SOMATOM

Instructions for Use – Definition AS

syngo CT VB10

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SIEMENS Healthineers

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Legend

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

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

⚠ WARNING

Legend

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1 Introduction

These instructions for use provide you with detailed information about the *syngo* CT software, your CT system, the system components, and the accessories.

1.1 Scope

The Instructions for Use are only valid for the stated software version, in conjunction with the latest Release Information.

The Instructions for Use applies to the following devices:

- SOMATOM Definition AS 128-slice configuration
- SOMATOM Definition AS 64-slice configuration
- SOMATOM Definition AS 40-slice configuration
- SOMATOM Definition AS 20-slice configuration
- SOMATOM Definition AS Open 64-slice configuration
- SOMATOM Definition AS Open 20-slice configuration

The Release Information can extend the validity of the Instructions for Use for these medical devices.

Components or software functionalities that may not be part of your system configuration are nevertheless described in the present instructions for use. It may be that not all of them are marked explicitly as optional. The availability of these components or software functionalities depends on your purchase contract.

1 Introduction

2 Safety information

This section provides information about safety precautions as well as warnings and cautions to be observed.

2.1 General safety information

The basis for ensuring the safety of people and equipment are statutory regulations as well as the information given in the Instructions for Use.

For the secure operation of your medical device, it is the responsibility of the system owner to ensure that each person who operates the system reads and understands the provided Instructions for Use.

⚠ CAUTION

Not observing the Instructions for Use of the system, system options and accessories!

Injury to the patient.

- Always use the Instructions for Use in conjunction with the Instructions for Use of the particular units used.
- Follow the safety instructions.

CAUTION

Not observing the Instructions for Use of the software and its applications!

Wrong basis for diagnosis.

- Always use this Instructions for Use in conjunction with all Instructions for Use provided.
- Follow the safety instructions.

- Keep the Instructions for Use for future reference.
- Keep the Instructions for Use near the workstations for easy access.
- Electronic Instructions for Use are provided on your CT system and on the workstation.

2.1.1 Qualification and competence

CAUTION

Operation of the system, applications, or functionalities by non-trained user!

Wrong basis for diagnosis or treatment.

- The system must only be used after appropriate training by persons with the certified necessary specialist knowledge according to country-specific regulations, for example, physicians, radiologists, or technologists.
- Consult your Siemens representative for appropriate training.

2.1.2 Statutory regulations

The *System Owner Manual* provides information that is part of the *Instructions for Use* and information that is required for your SOMATOM CT system.

These documents must be observed for the following subjects:

- Tests to be performed by the system owner, see *Standards and statutory regulations*.
- Operating conditions, see *Technical specification*.
- Dose information, see *Dosimetry and imaging performance report*.
- Forms for recording test results, see *Forms*.
- Labeling, see *Location of labels*.
- Preventative maintenance, see *Maintenance plan*.
- Disposal, see *Notes about disposal*.
- Tube description, see *X-ray tube technical specification*.
- Use of OSS software, see *Open source software notice*.

Required documents for your SOMATOM CT system, for example:

- Files according to country-specific regulations
- Upgrades and additional documentation

2.1.3 In the event of fire

WARNING

Fire inside or in the vicinity of the system!

Injury to the patient or the personnel, or damage to the equipment. Gas poisoning due to burning plastic.

- Switch off the acquisition system in the event of fire.
- Make sure that you and the patient know where the escape routes are.
- Make sure that you know where the fire extinguishers are located and familiarize yourself with the use of them.

2.1.4 Risk of electrical shock

At the system

CAUTION

The system carries line voltage!

Electric shock or burn from high short-circuit current.

- Never open components of the system.
- Leave all repairs to the Siemens Service.
- Make sure that no objects, for example, necklaces, paperclips, or liquids can get into the interior of the system (electric shock, short circuit).

At the uninterruptible power supply (UPS)

WARNING

Wrong handling of batteries!

Electric shock or burn from high short-circuit current.

- Observe proper precautions.
- Servicing should be performed by qualified service personnel knowledgeable of batteries and required precautions.
- Keep unauthorized personnel away from batteries.

At the monitor

WARNING

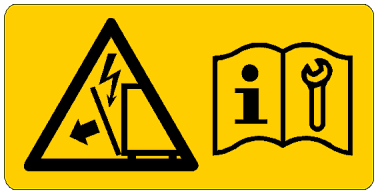
Unauthorized manipulation on or improper use of the system!

Electric shock

- Never open the monitor.
- Leave all repairs to the Siemens Service.
- Never place cups, glasses or other vessels containing liquid on or near the monitor, in case of accidental spillage.
- Make sure that no objects, for example, necklaces, paperclips, or liquids can get into the interior of the device (electric shock, short circuit).

Warning label

Warning, risk of electric shock



Risk of electric shock. Do not remove cover or back. Service must be performed by qualified service personnel. Consult accompanying documents. Call service.

2.1.5 In case of a malfunction

CAUTION

Monitor failure!

Uncontrolled system.

- Do not make any more entries via the keyboard.
- Interrupt the examination.
- If necessary, press a **STOP** key or, in case of an emergency, an **EMERGENCY OFF** button.

2.1.6 Terminating system movements and radiation

In the event of a risk of injury or damage, you can stop system movements and radiation by using the **STOP** keys.

After pressing the **STOP** key, the patient table may move up to 10 mm before it stops completely. Subsequently, no motorized system movements are possible.

You can then pull the patient table out of the opening of the gantry manually. (➔ Page 244 *Moving the table manually*)
(➔ Page 245 *Moving the table in case of emergency or power failure*)

To continue working, you must reactivate the system by selecting **Setup** > **Continue** at the workplace computer.

Location of STOP keys

The **STOP** keys are located on the gantry control panels and on the control box.

At the front of the gantry

At the rear of the gantry

At the control box

2.1.7 Shutdown in case of emergency

In addition to the **STOP** keys on the *syngo* CT unit, **EMERGENCY OFF** keys provided by the customer must be easily visible and within reach. Country-specific regulations must be observed.

CAUTION

Uncontrolled system movements and unintended radiation exposure!

Injury to the patient and personnel, and radiation damage.

- Always verify that the patient is correctly positioned.
- Always observe the patient during system movements.
- Press a **STOP** key in any of the following situations:
  - The patient is not positioned correctly during system movements
  - At any unintentional system movement (especially at autorange)
  - The patient table moves in a wrong direction
  - The patient table does not stop as expected
  - A key sticks or a movement does not stop immediately when a key is released
  - The **HOLD** key does not respond during a scan
- Press an **EMERGENCY OFF** key if the system does not respond to the STOP keys in any hazardous situation.
- Shut down the system immediately if system malfunctions are detected and notify the Siemens Customer Service.

EMERGENCY OFF keys interrupt the power supply of the system. Radiation and system movements will be stopped. Data may be lost.

The **EMERGENCY OFF** key must only be pressed if situations arise that could cause injury to the patient or user or damage to the equipment (for example, liquids, fire, or particles getting into the equipment).

2.1.8 Remote access

CAUTION

Misuse of data handling!

Wrong diagnosis

- Make sure that only a trained user gets remote access to the system.

CAUTION

The display quality at the remote assistance workplace cannot be guaranteed!

Wrong basis for diagnosis.

- If the remote assistance workplace shall be used for diagnostic purposes, make sure that all necessary regulatory and legal requirements for the monitor are fulfilled.

CAUTION

Remote and uncontrolled patient movement!

Possible injury to the patient by moving parts.

- Do not leave the *syngo* Acquisition Workplace unattended if full access is enabled. Local user still has full responsibility for appropriate usage of system.

CAUTION

Using *syngo* directly on a public or private network may lead to insufficient system performance!

Possible degradation of system performance or unexpected system behavior.

- Only use *syngo* in a secure and load-adapted network.

CAUTION

Wrong configuration of **Presentation State** support when configuring network nodes!

Loss of post-processing results.

- When configuring network nodes, enable **Presentation State** support only after verifying the remote node for PR support.

Only use remote access in high performance networks with powerful PCs to avoid insufficient display quality.

2.1.9 During scanning

Despite the design of the CT scanner, it is not possible to completely eliminate the risk of injury, including risk due to collision, contusion, radiation.

CAUTION

Locked screen when removing the PKI card during acquisiton!

Undesired radiation exposure.

- Do not remove the PKI card during acquisition.

- Never leave the CT scanner unsupervised during an examination.
- Never remove the PKI card during an examination.
- Take protective measures to avoid undesired radiation exposure. (→ Page 43 *Radiation protection*)

2.1.10 Working at the console

Observe the following safety information for your workplace.

CAUTION

Fluids in keyboard or control box!

Undesired radiation

- Keep liquids, for example, coffee and food, away from the equipment.

2.1.11 Radiation protection

For your own protection and the patient's protection, you must observe the radiation protection regulations.

The following diagrams show the distribution of stray radiation in the horizontal and vertical planes based on the scanner coordinate system (intersection of scanner axis with scan plane) for all configuration types of the SOMATOM Definition AS (according to the IEC 60601-2-44 standard). The values shown are Air Kerma in µGy per mAs.

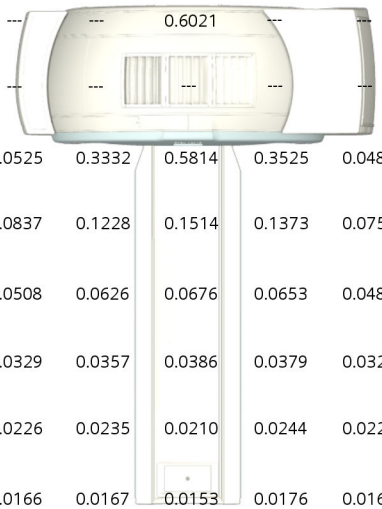
For the measurement, a cylindrical PMMA phantom with a diameter of 32 cm and a length of 15 cm ± 1 cm was centered in the scan plane.

The scanning was performed using the maximum tube voltage of 140 kV and the maximum collimation for each configuration type:

CT system	Configuration type	Maximum collimation
Definition AS	128-slice	64 x 0.6 mm
Definition AS	64-slice	32 x 0.6 mm
Definition AS	40-slice	16 x 1.2 mm
Definition AS	20-slice	16 x 1.2 mm
Definition AS Open	64-slice	32 x 0.6 mm
Definition AS Open	20-slice	16 x 1.2 mm

SOMATOM Definition AS 128-slice configuration (top view)

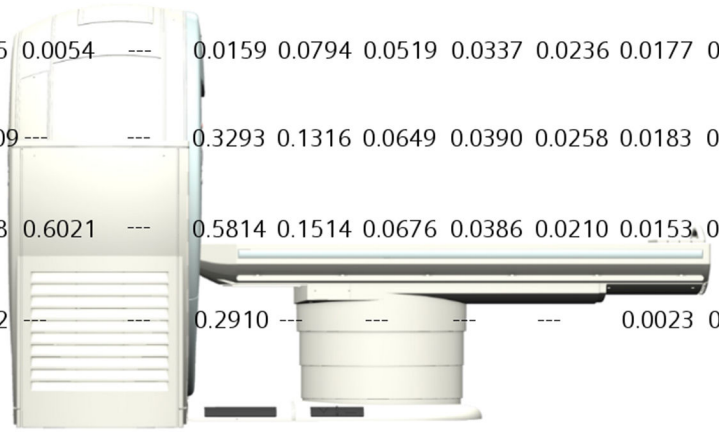
	1.50m	1.00m	0.50m	0.00m	0.50m	1.00m	1.50m
2.00m	0.0254	0.0374	0.0418	0.0432	0.0425	0.0363	0.0250
1.50m	0.0237	0.0491	0.0639	0.0673	0.0616	0.0495	0.0200
1.00m	0.0098	0.0496	0.1189	0.1578	0.1243	0.0427	0.0079
0.50m	0.0034	---	---	0.6021	---	---	0.0029
0.00m	0.0047	---	---	---	---	---	0.0028
0.50m	0.0124	0.0525	0.3332	0.5814	0.3525	0.0485	0.0091
1.00m	0.0301	0.0837	0.1228	0.1514	0.1373	0.0755	0.0286
1.50m	0.0364	0.0508	0.0626	0.0676	0.0653	0.0489	0.0333
2.00m	0.0274	0.0329	0.0357	0.0386	0.0379	0.0322	0.0256
2.50m	0.0206	0.0226	0.0235	0.0210	0.0244	0.0221	0.0190
3.00m	0.0155	0.0166	0.0167	0.0153	0.0176	0.0161	0.0142
3.50m	0.0118	0.0128	0.0130	0.0121	0.0130	0.0127	0.0121



(Values stated in units of Air Kerma in µGy per mAS)

SOMATOM Definition AS 128-slice configuration (side view)

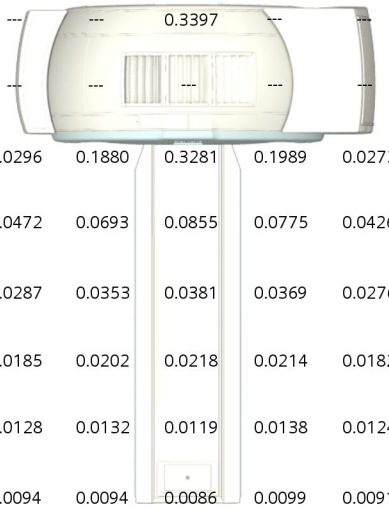
	2.00m	1.50m	1.00m	0.50m	0.00m	0.50m	1.00m	1.50m	2.00m	2.50m	3.00m	3.50m
1.50m	0.0253	0.0230	0.0103	0.0038	0.0036	0.0133	0.0241	0.0365	0.0282	0.0215	0.0170	0.0138
1.00m	0.0381	0.0519	0.0425	0.0054	---	0.0159	0.0794	0.0519	0.0337	0.0236	0.0177	0.0145
0.50m	0.0424	0.0666	0.01309	---	---	0.3293	0.1316	0.0649	0.0390	0.0258	0.0183	0.0143
0.00m	0.0432	0.0673	0.1578	0.6021	---	0.5814	0.1514	0.0676	0.0386	0.0210	0.0153	0.0121
0.50m	0.0400	0.0620	0.1112	---	---	0.2910	---	---	---	---	0.0023	0.0019
1.00m												



(Values stated in units of Air Kerma in µGy per mAS)

SOMATOM Definition AS 64-slice configuration and SOMATOM Definition AS Open 64-slice configuration (top view)

	1.50m	1.00m	0.50m	0.00m	0.50m	1.00m	1.50m
2.00m	0.0143	0.0211	0.0236	0.0244	0.0240	0.0205	0.0141
1.50m	0.0134	0.0277	0.0361	0.0380	0.0348	0.0279	0.0113
1.00m	0.0055	0.0280	0.0671	0.0890	0.0701	0.0241	0.0044
0.50m	0.0019	---	---	0.3397	---	---	0.0017
0.00m	0.0026	---	---	---	---	---	0.0016
0.50m	0.0070	0.0296	0.1880	0.3281	0.1989	0.0273	0.0052
1.00m	0.0170	0.0472	0.0693	0.0855	0.0775	0.0426	0.0161
1.50m	0.0205	0.0287	0.0353	0.0381	0.0369	0.0276	0.0188
2.00m	0.0155	0.0185	0.0202	0.0218	0.0214	0.0182	0.0144
2.50m	0.0116	0.0128	0.0132	0.0119	0.0138	0.0124	0.0107
3.00m	0.0088	0.0094	0.0094	0.0086	0.0099	0.0091	0.0080
3.50m	0.0067	0.0072	0.0073	0.0068	0.0073	0.0072	0.0068



(Values stated in units of Air Kerma in µGy per mAS)

SOMATOM Definition AS 64-slice configuration and SOMATOM Definition AS Open 64-slice configuration (side view)

	2.00m	1.50m	1.00m	0.50m	0.00m	0.50m	1.00m	1.50m	2.00m	2.50m	3.00m	3.50m
1.50m	0.0143	0.0130	0.0058	0.0021	0.0020	0.0075	0.0136	0.0206	0.0159	0.0121	0.0096	0.0078
1.00m	0.0215	0.0293	0.0240	0.0030	---	0.0090	0.0448	0.0293	0.0190	0.0133	0.0100	0.0082
0.50m	0.0239	0.0376	0.0739	---	---	0.1858	0.0743	0.0366	0.0220	0.0146	0.0103	0.0080
0.00m	0.0244	0.0380	0.0890	0.3397	---	0.3281	0.0855	0.0381	0.0218	0.0119	0.0086	0.0068
0.50m	0.0226	0.0350	0.0627	---	---	0.1642	---	---	---	---	0.0013	0.0011
1.00m												

(Values stated in units of Air Kerma in µGy per mAS)

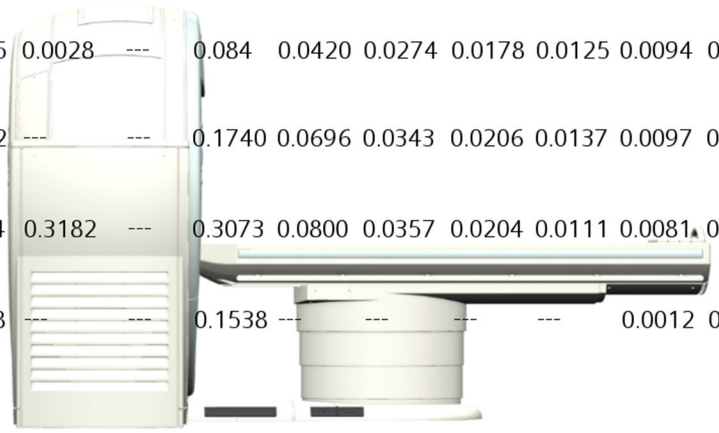
SOMATOM Definition AS 40-slice configuration (top view)

	1.50m	1.00m	0.50m	0.00m	0.50m	1.00m	1.50m
2.00m	0.0134	0.0198	0.0221	0.0228	0.0225	0.0192	0.0132
1.50m	0.0125	0.0260	0.0338	0.0356	0.0326	0.0261	0.0106
1.00m	0.0052	0.0262	0.0628	0.0834	0.0657	0.0226	0.0042
0.50m	0.0018	---	---	0.3182	---	---	0.0016
0.00m	0.0025	---	---	---	---	---	0.0015
0.50m	0.0066	0.0277	0.1761	0.3073	0.1863	0.0256	0.0048
1.00m	0.0159	0.0442	0.0649	0.0800	0.0726	0.0399	0.0151
1.50m	0.0192	0.0269	0.0331	0.0357	0.0345	0.0258	0.0176
2.00m	0.0145	0.0174	0.0189	0.0204	0.0200	0.0170	0.0135
2.50m	0.0109	0.0120	0.0124	0.0111	0.0129	0.0117	0.0100
3.00m	0.0082	0.0088	0.0088	0.0081	0.0093	0.0085	0.0075
3.50m	0.0062	0.0068	0.0069	0.0064	0.0069	0.0067	0.0064

(Values stated in units of Air Kerma in µGy per mAS)

SOMATOM Definition AS 40-slice configuration (side view)

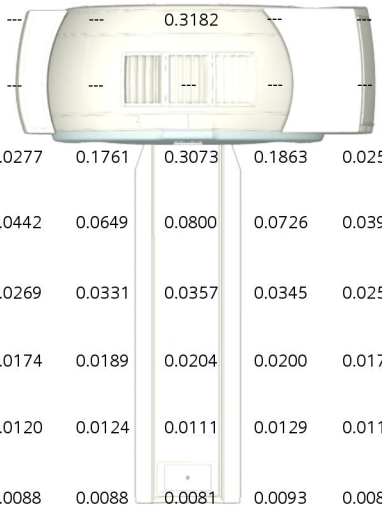
	2.00m	1.50m	1.00m	0.50m	0.00m	0.50m	1.00m	1.50m	2.00m	2.50m	3.00m	3.50m
1.50m	0.0134	0.0121	0.0055	0.0020	0.0019	0.0070	0.0128	0.0193	0.0149	0.0113	0.0090	0.0073
1.00m	0.0201	0.0274	0.0025	0.0028	---	0.084	0.0420	0.0274	0.0178	0.0125	0.0094	0.0077
0.50m	0.0224	0.0352	0.0692	---	---	0.1740	0.0696	0.0343	0.0206	0.0137	0.0097	0.0075
0.00m	0.0228	0.0356	0.0834	0.3182	---	0.3073	0.0800	0.0357	0.0204	0.0111	0.0081	0.0064
0.50m	0.0211	0.0328	0.0588	---	---	0.1538	---	---	---	---	0.0012	0.0010
1.00m												



(Values stated in units of Air Kerma in µGy per mAS)

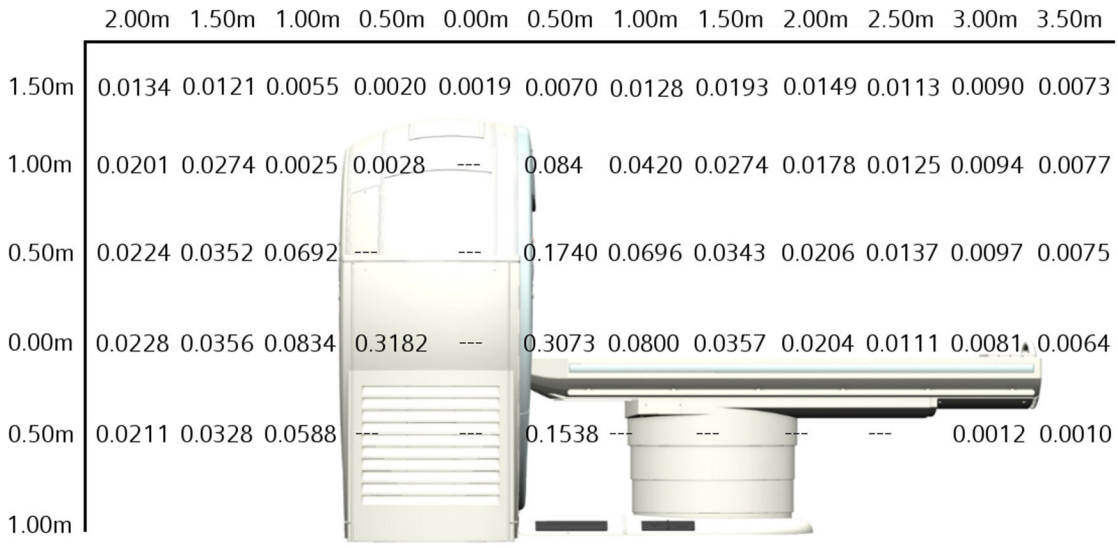
SOMATOM Definition AS 20-slice configuration and SOMATOM Definition AS Open 20-slice configuration (top view)

	1.50m	1.00m	0.50m	0.00m	0.50m	1.00m	1.50m
2.00m	0.0134	0.0198	0.0221	0.0228	0.0225	0.0192	0.0132
1.50m	0.0125	0.0260	0.0338	0.0356	0.0326	0.0261	0.0106
1.00m	0.0052	0.0262	0.0628	0.0834	0.0657	0.0226	0.0042
0.50m	0.0018	---	---	0.3182	---	---	0.0016
0.00m	0.0025	---	---	---	---	---	0.0015
0.50m	0.0066	0.0277	0.1761	0.3073	0.1863	0.0256	0.0048
1.00m	0.0159	0.0442	0.0649	0.0800	0.0726	0.0399	0.0151
1.50m	0.0192	0.0269	0.0331	0.0357	0.0345	0.0258	0.0176
2.00m	0.0145	0.0174	0.0189	0.0204	0.0200	0.0170	0.0135
2.50m	0.0109	0.0120	0.0124	0.0111	0.0129	0.0117	0.0100
3.00m	0.0082	0.0088	0.0088	0.0081	0.0093	0.0085	0.0075
3.50m	0.0062	0.0068	0.0069	0.0064	0.0069	0.0067	0.0064



(Values stated in units of Air Kerma in µGy per mAS)

SOMATOM Definition AS 20-slice configuration and SOMATOM Definition AS Open 20-slice configuration (side view)



	2.00m	1.50m	1.00m	0.50m	0.00m	0.50m	1.00m	1.50m	2.00m	2.50m	3.00m	3.50m
1.50m	0.0134	0.0121	0.0055	0.0020	0.0019	0.0070	0.0128	0.0193	0.0149	0.0113	0.0090	0.0073
1.00m	0.0201	0.0274	0.0025	0.0028	---	0.084	0.0420	0.0274	0.0178	0.0125	0.0094	0.0077
0.50m	0.0224	0.0352	0.0692	---	---	0.1740	0.0696	0.0343	0.0206	0.0137	0.0097	0.0075
0.00m	0.0228	0.0356	0.0834	0.3182	---	0.3073	0.0800	0.0357	0.0204	0.0111	0.0081	0.0064
0.50m	0.0211	0.0328	0.0588	---	---	0.1538	---	---	---	---	0.0012	0.0010
1.00m												

(Values stated in units of Air Kerma in µGy per mAS)

2.1.12 Radiation protection equipment

Special equipment is part of the radiation protection regulations.

Control area

The console is located outside the radiation control area. The patient can be observed through a lead glass window. The gantry and the patient table can be operated by remote control.

- When scanning, operate the system from the console whenever possible.

Radiation shielding

If scans need to be released from inside the control area, or if accompanying personnel need to remain there, safety measures must be taken. For example, lead aprons, protective walls, and so forth. (→ Page 52 *Protective measures*)

Protective measures

Take the following measures to protect both yourself and the patient.

CAUTION

Radiation in the examination room after the **Start** key has been pressed!

Undesired radiation exposure.

- Leave the examination room before initiating scanning or for interventional CT examination, wear protective clothing.

Personnel

Anyone who needs to be near the patient during scanning must observe the following precautions:

- Wear protective clothing, for example, a lead apron.
- Wear a PEN dosimeter and/or film badge.
- Stay in the zone shielded by the system i.e., to the side of the gantry or behind a mobile protective wall.

Patients

You are responsible for protecting the patient from unnecessary radiation, for example:

- Always use a gonadal shield, if possible.
- Use the pediatric mode for children.
- Use *CARE* products.

Reduction of the radiation exposure

You can avoid repeating a measurement and therefore reduce the radiation exposure to the patient by taking certain precautions. (→ Page 364 *Important safety information*)

- Observe the calibration and maintenance instructions in the manual. (→ Page 559 *Maintenance*)

2.1.13 Operating conditions

Only operate the system in rooms intended for medical purposes.

The following requirements must be fulfilled for operation of the system:

(➔ Page 53 *Climatic requirements in the examinations room*) (➔ Page 53 *Explosion protection*) (➔ Page 53 *Electromagnetic compatibility*) (➔ Page 54 *Protective measures*) (➔ Page 54 *Safety equipment*)

Climatic requirements in the examinations room

CAUTION

System is operated outside of the specified temperature range!

Wrong diagnosis possible (artifacts may occur).

- If the working conditions specified cannot be met, the room must be equipped with air-conditioning or the system must be shut down.

The air inside the examination room must fulfill the following requirements while running the CT system:

Temperature range: 18 – 28 °C (64.4 – 82.4 °F)

Humidity: 20 – 75 %

For further information, see *System Owner Manual*, chapter *Technical specification*.

Explosion protection

The CT system, components, and accessories are not suitable for operation or storage in areas containing explosive gases.

Electromagnetic compatibility

The system complies with the EMC stipulations, see *System Owner Manual*, chapter *Technical description*.

Certain items of equipment, for example, radio telephones (mobiles) exceed the limit values of the EMC stipulations. In extreme cases, use of such items can cause interference.

- Do not use a radio telephone or similar equipment in the vicinity of the system.

Protective measures

The following protective measures must be followed when installing the system:

- (→ Page 54 *Power connection*)
- (→ Page 54 *Fire extinguishers*)
- (→ Page 54 *Site On/Off-switch*)
- (→ Page 54 *Radiation warning lamps*)

Power connection

The power supply must be provided to all products operated as part of an X-ray system through a fixed wiring connection and a multipole interrupting device provided by the customer. The equipment must be installed according to specification DIN VDE 0100, Part 710 or must meet the respective national regulations.

Fire extinguishers

Fire extinguishers must be located in easily accessible and visible locations.

Site On/Off-switch

In compliance with the MDD (Medical Device Directive) an On/Off switch (EMERGENCY OFF) must be installed on site by the customer.

The On/Off state must be visible.

Radiation warning lamps

Radiation warning lamps are recommended to be installed on all doors of the examination room. They must be visible from all areas where radiation can be released.

Safety equipment

The system contains several items of safety equipment to protect the patient, the operating personnel, accompanying people and the system itself.

In addition to the measures already mentioned, the system has the following safety equipment:

(→ Page 54 *Temperature monitoring of the X-ray tube assembly*)
(→ Page 55 *Uninterruptible power supply, UPS*)
(→ Page 55 *Overheating*)

Temperature monitoring of the X-ray tube assembly

The temperature of the X-ray tube assembly is permanently monitored and calculated in advance. This function runs in the background. If the temperature rises above the limit value, a warning is given.

If necessary, scanning is postponed until the required cooling period has elapsed. This means that you might have to wait a certain time before you can continue with the examination as planned.

Overheating

The possible causes of overheating are:

- Ambient temperature too high
- Ventilation openings covered
- Defective cooling system
- Dirty air filters

To change the air filters, see *System Owner Manual*.

If certain parts of the equipment overheat, a warning is displayed on the monitor. (➔ Page 221 *Exceptional situations*)

- In this case, complete the current measurement as quickly as possible and shut down the system. (➔ Page 222 *Shutdown*) (➔ Page 222 *Restart*)

Uninterruptible power supply, UPS

The computers are equipped with an uninterruptible power supply (UPS). Furthermore, the entire system can be connected to the emergency power supply of the hospital.

If the uninterruptible power supply is active, a message or an acoustic signal indicates this. (➔ Page 221 *Exceptional situations*)

- Complete the current examination as quickly as possible and shut down the system.

Equipment modifications

Modifications of the system must be made in compliance with all legal stipulations by Siemens Service or other authorized personnel.

Limitation of liability

As the manufacturer, assembler, installer, or importer of the system, Siemens does not accept liability for the safety functions, reliability, or performance of the system if one of the following circumstances applies:

- Installation, upgrade, readjustment, modification, repair, or upgrading by persons not authorized to do so by Siemens.
- Components not properly replaced with original parts from Siemens.
- Electrical installation in the examination room that does not comply with the requirements of the currently valid standard DIN VDE 0100 Part 710 or other binding codes of practice.
- Operation of the system in a way which deviates from the instructions given in these manuals.

Certificate of conformity from other manufacturers

We therefore recommend that you obtain a certificate of conformity containing the following information:

- Type, extent and date of the work performed on the system
- Names of all those involved in the work (and their companies)
- Their signatures

Please note that this does *not* imply that the repairs are authorized. Siemens does *not* accept liability for repairs that are carried out without our written permission.

Equipment of other manufacturers

If you are planning to install equipment of other manufacturers, you must obtain information about potential dangers in connecting or using systems or equipment of other manufacturers. This information can be drawn from the system specification.

If this information is not sufficient, you must consult the manufacturer of such systems/equipment or a specialist about the following topics:

- Reliability and performance of the systems/equipment
- Potential safety risks for people and equipment

Accessory equipment connected to the analog and digital interfaces must be certified according to the respective IEC standards. Furthermore, all configurations must comply with the applicable standards, for example, IEC 60950 for data processing equipment and IEC 60601-1 for medical electrical equipment. For further information, see *System Owner Manual*, chapter *Standards and statutory regulations*.

Any person who connects additional equipment to the signal input part or signal output part is configuring a medical system and is therefore responsible for ensuring that the system complies with the applicable standards.

For further information, contact your local customer service representative or your Siemens regional office.

Software manipulation

Installations or upgrades of the system must be made in compliance with all legal stipulations by Siemens Service or other authorized personnel. (➔ Page 56 *Limitation of liability*)

CAUTION

Unauthorized access to the operating system!

Software manipulation

- Users are not authorized to work on operating system level. Any software manipulation is forbidden.

CAUTION

Manipulation of file system!

Software manipulation.

- Do not manipulate data in the file system, except within folders explicitly allowed by the Instructions for Use. Any software manipulation is forbidden.

CAUTION

Impermissible or faulty manipulations or changes of the hardware or software, or connection of the system to a network can cause the system to malfunction!

Unauthorized access, injury to the patient or damage to the equipment.

- Make sure that all necessary precautions with respect to the existing level of security are considered when adding a functionality or altering the shipped configuration.
- Do not open or remove the cover of the equipment nor install third-party software.

CAUTION

System infected by computer virus!

Manipulation of the software.

- *Never* use a data medium that could contain a computer virus, for example game CD.
- Check disks for viruses *before* using them.

2.1.14 Emergency access

CAUTION

User access may be prevented due to forgotten or unknown accounts or passwords, account lockout policy, or wrong setup, for example, in case of an emergency!

Inaccessible system

- Define a general user account for emergency access and assign it to a group and a role both called **Emergency Access**.
- Define a local user account for emergencies. The password for this account should never expire.
- Do not allow users to change the password for the emergency account.
- The users shall contact administrators immediately in case of problems.

2.1.15 *syngo* Security Package

CAUTION

Behavior of secured systems. The hospital's security policy affects the behavior of the *syngo* system. For example, password strength requirements, enabled empty passwords, or locking of an account after a specific number of failed logins!

Inaccessible system or data.

- Establish a user model for your hospital and verify it before the security system is activated.
- Establish a proper procedure for emergency access.
- Note that if you enable an empty password for the emergency account, this is enabled for all other users as well. Nevertheless, instruct the users to use strong passwords.
- Always back up your system before enabling the security system and before any major changes.
- Inform all users about any changes and settings. The users shall contact administrators immediately in case of problems.

2.1.16 Disposal of the system

CAUTION

Improper disposal of the system or parts of the system!

Pollution of the environment.

- System components hazardous to persons or the environment must be disposed of with care and in compliance with legally binding ordinances.
- Examples of environmentally relevant components are accumulators and batteries, transformers, capacitors, monitor picture tubes, and phantoms.
- For details contact your local customer service representative or your Siemens regional office.

For further information about disposal, see *System Owner Manual*.

2.2 Safety information on working with patient data

Observe the following sections when updating or deleting data in the **Patient Browser**.

2.2.1 Registering a patient

Observe the following safety information before performing an examination. Ensure that the registered patient data and patient position are correct.

CAUTION

Wrong entry of patient sex or age!

Wrong basis for diagnosis.

- Make sure that the patient sex and age are correct.

CAUTION

The operating system may not support all characters for the received DICOM document!

The display of the name, for example, the patient name may be incomplete or misleading.

- *syngo* will not change the used characters, for example, minority characters, even if it cannot display them.
- Use other attributes for identification, if possible.

CAUTION

When working with several monitors, the patient name displayed in the folder of a task card belongs only to this task card. Any other visible task card may contain data from another patient!

Possible wrong diagnosis.

- Use patient demographics displayed in the image text for clear identification.

CAUTION

Automatic registration for compare layout is not sufficient!

Insufficient basis of diagnosis.

- Check registration and use manual registration functionality to re-adjust registration if automatic registration is not sufficient.

2.2.2 Updating patient data

Observe the following safety information when updating the patient data after the examination and reconstruction of images.

CAUTION

Rearranging series or images to another series may lead to wrong image information if the selected images or series are not compatible!

Wrong diagnosis due to wrong image information.

- Correct the attributes which do not correspond first and then rearrange the series or images.

CAUTION

Correcting or rearranging objects containing references!

Possible loss of references.

- Rearrange the entire hierarchical group containing all objects with references in order to maintain the references.
- Only references found within the selection will be adapted.

CAUTION

Inconsistent patient data or image information for *syngo* CT and *syngo*.CT postprocessing applications!

Wrong basis for diagnosis.

- Do not modify patient data (**Edit > Correct** in the **Browser** menu) after results have been calculated.

CAUTION

Mix-up of patients due to changed image data!

Wrong diagnosis due to wrong information.

- Always verify that all corrected or rearranged data belongs to the correct patient.
- Take special care when using drag and drop.

CAUTION

Mix-up of patients due to insufficient configuration of image text!

Wrong diagnosis due to wrong information.

- Always apply full image text to avoid mix-up of patients.
- Make sure that customized image text contains at least the main patient demographics, for example, patient ID, name, date of birth, and sex.

Additional information on radiation therapy objects

CAUTION

If any Radiotherapy (RT) object is involved in a correction or rearrangement, the references to and from other objects are not updated. The Correct and Rearrange function checks if any RT objects are involved and prompts for confirmation!

Possible loss of references between images and RT objects.

- Use the application that was used to generate the RT object for managing their references.
- First correct images, for example, patient demographics, before using them within RT.

2.2.3 Searching patient data

CAUTION

If the Patient ID is not unique, studies may be listed, which do not belong to the patient selected and displayed in the information area!

Import of wrong patient data possible.

- Always check the patient data before importing them into your system.

2.2.4 Deleting patient data

Observe the following safety information before deleting patient data in the **Patient Browser**.

CAUTION

Deletion confirmation deactivated!

Possible loss of data.

- The option in the **General** tab card to configure the **Delete Confirmation** dialog box should not be switched off.
- Be careful when activating a filter for auto deletion of data sets that it fits to your workflow as well.

CAUTION

Deletion confirmation deactivated!

Possible loss of data.

- The option in the **General** tab card to configure the **Delete Confirmation** dialog box should not be switched off.
- Be careful when setting permissions to delete documents without check if flags are not set.

CAUTION

Deactivation of the **Delete Confirmation** dialog box for **Auto Delete**!

Loss of data, delay of diagnosis or therapy.

- The **Delete Confirmation** dialog box for **Auto Delete** should always be switched on, especially on modalities.
- If the **Delete Confirmation** dialog box for **Auto Delete** is switched off, **Auto Delete** will start without user confirmation.

CAUTION

The **Delete Confirmation** dialog box for auto deletion is kept open for a long time on scanner systems!

Loss of data if objects chosen for auto deletion are updated by acquisition when the Delete Confirmation dialog box is open.

- Do not keep the **Delete Confirmation** dialog box open for a long time in parallel during a patient examination, and close it before a patient registration.

CAUTION

Conflicting **Auto Delete Configuration** and **Transfer Configuration**!

Loss of data if both functionalities start in parallel.

- Do not use the **Sent** flag for rule "Delete all Series with flags..." if auto transfer is configured to start when the **Sent** flag is set in combination.
- Use storage commitment whenever the sending and receiving systems supported it.
- If this combination is not avoidable, always crosscheck if the data chosen for auto deletion is actually stored on the receiving system before confirming auto deletion.

2.3 Safety information on patient transport and positioning

For safe and secure patient transport and patient positioning, observe the following the sections depending on your workflow.

CAUTION

Incorrect patient positioning!

Injury to the patient by moving parts.

- Make sure that neither the patient's clothing nor hair can get caught in mechanical parts.
- Make sure that infusion lines and respiration tubes, catheters and ECG cables cannot get caught in the space between the table top and the side parts. These components must not be put under tensile stress in any other way.
- Make sure that patient bedding cannot get caught by moving parts of the patient table.
- Use positioning aids as described.

CAUTION

Not observing the Instructions for Use of the system, system options and accessories!

Injury to the patient.

- Always use the Instructions for Use in conjunction with the Instructions for Use of the particular units used.
- Follow the safety instructions.

The patient table and accessories are designed for certain maximum loads.

CAUTION

Exceeding the maximum load of the equipment!

Injury to the patient or the personnel, or damage to the equipment.

- Make sure that the maximum load is not exceeded. The maximum load is displayed on a label on the equipment.

The patient must always be positioned on the patient table.

Never position the patient directly in the gantry!

2.3.1 Patient table

CAUTION

Horizontal table top movement!

Possible injury to the hand (warning label).

- Do not place your hand in the gap of the table top support.

CAUTION

Lowering the patient table!

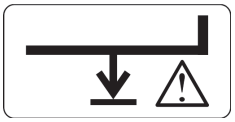
Body parts can get caught.

- Make sure that the patients body parts are above the patient table.
- Make sure that neither body parts of anybody nor any objects are below the patient table.

Warning, crushing hazard for hand

Increased risk that hands can get pinched between table top and patient table.

Caution, leg injuries



Contusion of legs is possible when lowering the patient table.

Caution: Consult accompanying documents.

Patient table with 1600 mm scan range

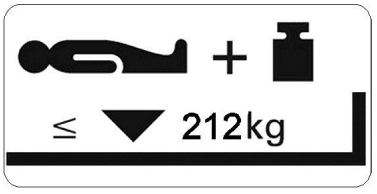
CAUTION

Unintended table top movement when the brake is released!

Injury to the patient or the personnel.

- Make sure that the brake is locked before positioning the patient.
- Always fix and observe the patient.
- Take special care during operation when the brake is released.

Total working load label



The maximum permissible working load must not exceed 212 kg (435 lbs), which is approximately 2079 N.

Patient table with 2000 mm scan range

The old label shows the maximum weight of the patient.

Total working load label (old)

The maximum permissible working load must not exceed 220 kg (485 lbs), which is approximately 2157 N.

The new label shows the maximum weight of the patient and additional mass.

Total working load label

The maximum permissible working load must not exceed 227 kg (500 lbs), which is approximately 2226 N.

Multi purpose table

The maximum load of the multi purpose table depends on the table top used.

Standard table top and the RTP table top

Total working load label

The maximum permissible working load must not exceed 227 kg (500 lbs), which is approximately 2226 N.

The total working load label shows the maximum weight of the patient and additional mass.

Maximum load label

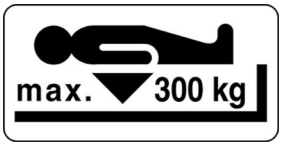
The maximum permissible working load must not exceed 220 kg (485 lbs), which is approximately 2157 N.

The maximum load label (old) shows the maximum weight of the patient.

High capacity table top

The old label shows the maximum weight of the patient.

Total working load label (old)



The maximum permissible working load must not exceed 300 kg (661 lbs), which is approximately 2942 N.

The new label shows the maximum weight of the patient and additional mass.

Total working load label

The maximum permissible working load must not exceed 307 kg (677 lbs), which is approximately 3010 N.

Standard surgical rail

Maximum load label

The maximum permissible load must not exceed 30 kg (66 lbs), which is approximately 294 N.

i-Control (interventional panel)

Observe the following safety information when using the i-Control (interventional panel).

CAUTION

Disturbance of peripheral electrical devices, for example, pace makers, due to electromagnetic emission!

Heart arrhythmia

- To ensure patient safety, keep the intervention module (i-Control) at a minimum distance of 10 cm away from the patient.

CAUTION

Uncontrolled system movement due to unintended signal activation by users!

Injury to the patient or damage to the system.

- Always observe the patient directly. Press the nearest **STOP** key immediately if an undesired system movement is performed.

CAUTION

Unintentional patient movement!

Unintentional activation of the i-Control by the patient.

- Always fix and observe the patient when using the i-Control.

CAUTION

Operation of the i-Control in the wrong examination room!

Injury to the patient or damage to the system.

- Always keep the i-Control at the associated CT scanner.

CAUTION

Uncontrolled system movement due to unintended signal activation by users!

Injury to the patient or damage to the system.

- Always keep the activated intervention module (i-Control) at the CT scanner to prevent unauthorized use.

Foot switches

Observe the following safety information when using a foot switch.

CAUTION

Use of unsuitable foot switches!

Incorrect function possible.

- Only an original Siemens foot switch must be installed.

2.3.2 Accessories

This section provides safety information on the accessories supplied with your system.

Patient transport (CARE TransX)

Observe the following safety information when using CARE TransX.

Trolley

CAUTION

Overload of the trolley!

Breakdown of the trolley.

- Always observe the permissible maximum load of the patient trolley.

CAUTION

Arms, legs or hairs are hanging down at the sides of the trolley!

Injury to the patient.

- Make sure that neither the patient's arms, legs nor hair can hang down at the sides.

CAUTION

The patient is not fixed correctly with the restraint straps!

The patient may fall off the trolley.

- Always firmly close the restraint straps to prevent the patient from falling off the trolley.

CAUTION

Faulty patient positioning using the CARE TransX trolley!

The patient may fall off the trolley.

- Before transferring the patient between trolley and table, always make sure that the caster brakes are locked to render the trolley immobile, and that the table top is exactly level with the trolley stretcher top at the outwards end position to avoid collision.
- Make sure that any infusion tubes are not squeezed or displaced during the transfer procedure.
- Also make sure that patient hair does not become entangled.
- Position the CARE TransX stretcher in a way that it is centered about the longitudinal axis of the table top and cannot hang over at the foot end or the head end.

Stretcher

CAUTION

During transport with the stretcher the patient is not firmly strapped to the stretcher!

The patient may fall off the stretcher.

- Strap the patient firmly to the stretcher before transport.

CAUTION

During transport the transport straps are not correctly attached to hold the stretcher unit securely!

The patient may fall off the stretcher.

- Before transport make sure that the transport straps are correctly attached in order to ensure that you can hold the stretcher unit securely.

CAUTION

During patient transport the stretcher is not carried horizontally!

The patient may fall off the stretcher.

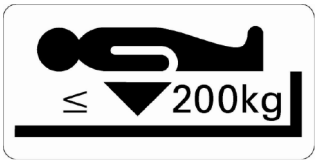
- Always carry the stretcher horizontally during transport.

Label **Warning, collision of the patient with the equipment**

Collision of the patient with the gantry.

Indicates possible collision of the patient with the gantry. Always watch the patient while the table is moving.

Maximum load label



The maximum permissible load must not exceed 200 kg (441 lbs), which is approximately 1961 N.

Mattress with flat surface

CAUTION

Use of the mattress with flat surface!

Contusion of patient's fingers during table movement.

- Always use both arm supports with the mattress with flat surface.
- Observe that the hands of the patient are completely covered by the arm support.
- Always fix and observe the patient during table movement.

Radiation Therapy Planning (RTP) table top

Observe the following safety information when using the Radiation Therapy Planning (RTP) table top.

CAUTION

Use of the RTP table top!

Contusion of patient's fingers during table movement.

- Always use both arm supports with RTP table top.
- Observe that the hands of the patient are completely covered by the arm support.
- Always fix and observe the patient during table movement.

Radiation Therapy Planning (RTP) Overlay

Observe the following safety information when using the Radiation Therapy Planning (RTP) overlay.

CAUTION

Use of unauthorized extensions!

Danger to the patient through collisions with the gantry.

- Only use extensions which are released for your CT system.

CAUTION

Use of the RTP overlay!

Contusion of patients fingers during table movement.

- Always use both arm supports with RTP overlay.
- Observe that the hands of the patient are completely covered by the arm support.
- Always fix and observe the patient during table movement.

The patient's hands must be completely covered by the arm supports.

CAUTION

Mounting of RTP overlay!

Contusion of operator's fingers between RTP overlay and patient table.

- Take care not to pinch your fingers when mounting the RTP overlay.

CAUTION

RTP overlay is an additional absorber in the scan field!

Reduced low contrast resolution at soft tissue tumors.

- Consider reduced low contrast resolution when identifying soft tissue tumors.

CAUTION

Design of the RTP overlay generates image artifacts!

Additional dose due to scan repetition.

- Image artifacts are normal during scanning with the RTP overlay. It is not necessary to repeat the scan.

Positioning aids

Observe the safety information on positioning aids supplied with your system.

Positioning aids are subject to wear and tear. They must be replaced with original parts if they become dirty or damaged.

CAUTION

Use of non-original positioning aids!

Injury to the patient through collisions with the gantry. Image quality may also decrease.

- Use only positioning aids that are mentioned in the Instructions for Use.

CAUTION

Improper use of positioning aids!

Injury to the patient or damage to the system are possible.

- Use the positioning aids exclusively for their original purpose.

CAUTION

Exceeding the maximum load of the equipment!

Injury to the patient or the personnel, or damage to the equipment.

- Make sure that the maximum load is not exceeded. The maximum load is displayed on a label on the equipment.

Head holder

CAUTION

If a head holder or support does not engage securely, it can come loose!

Injury to the patient.

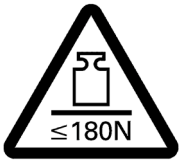
- Make sure that the pluggable positioning aids are seated firmly and securely engaged in the receptacle at the end of the table top.

Warning, collision of the patient with the equipment

Collision of the patient with the gantry.

Indicates possible collision of the patient with the gantry. Always watch the patient while the table is moving.

Maximum load label



The maximum permissible load must not exceed 180 N, which is approximately 18 kg (40 lbs).

Depending on the delivery date of the system, the position of this label can be inside of the bowl of the head holder.

Tiltable head holder

CAUTION

If a head holder or support does not engage securely, it can come loose!

Injury to the patient.

- Make sure that the pluggable positioning aids are seated firmly and securely engaged in the receptacle at the end of the table top.

CAUTION

Tiltable head holder not correctly locked in place!

Undesired radiation exposure due to repetition of the scan.

- Always make sure that the tiltable head holder is correctly locked in place.

CAUTION

Unobserved movement of the patient table or gantry!

Collision of the patient with the gantry.

- Monitor the patient continuously as long as the table top and gantry are moving.
- Take special care with the tilt of the gantry other than 0 degree or a table height other than the isocenter for the patient.

Warning, collision of the patient with the equipment

Collision of the patient with the gantry.

Indicates possible collision of the patient with the gantry. Always watch the patient while the table is moving.

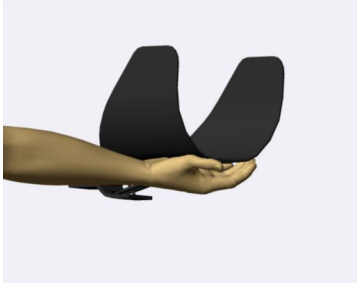
Maximum load label

The maximum permissible load must not exceed 200 N, which is approximately 20 kg (44 lbs).

The head holder can get damaged when movable parts are pinched in the tilt adjustment mechanism or when lateral forces bigger than 250 N are applied to the head holder.

Movable parts are, for example, patient bedding, straps, cables, or tubes.

- Only touch the areas marked in yellow with the palm of your hand to adjust the tiltable head holder.
- Take care not to pinch any movable parts.
- Do not lean or push laterally against the tiltable head holder.
- Ensure that the tilt adjustment mechanism is completely engaged to avoid unintended tilting. Do not use the tiltable head holder if the tilt adjustment does not fit properly.
- Contact your local customer service representative or your Siemens regional office if the tiltable head holder is damaged.



Head-arm support

CAUTION

If a head holder or support does not engage securely, it can come loose!

Injury to the patient.

- Make sure that the pluggable positioning aids are seated firmly and securely engaged in the receptacle at the end of the table top.

Warning, collision of the patient with the equipment

Collision of the patient with the gantry.

Indicates possible collision of the patient with the gantry. Always watch the patient while the table is moving.

Knee support

Warning, collision of the patient with the equipment

Collision of the patient with the gantry.

Indicates possible collision of the patient with the gantry. Take special care when the gantry is tilted or if the table height does not correspond to the isocenter of the patient.

Table top extension

Maximum load label

The maximum permissible load must not exceed 500 N, which is approximately 50 kg (110 lbs).

If you use the table top extension image artifacts might occur.

Bariatric positioning aids

CAUTION

Overloading of bariatric positioning aids!

Cuts and other injuries.

- Bariatric positioning aids must not bear weights of more than a special value shown on a label.

CAUTION

Unobserved movement of the patient table or gantry!

Collision of the patient with the gantry.

- Monitor the patient continuously as long as the table top and gantry are moving.
- Take special care with the tilt of the gantry other than 0 degree or a table height other than the isocenter for the patient.

Maximum load label

The maximum permissible load must not exceed 500 N, which is approximately 50 kg (110 lbs).

Baby mattress

Warning, collision of the patient with the equipment

Collision of the patient with the gantry.

Indicates possible collision of the patient with the gantry. Always watch the patient while the table is moving.

Immobilizing the patient

Different straps are supplied to safely immobilize the patient. Observe the following safety precautions when using straps.

CAUTION

The restraint straps are not permanently attached to the table!

They cannot prevent the patient from falling off the table.

Patients who do not keep still may fall off the table.

- Take special care with those patients.

Furniture

Monitor cart

Observe the following safety information when using the monitor cart.

CAUTION

Tripping of user and other persons!

Injury to the patient, the personnel, or other persons.

- Make sure that cables are installed in such a way that nobody can stumble over them.

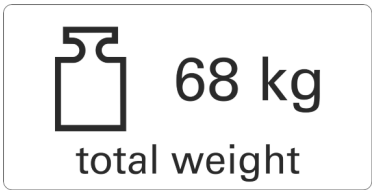
Maximum load label

The maximum permissible load must not exceed 25 kg (55 lbs), which is approximately 245 N.

Total weight label

The total weight with one monitor (mono cart) is 60 kg (132 lbs), which is approximately 588 N.

Total weight label



The total weight with two monitors (dual cart) is 68 kg (150 lbs), which is approximately 667 N.

Monitor ceiling system

Observe the following safety information when using the monitor ceiling system.

WARNING

Liquids in the monitor ceiling system, power supply cables are laid inside!

Electric shock

- Make sure that no liquids, for example cleaning fluids, can get into the interior of the monitor ceiling system.

WARNING

Cleaning of parts of the system while the system is connected to the power supply!

Electric shock due to possible contact with line voltage.

- Always switch the system off at the main power switch before cleaning or disinfecting.

CAUTION

Raising and moving the monitor ceiling system!

Damage to the monitor ceiling system.

- Do not use force when moving the device into the limit positions.
- Make sure that the monitor ceiling system does not collide with other components.

CAUTION

Dirt and liquid in the monitor arm of the ceiling mounted monitor!

Infection possible

- Clean the monitor and monitor arm after use.

CAUTION

Raising and moving the monitor ceiling system!

Injury to the personnel, damage to monitor ceiling system.

- Do not use force when moving the device into the limit positions.Make sure that the ceiling system does not collide with other components.

CAUTION

Unexpected movement or malfunction of the system or equipment!

Injury to the patient or personnel. Damage to the system or equipment.

- Contact your Siemens Service. Leave all repairs to the Siemens Service.

Accessory cart

Observe the following safety information when using the accessory cart.

CAUTION

Not observing the instructions of the disinfectant manufacturer!

Injury to the cleaning personnel.

- Follow the cleaning instructions of the Instructions for Use.
- Follow the instructions of the disinfectant manufacturer.

Console table

CAUTION

Persons or objects are near or under the table during movement!

Injury to the personnel or damage to the equipment.

- Before lowering the table make sure that neither body parts of anybody nor any objects can get caught.
- Before raising the table make sure that there is enough space between environment and the table top.
- Observe the environment during movement of the table.

CAUTION

Safety distance of 25 mm to building parts and surrounding equipment is not kept!

Injury to the personnel or damage to the equipment.

- Do not move the table if the safety distances are not kept.

CAUTION

The maximum load of the adjustable table of 100 kg (220.5 lbs) is exceeded!

Damage to the equipment.

- Do not exceed the maximum load.
- Do not sit on the table.

2.3.3 Laser light marker

CAUTION

Looking into laser beam with optical instruments!

Loss of sight possible.

- Do not look directly into the laser beam.

CAUTION

Laser radiation!

Possible loss of eyesight due to laser radiation.

- Do not look directly into the laser beam or at its reflection on smooth, mirror-like surfaces during adjustment.

2.3.4 During system movements

Observe the following safety information during system movements to avoid injuries and radiation damage.

CAUTION

Unobserved movement of the patient table or gantry!

Collision of the patient with the gantry.

- Monitor the patient continuously as long as the table top and gantry are moving.
- Take special care with the tilt of the gantry other than 0 degree or a table height other than the isocenter for the patient.

CAUTION

Unobserved movement of the patient table or gantry when using accessories and other supports!

Collision of the patient with the gantry.

- Monitor the patient continuously during table movement and gantry movement.
- Take special care of the patient when tilting the gantry.
- Follow the marking on the accessories.

CAUTION

Unintentional use of table movement keys of the control box!

Possible injury to the patient by moving parts.

- Make yourself familiar with the function of the control box keys.
- Always keep an eye on the patient during table movements.

Uncontrolled movement of the patient

CAUTION

Unintentional patient movement!

Injury to the patient.

- Always fix and observe the patient during the measurement.

CAUTION

Unintentional patient movement!

Contusion of patient extremities at patient table and gantry.

- Always fix and observe the patient during system movements.

Contusion points and contusion areas

CAUTION

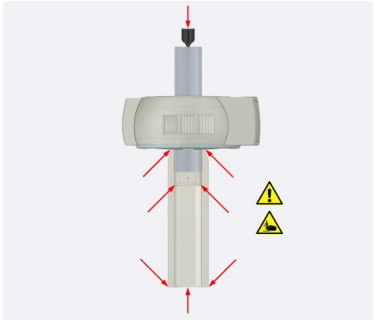
Movable parts of the CT system!

Possible injury to the patient by moving parts.

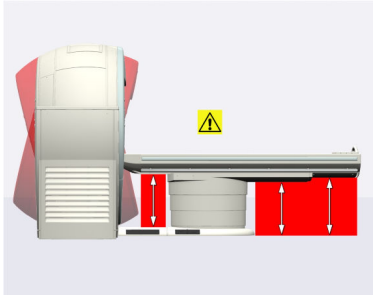
- Always observe the possible contusion points shown in the following pictures.

Particularly hazardous points are marked with red arrows and hazardous areas are colored red in the following drawings.

Contusion points at the gantry and patient table



Contusion areas at the patient table



Tensile stress on infusion tubes

CAUTION

Use of short infusion tubes!

Tensile stress on infusion tubes when moving the table top. Tubes can get caught.

- Only use infusion tubes that are long enough.

2.4 Safety information on patients with implanted devices

Observe the following safety information when examining patients with implanted devices.

WARNING

Rate meters may continue to count the pacemaker rate during occurrences of cardiac arrest or arrhythmia!

ECG leads to wrong diagnosis.

- Keep pacemaker patients under close surveillance.

CAUTION

Scanning patients with implanted devices such as pacemakers or neuro stimulators!

Interferences may cause malfunctions of the implanted device.

- Observe the patient closely during examination.

Contact the manufacturer of the active implanted device for more information.

2.5 Safety information on performing an examination

Observe the following safety information before and during an examination.

CAUTION

Radiation in the examination room after the **Start** key has been pressed!

Undesired radiation exposure.

- Leave the examination room before initiating scanning or for interventional CT examination, wear protective clothing.

2.5.1 Entering patient examination data

CAUTION

Wrong entry of patient position!

Wrong basis for diagnosis.

- Make sure that the patient position is correct.

CAUTION

Wrong labeling of the sides when the patient is repositioned!

Wrong basis for diagnosis and treatment.

- Correct the patient orientation when the patient is repositioned.
- Review the labeling of the sides, to avoid wrong operative intervention.

2.5.2 Examination settings

Check the examination settings before scanning.

CAUTION

Wrong table feed direction!

X-ray not, or only partially, usable.

- Always keep an eye on the patient.
- Stop scanning in case of wrong table feed direction.

CAUTION

Changed scan parameters are unsuitable!

Dose not as desired.

- Verify the changed scan parameters before scanning.

CAUTION

Superimposition by subfunctions, for example, SOMATOM life!

Scan parameters are superimposed. Dose not as desired.

- Close subfunctions before scan start.

CAUTION

Native Windows configuration dialog box does not disappear while radiation is started. The dialog box remains visible, as it is a dialog box displayed by “Windows” and not a *syngo* dialog box!

This may cause confusion.

- Avoid opening this dialog box while radiation can be applied. The computer and the *syngo* system should never be configured during an acquisition.

CAUTION

The quality reference parameters exceed the system limit for CARE Dose 4D!

The *mAs* curve of the topogram turns yellow in the respective area. Locally increased image noise.

- Adjust the scan parameters to allow for a higher mAs value.
- Modify scan time, pitch, or rotation time.
- Adapt the injection protocols, if necessary.

CAUTION

mA proposal of CARE Dose not adequate due to wrong attenuation data from topogram!

X-ray not or only partially usable.

- Check plausibility of the automatically selected scan parameters before scanning.

2.5.3 Communication with the patient

Observe the following safety information to ensure constant attention to the patient.

CAUTION

Patient intercom system nonfunctional!

Patient cannot be understood in case of an emergency.

- Leave the intercom system switched on during the examination (**Listen to patient** key).
- Keep eye contact with the patient when talking or listening to him or her.

2.5.4 Additional information on Single Source Dual Energy examinations

CAUTION

Images of Single Source Dual Energy: Inappropriate image results due to insufficient image registration!

No diagnosis possible.

- Make sure that the patient does not move between the scans.

2.5.5 Additional information on Cardiac CT examinations

CAUTION

Using a combination of different electronic devices on one patient!

The total leakage current may exceed safety limits.

- Do not use more electronic devices on the patient than absolutely necessary.

CAUTION

Contact between conductive parts of the ECG electrodes and other conductive parts!

Heart arrhythmia.

- To ensure patient safety, the conductive parts of the ECG electrodes (including associated connectors) and other patient-applied parts, should not contact other conductive parts, including earth ground, at any time.

CAUTION

Use of unsuitable ECG cables or electrodes!

Wrong diagnosis possible.

- Only original Siemens recommended ECG cables shall be used.

CAUTION

Wrong ECG signal detection!

Undesired radiation

- Check the correct position of the ECG electrodes before scan start.

CAUTION

Wrong setting in display!

Ionizing radiation

- Set the ECG pulsing window to clinically relevant value.

WARNING

Rate meters may continue to count the pacemaker rate during occurrences of cardiac arrest or arrhythmia!

ECG leads to wrong diagnosis.

- Keep pacemaker patients under close surveillance.

WARNING

ECG is used as survival or diagnostic equipment!

ECG leads to wrong diagnosis.

- The ECG monitor may only be used in conjunction with the HeartView/Cardiac CT option. It is not intended for monitoring the patient.

CAUTION

Use of defibrillator!

Patient injury (burn) and destroying the ECG unit.

- The CT plate is grounded. Follow the instructions in the Instructions for Use of the defibrillator before using it.

CAUTION

Missing ECG-Sync due to the disconnection of the patient's ECG-electrodes!

X-ray not, or only partially, usable.

- Check the ECG electrodes before scanning.
- A contrast enhanced scan should not be aborted but operated with synthetic ECG-data.

2.5.6 Additional information on contrast examinations

Observe the following safety information when performing a contrast examination.

CAUTION

Unintended activation of coupled mode!

Undesired radiation

- Verify that uncoupled mode is activated before starting the injection.

CAUTION

Misunderstanding of reference point for start delay in bolus examination!

Faulty synchronization between bolus and scanning.

- Make sure that the chosen delay time fits to the characteristics of the bolus injection.

CAUTION

Scanning with coupled contrast medium injection!

Contrast medium not or only partially usable.

- Follow the instructions in the Instructions for Use of your bolus injector.

CAUTION

Wrong start delay!

X-ray not, or only partially, usable.

- For acquisition with contrast medium, select the flooding time of the contrast medium as the delay.

CAUTION

Loss of communication to the bolus injector!

Injection will not be stopped automatically, if scan is aborted or suspended.

- If needed, stop injection at the bolus injector console.
- Stop scan if the bolus injector has not delivered enough contrast media.

CAUTION

Injection stopped by the user!

X-ray not, or only partially, usable.

- Press **Suspend** at scanner if not enough contrast media was administered.

CAUTION

Coupled start is not activated!

Injection will not be started automatically, if coupled start is not activated.

- Check in **Scan** subtask card whether a coupled start is activated or not.

2.5.7 Additional information on interventional examinations

Observe the following safety information when you perform an interventional examination.

CAUTION

Real-time images that are used for guiding an interventional examination are covered by the *syngo*.via application!

Injury to the patient.

- Close *syngo*.via manually before you start an interventional examination.

2.5.8 Additional information on Osteo examinations

Observe the following safety information when scanning a patient for an Osteo examination.

CAUTION

Scan lines at wrong position for osteo examination!

Wrong diagnosis due to wrong image information.

- Check that position of scan lines is in the middle of the vertebral body.

2.5.9 *syngo*.via postprocessing applications

Observe the following safety information when using *syngo*.via postprocessing applications.

CAUTION

User is not instructed in how to operate the applications!

Wrong basis for diagnosis.

- The operator must be qualified to use the applications.

CAUTION

Relevant information is hidden by *syngo*.via application windows!

Delayed diagnosis

- Minimize or close *syngo*.via before scanning.
- Do not start *syngo*.via while preparing or starting a scan.
- Operate *syngo*.via on the secondary monitor, if available.

CAUTION

Real-time images that are used for guiding an interventional examination are covered by the *syngo*.via application!

Injury to the patient.

- Close *syngo*.via manually before you start an interventional examination.

2.5.10 Additional information on Respiratory gating

Observe the following safety information when using the respiratory gating function.

CAUTION

Respiratory gating device not available or not active during measurement!

X-ray not, or only partially, usable.

- Make sure that the respiratory gating device is ready to use before scanning.

CAUTION

Assigning wrong respiratory data to the selected patient!

Wrong reconstruction result. Reconstruction has to be repeated.

- Make sure that respiratory and patient data match, for example, by defined naming.

CAUTION

Conductive parts become live!

Heart arrhythmia

- Ensure patient safety and make sure the conductive parts of the respiratory belt (including associated connectors) and other patient-applied parts do not contact other conductive parts, including earth ground, at any time.

2.5.11 PET CT

CAUTION

Configuration used for masking noise observed in PET slices around a circular ring near the edges is not adequate!

Masks diagnosis relevant information also.

- Users are recommended not to rely on rotating MIP as primary means for diagnosis.

2.6 Safety information on animal patients

Additionally, observe the following sections when examining animal patients.

CAUTION

Not observing the Instructions for Use of the system, system options and accessories!

Injury to the patient.

- Always use the Instructions for Use in conjunction with the Instructions for Use of the particular units used.
- Follow the safety instructions.

2.6.1 Injury to the operator, personnel, or attendants

CAUTION

The animal is not immobilized!

Contusion, fractures of the operator, personnel or attendant. Damage to the equipment.

- Always anesthetize or sedate the animal before scanning.
- Keep the number of persons in the examination room as low as possible.

2.6.2 Injury to the patient

CAUTION

Using an animal protocol for scanning a human!

Injury to the human or radiation damage.

- The scan protocols must be uniquely assigned as animal protocols.
- Do not use animal protocols for humans.

Uncontrolled movements causing image artifacts

CAUTION

The animal is not immobilized!

Wrong diagnosis due to wrong image information.

- Always anesthetize or sedate the animal before scanning.

CAUTION

Uncontrolled system movements and unintended radiation exposure!

Injury to the patient and personnel, and radiation damage.

- Always verify that the patient is correctly positioned.
- Always observe the patient during system movements.
- Press a **STOP** key in any of the following situations:
  - The patient is not positioned correctly during system movements
  - At any unintentional system movement (especially at autorange)
  - The patient table moves in a wrong direction
  - The patient table does not stop as expected
  - A key sticks or a movement does not stop immediately when a key is released
  - The **HOLD** key does not respond during a scan
- Press an **EMERGENCY OFF** key if the system does not respond to the STOP keys in any hazardous situation.
- Shut down the system immediately if system malfunctions are detected and notify the Siemens Customer Service.

CAUTION

Unintentional patient movement!

Injury to the patient.

- Always fix and observe the patient during the measurement.

Possibility of electrical shock

CAUTION

Body fluid (blood, urine etc.) comes into contact with electrical components!

Possibility of electrical shock.

- Always make sure that the animal cannot lose uncontrolled body fluid during scanning, for example by using catheters or diapers.

2.6.3 Cleaning media

CAUTION

Using of cleaning media not approved for humans!

Allergic reaction or allergic shock.

- Always use cleaning media also approved for humans.

CAUTION

Insufficient cleaning or disinfection of the equipment!

Injury to the patient or the personnel (bio hazard).

- Always clean or disinfect the equipment after use.
- Always observe the instructions for cleaning and disinfecting.
- Make sure that the table and the accessories are clean and covered with paper, if possible.

2.7 Safety information on reconstruction parameters

CAUTION

Reduced image quality caused by extended field of view!

Wrong diagnosis due to insufficient image information.

- For diagnosis, do not use the image area outside the regular field of view. It has reduced quality and may contain artifacts.

2.8 Safety information on basic image review

CAUTION

Images with lossy compression are used for diagnosis!

Wrong basis for diagnosis.

- Always verify your evaluation results with the original DICOM images (first reader duty).
- Never use lossy compressed images for primary diagnosis.
- Check the image text for information on lossy compression before starting an evaluation.

2.8.1 Loading or selecting images

CAUTION

Loading image data sets of different patients!

Mix-up of patients and incorrect diagnosis possible.

- When loading reference and model series, make sure that you select the data of the correct patient.

CAUTION

If you load large data sets, the image pixel data will be downsampled!

Possible insufficient image quality.

- Be aware of reduced image quality if indicated in image display.

CAUTION

If *syngo* receives images but the study or series UID is already available in the local database, the data will be assigned to this locally existing patient. This happens regardless of the patient identification (name, date of birth, gender and patient ID) of the received images. Changes of patient information on other systems will not automatically change the patient information in *syngo*!

Data retrieved from PACS or other nodes seems to be misaligned or lost, but is stored elsewhere in the database.

- Imported data will always be appended to the already existing patient on the local system, based on matching DICOM UIDs.
- If you imported data, but cannot find them on the local system under a certain name, use other criteria from the study or series to search for the imported data, or filter the data.
- To completely avoid these inconsistencies, always delete the local patient data after you have successfully archived them.

2.8.2 Viewing

CAUTION

The zoom factor for reference image display is selected such that the complete volume can be displayed. This pre-selected zoom factor influences the spatial resolution for reconstruction. The spatial resolution may be lower than the spatial resolution of the original images!

Reduced image quality (lower resolution) due to default zoom level.

- Center the relevant area, and select a suitable zoom factor before starting calculation of ranges or resampling.

2.8.3 Evaluating pixels with the pixel lens

CAUTION

The pixel lens has a constant size and is independent of the zoom factor of the image!

Wrong diagnosis due to misleading image information.

- Please note that the pixel lens is only a pointer indicating the position (not the size) of the measured area.

CAUTION

Use of pixel lens in the **Viewing** task card and in the **3D** task card!

The pixel lens may display different values.

- Be aware of differences in pixel lens measurements. The pixel lens measurement in the **Viewing** task card considers a rectangle around the clicked point, whereas measurement in the **3D** task card considers a cube surrounding the clicked point.

2.8.4 Modifications in medical images

CAUTION

Mix-up of patients due to changed image data!

Wrong diagnosis due to wrong information.

- Always verify that all corrected or rearranged data belongs to the correct patient.
- Take special care when using drag and drop.

CAUTION

Mix-up of patients due to insufficient configuration of image text!

Wrong diagnosis due to wrong information.

- Always apply full image text to avoid mix-up of patients.
- Make sure that customized image text contains at least the main patient demographics, for example, patient ID, name, date of birth, and sex.

CAUTION

Modifications in medical images are not saved automatically in the same way as image comment. Additionally, in case of a user switch where the new user has no adequate access rights, modifications of the image text may also be lost!

Image modifications may be lost.

- Use **Patient** > **Save...** in order to save the image comment and **Patient** > **Save As...** to save the image with modifications as a new image.

CAUTION

Modifications in medical images are not saved automatically in the same way as image comment! Additionally, in case of a user switch where the new user has no adequate access rights, modifications of the image text may also be lost.

Possible loss of image modifications.

- Choose **Patient** > **Save As...** in order to save the image with modifications as a new image.

2.8.5 2D and 3D evaluation

CAUTION

Distance and angle measurements in the topogram!

Incorrect measurement values due to the projection technique used.

- Only perform distance measurements in the topogram in the longitudinal direction (head-foot direction).
- Do not perform angle measurements.

CAUTION

Thickness, length, and angular measurements on MIP and SSD images do not reflect the actual anatomical conditions!

Wrong basis for diagnosis.

- Do not perform thickness and length measurements on MIP and SSD images.

2.8.6 Image artifacts

Even with a carefully manufactured, calibrated and maintained CT system, patterns can sometimes appear in images which are not part of the computed tomography image. Such patterns are called *artifacts*.

For best image quality results, we strongly recommend to position the patient such that the organ to be examined is in the center of the scan field.

Artifacts can have various causes which can in general be divided into 2 groups: *measurement related* artifacts and *system related* artifacts.

Measurement related artifacts

The most significant measurement related artifacts are the following:

- Patient table accessories
- Partial volume effects
- Beam hardening
- Metal artifacts
- Motion artifacts

Patient table accessories

The optional slicker is a cover for the patient mattress. It has overhanging parts (flaps).

CAUTION

Flaps outside of the scan range!

Image artifacts

- Always use patient restraint straps to fix the flaps on the patient.
- Make sure that the flaps at the head end are positioned under the patient.
- Do not scan the foot end region.

Partial volume effects

Thick slices are often preferred instead of thin slices. This helps to increase signal to noise ratio and to limit the examination time by reducing the number of slices. However, this may result in partial volume effects. These are caused by high density tissues (such as a bone) or objects (such as pacemakers) projecting only partly into the slice plane. One such well-known artifact is the so-called Hounsfield bar between the petrous bones. Other regions of the skull are also problematic with regard to partial volume effects which are visible as dark streaks. Additional correction and / or special parameter settings (head modes) help to minimize these effects.

- To avoid partial volume effects use thinner slices.

Beam hardening

When X-ray beams pass through tissue, the average energy of the radiation spectrum is shifted towards higher energy. This is known as *beam hardening*. It depends on the material density and thickness of the tissue through which the X-ray beam passes.

The effect of this beam hardening can lead to areas with reduced or increased CT values. The influence of the beam hardening on CT values can be reduced by using dedicated algorithms.

Additional corrections help to minimize these effects. Yet, they cannot fully eliminate them.

Metal artifacts

Metal objects such as dental fillings, surgical clips, jewelry, hair clips, belts or hip prostheses etc. can cause extreme forms of beam hardening artifacts. Depending on density and size, they can lead to total absorption of the radiation. This results in corresponding strong black or white streaks or star-shaped artifacts.

To reduce metal artifacts, **iterative Metal Artifact Reduction** (**iMAR**) is available. (➔ Page 428 *Performing a reconstruction with reduced metal artifacts (iMAR)*)

Motion artifacts

Movement of organs in the slice or displacement of the entire slice during scanning likewise causes bright and dark artifacts. These are usually seen as streaks or in areas of low density. To reduce motion artifacts use the automatic patient instructions (API) function for breathing and swallowing commands.

Greater difficulties are encountered with peristalsis. Heartbeat artifacts are also problematic. To solve the problem of heartbeat artifacts the **ECG Triggering** and **ECG Gating** functions are available as an option.

System related artifacts

System related artifacts may be due to the following:

- Uncalibrated system
- Detector deviations

CAUTION

When you restart the system, the detector has not yet reached operating temperature!

Wrong diagnosis due to image artifacts.

- Calibrate the system as part of the checkup. Repeat calibration if ring artifacts occur.

Calibration

If the CT system is not properly set up (for example, no checkup performed) CT scale displacements and inhomogeneities can result. This may result just after switching on the unit, during warm-up to operational temperature (calibration), or due to an extended length of service of the X-ray tube. The same applies to defects in the measurement system.

The daily quality checkup usually detects and reports such discrepancies.

Other system defects or calibration deviations cause streaks or (partial) rings to appear in the CT image.

Detector deviations

In CT systems with a rotating combined tube-detector system, even minimal deviations of individual detector channels from the original calibration level may lead to rings or partial ring artifact structures in the CT image. The closer such channels lie to the detector center, the greater are these effects.

CAUTION

When you restart the system, the detector has not yet reached operating temperature!

Wrong diagnosis due to image artifacts.

- Calibrate the system as part of the checkup. Repeat calibration if ring artifacts occur.

In an extreme case, rings may appear concentrated as a blurred spot in the center of the scan field (the scan field center appears at the image center if the **Center X** and **Y** image parameters are both zero). Such rings are easily recognizable, however, a blurred spot in the center of the scan field might lead to inaccurate diagnoses.

Repeating scans

Measurement related or system related artifacts cannot always be excluded. Therefore the scan should be repeated if a tomographic structure appears questionable. This should be done after slightly shifting the patient's position within the slice, e.g., by changing vertical position of the table by more than 5 mm. The result can be used to exclude system-dependent long-term or temporary equipment faults as the artifact cause.

Persisting object related artifacts can be considered measurement related with a high probability. They should be recognizable as such by an experienced radiologist.

CAUTION

Artifacts affecting the diagnosis are evident or suspected in a patient image, or the patient may have moved during scanning!

Improper diagnosis possible.

- Scanning must, under all circumstances, be repeated with a slight shift in patient position.

2.9 Safety information on documenting and reporting

CAUTION

Using scalable page mode may reduce the image quality. The resulting image quality may no longer be sufficient. The scalable page mode does not support real size!

Possible wrong diagnosis.

- Be aware of image quality reduction if scalable page mode is configured.

CAUTION

Use of paper printouts for diagnosis!

Wrong diagnosis due to wrong image information.

- Only use images on film for diagnostic purpose.

CAUTION

The image quality on paper printouts might be reduced so that the printouts may not be sufficient for diagnosis!

Possible wrong diagnosis.

- Only use images on film for diagnostic purposes.
- You may use printouts for diagnosis if the printer has been evaluated and released for this purpose by the manufacturer.

CAUTION

True Size printouts depend on printer settings, calibration, or other factors!

True Size printouts do not correlate to the real anatomic dimensions.

- Check and validate the precision limitations when printing in True Size.

  Usage of True Size printouts is in your own responsibility.

  Always compare the image scale bar on printed images with a physical measurement unit, for example, a ruler.

CAUTION

The printed flag is set if the images are successfully transferred to the printer control. Not all printers, for example, paper printers, may be able to solve printing problems themselves!

Possible loss of image printout.

- Verify that the printouts are available before you delete images.

CAUTION

Transferring manipulated non-square matrices or viewing segments!

Diagnostically relevant areas of images may be lost.

- When manipulated images are exported or sent to another workstation, the related original images should be sent, as well. It is strongly recommended to base the final diagnosis always on the original images and not on modified or manipulated images.

CAUTION

Exposing images with a non-verified camera!

Wrong basis for diagnosis.

- Only use cameras that have been released by Siemens or qualified by the user.

CAUTION

Missing camera test!

Wrong basis for diagnosis.

- Perform the camera test regularly at the recommended intervals.

2.9.1 Viewing structured reports

CAUTION

If there is no specific style sheet available locally for display of a SR document, then the generic style sheet is applied instead!

Not all information might be present or displayed correctly as a consequence, especially when private attributes are included in the structured reports.

- In the display of the report and in exported documents it will be indicated that only a generic mechanism has been applied.

CAUTION

When opening a SR document for further processing, an old version of a structured report document is accidentally opened!

Existing processing results within the latest version of the document might get lost because the currently opened document can now be saved as latest version.

- When opening and editing a structured report document, always assure that you use the latest version. The version information is recognizable within the *syngo* Patient Browser.

CAUTION

The image quality of images which are viewed within the Structured Report viewer might not be sufficient for reading purposes!

Possible wrong diagnosis.

- Do not base your diagnosis on images which were only displayed in the Structured Report viewer application.

2.10 Safety information on storing and archiving

Observe the following safety information and the following sections when storing and archiving images.

2.10.1 Storing data

CAUTION

The internal identification of patient data, for example, studies, series and images, uses the system time for generation of the patient identification. If it is necessary to turn the system clock back, duplicate identifiers may be created!

Data may be assigned to wrong patient.

- If it is necessary to turn the system clock back for synchronization purposes, wait until the previous clock setting has been passed before creating new patient data.

CAUTION

Patient folders containing data from other patient or series, for example, after patient merge, import of data from external media!

The diagnosis or treatment may be made on the basis of incorrect information.

- Check that data is assigned to the correct patient and series before using the data.

CAUTION

Insufficient memory or disk space may lead to an instable or blocked system!

System is not available in emergency cases.

- Do not ignore the storage capacity warning icons.
- Do not ignore the warning message.

CAUTION

Systems that do not use storage commitment only report back to the sending system when the data has been fully received (flags A and S). A user or an auto-delete mechanism at the sending system might subsequently delete the sent data. However, this response does not imply that the data has already been stored at the receiving system!

In the case that the receiving system cannot store the data, the data might irrevocably be lost.

- Double-check that the data is actually stored on the receiving system. Use storage commitment whenever it is supported by the sending and receiving systems.

CAUTION

Misleading or misinterpretation of the storage commitment flags AC/SC. Storage Commitment means storage to hard disk but this may not fulfill or guarantee regulatory requirements about long-term archiving. You can delete the committed objects!

Possible loss of data within the required period for retention.

- Observe the regulatory requirements regarding long-term archiving.

