click the **Shutdown** icon and choose **Restart Workplace**.



The **Restart Workplace** dialog box opens.

3 Click **Restart**.

The screen displays the progress of the restart process.

The *syngo* software on the workplace shuts down and restarts. The operating systems are not shut down.

5.3.4 Starting/ending Standby

If you do not intend to perform measurements for a longer period of time or only want to edit or evaluate images, you can save energy by enabling the Standby mode. In this mode, the MARS (measurement and reconstruction system) shuts down and the power saving mode of the MR cooling system turns on.

You cannot perform measurements in Standby mode.

✓ The **Home Screen** is open.

1 To start Standby, click the **Shutdown** icon and select **Scanner Standby**.

In the **Standby System** dialog box, click **Standby**.

The MR scanner switches to the low power Standby mode.

2 To end Standby, press the **SYSTEM ON** button on the alarm box.

5.4 Preparing the MR system

5.4.1 Connecting the squeeze bulb and headphones

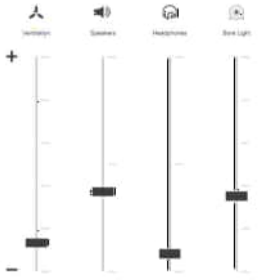
(1) Connection for squeeze bulb
(2) Connection for headphones

1 Connect the hose connector of the squeeze bulb to the corresponding connector at the foot end of the patient table.

2 Connect the headphone to the corresponding connector at the foot end of the patient table.

5.4.2 Setting conditions for patient comfort

1 On the Select&GO display, select the gearwheel icon in the upper-right corner to access the **Comfort** and the **Settings** menus.



2 Move the slider to make a setting, for example, tunnel ventilation.

Alternatively, you can set the volume of the headphones at the intercom.

5.5 Preparing the patient

CAUTION

Heat development during the examination!

Patient burns

- Instruct patients to press the squeeze bulb in case of unusually strong sensation of heat (before it becomes painful).

WARNING

Use of unapproved fMRI stimulation devices for the given magnetic field strength!

Injury to patient and operating personnel

- Ensure that the stimulation devices are approved for the field strength of your MR systems. For example, devices approved for low and medium field systems (0.2 – 1.5T) must not be used on a 3T system.

WARNING

Contact of injured skin with surfaces of the system may cause (mild to severe) allergic reactions.

Severe patient injury due to anaphylactic shock

- Cover injured skin with bandages or drapes, for example.

5.5.1 Informing the patient

1. Please note the safety instructions.
2. Inform the patient about the possible effects of MR examinations and the risks associated with the magnetic field.
3. Show the patient how to activate the patient alert by pressing the squeeze bulb.

4 Ensure that the patient holds the squeeze bulb in his/her hand during the measurement.

5.6 Positioning the patient

CAUTION

Incorrect patient positioning and trapping of arms and legs!

Pinching of fingers or toes

- Ensure that the fingers or toes of the patient do not get caught in the gap between the patient table and magnet during table movement.

CAUTION

Incorrect positioning of the patient's head when using a head or head/neck coil!

Wrong SAR calculation resulting in local overheating

- Always position the patient's head inside the head or head/neck coil.

1 Use positioning aids and table pads to position the patient as comfortably as possible on the patient table.

2 If the patient's hands or feet protrude over the table end, always use the corresponding positioning aids.

3 Ensure the patient's feet do not hit the handle at the foot end of the table or get caught in the gap between handle and table, especially if the patient is very tall. Use positioning aids to position the patient's feet a bit higher. When positioning the patient in the prone position always use the foot roll and take special care when the table moves out of the magnet.

4 If you are performing a triggered measurement: position the patient in the supine position where possible.

5 When examining extremities, ensure correct patient orientation and positioning.

Unlike examinations of the patient's torso, for which registration of the image orientation data and positioning choices are limited, imaging of the extremities is more freely selectable. Therefore, registration of image orientation data when imaging extremities may deviate from actual anatomical positioning of the patient.

Example: Positioning of the hand

- Right/left
- Palm/back of the hand
- Hand over the head
- Hand to the side along the body

6 Depending on the requirements, position the patient in the feet or head first orientation in the direction of the magnet bore.

We recommend that patients, especially those suffering from claustrophobia, are positioned with their feet toward the magnet bore.

To obtain optimal image quality and a homogeneous fat saturation, ensure the most isocentric position for the patient's extremity to be examined.

Especially in areas with high B_0 inhomogeneity, the STIR technique provides for a more robust fat suppression than spectral fat saturation. Protocols for both variants are included in the Siemens protocol tree.

The increased SAR limits are activated in the *First level controlled operating mode*. In this operating mode it should be ensured that heat dissipation is not impaired by clothing or blankets.

5.6.1 Positioning without a head/neck coil

If you do not use a head/neck coil, the head of the patient is positioned in the back-of-the-head support.

The back-of-the-head support must be positioned correctly so that the system knows the exact patient position and can determine the correct SAR values.

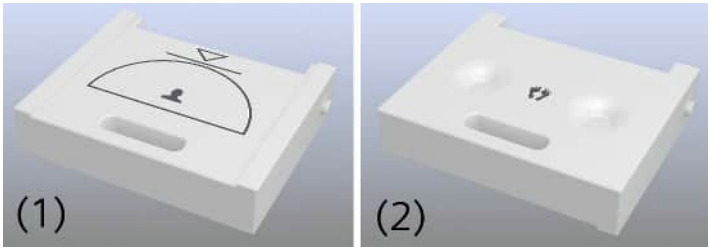
CAUTION

Patient positioning in head first orientation without a head or head/neck coil!

Wrong SAR calculation resulting in local overheating

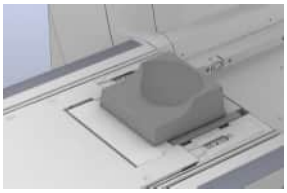
- Always use the back-of-the-head support if no head or head/neck coil is used.
- Make sure that the back-of-the-head support is positioned correctly on the head-heel insert so that it is flush with the edge marking of the head-heel insert.

- Position the head-heel insert to fill the gap at the head end of the patient table.



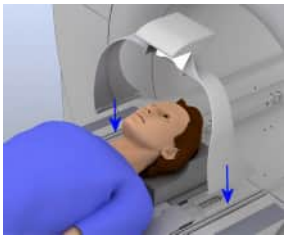
(1) For head first positioning of the patient, place the head-heel insert with the “head” label upside.
(2) For feet first positioning of the patient, place the head-heel insert with the “feet” label upside.

Head first position of the patient



1 Position the back-of-the-head support on the head-heel insert of the patient table so that it is flush with the edge marking of the head-heel insert.

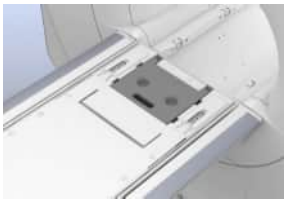
2 Position the patient's head on the back-of-the-head support.



3 If needed, insert the lookout mirror holder into the T-shaped groove on both sides of the patient table.

Feet first position of the patient

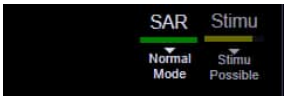
The head of the patient is positioned on the back-of-the-head support located at the foot end of the patient table. The feet of the patient are positioned on the back side of the head-heel insert.



- Position the patient's feet in the corresponding recesses for the heels on the head-heel insert.

5.7 Physiological effects

Due to the presence of alternating electromagnetic fields, patients may experience various physiological effects during MR measurements:



- **SAR**: warming of body tissue through RF fields of the RF transmitter coil (➔ Page 144 *Warming of body tissue*)
- **Stimu**: peripheral nerve stimulation through low-frequency fields of the gradient coils (➔ Page 148 *Peripheral nerve stimulation*)

These physiological effects can be evaluated by the technical quantities dB/dt (stimulations) and SAR (warming) respectively.

You can access information about **SAR** and **Stimu** in the software at any time. This chapter provides background information. For details about the operation in the software, see: **Operator Manual - MR Examination and Review**

It is generally accepted that no published evidence supporting the occurrence of cumulative and/or long-term effects after exposure to EMF emitted by the MR equipment exists.

5.7.1 Operating modes

To prevent health risks during MR measurements, several international organizations (for example, IEC) and various national health organizations have published guidelines and limit values (for example, IEC 60601-2-33 as the international safety standard for MRI). In compliance with country-specific approval guidelines, they are the basis for the monitoring functions integrated in the MR system with respect to stimulation and warming effects. The limits against too intense stimulation and warming effects (for example, dB/dt limits and SAR limits) are based on current scientific literature related to safety.

Two different operating modes are available depending on the patient's tolerance. With respect to stimulation and warming effects, the operating modes are defined independently of each other and can be selected separately.

Normal Operating Mode

The *Normal Operating Mode* can be used safely for all patients.
This is the standard mode. Routine patient monitoring is required.
(➔ Page 37 *Patient monitoring*)

Scanning of pregnant patients with the Body coil must be limited to the *Normal Operating Mode* with respect to the SAR level.

A fetus is especially sensitive to potential thermal events during the first three months of pregnancy. Therefore, avoid scanning pregnant patients in the first three months of pregnancy and avoid scanning patients with unknown pregnancy status.

First Level Controlled Operating Mode

In the *First Level Controlled Operating Mode*, patients may experience noticeable stress levels depending on the measurement programs selected. The decision to change to the *First Level Controlled Operating Mode* must be based on a medical consideration of the potential risks and benefits for the patient.

CAUTION

Exposure to RF electromagnetic fields in the *First Level Controlled Operating Mode*!

General or local hyperthermia of the patient

- Do not examine patients with restricted thermoregulatory capability (e.g. small children, elderly, sick, or medicated patients).
- Do not examine patients unable to communicate potential overheating effects (e.g. small children, seriously ill, paralyzed, unconscious, sedated, or handicapped patients).
- Ensure that patients wear light clothing (e.g. light pajamas or nightgown).
- Remove all additional insulation, e.g. blankets which could interfere with heat dissipation.
- Carefully observe the patient and advise the patient once again about the squeeze bulb.

Ensure medical monitoring of the patient (as required by the IEC standard). Also consider the need for breaks during the measurements, to allow the patient to cool off, for example.

CAUTION

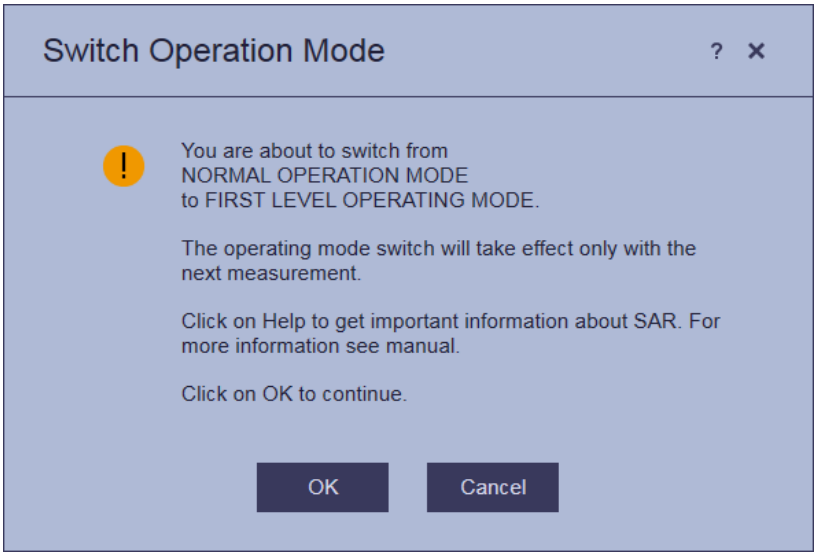
Stereotactic frames and similar devices: tips of screws may heat up considerably, especially if MR examinations are performed in the *First Level Controlled Operating Mode*!

Localized burns of the patient

- Please observe the recommendations and notes of the manufacturer of the stereotactic frame.
- If the device consists of conductive material, only perform measurements in the *Normal Operating Mode*.
- If you still need to switch to the *First Level Controlled Operating Mode*, please observe the related safety notes.

Switching operating modes

To switch from the *Normal Operating Mode* to the *First Level Controlled Operating Mode*, the user must explicitly select and confirm the change. The request appears at the *syngo* Acquisition Workplace. In the *First Level Controlled Operating Mode*, medical supervision is mandatory.



5.7.2 SAR: Exposure to RF electromagnetic fields

During the course of an MR measurement, the patient's body absorbs energy from the RF field of the transmitter coil. Depending on the type of transmitter coil used, the absorption is either concentrated locally (when using so-called "Local RF Transmit Coils") or relatively uniform across the part of the body examined (when using volume coils, for example, head, extremity, or body coil).

The *Specific Absorption Rate* (SAR), expressed as W/kg, serves as a stress indicator.

Unacceptably high local SAR values may lead to RF burns. High global SAR values (head, exposed part of the body, whole body) may lead to overstress the patient's thermoregulation and the cardiovascular system.

The B1+ rms value (root mean square value of the MR-relevant component of B1, which is indicated by the "+") is displayed at the *syngo* Acquisition Workplace for each sequence and may serve as an indication of the RF magnetic field intensity. For details and important notes about the B1+ rms value, please refer to the "SAR information" section in the **Operator Manual - MR Examination and Review**.

Warming of body tissue

The energy absorbed in the course of the MR measurement warms the tissue. The heat generated is dissipated by the thermoregulation mechanisms of the patient, e.g. through increased perspiration and blood flow.

The body temperature increases if the patient absorbs more energy per unit of time than can be dissipated through thermoregulation. The longer this condition lasts, the greater the increase in temperature.

The increase in core body temperature is usually well below 1°C during the course of the MR examination (if the SAR limits described below are maintained). Nevertheless, according to the IEC safety standard the following temperature limits must be observed.

Before starting the examination, the following maximum core temperatures of the patient apply:

- If the patient is allowed to be examined only in the *Normal Operating Mode*, the maximum core temperature of the patient (before starting the examination) is 38.5 °C.
- If the patient is allowed to be examined in the *First Level Controlled Operating Mode*, the maximum core temperature of the patient (before starting the examination) is 39.0 °C.

  If the patient is allowed to be examined in the *First Level Controlled Operating Mode* but the examination is performed only within the SAR limits of the *Normal Operating Mode*, the maximum core temperature of the patient is 39.5 °C.
- If the core temperature of the patient (before starting the examination) is higher than 39.5 °C, the patient must not be examined.

Noticeable effects on the patients

During the MR measurement, patients may experience heat sensations on the skin and, as a consequence of the RF energy absorption, patients may begin to perspire during the course of the MR examination. Their pulse rate may increase as well. The individual effects vary from patient to patient. The intensity of these effects depends on the measurement program selected. As compared to the *Normal Operating Mode*, measurement programs with considerably higher intensities may be used in the *First Level Controlled Operating Mode*. Following the examination, the body will cool off. The pulse rate will return to normal.

Temperature control inside the examination room: A temperature sensor, located near the air intake for the tunnel ventilation, monitors the room temperature. If the room temperature exceeds 25°C, the SAR limits are regulated and lowered by 0.25 W/kg per °C exceeding 25°C. As a result, the parameters of certain MR measurement sequences may need to be adjusted.

SAR limits

Considering all possible tolerances, the SAR values (quantities) are always calculated based on the worst-case assumption. This ensures that the specific SAR limit is maintained.

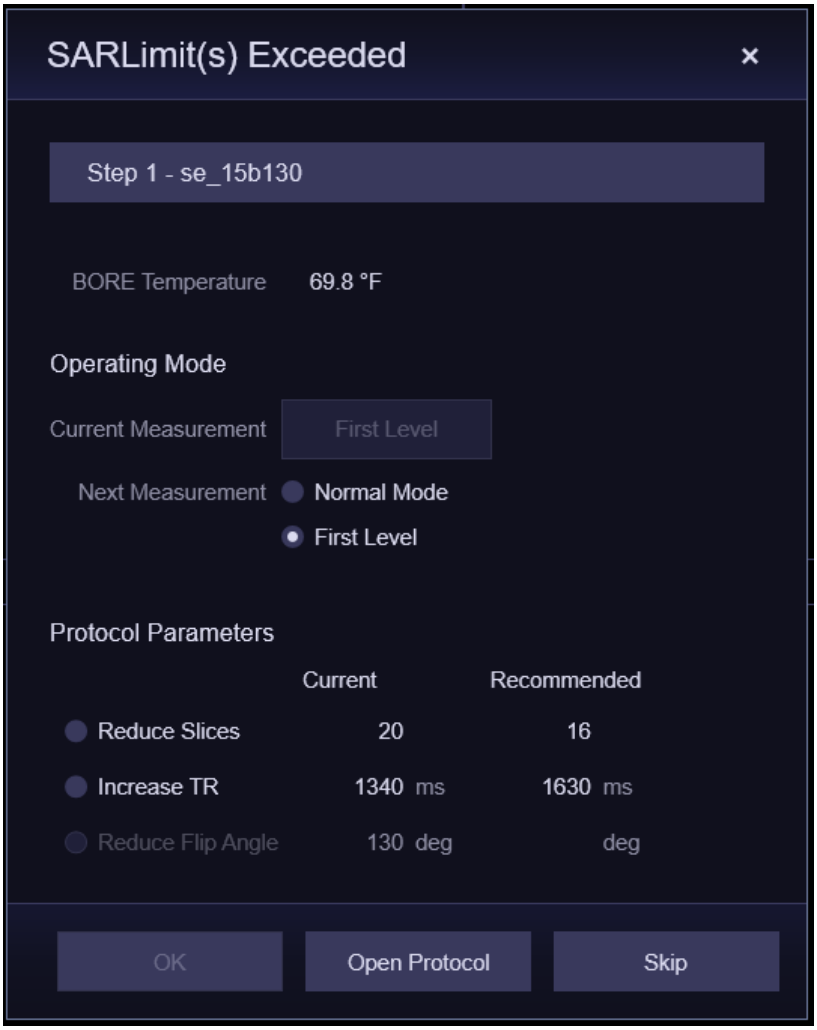
Depending on the medical question, different coils are used for the RF transmission (for example, head, extremity or body coil). The different coils lead to different RF exposure situations for the patient. Therefore, different SAR quantities and corresponding limits have been established (for example, head SAR, whole body SAR, local SAR, and SAR of the exposed part of the body). According to the guideline for monitoring SAR, the software automatically determines the SAR quantities to be monitored and applies the corresponding limits. For the actual RF exposure situation, one of the above-mentioned SAR quantities will show the highest "value to limit ratio". For example, in the case of a head examination with a typical head coil, this will be the global head SAR. If however, a transmitting coil with an inhomogeneous RF field is applied, this will be the local SAR.

SAR monitoring

SAR limits are observed by a software monitoring function.

Look Ahead monitoring: Prior to each measurement, the values of the SAR quantities to be observed are calculated (always as worst-case values) and compared with the corresponding limit values. If one of the calculated SAR values exceeds the corresponding limit, the measurement cannot be started. The following dialog box appears at the *syngo* Acquisition Workplace: **SAR Limit(s) Exceeded**

To ensure accurate calculation of the SAR values, the weight and height of the patient must be entered correctly during registration.



The dialog box offers examination parameters that you can adapt to allow the examination to continue. You can also change the operating mode using the button provided.

In the *First Level Controlled Operating Mode*, often only minor modifications (if any) may be required.

Online monitoring: The system constantly measures the transmit power and ensures that the appropriate limit values are observed. Examinations in progress will be aborted if the limit is exceeded.

Limit values: The SAR limits used by the Look Ahead monitoring function are set according to country-specific approval guidelines at the time of the *syngo* MR installation.

Normal operating mode: In the *Normal Operating Mode*, the patient barely notices the effects of the RF field. In general, the stress on the cardio-vascular system is low.

First Level Controlled Operating Mode: In the *First Level Controlled Operating Mode*, patients may experience noticeable stress levels depending on the measurement programs selected. This usually includes perspiration accompanied by an increase in pulse rate. Patients with reduced thermoregulatory capability and higher sensitivity toward increases in body temperature (e.g. patients with fevers or cardiac decompression, patients with perspiratory impairments, or pregnant women) would experience additional effects. Therefore, these patients must not be examined in *First Level Controlled Operating Mode*.

5.7.3 Stimu: Exposure to low frequency electromagnetic fields

During the measurement, patients are exposed to an electrical field created by the time-varying magnetic fields of the gradient coils. Assuming all other conditions remain constant, the strength of the electrical field is directly proportional to the change of the magnetic flux (dB/dt).

Peripheral nerve stimulation

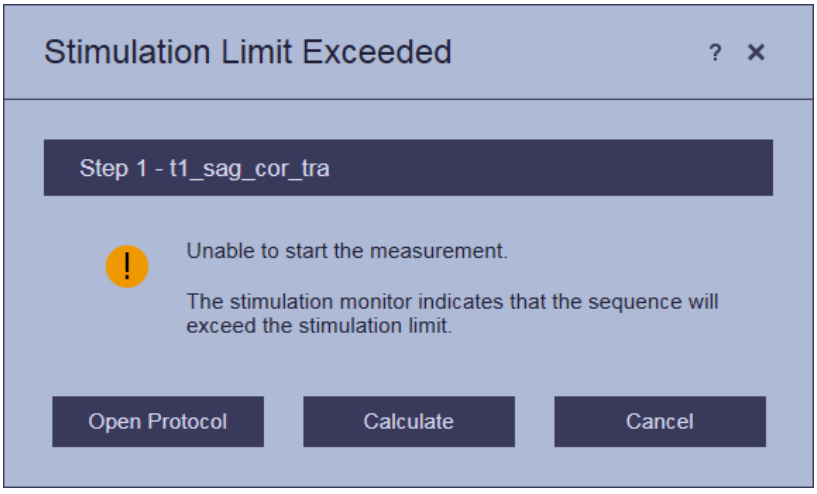
Stimulation threshold: The electrical field affects the patient. If the strength of the electrical field exceeds a certain threshold (stimulation threshold), the patient experiences peripheral nerve stimulation. Nerve stimulation manifests itself as e.g. tingling sensations or slight muscle spasms in the ribs, side, abdomen, hip, buttock, or thoracic regions, along the upper arms or the back muscles in the shoulder region. Depending on physiological conditions, the stimulation threshold may vary greatly from patient to patient.

Stimulation limits: So-called stimulation limits were determined by averaging the individual stimulation thresholds of test subjects during an extensive clinical trial. Based on the statistical distribution, it can be expected that up to 50 % of all patients will experience at least mild stimulations after reaching this stimulation limit.

Stimulation monitoring

The MR system software includes a monitoring feature (stimulation monitor) which monitors how close patients are to the stimulation limit.

Look Ahead monitoring: Prior to starting an MR measurement protocol, the stimulation monitor checks whether the stimulation limits may be exceeded. If so, the measurement cannot be started.



To perform the examination, the parameters of the measurement sequence must be adjusted accordingly.

Online monitoring: If the stimulation limit is exceeded while a measurement is in progress, the active measurement is aborted.

Operating modes

The MR system can be operated in two operating modes which differ with respect to different levels of stimulation.

The stimulation limits are based on stimulation models derived from the statistically determined stimulation limits. The higher the gradient output is, the higher the probability and the intensity of the effects (for example, peripheral nerve stimulation). To minimize the occurrence of peripheral nerve stimulations, it is recommended to operate the system in the *Normal Operating Mode*. However, heart stimulations can be excluded.

Normal Operating Mode: In the *Normal Operating Mode*, the limit is set to 80 % of the stimulation limit according to the IEC safety standard 60601-2-33. At the maximum performance allowed in this operating mode, the ratio of patients affected by peripheral nerve stimulation is rather low.

First Level Controlled Operating Mode: In the *First Level Controlled Operating Mode*, the performance limits are determined directly from the statistically determined stimulation limits. Accordingly, at the maximum performance allowed in this operating mode, up to 50 % of all patients may experience stimulations.

5.8 Starting/stopping the measurement

✓ Coil and patient are prepared and positioned on the table.

1 Align the laser-light localizer with the center of the region of interest.

– or –

Use the Select&GO display to position the table.

2 Start the measurement.

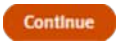
You start and stop a measurement using the software at the *syngo* Acquisition Workplace. For details about software operation, see: **Operator Manual - MR Examination and Review**

Alternatively, you can continue scanning in the examination room. You can start a paused measurement step using the control unit on the MR system cover.

5.8.1 Continue scanning

✓ The measurement protocol is loaded and paused.

✓ No MR measurement is active.



- Select the **Continue** icon at the Select&GO display.

  The measurement begins. The display is deactivated.

5.8.2 Stopping the measurement

✓ The MR measurement is active.

- Press any of the table movement buttons on the control unit.

  The measurement is stopped. The display is activated.

6 Coils

6.1 Basic principles

RF coils are divided into two categories:

- Transceiver coils (TxRx)
- Pure receiver coils (Rx)

When the RF coil is used as a receiver coil only, the RF pulse is transmitted by another RF coil that usually acquires a larger area (e.g. the Body coil).

During reception, the signal-to-noise ratio is higher, the closer the RF coil is located to the examination area. This explains why small RF coils have a better signal-to-noise ratio than e.g. the Body coil. They do, however, have a smaller measurement field.

The Body coil is a stationary coil installed in the magnet.

6.2 Attaching RF coils

Please note that plugged in coils may warm up after considerable time.

6.2.1 Proper handling

CAUTION

Touching inside of coil socket!

Electric shock

◆ Never touch the patient and the inside of the coil socket (with hands, fingers, or other objects) at the same time.

WARNING

Improper use of RF coils!

Injury to patient; damage to RF coils

- Read carefully through the safety information provided for RF coils in the individual coil chapters.

1 Handle RF coils with care.

Avoid applying excessive force (for example, more than 100 N) to the coil. Once the application of excessive force has been detected, the coil will no longer be covered by the Siemens Service contract. That force has been applied can be detected visually and/or will be indicated, for example, by a shock indicator. Most hardcover coils are fitted with shock indicators, which turn red when subjected to a shock.

2 Store RF coils so that they are protected against mechanical damage.

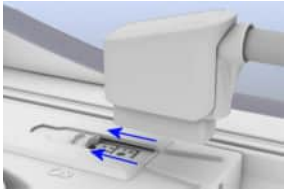
3 Only lift and carry RF coils at the lower part.

4 To avoid cable warming, do not route the coil cable in the proximity of the RF transmit coil.

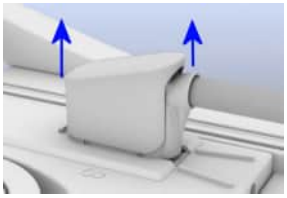
5 Always use the necessary positioning aids and cushions with RF coils.

6 When you cover the positioning aids and cushions with crepe paper, ensure that the crepe paper does not touch coil contacts.

7 Do not compress, bend or stretch the coil cables.



8 To connect the coil plug: Slide the socket cover with the coil plug away and connect the plug to the socket.



9 To remove the coil plug: Grasp the plug housing and lift it up vertically.

Some coils are connected with the Tim Coil Interface. (➔ Page 278 *Tim Coil Interface*)

Combining coils

You can use several coils in an examination, but you must pay attention to the number of coil channels. The number of coil channels used for the measurement is limited by the channel setup of the MR system. Your MR system only supports a defined maximum number of coil channels. The number depends on the system configuration.

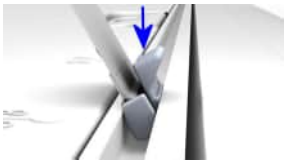
If you combine several coils, you must add together the coil channels of the individual coils. If you exceed the maximum, you can use alternative coils with a lower number of coil channels. Or you can retain your coil setup, but not use all channels for the measurement as configured in the coil file.

Always observe the message on the system display. If a coil code error is displayed, the connected coil is not released for use on your system!

6.2.2 Securing the coil

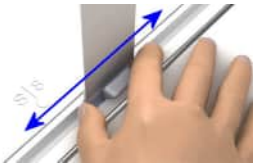
Use the straps attached to the patient table to secure the coil.

Securing straps in the groove

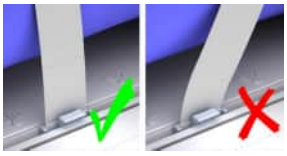


✓ Groove is free of dirt.

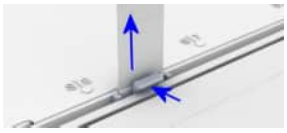
1 Position the mounting device of the strap slightly tilted toward the table center and insert it into the groove along the edge of the patient table until it audibly locks into place.



2 To adjust the position of the straps along the groove, grasp the mounting device of the strap and slide it to the required position.



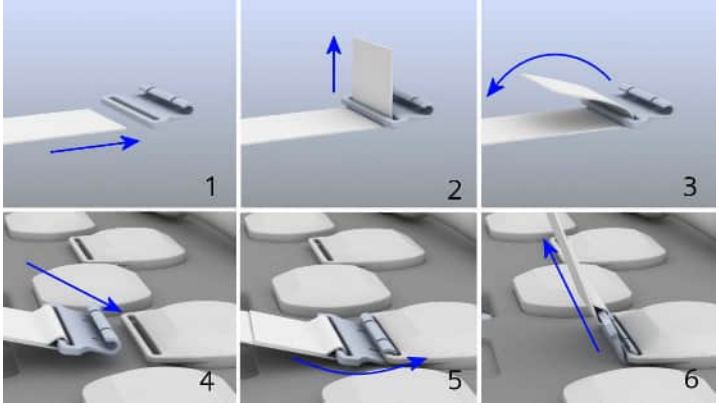
Position the mounting device so that the strap is vertical. If the strap is positioned at an angle, this may cause the mounting device to shift within the groove.



3 To remove the strap: Press against the middle part of the mounting device.

Attaching the straps to coils

You secure the coil on the patient using Velcro® straps. On some coils (for example, Body 30 or UltraFlex coil), the straps can be attached using special clips that are clipped onto the electronic boxes.



1 Attach the straps to the clips (1-3) and mount the clips to the electronic boxes (4-6).

2 Secure the patient with an additional belt strap. In case you use two anterior coils, route the belt strap over the overlapping area of the coil combination.

6.3 Storing RF coils

For storing the coils as well as the accessories you can use the coil cart.

6.3.1 Setting up the coil cart

1 As shown on the label on the lid, open the coil cart carefully and turn the lid completely to the backside of the cart. Never rest the lid against the wall.

2 Open the doors completely and lock them using the lateral bolts.

3 Lock the front wheels after moving the coil cart to the desired position.

4 Only reposition the coil cart (e.g. for cleaning) if the doors are closed.

5 Store heavy accessories (e.g. sandbags) only in the center bottom drawer to improve the stability of the cart.

6.4 Body coil

6.4.1 Description

Area of application

The main function of the Body coil is to generate a homogeneous RF magnetic field for the excitation of nuclear spins.

As a receiver coil for MR signals, the Body coil is used only for survey measurements because its signal-to-noise ratio is significantly lower than that of local coils located close to the body.

Configuration

The Body coil is the innermost shell of the three field-generating components: magnet, gradient coil and RF transmitter coil. It is permanently installed in the magnet.

The support tube of the Body coil functions as the inside lining of the magnet bore. It has guide rails for the patient table and, together with other components, is responsible for attenuating noise.

Functionality

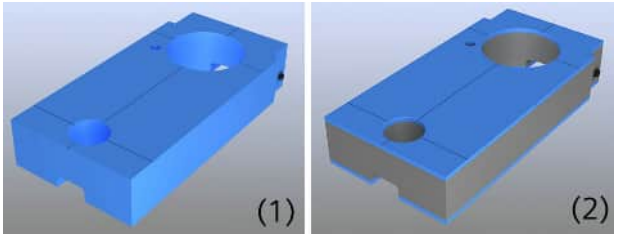
The Body coil functions as a transmitter coil during all measurements. Exception: when using local transceiver coils.

As a transmitter coil, the Body coil (aided by resonant current loops) produces an alternating magnetic field. The frequency of this magnetic field corresponds to the operating frequency of the MR system. The strength of the magnetic field is selected so that the nuclear spins are deflected according to the requirements of the selected MR measurement.

If the Body coil is not used as a receiver coil, the Body coil is detuned for receiving. As a result, the body signals are optimally received by all other transceiver coils without interference from the Body coil.

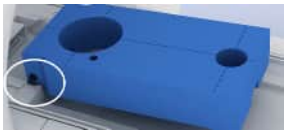
6.4.2 Quality measurement

On a 3T system, you use phantom holder 48 for the quality measurement of the Body coil. On a 1.5T system, you use phantom holder 49.

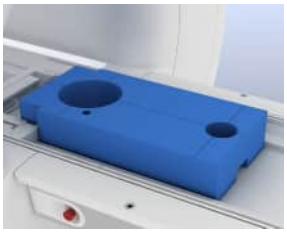


(1) Phantom holder 48 (for use on a 3T system)
(2) Phantom holder 49 (for use on a 1.5T system)

The following images show only phantom holder 48. Phantom holder 49 is handled the same way.

