MAGNETOM Sola

A BioMatrix System

Datasheet based on *syngo* MR XA11

siemens.com/sola

SIEMENS Healthineers

Embrace human nature with BioMatrix

Patients have unique, individual characteristics. Their different physiologies and anatomies – but also the way we interact with them and with technology – cause unwarranted variations.

These unique human characteristics – biovariabilities – pose significant challenges in MRI: Inconsistent exams. Poor image quality. Increased need for rescans. Unpredictable scheduling. They all can negatively impact the quality and cost of the care you provide.

BioMatrix technology helps to overcome these challenges with a whole new approach: by embracing human nature. Instead of expecting patients to adjust to the technology, BioMatrix automatically adjusts to the patient. BioMatrix Sensors, Tuners, and Interfaces allow you to anticipate motion, adapt to the patient, and to simplify and accelerate patient preparation – no matter who comes next.

"To provide our patients with individual therapies, we need every piece of information available. In imaging, this means we need robust, standardized, and reproducible image data, always of the same quality regardless of the patient or user. BioMatrix Technology gives us this data quality and comprehensive image information and is helping us on our way to quantitative radiology."

Professor Konstantin Nikolaou, M.D.
University Hospital Tübingen, Germany

BioMatrix Technology

Anticipate motion for high-quality results with BioMatrix Sensors.

Adapt to challenging anatomies for reliable exams with BioMatrix Tuners.

Accelerate patient preperation for increased efficiency with BioMatrix Interfaces.

BioMatrix Technology

Anticipate motion for high-quality results

BioMatrix Sensors

Respiratory Sensors
The Respiratory Sensors automatically detect breathing patterns as soon as the patient lies on the table. This provides a simplified workflow as respiratory triggered scans can be performed without additional user interaction.

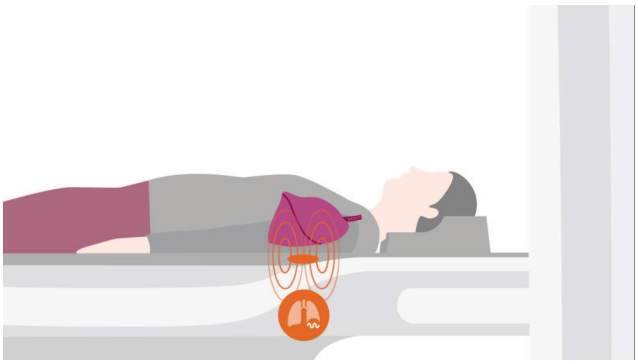
Kinetic Sensor
The Kinetic Sensor enables the operator to monitor head movement visually during head examinations. It is a wing-shaped 4-camera solution with a slim profile, which is mounted to the bore ceiling inside the MR scanner close to the isocenter.

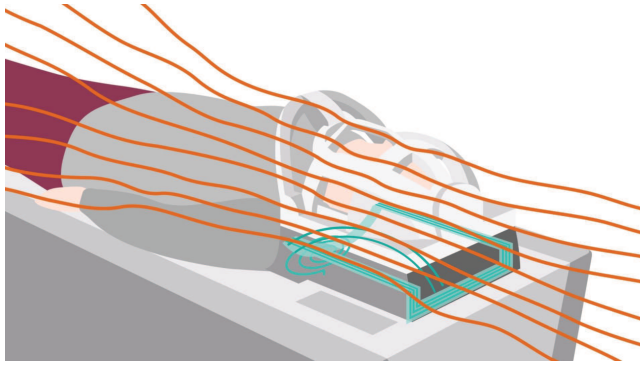
Adapt to challenging anatomies for reliable exams

BioMatrix Tuners

CoilShim
Integrated into the new BioMatrix Head/Neck coils, CoilShim increases diagnostic quality and reduces the need for repeat scans by delivering improved fat saturation and better DWI quality in the neck region. CoilShim technology ensures that the challenging area is automatically and optimally shimmed for reproducible quality in every patient.

SliceAdjust
SliceAdjust technology provides distortion-free whole-body DWI scans as well as reliable fat saturation for both DWI and TSE sequences. It avoids broken spine artifacts in whole-body DWI for excellent correlation with anatomical scans.