Pay attention to the storage capacity of the hard disk displayed by icons in the status bar of the task cards.

As soon as a predefined percentage of the storage capacity of the hard disk is reached, a warning icon is displayed in the status bar. The color of the icon depends on the storage capacity:

- Yellow icon: If 75% of the storage capacity is reached
- Red icon: If 90% of the storage capacity is reached

2.10.2 Exporting data

CAUTION

Archiving to media already containing clinical data!

Loss of data due to corruption of removable media.

- Avoid recording on removable media which already contains clinical data.

CAUTION

Taking out the CD-R, CD or DVD too early!

Loss of data and destruction of the CD-R, CD or DVD possible.

- Do not remove the CD-R, CD or DVD from the recorder until the recording process has been completed and the status LED has gone out.
- Use the **Transfer** menu to eject media.

CAUTION

When you simultaneously export data to a device, like CD-R, DVD-R drive, Blu-Ray, USB, Network share, and try to read data from the same device with external (non-*syngo*-based) applications, one job or both jobs can fail (depending on the timing)!

Possible loss of data. When data is being written to a drive, any external access at the same time will destroy the current write job and could even damage the storage disk.

Data already stored on a multi-session disk might also become unreadable.

- Do not try to access the device with non-*syngo*-based applications while it is writing data or reading data.
- To ensure successful writing or reading, check the **Local Job Status** to see if there are any write or import jobs in progress.

CAUTION

Switching off a device while writing to the device!

Possible loss of all data and damage of media.

- Never switch off the device while writing to the device.

CAUTION

DVD-R or Blu-Ray Medium used for export or archive may get corrupted or may not be readable with other DVD or Blu-Ray devices!

Loss of data or user perception of loss of data.

- Configure and use local media only as 'archive' media if the requirements regarding retention and readability are sufficiently fulfilled, for example, the manufacturer approved the media for archiving.
- Verify readability of the data on the medium before the data is deleted in the database.

CAUTION

Use of non-integrated USB storage device!

Reboot request of the operating system.

- Ignore the reboot request and press **Cancel**.
- Finish your examination or application.
- Restart the system.

CAUTION

Using USB devices without own power supply!

The USB controller can be permanently damaged.

- Use USB devices as recommended by the manufacturer of the device.

CAUTION

Removal of USB device without deactivation by the software!

Possible loss of data, damage of the operating system, and damage of media.

- Do not immediately unplug a USB device.
- Always use the software functionality for safe removal before unplugging.

CAUTION

Plugging or unplugging USB devices during acquisition can make the system unstable which may affect other processes like running acquisition tasks!

Loss of data, acquisition process disturbed.

- Do not plug in or unplug USB devices during acquisition tasks or other critical processes.

CAUTION

Removal of USB device without deactivation by the software!

Possible loss of data, damage of the operating system, and damage of media.

- Do not immediately unplug a USB device.
- Always use the software functionality for safe removal before unplugging.

CAUTION

A recording error may make a medium unusable!

In multi-session mode, all data previously stored on that medium could be lost, too.

If this happens, any archive flags set to this data in the database become invalid.

- Only delete the data that you have archived on a media from the local database after you have successfully finalized and verified the media.

CAUTION

Switching to multi session mode may destroy data previously recorded on this medium!

Previously stored data can no longer be read.

- Only delete the data that you have exported on a CD-R from the local database after you have completed the session.

CAUTION

A medium is not finalized!

Another system or device may show this medium as empty or defective, or the data of the last session is missing.

- Use **Eject with finalize** to complete the work on this medium and to ensure that the medium is readable on other systems or devices.
- If a medium on which you expected to find data seems to be empty or defective or the last data is missing, try to use original or another *syngo* system to finalize the medium for further read-only access.

2.10.3 Transferring data

CAUTION

Lossy compression is selected for data transfer!

Image quality of the lossy compressed images may no longer be adequate for diagnostic purpose.

- Do not use lossy JPEG compression for sending data to a report or primary diagnosis workstation.
- Do not use lossy JPEG compression for archiving.

2.11 Safety information on postprocessing applications

CAUTION

Not all graphic and evaluation results created by one software can be interpreted!

Not all information from post-processing available for diagnosis.

- A message box appears if not all information can be loaded and displayed.
- Be aware when using such data for diagnosis.
- Use original application to view the post processing results.

2.11.1 *syngo* 3D

CAUTION

Automatic registration for compare layout is not sufficient!

Insufficient basis of diagnosis.

- Check registration and use manual registration functionality to re-adjust registration if automatic registration is not sufficient.

CAUTION

Measurements in projected images!

Possible wrong diagnosis.

- Do not use measurements in projected images for diagnostic purposes.

CAUTION

Using non-planar slice images for diagnostic purposes!

Wrong diagnosis

- Be careful when interpreting orientation labels. Keep the shape of the curved cut and its orientation in the volume in mind.

CAUTION

The evaluation of distances, angles and ROIs in 3D (VRT or SSD) and projection (plain-film X-ray or fluoroscopic) images can be inaccurate!

Wrong measurement results and wrong diagnosis.

- Do not use uncalibrated projection images to make critical measurements.
- Do not assume that the image calibration is correct.

Loading image data sets

CAUTION

Loading image data sets of different patients!

Mix-up of patients and incorrect diagnosis possible.

- When loading reference and model series, make sure that you select the data of the correct patient.

CAUTION

Unintentional loading of series of different patients in 3D compare mode!

Possible mix-up of patient series and wrong diagnosis.

- Do not load data of different patients in 3D compare mode.

CAUTION

Unintentional loading of series of different patients in **Fusion** mode!

Mix-up of patients and incorrect diagnosis.

- Do not load data of different patients in **Fusion** mode.

3D Bone Removal

CAUTION

The semiautomatic algorithm used for bone removal may remove tissue, for example, vessels, stents, or plaques, or leave bone fragments!

Not all relevant structures of the tissue may be visible or not relevant fragments impact further calculations.

- Verify the masking using the parameter for the threshold, size and noise and add or remove relevant items in the bone mask or the non-bone mask.

CAUTION

The image is displayed with lower resolution when the bone and non-bone masks are being refined!

Not all relevant structures of the tissue may be visible.

- Verify the diagnosis after finishing bone masking on images with normal resolution.

Fusion function

CAUTION

Using fused images for diagnosis!

Wrong diagnosis

- Do not use fused images for diagnosis if the history of manipulations is not well known.

CAUTION

Image with earliest acquisition date and time is not included in the data set which is used for SUV calculation!

Earliest acquisition date and time is used in SUV calculation for the following scenarios:

1. Series Time is more recent than acquisition date and time(mMR datasets).

2. SUV calculation is for datasets for manufacturers other than Siemens or GE where the decay correction units is expressed in Bq/ml.

Wrong diagnosis due to incorrect SUV calculation.

- Make sure that the first image is included in the data set for correct calculation.

CAUTION

Reduced resolution of the fused range series!

Wrong diagnosis due to insufficient image quality.

- The resolution of fused range series is calculated as described below:
- When **Always resample with original resolution** is cleared (default configuration), the resolution of the fused range series is same as the resolution of the reference series (series loaded first).
- When **Always resample with original resolution** is selected, the higher resolution between the reference and model series is used for the fused range series irrespective of the loading order.

2.11.2 Dental

CAUTION

True Size printouts depend on printer settings, calibration, or other factors!

True Size printouts do not correlate to the real anatomic dimensions.

- Check and validate the precision limitations when printing in True Size.

  Usage of True Size printouts is in your own responsibility.

  Always compare the image scale bar on printed images with a physical measurement unit, for example, a ruler.

2.11.3 *syngo* Volume Perfusion CT – Neuro

CAUTION

Running the application on *syngo* Acquisition workplace!

Data acquisition interrupted due to system load.

- Avoid running the application during scanning.

CAUTION

Misregistration of input data sets!

Wrong basis for diagnosis.

- Make sure that the registration results are adequate.
- If registration is not correct, navigate back to registration step and correct manually.

CAUTION

Deletion of correct or keeping incorrect time points!

Wrong basis for diagnosis.

- Make sure that only the correct time points are used for the calculation.

CAUTION

Removal of relevant brain parts due to automatic segmentation!

Wrong basis for diagnosis.

- Make sure that the segmentation results are adequate.
- If segmentation is not correct, navigate back to segmentation step and correct manually.

CAUTION

Exclusion of important brain parts from the defined VOI!

Wrong basis for diagnosis.

- Make sure that the defined VOI is adequate before accepting them.

CAUTION

Definition of wrong reference vessel!

Wrong basis for diagnosis.

- Make sure that the automatically suggested reference vessel is correct before accepting it.

CAUTION

Wrong normalization suggestion!

Wrong basis for diagnosis.

- Make sure that the selected healthy brain side is correct before accepting it.

CAUTION

Evaluation settings are not adapted!

Wrong diagnosis

- Check that the thresholds for CBF and CBV are the intended ones.

2.11.4 *syngo* Volume Perfusion CT – Body

CAUTION

Running the application on *syngo* Acquisition workplace!

Data acquisition interrupted due to system load.

- Avoid running the application during scanning.

CAUTION

Misregistration of input data sets!

Wrong basis for diagnosis.

- Make sure that the registration results are adequate.
- If registration is not correct, navigate back to registration step and correct manually.

CAUTION

Deletion of correct or keeping incorrect time points!

Wrong basis for diagnosis.

- Make sure that only the correct time points are used for the calculation.

2.11.5 *syngo* CT Oncology

CAUTION

Misregistration of input data sets!

Wrong basis for diagnosis.

- Make sure that the registration results are adequate.

CAUTION

Wrong automatically found markers!

Wrong diagnosis

- Diagnose automatically found markers carefully.

CAUTION

Using fused images for diagnosis!

Wrong diagnosis

- Do not use fused images for diagnosis if the history of manipulations is not well known.

CAUTION

Type or version of segmentation algorithm changed!

Wrong diagnosis due to wrong information.

- Make sure that the segmentation results are adequate before accepting them.

CAUTION

Missing results in evaluation!

Wrong diagnosis due to wrong information.

- LungCAD is intended to streamline the workflow for data evaluation, acting as a secondary reader tool. The final diagnosis is the responsibility of the user.

2.11.6 *syngo* Neuro DSA CT

CAUTION

Selection of the wrong data set!

Wrong basis for diagnosis.

- Make sure at every workflow step that the displayed data corresponds to the selected data.

2.11.7 *syngo* Osteo CT

CAUTION

Use of other than original Siemens osteo phantom!

Wrong diagnosis due to wrong information.

- Only the original Siemens reference phantom must be used.

CAUTION

Air between the reference phantom and the region of interest!

Unusable results.

- Fill the free space with the gel pack.

CAUTION

Scan lines at wrong position for osteo examination!

Wrong diagnosis due to wrong image information.

- Check that position of scan lines is in the middle of the vertebral body.

2.11.8 Camtasia

Observe the following safety information when using the software tool **Camtasia**.

CAUTION

Using results from Camtasia for diagnosis or reading!

Wrong diagnosis due to inadequate image quality.

- The results from Camtasia are only intended to be used for training and communication.

CAUTION

Due to Camtasia screen capturing, the data disk fills up!

Examination is no longer possible or examination may be aborted.

- Only use Camtasia for short recording sequences. Do not use Camtasia for recording in parallel to the acquisition.

CAUTION

Using another directory for Camtasia data files!

Data disk is full and no further examination possible. You cannot delete files any more.

- Use only the configured directory for saving the Camtasia data files.

2.12 Safety information on quality assurance

Make sure to regularly perform the necessary tests on the equipment.

CAUTION

Lightmarker not positioned correctly!

X-ray not, or only partially, usable.

- Perform the lightmarker test regularly as part of the monthly constancy test.

CAUTION

Wrong correction tables!

X-ray not, or only partially, usable.

- Perform the daily quality tests every day before you start the actual examinations.

CAUTION

Missing maintenance of the scanning system!

Scan abortion or reduced image quality due to malfunction of the scanner.

- Make sure that maintenance is performed at the recommended intervals.
- Check the imaging performance with the monthly constancy test.

CAUTION

Missing constancy test of the monitor!

Wrong basis for diagnosis.

- Perform the monitor test regularly at the recommended intervals.

CAUTION

Missing camera test!

Wrong basis for diagnosis.

- Perform the camera test regularly at the recommended intervals.

2.12.1 Specific national regulations

The CT system and its components comply with the major relevant statutory and environmental protection regulations. See *System Owner Manual*, chapter *Standards and statutory regulations*.

Country-specific regulations must be observed for electromagnetic compatibility and power supply, as well as performing the following quality tests:

- Daily quality test (➔ Page 579 *Daily quality measurements*)
- Monthly quality test (➔ Page 584 *Constancy test*)
- Low contrast test (➔ Page 615 *Low contrast test*)
- Camera test (➔ Page 619 *Camera test*)
- Constancy test for image display devices (➔ Page 622 *Constancy test of the monitor*)

2.12.2 RT planning

CAUTION

Insufficient image information for RT planning caused by table misalignment requires new CT scan after quality assurance!

Additional dose of radiation.

- Please check table alignment accuracy regularly according to this manual and national quality assurance regulations. In case of misalignment, contact Siemens customer service.

CAUTION

Insufficient image information for RT planning caused by misaligned gantry tilt requires new CT scan after quality assurance!

Additional dose of radiation.

- Please check gantry tilt accuracy regularly according to this manual and national quality assurance regulations.
- In case of misalignment, please contact the Siemens customer service.

2.13 Safety information on system maintenance

- Do not perform a patient examination during periodic maintenance, routine checks, and service activities.

2.13.1 Cleaning and disinfecting the equipment

CAUTION

Not observing the instructions of the disinfectant manufacturer!

Injury to the cleaning personnel.

- Follow the cleaning instructions of the Instructions for Use.
- Follow the instructions of the disinfectant manufacturer.

WARNING

Cleaning of parts of the system while the system is connected to the power supply!

Electric shock due to possible contact with line voltage.

- Always switch the system off at the main power switch before cleaning or disinfecting.

CAUTION

Insufficient cleaning or disinfection of the equipment!

Injury to the patient or the personnel (bio hazard).

- Always clean or disinfect the equipment after use.
- Always observe the instructions for cleaning and disinfecting.
- Make sure that the table and the accessories are clean and covered with paper, if possible.

Cleaning the monitor

CAUTION

Dirt and liquid in the monitor arm of the ceiling mounted monitor!

Infection possible

- Clean the monitor and monitor arm after use.

WARNING

Cleaning of the monitor housing during operation!

Electric shock

- Only clean the housing when the monitor is switched off.

You can clean the *screen* even if the monitor is switched on.

Using an anti-static cleaner gives you the best results when cleaning the screen surface.

1. Always clean the housing with a damp but not wet cloth.
2. Use a soft cloth to clean the screen. If necessary, use a cloth moistened with water. Do not use cleaning solutions.
3. Remove water drops immediately. Extended contact with water discolors the surface.
4. In order to avoiding damage to the surface coating, never use corrosive agents to clean the screen surface.

2.13.2 Remote service

Your system can also be serviced by Siemens Service remotely through the internet.

CAUTION

Terminating remote service without consultation with the service engineers!

Terminating the remote service ends all service processes and may cause system malfunctions.

- Always coordinate termination with the service engineer before terminating the remote service.

CAUTION

Service session, for example, with limited access, running in parallel to data acquisition!

A dialog box may appear and cause confusion.

- Always close Service UI when work is done; do not minimize it.

2.14 Safety information on shutting down

CAUTION

Switching off the computer in Standby mode or without shutting down!

Possible loss of data, data corruption or system damage.

- Shut down the computer before switching off.

CAUTION

Switch user, shut down, logoff or restart without saving data!

Possible loss of unsaved changes.

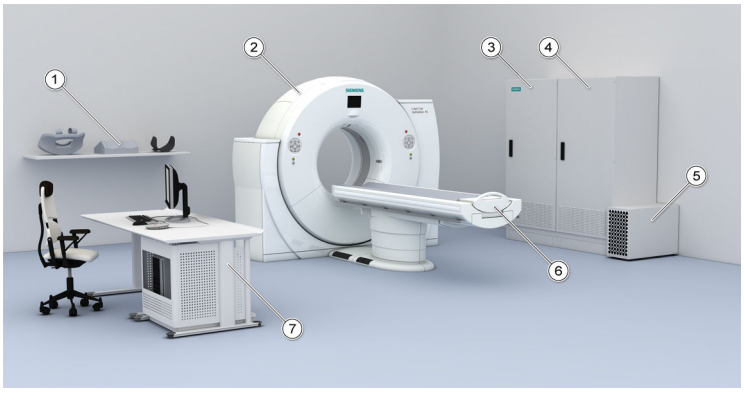
- Save data before switching user, shutting down, or restarting the system.

2 Safety information

3 System description

This section provides information about the CT system, the system components, and accessories.

3.1 System overview



(1) Accessories

Description of positioning aids

Use of positioning aids (➔ Page 364 *Positioning the patient*)

(2) Scan unit

Description of the scan unit (gantry) (➔ Page 152 *Scan unit (gantry)*)

Connectors (➔ Page 165 *Connectors*)

(3) Heat exchanger

Description of the heat exchanger (➔ Page 193 *Heat exchanger*)

(4) Power distribution cabinet

The entire system is powered by one power distribution cabinet which connects the CT system to the site power supply.

(5) Image reconstruction system

Description of the image reconstruction system

(6) Patient table

Description of the patient table (➔ Page 169 *Patient table with 2000 mm scan range*) (➔ Page 166 *Patient table with 1600 mm scan range*)

Description of the multi purpose table (optional) (➔ Page 173 *Multi-purpose table*)

Operation of the patient table (➔ Page 238 *Operation of the patient table*)

Changing the table top (optional) (➔ Page 246 *Changing the MPT table top*)

(7) Console

Description of the console

Computers

Keyboard

Mouse

Control box (➔ Page 187 *Control box*)

Monitor

Storage media and drives

Components or software functionalities that may not be part of your system configuration are nevertheless described in the present instructions for use. It may be that not all of them are marked explicitly as optional. The availability of these components or software functionalities depends on your purchase contract.

3.2 Scan unit (gantry)

This section describes displays, operating elements, and connectors of the scan unit (gantry).

3.2.1 Gantry front

The front of the gantry provides the following operating elements:

(1) Display

Description of the gantry display

Description of the ECG monitor (Cardiac CT) (➔ Page 194 *ECG monitor*)

(2) Intercom system

Description of the intercom system

Use of the intercom system (➔ Page 388 *Monitoring patients*) (➔ Page 389 *Talking to the patient*)

(3) STOP key

Terminating system movements and radiation (➔ Page 38 *Terminating system movements and radiation*)

(4) Gantry operator panels

Description of the gantry display

User guidance concept (➔ Page 165 *User guidance*)

Moving the patient table (➔ Page 239 *Moving the patient table using the gantry operator panel*)

(5) Laser light markers

Using the laser light marker (➔ Page 379 *Using the laser light marker*)

(6) Connectors

Description of the laser light marker

Location of the connectors (➔ Page 165 *Connectors*)

(7) Gantry operator panels

Description of the gantry display

User guidance concept (➔ Page 165 *User guidance*)

Moving the patient table (➔ Page 239 *Moving the patient table using the gantry operator panel*)

(8) STOP key

Terminating system movements and radiation (➔ Page 38 *Terminating system movements and radiation*)

3.2.2 Gantry rear

The rear of the gantry provides the following operating elements:

(1) Gantry operator panel

Description of the operator panels

User guidance concept (➔ Page 165 *User guidance*)

Moving the patient table (➔ Page 239 *Moving the patient table using the gantry operator panel*)

(2) STOP key

Terminating system movements and radiation (➔ Page 38 *Terminating system movements and radiation*)

(3) Intercom system

Description of the intercom system

Use of the intercom system (➔ Page 388 *Monitoring patients*) (➔ Page 389 *Talking to the patient*)

(4) Radiation warning lamp (optional)

3.2.3 Gantry operator panels

With the operator panels, you control the gantry functions, the movement of the patient table and trigger scanning.

Depending on the configuration, the system has one of the following gantry operator panels.

The workflow for positioning the patient depends on the gantry operator panel. Continue with the relevant section that is indicated for your gantry operator panel.

CAUTION

Uncontrolled system movements and unintended radiation exposure!

Injury to the patient and personnel, and radiation damage.

- Always verify that the patient is correctly positioned.
- Always observe the patient during system movements.
- Press a **STOP** key in any of the following situations:
  - The patient is not positioned correctly during system movements
  - At any unintentional system movement (especially at autorange)
  - The patient table moves in a wrong direction
  - The patient table does not stop as expected
  - A key sticks or a movement does not stop immediately when a key is released
  - The **HOLD** key does not respond during a scan
- Press an **EMERGENCY OFF** key if the system does not respond to the STOP keys in any hazardous situation.
- Shut down the system immediately if system malfunctions are detected and notify the Siemens Customer Service.

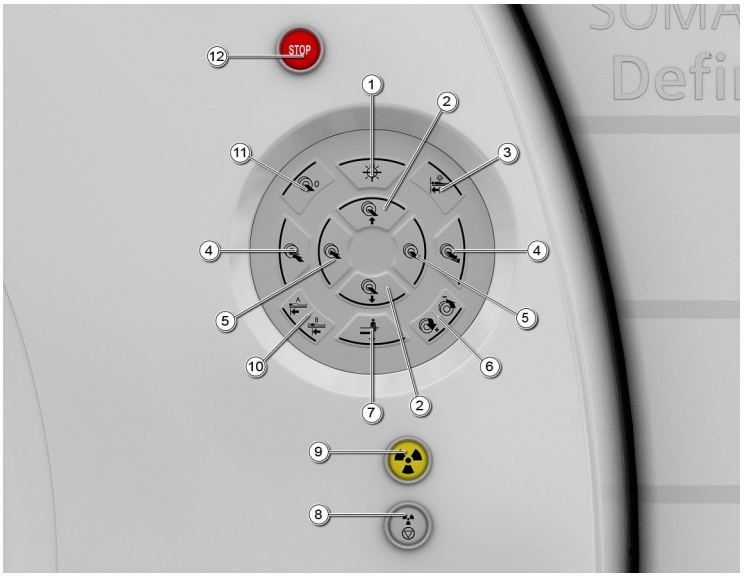
The operator panel is located left and right hand at the front and rear of the gantry.

The operator panels at the rear are optional.

(1) Previous gantry operator panel (➔ Page 160 *Previous gantry operator panel*)

(2) Current gantry operator panel (➔ Page 158 *Gantry operator panel*)

Gantry operator panel



(1) **Laser light marker** key

With this key, you switch the laser light marker on and off.
(➔ Page 379 *Using the laser light marker*)

(2) **Table movement up/down** keys

Pressing one of these keys elevates or lowers the table.
(➔ Page 239 *Moving the table top vertically*) (➔ Page 378 *Setting the table height*)

(3) **Offset** key

With this key, the table is moved from the outer light marker position to the inner scan position.

(4) Movement speed increase

Pressing the **Table out fast** key moves the table out of the gantry with increased speed.

Pressing the **Table in fast** key moves the table into the gantry with increased speed, and raises the table if it is below the minimum height.

(5) **Table movement in/out** keys

Pressing one of these keys moves the table into/out of the gantry.

(6) Gantry tilt

With the **Tilt** keys, you can tilt the gantry up to +/- 30° from the vertical position (0°) depending on the table type and height.
(➔ Page 234 *Operation of the gantry*)

(7) **Table retraction** key

Pressing this key moves the table out of the gantry opening and lowers it.

(8) **Suspend** key

Pressing this key interrupts the currently performed scan. The examination can be continued by pressing the **Start** key.

(9) **Start** key / radiation warning

Use this key to trigger scanning. The color of the illuminated ring indicates the operating state of the system.

Green: ready for scanning

Yellow: radiation warning

(10) **Predefined table position** keys

With the **A** and **B** keys, you can move the table to predefined horizontal and vertical positions.

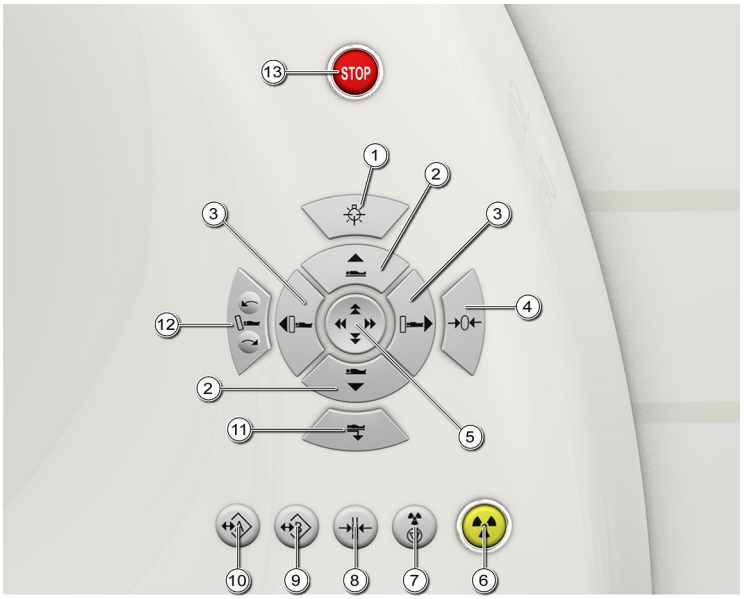
(11) **Horizontal zeroing** key

You can set the display for the horizontal table top position to zero with this key.

(12) **Stop** key

If you press the red **Stop** key, unit movements are interrupted and radiation is stopped immediately. The functions of the keys for system movements are also blocked.
(➔ Page 38 *Terminating system movements and radiation*)

Previous gantry operator panel



(1) Laser light marker

With this key, you switch the laser light marker on and off.
(➔ Page 379 *Using the laser light marker*)

(2) Table movement up/down

Pressing one of these keys elevates or lowers the table.
(➔ Page 239 *Moving the table top vertically*)
(➔ Page 378 *Setting the table height*)

(3) Table movement in/out

Pressing one of these keys moves the table into/out of the gantry.

(4) Horizontal zeroing

You can set the display for the horizontal table top position to zero with this key.

(5) Movement speed increase

Pressing the **Speed** key in combination with a table movement key increases the speed of the table movement as long as both keys are pressed.

Pressing the **Table in fast** key moves the table into the gantry with increased speed, and raises the table if it is below the minimum height.

Pressing the **Table out fast** key moves the table out of the gantry with increased speed.

(6) **Start** key / radiation warning

(7) **Suspend** key

Pressing this key interrupts the currently performed scan. The examination can be continued by pressing the **Start** key.

(8) **Offset** key

With this key, the table is moved from the outer light marker position to the inner scan position.

(9) Predefined table position

With the **B** key, you can move the table to predefined horizontal and vertical position B.

(10) Predefined table position

With the **A** key, you can move the table to predefined horizontal and vertical position A.

(11) Table retraction

Pressing the **Table retraction** key moves the table out of the gantry opening and lowers it.

(12) Gantry tilt

With the **Tilt** keys, you can tilt the gantry up to +/- 30° from the vertical position (0°) depending on the table type and height. (➔ Page 234 *Operation of the gantry*)

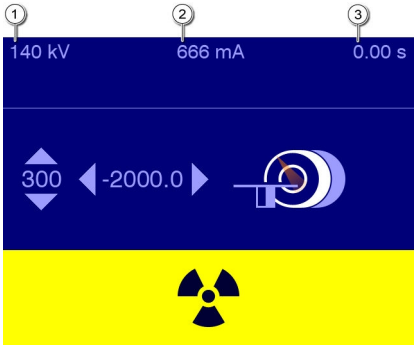
(13) **Stop** key

Gantry display

The gantry display is located at the front of the gantry. In this display you can observe your system operation.

Scan parameters displays

The following scan parameters are displayed in the upper part of the gantry display (example: single tube mode).



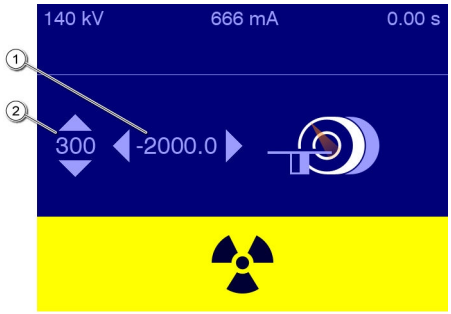
(1) Tube voltage (kV)

(2) Tube current (mA)

(3) Scan time (topograms or sequences) /Rotation time (spirals)

Display of table positions and tube mode

The following information is displayed in the middle of the gantry display.



(1) Horizontal table position

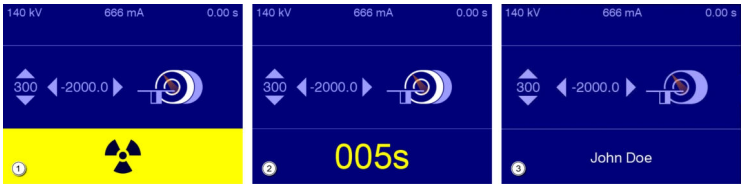
(2) Vertical table position

The value of table height is measured relative to the scan field axis of the gantry.

The value of horizontal table position is displayed with reference to a reference zero position, generally an anatomical marking. Movement towards the gantry is displayed as a negative value and movement out of the gantry opening as a positive value.

Variable additional displays

The display in the lower part of the gantry display depends on the current operation.



(1) Radiation warning

(2) Delay time

(3) Patient name

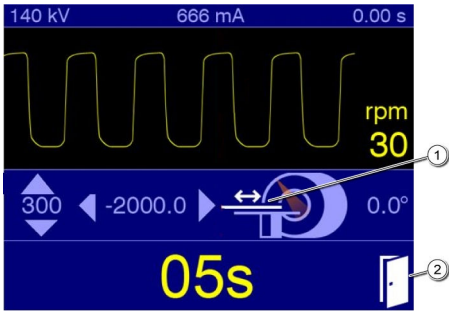
The patient name is shown at the gantry display. If displaying the patient name is not desired, the respective configuration can be performed by a service technician.

The patient name is removed from the display after the first scan entry was performed.

If a delay time is set, it is displayed instead of the patient name.

The radiation warning signal must light up in the gantry display if scanning has been triggered.

ICT mode monitor

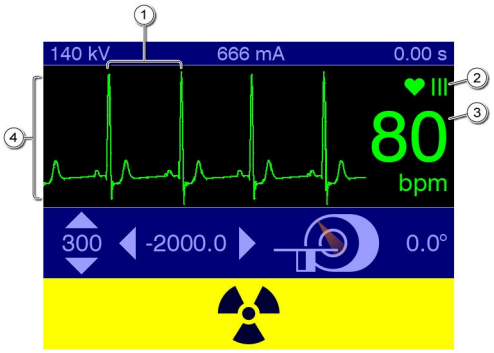


(1) Status: ICT mode on

(2) Status: Door of the examination room open

If the ICT mode is used, an ICT mode monitor is integrated in the gantry display.

ECG monitor



(1) R-peaks

(2) Channel

(3) Heart rate

(4) ECG signal

If the HeartView option is used and ECG electrodes are positioned, an ECG monitor is integrated in the gantry display.

User guidance

For user guidance, color indicators help to inform about the current operation:

- Possible operation/ready for operation: indicated by illuminated keys or highlighted icons (gantry display)
- Next required operation: indicated by blinking keys or blinking icons (gantry display)

Blinking stops when the operation is finished (e.g., reached position).

For safety reasons, the **STOP** keys are not backlit but certainly always available.

3.2.4 Connectors

The lower right front side of the gantry provides several connectors and a line on/off switch. For access the faceplate must be pulled and taken off.

Only connect equipment released by Siemens.

Connector elements

The following elements are located behind the faceplate:

(1) Line on/off switch (push button)

(2) Label (line on/off switch)

(3) Label (foot switch)

(4) Push button for plug release

(5) Foot switch (optional)

(6) i-Control connectors (optional)

(7) Respiratory Gating connector (optional)

3.3 Patient Table

The following patient tables are available with your system.

(→ Page 166 *Patient table with 1600 mm scan range*)

(→ Page 169 *Patient table with 2000 mm scan range*)

(→ Page 173 *Multi-purpose table*)

3.3.1 Patient table with 1600 mm scan range

The patient table consists of the following parts:

(1) Table top release key

Moving the table in Sliding Table Top Only mode
(→ Page 245 *Moving the table in Move Table Top Only mode*)

(2) Warning label: Maximum load / Warning label: Risk of contusion

(3) Lower foot end of the table

(4) Table handle

(5) Table top

Labels

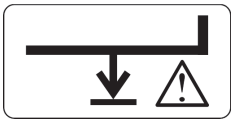
The following labels are depicted on the patient table:

Type B applied part

Equipment is not suitable for direct cardiac application.

Indicates the degree of patient protection of this applied part (Type B applied part according to IEC 60601-1).

Caution, leg injuries



Contusion of legs is possible when lowering the patient table.

Caution: Consult accompanying documents.

Material

The table top consists of material that is impervious to water.

Operating elements and connectors

At the patient table, there are components and operating elements for manual movement as well as the Physiological Measurement Module.

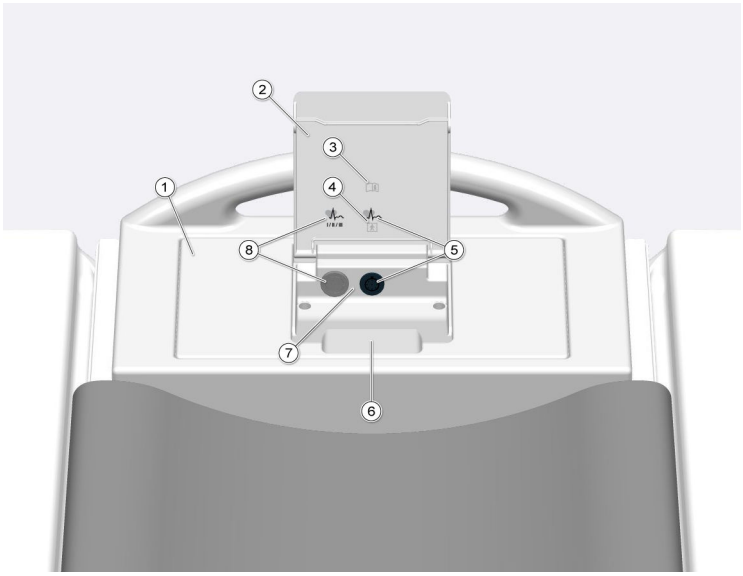
(→ Page 172 *Physiological measurement module for standard patient table*)

Equipotential bonding connector pin

The connector pin is used for potential equalization with other medical devices according to IEC 60601-1:2005, IEC 60601-1:1988 and DIN 42801-2. For further information, see *System Owner Manual*, chapter *Standards and statutory regulations*.

Physiological measurement module for standard patient table

The Physiological Measurement Module (PMM) provides the receptacle for the ECG electrodes and a push button for changing the ECG channel.



(1) PMM box

(2) Lid

(3) Label: Read manual

(4) Label: Type BF applied part (in accordance with IEC 60601-1)

(5) Cardiac CT (optional)

ECG socket and label

ECG monitor (➔ Page 194 *ECG monitor*)

ECG electrodes (➔ Page 196 *Europe version*)

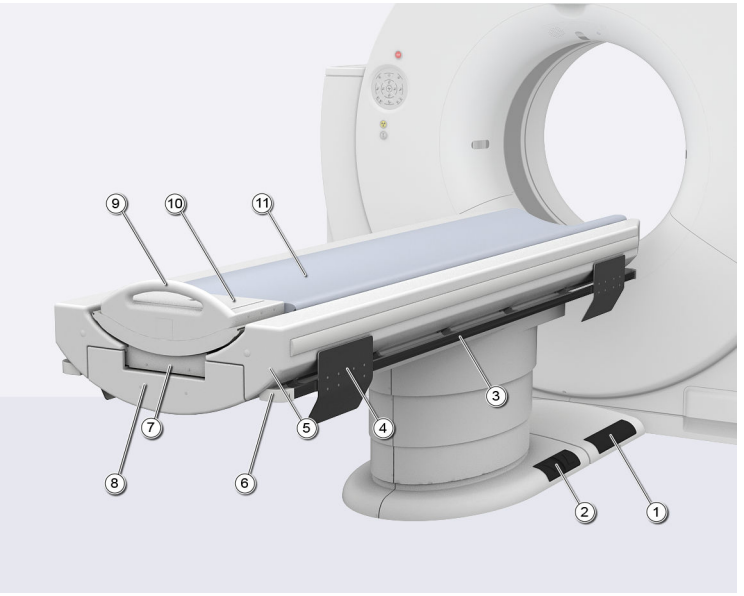
(6) Grommet for cables

(7) ECG socket (optional)

(8) Push button for ECG channel selection and label (optional)

3.3.2 Patient table with 2000 mm scan range

The patient table consists of the following parts.



(1) Table top release foot switch

Moving the table in interventional examinations
(➔ Page 242 *Moving the table in Move Table Top Only mode*)

Moving the table in Sliding Table Top Only mode
(➔ Page 245 *Moving the table in Move Table Top Only mode*)

(2) Up or down foot switch

Moving the patient table (➔ Page 239 *Moving the patient table using the gantry operator panel*)

(3) Surgical rail (optional)

(4) Guard plate

(5) Warning label: Maximum load / Warning label: Risk of contusion

(6) Cable deflector

(7) Label: Type B

(8) Release push button

Moving the table in interventional examinations (➔ Page 242 *Moving the table in Move Table Top Only mode*)

Moving the table in Sliding Table Top Only mode (➔ Page 245 *Moving the table in Move Table Top Only mode*)

Moving the table in case of emergency (➔ Page 245 *Moving the table in case of emergency or power failure*)

(9) Table handle

(10) Physiological Measurement Module (PMM)

Description of the PMM box (➔ Page 172 *Physiological measurement module for standard patient table*)

ECG electrodes (Cardiac CT) (➔ Page 194 *ECG monitor*)

(11) Table top

Labels

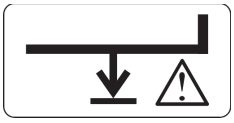
You find the depicted labels adhered to the patient table:

Type B applied part

Equipment is not suitable for direct cardiac application.

Indicates the degree of patient protection of this applied part (Type B applied part according to IEC 60601-1).

Caution, leg injuries



Contusion of legs is possible when lowering the patient table.

Caution: Consult accompanying documents.

Material

The table top consists of material that is impervious to water.

Operating elements and connectors

At the patient table, there are components and operating elements for manual movement as well as the Physiological Measurement Module.

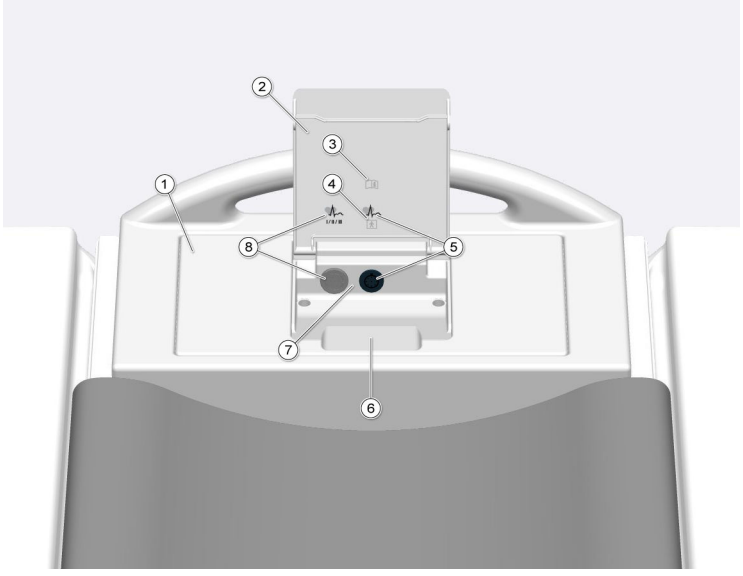
(→ Page 172 *Physiological measurement module for standard patient table*)

Equipotential bonding connector pin

The connector pin is used for potential equalization with other medical devices according to IEC 60601-1:2005, IEC 60601-1:1988 and DIN 42801-2. For further information, see *System Owner Manual*, chapter *Standards and statutory regulations*.

Physiological measurement module for standard patient table

The physiological measurement module (PMM) provides the receptacle for the ECG electrodes and a push button for changing the ECG channel.



(1) PMM box

(2) Lid

(3) Label: Read manual

(4) Label: Type BF applied part (in accordance with IEC 60601-1)

(5) Cardiac CT (optional)

ECG socket and label

ECG monitor (→ Page 194 *ECG monitor*)

ECG electrodes (→ Page 196 *Europe version*)

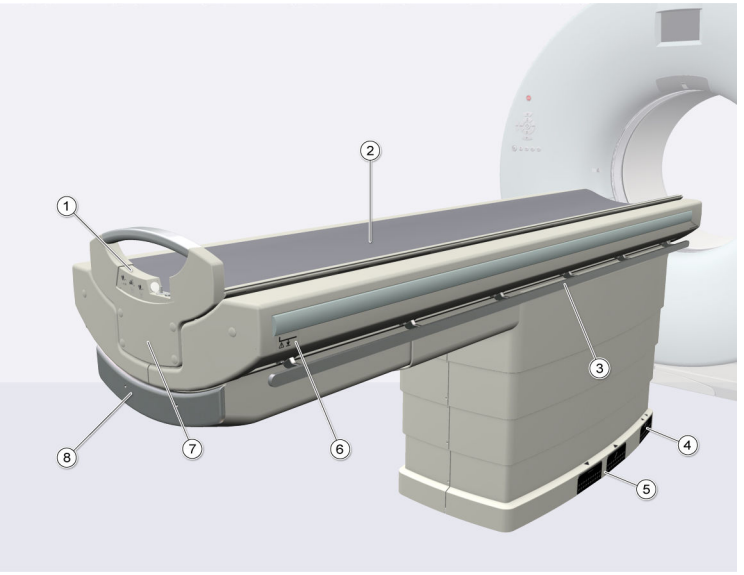
(6) Grommet for cables

(7) ECG socket (optional)

(8) Push button for ECG channel selection and label (optional)

3.3.3 Multi-purpose table

For special clinical requirements, a multi-purpose table (MPT) is available as an option. The patient table can be equipped with different optional table tops, each with a dedicated purpose.



(1) Physiological Measurement Module (PMM)

Description of the PMM box (➔ Page 175 *Physiological measurement module for multi-purpose table*)

ECG electrodes (Cardiac CT) ECG electrodes (Cardiac CT) (➔ Page 194 *ECG monitor*)

(2) Multi purpose table tops

(➔ Page 177 *Standard table top*)

(➔ Page 177 *High capacity table top*)

(➔ Page 178 *Radiation Therapy Planning (RTP) table top*)

Changing the table top (➔ Page 246 *Changing the MPT table top*)

(3) Surgical rail (optional)

(4) Table top release foot switch

Moving the table in interventional examinations (➔ Page 242 *Moving the table in Move Table Top Only mode*)

(5) Up or down foot switch

Moving the patient table (➔ Page 239 *Moving the patient table using the gantry operator panel*)

(6) Label: Risk of contusion

(7) Label: Type B

(8) Release push button

Moving the table in interventional examinations (➔ Page 242 *Moving the table in Move Table Top Only mode*)

Moving the table in Sliding Table Top Only mode (➔ Page 245 *Moving the table in Move Table Top Only mode*)

Moving the table in case of emergency (➔ Page 245 *Moving the table in case of emergency or power failure*)

Operating elements and connectors

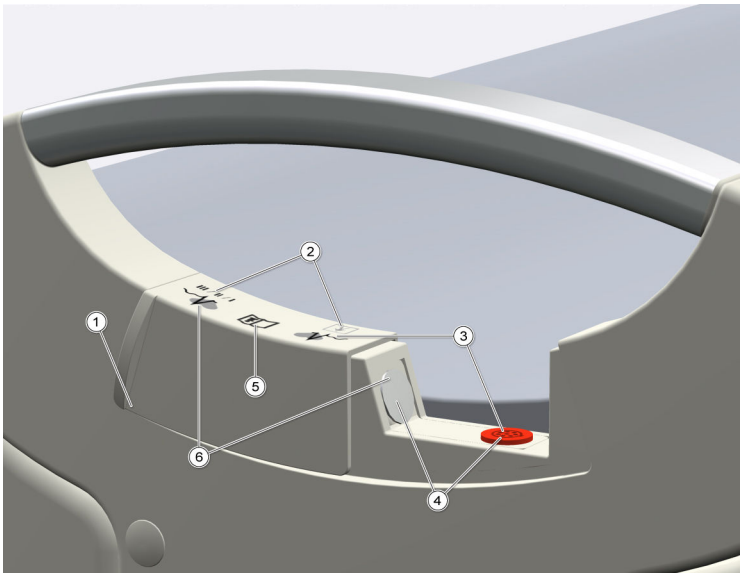
The appearance and the functionality of the multi purpose table slightly differ from the standard patient table.

Equipotential bonding connector pin

The connector pin is used for potential equalization with other medical devices according to IEC 60601-1:2005, IEC 60601-1:1988 and DIN 42801-2. For further information, see *System Owner Manual*, chapter *Standards and statutory regulations*.

Physiological measurement module for multi-purpose table

The Physiological Measurement Module (PMM) provides the receptacle for the ECG electrodes and a push button for changing the ECG channel.



(1) Lid

(2) Labels: Type BF applied part (in accordance with IEC 60601-1)

(3) ECG socket (optional)

(4) Cardiac CT

ECG monitor (➔ Page 194 *ECG monitor*)

ECG electrodes (➔ Page 196 *Europe version*)

(5) Label: Read manual

(6) Push button for ECG channel selection (optional)

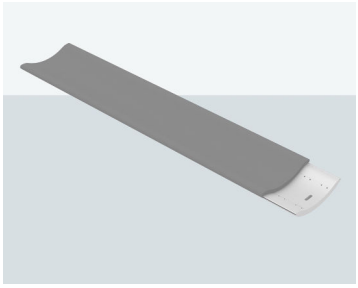
Table tops for the multi-purpose table

A variety of patient table tops are available for the multi-purpose table:

- (➔ Page 177 *Standard table top*)
- (➔ Page 177 *High capacity table top*)
- (➔ Page 178 *Radiation Therapy Planning (RTP) table top*)

Standard table top

The standard table top is used for standard examinations with no special requirements concerning the design of the table.



The standard table top has a curved surface.

Total working load label

The maximum permissible working load must not exceed 227 kg (500 lbs), which is approximately 2226 N.

The total working load label shows the maximum weight of the patient and additional mass.

Maximum load label

The maximum permissible working load must not exceed 220 kg (485 lbs), which is approximately 2157 N.

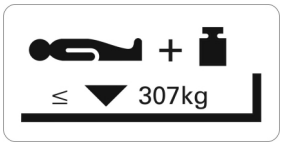
The maximum load label (old) shows the maximum weight of the patient.

Different accessories are available.

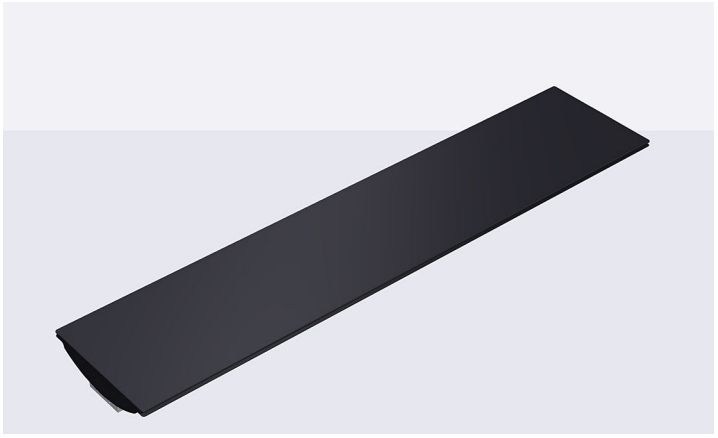
High capacity table top

The high capacity table top is compatible to standard slide boards used for the transfer of trauma patients and bariatric patients with a weight up to 300 kg (661 lbs).

3 System description



The maximum load of the high capacity table top is limited to 307 kg (676 lbs).

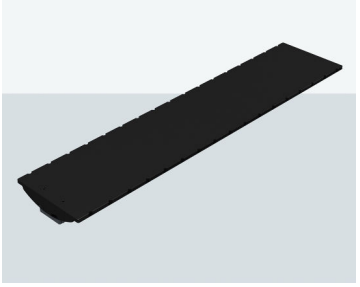


Radiation Therapy Planning (RTP) table top

The RTP table top is a flat table top used for exact and reproducible patient positioning in RTP as well as for standard examinations.

The RTP table top is highly optimized regarding stiffness and bending.

The RTP table top is a flat integral table top with an indexing system on both sides.

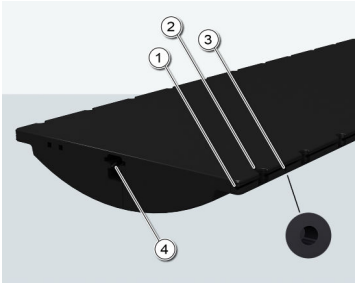


Total working load label

The maximum permissible working load must not exceed 227 kg (500 lbs), which is approximately 2226 N.

RTP adaptor connections

For a standardized patient setup, the table top provides different mounting possibilities (indexing systems).



(1) Slots along both sides of the RTP table top (for restraint straps)

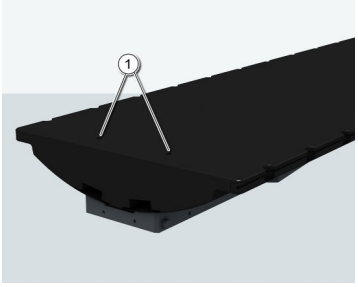
(2) Indentation (Interloc Indexing)

(3) Bore hole

(4) Plug connection for positioning aids

The indentations are used to mount adaptors.

The bore holes can be furnished with lens head screws. The screws are used to mount different accessories (for example, adaptors, rulers). The indexing systems are compatible with most of the accessories used in radiation therapy.

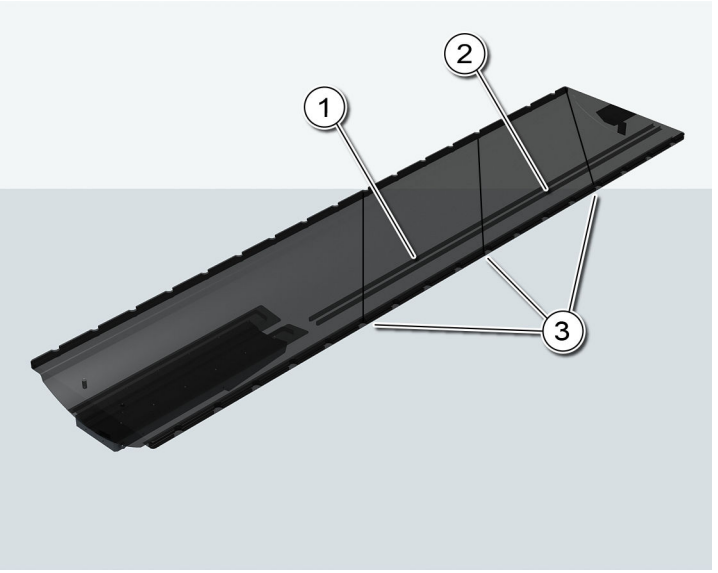


(1) Screw sockets located on the foot end for external devices

For instructions using accessories see the instruction for use of the manufacturer.

Orientation aids

The RTP table top is equipped with several orientation aids to facilitate the determination of position and density in the resulting CT image.



(1) Air filled plastic tube

(2) Perspex rod

(3) Copper wires

Object	Position	Function
Air filled plastic tube	Left side of table top, x-direction	Area with air density
Perspex rod	Left side of table top, x-direction	Areas with water equivalent density
3 copper wires	Diagonal across scannable range (angle 45°)	Enables z-coding

3.3.4 Definitions and limit values

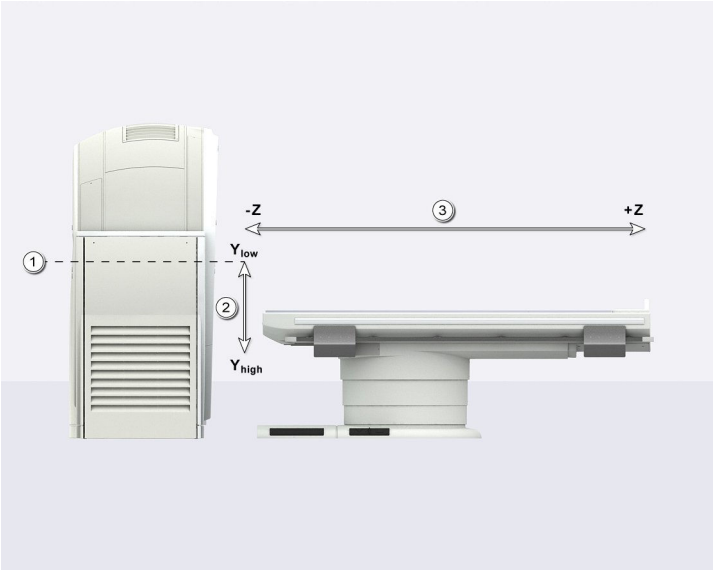
To enter the patient position correctly, you must be familiar with certain definitions concerning the patient table.

The head end and the foot end of the patient table are at the following positions.

(1) The head end is the end of the patient table closer to the gantry.

(2) The foot end is the end of the patient table furthest away from the gantry.

Directions



(1) Scan field

(2) Vertical movement of the patient table (y_{low} to y_{high})

(3) Horizontal movement of the patient table (-z to +z)

Limit values

For vertical movement of the patient table, you must be familiar with limitations.

CAUTION

Lowering the patient table!

Body parts can get caught.

- Make sure that the patients body parts are above the patient table.
- Make sure that neither body parts of anybody nor any objects are below the patient table.

During patient positioning the table top can be lowered to the following levels:

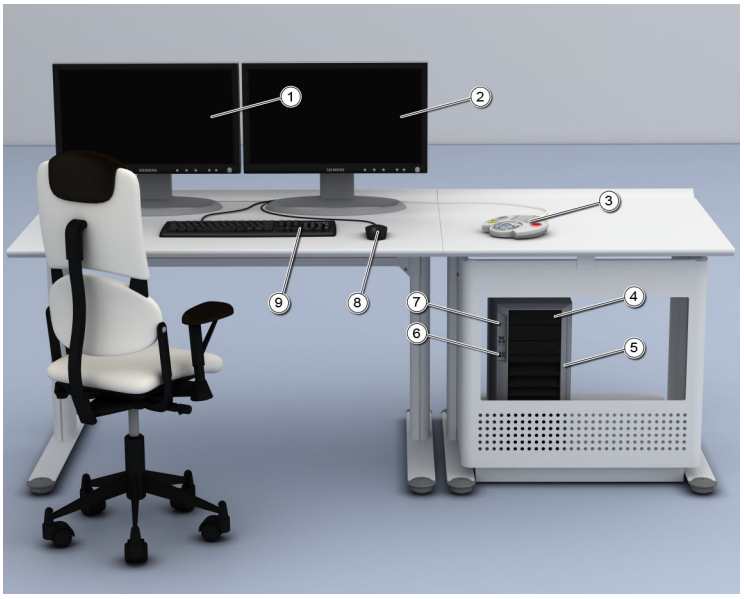
- 505 mm (patient table with 1600mm scan range)
- 480 mm (patient table with 2000mm scan range)
- 550 mm (multi purpose table)

The usual working height corresponds to the height of gantry opening of the system.

Before you can lower the patient table to its minimum height, you must retract the table top entirely.

3.4 *syngo* Acquisition Workplace

This section describes the operating elements of the console components.



(1) Monitor (*syngo* Acquisition Workplace)

Description of the monitor

(2) Dual monitor (optional)

Description of the monitor

(3) Control box

Description of the control box (➔ Page 187 *Control box*)

(4) DVD drive

Description of the DVD drive

(5) Computer

Description of the computer (➔ Page 186 *Workplace computer*)

(6) USB Device

Description of the USB device

(7) Power key (not for use!)

(8) Mouse

Description of the mouse

(9) Keyboard

Description of the keyboard

The pictures of the console components shown here are only examples. The appearance of your devices may be slightly different.

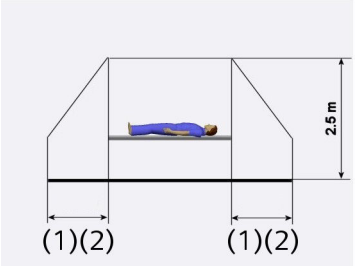
3.4.1 Functions

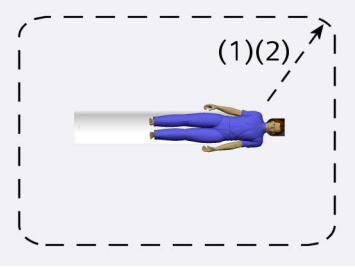
With the operating elements of the console, you can switch the system on and off, enter patient data, plan the examination, and trigger measurement.

You acquire the CT data and use it to reconstruct the CT images, which you can then evaluate.

3.4.2 Location of use

All console components, for example, *syngo* Acquisition Workplace, input units and monitor, including second acquisition monitor, and non-medical equipment are only to be operated outside the patient vicinity. For minimum distances, refer to the following diagrams.





(1) USA: 1.83 m

(2) All other countries: 1.50 m

The minimum distances do not apply to the monitors mounted on the monitor cart or the ceiling-mounted support.

3.4.3 Workplace computer

One workplace computer is delivered with your system.

The pictures shown here are only examples. The appearance of your device may be slightly different.

You use this computer to perform the following activities:

- Controlling the CT scanner
- Evaluating studies
- Storing studies

The workplace computer provides several components, for example, USB ports, DVD recorder. The location and the design of these components may vary.

Do not use the **computer on/off** key. The computer must be switched on and off by using control box and software only.

If you switch off the computer via the **computer on/off** key, it is not able to receive the start-up signal from the control box. In this case, you need to press the **computer on/off** key again to switch on the computer.

3.4.4 Control box

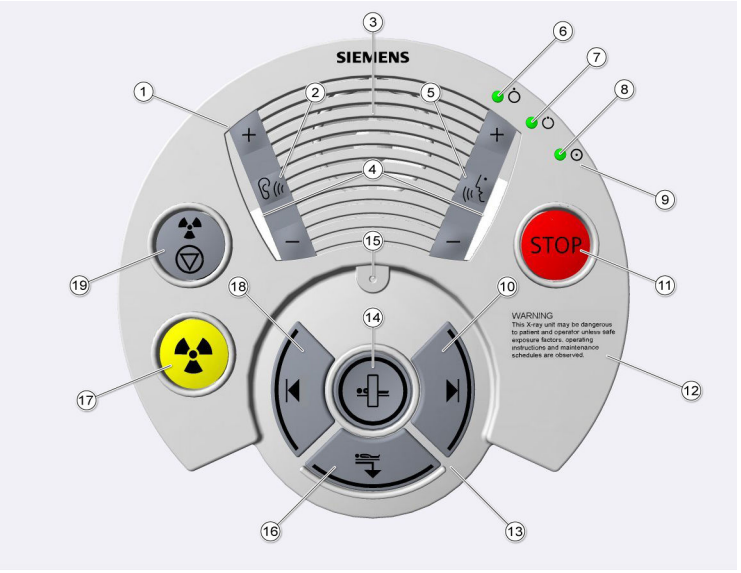
The control box can be used to control measurements and the patient table.

- You can start or stop a measurement.
- You can move the patient table from outside of the examination room.

It is within the responsibility of the personnel to make sure that no conflictive table movements or software actions are performed when the control box, the gantry operator panels, or the panel of the i-Control are in use.

A radiation warning lamp lights up and a warning signal sounds when X-radiation is being generated.

Operating elements



(1) Communication system

Equipment for communication with the patient

(2) Listen to patient

Pressing the center of this key activates the intercom connection to the patient (listen). Pressing the key again closes the connection.

Pressing **+** and **-** in the upper and lower edges of the key adjusts the volume of the gantry loudspeaker.

Using the intercom system (➔ Page 388 *Monitoring patients*)

(3) Loudspeaker

Equipment for communication with the patient

Adjusting the volume, see (5) Talk to patient.

(4) Volume adjustment

Equipment for communication with the patient

Adjusting the volume, see (5) Talk to patient.

(5) Talk to patient

Pressing the center of this key enables you to talk to the patient. The patient can hear you as long as the key is pressed.

Pressing **+** and **-** in the upper and lower edges of the key adjusts the loudspeaker volume.

Using the intercom system (➔ Page 389 *Talking to the patient*)

(6) System Off

Description of System Off key (➔ Page 216 *Shutdown and switching off*)

(7) Comp On

Description of Comp On key (➔ Page 214 *Switching on the computer only*)

(8) Sys On

Description of Sys On key (➔ Page 214 *Switching on the system*)

(9) Switching the system on and off

(➔ Page 213 *Switching the system on and off*)

(10) Step out

Pressing this key moves the patient table stepwise away from the gantry.

(11) STOP key

With the **STOP** key, you interrupt table movements in an emergency and switch off radiation.

If you press the red **STOP** key, unit movements are interrupted and radiation is stopped. The functions of the keys for system movements are also blocked. (➔ Page 38 *Terminating system movements and radiation*)

(12) Warning label (USA only)

(13) Patient table movement keys

Controlling table movement and measurement, see (14) **Move** key, (18) **Step in** key, (10) **Step out** key and (16) **Unload** key

(14) Move key

Pressing this key moves the patient table to the preselected scanning position.

(15) Microphone

Equipment for communication with the patient

Adjusting the volume, see (2) Listen to patient.

(16) Unload key

Pressing this key moves the patient table out of the gantry and lowers it simultaneously.

(17) Start key

With this key, you trigger scanning or you can resume a scan after a scan was suspended.

(18) Step in

Pressing this key moves the patient table stepwise towards the gantry.

(19) Suspend key

Pressing this key interrupts the currently performed scan. The examination can be continued by pressing the **Start** key.

Control box keys

You can move the patient table, for example, by retracting or lowering it, by using the corresponding keys of the control box at the *syngo* Acquisition Workplace console. (→ Page 187 *Control box*)

CAUTION

Unintentional use of table movement keys of the control box!

Possible injury to the patient by moving parts.

- Make yourself familiar with the function of the control box keys.
- Always keep an eye on the patient during table movements.

On/Off keys

On the rear of the control box, you will find keys for switching the computed tomography system on and off (power control).

System On

With the **System On** key, you can switch on the complete system for examinations.

The corresponding LED blinks and no further inputs are received by the system until the system is ready for operation. As long as the system is running, the corresponding LED is illuminated.

Computer On

With the **Computer On** key, you can switch on the computer only, for example, if you want to perform evaluations.

System Off

With the **System Off** key, you can switch off the system if the normal shutdown procedure via software fails. For normal shutdown, the software or the wall switch must be used. If the *syngo* Acquisition Workplace and the gantry are running, only the gantry will switch off when this key is pressed.

(→ Page 215 *Shutting down the system*)

The key can be pressed using a pointed item only, for example, a ballpoint pen or paper clip.

The corresponding LED blinks and no further inputs are received by the system until the system is switched off.

Pressing the **System Off** key will not disconnect the system from the mains. To disconnect the system you need to use the **site On/Off** switch provided by the system owner or the wall switch, if installed.

The *System Off* LED indicates that the entire system is switched off. Only the control box is still working and the data measurement system (DMS) is tempered.

3.5 Heat exchanger

The gantry can be cooled by an optional water/air heat exchanger in combination with an external fan assembly, usually mounted on the roof.

(1) Heat exchanger

(2) External fan assembly

3.6 Accessories

This section gives you an overview of the available accessories for your system.

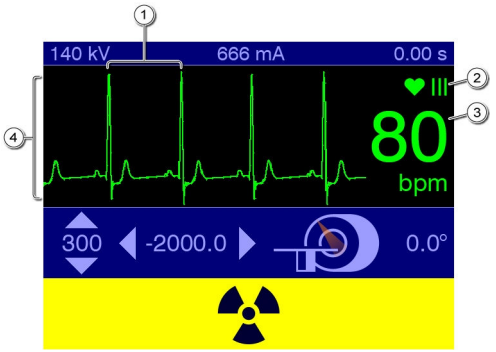
3.6.1 Released medical devices

Only use medical devices that are released for your CT system. The compatibility has to be confirmed by an EC Declaration according to Article 12 of Council Directive 93/42/EEC of June 14, 1993. Ask your Siemens representative for a list of medical devices that are compatible with the Siemens CT system, for example, respiratory gating systems or bolus injectors.

3.6.2 Cardiac CT

For motion artifact-free CT images in the heart region, an ECG triggering and gating function (HeartView option) is available.

ECG monitor



(1) R-peaks

(2) Channel

(3) Heart rate

(4) ECG signal

The HeartView option requires the Siemens ECG monitor. The ECG monitor signal is displayed on the gantry display.

The ECG monitor must not be used to establish a diagnosis.

WARNING

ECG is used as survival or diagnostic equipment!

ECG leads to wrong diagnosis.

- The ECG monitor may only be used in conjunction with the HeartView/Cardiac CT option. It is not intended for monitoring the patient.

WARNING

Rate meters may continue to count the pacemaker rate during occurrences of cardiac arrest or arrhythmia!

ECG leads to wrong diagnosis.

- Keep pacemaker patients under close surveillance.

When the R-peak amplitude becomes smaller than 0.2 mV the color of the ECG curve switches from green to gray. If the amplitude decreases further, the curve is shown as flat line.

QRS recognition reliability

In lowest ECG signals the PMM may detect more R-peaks than existing.

The reliability of QRS recognition can be improved by considering the following suggestions:

- Manual selection of a specific channel (I, II or III) to reduce the information and so the number of artificial R-peaks
- Cleaning especially dry skin surfaces with medical soap and attaching the electrode patch again with some pressure to achieve optimal contact between skin and electrode gel

ECG electrodes

The ECG electrodes are connected to the interface at the PMM (Physiological Measurement Module) at the patient table.
(→ Page 168 *Operating elements and connectors*)

The loose ECG cables can be secured with non-metal clips.

When applying the ECG electrodes to the patient, one of the following color coding is recommended.

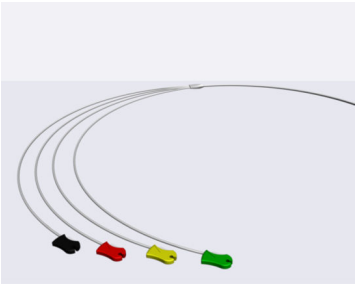
- Europe version: IEC (International Electrotechnical Commission)
- US version: AHA (American Heart Association)

As an option you can use advanced radiotranslucent ECG extensions in order to avoid artifacts during scanning (for example, when examining children).

The real-time triggering requires a reliable signal. Therefore, you are recommended to use ECG electrode patches that fulfill the following requirements:

- Diameter 55 mm
- Strongly adhesive
- Wet gel pad

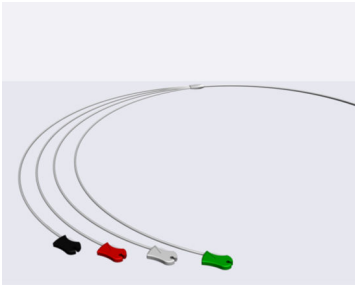
Europe version



Color coding according to IEC

- *Yellow electrode* – on the left mid-clavicular line, directly below the clavicle
- *Green electrode* – on the left mid-clavicular line, 6th or 7th intercostal space
- *Red electrode* – on the right mid-clavicular line, directly below the clavicle
- *Black electrode* – on the right mid-clavicular line, 6th or 7th intercostal space

US version



Color coding according to AHA

- *Black electrode* – on the left mid-clavicular line, directly below the clavicle
- *Red electrode* – on the left mid-clavicular line, 6th or 7th intercostal space
- *White electrode* – on the right mid-clavicular line, directly below the clavicle
- *Green electrode* – on the right mid-clavicular line, 6th or 7th intercostal space

When attaching the ECG electrodes, the cables must be secured at the outer edge of the radiation area. Cable loops must be avoided.

Cleaning

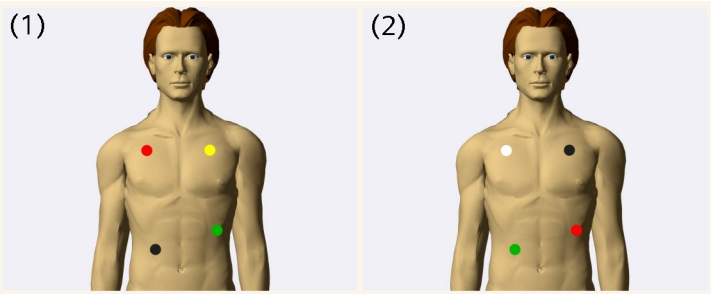
The ECG cable should be cleaned with isopropyl alcohol or another mild disinfectant only. Other agents, especially substances which contain acetone should not be used. This accessory may not be steam sterilized.

Placing ECG electrodes

ECG gating is required for all cardiac examinations. The proper placement of ECG electrodes is essential for a strong and stable signal. The loss of the ECG signal during the acquisition may result in images without diagnostic value.

1. Position and immobilize the patient on the patient table.
2. Make sure that the patient is warm and relaxed.
3. Shave the relevant skin area to enable a proper placement of the ECG electrodes.
4. Thorougly clean the shaved skin area with medical soap to allow for an oil-free surface.
5. Wait until the skin is dry and apply the electrolyte gel.
6. Place the ECG electrodes.

The correct placement of the ECG leads is illustrated in the following diagrams. Different color codings of ECG leads are used for Europe and the USA.



(1) Europe

(2) USA

7 Check the ECG signal with the Physiological Measurement Module (PMM). Toggle through the different channels (I, II or III) and select the best signal. (➔ Page 172 *Physiological measurement module for standard patient table*) (➔ Page 168 *Physiological measurement module for standard patient table*) (➔ Page 175 *Physiological measurement module for multi-purpose table*)

Usually channel II provides the best signal. If you use channel I, make sure that the chest electrodes are placed at a reasonable distance to each other.

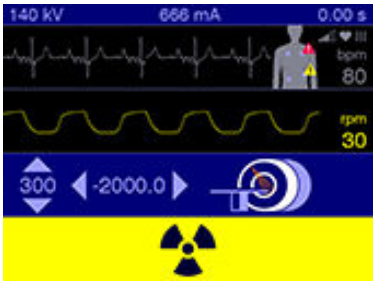
Quality of bonding

The quality of the ECG signal is strongly influenced by the contact of the ECG electrodes with the patient's skin.

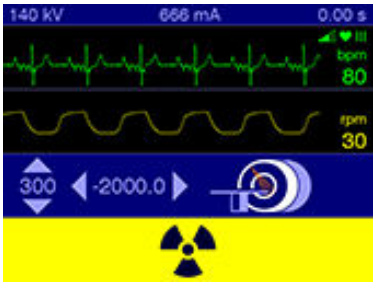
The system automatically checks if all electrodes are connected. The bonding of the electrodes to the skin and the strength of the ECG signal are displayed at the gantry display after a few seconds.

The measured strength of the ECG signal is continuously updated. The quality of the bonding is automatically checked once the system detects that all four electrodes are connected. To manually trigger the measurement of the bonding quality, click the channel selection button at the physiological monitoring module (PMM) and keep it pressed for longer than two seconds.

A warning is displayed in the gantry display if the electrodes are not connected.



A warning icon is displayed if the bonding value does not reach the required threshold.



ECG signal

The quality of the ECG signal is displayed as strength bars. The measured strength of the ECG signal is continuously updated.

Signal strength bars	Corresponding values [mV]
no strength bar	0.0 - 0.2
1 strength bar	0.2 - 0.4
2 strength bars	0.4 - 0.8
3 strength bars	0.8 - 1.2
4 strength bars	1.2 - 1.6
5 strength bars	≥ 1.6

If the signal quality is poor, check that the N electrode is properly attached.

The PMM requires a signal strength of at least two strength bars.

3.6.3 Respiratory gating system

For motion artifact-free CT images mainly in the chest region, a respiratory gating function is available.

The respiratory gating function requires the use of a respiratory gating system.

The follwing respiratory gating systems are released for your system:

- Respiratory Gating System, AZ-733V, ANZAI MEDICAL CO.,LTD
- Respiratory Gating for Scanners (RGSC) Device, Varian Medical Systems, Inc.

Respiratory gating

The respiratory gating function is operated via the console of your CT system. The respiration of the patient is recorded during spiral acquisition. Data are acquired during the entire respiration cycle. Images are reconstructed by matching data and respiration trace.

Respiratory triggering

Before starting the CT measurement via the console, the respiratory phase has to be defined using the laptop in the examination room. Sequential scans are triggered by a respiratory signal reaching a predefined respiratory amplitude of inspiration or expiration.

For instructions using the respiratory gating system please refer to the operator manual of the respiratory gating system manufacturer. More information can be obtained via Internet.

Connectors

The connectors for the respiratory gating system are located at the gantry. (➔ Page 165 *Connectors*) (➔ Page 166 *Connector elements*)

Trolley

A trolley for storage and transport of equipment is part of the Respiratory Gating package.

3.6.4 Bolus injector (CARE Contrast CT)

If the CARE Contrast option is active (coupled operation mode), it is possible to start the injector and the CT scanner with one single start button either at the CT control box, or at the injector. See also (➔ Page 447 *CARE Contrast CT*).

Released bolus injectors

The following hints have to be considered.

Only use injectors that are released for your system. Please contact your Siemens representative for more information.

For further instructions concerning the injector, please refer to the operator manuals of the injector manufacturers.

The injector is connected to the CT system via a permanently installed cable. The installation of the cable must be done by a Siemens service technician.

3.6.5 Distance enlargements

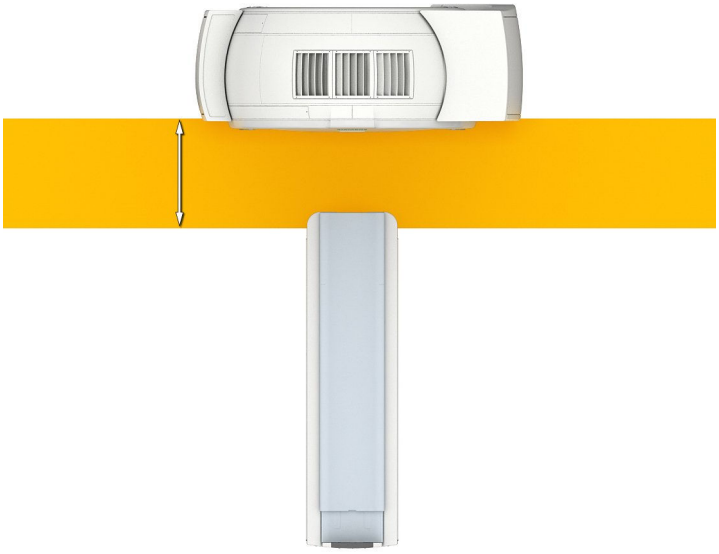
The distance enlargement SOMATOM Definition AS can only be used in conjunction with the multi-purpose table. The necessary cables are laid below the floor.

During the initial installation you can enlarge the distance between gantry and multi-purpose table by the following distances:

- 20 cm
- 40 cm

Distance enlargement 20 cm

Distance enlargement 40 cm



Scan ranges

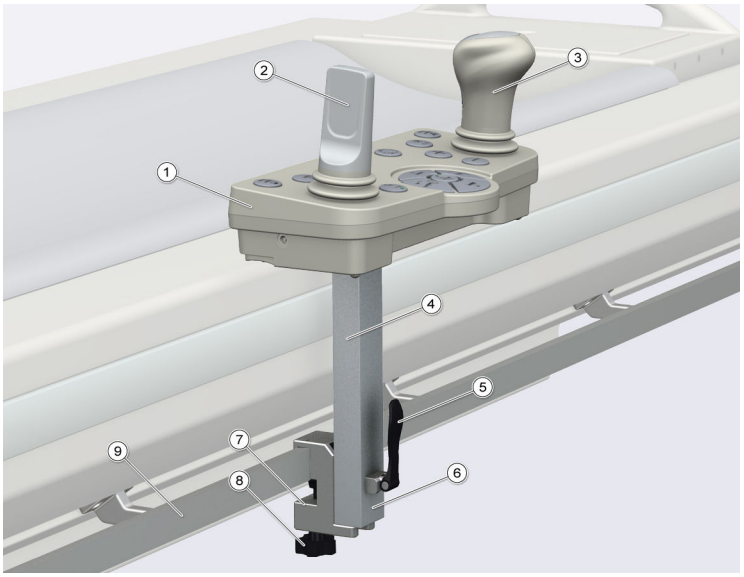
The different distance enlargements decrease the scan ranges of the multi-purpose table.

The respective maximum scan ranges are the following:

- 1800 mm (20 cm distance enlargement)
- 1600 mm (40 cm distance enlargement)

3.6.6 i-Control (interventional panel)

Using the optional i-Control, you can operate some of the CT functions as an alternative to the gantry control panels and the input units at the console.



(1) i-Control panel

(➔ Page 208 *Previous operating panel of the i-Control*)
(➔ Page 205 *i-Control operating panel*)

(➔ Page 518 *Operating the system using i-Control*)

(2) Joystick for patient table movement

Move the table top into or away from the gantry.

(3) Mouse joystick

Operate the software similarly to using the standard computer mouse of the *syngo* Acquisition Workplace.

(4) Guiding rod

(5) Fixing lever

(6) i-Control fixation

Mounting the i-Control at the surgical rail
(➔ Page 513 *Mounting i-Control to the surgical rail*)

(7) Mounting fixtures

(8) Fixing screw

(9) Surgical rail

The i-Control is delivered with the following components:

- i-Control (interventional panel)
- Mounting fixture for the surgical rail
- Cable
- Cable clips
- Sterile cap
- Charger lead (optional)
- Trolley for i-Control (optional)

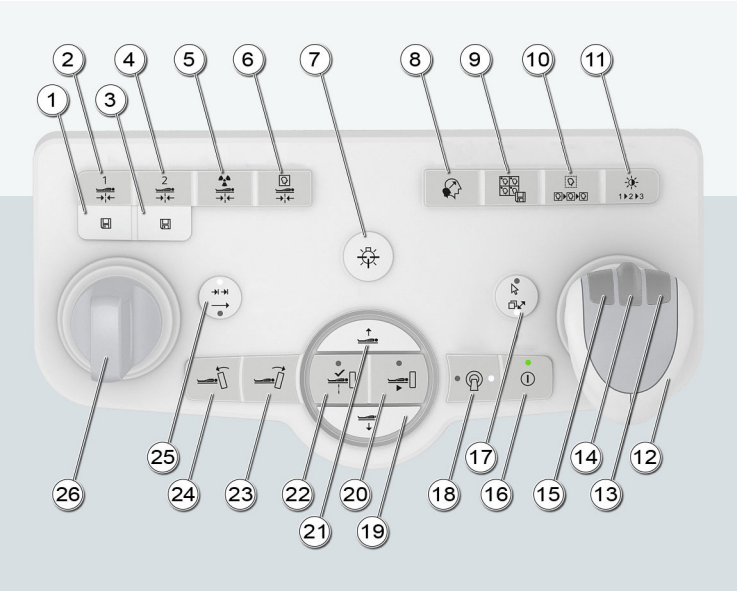
For more information on how to use the i-Control, see.

You can use the connection using the cable if one, or both, of the following conditions are fulfilled.

- The accumulator is discharged.
- No radio permission exists for your country, or a radio connection is not desired.

i-Control operating panel

The i-Control operating panel offers the following CT functions as an alternative to the gantry control panels and the input units at the console.



(1) Saves the current patient table position as the predefined table position 1.

(2) **Saved position 1**: Moves the patient table to the predefined table position 1.

(3) Saves the current patient table position as the predefined table position 2.

(4) **Saved position 2**: Moves the patient table to the predefined tableposition 2.

(5) **Last scan position**: Move the patient table to the scan position used for the last scan.

(6) **Current image position**: Move the patient table to the displayed image position.

This function may not be supported for your system.

(7) **Laser**: Switches on or off the laser light marker.

(8) **Blowup image**: Blow up view for the currently selected image.

This function may not be supported for your system.

(9) **Save displayed images**: Save all displayed images as key images.

This function may not be supported for your system.

(10) **Move active segment**: Toggles the focus between image segments.

(11) **Toggle Window**: Toggles between three organ window settings.

The window settings must be configured with **Examination Configuration**.

(12) Mouse joystick

(13) Right mouse key

(14) Middle mouse key

(15) Left mouse key

(16) **Power On/Off**: Switches on or off i-Control.

In wired mode (→ Page 516 *Operation of i-Control in wired mode*)

In wireless mode (→ Page 517 *Wireless operation of i-Control (optional)*)

(17) **Cursor / Navigation**: Toggle between the joystick functions, mouse-cursor mode and image-scroll mode.