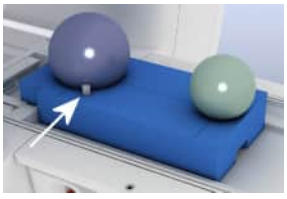


1 Position phantom holder 48 (3T system) or phantom holder 49 (1.5T system) at the head end on the patient table with the lateral detents of the phantom holder inserted in the forward recesses of the table.



2 Position the spherical phantom D240 on the rear recess of the phantom holder.

3 Position the spherical phantom D165 on the front recess of the phantom holder.



4 Position the 15ml plastic bottle in the corresponding recess on the phantom holder.

5 Align the laser-light localizer on the center marking of the phantom holder.

6 Start the quality measurement. (➔ Page 282 *Performing quality assurance (software)*)

6.5 Head/Neck 16

6.5.1 Description

The Head/Neck 16 is used for examinations of the head and the neck (e.g. nape of the neck and vessels of the neck), and combined measurements with other coils.

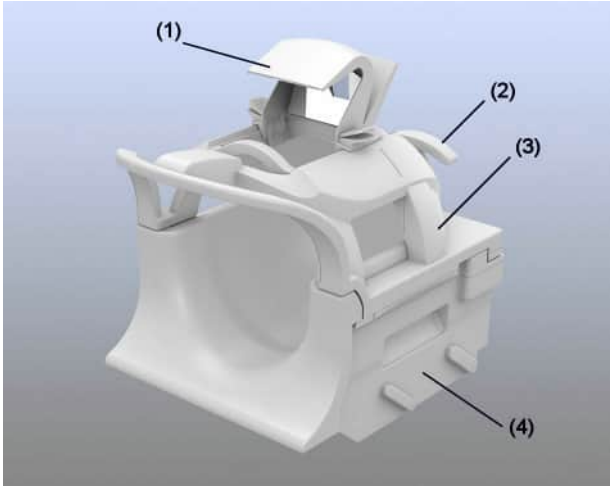
A mirror carrier can be attached to the upper part of the coil.

This coil is not available for all systems. For a list of supported coils, refer to the system owner manual for the respective system.

Accessories (→ Page 290 *Coil accessories*)

Configuration

The coil consists of the following components:

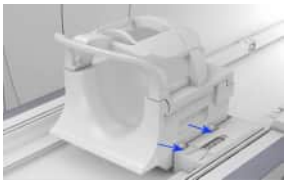


(1) Mirror
(2) Lever for release
(3) Upper Part
(4) Lower part

6.5.2 Use

Positioning the coil

✓ A spine coil or the table pads are positioned on the patient table.



1 Slide the coil into the lateral recesses at the head end of the patient table so that it locks into the coil sockets 5 and 6.

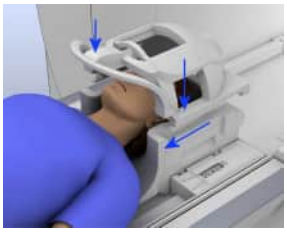
2 Move the lever to release the upper part of the coil and lift it up and off.

3 Place the pad 32 in the lower part of the coil.

4 Secure the patient's head using the corresponding cushions.

5 Use suitable positioning aids.

6 Position the head of the patient in the lower part of the coil. Ensure that the shoulders touch the lower part of the coil.



7 Place the upper part on the lower part and slide it forward until it locks into place.

For cervical neck examinations, the upper part of the coil may be omitted for slender patients.

Performing the measurement

1 Align the laser light localizer with the center of the region of interest.

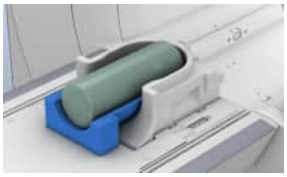
2 Start the measurement.

6.5.3 Quality measurement

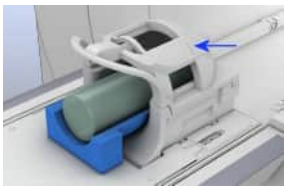
The quality measurement for the Head/Neck 16 is performed in two steps: for the head region and for the neck region.

✓ The lower part of the Head/Neck 16 is positioned on the patient table.

1 Position phantom holder 29 into the lower part of the coil.



2 Position the 5300 ml plastic bottle on phantom holder 29 so that the bulge of the bottle is positioned as far as possible in the lower part of the coil.



3 Place the upper part on the lower part of the coil and slide it forward until it locks into place.

4 Align the laser light localizer with the corresponding center marking of the coil.

5 Start the quality measurement. (➔ Page 282 *Performing quality assurance (software)*)

6.6 BM Head/Neck 20

6.6.1 Description

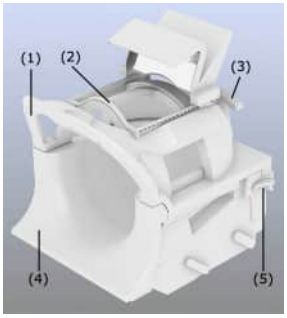
The BM Head/Neck 20 is used for examinations of the head and the neck (for example, nape of the neck and vessels of the neck), and combined measurements with other coils. The coil provides a tilt mechanism to provide more patient comfort and for examining patients suffering from special deformities, for example, Bekhterev's disease.

A mirror carrier can be attached to the upper part of the coil.

Accessories (➔ Page 290 *Coil accessories*)

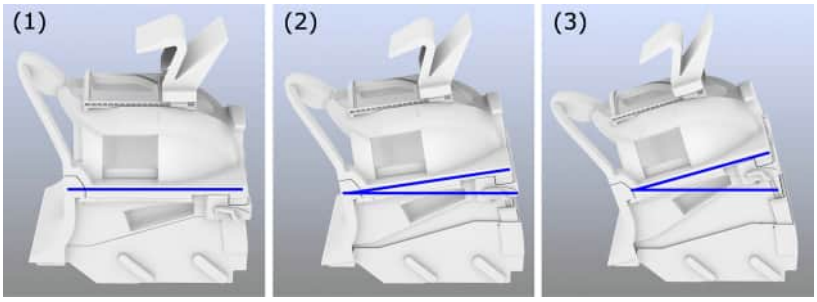
Configuration

The coil consists of the following components:



(1) Upper part
(2) Mirror carrier with mirror
(3) Lever to release the upper part
(4) Lower part
(5) Lever to release the coil to tilt it

The lower part of the coil can be tilted into the following positions:

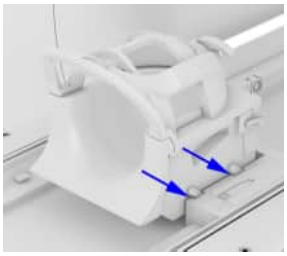


(1) Basic zero position without tilt
(2) Middle position with medium tilt for more patient comfort
(3) Highest position with maximum tilt, only for patients suffering from special deformities (for example, Bekhterev's disease)

6.6.2 Use

Positioning the coil

✓ The spine coil or the table pads are positioned on the patient table.



1 Slide the BM Head/Neck 20 into the lateral recesses at the head end of the patient table so that it locks into the coil sockets 5 and 6.

2 Move the lever to release the upper part of the coil and lift it up and off.

3 Place the pad 32 in the lower part of the coil.

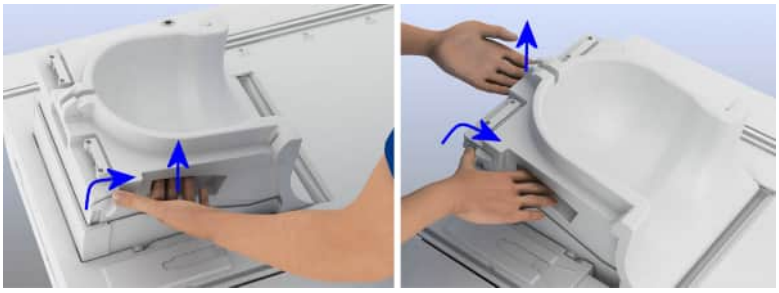
4 Secure the patient's head using the corresponding cushions.

5 Use suitable positioning aids.

6 Position the head of the patient in the lower part of the coil. Ensure that the shoulders touch the lower part of the coil.

7 If necessary, tilt the coil into the required position.

Release the lever for tilting (on the left or on the right side of the coil) and simultaneously lift the coil into the tilt position.



You can lift the coil only with one hand: Grip the lateral recess, pull the lever with your thumb, and tilt the coil.

Alternatively, tilt the coil with both hands: Use one hand to release the lever and use the other hand to grip the recess on the back of the coil to tilt the coil.

If the coil is already in a tilted position, make sure that you do not accidentally release the lever. Always hold the coil before you release the lever to prevent it falling back into the zero position.

8 Place the upper part on the lower part and slide it forward until it locks into place.

For cervical neck examinations, the upper part of the coil may be omitted for slender patients.

Performing the measurement

CAUTION

Tilting the head/neck coil during the examination!

Inconsistent images due to patient movement; wrong diagnosis

- Tilt the coil before the examination and use this tilt position throughout the MR measurement. Do not change the position of the coil during the examination.

1 Align the laser-light localizer with the center of the region of interest.

2 Start the measurement.

6.6.3 Quality measurement

The quality measurement of the BM Head/Neck 20 is performed only in the basic position (without tilt) and in two steps: for the head region and for the neck region.

✓ The lower part of the BM Head/Neck 20 is positioned on the patient table.

✓ The coil is in the basic position (not tilted).

1 Position phantom holder 29 into the lower part of the coil.

2 Position the 5300 ml plastic bottle on phantom holder 29 so that the bulge of the bottle is positioned as far as possible in the lower part of the coil.

3 Place the upper part on the lower part of the coil and slide it forward until it locks into place.

4 Align the laser-light localizer with the corresponding center marking of the coil.

5 Start the quality measurement. (➔ Page 282 *Performing quality assurance (software)*)

At the end of the quality measurement procedure the system checks the coil codes for the different tilt positions.

6 Position the coil in the corresponding three tilt positions (no tilt, medium tilt, and maximum tilt) to confirm the coil codes.

6.7 Head/Neck 64, BM Head/Neck 64

6.7.1 Description

The Head/Neck 64 provides examinations of the head and the neck (for example, nape of the neck and vessels of the neck), and combined measurements with other coils.

The Head/Neck 64 is available with CoilShim (BM Head/Neck 64) and without CoilShim (Head/Neck 64). As design and operation are the same for both coils, the descriptions in this manual apply to both coil types.

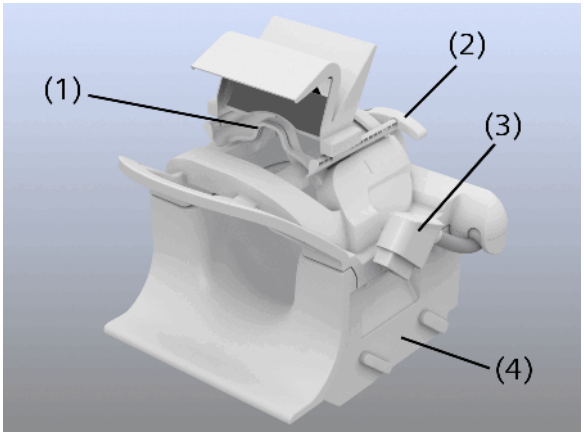
A mirror carrier can be attached to the upper part of the Head/Neck 64.

This coil is not available for all systems. For a list of supported coils, refer to the system owner manual for the respective system.

Accessories (➔ Page 292 *Head/Neck 64, BM Head/Neck 64*)

Configuration

The coil consists of the following components:

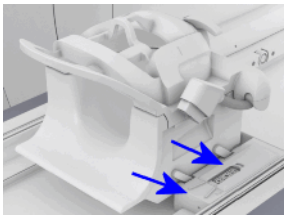


(1) Mirror carrier with mirror
(2) Lever for release
(3) Coil plug of the upper coil part (in parking position)
(4) Lower part of the coil

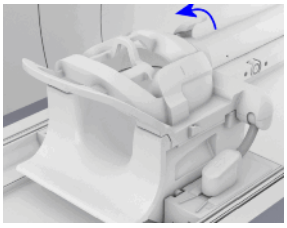
6.7.2 Use

Positioning the coil

✓ The spine coil or the table pads are positioned on the patient table.



1 Slide the Head/Neck 64 into the lateral recesses at the head end of the patient table so that it locks into the coil sockets 5 and 6.



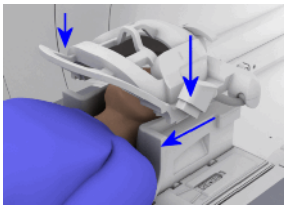
2 Move the lever to release the upper part of the coil and lift it up and off.

3 Place the pad 64 in the lower part of the coil.

4 Position the head of the patient in the lower part of the coil. Ensure that the shoulders touch the lower part of the Head/Neck 64.

5 If necessary, use additional suitable positioning aids.

6 If necessary, position the two head positioning wedges to stabilize the head of the patient.



7 Place the upper part on the lower part and slide it forward until it locks into place.

8 Connect the plug of the upper coil part to the coil socket 2.

For cervical neck examinations, the upper part of the Head/Neck 64 may be omitted for slender patients.

Performing the measurement

1 Align the laser-light localizer with the center of the region of interest.

2 Start the measurement.

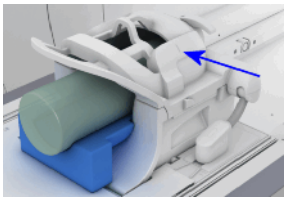
6.7.3 Quality measurement

The quality measurement for the Head/Neck 64 is performed in two steps: for the head region and for the neck region.

✓ The lower part of the Head/Neck 64 is positioned on the patient table.

1 Position phantom holder 29 into the lower part of the coil.

2 Position the 5300 ml plastic bottle on phantom holder 29 so that the bulge of the bottle is positioned as far as possible in the lower part of the coil.



3 Place the upper part on the lower part of the coil and slide it forward until it locks into place.

4 Connect the plug of the upper coil part to the coil socket 2.

5 Align the laser-light localizer with the corresponding center marking of the coil.

6 Start the quality measurement. (➔ Page 282 *Performing quality assurance (software)*)

6.8 Head 32

6.8.1 Description

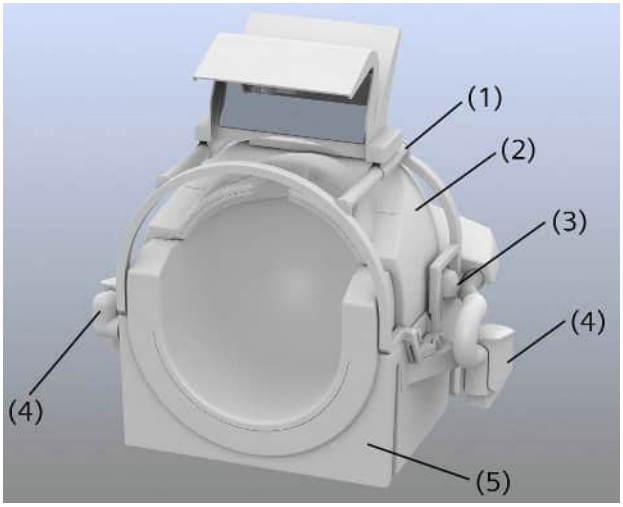
The Head 32 is limited to head examinations. This coil is available for 3T MR systems only.

A mirror can be attached and shifted on the mirror carrier.

Accessories (➔ Page 293 *Head 32*)

Configuration

The coil consists of the following components:

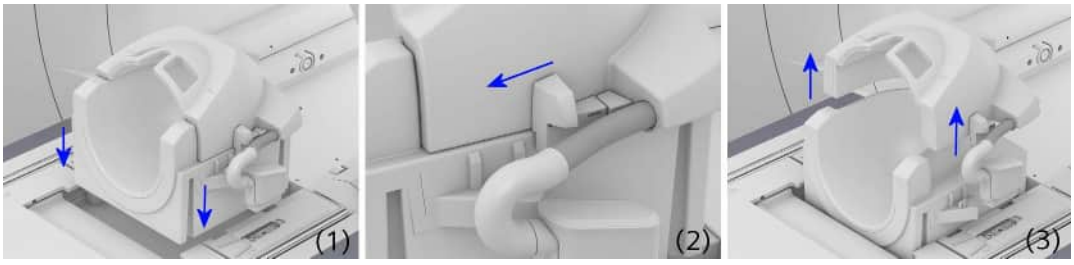


(1) Mirror carrier with mirror
(2) Upper part
(3) Release
(4) Coil plug
(5) Lower part

6.8.2 Use

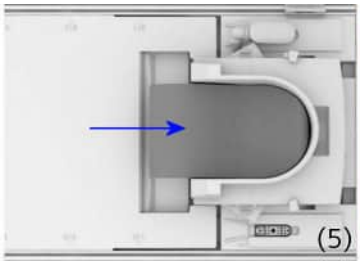
Positioning the coil

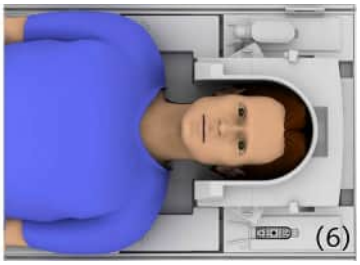
✓ A spine coil or the table pads are positioned on the patient table.



1 Position the coil at the head end of the patient table. Ensure that the coil is positioned at the end stop of the table.

2 Simultaneously pull both releases forward at the upper part of the coil and remove the upper part *vertically* toward the top.



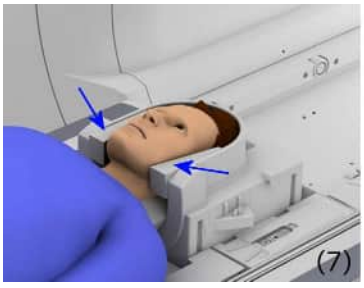


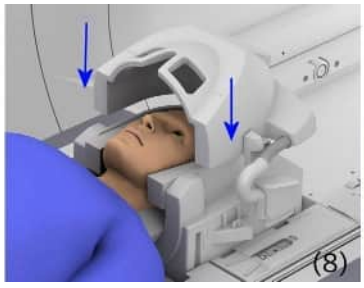
3 Connect the plug of the lower part to the coil socket 1.

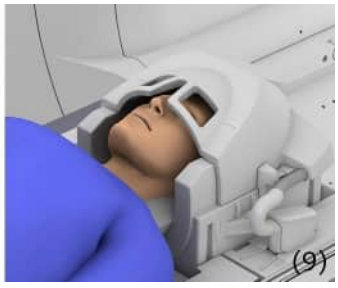
4 Position the filler cushion 32 in front of the lower part and the pad 32 in the lower part of the coil.

5 Position the head of the patient on the lower part of the coil.

6 If necessary, use additional suitable positioning aids.



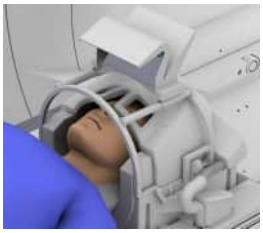




7 If necessary, position the two head positioning wedges to stabilize the head of the patient.

8 Place the upper part of the coil so that it locks into place on the lower part.

9 Connect the plug of the upper part to the coil socket 2.



10 If necessary, position the mirror carrier in the holders at the lower part of the coil.

You are able to use the mirror carrier with mirror without the upper part of the coil.

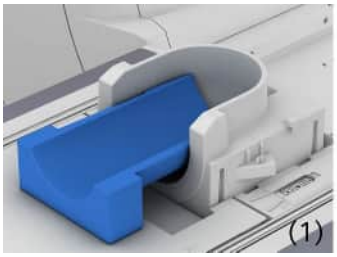
Performing the measurement

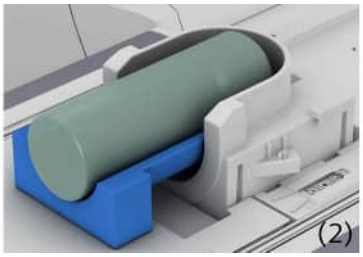
1 Position the laser-light localizer to the center mark on the upper part of the coil.

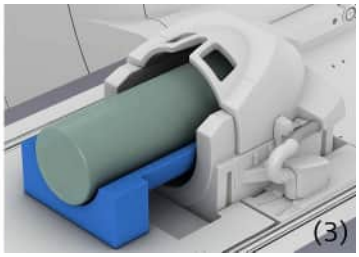
2 Start the measurement.

6.8.3 Quality measurement

✓ The lower part of the Head 32 is positioned on the patient table and connected.







1 Position phantom holder 29 into the lower part of the coil.

2 Position the 5300 ml plastic bottle on phantom holder 29 so that the bulge of the bottle is positioned as far as possible in the lower part of the coil.

3 Place the upper part on the lower part of the coil so that it locks into place.

4 Connect the plug of the upper part to the coil socket 2.

5 Align the laser light localizer with the center marking of the coil.

6 Start the quality measurement.

6.9 TxRx CP Head

6.9.1 Description

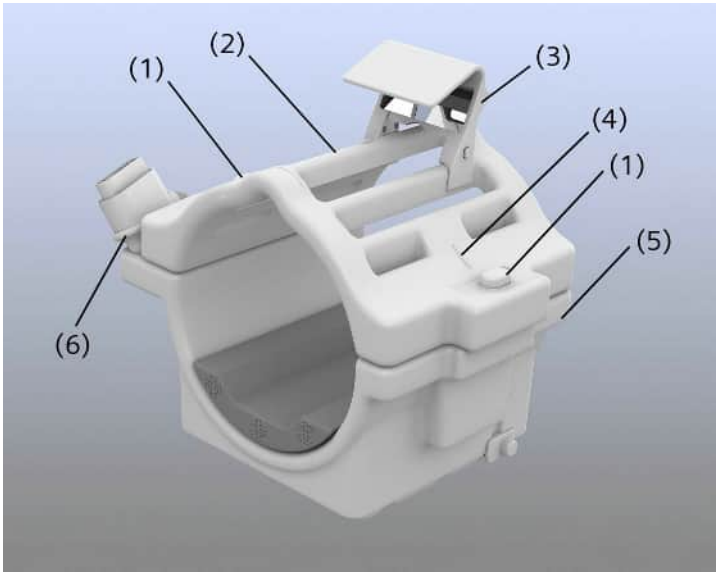
The TxRx CP Head is suitable for the following examination:

- Vascular examinations in the head, for example, vascular examinations of the base of the skull and the cerebrum

Standard accessories (→ Page 290 *Coil accessories*)

Configuration

The coil consists of the following components:



(1) Releases
(2) Upper part of coil
(3) Mirror
(4) Center marking
(5) Lower part of coil
(6) Cable fixation

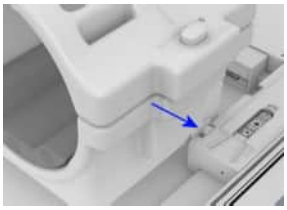
This label is attached to the upper part of the coil and indicates the direction of the head.

6.9.2 Use

Positioning the coil

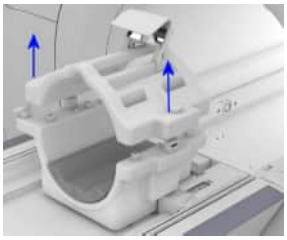
✓ The spine coil is removed. The table pads are positioned on the patient table.

✓ The serial numbers of the upper part (inside) and lower part (bottom) of the coil match.



1 Slide the coil into the front lateral recesses at the head end of the patient table.

2 Connect the coil plug to coil socket 1.



3 Simultaneously press both releases on the upper part of the coil and lift it up and off.

4 Place the head cushion in the lower part of the coil.

5 Use suitable positioning aids.

6 Place the Head-Spine table pad in front of the coil to fill the gap to the table pad 2.

7 Position the head of the patient on the lower part of the coil.

8 Place the upper part of the coil so that it locks into place on the lower part.

9 For examinations of the base of the skull, position the patient's head as far inside the coil as possible.

– or –

For examinations of the cerebrum, position the patient's head so that the eyebrows are lined up with the center marking.

10 Secure the patient's head using the head wedges.

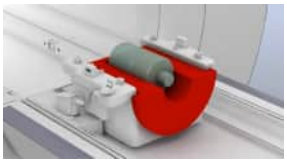
Performing the measurement

1 Align the laser-light localizer with the center marking of the coil.

2 Start the measurement.

6.9.3 Quality measurement

✓ Lower part of the coil is positioned on the patient table and connected.



1 Position the phantom holder TxRx CP Head in the lower part of the coil.

2 Position the 1900 ml plastic bottle so that the bottom of the bottle is facing the magnet bore.

3 Place the upper part of the coil on the lower part so that it locks into place.

4 Align the laser-light localizer with the center marking of the coil.

5 Start the quality measurement (➔ Page 282 *Performing quality assurance (software)*)

6.10 Pediatric 16

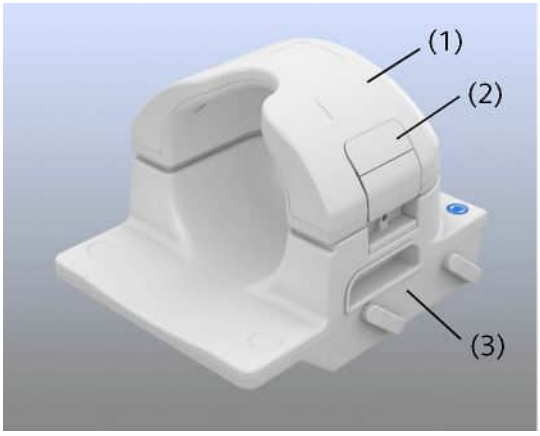
6.10.1 Description

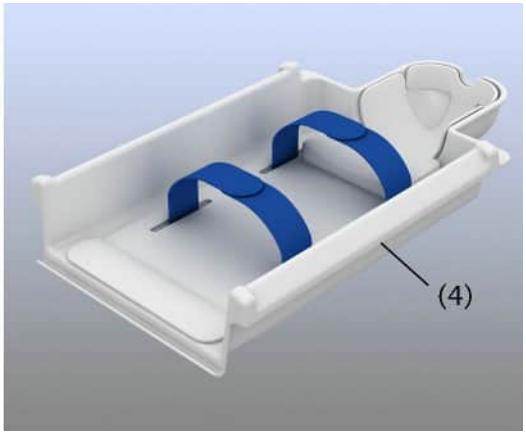
The Pediatric 16 is intended for use to produce diagnostic images of the head and neck of neonates and infants that can be interpreted by a trained physician.

The inner diameter of the Pediatric 16 has been adjusted to the head diameters of neonates and infants.

Configuration

The coil consists of the following components:





(1) Upper part
(2) Release
(3) Lower part
(4) Infant cradle

The coil consists of two main parts: the head coil itself and the infant cradle.

The infant cradle is used especially for positioning neonates. With the infant cradle you can position the patient outside the examination room before the measurement.

These labels are attached to the coil:	 Warning sign: pinching hazard	 Sign for mandatory hearing protection

Special positioning aids for the coil and the infant cradle help to secure the patient. (➔ Page 288 *Accessories*)

6.10.2 Use

General safety information

MR scanning is not established for safe imaging of fetuses and infants under two years of age. The responsible physician must evaluate the benefits of the MR examination compared to those of other imaging procedures.

WARNING

Noise development during the MR examination!

Injury to patient (hearing impairment up to permanent hearing loss)

- Provide the patient with appropriate hearing protection that lowers noise to at least 99 dB(A). For example, apply Ohropax® classic (wax material) to the patient.

CAUTION

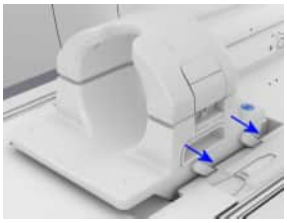
Hazard of bruising injury!

- Ensure not to bruise the patient.
- Keep the patient under visual control and take special care when positioning the upper part of the coil.

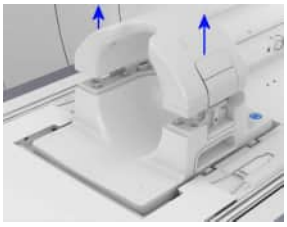
Positioning the coil

✓ The spine coil is positioned on the patient table.

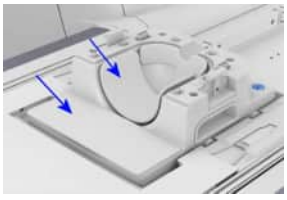
✓ The head coil has been removed.



1 Slide the Pediatric 16 into the lateral recesses at the head end of the patient table so that it locks into the coil sockets 5 and 6.



2 Simultaneously press both releases on the upper part of the coil and lift it up and off.



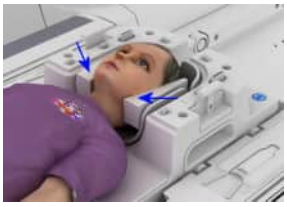
3 Place the head/crown pad in the lower part of the coil.

4 Place the coil transition pad in front of the lower part of the coil.

5 If necessary, position the neck elevation pad in front of the coil.

6 Use suitable positioning aids.

7 Position the head of the patient in the lower part of the coil.



8 If necessary, position the head positioning wedges to secure the patient's head.

9 Place the upper part of the coil so that it locks into place on the lower part.

Positioning the infant cradle

✓ The Pediatric 16 is positioned on the table.

✓ Upper part has been removed.

1 Position the appropriate cushions in the infant cradle. The cushions can be firmly attached to the infant cradle with the corresponding straps.

2 If necessary, position the neck elevation pad in front of the head end of the infant cradle.

3 Position the patient in the infant cradle.

To carry the infant in the infant cradle, always support the infant cradle, for example, with your arms under the cradle. Do not carry the infant cradle by holding the cradle only at the sides.

4 Apply the appropriate straps to secure the patient.

5 Position the infant cradle on the patient table so that the upper part of the infant cradle is positioned in the lower part of the coil.

6 Place the upper part of the coil so that it locks into place on the lower part.

Performing the measurement

1 Align the laser-light localizer with the center mark on the upper part of the coil.

2 Start the measurement.

6.10.3 Quality measurement

✓ The lower part of the Pediatric 16 is positioned on the patient table.

1 Position phantom holder 25 in front of the lower part of the coil.

2 Position the 5300 ml plastic bottle on phantom holder 25 so that the bulge of the bottle is positioned as far as possible in the lower part of the coil.

3 Place the upper part of the coil on the lower part so that it locks into place.

4 Align the laser-light localizer with the center marking of the coil.

5 Start the quality measurement.

6.11 BM Spine 24, BM Spine 32

6.11.1 Description

The BM Spine 24 and the BM Spine 32 are used for examining the spine and for combined measurements with other coils.

For both coils applies:

This coil is not available for all systems. For a list of supported coils, refer to the system owner manual for the respective system.

Accessories (→ Page 290 *Coil accessories*)

Respiratory sensors

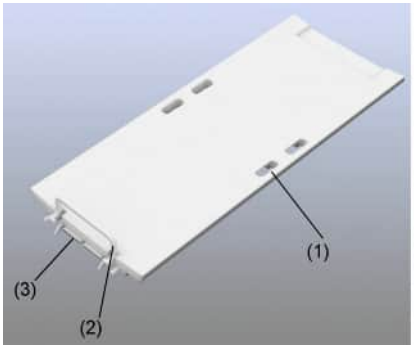
The coil is equipped with respiratory sensors, one for head first positioning and one for feet first positioning. The sensors are indicated by labels on the cushion support.

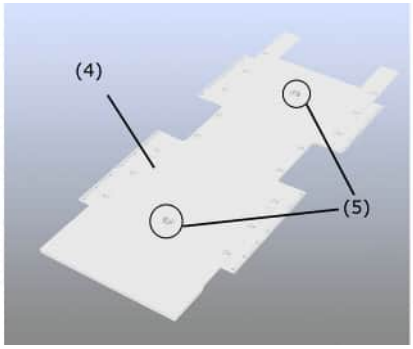
As long as the patient is not registered, the displays show the mean value of both sensors. If the patient moves his legs during this time, this may impact the displayed signal. When the patient registration is done, the displays show only the signal of the corresponding sensor (head first or feet first).

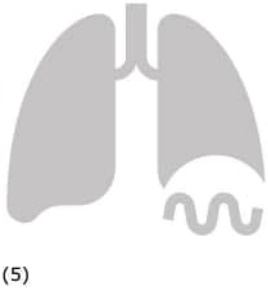
For general information about physiological imaging, see: Chapter "Physiological imaging"

Configuration

The coil consists of the following components:







(1) Carrying handle
(2) Lever for release
(3) Plug connection
(4) Cushion support (spine support 32 respiratory) with labels for the respiratory sensors
(5) Label for respiratory sensors

6.11.2 Use

Positioning the coil

1 Attach the cushion support to the spine coil.

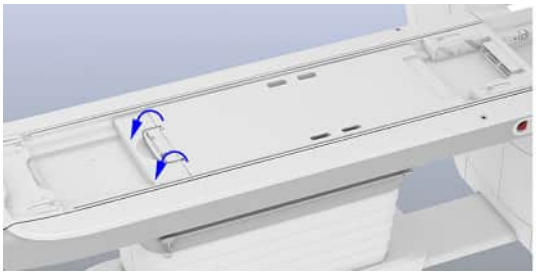
– or –

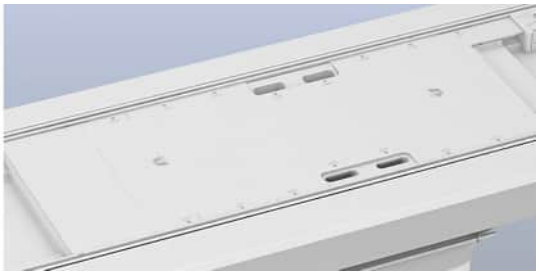
Use the optional easy X-change spine cushion on the spine coil.

