SIEMENS

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MAGNETOM Amira

A Tim+Dot System
Data sheet based on *syngo* MR E11

MAGNETOM Amira

The clever spin on 1.5T

Increase patient comfort

- Reduce sound pressure by up to 97% with Quiet Suite
- Contrast-free peripheral angiography examinations with QISS
- Appealing system design with short magnet, air flow, and illumination control as well as comfortable coils

Gain diagnostic value

- Gain diagnostic value with FREEZEit and CAIPIRINHA
- Expand your MRI services with *syngo* MR E11
- Provide quantitative imaging and reporting with *syngo*.via and *syngo*.MR OncoCare

[1] Data on file

Product Overview

Streamline operations

- 10 min exam slots with best-practice protocols for fast standardized imaging
- DotGO platform with Dot Cockpit to easily adapt predefined standards
- Define examination strategies for consistent results with the Dot engines
- Easy and fast patient handling with Tim 4G coils and intuitive scanner control

Save energy and costs

- Reduce up to 30% energy[1)] consumption with Eco-Power by automatically switching off the cold head compressor during system standby or power off at night while still maintaining zero helium boil-off.
- Save on operational costs by intelligently switching off components in between patients and with zero helium boil-off technology
- Low installation footprint < 28 m^2
- Flexible service offering depending on your patient load

Manage your fleet across your organization

- Complement your MRI fleet with MAGNETOM Amira's lower investment when 70 cm are not in focus
- Latest common software platform *syngo* MR E11 and similar workflow management allow easy staff rotation between systems
- Exchange most coils between our current 1.5T MAGNETOM systems

DirectRX Technology

General
Tim's new and unique all digital-out design integrates all RF receive components at the magnet • Optical RF system improves SNR by reducing electrical noise and increasing signal detection • Digital-out design: optical links between magnet and equipment room to achieve highest RF stability • Receiver is integrated in the magnet housing • Dual-Density Signal Transfer enables ultra-high density coil design by integrating key RF components into the local coil • Receiver with high dynamic range without adjustments

Transmit Technology		
Frequency stability (5 min)	$\pm 2 \times 10^{-10}$	
Frequency control	32 bits (0.015 Hz)	
Phase control	16 bits (0.006 degrees)	
Body coil	Integrated whole body no tune transmit/receive coil with 16 rungs	
	Optimized RF efficiency and signal-to-noise ratio (SNR)	
Transmitter path	Transmit amplitude	16 bit control 50 ns resolution
	Gain stability (after first minute)	<0.1 dB (1 s) <0.4 dB (5 min)
Transmit amplifier	Compact water-cooled amplifier	
	Transmit amplifier bandwidth	500 kHz
	Peak power	15 kW

RF Receiver Technology		
The revolutionary Total imaging matrix optimizes coil positioning and virtually eliminates coil changing times. It also features Dual-Density Signal Transfer in the local receive coils, which enables the high density design. All local coils are no tune coils. Further Tim 4G features are AutoCoilSelect for dynamic, automatic, or interactive selection of the coil elements within the FoV.		
Receive path	Number of coil elements	Up to 96
	Number of independent receiver channels	16, 24
	Quadrature demodulation and filtering	Digital
	Receiver bandwidth	500 Hz –1 MHz (for each channel)
	Receiver signal resolution	32 bit
	ADC sampling rate	80 MHz
	Preamplifier noise figure	<0.6 dB
	Dynamic range at coil connector (referred to 1 Hz resolution bandwidth)	156 dB instantaneous at receiver 161 dB with automatic gain control at local coil connector

Patient Handling

General

Tim and Dot help increase patient comfort and improve workflow efficiency.

- Ultra-light weight coils
- Imaging with optimized high element surface coil
- Remote table move
- Feet-first examinations for many applications (e.g. cardiac, liver, upper abdomen, pelvis, colonography, body angio) reduces the level of anxiety experienced by highly claustrophobic patients
- AutoPosition for selected exams
- Dot Display: fast and efficient exam preparation and start of measurement at the scanner. Display of physiological curves and guidance for patient set up of triggering device.
- Scan range of 140 cm allows for most examinations with full usage of the surface coils, without the need for patient repositioning
- Set up the patient once, no repositioning, no changing of coils needed

Patient Positioning Aids

Standard set of cushions for comfortable and stable patient positioning together with safety straps.

Tim Table

Comfortable patient table solution which fits the needs for patients up to 200 kg supporting full weight capacity in vertical and horizontal movement. Integrated coils for fast patient preparation and enhanced user comfort. Examinations of patients with a scan range of up to 140cm. Integrated infusion stand.

Max. patient weight for vertical and horizontal table movement		200 kg (440 lbs)
Max. scan range		140 cm
User can adjust the table speed with two predefined speed mode buttons or accelerate continuously with the wheel on the Dot Control Centers		
Vertical table movement	Range	58–89 cm +10 mm[1)]
	Lifting time	13 sec one click table up
Horizontal table movement	Max. range	2150 mm
	Max. speed	200 mm/s
	Repositioning accuracy[2)]	±0.5 mm

[1)] Depending on the floor conditions
[2)] Accuracy for repositioning from one direction

Dot Control Centers

Ergonomically designed control unit integrated into the front cover on the left side of the patient tunnel. Optionally there is an additional Dot control Center available on the right side.

- Continuous table movement or two speed predefined levels
- Automatic transfer from any vertical position to home position
- Automatic transfer to isocenter
- Automatic transfer from any horizontal position to home position
- In bore ventilation (6-step regulation)
- In bore lighting (6-step regulation)
- Headphone volume adjustment (6-step regulation)
- In room loudspeaker adjustment (6-step regulation)
- Laser light localization
- Start scan

Horizontal table movement, lighting adjustments, and ventilation are also possible from the console

Dot Display

Dot Display with user guidance for fast and efficient exam preparation and start of measurement at the scanner. Display of physiological curves and guidance for patient set up of triggering device.

Color LCD Monitor	13.3"; 16 : 10
Horizontal frequency	15.0–80.0 kHz
Vertical frequency	50.0–85.1 kHz
Screen Matrix	1280×800 pixels

Physiological Measurement Unit (PMU) – Wireless Physio Control	
Synchronizes the measurement with the physiological cycles (triggering to minimize motion artifacts caused by cardiac and respiratory movements). The physiological curves are visualized at the Dot Display.	
Wireless Sensors	Wireless Vector ECG/respiration and pulse sensors for physiologically synchronized imaging, rechargeable battery-powered – for optimized patient handling
Physiological Signals	• ECG (2 channels) • Pulse • Respiration
	ECG Triggering: • Acquisition of multiple slices, e.g. of the heart, at different phases of the cardiac cycle • Excellent image quality by synchronizing data acquisition with cardiac motion
	Peripheral PulseTriggering: • Reduces flow artifacts caused by pulsatile blood flow • Excellent image quality by synchronizing data acquisition to the pulsatile blood flow
	Respiratory Triggering: • Excellent image quality by synchronizing data acquisition with the respiratory motion
	External Triggering : • Interface for trigger input from external sources (e.g. Patient Monitoring System) inside the examination room • Interface for trigger input from external sources (e.g. pulse generator, trigger sources for fMRI) outside the examination room • Optical trigger output for fMRI
	Retrospective gating for ECG, peripheral pulse, and external trigger input

Patient Communication
Ergonomically designed patient communication unit – may be placed at any convenient location on the workplace table. • Intercom system incorporating active noise cancellation for improved patient communication • Assistance call via squeeze-bulb for the patient • Response to the patient's activation of the squeeze-bulb via communication unit • Table stop • Sequence stop • Volume of speaker in control room • Volume of speaker and headphones in examination room for voice commands • Connection to external audio system • Independent volume control of voice and music • Pneumatic system of ergonomically designed headphones • Loudspeaker • Microphone • Automatic and freely programmable voice commands for breathhold examinations

Noise Reduction Features

General Features

- Acoustically optimized mountings for all components including gradient coil and body coil
- Minimized structure borne noise transfer to building
- Noise attenuating foam between magnet and cover
- Encapsulation of noise producing components

Gradient

- Special epoxy resin and casting technology for damping vibrations
- Reduction of gradient stray field to decrease eddy currents
- Noise-optimization of the MR system with an acoustically soft but mechanically rigid mounting of the gradient coil inside the magnet
- Force compensation for all axes

Magnet

- Encapsulation of the entire magnet
- Efficient floor decoupling for reduction of noise transferred to the building
- Noise-optimized cold head

Body Coil

Material of supporting tube of the body coil is optimized for low vibration and noise.

- In order to achieve maximum noise reduction, the body coil tube was extended beyond the gradient coil
- Copper structures are slotted and glued to the tube to reduce high frequency noise
- The Body coil is acoustically decoupled by special suspensions

General Sequence Design

Optimized sequence timing.

- Sequences automatically avoid parameter settings that cause the gradient coil to resonate
- No relevant application drawbacks – no increase in sequence parameters, e.g. full performance

"Whisper Mode"

The "Whisper Mode" is a user selectable mode that reduces the max. slew rate and max. amplitude of the gradients and enables very quiet imaging techniques.

Quiet Suite

A family of sequences for extremely quiet neuro and orthopedic imaging, with up to 97% reduction in sound pressure[1)]:

- QuietX TSE, SE and GRE sequences for T1, T2, DarkFluid, SWI and DWI contrasts[2)]
- PETRA, a 3D T1-weighted UTE sequence.

Quiet Suite sequences employ optimized gradient waveforms to achieve highly significant noise reductions and smoother, more pleasant sounds with no decrements in image quality or substantial increases in scan times. Optimized protocols for the brain, spine and large joints are provided.

[1)] Data on file

[2)] Prerequisite: Advanced Diffusion Package (optional)

Acquisition Parameters

Acquisition Parameters[1)]		
2D	Number of slices	1–128 (steps of 1)
	Slice order	Sequential or interleaved
3D Slabs/Partitions	Number of 3D partitions for matrix 256×256	4–512
	Number of 3D Slabs (3D volumes)	1–128 (steps of 1)
Acquisition Matrix	Frequency encoding (true imaging matrix without interpolation or oversampling)	64–1024 (in steps of 2; sequence dependent)
	Phase encoding	32–1024 (in steps of 1)
Reduced Matrix	Phase resolution (rectangular matrix)	32×n ... n×n (steps of 1)
	Slice resolution (3D volumes)	50–100%
Partial Fourier Imaging	Phase partial Fourier (Half Fourier)	4/8–1 (steps of 1/8)
	Read partial Fourier (asymmetric echo)	Selectable
	Slice partial Fourier (3D volumes)	5/8–1 (steps of 1/8)
Rectangular Field of View	In phase encoding direction	3–100%
Averaging	Number of data acquisitions	1–32 (steps of 1)
	Averaging mode	Short term, Long term (LOTA)
Oversampling	Read oversampling	100% standard
	Phase oversampling	0–100% (steps of 12.5%)
	Slice oversampling (3D volumes)	0–100% (steps of 12.5%)
Interpolation	In plane interpolation	Selectable (factor of 2)
	3D interpolation (3D volumes)	Selectable (up to factor of 2)
Serial Acquisitions	Number of repeated scans	With constant delay times 1–4096
		With different delay times 1–65
Swap	Exchange of read-out and phase-encoding direction	Yes
Slice Orientation	Slice orientation for 2D and 3D scans	Transverse, sagittal, coronal, oblique, double oblique (steps of 0.1°)
	Multi-slice multi-angle (simultaneously)	Yes

[1)] Combinations of the parameters stated are not always possible; some parameters may depend on optional application packages

Standard Acquisition and Reconstruction Techniques

Standard techniques

- True Inversion Recovery to obtain strong T1-weighted contrast
- Dark Blood inversion recovery technique that nulls fluid blood signal
- Saturation Recovery for 2D TurboFLASH, gradient echo, and T1-weighted 3D TurboFLASH with short scan time (e.g. MPRAGE)
- Freely adjustable receiver bandwidth, permitting studies with increased signal-to-noise ratio
- Freely adjustable flip angle. Optimized RF pulses for image contrast enhancement and increased signal-to-noise ratio
- MTC (Magnetization Transfer Contrast). Off-resonance RF pulses to suppress signal from certain tissues, thus enhancing the contrast. Used e.g. in MRA
- Argus viewer for reviewing cine studies
- Report Viewer for DICOM structured reports including report editing
- Dynamic Analysis for addition, subtraction, division, standard deviation, calculations of ADC maps, T1 and T2 values, TTP, t-Test, etc.
- Image Filter
- 3D post-processing MPR, MIP, MinIP, SSD
- Flexible film formats and paper print
- Data storage of images and cine AVI files on CD/DVD with DICOM viewer as the viewing tool
- Selectable centric elliptical phase reordering via the user interface
- Inversion Recovery to nullify the signal of fat, fluid or any other tissue
- Multiple Direction Diffusion Weighting (MDDW) – diffusion tensor imaging measurements can be done with multiple diffusion-weightings and up to 12 directions for generating data sets for diffusion tensor imaging.
- WARP – 2D TSE sequence combining optimized high-bandwidth protocols and View Angle Tilting (VAT), tailored to reduce susceptibility artifacts caused by orthopedic MR Conditional[1)] metal implants.
- Advanced WARP – 2D TSE based Slice Encoding for Metal Artifact Correction (SEMAC) technique for the reduction of through-plane distortions from large MR Conditional[1)] implants.

Sequences

Spin Echo family of sequences	• Spin Echo (SE) – Single, Double, and Multi Echo (up to 32 echoes); Inversion Recovery (IR) • 2D/3D Turbo Spin Echo (TSE) – Restore technique for shorter TR times while maintaining excellent T2 contrast; TurboIR: Inversion Recovery for STIR, DarkFluid T1 and T2, TrueIR; Echo Sharing for dual-contrast TSE • 2D TSE with multiple average – it is possible to acquire T2-weighted TSE images during shallow breathing, in a time efficient manner • 2D/3D HASTE (Half-Fourier Acquisition with Single Shot Turbo Spin Echo) – Inversion Recovery for STIR and DarkFluid contrast • SPACE for 3D imaging with high isotropic resolution with T1, T2, PD, and DarkFluid Contrast • 2D/Optimized high bandwidth TSE (T1, T2, and PD weighted and STIR) with WARP. Reduces susceptibility artifacts.

[1)] MR imaging of patients with metallic implants brings specific risks. However, certain implants are approved by the governing regulatory bodies to be MR conditionally safe. For such implants, the previously mentioned warning may not be applicable. Please contact the implant manufacturer for the specific conditional information. The conditions for MR safety are the responsibility of the implant manufacturer, not of Siemens.

Sequences *(Continued)*	
Gradient Echo family of sequences	• 2D/3D FLASH (spoiled GRE) – dual echo for in-/opposed phase imaging 3D VIBE (Volume Interpolated Breathhold Examination) – quick fat saturation; double echo for in-phase/opposed phase 3D imaging; DynaVIBE: Inline 3D elastic motion correction for multi phase data sets of the abdomen; Inline Breast Evaluation • 2D/3D MEDIC (Multi Echo Data Image Combination) for high resolution T2 weighted orthopedic imaging and excellent contrast • 2D/3D TurboFLASH – 3D MPRAGE; single-shot T1 weighted imaging e.g. for abdominal imaging during free breathing • 3D GRE for field mapping • 2D/3D FISP (Fast Imaging with Steady State Precession) • 2D/3D PSIF – PSIF Diffusion • Echo Planar Imaging (EPI) – diffusion-weighted; single-shot SE and FID e.g. for BOLD imaging and Perfusion-weighted imaging; 2D/3D Segmented EPI (SE and FID) • ce-MRA sequence with Inline subtraction and Inline MIP • 2D/3D Time-of-Flight (ToF) Angiography – single slab and multi slab; triggered and segmented • 2D/3D Phase Contrast Angiography • BEAT Tool – TrueFISP segmented; 2D FLASH segmented; Magnetization-prepared TrueFISP (IR, SR, FS); IR TI scout; Retrogating
Turbo Gradient Spin Echo (TGSE)	Hybrid Turbo Spin Echo / Gradient Echo used primarily for T2-weighted imaging • Shorter measurement time • Decreased RF power deposition • Improved visualization of hemorrhage, due to magnetic susceptibility differences • High resolution imaging of brain and spine

Standard Fat/Water Imaging

- Fat and Water Saturation. Additional frequency selective RF pulses used to suppress bright signal from fatty tissue. Two selectable modes: weak, strong
- Quick FatSat
- SPAIR: robust fat suppression for body imaging using a frequency selective inversion pulse
- Fat/Water Excitation. Spectral selective RF pulses for exclusive fat/water excitation
- Dixon technique for fat and water separation – available on VIBE and Turbo Spin Echo sequences

Standard Flow Artifact Reduction

- LOTA (Long Term Data Averaging) technique to reduce motion and flow artifact
- Pre-saturation technique. RF saturation pulses to suppress flow and motion artifacts
- Tracking SAT bands maintain constant saturation of venous and/or arterial blood flow, e.g. for 2D/3D sequential MRA
- TONE (Tilted Optimized Non-saturating Excitation). Variable excitation flip angle to compensate inflow saturation effects in 3D MRA. TONE pulse selectable depending on the desired flow direction and speed
- GMR (Gradient Motion Rephasing). Sequences with additional bipolar gradient pulses, permitting effective reduction of flow artifacts

Standard Scan Time Reduction	
Elliptical scanning reduces scan time for 3D imaging	
iPAT – integrated Parallel Acquisition Technique high-performance and flexible Parallel Imaging with integrated AutoCalibration	Two algorithms – mSENSE and GRAPPA – for maximum quality for all applications
	iPAT is compatible with all relevant sequence techniques (e.g. SE, TSE, SPACE, MEDIC, TIRM DarkFluid, HASTE, EPI, MPRAGE, 3D VIBE, FLASH, TrueFISP, TurboFLASH, FLASH Phase Contrast, etc)
	iPAT is compatible with all multi-element coils, as well as coil combinations
	Tim Assistant facilitates optimized iPAT settings. Higher speed and temporal resolution can be used for: • Improved image resolution • Improved image quality due to reduced artifacts
	T-PAT with mSENSE and GRAPPA for advanced parallel imaging provides fast high-resolution dynamic imaging
	3 different calibration techniques can be used: • AutoCalibration with an integrated reference (calibration) scan to additionally save on total scan time • TurboCalibration uses a separate measurement directly before the actual measurement. Images measured using TurboCalibration are characterized by reduced PAT artifacts. • T-PAT and PAT averaging for motion artifact suppression using Self-Calibration
iPAT²	More slices and coverage in the same breathhold by applying PAT in 2 directions simultaneously (phase-encoding direction and 3D direction for 3D sequences)
	The effective PAT factor can be maximized, and PAT applications are extended. Typical clinical applications are MR Angiography or ultrafast isotropic T1-weighted 3D imaging of the head
	A new iPAT² sequence technique named CAIPIRINHA (Controlled Aliasing In Parallel Imaging Results IN Higher Acceleration) has been added. It can be applied to volumetric 3D imaging e.g. in the abdominal region.