(18) **Tableside location**: Selects the side of the patient table from which you operate the system via the i-Control

The current mode is indicated by the illuminated LED on the key. If i-Control is in a position where operation is not possible, both LEDs are off.

(19) Lower the patient table.

(20) Move the patient table horizontally to the selected position.

This function is only available if a move request is active, for example, after mode loading.

(21) Elevate the patient table.

(22) **Cancel move**: Stop movement of the patient table.

This function is only available if a move request is active, for example, after mode loading.

This function may not be supported for your system.

(23) Negative **Gantry tilt** key (optional)

Tilt the gantry into the negative direction, away from the patient table. (→ Page 236 *Tilting the gantry using the i-Control*)

(24) Positive **Gantry tilt** key (optional)

Tilt the gantry into the positive direction, towards the patient table. (→ Page 236 *Tilting the gantry using the i-Control*)

(25) **Continuous / Incremental**: Toggles between continuous and incremental table movement.

The current mode is indicated by the illuminated LED on the key.

(26) Table joystick

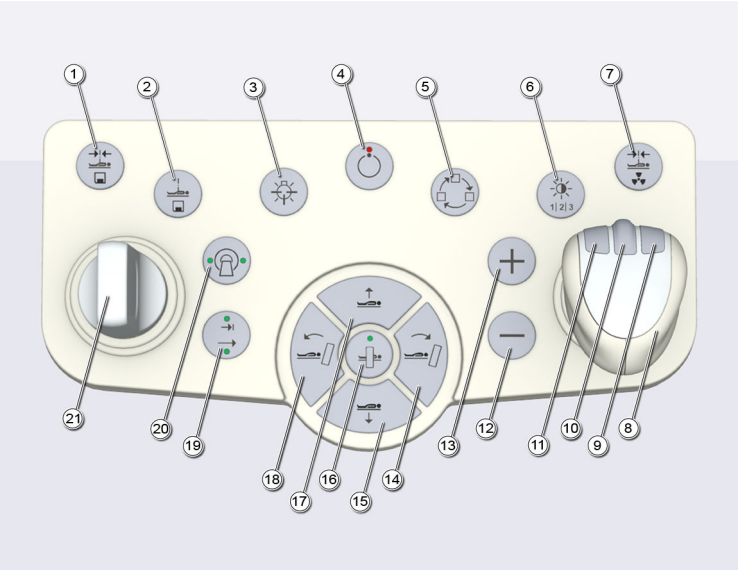
Joystick for horizontal table movement.

Only charge i-Control using the power adaptor provided.

Previous operating panel of the i-Control

With the optional i-Control, you can control some of the CT functions as an alternative to the gantry control panels and the input units at the console.

The previous operating panel provides the following operating elements:



(1) **Saved position**: Moves the patient table to the predefined position. (➔ Page 522 *Moving the table to predefined positions*)

(2) Saves the current patient table position as the predefined position.

(3) **Laser**: Switches on or off the laser light marker.

(4) **Power On/Off**: Switches on or off the i-Control.

In wired mode (➔ Page 516 *Operation of i-Control in wired mode*)

In wireless mode (➔ Page 517 *Wireless operation of i-Control (optional)*)

(5) **Move active segment**: Toggles the focus between image segments.

(6) **Toggle window**: Toggles between three organ window settings.

The window settings must be configured with **Examination Configuration**.

(7) **Last scan position**: Move the patient table to the scan position used for the last scan.

(8) Mouse joystick

(9) Right mouse key

(10) Middle mouse key

(11) Left mouse key

(12) Backward navigation through the image stack of the selected segment

Operating the *syngo* software (→ Page 523 *Operating the syngo software*)

(13) Forward navigation through the image stack of the selected segment

Operating the *syngo* software (→ Page 523 *Operating the syngo software*)

(14) Positive **Gantry tilt** key (optional)

Tilts the gantry into the positive direction, towards the patient table. (→ Page 237 *Tilting the gantry using the previous i-Control*)

(15) Lower the patient table

(16) Move the table to the preselected scanning position

(17) Elevate the patient table

(18) Negative **Gantry tilt** key (optional)

Tilts the gantry into the negative direction, away from the patient table. (→ Page 237 *Tilting the gantry using the previous i-Control*)

(19) **Continuous / Incremental**: Toggles between continuous and incremental table movement.

The current mode is indicated by the illuminated LED on the key.

(20) **Tableside location**: Selects the side of the patient table from which you operate the system via the i-Control.

The current mode is indicated by the illuminated LED on the key. If the i-Control is in a position where operation is not possible, both LEDs are off.

(21) Table joystick

Joystick for horizontal table movement

Optical and acoustical indications

During operation, i-Control emits optical and acoustical indications to inform you about the current operating state or critical conditions.

These indications are described in the following tables.

Optical indications

The LED at the **Power ON/OFF** key emits the optical indications.

Signal	Meaning
LED green	i-Control active, normal operation
LED yellow	Battery charging
LED red	Error Contact Siemens Service.
LED slowly blinking green	i-Control in standby mode
LED quickly blinking green	i-Control establishing radio connection to CT system
LED blinking yellow	Battery low, charging recommended
LED blinking red	Battery empty, charging required
LED quickly blinking red	i-Control lost radio contact to CT system

Acoustical indications

Signal	Meaning
1 beep	• **Power ON/OFF** key pressed, establishing radio connection • i-Control shutting down Possible reasons: battery empty, no radio connection possible, charging complete
2 beeps	Battery low, charging recommended
3 beeps	Battery empty, charging required
1 short beep	• Cable disconnected, establishing radio connection • Cable connected
2 short beeps, continuous	i-Control lost radio contact

4 System operation

This section provides information on system start-up and switching it off. You learn about function tests, data handling and how to configure the system settings.

4.1 Switching the system on and off

In this section you find information on how to start the system: switching it on and off, starting the operating system and the *syngo* software.

You then learn what you have to pay attention to when you shut down the system.

4.1.1 Switching on

The computed tomography system consists of the scanner and the computer.

You can either start the computer only (e.g., for evaluation and management), or the entire system (computer and scanner). Before you can perform examinations, you must switch on both components.

To assure best system performance it is recommended to reboot the system once a day. (→ Page 218 *Shutdown and restart*)

If a *syngo* CT Workplace is connected, it starts up with the system.

If the system was shut down (System End) but the computers are running the next morning, it indicates that a power failure happened during the night. This has no impact on the system and you can continue working as usual.

Switching on the system

- Press the **Sys On** key at the back side of the control box.
  (➔ Page 187 *Control box*)

Both the computer and the gantry are started. The LED blinks during startup and lights up when the systems are ready for operation.

Full operability is reached when both the gantry operator panels and the LED at the control box light up.

Switching on the computer only

- Press the **Comp On** key at the back of the control box.

The computer is started. The gantry is not activated. The LED blinks during start-up and lights up when the computer is ready for operation.

Switching the system on again

If you only wish to switch off the system for a few moments or have switched it off accidentally, do not switch it on again immediately.

- Wait for approx. one minute before switching the system on again.

4.1.2 Shutting down the system

The system shuts down in the following stages:

- Shutdown of the scan system except some components
- Termination of *syngo*
- Shutdown of the operating system

CAUTION

Switch user, shut down, logoff or restart without saving data!

Possible loss of unsaved changes.

- Save data before switching user, shutting down, or restarting the system.

CAUTION

Switching off the computer in Standby mode or without shutting down!

Possible loss of data, data corruption or system damage.

- Shut down the computer before switching off.

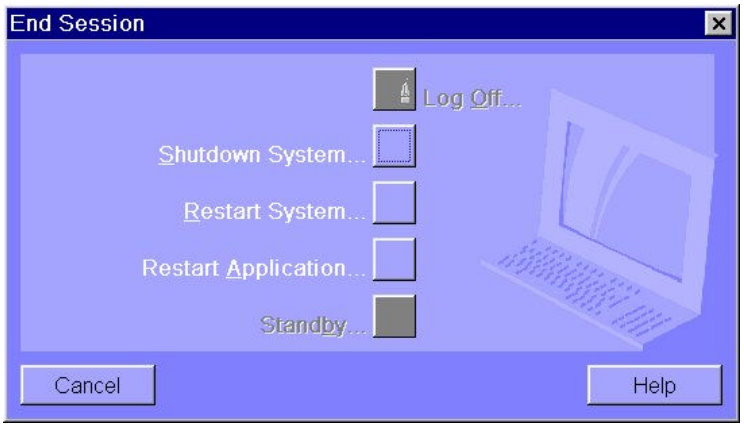
Before you can shut down the system, you must exit all examinations and applications.

A *syngo* CT Workplace that is connected to the system must be shut down first. Otherwise a corresponding dialog box appears.

Calling up the End dialog box

- Call up **System > End** in the main menu.

The **End Session** dialog box is displayed.



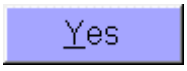
If you do not want to exit *syngo*, click on **Cancel**. You return to the user interface.

Shutdown and switching off

With the **End Session** dialog box, you shut down and switch off the system.

Shutting down the operating system

1 Click on **Shutdown System**.



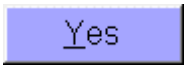
2 Confirm with **Yes** in the dialog box displayed.

The system is shut down.

Terminating active applications

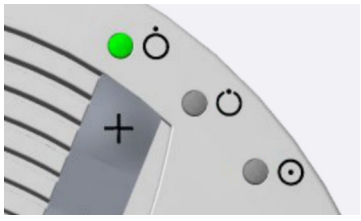
✓ A dialog box is displayed if applications are still active.

✓ A similar dialog is displayed when a patient examination is still running, or a connected *syngo* CT Workplace is still active.



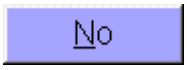
1 Click **Yes**.

All applications close. The system continues to shut down and both the CT scanner and the *syngo* Acquisition Workplace console switch off automatically. If an optional *syngo* CT Workplace is connected to the system, it shuts down as well. Meanwhile, the **System Off** LED is blinking.



After shutdown, the **System Off** LED lights up constantly.

– or –



Click **No**.

You return to the user interface.

2 Exit all applications on the user interface.

Unless absolutely necessary, do not switch off the system at the main switch provided by the customer or the **EMERGENCY OFF** key. Otherwise you have to calibrate the system several times when you restart it.

If the **main switch** is used for switching off, the UPS starts up. If a power failure occurs directly afterwards, the UPS may not have enough energy to supply the system. **EMERGENCY OFF** switches off the system immediately without UPS assistance. While unsaved data can still be saved, you have to calibrate the system in both cases.

Disconnecting the system from mains power

After system shutdown you have the possibility to disconnect the entire system from mains power.

However, you must disconnect the system from mains power after a system failure.

✓ System shutdown is completed.

◆ Press the **line on/off** switch behind the faceplate at the lower right side of the gantry.

Before restarting, the system remains disconnected as long as you push the **line on/off** switch.

Shutdown and restart

With the second option in the **End Session** dialog box, you shut down the system and restart it.

To assure best system performance it is recommended to reboot the system once a day.

Shutting down the gantry only

If the entire system is running and you do not need the gantry any longer, you have the possibility to shut down the gantry only. The rest of the system remains in operating state.

✓ The entire system is running.

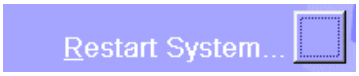
◆ Press the **Comp On** key at the back of the control box.

During gantry shutdown the *Comp On* LED blinks.

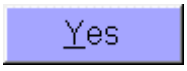
After completion of the gantry shutdown the *Comp On* LED is illuminated.

Pressing the **Sys On** key at the back side of the control box reactivates the gantry.

Restarting the system



1 Click on **Restart System** in the **End Session** dialog box.

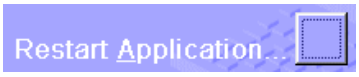


2 Confirm with **Yes** in the dialog box displayed.

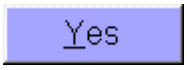
The system is restarted.

Restarting the application

If you want to close all applications and restart the *syngo* application only, use the third option in the **End Session** dialog box.



1 Click on **Restart Application** in the **End Session** dialog box.



2 Confirm with **Yes** in the dialog box displayed.

The applications terminate and *syngo* are restarted automatically.

Restarting after system emergency stop

In case the system has been switched off by pressing the **EMERGENCY OFF** key in the examination room (e.g., by accident), a controlled restart has to be done.

Country-specific regulations must be observed.

✓ All causes of danger have been found and remedied.

1 Release the **EMERGENCY OFF** key provided by the customer.

2 Switch off and on again the site **On/Off** switch provided by the customer.

3 Press the **Sys On** key on the back side of the control box.

4 Perform the usual checkup procedure to calibrate the system.

If you want to switch on the computer only, use the **Comp On** key instead of the **Sys On** key. The computer start takes a while.

Starting a maintenance shutdown

During a maintenance shutdown, the system cleans up unused pixel data and defragments the image directories for faster access. This operation may take several hours.

During the maintenance shutdown, access to the user interface or operating system is not possible.

1 Select **System > Run** from the main menu.

2 Select **System Clean Up and Shutdown**.

The **System Clean Up and Shutdown** dialog box opens.

3 Click on **Start**.

If you do not want to exit *syngo*, click **Cancel**.

Make sure that maintenance is performed at recommended intervals. See *System Owner Manual*.

4.1.3 Exceptional situations

Special circumstances can force the system to shut itself down or to reduce its function temporarily until a defined operating state is achieved.

There are three types of exceptional situations:

- Gantry temperature deviating from the specified limits (➔ Page 221 *Gantry temperature outside permissible range*)
- Overheating of the computer system (➔ Page 223 *Overheating of the computer system*)
- Power failure (➔ Page 224 *Power failure*)

The system responds to such exceptional situations in several steps:

Countdown

If the system reaches a critical state, a countdown is started to shut down the system. During this time, do not perform any examinations and terminate any current application(s).

Recovery

If the system returns to the normal state during countdown (temperature dropped, power supply restored), you can resume examination.

Shutdown

If the countdown has elapsed, the system is shut down.

Restart

If the system is shut down, a restart has to be performed once the exceptional situation has been remedied.

The system does not restart automatically.

Gantry temperature outside permissible range

Accurate measurements are only possible if the temperature inside the gantry is within a certain range.

If the temperature in the gantry falls below a specified limit, the quality of the images is affected because calibration is no longer correct.

Overheating or low temperature If the temperature of the gantry exceeds the permissible range, countdown starts. A temperature warning is displayed.

Recovery If the temperature moves back into the permissible range during countdown, the countdown stops. You can then return to the user interface.

Shutdown When the countdown has finished, measurement is disabled. A message is displayed in the status line. Measurement can be restarted manually as soon as the temperature reaches a permissible range again.

Restart After a shutdown due to overheating the system has to be restarted manually.

If the temperature in the gantry rises above a maximum value, e.g., as the result of a defective cooling system, the gantry is automatically switched off. A message appears stating that the gantry is no longer ready for operation.

Resolving the temperature warning

✓ Temperature warning dialog box is displayed.

✓ Countdown has started.

1 Finish the current examination and check the cooling system.

2 Confirm with **OK** in the dialog box displayed.

The dialog box is closed.

A text is displayed in the status bar during countdown.

Returning to the user interface

✓ The temperature moves back into the permissible range. Countdown stops.

✓ A dialog box is displayed.

◆ Confirm with **OK**.

The dialog box is closed.

You return to the user interface.

Restarting the system after automatic shutdown

✓ The system has shut down due to overheating.

◆ Restart the system after waiting for at least 10 minutes. (➔ Page 213 *Switching the system on and off*)

The system is restarted.

Overheating of the computer system

Parts of the computer system might overheat during operation. In this case, reliable operation and data security are endangered.

Keep the ventilation slots of the computers clear.

Warning If the temperature of the computer system rises above a certain threshold value, a dialog box indicates this to you.

Recovery If the temperature of the system falls below the threshold value, a message is displayed. You can continue operation.

If the temperature continues to rise and reaches a critical value, countdown is initiated.

Countdown As long as the countdown is running, you have the option of completing current actions and storing your data. A dialog box is displayed.

If the temperature falls below the threshold value during countdown, you can continue operation.

Shutdown If the countdown has finished and the temperature is still above the critical value, the system is shut down. A message is displayed in the status bar.

Restart

When the computer system has cooled down, you can restart the system.

Resolving the temperature warning

✓ Temperature warning dialog box is displayed.

1 Check the room temperature and the ventilation slots of the computer.

2 Confirm with **OK** in the dialog box displayed.

The dialog box is closed.

A text is displayed in the status bar.

Continuing operation

✓ The temperature moves back into the permissible range. Countdown stops.

✓ A dialog box is displayed.

◆ Confirm with **OK**.

The dialog box is closed.

You can continue operation.

Restarting the system after automatic shutdown

✓ The system has shut down.

1 Wait for the computer system to cool down.

2 Restart the system. (→ Page 213 *Switching on*)

Power failure

The uninterruptible power supply takes over the power supply of your computer system temporarily during a power failure.

However, during a power failure, the power to the measuring system is interrupted.

Countdown

When a power failure occurs, a dialog box is displayed and a 5-minute countdown starts.

If the power failure is remedied during the first 4 minutes, you can continue with normal operation after clicking the **Continue** button.

Nevertheless you should start completing current actions as long as the countdown is running. When the countdown is finished, the system shuts down.

Recovery Countdown is stopped if the normal power supply is available again.

Shutdown After the countdown has elapsed, shutdown is initiated.

Restart As soon as the normal power supply is reactivated you can restart your system.

Resetting the system

✓ Countdown is stopped.

✓ A corresponding dialog box is displayed.

1 Confirm with **OK**.

The dialog box is closed.

2 Call up **System > Continue**.

The system resets.

Restarting the system

✓ Normal power supply is reactivated.

CAUTION

When you restart the system, the detector has not yet reached operating temperature!

Wrong diagnosis due to image artifacts.

- Calibrate the system as part of the checkup. Repeat calibration if ring artifacts occur.

- Restart the system. (→ Page 213 *Switching on*)

4.1.4 Starting the Image Reconstruction System (IRS)

In some cases, when the IRS is defective, the system may shut down immediately after start. Contact your Siemens local Customer Service.

- Disconnect the IRS from Ethernet and power and restart the system to allow extraction of service relevant information from the event log.

4.2 Function tests

To ensure that the system is ready for operation and all functions relevant to safety are working correctly, you must perform function tests daily before beginning with the actual examination procedures.

For further information, see (➔ Page 227 *Testing the keys on gantry operator panel*) or *System Owner Manual*.

4.2.1 Checking the STOP keys

1 Press and hold one of the table movement keys on the gantry operator panel.

2 When the patient table moves, press **STOP**.

The table movement must stop immediately.

3 Check whether you can move the patient table out of the gantry manually after you have pressed a **STOP** key. (➔ Page 244 *Moving the table manually*)

After you have pressed a **STOP** key, you must restore system readiness with **System** > **Continue**.

4.2.2 Testing the keys on gantry operator panel

You must check the following keys on the gantry operator panel:

- Table positioning
- Gantry tilt
- Switching on the light marker
- Zero position of the horizontal table coordinates
- Moving the table from the light marker position to the inner scan plane
- Retracting the table

◆ Check the keys when you switch on the unit.

4.2.3 Checking radiation block and warning lamps

You must check the radiation warning lamps on the control box, the gantry (operator panel and display) and, if present, next to the doors of the examination room.

1 Check the proper function of the radiation warning lamps during the daily image quality tests.

The radiation warning lamps must light up when X-radiation is generated.

2 Make sure that radiation stops immediately when a door of the examination room is opened.

When the door is closed again you must restore system readiness with **System** > **Continue**.

4.2.4 Checking the laser light marker

CAUTION

Laser radiation!

Possible loss of eyesight due to laser radiation.

- Do not look directly into the laser beam or at its reflection on smooth, mirror-like surfaces during adjustment.

- Switch on the laser light marker and check the projections of the light beams on a white sheet of paper.

The laser beam must project a cross hair and the reference level laser beam a line mark.

The laser light marker does not work.

- Stop scanning to rule out any danger to patients.
- Call Siemens Customer Service.

4.2.5 Checking the intercom system

- Apply the **Listen to patient** and **Talk to patient** keys on the control box. (➔ Page 187 *Control box*)

The intercom system must work in both directions.

4.2.6 Checking the table top

You must check the mobility and cleanness of the table top.

1. Make sure that you can manually retract the table top from the gantry. (➔ Page 244 *Moving the table manually*)
2. Make sure that the scan field is free of residual contrast medium, blood or other contaminations.

4.2.7 Using the Customer CTDI service function

The Customer CTDI service function allows you to carry out CTDI measurement procedures using parameters and collimation values that correspond to arbitrary routine clinical scan protocols. CTDI measurements can be carried out according to the IEC 60601-2-44 regulations.

Using the Customer CTDI service function, clinical scan protocols are adapted to a single axial scan based on one of the following predefined protocol types:

- Adult head protocol
- Adult body protocol
- Pediatric body protocol

You can modify a scan protocol and configure its scan and reconstruction parameters according to your requirements.

We recommend that only appropriately trained personnel carry out CTDI measurements using the Customer CTDI service function.

Defining a special scan protocol for CTDI measurement

Only routine scan protocols are available for the Customer CTDI service function. When loading special scan modes such as Dual Source modes, Cardiac modes or UHR modes, a failure will occur.

Loading the routine scan protocol

You can define the examination data in the **Patient Model Dialog**.

The protocols are assigned to the respective regions of the body image by moving over the body regions. Further protocols are grouped in various categories: Dual Energy, Cardiac, Vascular, RT, Specials, or Private (depending on the available licenses).

✓ All current examinations are closed.

✓ The desired patient is registered.

✓ The **Patient Model Dialog** is opened.

✓ The desired patient is selected.

1 Click **Adult** or **Child** to load the set of scan protocols.

2 Select the desired scan protocol by clicking on the anatomical region you want to examine.

– or –

Select the desired scan protocol from the list at the right side of the body image.

The set of scan protocols is loaded.

3 Select the scan protocol in the displayed selection list.

4 Select the API language.

5 Click the **Save** button to confirm your entries.

The **Patient Model Dialog** is closed and the scan protocol is loaded.

Deleting all non-used ranges and recon jobs

Only one scan entry and one recon job are allowed for a CTDI measurement using the Customer CTDI service function.

✓ The scan protocol is loaded.

1 Select the non-used range.

2 Right-click on the non-used range and select **Cut** in the context menu.

The range is deleted.

3 Repeat these steps for all non-used ranges.

4 Select the non-used recon job.

5 Right-click on the non-used recon job and select **Delete Recon Job** in the context menu.

The recon job is deleted.

6 Repeat these steps for all non-used recon jobs.

Adapting the scan protocol parameters

✓ The desired scan protocol is loaded.

✓ Only one scan entry and one recon job are available.

1 Select the required range.

2 Click on the **Recon** parameter card.

3 If necessary, adapt the reconstruction parameters according to your requirements.

4 Click on the **Scan** parameter card.

5 Deactivate **CARE Dose4D**.

Make sure that the **CARE Dose4D** is disabled.

6 Click **Edit** > **Save Scan Protocol** to save the examination.

The required examination range is defined and the **Save Scan Protocol** box opens.

Saving the defined scan protocol

Assign the special scan protocol with one of the following file names and file types:

- CTDI_head as type Adult
- CTDI_body as type Adult
- CTDI_body as type Child

Save the protocol in the **Special** folder.

CTDI measurement using the Customer CTDI service function can only be done if the protocols are assigned with these special file names and file types.

✓ The required examination is defined.

✓ The reconstruction parameters are entered.

✓ **CARE Dose4D** is deselected.

✓ The **Save Scan Protocol** box is opened.

1 Select the required folder in the browser.

2 Enter the required file name and type.

3 Click the **Save** button to confirm your entries.

4 Click **Patient** > **Close Patient** in the main menu to close the current patient.

The defined scan protocol is saved.

Starting the scan on the console

1 Press the Start key on the control box.

The scan is started. When the scan is successfully completed, an image is stored to the Service Patient.

2 Follow the instructions on the screen to repeat the measurement.

– or –

Follow the instructions on the screen to finish the measurement.

The Customer CTDI service function is completed and the database is automatically cleaned up.

An image of each scan is automatically saved to the Service Patient in the Customer CTDI study. The image is assigned with a series for each scan protocol type used. Each series also carries the same name as the protocol type associated with it.

The images are overwritten when starting a new CTDI measurement with the same scan mode. To archive the data of the CTDI measurement, use another storage or storage media.

Starting CTDI measurement

You do not need a personal account and password for the Customer CTDI service function.

✓ The special scan protocols have been defined according to your requirements.

✓ The scan protocols are saved in the special folder with the required file names and file types.

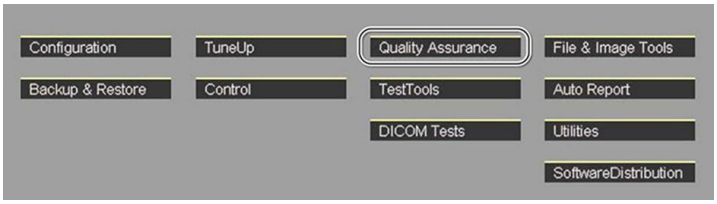
✓ The current patient study is closed.

1 From the main menu, choose**Options** > **Service** > **Local Service**.

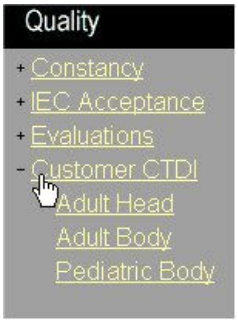
2 Delete the password entries and the account entries.

3 Click the **OK** button.

The **Home Menu** dialog window opens.



4 Click on the **Quality Assurance** button to display the **Quality** window.



5 Select **Quality** > **Customer CTDI** in the **Quality** window.

The **Customer CTDI** sub-menu opens with entries for the three different pre-defined protocol types.

6 Click **Adult Head**, **Adult Body** or **Pediatric Body** to select the desired region.

The Customer CTDI service function is started and the selected protocol is displayed.

7 Follow the instructions on the screen to load the previously defined special scan protocol. (➔ Page 229 *Defining a special scan protocol for CTDI measurement*)

The protocol is loaded.

4.3 Operation of the gantry

You can tilt the gantry using the gantry operator panel, i-Control, or control box. During an examination, the system tilts the gantry according to the planned scan ranges.

Take note of the following:

- In **Move Table Top Only** mode, you can only tilt the gantry using the gantry operator panel or the i-Control.
- You can tilt the gantry using the control box in single source systems.
- The gantry cannot be tilted when acquiring spirals or Adaptive 4D Spirals.

CAUTION

Unobserved movement of the patient table or gantry!

Collision of the patient with the gantry.

- Monitor the patient continuously as long as the table top and gantry are moving.
- Take special care with the tilt of the gantry other than 0 degree or a table height other than the isocenter for the patient.

CAUTION

Insufficient image information for RT planning caused by misaligned gantry tilt requires new CT scan after quality assurance!

Additional dose of radiation.

- Please check gantry tilt accuracy regularly according to this manual and national quality assurance regulations.
- In case of misalignment, please contact the Siemens customer service.

In case a scan range is selected in the chronicle, the **Tilt** parameter on the **Routine** parameter card defines the tilt of the scan range.

In case no scan protocol is loaded or no scan range is selected, the **Tilt** parameter is used to tilt the gantry itself.

In interventional CT table mode, you can only tilt the gantry at the gantry panel and the i-Control.

4.3.1 Tilting the gantry forward (positive direction)

- Press the corresponding **Tilt** key and hold it down as long as you want the tilting movement to continue.

The gantry is inclined so that the top of it moves toward the patient table (positive angle).

If the following positions have been reached, the tilting stops automatically:

- Vertical position (0° position)
- Maximal positive or negative angle
- Final position defined by the current table position or scan program

To continue movement release the button and press it again.

4.3.2 Tilting the gantry backward (negative direction)

◆ Press the corresponding **Tilt** key and hold it down as long as you want the tilting movement to continue.

The gantry is inclined so that the top of it moves away from the patient table (negative angle).

If the following positions have been reached, the tilting stops automatically:

- Vertical position (0° position)
- Maximal positive or negative angle
- Final position defined by the current table position or scan program

To continue movement release the button and press it again.

4.3.3 Tilting the gantry using the i-Control

You can tilt the gantry using the i-Control.

1 Press the **Forwards Tilt** key and hold it down as long as you want the tilting movement to continue.

The gantry is inclined so that the top of it moves towards the patient table (positive angle).

2 Press the **Backwards Tilt** key and hold it down as long as you want the tilting movement to continue.

The gantry is inclined so that the top of it moves away from the patient table (negative angle).

4.3.4 Tilting the gantry using the previous i-Control

With the optional i-Control, you can tilt the gantry as an alternative to the gantry operator panel and the control box.

1 Press the **Backward tilt** key and hold it down as long as you want the tilting movement to continue.

The gantry is inclined so that the top of it moves towards the patient table (positive angle).

2 Press the **Forward tilt** key and hold it down as long as you want the tilting movement to continue.

The gantry is inclined so that the top of it moves away from the patient table (negative angle).

4.3.5 Tilting the gantry using the console

Tilting the gantry by using the console provides an alternative to using the gantry operator panel and the i-Control.

1 In the **Tilt** field on the **Routine** parameter card, enter the tilt in degrees.

– or –

Click the arrow buttons beside the field to increase or decrease the tilt.

Positive values mean that the top of the gantry tilts towards the table top. Negative values mean that the top of the gantry tilts away from the table top.

The desired tilt may exceed the limits or may conflict with the current table position/table height. If so, the system sets the gantry tilt to the nearest possible value.

2 Press and hold the **Move** key at the control box until the gantry has reached its new position.

See the messages in the status bar.

– or –

Click **Cancel** to stop tilting the gantry.

4.4 Operation of the patient table

In this section, you learn how to move the patient table automatically and manually. Furthermore, the change of the MPT table top is described.

Most of the pictures in this section show the standard patient table. Nevertheless, all described actions are also applicable for the multi purpose table.

4.4.1 Patient table movements

During examination, the table movement is controlled from either the console or directly on the gantry control panel.

CAUTION

Wrong table feed direction!

X-ray not, or only partially, usable.

- Always keep an eye on the patient.
- Stop scanning in case of wrong table feed direction.

Note that the patient table with 1600 mm scan range moves in vertical and horizontal direction simultaneously when pressing the table movement keys.

STOP keys

With the **STOP** key, you can interrupt table movements in an emergency and switch off radiation.

If you press one of the red **STOP** keys, unit movements are interrupted and radiation is stopped. The functions of the keys for system movements are blocked as well. (➔ Page 38 *Terminating system movements and radiation*)

Displays

The table height and relative table feed are displayed both on the gantry display and on the screen.

Safety advice for biopsy

If the patient has a needle for biopsy, always be aware of the location of the needle in relationship to the gantry. Unplanned advancement of the needle could occur.

4.4.2 Moving the patient table using the gantry operator panel

You can adjust the table height and move the table into and out of the gantry directly using the gantry operator panel.
(➔ Page 156 *Gantry operator panels*)

Always ensure that the movement is not obstructed by any objects.

Do not place any objects underneath the patient table.

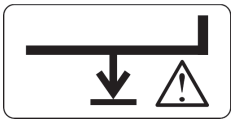
To avoid injuries due to acceleration and deceleration of the patient table in high pitch modes, we recommend performing scanning without the head holder.

Moving the table top vertically

With the **Table movement** keys, you can adjust the vertical table movements.

Before you lower the patient table to a minimum height, you must completely retract the table top out of the gantry.

Caution, leg injuries



Contusion of legs is possible when lowering the patient table.

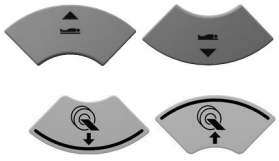
Caution: Consult accompanying documents.

CAUTION

Lowering the patient table!

Body parts can get caught.

- Make sure that the patients body parts are above the patient table.
- Make sure that neither body parts of anybody nor any objects are below the patient table.



- Press the **Table up** or **Table down** key and keep it pressed until the table is correctly positioned.

  The new vertical table top position (in mm) is displayed.

Moving the table top horizontally

CAUTION

Horizontal table top movement!

Possible injury to the hand (warning label).

- Do not place your hand in the gap of the table top support.

1 Press the **Table in** or **Table out** key and hold it pressed until the table is correctly positioned.

2 Press the **Speed** key in combination with the **Table in** or **Table out** key increases the speed of the table movement as long as both keys are pressed.

– or –

Press the **Table in fast** or **Table out fast** key to move the patient table into the gantry with increased speed.

The new table top position (in mm) is displayed.

Configuring table positions

With the **A** and **B** keys, you can move the table to predefined horizontal and vertical positions..

1 Move the table to the desired position.

2 Press the **Horizontal zeroing** key and the **A** key simultaneously until the **A** key starts blinking to save the position.

3 Move the table to another position you want to save.

You can save another position by performing the same workflow steps for the **B** key.

If you save a new position for the **A** and the **B** keys, the former position is overwritten.

Moving the table in Move Table Top Only mode

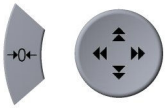
This function provides more space, for example, for additional devices, between the table base and the gantry during an intervention.

The scan range is limited to 1.60 m when the table top is moved out.

To activate the Move Table Top Only mode, do the following:

1 Press the **Zeroing** key and the **Offset** key simultaneously for 2 seconds.

– or –



Press the **Zeroing** key and the **Speed** key simultaneously for 2 seconds.

The movement keys flash.

2 Press the **Table out** key

The table moves away from the gantry.

The movement keys flash when the table has reached the final position.

3 Press the **Table in** key

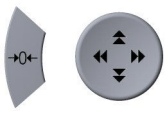
The table top moves to the gantry.

Deactivating the Move Table Top Only mode

To deactivate the Move Table Top Only mode, do the following:

◆ Press the **Zeroing** key and the **Offset** key simultaneously for 2 seconds.

– or –



Press the **Zeroing** key and the **Speed** key simultaneously for 2 seconds.

The table top moves back to the initial position.

Unloading the patient

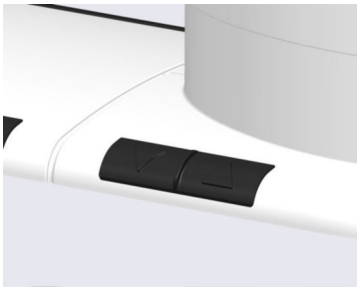
✓ The scan is completed.

◆ Press the **Unload** key.

The table is moved out of the gantry and lowered simultaneously.

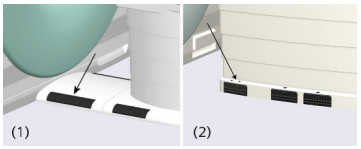
4.4.3 Moving the patient table using the foot switch

You can move the patient table with the foot switches.



Moving the table top vertically

- Press the **Table down** or **Table up** foot switch to lower or raise the patient table.



Moving the patient table in Move Table Top Only mode

1. Step on the **Table top release** foot switch.
2. Move the table top horizontally into the desired position.

Due to patient weight you may need more strength to move the table top.

3. Step off the foot switch.

   The table top engages.

4.4.4 Moving the table manually

In some situations, manual table movement can be necessary.

For this purpose, you can use the foot switch or the release mechanism integrated in the handle of the table.

Moving the table in Move Table Top Only mode

(1) Table top release key

1 Press the table top release key on the table.

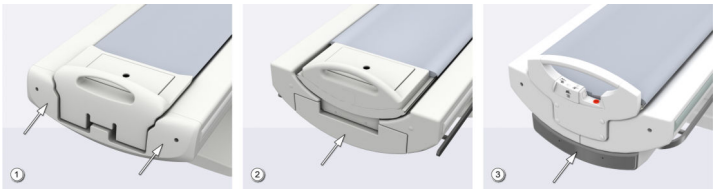
2 Move the table top horizontally into the desired position.

Due to patient weight you may need more strength to move the table top.

3 Release the table top release key.

The table top engages.

Moving the table in case of emergency or power failure



(1) Patient table with 1600 mm scan range

(2) Patient table with 2000 mm scan range

(3) Multi purpose table

1 Push against the lower foot end of the table.

2 Pull the table top forcefully out of the gantry.

Do not press the table top release push button during scanning. This causes a scan abort. This can also happen due to mechanical problems (for example, table top gets stuck because of a blanket or a cable).

4.4.5 Changing the MPT table top

The optional table top of the multi purpose table can be changed according to your clinical needs.

For a better and safer handling use two people to move the table tops.

Exchanging a table top

When exchanging table tops on the multi purpose table (MPT), you proceed as follows:

1 Remove the table top from the MPT.

2 Take care of your hands.

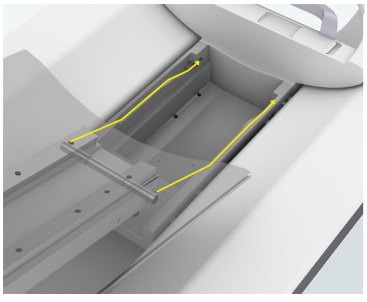
3 Place the table top in the wall holder vertically, with the heavy side down.

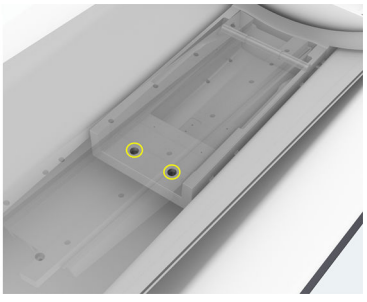
The illumination on the gantry operator panel, and on the control box remains.

You cannot move the table without a table top.

4 Place a new table top on the MPT.

5 Press down the table top until it locks in place.





After exchanging the table top

The illumination on the gantry operator panel, and on the control box remains.

- Press any key on the control box, or on the gantry operator panel.

4 System operation

5 Dose management and optimization

As with every imaging modality that uses ionizing radiation, CT scanning must be used in an appropriate manner. To reduce the exposure to patients, determine appropriate clinical indications before performing a CT examination.

5.1 Dose optimization features

During a CT examination, the patient is exposed to a certain amount of radiation. Therefore, it is important to limit the patient dose by using dose reduction techniques and applications.

The common practice is to apply the As Low As Reasonably Achievable (ALARA) principle. The aim of ALARA is to reduce the risk of radioactive exposure to a level that is necessary to obtain the desired diagnostic information.

The CARE Dashboard (optional) gives a quick overview of the dose optimization features and technologies for each scan range of the current examination. The features which are currently activated are indicated in green.

5.1.1 Dose Notification

The Dose Notification monitors the dose for each scan range. It informs you if the user-specified notification values are exceeded.

You can set the notification values individually for each scan using the **Scan Protocol Assistant**. (➔ Page 273 *Setting the values for the Dose Notification*)

If you load a scan range for which the configured notification values are exceeded, the $CTDI_{vol}$ and DLP values on the **Scan** and **Routine** parameter cards are marked red.

You can configure the system to additionally display a **Dose Notification** dialog box if the notification values are exceeded. In the **Dose Notification** dialog box, you can enter a diagnostic reason for the exeedance. (➔ Page 271 *Configuring the display of the Dose Notification dialog box*)

5.1.2 Dose Alert

The dose alert monitors the accumulated $CTDI_{vol}$ at any z-position as well as the accumulated DLP for all scan ranges to be scanned. It informs you if the user-specified alert values are exceeded.

You can configure the alert values in the **Examination Configuration** dialog box. (➔ Page 271 *Configuring the dose alert values*)

If the configured alert values are exceeded, the **Dose Alert** dialog box is displayed. (➔ Page 295 *Handling the Dose Alert*)

5.1.3 CARE Dose4D

CARE Dose4D is an automated exposure control which provides constant image quality for all body sizes and body regions at an optimized dose. It automatically adapts the tube current to the specific anatomical characteristics of each individual patient to deliver diagnostic image quality consistently.

CARE Dose4D combines different adaptation methods:

- (➔ Page 250 *Dose adaptation to the patient size*)
- (➔ Page 251 *Dose adaptation along the z-axis*)
- (➔ Page 252 *Angular modulation*)

Dose adaptation to the patient size

Larger patient sizes lead to more attenuation and a reduced number of X-ray quanta reaching the detector, resulting in increased noise in the images. This adverse effect can be limited with dose adjustment according to the body size.

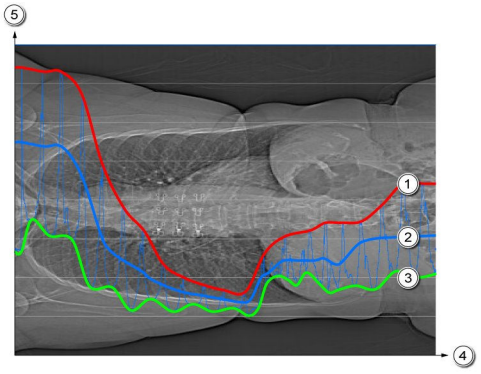
CARE Dose4D automatically modifies the tube current during acquisition. A Quality Reference mAs is used to define the baseline image quality based on the selected scan protocols. The Quality Reference mAs is used to establish the image quality for a reference patient weighing 70 kg to 80 kg (155 lbs to 180 lbs), even for child protocols.

The actual patient attenuation is determined from the topogram. Depending on the selected scan protocols and the patient size, the effective mAs (**Eff. mAs**) may increase or decrease during the acquisition.

Dose adaptation along the z-axis

Based on a single topogram either in the Anterior-Posterior (AP) or lateral position, the attenuation profile along the z-axis of the patient is measured in the direction of the X-ray projection. The attenuation profile is calculated for the perpendicular projection by a dedicated algorithm. For example, if the topogram is in the AP position, the attenuation profile is measured in the AP direction and calculated for a lateral projection and vice versa.

Based on these attenuation profiles, axial tube current profiles (both lateral and AP) and the resulting effective mAs for every table position are calculated. The correlation between attenuation and tube current is defined by an analytical function. This function results in an optimized dose and image noise in every slice of the scan. The correlation is based on a clinical assessment of diagnostic image quality. This assessment showed that, for good diagnostic image quality at a reasonably low dose level, the image noise does not need to be constant for all body sizes and body regions.



(1) Lateral mAs profile

(2) Mean mAs calculated from both mAs profiles

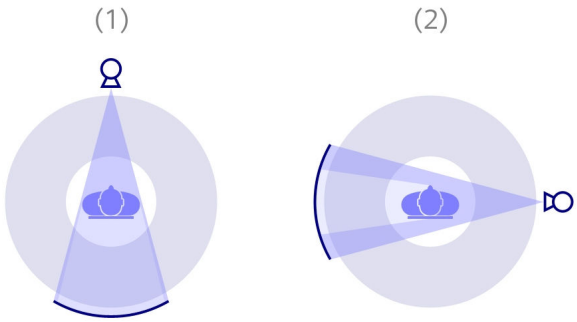
(3) AP mAs profile

(4) Z-direction

(5) mAs

Angular modulation

Without modulation, the attenuation of the X-ray beam for elliptical body regions such as the shoulders varies strongly with the tube rotation angle:



(1) In a front-to-back direction, the section is thinner and the X-ray attenuation is lower

(2) In a lateral direction, the section is thicker and the X-ray attenuation is higher

The angular modulation adapts the tube current over each single tube rotation according to the angular attenuation profile:

- For the low attenuation areas, the tube current is reduced to avoid excessive dose.
- For the high attenuation areas, the tube current is increased to reduce image noise.

The angular attenuation profile is measured during each single tube rotation. The appropriate modulation is applied for the next rotation with a delay of only half a rotation so that consistent image quality can be achieved.

Combined adaptations

CARE Dose4D automatically combines the following tube current adaptations, each of them bringing its specific benefits for optimum dose utilization:

Tube current adaptation	Operation
Dose adaptation to the patient size	General effective mAs level adjustment
Dose adaptation along the z-axis	Tube current changes depending on the local attenuation of the scanned section
Angular modulation	Tube current varies for different angular positons depending on the section shape

For certain examination protocols, the CARE Dose4D operation is modified to meet specific conditions.

, (➔ Page 269 *Adapting the CARE Dose4D settings*),
(➔ Page 276 *Setting CARE Dose4D*)

5.1.4 CARE kV

Conventional dose modulation approaches control only the X-ray tube current, while the X-ray tube voltage (the kV setting) is left untouched. Yet there is considerable potential for dose reduction by adapting the kV setting, and therefore the radiation energy to the diagnostic task. In this way, an optimized contrast-to-noise-ratio is achieved.

CARE kV is an extension of CARE Dose4D which supports optimizing radiation exposure to patients.

If CARE kV is activated, the system automatically proposes the appropriate kV and effective mAs settings. They optimize the applied dose while the image quality is maintained.

The proposal is based on the following parameters:

- Patient attenuation calculated based on the topogram
- Examination type (adjustable) (➔ Page 278 *Adjusting the examination type*)
- Quality reference mAs (adjustable) (➔ Page 279 *Setting the image quality*)

Image quality

The quality of CT images is characterized by the following parameters:

- Contrast
- Noise
- Sharpness (spatial resolution)

Improving these parameters will render a better image and enable the reading physician to make a more precise diagnosis. If, for example, the contrast is high and the noise is low, the image quality improves.

Additionally, an iodine contrast medium is often administered to improve contrast and therefore the visibility of organ structures, particularly in CT Angiography (CTA) examinations. The contrast is best with lowered X-ray tube voltage, since the low energy X-rays are better absorbed by the dense iodine than by the surrounding tissue. In order to maintain low noise levels, the tube current usually requires an adjustment.

For larger patients who have a higher X-ray attenuation, the output of the X-ray tube at lower kV settings may not be sufficient to produce the required contrast-to-noise-ratios. For these patients, higher X-ray tube voltages must be selected, despite reduced iodine contrasts.

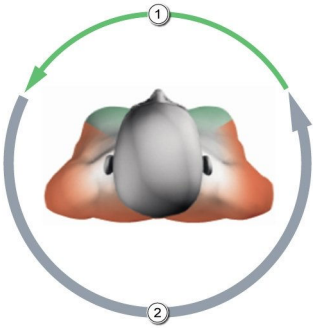
(➔ Page 277 *CARE kV settings*), (➔ Page 273 *Setting the CARE kV limits*)

5.1.5 X-CARE

X-CARE protects the eyes and the breast of the patient. When using X-CARE scan protocols, the tube current will be reduced in a predefined area at the front side of the patient during the whole scan. At the opposite area, the tube current is increased accordingly to maintain the image quality in comparison with a scan without X-CARE.

X-CARE reduces radiation dose at the surface, that is, for peripheral organs, in the frontal angle segment. However, dose reduction will not be reflected in the CT Dose Index (CTDI) or Dose Length Product (DLP) as they are defined by averaging over a full rotation.

X-CARE is applicable for spiral scans, except interventional scans, cardio scans, and high pitch spiral scans (4D scans).



(1) Reduced dose

(2) Increased dose

If X-CARE is on, the breast of the patient is irradiated with reduced dose (green color).

X-CARE adapts to the patient orientation. When an X-CARE protocol is chosen, the default orientation is selected. If another patient orientation is selected, the X-CARE protocol is adapted to the new selection.

If you have selected an X-CARE scan protocol, the pitch value is limited to a maximum of 0.6.

The area with reduced tube current for the patient is shown in the image on the **Routine** parameter card in green. The position of the displayed area takes the position of the patient into account. As soon as you change the patient position, the display is updated accordingly.

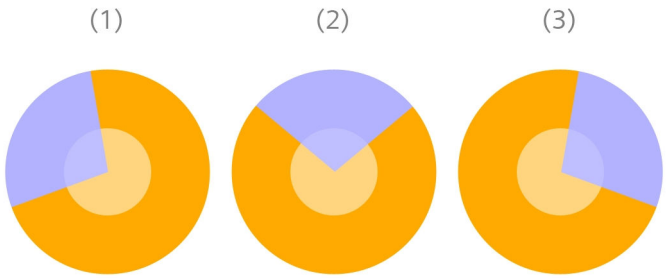
It is not possible to deactivate X-CARE in an X-CARE protocol. To deactivate X-CARE, select another protocol.

After scanning, “X-CARE” is inserted in the comment line of the image text. The use of X-CARE is documented as a comment within the dose report.

5.1.6 HandCARE

HandCARE is a function for reducing the dose to the hand of the operator and patient during a CT intervention by switching off the radiation for a fixed sector during the tube rotation. It is available only in the i-Sequence and i-Fluoro modes.

You can select three different positions to switch off the exposure: 10:00, 12:00, and 2:00 o' clock. These positions usually correspond to the user-preferred side or entry point during the procedure.



(1) 10:00 o'clock

(2) 12:00 o'clock

(3) 2:00 o'clock

For information on using HandCARE, see (➔ Page 533 *Setting a tube position for HandCARE*) .

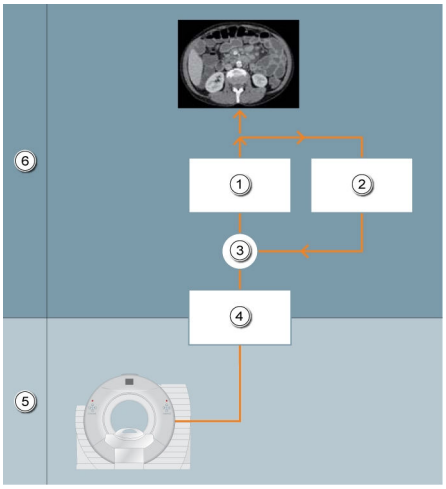
The use of HandCARE results in a slower frame rate for image display when using the i-Fluoro mode. It still permits continuous visualization and tracking of the needle.

5.1.7 Sinogram Affirmed Iterative Reconstruction Excel (SAFIRE Excel)

During the initial raw data reconstruction, a master volume is generated. This master volume contains the full amount of raw data information but at the cost of significant image noise also being included.

The following iterative corrections are consecutively performed in the image space. They clean up the image and remove the image noise without degrading the sharpness of the image. These corrections avoid time-consuming repeated projections and corresponding back projections. The noise texture of the image is comparable to the standard convolution kernels.

SAFIRE Excel results in artifact and noise reduction, increased image sharpness, and a dose reduction for a wide range of clinical applications.



(1) Image data reconstruction

(2) Image correction

(3) Compare

(4) Master volume reconstruction

(5) Slow raw data space

(6) Fast image data space

(➔ Page 283 *Setting the reconstruction parameters for SAFIRE Excel*)

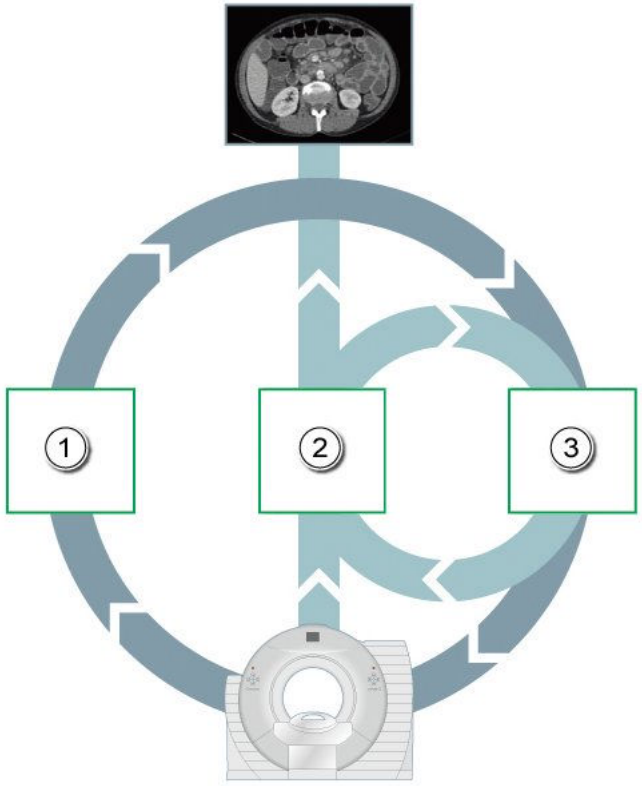
5.1.8 Sinogram Affirmed Iterative Reconstruction (SAFIRE) / Advanced Modeled Iterative Reconstruction (ADMIRE)

Iterative reconstruction approaches allow decoupling of spatial resolution and image noise.

With the Sinogram Affirmed Iterative Reconstruction (SAFIRE) or the Advanced Modeled Iterative Reconstruction (ADMIRE), correction loops are introduced into the image generation process. These iteration loops utilize raw-data information to significantly improve image quality.

Additionally, image noise is removed in the iterative corrections without degrading image sharpness. The noise texture of the images is comparable to the standard convolution kernels.

SAFIRE or ADMIRE results in an improved image quality with reduced noise and increased image sharpness.



(1) Raw data reconstruction

(2) Image data reconstruction

(3) Image correction

(→ Page 283 *Setting the reconstruction parameters for SAFIRE / ADMIRE*)

5.1.9 Neuro BestContrast

Neuro BestContrast improves image quality during the image reconstruction phase of head examinations. It improves contrast enhancement with a minimal increase in image noise.

Neuro BestContrast is applied to the kernels Hr32 - Hc45 (except Hr35, Hr34, Hr38, and Hr40) in all Siemens default protocols where **Brain** is selected as the organ characteristic, as well as in all customer protocols that are based on the respective Siemens default protocols.

Neuro BestContrast is not activated in the following cases:

- For reconstructions using kernels Hr45, Hr56, and Hr56.
- For all head scans where **Brain** is not the selected organ characteristic.

The image is divided into two data sets:

- Low spatial frequencies

  The low frequency pass image is reconstructed and tissue contrast is improved. During this reconstruction phase, the increase in noise is minimal.

- High spatial frequencies

  The high frequency pass image data contains the sharp details and original noise. During this reconstruction phase, noise is curbed.

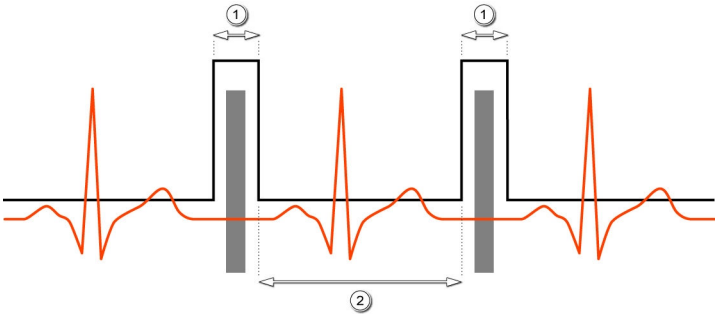
Finally, both data sets are merged, resulting in an improved image that has a better contrast-to-noise ratio.

5.1.10 ECG Pulsing and MinDose

ECG Pulsing is a method to modulate the radiation dose during a gated spiral CT scan.

The tube current is maintained at 100% of the desired level only during a predefined diagnostically relevant phase of the cardiac cycle.

During the rest of the time, the tube current is modulated by default to 25% of the nominal current. The resulting images are appropriate for a functional analysis and sufficient for a coronary evaluation.



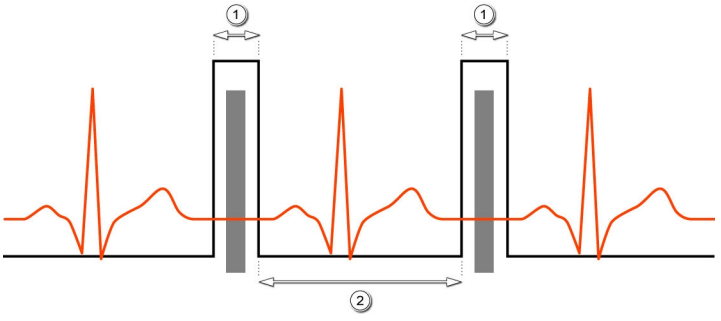
(1) High dose level

(2) Low dose level

(→ Page 305 *Using ECG Pulsing*)

MinDose

For MinDose, the tube current is reduced to 4% of the nominal current outside the diagnostically relevant heart phase. Therefore, the mean radiation dose is further reduced compared to the normal ECG pulsing setting.



(1) High dose level

(2) Low dose level

ECG-controlled dose modulation is based on the continuous monitoring of the ECG. An algorithm predicts when the desired ECG phase will start by calculating the mean durations of the preceding cardiac cycles. Therefore ECG Pulsing can react flexibly to arrhythmia and ectopic beats.

(➔ Page 307 *Using MinDose*)

5.1.11 Pitch Adaptation

When scanning a retrospective ECG-gated spiral, you only achieve continuous volume coverage in the same cardiac phase when the pitch or scanning speed is adapted to the heart rate of the patient. In general, low scanning speeds or pitch values are employed to provide sufficient overlap of the scanned volume in each rotation of the gated acquisition. This method ensures that there are no gaps in the volume data for retrospective cardiac reconstruction.

In the past, cardiac protocols employed fixed pitch values. The heart rate of the patient had to be observed and the appropriate scan protocol had to be selected. It had to be ensured that the heart rate of the patient did not vary out of range after loading the protocol and during the entire scan procedure. The pitch was intentionally preset to a lower value in order to meet the requirements for wider ranges for heart rates. As a result, the radiation doses with these protocols were high, especially when imaging patients with moderate to high heart rate ranges. Adapting the pitch value to the heart rate can therefore reduce the dose.

Currently you can change the scan pitch by choosing the appropriate heart rate range after selecting a cardiac protocol. Siemens recommends selecting the pitch manually only to experienced users in the event of a clear clinical indication.

Siemens recommends using the automatic pitch adaptation which is activated in the default protocols. It allows the system to monitor the heart rate of the patient over the last ten cardiac cycles. Additionally, it adapts the pitch instantly before initiation of the scan which is based on the lowest heart rate measured within these ten cycles. The CT scanner increases the pitch with higher heart rates, resulting in a faster scan and, therefore, a reduced dose.

(➔ Page 307 *Adapting the pitch*)

5.1.12 Adaptive Cardiac Sequence

Prospective ECG triggering combined with step-and-shoot acquisition of axial slices offers a way to scan a wide variety of patients. The ECG signal of the patient is monitored during the examination. Axial scans are started with a pre-defined time offset relative to the R waves.

With conventional approaches, the method reaches its limitations for patients with arrhythmia, since ECG-triggered axial scanning depends on a reliable prediction of the next cardiac cycle. Thereby the mean length of the preceding cardiac cycles is used.

With the Adaptive Cardiac Sequence, a more refined analysis of the ECG is performed. The acquisition window can be extended within the diastolic phase of the cardiac cycle to find the optimum reconstruction phase. Additionally, the variance of the heart rate is taken into account for the calculation of reconstruction time points. In case of ectopic heartbeats, the scan can be repeated at the same position.

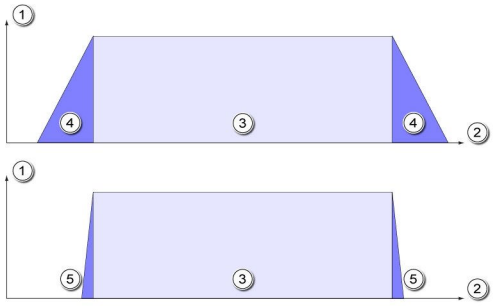
(→ Page 303 *Using the Adaptive Cardiac Sequence*)

5.1.13 Adaptive Dose Shield

The Adaptive Dose Shield dynamically adapts the collimation to reduce the excess dose applied at the edges of the scanned volume for spiral acquisitions.

In spiral scan modes, to collect all the required raw data for image reconstruction, the scan range must exceed the imaged range. This effect partly causes unused dose.

The over-radiation can be corrected with the use of dynamic collimation, which controls the size of the aperture at the start and end of the spiral acquisition. The spiral scan starts with the smallest possible aperture and gradually opens to the nominal collimation. Then it closes again at the end of the scan range.



(1) mAs

(2) Z-direction

(3) Nominal spiral length with full dose

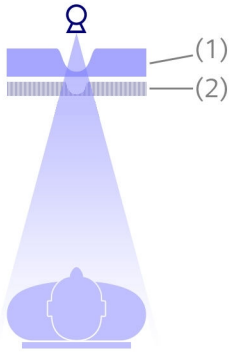
(4) Additional dose without Adaptive Dose Shield

(5) Additional dose with Adaptive Dose Shield

The $CTDI_{vol}$ is not affected by the Adaptive Dose Shield, but the DLP is corrected when the Adaptive Dose Shield is employed for the scan.

5.1.14 Shaped X-ray beam filter

The tube collimator houses two shaped X-ray beam filters. The shaped X-ray beam filters allow you to perform examinations where the best diagnostic image is focused on the targeted part of the scan field, for example, for imaging the heart.



(1) Standard shaped filter

(2) Narrow shaped filter

The standard shaped X-ray beam filter is permanently set.

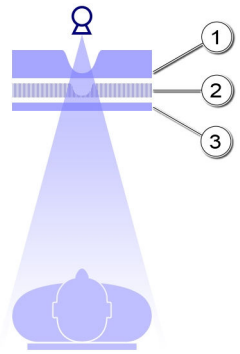
The narrow filter setting is moved in automatically and reduces the dose by approximately 20% (in body examinations) compared to the standard setting.

The default Siemens protocols ensure an optimized dose and image quality. Depending on the protocol type and the use case, the CT scanner automatically selects the required filter.

5.1.15 Split Filter

The tube collimator houses two shaped X-ray beam filters.
(➔ Page 265 *Shaped X-ray beam filter*)

Depending on the system configuration and the purchased licenses, your CT system can be equipped with an additional Split Filter that is divided along the z-axis into a tin part and a gold part.



(1) Standard shaped X-ray beam filter

(2) Narrow shaped X-ray beam filter

(3) Split Filter with a tin part and a gold part

The Split Filter is intended for the following use cases that are set in the scan protocol:

- TwinBeam Dual Energy scanning

  The Split Filter uses the gold part and the tin part to separate the low energy spectrum from the high energy spectrum of the X-ray beam. (➔ Page 415 *Acquiring a TwinBeam Dual Energy scan*)

- Tin filtered low dose scanning

  Only the tin part of the Split Filter is moved into the beam path covering the full detector range for tin filtration. (➔ Page 267 *Tin filtration for low dose scanning*)

The default Siemens protocols ensure an optimized dose and image quality. Depending on the protocol type and the use case, the CT scanner automatically selects the required filter.

5.1.16 Tin filtration for low dose scanning

Depending on the system configuration and the purchased licenses, your CT system can be equipped with an additional Split Filter whose tin part can be used for tin filtration. (➔ Page 266 *Split Filter*)

You can use the tin filtration for low dose scanning of topograms and spirals at voltages of Sn100 kV and Sn140 kV.

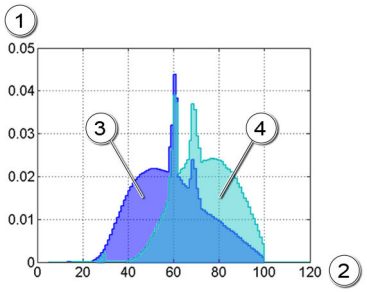
Depending on the voltage setting, tin filtration reduces the dose by a factor of about 4 to 10.

The tin filtered spectra Sn100 kV and Sn140 kV are available in dedicated scan protocols for non-contrast studies. These protocols are marked with the suffix **_Sn**. CARE kV selects Sn100 kV or Sn140 kV, respectively, depending on patient size and application.

Additionally, **Sn** topograms are available in the **Specials** folder of the **Patient Model Dialog**.

Function principle

The Tin Filter absorbs the low energy photons which results in a hardening of the spectrum.



(1) Number of quanta (arbitrary unit)

(2) Photon energy (keV)

(3) 100 kV (normalized curve)

(4) Sn100 kV (normalized curve)

5.2 Performing a dose-optimized workflow

The following workflow describes how you can adapt the configuration settings and the scan parameters for dose-optimized scanning. You are also informed about how you can proceed if conflicts occur and where the applied dose is documented.

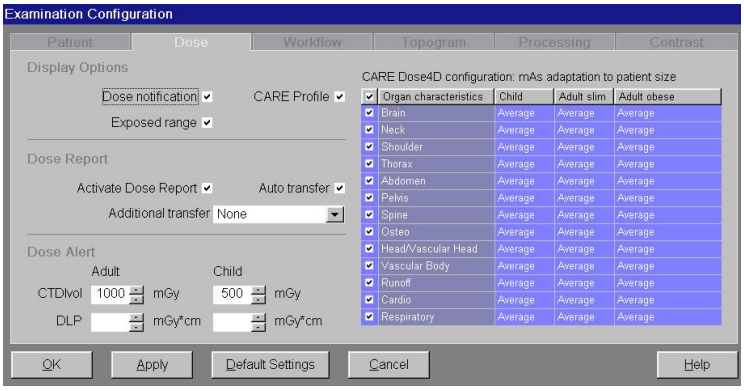
If you are not familiar with the basic procedures of preparing and performing a scan, see (→ Page 387 *Scan*).

5.2.1 Checking the examination configuration parameters

1 In the **Options** menu, choose **Configuration...**.

2 In the **Somaris/7 – Configuration Panel**, double-click the **Examination** icon.

3 Click the **Dose** tab card of the **Examination Configuration** dialog box to adapt the dose settings, if necessary.



Adapting the CARE Dose4D settings

In the field **CARE Dose4D configuration: mAs adaptation to patient size**, you can select a different CARE Dose4D adaptation strength to the patient size.

The adaptation strength can be set individually for the various organ characteristics and various patient sizes (**Child**, **Adult slim**, **Adult obese**).

1 For a specific organ characteristic, for example, **Abdomen**, click into the CARE Dose4D curve setting of a patient size, for example, **Adult slim**.

2 In the selection list, select a CARE Dose4D adaptation strength.

You can choose between **Very Weak**, **Weak**, **Average**, **Strong**, and **Very Strong**.

The setting of the adaptation strength is effective for all protocols with CARE Dose4D.

The organ characteristic is displayed on the **Scan** parameter card.

The CARE Dose4D curve is simultaneously adapted for all selected organ characteristics.

You can select all organ characteristics at once if you select the **Organ characteristics** checkbox.

For **Adult slim**, **Adult obese**, and **Child**, the Siemens default settings are **Average** for all organ characteristics.

If all images of slim patients are too noisy, select a weaker CARE Dose4D curve.

If all images of obese patients are too noisy, select a stronger CARE Dose4D curve.

For adapting the child-specific settings, see (➔ Page 300 *Adapting the dose to the patient size*).

Configuring the display of the CARE Profile (optional)

The CARE Profile displays the dose to be applied along the z-axis of the patient. It is displayed next to the topogram for a selected range.

- In the **Display Options** field of the **Dose** tab card, select the **CARE Profile** checkbox to display the mAs profile in the topogram.

  – or –

  Deselect the **CARE Profile** checkbox if you do not want to display the mAs profile in the topogram.

If a conflict occurs, the CARE Profile appears, even if it is deactivated or if no license is available.

Configuring the display of the exposed range

The exposed range is displayed as dashed orange lines on the topogram by default.

- In the **Display Options** field of the **Dose** tab card, deselect the **Exposed range** checkbox if you do not want to display the exposed range in the topogram.

Changes will be applied after you have restarted the system.

Configuring the display of the Dose Notification dialog box

The **Dose Notification** dialog box informs you if the notification values either for $CTDI_{vol}$ or DLP are exceeded. In the **Dose Notification** dialog box, you can enter a diagnostic reason for the exeedance.

- In the **Display Options** field of the **Dose** tab card, select the **Dose Notification** checkbox.

  To configure the notification values for **$CTDI_{vol}$** and **DLP** of the **Dose Notification**, see (➔ Page 273 *Setting the values for the Dose Notification*).

Configuring the dose alert values

The **Dose Alert** dialog box informs you if the accumulated dose of the examination exceeds the configured alert values either for **$CTDI_{vol}$** or **DLP** with the next scan range or the next scan ranges.

- In the **Dose Alert** field of the **Dose** tab card, configure the **$CTDI_{vol}$** and **DLP** alert values for **Adult** and **Child**.

In contrast to the **DLP**, the calculation of the accumulated **$CTDI_{vol}$** is specific to a z-position.

If no alert values are configured, the **Dose Alert** dialog box is not displayed.

For adapting the child-specific settings, see (→ Page 300 *Setting the dose alert values*).

Configuring the Dose Structured Report

You can configure the creation and the auto transfer of the dose report in the **Dose Report** field of the **Dose** tab card.

1. Select the **Activate Dose Report** checkbox to activate the automatic creation of the DICOM Dose Structured Report.
2. Select the **Auto transfer** checkbox to activate the automatic transfer of the dose report together with the image data, for example, to a DVD drive or network node.
3. In the **Additional transfer** selection list, select a network node to specify an additional destination node for the dose report.

5.2.2 Configuring limits and notification values

In the **Scan Protocol Assistant**, you can configure the dose-relevant limits and dose notification values.

The default Siemens protocols provide the best compromise between optimizing image quality, scan time, and dose.

1. In the main menu, choose **Options** > **Configuration...**.
2. In the **Somaris/7 – Configuration Panel**, double-click the **Scan Protocol Assistant** icon.

If you are not familiar with the functionalities of the **Scan Protocol Assistant**, see (→ Page 320 *Changing parameters*).

3 In the **Scan Protocol Assistant** dialog box, click the step **3** button.

4 In the upper area of the **Scan Protocol Assistant** dialog box, click the **Scan** button to open the **Scan** page.

5 Click the **Dose** tab card.

Setting the CARE kV limits

For individual scan ranges, certain kV values can be excluded if the CARE kV limits are configured.

- In the **CARE kV** selection list, select the minimum and maximum **kV** values for each scan, for example, **min. kV** = 80 kV; **max. kV** = 140 kV.

  The limits are displayed in the tooltip of the **kV** item on the **Scan** parameter card.

  CARE kV will select the tube voltage for an examination only within the configured CARE kV limits.

For scans within a CARE kV group with different limits, CARE kV selects the kV values within the defined limits for all scans of this CARE kV group. (➔ Page 280 *Adding scan ranges to a CARE kV group*)

If there is no appropriate value within these limits, the **Ref. kV** value will be used.

Do not select license-based kV values for **Ref. kV**, **min. kV**, or **max. kV** if you are using trial licenses. License-based kV values can be, for example, 70 kV, 90 kV, 110 kV, 130 kV.

If the license expires, these values are invalid. The relevant scan protocol entries cannot be executed.

Setting the values for the Dose Notification

For each scan, you can set the notification values either for **CTDI**$_{vol}$ or **DLP** or for both.

When you select one or more scan protocols in the **Scan Protocol Assistant**, all corresponding scan ranges and monitoring ranges, when indicated, are also selected.

If you then set the notification values for the **Dose Notification**, the values are also applied for the monitoring ranges.

When loading the monitoring ranges for an examination, the $CTDI_{vol}$ is calculated for a defined number of monitoring scans, usually 30 scans. Therefore the **Dose Notification** dialog box opens unnecessarily.

Make sure to set the notification values only for diagnostic scans.

1 In the **Range name** column, deselect the checkboxes of the monitoring ranges, where necessary.

2 In the **$CTDI_{vol}$** and **DLP** spin box of the **Dose Notification** field, set the notification values.

Effect of the Dose Notification values

If you load a scan range for which the configured notification values are exceeded, you will be notified:

- The $CTDI_{vol}$ and DLP values on the **Scan** and **Routine** parameter cards are marked red.
- The **Dose Notification** dialog box opens, if configured. (→ Page 295 *Handling the Dose Notification*)

If no notification values are set, the **Dose Notification** is switched off. In this case, the **$CTDI_{vol}$** and **DLP** notification values on the **Scan** parameter card always retain their color and the **Dose Notification** dialog box is not displayed.

The Siemens scan protocols are delivered without default notification values.

Setting the limits for FAST Adjust

Limits must be configured first to use FAST Adjust if the system limits are exceeded. Within these limits, the scan time can be increased or the **Eff. mAs** value can be reduced by using the Fully Automated Scanner Technology **FAST Adjust**. (➔ Page 288 *Using the Adjust button (optional)*)

1 In the **Upper limit max. scan time** spin box of the **FAST Adjust** field, set the maximum scan time for each scan range.

The maximum scan time can only be configured for non-cardiac spirals.

2 In the **Lower limit max. mAs** spin box of the **FAST Adjust** field, set the lower limit for the maximum mAs reduction (in %) from the peak value for each scan range.

The configured limits are displayed in the tooltip of the **Adjust** button. They are also displayed in blue in the **FAST Scan Assistant** dialog box.

If no limits for **FAST Adjust** are configured, the **Adjust** button will not be displayed.

Adapt the limits to the different kinds of examinations, for example, the maximum acceptable scan time for contrast scans.

(➔ Page 288 *Using FAST Adjust (optional) and FAST Scan Assistant*)

5.2.3 Activating password protection for the Dose Alert

You can activate password protection for the **Dose Alert** to allow only authorized persons to continue scanning in case the alert values are exceeded.

By default, password protection is deactivated.

1 In the main menu choose **Options** > **Service** > **Local Service...** to open the **Local Service** configuration.

   The **Authentication** window is displayed.

2 Delete all entries from the entry fields.

3 Click **OK**.

   The **Service Software** window is displayed.

4 Click the **Configuration** button.

5 Select the **Application** option.

6 In the **Dose Alert Password** field, enter a password.

7 Repeat the password in the field below.

8 Click **Save**.

   Password protection is activated.

If the **Dose Alert** dialog box appears during an examination, the configured password must be entered to continue scanning. Otherwise the scan range cannot be loaded.

The respective dose log file will document whether a password was configured or not.

5.2.4 Checking the parameter settings

After choosing a scan protocol from the selection list of the **Patient Model Dialog**, you can check and adapt the scan parameter settings in the parameter cards individually for each scan range.

Setting CARE Dose4D

Dose modulation provides constant image quality for all body sizes and body regions at an optimized dose. (➔ Page 250 *CARE Dose4D*)

◆ On the **Scan** parameter card, select the **CARE Dose4D** checkbox.

   After scanning the topogram, the average **Eff. mAs** value calculated by CARE Dose4D for the following scan is displayed on the **Routine** parameter card and the **Scan** parameter card.

Siemens recommends to keep CARE Dose4D activated.

As soon as the scan is completed, this value will be updated to the mAs actually applied. The value may differ slightly due to the online modulation according to the angular attenuation profile of the patient.

If CARE Dose4D is deactivated, adapt the **Eff. mAs** manually.

CARE kV settings

If CARE kV is activated, the system automatically sets the appropriate **kV** and **Eff. mAs** settings. They optimize the applied dose while keeping the image quality constant (→ Page 254 *CARE kV*). The image quality is defined by the **Quality Ref. mAs** and the **Ref. kV**.

CARE kV is only available for scans with CARE Dose4D.

CARE kV scanning is performed with a constant kV value (no online modulation of the voltage).

Activating CARE kV

For **CARE kV On**, an optimized **kV** value is automatically set by the system. This value is set within the limits configured in the **Scan Protocol Assistant** and based on the examination type defined by the setting of the **Dose Optimization** slider (→ Page 273 *Setting the CARE kV limits*).

✓ CARE Dose4D is activated.

◆ In the **CARE kV** selection list of the **Scan** parameter card, select **On**.

The **CARE kV** value is calculated for the next scan to be performed. This scan is indicated by a white triangle on the selected scan range.

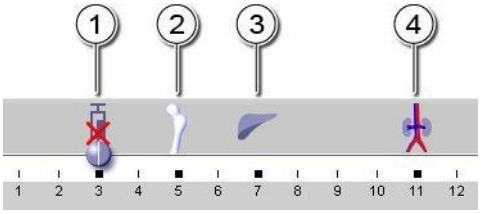
If **CARE kV** is set to **On**, the values for **Eff. mAs** / **mAs**, **kV**, **CTDIvol**, and **DLP** are displayed on the parameter cards after CARE kV has been calculated for the current scan range.

For repeated scans with **CARE kV On** or **CARE kV Semi**, always check the examination type.

If **CARE kV** is set to **Semi** or **On**, select the **FAST Window** checkbox on the **Recon** parameter card to automatically get the window values adapted.

Adjusting the examination type

1 Click the dose settings icon to open the **Dose Optimization** dialog box.



(1) **Non contrast**

(2) **Bone**

(3) **Soft tissue contrast**

(4) **Vascular**

2 In the **Dose Optimization** dialog box, drag the **Dose Optimization** slider with the mouse to the relevant examination type.

For contrast enhanced scans, ensure that the slider is set to a value higher than **3** (that is, to a position on the right-hand side of the **Non contrast** icon).

To move the slider, you can also use the arrow keys on your keyboard.

Setting the image quality

If you want to change the image quality, you can adapt the **Qual. Ref. mAs** value and the **Ref. kV** value.

1 In the **Qual. Ref. mAs** field, enter the value.

2 From the **Ref. kV** list, select the value.

For some examination types and patient sizes, CARE kV can set a higher kV value than the **Ref. kV** value.

For contrast enhanced scans, ensure that the slider is set to a value higher than **3**, which is to a position on the right-hand side of the **Non contrast** icon.

Defining a kV value for follow-up examinations

You can select **CARE kV Semi** to scan with a defined **kV** value, for example, to perform a follow-up examination which requires the same kV setting as in the prior scan.

✓ CARE Dose4D is activated.

1 In the **CARE kV** selection list, select **Semi** to set a defined **kV** value.

2 In the **kV** selection list, select the **kV** value.

The **Eff. mAs** value is calculated depending on the examination type which is defined by the **Dose Optimization** slider.

For repeated scans with **CARE kV On** or **CARE kV Semi**, always check the examination type.

If **CARE kV** is set to **Semi** or **On**, select the **FAST** Window checkbox on the **Recon** parameter card to automatically get the window values adapted.

Adding scan ranges to a CARE kV group

You can add scan entries to a CARE kV group to set the same kV value for all scan ranges at once, for example, to perform a three-phase liver examination.

✓ CARE kV is set to **On**.

✓ All scan entries have the same **Ref. kV** value.

✓ At least one value of the interval between **min. kV** and **max. kV** configured in the **Scan Protocol Assistant** must match. Otherwise the scan range cannot be added. See (➔ Page 273 *Setting the CARE kV limits*).

1 In the chronicle, right-click the scan entries to be grouped.

2 In the context menu of these scan entries, choose **Add to CARE kV group**.

Scan entries belonging to a CARE kV group are marked by a chain symbol in the chronicle.

All scan ranges which are added to a CARE kV group are scanned with the same kV value while the other settings are kept.

Copied or repeated scan entries within a CARE kV group are automatically a member of this group.

For a scan range which is added to a CARE kV group, **CARE kV On** is set automatically.

Via the context menu, you can also remove a scan entry from the CARE kV group.

Setting scan parameters for post-processing applications

If you use one of the following post-processing applications, observe the specific recommendations:

- (➔ Page 281 *Calcium Scoring*)
- (➔ Page 282 *NeuroDSA and NeuroPBV*)
- (➔ Page 282 *Follow-up*)
- (➔ Page 282 *LungCAD*)
- (➔ Page 282 *Colon PEV*)

Calcium Scoring

For an Agatston-equivalent calcium score, perform a cardiac scan with the following settings:

- Slice thickness: 3.0 mm
- Increment: 1.5 mm
- Kernel: Qr36 at a tube voltage of 120 kV (➔ Page 281 *Qr36 kernel*)

  Or, optionally, use the voltage-independent kernel Sa36 (Artifical120). (➔ Page 281 *Sa36 kernel (Artifical120)*)

Qr36 kernel

When using **CARE kV** in combination with the Qr36 kernel, ensure to set the CARE kV limits for **min. kV** and **max. kV** to 120 kV in the Scan Protocol Assistant. (➔ Page 273 *Setting the CARE kV limits*)

Sa36 kernel (Artifical120)

The series description of Artifical120 recon jobs adds the suffix **Artifical120**. On reconstructed Artifical120 images, the label **Artifical120** is displayed in the image comment area.

Series that were reconstructed using the Artifical120 kernel cannot be loaded into the Dual Energy postprocessing application.

When using **CARE kV** in combination with the Sa36 kernel, ensure to set the CARE kV limits for **min. kV**, for example, to 70 kV and the **max. kV** to 130 kV in the Scan Protocol Assistant. (➔ Page 273 *Setting the CARE kV limits*)

In the **Dose Optimization** dialog box, set and the slider to **Bone** (**4**). (➔ Page 278 *Adjusting the examination type*)

NeuroDSA and NeuroPBV

When using **CARE kV**, make sure that both the CTA and the non-contrast scan are grouped in a CARE kV group (chain symbol) (➔ Page 280 *Adding scan ranges to a CARE kV group*).

Follow-up For a reliable follow-up comparison of volumetric or density measurements between two time points, perform these scans with the same kV setting as that from the prior.

LungCAD You can achieve an optimized performance with a tube voltage of 120 kV.

KV settings that differ from settings ranging from 120 kV to 140 kV may influence the performance of the LungCAD algorithm with regard to sensitivity or specificity.