Use the spine coil only with a cushion on it!

2 Position the spine coil on the table. Hold the spine coil horizontally (parallel to the tabletop) during positioning and not at an angle to the tabletop.

3 When the spine coil is lying flat on the tabletop, slide the spine coil toward the foot end of the table so that the coil plugs lock into the coil sockets 7 and 8.





4 Turn the lever to lock the coil in place.

Positioning the patient head first

In the head first orientation, the patient's head must be positioned in the head/neck coil or in the back-of-the-head support.

1 Position the lower part of the head/neck coil in the recess at the head end of the patient table.

2 Position the table pad 3 on the foot end of the patient table.

3 Use suitable positioning aids.

4 Position the patient in the supine position and as straight as possible in the center of the coil. The shoulders must lie against the lower part of the head/neck coil.

   For most patients in this position, the respiratory sensors are in the correct physiological position to supply correct respiratory data (at the sternum).

For children and small patients with a shorter upper body, the position of the sensor is probably not correct. Examine these patients in the feet first orientation to ensure that you obtain a correct respiratory signal.

The respiratory data will be displayed on the Select&GO display (in the Physio menu) as soon as the patient is positioned correctly and the patient data have been entered.

Positioning the patient feet first

1 Position the back-of-the-head support at the foot end of the patient table.

2 Position the patient in the supine position and as straight as possible in the center of the coil.

3 Use suitable positioning aids.

4 If you use respiratory triggering for imaging, position the patient with the sternum at the level of the respiratory sensor. The position of the respiratory sensor is indicated by labels on both sides of the cushion support.

The respiratory data will be displayed on the Select&GO display (in the Physio menu) as soon as the patient is positioned correctly and the patient data have been entered.

General notes on using the respiratory sensors

1 Do not use cushions beneath the patient's back as additional distance between spine cushion and patient will decrease the quality of the respiratory signal.

2 Ask the patient to lie still during the measurement.

3 After table movements, wait until the respiratory signal is shown again on the display as table movements may lead to signal drifts.

Performing the measurement

1 Select the region of interest.

2 Align the laser-light localizer with the center of the region of interest.

3 Start the measurement.

Removing the coil

1 To remove the coil press the release at the patient table and lift the coil with the handle.

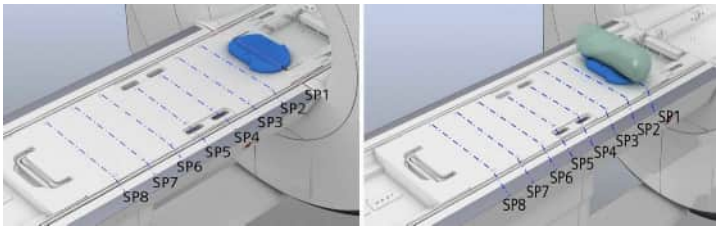
2 If the spine coil is not in use, store the coil in the horizontal position, for example, on a shelf.

– or –

To store the spine coil in the vertical position, position the coil with the coil plugs at the top.

6.11.3 Quality measurement

For the BM Spine 24 and the BM Spine 32, the quality measurement is performed separately for every coil element row (SP1 - SP8). The plastic bottle must be positioned in the center of the respective coil element row for each individual measurement.



1 Position phantom holder 25 on the spine coil in the center of the corresponding coil element row.

2 Align the laser-light localizer with the center marking of the phantom holder.

3 Position the 5300 ml plastic bottle on the phantom holder.

4 Start the quality measurement. (➔ Page 282 *Performing quality assurance (software)*)

5 Perform the quality measurement for the coil element rows SP1-SP8 in this way.

6.12 BM Spine 72

6.12.1 Description

The BM Spine 72 is used for examining the spine and for combined measurements with other coils.

The BM Spine 72 is available for the MAGNETOM Vida only.

Accessories (➔ Page 290 *Coil accessories*)

Respiratory sensors

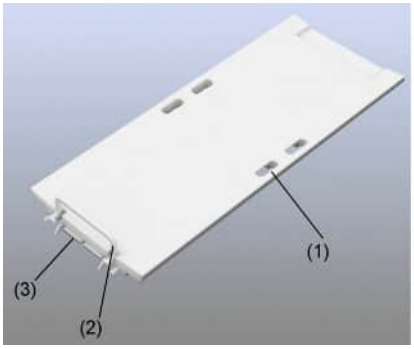
The coil is equipped with respiratory sensors, one for head first positioning and one for feet first positioning. The sensors are indicated by labels on the cushion support.

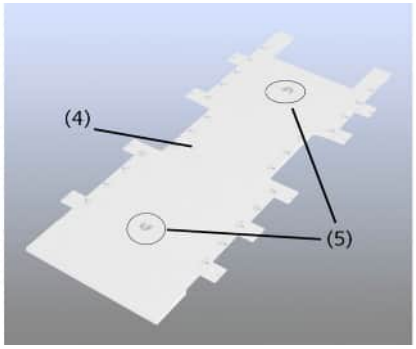
As long as the patient is not registered, the displays show the mean value of both sensors. If the patient moves his legs during this time, this may impact the displayed signal. When the patient registration is done, the displays show only the signal of the corresponding sensor (head first or feet first).

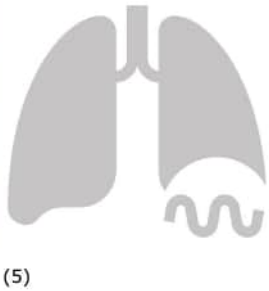
For general information about physiological imaging, see: chapter "Physiological imaging"

Configuration

The coil consists of the following components:







(1) Carrying handle
(2) Lever for release
(3) Plug connection
(4) Cushion support (pad Spine 72) with labels for the respiratory sensors
(5) Label for respiratory sensors

6.12.2 Use

Positioning the coil

1 Attach the cushion support to the spine coil.

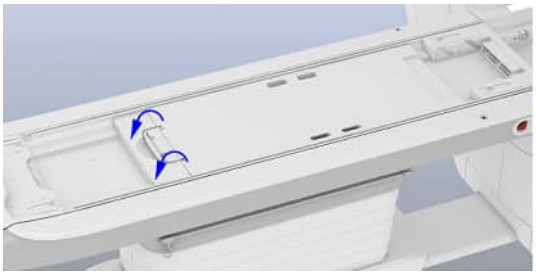
– or –

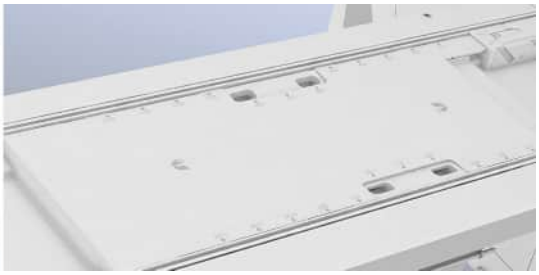
Use the optional easy X-change spine cushion on the spine coil.

Use the spine coil only with a cushion on it!

2 Position the spine coil on the table. Hold the spine coil horizontally (parallel to the tabletop) during positioning and not at an angle to the tabletop.

3 When the spine coil is lying flat on the tabletop, slide the spine coil toward the foot end of the table so that the coil plugs lock into the coil sockets 7 and 8.





4 Turn the lever to lock the coil in place.

Positioning the patient head first

1 Position the lower part of the head/neck coil in the recess at the head end of the patient table.

2 Position the table pad 3 on the foot end of the patient table.

3 Use suitable positioning aids.

4 Position the patient in the supine position and as straight as possible in the center of the coil. The shoulders must lie against the lower part of the head/neck coil.

For most patients in this position, the respiratory sensors are in the correct physiological position to supply correct respiratory data (at the sternum).

For children and small patients with a shorter upper body, the position of the sensor is probably not correct. Examine these patients in the feet first orientation to ensure that you obtain a correct respiratory signal.

The respiratory data will be displayed on the Select&GO display (in the Physio menu) as soon as the patient is positioned correctly and the patient data have been entered.

Positioning the patient feet first

1 Position the back-of-the-head support at the foot end of the patient table.

2 Position the patient in the supine position and as straight as possible in the center of the coil.

3 Use suitable positioning aids.

4 If you use respiratory triggering for imaging, position the patient with the sternum at the level of the respiratory sensor. The position of the respiratory sensor is indicated by labels on both sides of the cushion support.

The respiratory data will be displayed on the Select&GO display (in the Physio menu) as soon as the patient is positioned correctly and the patient data have been entered.

General notes on using the respiratory sensors

1 Do not use cushions beneath the patient's back as additional distance between spine cushion and patient will decrease the quality of the respiratory signal.

2 Ask the patient to lie still during the measurement.

3 After table movements, wait until the respiratory signal is shown again on the display as table movements may lead to signal drifts.

Performing the measurement

1 Select the region of interest.

For BM Spine 72 only: You can only use six element rows simultaneously. To scan all 12 element rows, you need to perform the measurement in two stages.

2 Align the laser-light localizer with the center of the region of interest.

3 Start the measurement.

Removing the coil

1 To remove the coil press the release at the patient table and lift the coil with the handle.

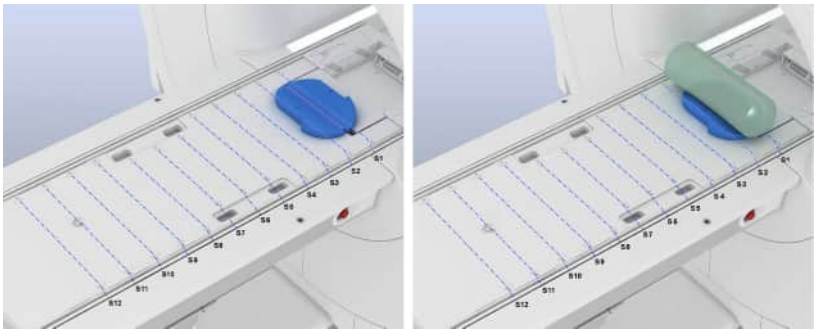
2 If the spine coil is not in use, store the coil in the horizontal position, for example, on a shelf.

– or –

To store the spine coil in the vertical position, position the coil with the coil plugs at the top.

6.12.3 Quality measurement

The quality measurement is performed on every two element rows simultaneously. The plastic bottle must be positioned in the center between two coil element rows.



1 Position phantom holder 25 on the spine coil between coil element rows S1 and S2.

2 Align the laser-light localizer with the center marking of the phantom holder.

3 Position the 5300 ml plastic bottle on the phantom holder.

4 Start the quality measurement. (➔ Page 282 *Performing quality assurance (software)*)

5 Perform the quality measurement for the remaining coil elements (S3+S4, S5+S6, ...) in this way.

6.13 BM Body 12

6.13.1 Description

The BM Body 12 enables examinations of the following body regions:

- Upper body and abdomen
- Pelvis
- Head and neck

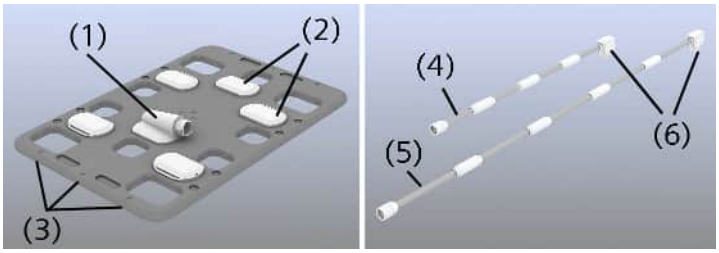
Depending on the requirements, the coil may be used in the head first or feet first orientation. Several BM Body 12 coils can be used for complete upper body examinations.

This coil is not available for all systems. For a list of supported coils, refer to the system owner manual for the respective system.

Accessories (➔ Page 288 *Standard accessories*)

Configuration

The coil consists of the following components:



(1) Plug for the coil cable
(2) Electronic boxes
(3) Cluster 1 - 3
(4) Coil cable 95 (scope of BM Body 12)
(5) Coil cable 165 (scope of BM Body 12 long)
(6) Coil plug

6.13.2 Use

In the following section, an examination of the entire upper body is shown. Two BM Body 12 coils are used and the patient is positioned *head first*.

Attaching/Detaching the coil cable

The BM Body 12 long is equipped with the long coil cable 165. Coil cable 95 and the coil cable 165 are attached to or detached from the coil in the same way.

- To attach the coil cable, align the marking on the connector of the coil cable with the marking on the coil plug and push the cable forward until it audibly locks in place.

  – or –

To detach the coil cable from the coil, turn the connector of the coil cable counterclockwise until it unlocks (about 10°) and pull off the cable.

Safe handling

1 Always position the BM Body 12 so that the coil cable does not touch the patient's head.

2 Secure the cables with the cable holders in the elongated holes of the patient table.

3 Do not bend the coil too much (for example, for ankle examinations) as this may damage the coil. If you bend the coil, ensure that the resulting diameter of bending is larger than 150 mm.

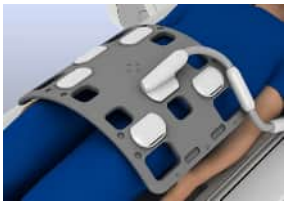
Positioning the coil

✓ The spine coil is positioned on the patient table.

✓ The lower part of the head coil is positioned.

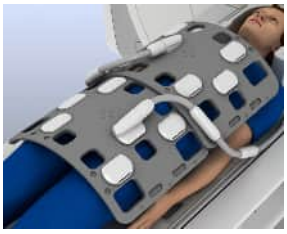
1 Position the patient in the supine position with the head toward the magnet.

2 Use suitable positioning aids.



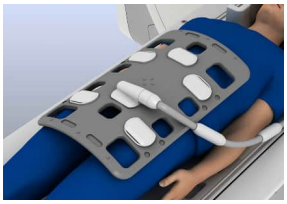
3 Position the BM Body 12 on the patient's pelvis.

4 Attach the coil cable to the BM Body 12 coil (if you have not already done so) and connect the coil to socket 1 or 2.



5 Position the second BM Body 12 so that it overlaps the first and is lying against its electronic boxes.

6 Connect the coil to the next free coil socket.

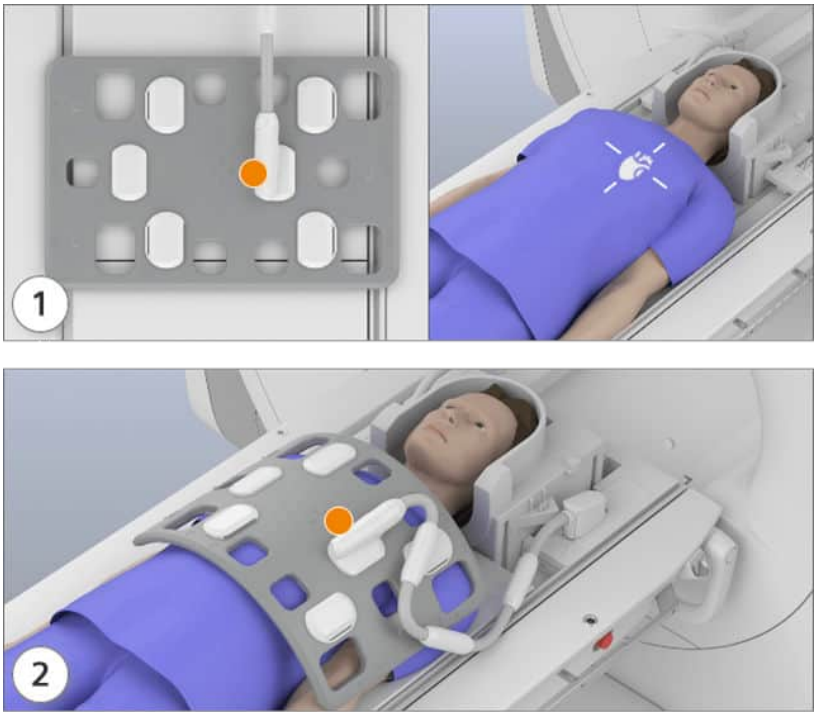


7 For slender patients: Position the BM Body 12 rotated by 90°.

8 Secure the connection cable with the cable holders.

Positioning for use with the Beat Sensor

A sensor in the coil can be used for cardiac triggering during the examination. The sensor must be positioned directly over the patient's heart. A Guidance for positioning the coil is also provided on the Select&GO display in the **Physio** menu.



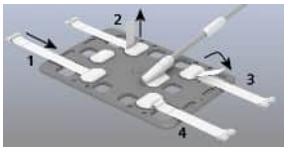
Position of the Beat Sensor (orange marking)

1 Position the coil on the chest of the patient with the coil cable pointing toward the magnet tunnel. Ensure that the sensor is positioned over the patient's heart.

2 Attach the coil cable (if you have not already done so) and connect the coil to socket 1 or 2.

3 Ensure that the coil cable does not touch the patient's head.

Securing the coil combination

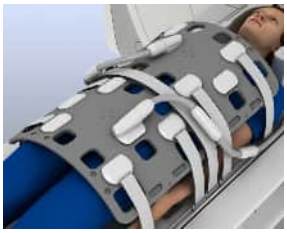


1 Slide the belts as shown through the flaps of the BM Body 12.

2 Secure both coils using the belts provided.

3 Secure the patient with an additional belt. Route the belt over the overlapping area of the coil combination.

Performing the measurement



1 Align the laser-light localizer with the center of the region of interest.

2 At the *syngo* Acquisition Workplace, select the two (up to four, depending on the coil configuration) corresponding clusters of the spine coil.

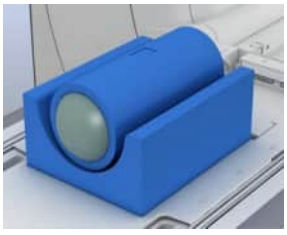
3 Start the measurement.

6.13.3 Quality measurement

The quality measurement is performed in the *head first* orientation. The phantom holder with the coil is positioned in four different orientations.

✓ The spine coil is positioned on the patient table.

1 Position phantom holder 26 on the table.



2 Place the phantom holder 27 around the 5300 ml plastic bottle.

3 Position the BM Body 12 on the plastic bottle and secure the coil on the bottle using the belts.

4 Position the coil with the plastic bottle on the phantom holder 26 so that the coil cable points toward the bottom of the phantom holder.

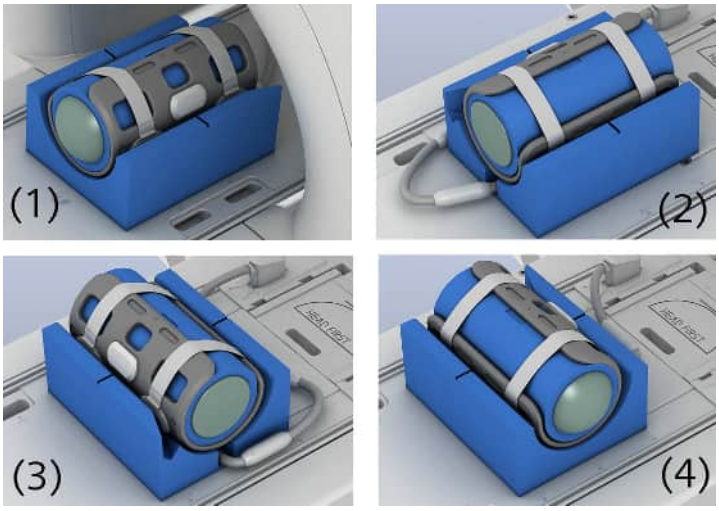
5 Ensure that the coil cable is routed through the groove along the bottom of the phantom holder and that the cable outlet is facing toward the head end of the table.

6 Connect the coil plug to a suitable socket.

7 Align the laser-light localizer with the center marking of the coil and the center of the phantom.

8 Start the quality measurement. (➔ Page 282 *Performing quality assurance (software)*)

At the end of the quality measurement procedure the system checks the coil codes for the different coil orientations.



(1) Initial position with the cable outlet toward the head end of the table
(2) Coil orientation with the cable outlet toward the foot end of the table
(3) Coil orientation with the cable outlet to the right
(4) Coil orientation with the cable outlet to the left

9 Position the phantom holder with the coil in the corresponding orientations with regard to the cable outlet and confirm the coil codes.

6.14 BM Body 18

6.14.1 Description

The BM Body 18 enables examinations of the following body regions:

- Upper body and abdomen
- Pelvis
- Head and neck

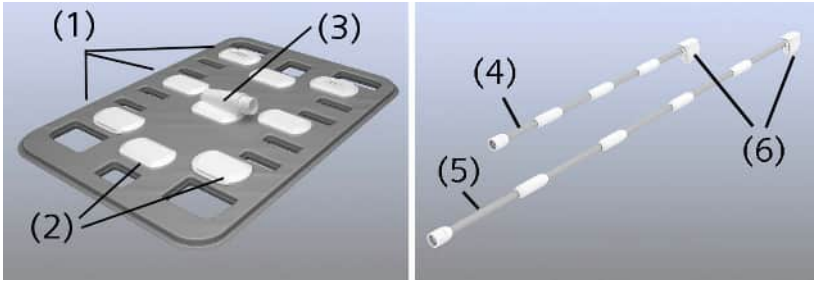
Depending on the requirements, the coil may be used in the head first or feet first orientation. Several coils can be used for complete upper body examinations.

This coil is not available for all systems. For a list of supported coils, refer to the system owner manual for the respective system.

Accessories (➔ Page 288 *Standard accessories*)

Configuration

The coil consists of the following components:



(1) Cluster 1 - 3
(2) Electronic boxes
(3) Plug for the coil cable
(4) Coil cable 95 (scope of BM Body 18)
(5) Coil cable 165 (scope of BM Body 18 long)
(6) Coil plug

6.14.2 Use

In the following section, an examination of the entire upper body is shown. Two BM Body 18 coils are used and the patient is positioned *head first*.

Attaching/Detaching the coil cable

The BM Body 18 long is equipped with the long coil cable 165. Coil cable 95 and the coil cable 165 are attached to or detached from the coil in the same way.

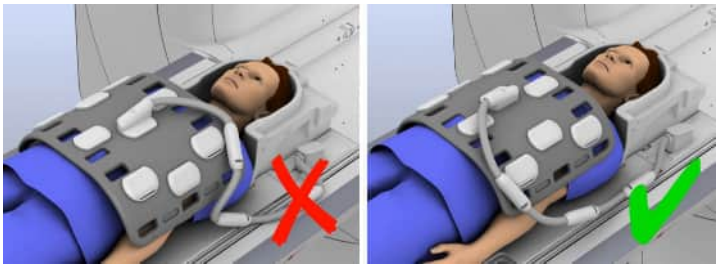
- To attach the coil cable, align the marking on the connector of the coil cable with the marking on the coil plug and push the cable forward until it audibly locks in place.

  – or –

To detach the coil cable from the coil, turn the connector of the coil cable counterclockwise until it unlocks (about 10°) and pull off the cable.

Safe handling

1 Always position the BM Body 18 so that the coil cable does not touch the patient's head.



2 Secure the cables with the cable holders in the elongated holes of the patient table.

3 Do not bend the coil too much (for example, for ankle examinations) as this may damage the coil. If you bend the coil, ensure that the resulting diameter of bending is larger than 150 mm.

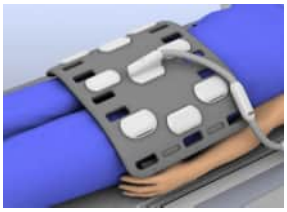
Positioning the coil

✓ The spine coil is positioned on the patient table.

✓ The lower part of the head coil is positioned.

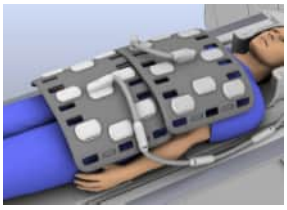
1 Position the patient in the supine position with the head toward the magnet.

2 Use suitable positioning aids.



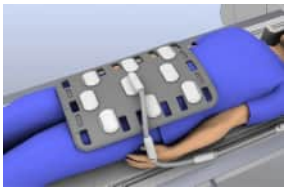
3 Position the BM Body 18 on the patient's pelvis.

4 Attach the coil cable to the BM Body 18 coil (if you have not already done so) and connect the coil to socket 1 or 2.



5 Position the second BM Body 18 so that it overlaps the first and is lying against its electronic boxes.

6 Connect the coil to the next open coil socket.

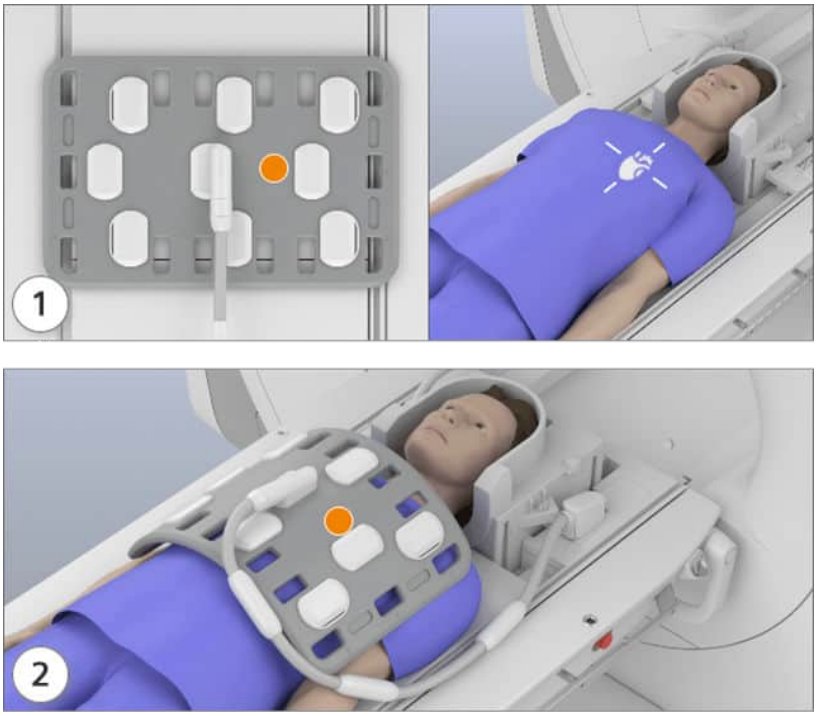


7 For slender patients: Position the BM Body 18 rotated by 90°.

8 Secure the connection cable with the cable holders.

Positioning for use with the Beat Sensor

A sensor in the coil can be used for cardiac triggering during the examination. The sensor must be positioned directly over the patient's heart. A Guidance for positioning the coil is also provided on the Select&GO display in the **Physio** menu.

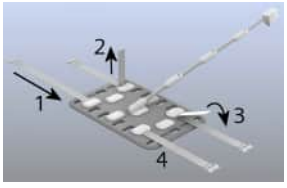


Position of the Beat Sensor (orange marking)

1 Position the coil on the chest of the patient with the coil cable toward the foot end of the table. Ensure that the sensor is positioned over the patient's heart.

2 Attach the coil cable (if you have not already done so) and connect the coil to socket 1 or 2.

Securing the coil combination

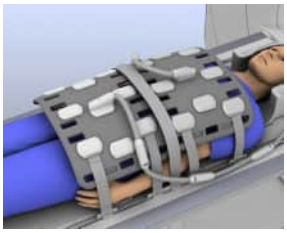


1 Slide the belts as shown through the flaps of the BM Body 18.

2 Secure both coils using the belts provided.

3 Secure the patient with an additional belt. Route the belt over the overlapping area of the coil combination.

Performing the measurement



1 Align the laser-light localizer with the center of the region of interest.

2 At the *syngo* Acquisition Workplace, select the two (up to four, depending on the coil configuration) corresponding clusters of the spine coil.

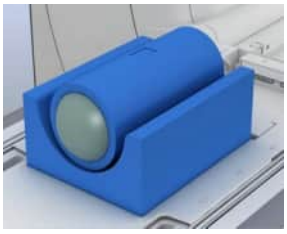
3 Start the measurement.

6.14.3 Quality measurement

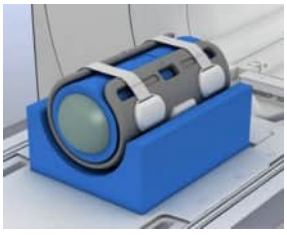
The quality measurement must be performed in the *head first* and *feet first* orientation. The setup is identical for both orientations. In addition, the measurement must also be performed with the coil rotated by 90° for the left and the right side.

✓ The spine coil is positioned on the patient table.

1 Position phantom holder 26 on the table.



2 Place the phantom holder 27 around the 5300 ml plastic bottle.



3 Position the BM Body 18 on the plastic bottle and secure the coil on the bottle using the belts.

4 Position the coil with the plastic bottle on the phantom holder 26 so that the coil cable points toward the bottom of the phantom holder.

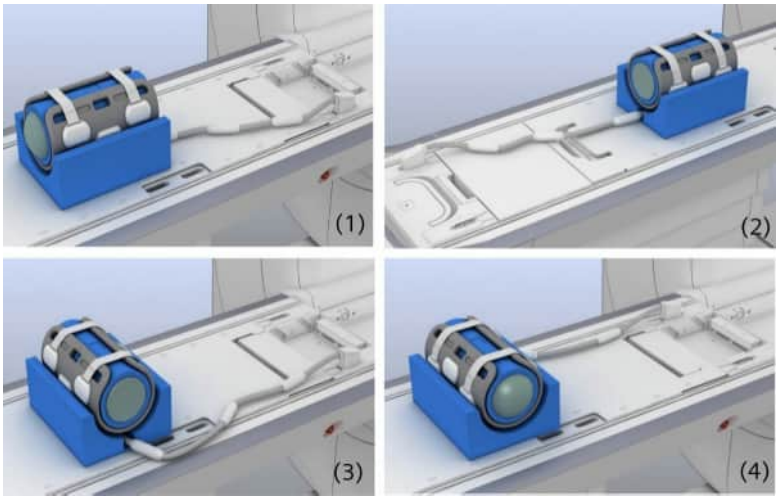
5 Ensure that the coil cable is routed through the groove on the bottom of the phantom holder.

6 Connect the coil plug to a suitable socket.

7 Align the laser-light localizer with the center of the coil.

8 Start the quality measurement. (➔ Page 282 *Performing quality assurance (software)*)

9 Perform the measurement successively for each orientation.



(1) Quality measurement, *head first* orientation
(2) Quality measurement, *feet first* orientation
(3) Quality measurement, left side
(4) Quality measurement, right side

6.15 Body 18

6.15.1 Description

The Body 18 enables examinations of the following body regions:

- Upper body and abdomen
- Pelvis

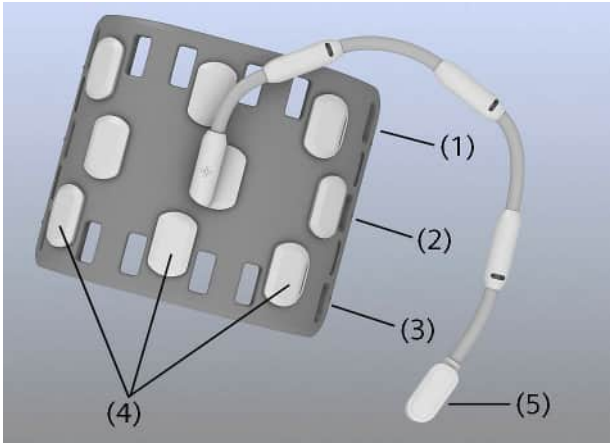
Depending on the requirements, the coil may be used in the head first or feet first orientation. Several Body 18 coils can be used for complete upper body examinations.

This coil is not available for all systems. For a list of supported coils, refer to the system owner manual for the respective system.

Accessories (➔ Page 290 *Coil accessories*)

Configuration

The coil consists of the following components:



(1) Cluster 1
(2) Cluster 2
(3) Cluster 3
(4) Electronic boxes
(5) Coil plug

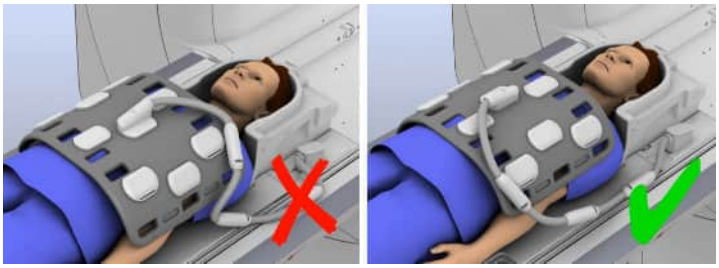
The Body 18 coil is also available as Body 18 Long with an extended coil cable. Use and handling are the same as for the Body 18.

6.15.2 Use

In the following section, an examination of the entire upper body is shown. Two Body 18 coils are used and the patient is positioned *head first*.