Standard Motion Correction	
BLADE	• Improves image quality by minimizing and correcting for the effects of motion during an MR sequence acquisition. e.g. head, spine, orthopedic imaging and the abdomen • Motion insensitive Turbo Spin Echo sequence • Can be used with all coils and in all planes • Supports T2-weighted, T1-weighted, STIR, and DarkFluid protocols • Simultaneous in-plane motion correction for arbitrary slice orientations • Versatile sequence e.g. supporting iPAT with GRAPPA, Restore pulses and supports respiratory triggered imaging of the abdomen using 2D PACE
1D PACE (Prospective Acquisition CorrEction)	Quick and easy acquisition control for free breathing examinations, e.g. for cardiac imaging
2D PACE Precise Motion Correction	• Detects and corrects respiratory motion of the heart, liver, etc. for free breathing high resolution 2D and 3D examinations • Significantly increased image quality • Improved security in the diagnosis of diseases in moving organs and precise slice registration for multi breathhold studies • Eliminates the need for respiratory belt • PAT averaging for motion artifact suppression using Self-Calibration
Standard Susceptibility Artifact Reduction	
WARP	• 2D TSE sequence combining optimized high-bandwidth protocols and View Angle Tilting (VAT), tailored to reduce susceptibility artifacts caused by orthopedic MR Conditional[1)] metal implants. • This helps in evaluation of soft tissue in proximity of the implant. • Available protocols include T1-weighted, T2-weighted, proton density and STIR contrast.
Advanced WARP	• Advanced WARP enables the reduction of gross metal artifacts (i.e. through-plane artifacts) caused by large orthopedic implants. • It contains the 2D TSE based SEMAC technique and is especially useful in the case of hip and knee joint replacements. • Available protocols include T1-weighted, T2-weighted, proton density and STIR contrast.
Standard Workflow Enhancements	
AutoCoilDetect	Detects the position and orientation of coils automatically. Shows coils in the user interface right within the graphical slice positioning.
AutoCoilSelect	Automatic detection and selection of all coil elements in the active Field-of-View.
syngo® Scan Assistant	Shows parameter constraints and provides possible solutions.
scan@center	Automated movement of table so that the scan is performed in the magnet isocenter – can be activated or deactivated by the user.

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Standard Workflow Enhancements *(Continued)*	
AutoVoiceCommands	These multi-language automatic voice commands during the scaning to help synchronize timing of breathing, scanning, and contrast media injection.
Phoenix and PhoenixZIP	Exchange of protocol data (e.g. via Internet) by drag & drop clinical images. PhoenixZIP allows transfer of whole measurement programs.
Online Help Functions	Context sensitive and quick resource for questions about software operation or MR physics.
DirectConnect	Cable-less direct connection for Head/Neck 16, Spine 18, Foot/Ankle 16[1)] .
SlideConnect	SlideConnect® cable connectors can be securely plugged-in with one hand only.
Inline Technology – Processing Instead of Post-processing	Inline Technology helps to streamline the clinical workflow by automating mundane post-processing steps before image viewing. See the clinical results immediately. Inline functionality is user-configurable. Examples: • Automatic subtraction of images, e.g. pre- and post-contrast enhancements • MIP on-the-fly, e.g. MR Angiography with automatic image subtraction and following MIP in three orthogonal planes • Prospective motion correction (1D and 2D PACE) on-the-fly • Automatic perfusion[1)] and diffusion maps • Automatic composing of multi-step images[1)] • Automatic on-the-fly calculation of standard deviation, for better differentiation of arterial and venous phases • Inline Display automatically shows reconstructed images. It offers immediate access to the results and opens automatically for e.g. interactive real-time scanning or CareBolus examinations • Inline Movie automatically starts the cine image display

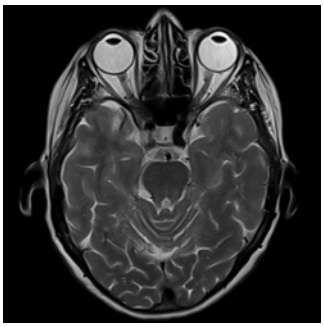
[1)] Optional

Tim Application Suite

The Tim Application Suite offers a complete range of clinically optimized examinations for all regions. The Tim Application Suite – allowing excellent head-to-toe imaging – is provided standard on MAGNETOM Amira.

- Neuro Suite
- Angio Suite
- Cardiac Suite
- Body Suite
- Onco Suite
- Ortho Suite
- Breast Suite
- Scientific Suite
- Pediatric Suite[1)]

Neuro Suite



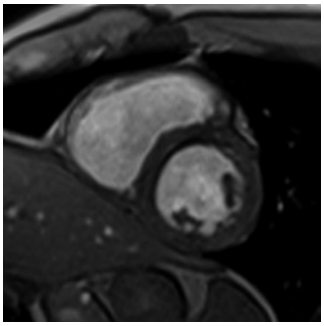
Comprehensive head and spine examinations can be performed with dedicated programs. High resolution protocols and fast protocols for uncooperative patients are provided. The Neuro Suite also includes protocols for diffusion imaging, perfusion imaging, and fMRI.

[1)] MR scanning has not been established as safe for imaging fetuses and infants under two years of age. The responsible physician must evaluate the benefit of the MRI examination in comparison to other imaging procedures.

Neuro Suite *(Continued)*[1)]	
General features	• Fast 2D imaging with SE, TSE, GRE protocols for highresolution imaging in all orientations and all contrasts • BLADE motion correction for TSE imaging in all orientations and contrasts • EPI sequences and protocols for diffusion imaging, perfusion imaging, and fMRI for advanced neuro applications. Diffusion-weighted imaging is possible with up to 16 b-values in the orthogonal directions • 3D TOF for non-contrast-enhanced angiography • 3D isotropic resolution volume imaging using T1 3D MPRAGE/ 3D FLASH, SPACE DarkFluid, T1 SPACE, T2 SPACE, BLADE, and 3D TSE T2-weighted high resolution 3D Restore protocols optimized for inner ear examinations • Double Inversion Recovery 3D protocols (DIR SPACE) with two user-selectable inversion pulses for the simultaneous suppression of e.g. cerebro-spinal fluid and white matter • MP2RAGE (Magnetization Prepared 2 Rapid Acquisition Gradient Echoes) provides homogeneous tissue contrast for segmentation and applications such as voxel-based morphometry. In combination with MapIt[1)], it also provides T1 mapping functionality. • Whole-spine protocols in multiple steps with software controlled table movement • 2D and 3D MEDIC protocols for T2-weighted imaging, particularly for C-spine examinations in axial orientation where reproducibility is difficult due to CSF pulsations and blood flow artifacts • 3D Myelo with 3D HASTE and 3D True-FISP for anatomical details • Dynamic sacro-iliac joint imaging after contrast administration using a fast T1-weighted FLASH 2D sequence • PSIF sequence for diffusion-weighted imaging of the spine • Precision filter for high spatial accuracy e.g. for neuro intra-operative imaging and stereotactic planning • 3D CISS (Constructive Interference in Steady State) for excellent visualization of fine structures such as cranial nerves. High resolution imaging of inner ear and spine • TGSE sequence used primarily for T2-weighted imaging for shorter measurement time, decreased RF power deposition, improved visualization of hemorrhage, and high resolution imaging of brain and spine • AutoAlign Head LS providing a fast, easy, standardized, and reproducible patient scanning supporting reading by delivering a higher and more standardized image quality

[1)] Option

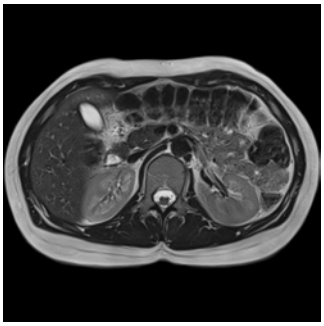
Angio Suite	
	Excellent MR Angiography can be performed to visualize arteries and veins with or without contrast agent
Contrast-enhanced MRA	• 3D contrast-enhanced MRA protocols for e.g. single step, dynamic, peripheral with the shortest TR and TE. The strong gradients make it possible to separate the arterial phase from the venous phase • TestBolus workflow for optimal bolus timing and excellent image quality • CareBolus functionality for accurate determination of the bolus arrival time and the "Stop and Continue" of the 3D ce-MRA protocol after the 2D bolus control scan • Dynamic ce-MRA for 3D imaging over time
Non-contrast MRA and venography	• 2D or 3D Time-of-Flight (ToF) protocols for MRA for the Circle of Willis, carotids, neck vessels, and breathhold protocols for abdominal vessels • Triggered 2D ToF sequences for non-contrast MRA, particularly in the abdomen and the extremities • 2D/3D Phase-Contrast • MR venography with 2D/3D Time-of-Flight (ToF) and Phase-Contrast • TONE (Tilted optimized non-saturating excitation) and MTC (Magnetization Transfer Contrast) techniques for improved Contrast-to-Noise Ratio (CNR)
Image processing tools	• MPR, MIP, MinIP, and 3D SSD • Inline MIP for immediate results • Inline subtraction of pre- and post-contrast measurements • Inline standard deviation maps of Phase-Contrast measurements for delineation of arteries and veins

Cardiac Suite	
	The cardiac suite covers comprehensive 2D routine cardiac applications, ranging from morphology and ventricular function to tissue characterization. Featuring BEAT 2D in conjunction with iPAT and T-PAT techniques
Cardiac views	• Fast acquisition of the basic cardiac orientations for further examination planning • Cardiac scouting provides users with a step-by-step procedure for the visualization and planning of typical cardiac views, e.g. based on TrueFISP or Dark Blood TurboFLASH: short-axis, 4-chamber, and 2-chamber views
BEAT	• Unique tool for fast and easy cardiovascular MR imaging • E.g. 1 click change from FLASH to TrueFISP for easy contrast optimization • 1-click to switch arrhythmia rejection on/off • 1-click change from Cartesian to radial sampling to increase effective image resolution (e.g. in pediatric patients)[1)] and avoid folding artifacts in large patients
Visualization of structural cardiovascular pathologies with CMR – BEAT	• Breathhold and free breathing techniques for strong contrast between the blood and vascular structures. Dark Blood TSE and HASTE imaging are available for the structural evaluation of the cardiothoracic anatomy, including vessels or heart valves. Cine techniques (FLASH & TrueFISP) for high-resolution valve evaluation • Multiple contrasts such as T1- and T2-weighted imaging for use in diseases such as myocarditis (inflammation/hyperaemia), ARVD (fibrous-fatty degeneration) or acute myocardial infarction (edema) • Dark-blood TSE with motion compensation for high-quality vessel wall imaging in small or large vessels

[1)] MR scanning has not been established as safe for imaging fetuses and infants under two years of age. The responsible physician must evaluate the benefit of the MRI examination in comparison to other imaging procedures.

Cardiac Suite *(Continued)*	
Tools for rapid evaluation of left or right ventricular function:	• Acquisition of a stack of short-axis slices (standard segmented FLASH, or advanced segmented TrueFISP) • Automatic adjustment of the acquisition window to the current heart rate • Use of the Inline ECG for graphical ECG triggering setup • Retrospective gating with cine sequences (TrueFISP, FLASH) • Protocols for whole-heart coverage • iPAT integration for highest temporal and spatial resolution • Real-time imaging in case the patient is not able to hold his breath
Dynamic imaging and tissue characterization with BEAT Protocols for high-contrast and high-resolution tissue characterization	• Protocols for stress and rest imaging with TrueFISP or TurboFLASH contrast support the acquisition of multiple slices with high resolution and arbitrarily adjustable slice orientation for each slice • T-PAT with mSENSE and GRAPPA for advanced parallel imaging provides fast high-resolution dynamic imaging • Segmented IR TrueFISP/FLASH with TI scout for optimization of tissue contrast • Advanced tissue characterization with 2D phase-sensitive IR (PSIR) sequences TrueFISP and FLASH contrast. Magnitude and phase-sensitive images with one acquisition • Simple: no adjustment of inversion time (TI) necessary with PSIR technique • Ungated single-shot PSIR imaging for tissue characterization under difficult conditions: free-breathing technique that can be applied even in case of arrhythmia

Body Suite



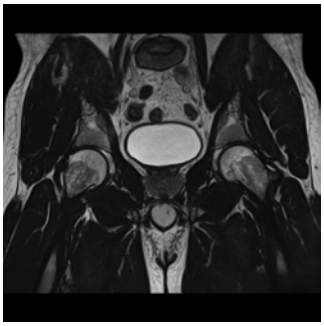
The Body Suite is dedicated to clinical body applications. Ultra-fast high resolution 2D and 3D protocols are provided for abdomen, pelvis, MR Colonography, MRCP, dynamic kidney, and MR Urography applications. 2D PACE technique makes body imaging easy, allowing for multi-breathhold examinations as well as free breathing during the scans. Motion artifacts are greatly reduced with 2D PACE Inline technology.
This package includes:

- Free breathing 2D PACE applications with 2D/3D HASTE (RESTORE) and 2D/3D TSE (RESTORE)
- It is possible to use a phase navigator, which measures respiratory induced off-resonance effects. The positioning can be done automatically for most protocols.
- Optimized fast single-shot HASTE protocols and high-resolution 3D RESTORE protocols based on SPACE and TSE for MRCP and MR Urography examinations
- REVEAL: diffusion imaging for abdomen and whole body exams. In protocols with multiple b-values individual numbers of averages may be specified per b-value. Inline calculation of ADC maps, exponential ADC maps and inverted b-value images can be selected. Inline calculation (extrapolation) of high b-values (up to b=1600 s/mm^2) is possible.

Abdomen	2D: • T1 (FLASH) breathhold scans with and without FatSat (SPAIR, Quick FatSat, in-/opp-phase) • T2 (HASTE, TSE/BLADE, EPI) breathhold scans with and without FatSat (SPAIR, FatSat, STIR) • 2D TSE with multiple average- it is possible to acquire T2-weighted TSE images during shallow breathing, in a time efficient manner • T1 (TFL) triggered scans (2D PACE free breathing) in-/opp-phase • T2 (HASTE, TSE/BLADE, EPI) triggered scans (2D PACE free breathing) with and without FatSat (SPAIR, FatSat, STIR) as well as HASTE- and TSE-multi-echo • Optimized fast single-shot HASTE protocols and high-resolution 3D RESTORE protocols based on SPACE and TSE for MRCP and MR urography examinations

Body Suite *(Continued)*	
Abdomen	3D: • Dixon (VIBE 2pt-Dixon) breathhold scans, following contrasts can be obtained: in-phase, opposed phase, fat and water image • Dynamic (VIBE and Quick-FatSat) protocols with Inline motion correction for best visualization of focal lesions with high spatial and temporal resolution • Colonography bright lumen with T2 TrueFISP and dark lumen with T1-weighted VIBE • CAIPIRINHA (Controlled Aliasing In Parallel Imaging Results IN Higher Acceleration) – reduces breath-hold times for 3D VIBE FS and 3D DIXON (in, opposed, water, fat)
Pelvis	• High-resolution T1, T2 pelvic imaging (prostate, cervix) • Isotropic T2 SPACE 3D protocols for tumor search in the pelvis • Dynamic volume examinations with 3D VIBE • REVEAL: Diffusion-weighted imaging of the prostate, cervix, rectum and other organs with multiple b-values. Inline calculation of ADC maps, exponential ADC maps and inverted b-value images can be selected. Inline calculation (extrapolation) of high b-values (up to b = 1600 s/mm^2) is possible.