Colon PEV For scans without intravenous contrast, use a standard exposure for supine and prone position of at least 50 mAs and 30 mAs respectively.

When using **CARE kV**, make sure to set the CARE kV limits for **min. kV** and **max. kV** in the Scan Protocol Assistant to 120 kV (➔ Page 273 *Setting the CARE kV limits*).

You can achieve an optimized resolution with the following settings:

- Collimation: ≤ 1 mm
- Slice width of ≤ 1 mm with 30% overlap
- Kernel: Br38/Br34 for supine data, Br32 for prone data

Setting the reconstruction parameters for SAFIRE / ADMIRE

Use an appropriate reconstruction technique like the Sinogram Affirmed Iterative Reconstruction (SAFIRE) or the Advanced Modeled Iterative Reconstruction (ADMIRE), if available.
(➔ Page 433 *Performing an iterative reconstruction (SAFIRE/ ADMIRE)*)

- On the **Recon** parameter card, select the **SAFIRE** or **ADMIRE** checkbox.

Avoid submillimeter slices. Select thicker slices, smoother kernels and wider windowing to reduce image noise, and in return to reduce dose if scan parameters are changed for future examinations.

Setting the reconstruction parameters for SAFIRE Excel

Use an appropriate reconstruction technique like the sinogram affirmed iterative reconstruction Excel (SAFIRE Excel), if available.
(➔ Page 434 *Performing an iterative reconstruction (SAFIRE Excel)*)

- On the **Recon** parameter card, select the **SAFIRE Excel** checkbox.

Avoid submillimeter slices. Select thicker slices, smoother kernel and wider windowing to reduce image noise, and in return to reduce dose if scan parameters are changed for future examinations.

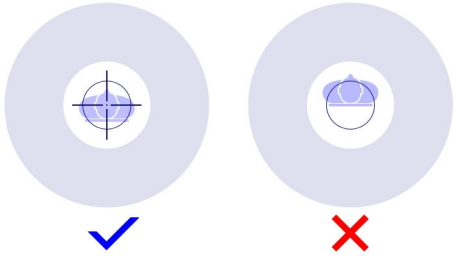
5.2.5 Positioning the patient

- Replace defective accessories with new original accessories immediately. Refer to (➔ Page 75 *Accessories*).

For adapting the child-specific settings, see (➔ Page 301 *Positioning the patient*).

Centering the patient

1. For optimum image quality and dose application to patient size and body shape with CARE Dose4D, position the patient in the isocenter of the gantry.



2 Double-check and verify the position of the patient with the laser light marker as well as in the topogram.

If the patient is positioned too high, the mAs for the subsequent scan is increased.

If the patient is positioned too low, the mAs for the subsequent scan is reduced and the images show increased noise.

For head scans with **Auto Isocenter**, you may be prompted to raise or lower the patient table. This has no impact on the dose modulation with CARE Dose4D.

Positioning the arms of the patient

- For optimum CARE Dose4D utilization, position the arms of the patient for thorax and body scans on the head-arm support.

5.2.6 Acquiring a topogram

If you are not familiar with the basic functionalities of acquiring a topogram, see (→ Page 390 *Acquiring a Topogram*).

If there is no topogram, CARE Dose4D and CARE kV cannot be activated.

1 From the **Specials** folder of the **Patient Model Dialog**, select an **Sn** topogram protocol, if available.

The availability of Tin Filter protocols depends on the system configuration and the purchased licenses.

2 Scan a topogram.

- If more than one topogram from the same tube position is available, the most recent one will be used to determine the **Eff. mAs** within its range. Outside the range of the most recent topogram, older topograms are also taken into account.

  If two topograms from different tube positions are available, for example, AP and lateral, both topograms will be used to determine the **Eff. mAs**.

  The calculated **Eff.mAs** value for both topograms takes a correction of the patient position into account and corresponds to the **Eff.mAs** value for one topogram with the isocentrical position of the patient.

- If the scan range exceeds the topogram range, the **Eff. mAs** value which was calculated at the last position of the topogram will be used.

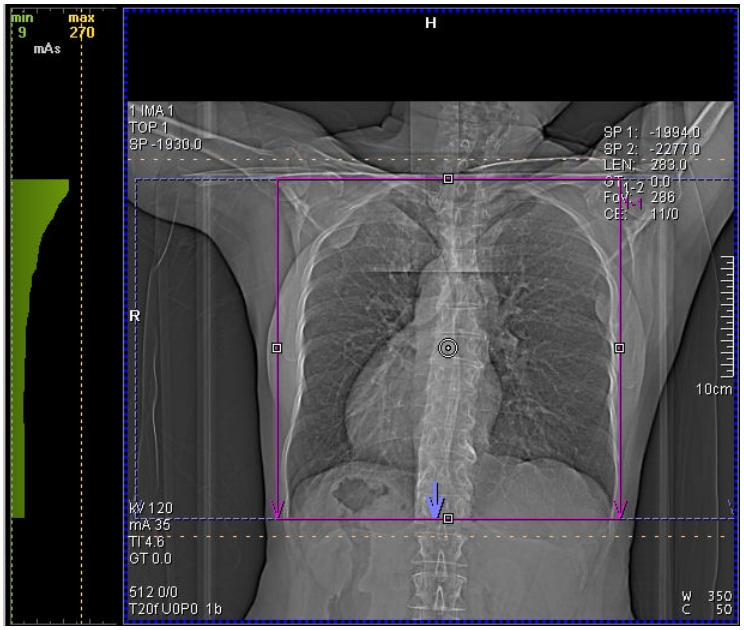
Avoid repositioning of the patient on the patient table and excessive motion of the patient between the topogram and the scan.

Best image quality is achieved when using protocols with CARE Dose4D for the body regions they are designed for. Use child protocols for children.

Check that the organ characteristic, which is displayed in the **Scan** parameter card, matches the scan to be performed.

Always check whether the scan range settings by FAST Planning are reasonable. (➔ Page 393 *Using recon planning for spirals*)

If configured in the **Examination Configuration** dialog box, the **CARE Profile** is displayed to the left of the topogram.
(➔ Page 270 *Configuring the display of the CARE Profile (optional)*)



The CARE Profile shows the distribution of the dose to be applied along the z-axis of the patient for a selected scan range. The system limits for the maximum possible mAs are displayed.

Depending on the examination, for example, Sequence, Spiral, or cardiac scan, the CARE Profile may look different. For a cardiac scan, the mean **Eff. mAs** for the whole scan range is displayed.

5.2.7 Handling parameter conflicts

A conflict occurs in the following situations:

- The system limits are exceeded.
- The amount of exceedance affects the dose to be applied or the image quality.

In case of a conflict, the CARE Profile may be displayed in the following colors:

- Green CARE Profile with green-striped peak
- Green CARE Profile with yellow peak
- Yellow CARE Profile

The area of the CARE Profile which exceeds the limits is colored depending on the amount of the exceedance.

If a conflict occurs, the CARE Profile appears, even if it is deactivated or if no license is available. (➔ Page 270 *Configuring the display of the CARE Profile (optional)*)

Green CARE Profile with green-striped peak

The mAs, which is calculated by CARE Dose4D and which is needed for achieving an appropriate image quality, slightly exceeds the system limits for some regions.

Loading is recommended since the impact on the image quality will be negligible. The peak of the CARE Profile will be lowered to the maximum possible mAs in this case.

Green CARE Profile with yellow peak

The mAs which is needed for some regions of the scan exceeds the limits of the system.

There are two possibilities to continue scanning:

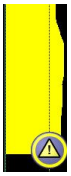
- Load the scan.

  The peak of the CARE Profile will be lowered to the maximum possible mAs. The image quality may be reduced in this area.

- Click the **Adjust** button to resolve the conflict. (➔ Page 288 *Using the Adjust button (optional)*)

  The scan time will be increased within the limits configured in the **Scan Protocol Assistant**. (➔ Page 275 *Setting the limits for FAST Adjust*)

Yellow CARE Profile



The mAs which is needed for the scan exceeds the limit of the system. Loading of the scan range is not possible. The scan range is invalid.

Adapt the scan parameters. (➔ Page 288 *Using the Adjust button (optional)*), (➔ Page 290 *Using the FAST Scan Assistant*) (➔ Page 292 *Using the FAST Scan Assistant*)

CAUTION

The quality reference parameters exceed the system limit for CARE Dose 4D!

The *mAs* curve of the topogram turns yellow in the respective area. Locally increased image noise.

- Adjust the scan parameters to allow for a higher mAs value.
- Modify scan time, pitch, or rotation time.
- Adapt the injection protocols, if necessary.

Using FAST Adjust (optional) and FAST Scan Assistant

If a conflict occurs, the **Adjust** button (optional) and the **FAST Scan Assistant** can be displayed.

The **Adjust** button is displayed if the peak of the CARE Profile or the whole CARE Profile is yellow. The **FAST Scan Assistant** is only displayed if the whole CARE Profile is yellow.

With **FAST Adjust** and the **FAST Scan Assistant**, scan parameter conflicts can be resolved automatically.

Using the Adjust button (optional)

If the system limits are exceeded, the **Adjust** button is displayed on the bottom of the chronicle.

The tooltip of the **Adjust** button displays the limits for scan time and the maximum mAs decrease configured in the **Scan Protocol Assistant**. (➔ Page 275 *Setting the limits for FAST Adjust*)

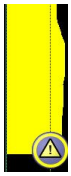
✓ The limits for **FAST Adjust** are configured in the **Scan Protocol Assistant**.

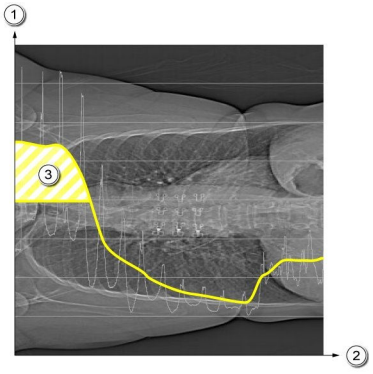
✓ The scan parameters are adjustable within the configured limits.

◆ Click the **Adjust** button to resolve the conflict automatically.

The values are automatically adapted within the limits configured in the **Scan Protocol Assistant**.

If the **Adjust** button is clicked, the tooltip displays the adjusted values.

Color of the CARE Profile	Reducing or solving the conflict
	If only the peak of the CARE Profile is yellow, the scan time will be increased until the conflict is resolved or the configured limit is reached.
	If the whole CARE Profile is yellow, first the scan time will be increased until the conflict is resolved. If increasing the scan time is not sufficient to resolve the conflict, the **Eff. mAs** will be additionally decreased until the conflict is resolved or the configured limit is reached. For example, the system allows for a **Eff. mAs** of 600 mAs, and the configured limit allows for a decrease of up to 25%. Then the **Eff. mAs** will be decreased until the conflict is resolved or until the lower limit of 450 mAs is reached. The mAs is only decreased for areas where system limits would be exceeded. Otherwise the mAs remains unchanged.



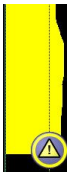
(1) mAs

(2) Z-direction

(3) Decrease of the mAs if the system limits are exceeded

As long as an adjusted scan range is not scanned, you can revoke the adaptations by clicking the **Adjust** button again.

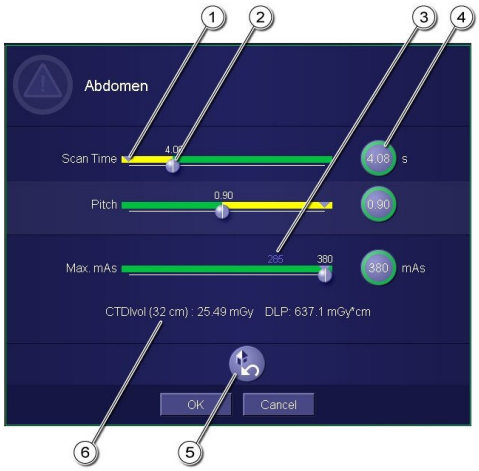
Using the FAST Scan Assistant



If a cooling or a scan parameter conflict occurs, the **FAST Scan Assistant** button is displayed. The invalid scan ranges and scan parameters are indicated in yellow in the parameter cards.

With the **FAST Scan Assistant**, you can check and change the settings made by the **Adjust** button.

1 Click the **FAST Scan Assistant** button to open the **FAST Scan Assistant** dialog box.



(1) Original value

(2) Currently set value

(3) Configured limit for the **Adjust** button

(4) Value which resolves the conflict

(5) **Undo** button

(6) Dose descriptors

If the system requires cooling time, a clock icon indicates the remaining cooling time in the **FAST Scan Assistant** dialog box.

The limits for **Scan Time** increase and **Max. mAs** decrease of **FAST Adjust**, which are configured in the **Scan Protocol Assistant**, are displayed above the sliders. (➔ Page 275 *Setting the limits for FAST Adjust*)

If a slider is positioned in the green zone, the scan parameter is valid and scannable. As long as one of the sliders is positioned in the yellow zone, the scan is invalid.

The buttons on the right-hand side display the values which resolve the conflict for the corresponding slider by either increasing the scan time or decreasing the maximum mean mAs. Clicking one of the buttons changes the value of the corresponding slider.

2 Adapt the scan parameters such that they are suitable for the patient and the examination.

To move the sliders manually, you can also use the arrow keys on the keyboard.

3 Click **OK**.

The **FAST Scan Assistant** dialog box is closed.

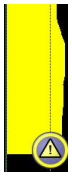
If the conflict is resolved, you can load the scan.

As long as an adjusted scan range is not scanned, you can revoke the adaptations by clicking the **Undo** button in the **FAST Scan Assistant** dialog box.

In the following cases, the changes by **FAST Adjust** and the **FAST Scan Assistant** for maximum mAs decrease are automatically revoked:

- CARE Dose4D has been activated or deactivated in the **Scan** parameter card.
- The **Eff. mAs** or the **mAs** value has been manually changed in the **Scan** parameter card.
- ECG Pulsing has been activated or deactivated in the **Trigger** parameter card.

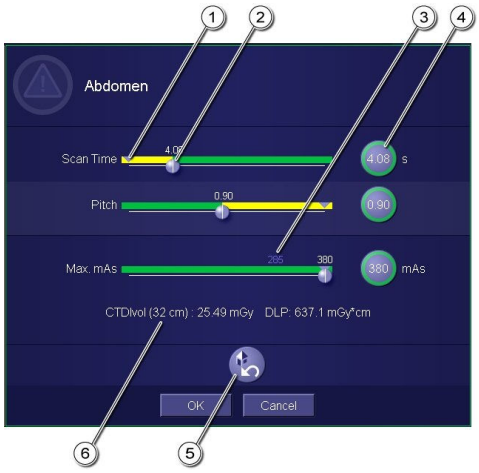
Using the FAST Scan Assistant



If a cooling or a scan parameter conflict occurs, the **FAST Scan Assistant** button is displayed. The invalid scan ranges and scan parameters are indicated in yellow in the parameter cards.

With the **FAST Scan Assistant**, you can check and change the settings made by the **Adjust** button.

1 Click the **FAST Scan Assistant** button to open the **FAST Scan Assistant** dialog box.



(1) Original value

(2) Currently set value

(3) Configured limit for the **Adjust** button

(4) Value which resolves the conflict

(5) **Undo** button

(6) Dose descriptors

If the system requires cooling time, a clock icon indicates the remaining cooling time in the **FAST Scan Assistant** dialog box.

The limits for **Scan Time** increase and **Max. mAs** decrease of **FAST Adjust**, which are configured in the **Scan Protocol Assistant**, are displayed above the sliders. (➔ Page 275 *Setting the limits for FAST Adjust*)

If a slider is positioned in the green zone, the scan parameter is valid and scannable. As long as one of the sliders is positioned in the yellow zone, the scan is invalid.

The buttons on the right-hand side display the values which resolve the conflict for the corresponding slider by either increasing the scan time or decreasing the maximum mean mAs. Clicking one of the buttons changes the value of the corresponding slider.

2 Adapt the scan parameters such that they are suitable for the patient and the examination.

To move the sliders manually, you can also use the arrow keys on the keyboard.

3 Click **OK**.

The **FAST Scan Assistant** dialog box is closed.

If the conflict is resolved, you can load the scan.

As long as an adjusted scan range is not scanned, you can revoke the adaptations by clicking the **Undo** button in the **FAST Scan Assistant** dialog box.

In the following cases, the changes by **FAST Adjust** and the **FAST Scan Assistant** for maximum mAs decrease are automatically revoked:

- CARE Dose4D has been activated or deactivated in the **Scan** parameter card.
- The **Eff. mAs** or the **mAs** value has been manually changed in the **Scan** parameter card.
- ECG Pulsing has been activated or deactivated in the **Trigger** parameter card.

Handling the Dose Notification

If you load a scan range for which the configured notification values are exceeded, you will be notified:

- The $CTDI_{vol}$ and DLP values on the **Scan** and **Routine** parameter cards are marked red.
- The **Dose Notification** dialog box opens, if configured.

1 Check if the scan parameters are suitable for the examination.

2 Continue a scan without correcting the exceeded scan parameters only if clinically justifiable.

If the **Dose Notification** dialog box opens, enter the **Diagnostic reason** (optional).

After confirming the **Dose Notification**, the exceedance of the dose parameters will be documented in the folder `H:\SiteData\DoseLogs` including the following information:

- Type (Dose Notification)
- Date and time
- Patient ID
- Diagnostic reason
- Scan range name
- Actual $CTDI_{vol}$ and $CTDI_{vol}$ notification value
- Actual DLP and DLP notification value

You are responsible for creating backups of the dose log files.

Use a calculator program, for example Microsoft Excel, to open a dose log file for a structured display of the content.

Handling the Dose Alert

If you are loading a scan for which the accumulated $CTDI_{vol}$ at any z-position or the accumulated DLP for the next scan range exceeds the alert values configured in the **Examination Configuration**, the **Dose Alert** dialog box will be displayed.

CAUTION

Changed scan parameters are unsuitable!

Dose not as desired.

- Verify the changed scan parameters before scanning.

1. Check if the current scan parameters are suitable for the examination.
2. Continue a scan without correcting the exceeded scan parameters only if clinically justifiable.

   In this case, enter your **User name** (mandatory) and the **Diagnostic reason** (optional) into the **Dose Alert** dialog box.
3. If password protection is activated, enter the configured password to continue scanning.

   Otherwise the scan range cannot be loaded. See (→ Page 275 *Activating password protection for the Dose Alert*).

   After confirming the **Dose Alert**, the scan continues until the next scan range that exceeds the configured alert values is reached.
4. Repeat steps 1 to 3.

In examinations that have a clinical requirement to exceed the alert value and where a repeated acknowledgment of the **Dose Alert** dialog box would severely affect the workflow, for example, interventional examinations, you may activate the **Do not show again for the remaining examination** check box as an exception.

After confirming the **Dose Alert**, the scan protocol can no longer be saved.

The exceedance of the dose parameters will be documented in the folder `H:\SiteData\DoseLogs` including the following information:

- Type (Dose Alert)
- Date and time
- Patient ID
- User name
- Diagnostic reason
- Actual $CTDI_{vol}$ and $CTDI_{vol}$ alert value
- Actual DLP and DLP alert value
- Configuration of password protection

You are responsible for creating backups of the dose log files.

Use a calculator program, for example Microsoft Excel, to open a dose log file for a structured display of the content.

5.2.8 Viewing the dose documentation

The applied dose can be documented in the Patient Protocol and in the DICOM Dose Structured Report for each scan.

Viewing a Patient Protocol

If configured, the system creates the Patient Protocol at the end of an examination.

The automatic creation of the Patient Protocol and the **Auto filming** function is set in the **Examination Configuration** dialog box.

◆ To view the Patient Protocol, load it into *syngo* **Viewing**.

If you click the **Hide Graphics** icon on the **Filming** task card, you also hide the Patient Protocol.

Viewing a DICOM Dose Structured Report

If configured, a Dose SR is generated automatically according to the DICOM standard for archiving and evaluation purposes at the end of an examination (→ Page 272 *Configuring the Dose Structured Report*). The Dose SR cannot be modified.

✓ The *syngo* Structured Report (SR) Viewer is installed.

◆ Double-click the icon in the content area of the Patient Browser to view the dose report in the *syngo* SR Viewer.

The complete information of the dose report is listed in the *syngo* SR Viewer despite the converse note displayed in the header line of the report.

5.3 Considerations for pediatric scanning

For the description of a basic dose-optimized workflow, see (→ Page 268 *Performing a dose-optimized workflow*). In the following chapter you will find the settings which must be taken into account for dose-optimized scanning of children.

Anatomical and physiological differences between children and adults require special attention when imaging pediatric patients. Image quality requirements are different, because of smaller structures, as well as higher heart rates and difficulties in cooperating during the scan, to name just a few reasons.

Adjusting imaging parameters is important to meet image quality requirements and in addition is essential to reduce dose as children are more sensitive to radiation than adults. The smaller the cross section of the patient, the higher the radiation dose that is actually absorbed.

Nevertheless, computed tomography imaging is of great importance for the treatment of pediatric patients, especially for complex lung imaging, for the treatment of congenital malformations, and in intensive care.

As a consequence, the ALARA principle (As Low As Reasonably Achievable) is of particular importance in pediatric patients. It calls for always selecting the dose that is as low as possible, yet sufficient for a reliable diagnosis.

Adjust the dose for each individual scan carefully to achieve the necessary image quality. Scans with lower radiation dose may have higher image noise, but deliver diagnostic image quality.

The $CTDI_{vol}$ and DLP for pediatric head scans are reported in the 16-cm CTDI phantom.

The $CTDI_{vol}$ and DLP for pediatric body scans are reported in the 32-cm CTDI phantom.

5.3.1 Characteristics of child protocols

For CT examinations of children, Siemens offers special child protocols in combination with accurate dose modulation.

You can access child protocols in the **Patient Model Dialog**. Based on the entered patient birth date or age, child protocols are automatically displayed in the **Patient Model Dialog** if the age of the patient is below the maximum child age. The default value for the maximum child age is 11 years. Child protocols incorporate features and optimized parameters at appropriate dose levels.

- Dose modulation parameters for CARE Dose4D dedicated to children
- Special kernels for head examinations (Hp38)
- Faster rotation times to shorten scan times and to reduce motion artifacts
- 70 kV (optional), for some protocols, for higher contrast-to-noise ratio, and lower dose level

The **Quality Reference mAs** for CARE Dose4D is defined for a patient weighing 70 kg to 80 kg, even for child protocols. Based on this value, the system adapts the **Eff. mAs** to the size and shape of the current patient.

5.3.2 Checking the examination configuration parameters

1 In the **Options** menu, choose **Configuration**.

2 In the **Somaris/7 – Configuration Panel**, double-click the **Examination** icon.

Adapting the dose to the patient size

You can adapt the settings of the CARE Dose4D adaptation strength separately for children.

For **Child**, the Siemens default settings for the CARE Dose4D adaptation strengths are **Average** for all organ characteristics.

1 In the **Examination Configuration** dialog box, click the **Dose** tab card.

2 In the selection lists for **Child** of the field **CARE Dose4D configuration: mAs adaptation to patient size**, select a CARE Dose4D adaptation strength, if necessary.

Setting the dose alert values

You can set the **Dose Alert** values separately for children.

The **Dose Alert** dialog box informs you if the alert values for **$CTDI_{vol}$** or **DLP** are exceeded for the whole examination.

1 In the **Examination Configuration** dialog box, click the **Dose** tab card.

2 In the **Dose Alert** field for **Child**, set the **$CTDI_{vol}$** and **DLP** alert values.

In contrast to the **DLP**, the calculation of the accumulated **$CTDI_{vol}$** is specific to a z-position.

If no alert values are configured, the **Dose Alert** dialog box is not displayed.

Adapting the maximum child age

1 In the **Examination Configuration** dialog box, click the **Patient** tab card.

2 In the **Max. child age** spin box of the **Patient Data** field, set the maximum age.

The default value for the maximum child age is 11 years.

The **Child** radio button is automatically selected when opening the **Patient Model Dialog** if a corresponding patient has been registered.

5.3.3 Positioning the patient

You can position babies comfortably and securely on the patient table by using the baby mattress (pediatric cradle)..

- For infants and small children, use the baby mattress (pediatric cradle).

5.4 Considerations for Cardiac CT

For the description of a basic dose-optimized workflow, see (➔ Page 268 *Performing a dose-optimized workflow*). In the following chapter you will find the settings which must be taken into account for dose-optimized Cardiac CT scanning.

5.4.1 Initial situation and scan mode

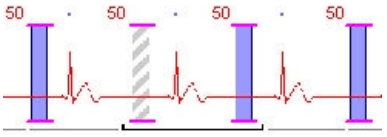
The following Cardiac CT modes are provided:

- ECG-triggered sequence
- ECG-gated spiral
- BiSegment spiral

Initial situation	Recommended scan mode
• Regular sinus rhythm • Moderate heart rate • Limited to increased variance • Several ectopic beats	• ECG-triggered sequence (➔ Page 302 *Scanning a prospectively ECG-triggered sequence*)
• High to very high heart rate • Very irregular heart rate, which needs a high flexibility in reconstruction up to editing the ECG	• ECG-gated spiral (➔ Page 305 *Scanning a retrospectively ECG-gated spiral*)
• Very high heart rate	• BiSegment spiral

5.4.2 Scanning a prospectively ECG-triggered sequence

Prospective ECG triggering combined with step-and-shoot acquisition of axial slices acquires the appropriate amount of scan data needed for image reconstruction during the previously selected heart phase. The ECG signal of the patient is monitored during examination, and axial scans are started with a pre-defined time offset relative to the R-waves. Irregularities are reliably detected, and in case of an ectopic beat, the scan is repeated at the same position.



The patient table moves the patient to the first z-position. The scan is triggered depending on the ECG. Then the patient is moved to the next z-position. The procedure is repeated until the range to be scanned is completed.

For low heart rates up to moderate heart rates, the optimum time point for data acquisition is in the end-diastolic phase at a heart phase of approximately 70%.

Using the Adaptive Cardiac Sequence

For the Adaptive Cardiac Sequence, the trigger timing for a scan is prospectively estimated based on the preceding three cardiac cycles.

If not activated by default, you can activate the Adaptive Cardiac Sequence mode in the **Scan Protocol Assistant** (➔ Page 491 *Activating the Adaptive Cardiac Sequence mode*).

Defining the scan range

Define the start and end phase of the scan.

- On the **Trigger** parameter card, enter the values in the **Scan** entry fields for the start and end phase of the scan.

Using ECG Pulsing

You can combine the Adaptive Cardiac Sequence with ECG Pulsing for individually defining the time points for the acquisition (**Range**) as well as the high dose level (**Pulsing**) used for ECG Pulsing.

Automatic definition of the scan and ECG Pulsing ranges

You can set the **auto** mode on the **Trigger** parameter card, to use the predefined values of the configuration.

These predefined values are determined by a heart rate type in combination with a variability type of the heart rate. These values are configured in the **Auto Trigger Configuration** of the **HeartView Configuration** dialog box.

The **auto** mode is suitable for all types of heart rates (**Low**, **Moderate**, **High**) and variabilities (**Regular**, **Unstable**, **Arrhythmic**).

In **auto** mode, scan ranges and pulsing ranges are identical. You can define a separate window for functional imaging.

- On the **Trigger** parameter card, from the **Scan** list, select **auto** to use the predefined values of the configuration.

Manual definition of the scan and ECG pulsing ranges

1. On the **Trigger** parameter card, from the **Scan** list , select **manual**.
2. From the **Unit** list, select **ms** or **%**.
3. In the **Range** fields, enter the values for the scan window.
4. In the **Pulsing** fields, enter the values for the pulsing window.

If you enter a positive value in ms, the scan window and the pulsing window stay constant. Therefore, heart rate variances do not lead to an extension of the scan window or the pulsing window.

Setting the reconstruction time point

The **Phase Start** value of 70% RR (diastolic phase) is set as a default value in the standard protocols.

Setting Phase Start

1. In the **Unit** selection list of the **Trigger** parameter card, select **ms** (absolute delay) or **%** (relative delay) as the trigger unit.
2. In the **Phase Start** spin box, set the recon delay, if necessary.

Setting Cardio BestPhase

Cardio BestPhase is used to identify the best diastolic or best systolic phases for image reconstruction.

The determined best phase represents the optimum image quality in the systolic phase (0-50% RR) or in the diastolic phase (50-100% RR).

- On the **Trigger** parameter card, from the **BestPhase** list, select **auto** to allow the system to select whether the systolic phase (**BestSyst**) or the diastolic (**BestDiast**) phase will be used for the BestPhase reconstruction.

  – or –

  Manually select **BestSyst** or **BestDiast**.

If the scan has started and irregular heartbeats are detected, a message in the ECG trigger field is displayed and that the scan is repeated.

5.4.3 Scanning a retrospectively ECG-gated spiral

In the spiral mode, data acquisition continuously proceeds while the patient table is moving forward with a constant pitch.

Due to the continuous data acquisition, the spiral mode allows maximum flexibility for data reconstruction. If necessary, you can also edit the ECG in this mode for challenging patients.

Since, compared with non-gated spirals, the pitch depends on the heart rate of the patient, very low pitch values of approximately 0.2 are needed. This may be at the expense of a higher radiation dose.

To alleviate this effect, the tube current should be modulated with ECG Pulsing and MinDose depending on the current heart phase.

Using ECG Pulsing

ECG Pulsing reduces the applied dose down to 25% of the nominal current.

Use ECG Pulsing if you want to perform a functional analysis on the reconstructed images, and a functional image impression based on a reduced dose level is acceptable.

Automatic definition of the ECG Pulsing ranges

You can set the **auto** mode on the **Trigger** parameter card, to use the predefined values of the configuration.

These predefined values are determined by a heart rate type in combination with a variability type of the heart rate. These values are configured in the **Auto Trigger Configuration** of the **HeartView Configuration** dialog box.

The **auto** mode is suitable for all types of heart rates (**Low**, **Moderate**, **High**) and variabilities (**Regular**, **Unstable**, **Arrhythmic**).

- On the **Trigger** parameter card, from the **Pulsing** list, select **auto** to use the predefined values of the configuration.

Manual definition of the ECG pulsing ranges

1. On the **Trigger** parameter card, from the **Pulsing** list, select **manual**.
2. From the **Unit** selection list, select **ms** or **%**.
3. In the **Range** fields, enter the values for the scan window.
4. In the **Pulsing** fields, enter the values for the pulsing window.

If you enter a positive value in ms, the scan window and the pulsing window stay constant. Therefore, heart rate variances do not lead to an extension of the scan window or the pulsing window.

For scanning patients with high heart rate variances, you can set the positive absolute delay values in the systolic phase (Range setting: 300 – 400 ms) for the pulsing window. This will ensure accurate triggering of the scan at a high dose in the systolic phase without an increase in patient dose.

The reconstruction has to be performed in ms in every setting of Cardio BestPhase as well.

Using MinDose

MinDose reduces the applied dose down to 4% of the nominal current. On average, around 20% of the dose can be reduced compared to the normal ECG pulsing setting.

Use MinDose if you do not want to perform a functional analysis on the reconstructed images.

- In the **ECG Pulsing** selection list of the **Trigger** parameter card, select **MinDose - manual** to define the start and the end point in the diastolic phase.

  – or –

  In the **ECG Pulsing** selection list, select **MinDose - auto** to activate the automatic dose modulation.

Adapting the pitch

The automatic pitch adaptation is set by default. This mode is activated when the estimated heart rate (**Est. HR**) is set to **auto**.

Select a manual pitch adaptation with the estimated heart rate only if clinically indicated, for example, in case of bigeminus, or if the heart rate decreases by about 10 beats during the breath-hold command.

Setting the reconstruction time point

The **Phase Start** value of 70% RR (diastolic phase) is set as a default value in the standard protocols.

Setting Phase Start

1 In the **Unit** selection list of the **Trigger** parameter card, select **ms** (absolute delay) or **%** (relative delay) as the trigger unit.

2 In the **Phase Start** spin box, set the recon delay, if necessary.

For sequences, enter the time when the scan shall be started.

For spirals, enter at which time the raw data is selected for reconstruction.

- For an absolute delay, use **ms**.
- For a percentage delay, use **%**.

Setting Cardio BestPhase

Cardio BestPhase is used to identify the best diastolic or best systolic phases for image reconstruction.

The determined best phase represents the optimum image quality in the systolic phase (0-50% RR) or in the diastolic phase (50-100% RR).

◆ On the **Trigger** parameter card, from the **BestPhase** list, select **auto** to allow the system to select whether the systolic phase (**BestSyst**) or the diastolic (**BestDiast**) phase will be used for the BestPhase reconstruction.

– or –

Manually select **BestSyst** or **BestDiast**.

5.4.4 Using CARE Dose4D and CARE kV

The use of CARE Dose4D and CARE kV is valid for all cardiac workflows.

Using CARE Dose4D

For cardiac scan protocols, CARE Dose4D is activated by default.

It is highly recommended to keep CARE Dose4D activated.

For cardiac scan protocols, the mAs/rot. setting is adjusted to the patient size. Additionally, ECG modulation is used.

Using CARE kV

CARE kV is activated by default.

It is recommended to keep CARE kV activated.

CARE kV optimizes the applied dose for a defined image quality level by automatically adapting the tube voltage and the tube current.

If CARE kV is activated, scanning is performed with a constant kV value (no online modulation of the voltage).

- In the **Dose Optimization** dialog box, set the slider to **Vascular**.

Setting kV manually

If you do not have the CARE kV option, set the tube voltage manually.

For CTA examinations, scanning with 100 kV provides images with a considerably higher contrast compared to 120 kV.

✓ Patient weight up to 80 kg (175 lbs)

- On the **Scan** parameter card, from the **kV** selection list, select **100 kV** tube voltage.

For patients weighing more than 80 kg, select **120 kV**.

If you set the tube voltage manually, you also have to adapt the **Quality Ref. mAs**.

5 Dose management and optimization

6 Examination

The following chapters describe how to register patients, handle scan protocols, move the patient table, scan patients, and reconstruct images.

6.1 Examination procedure overview

A CT examination workflow consists of steps that are performed in the examination room at the gantry and steps that are performed in the control room at the *syngo* Acquisition Workplace.

Step	Control room	Examination room
1	(➔ Page 312 *Registering the patient and selecting the scan protocol*)	
2		(➔ Page 313 *Preparing the examination*)
3	(➔ Page 313 *Obtaining a topogram*)	
4	(➔ Page 313 *Checking the scan protocol in the chronicle*)	
5	(➔ Page 314 *Planning the scan ranges*)	
6	(➔ Page 314 *Performing scans*)	
7	(➔ Page 314 *Reconstructing, evaluating, and manipulating images*)	

Step	Control room	Examination room
8	(➔ Page 315 *Completing and ending the examination*)	
9		(➔ Page 243 *Unloading the patient*)
10	(➔ Page 315 *Postprocessing the images with other applications*)	
11	(➔ Page 315 *Archiving and sending images*)	

6.1.1 Registering the patient and selecting the scan protocol

In the **Patient Registration** dialog box, enter the data of the patient and select a scan protocol. Then start the examination. The scan protocol is loaded into the chronicle. (➔ Page 349 *Registering a Patient*)

- If a patient is admitted who is in a critical condition and must therefore be examined and treated immediately, call up emergency registration. It reduces the time before you can begin the examination to a minimum.
- Do not ignore warning messages about the weight of the patient. Ensure you use only the appropriate protocols for heavy weight patients. Otherwise, the scan may be aborted due to the wrong table speed and an additional dose of radiation may be applied to the patient.
- To prepare the system to examine a patient at a later point in time, you can preregister the patient. For example, you can enter the data in the morning for all the patients to be examined during the day. To begin an examination, call up this data in the scheduler and edit it, if required. This saves time during the examinations.

6.1.2 Preparing the examination

To scan the topogram, position the patient on the patient table. (➔ Page 364 *Positioning the patient*),

- (➔ Page 367 *Preparing the patient table*)
- (➔ Page 375 *Preparing the patient*)
- (➔ Page 379 *Moving the patient into the scan plane*)

If required, at the gantry or on the topogram **Routine** parameter card, zero the table at the desired table position. (➔ Page 380 *Setting the table position to zero*)

Check the registered data, the patient position in the **Patient Model Dialog**, and the scan protocol in the chronicle.

6.1.3 Obtaining a topogram

The examination steps (scan protocol) are listed in the chronicle. The first step is activated, typically a topogram. The topogram is used to define the examination ranges. (➔ Page 390 *Acquiring a Topogram*)

For spiral examinations, you can plan and store different scan and recon ranges for the spiral examination directly after scanning the topogram.

You can omit scanning a topogram and define scan ranges without a topogram.

6.1.4 Checking the scan protocol in the chronicle

- Is the order of the steps correct?

  You may insert or delete protocol steps or even add another scan protocol. In the **Edit** menu and in the context menu, the **Cut**, **Copy**, **Repeat**, and **Paste** functions are available. Special protocol entries, such as a pause or memo, can be inserted using either the **Insert** menu or the context menu.

- Are the parameters of each step correct?

  You can check the parameters by clicking each protocol step. The parameters are displayed in the parameter cards.

  Check the scan parameters before scanning.

You can modify the scan protocol before, and even during, the examination.

6.1.5 Planning the scan ranges

Define the scan ranges according to the anatomy of the patient.
(→ Page 393 *Planning an Examination*)

You can modify the ranges:

- With the mouse, by pulling the handles of the graphical representation of the scan range in the topo segment, which is easier.
- By setting the parameters on the parameter cards appropriately, which is more precise (for example, to use the same parameters of a previous scan).

6.1.6 Performing scans

Click the **Load** button in the chronicle to load the parameters of the current protocol step. As soon as you click the **Load** button, the topogram is zoomed and moved in a way that the whole planned scan range is displayed.

Press the **MOVE** key on the control box to move the table to the start position of the range.

Press the **START** key to start scanning.

(→ Page 401 *Performing a sequence scan*)

6.1.7 Reconstructing, evaluating, and manipulating images

Images are reconstructed from the collected raw data and are automatically stored.

6.1.8 Completing and ending the examination

If you have obtained all the images required for the diagnostic study, complete and end the examination and export the E-Logbook before releasing the patient. You can then register the next patient for examination or you can preregister a new patient.

6.1.9 Postprocessing the images with other applications

Afterwards, you can use other applications to evaluate and postprocess the images.

6.1.10 Archiving and sending images

You can archive and send images by using the transfer functions. It is also possible to configure the auto transfer and auto send functions.

6.2 Configuration of examination settings

You can configure different settings for examination.

6.2.1 Using the Configuration Panel

Depending on the application, you can configure task cards, windows, and individual functions of the program to adapt them to your requirements.

1 From the main menu, choose **Options** > **Configuration...**.

The **Somaris/7 – Configuration Panel** opens.

2 Double-click the icon that represents the application to open the corresponding configuration window.

3 Adapt the functions of the application to your individual requirements.

6.2.2 Scan Protocol Assistant

The **Scan Protocol Assistant** is a tool for creating, exporting, listing, and editing single scan protocols or groups of scan protocols, as well as for defining, listing, importing, and exporting contrast protocols.

Two different categories of scan protocols are available:

- Siemens protocols
- User protocols

The number of available protocols has a high impact on the performance of the **Scan Protocol Assistant**. When you use the **Scan Protocol Assistant** very often, Siemens recommends reducing the number of protocols as far as possible.

Siemens default scan protocols provide an optimized set of parameters balancing image quality, scan time, and patient dose. They are defined to be applied directly to your examination after minor adaptions of, for example, the language of the Automatic Patient Instructions. Special clinical conditions and applications may require the adaption of the default recommendations. As the final diagnosis is the sole responsibility of the user, the user always has to make sure that the chosen scan protocol meets the requirements of the examination.

You can only manipulate and create user protocols.

The availability of scan protocols depends on your license.

Additionally, the availability of features depends on your user account. For this reason, Siemens recommends closing the **Scan Protocol Assistant** and logging off before changing user.

Calling up and closing the Scan Protocol Assistant

You call up the **Scan Protocol Assistant** via the **Somaris/7 – Configuration Panel**.

1 Select **Options** > **Configuration...** to open the **Somaris/7 – Configuration Panel**.

2 Double-click the **Scan Protocol Assistant** icon in the **Somaris/7 – Configuration Panel** to open the **Scan Protocol Assistant**.

The step **1** page of the Scan Protocol Assistant is displayed.

Click the **Quit** icon to close the **Scan Protocol Assistant** without saving the changes.

Operations in the Scan Protocol Assistant

On the step **1** page, you can select one of the following operations:

- **Manipulate scan protocols (cut/copy/paste/delete)**
- **Change parameters**
- **Import user scan protocols**
- **Import from teamplay**
- **Export scan protocols**
- **Mapping syngo.via workflow**

  Only available if a *syngo*.via server has been configured in **Local Service** and is online.
- **Restore scan protocols to Siemens default**
- **Define contrast protocols**
- **List/import/export contrast protocols**

Additionally, the **Update customer protocols** button is available. The Siemens Service uses the **Update customer protocols** button to convert customer protocols from former software versions. After the conversion the button displays the status **Done**.

Workflow

Depending on which operation you select after opening the **Scan Protocol Assistant**, it takes 3 to 5 steps to finalize it:

- Select the operation page.
- Perform the operation in one or two operation-specific windows.
- Confirm the modifications.
- Finalize the operation by quitting or continuing with a new operation.

Modifying scan protocols

Using the Scan Protocol Assistant, you can perform the following operations:

- Move scan protocols to another body region (drag-and-drop)
- Cut/copy/remove/paste scan protocols
- Set the emergency scan protocol

1 Click the **Manipulate scan protocols (cut/copy/paste/delete)** radio button on the step **1** page of the **Scan Protocol Assistant**.

2 Click the step **2** button.

The step **2** page is displayed, in which all scan protocols are listed according to body region.

3 Select **Adult** or **Child**.

4 Drag a single protocol to sort the order of the scan protocols.

– or –

Activate the check box of the scan protocol you want to modify.

– or –

Activate the **Select invalid protocols** check box to show all invalid scan protocols.

If you want, you can export a list of the invalid protocols.
(→ Page 341 *Listing scan protocols*)

5 Right-click the scan protocol.

The context menu is displayed.

6 Select **Cut**, **Copy Remove**, or **Paste** from the context menu.

The selected action is performed and the scan protocol lists within the relevant body regions are adapted accordingly.

You cannot remove the **Emergency** protocol.

Assigning an Emergency protocol

You can set one scan protocol as the **Emergency** protocol with the **Emergency** icon in front of its name.

1 Select the protocol you want to set as the **Emergency** protocol on the step **2** page.

2 Click the **Set Emergency Protocol** icon.

3 Click **OK** to confirm.

4 Click the step **3** button.

The **Confirmation** page is displayed.

Confirming the changes

The **Confirmation** page lists all regions where the protocol is manipulated. This includes information about the deleted protocol name, the destination folder of the changed protocol, and the name of the changed emergency protocol.

1 Check the modifications that you have performed.

2 If necessary, clear the check box in front of the protocol to discard the changes.

3 Click the **Yes** button to save the changes.

The **Changes saved** page is displayed.

If a password protection is activated in the Local Service configuration, the **Save Scan Protocol** dialog box opens. See (→ Page 347 *Activating a password protection*). Enter the configured password. Otherwise the scan protocol cannot be saved.

4 Click the **Yes** button to make further changes.

– or –

Click the **End** button to exit the **Scan Protocol Assistant**.

5 Restart the system to activate a new default **Emergency** protocol.

Changing parameters

Using the **Scan Protocol Assistant**, you can modify all scan protocols and save them as customized protocols. You can change the parameters of several scan protocols simultaneously.

You can select the following groups of scan protocols:

- All scan protocols
- Axial recon jobs
- 3D recon jobs
- SAFIRE/ADMIRE recon jobs
- All scan protocols with ECG
- Protocols with Dual Source and Dual Energy
- Respiratory protocols
- Interventional protocols
- All customized scan protocols
- All Siemens default protocols
- Single scan protocols
- All scan protocols within a body region
- Several body regions

The display of the scan protocol parameters depends on the selected section.

1 Click the **Change parameters** radio button on the step **1** page of the **Scan Protocol Assistant**.

2 Click the step **2** button.

The **Change parameters** page is displayed.

3 Select **Adult** or **Child**.

If the **Child** checkbox is selected, a text is shown to tell you about the definition of **Quality ref. mAs** value for child scan protocols.

When you change the **Quality ref. mAs** value for a child protocol and if the protocol is from an older software version, a notice window informs you to adjust the value to the new reference patient size.

4 Select the required scan protocols for changing parameters.

– or –

Activate the **Select invalid protocols** checkbox to show all invalid scan protocols.

5 Click the step **3** button.

The **Change parameters** dialog box is displayed. The dialog box shows the following buttons in the upper area of the **Scan Protocol Assistant** dialog box:

Protocol (displayed first by default), **Topogram**, **Scan**, **Recon**, **Auto Tasking**, **Trigger**, **Intervention**, and **Contrast**.

6 Click the required button.

The corresponding **Change parameters** page opens.

7 Double-click the parameter entry in a cell of the grid.

8 Change the parameters in the cell.

– or –

Select the required item from the selection list.

Special characters (for example, * ! = ; ? % /) are not allowed to be included in the name of a scan protocol.

9 Click another parameter entry to confirm your changes.

The background of the modified parameters is displayed in different colors, depending on the status of the parameters:

- Green: Valid modified parameters
- Yellow: Invalid modified parameters
- White: Existing, not modified or saved parameters

These color rules only work for the selected protocols. After saving, the modified parameters change to having white as a background color.

10 Click the step **4** button.

The **Confirmation Page** page is displayed, including names of modified protocols and relevant parameters, as well as old and new values of the modified parameters. See (➔ Page 332 *Confirming changes*).

Modifying protocol parameters

On the **Change parameters** - **Protocol** page, you can change the following protocol parameters, for example:

- Protocol name
- Default patient position
- Auto reference lines
- Language
- Body region

1 Select the check box in front of a protocol.

– or –

Select all protocols to make changes to all protocols at once.

2 Make your changes in the selected protocols.

3 Click the step **4** icon in the upper area.

The **Confirm changes** page is displayed, listing all protocols with their modified protocol parameters, including the protocol name, old value, and new value. See (→ Page 332 *Confirming changes*).

Modifying topogram parameters

On the **Change parameters** - **Topogram** page, you can change the following topogram parameters, for example:

- mA
- Topogram length
- Tube position
- kV
- API
- Direction
- Auto viewing
- Auto filming
- Auto transfer

1 Select the check box in front of a protocol.

– or –

Select all protocols to make changes to all protocols at once.

2 From the context menu, choose **Remove Topo** or **Append Topo** to append or remove a topogram.

3 Make your changes in the selected protocols.

4 Click the step **4** icon in the upper area.

The **Confirm changes** page is displayed, listing all protocols with their modified topogram parameters, including the protocol name, old value, and new value. See (→ Page 332 *Confirming changes*).

Modifying scan parameters

On the **Change parameters** - **Scan** page, you can change the following scan parameters, for example:

- **mAs / (Eff.) mAs**
- **CARE Dose type**
- **Dose modulation**
- **Quality Ref. mAs**
- **Ref. kV / kV**
- **Slice**
- **Cycle time**
- **Cycle time table** (for Adaptive 4D Spiral and non-gated perfusion sequence)
- **Rotation time**
- **Pitch**
- **Scan time**
- **Scan direction**
- **Start delay**
- **API**
- **Range name**
- **Scan start**
- **Comments**
- **Dose saving optimization**
- **FAST Adjust**

- **CARE kV**
- **Dose Notification**

The topogram information is listed if the **including topogram** check box is selected.

The parameter area of the **Change parameters** page is divided into two subtask cards: **Dose** and **Parameter**. You can easily find dose-related parameters on the **Dose** subtask card.

The **Dose saving optimization** parameter will be disabled if the license for CARE kV is not available or if the CAREDose type is CARE Dose.

The **Upper limit max. scan time** parameter and **Lower limit max. mAs parameter** are disabled if the license for FAST adjust is not available.

1 Select the required protocol type to which you want to apply changes:

   - **Select all**
   - **Sequence Scans**
   - **Spiral Scans**
   - **Multiscans**
   - **Interventional**
   - **Adaptive 4D spiral scans**
   - **i-Sequence**
   - **i-Spiral**
   - **i-Fluoro**

2 Right-click on the entry you want to change.

A context menu with the following functions is provided:

- Appending or deleting a protocol (**Append**, **Delete**).
- Inserting or removing a pause in an auto-range (**Insert Pause**, **Remove Pause**).
- Adding the current scan entry to CARE kV group or removing it (**Add to CARE kV group**, **Remove from CARE kV group**) if the license for CARE kV is available.

3 Make your changes in the selected protocols.

4 Click the step **4** button.

The **Confirmation Page** page is displayed, including names of modified protocols and relevant parameters as well as old and new values of the modified parameters. See (→ Page 332 *Confirming changes*).

Modifying recon parameters

On the **Change parameters** - **Recon** page, you can change the following recon parameters, for example:

- **Slice**
- **Position increment**
- **Kernel**
- **Window**
- **FoV**
- **HD/Extended FoV**
- **Image order**
- **Mirroring**
- **No. of images**
- **Recon job type**
- **Recon axis**
- **Matrix size**

- **SAFIRE/ADMIRE**
- **iMAR**

1 Select the required protocol type to which you want to apply changes:

- **Select all**
- **Sequence scans**
- **Spiral scans**
- **Multiscans**
- **Interventional scans**
- **Axial recon jobs**
- **3D recon jobs**
- **SAFIRE/ADMIRE**
- **Adaptive 4D spiral scans**
- **i-Sequence**
- **i-Spiral**
- **i-Fluoro**

A context menu with the following functions is provided:

- Copying the current recon job to the end (**Append Recon Job**).
- Deleting the current recon job (**Delete Recon Job**).

2 Make your changes in the selected protocols.

3 Click the step **4** button.

The **Confirmation Page** page is displayed, including names of modified protocols and relevant parameters as well as old and new values of the modified parameters. See (→ Page 332 *Confirming changes*).

Modifying Auto tasking parameters

On the **Change parameters** - **Auto tasking** page, you can change the following auto-tasking parameters, for example:

- **Auto transfer 1**
- **Auto transfer 2**
- **Auto transfer 3**
- **Auto viewing**
- **Auto filming**
- **Auto Recon**
- **Auto postprocessing**
- **Auto Reference Lines**
- **every**
- **Body part examined**

1 Select the required protocol type to which you want to apply changes:

   - **Select all**
   - **Axial recon jobs**
   - **3D recon jobs**

2 Make your changes in the selected protocols.

3 Click the step **4** button.

   The **Confirmation Page** page is displayed, including names of modified protocols and relevant parameters as well as old and new values of the modified parameters. See (→ Page 332 *Confirming changes*).

Modifying Trigger parameters

On the **Change parameters** - **Trigger** page, you can change the following trigger parameters, for example:

- **Best phase**
- **Phase start**
- **Pulsing**

- **Multi phase**
- **Cardio API Delay**

Only scan protocols with ECG and respiratory scans are displayed on the **Trigger** page.

The scan and recon information is displayed if the included scan and recon information check box is activated.

1 Select the required protocol type to which you want to apply changes:

   - **Select all**
   - **Cardio sequence scans**
   - **Cardio spiral scans**
   - **Resp. spiral scans**

2 Make your changes in the selected protocols.

3 Click the step **4** button.

   The **Confirmation Page** page is displayed, including names of modified protocols and relevant parameters as well as old and new values of the modified parameters. See (➔ Page 332 *Confirming changes*).

Modifying Interventional parameters

On the **Change parameters** - **Interventional** page, you can change the following interventional parameters, for example:

- **CARE Dose type**
- **kV**
- **i-Precision view**
- **Slice**
- **No. of images**
- **Layout**
- **Kernel**

- **Window**
- **Key images**

The topogram information is displayed if the **including topogram** check box is activated.

1 Select the required protocol type to which you want to apply changes:
   - **Select all**
   - **i-Sequence**
   - **i-Spiral**
   - **i-Fluoro**
2 Make your changes in the selected protocols.

3 Click the step **4** button.

   The **Confirmation Page** page is displayed, including names of modified protocols and relevant parameters as well as old and new values of the modified parameters. See (→ Page 332 *Confirming changes*).

Modifying Contrast parameters

On the **Change parameters** - **Contrast** page, you can change the following contrast parameters, for example:

- **Scan start**
- **Contrast protocol**
- **Insert**

1 Select the required protocol type to which you want to apply changes:

- **Select all**
- **Sequence scans**
- **Spiral scans**
- **Multiscans**
- **Interventional**
- **Adaptive 4D spiral scans**
- **i-Sequence**
- **i-Spiral**
- **i-Fluoro**

2 To insert a contrast entry, right-click on the scan protocol entry above the point at which you want to insert it.

A context menu with the following functions is provided:

- **Insert Contrast**
- **Insert Bolus Tracking**
- **Insert TestBolus**

3 Select the required action.

The contrast entry is inserted.

4 To remove a contrast entry, right-click on this entry.

A context menu with the following functions is provided:

- **Remove Contrast**
- **Remove Bolus Tracking**
- **Remove TestBolus**

5 Select the required action.

The contrast entry is removed.

6 Make your changes in the selected protocols.

7 Click the step **4** button.

The **Confirmation Page** page is displayed, including names of modified protocols and relevant parameters as well as old and new values of the modified parameters. See (→ Page 332 *Confirming changes*).

Linking to a scan protocol

You can link a contrast to a scan protocol. If a contrast protocol has been linked to a scan protocol, when you load the scan protocol into the chronicle during a patient examination the linked contrast will also be loaded into the chronicle automatically.

1 Right-click on a scan entry that you want to link.

2 From the context menu, choose **Insert Contrast**.

3 Double-click on the parameter of **Scan start** on the contrast entry.

4 Select **Injector coupled** (start button) or **Injector coupled** (foot switch) from the list.

5 Double-click on the **Contrast protocol** parameter on the contrast entry.

6 Select a contrast protocol that you want to be linked from the list.

7 Click the step **4** button.

The **Confirmation Page** page is displayed, including names of modified protocols and relevant parameters as well as old and new values of the modified parameters. See (→ Page 332 *Confirming changes*).

If the linked contrast protocol is removed, the **Contrast protocol** parameter on the contrast entry will be set to **Manual.**

Confirming changes

On the **Confirmation** page, you confirm the changes.

◆ Click **Yes** to save the changes.

If a password protection is activated in the Local Service configuration, the **Save Scan Protocol** dialog box opens. See (→ Page 347 *Activating a password protection*). Enter the configured password. Otherwise the scan protocol cannot be saved.

The **Changes saved** dialog is displayed.

– or –

Click **Back** to go back.

Changing the parameter panel set

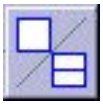
You can change the view of the parameter panel and call up special functions on the **Change parameters** page.

1 Click the **Column Configuration** icon to change the view of the parameter panel if necessary.

You can change the order of the columns, as well as their width, and show or hide them in the panel.

When you have finished your changes, click the required button:

- **Apply** to confirm the changes.
- **Cancel** to abort the changes.
- **Set Default** to restore the default settings.



2 Click the **Show/Hide Parameter** to show or hide the parameter modification area if necessary.

3 Click the **Parameter Property** if necessary.

You can see the **Minimum value**, **Maximum value**, **Increment**, and **Unit** of the parameters.

4 Click **Find / Replace** to find the parameter you want to change and replace it with a new one.

Set Auto filming by condition

For several functions, you can further specify the search items and set the configurations for predefined conditions when performing **Find/Replace**.

1 Click **Auto tasking**.

2 Click **Find/Replace**.

3 Select the **Auto filming** column on the column header.

4 Select **Special Task**.

5 Select the **Set Auto filming on** function.

6 Select < or ≤ from the list and enter a value for the slice width (for example slice thickness = 5 mm, or 2 mm < slice < 8 mm).

7 Click **Find next** to search for the next condition-matching cell and highlight it.

8 Click **Replace** to replace the currently highlighted value with the new desired value.

– or –

Click **Replace all** to search for all condition-matching cells and replace them with the new desired value.

Set CDBURNING by condition

For several functions, you can further specify the search items and set the configurations for predefined conditions when performing **Find/Replace**.

1 Click **Auto tasking**.

2 Click **Find/Replace**.

3 Select the **Auto transfer 1**, **Auto transfer 2**, or **Auto transfer 3** column on the column header.

4 Select **Special Task**.

5 Select the **Set CDBURNING** function.

6 Select < or ≤ from the list and enter a value for the slice width (for example slice thickness = 5 mm, or 2 mm < slice < 8 mm).

7 Click **Find next** to search for the next condition-matching cell and highlight it.

8 Click **Replace** to replace the currently highlighted value with the new desired value.

– or –

Click **Replace all** to search for all condition-matching cells and replace them with the new desired value.

Assign Transfer Node

For several functions, you can further specify the search items and set the configurations for predefined conditions when performing **Find/Replace**.

1. Click **Auto tasking**.
2. Click **Find/Replace**.
3. Select the **Auto transfer 1**, **Auto transfer 2**, or **Auto transfer 3** column on the column header.
4. Select **Special Task**.
5. Select the **Assign Auto Transfer Node** function.
6. Select the required node from the **Node** selection list.
7. Select < or ≤ from the list and enter a value for the slice width (for example slice thickness = 5 mm, or 2 mm < slice < 8 mm).
8. Click **Find next** to search for the next condition-matching cell and highlight it.
9. Click **Replace** to replace the currently highlighted value with the new desired value.

   – or –

   Click **Replace all** to search for all condition-matching cells and replace them with the new desired value.

Increase/Decrease (eff.)mAs

For several functions, you can further specify the search items and set the configurations for predefined conditions when performing **Find/Replace**.

1. Click **Auto tasking**.
2. Click **Find/Replace**.
3. Select the **(Eff.)mAs** column on the column header.
4. Select **Special Task**.
5. Select the **Increase/Decrease value by X %** function.

6 Enter a value for X percent.

The default value for **(Eff.)mAs** is 10%.

7 Click **Find next** to search for the next condition-matching cell and highlight it.

8 Click **Replace** to replace the currently highlighted value with the new desired value.

– or –

Click **Replace all** to search for all condition-matching cells and replace them with the new desired value.

Recon increment according to the slice

For several functions, you can further specify the search items and set the configurations for predefined conditions when performing **Find/Replace**.

1 Click **Auto tasking**.

2 Click **Find/Replace**.

3 Select the **Recon increment** column on the column header.

4 Select **Special Task**.

5 Select the **Set to X% of Slice** function.

6 Enter a value for X percent.

Calculate the recon increment value depending of the slice width and an individual percent value (for example, slice width: 5 mm, percent value: 80%, recon increment is calculated to 4 mm).

7 Click **Find next** to search for the next condition-matching cell and highlight it.

8 Click **Replace** to replace the currently highlighted value with the new desired value.

– or –

Click **Replace all** to search for all condition-matching cells and replace them with the new desired value.

Importing user scan protocols

You can import scan protocols from a CD-R/DVD-R or a USB device.

The scan protocols that are displayed depend on your system licenses.

You can only import scan protocols that have been exported from an equivalent CT system having the same or an older software version.

1 Insert the medium on which the scan protocols are stored.

2 Copy the scan protocols data to the `H:\SiteData\ImportScanProtocols` folder via the **File Browser**.

3 Click the **Import user scan protocols** radio button on the step **1** page of the **Scan Protocol Assistant**.

4 Click the step **2** button.

The list of scan protocols to be imported is displayed.

5 Select the protocols you want to import.

6 Click the **Import** button to import the selected scan protocols.

The selected scan protocols are copied to the system and placed on the corresponding body region in the **Scan Protocol Assistant**.

7 Click the step **3** button.

The step **3 Confirmation** page is displayed.

8 Click the **Yes** button to make further changes.

– or –

Click the **End** button to finish the import.

Importing from teamplay Protocols

You can import scan protocols that are available from teamplay Protocols.

You are notified of new protocols:

- By the teamplay icon that is displayed in the status bar of the **Examination** task card.
- By a corresponding message at system startup.

1 Click the **Import from teamplay** radio button on the step **1** page of the **Scan Protocol Assistant**.

2 Click the step **2** button.

The protocols that are available for import are displayed on the corresponding body region.

3 Select the protocols you want to import.

4 Click the **Import** button.

The selected scan protocols are imported.

5 Click the step **3** button.

The step **3 Confirmation** page is displayed.

6 Click the **End** button to finish the import.

If the Scan Protocol Assistant detects incompatible protocols, these protocols are not imported.

A message informs you that they have been moved to the following folder:

`H:\SiteData\teamplay\ScanProtocols\NotImported`.

Exporting scan protocols

You can export scan protocols to the `H:\SiteData\ExportedScanProtocols` folder and use the **File Browser** to transfer them to the peripheral equipment.

1 Click the **Export scan protocols** radio button on the step **1** page.

2 Click the step **2** button.

3 Select a scan protocol or a group of scan protocols.

4 Click the step **3** button.

The list of scan protocols to be exported is displayed in the **Export overview** window.

5 Click the **Yes** button to confirm the export.

A message box is displayed to inform you that the scan protocols have been exported to the `H:\SiteData\ExportedScanProtocols` folder.

6 Click the **OK** button.

Step **4** page is displayed.

7 Click the **Yes** button to make further changes.

– or –

Click the **End** button.

Restoring scan protocols to Siemens default

You can restore the scan protocols that you have modified to the Siemens default.

1 Click the **Restore scan protocols to Siemens default** radio button on the step **1** page of the **Scan Protocol Assistant**.

2 Click the step **2** button.

The step **2** page is displayed, in which all modified scan protocols are listed according to body region.

3 Select **Adult** or **Child**

4 Select all the modified protocols that you want to restore to the Siemens default.

– or –

Activate the **Select all protocols** check box if you want to restore all protocols to the Siemens default.

– or –

Activate the **Select deleted Siemens scan protocols** check box if you want to restore all deleted Siemens scan protocols.

Replacing protocols

1 Select the modified scan protocols you want to restore to the Siemens default.

2 Select **Replace customized protocols with same name**.

3 Click the step **3** button.

All selected protocols are displayed.

4 Click the **Yes** button on the confirmation page to confirm the substitution.

All selected scan protocols are replaced with the Siemens default scan protocols. The changed protocols will be replaced.

If a scan protocol with the same name exists, new copies are numbered.

Confirming changes

On the **Confirmation** page, you confirm the changes.

- Click **Yes** to save the changes.

  If a password protection is activated in the Local Service configuration, the **Save Scan Protocol** dialog box opens. See (→ Page 347 *Activating a password protection*). Enter the configured password. Otherwise the scan protocol cannot be saved.

  The **Changes saved** dialog is displayed.

  – or –

  Click **Back** to go back.

Duplicating protocols

1 Select the scan protocols you want to duplicate.

2 Select **Add Siemens protocols as duplicates**.

3 Click the step **3** button.

All selected protocols are displayed.

4 Click the **Yes** button to confirm the duplication.

All modified scan protocols having the same name as original Siemens protocols are saved with the extension **Customized**.

The original Siemens protocols are copied to the corresponding body region folder.

You can activate the **Select all** checkbox to view all deleted and modified Siemens default scan protocols for the current body size.

Listing scan protocols

You can have all or the selected scan protocols listed in an overview window, and can also export a scan protocol list.

The displayed parameters of the list are set by the system.

1 Click the **List all protocols** icon in the lower left corner of the **Scan Protocol Assistant** to list all scan protocols.

– or –

Click the **List selected protocols** icon to list all currently selected scan protocols.

The **Scan protocol listing** dialog box is displayed.

2 Click the **Export** button to export the list.

The scan protocol list is exported to `H:\SiteData\protocols` for reuse in Microsoft Excel on an external computer.

You have to use the **File Browser** to transfer the XML file and the corresponding XSLT stylesheet to the peripheral equipment, for example, with a USB device.

Mapping *syngo*.via workflow

The *syngo*.via workflows are available if your CT system is configured for the connection to a *syngo*.via server and if the server is online. You can map the *syngo*.via workflows to scan protocols in the **Scan Protocol Assistant**.

1 Click the **syngo.via** radio button on the step **1** page of the **Scan Protocol Assistant**.

2 Click the step **2** button.

The step **2** - **Connect to syngo.via page** is displayed.

3 Select **Adult** or **Child**.

4 Select the check box of one or more scan protocols.

5 Click the step **3** button.

The list of scan protocols to be defined is displayed.

6 Double-click the **Workflow** entry in a cell of the grid and select a workflow from the selection list.

7 Select the check box of the required recon job.

8 Double-click the **Data role** entry in a cell of the grid and select a data role from the selection list.

9 Click the step **4** button.

The scan protocols with changes are listed.

10 Clear the **Apply** check boxes of the scan protocols in case you do not want to change them.

11 Click **Yes** to save the changes.

The step **5** - **Changes saved** page is displayed.

If a password protection is activated in the Local Service configuration, the **Save Scan Protocol** dialog box opens. See (→ Page 347 *Activating a password protection*). Enter the configured password. Otherwise, the scan protocol cannot be saved.

12 Click **Yes** to make further changes.

– or –

Click **End** to exit the **Scan Protocol Assistant**.

Defining contrast protocols

Using the Scan Protocol Assistant, you can select, copy, paste, add, remove and define contrast protocols.

Manipulating contrast protocols

1 Click the **Define contrast protocols** radio button on the step **1** page of the **Scan Protocol Assistant**.

2 Click the step **2** button.

The step **2** page is displayed.

3 Right-click the contrast protocol.

The context menu is displayed.

4 From the context menu, choose **Copy**, **Paste** or **Remove**.

The selected action is performed and the contrast protocol list is adapted accordingly.

The contrast protocols cannot be restored after being removed.

A contrast protocol can be linked to a scan protocol on the **Contrast** page under the **Change parameters** task. If the linked contrast protocol is removed, the parameter of the **Contrast protocol** on the contrast entry will be set to **Manual**.

5 Click the **Add new protocol** button to create a new contrast protocol if necessary.

The step **3** page is displayed.

The newly created contrast protocol initially only consists of a contrast phase and a saline phase.

Defining contrast protocols

1 Activate the checkbox of the required contrast protocol on the step **2** page.

2 Click the step **3** button.

The **Define contrast protocols** page is displayed.

3 Right-click on a phase in the parameter grid.

The context menu is displayed.

4 Select **Insert phase** or **Delete phase** if necessary.

It is impossible to insert more than 10 phases in a contrast protocol. The last remaining phase is not deletable.

5 Double-click the parameter entry you want to change in a cell of the grid.

6 Change the parameter in the cell.

– or –

Select the desired item from the selection list.

7 Click another parameter entry to confirm the changes.

The background of the modified parameters is displayed in different colors, depending on the status of the parameters:

- Green: Valid modified parameters
- Yellow: Invalid modified parameters
- White: Existing, not modified or saved parameters

These color rules only work for the selected protocols. After saving, the modified parameters change to having white as a background color.

8 Click the step **4** button.

All relevant information is displayed on the **Confirmation Page**, including names of modified protocols and relevant parameters, as well as old and new values of the modified parameters.

9 Deactivate the **Apply** checkboxes of the protocols in case you do not want to change them.

10 Click the **Yes** button to save the changes.

Step **5** is displayed.

If a password protection is activated in the Local Service configuration, the Save Scan Protocol dialog box opens. See (➔ Page 347 *Activating a password protection*). Enter the configured password. Otherwise, the scan protocol cannot be saved.

11 Click the **Yes** button to make further changes.

– or –

Click the **End** button to exit the **Scan Protocol Assistant**.

Listing/importing/exporting contrast protocols

You can list the contrast protocols, and import them from or export them to a CD-R/DVD-R or a USB device.

You can only import contrast protocols that have been exported from an equivalent CT system having the same or an older software version.

1 Click the **List/import/export contrast protocols** radio button on the step **1** page of the **Scan Protocol Assistant**.

2 Click the step **2** button.

The **Select contrast protocols** page is displayed with a list of the contrast protocols.

3 Select the desired contrast protocol from the list.

Now you can carry out the following operations for the selected contrast protocol, if a contrast license is available.

Listing contrast protocols

1 Click the **List all contrast protocols** button in the lower left corner of the **Scan Protocol Assistant** to list all contrast protocols.

– or –

Click the **List selected contrast protocols** button to list all selected contrast protocols.

A message box is displayed to inform you that the contrast protocols have been successfully exported.

2 Click the **OK** button to confirm.

The **Contrast protocol listing** dialog box is displayed.

The contrast protocol list is exported to `H:\SiteData\ContrastProtocols` for reuse in Microsoft Excel on an external computer.

You have to transfer the XML file and the corresponding XSLT stylesheet, for example, with a USB device.

Importing contrast protocols

You can import protocols from a CD-R/DVD-R or a USB device.

1 Insert the medium on which the contrast protocols are stored.

2 Copy the contrast protocols data to the `H:\SiteData\ImportContrastProtocols` folder via the **File Browser**.

3 Click the **Import contrast protocols** button in the lower left corner of the **Scan Protocol Assistant**.

The list of contrast protocols that can be imported is displayed.

4 Select the protocols you want to import.

5 Click the **Import** button.

The step **3** page is displayed to inform you that the selected contrast protocols have been successfully imported.

6 Click the step **4** button.

The step **4** page is displayed.

7 Click the **Yes** button to make further changes.

– or –

Click the **End** button to finish the import operation.

Exporting contrast protocols

1 Select the contrast protocol you want to export on the step **2** page.

2 Click the **Export selected contrast protocols** button in the lower left corner of the **Scan Protocol Assistant**.

3 Click the **Export** button to confirm the export.

A message box is displayed to inform you that the contrast protocols have been successfully exported to the `H:\SiteData\ExportedContrastProtocols` folder.

4 Click the **OK** button.

The step **4** page is displayed.

5 Click the **Yes** button to make further changes.

– or –

Click the **End** button.

Activating a password protection

You can activate a password protection to allow only authorized persons to save changes to a scan protocol.

By default, the password protection is deactivated.

1 In the main menu, choose **Options** > **Service** > **Local Service...** to open the **Local Service** configuration.

The **Authentication** window is displayed.

2 Delete all entries from the entry fields.

3 Click **OK**.

The **Service Software** window is displayed.

4 Click the **Configuration** button.

5 Select the **Application** option.

6 In the field **Scan Protocol Password**, enter a password.

7 Repeat the password in the line below.

8 Click **Save**.

The password protection is activated. When saving a scan protocol, you must enter the configured password.

Ending the Scan Protocol Assistant

In the **Changes saved** dialog box you have the following options:

- Click **Yes** to go back to the operation selection in step 1 to make further changes.

  – or –

  Click **End** to close the Scan Protocol Assistant.

6.3 Preparations

Before you can examine a patient with your system, register the patient. Registration means that you give your system all the information about a patient that it requires for an examination.

If a patient is admitted who is in a critical condition and must therefore be examined and treated immediately, call up emergency registration. It reduces the time before you can begin the examination to a minimum.

If you want to prepare the system to examine a patient at a later point in time, then you can preregister the patient.

For example, you can enter the data in the morning for all the patients to be examined during the day. When you want to begin an examination, simply call up this data via scheduler and edit it, if necessary. It saves time during the examinations.

On systems with gantry displays that cannot be configured using the **Configuration Panel**, the patient name is shown at the gantry display. If you do not want the patient name to be displayed, a service technician can modify the configuration.

If your system is linked to, licensed and registered for an HIS/RIS system (hospital and radiology information system), you can call up data for the patient to be examined.

When Security Package is activated, you can register a patient only if you are authorized to do so. InvokeRegistration is the privilege that allows you to open the registration form and perform registration.

If you are not familiar with the basic functionalities of the *syngo* software, refer to the (→ *Basic functionalities section*) in the *Basic applications* document.

6.3.1 Registering a Patient

Before you can examine a patient with your system, register the patient. You can do that in one of the following ways:

- Entering the new patient with all the patient data
- Selecting known patients from the database
- Using scheduler for preregistered patients or patients from HIS/RIS
- Registering an emergency patient

If a current examination is not completed, a corresponding dialog box is displayed.

CAUTION

The operating system may not support all characters for the received DICOM document!

The display of the name, for example, the patient name may be incomplete or misleading.

- *syngo* will not change the used characters, for example, minority characters, even if it cannot display them.
- Use other attributes for identification, if possible.

CAUTION

When working with several monitors, the patient name displayed in the folder of a task card belongs only to this task card. Any other visible task card may contain data from another patient!

Possible wrong diagnosis.

- Use patient demographics displayed in the image text for clear identification.

CAUTION

Automatic registration for compare layout is not sufficient!

Insufficient basis of diagnosis.

- Check registration and use manual registration functionality to re-adjust registration if automatic registration is not sufficient.

CAUTION

Wrong entry of patient sex or age!

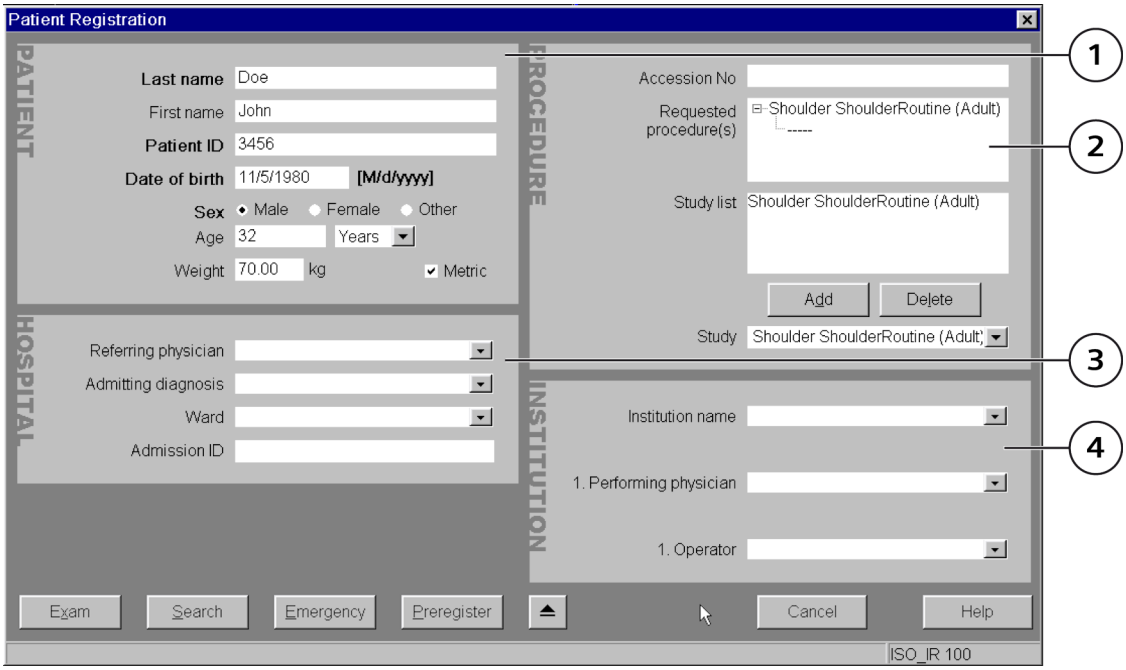
Wrong basis for diagnosis.

- Make sure that the patient sex and age are correct.

Registering a new patient

With the **Emergency** button in the **Patient Registration** dialog box, you can start emergency registration at any time.

1 Click the **Patient Registration** icon to open the **Patient Registration** dialog box.



(1) Personal data of the patient (PATIENT)

(2) Study-specific data (PROCEDURE)

(3) Referral data (HOSPITAL)

(4) Institution data (INSTITUTION)

2 Fill out at least the fields, which are displayed in boldface type.

3 Click the **Exam** button to examine the patient immediately.

– or –

Click the **Preregister** button.

The patient information is then saved for a later examination.

If you preregister a new patient (or there is a HIS/RIS), you only have to call up the patient data from the scheduler database when you perform the examination.

6.3.2 Calling up the Patient Model Dialog

You can define the examination data in the **Patient Model Dialog**.

The **Patient Model Dialog** is used for two tasks:

- To check and modify the characteristics of the current patient before scanning.
- To select a predefined scan protocol for the examination.

◆ Click the **Exam** button in the **Patient Registration** dialog box to call up the **Patient Model Dialog**.

– or –

To open the **Patient Model Dialog** manually, click the **Select or change exam** icon on the **Examination** task card.

Entering the patient examination data

The protocols are grouped by body regions. Further protocols are grouped in various categories: Dual Energy, Cardiac, Vascular, RT, Specials, or Private (depending on the available licenses).

Siemens default scan protocols provide an optimized set of parameters balancing image quality, scan time, and patient dose. They are defined to be applied directly to your examination after minor adaptions of, for example, the language of the Automatic Patient Instructions. Special clinical conditions and applications may require the adaption of the default recommendations. As the final diagnosis is the sole responsibility of the user, the user always has to make sure that the chosen scan protocol meets the requirements of the examination.

CAUTION

Wrong entry of patient position!

Wrong basis for diagnosis.

- Make sure that the patient position is correct.

CAUTION

Wrong labeling of the sides when the patient is repositioned!

Wrong basis for diagnosis and treatment.

- Correct the patient orientation when the patient is repositioned.
- Review the labeling of the sides, to avoid wrong operative intervention.

✓ If the local service established a configured *syngo*.via node on your CT system, the *syngo*.via icon as well as the **Workflow** field are displayed in the **Patient Model Dialog**.

1 Select the set of scan protocols by checking **Adult** or **Child**.

2 Select the desired scan protocol by moving the mouse cursor over the anatomical region you want to examine or to the non-anatomical regions on the right.

3 Select the protocol in the displayed selection list.

If a *syngo*.via workflow was defined for the selected scan protocol in the **Scan Protocol Assistant**, the defined workflow is displayed in the **Workflow** field of the **Patient Model Dialog**. To define a *syngo*.via workflow for a scan protocol, see (→ Page 342 *Mapping syngo.via workflow*).

4 Confirm the patient position.

5 Select **Replace** to replace the last unscanned entries of the chronicle.

– or –

Select **Append** to add the protocol.

6 Select **Keep** to add a topogram when appending or replacing a new protocol to the chronicle.

– or –

Select **Cut** if a topogram should not be added.

7 Select the API language.

8 Select if and how reference lines are applied to all tomogram recon jobs of the scan.

The corresponding orientation markers will be shown on the reconstructed images.

9 Confirm your entries with the **OK** button.

Changing the patient position

If it is necessary to change the patient's position either before the examination starts or during the examination, you must update the patient's examination data in the **Patient Model Dialog** as this is not done automatically by the CT system.

CAUTION

Wrong entry of patient position!

Wrong basis for diagnosis.

- Make sure that the patient position is correct.

CAUTION

Wrong labeling of the sides when the patient is repositioned!

Wrong basis for diagnosis and treatment.

- Correct the patient orientation when the patient is repositioned.
- Review the labeling of the sides, to avoid wrong operative intervention.

If you have already started the examination, proceed with step 1. If the **Patient Model Dialog** is still open, proceed with step 2.

1 Click the **Select or change exam** icon on the left-hand side of the chronicle.

The **Patient Model Dialog** dialog box opens.

2 Click the **Change patient position** icon.

The icons for the patient position are operable again.

3 Select the new patient position.

4 Click **OK** to confirm your changes.

The entry new position is displayed in the chronicle.

Appending or replacing a scan protocol

In the **Patient Model Dialog**, you can append or replace the current scan protocol with another scan protocol.

Modifications are only valid for the current examination. The predefined scan protocol will not be changed. Each scan protocol can contain up to 100 entries.

The **Append** and **Replace** radio buttons are only operable when at least one scan protocol has been loaded into the chronicle. The selected scan protocol will be added after, or instead of, the current protocol.

1 Click the **Select or change exam** icon to open the **Patient Model Dialog**.

2 Select the **Append** radio button to append the protocols.

– or –

Select the **Replace** radio button to replace the entries of the current scan protocol with the newly selected scan protocol.

The new protocol will be created. The not yet executed protocol steps will be deleted.

3 Click the respective body part of the displayed graphic or the buttons for the special scan protocol (for example, **Cardiac**, **Specials**, or **RT**).

A list of scan protocols is displayed.

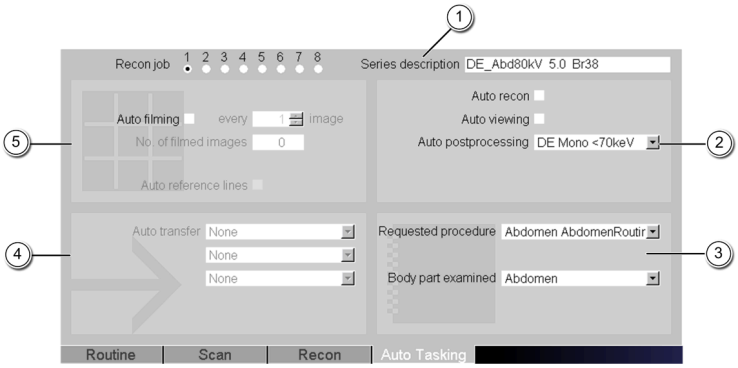
4 Mark the relevant name in the list of the scan protocols.