Safe handling

1 Always position the Body 18 so that the coil cable does not touch the patient's head.



2 Secure the cables with the cable holders in the elongated holes of the patient table.

3 Do not bend the coil too much (for example, for ankle examinations) as this may damage the coil. If you bend the coil, ensure that the resulting diameter of bending is larger than 150 mm.

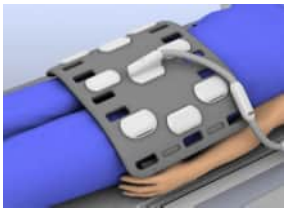
Positioning the coil

✓ The spine coil is positioned on the patient table.

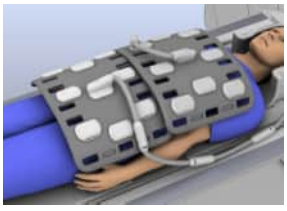
✓ The lower part of the head coil is positioned.

1 Position the patient in the supine position with the head toward the magnet.

2 Use suitable positioning aids.

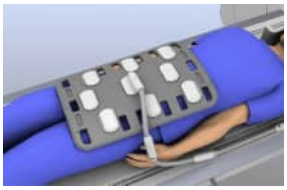


3 Position the Body 18 on the patient's pelvis and connect the coil to socket 1 or 2.



4 Position the second Body 18 so that it overlaps the first and is lying against its electronic boxes.

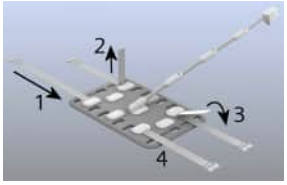
5 Connect the coil to the next open coil socket.



6 For slender patients: Position the Body 18 rotated by 90°.

7 Secure the connection cable with the cable holders.

Securing the coil combination

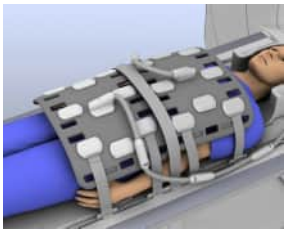


1 Slide the belts as shown through the flaps of the Body 18.

2 Secure both coils using the belts provided.

3 Secure the patient with an additional belt. Route the belt over the overlapping area of the coil combination.

Performing the measurement



1 Align the laser-light localizer with the center of the region of interest.

2 At the *syngo* Acquisition Workplace, select the two (up to four, depending on the coil configuration) corresponding clusters of the spine coil.

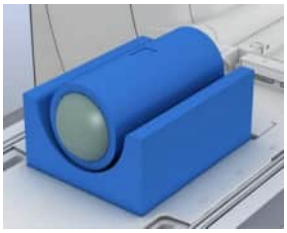
3 Start the measurement.

6.15.3 Quality measurement

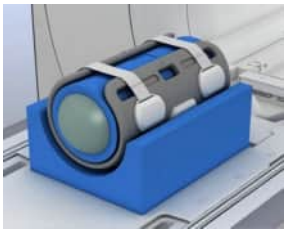
The quality measurement must be performed in the head first and feet first orientation. The setup is identical for both orientations. In addition, the measurement must also be performed with the coil rotated by 90° for the left and the right side.

✓ The spine coil is positioned on the patient table.

1 Position phantom holder 26 on the table.



2 Place the phantom holder 27 around the 5300 ml plastic bottle.



3 Position the Body 18 on the plastic bottle and secure the coil on the bottle using the belts.

4 Position the coil with the plastic bottle on the phantom holder 26 so that the coil cable points toward the bottom of the phantom holder.

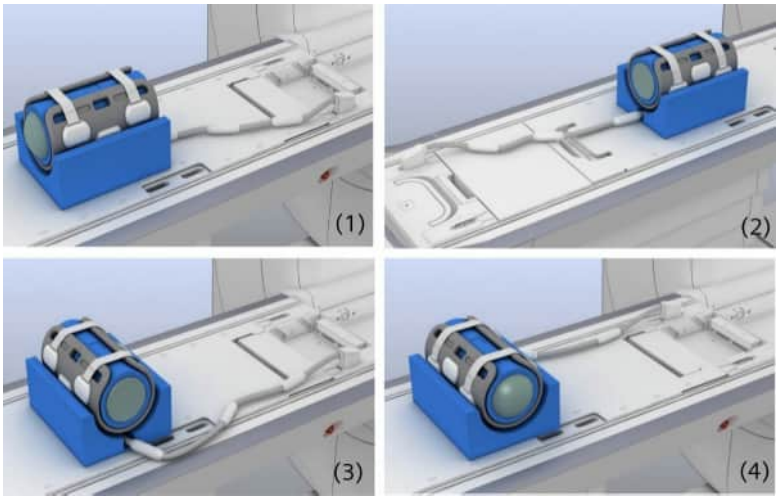
5 Ensure that the coil cable is routed through the groove on the bottom of the phantom holder.

6 Connect the coil plug to a suitable socket.

7 Align the laser-light localizer with the center of the coil.

8 Start the quality measurement.

9 Perform the measurement successively for each orientation.



(1) Quality measurement, head first orientation
(2) Quality measurement, feet first orientation
(3) Quality measurement, left side
(4) Quality measurement, right side

6.16 Body 6

6.16.1 Description

The Body 6 enables examinations of the following body regions:

- Upper body and abdomen
- Pelvis

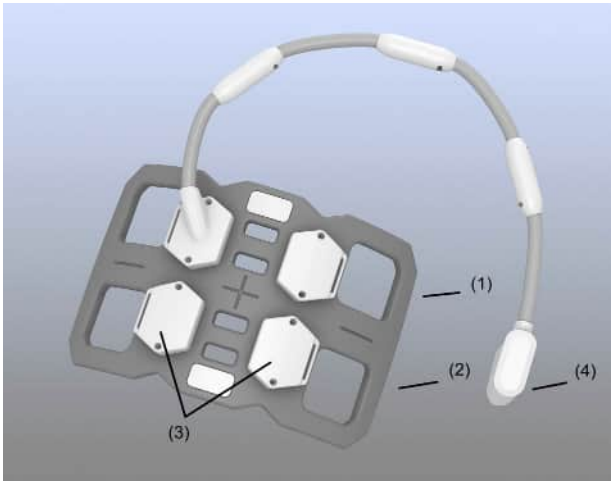
Depending on the requirements, the coil may be used in the head first or feet first orientation. Several Body 6 coils can be used for complete upper body examinations.

This coil is not available for all systems. For a list of supported coils, refer to the system owner manual for the respective system.

Accessories (➔ Page 290 *Coil accessories*)

Configuration

The coil consists of the following components:



(1) Cluster 1
(2) Cluster 2
(3) Electronic boxes
(4) Coil plug

For some MR systems, the Body 6 coil is also available as Body 6 Long with an extended coil cable. Use and handling are the same as for the Body 6.

6.16.2 Use

In the following section, an examination of the entire upper body is shown. Two Body 6 coils are used and the patient is positioned *head first*.

Safe handling

1 Always position the Body 6 so that the coil cable does not touch the patient's head.

2 Use the iPAT cushion for a more homogeneous image contrast.

3 Do not bend the coil too much (for example, for ankle examinations) as this may damage the coil. If you bend the coil, ensure that the resulting diameter of bending is larger than 150 mm.

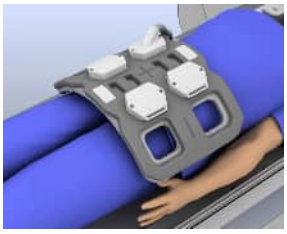
Positioning the coil

✓ The spine coil is positioned on the patient table.

✓ The lower part of the head/neck coil is positioned.

1 Position the patient in the supine position with the head toward the magnet.

2 Use suitable positioning aids.



3 Position the Body 6 on the patient's pelvis and connect the coil to socket 1 or 2.

4 Position the second Body 6 so that it overlaps the first and is lying against its electronic boxes.

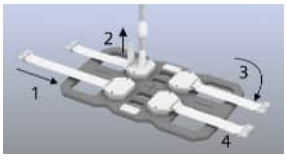
5 Slide the second iPAT cushion under the second Body 6 without overlapping with the first iPAT cushion.

6 Check that the coils fit together, they have been designed to fit.

7 Connect the coil to the next open coil socket.

8 Secure the connection cable with the cable holders.

Securing the coil combination



1 Slide the belts as shown through the flaps of the Body 6.

2 Secure both coils using the belts provided.

3 Secure the patient with an additional belt. Route the belt over the overlapping area of the coil combination.

Performing the measurement

1 Align the laser-light localizer with the center of the region of interest.

2 At the *syngo* Acquisition Workplace, select the two (up to four, depending on the coil configuration) corresponding clusters of the spine coil.

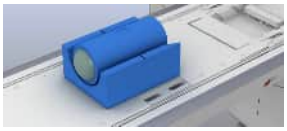
3 Start the measurement.

6.16.3 Quality measurement

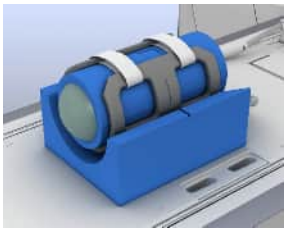
The quality measurement must be performed in the head first orientation. In addition, the measurement must also be performed with the coil rotated by 180 °.

✓ The spine coil is positioned on the patient table.

1 Position phantom holder 40 on the table.



2 Place the phantom holder 27 around the 5300 ml plastic bottle.



3 Place the Body 6 around the plastic bottle and secure the coil on the bottle using the belts.

4 Position the coil with the plastic bottle on the phantom holder 40 so that the coil cable points toward the groove on the side of the phantom holder.

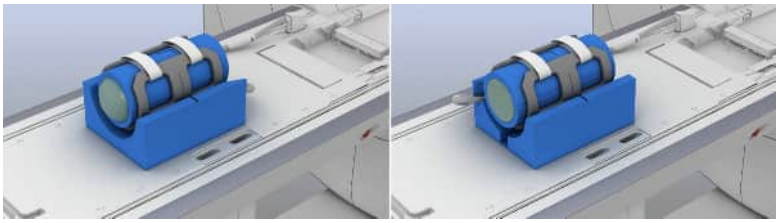
5 Ensure that the coil cable is routed through the groove on the side of the phantom holder.

6 Connect the coil plug to a coil socket 1 or 2.

7 Align the laser-light localizer with the center of the coil.

8 Start the quality measurement.

9 Perform the measurement successively for each orientation.



(1) Quality measurement, head first 0 ° orientation
(2) Quality measurement, head first 180 ° orientation

6.17 Body 30/Body 60

6.17.1 Description

The Body 30 enables examinations of the following body regions:

- Upper body, abdomen, liver
- Pelvis
- Heart

Depending on the requirements, the coil may be used in the head first or feet first orientation.

The Body 30 can be used as an anterior coil in combination with a spine coil, or in combination with a second Body 30 coil as posterior coil. The combination of two Body 30 coils (anterior/posterior) is referred to as “Body 60”.

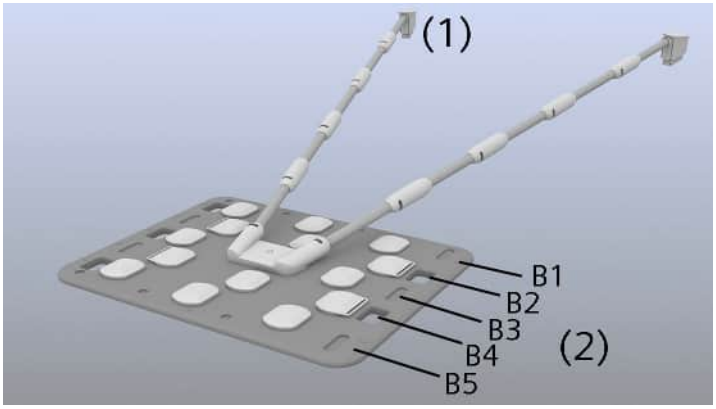
Several anterior coils can be used for complete upper body examinations.

This coil is not available for all systems. For a list of supported coils, refer to the system owner manual for the respective system.

Accessories (➔ Page 296 *Body 30/Body 60*)

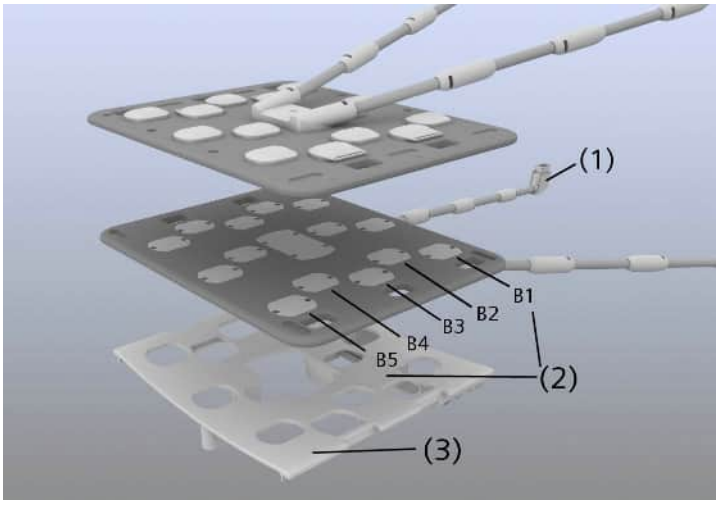
Configuration

The coil consists of the following components:



Body 30

(1) Coil plug
(2) Coil element rows (clusters B1-B5)



Body 60 setup

(1) Coil plug
(2) Coil element rows (clusters B1 - B5)
(3) Frame to use the Body 30 as posterior coil

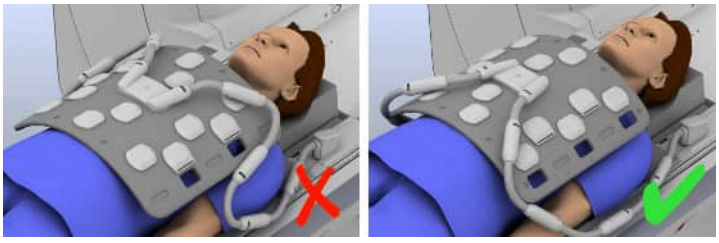
6.17.2 Use

In the following section, two examinations are described:

- Examining the upper body with one or two Body 30 anterior coils
- Examining the upper body with the Body 60 (two Body 30 coils anterior/posterior)

Safe handling

1 Always position the Body 30 so that the coil cables do not touch the patient's head.



2 Secure the cables with the cable holders in the elongated holes of the patient table.

3 Do not bend the coil too much (for example, for ankle examinations) as this may damage the coil. If you bend the coil, ensure that the resulting diameter of bending is larger than 150 mm.

4 Secure the coils using the Velcro® straps.

Using the Body 30

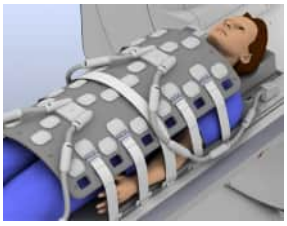
✓ The spine coil is positioned on the patient table.

✓ The lower part of the head coil is positioned.

1 Position the patient in the supine position with the head toward the magnet.

2 Use suitable positioning aids.

3 Position the Body 30 on the patient's pelvis and connect the coil to sockets 1 and 2.



4 If required, position a second Body 30 so that it overlaps the first and is lying against its electronic boxes.

5 Connect the coil to the coil sockets 3 and 4.

For two anterior coils, you must first connect both coil plugs of the first coil and then both coil plugs of the second coil.

6 For slender patients: Position the Body 30 rotated by 90°.

7 Connect the coil to coil sockets 1 and 3, or 2 and 4.

8 Secure the connection cable with the cable holders.

Using the Body 60

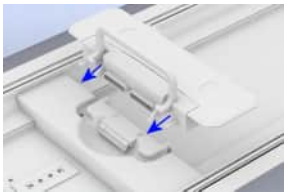
The Body 30 can be positioned in a frame and can then be used as posterior coil. Together with a second Body 30 as anterior coil, this setup is called “Body 60”.

✓ The spine coil or the table pads are removed from the patient table.

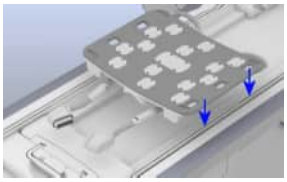
1 Lay the Body 30 with the coil cables on the upper side on a plane surface.

2 Route the coil cables through the recess of the frame and position the frame on the coil so that the cable outlets of the coil and the electronic boxes fit in the corresponding recesses.

3 Fix the coil cables on the cable holders on the lower side of the frame.



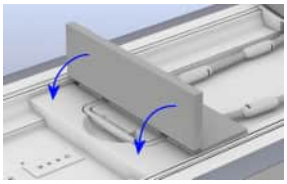
4 Connect the adapter to the spine coil sockets.



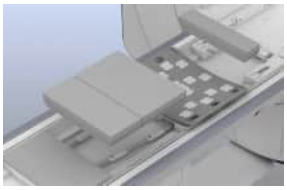
5 Insert the frame with the posterior coil in the T-shaped grooves on both sides of the patient table.

6 Slide the frame to the desired position on the patient table.

7 Connect the posterior coil to the adapter coil sockets.

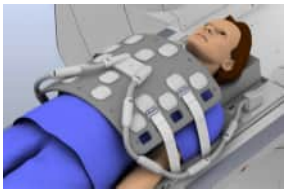


8 Position the Body 30 table pad 4 on the adapter and fold it down to cover the coil sockets.



9 Position the table pads on the patient table as required for the current coil position.

10 Position the patient on the posterior coil with the head toward the magnet.



11 Position the anterior coil on the patient and secure the coil with the Velcro® straps.

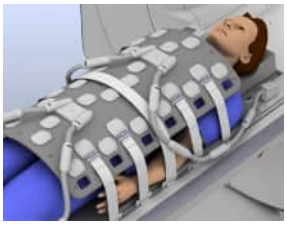
12 Connect the anterior coil to coil sockets 1 and 2.

13 Secure the coil cables with the cable holders.

When you use the Body 60 setup, ensure that the posterior and the anterior coils are positioned accurately above each other to avoid possible image artifacts.

You can furthermore position another Body 30 anterior coil.

Performing the measurement



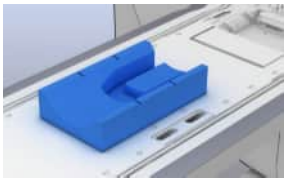
1 Align the laser-light localizer with the center of the region of interest.

2 Start the measurement.

6.17.3 Quality measurement

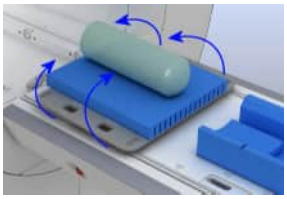
The quality measurement is performed in the head first and feet first orientation. The setup is identical for both orientations. The measurement must also be performed with the coil rotated by 90° for the left and the right side.

✓ The spine coil is positioned on the patient table.



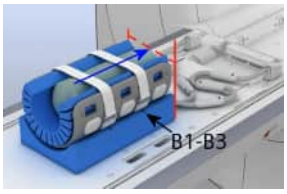
1 Position phantom holder 46 on the table with the recesses for the coil cables towards the magnet.

2 Position the Body 30 on a plane surface, for example the patient table.



3 Position the phantom holder 47 and the 5300 ml plastic bottle on the Body 30.

4 Wrap the coil and the phantom holder 47 around the plastic bottle and secure the setup using the straps.

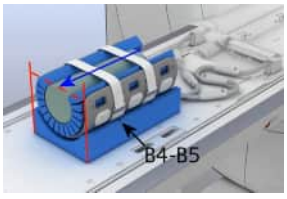


5 Align the plastic bottle and the phantom holder 47 with the edge of the coil on the side of the cable outlets.

6 Connect the coil plugs to suitable sockets.

7 Align the laser light localizer with the second row of the electronic boxes of the coil.

8 Start the quality measurement for clusters B1-B3.



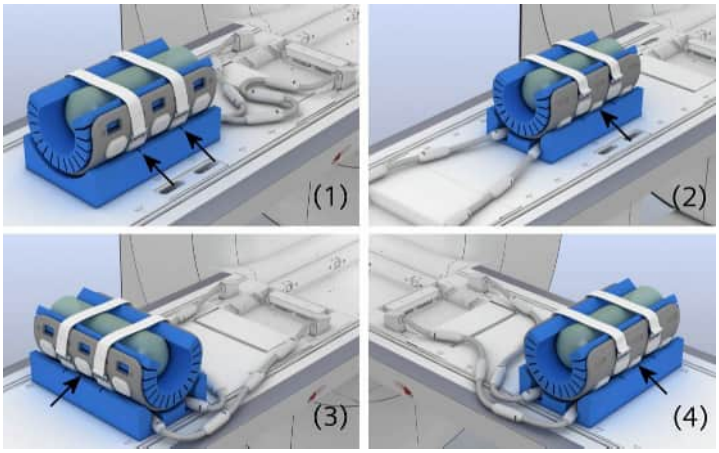
9 Align the plastic bottle with the phantom holder 47 on the other edge of the coil and secure the coil with the straps.

10 Align the laser light localizer with the fourth row of the electronic boxes of the coil.

11 Start the quality measurement for clusters B4-B5.

12 Afterwards, perform the measurements successively for the orientations left and right:

Turn the setup in each direction and align the laser light localizer with the third row of the electronic boxes of the coil.



(1) Quality measurement, head first orientation
(2) Quality measurement, feet first orientation
(3) Quality measurement, left side
(4) Quality measurement, right side

6.18 Contour 24/Contour 48

6.18.1 Description

The Contour 24 coil enables examinations of different body regions. Depending on the area to be examined, the coil is positioned on the patient and is used to image the area of the body that it covers, for example, the abdomen.

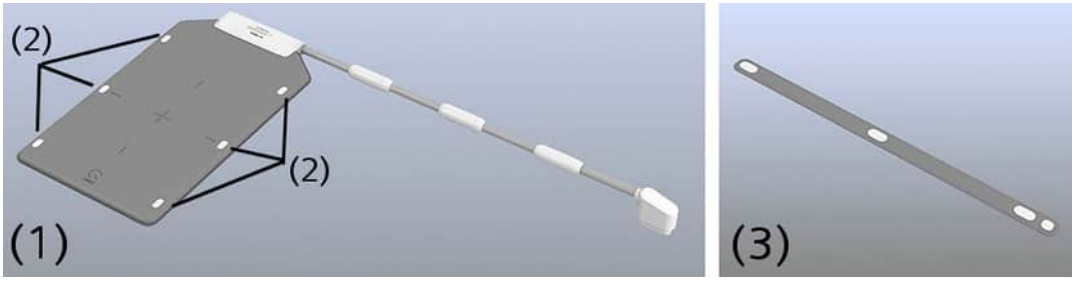
You can combine two Contour 24 coils with the Velcro adapter strap to form the Contour 48.

This coil is not available for all systems. For a list of supported coils, refer to the system owner manual for the respective system.

Depending on the requirements, the coil may be used in the head first or feet first orientation.

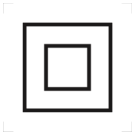
Configuration

The coil consists of the following components:



(1) Contour 24 coil
(2) Velcro pads for attaching the Velcro adapter strap
(3) Velcro adapter strap for combining two coils

This label is located on the coil and reminds you to read the operator manual.



Class II label

Intended use

The Contour 24 is intended for use with Siemens 1.5T and 3.0T MR systems to produce diagnostic images of general human anatomy that can be interpreted by a trained physician.

6.18.2 Use

Safe handling

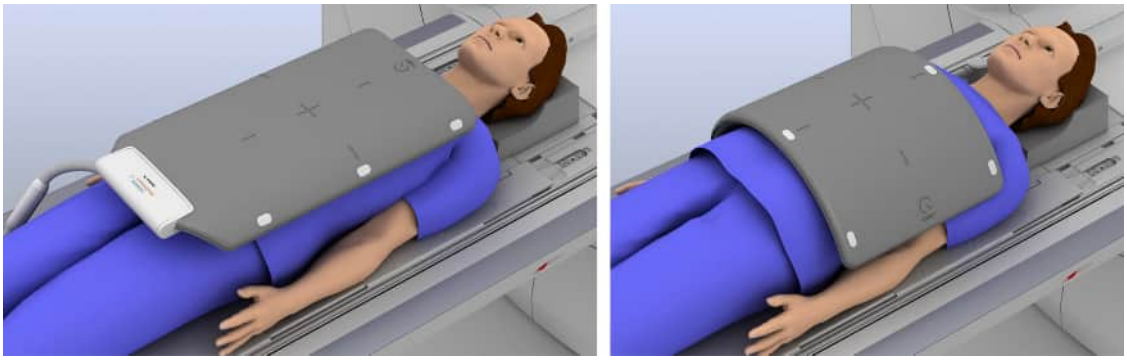
1 Always position the coil so that the coil cable does not touch the patient's head.

2 Since the coil is not made of breathable material, use table sheets and/or covers to prevent the coil surface from touching the patient in order to enhance patient comfort.

3 Attach the cable to the cable holders in the elongated holes of the patient table.

Using the coil

As an example, the examination of the patient's abdomen is described.



The procedure for examining other body regions or for using other patient positions is similar.

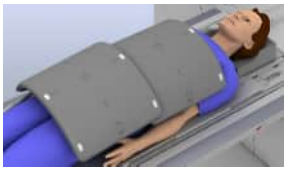
✓ The spine coil is positioned on the patient table.

1 Position the patient in the supine position with the head pointing toward the magnet.

2 Use suitable positioning aids.

3 Position the Contour 24 coil on the patient's abdomen and connect the coil to coil socket 1.

Using the contour 48 configuration

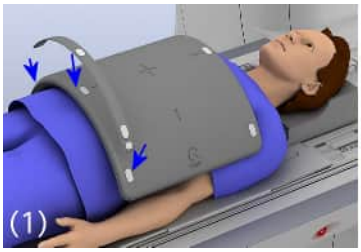


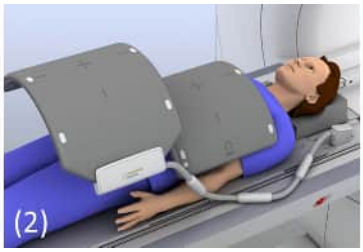
You can combine two Contour 24 coils with the Velcro adapter strap to form the Contour 48.

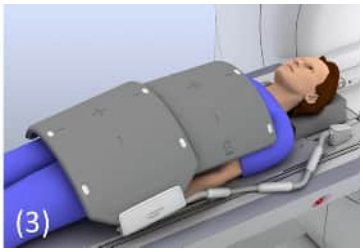
✓ The spine coil is positioned on the patient table.

1 Position the patient in the supine position with the head pointing toward the magnet.

2 Position the first Contour 24 coil on the patient and connect the coil to coil socket 1.





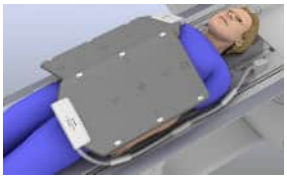


3 Attach the Velcro adapter strap to the Velcro pads along the edge of the first Contour 24 coil. The Velcro pads are on the reverse side of the cable outlet. Ensure that the strap is attached to all three Velcro pads.

4 Position the second Contour 24 coil so that it overlaps the first coil, with the Velcro pads positioned directly over the Velcro adapter strap.

For a better balance of the coil combination on the patient, you should position the two coils with their boxes (cable outlets) on opposite sides.

5 Connect the second coil to coil socket 2.



6 You can also use the coil combination with the cable outlets pointing to the head and feet. This positioning may be useful for larger patients.

If necessary, adjust the position of the coil combination according to your needs.

7 If necessary, use standard positioning accessories to secure the coil combination. For example, use straps.

Performing the measurement

1 Align the laser-light localizer with the center of the region of interest.

2 Start the measurement.

6.18.3 Quality measurement

✓ The spine coil is positioned on the patient table.

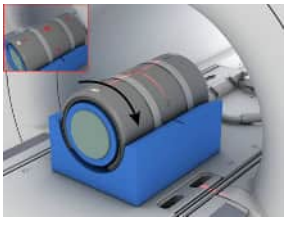
1 Position phantom holder 26 on the table.

2 Place the 5300-ml plastic bottle inside the phantom holder 27.

3 Position the Contour 24 coil between the phantom holder 26 and the plastic bottle.

4 Secure the coil on the bottle using the straps.

5 Position the coil with the plastic bottle on the phantom holder 26 so that the coil cable points toward the magnet.



6 Rotate the coil by 180 degrees so that the center marking of the coil (embossed cross) points upward.

7 Connect the coil plug to socket 1 or 2.

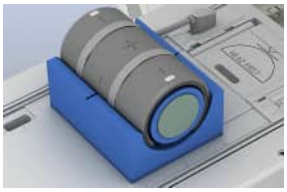
8 Align the laser-light localizer with the center marking of the coil.

9 Start the quality measurement for the head orientation (center marking pointing up).

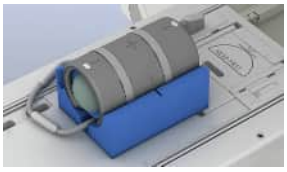
10 Move the table into the Home position.

11 Perform the quality measurement for each of the following orientations.

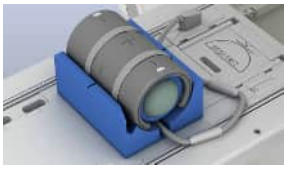
To measure these orientations, it is not necessary to use the laser-light localizer or to move the table into the magnet bore.



12 Left orientation: Rotate the phantom setup by 90 degrees so that the cable points to the left, and start the measurement.



13 Feet orientation: Rotate the phantom setup by 90 degrees so that the cable points to the foot end of the table, and start the measurement.



14 Right orientation: Rotate the phantom setup by 90 degrees so that the cable points to the right, and start the measurement.

6.19 Endorectal

6.19.1 Description

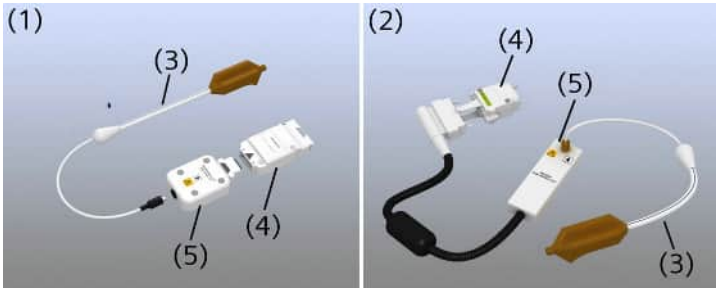
The Endorectal coil is suitable for examinations of the prostate, colon, and Cervix Uteri. The coil is used only in the *feet first* orientation. The spine coil and a body coil are required for the examination.

The coil is a disposable coil and used only once.

Accessories (→ Page 290 *Coil accessories*)

Configuration

The coil consists of the following components:



(1) Endorectal coil for 1.5T systems
(2) Endorectal coil for 3T systems
(3) Disposable coil
(4) Endorectal Adapter
(5) Endorectal Interface

6.19.2 Use

Contraindications

The Endorectal coil cannot be used if one of the following applies:

- Major surgery in the rectal area
- Minor surgery within the last eight weeks (except for transrectal needle biopsy)
- Inflammatory intestinal diseases causing impairments of the rectum and the surrounding structures (e.g. ulcerative colitis, Crohn's syndrome)
- Strictures due to radiation therapy
- Obstructive masses within the rectum
- Complicated haemorrhoids

Safe handling

CAUTION

Improper use of the Endorectal coils and interface!

Injury/burns to patient; incorrect diagnosis

- Adhere to the operator manual supplied by the manufacturer of the Endorectal coil.
- Only use the Endorectal coils once unless otherwise specified.
- Do not clean or sterilize Endorectal coils.
- Only use the Endorectal Interface.
- To avoid damage, store the Endorectal Interface as described.

Avoid cable loops, observe the operator manual

This label is located on the Endorectal Interface (3T).

CAUTION

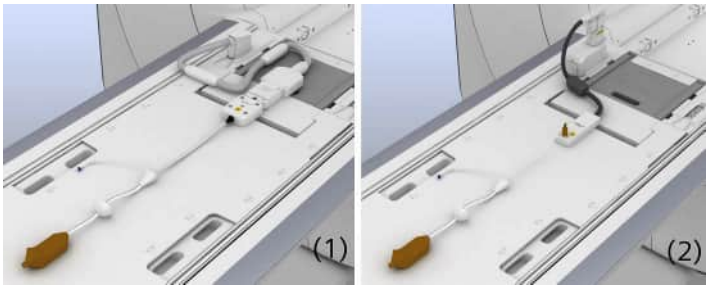
Incorrect positioning of patient and coil!

Patient burns

- Ensure that the patient is in the supine and *feet first* position during the MR examination.
- Position the legs of the patient on the endo cushion.
- Ensure that the Endorectal coil is used only when inserted into the patient's rectum.
- Position the coil in the center and parallel to the axis of the Body coil.
- Ensure that the cable of the Endorectal coil is routed below the endo cushion.
- Do not route wires and cables of the physiological receptors under/next to the coil or coil cable.

Preparing the coil

Use the Flex Coil Interface for 1.5T systems and Tim Coil Interface for 3T systems when using the Endorectal coil.