Onco Suite

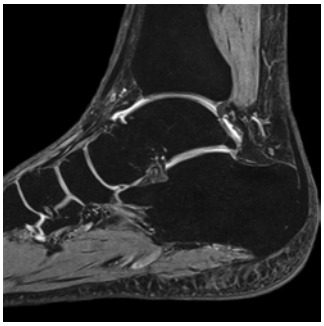


MR imaging has an excellent advantage of soft tissue contrast, multi-planar capabilities and the possibility of selectively suppressing specific tissue e.g. fat or water. The Onco Suite features a collection of sequences as well as protocols and evaluation tools that may be used for a detailed assessment of a variety of oncological conditions.

General features	• STIR TSE, HASTE, and FLASH in-phase and opposed-phase protocols for highly sensitive visualization of focal lesions • Dynamic imaging protocols for assessment of the kinetic behavior of tissue • Quantitative evaluation and fast analysis of the data with colorized Wash-in, Wash-out, Time-To-Peak, Positive-Enhancement-Integral, MIPtime and combination maps with Inline technology or for offline calculation • Display and analysis of the temporal behavior in selected regions of interest with the included MeanCurve postprocessing application. This includes the capability of using additional datasets as a guide for defining regions of interest even faster and easier than before. • REVEAL: diffusion imaging for liver and other body region exams. In protocols with multiple b-values a different number of averages may be specified for each b-value.
Prostate protocols	• Dedicated prostate protocols for a variety of clinical scenarios • Protocols with high temporal resolution (VIBE, TWIST[1)] and TWIST-VIBE[1)]) allow time course evaluation of contrast wash-in and wash-out behavior. • Prostate spectroscopy (3D CSI[1)] volume scan) with up to 8 sat bands (suppression of water and fat signal) • REVEAL: Diffusion-weighted imaging of the prostate with multiple b-values. Inline calculation of ADC maps, exponential ADC maps and inverted b-value images can be selected. Inline calculation (extrapolation) of high b-values (up to b=1600 s/mm^2) is possible.

[1)] Option

Ortho Suite

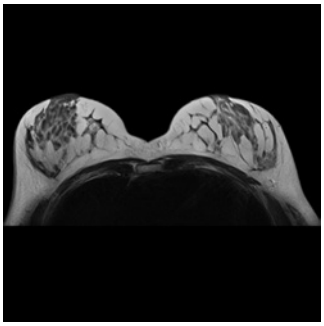


The Ortho Suite is a comprehensive collection of protocols for joint imaging including the spine. Also in case of tumors, infections, or vascular necrosis, a large amount of additional information can be acquired using the protocols provided as standard in this suite.

General features	• 2D TSE protocols for PD, T1, and T2-weighted contrast with high in-plane resolution and thin slices • 3D MEDIC, 3D TrueFISP protocols with water excitation for T2-weighted imaging with high in-plane resolution and thin slices • High resolution 3D VIBE protocols for MR Arthrography (knee, shoulder, and hip) • 3D MEDIC, 3D TrueFISP, 3D VIBE protocols with Water Excitation having high isotropic resolution optimized for 3D post-processing • T1, T2, and PD SPACE, 3D imaging with high isotropic resolution optimized for post-processing • Whole-spine, single-step, and multi-step protocols • Excellent fat suppression in off-center positions, e.g. in the shoulder due to high magnet homogeneity • Dynamic TMJ protocol (different joint positions) • Dynamic ilio-sacral joint protocol for contrast dynamics • Multi Echo SE sequence with up to 32 echoes for T2 time mapping • High resolution 3D DESS (Double Echo Steady State): T2/T1-weighted imaging for excellent fluid-cartilage differentiation • 2 point Dixon technique for fat and water separation – Turbo Spin Echo sequence • WARP – 2D TSE sequence combining optimized high-bandwidth protocols and View Angle Tilting (VAT), tailored to reduce susceptibility artifacts caused by orthopedic MR Conditional[1)] metal implants. This helps in evaluation of soft tissue in proximity of the implants. Available protocols include T1-weighted, T2-weighted, proton density and STIR contrast. • Advanced WARP enables the reduction of gross artifacts (i.e. through-plane artifacts) caused by large MR Conditional[1)] implants. It contains the 2D TSE based SEMAC techniques and is especially useful in the case of hip and knee joint replacements. Available pulse sequences include T1-weighted, T2-weighted, proton density and STIR contrast.

[1)] MR imaging of patients with metallic implants brings specific risks. However, certain implants are approved by the governing regulatory bodies to be MR conditionally safe. For such implants, the previously mentioned warning may not be applicable. Please contact the implant manufacturer for the specific conditional information. The conditions for MR safety are the responsibility of the implant manufacturer, not of Siemens.

Breast Suite



MR imaging provides excellent tissue contrast that may be useful in the evaluation of the breasts. Extremely high spatial and temporal resolution can be achieved in very short measuring times by using iPAT with GRAPPA and CAIPIRINHA.
Customized protocols (e.g. with fat saturation or water excitation or silicone excitation), as well as flexible multiplanar visualization allow for fast, simple and reproducible evaluation of MR breast examinations.

General features	This package includes: • High-resolution 2D protocols for morphology evaluation • High-resolution 3D protocols covering both breasts simultaneously • Protocols to support interventions (fine needle and vacuum biopsies, wire localization) • Protocols for evaluating breasts with silicone implants • Automatic and manual frequency adjustment, taking into account the silicone signal • Detection of the silicone signal either to suppress the silicone signal, if the surrounding tissue is to be evaluated, or to suppress the tissue signal in order to detect an implant leakage • SPAIR – robust fat sat (robust fat suppression using an adiabatic frequency selective inversion pulse) • DIXON – 2-point Dixon with 3D VIBE, the following contrasts can be obtained: in-phase, opposed phase, fat and water image • iPAT with GRAPPA for maximum resolution in short time • iPAT² with CAIPIRINHA allows state-of-the-art sagittal breast imaging and further improvement of the temporal resolution in dynamic scans while maintaining spatial resolution

[1] Option

Breast Suite *(Continued)*	
General features	• Inline subtraction and MIP display • Offline subtraction, MPR and MIP display • REVEAL: diffusion imaging for breast exams. In protocols with multiple b-values individual numbers of averages may be specified per b-value. • RESOLVE[1)]: Diffusion-weighted, readout-segmented (multi shot) EPI sequence for high-resolution susceptibility-insensitive DWI of the breast
RADIANT	Ultra-sound like reconstruction around the nipple
VIEWS (Volume Imaging with Enhanced Water Signal)	• Bilateral – both breasts are examined simultaneously • Axial – the milk ducts are directly displayed • Fat-saturated or water-excited – fat complicates clinical evaluation and is suppressed • Near-isotropic 3D measurement – the same voxel size in all three directions for reconstruction in any slice direction • Submillimeter voxel – highest resolution for precise evaluation

[1)] Option

Scientific Suite

The Scientific Suite supports scientific users by providing easy access to application-specific data for further processing and advanced image calculus.

General features	• Support of USB Memory sticks • Access to file system via a secure and comfortable File Browser • Anonymization of patient data • Easy creation of AVIs and screen snapshots to include in presentations or teaching videos • Export of tables, statistics and signal time courses to communal exchange formats like e.g. tabulated text files (MeanCurve, Spectroscopy evaluation, DTI evaluation) • Advanced image calculus including T2 and T1 time calculation, addition, subtraction, multiplication, division, log, and integration of images

Pediatric Suite[1)]

Tissue relaxation times in pediatrics are very different compared to those of adults. The reasons for these differences are: developing tissues, body size, faster heart rates, and compliance with breathhold commands. Protocols can be easily adapted for imaging infants.

[1)] MR scanning has not been established as safe for imaging fetuses and infants under two years of age. The responsible physician must evaluate the benefit of the MRI examination in comparison to other imaging procedures.

DotGO. Go for consistent results, efficiently

In 2009, Siemens set the benchmark in MR scanning and productivity by introducing Dot. Easily adapt to the patient's condition or clinical question, consistently achieve reproducible, high-quality results, and consequently reduce exam times and the number of rescans. From 2014 on, the newest generation of Dot – DotGO – is also setting the standard in protocol configuration. For true flexibility, consistency and efficiency in every aspect of MRI.

Flexibility. Intuitive protocol management.

One central user-interface for easy and flexible configuration and maintenance of all protocols and Dot Engines. Intuitive, fast functionality results in 80%[1)] improved usability in exam configuration. DotGO empowers you to provide your MRI expertise for the entire department and to define a higher standard of care for more patients and referrers.

Consistency. Quality results for each exam.

Every patient is different. Every referrer's and radiologist's requirement is different. Imaging results need to be consistent and of high quality. Your daily schedule has to be met. DotGO partners you in meeting all of these different needs with dedicated functionality for the clinical question at hand.

Efficiency. Stay on time with less than 1 minute exam-time variation.[2)]

Time, quality and costs define the efficiency of your MRI exams. DotGO enables scheduling to be more predictable through reducing time-consuming software interaction by up to 46%[3)], thus resulting in reduction of exam-time variations to less than a minute[2)]. Standardized procedures support quality results for each exam and help to reduce rescans. All in all the diagnostic turnaround time to the referrer is quicker, higher image quality is maintained, and MRI services are more efficient.

[1)] Compared to MR protocol configuration without Dot Cockpit, Usability Study, 2013
[2)] Zhongshang Hospital Fudan University, Fudan, CN, Abdomen Dot Engine Workflow Study
[3)] University Hospital Essen, GER, Brain Dot Engine Workflow Study

Dot Cockpit

Intuitive protocol management ...

by providing unprecedented flexibility in MRI configuration.

At the heart of this new flexibility is the Dot Cockpit. It is the central protocol management platform enabling highly flexible and intuitive configuration, manipulation, organisation and updating of all protocols. Whether you are using a Dot engine or not, the Dot Cockpit is the new starting point for every exam.

MRI flexibility from the start:

- One central user-interface for every protocol
- Fast and intuitive protocol configuration
- User-friendly functionalities like drag&drop, Dynamic Search
- Exam strategies created with one click
- Multiple strategies in one protocol
- Change protocols on the fly
- Update parameter changes to all or a selection of identically configured protocols anywhere in the Dot Cockpit. (Identical Configurations)

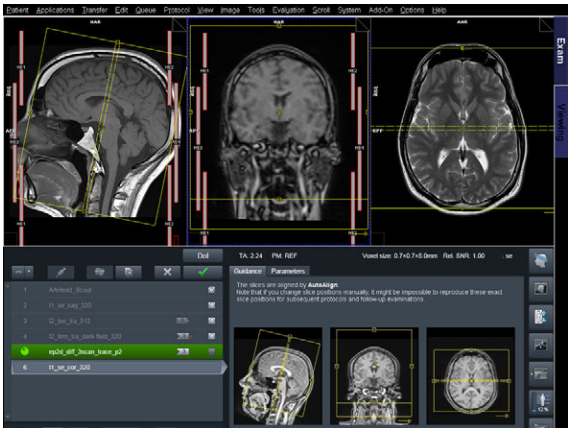
Take the lead in defining the standard of MRI in your institution!

Dot Cockpit

Designed to realize the full potential of the Dot engines. The new Dot Cockpit is your central interface for all protocol management tasks. This includes flexible configuration of all Dot engines, according to your standards of care. In the following, we introduce the most important features of the new Dot Cockpit.

Dot Cockpit *(Continued)*	
Configure all protocols from one central interface	The Dot Cockpit enables you to configure and save all of your MRI protocols and Dot engines.
Dot Explorer and Program Editor on one page	The Dot Cockpit offers two tasks: Dot Explorer and Program Editor. In the Dot Explorer, you browse through and organize your protocols. In the Program Editor, you modify them.
A new program overview	With the Dot Cockpit, you can see the whole exam workflow, the different strategies, decisions, sequences and AddIns are visualised together on one page.
Dynamic search delivers highlighted results	In the Dot Explorer, searching for protocols is very quick. Just type in your search query, and results are highlighted instantly.
Editing protocols instantly	In order to modify a protocol opened in the Dot Explorer, you can immediately switch to the Program Editor with one click.
Adding a new Exam Strategy	In the Program Editor, just drag & drop or click on the strategy button in the sidebar, and a new Exam strategy is added to your exam workflow. This step automatically creates a new Dot engine.
Drag & drop from the sidebar	In the Program Editor, you can add protocols to a strategy by drag & drop from the sidebar.
User-friendly toolbar	Use the toolbar for opening and saving of programs, for copy, paste, undo, redo – in the same way as you are used to in Office programs.
10-min exam	
The 10-min exam provides fast protocols for the most common MRI examinations for the anatomies brain, spine and the large joints. The body regions specific protocols are implemented in the DotGO workflow.	
General features	• Best-practice based protocols • Optimized image quality for the high throughput requirement • For most commonly scanned body regions: brain, c-spine, t-spine, l-spine, shoulder, hip and knee • Integrated with DotGO workflow

Brain Dot Engine



The Brain Dot Engine optimizes brain examinations with guided and automated workflows customized to your standards of care. The Brain Dot Engine supports the user in achieving reproducible image quality using automation tools and functionalities incorporated into the program.

Patient View	Within the Patient View the user can easily tailor examinations to an individual patient. Dot Exam Strategies allow you to choose the most appropriate strategy with one mouse click, the complete scan setup is then automatically prepared.
Guidance View	Step-by-step user guidance is seamlessly integrated. Example images and guidance text are displayed for each individual step of the scanning workflow to ensure perfect scanning even by the non-expert operators. Both images and text are easily configurable by the user.
Parameter View	The new streamlined Parameter View displays a user-defined subset of parameters which are available for manual protocol optimization. If desired, the user can switch to the conventional – fully loaded – parameter view at any time.
AutoPosition	Accurate positioning of the anatomy in the isocenter without need for laser light positioning.
AutoAlign Head LS	Automated, positioning and alignment of slice groups to the anatomy, relying on multiple anatomical landmarks. Provides fast, easy, and reproducible patient scanning and facilitates the reading by consistently delivering high image quality with a standardized slice orientation, both for follow-ups and across patients. AutoAlign Head LS computes the central positioning for many routine brain structures such as AC-PC, Midbrain & Temporal Lobes. The inner ear, the orbits and the optic nerve are also standard positioning orientations with the AutoAlign Head LS. It delivers robust and consistent results independently of patient age, head position, disease or existing lesions.
AutoCoverage	Maximizes the speed of the examination by automatically setting the number of slices and the FoV to fully cover the brain. This is performed based on the information delivered by AutoAlign, eliminating manual setting and the scanning of unnecessary slices.

Brain Dot Engine *(Continued)*	
Dot Exam Strategies	Examinations can be easily personalized to the individual patient condition and clinical need. The Brain Dot Engine comes with the following predefined examination strategies, which the user can select according to patient conditions or change at any time during the workflow, when conditions change: • Standard: Standard examination with 2D protocols • Resolution focus: Examination with 3D protocols (e.g. SPACE) for detailed views • Speed focus: Examination with fast 2D protocols (e.g. HASTE) for further speeding up the exam • Motion-insensitive: Examination with BLADE protocols to minimize and correct for the effects of motion automatically
BLADE	Motion insensitive Turbo Spin Echo sequence. Improves image quality by correcting for the effects of motion during an MR acquisition. (Can be used in head, spine, and other body regions).
Rerun	A sequence inside the examination Queue can be selected and a rerun of the corresponding series can be triggered with identical sequences or parameters.
Inline MPRs	Automatic multiplanar reconstruction for 3D datasets. The Multi Planar Reconstruction (MPR) tool can be easily configured to automatically generate any required 2D images from high resolution 3D acquisitions by using the position information from the AutoAlign algorithm.
Inline Diffusion	Automatic calculation of trace-weighted images and ADC maps with Inline Technology.
Customization	The Brain Dot Engine can be easily modified by the user to their individual standard of care. • Add/remove protocol steps • Change guidance content (images and text) • Change or add Dot exam strategies • Add clinical decision points • Add/remove parameters in the parameter viewing card • User-defined offsets to the standard positions delivered by AutoAlign • Customize within the Dot AddIn functionalities such as AutoCoverage, AutoFOV, InlineMPR reconstructions

Large Joint Dot Engine

The Large Joint Dot Engine optimizes image quality of knee, hip and shoulder scans by proposing the most appropriate protocols according to the examination strategy chosen for the specifi c patient. It ensures reproducible image quality and streamlines large joint examinations to the greatest extent. The Large Joint Dot Engine features AutoAlign and AutoCoverage for knee, hip and shoulder. The WARP and Advanced WARP techniques (including high bandwidth protocols, VAT and SEMAC) provide susceptibility artifact reduction functionality (e.g. from MR Conditional metal[1)] implants), and include optimized protocols for knee and hip examinations. High resolution 3D imaging programs together with user-configurable automatic Inline MPR (Multi Planar Reconstruction) calculations provide increased effi ciency, reproducibility and ease of use.

AutoPosition	Accurate positioning of the anatomy in the isocenter without need for laser light positioning.
Patient View	Within the Patient View the user can easily tailor examinations to an individual patient. Dot Exam Strategies allow you to choose the most appropriate strategy with one mouse click, the complete scan setup is then automatically prepared.
Guidance View	Step-by-step user guidance is seamlessly integrated. Example images and guidance text are displayed for each individual step of the scanning workflow to ensure perfect scanning even by novice operators. Both images and text are easily configurable by the user.
Parameter View	The new streamlined Parameter View displays a user-defined subset of parameters which are available for manual protocol optimization. If desired, the user can switch to the conventional – fully loaded – parameter view at any time.