6.3.3 Using automatic functions

Your system provides several automatic functions for routine examinations:

- Automatic processing of consecutive acquisitions (**Auto Range**): Auto ranges are marked by brackets in the chronicle.
- Time-saving Real Time Display reconstruction of the images simultaneous with scanning (**RTD**)
- Automatic patient instruction system (API): This function is active if a patient instruction is selected on the **Scan** parameter card and the **API** icon is switched on.
- Automatic transferring of topograms and all images after reconstruction and automatic transferring of images and data to other applications for each Recon job (**Auto Tasking** parameter card)

You can make the following settings on the **Auto Tasking** parameter card.



(1) **Series description**

The length of the series description is limited to a maximum of 64 characters.

In case the range name contains an asterisk, equals sign, backslash or caret, the symbols are replaced by blanks in the series description.

(2) Postprocessing functions

(→ Page 357 *Postprocessing parameters*)

(3) Documentation parameters

(→ Page 359 *Documentation parameters*)

(4) Auto transfer parameters

(→ Page 359 *Transfer parameters*)

(5) Filming parameters

(→ Page 360 *Filming parameters*)

Postprocessing parameters

Parameter	Meaning
Auto recon	If the recon job was not processed during scanning, it will be started automatically when the single scan entry or the last scan entry of the autorange is finished.
Auto viewing	Images are automatically loaded to the **Viewing** task card.

Parameter	Meaning
Auto postprocessing	Specifies the postprocessing function for the selected recon job. The selected function is applied to all resulting image series of the recon job and is executed when all series are finished. The available entries depend on the scan mode and the active licenses. The entries are grouped according to their purpose: • Entry for applying no postprocessing function: **None**. • Entries for selecting the image type of the series that will be automatically transferred to the **3D** task card: – **MPR** – **MPR Range** – **MIP Thin** – **MIP Thin Range** • Entries for selecting the postprocessing application to which the image series will be transferred. • Entries for selecting the postprocessing function for respiratory gating scans: – **t-MaxIP** – **t-MinIP** (➔ Page 480 *Generating t-MaxIP or t-MinIP series*)

Parameter	Meaning
	• Entries for selecting a FAST DE Results Dual Energy processing algorithm: – **DE Mono** <Voltage> **keV** – **DE Mono <** <Voltage> **keV** – **DE Mono >** <Voltage> **keV** – **DE Mixed** – **DE Iodine*** – **DE Iodine + VNC*** – **DE Optimum Contrast*** – **DE Rho/Z** * Not available for Dual Spiral Dual Energy reconstructions. (➔ Page 361 *Automatic postprocessing of Dual Energy images*)
Auto Tasking DE series	For Dual Energy scans, up to three series can be reconstructed. By selecting an item from this series list, you can define which series is used for the auto tasking. This selection has no impact on FAST DE Results.

Documentation parameters

Parameter	Meaning
Requested Procedure	Defines the type of MPPS associated to the series.
Body part examined	You can assign the organ or body region to the image series that was scanned. • Select the organ or body region from the selection list. • To enter a new list element, select **New entry**.

Transfer parameters

If your local service established FastTransfer nodes (*syngo*.via or MM WP), you can select one of these nodes in the **Auto transfer** area. The data transfer is performed for this node via FastTransfer. If the transfer is failing, DICOM transfer is used automatically instead.

If you select a configured *syngo*.via node from the **Auto transfer** selection list, the corresponding **Workflow** and **Data role** defined in the **Scan Protocol Assistant** will be displayed on the parameter card. (➔ Page 342 *Mapping syngo.via workflow*)

Parameter	Meaning
Auto transfer	Destinations to which the images are sent. You can send the images to up to three destinations. **None** means that images are not sent. If your local service established a FastTransfer *syngo*.via node, you can select the configured *syngo*.via node from the **Auto transfer** selection list. The corresponding Workflow and Data role defined in the Scan Protocol Assistant **Mapping syngo.via workflow** will be displayed on the **Auto Tasking** parameter card. (➔ Page 342 *Mapping syngo.via workflow*)

Filming parameters

Parameter	Meaning
Auto filming	Activates automatic filming. Reconstructed images are automatically transferred to the virtual film sheet (**Filming** task card). Auto filming parameters are set individually for each recon job on the **Auto Tasking** parameter card. When **Auto filming** is selected, each new series is automatically transferred to the Virtual Film Sheet. The images of a patient are collected in a film job. • RTD images are never automatically filmed. • Images of cancelled recon jobs are transferred to the **Filming** task card when you close the patient. To expand workflow automation, additional features are provided in the configuration, for example, automatic exposure of film jobs or the automatic filming of a patient protocol.
every ... image	Defines whether every n-th image or all images (n=1) of this recon job are to be transferred to the **Filming** task card.
No. of filmed images	Shows the number of images to be filmed.

Parameter	Meaning
Auto reference lines	Creates reference lines for topograms or reference images. If the **Auto reference lines** mode is switched on in the **Patient Model Dialog**, the corresponding item is checked automatically for the first recon job of each scan range, independent of study or series level. All reference lines for one study will be displayed on one topogram or each series will be displayed on one topogram.

Automatic postprocessing of Dual Energy images

FAST DE Results calculates Dual Energy images immediately after the two required reconstructions have finished. If configured, the generated Dual Energy images are sent to another DICOM node, for example, PACS.

Observe the following recommendations to achieve the best image quality with FAST DE Results:

- The slice thickness of the reconstructed input images should not exceed 2 mm.
- The slice increment of the reconstructed input images should not exceed 1.5 mm.

For each reconstruction job, you can assign one Dual Energy processing algorithm. A Dual Energy algorithm is named with the common prefix **DE**.

1 Open the **Auto Tasking** parameter card.

2 From the **Auto postprocessing** selection list, select a Dual Energy processing algorithm.

When a reconstruction is finished, up to three series per processing algorithm are calculated. Automatic archiving of these series is possible when auto transfer is configured, regardless of the series that are set in the **Auto Tasking DE series** selection list.

Automatic archiving of these series is possible when a transfer rule is configured in the **Transfer Configuration** dialog.

The configured transfer rule is applied to all series that are generated with **Auto Postprocessing**. This is independent from the auto-transfer rules that are configured for the original low and high energy images in the **Auto Tasking** parameter card.
(→ Page 357 *Postprocessing parameters*)

Check the status bar at the bottom of the task card for messages.
(→ Page 363 *Resolving FAST DE Results issues*)

The **DE LungPBV** processing algorithm is not available for automatic postprocessing of TwinBeam Dual Energy scans with FAST DE Results.

In Single Source Dual Energy scans, FAST DE Results starts an image registration between both volumes. The image registration is intended to correct motion artifacts. Verify that the image registration is correct by looking for remaining artifacts, for example, suspicious dark or bright rims of bones or air in areas of motion.

Series descriptions

For series descriptions of FAST DE Results series, the following suffixes are added:

- For the selected Dual Energy processing algorithm: <Filter name>, for example, **Mono40**
- For the series numbers of both of the two original reconstructions: **_S**<series number of the first series>**_S**<series number of the second series>**_1**

The series description may be, for example, **TB_Abdomen 5.0 D30f Mono40_S2_S3_1**.

Image comments

In the image comment area of the result images, the following information is displayed:

- For all FAST DE Results images: **Automatic Results**
- For DE Monoenergetic processing algorithms: **DE Monoenergetic E=**<Voltage> **keV**

- For the DE Optimum Contrast processing algorithm: **DE Blended c=**<Blending Center slider value>**, w=**<Blending Width slider value>
- For the DE Mixed processing algorithm: **DE Mixed w=**<Mixing ratio>
- For the DE LungPBV processing algorithm: **DE LungPBV**
- For the DE Iodine processing algorithm: **DE Iodine**
- For the DE VNC processing algorithm: **DE VNC**
- For DE Iodine+VNC processing algorithm, two series are calculated with different image comments: **DE Iodine** and **DE VNC**
- For DE Iodine processing with enabled **Organ Contour Enhancement** (Dual Energy algorithm **Virtual Unenhanced** in **FAST DE Results Configuration**): **DE Iodine CE**
- For the **DE Rho/Z** processing algorithm two series are calculated with different image comments: **DE Rho** for electron density and **DE Z** for effective atomic number.

The Dual Energy processing algorithm parameters can be configured in the **FAST DE Results Configuration** dialog box.

The progress of the FAST DE Results algorithm is displayed in the **Examination Job Status** window.

Resolving FAST DE Results issues

Issues that occur during **FAST DE Results** postprocessing are displayed in the status bar at the bottom of the task card.

◆ Follow the instructions below for each message.

FAST DE Results failed: Insufficient memory.

◆ Create a reconstruction job with fewer images.

◆ Close an application and start a new reconstruction.

FAST DE Results failed: Different number of images at lowkV or high kV.

- Start a new reconstruction.
- In the **Begin position** and **End position** fields, check the positions of the first and the last image to be reconstructed in low kV and high kV reconstructions. To get the same number of recon images, the begin positions and the end positions must be identical.

6.4 Positioning the patient

This section gives you information about positioning the patient.

We start with important information about positioning. Then, you learn how to position the patient correctly.

After that, the use of accessories for positioning in various examinations is discussed.

The CT images shown in this section are only examples.

6.4.1 Important safety information

Safety stop function of the patient table

The patient table is equipped with a safety stop function. The patient table stops when malfunctions occur.

- If the patient table is not movable anymore, call Siemens Customer Service.

Positioning aids

To avoid danger of injuring the patient during table movements, only positioning accessories released by Siemens should be used. In this way also artifacts can be avoided which degrade the image quality. (→ Page 75 *Accessories*)

CAUTION

Use of non-original positioning aids!

Injury to the patient through collisions with the gantry. Image quality may also decrease.

- Use only positioning aids that are mentioned in the Instructions for Use.

- Replace damaged or worn positioning accessories, especially if mechanical strength is in question.

Radiotranslucency

Positioning aids that are used in the region of interest must be made of special radiotranslucent material. They are shaped in such a way that they do not cause image artifacts affecting the examination results.

- Nevertheless, use the positioning aids in such a way that they do not protrude into the slice plane, if possible.

Cleanliness

- Remove all impurities, especially residual contrast medium, as quickly as possible. (→ Page 562 *Cleaning and disinfecting*)

Artifacts

Various influences can cause a distorted image. (→ Page 116 *Image artifacts*)

When positioning the patient, please ensure that the object of interest is as near to the center of the measuring field as possible. If it is not, image artifacts may appear on subsequent reconstructions, such as MPR, 3D etc..

- Follow the operating instructions and safety information to avoid repetition of scans and , therefore, additional radiation exposure to the patient.
- Reconstruct an overview image if streaky artifacts impair the image quality. Use a larger window.

  This makes it easier to find the causes of the streaks and to avoid them (e.g., residual contrast medium, hair clips etc.).

Examination limits

The black lines on the table top mark the limits of the examination region.

- If necessary, reposition the patient.

Patient information

You must inform the patient about all the necessary facts of the examination which you are about to perform.

Patient comfort

The patient should be positioned comfortably in an anatomically correct position in the middle of the table top.

- Use positioning aids, if necessary.

This makes it easier for the patient to rest calmly during the examination.

Avoid delays

- Prepare the patient for the examination.
- Place the contrast medium within reach before the examination is started.

In this way, you avoid delays.

Correct respiration

The patient must hold his or her breath during CT acquisitions. This especially applies to examinations of the thorax and abdomen, of course. However, the slight movement that respiration inevitably causes, can also lead to artifacts in other regions.

- Explain to the patient before the examination how he or she should breathe.
- Explain to the patient that he or she must hold his or her breath for a relatively long time.
- Use the intercom system to give the patient breathing instructions.

Patient weight

Patients weighing up to 227 kg (500 lbs) can be examined without any restriction.

- Be especially careful when positioning heavy patients on the table.
- Before you start the examination convince yourself that the patient is not endangered by the movement of the table.

Problematic patients

Special caution is required with obese, unconscious, apathetic, unresponsive or pediatric patients.

6.4.2 Preparing the patient table

Before you can position the patient onto the patient table, prepare the patient table, position a mattress, and attach positioning aids, if necessary.

CAUTION

Lowering the patient table!

Body parts can get caught.

- Make sure that the patients body parts are above the patient table.
- Make sure that neither body parts of anybody nor any objects are below the patient table.

1 Lower the patient table until the patient can easily sit down or be placed on it.

The positioning mattress must be correctly secured.

We recommend covering the mattress with paper, for example with HOSTESS paper cloths no. 75312 (Length 50 m, width 60 cm, perforation every 28 cm).

2 Use any positioning accessories which might be necessary.
(→ Page 364 *Positioning the patient*)

Positioning the mattress

This section describes the accessories for positioning a mattress and the available mattresses.

Fixing the mattress with spill protection

The mattress with spill protection must be fixed to the patient table.

- When positioning the mattress with spill protection, use Velcro to fix the mattress to the table.

The mattress is now fixed to the table and cannot move.

Connecting the equipotential bonding cable

Connect the equipotential bonding cable to ensure the potential equalization of the mattress with other medical devices.

1 Connect the equipotential bonding cable to the equipotential bonding connector pin at the backside of the mattress with spill protection.

2 Connect the equipotential bonding cable to the potential equalization conductor at the Physiological Measurement Module.

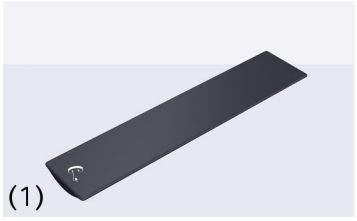
When the equipotential bonding cable is connected, the equipotential bonding connector pin is covered by the mattress and only the cable is still visible.

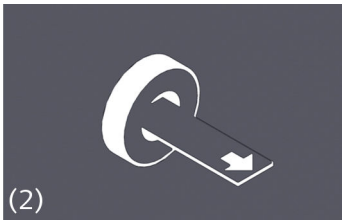
Using the mattress with flat surface

The mattress with flat surface is used with concave table tops.

Positioning the mattress with flat surface

The mattress with flat surface is used with concave table tops.





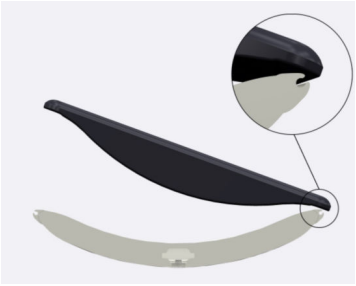
(1) Mattress with flat surface

(2) Logo indicating the foot end

When positioning the mattress with flat surface on the patient table, do the following:

1 Remove the supported mattress from the table top.

2 Position the side of the mattress with flat surface with the logo on the table top side furthest away from the gantry.



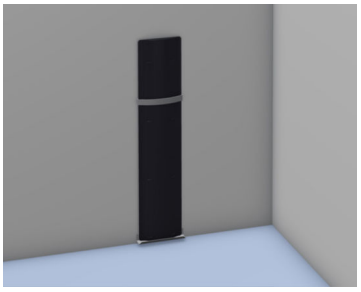
3 Apply the side edge of the mattress with flat surface over the side edge of the table top.

4 Press the mattress with flat surface onto the Velcro straps fixing points.

Please make sure that the Velcro straps of the mattress with flat surface are attached on the table top.

Storing the mattress with flat surface

You can store the mattress with flat surface in the wall holder.



- Place the mattress with flat surface in the storage holder vertically, and fix it with the Velcro straps in such a way that the mattress lays flat against the wall.

Please observe the manufacturer's notes in the attached assembly instructions.

Positioning the arm supports

The arm supports are placed under the patient and fixed by the patient's weight. The arm supports should be positioned outside the scan area, if possible.

CAUTION

Use of the mattress with flat surface!

Contusion of patient's fingers during table movement.

- Always use both arm supports with the mattress with flat surface.
- Observe that the hands of the patient are completely covered by the arm support.
- Always fix and observe the patient during table movement.

✓ The patient is correctly positioned.

1 Slightly lift the patient at the level of his or her arms.

2 Push the first arm support with its flat side into the space between patient and table.

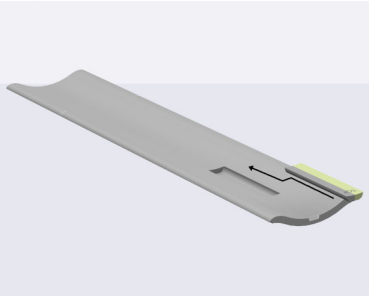
3 Position the arm support in a way that the patient's arm lies tight and comfortable against his or her body.

4 Ensure that the patient's hand is completely covered by the arm support.

5 Proceed to position the second arm support on the other side of the patient's body similarly.

After finishing the examination, the arm supports must be removed before the patient gets up from the table.

Using the Osteo positioning mattress



- Position the reference phantom in the cut out of the Osteo positioning mattress.

Position the reference phantom in such a way that the marking “TOP” points up toward the gantry.

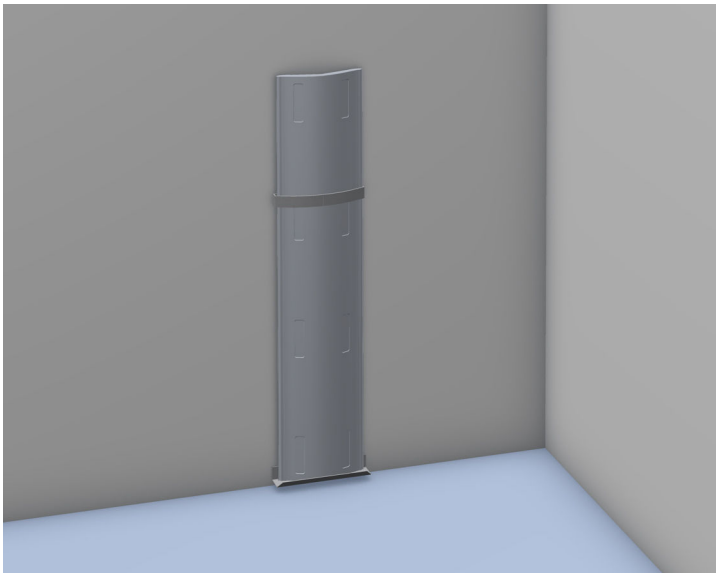
Inserting the gel pack

Normally, there is a space between the spine of the patient and the reference phantom. This falsifies the evaluation.

- Use the gel pack to fill the space.

Storing the Osteo positioning mattress

With the Velcro strap supplied you can hang the Osteo postioning mattress on the wall when not in use.



1 Attach the self-adhesive Velcro strap vertically to the wall in a suitable location in the examination room.

2 To store, press the fluffy reverse side of the mattress onto the Velcro strap.

Using positioning aids

The following positioning aids are mounted in the same way at the head end of the patient table:

- Head holder
- Head-arm rest
- Tiltable head holder
- Table top extension

CAUTION

If a head holder or support does not engage securely, it can come loose!

Injury to the patient.

- Make sure that the pluggable positioning aids are seated firmly and securely engaged in the receptacle at the end of the table top.

CAUTION

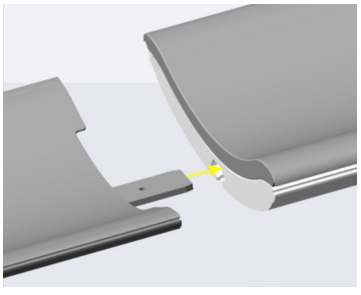
Tiltable head holder not correctly locked in place!

Undesired radiation exposure due to repetition of the scan.

- Always make sure that the tiltable head holder is correctly locked in place.

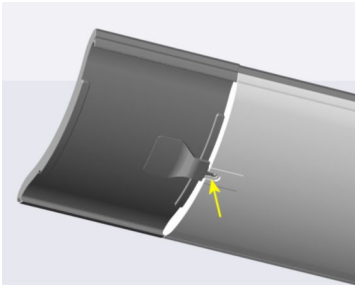
To avoid injuries, the safety information concerning the tiltable head holder must be observed. (➔ Page 82 *Tiltable head holder*)

Attaching a positioning aid



- Push the holding bracket into the receptacle at the head end of the table.

Removing a positioning aid



- Press the release button from below and pull the positioning aid out of the receptacle.

6.4.3 Preparing the patient

This section describes how to prepare the patient for an examination and how to position the patient on the patient table. In addition, the use of accessories for positioning in various examinations is discussed.

CAUTION

Incorrect patient positioning!

Injury to the patient by moving parts.

- Make sure that neither the patient's clothing nor hair can get caught in mechanical parts.
- Make sure that infusion lines and respiration tubes, catheters and ECG cables cannot get caught in the space between the table top and the side parts. These components must not be put under tensile stress in any other way.
- Make sure that patient bedding cannot get caught by moving parts of the patient table.
- Use positioning aids as described.

1 Make sure that there is no metal in the scanning area. Jewelry, glasses, and prostheses, for example, must be removed from the body region to be examined.

2 Use any suitable positioning aid which might be necessary (for example, cushions) to position the patient safely and comfortably.

It is only possible to scan the region of the body that is inside the range marked on the table top.

Immobilizing the patient

If necessary, immobilize the patient with one or more restraint straps, such that the patient is centered on the table with the extremities secured.

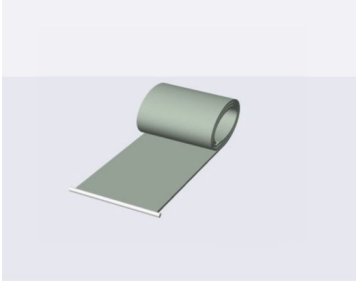
CAUTION

The restraint straps are not permanently attached to the table!

They cannot prevent the patient from falling off the table.

Patients who do not keep still may fall off the table.

- Take special care with those patients.



1 Insert the straps in the slots at the sides of the patient table.

2 Position the straps by overlapping them across the patient and secure them with the Velcro strip.

Using the flaps and the restraint straps

✓ The patient is positioned on a mattress with spill protection.

- Close the flaps around the patient's body. If necessary, fix the flaps with one or more restraint straps.

The flaps are now protecting the table against body fluids.

The restraint straps are used to secure the flaps around the patient's body. They are not used to prevent the patient from falling off the table.

CAUTION

Improper use of positioning aids!

Injury to the patient or damage to the system are possible.

- Use the positioning aids exclusively for their original purpose.

CAUTION

Unintentional patient movement!

Contusion of patient extremities at patient table and gantry.

- Always fix and observe the patient during system movements.

Applying infusion tubes

CAUTION

Use of short infusion tubes!

Tensile stress on infusion tubes when moving the table top. Tubes can get caught.

- Only use infusion tubes that are long enough.

- Make quite sure that tubes cannot get caught anywhere.

6.4.4 Moving the patient to the scan start position

In this section you will find out how to move the patient on the patient table to the topo scan position.

Setting the table height

CAUTION

Lowering the patient table!

Body parts can get caught.

- Make sure that the patients body parts are above the patient table.
- Make sure that neither body parts of anybody nor any objects are below the patient table.

- Use the gantry operator panel keys to set the table height such that the region of interest is in the center of the scan field.

(→ Page 239 *Moving the table top vertically*)

You can achieve optimum image quality if the center of the measuring object coincides with the light beam of the lateral light marker. The light marker marks the center of the measuring field.

Setting the gantry tilt

- Set the gantry vertical for a topogram.

  – or –

  Tilt the gantry for examinations of the skull or the spine, if necessary.

Moving toward the gantry

- Move the table top with the patient toward the gantry.

You can use the **A** and **B** keys to move the patient table to predefined positions.

Moving the patient into the scan plane

- Press the **Offset** key until the table movement stops.

  The table top position previously marked with the laser light marker is in the scan plane.

Using the laser light marker

CAUTION

Looking into laser beam with optical instruments!

Loss of sight possible.

- Do not look directly into the laser beam.

CAUTION

Laser radiation!

Possible loss of eyesight due to laser radiation.

- Do not look directly into the laser beam or at its reflection on smooth, mirror-like surfaces during adjustment.

The patient must not wear glasses or contact lenses.

1 Instruct the patient not to look directly into the laser beam.

2 Switch on the light marker.

3 Adjust the longitudinal position of the table using the keys for horizontal table movement.

The starting point for scanning is now marked by the offset light marker.

4 Adjust the height of the patient table using the keys for vertical table movement.

The vertical light marker indicates that the examination region is in the center of the scan field.

The light markers coincide with the scanning plane.

5 Switch the light marker off.

The patient must lie still from now on.

Setting the table position to zero

- Press the **Zeroing** key.

  This will set the starting point of the topogram to zero.

Zeroing is only possible between patient registration and the start of the very first scan.

Checking the patient position

CAUTION

Wrong labeling of the sides when the patient is repositioned!

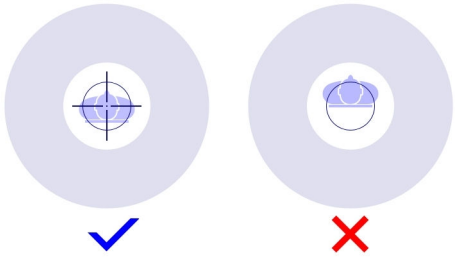
Wrong basis for diagnosis and treatment.

- Correct the patient orientation when the patient is repositioned.
- Review the labeling of the sides, to avoid wrong operative intervention.

- Check whether the position and orientation of the patient were correctly entered when the patient data were entered.

Centering the patient

1 For optimum image quality and dose application to patient size and body shape with CARE Dose4D, position the patient in the isocenter of the gantry.



2 Double-check and verify the position of the patient with the laser light marker as well as in the topogram.

If the patient is positioned too high, the mAs for the subsequent scan is increased.

If the patient is positioned too low, the mAs for the subsequent scan is reduced and the images show increased noise.

For head scans with **Auto Isocenter**, you may be prompted to raise or lower the patient table. This has no impact on the dose modulation with CARE Dose4D.

Checking patient safety

CAUTION

Unobserved movement of the patient table or gantry!

Collision of the patient with the gantry.

- Monitor the patient continuously as long as the table top and gantry are moving.
- Take special care with the tilt of the gantry other than 0 degree or a table height other than the isocenter for the patient.

1 Before starting the examination, make sure that table top movement toward the gantry opening is not obstructed.

2 Ensure that the patient cannot be injured by a movement of the table.

Always observe agitated and unresponsive patients all the time during the examination.

6.4.5 Stopping system movements and radiation

In case of an emergency, all system movements and radiation can be interrupted by pressing the **STOP** or **EMERGENCY OFF** key.

1 Make sure that you know where the **STOP** keys and **EMERGENCY OFF** key are located. (➔ Page 38 *Terminating system movements and radiation*) (➔ Page 39 *Shutdown in case of emergency*)

You find **STOP** keys at the gantry and on the control box.

2 Always observe the patient directly. In critical situations press the nearest **STOP** key.

All system movements are stopped immediately. Radiation is shut down. (➔ Page 38 *Terminating system movements and radiation*)

3 Press an **EMERGENCY OFF** if the system does not respond to the **STOP** keys in any hazardous situation.

The **EMERGENCY OFF** key interrupts the power supply of the system. Data can be lost.

6.5 Positioning animal patients

The SOMATOM CT system can be used for both animal and human patients. Besides those restrictions implied by technical specifications of the SOMATOM CT system (for example, aperture of the gantry), there are no additional restrictions when using the system for animal patients.

The technical specifications for the SOMATOM CT system equipment are given in: *System Owner Manual*. For more information on the relevant safety measures, refer to: (➔ Page 33 *Safety information*).

United States federal law restricts this device to sale by or on the order of a physician or veterinarian (21 CFR 801.109(b)(1)).

Veterinary use does not cover laboratory or other primary scientific animal use.

CAUTION

Not observing the Instructions for Use of the system, system options and accessories!

Injury to the patient.

- Always use the Instructions for Use in conjunction with the Instructions for Use of the particular units used.
- Follow the safety instructions.

CAUTION

Body fluid (blood, urine etc.) comes into contact with electrical components!

Possibility of electrical shock.

- Always make sure that the animal cannot lose uncontrolled body fluid during scanning, for example by using catheters or diapers.

CAUTION

Using an animal protocol for scanning a human!

Injury to the human or radiation damage.

- The scan protocols must be uniquely assigned as animal protocols.
- Do not use animal protocols for humans.

6.5.1 Immobilizing animal patients

Sedate or anesthetize

Veterinary use of the SOMATOM CT system requires that you sedate or anesthetize the animal patient before scanning. This is done to prevent injury to the animal patient or attending personnel, damage to the equipment, or misdiagnosis due to movement of the animal patient during scanning.

CAUTION

The animal is not immobilized!

Contusion, fractures of the operator, personnel or attendant. Damage to the equipment.

- Always anesthetize or sedate the animal before scanning.
- Keep the number of persons in the examination room as low as possible.

CAUTION

The animal is not immobilized!

Wrong diagnosis due to wrong image information.

- Always anesthetize or sedate the animal before scanning.

Movement during scanning

If the effect of the sedation or anesthetization weakens during scanning, uncontrolled movements of the animal patient could also result in injury or misdiagnosis. Therefore the animal patient needs to be observed at all times.

CAUTION

Unintentional patient movement!

Injury to the patient.

- Always fix and observe the patient during the measurement.

CAUTION

Uncontrolled system movements and unintended radiation exposure!

Injury to the patient and personnel, and radiation damage.

- Always verify that the patient is correctly positioned.
- Always observe the patient during system movements.
- Press a **STOP** key in any of the following situations:
  - The patient is not positioned correctly during system movements
  - At any unintentional system movement (especially at autorange)
  - The patient table moves in a wrong direction
  - The patient table does not stop as expected
  - A key sticks or a movement does not stop immediately when a key is released
  - The **HOLD** key does not respond during a scan
- Press an **EMERGENCY OFF** key if the system does not respond to the STOP keys in any hazardous situation.
- Shut down the system immediately if system malfunctions are detected and notify the Siemens Customer Service.

6.6 Scan

When examining a patient, you have to perform the following workflow steps:

- Scan a topogram
- Plan scan and reconstruction jobs
- Scan a tomogram

syngo offers many ways of optimizing the dose applied to a patient. For more information, see (➔ Page 249 *Dose management and optimization*).

If you change any values via keyboard, it is necessary that you confirm them by pressing the **Enter** key afterwards.

In the chronicle. you may see a delay which is inserted between the scan ranges. The delays are automatically added to keep the X-ray tube from overheating. If the actual tube temperature after a scan is lower than that anticipated, the system will remove the delay before the next scan. This can occur, for example, because of a pause in between.

If you are not familiar with the basic functionalities of the *syngo* software, refer to the (➔ *Basic functionalities section*) in the *Basic applications* document.

CAUTION

Scanning patients with implanted devices such as pacemakers or neuro stimulators!

Interferences may cause malfunctions of the implanted device.

- ◆ Observe the patient closely during examination.

CAUTION

Native Windows configuration dialog box does not disappear while radiation is started. The dialog box remains visible, as it is a dialog box displayed by "Windows" and not a *syngo* dialog box!

This may cause confusion.

- Avoid opening this dialog box while radiation can be applied. The computer and the *syngo* system should never be configured during an acquisition.

CAUTION

Superimposition by subfunctions, for example, SOMATOM life!

Scan parameters are superimposed. Dose not as desired.

- Close subfunctions before scan start.

6.6.1 Monitoring patients

As long as the table or scanning unit is moving during scanning, the patient must always be visible and the intercom system must be switched on to hear the patient.

Special care is required if contrast medium is injected intravenously during an examination with table feed (for example, spiral scans).

CAUTION

Patient intercom system nonfunctional!

Patient cannot be understood in case of an emergency.

- Leave the intercom system switched on during the examination (**Listen to patient** key).
- Keep eye contact with the patient when talking or listening to him or her.

✓ The patient is informed to speak loudly during the communication process.

1 At the control box, press the center of the **Listen to patient** key to turn on the listening connection.

The icon on the **Listen to patient** key is backlit. You can hear the patient talking.

2 Press **+** and **-** in the upper and lower edges of the key to adjust the volume of the gantry loudspeaker.

3 Press the **Listen to patient** key again to cut off the listening connection.

6.6.2 Talking to the patient

With the intercom system, you can talk to the patient or play back several permanently stored patient instructions. It is also possible to record two additional announcements with a maximum length of 30 seconds each.

1 Press the center of the **Talk to patient** key and keep it pressed while talking into the microphone.

2 Press **+** and **-** in the upper and lower edges of the key to adjust the loudspeaker volume.

3 Release the **Talk to patient** key to cut off the connection.

When talking to the patient, a distance of approximately 30 to 40 cm (10 to 15 in) to the microphone of the control box is recommended. If there is a high noise level the distance should be 20 to 30 cm (8 to 10 in.).

When recording a patient instruction, a distance of approximately 20 to 30 cm (8 to 10 in) to the microphone of the control box is recommended.

6.6.3 Acquiring a Topogram

A topogram is used as follows:

- To plan the scan and recon ranges
- To watch the progress of an active tomogram scan
- To document the reconstructed slices with reference lines

Checking the topogram parameters

1 Select the topogram step of your scan protocol in the chronicle.

2 Check the topogram parameters set on the **Routine** parameter card.

If necessary, you can correct the topogram length.

3 In the **Topogram length** field, enter the required length of the topogram range.

If necessary, you can correct the tube position.

4 Click the relevant button:

- **Top**: Radiation top down; tube is in top position
- **Bottom**: Radiation bottom up
- **Lateral**: Radiation from the side of the gantry

If the topogram cannot be scanned in full length because of the current table position, a message pops up in the status bar. A shortened topogram will then be scanned and reconstructed.

Topogram scan sequences for Auto reference line usage

For best results when using the **Auto reference lines** function, consider the following recommendations.

When scanning several topograms for separate body areas, observe the following sequence: After scanning the topogram for a specifc body area, scan the tomogram for the same body area. Repeat this sequence for each body area to be examined.

When scanning at tilted gantry a top or bottom topogram and a lateral topogram that are to be used for the same body area, scan the top or the bottom topogram first. The reference lines will be placed on the lateral topogram.

Starting the topogram scan

If you have a scan room door observation, a yellow message bubble is displayed after you have loaded the scan protocol, and the door of the examination room is not closed.

When gantry tilt is not zero the message bubble **Press move to tilt** appears. You have to press **Move** or use the control panel to set the tilt to zero.

A transparent blue shutter is displayed on the topogram, which indicates the available FoV. It is shown when the corresponding tomogram scan entry is selected.

The area where image quality prevails is inside the blue shutter, and needs to be kept in mind for patient positioning:

- Head: The blue shutter in the resulting topogram indicates the part that cannot be reconstructed.

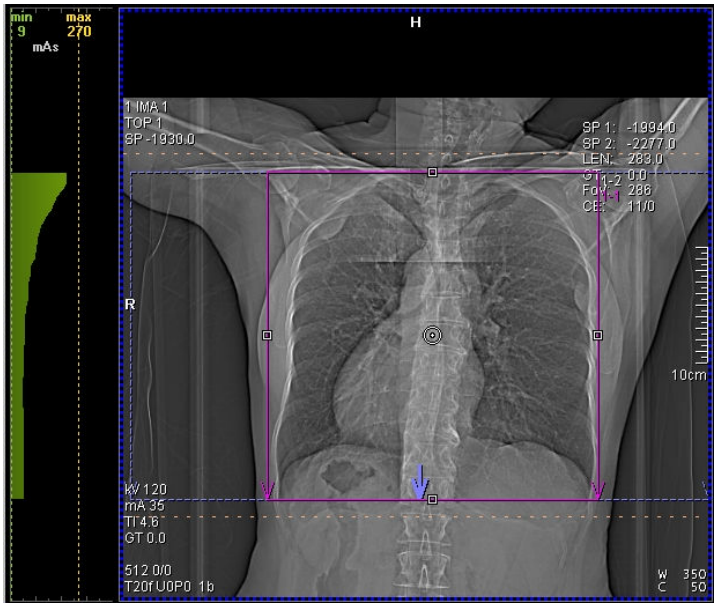
To achieve the required images, it is necessary to position the patient correctly.

1 When positioning the patient, zero the table position at the gantry or on the topogram **Routine** parameter card in a way that future table positions always refer to this position.

2 Click the **Load** button to confirm the scan parameters.

3 Press the **START** key on the control box.

The topogram and the **CARE Profile** are displayed in the upper left segment of the **Examination** task card.



The **CARE Profile** shows the distribution of the dose to be applied along the z-axis of the patient for the selected scan range.

In the topogram, two dashed orange lines are displayed. These lines delimitate the area in which the patient may be exposed to radiation for the tomogram scan.

The topogram is displayed in real time. You can stop the scan with the **Suspend** button as soon as enough data is acquired.

4 On the **Routine** parameter card, adjust the table position stepwise, if necessary.

You have to pay special attention while moving the patient table to avoid any risk of injury to the patient.

6.6.4 Planning an Examination

There are many possibilities to optimize the dose applied to a patient. For more information, see (➔ Page 249 *Dose management and optimization*).

There are two recon and scan planning modes, one for spirals and one for the other scan modes.

CAUTION

Wrong start delay!

X-ray not, or only partially, usable.

- For acquisition with contrast medium, select the flooding time of the contrast medium as the delay.

CAUTION

Misunderstanding of reference point for start delay in bolus examination!

Faulty synchronization between bolus and scanning.

- Make sure that the chosen delay time fits to the characteristics of the bolus injection.

CAUTION

Artifacts affecting the diagnosis are evident or suspected in a patient image, or the patient may have moved during scanning!

Improper diagnosis possible.

- Scanning must, under all circumstances, be repeated with a slight shift in patient position.

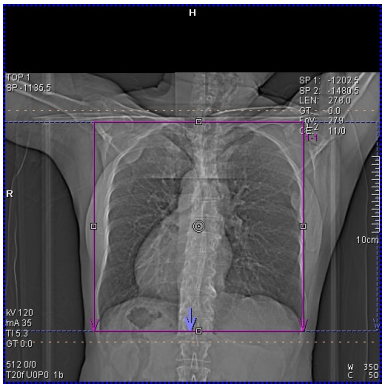
Using recon planning for spirals

You can plan and store different scan and reconstruction ranges for spiral examination directly after scanning the topogram, before scanning the tomogram.

After scanning the topogram, the recon planning is active whenever a recon job is selected. The recon range frame in the topo segment is displayed in magenta.

Recon planning before scanning allows you to do the following procedures:

- Plan and scan adjoining, overlapping recon ranges, and recon ranges with gaps in-between
- Predefine adjoining recon ranges, in one scan, for example, thorax and abdomen



The ranges are indicated as follows:

- Scan range in blue, blue dotted during recon planning
- Recon range in magenta

1 Use the dog-ear to select another image in the tomo segment to set the recon target (if the range has already been scanned).

2 To display the recon target, scale down the tomogram image with the zoom function first.

– or –

Click the **Overview** button on the **Recon** parameter card. An overview image covering the maximum FoV is reconstructed and displayed.

Detecting regions

FAST Planning positions the recon range and the scan range on regions specified in the scan protocol. After acquiring a topogram, you can detect further regions.

1 Select the **Recon** parameter card.

2 From the **Recon Region** drop-down list, select another region to be detected.

3 Select **Wide** to include soft tissue.

– or –

Select **Narrow** if you do not want soft tissue included.

The recon range is adapted.

Only for head examinations: If the head is not in the ISO center when loading the head range, you are prompted to move the patient table to achieve best image quality.

Only for head examinations:The FoV is adjusted to at least 200 mm.

Adapting FoV manually

1 Select the recon job using the **Recon** icon in the chronicle.

2 Check in the topo segment whether the position of the FoV in the tomogram is correct. If not, move the center.

3 Change the size of the FoV with the side handles to keep the manually adapted FoV.

When to FoV is adapted, the entry in the **Recon Region** drop-down list is set to None.

Performing the recon planning

Recon range planning is possible on selected parameter cards (**Routine**, **Recon**, **Auto Tasking**, **Intervention**, or **Trigger**), except for the **Scan** parameter card.

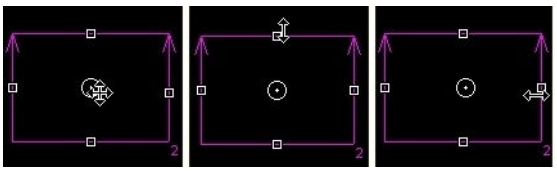
If a recon range manipulation causes one or more axial gaps, a message box is displayed informing you about it. This message box is displayed after saving a scan protocol or pressing the **LOAD** button.

The FoV is inherited if the recon jobs have the same FoV and center position, irrespective of their beginning or end position.

The recon jobs of a scan range define the length of the scan range. You can modify the length by the recon jobs. Resizing the scan range is possible with recon planning.

1 Select the recon job in the chronicle you want to edit.

2 Move the range or the cutlines by dragging the center.



3 Modify the length of the range by dragging one of the handles (upper/lower handle - range begin/end position handles) or the FoV of the range (side handles).

4 Set the tilt by grabbing and tilting a corner of the range in a lateral topogram.

5 To avoid modifications of the following ranges with the same FoV and the same center position, use the **Shift** key.

The parameters defining the reconstruction area are passed on from one recon job to another. The scan range size is adapted corresponding to the applied recon range operation.

6 Perform the spiral and subsequent reconstructions in the usual way. For how to proceed: (➔ Page 404 *Performing the spiral acquisition*)

7 Select **Edit** > **Save Scan Protocol** in the main menu whenever you want to save the current scan protocols during the examination.

The scan protocol is saved. For more information, refer to:

You can view the scan protocols and edit their parameters in the **Scan Protocol Assistant**.

ThorAbd (Thorax Abdomen) protocol

With the ThorAbd protocol, you can examine the thorax and the abdomen range by using one scan procedure.

- The ThorAbd protocol contains a thorax range with reduced dose and a standard dose abdomen range.
- The scan range is divided into typically one or two ranges with reduced dose and a cardiac/standard dose range by a special standard dose recon job.

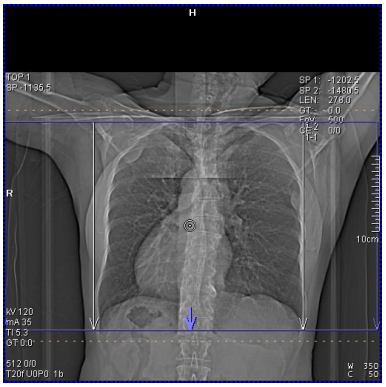
You cannot delete the special standard dose recon job. A copy of this recon job will only inherit the normal parameters but not the property for defining the cardiac/standard dose range.

- The range with reduced dose is above and/or below the cardiac/standard dose range.
- Dashed green lines show the limits of the cardiac/standard dose range in table direction.

If you resize the range of the standard dose recon job or move it, the values will be adapted.

Using scan planning for spirals

Scan range planning is possible on the **Scan** parameter card.



The ranges are indicated as follows:

- Scan range in blue
- Deselected scan ranges in gray
- Recon ranges in white

The scan range contains the recon ranges of the current scan. The chronicle entry is surrounded by a blue selection rectangle.

You cannot resize a scan range; you can move the scan range only vertically. You cannot adapt the FoV during the scan planning. You cannot tilt a scan range.

If you move a scan range, all recon ranges inside this scan range are moved.

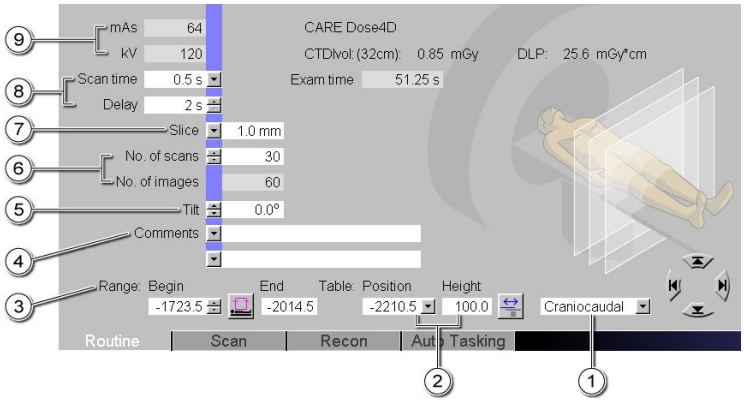
When planning spiral scan ranges with very low pitch, it may happen that the recon range frame can only be moved in short steps in the topogram image. In that case, select the **Scan** parameter card before moving the scan range frame to the desired position in the topogram image directly.

6.6.5 Acquiring a Sequence

Acquiring a sequence scan includes following steps:

- (➔ Page 399 *Checking parameter settings*)
- (➔ Page 400 *Optimizing the applied dose with CARE Dose4D and CARE kV*)
- (➔ Page 401 *Performing a sequence scan*)

Checking parameter settings



(1) Examination direction

(2) Table position (horizontal/vertical)

(3) Examination range

(4) Comment lines

(5) Gantry tilt (optional)

(6) Number of scans and images

(7) Slice thickness

(8) Time settings

(9) Radiation parameters

The **Scan** parameter card contains further parameter settings for scanning.

CAUTION

Changed scan parameters are unsuitable!

Dose not as desired.

- Verify the changed scan parameters before scanning.

- On the **Routine** parameter card, check the default scan parameters, and adapt them if necessary.

Certain modes of operation allow selections of scan parameters that may lead to a peripheral $CTDI_{100}$ of more than 1 Gy. This dose may exceed the threshold for deterministic radiation effects on the patient's skin or eye lenses. For information on dose reduction techniques, see: (➔ Page 249 *Dose management and optimization*). For general dose information on the CT system, see: *System Owner Manual*.

Optimizing the applied dose with CARE Dose4D and CARE kV

CARE Dose4D calculates optimized scan parameters from attenuation data of the topogram.

CARE kV optimizes the applied dose for the defined image quality level, and reduces influences due to technical limits of the system. To achieve this, **CARE kV** adapts the tube voltage and the tube current.

CAUTION

mA proposal of CARE Dose not adequate due to wrong attenuation data from topogram!

X-ray not or only partially usable.

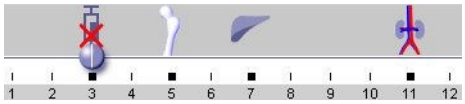
- Check plausibility of the automatically selected scan parameters before scanning.

1 Select the **Scan** parameter card.

2 Select **CARE Dose4D** for the current scan.

3 From the **CARE kV** drop-down list, select **On** or **Semi**.

4 Click the dose settings icon.



5 Select an examination type with the slider.

The system optimizes the dose for the defined image quality. For more information, see (➔ Page 249 *Dose optimization features*).

The CARE Profile and scan parameters are yellow.

A scan parameter conflict occurred.

- See (➔ Page 286 *Handling parameter conflicts*).

Performing a sequence scan

After you changed scan parameters, you must confirm the new settings with **Load** before starting the scan.

If the sequence is part of an auto range and not all ranges have been selected at least once, a parameter overview is displayed. You can display this overview manually with **View** > **Examination Overview...**.

1 Click the **Load** button to confirm the scan parameters.

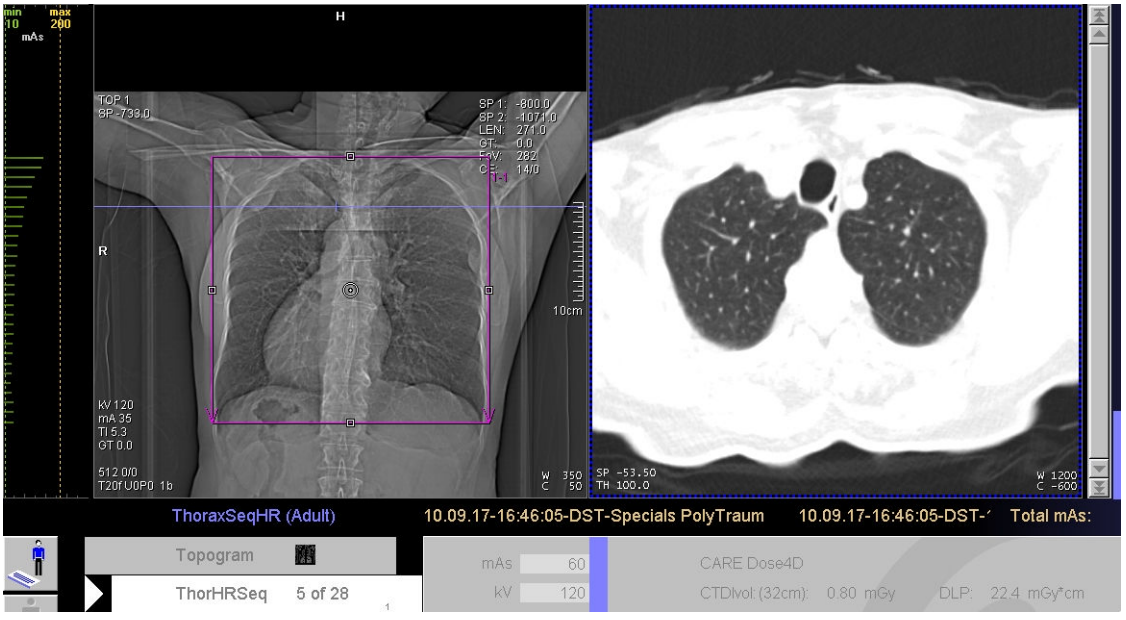
As soon as you click the **Load** button, the topogram is zoomed and moved in a way that the whole planned scan range is displayed.

2 Press the **MOVE** key on the control box until table movement stops.

– or –

Click the **Cancel Move** button to begin the sequence at the current table position and gantry tilt.

3 Press the **START** key on the control box.



You can observe the progress of the sequence on the screen:

- In the chronicle, you can see the number of scans already acquired and the total number of scans to be performed.
- In the topogram, the current scan position is displayed.
- In the tomo segment, the calculated tomograms are displayed.

RTD (Real Time Display) images are reconstructed to observe the scan progress.

4 Reconstruct the scan series with full image quality at the end of scanning.

Canceling in an emergency

You can interrupt the scan at any time with the **Suspend** button or the **Suspend** key on the control box.

After pressing the **STOP** key while tilting, the stopping angle of the gantry can be up to 0.5°.

1 In an emergency press the **STOP** key on the control box.

Radiation is stopped immediately and the entire system is blocked. A message box is displayed.

2 Click the **Continue** button to enable the system again.

6.6.6 Acquiring a Multiscan

A Multiscan is a multiple-rotation scan without table feed. It allows reconstructions at variable points of time with the same table position.

If you want to perform Multiscan reconstruction jobs, 3D functions in the **Auto postprocessing** selection list on the **Auto Tasking** parameter card are not available.

1 On the **Routine** parameter card, check the default scan parameters, and adapt them if necessary.

Certain modes of operation allow selections of scan parameters that may lead to a peripheral $CTDI_{100}$ of more than 1 Gy. This dose may exceed the threshold for deterministic radiation effects on the patient's skin or eye lenses. For information on dose reduction techniques, see: (➔ Page 249 *Dose management and optimization*). For general dose information on the CT system, see: *System Owner Manual*.

2 Perform a Multiscan in the usual way. (➔ Page 404 *Acquiring a Spiral*)

3 Observe the instructions on handling the **Dose Alert**, if the **Dose Alert** dialog box is displayed. (➔ Page 295 *Handling the Dose Alert*)

4 Perform the subsequent reconstructions in the usual way.

6.6.7 Acquiring a Spiral

Acquiring a spiral scan includes following steps:

- (➔ Page 400 *Optimizing the applied dose with CARE Dose4D and CARE kV*)
- (➔ Page 404 *Performing the spiral acquisition*)

Performing the spiral acquisition

After you changed scan parameters, you must confirm the new settings with **Load** before starting the scan.

If the spiral is part of an auto range and not all ranges have been selected at least once, a parameter overview is displayed. You can display this overview manually with **View** > **Examination Overview...**.

1 Click the **Load** button to confirm the scan parameters.

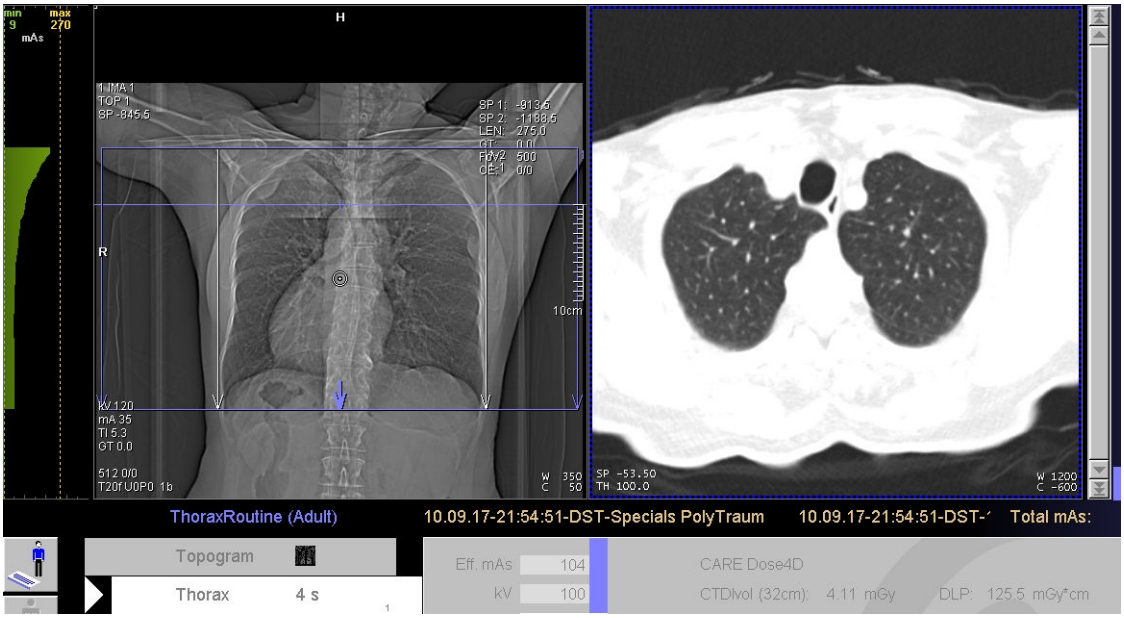
As soon as you click the **Load** button, the topogram is zoomed and moved in a way that the whole planned scan range is displayed.

2 Press the **MOVE** key on the control box until table movement stops.

– or –

Click the **Cancel Move** button to begin the spiral at the current table position and gantry tilt.

3 Press the **START** key on the control box.



You can observe the progress of your scan on the screen:

- In the chronicle, you can see the remaining scan time.
- In the topogram, the current scan position is displayed.
- In the tomo segment, the calculated tomograms are displayed.

RTD (Real Time Display) images are reconstructed to observe the scan progress.

4 Use the **MOVE** key to move to the starting position of the next range.

5 Begin with the next scan.

– or –

Reconstruct the scan series with full image quality.

6 Conclude the examination by creating a topographic image. For how to proceed: (➔ Page 418 *Reconstruction*), (➔ Page 424 *Concluding an Examination*)

6.6.8 Acquiring an Adaptive 4D spiral

Adaptive 4D spiral scans are spiral scans with continual table movement back and forth. They allow you to scan a volume larger than the detector length and allow image reconstruction at variable points in time. You can use it for example for measuring the extension of an infarcted area.

For the Adaptive 4D spiral, the scan range and temporal resolution are linked with each other. The highest temporal resolution can be achieved for small scan ranges. If a maximum temporal resolution is not required, the scan range can be extended accordingly.

The availability of Adaptive 4D spiral scans depends on the scan protocol.

Adaptive 4D spiral scans are possible in the **Move Table Top Only** mode.

Adaptive 4D spiral scans are not available for the patient table with 1600 mm scan range.

Checking parameter settings

The **Scan** parameter card contains further parameter settings for scanning.

The **4D Range** entry shows the scan range length and the corresponding time. You cannot modify it graphically.

The complete examination time on the **Scan** parameter card displays more than the total scan time for the adaptive 4D spiral scan. The patient table movement contributes to the total examination time.

CAUTION

Changed scan parameters are unsuitable!

Dose not as desired.

- Verify the changed scan parameters before scanning.

- On the **Routine** parameter card, check the default scan parameters, and adapt them if necessary.

Certain modes of operation allow selections of scan parameters that may lead to a peripheral $CTDI_{100}$ of more than 1 Gy. This dose may exceed the threshold for deterministic radiation effects on the patient's skin or eye lenses. For information on dose reduction techniques, see: (➔ Page 249 *Dose management and optimization*). For general dose information on the CT system, see: *System Owner Manual*.

Displaying the Cycle time table dialog box

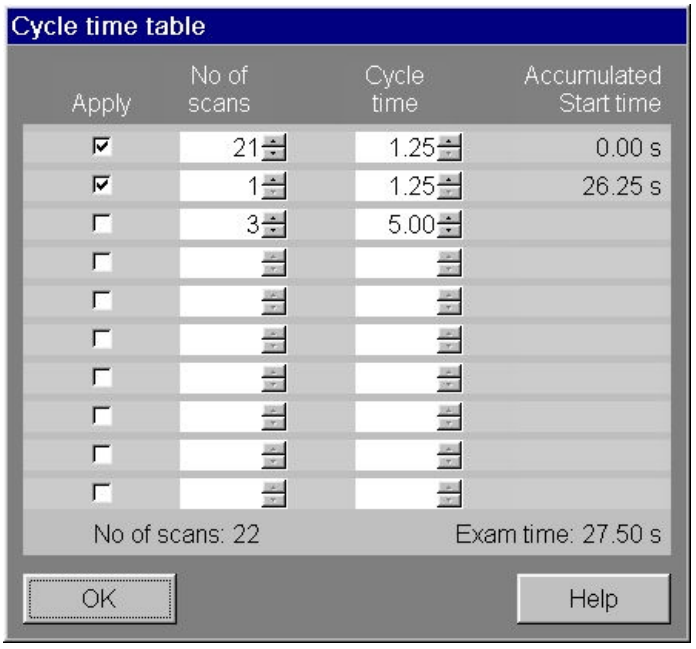
You can define different cycle times for one Adaptive 4D Spiral scan in the **Cycle time table** dialog box.

1 Click the **Activate cycle time table** icon on the **Scan** parameter card.

The **Cycle time** entry changes to **Multiple**.

2 Right-click the **Edit cycle time table** icon.

The **Cycle time table** dialog box is displayed.



You can use the cycle time table also for certain scan protocols without table feed, for example, non-gated perfusion sequence scans.

Defining different cycle times

You can define different cycle times for one Adaptive 4D Spiral scan in the **Cycle time table** dialog box.

The values that are displayed in **No of scans** and **Cycle time** are derived from the scan protocol or the current scan entry. You can change these entries and add more entries.

Already scanned entries are dimmed.

✓ The **Cycle time table** dialog box is open.

1 Enter how many scans have to be performed with a specified cycle time into the **No of scans** field.

2 Specify the cycle time in the **Cycle time** field.

3 Repeat this for each cycle time. You can define up to ten cycle times.

4 Select the **Apply** check boxes for all cycle times that you want to scan.

5 Click **OK**.

To synchronize the reconstruction of the images (displayed in the tomo segment) with scanning, you can increase the cycle time.

You can use the Cycle time table also for certain scan protocols without table feed, for example, non-gated perfusion sequence scans.

Performing acquisition

After you changed scan parameters, you must confirm the new settings with **Load** before starting the scan.

1 Click the **Load** button to confirm the scan parameters.

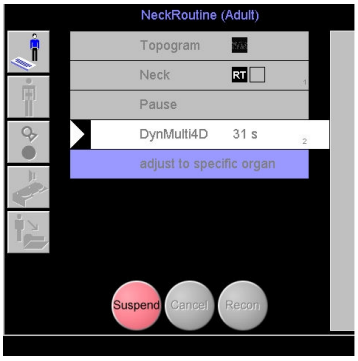
As soon as you click the **Load** button, the topogram is zoomed and moved in a way that the whole planned scan range is displayed.

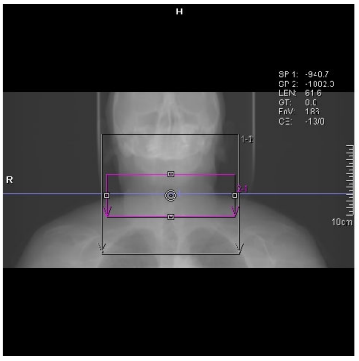
2 Press the **MOVE** key on the control box until table movement stops.

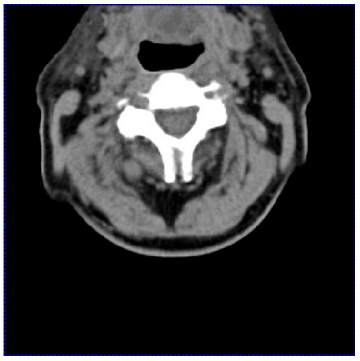
– or –

Click the **Cancel Move** button to begin the spiral at the current table position.

3 Press the **START** key on the control box.







You can observe the progress of your scan on the screen:

- In the chronicle, you can see the remaining scan time.
- In the topogram, the current scan position is displayed.
- In the tomo segment, the calculated tomograms are displayed.

RTD (Real Time Display) images are reconstructed to observe the scan progress.

4 Reconstruct the scan series with full image quality at the end of scanning.

5 Conclude the examination by creating a topographic image. For how to proceed: (➔ Page 418 *Reconstruction*), (➔ Page 424 *Concluding an Examination*)

Real Time Display reconstruction mode

RTD provides real-time reconstruction during scanning with reduced resolution. Gaps are left to keep track with the scanning procedure, so that real-time imaging is possible.

Full image reconstruction starts after you click the **Recon** button without defining an additional recon job.

Real Time Display reconstruction mode (RTD) is used for all scans (except for Intervention, Premonitoring, and Monitoring scan).

Canceling in an emergency

You can interrupt the scan at any time with the **Suspend** button or the **Suspend** key on the control box.

After pressing the **STOP** key while tilting, the stopping angle of the gantry can be up to 0.5°.

1 In an emergency press the **STOP** key on the control box.

Radiation is stopped immediately and the entire system is blocked. A message box is displayed.

2 Click the **Continue** button to enable the system again.

Canceling in an emergency

You can interrupt the scan at any time with the **Suspend** button or the **Suspend** key on the control box.

After pressing the **STOP** key while tilting, the stopping angle of the gantry can be up to 0.5°.

1 In an emergency press the **STOP** key on the control box.

Radiation is stopped immediately and the entire system is blocked. A message box is displayed.

2 Click the **Continue** button to enable the system again.

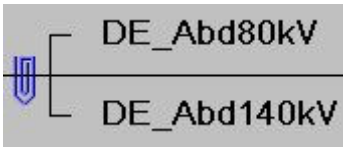
6.6.9 Acquiring a Dual Spiral Dual Energy scan

With the Dual Spiral Dual Energy option, Dual Energy scan protocols are offered for single tube systems.

A Dual Spiral Dual Energy scan protocol consists of a special kind of auto range with two spirals of different voltages:

- First spiral: 80 kV
- Second spiral: 140 kV

Both scans must be performed with the same table height and patient orientation.



In the chronicle, a Dual Spiral Dual Energy auto range is indicated by a paper clip symbol.

You cannot split a Dual Spiral Dual Energy auto range or insert additional scan ranges into this auto range.

In a Dual Spiral Dual Energy auto range, gantry tilt, Bolus Tracking, kV, and CARE kV cannot be edited or applied.

CAUTION

Images of Single Source Dual Energy: Inappropriate image results due to insufficient image registration!

No diagnosis possible.

- Make sure that the patient does not move between the scans.

1. Edit the parameters for the first spiral.
2. Set the values for table position and table height for the first spiral.

   The parameters of the second spiral are inherited from the parameters of the first spiral. You cannot edit the parameters of the second spiral.

3 Instead of using the API functionality, instruct the patient directly.

For abdominal scans, perform both spirals while the patient is holding their breath.

In order to use Dual Energy postprocessing, the delay between both scans must be less than 300 seconds. Make sure that the patient does not move during the whole examination.

Dual Spiral Dual Energy scans are not recommended for studies with high contrast media dynamics, for example, for scanning in the arterial phase.

If the **Recon job type** is set to **3D** for the first spiral, the parameters of the **Recon** and **Auto Tasking** parameter card are not inherited by the corresponding recon job of the second spiral. You can edit these parameters for the first and the second spiral.

In the **Scan Protocol Assistant**, the parameters of both spirals are displayed on the grid. On the corresponding tab cards below, you can only display and edit the parameters of the first spiral.

4 Perform the spiral acquisition in the usual way.
(➔ Page 404 *Acquiring a Spiral*)

You cannot load the following reconstruction series into Dual Energy postprocessing applications:

- **3D**
- **FAST Spine**
- **Extended CT scale**
- **Extended FoV**
- **HD FoV**

You cannot adjust the DE composition factor. A default value is used instead.

Brain Hemorrhage scan requirements

If you perform a single source Dual Energy scan for an evaluation with Brain Hemorrhage, the scan has to meet the following requirements:

- The scan is performed with the scan protocol DE_Head_BrainHem_post_intervention or a scan protocol derived from it.
- The images have to be reconstructed with the standard kernels as defined in the standard protocol for Brain Hemorrhage, for example, Qr36 or Qr40 for the Definition Edge.
- No additional contrast agent is injected.
- The patient does not move his head during the scan. Otherwise, the two single source Dual Energy data sets may not be registered successfully.

Liver VNC scan requirements

If you perform a single source Dual Energy scan for an evaluation with Liver VNC, the scan has to meet the following requirements:

- The scan is performed with the scan protocol DE_Abdomen_LiverVNC_late or a scan protocol derived from it.
- The first scan starts in a venous phase at least 75 s after the start of the contrast agent injection.
- The contrast agent injection does not take longer than 45 s.

6.6.10 Acquiring a TwinBeam Dual Energy scan

Single Source Dual Energy supports Dual Energy scan protocols for single tube systems.

A TwinBeam Dual Energy scan consists of one spiral scan performed at 120 kV. Simultaneous scanning with two different energy spectra becomes possible by using a Split Filter. This Split Filter consists of gold on one side (low energy spectrum) and tin on the other side (high energy spectrum). This scan mode can also be used for contrast enhanced arterial examinations.

For TwinBeam Dual Energy scans, **AuSn120** is displayed in the **kV** selection list.

TwinBeam Dual Energy scans with the aim of evaluating iodine enhancement of the lung parenchyma require sufficient contrast enhancement. The recommended CT value is at least 350 HU at **AuSn120kV** in the pulmonary trunk and in the ascending aorta. Try to avoid the Vasalva effect. The patient should not press during the breath-hold.

It is strongly recommended to use Bolus Tracking or TestBolus for this examination.

To compensate for the attenuation by the filter, the default mAs value for the default TwinBeam Dual Energy protocols has been increased. For estimating the impact of the increased mAs on patient dose, consider the $CTDI_{vol}$ and DLP values.

Moving the filter in or out takes approximately 5 to 7 seconds. Therefore, the minimum delay in an auto range between scans with and without filter is automatically adapted.

Premonitoring scans or monitoring scans that are inserted before a spiral range with TwinBeam Dual Energy will also be scanned with the filter. As a result, the mAs value in these scans is higher than configured for other single source scans.

For correct postprocessing, make sure that the patient does not move during the whole examination.

For best image quality, abdomen and thorax-abdomen scans should be performed in feet first position.

1 Select a TwinBeam Dual Energy scan protocol. The protocol is named with the common prefix **TBDE_**.

2 Perform the spiral acquisition in the usual way.
(→ Page 404 *Acquiring a Spiral*)

You cannot load 3D and FAST Spine reconstruction series into *syngo* Dual Energy.

You cannot adjust the DE composition factor. A default value is used instead.

6.6.11 Ultra High Resolution (UHR) modes

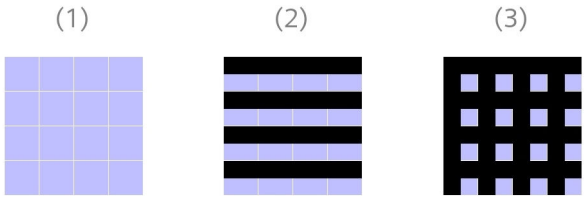
Ultra High Resolution modes are the scanning modes which provide the highest spatial resolution, up to 30 lp/cm (line pairs per centimeter).

Two high-resolution spiral modes are available:

- UHR: This mode provides in-plane spatial resolution up to 0.4 mm with the use of a post-patient comb filter to reduce the aperture size over detector elements along the fan angle (in-plane) and resultant slice thickness (slice width) of 0.6 mm (since no collimation is applied in the z-direction).
- z-UHR: This mode provides in-plane spatial resolution up to 0.24 mm with the use of a comb filter to reduce the detector aperture along the in-plane and the z directions. The resulting z resolution is 0.25 mm.

There is also a sequential UHR mode, which achieves the same in-plane resolution of 0.24 mm with a resultant slice width of 0.6 mm.

The following graphic illustrates how the two types of comb filters are displayed in the UHR and z-UHR modes:



(1) Standard mode: Full aperture in both directions

(2) UHR mode: Detector is covered with the comb filter in the shape of bars, covering half of the area of each detector element in one direction.

(3) z-UHR mode: Detector is covered with the comb filter resembling a grid covering halves of the detector rows in both directions

Using UHR modes in combination with Bolus Tracking increases the start delay between the monitoring scan and the diagnostic scan.

6.7 Reconstruction

Every CT examination collects raw data. From one raw data set, it is possible to reconstruct several image sets with different parameter settings (recon jobs).

Before performing a reconstruction, you can plan the recon jobs (if you did not plan them before scanning).

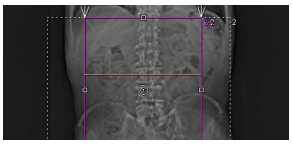
When the system is switched off, the jobs are stopped and their current state is saved. After restart the execution of the reconstruction jobs continues.

Adapting the FoV before starting the reconstruction allows an appropriate spatial resolution for the resulting reconstructed image.

If **Auto transfer** is activated, the export of the data to the DVD drive only begins if all Recon jobs of a patient are finished and the patient is closed (Exam card). There is one session per study created on the DVD instead of one session per series. The number of burn sessions on one DVD is limited to 30 sessions.

If you change any values via keyboard, it is necessary that you confirm them by pressing the **Enter** key.

6.7.1 Defining the reconstruction target



An amber line represents the position of the currently displayed tomo image movements, and displays interactively the corresponding tomo image.

The following functionalities are described in the subsequent sections:

- (➔ Page 419 *Adapting the FoV manually*)
- (➔ Page 419 *Reconstructing images with Extended FoV and HD FoV*)

Adapting the FoV manually

You can adapt the FoV (Field of View) manually by using the mouse.

◆ Adapt the FoV (Field of View) in the tomo segment to the region of interest using the mouse.

Reconstructing images with Extended FoV and HD FoV

The **Extended FoV** reconstruction and the **HD FoV** reconstruction provide a FoV of up to 78 cm (80 cm for SOMATOM Definition AS Open) including the area outside of the FoM (Field of Measurement).

If you have activated the **HD FoV** checkbox, the patient contour is estimated automatically outside the field of measurement. The **HD FoV** function is especially useful for radiation therapy planning (RTP). A precise calculation of dose distribution for RTP to different organs is necessary in order to increase the dose delivered to the tumor and reduce the dose applied to healthy tissue. For that reason, the patient contour must be known and a high stability of the HU values within the image must be given.

The images contain a dotted red circle to indicate where the area of the regular FoV ends.

CAUTION

Reduced image quality caused by extended field of view!

Wrong diagnosis due to insufficient image information.

- For diagnosis, do not use the image area outside the regular field of view. It has reduced quality and may contain artifacts.

- On the **Recon** parameter card, select the **Extended FoV** checkbox.

  – or –

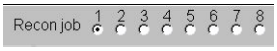
  On the **Recon** parameter card, select the **HD FoV** checkbox.

Depending on your system configuration and the selected scan mode, the **Extended FoV** and the **HD FoV** option may not be available.

You can delete the circle from the reconstructed images in the **Viewing** tab card.

6.7.2 Creating new reconstruction jobs

1 Select the acquisition series that you want to reconstruct again in the chronicle.



2 Click the second radio button on the **Recon** parameter card to plan a second recon job.

To define more than eight recon jobs for one range, you can execute eight jobs in the first run. Afterwards, you must delete one recon job before you can define an additional one. The images are not deleted automatically from the local database.

6.7.3 Performing a reconstruction

The following chapter describes the basic concepts of common reconstructions.

Starting reconstruction

The bar display on the right-hand edge indicates the progress of reconstruction.

- Click the **Recon** button to start reconstruction of the currently selected recon job.

  In the tomo segment, all the images calculated are displayed one after the other.

State of Reconstruction

The position of the icon on the scan entry (1st, 2nd, 3rd, 4th, 5th, 6th, 7th, 8th, four in one row) corresponds to the number of the recon job on the **Recon** or **Auto Tasking** parameter card. The following icons indicate the status of a recon job:

	A defined but not yet executed recon job.
	Indicates that the recon job is selected.
	Indicates that it is a planned 3D recon job.
	Indicates that images will be executed with RTD (real-time display) recon.
	• Indicates that images have been reconstructed with RTD (realtime display). • Click the **Recon** button to reconstruct these images with full quality.

	Indicates that the recon job has been executed with reduced resolution.
	Indicates that the recon job has been interrupted.
	Indicates that the recon job was interrupted by the system because of a scanning process.
	Indicates that the recon job is being executed.
	Indicates that the recon job is queued.
	• Indicates that images have been reconstructed. • Click this icon to display the images of the reconstructed series in the tomo segment. • With the dog-ear and scroll bar, you can scroll through the images. • Exception: Topograms are displayed in the topo segment. • If you move the cursor to this icon, the series description of the corresponding recon job is displayed.

Performing retrospective reconstruction

You can reconstruct the images of an examination after the examination is closed as long as the raw data was not deleted.

Depending on the detector system of your scanner, the reconstruction of raw data acquired at a different detector system may not be possible.

1 Select the required study or series of the patient for image reconstruction.

2 Choose **Patient > Reconstruction** to transfer the selected data to the **Examination** or **Recon** task card.

– or –

On the tool bar of the **Patient Browser**, click the **Reconstruction** icon.

3 Start the unprocessed reconstruction jobs or define new ones.

By activating **Patient > Mode Reference Lines**, you can document the scans as ranges and cutlines in the topogram even after completing an examination.

Interrupting and resuming reconstruction

You can interrupt and resume the reconstruction, for example to correct the FoV.

1 Click the **Hold Recon** button, for example, to correct the FoV.

If a scanned entry is selected, the selected recon job will be stopped. If no protocol entry is selected, all recon jobs will be stopped.

2 Click the **Recon** button to resume reconstruction.

Reconstruction can be continued without any gaps or double images, even if you have scanned another patient in the meantime.

Using Automatic Post-Processing

On the **Auto Tasking** parameter card, you define in which way a reconstructed series is automatically post-processed. Depending on the type of scan, not all options may be available.

Auto Tasking parameters are set individually for each recon job.

- Define on the **Auto Tasking** parameter card in which way you want to post-process the reconstructed series. (➔ Page 356 *Using automatic functions*)

Concluding an Examination

You can create **Auto reference lines** for a specific tomogram recon job. To do so, activate the checkbox in the **Patient Model Dialog** and on the **Auto Tasking** parameter card.

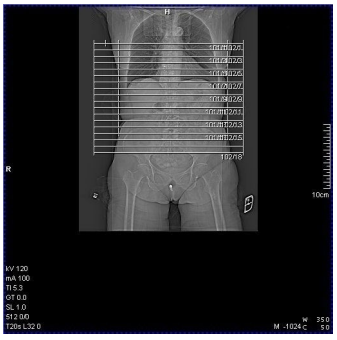
Getting an examination overview by creating a reference lines image

The reference lines function is used to create an examination overview. Images that have been reconstructed are visualized as cut lines on the topogram. These graphics can be stored with the topogram image.

Creating a reference lines image by using drag-and-drop

1. Select a topogram in the chronicle.
2. Select the recon icon of a reconstructed series in the chronicle.
3. Drag the recon icon to the topo segment and drop it onto the topogram.

   The images of the recon job are drawn in and saved as cutlines in the topogram.



Creating a reference lines image by using the main menu

1. Select the **View** > **Start Reference Lines** menu item.

The system enters the reference lines mode. The **Patient Browser** appears and the current examination is selected. Based on the preselection, all the images are visualized, that have been reconstructed so far.

2 Leave the preselection unchanged.

– or –

Select the images or series of this examination that you want to display on the topogram. Multiple selection is possible.

3 In the **Patient Browser**, select the **Patient** > **Update Reference Lines** menu item.

Cut lines for single images for series will be drawn onto the topogram.

4 To remove all graphics, clear the **Patient** > **Mode Reference Lines** menu item in the **Patient Browser**.

– or –

Clear the **View** > **Mode Reference Lines** menu item in the **Examination** task card.

The display mode of the topo segment switches from reference lines mode to graphical slice positioning (GSP) mode.

5 To switch back to the normal topogram display, deselect the **View** > **Mode Reference Lines** menu item.

Storing the reference lines image

Documenting the scans as ranges and cut lines in the topogram is part of completing an examination.

To store the drawn cut lines and ranges with the topogram, the reference lines mode needs to be activated when closing the patient.

- Drag-and-drop the icon to the topogram.

  – or –

  On the **Examination** task card, select the **View** > **Mode Reference Lines** menu item.

– or –

In the **Patient Browser**, select the **Patient** > **Mode Reference Lines** menu item.

Close the **Patient Browser** and proceed with closing the patient.

Ending the examination

1 Click the **Close current patient** icon.

If configured, the E-Logbook is displayed.

2 Modify the desired fields in the E-Logbook input window.

3 Click **OK** to save the changes and to end the examination.

6.7.4 Performing a 3D reconstruction

You can start the 3D recon jobs on the **Examination** task card and on the **Recon** task card directly after spiral scanning. The axial images created during scanning are used as a planning base (3D Graphical Reconstruction Planning (GRP) Base). The default RT FoV is 500 mm x 500 mm.

1 Select **3D** as recon job type in the **Recon** parameter card after scanning.

The three 3D Recon segments (coronal, axial, sagittal) are displayed instead of the standard tomo segment and topo segment.

Each 3D segment shows one plane of the image volume (default: coronal, axial, sagittal). The coordinate axes are perpendicular to each other. You cannot change the angles between the axes.

For good performance, a slice thickness of 3 mm is used for the 3D GRP even when you have specified a slice thickness of less than 3 mm for the recon job. When the reconstruction starts, the specified slice thickness for the recon job is used.

2 Optimize the image display by interacting in the three segments.

If you tilt reconstruction axes within a 45° range, the selected orientation of the recon job will be kept and displayed in the series description. If you tilt the reconstruction axes outside this range, the orientation will be adapted accordingly.

3 Click the **Recon** button to start reconstruction.

The system returns to the standard display if you start the reconstruction of the 3D recon job. The reconstructed images are displayed in the tomo segment, the reference image in the topo segment.

If a 3D reconstructed series is sent to a 3D application, the reference image will not be sent.

6.7.5 Performing a FAST 3D reconstruction

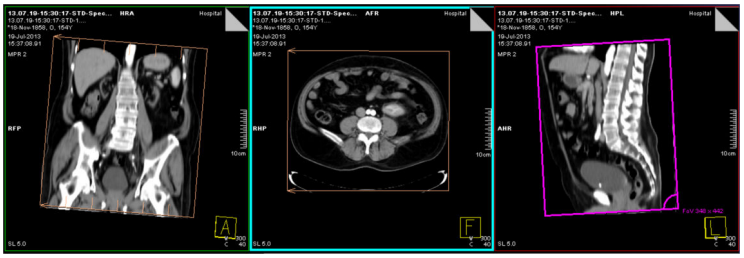
For 3D recon jobs, the **FAST 3D** option provides automatic centering and aligning of a scanned volume. As a result, three 3D Recon segments (coronal, sagittal, axial) are calculated which contain the complete aligned body region without black images.

The Real Time Displays (RTDs) are used as planning base if nothing else is specified.

FAST 3D can be enabled or disabled for each 3D recon job either in the scan protocol or in the **Recon** parameter card.

As soon as Real Time Displays (RTDs) are available, FAST 3D detects the boundaries and the centerline of the data set, based on the bone structures that are visible in the scanned area.

As a result, the 3D Recon segments are displayed with the reconstruction axes aligned to the patient's anatomy.



The results are well suited to be automatically reconstructed, but it is still possible to tilt the reconstruction axes manually to further improve the alignment.

If **Auto recon** has been set as a parameter in **Auto Tasking**, the **FAST 3D** reconstruction will be automatically executed in the background.