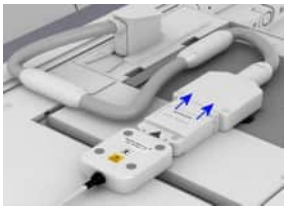


(1) Configuration for 1.5 T
(2) Configuration for 3 T

✓ The spine coil is positioned on the patient table.

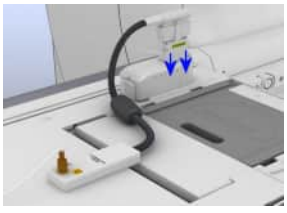
1 Connect the Endorectal coil to the Endorectal Interface.

2 Connect the Endorectal Interface to the Endorectal Adapter.



3 For 1.5T systems: Connect the Endorectal Adapter to the Flex Coil Interface. (➔ Page 279 *Flex Coil Interface*)

– or –



For 3T systems: Connect the Endorectal Adapter to the Tim Coil Interface. (➔ Page 137 *Positioning the patient*)

Preparing the patient

1 Inform the patient about the examination procedure.

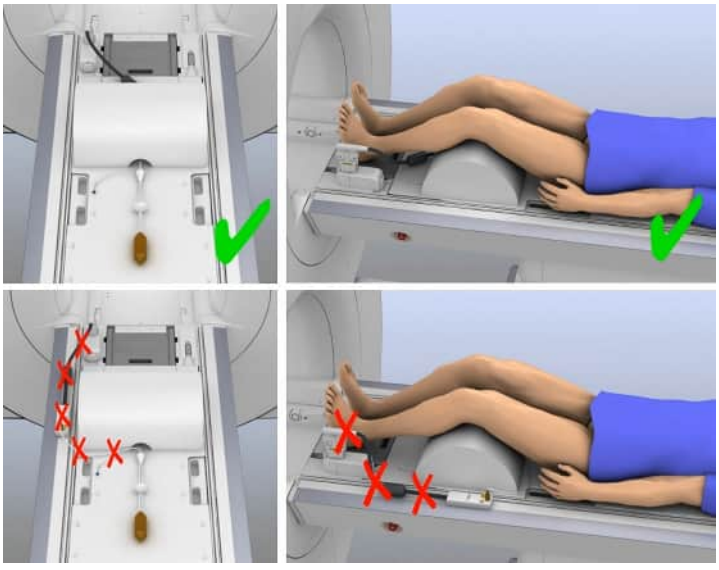
2 Perform a tactile examination of the rectum.

3 Check if the urinary bladder is filled to a maximum of 1/3 of its capacity.

4 Perform a rectal cleaning.

5 If necessary, administer spasmolytics to avoid motion artifacts due to peristalsis.

Positioning



1 Position the patient on his side with the feet toward the magnet bore.

2 Use suitable positioning aids.

3 Ensure that the blue line on the coil shaft is pointing in the ventral direction.

4 Insert the coil into the patient's anus.

For easier penetration, apply gel (e.g. Install-Gel) to the coil head.

Coil cables and coil connectors must remain dry.

5 Inject approx. 100 ccm of air into the coil using a conventional syringe. Ensure that the patient can tolerate the air volume.

6 Position the migration stop directly on the patient's anus.

This prevents cranial migration of the coil.

7 Turn the patient into the supine position.

8 Position the legs of the patient on the endo cushion. Ensure that the coil cable is routed through the tunnel of the endo cushion.

9 To ensure optimal image quality, verify that the coil is properly and securely positioned.

10 Position a body coil on the patient's lower abdomen and connect the coil plug.

Performing the measurement

1 Align the laser-light localizer with the center marking of the body coil.

2 At the *syngo* Acquisition Workplace, select two clusters of the spine coil in the examination area located under the body coil.

3 Start the measurement.

6.19.3 Quality measurement

Use the quality assurance coil for quality measurements.

✓ The Endorectal Interface and the Endorectal Adapter are positioned and connected.

✓ For 1.5T systems: The Flex Coil Interface is positioned and connected.

✓ For 3T systems: The Tim Coil Interface is positioned and connected.

Measuring 1.5T systems

1 Place the Endorectal coil simulator on the patient table.

2 Position the special phantom in the Endorectal coil simulator.

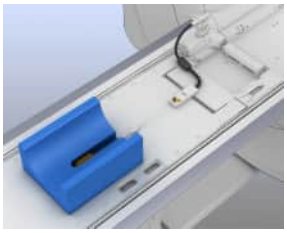
3 Connect the Endorectal coil simulator to the Endorectal Interface.

4 Ensure that the cable of the coil simulator is fully extended.

5 Align the laser light localizer with the center of the special phantom for the Endorectal coil.

6 Start the quality measurement. (➔ Page 282 *Performing quality assurance (software)*)

Measuring 3T systems

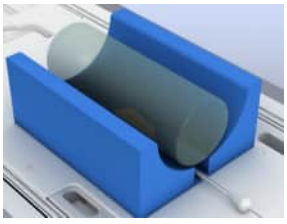


1 Place phantom holder 26 on the patient table.

2 Position the coil head in the groove on the bottom of the phantom holder.

3 Ensure that the blue line on the coil shaft is pointing upward.

4 Connect the coil to the Endorectal Interface.



5 Position the 5300 ml plastic bottle on the coil.

6 Position the laser light localizer at the center of the 5300 ml plastic bottle.

7 Start the quality measurement. (➔ Page 282 *Performing quality assurance (software)*)

6.20 Breast 18

6.20.1 Description

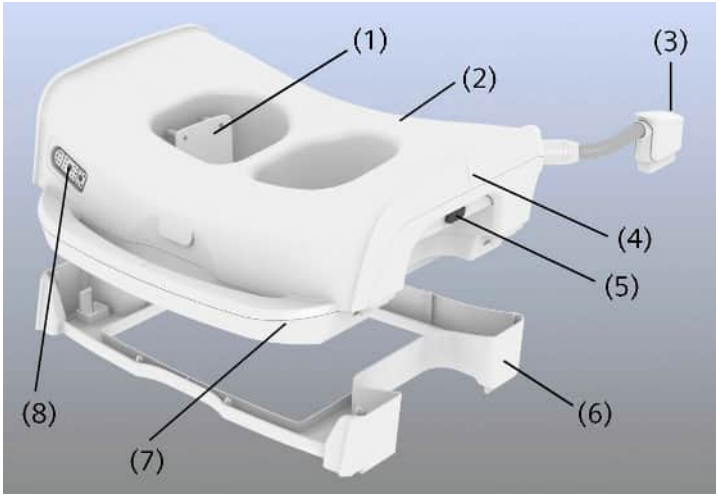
The Breast 18 is used for examining female patients. Depending on the requirements of the examination, the coil may be used in the head first or feet first orientation.

Both sides of the breast are displayed simultaneously to allow for comparative evaluations.

Accessories (➔ Page 288 *Standard accessories*)

Configuration

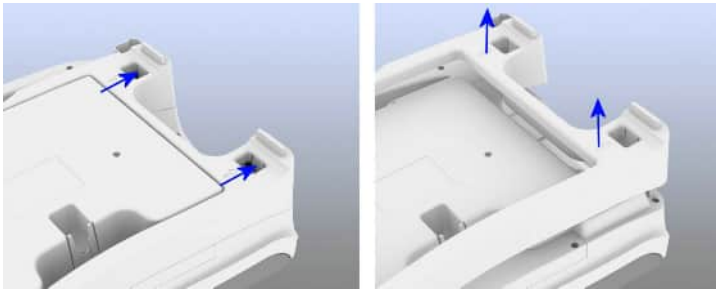
The coil consists of the following components:



(1) Breast fixations
(2) Coil
(3) Coil plug
(4) Center marking
(5) Knobs to adjust the breast fixations
(6) Base plate (not used on all MR systems)
(7) Coil handle
(8) Park position for coil plug

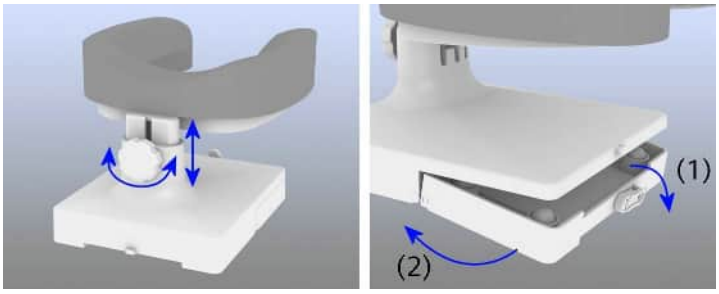
Base plate

The base plate is attached to the bottom of the coil. For some systems, the base plate must be removed before positioning the coil. To remove the base plate, you use the clamps on the lower side and lift it off.

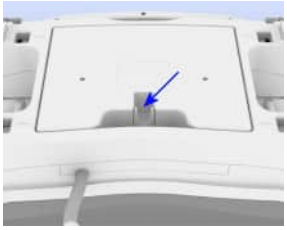


Head support

The head support can be adjusted in height. To position the head support for feet first examinations on the table, the pedestal can partly be turned down.



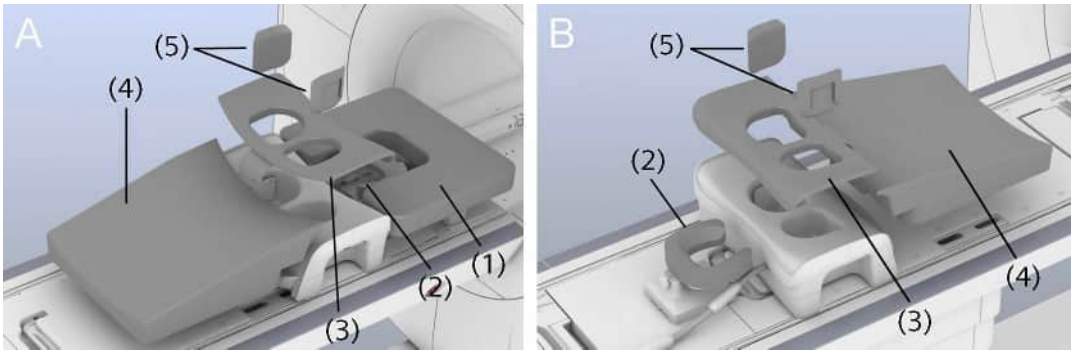
Opening for spectroscopy reference probe



On the bottom of the coil you can mount the spectroscopy reference probe in the corresponding holder.

Positioning aids

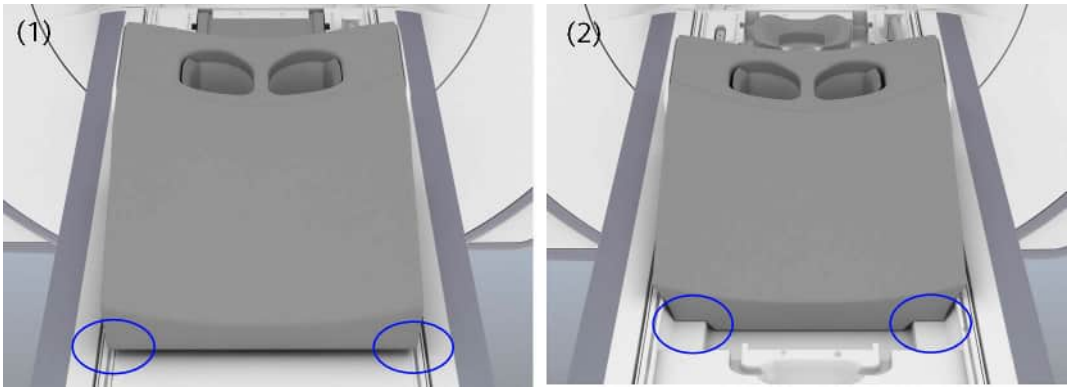
For patient comfort, there are several positioning aids and cushions for the Breast 18. Depending on the orientation, the cushions are positioned as shown in the following images.



Positioning the Breast 18 cushions for *head first* orientation (A) and for *feet first* orientation (B) on systems using the spine coil

(1) Arm rest pad (only when positioning the patient with the hands above the head)
(2) Head support pad
(3) Coil pad
(4) Body pad 70
(5) Cushions for the breast fixations

The design of the body pad can vary with regard to the corresponding use case.



(1) Body pad 70: standard pad for use on a spine coil
(2) Body pad 60: pad with shaped edges suitable for use directly on the table (without spine coil)

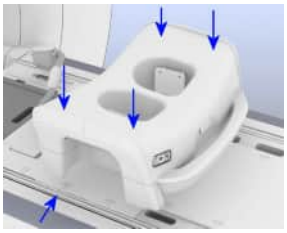
6.20.2 Use

The Breast 18 is used with the base plate and usually with a spine coil.

For TimTX TrueShape option only: Special care has to be taken when using the Breast 18 coil on a Siemens MAGNETOM scanner with TimTX TrueShape option. In B1 shimming mode, high B1 fields may occur which may heat the coil housing of the Breast 18 when applied over a relatively long time. In order to avoid heating sensations, make sure that the coil pad is mounted before performing B1 shim.

Positioning the coil head first

✓ The spine coil is positioned on the patient table.



1 Position the coil on the patient table with the guide knobs in the recesses of the T-shaped groove.

2 Connect the coil plug to coil socket 2.

3 Set the breast fixations to a middle position and position the coil pad on the coil and fix it.

4 Cover the breast fixations with the corresponding pads.

CAUTION

Body pad 60 used on spine coil!

Injury of the patient

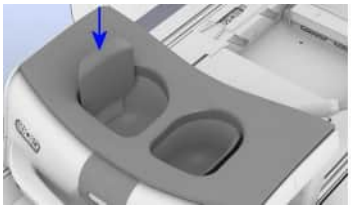
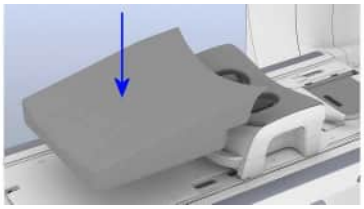
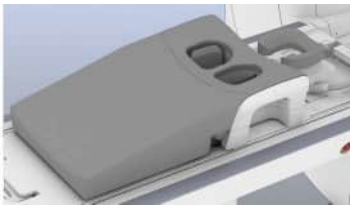
Instable position; shaped edges of body pad 60 may lead to tilt

- Only use body pad 70 on the spine coil.
- Only use body pad 60 directly on the table (without spine coil).

5 Position the body pad 70 on the table so that the body pad fits into the handle of the coil.

6 Position the head support in front of the coil.

7 When positioning the patient with the arms above the head: Also position the arm rest pad in front of the coil.

Optional use case: Positioning the coil without spine coil

In exceptional cases (for example, for an enlarged Field of View), it might be necessary to position the coil without the spine coil on the table.

CAUTION

Positioning of the Breast 18 without the spine coil leads to a decentral position of the coil which may result in loss of image quality!

Incorrect diagnosis

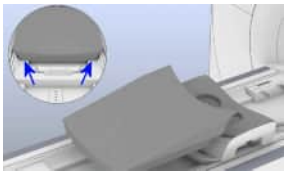
- Only position the Breast 18 directly on the table if really necessary (for example, for an enlarged Field of View). Be aware of reduced image quality.

1 Remove the spine coil from the patient table.

2 Remove base plate from the coil.

3 Position the coil on the patient table with the guide knobs in the recesses of the T-shaped groove.

4 Connect the coil and use the breast fixations as for the standard use case (with spine coil).



5 Position the body pad 60 on the table so that the body pad fits into the table.

6 Position the head support in front of the coil.

7 When positioning the patient with the arms above the head: Also position the arm rest pad in front of the coil.

8 To cover the coil sockets for the spine coil use the table pad Breast 18.

Positioning the coil feet first

✓ Spine coil is positioned on the patient table.

1 Position the coil on the patient table with the guide knobs in the recesses of the T-shaped groove.

2 Connect the coil plug to coil socket 4.

3 Set the breast fixations to a middle position and position the coil pad on the coil and fix it.

4 Cover the breast fixations with the corresponding pads.

CAUTION

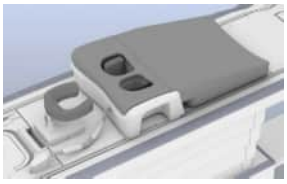
Body pad 60 used on spine coil!

Injury of the patient

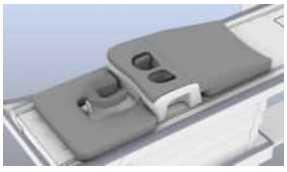
Instable position; shaped edges of body pad 60 may lead to tilt

- Only use body pad 70 on the spine coil.
- Only use body pad 60 directly on the table (without spine coil).

5 Position the body pad 70 on the table so that the body pad fits into the handle of the coil.



6 Position the head support in front of the coil.



7 When positioning the patient with the arms above the head: Also position the arm rest pad in front of the coil.

Optional use case: Positioning the coil without spine coil

In exceptional cases (for example, for an enlarged Field of View), it might be necessary to position the coil without the spine coil on the table.

CAUTION

Positioning of the Breast 18 without the spine coil leads to a decentral position of the coil which may result in loss of image quality!

Incorrect diagnosis

- Only position the Breast 18 directly on the table if really necessary (for example, for an enlarged Field of View). Be aware of reduced image quality.

1 Remove the spine coil from the patient table.

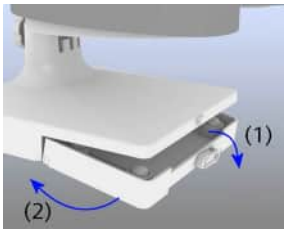
2 Remove base plate from the coil.

3 Position the coil on the table, so that the head end of the coil is aligned with the coil sockets of the spine coil.

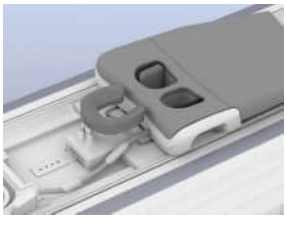
4 Connect the coil and use the breast fixations as for the standard use case (with spine coil).

5 Position the body pad 60 on the table so that the body pad fits into the table.

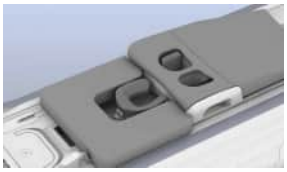
6 Position the table pad 3 on the head end of the patient table to fill the gap between the body pad and the head-heel insert.



7 Prepare the head support: Release the lever on the pedestal of the head support and turn the lower front part of the pedestal down.



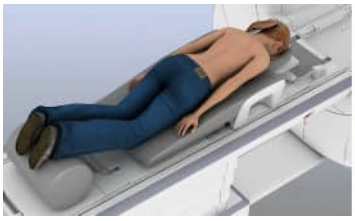
8 Position the head support on the table so that the edge on the bottom fits on the coil sockets 7 and 8 in the middle of the table.



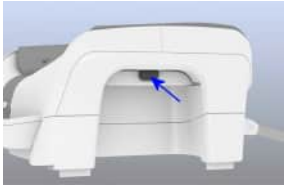
9 When positioning the patient with the arms above the head: Also position the arm rest pad in front of the coil.

Positioning the patient

✓ Breast fixations are in the outermost position.



1 Position the patient in the prone position with the breasts in the recesses.



2 Depending on the female patient, adjust the breast fixations: Push and hold the buttons on both sides of the coil and move the breast fixations. To fixate the position release the buttons so that the breast fixation locks in the current position.

3 When positioning the patient with the arms above the head: Use the insulation pad to avoid current loops.

4 Use suitable positioning aids.

Performing the measurement

CAUTION

Collision when moving into the magnet!

Injury to the patient

- Carefully pay attention to the patient while moving the patient manually into the magnet bore.
- Do not use the **Center Position** button.

1 Align the laser light localizer with the center marking of the coil.

2 Start the measurement.

6.20.3 Quality measurement

The quality measurement of the Breast 18 is performed in the head first orientation.

✓ The spine coil is positioned on the patient table.

✓ The coil is positioned and connected.

✓ The spectroscopy reference probe is removed.

✓ The breast fixations are in the outermost position.

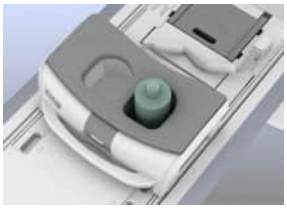
✓ Cushions for the breast fixations are removed.

1 Position the phantom holder 45 in the recesses of the coil.

2 Position the 1900 ml plastic bottle in the left recess of the coil.

3 Align the laser-light localizer with the center marking of the coil.

4 Start the quality measurement. (➔ Page 282 *Quality assurance*)



5 Position the 1900 ml plastic bottle in the right recess of the coil.

6 Align the laser-light localizer with the center marking of the coil.

7 Start the quality measurement. (➔ Page 282 *Quality assurance*)

6.21 Breast biopsy coils

The following breast coils may be available for your system:

- 4 Ch BI Breast / 16 Ch AI Breast
- Breast BI 7
- 2-/4-/8-Channel Sentinelle Breast Coil
- 2-/10-/16-Channel Sentinelle Breast Coil

For detailed information, please refer to the individual operator manuals of these coils.

For a list of coils supported by your system, refer to the system owner manual.

6.22 Shoulder Shape 16

6.22.1 Description

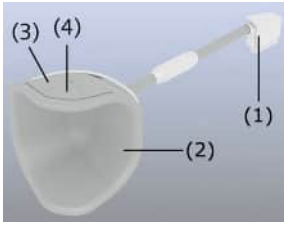
The Shoulder Shape 16 is used for examining the shoulder and is equipped with a flexible shoulder cup.

This coil is not available for all systems. For a list of supported coils, refer to the system owner manual for the respective system.

Accessories (➔ Page 290 *Coil accessories*)

Configuration

The coil consists of the following components:



(1) Coil plug
(2) Shoulder coil cup
(3) Velcro area
(4) Center marking

6.22.2 Use

In the following section, the examination of the left shoulder is shown.

✓ The spine coil is positioned on the patient table.

✓ The head-heel insert and the back-of-the-head support are positioned on the patient table.

1 If necessary, position the L-shaped holder in the groove of the table to border the coil in x direction.

2 Position the patient in the supine position with the head toward the magnet bore.

3 Position the shoulder coil cup on the patient's shoulder against the L-shaped holder.

4 If necessary, place a thin cushion under the shoulder. Use positioning aids best suited to the current situation.

5 Use straps to secure the shoulder coil cup. You can use Velcro straps, you affix on the back and on the front of the coil cup. Or you can place the table straps across the patient to secure the cup.

You can also use the body strap to affix the coil to the patient.

6 Connect the coil plug of the shoulder coil cup to the coil socket (left shoulder: 2, right shoulder: 1).

Performing the measurement

1 Align the laser-light localizer with the center marking of the coil.

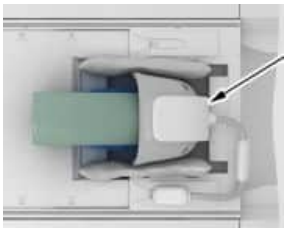
2 Start the measurement.

6.22.3 Quality measurement

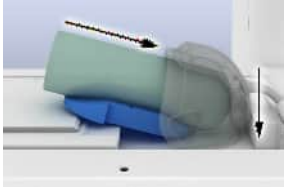
✓ The spine coil is positioned on the patient table.

✓ Head-heel insert and the table pad 4 are removed.

1 Position phantom holder 25 in the gap at the head end of the patient table.



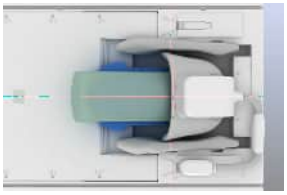
2 Position the 5300 ml plastic bottle on the phantom holder so that the bulge of the bottle is facing the magnet bore.



3 Position the coil on the plastic bottle so that the bulge of the plastic bottle fits into the coil cup.

4 Position the setup (phantom holder, bottle and coil) as far as possible at the head end of the table and stabilize the coil with sandbags.

Position the setup so that the coil is completely on the table and the phantom bottle is positioned in the coil up to the end stop.



5 Connect the coil plug to sockets 1 or 2.

6 Align the laser-light localizer with the edge of the coil as shown in the quality assurance setup picture.

7 Start the quality measurement.

6.23 Shoulder Small/Large 16

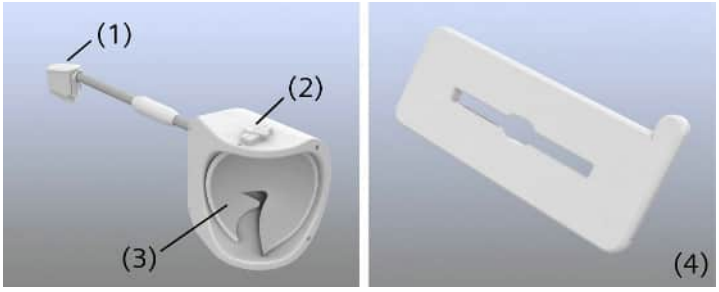
6.23.1 Description

The Shoulder Small/Large 16 is used for examining the shoulder.

Accessories (→ Page 290 *Coil accessories*)

Configuration

The coil consists of the following components:



(1) Coil plug
(2) Guide knob with center marking
(3) Shoulder coil cup with shoulder cup cushion
(4) Base plate

6.23.2 Use

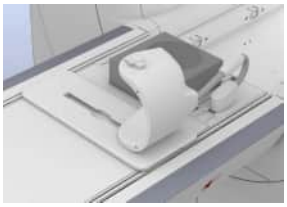
For optimal image quality with slim patients, the shoulder coil cup should be positioned at the inner position on the base plate. The outer position should be used only for muscular and adipose patients.

Positioning the coil

In the following section, the examination of the left shoulder is shown.

✓ The spine coil is positioned on the patient table.

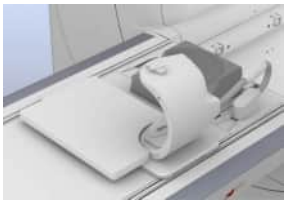
✓ The head-heel insert and the back-of-the-head support are positioned on the patient table.



1 Position the base plate at the head end of the patient table. Ensure that the base plate is seated correctly in the recess.

2 Slide the shoulder coil cup onto the guide rail for the shoulder to be examined.

3 Connect the coil plug of the shoulder coil cup to the coil socket (left shoulder: 2, right shoulder: 1).



4 Position the corresponding base plate cushion, depending on the position of the coil cup.

5 Place the positioning aids suitable for the current situation.

For example, place the lordosis cushion to bridge the spine coil and the base plate.

Positioning the patient

1 Position the patient in the supine position with the head to the magnet.

2 Align the shoulder coil cup on the guide rail so that it adapts to the shape of the patient's shoulder.

3 Ensure the most isocentric position for the shoulder to be examined to obtain optimal image quality.

Make sure that the distance between the coil cable and the patient's head is sufficient.

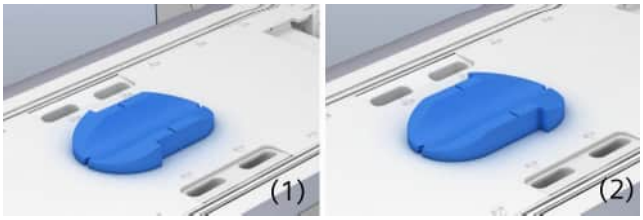
Performing the measurement

1 Align the laser-light localizer with the center marking of the coil.

2 Start the measurement.

6.23.3 Quality measurement

✓ The spine coil is positioned on the patient table.



(1) Position of the phantom holder: Shoulder Small 16
(2) Position of the phantom holder: Shoulder Large 16

1 Position the phantom holder 25 on the patient table.

2 Position the 5300 ml plastic bottle on the phantom holder so that the bulge of the bottle is facing the magnet tunnel.

3 Position the coil on the plastic bottle, so that the bulge of the plastic bottle fits into the coil cup.

4 Connect the coil plug to sockets 1 or 2.

5 Align the laser-light localizer with the center marking of the coil.

6 Start the quality measurement.

6.24 Hand/Wrist 16

6.24.1 Description

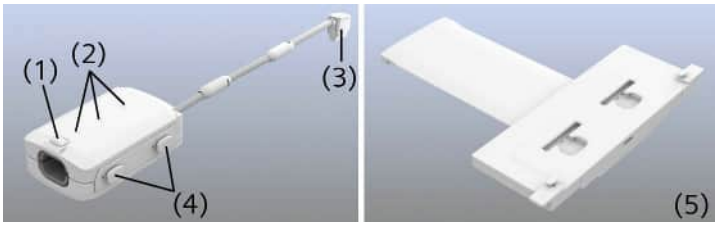
The Hand/Wrist 16 is used to examine wrists, hands, and fingers.

Depending on the requirements, the coil may be used with the patient in the *head first* (prone position) or *feet first* (supine position) orientation. For the *feet first* orientation, the coil is positioned on the base plate.

Accessories (➔ Page 290 *Coil accessories*)

Configuration

The coil consists of the following components:



(1) Unlocking mechanism
(2) Center markings
(3) Coil plug
(4) Guide knobs
(5) Base plate

6.24.2 Use

In the following section, the examination of the right hand is described for the following table positions:

- Supine/feet first:

  Coil is located in vertical direction on the lateral guide rail

- Prone/head first:

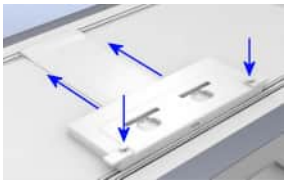
  Coil is located in horizontal direction on the patient table

All measurements (including quality measurement) with the Hand/Wrist 16 will function correctly only if the upper part of the coil is fully closed.

The examination procedure of the left hand is analog to the following description - unless the coil is positioned on the opposite side of the patient table.

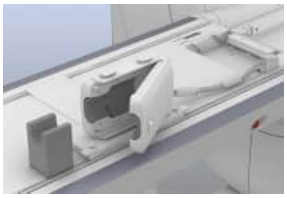
Examining the hand in the supine position

✓ The spine coil or the respective table pads are positioned on the patient table.



1 Position the base plate on the patient table.

2 If required, press on the fixation knob and slide the base plate toward the center of the patient table.



3 Using the guide knobs, slide the coil vertically into the recesses on the base plate until it locks into place.

4 If necessary, use suitable table pads.

5 Place the elbow pad in front of the coil opening.

6 Connect the coil plug to coil socket 2.

Positioning the patient

✓ The back-of-the-head support is positioned.

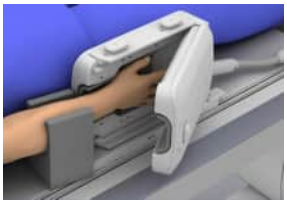
✓ Head-heel insert is positioned on the head end of the patient table.

1 Position the patient in the supine position with the feet toward the magnet.

2 Use suitable positioning aids.

3 Open the upper part of the coil with the unlocking mechanism.

4 Position the wrist pad in the coil.

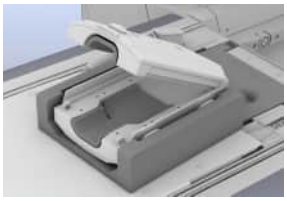


5 Position the patient's hand in the coil and ensure that the pad is positioned correctly.

6 Close the upper part of the coil so that it audibly locks into place.

Examining the hand in the prone position

✓ The spine coil or the respective table pads are positioned on the patient table.



1 Place the Hand/Wrist 16 on the patient table.

2 Center the coil as much as possible.

3 Use suitable table pads for height adjustments.

4 Connect the coil plug to coil sockets 1 or 2.

5 Position the wrist pad in the coil.

Positioning the patient

1 Use suitable positioning aids.

2 Position the patient in the prone position with the head toward the magnet.

3 Open the upper part of the coil with the unlocking mechanism.

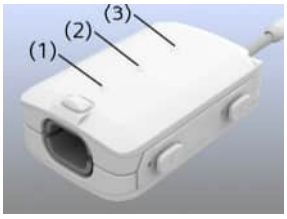
4 Position the patient's hand in the coil and ensure that the pad is positioned correctly.

5 If necessary, use the sandbags to stabilize the coil.

In the horizontal coil position, you can also turn the coil at an angle to adjust it to the patient's position.

6 Close the upper part of the coil so that it locks into place.

Performing the measurement



(1) Center marking for wrist
(2) Center marking for hand
(3) Center marking for fingers

1 Align the laser-light localizer with the corresponding center marking.

2 Start the measurement.

6.24.3 Quality measurement

✓ The spine coil is positioned on the patient table.

1 Place the Hand/Wrist 16 in the center on the patient table.

2 Connect the coil plug to coil sockets 1 or 2.

3 Open the upper part of the coil with the unlocking mechanism.

4 Position the Hand/Wrist 16 phantom so that it is held immobile.

5 Close the upper part of the coil.

6 Align the laser-light localizer with the center marking for the hand.

7 Start the quality measurement.

6.25 Peripheral Angio 36

6.25.1 Description

The Peripheral Angio 36 is suitable for vascular examinations of the lower extremities. Depending on the requirements, the coil may be used in the *head first* or *feet first* orientation.