[1)] MR imaging of patients with metallic implants brings specific risks. However, certain implants are approved by the governing regulatory bodies to be MR conditionally safe. For such implants, the previously mentioned warning may not be applicable. Please contact the implant manufacturer for the specific conditional information. The conditions for MR safety are the responsibility of the implant manufacturer, not of Siemens.

Large Joint Dot Engine *(Continued)*	
Dot Exam Strategies	Examinations can be easily personalized to the individual patient condition and clinical need. The Large Joint Dot Engine comes with the following predefined examination strategies, which the user can select according to patient conditions or change at any time during the workflow, when conditions change: • Standard: Achieve highest image quality in a reasonable scan time with 2D and 3D protocols. • Speed focus: Examine patients in the shortest possible time with protocols being accelerated to the maximal extension. • Motion Insensitive (BLADE): Compensate for the effects of motion with motion insensitive BLADE protocols. • High Bandwidth (WARP): Optimized strategy for the reduction of susceptibility artifacts[1)].
AutoAlign	Automated, positioning and alignment of slice groups to the anatomy, relying on multiple anatomical landmarks. Provides fast, easy, and reproducible patient scanning and facilitates the reading by consistently delivering high image quality with a standardized slice orientation.
AutoCoverage	Maximizes the speed of the examination by automatically setting the number of slices and the FoV to fully cover knee, hip or shoulder anatomy. This is performed based on the information delivered by AutoAlign, eliminating manual setting and the scanning of unnecessary slices. This feature is configurable.
Inline MPRs	Automatic multiplanar reconstruction for 3D datasets. The Multi Planar Reconstruction (MPR) tool can be easily configured to automatically generate any required 2D images from high resolution 3D acquisitions by using the position information from the AutoAlign algorithm.
WARP Susceptibility Artifact Reduction	WARP and adavanced WARP (SEMAC) integrates different techniques tailored to reduce susceptibility artifacts caused by orthopedic MR conditional[1)] metal implants. 2D TSE sequence combining optimized high-bandwidth protocols and View Angle Tilting (VAT) technique, helps in evaluation of soft tissue in proximity of the implant. SEMAC (Slice Encoding for Metal Artifact Correction) is a technique to correct through-plane distortions by means of additional phase encoding in slice direction. It is especially useful in the case of hip and knee joint replacements. Available protocols can be found in the library.
Customization	The Large Joint Dot Engine can be easily modified by the user to their individual standard of care. • Add/remove protocol steps • Change guidance content (images and text) • Change or add Dot exam strategies • Add clinical decision points • Add/remove parameters in the parameter viewing card • User-defined offsets to the standard positions delivered by AutoAlign • Customized inline MPR reconstructions

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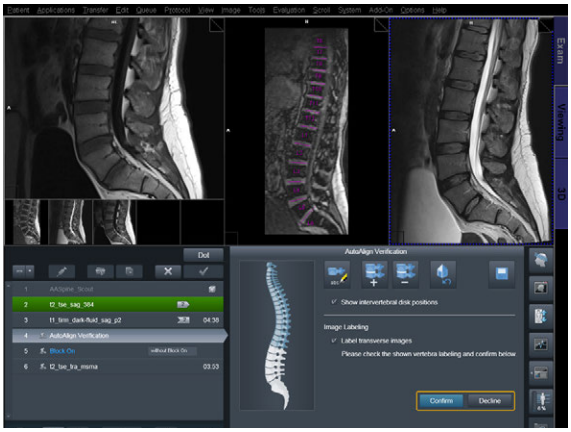
Spine Dot Engine



The Spine Dot Engine delivers optimized cervical, thoracic and lumbar spine imaging for patients of all conditions and provides guided and automated workflows customized to your standards of care. The Spine Dot Engine supports the user in achieving reproducible image quality with increased ease of use and time efficient exams.

Patient View	Within the Patient View the user can easily tailor examinations to an individual patient. Dot Exam Strategies allow you to choose the most appropriate strategy with one mouse click, the complete scan setup is then automatically prepared.
Guidance View	Step-by-step user guidance can be seamlessly integrated. Example images and guidance text can be displayed for each individual step of the scanning workflow to ensure perfect scanning even by novice operators. Both images and text are easily configurable by the user.
Parameter View	The new streamlined Parameter View displays a user-defined subset of parameters which are available for manual protocol optimization. If desired, the user can switch to the conventional – fully loaded – parameter view at any time.
AutoPosition	The C, T or L spine of the patient is automatically placed at the isocenter without any laser marking required.
AutoAlign Spine LS	Automated, positioning and alignment of slice groups to the spine anatomy, relying on multiple anatomical landmarks. Provides fast, easy, and reproducible patient scanning and facilitates the reading by consistently delivering high image quality with a standardized slice orientation, both for follow-ups and across patients. AutoAlign Spine LS automatically detects and labels vertebra and body disks, suggests positioning for sagittal, coronal and double oblique axial slices in the spine. The anterior saturation band is automatically positioned to reduce imaging artifacts. All settings are open to user modifications.
AutoLabeling	Automatic labeling of vertebra for easier examination planning and faster reading

Spine Dot Engine *(Continued)*	
Interactive Snapping	Just drag the slide group over the sagittal plane. AutoAlign Spine LS delivers automatic double oblique positioning of axial slice groups to intervertebral disk layers.
AutoCoverage	Maximizes the speed of the examination by automatically setting the number of slices and the FoV to fully cover the C, T or L-spine. This is performed based on the information delivered by AutoAlign Spine LS, eliminating manual setting and the scanning of unnecessary slices.
Dot Exam Strategies	Examinations can be easily personalized to the individual patient condition and clinical need. The Spine Dot Engine comes with the following predefined examination strategies, which the user can select according to patient conditions or change at any time during the workflow, when conditions change: • Standard: for fast routine spine examinations • Post surgery: for detailed evaluation of spine including fat saturation and DIXON techniques. • High Bandwith (WARP) : Optimized strategy for the reduction of susceptibility artifacts.
WARP Susceptibility Artifact Reduction	WARP integrates different techniques tailored to reduce susceptibility artifacts caused by orthopedic MR Conditional[1)] metal implants. 2D TSE sequence combining optimized high-bandwidth protocols and View Angle Tilting (VAT) technique, helps in evaluation of soft tissue in proximity of the implant.
Rerun	An image inside the examination UI can be selected and a rerun of the corresponding series can be triggered with identical sequences or parameters.
Inline Curved reconstructions	Automatic curved reconstruction from 3D acquisitions by using the position information from the AutoAlign Spine LS algorithm.
Customization	The Spine Dot Engine can be easily modified by the user to their individual standard of care. • Add/remove protocol steps • Change guidance content (images and text) • Change or add Dot Exam Strategies • Add clinical decision points • Add/remove parameters in the parameter viewing card • User-defined offsets to the standard positions delivered by AutoAlign Spine LS(also for the saturation region) • Customized inline curved and MPR reconstructions

[1)] MR imaging of patients with metallic implants brings specific risks. However, certain implants are approved by the governing regulatory bodies to be MR conditionally safe. For such implants, the previously mentioned warning may not be applicable. Please contact the implant manufacturer for the specific conditional information. The conditions for MR safety are the responsibility of the implant manufacturer, not of Siemens

syngo MR Software

***syngo* MR Examination**	
Exam Explorer	• Free and flexible programming of customized integrated exam programs • Simple change of exam programs via drag & drop • Allows configuration of Dot: e.g. customization of image and text guidance, definition of strategies and decision points and to add sequences • Automatic adjustment of frequency, transmitter power and 3D Shim • Eliminates the need for receive adjustments through dynamic receiver gain control, significantly reducing scan time • Allows for individual interactive adjustments • No coil tuning necessary, also saving examination time
AutoScout	• Automatic start of localizer scan with very short acquisition time • Arbitrary orientations (multi-slice multi-angle) • Automatically loads images into Graphical Slice Positioning
Graphical Slice Positioning	Simultaneous use of three arbitrary localizer images from possibly different measurements for graphically positioning slices and sat regions. Interactive modification of measurement parameters (slice thickness, distance factor, oversampling etc.): • Automatic selection of relevant coil elements • Graphical selection of coil elements • Off-center positioning (shift of FoV within the selected slice position) • True multi-slice multi-angle, e.g. simultaneous measurement of multiple images (stacks with different orientation) • Recall of previous slice and/or sat region positioning • Paging through all images during graphical positioning • Inline Movie, allowing positioning of slices on e.g. the beating heart • Loads images immediately when they are available, e.g. during image reconstruction • Allows quick overview via image stamps. Loads entire series of planning images with drag-and-drop • Slice positioning (GSP) on 3D reconstructed images • Slice positioning (GSP) on 2D and 3D distortion corrected images • Slice positioning (GSP) on composed images

syngo MR Image Viewing and Filming	
Image Display	• Various display layouts selectable • Up to 3 patients can be simultaneously active in the viewer • Image annotation and labeling • Non-interpolated display • Fast paging through up to 500 images with 15 images/s for full screen display
Windowing	• Freely selectable window width and center • Windowing on succeeding images • Auto-windowing for optimized contrast • Saves and sends window values
Automatic Movie for cine display	
Interactive movie paging by dragging the mouse or Automatic Movie mode by clicking the icon	
Evaluation	Parallel evaluation of up to 40 regions of interest • Circle • Rectangle • Freehand ROI • Pixel lens with position marker • Statistical evaluation • Area • Standard deviation • Mean value • Min/max values • Image scrolling • Magnification • Distance • Angle
2D Post-processing	Image manipulations • Reversal of gray-scale values • Image rotation by 90° or by user-defined angle • Flip horizontally/vertically • Image zoom and pan • Shutter • Annotation
Position display	Displays measured slice positions on localizer image and selected series.

***syngo* MR Image Viewing and Filming** *(Continued)*		
Argus Viewer	Viewing software for cardiac MR studies and large data sets • Efficient cine review of cardiac and other dynamic data sets • Multiple sorting options • Single movie as well as 2, 4, or 8 simultaneous slices together in movie mode • Rapid avi creation of 1 to 8 slices simultaneously • Creates and edits DICOM structured reports	
Mean Curve	Time-intensity analysis for contrast-enhanced examinations • Creates and edits DICOM structured reports	
Filming	• Connection via DICOM Basic Print • Interactive filming • Filming parallel to other activities • Independent scanning and documentation – no wait time due to camera delays • Freely selectable positioning of images onto virtual film sheet • Selectable various film layouts • Mother-in-Child display • Windowing, image zoom and pan on film sheet • Configurable image text • Simultaneous handling of multiple film jobs • Up to 100 virtual film sheets	
Dynamic Analysis	Arithmetic operations on images and series (e.g. for evaluation of contrast media studies) • Addition, subtraction, multiplication, division of single images and whole series • Arithmetic mean and standard deviation across a range of selected images • Calculation of T1 and T2, and logarithmic images • Differentiation/integration of selected images • Calculation of a mean slope image from a range of selected images • Calculation of z-score (t-test) images for evaluation of BOLD imaging data (Blood Oxygenation Level Dependent) • Time-to-peak evaluation (TTP) • ADC maps Several evaluation functions may be started consecutively in the background	
Printing on Paper	Interface and software for printing images on paper (laser printer not included)	
	Supported printing	Grey levels and color
	Data format	PostScript Level 2

syngo MR 3D Post-processing	
MPR – Multi-Planar Reconstruction	Real-time multi-planar reformatting of secondary views • Viewing perspectives: sagittal, coronal, axial, oblique, double oblique, curved (freehand) • Reconstruction along polygon and/or curved (freehand) cut lines • Reconstruction based on reconstructed planes possible • Reconstruction of user-defined ranges of parallel, radial or freehand cuts • Selectable slice thickness and slice increment of reconstructed images • Storing of post-processing protocols • Annotations and 2D evaluations such as distance and ROI
MIP – Maximum Intensity Projection	3D reconstructions of vessels from a 3D data set, or a 2D sequential slice data set (acquired with dedicated MR Angiography sequences) • Volume of Interest (VoI) defined to increase reconstruction speed and to improve image quality • Freehand MIP • Arbitrary views along any direction can be defined interactively with mouse-driven virtual trackball • Multiple view angles around any orthogonal axis • Projections displayed as single images, as interactive movie or by fast paging • MIP thin/MIP thick
MinIP – Minimum Intensity Projection	Similar to MIP but reconstructs the minimum intensity (e.g. for Dark Blood techniques)
SSD – Shaded Surface Display	Three-dimensional display of surfaces, such as contrast-enhanced vessels • Selectable variable threshold values • Multiple view angles around any orthogonal axis
Volumes of Interest (VoI)	Rectangular and irregular VoI can be defined to improve image quality

syngo MR Network Communication	
DICOM Services (Digital Imaging and Communications in Medicine)	Interface for transmitting medical images and information in the DICOM 3.0 industrial standard. Allows for communication between devices from different manufacturers • DICOM Send/Receive • DICOM Query/Retrieve • DICOM SC Storage commitment • DICOM Basic Print • DICOM Modality Worklist • DICOM MPPS Modality performed procedure steps. Communication back to information system • DICOM Structured Reports • DICOM Study Split
DICOM Study Split	DICOM Study Split provides the mapping of one study acquired based on multiple requests to multiple studies directly at the scanner. For example, two requests for head and neck acquisition can be registered once, scanned once and immediately mapped to two separate studies for individual reading.
	Multiple requested procedures can be combined in a time saving manner by scanning a larger body region and then splitting them to individual billing relevant studies for separate reading.
	This package allows: • Time saving simple mapping of multiple requested procedures to multiple acquired series with one scan • Simple creation of studies with individual billing based on one scan workflow • Improvement for departmental workflow by eliminating need to load/change and to request/execute splitting on a separate workstation after the scan • Immediate visual selection, check and correction of images to study assignments. • Overlapping region images can be copied to both studies

***syngo* MR Network Communication** *(Continued)*		
syngo MR Network Communication	Exchange Media Storage of images and additional data (e.g. AVI files) on CD/DVD	
DICOM Viewer	A viewing tool which can be stored together with images on a DICOM CD/DVD to be handed out to the patient	
Virus Protection	• Permanent scanning for malicious software in the background to provide maximum security • Via Remote Access over secure network connection the latest virus scanner updates and operating system hotfixes are installed automatically • Provided in conjunction with a service contract with Siemens (UPTIME Services)	
Image Transfer	Local network	Ethernet
	Data transfer rate	Max. 1 Gbit/s
	Transfer rate (256×256 image)	Approx. 60 images/s

Computer System

syngo Acquisition Workplace		
General	Full multi-tasking for simultaneous functionality, e.g.: • Patient registration and pre-registration • Scanning • Reconstruction • Viewing • Post-processing • Filming • Data storage	
Color LCD Monitor	High resolution flicker-free flat-screen monitor Horizontally tiltable, forward and backward Automatic backlight control for long-term brightness stability Optional second monitor	
	Screen size (diagonal)	19”
	Horizontal frequency	30–100 kHz
	Vertical frequency	50–75 Hz
	Screen matrix	1280×1024
Host computer	Processor	Intel Xeon E5-1620 QuadCore
	Clock rate	3.5 GHz, or comparable
	RAM	≥32 GB
	1st hard disk (system SW)	≥300 GB SAS
	2nd hard disk (data base)	≥300 GB SAS
	3rd hard disk (images)	≥300 GB SAS
	CD-R writer	Approx. 4000 images 256^2 DICOM Standard, ISO 9660
	DVD-R writer	Approx. 25 000 images 256^2 DICOM Standard, ISO 9660
	Media drives	CD/DVD drive

***syngo* Acquisition Workplace** *(Continued)*		
Measurement and reconstruction system Tim [96x16]	Processor	Intel Xeon E3-1225 Quad-Core
	Clock rate	3.2 GHz, or comparable
	Main memory (RAM)	≥16 GB
	Hard disk for raw data	≥500 GB x 2
	Hard disk for system software	≥500 GB
	Parallel Scan & Recon	Simultaneous scan and reconstruction of up to 12 data sets
	Reconstruction speed	11 800 recons per second (256^2 FFT, full FoV) 54 140 recons per second (256^2 FFT, 25% recFoV)
Measurement and reconstruction system Tim [96x24]	Processor	Intel Xeon E3-1225 Quad-Core
	Clock rate	3.2 GHz, or comparable
	Main memory (RAM)	≥32 GB
	Hard disk for raw data	≥500 GB x 2
	Hard disk for system software	≥500 GB
	Reconstruction speed	11 800 recons per second (256^2 FFT, full FoV) 54 140 recons per second (256^2 FFT, 25% recFoV)
	Parallel Scan & Recon	Simultaneous scan and reconstruction of up to 12 data sets.
***syngo* MR Workplace**[1)]		
Color LCD Monitor as for *syngo* Acquistion Workplace		
Host computer	Processor	Intel Xeon E5-1620 QuadCore
	Clock rate	3.5 GHz, or comparable
	RAM	≥8 GB
	1st hard disk (system SW)	≥300 GB SAS
	2nd hard disk (data base & images)	≥300 GB SAS
	CD-R writer	Approx. 4000 images 256^2 DICOM Standard, ISO 9660
	DVD-R writer	Approx. 25 000 images 256^2 DICOM Standard, ISO 9660
	Media drives	CD/DVD drive