When creating a new 3D recon job, **FAST 3D** is selected by default.

With a scan that shows only a few bone structures, the automatic calculation of the 3D Recon segments might not work properly. This might be the case, for example, when scanning the liver without inclusion of the pelvis or ribs. You can tilt the reconstruction axes manually to improve the alignment.

FAST 3D is not available for examinations of the extremities.

6.7.6 Performing a reconstruction with reduced metal artifacts (iMAR)

Metal objects, such as metal implants or metal markers, can cause beam hardening artifacts. Depending on density and size, these metal artifacts can lead to a total absorption of the radiation resulting in strong black or white streaks or in star-shaped artifacts.

The iterative Metal Artifact Reduction (iMAR) reduces the effects of metal artifacts.

The following implants are supported:

- **Neuro coils**
- **Dental fillings**
- **Spine implants**
- **Shoulder implants**
- **Pacemaker**
- **Thoracic coils**
- **Hip implants**
- **Extremity implants**

The image impression of images which are reconstructed with iMAR can differ from images which are reconstructed with a conventional method. Furthermore, the iMAR algorithm can occasionally introduce artifacts, particularly in the close vicinity of metal implants. Therefore, it is recommended to perform an additional conventional image reconstruction. Compare the iMAR images with the conventional images side-by-side.

iMAR is available for the reconstruction jobs of most modes except for the following modes:

- i-Fluoro
- Real Time Display
- CARE Bolus CT
- TestBolus
- Osteo

Image reconstruction with iMAR is not possible at high kernel sharpness levels above sharpness level 59. In these cases, the **iMAR** list is dimmed.

Do not load images that were reconstructed with iMAR into *syngo* Osteo CT and *syngo* Calcium Scoring.

Reconstruction with iMAR takes longer than conventional reconstruction. Consider this when choosing iMAR.

Selecting a metal implant

✓ A kernel that supports iMAR is selected.

1 On the **Recon** parameter card, click the **Advanced reconstruction options** icon.

   The **Advanced reconstruction options** dialog box opens.

2 From the **iMAR** list, select an implant.

3 Click the **Advanced reconstruction options** icon again to close the **Artifact correction** dialog box.

To deactivate **iMAR**, select **None** from the **iMAR** list.

4 Start the reconstruction. See (→ Page 421 *Starting reconstruction*).

The following labels are displayed in the image comment area of the reconstructed images:

- For **Neuro coils**: **iMARne**
- For **Dental fillings**: **iMARde**
- For **Spine implants**: **iMARsp**
- For **Shoulder implants**: **iMARsh**
- For **Pacemaker**: **iMARpa**
- For **Thoracic coils**: **iMARth**
- For **Hip implants**: **iMARhi**
- For **Extremity implants**: **iMARex**

Series descriptions

For series descriptions of iMAR recon jobs, the following suffix is added:

- **iMAR**

The suffix is not shown in the **Recon** parameter card.

6.7.7 Performing a DirectDensity reconstruction

DirectDensity™ reconstruction is designed for use in Radiation Therapy Planning (RTP) only. Images delivered by the system using DirectDensity reconstruction can be used by trained staff as an aid for Radiation Therapy Planning. DirectDensity™ reconstruction is not intended to be used for diagnostic imaging.

Reconstructions with DirectDensity algorithms generate CT images that show the electron density of a material relative to the electron density of water, nearly independently of the tube voltage in the examination.

The electron density ratio is mapped to gray scale values in the same way as attenuation ratios are mapped in the Hounsfield Unit (HU) scale.

This means that air receives a value of -1000 and water a value of 0.

In this modified scale, the electron density ratio of bone is substantially lower than the CT values of bone in HU, in standard CT images.

By default, electron density images are shown in gray scale.

DirectDensity algorithms are available for conventional reconstructions and for iterative reconstructions (SAFIRE/ADMIRE).

The DirectDensity algorithms are compatible with the following functionalities:

- Iterative reconstructions (SAFIRE/ADMIRE)
- iMAR
- Respiratory gating

The DirectDensity algorithms are designed for reconstructing natural body materials, such as fat, water, or bone. Image artifacts and different materials, such as contrast agents or metal implants decrease the accuracy of the results within their own volume and the surrounding volume.

The series description of DirectDensity recon jobs adds the suffix **eDDensity**.

On reconstructed DirectDensity images, the label **eDDensity** is displayed in the image comment area.

The suffix is not shown in the **Recon** parameter card.

Selecting a DirectDensity algorithm

DirectDensity algorithms are not available for the following recon job types:

- Real-time display recon jobs
- Recon jobs from pre-monitoring scans
- Recon jobs from monitoring scans

For all other recon jobs, DirectDensity algorithms are available if the **Extended CT Scale** check box is cleared on the **Recon** parameter card.

Series that were reconstructed using a DirectDensity alogrithm cannot be loaded into the Dual Energy postprocessing application.

1 On the **Recon** parameter card, select **Sd40** from the **Kernel** list.

2 If required, activate iterative reconstruction (SAFIRE/ADMIRE). (➔ Page 434 *Activating SAFIRE/ADMIRE*)

3 Start the reconstruction. (➔ Page 421 *Starting reconstruction*).

6.7.8 Performing an iterative reconstruction (SAFIRE/ ADMIRE)

The sinogram affirmed iterative reconstruction (SAFIRE) and the advanced modeled iterative reconstruction (ADMIRE) allow you to use low-dose scans to reconstruct scans with less noise and increased image sharpness.

The available algorithm (SAFIRE or ADMIRE) depends on your configuration.

Not available when **Extended CT Scale** is selected.

The noise reduction performance of SAFIRE or ADMIRE may be reduced for small reconstructed FoV or for slice thicknesses > 5 mm.

The image impression of images which are reconstructed with SAFIRE or ADMIRE can differ from the images which are reconstructed with a conventional method.

Compare the SAFIRE or ADMIRE images with the conventional images side-by-side.

syngo offers many possibilities to optimize the dose applied to a patient.

SAFIRE or ADMIRE are available for the recon jobs of the following scan modes:

- Spiral scans without interventional examination
- Sequence scans with feed and subsequent cone beam correction reconstructions

Activating SAFIRE/ADMIRE

You can select SAFIRE/ADMIRE for each kernel. In the Siemens protocols, **3** is preset as a suitable **Strength** value. This value can be adapted, if necessary.

1 On the **Recon** parameter card, select the **SAFIRE/ADMIRE** check box.

2 In the **Strength** field, adapt the value (between 1 and 5), if necessary.

The reconstructed images become more artificial the higher the **Strength** value is.

6.7.9 Performing an iterative reconstruction (SAFIRE Excel)

SAFIRE Excel is an iterative reconstruction mode that allows you to improve the image quality while reducing the necessary dose.

SAFIRE Excel is not active in the following cases:

- The corresponding license is not available.
- SAFIRE or ADMIRE is available on the CT scanner.

The image impression of images which are reconstructed with SAFIRE Excel can differ from the images which are reconstructed with a conventional method.

Compare the SAFIRE Excel images with the conventional images side-by-side using comparable kernels.

SAFIRE Excel is available for the recon jobs of most modes, except for the following:

- Interventional examination
- PreMonitoring
- Monitoring
- UHR
- zUHR
- Topogram
- Adaptive 4D Spiral scans
- Heart Perfusion scans
- Multiscans
- All 2D sequences
- Dynamic Serio scans

Do not load images which were reconstructed with the SAFIRE Excel algorithm into Osteo and CaScoring.

1 On the **Recon** parameter card, select the **SAFIRE Excel** checkbox to activate the iterative reconstruction.

Not available when **Extended CT Scale** is selected.

2 Start the reconstruction. (→ Page 421 *Starting reconstruction*)

6.7.10 Performing a Dual Spiral Dual Energy reconstruction

Dual Spiral Dual Energy reconstruction jobs define the following series:

- **80kV**: Series of the low energy spectrum
- **140kV**: Series of the high energy spectrum

The series description, for example, may be **DE_Spine80kV 3.0 Br38** for the low energy spectrum and **DE_Spine140kV 3.0 Br38** for the high energy spectrum.

1 In the chronicle, select the entry of the first spiral.

2 Select the **Recon** parameter card.

3 In the **Recon job** area, select the recon job whose parameters you need to check or modify.

4 Set the recon parameters according to your needs.

The parameter settings are inherited by the corresponding recon jobs of the second spiral, unless **3D** is selected as the **Recon job type**. (➔ Page 437 *Selecting a Dual Spiral Dual Energy 3D recon job*)

Series that were reconstructed using the Sd40 kernel (eDDensity) or the Sa36 kernel (Artificial120) cannot be loaded into the Dual Energy postprocessing application.

5 Ensure that the name of the series description precisely identifies the content of the recon job.

If **Auto recon** is selected on the **Auto Tasking** parameter card, all recon jobs of the low energy spectrum are reconstructed before the recon jobs of the high energy spectrum. Precise naming is important to assign the series of the different energies correctly.

6 On the **Auto Tasking** parameter card, set the automatic functions according to your needs. (➔ Page 356 *Using automatic functions*)

7 You can start the reconstruction for all recon jobs simultaneously, or individually for a selected recon job.

To start the reconstruction for all recon jobs, deselect the entry of the first spiral and click the **Recon** button.

All recon jobs are reconstructed.

– or –

To reconstruct an individual recon job, select the recon job icon in the chronicle and click the **Recon** button.

The selected recon job is reconstructed.

Selecting a Dual Spiral Dual Energy 3D recon job

1 In the chronicle, select the entry of the first spiral.

2 Select the **Recon** parameter card.

3 In the **Recon job type** area, select the **3D** option.

The displayed image reconstructions parameters change. The following **3D** relevant parameters are displayed: **Recon axis**, **Type**, **FAST 3D**. For more information on the parameters, press the F1 key.

4 Set the parameters according to your needs.

(➔ Page 426 *Performing a 3D reconstruction*)

The parameter settings of a **3D** recon job can be set individually for the second spiral.

5 Repeat the steps for the corresponding recon job of the second spiral.

3D reconstructions cannot be loaded into the Dual Energy postprocessing application.

6.7.11 Performing a TwinBeam Dual Energy reconstruction

TwinBeam Dual Energy reconstruction jobs define the following series:

- **H**: Series of the high energy spectrum
- **L**: Series of the low energy spectrum
- **C**: Composed series of both spectra

Series that were reconstructed using the Sd40 kernel (eDDensity) or the Sa36 kernel (Artificial120) cannot be loaded into the Dual Energy postprocessing application.

Series descriptions

For series descriptions of TwinBeam Dual Energy reconstruction jobs, the following suffixes are added:

- For the high energy spectrum: **H_Sn120kV**
- For the low energy spectrum: **L_Au120kV**
- For composed series: **C_AuSn120kV**

The suffix is not shown in the **Recon** parameter card.

The series description may be, for example, **TB_Thorax 5.0 Qr40 H_Sn120kV**.

Selecting a reconstruction series

On the **Recon** parameter card, select the reconstruction series from the **Series** selection list:

1 To reconstruct series L and H, select **L+H**.

Series **L+H** can be used for postprocessing.

2 To reconstruct a composed series C, select **C**.

Series **C** can be used for primary diagnosis and for 3D reconstruction. (➔ Page 438 *Selecting a TwinBeam Dual Energy 3D recon job*)

Selecting a TwinBeam Dual Energy 3D recon job

✓ The **Recon** parameter card is displayed.

✓ **C** is selected from the **Series** list of a TwinBeam Dual Energy scan.

◆ In the **Recon job type** area, select **3D**.

The displayed image reconstructions parameters change. The following **3D** relevant parameters are displayed: **Recon axis**, **Type**, **FAST 3D**. For more information on the parameters, press the F1 key.

Recon job type **3D** only supports **C** series.

3D reconstructions cannot be loaded into the Dual Energy postprocessing application.

6 Examination

7 Enhanced examination

The following chapters describe how to perform contrast examinations, as well as cardiac and interventional examinations.

7.1 CARE Bolus CT

Many CT examinations are performed with intravenous (I.V.) injection of contrast medium (CM).

For all vascular examinations, it is essential to have a precise timing of the contrast medium. This means that the scan must be performed when the organ or vessel of interest has the optimal contrast enhancement.

Bolus Tracking (CARE Bolus) monitors the flow of CM in the vessel, and triggers the scan at a predefined HU value. It does not require an additional injection of CM but uses the injected CM for the diagnostic scan (spiral, sequence, adaptive 4D spiral, multiscan, Heart Perfusion scan, etc.).

If you change any values via keyboard, it is necessary that you confirm them by pressing the **Enter** key.

If you are not familiar with the basic functionalities of the *syngo* software, refer to the (→ *Basic functionalities section*) in the *Basic applications* document.

7.1.1 Performing a PreMonitoring Scan

A **PreMonitoring** scan is always acquired using sequence mode without contrast medium.

- Select the **PreMonitoring** scan in the chronicle.

Setting the scan parameters

You can modify the parameters of the **PreMonitoring** scan on the **Routine** parameter card, if necessary.

When inserting Bolus Tracking, for example, via the main menu, the optimal start delay for the diagnostic scan defines the position of the **PreMonitoring**/**Monitoring** scan. (→ Page 456 *Defining the start delay*)

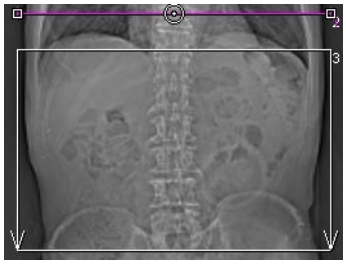
The start delay time is longer when scanning with Ultra High Resolution modes or the Tin Filter.

While the mAs value for the diagnostic scan must be high enough to ensure diagnostic image quality, lower mAs values are sufficient for the monitoring scans.

You can define default values for the **mAs** on the **PreMonitoring** tab card of the **Bolus Tracking Configuration** dialog box.

1 Check and adapt the mAs values, if necessary.

2 Define the position and the FoV in the topogram, depending on the organ to be examined.



The position of the **Monitoring** and **PreMonitoring** scan must be the same.

You cannot modify the gantry tilt of the **PreMonitoring** scan. The tilt of the **PreMonitoring** scan is equal to the tilt of the corresponding diagnostic scan.

Initiating scanning

1 Confirm the parameters of the **PreMonitoring** scan with **Load**.

2 Move the table.

3 Press the **Start** key on the control box.

If necessary, you can repeat the **PreMonitoring** scan.

7.1.2 Preparing Monitoring Scan and Diagnostic Scan

The **PreMonitoring** scan is displayed in the tomo segment. **Contrast** is now selected in the chronicle.

Defining the trigger ROI

On very small structures, you can zoom the **PreMonitoring** scan to make it easier to draw the ROI.

The **PreMonitoring** image is used as a reference for the enhancement calculation during the monitoring phase. Thus the enhancement values calculated in the monitoring phase are relative and not absolute.

You can define a default value for the ROI size on the **Trigger** tab card of the **Bolus Tracking Configuration** dialog box.

1 Click into the tomo segment to position the ROI.

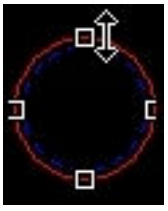
The ROI is divided into two areas:

- The solid red circle is the one you work with.
- The dotted blue circle is used for evaluation (and takes patient movement into account).

The red circle must be completely inside the vessel.

You can show or hide the blue circle in the **Bolus Tracking Configuration** dialog box.

2 Click into the ROI keeping the left mouse button pressed and move the ROI to the required position.



3 Click the outline of the ROI and, keeping the left mouse button pressed, move it out (larger) or in (smaller).

4 Click the **Accept** button to confirm the previously defined ROI.

Defining the Contrast parameters

You can save the entered information with the scan protocol at the end of the examination. For that purpose, you can call up **Edit** > **Save Scan Protocol** in the main menu. If you insert Bolus Tracking into a scan protocol afterwards, all contrast medium values are reset to 0.

When you save the protocol, only the used monitoring scans are saved as well. For example, if the monitoring only takes 2 scans, this is what will be saved for all patients. Therefore, you should raise the monitoring to a minimum of 15 scans.

1 Edit the contrast medium parameters on the **Contrast** parameter card, if necessary.

2 Set the trigger threshold value using the **Level** spin box.

You enter a value for the difference of HU values, for example, the relative density increase caused by the contrast medium. For a native value of 80 HU, for example, enter 120 to achieve an absolute trigger level of 200 HU.

You can define default values for the **Trigger Level [HU]** on the **Trigger** tab card of the **Bolus Tracking Configuration** dialog box.

With the **Auto trigger** mode activated, the diagnostic scan is initiated automatically after reaching the trigger level selected by default.

You can also correct the trigger level value on the **Trigger** parameter card with the mouse. Click the **Monitoring** step in the chronicle and then click the **Trigger** parameter card. Drag the blue line to the HU level.

7.1.3 Starting Bolus Tracking

As soon as the set threshold value within the ROI is reached, the diagnostic scan is started automatically.

You can also start the scan manually with the **Start** key on the control box. This may be necessary if the measured vessel has moved outside the trigger ROI or if the trigger threshold is too high.

The contrast medium parameters and the trigger parameters for the **Contrast** step are entered into the **Contrast** parameter card.

✓ The bolus tracking scan protocol is loaded after you have clicked the **Accept** button for the monitoring ROI.

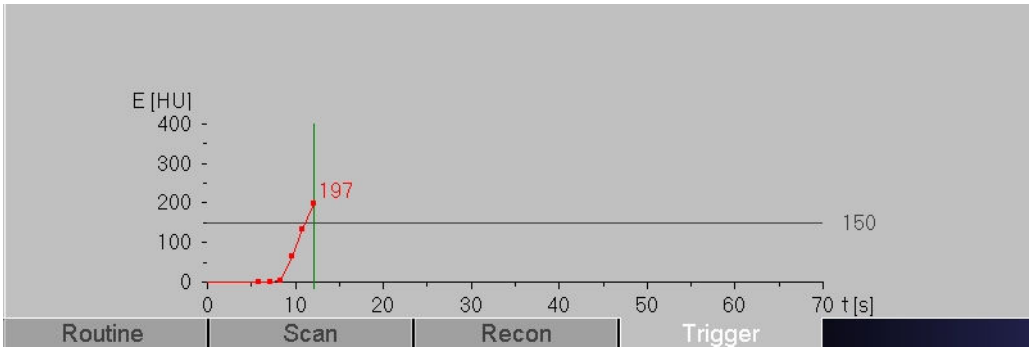
1 If you have changed parameters after accepting the monitoring ROI, click the **Load** button, and follow the suggestions of the program.

2 Start contrast medium administration by using the bolus injector and the **Monitoring** scan simultaneously with the **Start** key or the foot switch.

The CARE Contrast CT option allows a coupled start of scanning and injection, either via the CT scanner or via the bolus injector.
(→ Page 447 *CARE Contrast CT*)

Starting the Monitoring scan

After the specified delay time, the system starts the **Monitoring** scan.



1 Check the time-density curve of the contrast enhancement on the **Trigger** parameter card.

If the contrast enhancement does not increase after a few scans, the scanning must be stopped and the bolus injector equipment, the needle, or the vein must be checked.

2 Start the scan if there is contrast enhancement visible in the tomo segment.

After suspending a **Monitoring** scan, you can start the range manually or repeat the **Monitoring** scans.

If the trigger level is not reached or **Auto trigger** is disabled, a message appears after the defined number of monitoring scans. Repeat the monitoring scan or start the diagnostic scan immediately by pressing the **Start** key on the control box.

7.2 CARE Contrast CT

The majority of CT examinations are performed with intravenous (i.v.) injection of contrast media (CM). The contrast scan yields good results only, if the acquisition occurs during the optimal phase of enhancement in the region of interest. Therefore, it is essential to determine the exact timing of the contrast injection and the scan. It is also necessary to map this timing onto the CT scanner and bolus injector in a synchronized way.

CARE Contrast CT couples the CT scanner with bolus injectors. Connecting both systems allows the scanner to interact with the bolus injector and vice versa.

If your CT scanner is connected to a bolus injector, communication allows you to start injection and scanning, and stop injection either via the CT scanner or via the bolus injector. You can set the bolus injector parameters on both systems. The parameters are automatically adopted by the other system, and are displayed on the **Contrast** parameter card. The CT system documents the injection parameters. (→ Page 450 *Start/Stop behavior in coupled/uncoupled mode*)

CARE Contrast CT treats the **Pressure Limit** injection parameter as part of the contrast protocol.

We do not recommend establishing a connection to the bolus injector, or switching on the bolus injector during the scan.

For more information on scanning in coupled mode, refer to the operator manual of the used bolus injector.

You can predefine the coupled mode for your contrast enhanced scan protocols in the **Scan Protocol Assistant**.

For interventional scan protocols, only the first i-Spiral can be acquired in coupled mode.

In compliance with country-specific regulations, only bolus injectors released by Siemens are supported. As soon as the bolus injector is connected, the software checks whether the bolus injector is authorized. It is also checked whether the parameter transfer from the scanner to the bolus injector is available for your bolus injector, or only the transfer from the bolus injector to the scanner.

Contact your Siemens representative for more information on the released bolus injectors.

If you change any values via keyboard, it is necessary that you confirm them by pressing the **Enter** key.

If you are not familiar with the basic functionalities of the *syngo* software, refer to the (➔ *Basic functionalities section*) in the *Basic applications* document.

7.2.1 Activating the coupled mode

You can couple the CT scanner and the bolus injector so that you can start and stop both systems, and transfer the injection parameters between the two systems. The scanner gets extended operational control over the bolus injector. The scanner is able to retrieve information from the bolus injector about the applied injection.

If you paste or repeat a coupled range, the new range is reset to uncoupled.

You can see the status of the bolus injector by different icons in the status bar of the monitor:

Icon	Meaning
	Bolus injector coupling rejected
	Bolus injector available
	Bolus injector ready
	Local procedure on bolus injector active

By selecting **Edit** > **Save Scan Protocol** from the main menu, you can save scan protocols with **Injector coupled** as predefined scan start.

Scan ranges are marked within the chronicle to distinguish an unscanned from an already finished or uncoupled scan range.

Icon	Meaning
	Coupled unscanned scan range
	Coupled scanned scan range
	Uncoupled scan range

Start/Stop behavior in coupled/uncoupled mode

	Mode	Action	Result
Start	Uncoupled	**Start** key/foot switch	• Scan starts • Injection will not start • Injection parameters can only be entered for documentation purposes
	Coupled (start button)	• **Start** key at the control box • **Start** key at the gantry • Bolus injector console • Bolus injector head	• Injection protocol is sent to or received from the bolus injector • Injection and scan will start simultaneously
	Coupled (foot switch)	• Foot switch at the CT scanner • Bolus injector console • Bolus injector head	• Injection protocol is sent to or received from the bolus injector • Injection and scan will start simultaneously

	Mode	Action	Result
Stop	Coupled (start button or foot switch)	**Stop** key at the CT scanner	• Injection is canceled • Scan is canceled
		• **Suspend** key at the CT scanner • **Suspend** button on the **Examination** task card	• Injection is canceled • Scan is canceled
		Stop injection at the bolus injector	• Injection is canceled • Scan is not canceled
		Bolus injector stops injection due to an incident	• Injection is canceled • Scan is not canceled
		CT scanner stops scan due to an incident	• Injection is canceled • Scan is canceled

Setting the coupled mode

Please observe the safety instructions in the operator manual of the bolus injector manufacturer.

CAUTION

Unintended activation of coupled mode!

Undesired radiation

◆ Verify that uncoupled mode is activated before starting the injection.

CAUTION

Scanning with coupled contrast medium injection!

Contrast medium not or only partially usable.

- Follow the instructions in the Instructions for Use of your bolus injector.

CAUTION

Coupled start is not activated!

Injection will not be started automatically, if coupled start is not activated.

- Check in **Scan** subtask card whether a coupled start is activated or not.

1 Load a scan protocol with **Contrast** entry.

– or –

Right-click the chronicle.

2 Choose **Contrast**, **Bolus Tracking**, or **TestBolus** on the context menu.

You can change the scan start (**Scan** parameter card) to any coupled option. In this case, a **Contrast** entry is inserted automatically.

3 Select the **Contrast** entry in the chronicle.

The **Contrast** parameter card is displayed.

4 Select **Injector coupled (start button)** or **Injector coupled (foot switch)** from the **Scan start** selection list.

You can save the new settings as default start options for this scan protocol.

You can predefine the coupled mode for any contrast enhanced scan protocol via the **Scan Protocol Assistant**.

Autoranges in coupled mode

In an autorange, select the **Injector coupled** setting for the first scan range only. The injector is automatically coupled for all remaining ranges.

If you suspend the scan in an autorange, the injection is canceled immediately for the current scan range.

7.2.2 Checking the parameter settings

As the CT scanner and the bolus injector start simultaneously, you have to adjust the scan delay time.

If you activate the coupled mode by inserting a **Contrast** entry, the injection parameters are received from the bolus injector. You can then edit the parameters either on the **Contrast** parameter card, or on the bolus injector, depending on the selected contrast protocol.

Invalid parameters are displayed with a yellow background color.

Changing the injection parameters on the **Contrast** parameter card may not be possible on your system. Change the parameters on the bolus injector instead.

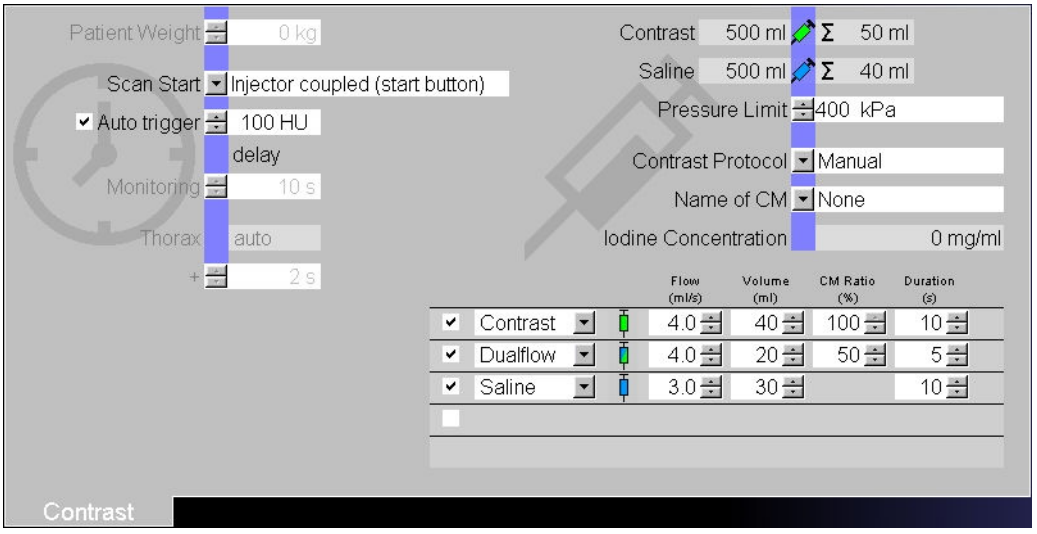
We recommend placing the remote control of the bolus injector close to the *syngo* Acquisition Workplace to observe additional messages coming from the bolus injector.

On the **Contrast** parameter card, up to 10 injection phases (incl. delay phases) can be displayed. You cannot see additional phases from the bolus injector.

The **Contrast** parameter card is subdivided into three different areas:

- Left part: Scan parameters
- Upper right part: Injector status, currently set pressure limit, selected contrast protocol, contrast medium information
- Lower right part: Contrast protocol (injection parameters)

In the upper right part of the **Contrast** parameter card, you can see the total amount of remaining contrast medium and saline. ∑ indicates the total amount of the contrast medium and saline to be applied.



From the selection list on the **Contrast** parameter card, you can choose the different kinds of bolus injector parameter handling:

- **Injector**: The injection parameters are received from the bolus injector and are displayed on the **Contrast** parameter card.
- **Manual**: In the coupled mode, the injection parameters are editable and will be immediately transferred to the bolus injector for parametrizing.
- User-defined contrast protocols: The injection parameters of the user-defined contrast protocols are used for setting the parameters of the bolus injection.

Double-check the pressure limit before each scan. Make sure you check the pressure limit on the **Contrast** parameter card and at the bolus injector.

The CT system is supposed to only send protocol data to the injector if the injector is in a ready-to-receive mode. This implies that no other functions are active on the injector. Other functions are active if, for example, the injector is prompting user interaction, such as filling the syringes or confirming the air free state. You can easily check the current operating state at the touch screen of the injector remote control.

Only valid contrast protocols can be sent to the bolus injector. The contrast protocols of the CT system and the bolus injector will only match if valid parameters are set.

1 In the chronicle, select the **Contrast**, **TestBolus**, or **Bolus Tracking** entry.

  The **Contrast** parameter card is displayed.

2 From the **Contrast Protocol** selection list, select the desired contrast protocol.

  The injection parameters on the bolus injector will be overwritten.

3 On the **Contrast** parameter card or on the bolus injector, check the injection parameters.

Instead of clicking each injection parameter value separately, you can also use the **Tab** key of your keyboard.

4 On the **Contrast** parameter card or on the bolus injector, change the parameters, if necessary.

After changing the parameters on the **Contrast** parameter card, they are sent immediately to the bolus injector. The entry in the **Contrast Protocol** selection list changes to **Manual**.

5 In the **Name of CM** selection list, check the used contrast medium and change it, if necessary.

On the **Contrast** tab card of the **Examination Configuration** dialog box, you can add more contrast media to the **Name of CM** selection list.

In the **Apply** selection list, choose **Dualflow** instead of **Saline** or **Contrast** to apply saline and contrast medium at the same time. **Dualflow** is only available for the coupled mode if the connected bolus injector supports this feature. In the **CM Ratio%** entry field, you can adjust the amount of the applied contrast medium.

6 Select the diagnostic scan entry in the chronicle.

7 Check the default scan parameters on the **Routine** parameter card and correct them, if necessary.

Defining the start delay

You can perform a TestBolus scan with a small amount of contrast medium to define the start delay. Therefore choose **TestBolus** from the context menu of the chronicle. Load the acquired images in *syngo* Dynamic Evaluation to evaluate the time to peak enhancement. This time can then be used as the optimal start delay time for the diagnostic scan.

CAUTION

Misunderstanding of reference point for start delay in bolus examination!

Faulty synchronization between bolus and scanning.

- Make sure that the chosen delay time fits to the characteristics of the bolus injection.

- Enter the required scan delay time in the **Delay** entry field.

  On the **Contrast** parameter card, the delay is updated accordingly (read-only).

7.2.3 Performing a scan in coupled mode

If your CT scanner is connected to a bolus injector, communication allows you to start injection and scanning, and stop injection either via the CT scanner or via the bolus injector. If the bolus injector is released for the injection parameter transfer from the CT scanner to the bolus injector, the injection parameter are also editable on the **Contrast** parameter card.

1. Perform the scan in the usual way. (→ Page 387 *Scan*)

   If the connected bolus injector is not ready for injection yet, a yellow message bubble will be displayed that prompts you to check the bolus injector.

2. Check the bolus injector as described in the operator manual of the bolus injector.

3. Enable the bolus injector for injection.

If you have checked it already before loading, the yellow message bubbles **Press foot switch** or **Press START** together with a syringe icon indicate that both systems are ready for scanning.

As soon as the bolus injector is enabled for injection, the parameters are dimmed on the **Contrast** parameter card.

For more information on the remote CT scanner start, refer to the operator manual of the configured bolus injector.

4 Press the **START** key on the control box or the foot switch of the CT scanner to start both systems.

– or –

Press the **START** key on the bolus injector to start both systems.

After the injection, the effectively used injection parameters are updated on the **Contrast** parameter card, and are documented by the CT system.

Depending on the bolus injector, the bolus injector console shows nominal values of the injection protocol after the injection. On the **Contrast** parameter card, the achieved values are displayed.

For further instructions on switching the display to the achieved values of the injection (flow and pressure curve), refer to the operator manuals of the bolus injector manufacturer.

The values for the injection phase duration and pressure limit which are displayed at the bolus injector and the **Contrast** parameter card can slightly differ. This behavior is caused by different rounding methods.

The contrast management and the injection parameters are documented via the following features:

- MPPS
- Patient protocol
- E-Logbook

7.2.4 Canceling a scan in coupled mode

For more information on the bolus injector handling, see the operator manual of the bolus injector manufacturer.

Please observe the safety instructions in the operator manual of the bolus injector manufacturer.

CAUTION

Loss of communication to the bolus injector!

Injection will not be stopped automatically, if scan is aborted or suspended.

- If needed, stop injection at the bolus injector console.
- Stop scan if the bolus injector has not delivered enough contrast media.

CAUTION

Injection stopped by the user!

X-ray not, or only partially, usable.

- Press **Suspend** at scanner if not enough contrast media was administered.

- Click the **Suspend** button to cancel both, injection of contrast medium and radiation.

If the injection is canceled at the bolus injector, the scan is not automatically stopped. (➔ Page 450 *Start/Stop behavior in coupled/uncoupled mode*)

– or –

Press the **STOP** key on the control box or the gantry panel to stop both systems.

Radiation and the injection of contrast medium is stopped immediately, and the entire system is blocked.

7.2.5 Saving a contrast protocol

A contrast protocol is part of the scan protocol.

When you save a scan protocol, the corresponding contrast protocol is also saved.

Instead of saving the contrast protocol along with the scan protocol, you can save the contrast parameter settings separately. Then you can append the saved contrast protocol to any scan protocol.

Saving the contrast protocols may not be possible on your system, depending on the bolus injector and your country-specific regulations.

1. On the **Contrast** parameter card, change the injection parameters.
2. On the main menu, choose **Edit** > **Save Contrast Protocol** to overwrite the current contrast protocol.

   – or –

   Choose **Edit** > **Save Contrast Protocol As...** to save a new contrast protocol.

3 In the **File name** entry field of the **Save Contrast Protocol** dialog box, enter the name of the contrast protocol.

4 Click the **Save** button.

Appending a contrast protocol to a scan protocol

The same contrast protocol can be appended to different **Contrast** entries in different scan protocols. This means that changing a contrast protocol influences all scan protocols which are linked with this particular contrast protocol.

1 Load a scan protocol.

2 Insert a **Contrast**, **TestBolus**, or **Bolus Tracking** entry.

3 From the **Contrast Protocol** selection list, select a contrast protocol.

In the Scan Protocol Assistant, you can also append a contrast protocol to a scan protocol.

7.3 Respiratory Gating

Respiratory Gating provides respiration correlated scans for radiation therapy evaluation.

These scans enable you to separate tumor contours according to the tumor motion. Therefore, you can plan the radiation therapy more reliably.

For instructions using the Respiratory Gating System please refer to the instructions for use of the Respiratory Gating System manufacturer. More information can be obtained via Internet.

The image data are synchronized to the respiratory cycle. To achieve this synchronization, two methods are available which belong to the data acquisition mode:

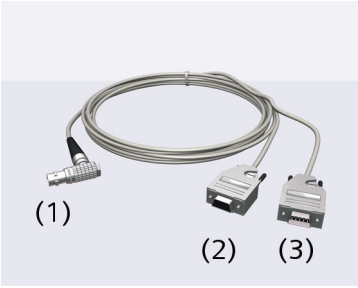
- In Prospective Triggering, the respiratory signal is used to trigger a CT scan at the appropriate phase of the respiratory cycle.
- In Retrospective Gating, the respiratory curve and the CT raw data are recorded simultaneously. Retrospective gating allows to reconstruct images from any predefined phase of the respiratory cycle.

If you change any values via keyboard, it is necessary that you confirm them by pressing the **Enter** key.

If you are not familiar with the basic functionalities of the *syngo* software, refer to the (➔ *Basic functionalities section*) in the *Basic applications* document.

7.3.1 Connecting the Anzai respiratory gating system

For triggering, a supplementary laptop in the examination room is used. Therefore the connections at the signal converter are different for gating and triggering.



(1) Plug for connection to gantry

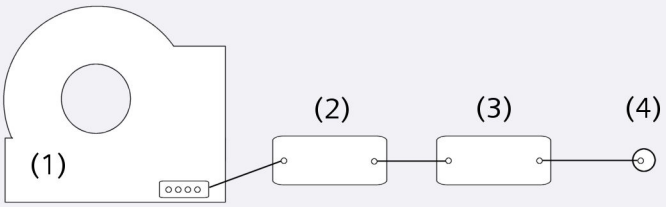
(2) Plug for connection to the signal converter of the respiratory gating system (for gating)

(3) Plug for connection to the signal converter of the respiratory gating system (for triggering)

For detailed illustrations of the receptacles please refer to the operator manual of the respiratory gating system manufacturer.

Using gating with the Anzai respiratory gating system

✓ Signal converter and sensor unit are mounted in the examination room.



(1) Gantry

(2) Signal converter

(3) Sensor unit

(4) Load cell

1 Connect plug (1) of the connection cable to the receptacle at the gantry. (➔ Page 462 *Connecting the Anzai respiratory gating system*) (➔ Page 165 *Connectors*)

2 Connect plug (2) of the connection cable to the receptacle at the back of the signal converter of the respiratory gating system. (➔ Page 462 *Connecting the Anzai respiratory gating system*)

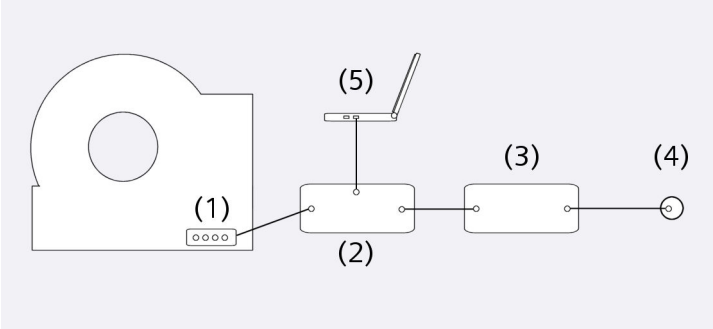
3 Connect all components of the respiratory gating system according to the operator manual provided by the respiratory gating system manufacturer.

4 Position the patient on the patient table.

5 Start the CT measurement via the console.

Using triggering with the Anzai respiratory gating system

✓ Signal converter, sensor unit and laptop are mounted in the examination room.



(1) Gantry

(2) Signal converter

(3) Sensor unit

(4) Load cell

(5) Laptop

1 Connect plug (1) of the connection cable to the receptacle at the gantry. (➔ Page 462 *Connecting the Anzai respiratory gating system*) (➔ Page 165 *Connectors*)

2 Connect plug (3) of the connection cable to the receptacle at the back of the signal converter according to the operator manual provided by the respiratory gating system manufacturer. (➔ Page 462 *Connecting the Anzai respiratory gating system*)

3 Connect all components of the respiratory gating system according to the operator manual provided by the respiratory gating system manufacturer.

4 Position the patient on the patient table.

5 Define the respiratory phase using the laptop in the examination room.

6 Start the CT measurement via the console.

7.3.2 Connecting the Varian RGSC respiratory gating system

The respiratory gating system is installed by your local customer service representative.

For details, contact your local customer service representative or your Siemens regional office.

7.3.3 Connecting the Varian RPM Respiratory Gating system

You can connect the Varian RPM respiratory gating system at the Open Interface (➔ Page 466 *Connecting an Open Interface respiratory gating system*).

7.3.4 Connecting an Open Interface respiratory gating system

The Open Interface is a connector at your CT system that enables you to run any Open Interface compatible respiratory sensor system that is compatible with your CT system.

For connecting the respiratory sensor system to the Open Interface at the gantry, a special cable is delivered: The Open Interface cable.

(1) Plug for connection to gantry

(2) Plug for connection to respiratory sensor system

For a detailed illustration of the receptacles, or instructions on assembly and mounting of the respiratory sensor system, please refer to the operator manual of the manufacturer.

Pinning

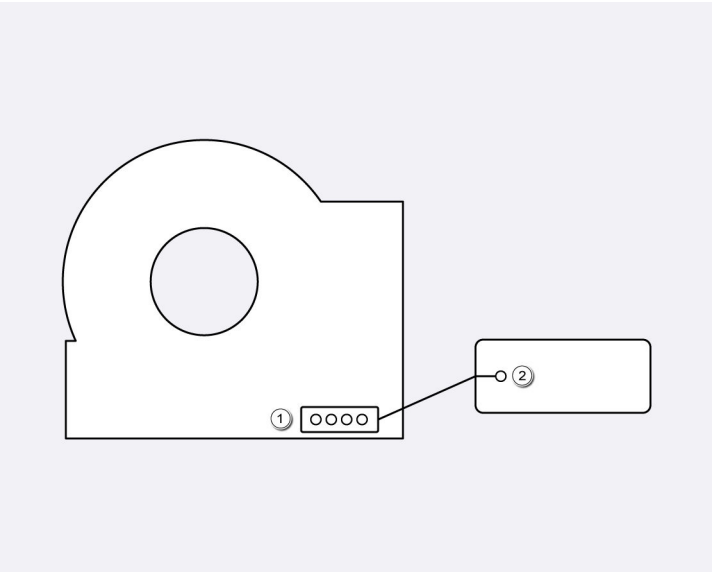
The following table shows the pinning of the Open Interface cable:

X310	Open Interface	Signal type
1	1	
3	2	X-ray signal
6	6	Trigger signal

Connecting the cable

According to the IEC 60601-1 standard, first connect the Open Interface cable at the compatible respiratory sensor system, then at the gantry.

✓ The respiratory sensor system is mounted in the examination room and configured correctly.



(1) Receptacle at the gantry

(2) Receptacle at the respiratory sensor system

1 Connect plug (2) of the Open Interface cable to the receptacle at the respiratory sensor system. (➔ Page 466 *Connecting an Open Interface respiratory gating system*)

2 Connect plug (1) of the Open Interface cable to the receptacle at the gantry. (➔ Page 466 *Connecting an Open Interface respiratory gating system*)

3 Position the patient on the patient table.

4 Start the CT measurement via the console.

Disconnecting the cable

To disconnect the respiratory sensor system, the cable must be removed vice versa to the connecting procedure.

✓ The respiratory sensor system is mounted in the examination room and connected to the gantry with the Open Interface cable.

1 Disconnect plug (1) from the receptacle at the gantry.

2 Disconnect plug (2) from the receptacle at the respiratory sensor system.

7.3.5 Preparing the Acquisition

In addition to the usual preparations in the examination room and on the console, some actions which are specific to Respiratory Gating are required.

CAUTION

Respiratory gating device not available or not active during measurement!

X-ray not, or only partially, usable.

- Make sure that the respiratory gating device is ready to use before scanning.

If you register the patient for a Respiratory Gating examination and the connected respiratory gating system is not ready for use (for example, the pressure sensor has not yet been connected), a dialog box opens. Ensure that all parts are connected and then click the **Try again** button.

1 Switch your respiratory gating system to the gating mode.

2 Position the patient on the patient table.

3 If necessary, immobilize the patient using the positioning accessories.

4 Anzai only: Apply the respiration belt with the pressure sensor and connect the cable to the sensor port.

– or –

Varian only: Position the reflector block on the patient.

5 Register the patient for the examination.

6 For Prospective Triggering, select a **Prospective Triggering** scan protocol in the **Patient Model Dialog**, for example RT_RespSeq.

Proceed with (➔ Page 470 *Acquiring with Prospective Triggering*).

– or –

For Retrospective Gating, select a **Retrospective Gating** scan protocol in the **Patient Model Dialog**, for example RT_Resp.

Depending on your workflow, proceed with the FAST 4D workflow (➔ Page 471 *Acquiring with Retrospective Gating in FAST 4D workflow*) or the manual workflow (➔ Page 472 *Acquiring with Retrospective Gating in manual workflow*).

The FAST 4D workflow is not available for an Open Interface respiratory gating system.

7.3.6 Acquiring with Prospective Triggering

You can perform a scan by using prospective triggering.

The scan time defines the single length of a scan. The total length of the sequence depends on the respiration rate. The more irregular the respiration rate, the longer the sequence scanning will take.

If you want to acquire a Respiratory Sequence, you have to set the trigger parameters at the computer of the respiratory gating system.

1 For how to set the trigger parameters, refer to the instructions for use of the respiratory gating System manufacturer.

2 Perform the sequence acquisition as usual. (➔ Page 399 *Acquiring a Sequence*)

7.3.7 Acquiring with Retrospective Gating in FAST 4D workflow

The FAST 4D workflow provides a protocol with an automatic selection of the rotation time and the pitch for the scan. The system adapts these scan parameters according to the breathing cycle of the patient.

The FAST 4D workflow is not available for an Open Interface respiratory gating system.

✓ The license for the FAST 4D workflow is available on the CT system.

✓ The patient is positioned on the table and the respiratory gating device is correctly connected.

✓ The patient is registered for the examination.

✓ A **Retrospective Gating** scan protocol is selected in which the **Est. Respiration Rate** parameter is set to **auto**, for example RT_Resp.

1 Scan the topogram.

The breathing curve is displayed on the **Trigger** parameter card.

In the chronicle, the **FAST 4D** button is active and the **Load** button is dimmed.

2 Click the **FAST 4D** button.

The evaluation of the breathing curve is started. Once the breathing curve is stable and reproducible, the scan parameters are automatically modified accordingly.

The **Load** button becomes active.

3 Click the **Load** button.

The respiratory spiral scan is performed with the determined scan parameters.

If the patient's breathing rate is faster than 30 RPM or slower than 6 RPM, the breathing rate is not considered as suitable. A corresponding message is displayed:

Please consider coaching the patient and repeating FAST 4D.

7.3.8 Acquiring with Retrospective Gating in manual workflow

In the manual workflow, you can change the scan parameters on the **Routine** and the **Scan** parameter card, depending on the respiration rate of the patient.

If the scan should continue in case of respiration signal loss, you must activate the **Synthetic Sync** option. Consider the usage of this option, especially for scans with a contrast medium.

1. On the **Routine** and the **Scan** parameter card, check the scan parameters of the scan protocol.
2. Activate **Synthetic Sync** for examinations with contrast medium.
3. On the **Trigger** parameter card, from the **Est. Respiration Rate** list, select the respiration rate.
4. Modify the scan parameters, if parameter conflicts occur.
5. Perform the spiral acquisition. (→ Page 404 *Acquiring a Spiral*)

   In parallel to the spiral acquisition, the respiratory curve is acquired.

7.3.9 Setting the gating parameters for reconstruction

It is possible to define all recon jobs before the scan has been started or after the scan.

On the **Trigger** parameter card, from the **Unit** list, you can select different modes for the reconstruction:

- **% In**: Gating based on the local amplitude (inspiration)
- **% Ex**: Gating based on the local amplitude (expiration)
- **% Pi**: Gating based on the respiratory phase (only available with a Varian respiratory gating system).
- **%**: Gating based on the breathing cycle time

1 From the **Unit** list, select a reconstruction mode.

2 In the **Phase Start** field, enter the percentage value.

By setting the unit and the percentage value, you determine the start of the reconstruction (→ Page 476 *Reconstructing with respiratory data*).

7.3.10 Scaling the respiratory curve manually

In addition to an automatic mechanism (default), you can adjust the available respiratory curve manually before the examination.

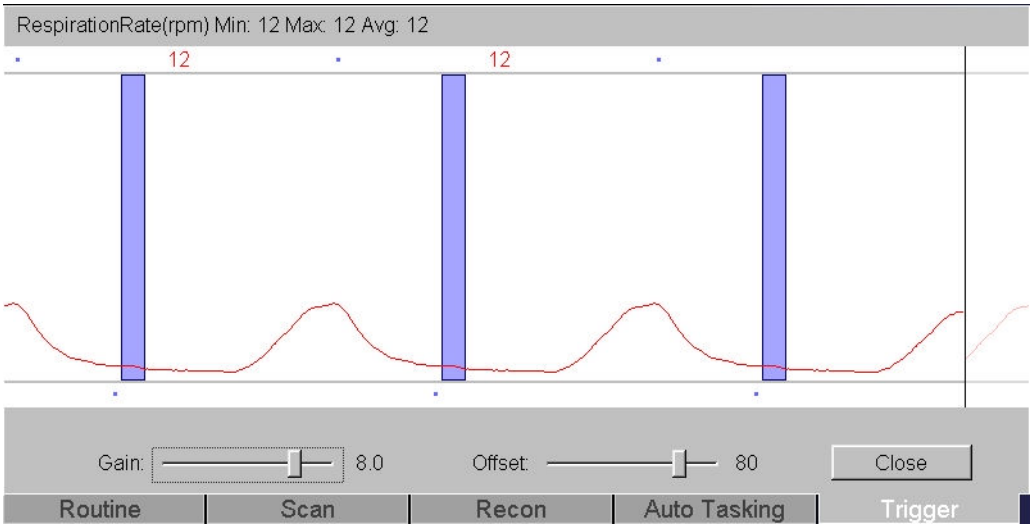
If you choose the manual waveform setup, automatic adjustment is switched off until the examination is ended.

The curve setup is only possible when using ANZAI as respiratory gating device.

1 Select the **Trigger** parameter card.

2 Click the **Curve Setup** icon on the **Trigger** parameter card.

The **Gain** and the **Offset** sliders are displayed.



3 Move the **Gain** slider to modify the curve amplitude.

4 Move the **Offset** slider to shift the entire curve along the y-axis until the requested value and the respective position are reached.

5 Click the **Close** button to switch back to the normal display mode.

7.3.11 Using the Open Interface mode

You can connect other respiratory gating devices, for example, Varian Real-time Position Management (RPM).

In addition to the amplitude information, the Varian respiratory file can contain information about the respiratory phase (**% Pi**). Only if the file contains this information, you can perform a phase-based reconstruction.

Activating the Open Interface mode

✓ The external device provides the breathing information as a persistent file in the Varian file format.

1 Connect the external device to the CT system.

2 Select **Options** > **Configuration** from the main menu.

The **Somaris/7 – Configuration Panel** is displayed.

3 Double-click the **Respiratory Gating** icon.

The **Respiratory Gating** dialog box is displayed.

4 Select the **Device** tab card.

5 Select **Open Interface (or Average CT without gating device)**.

6 Click **OK**.

Acquiring the scan

1 Load a Respiratory Gating spiral scan in the chronicle.

If an external device other than ANZAI or Varian RGSC is connected, a message is displayed to inform you to record a respiratory data file.

2 Click **OK** to continue with the Open Interface mode.

3 From the **Est. Respiration rate** drop-down list on the **Trigger** parameter card, select the respiration rate.

4 Start and complete the scan.

During the acquisition, the breathing curve is not displayed.

Importing the respiratory file

If you have completed the scan, the **Import Respiratory File** dialog box opens. You can select any respiratory file (*.vxp) from the local or connected network drives. The service technician can configure your system so that the respiratory files are saved in the folder H:\SiteData\OffLine by default.

✓ The imported files have at least Varian file version 1.6.

CAUTION

Assigning wrong respiratory data to the selected patient!

Wrong reconstruction result. Reconstruction has to be repeated.

- Make sure that respiratory and patient data match, for example, by defined naming.

1 Select the vxp-file.

If you select an unsuitable file or no file is available, the reconstruction is still possible, but it can provide images with artifacts. Do not use these images for diagnosis.

2 Click **OK**.

The breathing curve is displayed on the **Trigger** parameter card after a successful import.

3 If necessary, click the **Import** icon on the **Trigger** parameter card to repeat the import of the respiratory file.

You can repeat the import at any time. You can also unload an imported file by right-clicking the **Import** icon.

7.3.12 Reconstructing with respiratory data

The respiratory curve contains a scroll bar after the scan which allows you to call up the respiratory progression. Therefore, you can optimize the position of the recon boxes for the entire spiral acquisition.

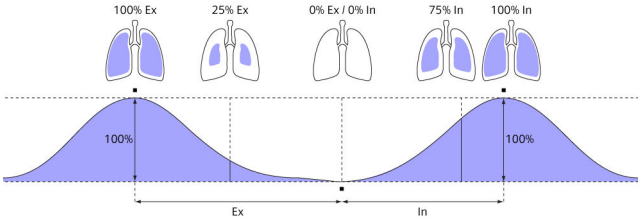
The respiratory data of the spiral acquisition is stored together with the raw data in the local database.

With **Original RESP**, you can switch back and forth between the original and the modified respiratory signal. Since no editing is possible for phase-based reconstruction, the **Original RESP** check box is selected by default and cannot be cleared.

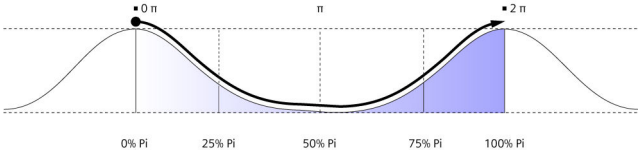
If you select the **Original RESP** check box after editing syncs, a message will inform you that the edited syncs will be reset to the original sync.

Unit	Reconstruction mode	Description	Example
%In	Gating based on the local amplitude	Defines time stamps as fractions of the local amplitude of each inspiration slope, but not relative to the temporal duration of the inspiration	20% In: Patient inhaled to 20% of the local breathing amplitude (20% of the inspiration is completed)
%Ex	Gating based on the local amplitude	Defines time stamps as fractions of the local amplitude of each expiration slope, but not relative to the temporal duration of the expiration	20% Ex: Patient exhaled to 20% of the local breathing amplitude (80% of the expiration is completed)
%Pi	Gating based on the respiratory phase	The respiratory phase is a parametrization of the breathing cycle where the full breathing cycle corresponds to 2π. The inspiration peak corresponds to 0 of the new breathing cycle and 2π of the preceding cycle.	10% Pi: Patient completed 10% of one breathing cycle
%	Gating based on the breathing cycle time	The time stamps are calculated based on fractions of the total length of the breathing cycle.	10%: Patient completed 10% of one breathing cycle

Amplitude-based reconstruction



Phase-based and time-based reconstruction



1 Select a reconstruction job in the chronicle.

2 If necessary, edit the signal by using the entries of the context menu for amplitude-based reconstruction.

3 Change the **Phase Start** on the **Trigger** parameter card to move the recon box to the required position.

4 Define the further reconstruction parameters, if necessary.

On the **Trigger** parameter card, you can select the **Average CT** check box to reconstruct the selected recon job as a standard spiral and not as a respiratory spiral.

The **Average CT** feature creates images, which contain raw data from at least one complete respiratory cycle to create an overview of the complete tumor motion within a respiratory cycle. To ensure that the full breathing cycle is represented within Average CT images, reconstruct the images with a sufficient slice width of at least 2 mm.

5 Start the reconstruction.

7.3.13 Reconstructing Multiphase series

Using multiphase you can reconstruct up to 24 different phases within one recon job.

1 Set the reconstruction parameters as desired on the **Recon** parameter card.

2 Click the **Multiphase** icon on the **Trigger** parameter card.

3 Click the **Recon** button to start reconstruction.

The images are reconstructed and stored in one series.

For every respiration cycle and every selected phase, a blue colored recon box is displayed. Its width is determined by the temporal resolution of the images, which are reconstructed at the corresponding z-position.

Selecting phases for Multiphase reconstruction

You can select single phases in a range from 0% through 100%.

- On the phase bar on the **Trigger** parameter card, select single phases.

  – or –

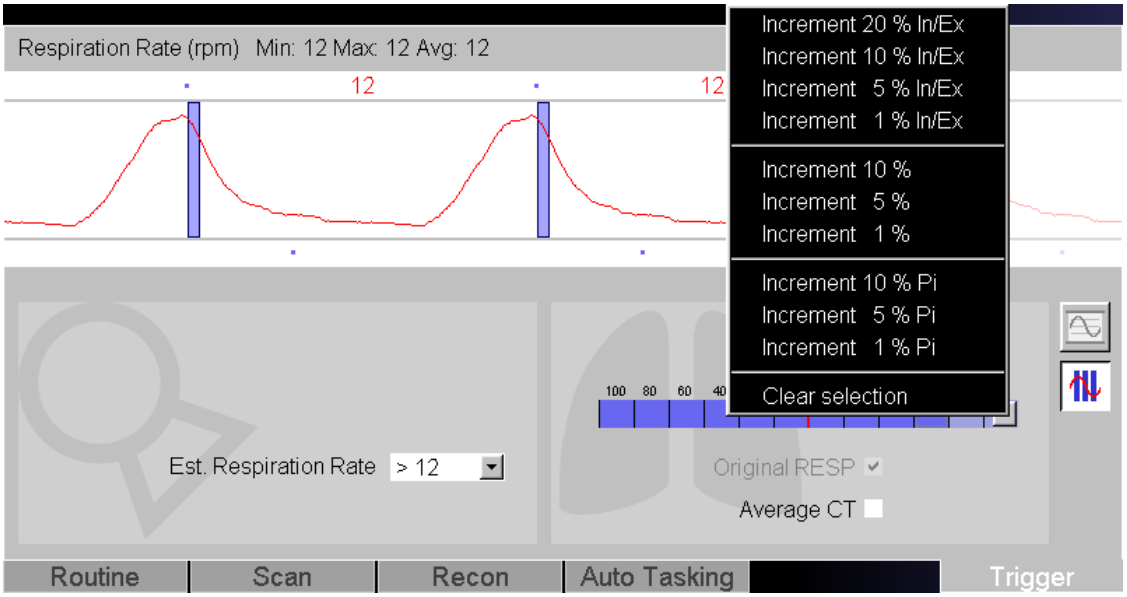
  Select a range of phases by clicking and dragging the mouse.

If too many phases are displayed, you can scroll through the list and select the phases.

Modifying Multiphase parameters

1 Click the drop-down icon next to the multiphase list on the **Trigger** parameter card.

2 Change the phase increment via the selection list.



Splitting up multiphase series

You can split up multiphase series into singlephase series to make sure that they can be used for radiation therapy planning.

In the RT_Resp protocol, the **Series Splitting** check box is selected by default on the **Recon** parameter card.

Once the reconstruction of the multiphase series is completed, the series is split into singlephase series.

If **Auto Transfer** is configured, the singlephase series are automatically sent to the relevant DICOM node.

If configured, the singlephase series are mapped to the *syngo*.via workflow and assigned to the specified data roles.

Generating t-MaxIP or t-MinIP series

In t-MaxIP series, the maximum HU value across the input phases is used for calculating the result images. In t-MinIP series, the minimum HU value is used.

You can combine the **Series Splitting** setting on the **Recon** parameter card with specific settings on the **Auto Tasking** parameter card to allow for an automatic generation of t-MaxIP or t-MinIP series.

◆ On the **Auto Tasking** parameter card, from the **Auto postprocessing** list, select t-MaxIP or t-MinIP.

Once the singlephase series are generated, the t-MaxIP or t-MinIP series are automatically reconstructed.

If **Auto Transfer** is configured, the t-MaxIP or t-MinIP series are automatically sent to the relevant DICOM node.

If configured, the t-MaxIP or t-MinIP series are mapped to the *syngo*.via workflow and assigned to the specified data roles.

7.4 Cardiac CT

The HeartView option uses an ECG as a trigger for capturing images at the same heart phase. It reduces or even suppresses motion artifacts.

The image data is synchronized to the heart cycle. To achieve the synchronization, several methods are available, which belong to the mode of data acquisition:

- For prospective triggering sequences are employed. The ECG signal is used to trigger a CT scan at the appropriate heart phase. It is triggered with a certain delay after the R-wave.
- For ECG mode spirals are employed. The ECG and the CT raw data are recorded simultaneously. Then retrospective gating selects only a portion of the spiral data to reconstruct images of the selected heart phase.

For monitoring and controlling the Cardiac CT option, the **Trigger** parameter card is displayed as soon as you choose a cardiac scan mode. On this parameter card, you can monitor the ECG from the connected electrocardiograph and set the necessary parameters.

We recommend the use of images with 1 mm width for MPRs and VRTs.

If you change any values via keyboard, it is necessary that you confirm them by pressing the **Enter** key afterwards.

syngo offers many possibilities to optimize the dose applied to a patient. For more information, see (➔ Page 249 *Dose management and optimization*).

For a dose optimized cardiac workflow, see (➔ Page 301 *Considerations for Cardiac CT*).

If you are not familiar with the basic functionalities of the *syngo* software, refer to the (➔ *Basic functionalities section*) in the *Basic applications* document.

CAUTION

Missing ECG-Sync due to the disconnection of the patient's ECG-electrodes!

X-ray not, or only partially, usable.

- Check the ECG electrodes before scanning.
- A contrast enhanced scan should not be aborted but operated with synthetic ECG-data.

7.4.1 Preparing the Acquisition

In addition to the usual preparations in the examination room and on the console, some actions specific to Cardiac CT are required.

If you register the patient for a Cardiac CT examination and the ECG electrodes have not been connected yet, a dialog box is displayed. Connect the ECG electrodes, and then click the **Try again** button.

Using CARE Bolus CT you can synchronize the cardiac scan with administration of the contrast medium. Insert the CARE Bolus examination steps into the chronicle after you have set the scan and trigger parameters of the spiral. The cardiac scan is started like any CARE Bolus examination as soon as the defined Bolus threshold is reached. As soon as you start the monitoring scan, the **Trigger** parameter card moves to the foreground. In addition to the ECG signal, it now also displays the threshold value diagram

For scans with contrast medium, always activate the synthetic trigger so that a scan does not stop if problems arise with the ECG signal. (➔ Page 485 *Setting gating parameters*), (➔ Page 490 *Setting trigger parameters*)

For training and presentation you can use the **ECG Monitor Demo Mode**. After loading a scan protocol, the DEMO MODE is displayed on the ECG curve of the **Trigger** parameter card.

Make sure to end the ECG Monitor Demo Mode by clicking the **Close Patient** icon before starting a normal Cardiac CT scan.

1 Position the patient on the patient table.

2 Use positioning aids to ensure that the patient is in a comfortable and secure position.

3 Immobilize the patient, if necessary.

CAUTION

Wrong ECG signal detection!

Undesired radiation

- Check the correct position of the ECG electrodes before scan start.

4 Apply the electrodes for the electrocardiogram (ECG) and connect the ECG cable to the socket at the bottom end of the table. (➔ Page 197 *Placing ECG electrodes*).

The ECG cables shall be applied outside the heart region to avoid artifacts.

5 Select the required **Cardiac** scan protocol in the **Patient Model Dialog** and register the patient for examination.

The **Trigger** parameter card is available for controlling Cardiac CT. It is also accessible for non-cardiac steps to monitor the heart rate.

6 Scan a topogram and define the ranges for the spiral or sequence.

7 Prepare for scanning with contrast medium, if applicable.

7.4.2 Acquiring an ECG-Gated Spiral

In the spiral mode, data acquisition continuously proceeds while the patient table is moving forward with a constant pitch.

Due to the continuous data acquisition, the spiral mode allows maximum flexibility for data reconstruction. If necessary, you can also edit the ECG in this mode for challenging patients.

Since, compared with non-gated spirals, the pitch depends on the heart rate of the patient, very low pitch values of approximately 0.2 are needed. This may be at the expense of a higher radiation dose.

To alleviate this effect, the tube current should be modulated with ECG Pulsing and MinDose depending on the current heart phase.

If an image is marked in the comment line with “RQ, ...” the image was reconstructed with projections from low dose window and may show increased image noise.

Setting scan parameters

You cannot modify the **Scan time** and the **Pitch** on the **Scan** parameter card.

- Check the scan parameters preset in the scan protocol on the **Routine** and the **Scan** parameter card and adapt them, if necessary.

Setting gating parameters

You can modify the predefined values of the configuration and set the recon delay.

1 Select **Options** > **Configuration** from the main menu.

2 Double-click the **HeartView** button.

3 Select the **ECG Synthetic Trigger / Sync** check box, and click the **OK** button to activate the synthetic sync for examinations with contrast medium in particular.

You can activate the **ECG Synthetic Trigger / Sync** check box in an examination with ECG pulsing. If the system detects a missing ECG signal during measurement, the ECG pulsing will be switched off automatically. At that time, the mAs (tube current) will be set back to 100% of the initially adjusted value.

4 From the **Unit** selection box, select **ms** (absolute delay) or **%** (relative delay) as the trigger unit.

5 Set the recon delay in the **Phase Start** field. (→ Page 308 *Setting Phase Start*)

A positive value in the **Phase Start** field means a delay after the R wave. A negative value means that the starting point of the scan window is before the next estimated R wave.

Adapting the pitch

It is possible to adapt the pitch automatically or manually according to the heart rate of the patient.

The heart rate is monitored during at least 10 heart cycles to achieve a stable heart rate overview.

By clicking the **LOAD** button, the current heart rate and the estimated heart rate is compared. If the estimated heart rate setting exceeds the actual heart rate, a message box opens:

- By clicking the **Start** button, the scan is continued without pitch adaptation
- By clicking the **Reload** button, the system adapts the estimated heart rate automatically
- By clicking the **Cancel** button, the mode is canceled

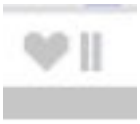
1 Select the estimated heart rate of the patient from the **Est. HR** selection list on the **Trigger** parameter card to activate the manual pitch adaptation.

2 Select **auto** to activate the automatic pitch adaption.

Based on the last 10 heart cycles, the pitch is calculated.

During the breath hold command, the heart rate may drop with a delta beyond 8 beats per minute (bpm). Therefore, artifacts may be caused. Observe the heart rate of the patient also during the breath hold command.

Selecting ECG channels



The heart symbol and the channel numbers I-III on the **Trigger** parameter card below the diagram show the currently selected ECG recording channel.

◆ Toggle through the different channels to find the optimal channel.

The second ECG channel with the best amplitude enables high-quality scan data.

Scanning with ECG Pulsing

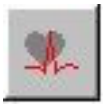
Scanning with ECG Pulsing offers you the option to activate a dose modulation mechanism. With ECG Pulsing, you can reduce the dose beyond the high dose plateau. (➔ Page 261 *ECG Pulsing and MinDose*)

Heart examinations are a typical application of ECG Pulsing where one of the following points is required:

- Functional analysis is desired
- A functional image impression based on a reduced dose level is acceptable

If ECG Pulsing is enabled, the dose value on the **Routine** parameter card is adapted to the actual ECG pulsing dose reduction potential.

Only data acquired in the scan window can be reconstructed with high image quality if ECG Pulsing is activated.



You can modify the predefined values of the configuration by clicking the **Auto Trigger configuration** icon on the **Trigger** parameter card. The **HeartView** configuration dialog box opens, and you can make your modifications for each heart rate.

1 Select **manual** in the **Pulsing** selection list on the **Trigger** parameter card to activate dose modulation for reducing dose during scanning.

CAUTION

Wrong setting in display!

Ionizing radiation

- Set the ECG pulsing window to clinically relevant value.

2 Modify the start and end point of the high dose plateau in the entry fields on the **Trigger** parameter card.

– or –

Select **auto** in the **Pulsing** selection list on the **Trigger** parameter card to use the predefined values of the configuration depending on the heart rate.

Using MinDose

The scanning with the **MinDose** option provides you the ability to activate an enforced dose modulation mechanism. In this way, you can reduce the dose beyond the high dose plateau down to a minimum of 4%. If MinDose is not available, the value of the dose plateau is reduced to 25%.

A typical application of MinDose are heart examinations where the functional analysis is not desired. Reconstructions outside the high dose plateau are possible but images do not have sufficient image quality for reporting or functional imaging.

Images obtained beyond the high dose plateau are of reduced image quality. Postprocessing applications may not accept these images.

You can modify the start and the end point of the high dose plateau also for the **MinDose** option.

1 On the **Trigger** parameter card, use the **Pulsing** selection list to switch between standard dose and **MinDose**.

2 Select **MinDose - manual** to activate the manual dose modulation for reducing the dose beyond the high dose plateau.

– or –

Select **MinDose - auto** to activate the automatic dose modulation for reducing the dose beyond the high dose plateau.

3 Load the mode.

A message box is displayed to inform you that the image quality for diagnostic purposes is not guaranteed.

Acquiring the spiral

You can synchronize an ECG-gated spiral with application of the contrast medium.

- Perform the spiral acquisition in the usual way.
  (→ Page 404 *Acquiring a Spiral*)

Make sure that you give the patient breathing instructions.

During scanning, the **Trigger** parameter card automatically pops up so that you can monitor the scan.

7.4.3 Acquiring an ECG-Triggered Sequence

Prospective ECG triggering combined with step-and-shoot acquisition of axial slices acquires the appropriate amount of scan data needed for image reconstruction during the previously selected heart phase. The ECG signal of the patient is monitored during examination, and axial scans are started with a pre-defined time offset relative to the R-waves. Irregularities are reliably detected, and in case of an ectopic beat, the scan is repeated at the same position.

In the ECG-triggered sequence mode, the patient table moves the patient to the first z-position. The scan is triggered depending on the ECG. Then the patient is moved to the next z-position. The procedure is repeated until the range to be scanned is completed.

Setting scan parameters

When scanning with API, sequence scans are clustered (except Adaptive Cardiac Sequences), and scan pauses are inserted accordingly.

Check the correct setting of the breathhold time via **Options** > **Configuration** > **Examination** > **Patient** from the main menu.

1 Check the default scan parameters on the **Routine** and **Scan** parameter cards, and change them, if necessary.
(→ Page 399 *Checking parameter settings*)

The **Scan time** represents the single length of a scan. The examination time of the sequence depends on the heart rate. The more irregular the heart rate, the longer the sequence scanning will take.

2 If necessary, select another **Scan time** or modify the **Feed** of the table ("0" is available, for example, for contrast examinations).

Setting trigger parameters

If **Synthetic Trigger** is activated, the scans are continued in case of ECG signal loss.

1 Select **Options** > **Configuration** from the main menu.

2 Double-click the **HeartView** button.

3 Select the **ECG Synthetic Trigger / Sync** check box, and click the **OK** button to activate the synthetic sync for examinations with contrast medium in particular.

You can activate the **ECG Synthetic Trigger / Sync** check box in an examination with ECG pulsing. If the system detects a missing ECG signal during measurement, the ECG pulsing will be switched off automatically. At that time, the mAs (tube current) will be reset to 100% of the initially adjusted value.

4 Select **ms** (absolute delay) or **%** (relative delay) as the trigger unit in the selection box on the **Trigger** parameter card.

5 Change the **Phase Start** on the **Trigger** parameter card to move the recon window to the desired position.

Acquiring the sequence

After you started the scan, the scan windows are marked with magenta lines. It is then no longer possible to change the trigger delay time.

- Perform the sequence and subsequent reconstructions in the usual way. (➔ Page 399 *Acquiring a Sequence*)

Ensure that you give the patient breathing instructions.

Adaptive Cardiac Sequence

The Adaptive Cardiac Sequence is a special scan mode, that monitors the ECG of the patient while the scan is being performed. It is able to detect irregular heartbeats and repeat scans at a certain z-position, if necessary. It also allows more than one phase of the heart cycle to be scanned.

You can adapt the scan range within two R-peaks according to your needs. You can find the most appropriate heart phase by retrospectively selecting the phase start from the final scan.

You can use the Adaptive Cardiac Sequence mode for all cardio sequences and also for Calcium Scoring and Coronary CT Angiography examinations.

syngo 3D, *syngo* Circulation, and *syngo* InSpace 4D CT can postprocess the images scanned with Adaptive Cardio Sequence.

If during scanning no R-peak is detected for more than 3 s and you have activated the **Synthetic Trigger** option, the scan will continue to run. If you have not activated **Synthetic Trigger**, the scan will be aborted after 3 s.

Activating the Adaptive Cardiac Sequence mode

You can activate the Adaptive Cardiac Sequence in the **Scan Protocol Assistant**.

✓ The **Trigger** page of step **3** in the **Scan Protocol Assistant** is open.

✓ The scan protocol is selected.

1 Double-click the cell in the **Adaptive Cardio Sequence** column.

2 To activate the Adaptive Cardiac Sequence mode, select **on** from the selection list.

3 Save the scan protocol.

Acquiring an Adaptive Cardiac Sequence

On the **Trigger** parameter card, you can choose between automatic and manual selection of the scan range and the ECG pulsing window for acquiring an Adaptive Cardiac Sequence.

Automatic selection on the Trigger parameter card

✓ The **Trigger** parameter card is selected.

1 From the **Scan** list on the **Trigger** parameter card, select **auto**.

The position of the scan range and the ECG plusing window is set by the system, based on the settings in the **Auto Trigger** tab of the HeartView configuration.

2 Perform the sequence. (➔ Page 399 *Acquiring a Sequence*)

If an irregular heartbeat is detected, a status bar message is displayed to inform you about the detected arrhythmia and that the scan will be repeated.

The system repeats the scan automatically at the same z-position.

If you suspend a running Adaptive Cardiac Sequence, the current scan is completed.

Manual selection on the Trigger parameter card

✓ The **Trigger** parameter card is selected.

1 From the **Scan** list on the **Trigger** parameter card, select **manual**.

2 In the **Range** fields, define the start phase and end phase of the scan. The valid phase values range from 0% to 100% and from -2000 ms to 2000 ms.

3 In the **Pulsing** fields, enter the ECG pulsing window range in 1% or 1-ms steps.

A preview of the current scan range and the ECG pulsing window is displayed.

4 Perform the sequence. (➔ Page 399 *Acquiring a Sequence*)

If an irregular heartbeat is detected, a status bar message is displayed to inform you about the detected arrhythmia and that the scan will be repeated.

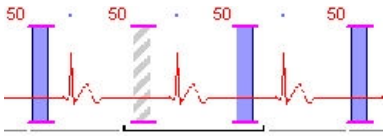
The system repeats the scan automatically at the same z-position.

If you suspend a running Adaptive Cardiac Sequence, the current scan is completed.

Heart phase selection for reconstruction

You can find the most appropriate heart phase by retrospectively selecting the phase start from the final scan.

If there are repeated scans (arrhythmia), the first scan will be disabled by default. It is displayed in gray stripes. The second scan is reconstructed by default.

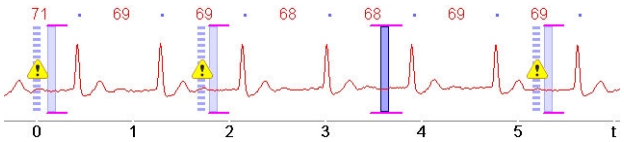


We recommend viewing both scans with the same z-position to decide which of them is more appropriate for reconstruction.

You can enable exactly one scan for every z-position by right-clicking the recon bar and selecting the **Enable Sync** menu entry. The state of the other scan box at the same z-position is adapted automatically.

If a phase start exceeds the reconstructable range, the display changes as follows:

- The corresponding recon window is displayed as a horizontally striped bar with an attention sign above.
- A second light blue bar is displayed at the actually used reconstruction phase within the performed scan (represented by the magenta lines).



The reconstruction phase is shifted to the range of reconstructable data. Reconstruction of images is still possible.

You can also use Auto Recon.

Clustering is not possible for Adaptive Cardiac Sequences.

You cannot scan the Adaptive Cardiac Sequence with the feed set to zero.

To move the recon window to the required position, the Phase Start can be changed on the **Trigger** parameter card.

Reconstruction options

- The reconstruction of Adaptive Cardiac Sequences with Cardio BestPhase is only performed on the scanned phases.
  (→ Page 495 *Reconstructing with Cardio BestPhase*)
- To reconstruct a multiphase series, you can only select those phases for reconstruction that are common to all scans of the mode. If the Adaptive Cardiac Sequence range has no common phases, the multiphase reconstruction is not possible.
  (→ Page 499 *Reconstructing a Multiphase series*),
  (→ Page 499 *Selecting phases for Multiphase reconstruction*),
  (→ Page 501 *Modifying Multiphase parameters*)
- To perform a TrueStack reconstruction, see
  (→ Page 501 *Performing a TrueStack reconstruction*).

7.4.4 Reconstructing

The values you can select depend on the current scan protocol. The selected value is indicated in the comment line of the second image.

1. Select a reconstruction job in the chronicle.
2. Select the **Trigger** parameter card.
3. Ensure that **BestPhase** is set to **manual**.
4. Change the **Phase Start** to move the recon window to the required position.
5. Select the temporal resolution you need (in ms) in the **Unit** selection list.
6. Select the **Recon** parameter card.

7 Define further reconstruction parameters where necessary and then start reconstruction.

With **Original ECG**, you can switch between the original and the modified ECG signal (ECG editing).

For the first recon job of ECG-triggered sequences, the whole range is always reconstructed. Therefore, **Recon begin** and **Recon end** cannot be changed. You can repeat the image reconstruction with different recon parameters.

Reconstructing with Cardio BestPhase

Cardio BestPhase enables you to minimize the heart motion effects and to choose the most appropriate heart phase for postprocessing.

The determined best phase represents optimal image quality in systolic phase (0-50% RR) or in diastolic phase (50-100% RR).

Use Cardio BestPhase to reconstruct the images automatically irrespective of the heart motion.

As the system software defines the phase start for Cardio BestPhase reconstruction automatically, the **Phase Start** settings are dimmed. The **Multiphase** and **Test series** buttons are inactive. This phase is updated after the recon finished.

◆ In the **BestPhase** list of the **Trigger** parameter card, select the appropriate option for the reconstruction phase:

- **auto**

  If you select **auto**, the system determines if a systole phase or a diastole phase is best suited for the reconstruction. Depending on the patient's heart rate, the system selects the best suited phase and sets the appropriate **Unit**.

- **BestSyst**

  If you select **BestSyst**, the system determines the best systole phase for the reconstruction. You have to select the appropriate **Unit**.

- **BestDiast**

  If you select **BestDiast**, the system determines the best diastole phase for the reconstruction. You have to select the **Unit**.

- **manual**

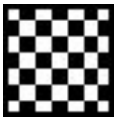
  If you select **manual**, you have to select the required heart phase that is to be used for the reconstruction. You have to select the **Unit**.

The reconstruction is performed based on the delay value of the determined phase.

The best phase is displayed on the **Trigger** parameter card. After the reconstruction is finished, the recon boxes will be set to the right phase.

Reducing the image resolution

To achieve a faster performance in transfer, loading and processing, it is possible to reduce the image resolution for axial spiral cardiac reconstruction.



Recon jobs performed with reduced image resolution are marked with a **Reduced Matrix** icon in the chronicle.

◆ Select the **256 Matrix** option on the **Recon** parameter card.

Reconstructing a Preview series

For Cardiac CT spirals, a preview series can be used to find out the optimum phase start for additional reconstruction. A preview series consists of several images at one slice position, each with a different delay. Offset mode, interval, and number of images are set up in the **HeartView Configuration** dialog box.

✓ The **Recon** parameter card is open.

1 On the **Recon** parameter card, set the reconstruction parameters as desired.

2 In the tomo segment, display the image of the slice position.

Use the dog-ear for scrolling.

3 On the **Trigger** parameter card, enter the offset in the **Phase Start** field.

- For an absolute delay, use the **ms** unit.
- For a percentage delay, use the **%** unit.

4 Click the **Preview Series** icon.

Images with different delays are reconstructed, stored in a separate series, and displayed in the tomo segment.

The actual trigger delay is displayed in the lower center of the images.

Offset mode	Interval	No. of Images	ECG Pulsing Start	Offset delay depends on ECG Pulsing Start and off-set mode	Trigger delays resulting images
Start	+50 ms	3	400 ms		400 ms, 450 ms, 500 ms
Center	+50 ms	3	400 ms		350 ms, 400 ms, 450 ms
End	+50 ms	3	400 ms		300 ms, 350 ms, 400 ms
Start	+10%	3	55%		55%, 65%, 75%
Center	+10%	3	55%		45%, 55%, 65%
End	+10%	3	55%		35%, 45%, 55%

Example for a Preview Series

5 Scroll through the preview images to find the delay best suited for reconstruction.

You can create further preview series with different offsets.

6 Set the gating parameters for reconstruction.

Reconstructing a Multiphase series

With multiphase, it is possible to reconstruct up to 24 different heart phases within one recon job.

Start delay, end delay, and the increment between start and end delay are set up on the **Multiphase** tab card of the **HeartView Configuration** dialog box.

With the **Preview Series** icon, you can reconstruct images at a scan position with different delays to optimize the phase start setting (configurable).

If you create a preview series, some image processing steps are skipped for reasons of performance. Therefore, cone beam artifacts may occur in the images.