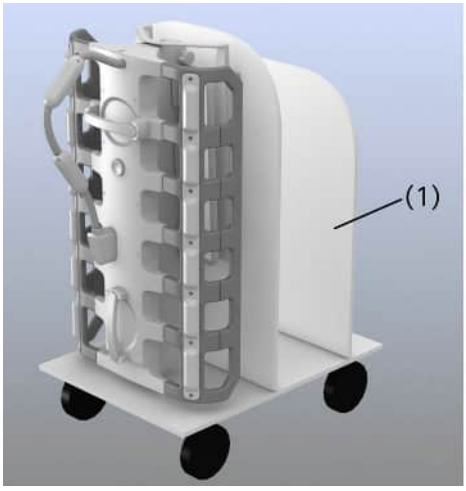
The Peripheral Angio 36 can be used in combination with the spine coil and one or more body coils. The area of examination is expanded by combining these coils.

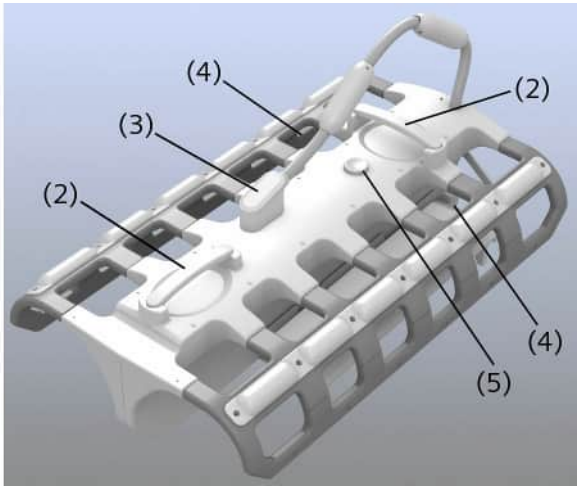
The delivery volume includes a coil cart for storing the coil as well as additional accessories. If the Peripheral Angio 36 is not in use, it should be suspended at the coil cart. The coil connector should remain in the holder in the coil center.

Accessories (➔ Page 290 *Coil accessories*)

Configuration

The coil consists of the following components:





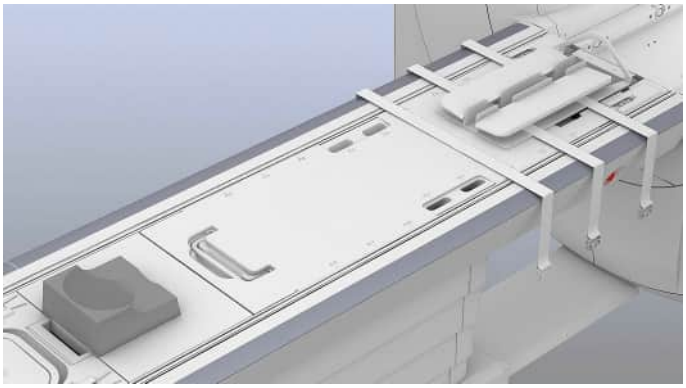
(1) Coil cart
(2) Carrying handles
(3) Coil plug in park position
(4) Coil elements PA1 - PA6 for left and right extremity
(5) Knob for height adjustment

6.25.2 Use

1 Use only the handles for transporting or positioning the Peripheral Angio 36.

2 After using, return the coil to the coil cart and only store the coil there to avoid damages.

Preparing the patient table feet first



✓ The spine coil is positioned on the patient table.

✓ The table pad 3 is positioned.

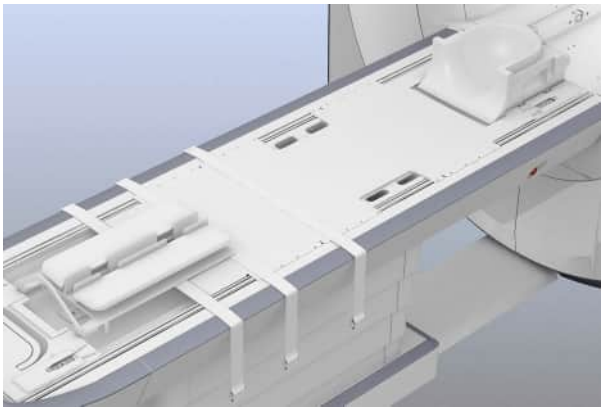
✓ The back-of-the-head support is positioned.

1 Insert the PA leg support into the recess at the head end of the patient table.

2 Move the two PA leg supports up to the end stops in the direction of the magnet.

3 Fold the straps of the PA leg support and move them to the side.

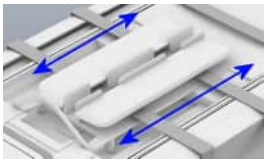
Preparing the patient table head first



✓ The spine coil is positioned on the patient table.

✓ The lower part of the head coil is positioned.

1 Position the PA leg support on the foot end of the patient table.



2 Choose the position corresponding to the height of the patient's body by sliding the PA leg supports accordingly.

3 Fold the straps of the PA leg support and move them to the side.

Positioning the patient

1 Position the patient with his lower legs on the PA leg support.

2 If necessary, use the lordosis cushion.

Positioning the coil

1 Hold the coil by the handles and lift it off the coil cart.

2 Position the coil together with the base between the legs of the patient.

3 Ensure that the base simultaneously contacts the patient's crotch and the spine coil. This is the only way to obtain optimal image quality.

The Peripheral Angio 36 may also be used for obese patients if the base does not contact the spine coil and the flexible side panels do not fully enclose the extremities.

4 If necessary, adjust the position of the patient.

5 Optimize the height of the coil by using the height adjustment.

6 Position the coil so that the flexible side parts are located as closely as possible to the legs.

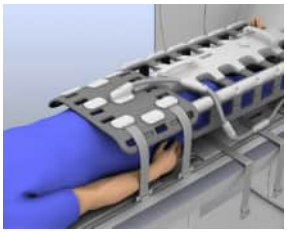
Particularly for obese patients, ensure that the legs or feet do not touch one another.

7 Connect the coil plug of the coil to coil sockets 1 or 2 (*feet first*), or to coil sockets 3 or 4 (*head first*).

8 Stabilize the coil as closely as possible to the legs using the belts.

Positioning the Body 18

In the following section, the additional use of up to two Body 18 coils is described. This is an example only, the Peripheral Angio 36 can also be used with other body coils.

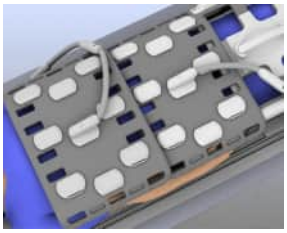


1 Position a Body 18 on the patient's abdomen.

2 Position the Body 18 on the patient's abdomen so that it overlaps with the Peripheral Angio 36 and is lying directly adjacent to the Peripheral Angio 36.

3 Route the coil cable beside the patient to the coil sockets near the patient's head. But ensure that the cable does not touch the head.

4 Connect the coil plug of the Body 18 to the respective coil sockets.



5 Position a second Body 18 on the patient's thorax.

6 Position the Body 18 so that it overlaps with the first Body 18 and is lying against its electronic boxes.

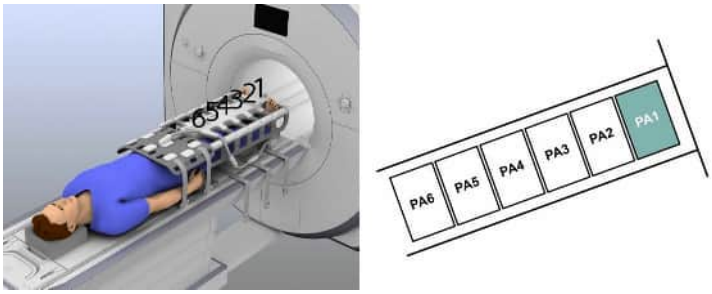
7 Connect the coil plug of the Body 18 to the free coil socket near the patient's head.

8 Ensure that the patient's arms are lying against the body.

9 Secure the Body 18 using straps.

Performing the measurement

In the following section, the measurement for the *feet first* position with two Body 18 coils is described as an example. Measurements in the *head first* position are performed in a comparable manner.



Positions of the coil element pairs 1-6

Measurements are performed in three different stages. During the measurement, the patient table automatically moves a predefined distance. There is no need to reposition the patient.

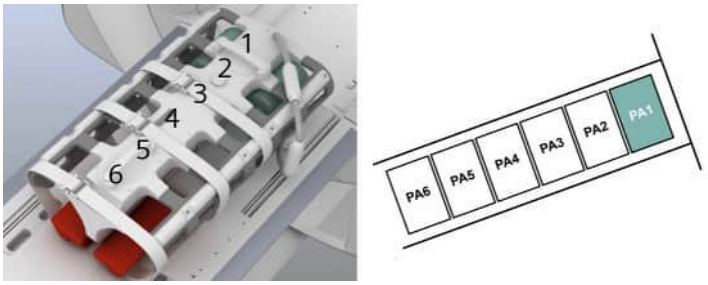
1 Align the laser-light localizer with the desired measurement stage. Use the line markings on the flexible side panels of the coil.

2 Select the coil elements at the *syngo* Acquisition Workplace.

3 Start the measurement.

6.25.3 Quality measurement

The quality measurement for the Peripheral Angio 36 is performed separately for every coil element pair (PA1 - PA6). The plastic bottles must be positioned in the center of the respective coil element for each individual measurement. To simplify positioning, each coil element includes center markings.

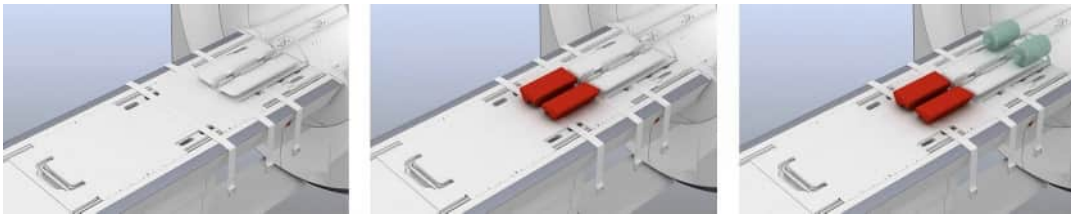


Position of coil element pairs 1-6 (PA1 - PA6) feet first

✓ The spine coil is positioned on the patient table.

✓ There are no cushions at the head end of the patient table.

✓ The two plastic bottles are located at the height of coil element PA1.



1 Position the PA leg support at the head end of the patient table.

2 Place two phantom holders 18 in front of the PA leg support.

3 Place two 1900 ml plastic bottles on the PA leg supports and move them up to the end stop.

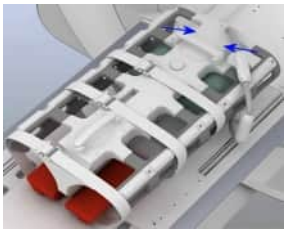
4 Position the Peripheral Angio 36 on the plastic bottles at the end stop of the PA leg support.

5 Ensure that the base of the coil contacts the spine coil (height adjustment).

6 Connect the coil plug to coil socket 1 or 2.

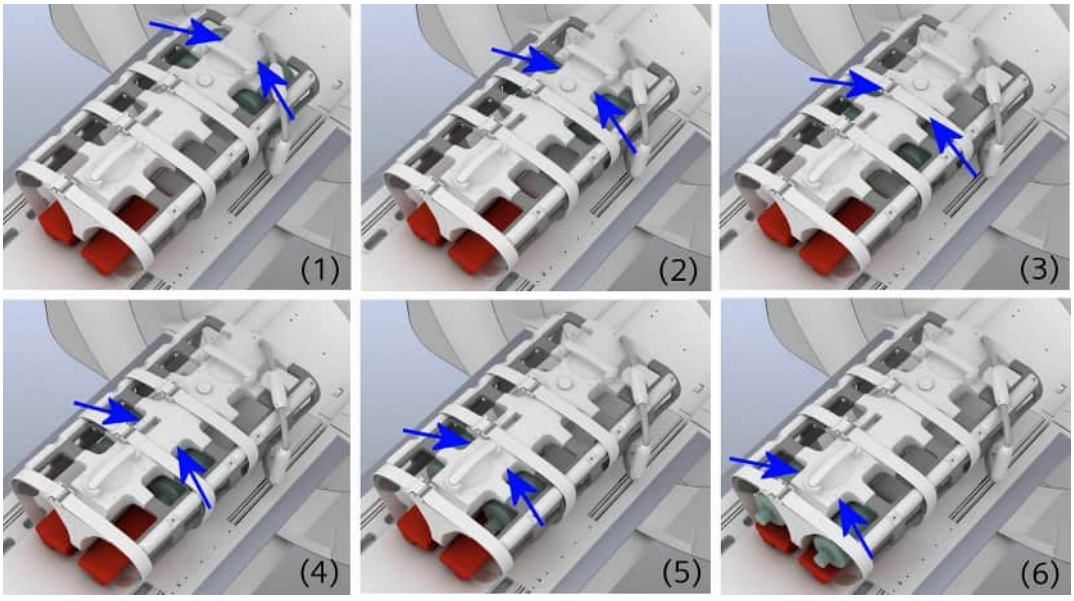
7 Stabilize the coil as closely as possible to the plastic bottles using the belts.

Beginning with coil element PA1, the plastic bottles must be shifted to the next coil element pair for each subsequent measurement.



8 Align the laser-light localizer with the center marking PA1.

9 Start the quality measurement for coil element pair PA1.
(➔ Page 282 *Performing quality assurance (software)*)



(1) Coil element pair 1 (PA1)
(2) Coil element pair 2 (PA2)
(3) Coil element pair 3 (PA3)
(4) Coil element pair 4 (PA4)
(5) Coil element pair 5 (PA5)
(6) Coil element pair 6 (PA6)

10 Perform the quality measurement for additional coil element pairs (PA2 - PA6) analogous to the description for PA1. Please ensure that the plastic bottles and the laser-light localizer are located at the height of the respective center marking.

6.26 TxRx Knee 18

6.26.1 Description

The TxRx Knee 18 is used for examinations of the left or right knee.

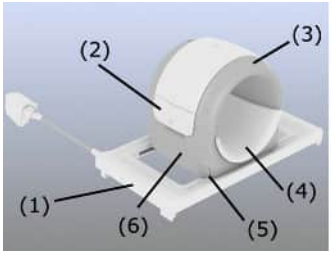
The coil can be shifted laterally on the base plate to center it for optimal image quality.

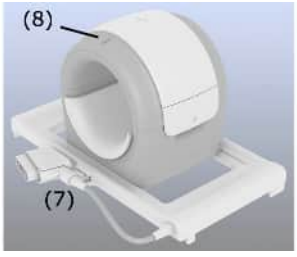
This coil is not available for all systems. For a list of supported coils, refer to the system owner manual for the respective system.

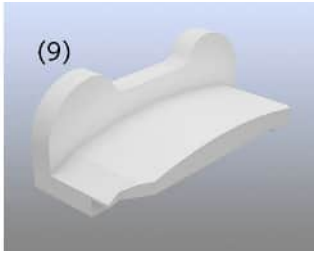
Accessories (→ Page 300 *TxRx Knee 18*)

Configuration

The coil consists of the following components:







(1) Base plate
(2) Release to lift the upper part (on both sides)
(3) Upper part of the coil
(4) Support cushion
(5) Release to slide the coil along the base plate
(6) Lower part of the coil
(7) Parking position for coil plug
(8) Marking to ensure the correct orientation of the upper part (marking facing the feet)
(9) Leg cushion (ensures sufficient distance between the coil and the healthy leg)

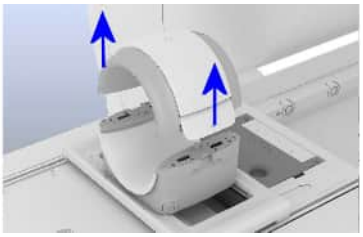
6.26.2 Use

✓ The spine coil or the table pads are positioned on the patient table.

✓ The head-heel insert is positioned at the head end of the patient table.

Positioning the coil





1 Position the coil with the base plate on the patient table at the level of the patient's knee. Position the base plate with the detents in the recesses of the table.

2 Remove the upper part of the coil: Open the releases on the side by pulling them outward and lift the upper part of the coil up and off.

3 Connect the coil plug to coil socket 1.

Positioning the patient

1 Position the patient in the supine position with the feet toward the magnet bore.

2 Press the release on the lower part of the coil and center the coil on the base plate as much as possible.

3 Position the foot pad on the patient table to stabilize the leg to be examined.

4 Use positioning aids and cushions best suited to the current situation. Ensure that the other leg is comfortably positioned (for example, bend the knee slightly and support the knee).

5 Place the upper part of the coil so that it locks into position on the lower part. Ensure that the marking at the top of the upper part faces the feet.

6 Ensure that the patient does not feel too much pressure.

Position the other leg so that it is a small distance from but does not touch the coil.

Performing the measurement

1 Align the laser-light localizer with the center marking of the coil.

2 Start the measurement.

6.26.3 Quality measurement

✓ The spine coil or the table pads are positioned on the patient table.

✓ The coil is positioned on the patient table and connected.

1 Place phantom holder 28 in the lower part of the coil.

2 Position the 1900 ml plastic bottle on the phantom holder so that the bottom of the bottle is facing the magnet bore.

3 Place the upper part of the coil so that it locks into position on the lower part.

4 Align the laser-light localizer with the center marking of the coil.

5 Start the quality measurement.

6.27 Foot/Ankle 16

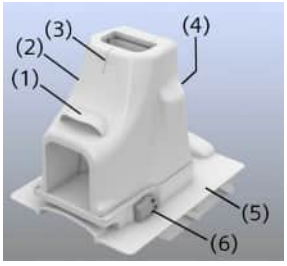
6.27.1 Description

The Foot/Ankle 16 is used to examine feet and ankles.

Accessories (➔ Page 290 *Coil accessories*)

Configuration

The Foot/Ankle 16 comprises an upper part and a base plate.



(1) Hand grip
(2) Upper part
(3) Center marking
(4) Lever handle (Release)
(5) Base plate
(6) Tilt locking mechanism

6.27.2 Use

A sample examination of the right foot/ankle is described.

Positioning the coil

✓ The spine coil is positioned on the patient table.

✓ Table pad 3 is positioned on the patient table.

◆ Slide the Foot/Ankle 16 into the lateral recesses at the head end of the patient table so that it locks into the coil sockets 5 and 6.

Positioning the patient

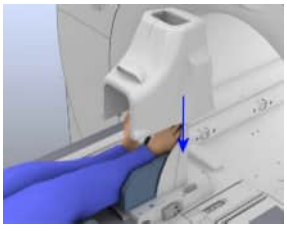
✓ The back-of-the-head support is positioned on the patient table.

1 Use the lever handle at the back to remove the upper part from the base plate.

2 Place the heel cushion in the lower part of the coil.

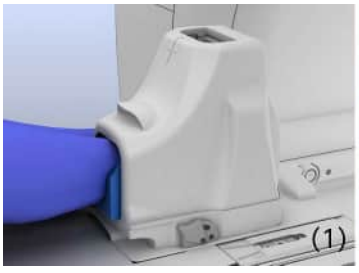
3 Position the foot to be examined on the heel cushion.

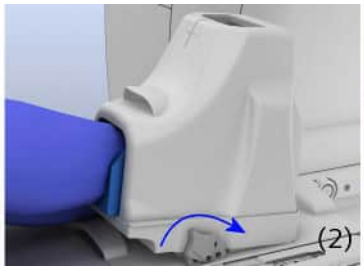
4 Position the foot cushion under the other foot. Relieve the weight of the leg to be examined with the knee cushion.

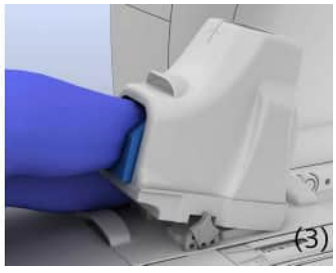


5 Place the upper part on the lower part so that it locks into place.

6 If necessary, tilt the coil slightly in the direction of the magnet (with the tilt locking mechanism) to position the patient more comfortably.







Performing the measurement

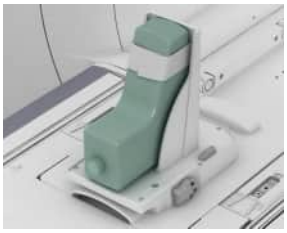
1 Align the laser-light localizer with the center marking of the coil.

2 Start the measurement.

6.27.3 Quality measurement

✓ The spine coil and table pads are positioned on the patient table.

✓ Lower part of the Foot/Ankle 16 is positioned on the patient table.



1 Position the Foot/Ankle 16 phantom correctly in the lower part of the coil.

2 Place the upper part of the coil onto the base plate.

3 Align the laser-light localizer with the center marking of the coil.

4 Start the quality measurement.

6.28 Flex Small/Large 4

6.28.1 Description

The Flex coil is available in sizes small and large. Depending on the area to be examined, the coil is positioned on the patient and is used to image the area of the body it covers.

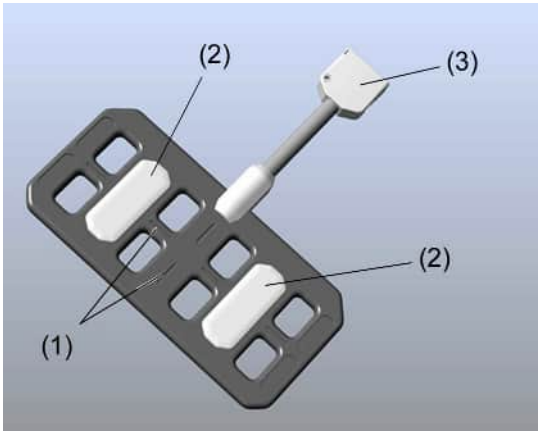
For example, the following regions of the body can be examined:

- Hand
- Elbow and shoulder
- Hip and knee

Accessories (➔ Page 290 *Coil accessories*)

Configuration

The coil consists of the following components:



(1) Center markings
(2) Electronics boxes
(3) Coil plug

6.28.2 Use

In what follows, two examination examples are described:

- Shoulder and hip in supine position (Flex Large 4)
- Hand and elbow in prone and supine positions (Flex Small 4)

General information

1 Use the Flex Coil Interface as described.

See: (➔ Page 279 *Flex Coil Interface*)

2 Position the coil with the flat side against the region of interest.

Examinations of the shoulder and hip may show strong artifacts caused by layers of fat.

3 To avoid artifacts, increase the distance between the coil and the area to be examined by using the iPAT cushion.

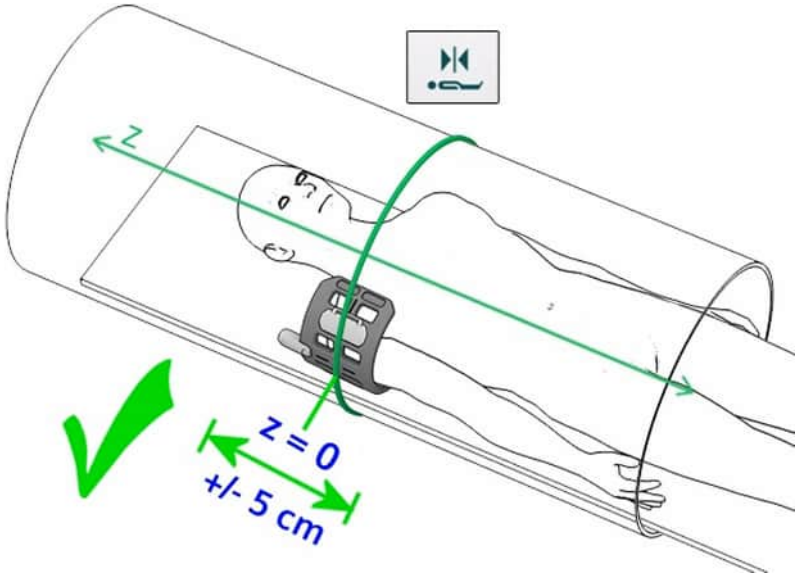
Ensure that the coil cable does not hang over the sides of the patient table.

Safety measures for the MAGNETOM Skyra

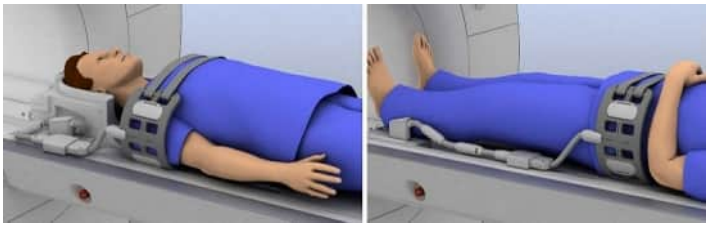
CAUTION

Local overheating of Flex Large 4

- Do not use this coil for scanning with table movements (for example, whole body or angio examinations).
- Always position the coil isocentrically in head-foot direction (z position). The maximum deviation should not exceed ±5 cm in the head-foot direction.



Examining the shoulder and hip



✓ The spine coil is positioned on the patient table.

✓ The Flex Coil Interface is connected.

✓ The coil is connected at the Flex Coil Interface.

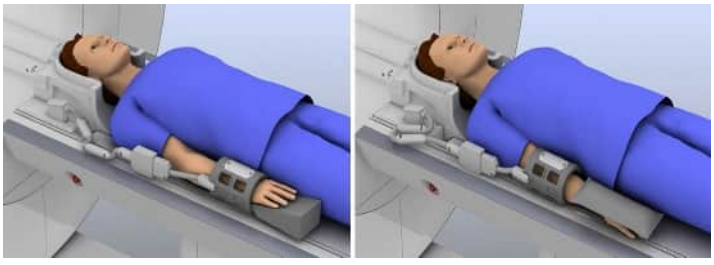
1 Attach the strap to the side of the patient table opposite the shoulder to be examined.

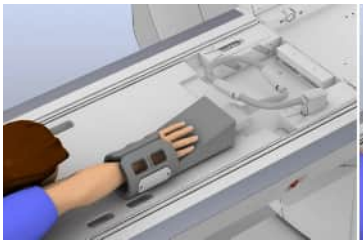
2 Position the coil.

3 Ensure that the region to be examined is contained within the side flaps of the coil.

4 Secure the coil with the strap.

Examining the elbow and hand





✓ The spine coil is positioned on the patient table.

✓ The Flex Coil Interface is connected.

✓ The coil is connected at the Flex Coil Interface.

1 Position the patient in the prone or supine position with the head to the magnet.

2 Position the region of interest as centered as possible.

3 Attach the strap to the bottom side of the coil.

4 For examinations of the hand, position the hand wedge and the hand of the patient on the coil.

5 Wrap the coil around the patient's hand or elbow.

6 Secure the coil with the strap.

For examinations in supine position, it may be necessary to use a strap and/or a sandbag to stabilize the arm.

Performing the measurement

1 Align the laser-light localizer with the center marking of the coil.

2 Start the measurement.

6.28.3 Quality measurement

✓ The Flex Coil Interface is connected.

✓ The coil is connected to the Flex Coil Interface.

1 Position phantom holder 26 on the spine coil.

2 Position the Flex Coil to be measured with the iPat cushion on the phantom holder.

3 Attach the coil around the 1900 ml plastic bottle using belts.

Quality measurement Flex Small

Quality measurement Flex Large

4 Align the laser-light localizer with the center marking of the coil.

5 Start the quality measurement.

6.29 UltraFlex Small/Large 18

6.29.1 Description

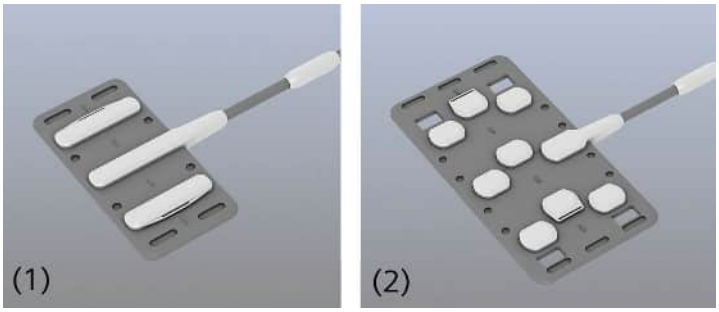
The UltraFlex coil is available in sizes small and large. Depending on the area to be examined, the coil is positioned on the patient and is used to image the area of the body it covers.

For example, the following regions of the body can be examined:

- Hand and wrist
- Elbow and shoulder
- Hip and knee
- Foot and ankle
- Head and neck

Accessories (→ Page 290 *Coil accessories*)

Configuration



(1) UltraFlex Small 18
(2) UltraFlex Large 18

6.29.2 Use

In what follows, two examination examples are described:

- Shoulder and hip in supine position (UltraFlex Large 18)
- Hand and elbow in prone and supine positions (UltraFlex Small 18)

General information

1 Position the coil with the flat side against the region of interest.

Examinations of the shoulder and hip may show strong artifacts caused by layers of fat.

Ensure that the coil cable does not hang over the sides of the patient table.

2 Secure the coils using the Velcro® straps.

Examining the shoulder and hip

✓ The spine coil is positioned on the patient table.

1 Attach the strap to the side of the patient table opposite the shoulder to be examined.

2 Position the coil.

3 Ensure that the region to be examined is contained within the side flaps of the coil.

4 Secure the coil with the strap.

Examining the elbow and hand

✓ The spine coil is positioned on the patient table.

1 Position the patient in the prone or supine position with the head to the magnet.

2 Position the region of interest as centered as possible to obtain optimal image quality.

3 Attach the strap to the bottom side of the coil.

4 For examinations of the hand, position the hand wedge and the hand of the patient on the coil.

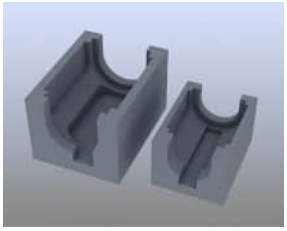
5 Wrap the coil around the patient's hand or elbow.

6 Secure the coil with the strap.

For examinations in supine position, it may be necessary to use a strap and/or a sandbag to stabilize the arm.

Using the positioning pads

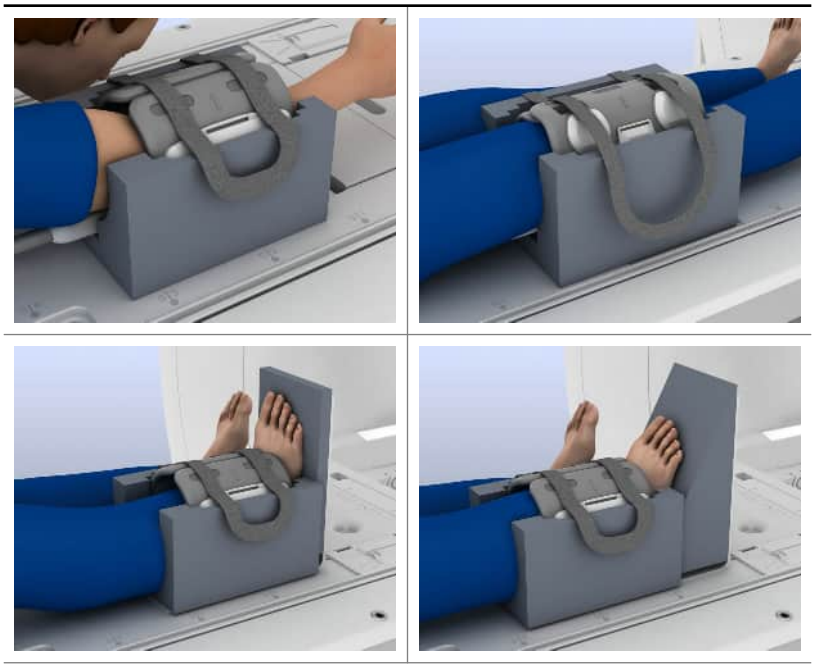
Special positioning pads are available for the large and the small UltraFlex 18 coil. They help to vary the position of the patient.

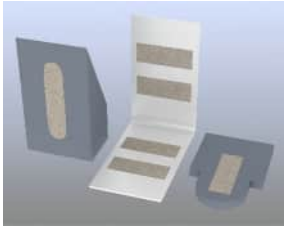


1 Choose a positioning pad suitable for the coil used (the large pad with the large coil and the small pad with the small coil) and place the coil in the corresponding pad.

   Position the region to be examined in the center of the coil. Secure the coil with appropriate Velcro straps.

Ultra Flex Small/Large 18 with positioning pads





2 Use the foot/ankle positioning pads to stabilize the foot.

3 For hip or shoulder examinations, position the soft wedge under the coil. This is a more comfortable position for the patient as the electronic boxes of the coil press into the soft pad, avoiding pressure marks on the patient.

Performing the measurement

1 Align the laser-light localizer with the center marking of the coil.

2 Start the measurement.

6.29.3 Quality measurement

✓ The spine coil is positioned on the patient table.

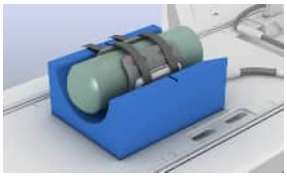
1 Position phantom holder 26 on the table.