[1)] Optional

Installation

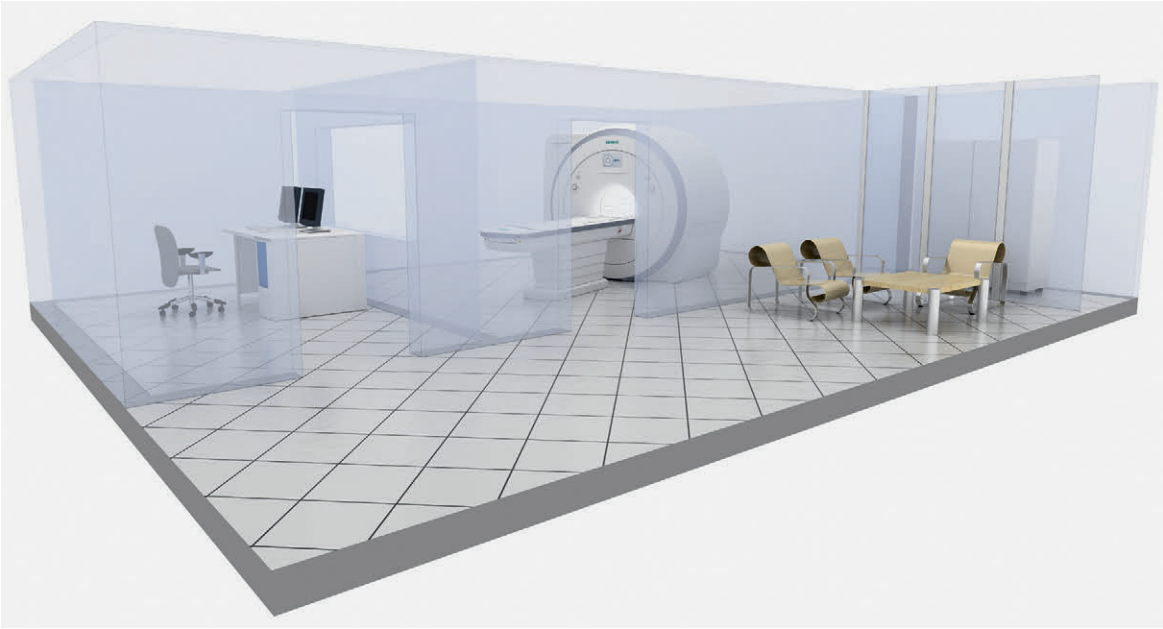
Siting and Installation	
Short installation time due to integrated digital DirectRF technology	
Typical installation time	Less than 7 working days
Radio Frequency Shielding	
For shielding the examination room from external RF sources	
RF attenuation factor	>90 dB
Frequency range	15–65 MHz
Magnetic Shielding	
Room shielding	For additional reduction of the magnetic fringe field, suitable iron shielding can be installed in the walls of the examination room. The room shielding can be used to create a magnetic shielding enclosure
One-Floor Installation	A combination of active shielding and a special shielding (installed on the ceiling of the magnet room or below it) will keep the 0.5 mT line within the same floor as the MRI scanner installation, even in case of very low room heights
System Electronics Cabinets	
Two cabinets which may be placed directly against the wall or even in a corner	
Require service access only from the front, saving considerable space	
Integrated water cooling cabinet may eliminate the need for a dedicated computer room	
Power Requirements	
Line voltage	380, 400, 420, 440, 460, 480 V
Stability tolerances	±10%
Line frequency	50/60 Hz, ±1 Hz
Connection value	38 kVA

Cooling		
Two different customer specific cooling alternatives (Separator or Eco Chiller) available.		
Separator option for connection to available cooling system	Water consumption	50 l/min[1)]
	Heat dissipation to water	36 kW
Eco Chiller option with automatic adaptation to the required cooling demands (e.g. different night / day mode) to decrease energy cost		

Power Consumption[2)]	
System off	4.4 kW
System ready to measure[2)]	8.7 kW
Scan[2)]	13.1 kW

All values are typical values, applicable for 400V/50Hz
Consumption for optional separator pump and other options not included
Peak power in scan mode is significantly higher

Space Requirements	
Min. total space requirement (for magnet, electronics, and console room)	< 28 m^2



[1)] Water temperature 12 °C/45 °F
[2)] The power consumption described herein is based on results that were achieved in a setting according to the COCIR methodology MRI - Measurement of the energy consumption (http://www.cocir.org/site/index.php?id=46). Since many variables impact power consumption (e.g. sequences used for scanning and sequence parameters, scan time), there can be no guarantee that each customer will achieve the same values.

Dimensions					
		Width [cm]	**Depth [cm]**	**Height [cm]**	**Weight [kg]**
Examination Room	Magnet 1.5 Tesla AS (incl. Helium)	222	155	213	3200
	Magnet in operation, incl. gradient coil, body coil, Tim Table and covers	234	425	218	4564
	Tim Table	77	251	58–89 +1.0[1)]	
	Required min. room height clearance			240[2)]	
	Min. transport dimensions	234	171	212	
Control Room	*syngo* Acquisition Workplace (table + monitor)	120	80	118 (75+43)	
	Host computer	17	45	43	
	syngo MR Workplace (optional)	120	80	118 (75+43)	
Equipment Room	Electronics cabinet, incl. system control, RF system, gradient power system, image processor	160	65	198[3)]	1270
	Heat dissipation	≤5 kW, only ventilation might be required			
	Cooling system	65	65	189	340

[1)] Depending on the floor conditions
[2)] Finished floor to finished ceiling
[3)] Without attachments

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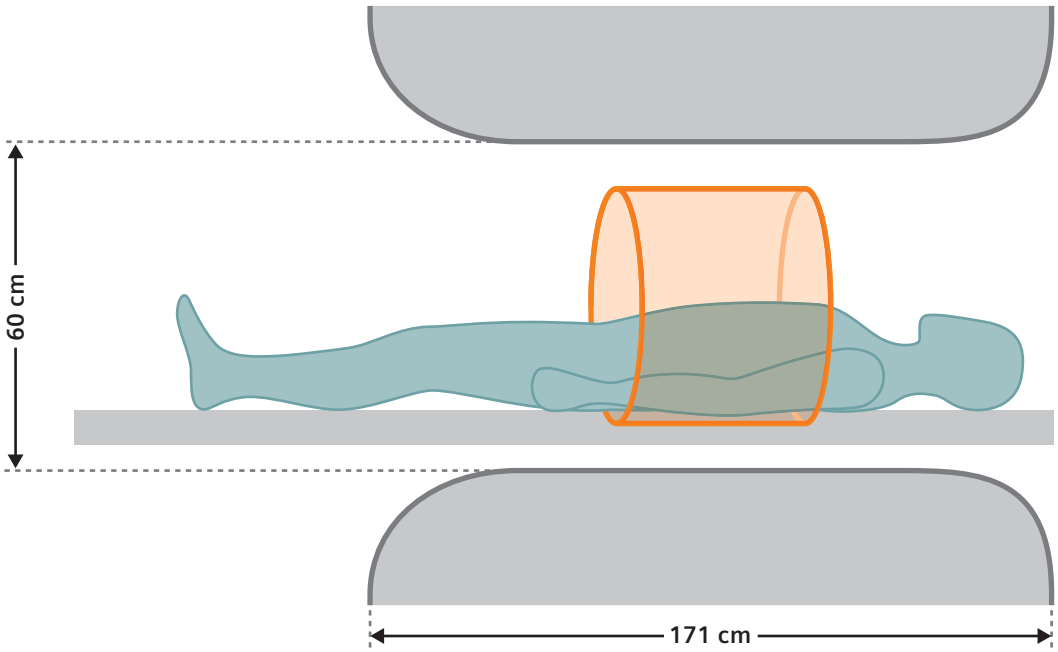
Tim [96x16] XF Gradients
Tim [96x24] XF Gradients

Magnet System



General	
Superconducting Magnet	Short bore, patient-friendly design, high homogeneity 1.5 Tesla with 60 cm bore design
	Easy siting due to AS (Active Shielding) and E.I.S. (External Interference Shielding) magnet technology
TrueForm Magnet Design	TrueForm magnet design produces a cylindrically optimized homogeneity volume that corresponds better to the true form of the human body. This results in better image quality as well as better fat saturation for the whole area covered in a scan. TrueForm reduces the overlap needed between steps for large virtual FoV exams and thus reduces the number of steps needed for a given scanning range

Magnet Parameters		
Operating field strength	1.5 Tesla	
Magnet type	Superconductor	
Field stability over time	<0.1 ppm/h	
Weight (with cryogens)	3200 kg	
Magnet length	1.55 m	
System length cover to cover	1.71 m	
Bore design	60 cm	
Homogeneity (based on highly accurate 24 plane plot)		
TrueForm magnet design with a cylindrically optimized homogeneity volume for higher image quality		
10 cm DSV	Guaranteed	0.02 ppm
	Typical	0.01 ppm
20 cm DSV	Guaranteed	0.075 ppm
	Typical	0.04 ppm
30 cm DSV	Guaranteed	0.3 ppm
	Typical	0.15 ppm
40 cm DSV	Guaranteed	1.4 ppm
	Typical	1.07 ppm
50×50×45 cm^3 DEV	Guaranteed	5.0 ppm
	Typical	4.7 ppm

In compliance with the German “Qualifikationsvereinbarung”.

Standard deviation Vrms (volume root-mean square) measured with highly accurate 24 plane plot method (20 points per plane).

Standart active shim with 3 linear channels.

DSV = Diameter spherical volume (x, y, and z direction); DEV = Diameter elliptical volume.

Shimming		
Both: passive and active shimming. Passive shimming during installation		
Standard active shim with 3 linear channels (1st order)		
3D Shim	Patient-specific automated shim	
	Time to shim	Approx. 20 s
Shielding		
Active Shielding (AS)	5th generation active shielding (AS) technology with counter coils	
Fringe field (axial × radial)	0.5 mT[1)]	4.0×2.5 m
	0.1 mT	5.8×3.4 m
External Interference Shield (E.I.S.)	Patented shielding system integrated into the magnet	
	Continuous compensation and automatic suppression of external magnetic field interferences during measurement (caused by moving ferromagnetic objects or nearby power lines)	
Magnet Cooling System		
Zero Helium boil-off technology		
Refill interval (typical)[2)]	Not applicable	
Boil-off rate (typical)[2)]	0.0 liter/year	
Max. helium capacity	Approx. 1300 liters	

[1)] Pacemaker safety limit

[2)] For typical clinical use, depending on sequences and operating time with running helium compressor. The system needs to be serviced at regular interval. Undisturbed magnet cooling for 24 hours and 7 days a week.

Gradient System

XF Gradients: General Features
• Actively shielded (AS) whole-body gradient coil system • Extremely low eddy currents • Water-cooled coil and amplifier for maximum performance • All axes force compensated

Gradient Performance for Each Axis	
Max. amplitude	33 mT/m
Min. rise time	264 µs
Max. slew rate	125 T/m/sec

Vector Gradient Performance (vector addition of all 3 gradient axes)	
Max. eff. amplitude	57 mT/m
Max. eff. slew rate	217 T/m/s
Gradient duty cycle	100%

XF Gradients: Amplifier	
Water-cooled, highly compact, modular design	
Ultra-fast solid-state technology with very low switching losses	
Max. output voltage[1)]	1125 V
Max. output current[1)]	330 A

XF Gradients: Resolution Parameters	
Min. FoV	5 mm
Max. FoV[2)]	500 mm
Slice thickness 2D	min. 0.1 mm max. 200 mm
Partition thickness 3D	min. 0.05 mm max. 20 mm
Slab thickness 3D	min. 5 mm max. 500 mm
Max. matrix	1024
Highest in-plane resolution	14 µm

[1)] Values for each of the 3 gradient axes
[2)] Depending on the application, the maximum FoV in the z-direction can be up to 45 cm

Sequences: XF Gradients				
		Matrix		
		64	128	256
Spin Echo	min. TR [ms]	5.7	5.9	6.4
	min. TE [ms]	1.6	1.7	2.1
Inversion Recovery	min. TR [ms]	27	28	28
	min. TE [ms]	1.6	1.7	2.1
	min. TI [ms]	21	21	21
2D GRE	min. TR [ms]	0.68	0.91	1.14
	min. TE [ms]	0.28	0.28	0.28
3D GRE	min. TR [ms]	0.68	0.91	1.14
	min. TE [ms]	0.28	0.28	0.28
TrueFISP	min. TR [ms]	1.86	2.07	2.74
	min. TE [ms]	0.85	0.87	1.15
TSE (HASTE)	min. Echo Spacing [ms]	1.6	1.7	2.3
	min. TR [ms]	5.7	5.9	6.7
	min. TE [ms]	1.6	1.7	2.3
	max. Turbo Factor = 512			
Turbo GSE	min. Echo Spacing [ms]	0.8	0.98	1.08
	min. TR [ms]	6.3	6.9	7.4
	min. TE [ms]	3	3.5	4
	max. Turbo Factor = 65			
	max. EPI Factor = 21			
EPI (single-shot and multi-shot)	min. Echo Spacing [ms]	0.33	0.51	0.81
	min. TR [ms]	10	10	10
	min. TE [ms]	2.2	2.4	2.9
	min. Measurement time	16	21	35
	max. EPI Factor = 256			
Diffusion Imaging	Max. b-value = 10 000 s/mm^2			
	Min. TE [ms] with b = 1000 s/mm^2	53	55	60

All matrices without interpolation. Combinations of the stated parameters are not always possible; some parameters may require optional application packages.

Coils

Standard Integrated Whole-Body Coil

No tune transmit/receive coil

1.5T Tim 4G Coils

The Tim 4G coils are designed for high image quality in combination with easy handling. High element coils increase SNR and reduce examination times. DirectConnect® and SlideConnect® technology reduce patient set up time. Light weight, ergonomically designed coils enable highest patient comfort.

- No coil changing with multi-exam studies saves patient setup time
- All coils are time-saving "no-tune" coils
- Low-noise preamplifiers
- AutoCoilSelect for dynamic, automatic, or interactive selection of the coil elements within the Field of View

Standard Coils

Head/Neck 16 (DirectConnect)	Application area	Head and neck
	Dimensions with look out mirror (L×W×H)	440 mm × 330 mm × 370 mm
	Weight	4.7 kg
Spine 18 (DirectConnect)	Application area	Spine
	Dimensions (L×W×H)	1200 mm × 489 mm × 63 mm
	Weight	11 kg
Body 13 (SlideConnect)	Application area	• Thorax • Pelvis • Heart • Hip • Abdomen
	Dimensions (L×W×H)	380 mm × 540 mm × 40 mm
	Weight	1.4 kg
Flex Large 4	Application area	Multi purpose
	Dimensions (L×W)	516 mm × 224 mm
	Weight	550 g
Flex Small 4	Application area	Multi purpose
	Dimensions (L×W)	366 mm × 174 mm
	Weight	450 g
Accessories	• Flex Coil Interface 1.5T	

Combination of all coils possible for large Field of View exams.

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Head/Neck 16

General

The Head/Neck 16 is part of the standard system configuration

- 16-channel design with 16 integrated pre-amplifiers, two rings of 6 elements each and one ring with 4 elements
- Cable-less coil with DirectConnect™ technology
- Combined coil for head and neck examination for optimized workflow
- Upper coil part easy removable
- Lower coil part usable without upper part for highly claustrophobic patients
- Lower coil part may stay on the patient table for most of the examinations
- Smoothly integrated into the patient table with Spine 18
- Open patient-friendly design
- Cushioned head stabilizers (removable)
- No coil tuning
- iPAT-compatible in all directions
- Dual-Density Signal Transfer enables ultra-high density coil designs by integrating key RF components into the local coil
- Detachable double mirror

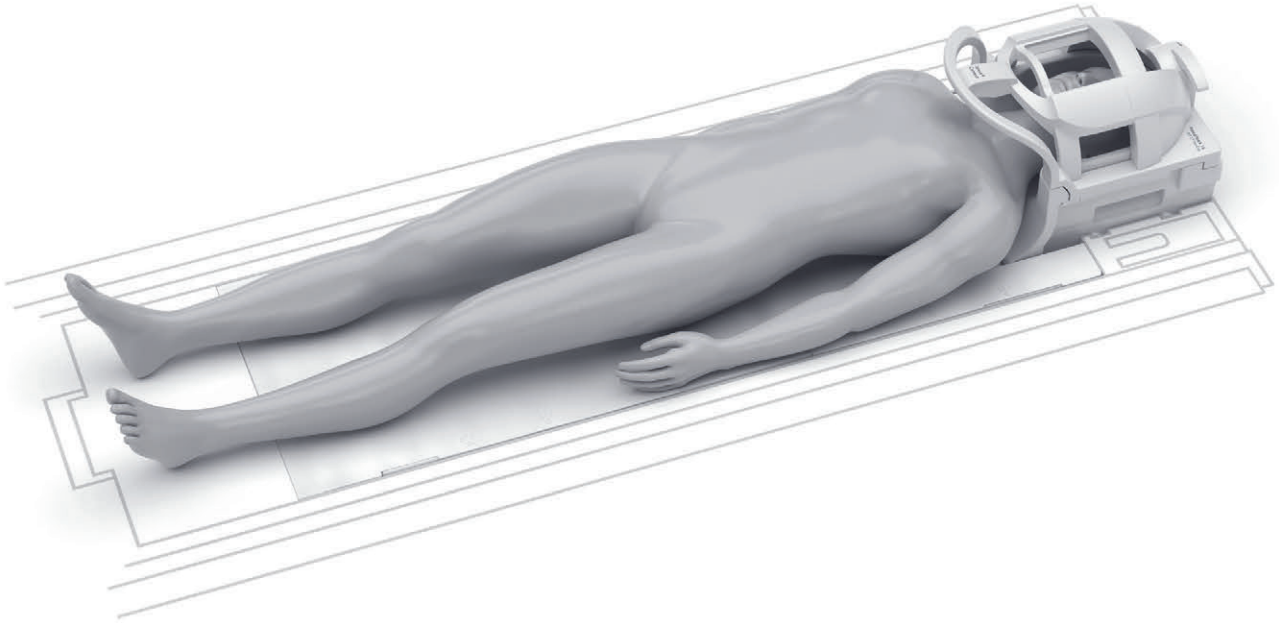
Applications

- Head examination
- Neck examination
- MR Head/Neck Angiography
- Combined head/neck examination
- TMJ (temporomandibular joints)

Typically combined with

- Spine 18
- Body 13
- Special-Purpose 4
- Flex Large 4
- Flex Small 4

Head/Neck 16



Weight	
Total	4.7 kg
Anterior part	1.7 kg

Dimensions (L × W × H)
440 mm × 330 mm × 370 mm

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Spine 18

General

The Spine 18 is part of the standard system configuration.