1 Set the reconstruction parameters as desired on the **Recon** parameter card.

2 Click the **Multiphase** icon on the **Trigger** parameter card.

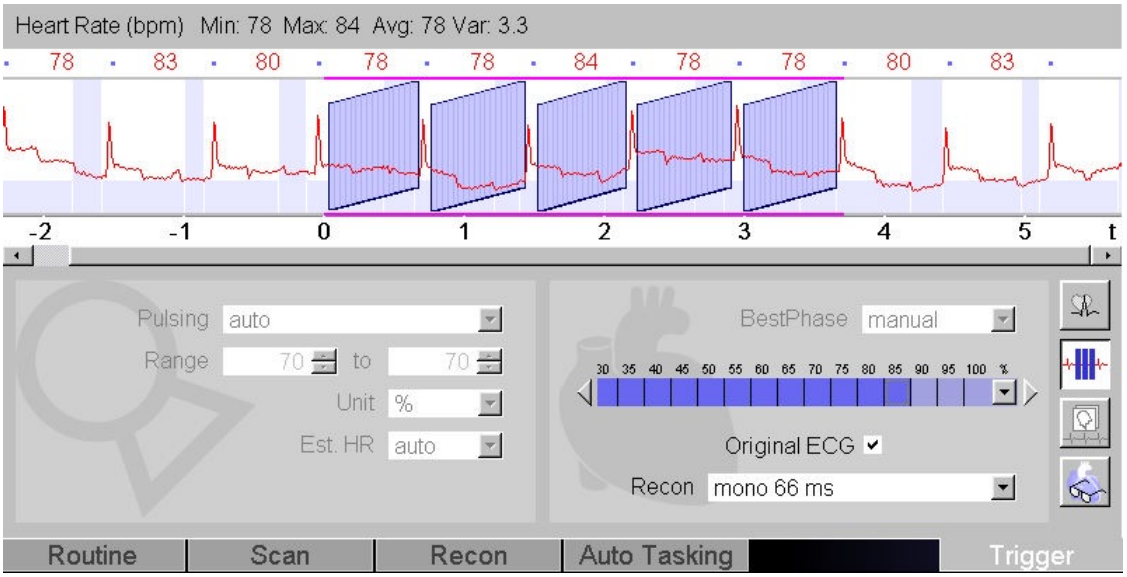
3 Click the **Recon** button to start reconstruction.

The images are reconstructed and stored in one series.

The ECG data of the spiral acquisition is stored together with the raw data to the local database.

Selecting phases for Multiphase reconstruction

For Multiphase reconstruction, select the desired phases first.



- Select phases in the range 0% to 100% or -2000 ms to 2000 ms in the list on the **Trigger** parameter card.

  – or –

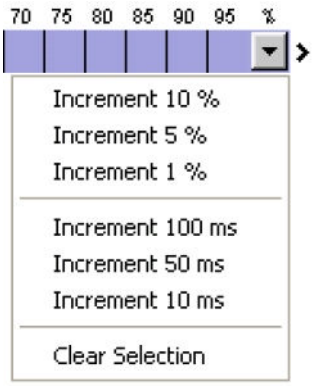
  Select a range of phases by clicking and dragging the mouse in the blue bar.

If all phases cannot be displayed at once, you can scroll the multiphase list to the left and to the right.

If you have not selected a phase, it changes to yellow.

– or –

Scroll through the list of phases if too many phases are displayed.



Modifying Multiphase parameters

You can change the parameters for Multiphase reconstruction according to your needs.

1 Click the dropdown icon next to the multiphase list on the **Trigger** parameter card.

2 Change the increment and unit via the selection list.

Performing a TrueStack reconstruction

With TrueStack reconstruction, the individual cardiac cycles are displayed without data overlap. By performing a reconstruction with TrueStack, you can create a reconstruction without stack mixing, generating an image set with sharp boundaries.

- Select the desired **TrueStack** item in the **Recon** selection list on the **Trigger** parameter card to perform a reconstruction without stack overlapping.

Using the Direct Viewer

The Direct Viewer is intended to complete the workflow of best phase finding. It provides you with direct viewing in 3D and supports you in finding the most suitable heart phase for reconstruction. It also supports you in easy checking the quality of the phase determined by the Cardio BestPhase algorithm.

The Direct Viewer is only available for already scanned cardiac spirals.

1 Reconstruct a recon job.

2 Select a not executed recon job in the chronicle.

3 Click the **Direct Viewer** icon on the **Trigger** parameter card.

The **Direct Viewer** floating toolbar is displayed.

4 Select the already reconstructed series from the selection list as a planning base.

The selected series is displayed as VRT in the topo segment. A MIP projection is displayed in the tomo segment.

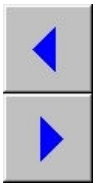
5 Click the **Phase Viewer Heart Isolation** icon to activate the Heart Isolation function.

6 Click the **VRT rotation** icon to rotate the VRT images.

If you deselect the **VRT rotation** icon and click on the VRT image, a **MIP Thin** image is displayed in the right segment.

7 Click the **Phase Viewer Gallery** icon to open the **VRT Gallery** dialog box and modify the settings, if necessary.

If the loaded recon series is a multiphase series, you can navigate between the different phases.



8 Click these icons to navigate backwards or forwards to the different phases.

The topo and tomo segments with the VRT and MIP projections are updated accordingly.

To facilitate the best phase selection, you can rotate both projections freely.

9 Select the best heart phase.

The selected phase is considered as Phase Start.

10 Click the **Recon** button to start reconstruction.

You can also perform the phase selection by starting the **Direct Viewer** immediately for a reconstructed job. You perform the same steps, but the selected phase is not considered as Phase Start.

Adaptive Cardio Volume (ACV)

For Cardiac CT Spirals only.

Heartbeats cause motion artifacts on the images. The shorter the temporal resolution of the images, the less motion artifacts the images will have.

For the reconstruction of Cardiac CT spirals, you can use the ACV option to freeze the heart motion.

Monophase reconstruction (mono) as well as biphase reconstruction (bi) can be selected in the **Recon** selection list on the **Trigger** parameter card.

- mono: Images are reconstructed from the raw data of one RR-interval. This option is recommended for irregular ECG-curves, for example, an ECG with extrasystoles and for obese patients.
- bi: Images with a smaller temporal resolution are reconstructed from the raw data of up to two neighboring RR-Intervals. This feature is only available for special scan protocols and for heart rates higher than 75 bpm.

Reconstructing after editing syncs

For additional reconstruction of Cardiac CT spirals, you can insert, move, and disable syncs on the cardiogram. The syncs are indicated by dots that are located above the R-peaks.

For reconstruction, you can switch between the original and the modified ECG signal with the **Original ECG** check box on the **Trigger** parameter card.

Example: You can reposition a sync in case the system has misinterpreted a high P-wave as an R-peak.

1. To move a sync, use the mouse to drag-and-drop the sync above the R-peak.
2. To insert a sync, right-click between two syncs and select **Insert Sync** from the context menu.

   The corresponding scan window will be considered for image reconstruction.

   Example: You can disable a sync to skip extrasystoles.
3. To disable a sync, right-click the sync and select **Disable Sync** from the context menu.

   The scan window is displayed in blue. The scan window is not considered for image reconstruction.

To re-enable a sync, right-click and select **Enable Sync** from the context menu.

4 To remove a sync, right-click the sync and select **Delete Sync** from the context menu.

5 To switch between the edited and the original ECG, click the **Original ECG** check box.

- **Original ECG** on: The original ECG is displayed.
- **Original ECG** off: The edited ECG is displayed.

For reconstruction, the currently displayed ECG is used.

If you modify the original ECG a second time, you are prompted to decide whether you want to open the formerly edited ECG or overwrite it.

7.5 Adaptive 3D Intervention

Adaptive 3D Intervention is a special examination mode for interventions under CT control like biopsies or drainages. The examining physician can trigger individual scans in the examination room at a valid table position.

The **Examination** task card is displayed on a monitor inside the examination room. In that way, the examining physician can plan the movement of the surgical instrument precisely to avoid injuries of sensitive structures like vessels or nerves.

In an Adaptive 3D Intervention, you can use three different scan modes:

- **i-Sequence**

  i-Sequence is suitable for interventions in which the instrument stays within a few reconstructed slices.

- **i-Spiral**

  The i-spiral can be used if an extended range is of interest.

- **i-Fluoro**

  In the i-Fluoro mode, images are continuously reconstructed. The examining physician can monitor the movement of the surgical instrument.

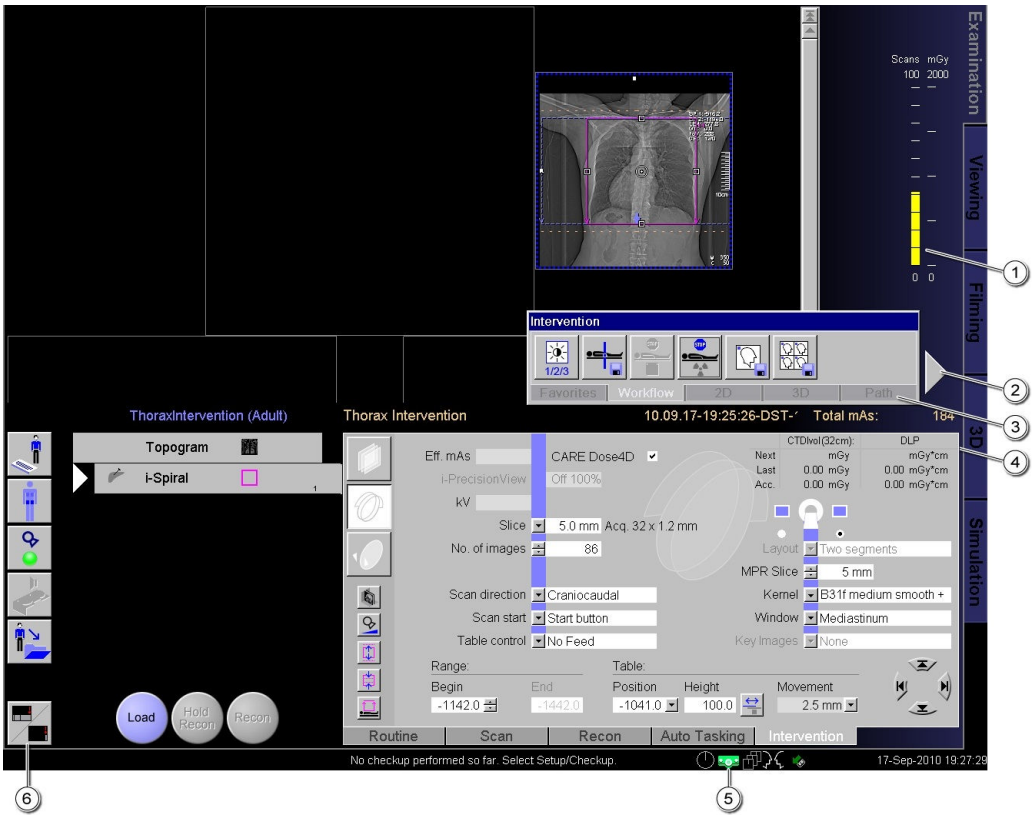
Observe the instructions on handling the **Dose Alert**, if the **Dose Alert** dialog box is displayed. (➔ Page 295 *Handling the Dose Alert*)

During a scan, you cannot load images into any task card.

If you change any values via keyboard, it is necessary that you confirm them by pressing the **Enter** key afterwards.

If you are not familiar with the basic functionalities of the *syngo* software, refer to the (➔ *Basic functionalities section*) in the *Basic applications* document.

7.5.1 Using the Intervention parameter card and tool bar



(1) Dose display

(2) Show/Hide Intervention tool bar

(3) Intervention tool bar

(4) Intervention parameter card

(5) i-Control icon

(6) Show/Hide parameter card and chronicle

Functions of the Intervention tool bar

The **Intervention** tool bar is displayed, as soon as an interventional protocol step is selected in the chronicle.

The **Intervention** tool bar consists of five tab cards:

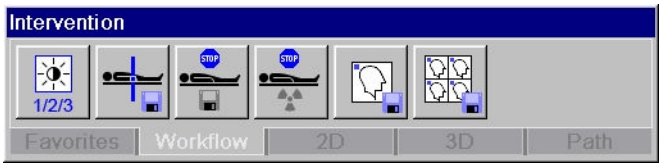
- **Favorites** tab card
- **Workflow** tab card
- **2D** tab card
- **3D** tab card
- **Path** tab card

Favorites tab card

On the **Favorites** tab card, which is empty at delivery, you can assemble frequently used icons from the other tab cards. For how to proceed: (➔ Page 510 *Assembling frequently used icons (favorites)*)

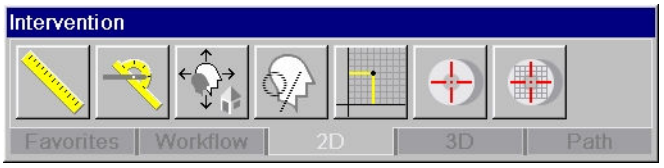
Workflow tab card

The **Workflow** tab card contains icons for windowing, autostopping table, and saving key images. For how to proceed:,
(➔ Page 556 *Saving Key Images*)



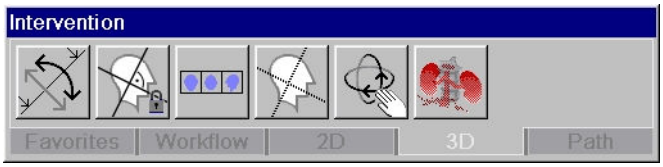
2D tab card

The **2D** tab card provides functions for the 2D evaluation of images. For how to proceed: (➔ Page 510 *Using 2D tools*)



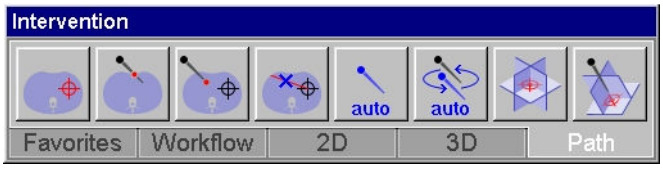
3D tab card

The **3D** tab card provides functions for the 3D intervention. For how to proceed: (➔ Page 544 *Using 3D Intervention*)



Path tab card

Via the icons of the **Path** tab card, you can define the target point, the entry point, the needle path, activate needle detection, and select a 3D view mode. For how to proceed: (➔ Page 547 *Planning the needle path*), (➔ Page 555 *Detecting the needle*), (➔ Page 556 *Saving Key Images*)



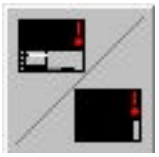
Showing/hiding the Intervention tool bar

1 Click the **Intervention Toolbar Switch** icon to show the **Intervention** tool bar.

2 Click the **Intervention Toolbar Switch** icon to hide the **Intervention** tool bar.

Moving the chronicle and the parameter card in/out

The parameter cards and the chronicle can be hidden, what is beneficial if you select a screen layout with image segments in the lower screen area. With the scan start, the parameter cards and the chronicle are hidden automatically.



- Click the **Move Chronicle and STC out/in** icon to show or hide the chronicle and parameter cards manually.

If you have selected the **Intervention** parameter card, the icons on the left border always remain visible for a direct control.

Assembling frequently used icons (favorites)

You can define frequently used icons available on the **Favorites** tab card.

Adding favorite icons

You can add an icon from the other tab cards of the **Intervention** tool bar to the **Favorites** tab card.

1. Right-click the icon you want to add.
2. Select **Add to Favorites** from the context menu.

Removing favorite icons

You can remove an icon from the **Favorites** tab card.

1. Right-click the icon you want to remove.
2. Select **Remove from Favorites** from the context menu.

Using 2D tools

The **2D** tab card of the **Intervention** tool bar provides functions for the 2D evaluation of images.

Measuring a distance

1. Click the **Distance** icon.
2. Drag out a line between two points in the image while holding the left mouse button down to display the distance in the image.

Measuring an angle

1 Click the **Angle** icon.

2 Drag out a line while holding the left mouse button down to define the first leg of the angle.

3 Draw another line for the second leg.

Restoring the zoom factor

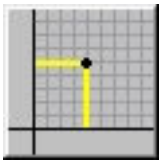
- Click the **Home Zoom/Pan** icon.

Hiding graphics

- Click the **Hide Graphics** icon.

Displaying a crosshair with scales

You can display a crosshair in the selected segment.



1 Click the **Crosshair** icon.

2 Click in the image to position the crosshair.

Displaying the laser crosshair

In axial segments, you can display a crosshair, which represents the lightmarker.

- Click the **Laser Crosshair** icon to display the crosshair of the lightmarker (without grid lines).

  – or –

Click the **Laser Grid** icon to display the crosshair of the lightmarker and grid lines.

7.5.2 Using the i-Control

In interventional CT examinations, the entire system can be operated using the i-Control.

It is possible to use the i-Control:

- Wired and fixed to the trolley
- Wired/wireless and fixed to the patient table

In all other modes, the i-Control is not operable. The power button LEDs are still lighting, but the gantry orientation button LEDs are turned off, and the **i-Control** icon on the user interface is dimmed.

CAUTION

Disturbance of peripheral electrical devices, for example, pace makers, due to electromagnetic emission!

Heart arrhythmia

- To ensure patient safety, keep the intervention module (i-Control) at a minimum distance of 10 cm away from the patient.

CAUTION

Uncontrolled system movement due to unintended signal activation by users!

Injury to the patient or damage to the system.

- Always observe the patient directly. Press the nearest **STOP** key immediately if an undesired system movement is performed.

CAUTION

Unintentional patient movement!

Unintentional activation of the i-Control by the patient.

- Always fix and observe the patient when using the i-Control.

CAUTION

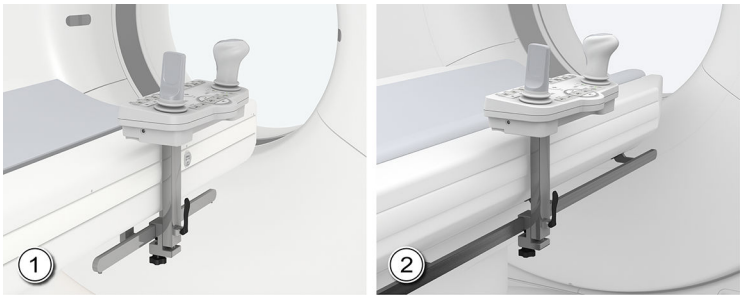
Operation of the i-Control in the wrong examination room!

Injury to the patient or damage to the system.

- Always keep the i-Control at the associated CT scanner.

Mounting i-Control to the surgical rail

i-Control can be mounted to both sides of the patient table. Therefore, the mounting fixtures must be attached to the patient table first.



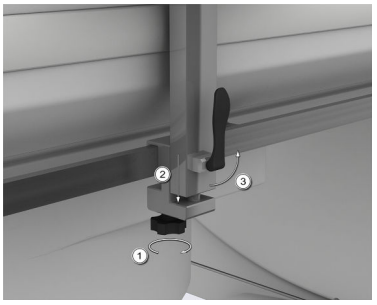
(1) i-Control mounted to the standard surgical rail at the patient table with 1600 mm scan range

(2) i-Control mounted to the standard surgical rail at the patient table with 2000 mm scan range or on the multi-purpose table

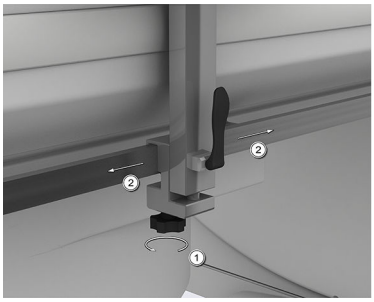
If i-Control is mounted at the surgical rail, the movement direction for the table joystick is set automatically.

Attaching the mounting fixture

◆ Mount the fixtures.



Shifting the mounting fixtures

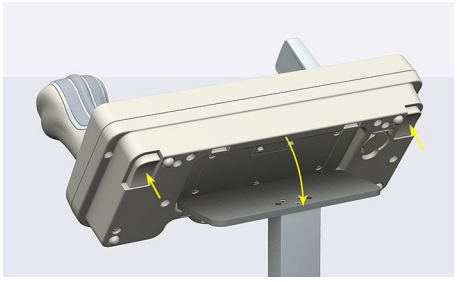


1 Loosen the mounting fixtures.

2 Shift the mounting fixtures along the surgical rail.

3 After shifting the i-Control, fix the mounting fixtures again.

Attaching i-Control

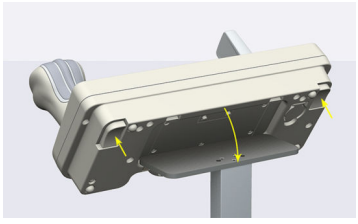


1 Push and hold the two keys at the bottom of i-Control.

2 Attach i-Control to the mounting fixture, as displayed, until it locks in place.

Mounting i-Control to the trolley

i-Control can be mounted on the trolley.



- Push the two keys at the bottom of i-Control and attach i-Control to the top of the trolley as displayed until it locks in place.

Prior to operation, press the **Tableside location** key on i-Control to select the desired table movement direction. (➔ Page 518 *Setting tableside location*) (➔ Page 521 *Choosing table movement direction*)

Turning on i-Control

How to turn on i-Control depends on the current operation state.

(➔ Page 516 *Operation of i-Control in wired mode*)

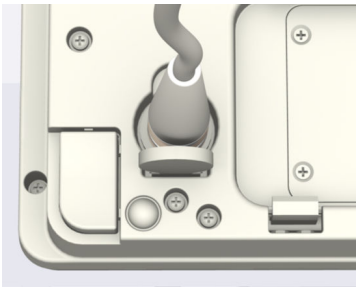
(➔ Page 517 *Wireless operation of i-Control (optional)*)

(➔ Page 518 *Turning on from standby*)

Operation of i-Control in wired mode

If a wireless operation is not possible, you can use i-Control in wired mode.

You can change between wired and wireless mode at any time during operation. When you change back to wireless operation,i-Control establishes a radio controlled connection to the system, if possible. (➔ Page 517 *Wireless operation of i-Control (optional)*)



1 Connect one plug of the cable to the i-Control receptacle.

2 Connect the other plug of the cable to the gantry receptacle. (➔ Page 165 *Connectors*)

When connected to the gantry, i-Control battery is charged, if necessary.

Switching on

✓ The LED at the **Power On/Off** key is off.

◆ Press the **Power On/Off** key.

The LED lights up green and the i-Control is ready for operation.

Wireless operation of i-Control (optional)

You can operate i-Control in wireless mode if the battery is charged and wireless operation is legal in your country.

You can change to wired mode at any time during the operation.
(➔ Page 516 *Operation of i-Control in wired mode*)

Switching on

✓ The LED at the **Power On/Off** key is off.

1 Press the **Power On/Off** key.

The LED blinks green quickly as long as the i-Control tries to establish the radio connection to the CT system.

2 Wait until the LED constantly lights up green.

The i-Control is ready for operation.

The LED at the Power On/Off key blinks red quickly.

The i-Control cannot establish the radio connection to the CT system or has lost contact.

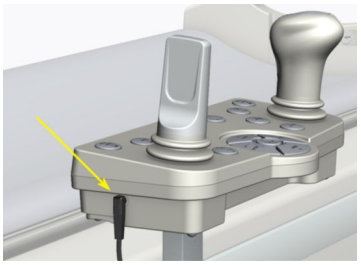
◆ Connect the i-Control with the cable to the gantry.
(➔ Page 516 *Operation of i-Control in wired mode*)

◆ Contact Siemens Customer Service.

Charging the i-Control battery

You must charge the battery of i-Control prior to wireless operation. Therefore, connect the power adapter to i-Control.

Charge the battery of i-Control, if the LED by the **Power On/Off** key blinks yellow or red.



1 Connect one plug of the cable to the i-Control receptacle.

2 Connect the other plug of the cable to the socket.

The LED at the **Power On/Off** key lights up yellow while charging.

When the cable is removed or the battery is charged completely, the LED lights up green.

The i-Control battery must be changed by Siemens Customer Service only.

Turning on from standby

✓ The LED by the **i-Controlon/off** key slowly blinks green (standby).

◆ Slightly move the mouse or table joystick.

The LED lights up green and i-Control is ready for operation.

Operating the system using i-Control

You can control the following CT functions using i-Control:

- Horizontal and vertical table movements
- Software actions on the *syngo* Acquisition Workplace

It is within the responsibility of the personnel to make sure that no conflictive table movements or software actions are performed when both, control box and i-Control are in use.

Moving the patient table

You can perform horizontal and vertical movements of the patient table using i-Control.

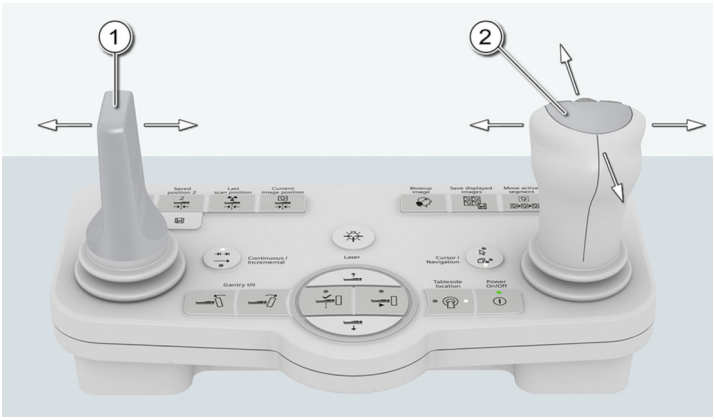
Setting tableside location

If i-Control is not mounted on the surgical rail, you must set the direction of patient table movements corresponding to the table joystick.

◆ Press the **Tableside location** key to set the correct movement direction.

The corresponding LED indicates the side of the patient table where i-Control is operated.

Moving the patient table to any position



(1) Table joystick

(2) Mouse joystick

1 Move the **Table joystick** to the left or to the right, to cause a horizontal movement of the patient table.

2 Switch between incremental or continuous patient table movement.

3 Elevate the patient table.

4 Lower the patient table.

Moving the patient table to predefined positions

You can stop the patient table automatically at any other position, which is saved before as the table home position.

1 Move the table to the desired patient table position.

2 Set the current position as predefined patient table position 1 or patient table position 2.

3 Press and hold the **Saved position 1** key to move the patient table to the predefined table position 1.

The patient table stops automatically at the predefined table position 1.

– or –

Press and hold the **Saved position 2** key to move the patient table to the predefined table position 2.

The patient table stops automatically at the predefined table position 2.

Moving the patient table to the position of the last scan

The position of a scan is saved automatically. You can set an automatical table stop at the position of the last scan.

- Press and hold the **Last scan position** key to move the patient table to the scan position used for the last scan.

Moving the patient table to the predefined position

You can set a patient table stop at a predefined position.

- Move the table to the preselected scanning position.

  The patient table stops automatically at the preselected scanning position.

Moving the patient table to the image position

You can position the patient table at the same horizontal table position as the image which is displayed in the selected tomo segment on the console.

✓ An axial segment is selected.

1 Press the **Move to image position** key.

The light at the **Move** key is blinking.

2 Press and hold the **Move** key until the patient table stops moving.

The patient table is repositioned so that the middle of the scan range is located at the horizontal table position of the selected image.

The horizontal slice position of the resulting nearest image might differ up to half the slice width.

Make sure to select an axial segment. This function is not supported for segments, such as topogram, 3D, or reference segments.

This function may not be supported for your system.

Cancelling patient table movement

You can cancel a table move request if you wish to start scanning at the current patient table position.

✓ A move request is active and the light at the **Move** key is blinking.

◆ Press the **Cancel move** key to begin the scan at the current patient table position and gantry tilt.

This function may not be supported for your system.

Moving the patient table using the previous i-Control

Horizontal and vertical movements of the patient table can be performed with the i-Control.

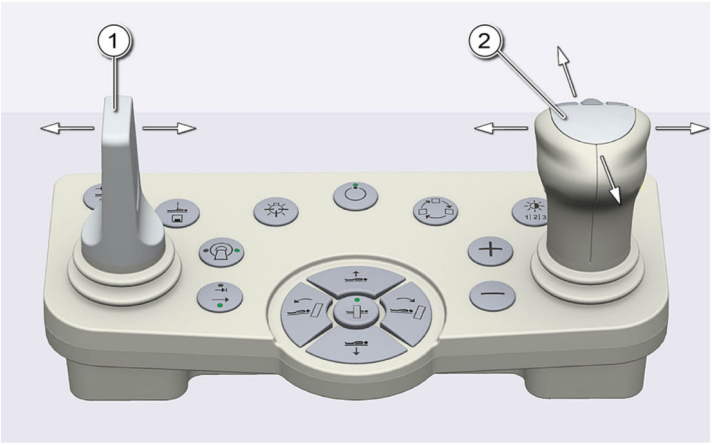
Choosing table movement direction

If the i-Control is not mounted at the surgical rail, the direction of table movements corresponding to the table joystick must be set.

◆ Press the **table direction** key to set the correct movement direction.

The corresponding LED indicates the side of the patient table where the i-Control is operated.

Moving the table to any position



(1) Table joystick

(2) Mouse joystick

1 Move the **table joystick** to the left or to the right to cause a horizontal movement of the patient table.

2 Switch between incremental or continuous table movement.

3 Elevate the patient table.

4 Lower the patient table.

Moving the table to predefined positions

You can toggle between two table positions, for example, scan and working position.

Stopping automatically at the position of the last scan

The position of a scan is saved automatically. You can make the table stop automatically at the position of the last scan.

- Press this key to move the table to the scan position used for the last scan.

Stopping automatically at any other position

You can also make the table stop automatically at any other position, which is saved before as home table position.

1 Move the table to the desired table position.

2 Set the current position as predefined table position.

3 Move the table to the predefined table position.

The table automatically stops at the predefined table position.

Stopping at a predefined position

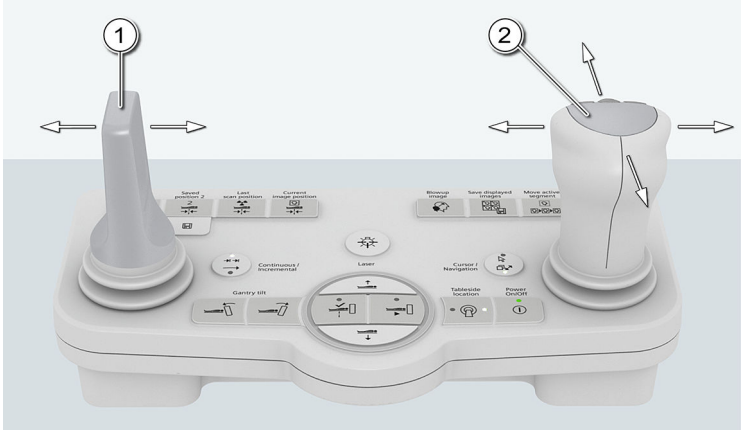
You can make the table stop at the predefined position.

- Move the table to the preselected scanning position.

  The table automatically stops at the preselected scanning position.

Operating the *syngo* software

You can operate some of the software functionalities using i-Control.



(1) Table joystick

(2) Mouse joystick

Scrolling through the image stack

✓ Image segment is selected.

✓ The image-scroll mode is active by default.

1 If the image-scroll mode is currently not active, press the **Cursor / Navigation** key to activate the image-scroll mode.

The lower LED lights up.

2 Move the **Mouse joystick** up or down to scroll through the images.

The joystick direction corresponds to the scroll bar on the screen at the console.

Controlling the *syngo* software

✓ The image-scroll mode is active.

1 Press the **Cursor / Navigation** key to activate the mouse-cursor mode.

The upper LED lights up.

2 Use the **Mouse joystick** and the mouse keys to control the mouse cursor of the *syngo* software.

Toggling between image segments

◆ Toggle between the image segments.

Toggling between window settings

✓ The three organ window settings are configured with **Examination Configuration**.

◆ Toggle between the organ window settings.

Using the Blow-up mode

1 Press the **Blow-up image** key to activate the **Blow-up** view for the currently selected image.

2 Press the **Blow-up image** key again to return to the initial layout of the chosen segment.

Saving displayed images as key images

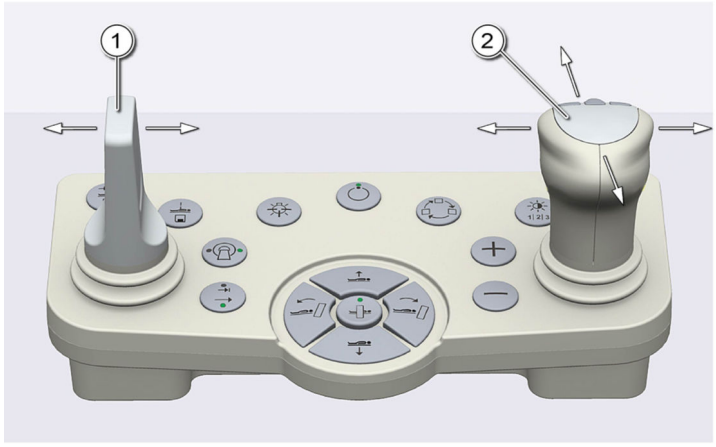
✓ You can document the interventional examination by saving all displayed images as key images.

◆ Press the **Save displayed images** key to save all displayed images as key images.

Operating the *syngo* software using the previous i-Control

You can operate some of the software functionalities using i-Control. Use the mouse joystick to move the mouse, similarly to using your standard computer mouse. Additionally, you can use the software keys, for example, to scroll through the image stack.

Using the mouse joystick



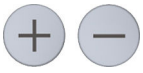
(1) Table joystick

(2) Mouse joystick

◆ Use the mouse joystick and the mouse buttons to control the mouse cursor of the *syngo* software.

Scrolling through the image stack

✓ Image segment is selected.



◆ Scroll forward or backward through the image stack.

Toggling between image segments

- Toggle between the image segments.

Toggling between window settings

✓ The three organ window settings are configured with ExamConfig.

- Toggle between the organ window settings.

7.5.3 Using the foot switch

In interventional CT examinations, a scan can be controlled with the foot switch in the examination room.

For radiation protection, see (→ Page 43 *Radiation protection*).

You can use the foot switch and the keys on the gantry control panel in parallel.

CAUTION

Use of unsuitable foot switches!

Incorrect function possible.

- Only an original Siemens foot switch must be installed.

Triggering the scan

- Press the foot switch and keep it pressed.

The scan is performed for as long as the foot switch remains pressed.

Terminating the scan

- Release the foot switch.

Scanning is terminated. The system is again ready to scan.

7.5.4 Using the monitor cart and monitor ceiling system

The monitor cart and monitor ceiling system are movable as described in this section.

WARNING

Liquids in the monitor ceiling system, power supply cables are laid inside!

Electric shock

- Make sure that no liquids, for example cleaning fluids, can get into the interior of the monitor ceiling system.

CAUTION

Dirt and liquid in the monitor arm of the ceiling mounted monitor!

Infection possible

- Clean the monitor and monitor arm after use.

CAUTION

Raising and moving the monitor ceiling system!

Damage to the monitor ceiling system.

- Do not use force when moving the device into the limit positions.
- Make sure that the monitor ceiling system does not collide with other components.

CAUTION

Raising and moving the monitor ceiling system!

Injury to the personnel, damage to monitor ceiling system.

- Do not use force when moving the device into the limit positions.Make sure that the ceiling system does not collide with other components.

Positioning the monitor cart

1 Move the monitor cart by using the handle only.

CAUTION

Tripping of user and other persons!

Injury to the patient, the personnel, or other persons.

- Make sure that cables are installed in such a way that nobody can stumble over them.

2 Place the monitor cart at any position and lock the brakes.

Using the monitor ceiling system

The following section provides instructions on how to bring the monitor into the most convenient working position.

CAUTION

Raising and moving the monitor ceiling system!

Damage to the monitor ceiling system.

- Do not use force when moving the device into the limit positions.
- Make sure that the monitor ceiling system does not collide with other components.

CAUTION

Unexpected movement or malfunction of the system or equipment!

Injury to the patient or personnel. Damage to the system or equipment.

- Contact your Siemens Service. Leave all repairs to the Siemens Service.

Adjusting the horizontal position

- Pull or push the monitor frame gently into the desired horizontal position.

Adjusting the vertical position

- Pull or push the monitor frame gently into the desired vertical position.

Parking the monitor ceiling system

- Select a parking position for the monitor ceiling system that is outside the working range.

7.5.5 Preparing Intervention

You activate Adaptive 3D Intervention by selecting an interventional scan protocol from the corresponding body region in the **Patient Model Dialog**.

CAUTION

Real-time images that are used for guiding an interventional examination are covered by the *syngo*.via application!

Injury to the patient.

- Close *syngo*.via manually before you start an interventional examination.

✓ Online Help windows on the **Examination** task card are not closed automatically when a scan is started. Make sure all Online Help windows are closed before starting an interventional examination.

1 Select the protocol.

2 Scan a topogram and define the examination ranges.

3 Perform a reference scan if necessary.

You can also use an i-Spiral as a reference scan.

7.5.6 Selecting the Interventional Scan Mode

1 On the **Intervention** parameter card, click the **i-Sequence** icon.

– or –

On the **Intervention** parameter card, click the **i-Spiral** icon.

– or –

On the **Intervention** parameter card, click the **i-Fluoro** icon.

The parameters of the selected scan mode are displayed on the **Intervention** parameter card.

2 Check the settings and modify them, if necessary.

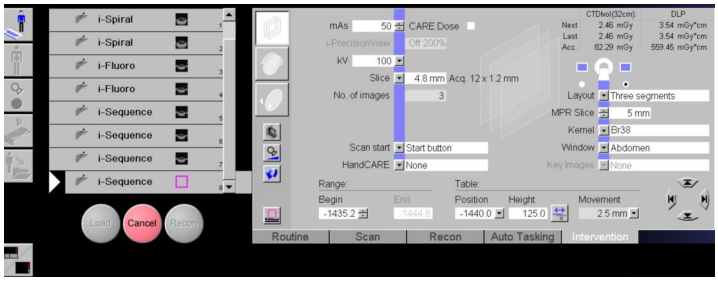
In the i-Sequence and i-Spiral modes, the raw data of the last scan is saved. You can reconstruct additional images after you have completed the Adaptive 3D Intervention.

In the i-Sequence and i-Spiral modes, you can also add recon jobs by right-clicking the relevant icon on the **Intervention** parameter card.

7.5.7 Displaying the parameters

1 Click the **Intervention** protocol step in the chronicle.

The **Intervention** parameter card and tool bar are displayed.



You can display the parameters of the respective interventional scan mode.

Certain modes of operation allow selections of scan parameters that may lead to a peripheral $CTDI_{100}$ of more than 1 Gy. This dose may exceed the threshold for deterministic radiation effects on the patient's skin or eye lenses. *syngo* offers many possibilities to optimize the dose applied to a patient. (→ Page 249 *Dose management and optimization*).

For general dose information on the CT system, see: *System Owner Manual*.

For interventional examinations, the display provides accumulated dose values: **$CTDI_{vol}$ (accumulated)** and **DLP (accumulated)**. **$CTDI_{vol}$ (last)** and **DLP (last)** correspond to the dose values of the latest interventional scan of the current examination. One scan is from the time the foot switch is pressed to the time it is released.

Note that dose values from additional scans based on other scan protocols, that are executed between the interventional scans, are not included in the accumulated values!

2 Click the icon of the respective interventional scan mode on the **Intervention** parameter card. (→ Page 530 *Selecting the Interventional Scan Mode*)

A new chronicle entry is added in the following cases:

- For i-Spiral scans, after each scan
- For i-Sequence scans, after 20 scans of the sequence
- For i-Sequence scans and i-Fluoro scans, after you changed a scan-relevant or a recon-relevant parameter.

7.5.8 Setting the parameters

1 Set the parameters on the **Intervention** parameter card.

Only for Definition Edge and Definition AS 128-slice configuration: For i-Fluoro scans, a special slice mode is available under the collimation 32 x 1.2 mm: 9.6 mm - 19.2 mm - 9.6 mm.

The selectable slice width is displayed as 19.2 mm on the parameter card. The number of images is set to three. The image text of the **Effective Slice Width** is set to the real slice width of the image: 9.6 mm or 19.2 mm.

2 On the **Routine** and on the **Scan** parameter card, check the default scan parameters.

3 Correct them, if necessary.

In the majority of cases, you modify the parameters on the **Intervention** parameter card only. Otherwise you can change the parameters on the **Routine** and/or **Scan** parameter card for each of the three scan modes separately.

In the i-Sequence and i-Spiral modes, the raw data of the last scan is saved. You can reconstruct additional images after you have completed the Adaptive 3D Intervention.

4 In i-Sequence or i-Spiral mode, select **Start button** or **Foot Switch** from the **Scan Start** selection list.

In i-Fluoro mode, you always perform a scan with the foot switch.

7.5.9 Setting a tube position for HandCARE

HandCARE helps to reduce radiation dose for operators inside the examination room.

HandCARE is only available in the i-Sequence and i-Fluoro scan modes. (→ Page 257 *HandCARE*)

- From the **HandCARE** selection list, select a tube position - for example, **10 o'clock position** - where the radiation is paused.

HandCARE setting	10 o'clock	12 o'clock	2 o'clock	None
HandCARE symbol for i-Sequence				
HandCARE symbol for i-Fluoro				

HandCARE is displayed as watermark on the **Intervention** parameter card, on the scan mode icons for i-Sequence and i-Fluoro, and on the **Routine** parameter card.

If **HandCARE** is switched off, the maximum length of an i-Fluoro scan is 100 s. If **HandCARE** is switched on, the maximum length of an i-Fluoro scan is 50 s.

7.5.10 Defining the table movement

In the **Movement** selection list, you specify the step length the table moves when you use the joystick or press the symbol keys at the gantry panel.

You can change the step length by entering the desired value in the field. The default step length is half the slice width.

If you press a key at the gantry panel to move the table or push the joystick longer than half a second, the table continuously moves to the intended direction.

- Select **Incremental** to move the table by half of the slice width on every interaction.

  – or –

  Select **User defined** to move the table with a user-defined feed and enter the desired step length in the input field.

You can click the **Move Table Top Only** icon to move only the table top. This function provides more space, e.g., for additional devices, between the table base and the gantry during an intervention. A message box informs you when the table top must be moved out of the gantry first.

If the **Move Table Top Only** mode is active, you can tilt the gantry only at the gantry panel and the i-Control.

7.5.11 Defining the table repositioning

Via the items of the **Table control** selection list, you define the automatic table repositioning after each i-Spiral.

To define the table repositioning, there are prerequisites:

✓ The i-Spiral scan mode is active.

- Select **No Feed** to position the table at the end of the preceding i-Spiral.

– or –

Select **Feed to Begin Position** to position the table at the begin of the preceding i-Spiral.

– or –

Select **Feed to i-Sequence Scan Position** or **Feed to i-Fluoro Scan Position** to position the table at the previous i-Sequence or i-Fluoro scan position.

The items **Feed to i-Sequence Scan Position** or **Feed to i-Fluoro Scan Position** are only available if i-Sequence or i-Fluoro has been scanned in the current intervention.

7.5.12 Defining the image order

The image order on the monitor of the *syngo* Acquisition Workplace depends on the in-room monitor position and the patient position.

The image order is as follows:

Patient orientation	Monitor left of the gantry	Monitor right of the gantry
Head first	Feet-Center-Head	Head-Center-Feet
Feet first	Head-Center-Feet	Feet-Center-Head

- Click the radio button of the real monitor position.

  The images are labeled according to the image order.

7.5.13 Selecting the default screen layout

You can define screen layouts according to your needs.

- Select the desired screen layout of the image area in the **Layout** selection list.

In the i-Fluoro mode, all acquired images are immediately displayed. Therefore, the list of available screen layouts depends on the No. of images per collimation. If you have modified the parameter **No. of images**, the system verifies if the selected screen layout has a sufficient number of axial segments. If there are not enough axial segments, the system automatically switches to a suitable screen layout.

7.5.14 Selecting the default window settings

- Select the desired window settings in the **Window** selection list.

7.5.15 Starting the acquisition

As soon as you defined the scan and reconstruction parameters, you can start the acquisition.

The scan start type is predefined on the **Intervention** parameter card.

1. Confirm the scan parameters with **Load**.
2. Start the scan.

   You can interact on the CT system during scans (i-Fluoro) and scan pauses.
3. Use the joystick or the keys at the gantry to move the table horizontally.
4. Modify the settings for the next scan.

You can modify, for example, the following settings for the next scan:

- (➔ Page 530 *Selecting the Interventional Scan Mode*)
- (➔ Page 538 *Acquiring images in i-PrecisionView mode*)
- (➔ Page 544 *Switching to 3D Intervention*) (i-Sequence or i-Spiral only)
- (➔ Page 545 *Refreshing 3D images*)
- (➔ Page 540 *Auto stopping the table*)
- (➔ Page 537 *Using i-NeedleSharp*)

7.5.16 Using i-NeedleSharp

To reduce needle artifacts use the i-NeedleSharp function. According to the needle gauge, i-NeedleSharp sets the gantry tilt and the number of slices.

There are three different needle gauges: small, medium, and large.

✓ The i-Sequence scan mode is active.

Selecting a needle gauge

1 Select the **i-NeedleSharp** check box.

2 Click the suitable needle gauge icon.

Gantry tilt and number of slices are set.

Alternatively, you can change the gantry tilt manually in the **Tilt** field. You can save the protocol with the modified tilt value.

Adjusting the scan position

To assure that the needle is within the reconstruction range, you adjust the scan position.

1 Scroll through the images until the best image is displayed.

2 Click the **Move scan range to Displayed table position** icon.

The center of the interventional scan range is positioned at the position of the displayed image.

The horizontal slice position of the resulting nearest image might differ up to half the slice width.

– or –

Switch on the lightmarker on the gantry.

Move the table to place the crosshair of the lightmarker on the Needle position.

3 Start the scan.

From the acquired data, the system reconstructs axial images as if they had been obtained without gantry tilt. The artifacts caused by a metal needle are reduced.

If the table is positioned from the *syngo* Acquisition Workplace via icons and simultaneously from the gantry panel or the i-Control, unexpected results may occur.

7.5.17 Acquiring images in i-PrecisionView mode

The i-PrecisionView mode is used to acquire images with a higher or lower eff. mAs/mAs value.

If you click the **i-PrecisionView** icon, you can edit or view the following fields:

- You can edit the **i-PrecisionView** field on the **Intervention** parameter card. The % value defines the eff. mAs/mAs value for the next scan, whereas the value 100% correspond to the default eff. mAs/mAs value.
- The **Eff. mAs/mAs** field is dimmed. It displays the calculated eff. mAs/mAs value to be used for the next scan.

Example: If the default eff. mAs value is 50 mAs and the i-PrecisionView value is set to 120%, the new calculated eff. mAs value is 60 mAs. If the default eff. mAs value is 50 mAs and the i-PrecisionView value is set to 80%, the new calculated eff. mAs value is 40 mAs.

1 On the **Intervention** parameter card, click the **i-PrecisionView** icon.

2 Enter the % value for the i-PrecisionView.

The **i-PrecisionView %** and the **Eff. mAs/mAs** values are updated. The mAs values are only used for the next scan. The %-value is retained.

After the scan, the i-PrecisionView mode is deselected automatically, and the default eff. mAs/mAs value is set again. **Off** is displayed and the item is dimmed.

7.5.18 Modifying the scan range

To modify the scan range, there are prerequisites:

✓ The i-Spiral scan mode is active.

1 Click the **Increase Range** icon on the **Intervention** parameter card to enlarge the scan range.

2 Click the **Decrease Range** icon to shorten the scan range.

The scan range is enlarged or shortened at begin and end position by one slice.

If enlarging or shortening is not possible, the respective icon is dimmed.

7.5.19 Modifying the window values

You can predefine up to three interventional window settings on the **General** tab card of the **Intervention Configuration** dialog box.

1 Select the image you want to modify.

2 Click the **Window Toggle Button** icon on the **Workflow** tab card of the **Intervention** tool bar.

The window switches to the next of four values: The three configured window settings and the value which was manually set before.

7.5.20 Auto stopping the table

The Auto stop functions are used to toggle between two table positions, for example, scan and working position.

Stopping the patient table at a scan position

The position of a scan is saved automatically. You can make the table stop automatically at the position of the last scan:

- Click the **Auto Scan TP** icon on the **Workflow** tab card of the **Intervention** tool bar.

Stopping the patient table at a working position

You can also make the table stop automatically at any other position, which is saved before as working position:

1 Move the table to the desired table position.

2 Click the **Save TP** icon.

3 Click the **Auto Save TP** icon to make the table automatically stop at the saved table position.

As soon as one of the auto stop table positions has been reached, the corresponding icon is highlighted in green.

If the home table position is invalid or not set, the **Auto Home TP** icon is dimmed.

7.5.21 Moving the table with the function Same TP

You can use the **Same TP** function to position the table at the same horizontal table position as the image which is displayed in the selected tomo segment.

- Click the **Move scan range to Displayed table position** icon.

  – or –

  From the **Position** selection list on the **Routine** or the **Intervention** parameter card, select the **Same TP** option.

The table is repositioned so that the middle of the scan range is located at the horizontal table position of the selected image.

The horizontal slice position of the resulting nearest image might differ up to half the slice width.

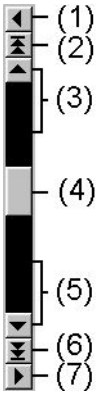
You can also use this function if you have tilted the gantry. In case the center y is not equal to 0, the displayed table position can differ from the image text. Nevertheless, the table is moved to the correct position.

7.5.22 Scrolling through images

To the right of the image display area, the interventional scroll bar is displayed.

The scroll bar provides two different scrolling functions:

- Scrolling through the images *within* an interventional scan
- Scrolling through the images *across* interventional scans



(1) Previous scan

(2) First image

(3) Previous image

(4) Slider

(5) Next image

(6) Last image

(7) Next scan

When scrolling through the images within a scan using the interventional scroll bar, **n of m images** is displayed on the mouse pointer:

- **n** = the number of the image in the axial center segment
- **m** = the total number of images of the interventional scan

When scrolling through the images across the scans using the interventional scroll bar, **n of m scans** is displayed on the mouse pointer:

- **n** = the number of the currently displayed scan
- **m** = the total number of scans

For scrolling through the images within an i-Spiral or i-Sequence scan, you can also use the dog ears and the keys on the symbol keypad.

If you have used the screen layout during the i-Fluoro scan, only the stored images are displayed when scrolling through the images.

If not all images are available, the corresponding segments remain empty. Independent of the configured **i-Fluoro Image Storage Rate**, the last images of the currently performed i-Fluoro scan can be displayed during the intervention.

1 Click the previous scan icon to display the images of the previous scan.

2 Click the first image icon to display the first image of the currently displayed scan.

3 Click the previous image icon to display the previous image of the currently displayed scan.

4 Drag the slider to scroll through the images of the currently displayed scan.

5 Click the next image icon to display the next image of the currently displayed scan.

6 Click the last image icon to display the last image of the currently displayed scan.

7 Click the next scan icon to display the images of the next scan.

Navigating between MPRs and axial images

MPRs and axial images are connected. This function helps you, for example, to display a needle entry point.

1 In the MPR segment, scroll to the needle position.

2 Click the needle.

The axial images that correspond best to this position are displayed. In this example, the needle entry point is displayed.

7.5.23 Loading different series in a segment

You can load a different series (for example, a reference series) from the chronicle or the **Patient Browser** in the predefined reference segment.

- Load the series via drag-and-drop in the reference segment.

When working with dual monitors, dragging from the chronicle is only possible on the main monitor.

7.5.24 Loading a different recon job

In the 3D layout, you can load any recon job (except i-Fluoro) of the current interventional examination from the chronicle. You can then use these data sets to plan a needle path.

1. Load a recon job via drag-and-drop in the MPR segment.
2. Plan the needle path (➔ Page 547 *Planning the needle path*).

7.5.25 Using 3D Intervention

In 3D Intervention mode, axial, coronal, and sagittal MPR projections are automatically displayed for i-Spiral and i-Sequence. Furthermore, you can display a VRT projection. You can use the 3D Intervention for improved targeting and navigation during instrument path planning.

Switching to 3D Intervention

- On the **Intervention** parameter card, click the **i-3D** icon.

  The screen layout switches to the corresponding 3D layout. For i-Spiral, you can immediately see the images. For i-Sequence, you can see the images when the scan starts.

If you have performed a new scan, e.g., a 2D scan, and 3D images from the previous scan are still displayed, they are marked by the image text **Not from current scan** and framed gray.

Defining the MPR slice thickness

You can modify the slice thickness of the 3D MPR projections. This parameter is relevant when using 3D intervention. The maximum slice thickness is 20 mm.

- Enter the desired slice thickness in the **MPR Slice** field on the **Intervention** parameter card.

  – or –

  Press and move the mouse at the bottom of a 3D MPR image to the right or left to increase or decrease the slice thickness.

  The new value is applied to all 3D MPR images.

Refreshing 3D images

If there are 3D projections from a previous scan, you can refresh the last 3D images easily.

- On the **Intervention** parameter card, click the **i-Refresh** icon to add a scan and refresh the 3D projections if you have a 2D i-Sequence or i-Fluoro scan.

  – or –

  Press the **START** key on the control box to refresh the 3D projections if you have a 3D scan.

  – or –

  On the **Intervention** parameter card, click the **i-3D** icon to refresh the 3D projections if you have a 2D Spiral scan.

  In order to refresh the displayed 3D projections, the system repeats the previous 3D scan automatically. After the 3D scan is completed, the previous 2D scan mode is repeated automatically.

If there are no 3D projections from a previous scan, or if the current scan is a 3D scan or an i-Spiral, the **i-Refresh** icon is dimmed.

Using 3D tools

The **3D** tab card of the **Intervention** tool bar provides functions for the 3D evaluation of images.

In order to change position and orientation of the 3D projections, you can perform the following workflow steps:

- Move the reference lines (MPR only)
- Rotate the reference lines (MPR only)
- Rotate images with the mouse (VRT only)

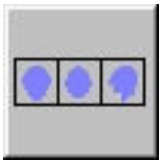
Activating free mode for MPR projections

- Click the **Free Mode** icon on the **3D** tab card to rotate the axes in any segment.

Unlocking the reference lines in MPR projections

- Click the **Unlock Reference Lines** icon on the **3D** tab card to move or rotate the reference lines separately.

Resetting the orientation of an MPR projection



- Click the **Default Orientation** icon on the **3D** tab card to reset the orientation of all 3D segments.

Hiding the reference lines in MPR projections

- Click the **Hide Reference Lines** icon on the **3D** tab card to show or hide the reference lines.

Activating VRT rotation mode

- Click the **VRT Rotation** icon on the **3D** tab card to rotate the images with the mouse.

Opening the VRT Gallery

- Click the **VRT Gallery Dialog** icon to open the **VRT Gallery** dialog box.

You can predefine the VRT gallery presets on the **3D** task card. The last selected preset is displayed the next time automatically.

Planning the needle path

To navigate the needle safely during the intervention, you plan the needle path by marking the target point and the entry point.

The 3D visualization of the planned needle path makes it easier to identify areas of risk alongside the path.

It is not possible to set the path points into the topogram or VRT image. You can adjust the path by redefining the path points. For more information, refer to: (→ Page 551 *Adjusting the needle path*)

It is also possible to define a target point only. Then the 3D images are centered to the target.

1 On the **Intervention** parameter card, click the **i-3D** icon.

2 Click the **Needle Target Point** icon on the **Path** tab card of the **Intervention** tool bar.

3 Use the image that suits best for setting the target point and the entry point (coronal, sagittal, or axial image).

4 Click the target in the image.

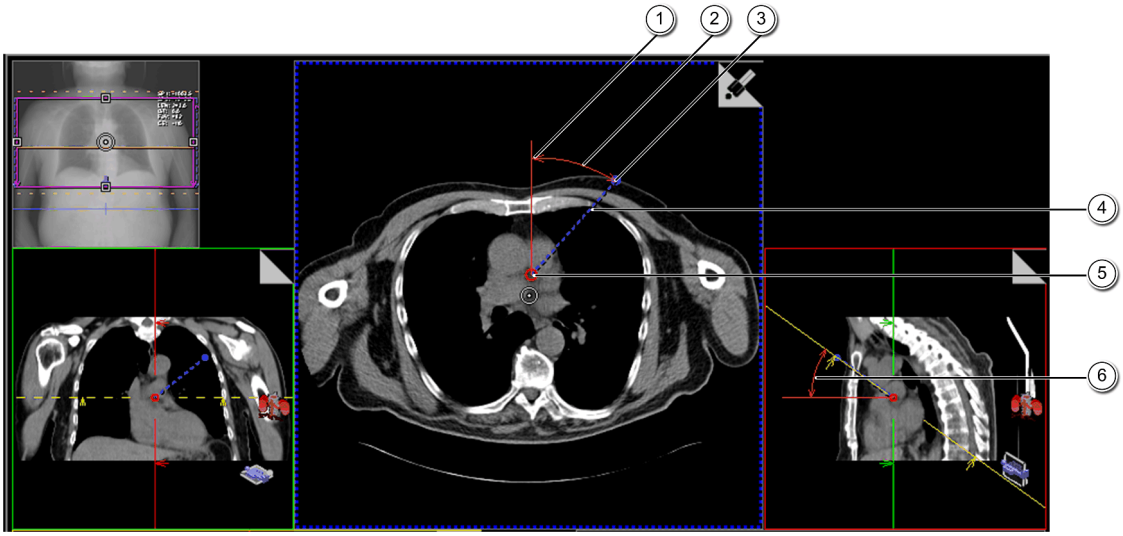
The target point is marked and the 3D projections are centered to the target.

5 Click the **Needle Entry Point** icon on the **Path** tab card of the **Intervention** tool bar.

6 If necessary, scroll to a different image in the image stack.

7 Click the entry point in the image.

The entry point is marked and the path is drawn. The path is applied for the subsequent interventional scans.



(1) Y-axis

Not shown on the actual image. Serves as reference axis for measuring the angles in the x-direction the z-direction.

(2) Angle (x-direction)

Indicates the angle between the needle path and the y-axis in the axial plane.

(3) Entry point

(4) Needle path

(5) Target point

(6) Angle (z-direction)

Indicates the angle between the needle path and the y-axis in the sagittal plane.

You can correct the position of the target or entry point.

8 Set a new target respectively at a new entry point.

– or –

Move the entry point by dragging it to the correct position.

The values for the angles change accordingly:

Angle (x-direction): in the axial image

The values change between 0 degrees and 180 degrees if the entry point is on the right of the y-axis that goes through the target point. In that case, the entry point is to the right from the sagittal plane that goes through the target point.

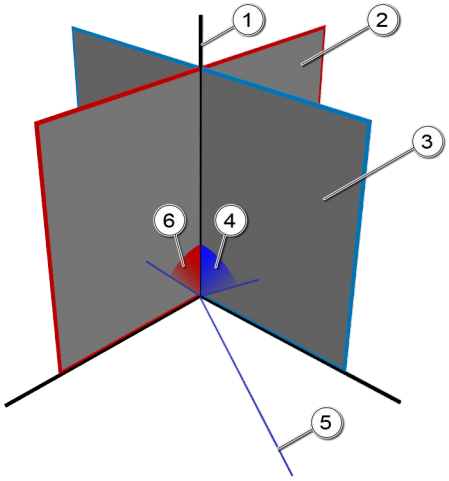
The values change between 0 degrees and -180 degrees if the entry point is on the left of the y-axis that goes through the target point. In that case, the entry point is to the left from the sagittal plane that goes through the target point.

Angle (z-direction): in the sagittal image

The values change between 0 degrees and 90 degrees if the entry point is above the y-axis that goes through target point. In that case, the entry point is behind the axial plane that goes through the target point.

The values change between 0 degrees and -90 degrees if the entry point is below the y-axis that goes through target point. In that case, the entry point is in front of the axial plane that goes through the target point.

Example of a needle path in a 3D model



(1) Y-axis through the target point

(2) Sagittal plane

(3) Axial plane

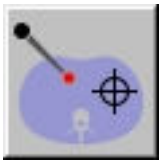
(4) Angle in x-direction

(5) Needle path

(6) Angle in z-direction

Adjusting the needle path

If the needle deviates from the planned path, you can adjust the path during the intervention.



1 Click the **Needle Tip Point** icon on the **Path** tab card of the **Intervention** tool bar.

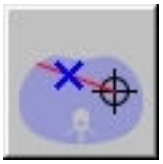
2 Click the needle tip in the image.

The needle path is displayed extended between needle tip point and toward the target to the vertical. Needle-oriented images are updated.

- The target point remains marked.
- The angle values in the MPR projections display the deviation of the new path from the line between entry and target point.
- If no path is defined, the **Needle Tip Point** icon is dimmed.

For more information, refer to: (➔ Page 555 *Detecting the needle*)

Deleting the needle path



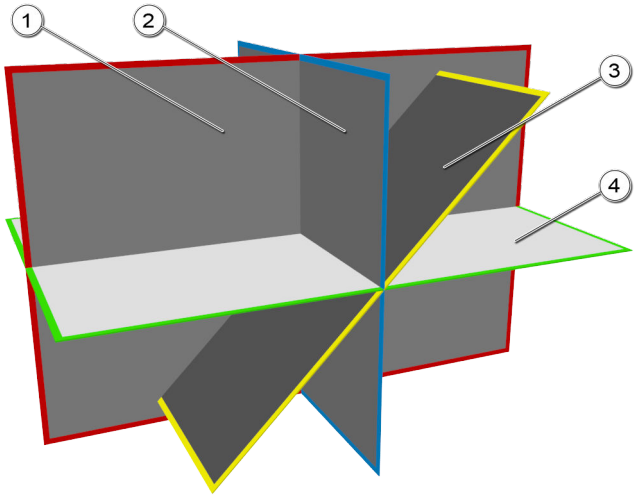
◆ Click the **Delete Needle Path** icon on the **Path** tab card of the **Intervention** tool bar.

Switching to the 3D view mode

In an Adaptive 3D Intervention, the system provides two different 3D view modes.

Patient-oriented view

In the patient-oriented view, the 3D planes meet in the center of the volume. The axial, coronal, and sagittal planes meet in the target point. You can switch the axial image to the i-VirtualTilt projection. The i-VirtualTilt projection shows a virtual gantry tilt according to the needle.



(1) Sagittal image plane

(2) Axial image plane

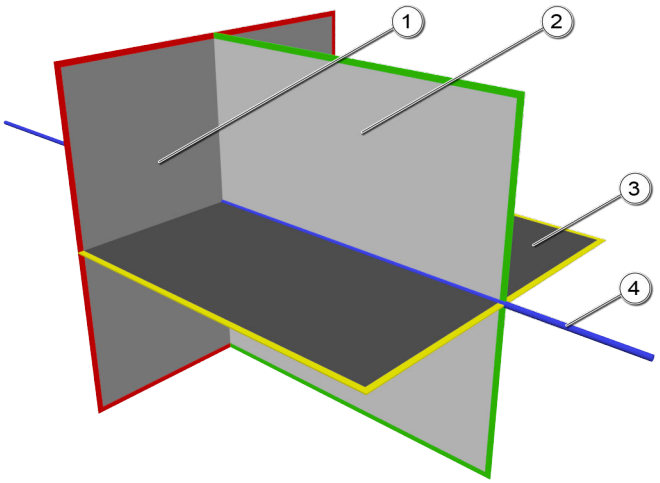
(3) i-VirtualTilt image plane

(4) Coronal image plane

The needle path defines the i-VirtualTilt image plane. It displays the needle path completely. The i-VirtualTilt segment is framed in yellow. Instead of the cyan reference line, the image plane is displayed as yellow reference line in the other MPR segments.

Needle-oriented view

The needle-oriented view consists of an i-VirtualTilt image and a needle view image (view through the needle). The plane of the third image is orthogonal to the i-VirtualTilt and the needle view.



(1) Needle view plane

(2) Third image plane

(3) i-VirtualTilt image plane

(4) Needle

◆ Click the **Patient Oriented View** icon on the **Path** tab card of the **Intervention** tool bar.

– or –

Click the **Needle Oriented View** icon.

Detecting the needle

There are two possibilities for needle detection:

- Start automatically after each 3D scan
- Start manually after a 3D scan

The Needle Detection algorithm also detects if the needle is curved. If a curved needle is used, the calculated distance and angles values are not correct. Therefore, the label is extended for curved needles with: **Curved needle!**

1 Click the **Auto Needle Detection** icon on the **Path** tab card of the **Intervention** tool bar to start detection automatically.

– or –

Click the **Single Needle Detection** icon to start detection manually.

Needle-oriented images are updated.

2 Click the **Single Needle Detection** icon again to switch to the next needle in a multi needle intervention.

Selecting the image type of a 3D segment

At the right border of the 3D MPR segments, there are icons to switch the image type.

Toggling VRT view and MPR view

◆ Click the **VRT** icon to switch to VRT view.

– or –

Click the **MPR** icon to switch to MPR view.

Toggling i-VirtualTilt view and axial view

If a needle path is defined, you can select two further image types for the axial segment of the patient-oriented view. You can also switch to these views without a defined needle path, but you can only see a difference after planning the path.

- Click the **i-VirtualTilt** icon to switch to i-VirtualTilt view.

– or –

Click the **3D Axial** icon to switch to axial view.

7.5.26 Saving Key Images

During the intervention, you can save images that you want to keep for reporting.

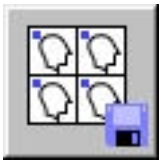
On the **Storage** tab card of the **Intervention Configuration** dialog box, you can activate the auto saving of recently displayed images.

Defining a transfer destination

You can define a transfer destination for the key images. All key images are saved in one dedicated key image series.

- Select the desired transfer destination for the key images in the **Key Images** selection list on the **Intervention** parameter card.

Saving all displayed images



- Click the **Save all displayed images as key images** icon on the **Workflow** tab card of the **Intervention** tool bar.

Saving a single image

1 Select the segment with the image you want to save.

2 Click the **Save Key Image** icon on the **Workflow** tab card of the **Intervention** tool bar.

7.5.27 Ending Intervention

Once you have completed the last scan required for the intervention you close the intervention mode.

1 Click the **Cancel** button to cancel the intervention.

2 Continue with the next scan listed in the chronicle or close the examination with the **Close current patient** icon.

With **Close current patient**, the display for the entire radiation dose is reset. It restarts from the beginning at the next examination. If you use **StudyContinue**, the primary dose is used as basis.

7 Enhanced examination

8 Maintenance

Regular maintenance and service is important for the safety of patients, personnel, and people accompanying the patient as well as for the functional integrity of the system.

For that reason, all maintenance work with exception of the cleaning of equipment and accessories should be performed by Siemens Service. (➔ Page 562 *Cleaning and disinfecting*)

Technical documents

On request, technical documents can be obtained from Siemens at a small charge.

Malfunctions

If the system does not function perfectly, it must be checked immediately.

- Notify Siemens Customer Service.

Maintenance contract

On request, maintenance work can be performed regularly by Siemens Customer Service.

- Please contact your Siemens Service to agree on a maintenance contract for your system.

Maintenance intervals

CAUTION

Missing maintenance of the scanning system!

Scan abortion or reduced image quality due to malfunction of the scanner.

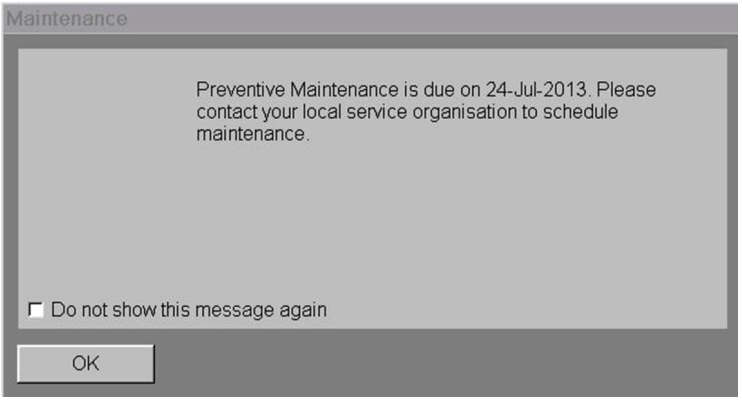
- Make sure that maintenance is performed at the recommended intervals.
- Check the imaging performance with the monthly constancy test.

- For further information on maintenance and maintenance intervals, consult: *System Owner Manual*

Software guided maintenance

The system calculates and reports the required maintenance content and time schedule by itself.

If the function is enabled by the local service organization, the following message window may come up during system start-up:



Please contact your local service organisation to schedule maintenance in this case.

8.1 Service

If you require technical support or additional assistance with applications, please call your local Siemens branch office or Customer Care Center (CCC).

Contacting Uptime Service Center

You can obtain the required contact information (e.g., phone number) via Internet, e.g. via: *www.medical.siemens.com> USA > Contact*.

Information required

To be able to help you quickly, we require the following information:

- Software version and service packs

  (Call up **Options > Version** in the main menu to display this information)
- Model and serial number of your system
- Brief description of the problem
- Your name and your telephone number

8.1.1 Warranty

For warranty terms, please refer to your purchase contract.

8.1.2 Sending a ticket to the Customer Care Center

If you experience an issue with your SOMATOM system or the *syngo* CT software, contact your local Customer Care Center.

1 From the main menu, select **Help** > **FAST Contact**.

2 Log in using your LifeNet account.

3 Complete the form.

4 Click **Send**.

The Customer Care Center will call you as soon as possible.

FAST Contact must be configured by your local customer service representative. For details, contact your local customer service representative or your Siemens regional office.

8.2 Cleaning and disinfecting

This section informs you how to clean special parts of the system.

CAUTION

Not observing the instructions of the disinfectant manufacturer!

Injury to the cleaning personnel.

- Follow the cleaning instructions of the Instructions for Use.
- Follow the instructions of the disinfectant manufacturer.

WARNING

Cleaning of parts of the system while the system is connected to the power supply!

Electric shock due to possible contact with line voltage.

- Always switch the system off at the main power switch before cleaning or disinfecting.

8.2.1 Disinfectants

You can use commercially available disinfectants with the given restrictions for disinfecting the patient table and the accessories as classified below:

- Aldehyde
- Aldehyde decompositors
- Alcohols

- Quaternary compounds
- Organic acids
- Peroxide compounds

Use of disinfectants containing aldehyde or aldehyde decompositors discolors the surfaces of the therapy mattress, positioning mattress and head holder.

Use of disinfectants containing alcohols or quaternary compounds impairs the surface of immobilization straps.

Do not use alcohol, phenol derivatives, aldehyde, or surgical spirits for disinfecting accessories.

Organic acids and peroxide compounds can be used without restriction.

8.2.2 Cleaning agents

You can use the following cleaning agents with the given restrictions to clean the sides of the table, the table top cover, gantry cover, cushions, armrests, knee supports and head holder:

- Commercially available washing-up liquid

  It can be used without restriction.

- Ethyl alcohol

  Ethyl alcohol impairs the surface of the immobilization straps, the protective goggles and the foot switch. The surface of the head cushion fades with ethyl alcohol.

- Surgical spirit

  The surface of the air bellows of the patient table and the head cushion fades with surgical spirit.

Check whether the cleaning agents used for the gantry and patient table are compatible with cleaning agents used for the floor.

8.2.3 Unsuitable cleaning agents and disinfectants

Some agents cause damage to the equipment and must therefore not be used.

Sprays

Sprays can enter equipment and damage electrical components. They can also corrode various plastics and form flammable mixtures with air and solvent vapors.

Do not use vaporizing cleaning agents and vaporizing disinfectants because they damage the electrical components of the CT system.

Abrasive agents or organic solvents

The following agents can cause damage to surfaces or hairline cracks. Even the smallest load can then damage the material irreversibly.

- Abrasive cleaning liquids
- Organic solvents such as aldehyde, acetone, stain remover, cleaner's naphtha, benzine or alcohol
- Agents that release ammonia when they are dissolved or decomposed (ammonia has a corrosive effect)
- Agents containing silicone

  Silicone decays over time and can form sticky deposits that interfere with electrical contacts.
- Disinfectants based on substituted phenols or disinfectants that release chlorine

8.2.4 Cleaning surfaces

- Immediately remove residual contrast medium or blood on the gantry or patient table with a wet cloth (warm water).

8.2.5 Cleaning the image reconstruction system (IRS)

You can use the following cleaning agents to clean the outer surface of the IRS:

- Commercially available washing-up liquid

  It can be used without restriction.

- Ethyl alcohol and surgical spirit

  It may fade the surface of the IRS.

- Phenol derivatives

  It may fade the surface of the IRS.

Always clean the outer surface of the IRS with a damp but not wet cloth.

It is recommended to avoid using alcohol or phenol derivatives for disinfecting the outer surface of the IRS.

8.2.6 Cleaning accessories

- Clean accessories with soap solution or diluted cleaning liquid only.

Surgical spirit is not suitable for cleaning foam material. It could cause the surface material to become wrinkled.

Use of disinfectants containing alcohols or quaternary compounds discolors the surfaces of the accessories like the positioning mattress.

8.2.7 Cleaning body straps

The body straps can be machine-washed at temperatures up to 35° C. Washing may lead to minor changes on the surface of the straps (e.g., it softens the straps). This has no negative impact as washing does not affect the flame-retardance.

Only dry-clean or wash restraint straps closed in order to protect the Velcro parts.

Make sure that straps are completely dry before storing them.

1. Remove superficial contaminations with a wet cloth and neutral cleaning agent.
2. Remove heavy contaminations with alcohol or surrogate turpentine.

After the use of alcohol or surrogate turpentine always clean the corresponding parts with hot water containing neutral cleaning agent.

On site cleaning and disinfection can be performed using sodium hypochlorite (max. 0.1 % active chlorine) or branded disinfectants.

8.2.8 Cleaning and disinfecting the gantry operator panel

Cleaning agents that contain alcohol, such as ethyl alcohol or isopropanol, impair the surface of the gantry operator panel keys. The surface becomes tarnished if cleaning agents that contain more than 70 Vol% alcohol are applied.

- For cleaning and disinfecting the gantry operator panel, only use cleaning agents that contain less than 70 Vol% alcohol.

After the use of alcohol or surrogate turpentine, always clean the corresponding parts with hot water containing neutral cleaning agent.

8.2.9 Cleaning the monitor screen

WARNING

Cleaning of the monitor housing during operation!

Electric shock

- Only clean the housing when the monitor is switched off.

The monitor screen has a sensitive anti-reflective coating which has to be treated with care.

You can clean the *screen* even if the monitor is switched on.

1 Clean the monitor screen with a soft cloth, if necessary, moistened with water. Do not use cleaning solutions.

Grease stains can also be removed from the monitor screen with water.

Using an anti-static cleaner gives the best results when cleaning the screen surface.

2 In order to avoid damage to the surface coating, never use corrosive agents to clean the screen surface.

3 Always clean the housing with a damp but not wet cloth.

4 Remove water drops immediately. Extended contact with water discolors the surface.

8.2.10 Cleaning the mouse

- Clean the lense and the contact surface of the optical mouse with a dry or wet cloth.

8.2.11 Cleaning storage media

- Use a professional duster system to remove particles from the surface of the data medium (e.g., *compressed air* in an aerosol can).

Never rub or wipe the surface or use chemical solutions and cleaning liquids. Certain substances (e.g., ammonia vapors) can contaminate the surface of the disk making it unreadable.

8.2.12 Veterinary use

Veterinary use of the SOMATOM CT system requires that you sufficiently clean the table and positioning aids. In case of mixed operation for both animal and human patients, the cleaning media used should also be approved for humans.

CAUTION

Insufficient cleaning or disinfection of the equipment!

Injury to the patient or the personnel (bio hazard).

- Always clean or disinfect the equipment after use.
- Always observe the instructions for cleaning and disinfecting.
- Make sure that the table and the accessories are clean and covered with paper, if possible.

CAUTION

Using of cleaning media not approved for humans!

Allergic reaction or allergic shock.

- Always use cleaning media also approved for humans.

9 Quality assurance

To ensure a constantly high image quality, you must perform quality measurements regularly.

After switch on

Whenever you start the system, you can perform automatic checks and a series of warm-up scans.

Regular checks

Quality tests are performed in several steps:

- Daily quality measurements
- Monthly quality measurements (constancy test)
- Camera test

We recommend having the constancy test performed by Siemens Customer Service as part of a service contract.
(➔ Page 584 *Constancy test*)

All parameters and images shown in this manual are examples. Only the parameters displayed by your system are definite.

9.1 Accessories for quality measurement

You require the set of phantoms for the quality measurement and possibly additional accessories for the constancy test.

Accessories for daily quality measurement

The following components are required for the daily quality measurement:

- Phantom holder (➔ Page 575 *Using the long phantom holder*) (➔ Page 576 *Using the short phantom holder*)
- Quality phantom (➔ Page 570 *Quality phantom*)

Accessories for the monthly constancy test

For the monthly constancy test, you require the following phantoms and accessories:

- Phantom holder (➔ Page 575 *Using the long phantom holder*) (➔ Page 576 *Using the short phantom holder*)
- Quality phantom (➔ Page 570 *Quality phantom*)
- 100 kg (220 lbs) weight (a patient equivalent load not exceeding 135 kg (297 lbs))
- Ruler, 40 cm or longer

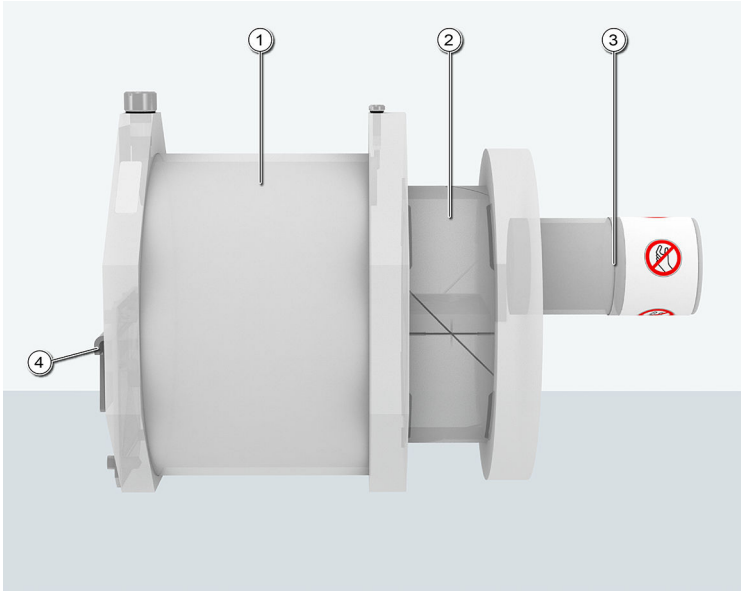
Accessories for the Low Contrast test

For the low contrast test, you require the following phantoms and accessories:

- Phantom holder (➔ Page 575 *Using the long phantom holder*) (➔ Page 576 *Using the short phantom holder*)
- Low contrast phantom (➔ Page 570 *Quality phantom*)

9.1.1 Quality phantom

The quality phantom comprises the water phantom, the slice thickness phantom and the wire and ball phantom.



(1) Water phantom

(2) Slice thickness phantom with reference markings

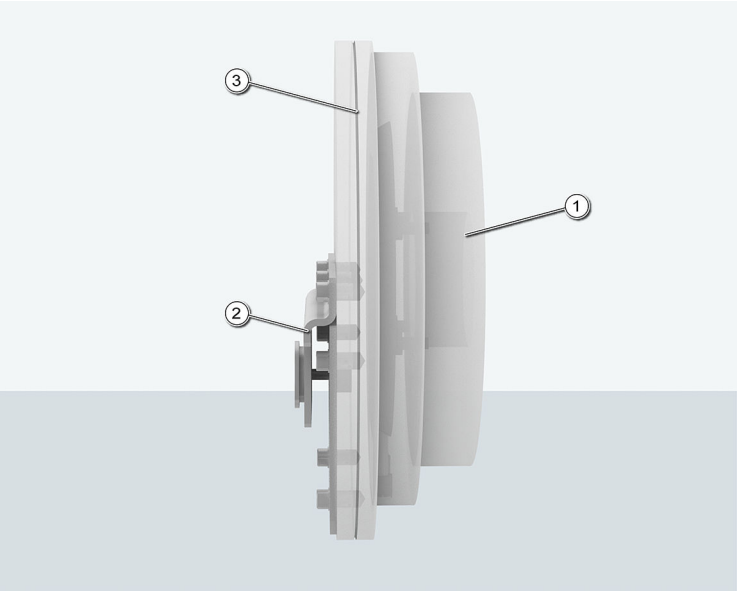
(3) Wire and ball phantom

(4) Phantom holder bracket

Depending on the delivery date, the wire and ball phantom is removable or not.

9.1.2 Low contrast phantom

Use the low contrast phantom to perform the low contrast test.



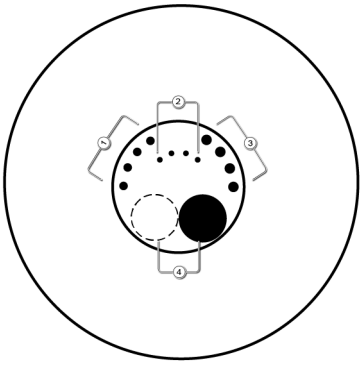
(1) Low contrast phantom

(2) Phantom holder bracket

(3) Phantom holder with reference markings

The low contrast phantom consists of a 165 mm diameter, 25 mm thick, water-equivalent, brown plastic cylinder.