Accelerate patient preparation for increased efficiency

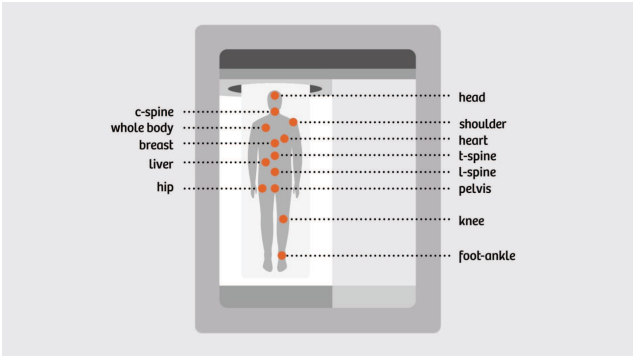
BioMatrix Interfaces

Select&GO
With one-touch positioning on the Select&GO touch display based on the underlying BioMatrix Body Model artificial intelligence is employed to accelerate patient positioning by up to 30%[1]. Delays due to incorrect positioning can now be avoided. The user simply selects the region or organ to be scanned on the touch display and the patient is automatically and precisely positioned for the respective scan

- Select&GO suggests scan scenarios based on the set of coils plugged in.
- Precise positioning is empowered by an intelligent anatomical body model for organ localization.
- Use cases without upfront patient registration are supported.
- Physiological curves and guidance for patient set up of triggering device are displayed.
- Breast biopsy planning results can be displayed for both Grid method and Post Pillar method .

Further functionalities include:

- In-bore ventilation (6-step regulation)
- In-bore lighting (6-step regulation)
- Headphone volume adjustment (25-step regulation)
- In-room loudspeaker adjustment (25-step regulation)
- Start scan
- Alarm off



- MoodLight regulation for Sola
- Continuous table movement at two predefined speed levels
- Automatic transfer from any vertical position to home position
- Automatic transfer to isocenter
- Automatic transfer from any horizontal position to home position
- Laser light localization, horizontal table movement, lighting adjustments, and ventilation are also possible from the console

Technology
Color TFT-LCD (LED Backlight), Projective Capacitive Touch Technology (PCAP)

Screen Size
10.4", 4:3

Screen Matrix
1024 x 768 pixels

Color Depth
24 bit

BioMatrix Dockable Table with eDrive[2]
The BioMatrix dockable table with eDrive support provides motorized assistance so that even the heaviest patient can be effortlessly moved to and from the scanner.

[1] Data on file, results may vary.
[1] Optional

Embrace human nature at 1.5T with MAGNETOM Sola

- First 1.5T BioMatrix system, reducing unwarranted variations
- New 1.5T magnet, 70 cm Open Bore and large 50 x 50 x 50 cm^3 FoV
- New BioMatrix Sensors for increased consistency – capturing respiratory, cardiac, and head motion
- Expanded BioMatrix Tuners for excellent homogeneity –adapting to challenging body regions
- Enriched BioMatrix Interfaces to ease patient preparation – enabling 30% faster patient positioning[1)]
- Free-breathing exams with Compressed Sensing for higher patient comfort
- Push-button exams and GO technologies powered by AI technology for increased patient throughput
- New accelerated applications with Simultaneous Multi-Slice reducing scan time by up to 46% for comprehensive MSK exams[1)]
- New anatomy-adaptive coils for improved patient experience
- New user environment with syngo MR XA11 for intuitive handling
- Efficient energy management with EcoPower for cost-effectiveness

[1)] Data on File, Results may vary.

The world's first
1.5T BioMatrix system

DirectRF Technology

Transmit Technology		
Frequency stability (5 min)	$\pm 2 \times 10^{-10}$	
Frequency control	32 bits (0.03 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)	
	Real-time Feedback loop for unmatched RF stabilization	
Transmitter path	Transmit amplitude	16 bit control 25 ns resolution
	Gain stability (after first minute)	< 0.1 dB (1 s) < 0.5 dB (5 min) incl. body coil
Transmit amplifier	Extremely compact, water-cooled solid state amplifier, fully integrated at the magnet as part of DirectRF technology	
	Transmit amplifier bandwidth	500 kHz
	Peak power	29.2 kW

DirectRF Technology

RF Receiver Technology

The Total imaging matrix optimizes coil positioning and virtually eliminates coil changing times. It also features Dual-Density Signal Transfer technology 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	Maximum number of channels[1)]	204
	Number of independent receiver channels that can be used simultaneously in one single scan and in one single FoV, each generating an independent partial image	32, 48, 64[2)]
	Quadrature demodulation and filtering	Digital
	Receiver bandwidth	500 Hz –1 MHz (for each channel)
	Receiver signal resolution	32 bit
	ADC sampling rate	80 MHz
	Dynamic range at coil connector (referred to 1 Hz resolution bandwidth)	164 dB instantaneous at receiver 169 dB with automatic gain control at local coil connector

[1)] Channels (coil elements) that can be connected simultaneously
[2)] Optional

Patient Handling

General

BioMatrix Interfaces, Tim 4G and Dot help increase patient comfort and improve workflow efficiency.