- 18-channel design with 18 integrated pre-amplifiers, 6 rows of 3 elements each
- Cable-less coil with DirectConnect™ technology
- Smoothly integrated into the patient table and streamlined with Head/Neck 16
- May remain on the patient table for nearly all exams
- No coil tuning
- iPAT-compatible in all directions
- Dual-Density Signal Transfer enables ultra-high density coil designs by integrating key RF components into the local coil

Applications

- High resolution imaging of the whole spine
- Various applications in combination with additional coils

Typically combined with

- Body 13
- Head/Neck 16
- Peripheral Angio 16 (optional)
- Flex Large 4
- Flex Small 4

Spine 18

Weight	Dimensions (L × W × H)
11 kg	1200 mm × 489 mm × 63 mm

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Body 13

General

The Body 13 is part of the standard system configuration.

- 13-channel design with 13 integrated pre-amplifiers, with 2 rows of 4 elements each and 1 row of 5 elements
- Can be combined with further Body 13 coils for larger coverage
- No coil tuning
- iPAT-compatible in all directions
- Dual-Density Signal Transfer enables ultra-high density coil design by integrating key RF components into the local coil.
- SlideConnect® technology for easy coil set up

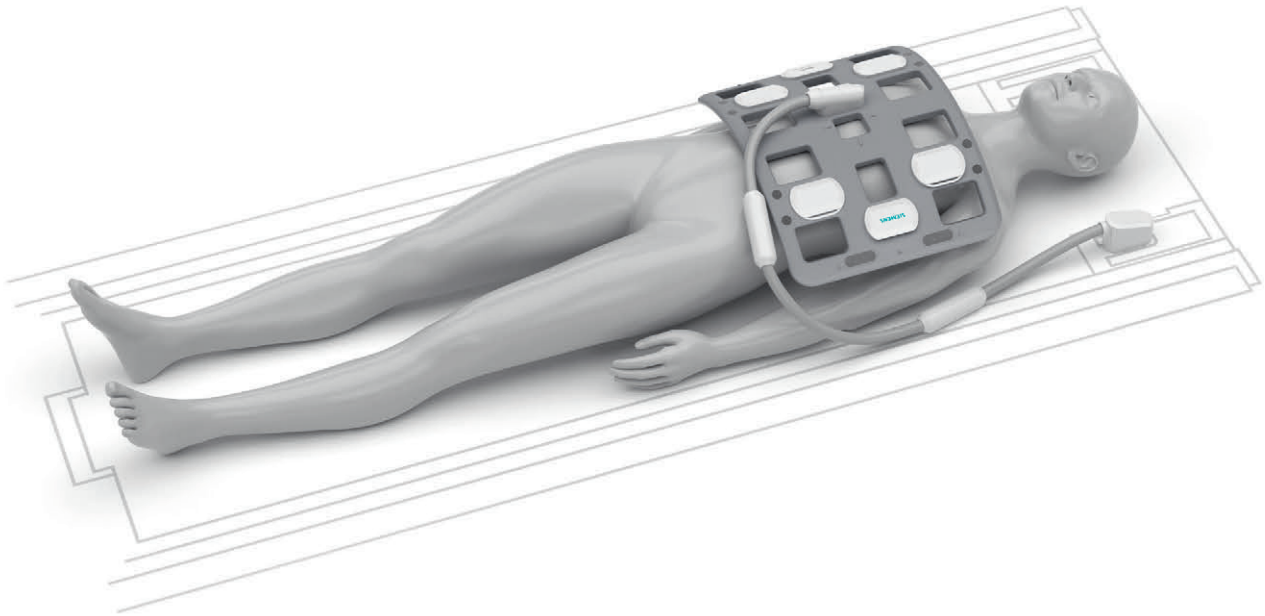
Applications

- Thorax
- Heart
- Abdomen
- Pelvis
- Hip
- Vascular

Typically combined with

- Head/Neck 16
- Spine 18
- Additional Body 13 coils (optional)
- Peripheral Angio 16 (optional)
- Flex Large 4
- Flex Small 4

Body 13



Weight
1.4 kg “patient-felt” weight of coil only – 0.9 kg

Dimensions (L × W × H)
380 mm × 540 mm × 40 mm

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Flex Large 4
Flex Small 4

General

The Flex Large 4 and Flex Small 4 are part of the standard system configuration.

- Four integrated low-noise preamplifiers
- Allows flexible coil positioning
- Only one interface necessary for all Flex coils
- Several Flex Coil Interfaces can be used simultaneously
- Connection via Flex Coil Interface 1.5T

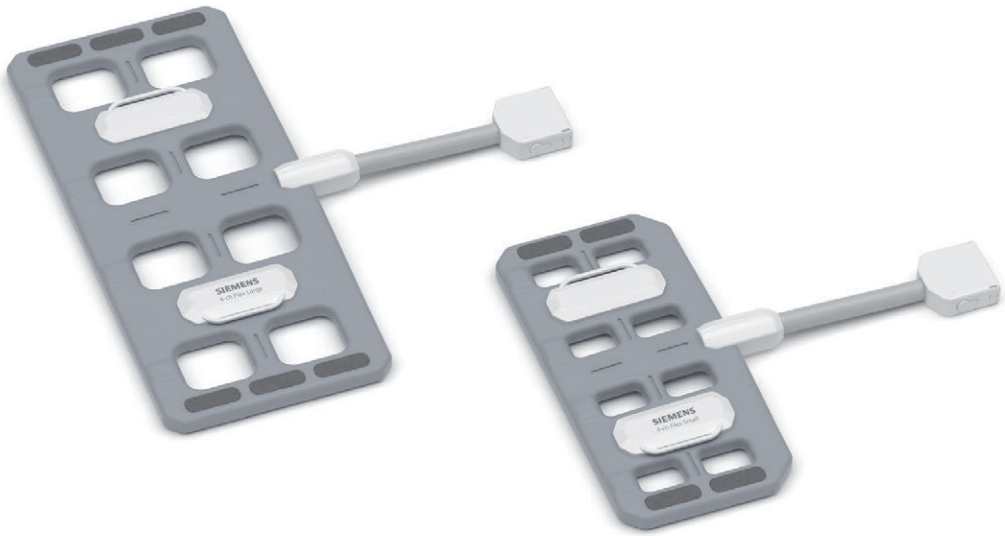
Features

- Wrap-around coil made from soft and flexible material
- 4-channel design
- iPAT-compatible
- No coil tuning

Flex Large 4	FlexSmall 4
Applications	
Imaging of large regions such as medium to large shoulder, hip, and knee	Imaging of small regions such as small to medium shoulder, wrist, elbow, and ankle
Typically combined with	
• Head/Neck 16 • Body 13 • Peripheral Angio 16 (optional) • Flex Small 4[1)]	

[1)] Second Flex Coil Interface 1.5T required (option)

Flex Large 4 and Flex Small 4



Weight	
Flex Large 4	**FlexSmall 4**
550 g	450 g

Dimensions (L × W × H)	
Flex Large 4	**FlexSmall 4**
516 mm × 224 mm	366 mm × 174 mm

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Hand/Wrist 16

General

- 16-channel coil with 16 integrated preamplifiers
- iPAT-compatible in all directions
- Hinged design of the upper part for quick and easy patient positioning
- Stabilization pads for comfortable positioning
- Holder allows off-center positioning to ensure a comfortable position for the patient
- No coil tuning

General *(Continued)*

- Dual-Density Signal Transfer enables ultra-high density coil designs by integrating key RF components into the local coil
- SlideConnect® technology for easy coil set up

Applications

High resolution hand and wrist imaging

Hand/Wrist 16

Weight	
Coil	approx. 2.8 kg
Base plate	approx. 1.6 kg

Dimensions (L × W × H)	
Coil	approx. 332 mm × 215 mm × 115 mm
Base plate	approx. 528 mm × 470 mm × 45 mm

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Foot/Ankle 16

General

- 16-channel coil with 16 integrated preamplifiers
- iPAT-compatible in all directions
- Boot-like coil design
- Cable-less coil with DirectConnect™ technology
- Stabilization pads for comfortable patient positioning
- No coil tuning

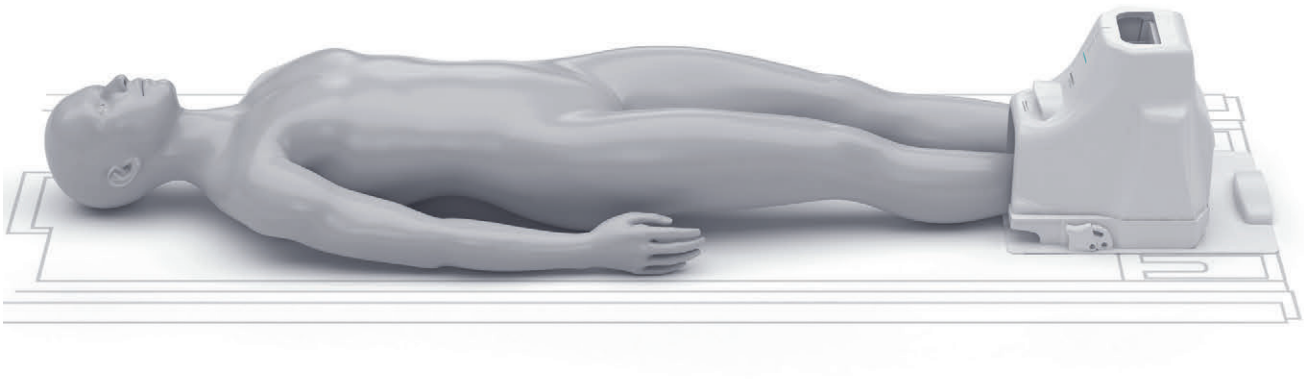
General *(Continued)*

- Dual-Density Signal Transfer enables ultra-high density coil designs by integrating key RF components into the local coil

Applications

High resolution foot and ankle imaging

Foot/Ankle 16



Weight	
Coil	3.2 kg
Base plate	7.1 kg

Dimensions (L × W × H)	
Coil	410 mm × 330 mm × 390 mm
Base plate	427 mm × 333 mm × 383 mm

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Legal Manufacturer
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Siemens MRI Center
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MAGNETOM Amira

Shoulder Large 16
Shoulder Small 16

General

- Two 16-channel coils to cover small and large shoulder anatomy, – each with 16-channel coil design with
  16 integrated preamplifiers
- For narrow or wide shoulders the coil can be attached at different positions on the base plate
- Includes one base plate pad for high patient comfort
- No coil tuning
- iPAT-compatible in all directions

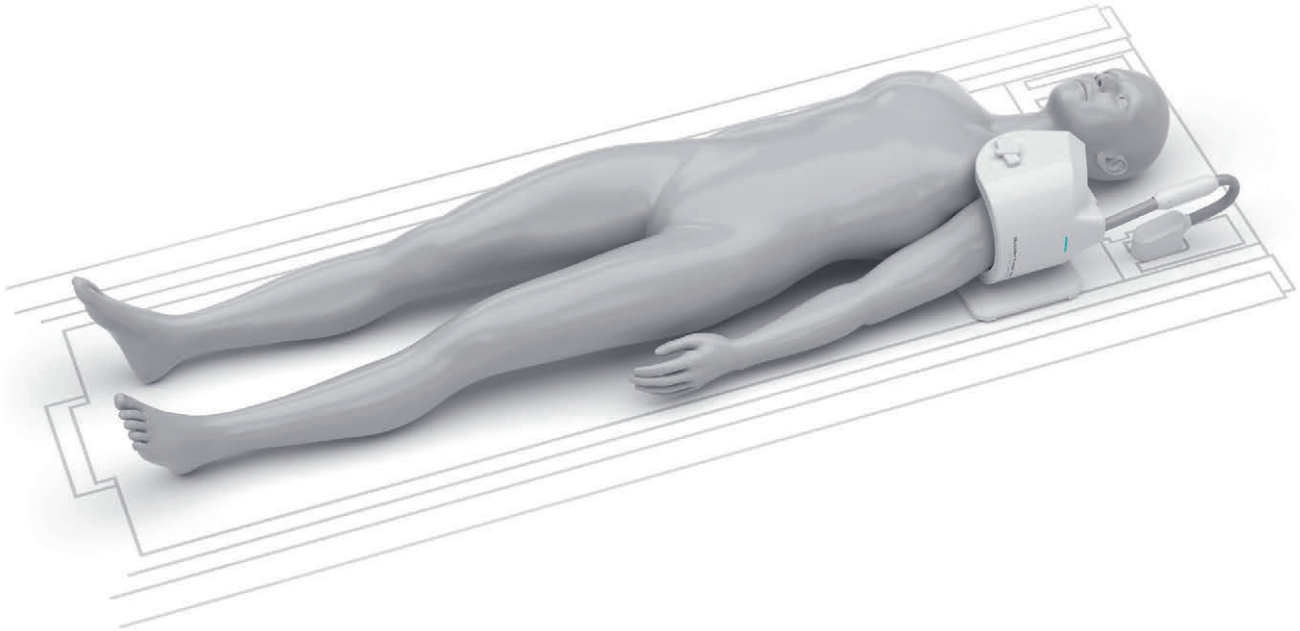
General *(Continued)*

- Dual-Density Signal Transfer enables ultra-high density coil designs by integrating key RF components into the local coil
- SlideConnect® technology for easy coil set up

Applications

- Best visualization of small anatomical structures (e.g. labrum)
- Higher SNR and better field homogeneity
- Reduced slice thickness and measurement times

Shoulder Large and Shoulder Small 16



Technical Data		
Shoulder Large 16	Opening	200 mm
	Weight	2.3 kg
Shoulder Small 16	Opening	165 mm
	Weight	2.2 kg

Technical Data *(Continued)*		
Base plate	Dimensions (L × W)	445 mm × 490 mm
	Weight	1.7 kg

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MAGNETOM Amira

iTX Extremity 18

General

- 18-channel inductive transmit/receive coil
- Transmission layer integrated working as inductive coupled local transmit coil with body coil brings higher transmit efficiency and lower whole body SAR
- 18-channel coil with 18 integrated preamplifiers, elements arranged in 3 rungs by 6 elements
- iPAT-compatible in all directions
- Upper coil part removable
- Holder allows off-center positioning to ensure a comfortable position for the patient

General *(Continued)*

- Cushions for patient comfort and stabilization of the anatomy
- No coil tuning
- One plug only
- SlideConnect® technology for easy coil set up

Applications

- Examinations of joints in the area of the lower extremities
- High resolution knee imaging

iTX Extremity 18

Weight
7.5 kg
Dimensions (L × W × H)
530 mm × 240 mm × 313 mm

Minimum inner dimension
170 mm

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Application Packages

Application Packages

Quiet Suite

Quiet Suite enables complete, quiet examinations of the brain, spine and large joints. Quiet Suite includes QuietX, an algorithm which enables intelligent gradient optimization to substantially reduce noise without significant compromise to image quality or scan time.
In addition, Quiet Suite includes PETRA, a 3D T1-weighted sequence which is barely audible above background noise.

- Quiet prescan normalize and quiet localizers
- QuietX TSE, SE and GRE sequences for T1, T2, and DarkFluid contrasts
- QuietX SWI[1)]
- QuietX DWI[2)]
- PETRA (Pointwise Encoding Time Reduction with Radial Acquisition) for inaudible 3D T1-weighted imaging
- Optimized Quiet protocols for the brain, spine and large joints

FREEZEit[3)]

FREEZEit combines the two applications TWIST-VIBE and StarVIBE.