A clear plastic insert at the center contains three sets of low contrast pins (with diameters of 3, 4, and 5 mm, each set with four pins) and two 20 mm diameter measurement areas.



(1) 4 mm pins

(2) 3 mm pins

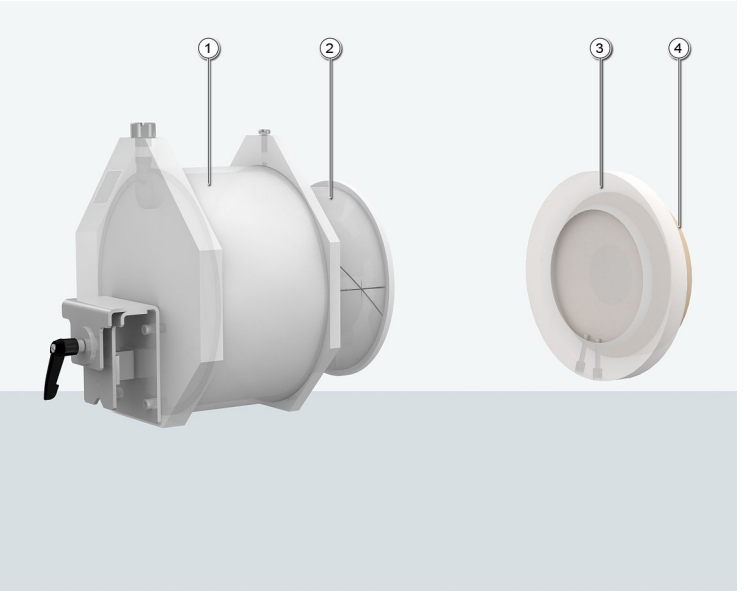
(3) 5 mm pins

(4) 20 mm measurement areas

The two 20 mm diameter measurement areas are used to establish low contrast differences between the pins and the surrounding area. The rated contrast between the pins and the surrounding area is 6 HU ± 1 HU (0.6 % ± 0.1 % contrast).

9.1.3 Low contrast phantom (previous)

To use the previous quality phantom for the low contrast test, the wire and ball phantom needs to be removed and the low contrast phantom needs to be added.



(1) Water phantom

(2) Slice thickness phantom with reference markings

(3) Phantom holder

(4) Low contrast phantom

Preparing the previous low contrast phantom

1 Remove the wire and ball phantom from the quality phantom set.

Touching prohibited

Do not touch the ball phantom on the labeled parts for mounting or transportation.

2 If the low contrast phantom is attached to the phantom holder with reference markings, remove it by loosening the two mounting screws. (➔ Page 571 *Low contrast phantom*)

3 Attach the low contrast phantom to the slice thickness phantom by using the dovetail connection and the two mounting screws.

4 Mount the phantom set to the patient table at normal body height. (➔ Page 575 *Using the long phantom holder*) (➔ Page 576 *Using the short phantom holder*)

5 Position the phantom set using the markings on the slice thickness phantom. (➔ Page 577 *Positioning the phantoms*)

Mounting the low contrast phantom to the previous quality phantom

✓ The low contrast phantom is mounted to the phantom holder with reference markings.

Remove the low contrast phantom from the phantom holder with reference markings. (➔ Page 571 *Low contrast phantom*)

1 Loosen the two mounting screws at the low contrast phantom.

2 Use the two mounting screws to attach the low contrast phantom to the slice thickness phantom.

9.1.4 Mounting the phantoms to the patient table

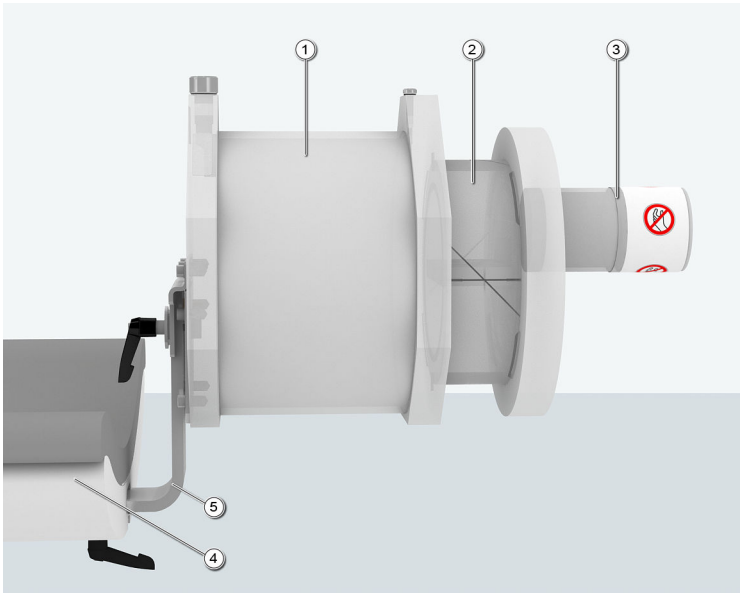
◆ Mount the quality phantom (set) or the low contrast phantom to the patient table using a phantom holder.

- (➔ Page 575 *Using the long phantom holder*)
- (➔ Page 576 *Using the short phantom holder*)

Using the long phantom holder

1 Attach the long phantom holder with the phantom at the head end of the patient table until it clicks into place.

2 Start the quality measurement.



(1) Water phantom

(2) Slice thickness phantom with reference markings

(3) Wire and ball phantom

(4) Patient table

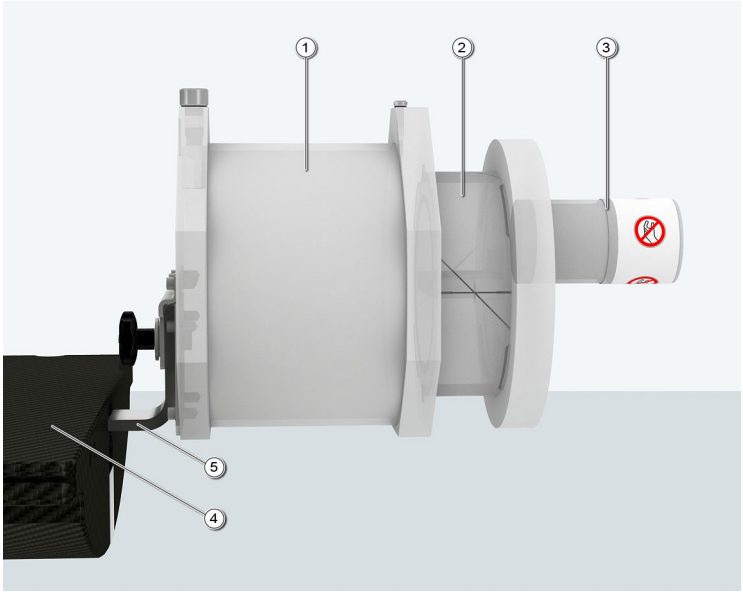
(5) Long phantom holder

Using the short phantom holder

1 Attach the short phantom holder with the phantom at the head end of the patient table until it clicks into place.

2 Replace the tommy screw at the phantom with the delivered star knob screw.

3 Start the quality measurement.



(1) Water phantom

(2) Slice thickness phantom with reference markings

(3) Wire and ball phantom

(4) RTP table top

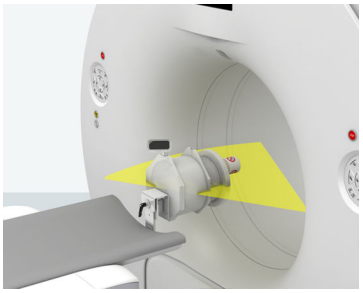
(5) Short phantom holder

Use the short phantom holder only with the RTP table top.

9.1.5 Positioning the phantoms

1 Activate the light marker.

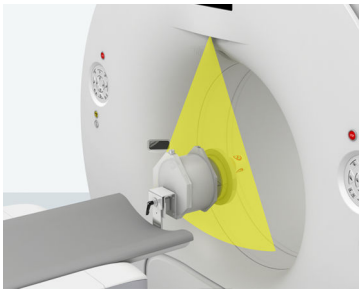
2 Set the appropriate table height using the light marker.



The numerical value for the correct table height is displayed after the phantom position check.

3 Move the patient table into the gantry.

The beam of the light marker at the outer offset level has to be aligned with the reference marking of the slice phantom.



4 Press the **Offset** key until the table movement stops.

9.1.6 Removing the phantom assembly

This section describes the steps to remove the phantom assembly from the patient table.

Removing the phantom assembly and long phantom holder

The long phantom holder is secured by a locking mechanism underneath the patient table.

1 Loosen the upper clamp screw.

2 Lift the phantom of the long phantom holder.

3 Loosen the clamp screw under the patient table and push the button next to the clamp screw.

4 Pull out the long phantom holder.

Removing the phantom assembly and short phantom holder

The short phantom holder is secured by a locking mechanism underneath the patient table.

1 Loosen the star knob screw.

2 Lift the phantom of the short phantom holder.

3 Push the button underneath the patient table.

4 Pull out the short phantom holder.

9.2 Daily quality measurements

The daily quality measurements only require checking of three parameters on the water phantom:

- The CT value of water and the homogeneity of the images are calculated in Hounsfield units (HU)
- The pixel noise of images is calculated as a standard deviation
- Tube voltages are measured directly at the X-ray tube

These measurements are performed for the head mode and the body mode.

Storage

The images of the **Daily Quality Check** measurements are stored as images of the "Quality Assurance Patient".

All values of the **Daily Quality Check** measurements are stored in the **Report Files**. (➔ Page 612 *Viewing the measurement report*)

9.2.1 Performing quality measurements

CAUTION

Wrong correction tables!

X-ray not, or only partially, usable.

- Perform the daily quality tests every day before you start the actual examinations.

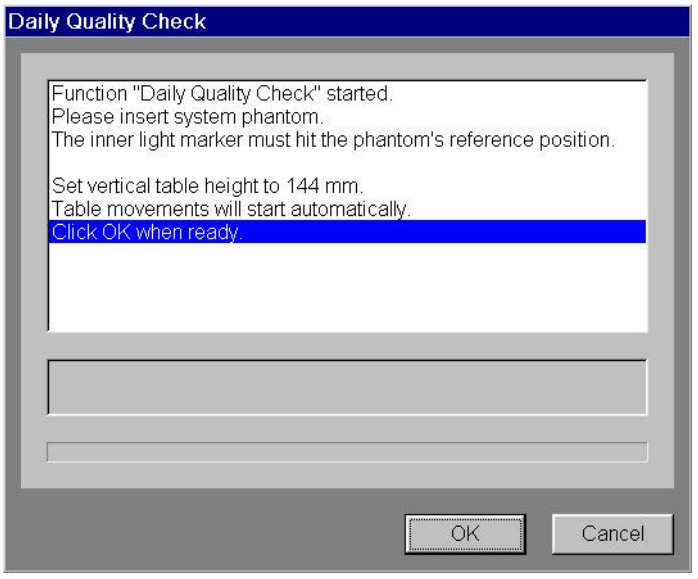
You must perform calibration before you start quality measurement.

1 Call up **Setup > Calibration**.

2 Position the phantom. (➔ Page 577 *Positioning the phantoms*)

3 Call up **Setup > Quality**.

The **Daily Quality Check** dialog box is displayed.

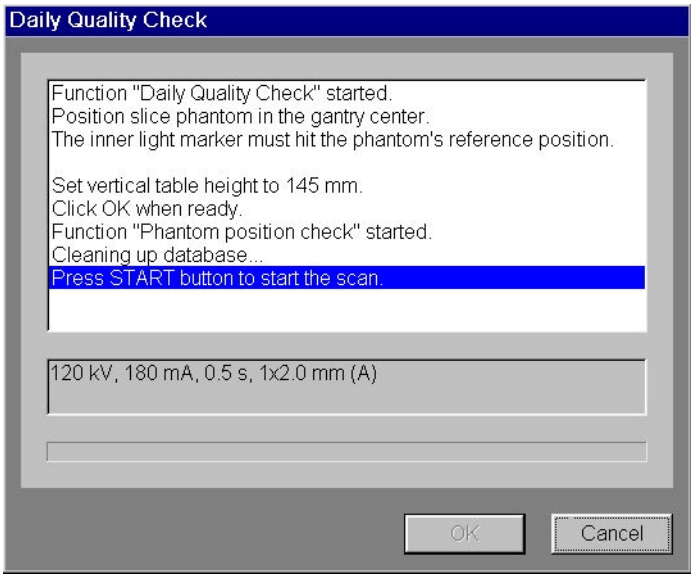


4 Position the patient table such that the slice thickness phantom with reference markings is in the scan plane.

5 Click **OK**.

The “Quality Assurance Patient” is automatically selected. Table movement starts automatically.

In the **Daily Quality Check** dialog box you are prompted to initiate radiation.

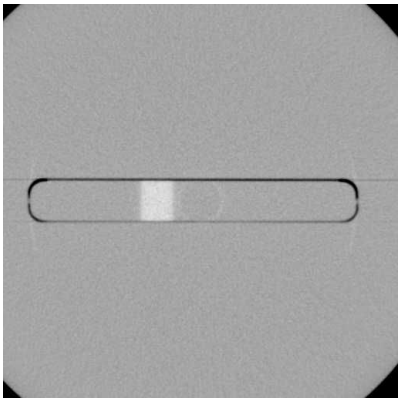


6 Press the **Start** key on the control box.

The position of the phantom set is checked and displayed. Then, the first measurement is started automatically.

For incorrect positioning of the phantom set, a message is displayed. Correct the position, if necessary.

After the first measurement, a CT-image of the slice phantom is displayed in the active segment.



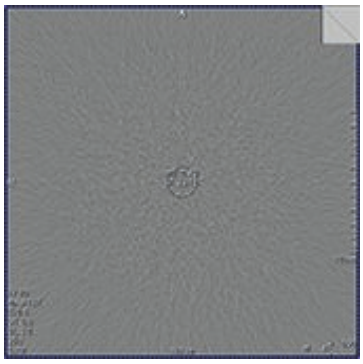
The next measurements are started automatically. An image is displayed with the following evaluations:

- ROIs in image center and 3, 6, 9, and 12 o'clock position
- Mean value of the CT value
- Standard deviation

The homogeneity is calculated by evaluating a central and four different outer ROIs. For the noise measurement, the difference between the first and the second measurement is calculated and displayed.

The following evaluations are shown:

- ROIs
- Mean value of the CT value
- Sigma value (measure for pixel noise)



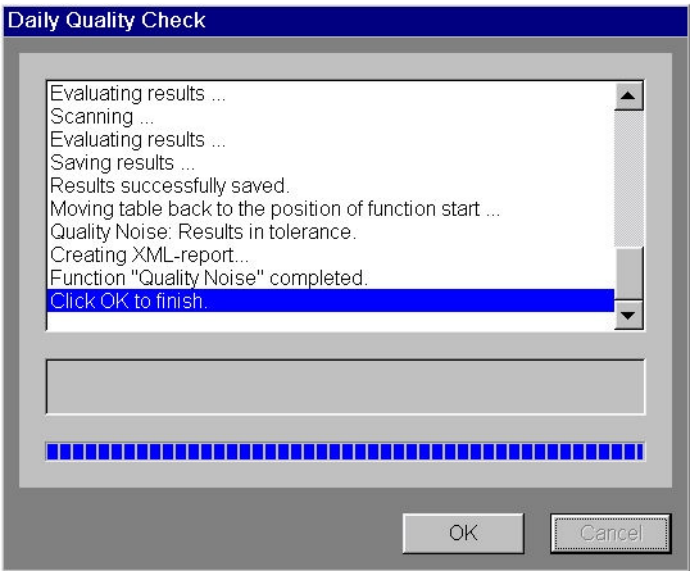
The measurements are done automatically for each defined mode.

Stopping measurement

◆ Click **Cancel**.

The **Daily Quality Check** measurement is aborted.

You have to repeat the quality measurement from the beginning before you start the actual examinations.



All measurements were performed and evaluated.

Test results are displayed in the **Daily Quality Check** dialog box.

7 Click **OK**.

The **Daily Quality Check** measurement is terminated.

Test results of the Daily Quality Check measurement are out of tolerance.

- Call your Siemens Customer Service.

9.3 Constancy test

Together with other characteristic values, the daily test values are checked for constancy monthly. These tests are performed on the complete set of phantoms.

In addition, the CTDI (CT Dose Index) must be measured at least once every six months. The CTDI must also be measured after any maintenance work that might have altered the test results.

We recommend having the constancy test and the CTDI measurement performed by appropriately trained personnel.

Failure to conduct regular constancy tests and CTDI measurements may compromise the status of the operating license. Please observe the law of your country.

If you want to conduct the constancy test and the CTDI measurement yourself, you must perform all steps of the constancy test or the CTDI measurement under your own responsibility.

9.3.1 Performing the constancy test

The monthly quality test is performed via the **Quality Constancy** dialog box of the **Siemens Med Service Software** window.

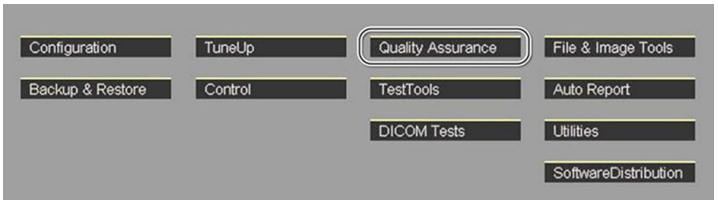
In the constancy test, the following factors are checked:

- Phantom and phantom position check
- Position of the lightmarker; **Lightmarker**
- Position of the external lightmarker; **External Lightm**.
- Position of the sagittal and coronal lightmarker; **Sag./Cor. Lightm**.
- Automatic positioning of the tomographic plane using a preview image; **Topogram Pos**.
- Tomographic slice thickness; **Slice**
- Homogeneity; **Homogeneity/Water**
- Pixel noise; **Noise**
- Spatial resolution by calculation of the Modulation transfer function; **MTF**
- Position of the patient table; **Table Position**
- Measurement of the Computed Tomography Dose Index; **CTDI-Air**

If using the MPT, the *standard table top* must be positioned to perform the constancy test.

1 Call up **Options > Service > Local Service**, delete the password entries, and click on **OK**.

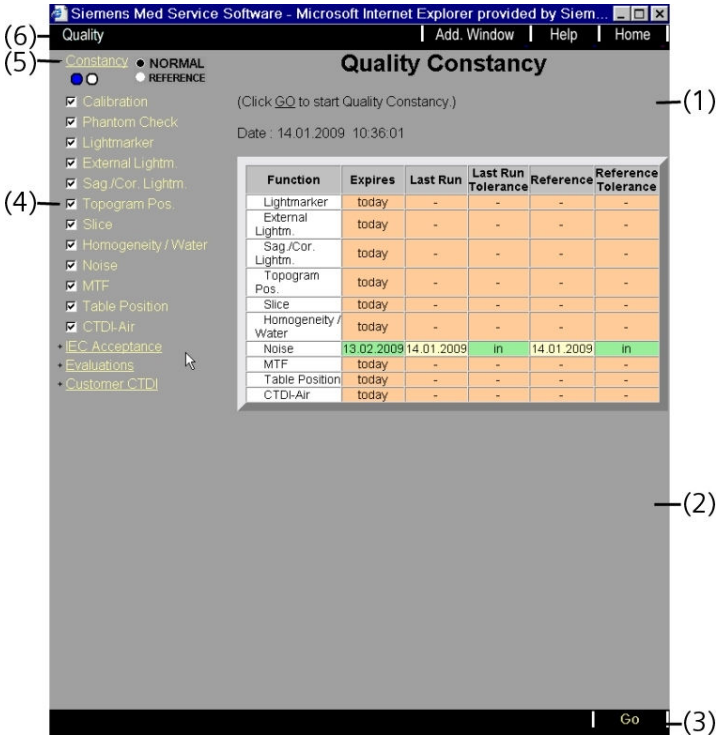
The **Home Menu** dialog window is displayed.



2 Click on the **Quality Assurance** button to display the **Quality Assurance** dialog box.

3 Select the **Constancy** procedure.

The **Quality Constancy** dialog box is displayed.



(1) Content area

(2) Status and error message area

(3) Command buttons

(4) Quality functions

The single functions of the constancy test are preselected with a checkmark. Deselect the tests that you do not require by clicking on them.

(5) Mode button(s)

(6) Title bar

Selecting reference measurements

Evaluation of the constancy test results are based on a comparison with reference data that are stored in your system. These are determined by Siemens Service.

If you have any of the system parts replaced (e.g., tubes), the reference data must be determined again. You can do this with a reference measurement.

- Click the field **Reference/NORMAL** to toggle between a normal constancy measurement and a reference measurement.

In reference mode, the individual selected tests are marked by an "R". The test results are used as reference data in the future.

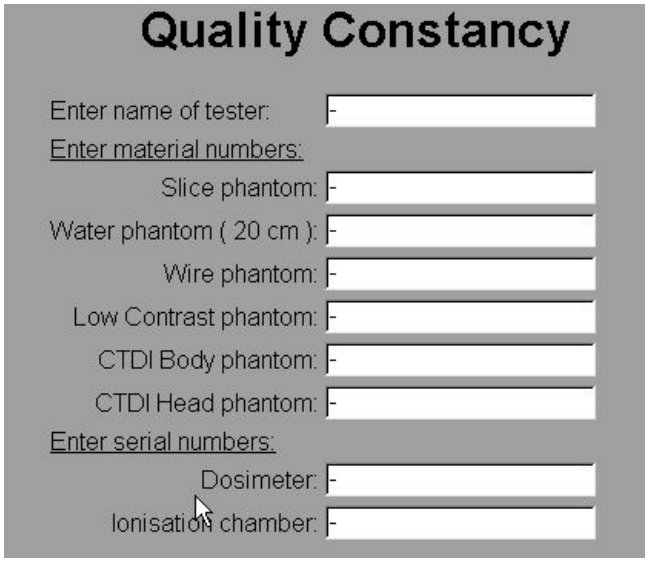
We recommend that Siemens Service always performs your reference measurements.

Starting the constancy test

A reference measurement follows the same sequence as a normal constancy test.

1 Confirm selection of the constancy test with **Go**.

You are prompted to enter the name of the tester and the material numbers of the phantoms.



2 Enter your name and the data required.

3 Prepare the measurement as described. (➔ Page 569 *Quality assurance*)

Table movement starts automatically.

4 Click **Go** when you have completed your preparations.

The "Quality Assurance Patient" is selected.

A **Calibration** is performed.

You are prompted to press **Start**.

5 Press the **Start** key on the control box.

You are prompted to select the required phantom.

6 Select the radio button of the phantom that is used for the current test.

- **System phantom with aluminum ball** (➔ Page 570 *Quality phantom*)
- **System phantom with low contrast**

Go

7 Confirm the settings with **Go**.

The phantom position is checked.

The system alerts you if the phantom is positioned incorrectly. Correct the position, if necessary.

The system then starts the first quality measurement. This is usually checking the **Lightmarker** position (z-positioning).

The several selected functions are started automatically.

Interrupting the constancy test

You can interrupt each test within a constancy measurement.

Cancel

◆ Click on the **Cancel** button.

The current measurement and the complete procedure is aborted.

Successfully saved results of already completed quality measurements within the procedure are not deleted.

9.3.2 Performing the lightmarker test (z-position)

With the quality measurement, you determine the deviation of inner light marker from the current slice plane.

✓ The set of phantoms is positioned in such a way that the inner light marker points on the reference marking on the slice thickness phantom. (➔ Page 577 *Positioning the phantoms*)

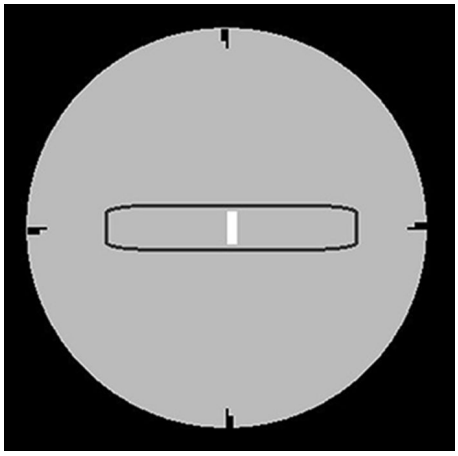
✓ The **Lightmarker** test mode is loaded.

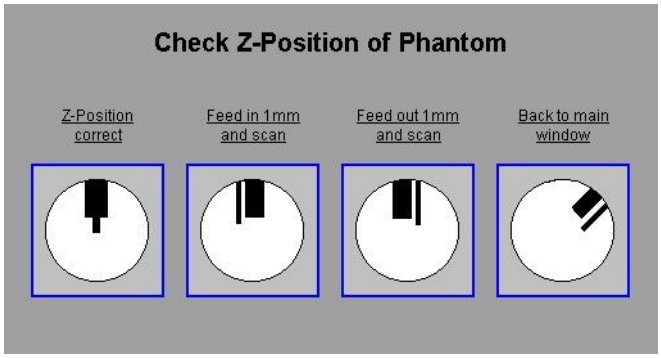
✓ You are prompted to press **Start**.

1 Press the **Start** key on the control box.

Scanning is started.

In the image area, the phantom is displayed as a circle in the image. For the light marker test it is important to have the short and the long strip in the 12 o'clock position.





2 Compare the position of the short / long strip on the image with the options displayed in the content area of the **Quality Constancy** dialog box.

3 Correct the table position by clicking **Feed In** or **Feed Out**.

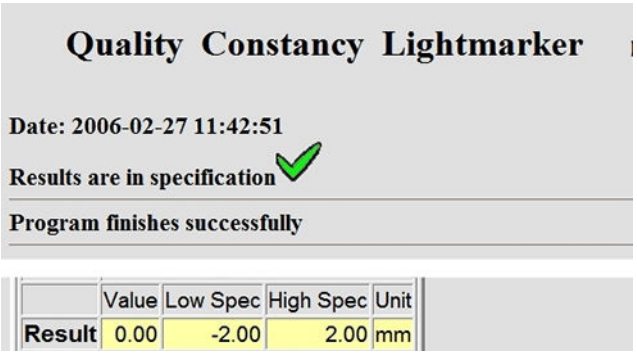
With **Feed In** and **Feed Out**, you can move the table by 1 mm.

4 Compare the position of the strips again after an image was recorded.

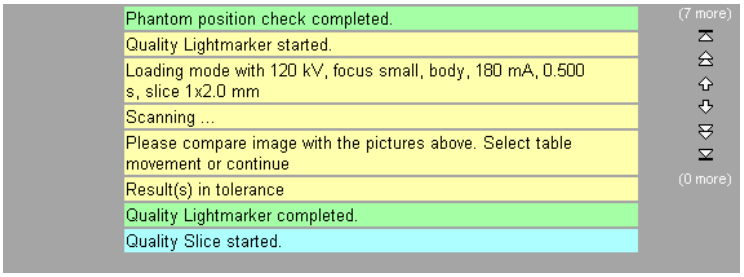
5 Repeat the correction of the table position until you have set the correct z-position.

6 Click on **Continue**.

The result of the test is displayed in the content area of the **Quality Constancy** dialog box.



In the status and error message area the result of this test (in tolerance or out of tolerance) is displayed.



9.3.3 Performing the external lightmarker test

With the quality measurement, you determine the position of external lightmarker.

✓ The set of phantoms is positioned in such a way that the external light marker points to the reference marking on the slice thickness phantom. (➔ Page 577 *Positioning the phantoms*)

✓ The phantom is positioned at the inner lightmarker position.

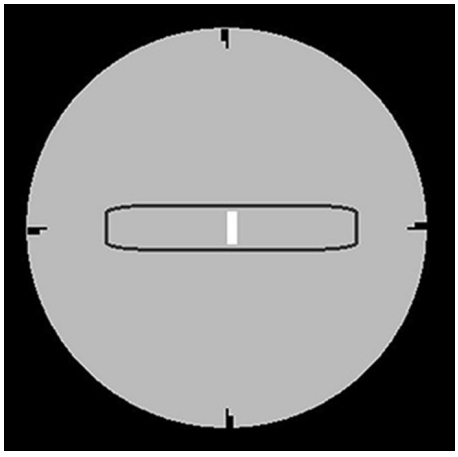
✓ The **External Lightm**. test mode is loaded.

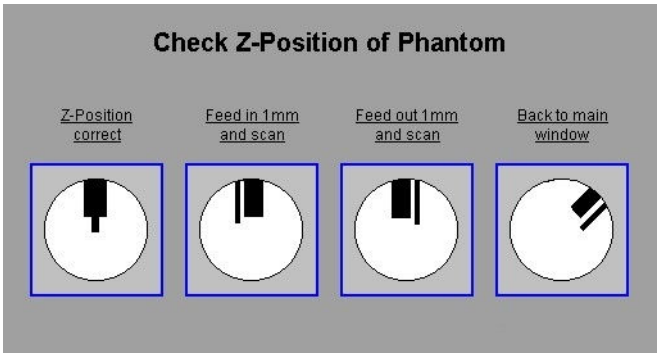
✓ You are prompted to press **Start**.

1 Press the **Start** key on the control box.

Scanning is started.

In the image area, the phantom is displayed as a circle in the image. For the light marker test it is important to have the short and the long strip in the 12 o'clock position.





2 Compare the position of the short / long strip on the image with the options displayed in the content area of the **Quality Constancy** dialog box.

Feed In

Feed Out

3 Correct the table position by clicking **Feed In** or **Feed Out**.

With **Feed In** and **Feed Out**, you can move the table by 1 mm.

4 Compare the position of the strips again after an image was recorded.

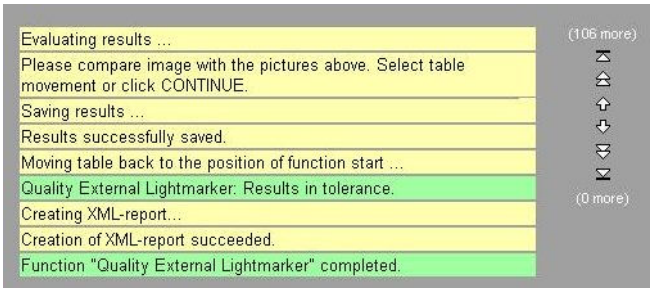
5 Repeat the correction of the table position until you have set the correct position.

Continue

6 Click on **Continue**.

The result of the test is displayed in the content area of the **Quality Constancy** dialog box.

In the status and error message area the result of this test (in tolerance or out of tolerance) is displayed.



9.3.4 Performing the sagittal/coronal lightmarker test

With the quality measurement, you determine the position of the sagittal/coronal lightmarker.

✓ The slice thickness phantom is positioned in such a way that the sagittal and horizontal lightmarkers mark the horizontal and vertical center.

✓ The phantom is positioned at the laser light marker position. The **Sag./Cor. Lightm.** test mode is loaded.

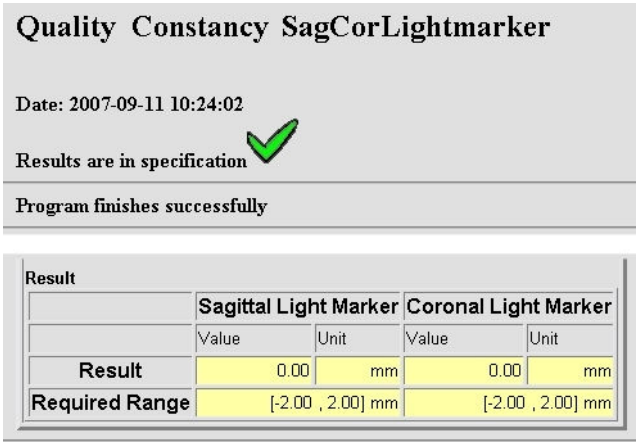
✓ You are prompted to press **Start**.

◆ Press the **Start** key on the control box.

Scanning is started.

In the image, the middle of the phantom is determined. The result is the deviation from the horizontal and vertical middle of the image to the middle of the phantom.

The result of the test is displayed in the content area of the **Quality Constancy** dialog box.



Quality Constancy SagCorLightmarker

Date: 2007-09-11 10:24:02

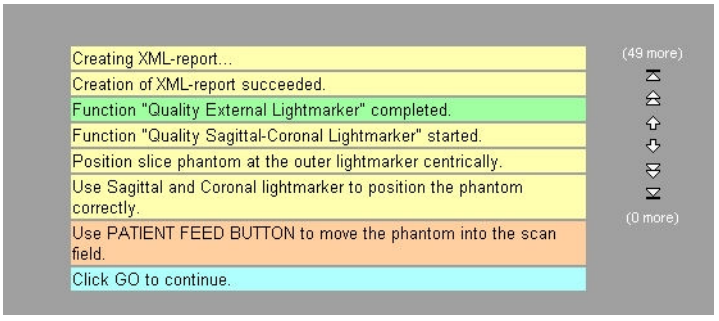
Results are in specification

Program finishes successfully

Result

	Sagittal Light Marker		Coronal Light Marker	
	Value	Unit	Value	Unit
Result	0.00	mm	0.00	mm
Required Range	[-2.00 , 2.00] mm		[-2.00 , 2.00] mm	

In the status and error message area the result of this test (in tolerance or out of tolerance) is displayed.



9.3.5 Performing the Topogram position test

With the quality measurement, you determine the automatic positioning of the tomographic plane using a preview image.

✓ The set of phantoms is positioned in such a way that the inner light marker points to the reference marking on the slice thickness phantom.

✓ The table height is set so that the phantom is in the gantry isocenter.

✓ The **Topogram Pos.** test mode is loaded.

✓ You are prompted to press **Start**.

1 Press the **Start** key on the control box.

In the **Quality Constancy** dialog box the topogram image is displayed. You can see a horizontal line in the image and the corresponding table position to the line position is shown.

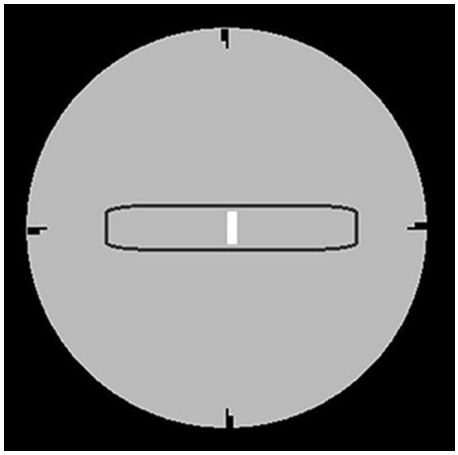
2 Move the horizontal line and mark the position of the middle of the slice thickness phantom where the lines are crossing.

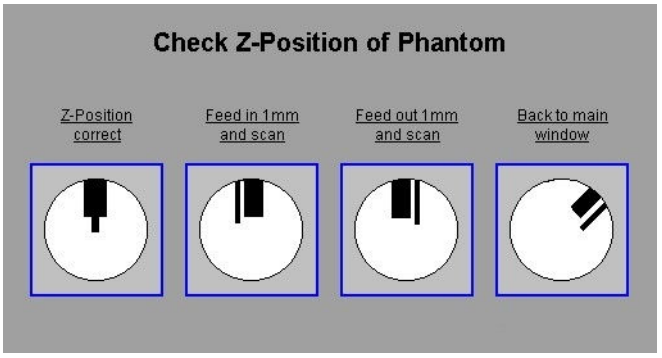
3 Click on **Go**.

The patient table moves automatically to the marked position.

Scanning is started.

In the image area, the phantom is displayed as a circle in the image. For the preview image it is important to have the short and the long strip in the 12 o'clock position.





4 Compare the position of the short / long strip on the image with the options displayed in the content area of the **Quality Constancy** dialog box.

Feed In

Feed Out

5 Correct the table position by clicking **Feed In** or **Feed Out**.

With **Feed In** and **Feed Out**, you can move the table by 1 mm.

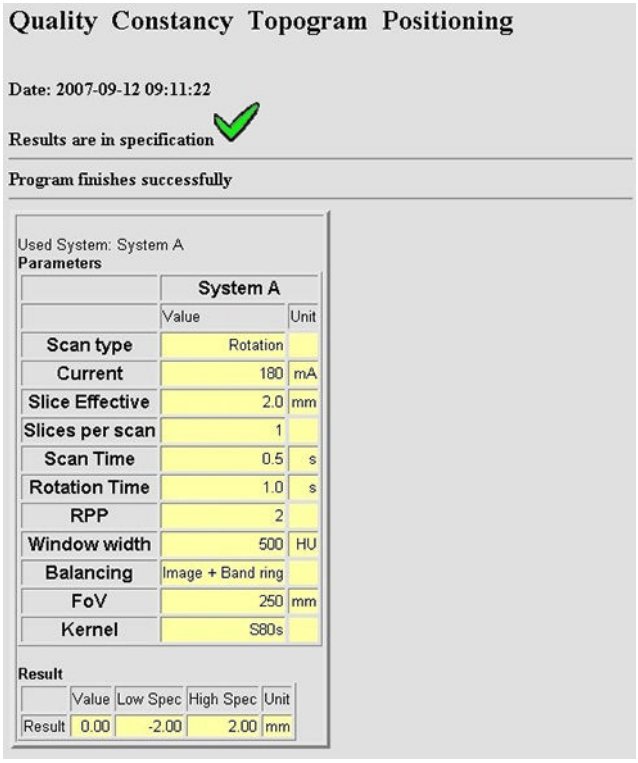
6 Compare the position of the strips again after an image was recorded.

7 Repeat the correction of the table position until you have set the correct position.

Continue

8 Click on **Continue**.

The result of the test is displayed in the content area of the **Quality Constancy** dialog box.



Quality Constancy Topogram Positioning

Date: 2007-09-12 09:11:22

Results are in specification

Program finishes successfully

Used System: System A

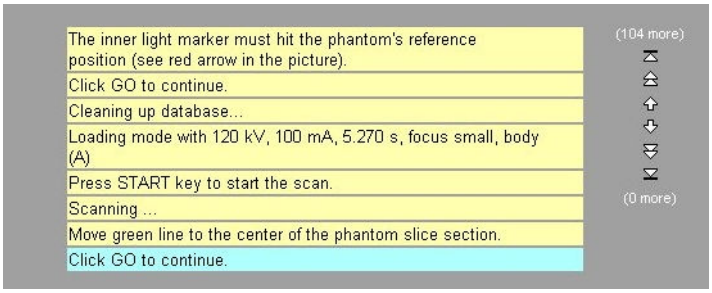
Parameters

	System A	
	Value	Unit
Scan type	Rotation	
Current	180	mA
Slice Effective	2.0	mm
Slices per scan	1	
Scan Time	0.5	s
Rotation Time	1.0	s
RPP	2	
Window width	500	HU
Balancing	Image + Band ring	
FoV	250	mm
Kernel	S80s	

Result

	Value	Low Spec	High Spec	Unit
Result	0.00	-2.00	2.00	mm

In the status and error message area the result of this test (in tolerance or out of tolerance) is displayed.



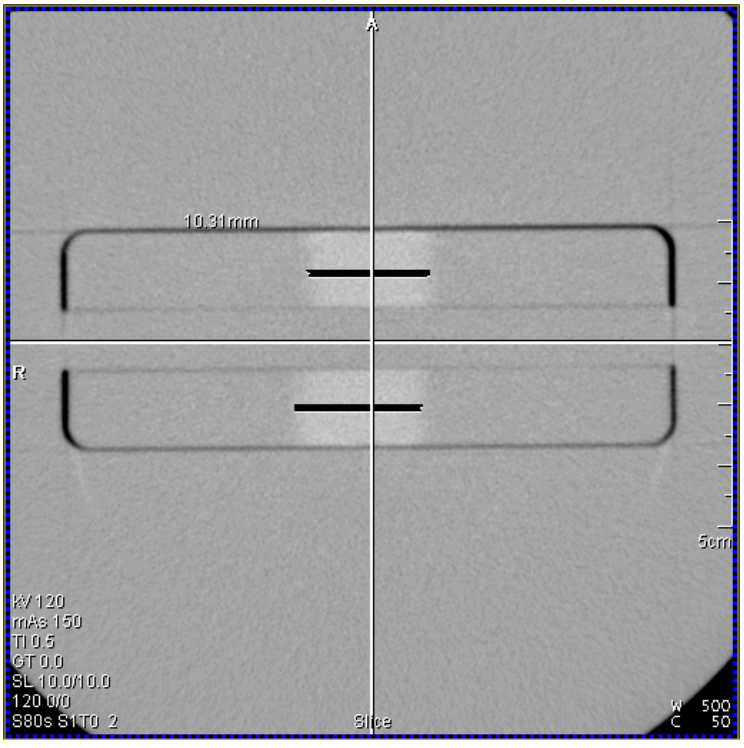
9.3.6 Performing the slice thickness test

The slice thickness is determined with the slice thickness phantom. For each slice thickness, a tomogram of the phantom is recorded and the reconstructed slice thickness is calculated from this.

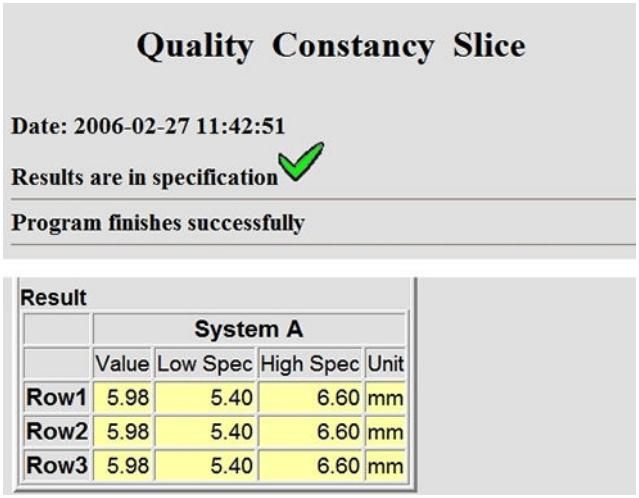
- Press the **Start** key on the control box.

  Scanning is started.

An image of the slice thickness phantom is displayed in the image area and the slice thickness is calculated. The procedure is repeated automatically for all defined modes.

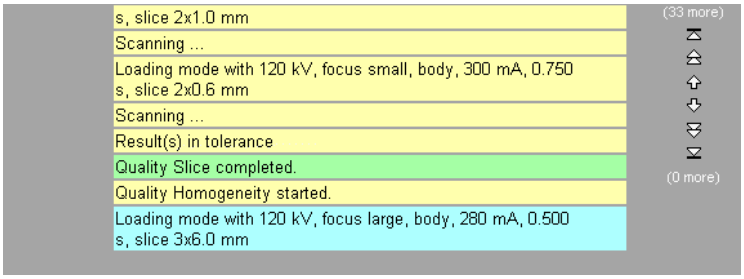


After all slice thicknesses have been evaluated, the result of the test is displayed in the content area of the **Quality Constancy** dialog box.



Use the vertical scroll bar to view all test results.

In the status and error message area the result of this test (in tolerance or out of tolerance) is displayed.



9.3.7 Performing the homogeneity test

With this test, you measure the homogeneity of the CT values in 5 regions of the water phantom.

- Press the **Start** key on the control box.

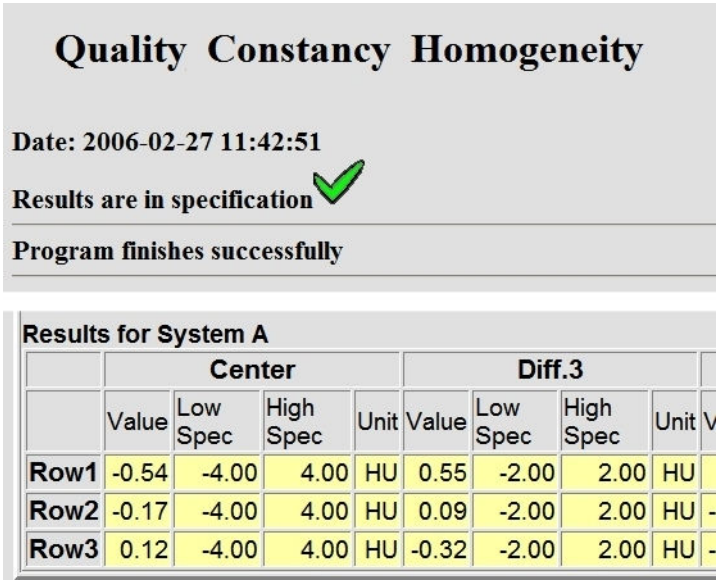
  Scanning is started.

An image of the water phantom is recorded. 5 ROIs are marked in the image, one central and four peripheral.

In addition to the ROIs, the mean values and standard deviations of the CT values are displayed.

The difference between the mean values of the central ROI and the peripheral ROIs is displayed.

The measurement is repeated automatically for all defined modes. The results of the test are output in the content area of the **Quality Constancy** dialog box.



Quality Constancy Homogeneity

Date: 2006-02-27 11:42:51

Results are in specification

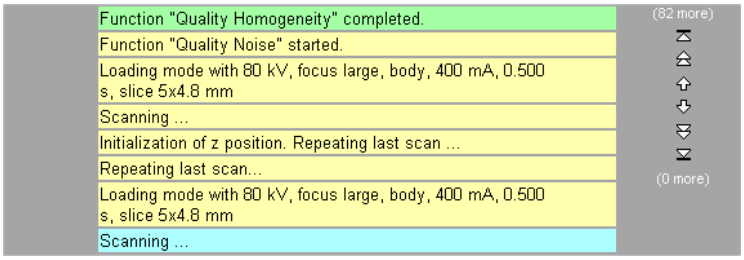
Program finishes successfully

Results for System A

	Center				Diff.3				
	Value	Low Spec	High Spec	Unit	Value	Low Spec	High Spec	Unit	V
Row1	-0.54	-4.00	4.00	HU	0.55	-2.00	2.00	HU	
Row2	-0.17	-4.00	4.00	HU	0.09	-2.00	2.00	HU	-
Row3	0.12	-4.00	4.00	HU	-0.32	-2.00	2.00	HU	-

Use the vertical scroll bar to view all test results.

In the status and error message area the result of this test (in tolerance or out of tolerance) is displayed.



9.3.8 Performing the pixel noise test

The pixel noise is determined from two tomograms of the water phantom in the same way as for the daily quality measurement.
(➔ Page 579 *Daily quality measurements*)

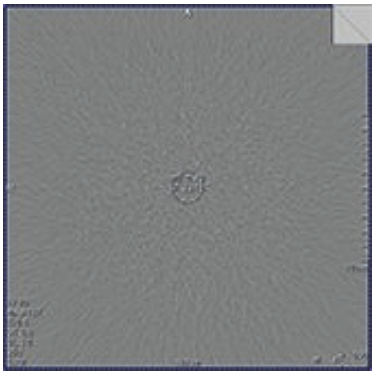
◆ Press the **Start** key on the control box.

Scanning is started.

Two images of the water phantom are recorded with identical parameters. The difference between the first and the second measurement is shown.

The following evaluations are displayed:

- ROI
- Mean value of the CT value
- Sigma value (pixel noise)



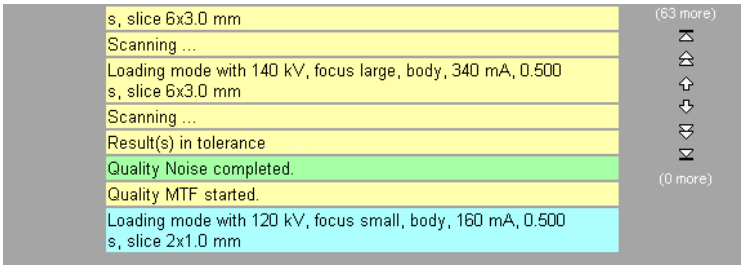
The measurement is repeated automatically for all defined modes. The results of the test are output in the content area of the **Quality Constancy** dialog box.

Result

	Results for System A				
	Value	Low Spec	High Spec	Ref. Value	Unit
Row1	8.15	7.37	8.80	8.19	HU
Row2	8.15	7.37	8.80	8.19	HU
Row3	8.14	7.35	8.80	8.17	HU
Row4	8.18	7.40	8.80	8.22	HU
Row5	8.17	7.34	8.80	8.16	HU
Row6	8.13	7.33	8.80	8.14	HU

Use the vertical scroll bar to view all test results.

In the status and error message area the result of this test (in tolerance or out of tolerance) is displayed.



9.3.9 Performing the MTF test

The spatial resolution is characterized through the modulation transfer function (MTF). The MTF describes the sharpness of the reconstructed image. The test determines the contribution of spatial frequencies to the image. Images are measured with the wire phantom.

- Press the **Start** key on the control box.

  Scanning is started.

The MTF is represented graphically as a function of the spatial frequency (object modulation, measured in line pairs per cm, LP/cm). In addition, several characteristic values, for example, 50% MTF, 10% MTF and 2% MTF are displayed.

10% MTF means that the frequency content has dropped to 10% of the value obtained at 0 Lp/cm.

The scan is displayed in the image area. The result image is calculated and stored in the local database.

The result image can be displayed in the **Viewing** task card after the constancy test has been completed. (➔ Page 612 *Output of results*)

The evaluation is done for several modes using different kernels. The results of the test are output in the content area of the **Quality Constancy** dialog box.

Quality Constancy MTF

Date: 2006-02-27 11:42:51

Results are in specification

Program finishes successfully

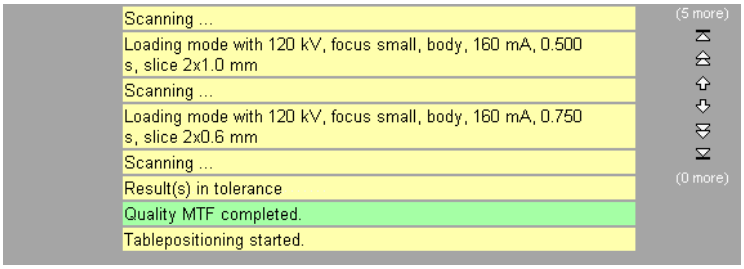
Evaluated slice width: 3x6.0mm

Results for System A

	50.00%	10.00%	
	Value	Value	Value
Row1	4.08	6.18	
Row2	4.08	6.18	
Row3	4.08	6.18	
Required Range	[3.51 , 4.29] lp/cm	[5.67 , 6.93] lp/cm	[6.93

Use the vertical scroll bar to view all test results.

In the status and error message area the result of this test (in tolerance or out of tolerance) is displayed.



9.3.10 Performing the table position test

With this quality measurement, you test whether the actual table position matches the table position displayed.

The **Table Position** test is performed without triggering radiation. It is started with **Go** in the **Quality Constancy** dialog box.
(➔ Page 585 *Performing the constancy test*)

1 Mount a ruler at the mobile part of the patient table so that the 0 mm mark of the ruler is aligned with the stationary part of the table.

2 Place a patient equivalent load on the patient table that does not exceed 135 kg (297 lbs) (a weight of 100 kg (220 lbs) is recommended by Siemens).

3 Set the horizontal table position to 0.

4 Start the measurement with **Go**.

The table top moves 300 mm in the direction of the gantry.

5 Read the -300 m position on the ruler.

6 Enter the value in the entry field of the content area.

7 Click on **Continue**.

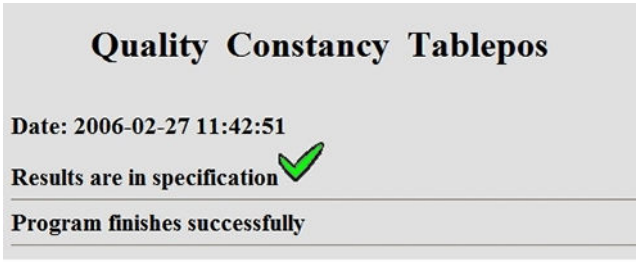
Three more table positions are checked this way.

8 Enter the particular values when prompted and confirm with **Continue**.

The table top now moves stepwise into the gantry (300 mm) and back.

9 Enter the actual values for all checked table positions in the entry field again.

The deviations of the actual from the displayed positions are calculated. The results of the test are output in the content area of the **Quality Constancy** dialog box.



Quality Constancy Tablepos

Date: 2006-02-27 11:42:51

Results are in specification

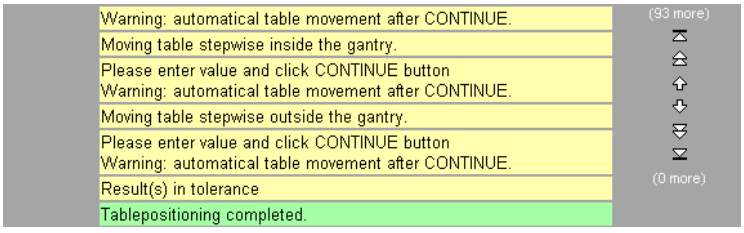
Program finishes successfully

Function Common

	Continuous Move				Stepwise Move		
	Value	Low Spec	High Spec	Unit	Value	Low Spec	High Spec
Position1	-300.00	-301.00	-299.00	mm	-300.00	-301.00	299.00
Position2	0.00	-1.00	1.00	mm	0.00	-1.00	1.00
Position3	300.00	299.00	301.00	mm	300.00	299.00	301.00
Position4	0.00	-1.00	1.00	mm	0.00	-1.00	1.00

Use the vertical scroll bar to view all test results.

In the status and error message area the result of this test (in tolerance or out of tolerance) is displayed.



9.3.11 Performing the CTDI-Air test

With this quality measurement you measure the dose in the system axis.

Measurement is performed using a 100 mm ionization chamber with the necessary accessories.

The dosimeter is not supplied with the system.

Please follow the instructions for use supplied by the manufacturer of the measuring device.

Please note that the lead connecting the dosimeter and the ionization chamber is very sensitive.

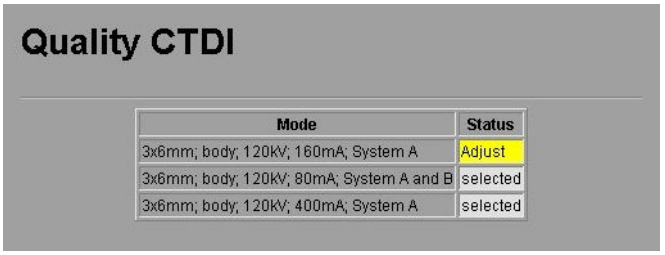
✓ The ionization chamber is centered in the axial direction in the system axis. The slice plane has to run through the center of the chamber. An appropriate dosimeter is connected to the ionization chamber.

✓ The **CTDI-Air** test mode is loaded.

✓ You are prompted to press **Start**.

1 Press the **Start** key on the control box.

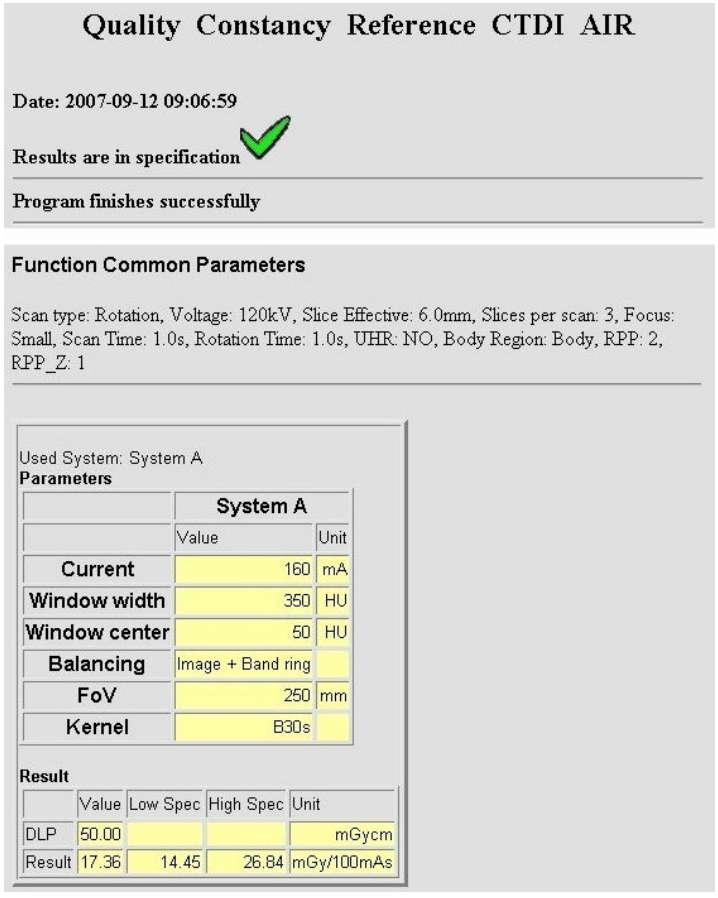
Scanning is started.



2 Read off the dose length product on the dosimeter. Enter this value in mGy*cm in the entry field of the **Quality Constancy** dialog box.

3 Continue with the next mode.

The results of the test are output in the **Siemens Med Service Software** window.



Quality Constancy Reference CTDI AIR

Date: 2007-09-12 09:06:59

Results are in specification

Program finishes successfully

Function Common Parameters

Scan type: Rotation, Voltage: 120kV, Slice Effective: 6.0mm, Slices per scan: 3, Focus: Small, Scan Time: 1.0s, Rotation Time: 1.0s, UHR: NO, Body Region: Body, RPP: 2, RPP_Z: 1

Used System: System A

Parameters

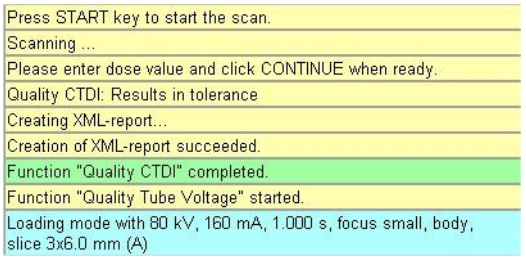
	System A	
	Value	Unit
Current	160	mA
Window width	350	HU
Window center	50	HU
Balancing	Image + Band ring	
FoV	250	mm
Kernel	B30s	

Result

	Value	Low Spec	High Spec	Unit
DLP	50.00			mGycm
Result	17.36	14.45	26.84	mGy/100mAs

Use the vertical scroll bar to view all test results.

In the status and error message area, the result of this test (in tolerance or out of tolerance) is displayed.



9.3.12 Exiting the constancy test

After the final test has been completed, you terminate the monthly constancy test and return to the **Home Menu** dialog box.

In **Reference** mode, all results in the tolerance range are saved automatically.

Home

1 Click on **Home**.

You return to the **Home** window.

You can now view the measurement report with the results of the current and previous tests. (➔ Page 612 *Viewing the measurement report*)

2 Close the **Siemens Med Service Software** window.

You return to the *syngo* user interface.

9.3.13 Output of results

The results are stored as reports, see (➔ Page 612 *Viewing the measurement report*).

The images recorded during measurement are stored as images of the “Quality Assurance Patient”.

Viewing the measurement report

You can view the results of the daily and monthly quality test with the **Report** function of the **Local Service**.

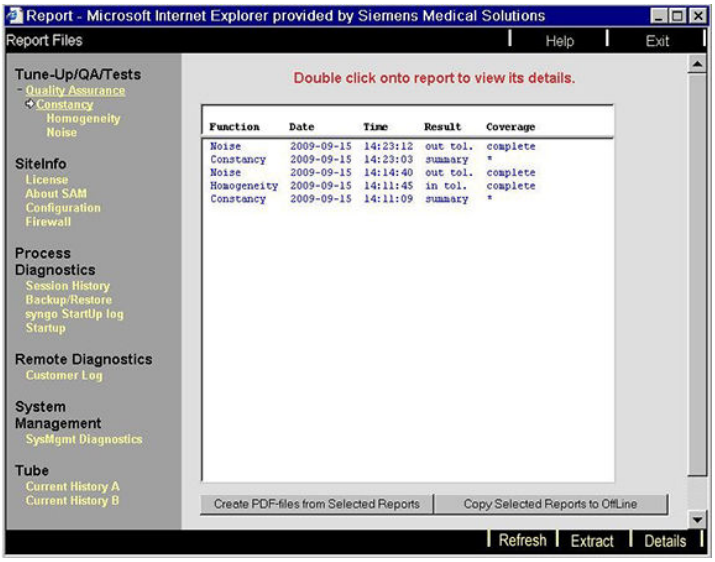
1 Call up **Options > Service > Local Service**, delete the password entries, and click on **OK**.

2 Click on **Reports** in the **Home Menu** dialog window.

The **Report Files** dialog box is displayed.

3 Select **Quality Assurance**.

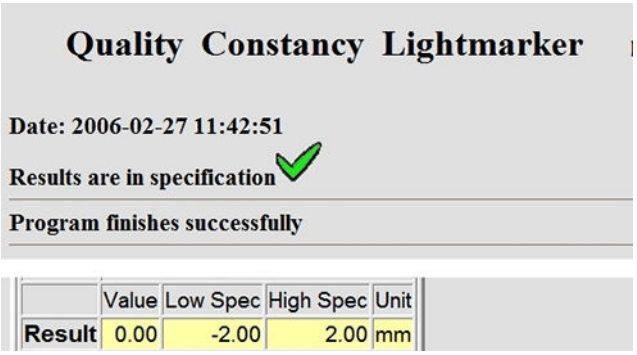
A list of the quality measurements performed (daily quality tests and constancy tests) is displayed sorted by date.



4 Double-click on a quality test in the list to have more detailed information displayed.

A click on the **Extract** button generates a compressed file of report data and stores this file in a specific folder. This function is for service purposes only.

The results of the selected quality test are displayed in the content area.



Quality Constancy Lightmarker

Date: 2006-02-27 11:42:51

Results are in specification

Program finishes successfully

	Value	Low Spec	High Spec	Unit
Result	0.00	-2.00	2.00	mm

Any test results outside the tolerance range are marked “<” or “>”. Alternatively, results outside the tolerance range are displayed on a red background while results within tolerance have a yellow background.

Documenting results

The forms are generated automatically and must be printed out, signed and filed in the System Owner Manual. See *System Owner Manual*

Test films and test forms must be stored for at least two years. The date of the generated form is part of the file name.

1. Call up **Option > FileBrowser** in the main menu.
2. Open the folder **ConstancyReports**.
3. Mark one or more of the PDF-files named **Quality_Constancy_DATE.pdf**.
4. Call up **File > Print** in the context menu to send the selected files to the predefined printer.

   – or –

   Call up **Send To > BurnFolder** in the context menu to burn the files to a storage medium and print them on another system.

Viewing quality test images

You can view the quality images (i.e., the result images of the MTF test) in the **Viewing** task card.

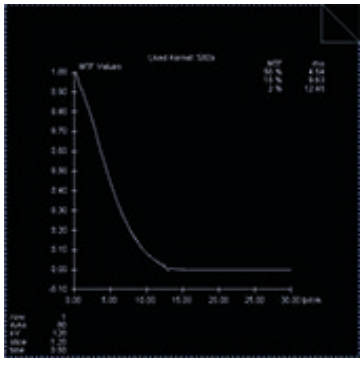
1 Open the **Patient Browser**.

2 Select the desired images of the "Quality Assurance Patient".

3 Call up **Patient > Load to Viewing**.

The images are displayed in the **Viewing** task card.

Example: Result images of the MTF test.



4 Call up **Patient > Close patient** to close the data set.

Closing the report function

◆ Click on **Exit**.

You return to the **Home Menu** dialog box.

9.4 Low contrast test

This section describes how to use the low contrast phantom and how to do the low contrast test.

The low contrast test has to be performed during system installation and after the replacement of image quality related components.

The availability of the low contrast test is country-specific. It has to be activated by Siemens Service.

9.4.1 Starting the test

The **Low Contrast** test is performed in the **Quality Constancy** dialog box of the **Siemens Med Service Software** window.

1 Open the **Quality Constancy** dialog box.

2 Select **Phantom Check** and **Low Contrast**.

3 Confirm selection of the constancy test with **Go**.

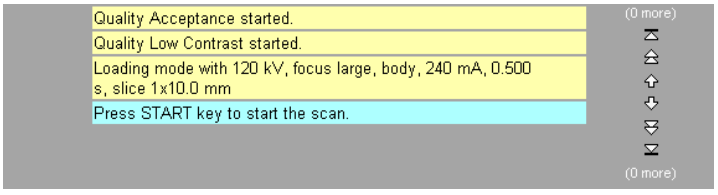
You are prompted to enter the name of the tester and the serial numbers of the phantoms.

4 Enter your name and the data required.

5 Start the low contrast test with **Go**.

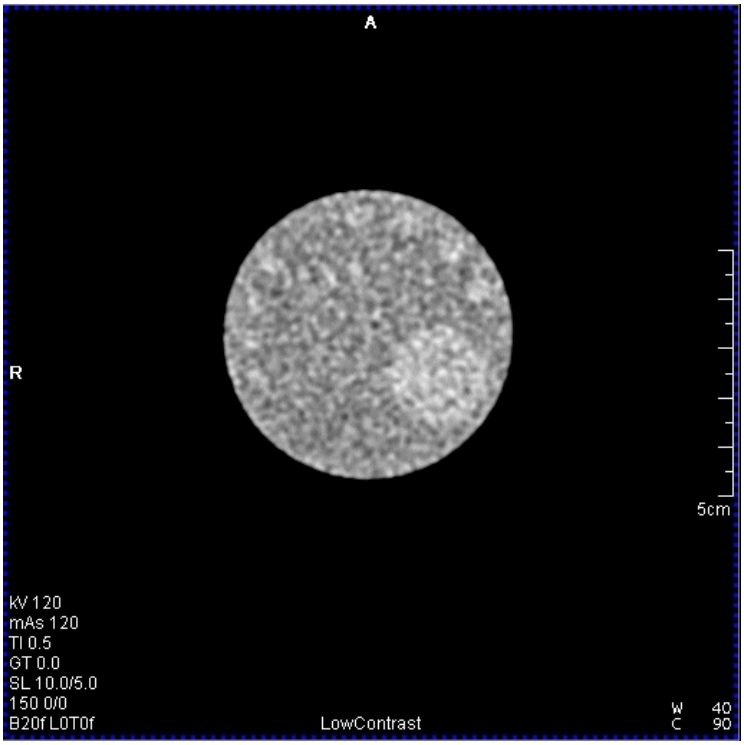
The “Quality Assurance Patient” is selected.

You are prompted to press **Start**.



6 Press **Start** on the control box.

The phantom position and the gantry inclination are checked.



The image of the low contrast phantom is displayed in the image area.

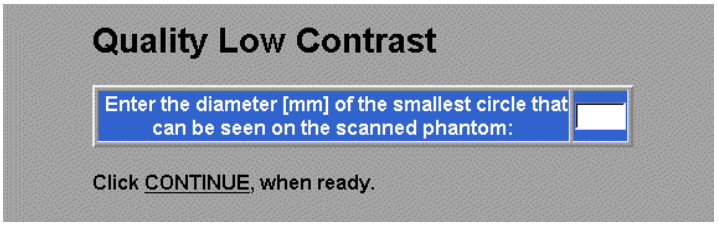
9.4.2 Evaluating the test

Normally one scan is sufficient to discern the pins in the row with the smallest diameter (3 mm). However, the procedure may be repeated if desired. Low contrast measurements are directly affected by the level of noise ("sigma") in the CT system, which may vary from scan to scan within a specified range. Low contrast estimations involve visual verification methods that are somewhat subjective. It is normal to expect some variations in assessing low contrast of the smallest (3 mm) pins.

1 Adjust the window width and center to improve visualization (adequate starting values: 40 width / 90 center).

2 Observe the region where the small pins are located just above the two 20 mm measurement areas.

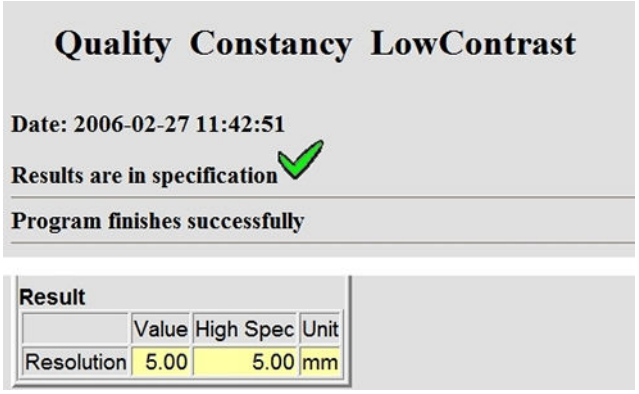
It may help to observe the image in a semi-darkened room and from distance of up to 5 feet.



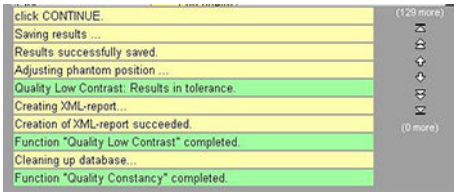
3 Enter the resolution in the corresponding entry field of the content area.

4 Click on **Continue**.

The result of the test is output in the content area of the **Quality Constancy** dialog box.



In the status and error message area the result of this test (in tolerance or out of tolerance) is output.



Test is out of tolerance.

- Contact Siemens Customer Service.

9.5 Camera test

With the camera test, the image quality and the camera settings are checked.

You can also film test images of the quality measurement in order to meet requirements for documentation.

Image quality of the camera

The camera was set for optimum image quality during installation and should not be changed.

Please note the following points:

- Use the correct film type (emulsion number)
- Keep the developer bath at a constant temperature
- Use the correct chemicals
- Follow the development instructions supplied by the film manufacturer

Test film

After installation, a test film is recorded and evaluated. The results are summarized in a table. These values are used as reference values for the daily quality check of the camera.

If the equipment or the emulsion number of the film is changed, the camera must be readjusted by a customer service technician who is authorized to do so. After this, another camera test is required.

Camera test report

You find a form for the test report in *System Owner Manual*.

9.5.1 Performing the camera test

With the camera test (Film Demo), you can check the settings of the camera by filming the images of the "Reference Images" patient.

You also have the option of filming the images of a previous constancy test to check the camera settings (Film Quality).

CAUTION

Missing camera test!

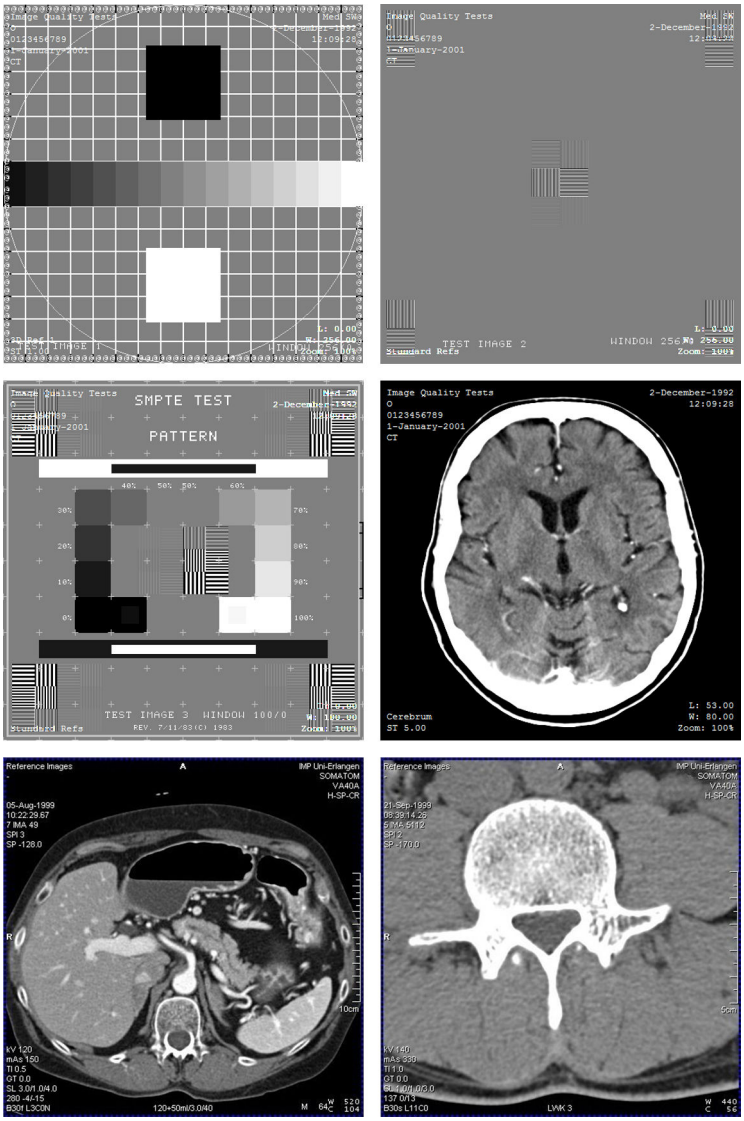
Wrong basis for diagnosis.

- Perform the camera test regularly at the recommended intervals.

Starting the test

1. In the **Patient Browser**, transfer the test images of the "Reference Images" patient to the **Viewing** task card.
2. In the **Viewing** task card, film the test images of the "Reference Images" patient.

Examples of test images



Evaluating the test

1 Compare the test results with the reference values.

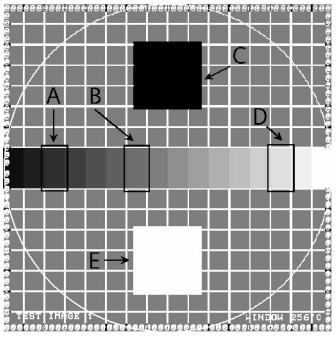
2 Measure the fields marked in the first test image with the densitometer (X-RITE 331).

3 Enter the measured values in the constancy test report.

Test is out of tolerance.

- Contact Siemens Customer Service.

Example



Here is an example of test image 1 with measurement fields marked by the technologist.

9.6 Constancy test of the monitor

Monitors are subjected to a constancy test to ensure that the image quality and measured values lie within a defined range.

Constancy test requirements for image display devices (monitors) may vary according to different national regulations.

The monitor constancy test must be performed in intervals according to different national regulations.

The constancy test described herein complies with the German X-ray regulations and is based on requirements given in DIN 6868-57. The new constancy test according to DIN 6868-157 is described in the separate Instructions for Use of the Constancy test of the monitor.

We recommend that the constancy test and collection of the reference values is performed and documented by authorized personnel.

Image quality of the monitor

The acceptance test performed during initial start up commissioning ensures optimum image quality of the device. The results of these measurements are documented in an acceptance test report and serve as reference values for the follow up constancy test.

If any alterations are made to the device that affect the image quality, e.g., repairs, replacement of parts, or readjustments, the acceptance test according to the Germany X-ray regulations must be repeated.

Measuring and test equipment

The constancy test according IEC 61223-2-5 is performed using the following test equipment:

- Luminance meter for LCD monitors

  Specification: Class B (DIN 5032-7) with valid calibration, range 0.05 cd/m^2 – 20000 cd/m^2 (recommended device: SMfit Act with Siemens Serial Spot Meter)

- Test image source (imaging device)
- Test images:

  Technical images (1,2,3)

  Clinical reference images (4,5,6)

9.6.1 Performing the monitor test

In the **Patient Browser** window, you can select the test images stored in the database under **Local Database/Reference Images**.

You also have the option of filming the images of a previous constancy test to check the camera settings (Film Quality).

CAUTION

Missing constancy test of the monitor!

Wrong basis for diagnosis.

- Perform the monitor test regularly at the recommended intervals.

Starting the monitor test

1 Load the test image of your choice in the **Viewing** task card.

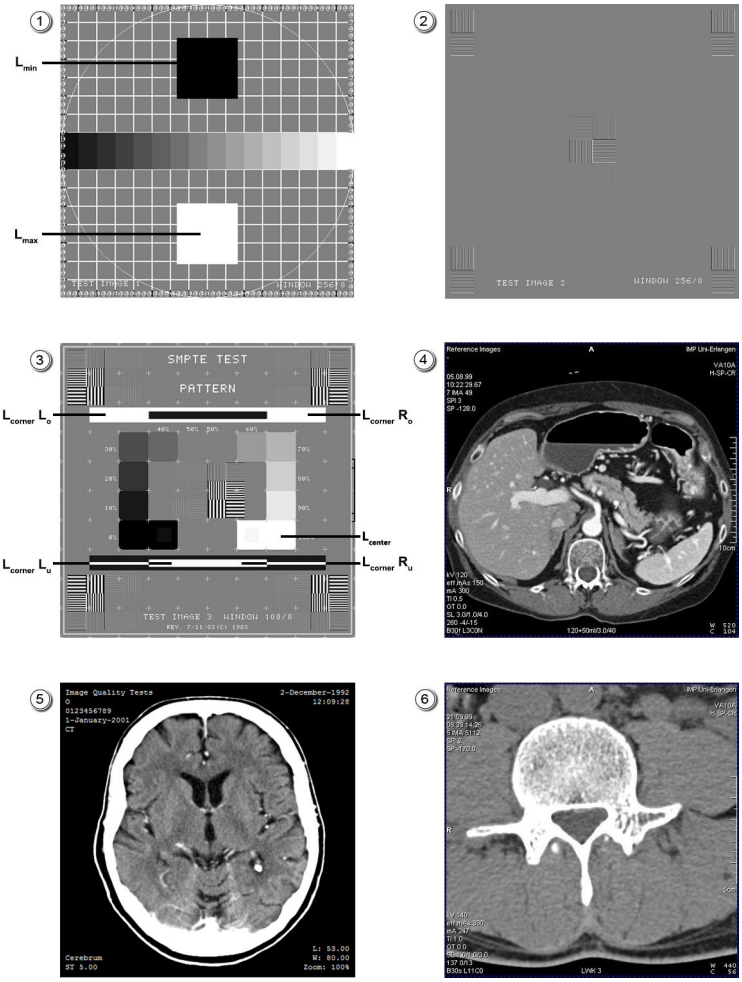
To ensure that the criteria of the constancy test are met, make sure that the requirements for the room lighting are fulfilled or restored according to the acceptance test performed during initial start up.

2 Perform the individual tests as described. (➔ Page 626 *The individual tests*)

3 Enter the test results in the forms supplied. See *System Owner Manual*.

All measurement and test results must be confirmed with the date and initials.

Examples of test images



Test is out of tolerance.

- Contact Siemens Customer Service.

9.6.2 The individual tests

The following tests must be performed:

- Luminance measurement (➔ Page 626 *Performing the luminance measurements*)
- Spatial and contrast resolution (➔ Page 627 *Testing the spatial and contrast resolution*)
- Homogeneity of the image brightness (➔ Page 627 *Testing the homogeneity of the image brightness*)

Performing the luminance measurements

In this test the veiling luminance (environmental lighting) and the maximum contrast are tested.

1. Switch the monitor off and wait at least 30 seconds.
2. Adjust then the room lighting to the operating conditions using the dimmer switch.
3. Measure veiling luminance Ls at the center of the screen with the luminance meter.

When taking measurements with the luminance meter, observe the distance recommended by the manufacturer (40 – 60 cm).

4. Switch on the monitor.
5. Select test image 1 to measure the minimum and maximum luminance.

In test image 1, the squares for the maximum grayscale value ($L_{max.}$, bright field) and the minimum grayscale value ($L_{min.}$, black field) are used.

6. With the luminance meter, measure the minimum contrast ($L_{min.}$) and the maximum contrast ($L_{max.}$).

   The ratio $L_{max.}/L_{min.}$ is calculated as maximum contrast MK (≥ 40:1).

You can simply increase the contrast ratio by reducing the environmental lighting intensity. However, make sure that enough light is available for reading and writing.

Testing the spatial and contrast resolution

The visual resolution is checked in this test.

1 Select test image 2 or test image 3.

2 Check the lines of the grid with a modulation of 100% high contrast (HC) at the center and in the four corners.

The lines of the grid must be recognizable.

Testing the homogeneity of the image brightness

This test ascertains any deviations in the luminance (L) within the image.

1 Select test image 3.

2 With the luminance meter measure a point close to the center (L_{center}) and four measuring points in the corners (L_{corner}).

Maximum deviation of the corner points:

- Flatscreen ± 20% (max.)

Calculation of the deviation in % = 100 x ($L_{center} - L_{corner}$) / L_{center}.

Visual interference such as ghosting, artifacts, overshoots, light or dark spots, flickering etc. are encountered.

◆ Please consult your service technician.

9 Quality assurance

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CE
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Manufacturer's note:

This device bears a CE mark in accordance with the provisions of Council Directive 93/42/EEC of June 14, 1993 concerning medical devices and the Council Directive 2011/65/EU of June 08, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

The CE marking applies only to Medical Devices which have been put on the market according to the above-mentioned EC Directives.

Unauthorized changes to this product are not covered by the CE mark and the related Declaration of Conformity.

Products with serial numbers between 83001 and 83199 (for SOMATOM Definition Edge), 59801 and 59825 or 64001 and 67999 (for SOMATOM Definition AS), 73001 and 74029 or 74901 and 74975 (for SOMATOM Definition Flash), may contain non RoHS compliant material.

Caution: Federal law restricts this device to sale by or on the order of a physician, dentist, or veterinarian (21 CFR 801.109(b)(1)).

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