- BioMatrix Interfaces simplify how the user interacts with the MRI scanner. One-touch positioning using the Select&GO touch display with the underlying BioMatrix Body Model accelerates patient positioning - powered by artificial intelligence. Delays due to incorrect positioning can now be avoided. The user simply selects the region or organ to be scanned on the touch display and the patient is automatically and precisely positioned for the respective scan.
- Set up the patient once, no repositioning, no changing of coils needed
- Scan range of 205 cm allows whole-body examinations with full usage of the surface coils, without the need for patient repositioning
- Imaging with optimized high coil element density ultra-light weight surface coils
- 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
- DotGO gives the user advice during the positioning process, on the Select&Go displays, – very helpful in the case of ECG, for example

Patient Positioning Aids

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

Table

Comfortable patient table solution which fits the needs for patients up to 250 kg supporting full weight capacity in vertical and horizontal movement. Integrated coils for fast patient preparation and enhanced user comfort. Scan range up to 205 cm. Integrated infusion stand and paper roll holder.

Max. patient weight for vertical and horizontal table movement	250 kg (550 lbs)	
Max. scan range	205 cm	

Users can adjust the table speed with two predefined speed mode buttons or accelerate continuously with the jog-wheel on the Select&GO Control Centers

Vertical table movement	Range	52–97 cm + 5cm[1)] +13 mm[2)]
	Speed	32 mm/s; one click table up
Horizontal table movement	Max. range	2665 ± 10 mm
	Max. speed	200 mm/s
	Repositioning accuracy[3)]	± 0.5 mm

Capable of continuous table movement during scan

[1)] Including Heightening Kit, if necessary
[2)] Depending on the floor conditions
[3)] Accuracy for repositioning from one direction

Patient Handling

Physiological Measurement Unit (PMU) – Wireless Physio Control

Synchronizes the measurement with physiological cycles (triggering to minimize motion artifacts caused by cardiac and respiratory movements). The physiological curves are visualized at the Select&GO Display.

Wireless Sensors	Wireless Vector ECG / respiration and pulse[1)] sensors for physiologically synchronized imaging, rechargeable battery-powered – for optimized patient handling
Physiological Signals	• ECG (3 channels) • Pulse[1)] • 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 Pulse Triggering[1)]: • 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[1)] (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.

- 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 breath-hold examinations
- Automatic mute of music to ensure a proper patient communication
- Two-way intercom communication, i.e. the patient and user in the control room can speak and be heard by the other party simultaneously

[1)] Optional

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 gradient coil and cover, and 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
- Unique design with thermally balanced materials to minimize physical interactions between core components.
- Acoustic decoupling between magnet and cover

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 93% reduction in sound pressure[1)]:

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

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

[1)] Data on file, Results may vary.
[2)] Prerequisite: SWI license (Optional)

Acquisition Parameters

Acquisition Parameters[1)]	AWP	
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
- Analysis Tools for addition, subtraction, division, multiplication, calculations of ADC maps and b-value images
- Image Filter
- 3D post-processing MPR, MIP, MinIP, VRT
- Data storage of images on CD/DVD with DICOM viewer
- Export of cine AVI files on external media
- 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 pulse sequences and View Angle Tilting (VAT), tailored to reduce susceptibility artifacts caused by orthopedic MR Conditional[1)] 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 • 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 for the reduction of susceptibility artifacts caused by MR Conditional[1)] metal implants.

[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.