FREEZEit facilitates high quality diagnostic body MR imaging. Based on the excellent soft tissue contrast that MRI inherently offers, FREEZEit now adds imaging speed and motion compensation to body MRI and beyond. This allows i.e. imaging the entire arterial phase of the liver with multiple 3D datasets within seconds while maintaining a high spatial image resolution. Furthermore, the motion compensation of FREEZEit enables contrast-enhanced MR imaging during free breathing.

StarVIBE	StarVIBE is a motion insensitive VIBE sequence using a stack-of-stars trajectory. It allows abdominal, head, head neck, spinal, thoracic and pelvic imaging in free breathing mode, providing a solution for patients without breathhold capabilities.
TWIST-VIBE	TWIST-VIBE is a fast, high-resolution 4D imaging sequence for i.e. multi-arterial liver imaging and for thoracic, abdominal and pelvic application. It is a VIBE sequence with CAIPIRINHA capability providing high spatial resolution. The view-sharing mode provides temporal information to ensure the right contrast timing for different lesions. Dixon is used for fat-water separation.

LiverLab[4)]

Within the Abdomen Dot Engine, LiverLab is a system guided workflow to examine the hepatic fat and iron status. The Inline Dixon VIBE sequence gives the user a first overview of possible fat and/or iron overload in the whole liver. Based on the resulting images, liver segmentation runs without user interaction. If further evaluation is needed, the user can choose from two methods: HISTO is a push-button single-breathhold single-voxel spectroscopy method to calculate fat signal fraction as well as water R2; Multi-echo Dixon VIBE is an image based method to calculate maps such as water, fat, fat signal fraction, and R2*.

[1)] Precondition SWI (optional)
[2)] Prerequisite: Advanced Diffusion Package (optional)
[3)] Optional
[4)] Prerequisite: Abdomen Dot Engine (optional)

Advanced WARP[1)]

Advanced WARP enables the reduction of gross metal artifacts (i.e. through-plane artifacts) caused by large orthopedic implants. It contains the 2D TSE based SEMAC technique and is especially useful in the case of hip and knee joint replacements. Available protocols include T1-weighted, T2-weighted, proton density and STIR contrast.

RESOLVE (Advanced Diffusion package)[2)]

RESOLVE (Readout Segmentation Of Long Variable Echo-trains) delivers high-resolution low-distortion diffusion-weighted imaging (DWI) for accurate depiction of lesions. Additionally, this technique is largely insensitive to susceptibility effects, providing detailed anatomy-true diffusion imaging for brain, spine, breast and prostate. In combination with the DTI Tractography package, RESOLVE enables excellent white-matter tract imaging even in the most challenging areas, such as the cervical spine.
RESOLVE and QuietX DWI together make up the Advanced Diffusion package.

- Diffusion-weighted, readout-segmented (multi shot) EPI sequence for high-resolution susceptibility-insensitive DWI
- Variable number of readout segments for greater flexibility
- 2D navigator-based phase correction for pulsation artifact reduction and automatic reacquisition of corrupted data
- Inline calculation of diffusion tensor (DTI) and diffusion parameter maps

Tim Planning Suite

Easy planning of extended Field of View examinations in an efficient way using Set-n-Go protocols. It allows planning of several stations at once e.g. on composed localizer images. The overlap of slice groups can be adjusted. All stations can have independent parameter settings although they are displayed together. A special coupling mode allows easy positioning of all stations at once according to the patient's anatomy. Fully supports scan@center and Phoenix functionality.

- Tim Planning UI with optimized layout for slice positioning
- Ready to use Set-n-Go protocols for different clinical questions
- Integrated toolbar for fast advanced slice planning: FoV-Plus, FoV-Minus, AlignParallel, AlignFieldOfViews

[1)] MR imaging of patients with metallic implants brings specific risks. However, certain implants are approved by the governing regulatory bodies to be MR conditionally safe. For such implants, the previously mentioned warning may not be applicable.Please contact the implant manufacturer for the specific conditional information. The conditions for MR safety are the responsibility of the implant manufacturer, not of Siemens.

[2)] Optional

MapIt[1)]

MapIt provides protocols and Inline calculation functionality to obtain parametric maps of T1, T2, T2*, R2 and R2* properties of the imaged tissue. The application range includes cartilage evaluation of joints and also the evaluation of other organs such as liver, kidney or prostate.

- 3D VIBE sequence for Inline T1 mapping
- Multi-echo spin echo sequence for Inline T2/R2 mapping
- Multi-echo gradient echo sequence for Inline T2*/R2* mapping
- Protocols for fully automated Inline parametric mapping

SWI (Susceptibility Weighted Imaging)[1)]

Siemens-unique sequence technique for Susceptibility Weighted Imaging

- Visualization of local changes of the magnetic field due to tissue properties in general and due to the presence of deoxygenated blood or blood decomposition products
- 3D GRE sequence with full flow compensation to support venous angiography
- Enhanced susceptibility weighting of the magnitude images by phase images

Inline BOLD Imaging[1)] (Blood Oxygen Level Dependent)

Examination of intrinsic susceptibility changes in different areas of the brain, induced by external stimulation (e.g. motor or visual). Automatic real-time calculation of z-score (t-test) maps with Inline Technology, for variable paradigms.

- Compatible with single-shot EPI with high susceptibility contrast for fast multi-slice imaging
- ART (Advanced Retrospective Technique) for fully automatic 3D retrospective motion correction, for 6 degrees of freedom (3 translations and 3 rotations)
- Mosaic images for efficient storage and transfer of large data sets
- 3D spatial filtering
- Inline calculation of t-statistics (t-maps) based on a general linear model (GLM) including the hemodynamic response function and correcting for slow drifts
- Overlay of inline calculated statistical results on the EPI images

Simultaneous Multi-Slice (SMS)[1)]

SMS is a revolutionary method to significantly reduce imaging times for diffusion and BOLD imaging through excitation and readout of multiple slices simultaneously. It is the only acceleration technique that does not result in SNR-related losses due to sub-sampling. Implementation includes a multi-band pulse coupled with the blipped CAIPIRINHA technique to minimize g-factor related SNR penalties.

- For diffusion-weighted imaging, slice acceleration can be used to reduce scan time and/or achieve higher spatial/diffusion resolution.
- For BOLD, slice acceleration can be used to increase temporal sampling of BOLD data, for higher sensitivity to BOLD signal changes, and/or to increase slice coverage/resolution.
- SMS accelerated BOLD and diffusion-weighted protocols for the brain are provided.

[1)] Optional

Neuro Perfusion[1)]

Inline Perfusion helps to streamline the clinical workflow by automating post-processing perfusion data during data acquisition. This makes it possible to see the clinical results immediately and facilitates instantaneous image quality assurance. Inline perfusion functionality is user-configurable. Neuro Perfusion measures perfusion deficits and assist in the diagnosis and grading of e.g. vascular deficiencies and brain tumors.
Neuro Perfusion provides the inline calculation of relative Cerebral Blood Volume (relCBV), corrected relative CBV, relative Cerebral Blood Flow (rel CBF), relative Mean Transit Time (relMTT), Global Bolus Plot, Percentage of Baseline at Peak. It also features retrospective motion correction of the time series. Color display of the relMTT, relCBV, and relCBF maps are supported. Flexible selection of the Arterial Input Function (AIF) for more reliable analysis taking into account the dynamics over time of the contrast agent enrichment, as well as the use of automated local AIFs are available.

3D PACE[1)]

3D PACE (Prospective Acquisition CorrEction) enhances Inline BOLD imaging with motion correction during the acquisition of a BOLD exam.

In contrast to a retrospective motion correction that corrects previously acquired data, the unique 3D PACE tracks the head of the patient, correcting for motion in real time during the acquisition. This increases the data quality beyond what can be achieved with a retrospective motion correction.

3D PACE *(Continued)*

- Fully automatic 3D prospective motion correction during data acquisition, for 6 degrees of freedom (3 translations and 3 rotations)
- Motion correction covering the complete 3D volume
- Provides high accuracy functional maps by substantially reducing motion-related artifacts in t-test calculations
- Significantly increased signal changes in the activated neuronal volume
- Increased functional MRI (fMRI) sensitivity and specificity

DTI (Diffusion Tensor Imaging)[1)]

Acquisition of data sets with multi-directional diffusion weighting to assess anisotropic diffusion properties of brain tissue

- Measurement of up to 256 directions of diffusion weighting with up to 16 different b-values
- Inline calculation of the diffusion tensor
- Inline calculation of Fractional Anisotropy (FA) maps (grey-scale as well as color-coded for principle diffusion direction), Apparent Diffusion Coefficient (ADC) maps and trace-weighted images based on the tensor
- Measurement of user defined diffusion directions (Free Mode)

Diffusion Spectrum Imaging (DSI) is a type of diffusion weighted imaging. This technique allows for more accurate fiber tracking than conventional diffusion techniques due to a higher sensitivity to intra-voxel diffusion caused by crossing fiber tracks. The DSI acquisition technique comes as part of the DTI package.

- Cartesian sampling approach performed in q-space
- Measure multiple directions with independent b-values
- Up to 514 different directions

[1)] Optional

Inline Composing

Automatic anatomical or angiographic composing of multiple adjacent coronal or sagittal images for presentation and further evaluation.

Composed images can be automatically loaded into Graphical Slice Positioning for planning purposes.

TWIST[1)]

This package contains a Siemens-unique sequence and protocols for advanced time-resolved (4D) MR angiography and dynamic imaging in general with high spatial and temporal resolution. TWIST supports comprehensive dynamic MR angio exams in all body regions. It offers temporal information of vessel filling in addition to conventional static MR angiography, which can be beneficial in detecting or evaluating malformations such as shunts. TWIST can be combined with water excitation.
New reconstruction algorithms for iPAT^2 enable highly efficient multi-directional parallel imaging.

NATIVE[1)]

Integrated software package with sequences and protocols for non-contrast enhanced 3D MRA with high spatial resolution. NATIVE particularly enables imaging of abdominal and peripheral vessel

NATIVE offers:
- Non-contrast MRA
- Separate imaging of arteries and veins
- Visualization of – e.g. – renal arteries or peripheral vessels

The NATIVE package comprises:
- NATIVE TrueFISP
- NATIVE SPACE

QISS[1)]

Software package for non-contrast enhanced peripheral MR angiography based on quiescent interval single-shot imaging.

QISS *(Continued)*

- ECG triggered
- robust, 2D non-subtractive technology
- Set'n Go implementation (Dot AddIn) for workflow optimized application
- allows export of all images in one series (Combined View, CT-like)

ASL (Arterial Spin Labeling) 2D[1)]

Arterial Spin Labeling (ASL) is an MR technique using the water in arterial blood as an endogenous contrast agent to evaluate perfusion noninvasively. ASL provides unique insight into human brain perfusion and function by giving information on relative cerebral blood flow. ASL is capable of high spatial resolution perfusion imaging. ASL may also be useful in basic neuroscience, e.g. for studies of functional CBF changes.

- Fully compatible with iPAT
- Includes 3D PACE motion correction for increased reliability
- Fully automated Inline calculation of relative blood flow color maps
- Supports the “Pulsed Arterial Spin Labeling” – technique (PASL)

ASL (Arterial Spin Labeling) 3D[1)]

Arterial Spin Labeling (ASL) is an MR technique using the water in arterial blood as an endogenous contrast agent to evaluate perfusion noninvasively. ASL 3D provides valuable information regarding the nature of pathology by estimating whole brain perfusion without the use of a contrast agent.

ASL 3D is capable of high spatial resolution brain perfusion-weighted images

- Based on a 3D TGSE sequence for minimal low susceptibility and full brain coverage
- Higher SNR, optimized contrast uniformity and reduced motion sensitivity.
- Perfusion maps can be easily fused with anatomical images for detail evaluation in Neuro 3D[1)].

[1)] Optional

Advanced Cardiac[1)]	
This package contains special sequences and protocols for advanced cardiac imaging including 3D and 4D BEAT functionalities. It supports advanced techniques for ventricular function imaging, dynamic imaging, tissue characterization, coronary imaging, and more.	
BEAT is a unique tool for fast and easy cardiovascular MR imaging. It provides 1-click switch from cine imaging to tagging for wall motion evaluation and 1-click switch from 2D to 3D imaging. BEAT automatically adjusts all parameters associated with the changes.	
Cardiac and vessel morphology	• Multi echo technique thalassemia assessment
	• 3D aortopathy imaging with free breathing (SPACE)
Morphology and global or regional ventricular wall motion analysis with BEAT	• 3D cine acquisition for full CT-like heart coverage
	• 2D segmented FLASH for visualization of the regional wall motion using various tagging techniques (grid or stripes)
Dynamic myocardial imaging with BEAT	• Ultra-fast, high-SNR sequence for dynamic imaging with GRE EPI contrast for stress and rest exams
Tissue characterization with BEAT	• Robust myocardial tissue characterization with 3D PSIR (phase-sensitive inversion recovery)
	• Fast and complete coverage of the myocardium with IR 3D FLASH and TrueFISP
Coronary imaging with BEAT	• 3D whole heart non-contrast coronary MRA
	• 3D whole heart MRA with advanced free-breathing navigator compensating diaphragm shifts during the acquisition (motion-adaptive respiratory gating)

MyoMaps[1)]	
On the basis of fully system guided HeartFreeze Inline Motion Correction, MyoMaps provides pixel-based T1, T2 and T2* myocardial tissue quantification. Results are presented in fully system guided inline colored parametric maps of the heart.	
T1 Map	based on Modified Look-Locker Inversion Recovery T1 mapping
T2 Map	based on T2-prepared single-shot TrueFISP T2 mapping
T2* Map	based on a multi-echo segmented gradient echo acquisition with black blood preparation

[1)] Optional

Flow Quantification[1)]

Special sequences for quantitative flow determination studies

- Non-invasive blood/CSF flow quantification
- ECG Triggered 2D phase contrast with iPAT support
- Retrospective reconstruction algorithms for full R-R interval coverage

Interactive Realtime[1)]

Sequences for interactive real-time scanning

Uses ultra-fast Gradient Echo sequences for high image contrast

Real-time reconstruction of the acquired data

The user can navigate in all planes on-the-fly during data acquisition

- Real-time cardiac examinations
- Real-time interactive slice positioning and slice angulation for scan planning

Single Voxel Spectroscopy[1)]

Integrated software package with sequences and protocols for proton spectroscopy. Streamlined for easy push-button operation

- Matrix Spectroscopy – phase-coherent signal combination from several coil elements for maximum SNR based on the Head/Neck coil
- Spectral suppression (user definable parameter) to avoid lipid superposition in order to reliably detect e.g. choline in the breast
- Up to 8 regional saturation (RSat) bands for outer volume suppression can be defined by the user
- Automatic reference scan to allow less evaluation time
- Physiological triggering (ECG, pulse, respiratory or external trigger) in order to avoid e.g. breathing artifacts.
- Spectroscopy can be combined with Free-Breath Prospective Acquisition Correction (2D-Phase navigator) when needed
- Spectroscopy relevant GRE-based shim protocols provided
- Clinical applications: brain, breast, prostate

SVS Techniques SE and STEAM

- Short TEs available
- Fully automated adjustments including localized shimming and adjustment of water suppression pulses
- Also available: Interactive adjustments and control of adjustments
- Optimized protocols for brain applications

[1)] Optional

CSI 2D: Chemical Shift Imaging[1)]

Integrated software package with sequences and protocols for Chemical Shift Imaging (CSI)

Extension of the Single Voxel Spectroscopy (SVS) package, offering the same level of user-friendliness and automation

- Matrix Spectroscopy – phase-coherent signal combination from several coil elements for maximum SNR with configurable prescan-based normalization for optimal homogeneity
- 2D Chemical Shift Imaging
- Hybrid CSI with combined volume selection and Field of View (FoV) encoding
- Short TEs available (30 ms for SE, 20 ms for STEAM)
- Automated shimming of the higher order shimming channels for optimal homogeneity of the larger CSI volumes
- Weighted acquisition, leading to a reduced examination time compared to full k-space coverage while keeping SNR and spatial resolution
- Outer Volume Suppression
- Spectral Suppression
- Semi-LASER sequence available for CSI examination of the brain

CSI 3D: Chemical Shift Imaging[1)]

Integrated software package with sequences and protocols for Chemical Shift Imaging (CSI) Extension of the SVS package, offering the same level of user-friendliness and automation

- Matrix Spectroscopy – phase-coherent signal combination from several coil elements for maximum SNR with configurable prescan-based normalization for optimal homogeneity
- 3D Chemical Shift Imaging
- Hybrid CSI with combined volume selection and Field of View (FoV) encoding
- Short TEs available (30 ms for SE, 20 ms for STEAM)
- Automated shimming of the higher order shimming channels for optimal homogeneity of the larger CSI volumes
- Weighted acquisition, leading to a reduced examination time compared to full k-space coverage while keeping SNR and spatial resolution
- Outer Volume Suppression
- Spectral Suppression
- Protocols for prostate spectroscopy

[1)] Optional

GRACE (GeneRAlized breast speCtroscopy Exam)[1)]

SVS technique (spin echo sequence) optimized for breast spectroscopy.
The technique contains a special spectral lipid suppression pulse (user definable) for lipid signal reduction.

Siemens unique water reference detection to visualize the normalized choline ratio.