2 Position the coil to be measured on the phantom holder.

3 Ensure that the coil cable is routed through the groove on the bottom of the phantom holder.

4 Connect the coil plug to a suitable socket.

Performing the quality measurement for the UltraFlex Small 18

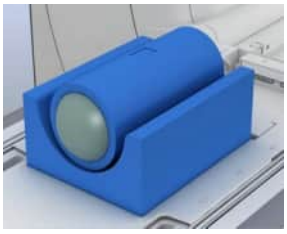


1 Position the 5300 ml plastic bottle on the coil and use soft straps to secure the coil around the bottle.

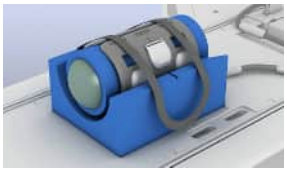
2 Align the laser-light localizer with the center marking of the coil.

3 Start the quality measurement.

Performing the quality measurement for the UltraFlex Large 18



1 Place phantom holder 27 around the 5300 ml plastic bottle.



2 Position the plastic bottle on the coil with phantom holder 27 and use soft straps to secure the coil around the bottle.

3 Align the laser-light localizer with the center of the coil.

4 Start the quality measurement.

6.30 Loop 4/7/11

6.30.1 Description

Loop coils are available in the following sizes:

- 4 cm
- 7 cm
- 11 cm

Loop coils are used for examinations of the following body regions:

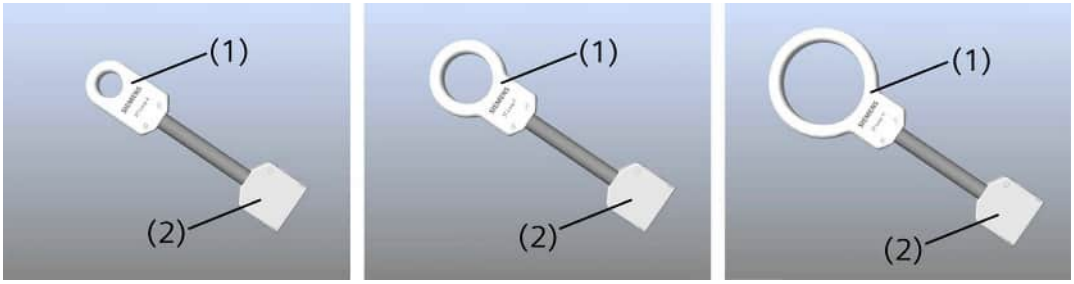
- Skin, for example: fingers, wrist bone, or toes
- Melanoma, birth marks, and other skin anomalies

Loop coils are selected according to the size and type of the area to be examined. They are freely positionable at the patient. Optimal image quality is obtained from the area inside of the coil rings of the Loop coils.

Accessories (→ Page 290 *Coil accessories*)

Configuration

Each coil consists of the following components:

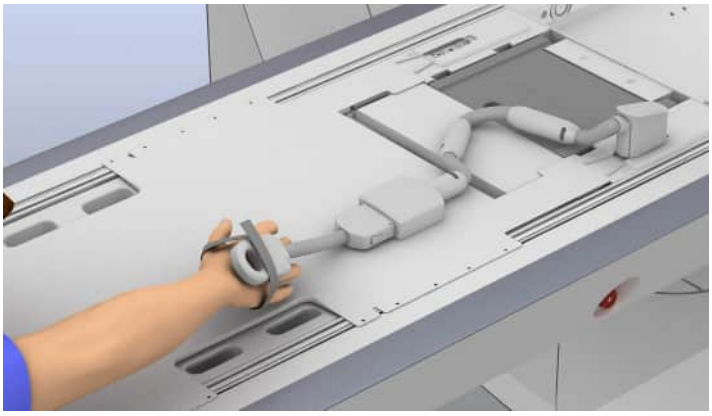


(1) Coil loop
(2) Coil plug

6.30.2 Use

The following applications show examples of using the Loop, 4 cm, in the head first position. They apply in a similar manner to other Loop coils.

Examining the hand



✓ The spine coil is positioned on the patient table.

✓ The Flex Coil Interface is connected.

✓ The coil is connected at the Flex Coil Interface.

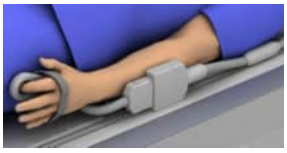
1 For prone positioning: Position the Flex Coil Interface so that the box is centered on the patient table and points to the magnet.

2 Position the patient in the prone or supine position with the head to the magnet.

3 Position the region of interest as centered as possible.

4 Position the Loop coil on the location to be examined.

– or –



Slide the Loop coil along the finger to be examined so that it encloses the area of interest.

5 Secure the Loop coil with a Velcro strap.

Performing the measurement

1 Position the laser-light localizer in the center of the coil.

2 Start the measurement.

6.30.3 Quality measurement

The following description applies to the quality measurements of all Loop coils. The measurement phantoms are handled the same way for all coils.

✓ The spine coil is positioned on the patient table.

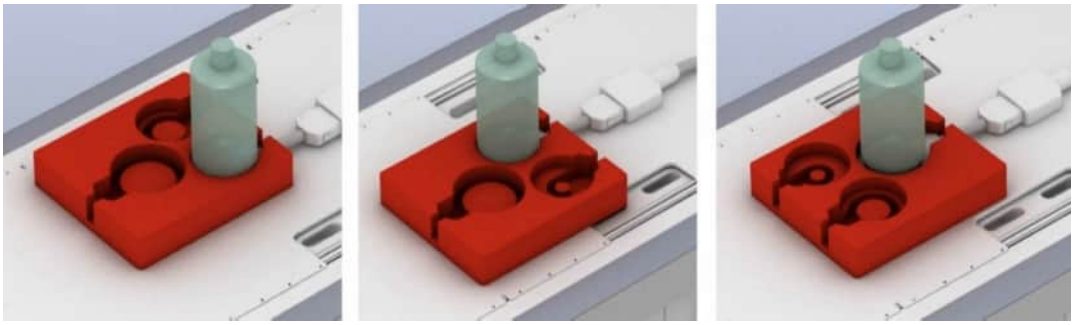
✓ The Flex Coil Interface is connected.

✓ The coil is connected at the Flex Coil Interface.

1 Position phantom holder 17 on the spine coil.

2 Place the Loop coil to be measured into the appropriate recess of phantom holder 17.

3 Position the 1900 ml plastic bottle on the coil in phantom holder 17.



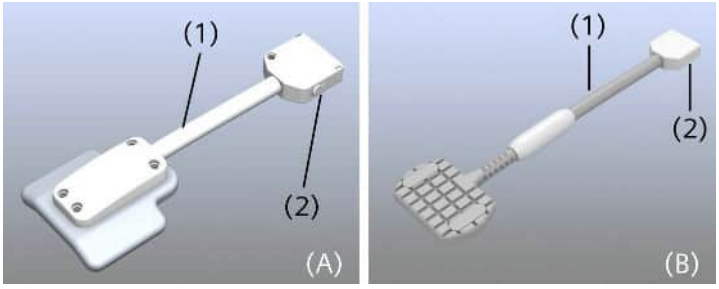
4 Position the laser-light localizer at the center mark of the bottle.

5 Start the quality measurement.

6.31 Special Purpose 4

6.31.1 Description

The Special Purpose 4 can be used to examine small body regions near the skin surface.



Special Purpose 4 for 1.5T (A) and for 3T (B)

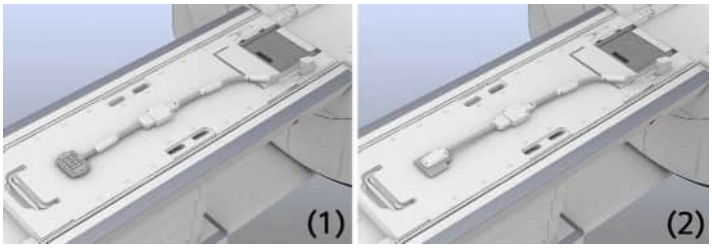
(1) Coil cable
(2) Coil plug

Standard accessories (➔ Page 290 *Coil accessories*)

6.31.2 Use

✓ The spine coil is positioned on the patient table.

✓ The Flex Coil Interface is connected.



(1) Using the 3 T coil
(2) Using the 1.5 T coil

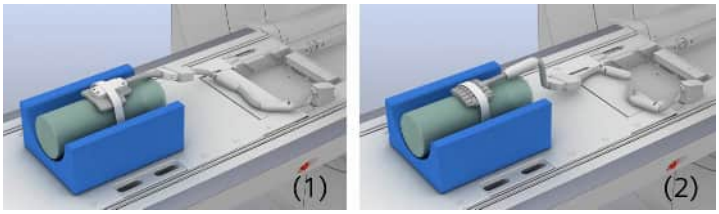
1 Connect the Special Purpose 4 to the Flex Coil Interface.

2 Position the coil on the region of interest.

3 Align the laser-light localizer with the center marking of the coil.

4 Start the measurement.

6.31.3 Quality measurement



(1) Configuration for 1.5 T
(2) Configuration for 3 T

✓ The spine coil is positioned on the patient table.

✓ The Flex Coil Interface is connected to the socket 1 or 2.

✓ The Special Purpose 4 is connected to the interface.

1 Position the phantom holder 26 on the patient table.

2 Position the 5300 ml plastic bottle on the phantom holder so that the bulge of the bottle is facing the magnet bore.

3 Position the Special Purpose 4 on the plastic bottle.

4 Secure the coil using the straps.

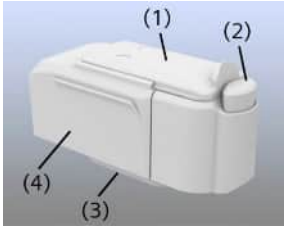
5 Align the laser-light localizer with the center marking of the coil.

6 Start the quality measurement. (➔ Page 282 *Performing quality assurance (software)*)

6.32 Interfaces

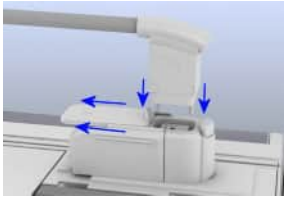
6.32.1 Tim Coil Interface

Some coils are connected with the Tim Coil Interface.

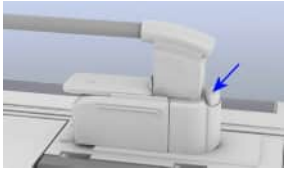


(1) Socket cover for coil socket
(2) Release for coils
(3) Interface coil plug
(4) Release for Tim Coil Interface

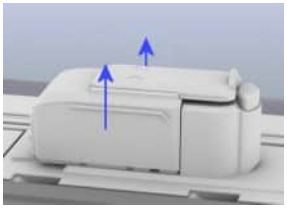
1 Connect the Tim Coil Interface to the patient table.



2 To connect the coil: Slide the socket cover of the Tim Coil Interface with the coil plug away and connect the plug to the socket.



3 To remove the coil: Use the release on the Tim Coil Interface.

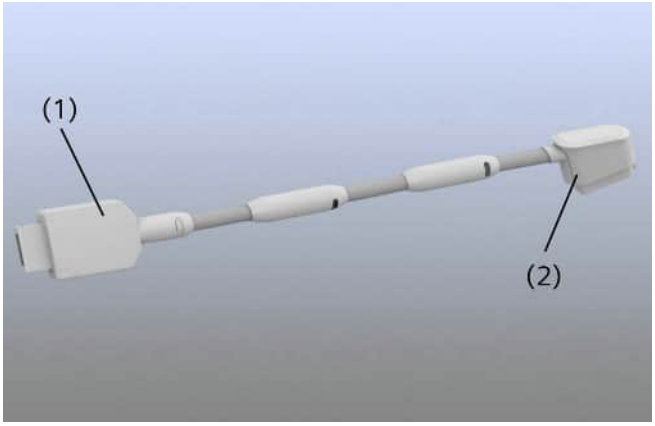


4 To remove the Tim Coil Interface: Grasp the housing and lift it up vertically.

6.32.2 Flex Coil Interface

Description

The Flex Coil Interface is required for connecting the Flex 4 coils, the Loop coils, the Endorectal coil 1.5T, and the Special Purpose 4 coil.



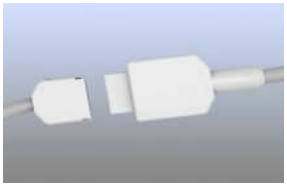
(1) Coil socket
(2) Plug for coil socket on the patient table

The Flex Coil Interface can be connected to coil sockets 1, 2, 3, or 4 on the patient table.

Connection

1 Connect the coil connector of the Flex Coil Interface to a suitable coil socket on the patient table.

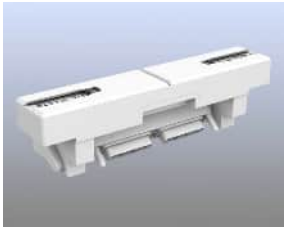
2 Ensure that the cable of the Flex Coil Interface does not hang over the sides of the patient table.



3 Connect the coil plug of the coil used to the coil socket of the Flex Coil Interface.

4 Secure the cable of the Flex Coil Interface with the cable holders.

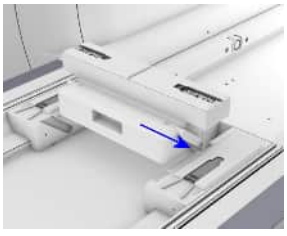
6.32.3 Multi-Channel Interface



You can use the Multi-Channel Interface as an adapter. It is connected to the two DirectConnect sockets 5 and 6 at the head end of the patient table and provides two SlideConnect sockets. You can use the SlideConnect sockets of the Multi-Channel Interface to connect, for example, two more Tim Coil Interfaces.

The Multi-Channel Interface is available for 3T systems (with green socket covers) and for 1.5T systems (with gray socket covers).

Connecting the Multi-Channel Interface



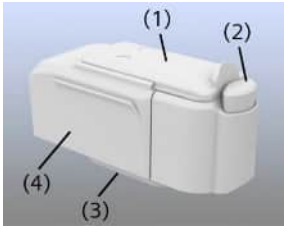
◆ Slide the Multi-Channel Interface into the lateral recesses at the head end of the patient table so that it locks into the Direct Connect coil sockets 5 and 6.

Now you can use the SlideConnect sockets of the Multi-Channel Interface to connect coils or interfaces that are enabled for the coil sockets 5 and 6.

6.32.4 Multi-nuclei option Interface (MNO Interface)

The MNO Interface is used as an adapter for X-nucleus measurements (multi-nuclei option) to connect special X-nucleus coils.

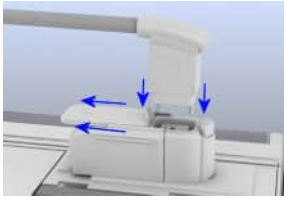
This interface is not available for all systems. For a list of supported interfaces, refer to the system owner manual for the respective system.



(1) Socket cover for coil socket
(2) Release for coils
(3) Interface for coil plug
(4) Release for MNO Interface

Spectroscopy only: During X-nucleus measurements you must remove all ^{1}H coils (“standard” coils, for example, the spine coil) from the patient table. Only use the specific X-nucleus coils.

1 Connect the MNO Interface to the patient table.



2 To connect the coil, slide back the socket cover of the MNO Interface using the coil plug and connect the plug to the socket.

To use transceiver coils (TxRx), always connect the MNO Interface to coil socket 2. Pure receiver coils (Rx) can also be connected to other coil sockets.

7 Quality assurance

A degraded MR image quality may indicate a malfunctioning RF coil. A quality measurement is performed for each RF coil to verify satisfactory operation.

Measurement phantoms are used for quality measurements.

The fluid in the measurement phantoms presents a health hazard. Follow the safety regulations in case of phantom fluid spills.

The quality measurement is performed with the quality program at the *syngo* Acquisition Workplace. The program checks the signal-to-noise ratio for all RF coils. In addition, it checks the artifact behavior for the Body coil.

If the quality measurement results are outside specifications, the phantom fluid may have moved inside the phantom. Measurement phantoms must be positioned for at least 3 minutes at rest on the phantom holder.

If the values of the quality measurement for an RF coil are outside specifications, please repeat the quality measurement.

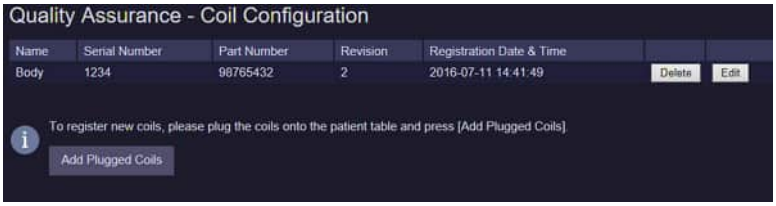
7.1 Performing quality assurance (software)

The **?** icon opens a help feature that describes the steps required to quality assurance.

7.1.1 Selecting the coil

1 In the Administration Portal, select **Quality Assurance**.

The dialog box **Quality Assurance - Coil Configuration** opens.



2 Go to the selection list and select the coil for the quality measurement.

7.1.2 Registering coils

It may be that some coils are not available in the list. Coils of these coil types must be registered before starting the quality assurance.

✓ Coil is connected to the patient table.

1 In the **Quality Assurance - Coil Configuration** dialog box, click the **Add Plugged Coils** button to add the type of the connected coil to the list.

2 Wait at least one minute until the update process is complete.

The list is updated automatically.

7.1.3 Configuring the quality measurement

During the quality measurement, the signal-to-noise ratio and the signal uniformity of the individual coils are checked.

✓ The coil is selected.

1 In the **Quality Assurance - Coil Configuration** dialog box, configure the list of coils to check and save it.

2 In the **Customer Quality Assurance** dialog box, select the check box of the coils to be checked.

7.1.4 Starting the quality measurement

✓ The quality measurement is configured.

1 Follow the instructions for positioning the coil, the phantom, as well as the phantom holder.

2 Connect the coil to be measured.

3 In the **Customer Quality Assurance** dialog box, click the button **Go**.

During the measurement, messages regarding the measurement status are displayed.

Status	Status of quality measurement
ToDo	Measurement still waiting to be performed
Running	Running
Done	Completed Parameters correspond to specifications
NotOk	Completed Parameters are out of specification
Error	Measurement cannot be performed

The quality measurement does not provide satisfactory results?

Parameters are out of specification.

- Optimize the position of the phantom.
- Optimize the position of the laser-light localizer.
- Repeat the measurement.
- If the repeated quality measurement does not provide satisfactory results: Notify Siemens Service.

7.1.5 Completing the quality measurement

✓ The quality measurement is finished.

◆ Click the **Exit** icon.

A window including a safety query appears that must be confirmed.

8 Maintenance

8.1 Cleaning and disinfection

All instructions in the operator manual regarding cleaning, disinfecting, and, if applicable, sterilization must be always observed.

WARNING

Improper cleaning and disinfection of the MR system (including coils and accessories)!

Infection or severe injury from contamination

- Follow the cleaning and disinfection instructions in the separate **Addendum - Cleaning and Disinfection Instructions**.

Residual risks due to insufficient cleaning, disinfection, and, if necessary, improper sterilization are risk of infection to the patient and/or possible damage to the system.

8.2 Green performance management

This chapter contains information for environment-friendly handling of your system. In general, environmental protection aspects have already been taken into account in the design of the system. In addition, Siemens Healthineers supports you with the return and disposal of the product.

Please contact your local Siemens Healthineers Sales organization for information about the following aspects:

- Possibility of product refurbishment, replacement, or disposal

8.2.1 MR System

WARNING

Explosion hazard during improper disassembly!

Injury of persons

- Ensure that only trained personnel disassemble the MR system because the system includes a pressurized container and cryogenic helium.

1 Please contact your local Siemens Healthineers Customer Services for information on consumables and disposable components in your system, and for the current Disposal Instructions. The Disposal Instructions provide information on how to recycle or dispose of your MR system or its components as well as hazardous materials.

   For further information, see:

   - System Owner Manual, chapter “Location of labels”
   - Chapter “Safety > Quality assurance/phantom handling”

2 To ensure that your MR system is working efficiently with minimal impact on the environment (for example, minimum consumption of energy, consumable materials and spare parts, as well as minimum emissions), please observe the recommended maintenance intervals to be conducted by your Siemens Healthineers Customer Services. For details, please refer to the chapter “Maintenance Plan” in the System Owner Manual of your system.

3 Observe national regulations.

8.2.2 Packaging

Siemens is obligated to accept the return of packaging material.

1 Contact Siemens Service regarding questions with respect to the return as well as subsequent disposal of packaging material.

2 Observe national regulations.

8.2.3 Batteries and accumulators

Siemens is obligated to accept the return of batteries and accumulators and to dispose of them.

1 Contact Siemens Service with respect to questions regarding the return and disposal of batteries and accumulators.

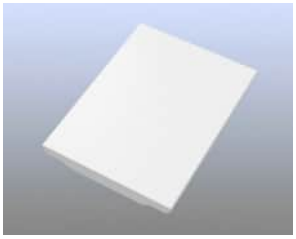
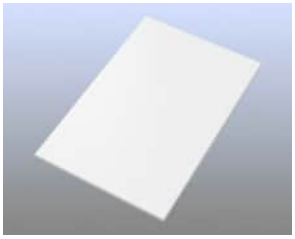
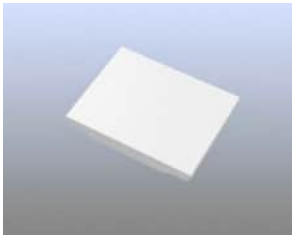
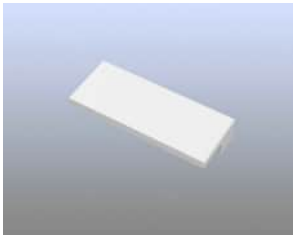
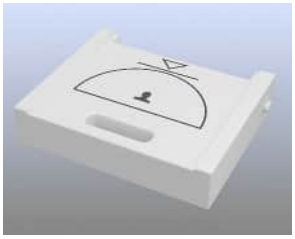
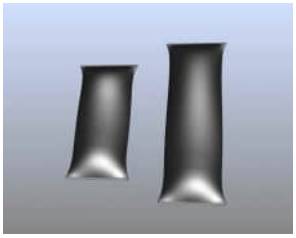
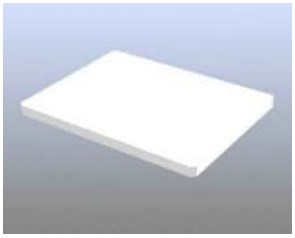
2 Observe national regulations.

9 Accessories

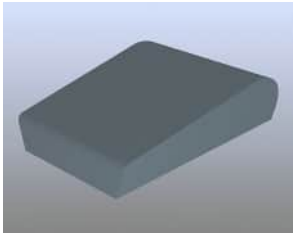
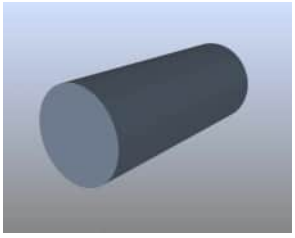
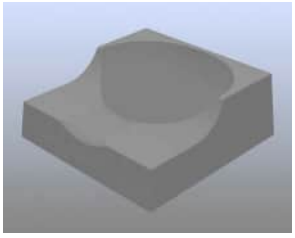
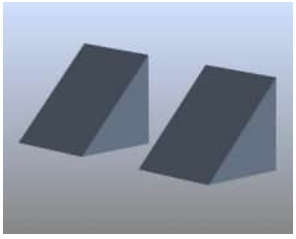
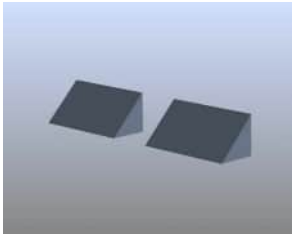
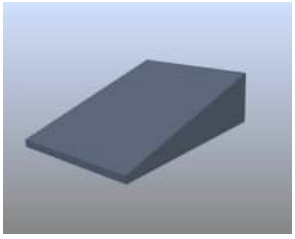
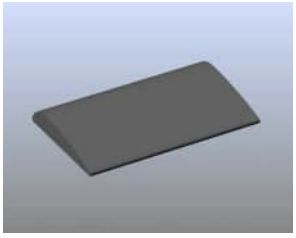
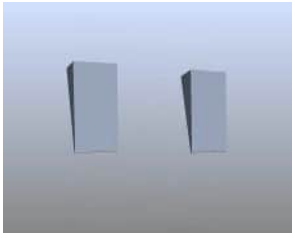
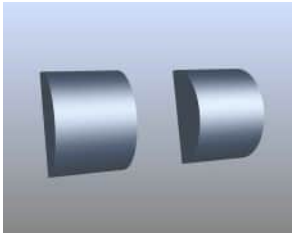
9.1 Standard accessories

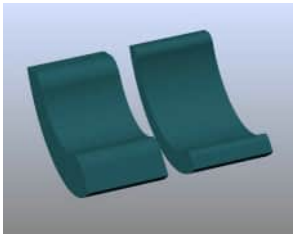
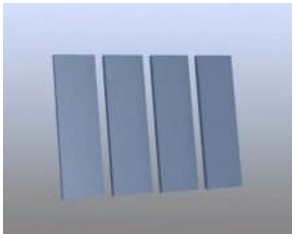
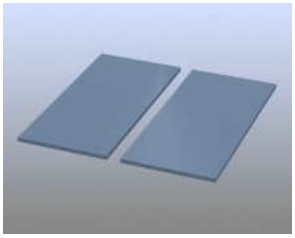
The following standard accessories for patient positioning are included in the delivery volume of the MR system.

9.1.1 Cushions and positioning aids

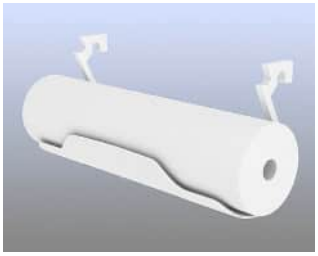
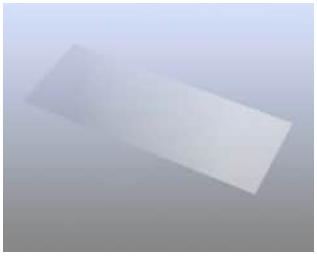
 Table pad 1	 Table pad 2	 Table pad 3
 Table pad 4	 Head-heel insert	 4 belt straps
 2 different-sized sandbags, 2 each	 Lookout mirror holder	 Cardiac spacer cushion

9.1.2 Set of positioning aids

		
1 knee wedge	1 positioning roll	1 back-of-the-head support
		
2 large triangles	2 small triangles	1 wedge
		
1 lordosis cushion	2 flat wedges (wedge pads)	2 pads (half round)

		
2 different-sized multipurpose cushions (cushion MP), 3 pieces each	Gap cushion set small	Gap cushion set large

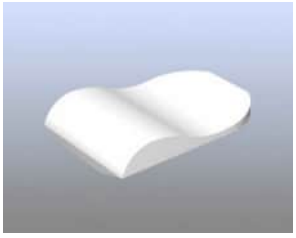
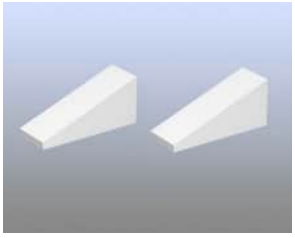
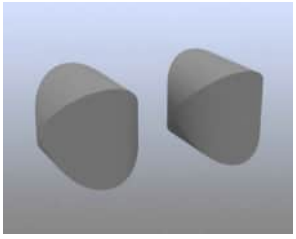
9.1.3 Other accessories

		
1 paper roll holder	Protective film for patient table	3 cable holders

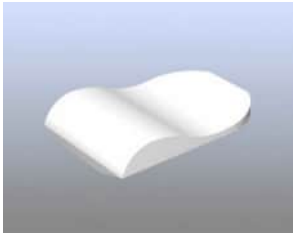
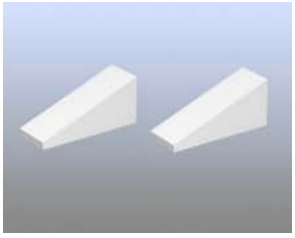
9.2 Coil accessories

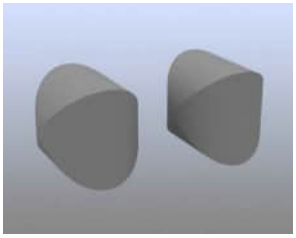
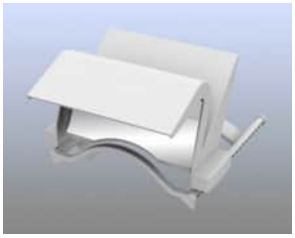
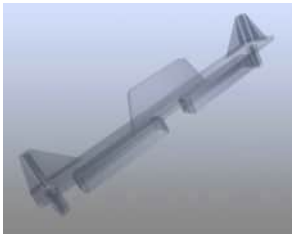
Specific positioning aids are available for the following coils and are included in the delivery volume of the coils.