Standard Acquisition and Reconstruction Techniques

Gradient Echo family of sequences	• 2D/3D FLASH (spoiled GRE) – dual echo for in-/opposed phase imaging 3D VIBE (Volume Interpolated Breath-hold 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) • RESOLVE (Readout Segmentation Of Long Variable Echo-trains) delivers high-resolution, low-distortion diffusion-weighted imaging (DWI) for accurate depiction of lesions. • 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 • High-resolution imaging of brain

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 and thorax 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 Acquisition and Reconstruction Techniques

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
	T-PAT with mSENSE and GRAPPA for advanced parallel imaging provides fast high-resolution dynamic imaging
	3 different calibration techniques are supported: • AutoCalibration with an integrated reference (calibration) scan to additionally save on total scan time (RefScan: Integrated) • TurboCalibration uses a separate measurement directly before the actual measurement (RefScan: External). 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 breath-hold 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
	The iPAT² sequence technique named CAIPIRINHA (Controlled Aliasing In Parallel Imaging Results IN Higher Acceleration) is available. It can be applied to volumetric 3D imaging e.g. in the abdominal region.

Standard Acquisition and Reconstruction Techniques

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 pulse sequences • 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, e.g. for cardiac imaging • Allows examination of patients with free breathing
2D PACE Precise Motion Correction	• Detects respiratory motion of the heart, liver, etc. for free-breathing high resolution 2D and 3D examinations • Significantly increased image quality • Improved tissue imaging in moving organs and precise gating for multi-breath-hold studies • Data acquisition during free breathing for high resolution 2D and 3D examinations • Eliminates the need for respiratory belt • PAT averaging for motion artifact suppression using Self-Calibration
PSIR HeartFreeze (Phase-Sensitive Inversion Recovery)	• Motion correction/averaging of multiple measurements with iPAT, ePAT or T-PAT accelerated single-shot TrueFISP or GRE images of the heart, for free-breathing acquisition
Standard Susceptibility Artifact Reduction	
WARP & Advanced WARP	• WARP – 2D TSE sequence combining optimized high-bandwidth pulse sequences 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 pulse sequences 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 technique 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.

Standard Acquisition and Reconstruction Techniques

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. Additionally the "LocalRange" Positioning Mode can be used for regions like e.g. the Heart or the Brain, using a tolerance with a fix table position. This increases the scan efficiency by reducing Adjustment time.
AutoVoiceCommands	These multi-language automatic voice commands during the scan assist the user in providing optimal timing of breathing, scanning, and contrast media injection.
Phoenix and PhoenixZIP	Exchange of pulse sequences data (e.g. via Internet) by drag & drop of 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 BioMatrix Head/Neck 20, BioMatrix Spine 32[3], Pediatric 16[1, 2], Foot/Ankle 16[1]
SlideConnect	SlideConnect cable connectors can be securely plugged-in with one hand only.

[1] Optional
[2] 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.
[3] Tim [204x64]

Standard Acquisition and Reconstruction Techniques

Standard Workflow Enhancements *(Continued)*

Recon&GO technology – Zero-click post-processing

Recon&GO technology encompasses a wide range of Inline functionalities to help streamline the clinical workflow by automating post-processing steps before image viewing.

Recon&GO provides Ready-to-Read results with zero clicks, even for advanced cases. Examples:

- Inline Composing: automatic composing of multiple adjacent coronal or sagittal images for anatomical or angiographic examinations.
- Inline Substraction: Automatic subtraction of images, e.g. pre- and post-contrast enhancements
- Inline calculation of ADC and extrapolated b-values
- Inline 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 and diffusion maps
- Automatic on-the-fly calculation of standard deviation, for better differentiation of arterial and venous phases
- Automatic launch of post-processing applications
- Inline Display: automatically shows reconstructed images. It offers immediate access to the results and opens automatically for e.g. interactive real-time scanning or Care Bolus examinations
- Inline Movie: automatically starts the cine image display

TimCT FastView

TimCT FastView is the “one go” localizer for the whole-body or large body regions such as the whole spine or the whole abdomen. It acquires the complete extended Field of View in one volume with isotropic resolution. Transverse, coronal and sagittal reformats of the volume are calculated in-line and displayed for planning subsequent exams.

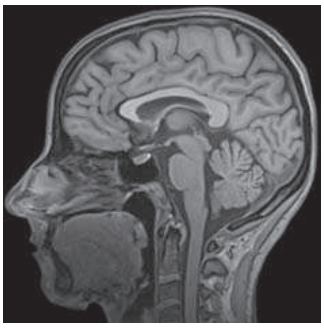
- Inline reconstruction of the localizer images during the scan
- Localizing images in three planes over the maximum Field of View available for subsequent planning in all orientations
- TimCT FastView runs without laser light positioning to further streamline the workflow for several indications

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 Sola.

- 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 pulse sequences and motion-insensitive pulse sequences for patients which have difficulties to lay still are provided. The Neuro Suite also includes pulse sequences 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.