Online frequency shift correction for reduction of breathing related artifacts, Inline implementation – no additional user interaction is required.

***syngo* System Security Basic**

This *syngo* software version provides security settings to protect the scanner against known security threats.

- New Security Delivery process to frequently distribute security updates.
- Whitelisting (Embedded Control) against manipulation of scanner software.
- It also allows configuration of trusted nodes and DICOM encryption.
- Option to protect customer protocol trees against unauthorized modifications.

***syngo* System Security Enhanced[1)]**

The Security Enhanced option additionally allows the assignment of different user roles to users and the allocation of patients to different patient groups.

- It supports customers to implement their security policy including compliance with HIPAA (Health Insurance Portability and Accountability Act).

MR Elastography[1)]

MR Elastography can be used to non-invasively assess variations in relative tissue stiffness

MR Elastography includes pulse sequence and processing software.*
- Sequence and protocols with 2D gradient-echo sequences with cyclic motion-encoding gradients (MEG)

Advanced Siemens implementation
- iPAT enables shortened breathhold time
- Fully integrated processing of the elastogram at the scanner
- Completely automated calculation of wave images and corresponding elastograms
- Confidence map for reliability

* Please note that this functionality can only be used in combination with a dedicated hardware, which is not part of the MR Elastography package.

[1)] Optional

Expert-i[1)]	
Interactive real-time access to imaging data and exam information from any PC within the hospital network during the MR exam.	
Until now, radiologists or other experts had to stop what they were doing and go to the MR scanner to see the acquired images, help with the scan set-up, or answer an open question. Now, questions can be addressed quickly and efficiently via remote PC.	
Benefits of Expert-i	• Excellent results right from the first examination • Streamlined workflow and faster patient throughput • Reduced repeat rates with a check on images while the patient is still in the examination room • Reduced training effort by enabling expert assistance for specialized procedure
Remote Assist	
Direct computer link to the local Siemens service department or the Siemens service centers (via router with telephone connection)	
Image transfer for further evaluation	• Image and file transfer in batch mode • Reading of entries in the error logbook • Remote trouble shooting • Remote access to service manuals written in easy-to-use HTML format • Remote access to Service Site Database • Start of preventive maintenance and quality assurance routines. Provided in conjunction with a service contract with Siemens (UPTIME Services) • Remote access granted only with permission of the institution. Data security is ensured by secure access

[1)] Optional, within the hospital enterprise

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Post-processing Packages

Post-processing Packages

All post-processing packages are separately available for the *syngo* Acquisition Workplace or the *syngo* MR Workplace.

Argus 4D Ventricular Function[1)]

Argus 4D VF software processes MR cine images of the heart and generates quantitative results for physicians in the diagnostic process. It provides volumetric cardiac data of a given patient very quickly and easily. Parametric results and volume-time curves are being calculated upon automatic creation and adaptation of a 4D model of the left ventricle. The resulting 4D model of the patient's heart can be visualized superimposed to anatomical images as reference.

Argus 4D VF includes the well-known functionalities of Argus Function, the automated tool for cardiac function evaluation.

- Fully automatic left ventricle and semi-automatic right ventricular segmentation
- Easy user guidance with graphical selection of ED, ES, basal and apical slices
- Volumetric and regional wall motion analysis (e.g. stroke volume and bull's-eye plots)

Argus Flow[1)]

Automated tool for analysis of blood and CSF flow.

- Semi-automatic detection of regions of interest over time
- Color-coded display of velocity values
- Calculation of flow and velocity parameters (e.g. peak velocity, average velocity, flow, integral flow)

Argus Dynamic Signal[1)]

Automated tool for dynamic data analysis.

- Manual or automatic segmentation
- Automatic compensation of contours in regard to translation or deformation of organs over time
- Sector-based or ROI-based evaluation
- Evaluation of Time-to-Peak, Peak Value, Uptake Slope, Area under the Curve
- Graphical display of results in parametric bull's eye plots

Vessel View[1)]

Interactive analysis of vessel disease using MR or CT angiography data.

Viewing with VRT, MPR or MIP mode.

- Semi-automatic detection of vessel segments
- Quantification of changes in vessel size (e.g. stenosis graduating, aneurysm volume measurement)
- Protocol-based software for workflow support
- Creates and edits DICOM structured reports

Vessel View Artery-Vein-Separation[1)]

This package allows semi-automated segmentation and separation of arteries and veins, as well as suppression of surrounding tissue. Supports modes allowing the display of only arteries or only veins, or arteries and veins together in different colors. (Prerequisite: Vessel View)

[1)] Optional

3D VRT Volume Rendering Technique[1)]

3D visualization for clearer depiction of complex anatomy and relationship of anatomy in 3D for contrast MR Angiography and VIBE imaging.

More productive surgical planning and discussion with referring physicians.

- Integrated with other 3D functionality
- Color image creation
- Color gallery of icon presets
- Additional threshold-based segmentation of 3D objects
- Volume measurements

BOLD 3D Evaluation[1)]

Comprehensive processing and visualization package for BOLD fMRI. It provides a full set of features for clinical fMRI, as well as advanced features for more research oriented applications.

This package provides statistical map calculations from BOLD datasets and enables the visualization of task-related areas of activation with 2D or 3D anatomical data. This allows the visualization of the spatial relation of eloquent cortices with cortical landmarks or brain lesions.

On the *syngo* Acquisition Workplace the unique Inline function of BOLD 3D Evaluation merges, in real time, the results of ongoing BOLD imaging measurements with 3D anatomical data. Additionally, evolving signal time courses in task-related areas of activation can be displayed and monitored.

Functional and anatomical image data can be exported for surgical planning as DICOM datasets, additionally all color fused images and results can be stored or printed.

- Statistical map generation: paradigm definition, calculation of t-value map with General Linear Model or t-test
- 3D Visualization: fused display of fMRI results, color t-value maps on anatomical datasets
- Inline 3D real time monitoring of the fMRI acquisition
- On-the-Fly Adjustment for t-value thresholding, 3D clustering, and opacity control
- Data export to neurosurgical planning software
- Fly Through the Volume: Zoom, pan, rotate, cut planes
- Analysis of Signal Time Curves
- Data Quality Monitoring: B0 field map, cine display of the BOLD time series
- Archiving & Distribution of results and views as colored DICOM images and bit maps
- If the respective options are available, results from Diffusion Tensor Imaging and DTI Tractography can be displayed together with fMRI results and anatomy

[1)] Optional

DTI Evaluation[1)]

Offline post-processing to generate and visualize parametric maps derived from the diffusion tensor in order to assess anisotropic diffusion properties of brain tissue

- Generation of diffusion maps based on tensor including: Fractional Anisotropy (FA), Volume Ratio (VR), trace-weighted, ADC, E1–E3, E1, linear, planar, tensor maps
- Display of maps in scalar mode (grey scale), vectorized mode (directions color coded) and tensorized mode (using tensor graphics like ellipsoid or cuboids); overlay of maps onto anatomical images
- Side by side display of several maps (e.g. ADC, FA, and trace-weighted) and anatomy for simultaneous ROI based evaluation; generation of a results table in order to support the assessment of diseases of the white matter
- Integrated into Neuro 3D taskcard: display of DTI maps in the context of an anatomical 3D data set; arbitrary oriented clip planes allow to explore the 3D volume
- Fused display with white matter tracts if the "DTI Tractography" option is present.
- Export of reformatted images for neuro navigation
- Together with the "BOLD 3D Evaluation" option: simultaneous display of anatomical, fMRI, and DTI data

DTI Tractography[1)]

DTI Tractography allows the visualization of multiple white matter tracts based on diffusion tensor imaging data. DTI Tractography is optimized to support the presurgical planning and to allow for neuro physiological research with respect to connectivity and white matter pathology.

- Advanced 3D visualization of white matter tracts in the context of 2D or 3D anatomical and DTI datasets
- Texture Diffusion, a highly versatile in-plane visualization of white matter tracts, allows to display and read DTI Tractography results on PACS reading stations and in the OR
- Seed points for tracking with single ROI and with multiple ROIs to assess connectivity
- Tract and seeding ROI statistics (mean / max FA value, min / mean / max ADC value, and more)
- DICOM export of views, HTML export of Tract, and seeding ROI statistics
- Interactive QuickTracking displays the tract originating from the mouse pointer position while moving over the DTI data set

[1)] Optional

Neuro Perfusion Evaluation[1)]

Dedicated task card for quantitative processing of neuro perfusion data.

- Color display of relative Mean Transit Time (relMTT), relative Cerebral Blood Volume (relCBV), and relative Cerebral Blood Flow (relCBF)
- Flexible selection of Arterial Input Function (AIF) for reliable analysis. This function takes into account the dynamics over time of the contrast agent enhancement

Composing[1)]

Composing of images from different table positions.

- Automatic and manual composing of sagittal and coronal images
- Dedicated algorithms for spine, angiography, and adaptive composing algorithms
- Measurement on composed images (angle, distance)

Fly Through[1)]

Simulated endoscopic views of the inside of bronchi, vessels, colon, and any other hollow structures.

Multi-modality application for CT, MR, and 3D AX data.

Fully integrated into the familiar 3D workflow and user interface.

- Ready-to-use from day one
- One click to action

Spectroscopy Evaluation[1)]

Integrated software package with extensive graphical display functionality

Comprehensive and user-friendly evaluation of spectroscopy data

Display of CSI data as colored metabolite images or spectral overview maps, overlayed on anatomical images

- Export of spectroscopy data to a user-accessible file format
- Relative quantification of spectra, compilation of the data to result table

Automated peak normalization tissue, water or reference

New dedicated Single Voxel Spectroscopy breast evaluation protocols

Image Fusion[1)]

Image fusion of multiple 3D data sets with alpha blending, i.e. overlay of two images with manual setting of the opacity

- Multiple 3D data sets from different modalities (MR, CT, Nuclear Medicine, PET)
- Visual alignment, automatic registration, or landmark based registration

[1)] Optional

BreVis*[1)]

BreVis is easy-to-use, fast, and reliable. Quick preprocessing, which includes elastic motion correction in case of patient movement, enables efficient breast reading and reporting.

This flexible tool provides various functionalities such as:

- Intelligent visualization of 2D-, 3D- and 4D-datasets according to customized layouts, e.g. dedicated layouts for intervention, multiple time point follow-up
- Elastic Motion Correction
- Multi-modality viewing capabilities
- Reporting according to BI-RADS** standard
- On-the-fly reconstruction of subtracted images
- Auto-MultiPlanar Reformatted images (MPR) and auto-Maximum Intensity Projection (MIP)
- Real-time display and analysis of kinetic parameters (timecourse evaluation, color overlay maps to visualize angiogenesis or curve types)
- Graphical volume statistics of lesion enhancement
- Calculation of lesion volumes

* Not available on MR AWP

** Breast Imaging Reporting and Data System

BreVis Biopsy[1)]

BreVis Biopsy is a professional solution for a fast and accurate MR biopsy workflow with automatic calculation of target coordinates.

The easy-to-handle workflow enables shorter examination times to the benefit of both the patient and operator. The user interface offers a guide for MR breast interventional planning, supporting, e.g., the following biopsy system:

- 4-channel BI Breast Coil
- Related accessories for the post-pillar and grid methods.

BreVis Biopsy enables path planning directly at the scanner – no sending of data over the network required.

Breast Biopsy Software[1)]

Easy to use *syngo*-based post-processing software helps finding the coordinates for needle insertion for biopsy or localization of breast lesions detected by MR

Allows calculation of the coordinates after clicking the center of the lesion and the 0 marker of an third party breast biopsy device

- Printout of working sheet
- Multi-lesion calculation

Prerequisites • 4-channel BI breast coil

Soft Tissue Motion Correction[1)]

3D elastic motion correction, for offline 3D correction in all directions over entire 2D and 3D data sets suitable for e.g. soft tissue MR exams.

Allows higher conspicuity and accuracy especially for multi-focal lesion detection.

New image data is reconstructed and saved in a separate series within the patient browser. It can be combined with the original non-corrected image data.

[1)] Optional

Tissue 4D[1)]	
Tissue 4D is an application card for visualizing and post-processing dynamic contrast-enhanced 3D datasets; it includes the Tofts model.	
Evaluation options	• Standard curve evaluation • Curve evaluation according to a pharmacokinetic model
Visualization features	4D visualization (3D and over time)
	Color display of parametric maps describing the contrast media kinetics such as: • Transfer constant (Ktrans) • Reflux constant (Kep) • Extra vascular extra cellular volume fraction (Ve) • Initial Area-Under-Curve (iAUC) for the first 60 seconds
	Additional visualization of 2D or 3D morphological dataset
Post-processing features	Elastic 3D motion correction
	Fully automatic calculation of subtracted images
Pharmacokinetic model	Pharmacokinetic calculation on a pixel-by-pixel basis using a one-compartment model.
	Calculation is based on the Tofts model. Various model functions are available.
	Manual segmentation and calculation on the resulting images.
	The following resulting images can be saved as DICOM images: • 3D motion-corrected, dynamic images • Colored images • Storage of calculated results • Export of results in the relevant layout format

[1)] Optional

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MAGNETOM Amira

***syngo*.via and MAGNETOM Amira**

syngo.via and MAGNETOM Amira

syngo.via is our advanced imaging software, creating an exciting experience in efficiency and ease of use – anywhere[1]. *syngo*.via is your agent for productivity throughout your radiology workflow. From scanning to result sharing.

Integrated Engine concept	
The Engine concept integrates the scanning and reading processes into one holistic workflow and enables you to maximize your scanner and application investment.	
Key features	The Dot (Day optimizing throughput) engines optimize the performance of MAGNETOM Amira and offer patient personalization, user guidance, and exam automation.
	syngo.via offers reading workflows, which are optimally adjusted to the Dot engines for the best reading outcomes
	The scanning and reading workflows are easily customizable to the user's standards of care.
	Results from the scanner are optimally displayed in the reading workflows.
Key benefits	Guidance, standardization and flexibility is offered for every step of the workflow, reducing the need for further inquiry
	Increasing throughput, minimizing recalls, and enhancing quality of care.

1) Prerequisites include: internet connection to clinical network, DICOM compliance, meeting of minimum hardware requirements and adherence to local data security regulations

Direct Image Transfer (DIT)	
After completion of a series of images, they are transferred automatically to *syngo*.via. Easily view the images with any *syngo*.via client immediately after they were acquired.	
Key features	This data will be automatically transferred to the *syngo*.via data base and loaded into the related workflow. Enhanced DICOM MR enables the transfer of data and data in DICOM standard format. *syngo*.via and any PACS supporting this standard can work with this data.
Key benefits	Images are immediately available throughout the institution. This enables fast and convenient feedback from everywhere.
Direct Image Transfer Pro	The MAGNETOM scanner and *syngo*.via server are directly connected, enabling image transfer.
Seamless workstation integration	
syngo.via. integrates smoothly with *syngo* MultiModality Workstation (MMWP). Open MMWP directly out of *syngo*.via, and vice versa.	
Key features	Remotely open the same patient at the MMWP easily with Expert-i
	The MMWP results can then be easily integrated into the *syngo*.via report
	syngo.via client can be opened from any MMWP with one click
Key benefits	Remote and easy access of all MMWP applications
	Smooth integration of results into *syngo*.via

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MAGNETOM Amira

Parts & Accessories

Parts & Accessories

Patient Video Monitoring

Dedicated MAGNETOM Amira video camera for comprehensive patient observation in the examination room.

- Up to two in-room cameras for optimized patient observation from front end and rear-end
- Color 640×480 pixel LCD monitor may be positioned at the *syngo* Acquisition Workplace or at a convenient wall location

Remote Viewing Monitor

Color LCD monitor (1280×1024) to be connected in parallel to the Workplace monitor.

Data transfer via ethernet for high signal quality over a long distance allows the computer and user to be located anywhere on the 100 or 1000 Mbps network with full routing of data across routers, switches and subnets (1 Gbit/s recommended).

The system supports SSL (Secure Sockets Layer) via a TCP/IP connection. All media streams transferred in the network are encrypted.

syngo MR Workplace

Additional integrated Workplace with host computer for post-processing and image evaluation.

Same user interface as the *syngo* Acquisition Workplace, except for scan control.

Shared database with *syngo* Acquisition Workplace, therefore eliminating image copy time.

Host Computer and LCD Monitor technical data: refer to “Computer System” section of the main data sheet.

Workplace Table

Ergonomically designed table for:

- Color monitor
- Keyboard
- Mouse
- Patient communication unit
- Patient supervision display

Patient Transport Stretcher

MR-compatible design on wheels for transporting a patient into the examination room.

- Non-ferromagnetic, height-adjustable design
- Trendelenburg positioning possible

Max. patient weight	160 kg (350 lbs)

Coil Storage Cart			
Specially designed non-ferromagnetic cart for easy storage of some of the most commonly used coils and accessories			
May be rolled to convenient locations in the examination room			
Additional storage space on the inside of the doors when doors are opened			
Coil storage	Width	cart closed	140 cm (4’7”)
		cart opened	280 cm (9’2”)
	Depth		54 cm (1’9”)
	Height		121 cm (3’12”)
Upper drawer	Height		13.3 cm
Tray	Height		9.0 cm
Lower drawer	Height		24.0 cm

> Additional optional accessories and consumables for MR:
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