9.2.1 Head/Neck 16

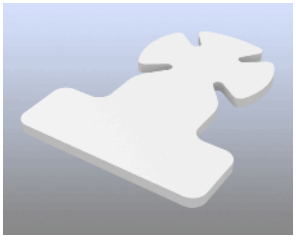
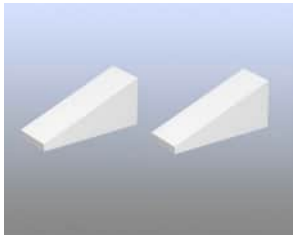
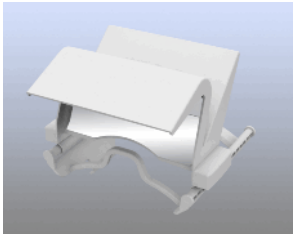
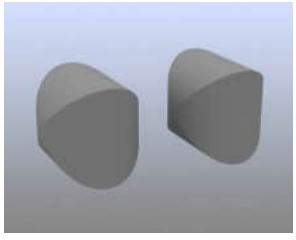
		
Pad 32	Cushion neck	Head positioning wedges
		
Clamp cushions	Mirror carrier with mirror Head/ Neck 16	

9.2.2 BM Head/Neck 20

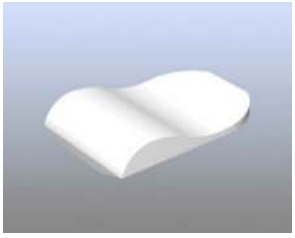
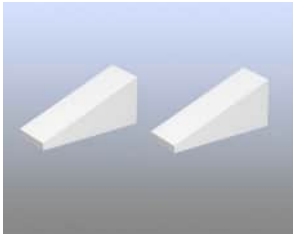
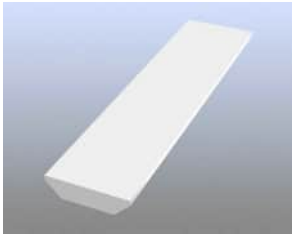
		
Pad 32	Cushion neck	Head positioning wedges

		
Clamp cushions	Mirror carrier with mirror BM Head/Neck 20	Protective cover for the head/neck coil sockets

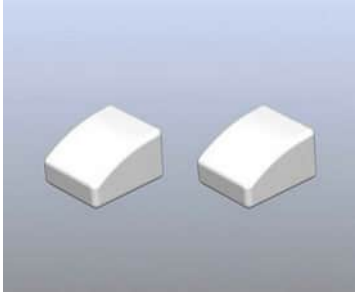
9.2.3 Head/Neck 64, BM Head/Neck 64

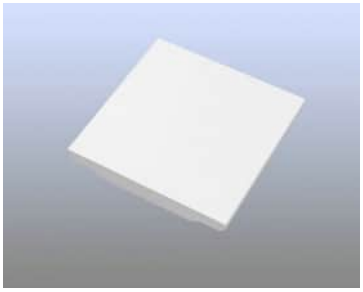
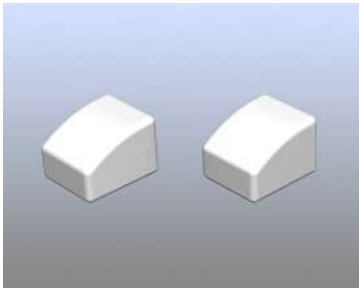
	
Pad 64	Head positioning wedges, long
	
Mirror carrier with mirror	Clamp cushions

9.2.4 Head 32

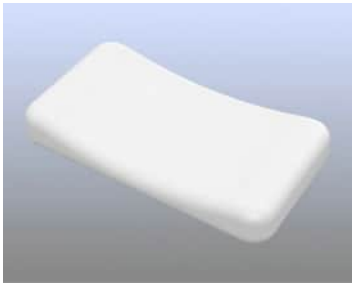
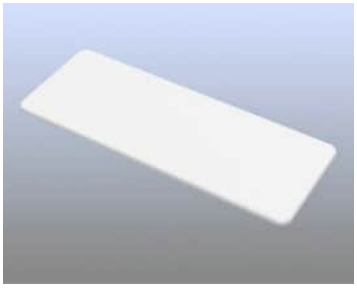
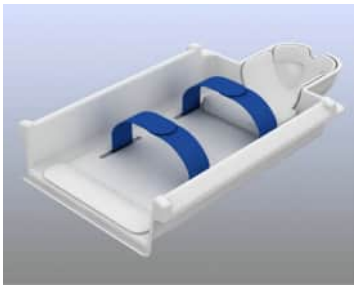
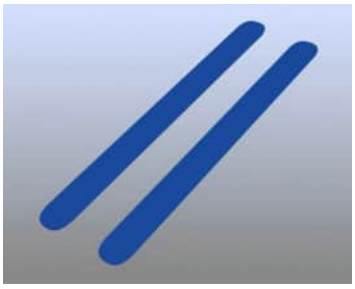
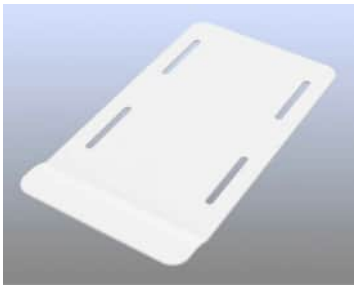
	
Mirror carrier with mirror	Pad 32
	
Head positioning wedges	Filler cushion 32

9.2.5 TxRx CP Head

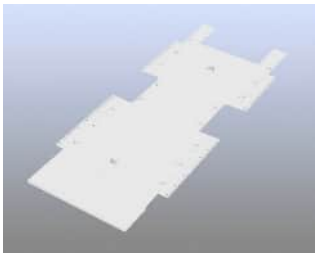
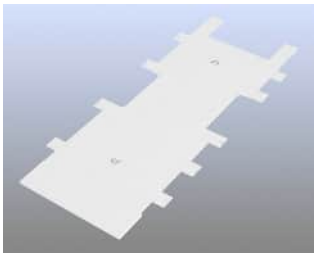
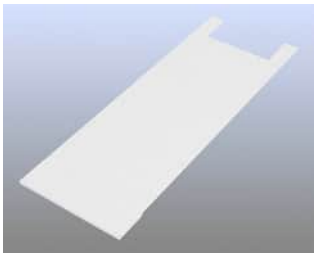
	
Head cushion	2 head wedges (thin size)

	
Head-Spine table pad	2 head wedges (thick size)

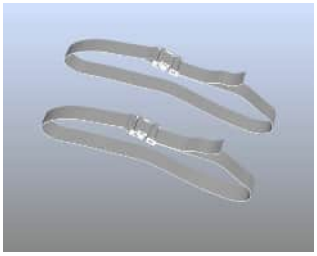
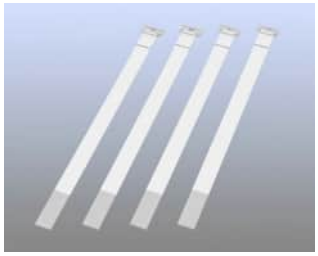
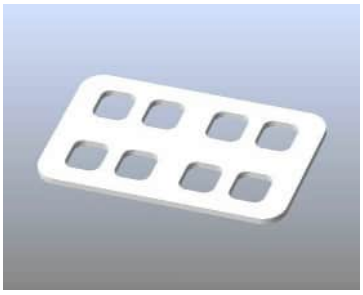
9.2.6 Pediatric 16

		
Head/Crown pad	Neck elevation pad	Coil transition pad (for the use without infant cradle)
		
Infant cradle	Straps (for infant cradle only)	Cradle pad (for infant cradle only)

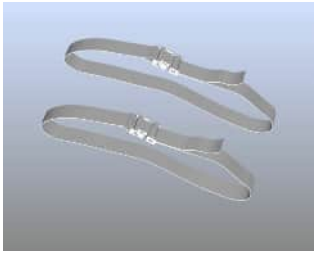
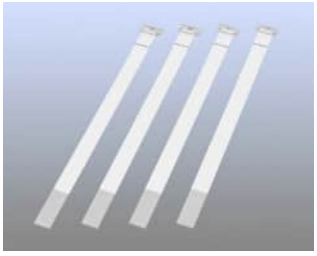
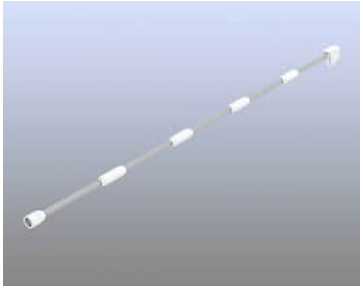
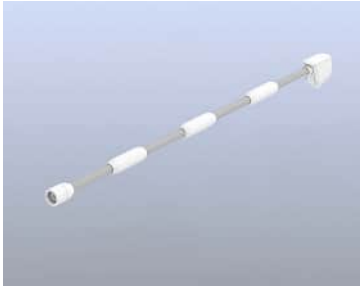
9.2.7 BM Spine 24, BM Spine 32, BM Spine 72

		
Cushion support (spine support 32 respiratory) for BM Spine 24 and BM Spine 32	Cushion support (pad spine 72) for BM Spine 72	Easy X-change spine cushion

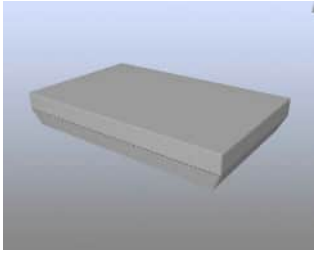
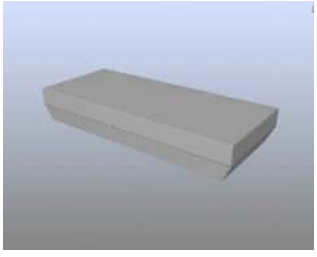
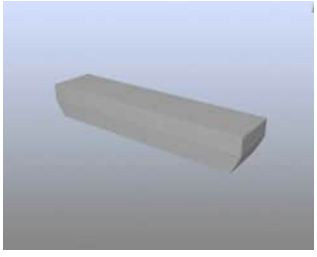
9.2.8 Body 6

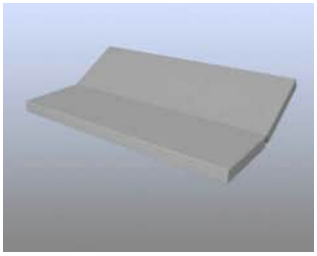
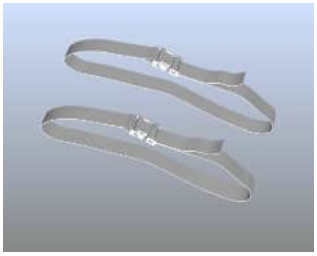
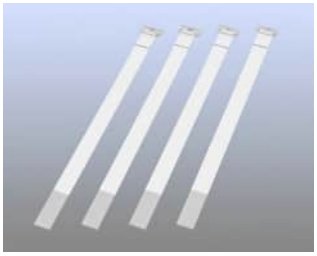
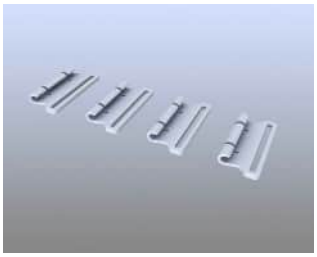
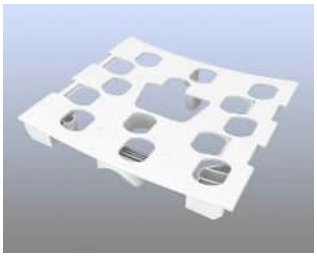
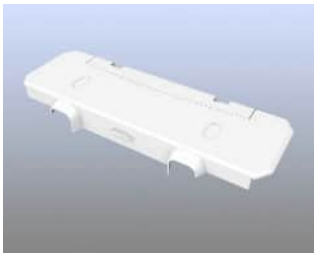
	
2 Belts 1500	4 Belts Body
	
iPAT cushion	Connection clamp Body

9.2.9 BM Body 18, Body 18, BM Body 12

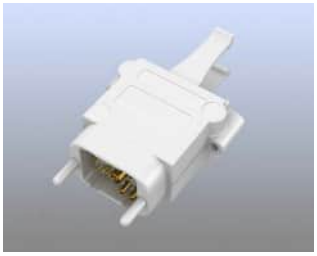
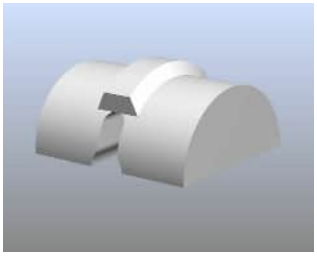
	
2 Belts 1500	4 Belts Body 18
	
Coil cable 165 (long version), only for BM Body coils	Coil cable 95, only for BM Body coils

9.2.10 Body 30/Body 60

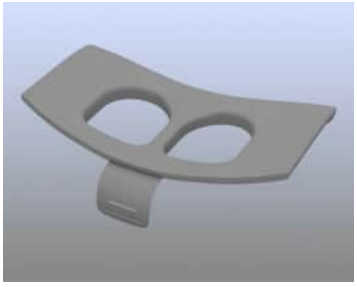
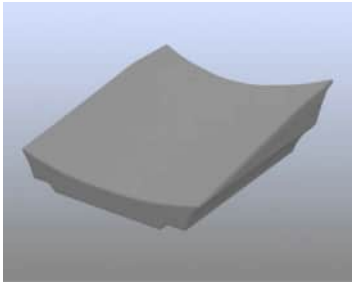
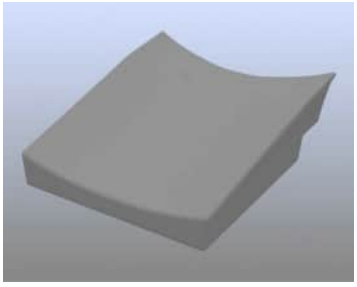
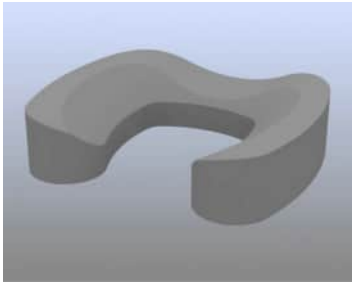
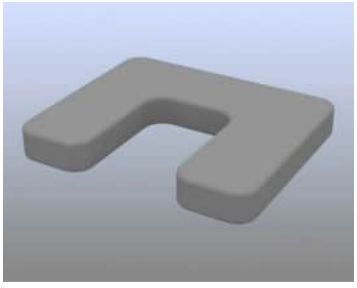
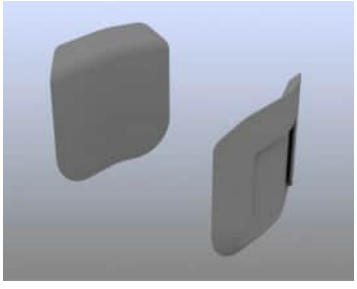
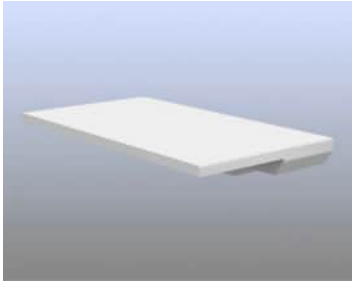
		
Body 30 table pad 1 (cushion 320)	Body 30 table pad 2 (cushion 210)	Body 30 table pad 3 (cushion 110)

 Body 30 table pad 4 (cushion direct connect interface)	 2 Belts 1500	 4 Belts Body 30
 4 belt clips	 Frame for use as posterior coil (Body 30 sliding device)	 Adapter for spine coil sockets (direct connect interface)

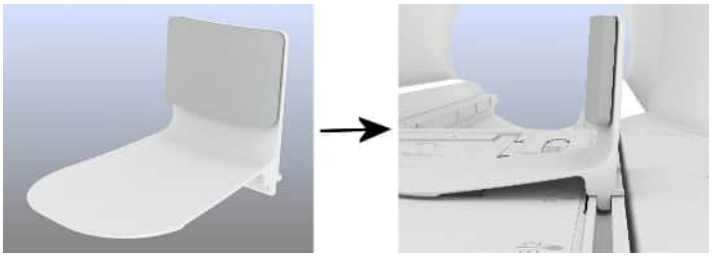
9.2.11 Endorectal

 Endorectal Adapter 1.5T	 Endorectal Adapter 3T	 Endo cushion

9.2.12 Breast 18

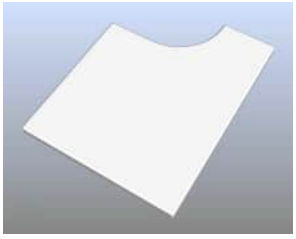
 Coil pad (padding Breast 18)	 Body pad 60 (wedge connector 60 Breast 18)	 Body pad 70 (wedge connector 70 Breast 18)
 Head support (head rest Breast 18)	 Head support cushion (head cushion Breast 18)	 Armrest pad Breast 18
 Cushions for the breast fixations (slider pad Breast 18)	 Table pad Breast 18	

9.2.13 Shoulder Shape 16

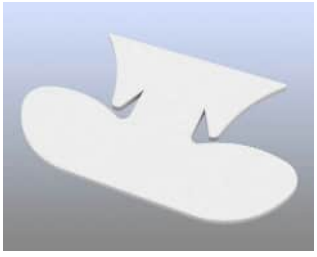


L-shaped holder

9.2.14 Shoulder Small/Large 16



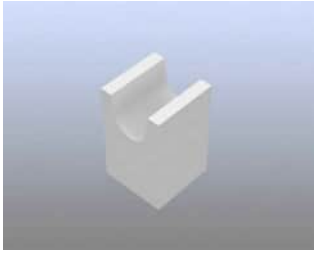
Base plate pad



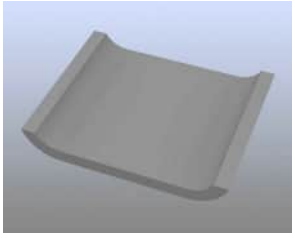
Shoulder cup cushion

9.2.15 Hand/Wrist 16

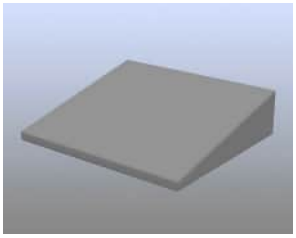
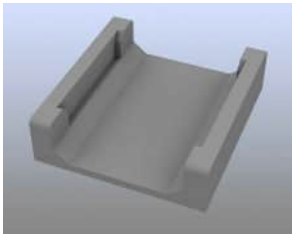
Wrist pad



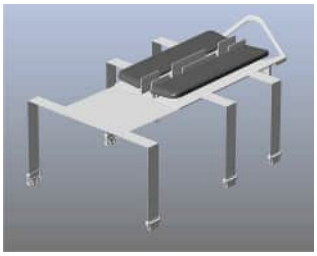
Elbow pad



Palm pad

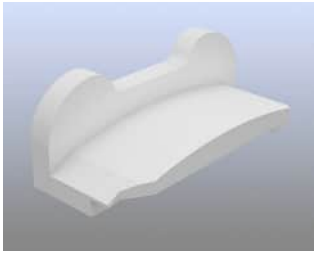
		
Wedge cushion	Wrist support cushion	

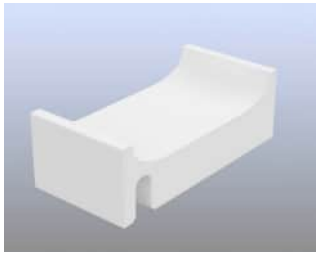
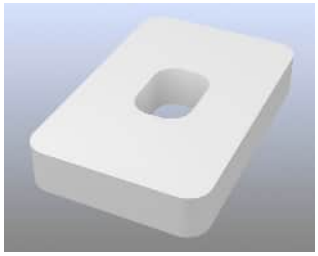
9.2.16 Peripheral Angio 36



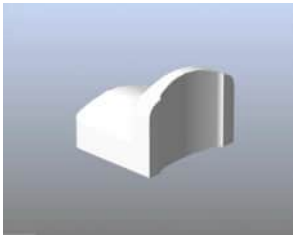
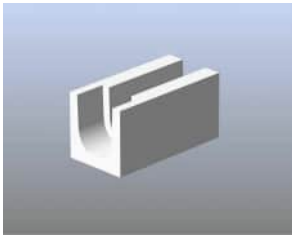
PA leg support

9.2.17 TxRx Knee 18

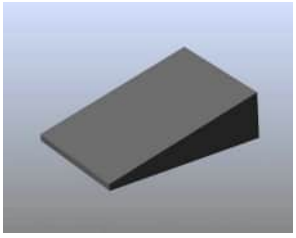
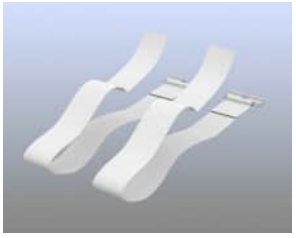
	
Knee cushion	Leg cushion

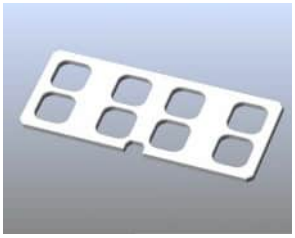
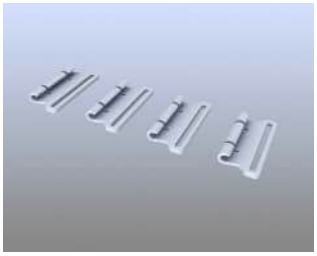
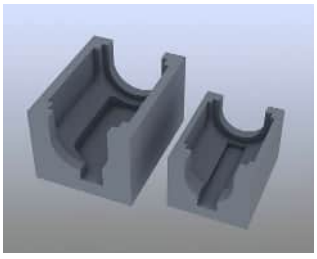
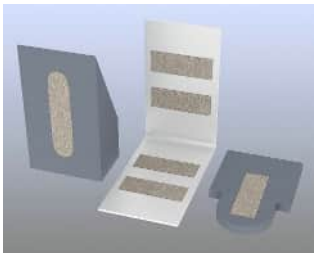
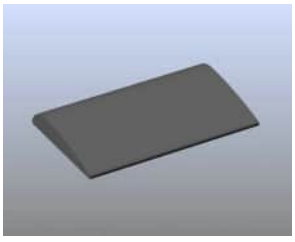
	
Feet cushion	Cushion 4

9.2.18 Foot/Ankle 16

		
Knee cushion	Heel cushion	Foot cushion

9.2.19 Flex Small/Large 4, Loop, UltraFlex Small/Large 18

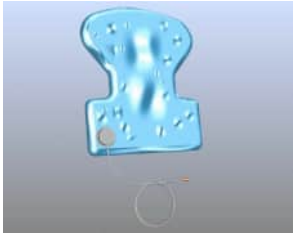
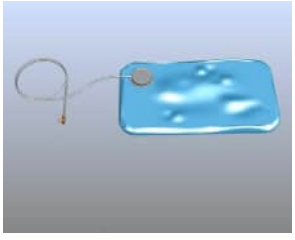
		
Hand wedge with Velcro straps	2 soft straps	4 belts

 iPat cushion, small (only for Flex Small 4)	 iPat cushion, large (only for Flex Large 4)	 4 strap clips only for Ultra-Flex coils
 Positioning pads only for Ultra-Flex coils	 Foot/ankle positioning pads only for UltraFlex coils	 Soft wedge pad only for Ultra-Flex coils

9.3 Vacuum cushion

9.3.1 Description

An optional set of vacuum cushions is available for comfortable and stable patient positioning.

 Head cushion	 Spine cushion	 Small cushion

Use of vacuum cushions

Vacuum cushion	Area of application
Small cushion	Hands, elbows, ankle
Head cushion	Head, neck
Spine cushion	Torso
Head and spine cushions combined	Whole body

The vacuum cushions are filled with styrofoam beads. When a vacuum cushion is placed around a part of the body and the air is evacuated, the shape of the vacuum cushion stabilizes.

9.3.2 Operation

Combining head and spine cushions

The additional valve located on the spine cushion allows you to combine it with the head cushion.

1 Open the additional valve by removing the plug.

2 Connect the head cushion to the open valve.

Positioning the vacuum cushions

The vacuum cushions may be positioned both on the inside or outside of a coil.

1 Place the vacuum cushion where needed e.g. in the lower part of the head coil.

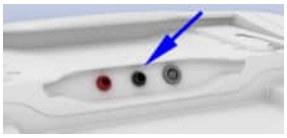
2 If you position the cushion in the head coil, ensure that the hose points toward the foot end of the patient table.

3 Fit the vacuum cushion to the shape of the body region.

– or –

Position the patient on the patient table with the head on the head cushion.

Evacuating the vacuum cushions



Example (actual design may be different on your system)

✓ The vacuum cushion is vented.

1 Connect the hose of the vacuum cushion to the corresponding connection at the foot end of the patient table.

The vacuum cushion is evacuated.

2 During evacuation, fit the vacuum cushion so that it supports the corresponding part of the body.

Airing the vacuum cushion after use

✓ The vacuum cushion is evacuated.

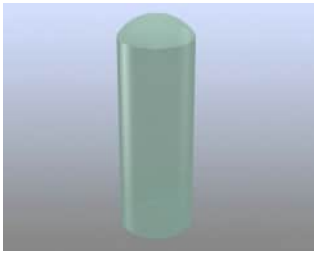
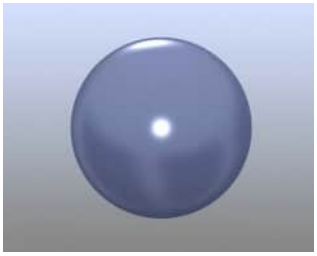
◆ Disconnect the hose of the vacuum cushion from the connection at the patient table.

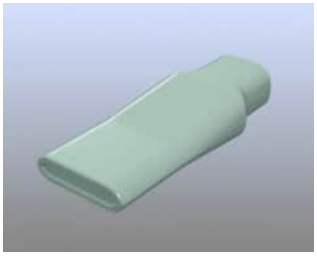
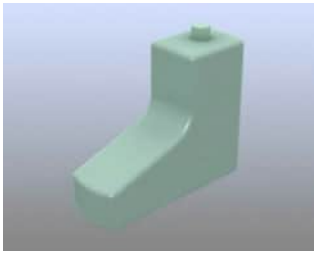
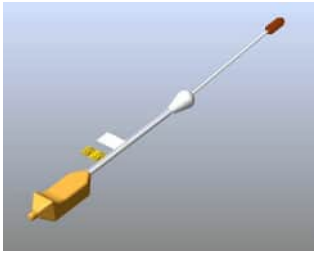
After the vacuum cushion is vented, it can be removed.

9.4 Accessories for quality assurance

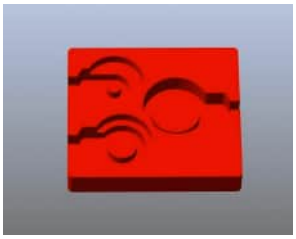
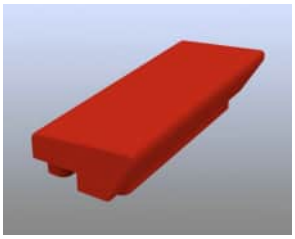
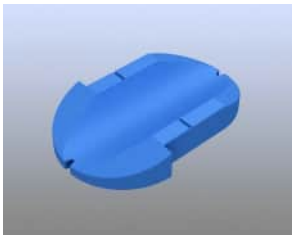
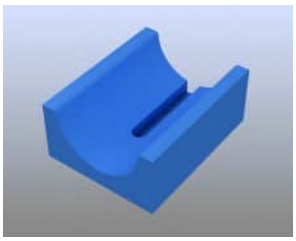
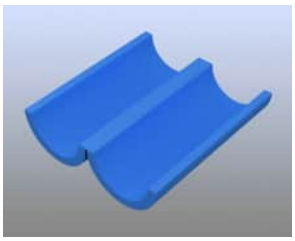
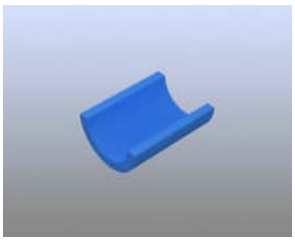
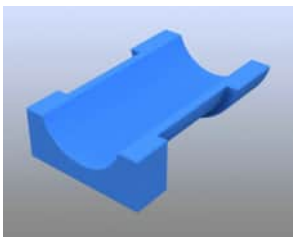
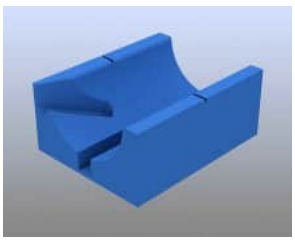
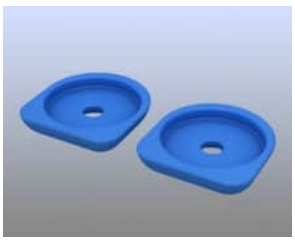
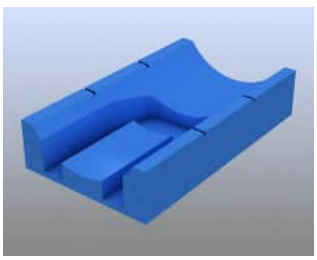
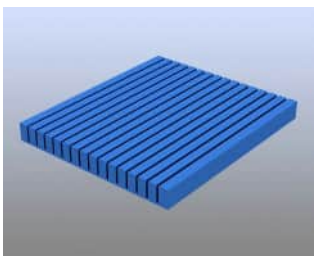
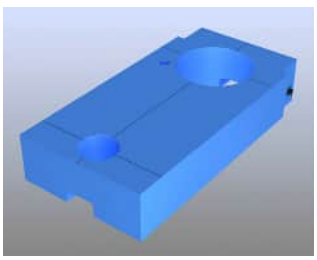
9.4.1 Measurement phantoms

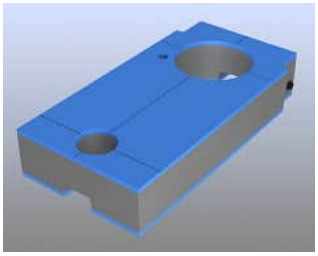
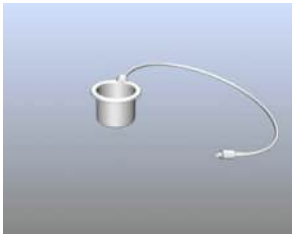
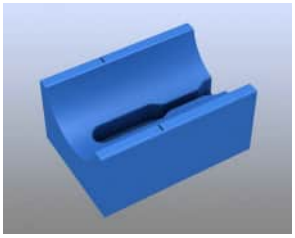
	Plastic bottle, 15ml • Solutes per 1000 g H_2O dist.: 3g $MnCl_2$ * 4 H_2O + 5g NaCl

	Plastic bottle, 1900ml • Solutes per 1000 g H_2O dist.: 3.75g $NiSO_4$* 6 H_2O + 5g NaCl
	Plastic bottle, 5300ml • Solutes per 1000 g H_2O dist.: 3.75g $NiSO_4$* 6 H_2O + 5g NaCl
	Spherical phantom D165 • Diameter: 165 mm • Contents: 2570 ml • Solutes per 1000 g H_2O dist.: 1.25g $NiSO_4$ * 6 H_2O
	Spherical phantom D240 • Diameter: 240 mm • Contents: 7300 ml • Solutes: MARCOL-Oil + 0.011g MACROLEX blue

	Hand/Wrist 16 phantom • Contents: 1100 ml • Solutes per 1000 g H_2O dist.: 3.75g $NiSO_4$* 6 H_2O + 5g NaCl
	Foot/Ankle 16 phantom • Contents: 3300 ml • Solutes per 1000 g H_2O dist.: 3.75g $NiSO_4$* 6 H_2O + 5g NaCl
	Quality assurance coil for 3T Endorectal
	Special phantom for Endorectal A powder is included with the special phantom for the Endorectal coil. It is used to prepare the phantom fluid. For additional information, refer to the Operator Manual for the special phantom.

9.4.2 Phantom holder

 Phantom holder 17	 Phantom holder 18	 Phantom holder 25
 Phantom holder 26	 Phantom holder 27	 Phantom holder 28
 Phantom holder 29	 Phantom holder 40	 Phantom holder 45
 Phantom holder 46	 Phantom holder 47	 Phantom holder 48

 Phantom holder 49	 Endorectal coil simulator	 Prostate 2 phantom holder

10 Appendix: Coil names

The following tables list the most common coil names currently used.

The tables distinguish between the following name categories:

- **User documentation**: name of the coil that is used in the user documentation (operator manuals)
- **Product inscription**: name of the coil that is printed directly on the surface of the product
- **Product label**: name of the coil that is shown on the product label on the coil or product

10.1 Head and neck

User documentation	Product inscription	Product label
Head/Neck 16	Head/Neck 16; A 3T Tim Coil	Head/Neck 16
BM Head/Neck 20	Head/Neck 20; A 3T BioMatrix Coil	Head/Neck 20 shim MR Coil 3T
BM Head/Neck 64	Head/Neck 64; A 3T BioMatrix Coil	Head/Neck 64 shim MR Coil 3T
Head/Neck 64	Head/Neck 64; A 3T Tim Coil	Head/Neck 64 MR Coil 3T
Head 32	Head 32; A 3T Tim Coil	Head 32 MR Coil 3T
TxRx CP Head	TxRx CP Head Coil 3T	TxRx CP Head MR Coil 3T
Pediatric 16	Pediatric 16; A 3T Tim Coil	Pediatric_16 MR Coil 3T

10.2 Upper body and organs

User documentation	Product inscription	Product label
BM Spine 24	Spine 24; A 3T BioMatrix Coil	BM Spine 24
BM Spine 32	Spine 32; A 3T BioMatrix Coil	Spine 32 respiratory MR coil 3T

User documentation	Product inscription	Product label
BM Spine 72	Spine 72; A 3T BioMatrix Coil	Spine 72 respiratory MR coil 3T
BM Body 12	Body 12; A 3T BioMatrix Coil	BM Body 12
BM Body 18	Body 18; A 3T BioMatrix Coil	BM Body 18
Body 18	Body 18; A 3T Tim Coil	Body 18 MR Coil 3T
Body 18 Long	Body 18 long; A 3T Tim Coil	Body 18 long MR Coil 3T
Body 6	Body 6; A 3T Tim Coil	Monet 3T Body 6
Body 30	Body 30; A 3T Tim Coil	Body 30 MR coil 3T
Contour 24	Contour 24; A 3T Tim 4G Coil	Contour 24
Endorectal	Endo Adapter	Endo Interface 3T

10.3 Breast

User documentation	Product inscription	Product label
Breast 18	Breast 18; A 3T Tim Coil	Breast 18 MR Coil 3T
Breast BI 7	Breast BI 7; A 3T Tim Coil	Breast BI 7 MR Coil 3T
2-/4-/8-Channel Sentinelle Breast Coil	-	*8-Channel Sentinelle Breast Coil*: 3CH Left Coil Element Sen 3T 3CH Right Coil Element Sen 3T Medial Coil Element Sen 3T Interface Box Breast Coil Sen 3T
		2-/4-/8-Channel Sentinelle Breast Coil: 1CH Left Coil Element Sen 3T 1CH Right Coil Element Sen 3T Medial plug Sen 3T

User documentation	Product inscription	Product label
2-/10-/16-Channel Sentinelle Breast Coil	-	8Ch Medial Coil Sen 3T 4Ch Left Lateral Coil Sen 3T 4Ch Right Lateral Coil Sen 3T 16Ch Interf. Box Breast Coil Sen 3T

10.4 Joints and extremities

User documentation	Product inscription	Product label
Shoulder Shape 16	Shoulder Shape 16; A 3T Tim Coil	3T Shoulder Shape 16
Shoulder Small/Large 16	Shoulder Small 16; A 3T Tim Coil Shoulder Large 16; A 3T Tim Coil	3T Shoulder 16 Large 3T Shoulder 16 Small
Hand/Wrist 16	Hand/Wrist 16; A 3T Tim Coil	3 T Wrist Coil
Peripheral Angio 36	Peripheral Angio 36; A 3T Tim Coil	PA 36 MR Coil 3T
TxRx Knee 18	Tx/Rx Knee 18; A 3T Tim Coil	Tx/Rx Knee MR coil 3T
Foot/Ankle 16	Foot/Ankle 16; A 3T Tim Coil	3T Foot Ankle 16 pTx
Flex Small/Large 4	Flex Large 4; A 3T Tim Coil Flex Small 4; A 3T Tim Coil	Flex Large 4 MR coil 3T Flex Small 4 MR coil 3T
UltraFlex Small/Large 18	UltraFlex Large 18; A 3T Tim Coil UltraFlex Small 18; A 3T Tim Coil	Flex Large 18 MR coil 3T Flex Small 18 MR coil 3T
Loop 4/7/11	3T Loop 11 cm 3T Loop 7 cm 3T Loop 4 cm	3T Loop 11 cm MR coil 3T Loop 7 cm MR Coil 3T Loop 4 cm MR Coil
Special Purpose 4	3T Special Purpose Coil	special purpose coil 4

10.5 Interfaces

User documentation	Product inscription	Product label
Flex Coil Interface	Flex Coil Interface 3T	Flex Coil Interface 3T
Tim Coil Interface	Tim Coil Interface 3T	TIM Coil Interface 3.0T
Multi-Channel Interface	-	Multi-Channel Interface 3T
MNO Interface	MNO Coil Interface 3T	MNO Coil Interface 3.0

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Please note: For products that are not manufactured by Siemens but distributed, please refer to the addendum "Regulatory Information"!

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