Tim Application Suite

Neuro Suite *(Continued)*

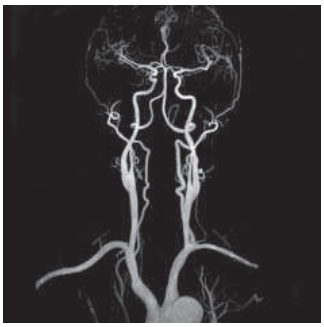
General features

- Fast 2D imaging with TSE and GRE pulse sequences for high-resolution imaging
- BLADE for motion-insensitive TSE imaging
- EPI pulse sequences 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. For reduced distortions and homogeneous signal intensity even in the presence of challenging susceptibility interfaces and at station boundaries, SliceAdjust (slice-by-slice adjustments) can be selected.
- 3D TOF for non-contrast-enhanced angiography
- 3D isotropic resolution volume imaging using T1 3D MPRAGE/3D FLASH, SPACE DarkFluid, T1 SPACE, and T2 SPACE pulse sequences
- High-resolution T2 SPACE pulse sequence optimized for inner ear examinations
- Double Inversion Recovery 3D pulse sequences (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 pulse sequences in multiple steps with software controlled table movement
- 2D and 3D MEDIC pulse sequences for T2-weighted imaging, particularly for C-spine examinations in axial orientation where reproducibility is difficult due to CSF pulsations and blood flow artifacts
- RESOLVE (Readout Segmentation Of Long Variable Echo-trains) delivers high-resolution, low-distortion diffusion-weighted imaging (DWI) for accurate depiction of lesions
- BioMatrix's CoilShim helps reduce patient-induced strongly localized B0 inhomogeneities as may arise, e.g., in the neck region.
- 3D Myelo with 3D HASTE 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.
- TGSE sequence used primarily for T2-weighted imaging for shorter measurement time, decreased RF power deposition, and high resolution imaging of the brain
- AutoAlign Head LS providing a fast, easy, standardized, and reproducible patient scanning supporting reading by delivering a higher and more standardized image quality

[1)] Optional

Tim Application Suite

Angio Suite



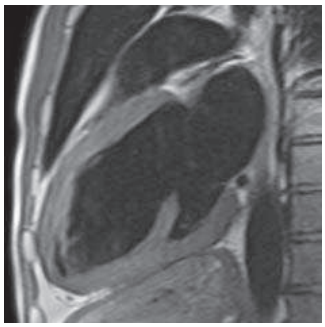
Excellent MR Angiography can be performed to visualize arteries and veins.
- 3D MRA pulse sequences for carotid arteries, abdominal arteries, and peripheral arteries, with short TR and TE. The strong gradients make it possible to separate the arterial phase from the venous phase
- Dynamic MRA for 3D imaging over time
- Signal from Respiratory Sensors can be selected to actively trigger MR image acquisition, e.g. with NATIVE[1)]

Contrast-enhanced MRA	• 3D contrast-enhanced MRA pulse sequences for dynamic, carotid, abdominal, and peripheral arteries, 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 pulse sequence after the 2D bolus control scan • Dynamic ce-MRA for 3D imaging over time
Non-contrast MRA and venography	• Time-of-Flight (ToF) pulse sequences for MRA for the Circle of Willis, carotids and neck vessels; can be adapted for venography • Triggered 2D ToF sequences for non-contrast MRA in the legs • MR venography and arteriography with Phase-Contrast • TONE (Tilted optimized non-saturating excitation) techniques for improved Contrast-to-Noise Ratio (CNR)
In-line image processing tools	• 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

[1)] Optional

Tim Application Suite

Cardiac Suite



The cardiac suite covers comprehensive 2D routine cardiac applications, ranging from morphology and ventricular function to tissue characterization. It moreover features BEAT 2D in conjunction with iPAT, T-PAT, and ePAT 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	• Breath-hold 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 • 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.

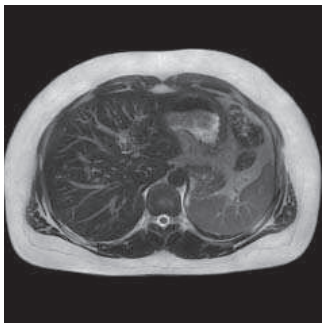
Tim Application Suite

Cardiac Suite *(Continued)*	
Tools for rapid evaluation of left or right ventricular function:	• Acquisition of a stack of short-axis slices (standard: 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) • Pulse sequences for whole-heart coverage • Integration of Compressed Sensing Cardiac Cine[1)] for highest temporal and spatial resolution (segmented and real-time pulse sequences) • Real-time imaging in case the patient is not able to hold his breath
4D imaging and tissue characterization with BEAT Pulse sequences for high-contrast and high-resolution tissue characterization	• Pulse sequences for stress and rest imaging with TurboFLASH contrast support the acquisition of multiple slices with high resolution and arbitrarily adjustable slice orientation for each slice • T-PAT and ePAT 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) pulse sequences with TrueFISP and FLASH contrast. Magnitude and phase-sensitive images with one acquisition. • Simple: no adjustment of inversion time (TI) necessary with PSIR technique • Motion correction/averaging of multiple measurements with iPAT or tPAT accelerated single-shot TrueFISP or GRE images of the heart, for free-breathing acquisition

[1)] Optional

Tim Application Suite

Body Suite



The Body Suite is dedicated to clinical body applications. Ultra-fast high resolution 2D and 3D pulse sequences are provided for abdomen, pelvis, MR Colonography, MRCP, dynamic kidney, and MR Urography applications.
2D PACE technique makes body imaging easy, allowing multi-breath-hold 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 HASTE (RESTORE) and 2D/3D TSE – it is possible to use a phase navigator, which measures respiratory induced off-resonance effects. The positioning can be done automatically for most pulse sequences.
- Optimized fast single-shot HASTE pulse sequences and high-resolution 3D pulse sequences based on SPACE and TSE for MRCP and MR Urography examinations
- REVEAL: diffusion imaging for abdomen and whole-body exams. For reduced distortions and homogeneous signal intensity even in the presence of challenging susceptibility interfaces and at station boundaries, SliceAdjust (slice-by-slice adjustments) can be selected.
- In pulse sequences 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=5000 s/mm^2) is possible.
- Signal from Respiratory Sensors can be selected to actively trigger MR image acquisition.

Abdomen

2D:

- T1 (FLASH) breath-hold scans with and without FatSat (SPAIR, Quick FatSat, in-/opp-phase)
- T2 (HASTE, TSE/BLADE, EPI) breath-hold scans with and without FatSat (SPAIR, FatSat, STIR)
- 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 pulse sequences and high-resolution pulse sequences based on SPACE and TSE for MRCP and MR urography examinations

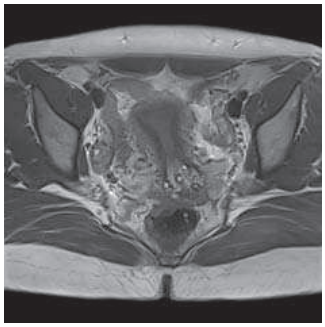
Tim Application Suite

Body Suite *(Continued)*	
Abdomen	3D: • Dixon (VIBE 2pt-Dixon) breath-hold scans, following contrasts can be obtained: in-phase, opposed phase, fat and water image • Dynamic (VIBE and Quick-FatSat) pulse sequences with Inline motion correction for visualization of focal lesions with high spatial and temporal resolution • Colonography dark lumen with T1-weighted 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=5000 s/mm^2) is possible.
Pelvis	• High-resolution T1, T2 pelvic imaging • Isotropic T2 SPACE 3D pulse sequences • Dynamic volume examinations with 3D VIBE
Thorax	• High-resolution T1, T2 thorax imaging • Motion-insensitve pulse sequences (BLADE, HASTE) • TrueFISP pulse sequences for imaging of respiratory mechanics • Dynamic imaging with TWIST[1)], TWIST-VIBE[1)] • Non-contrast-enhanced vessel visualization with SPACE pulse sequences • STIR pulse sequences for the evaluation of lymph nodes • Diffusion-weighted imaging with REVEAL

[1)] Optional

Tim Application Suite

Onco Suite



MR imaging provides excellent soft-tissue differentiation, multi-planar capabilities, and the possibility of selectively suppressing specific tissue, e.g. fat or water. The Onco Suite features a collection of pulse sequences 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 pulse sequences for highly sensitive visualization of focal lesions
- Dynamic imaging pulse sequences 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, MIP-time and combination maps with Inline technology
- 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-weighted imaging with multiple b-values. In pulse sequences 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 = 5000 s/mm^2) is possible. For reduced distortions and homogeneous signal intensity even in the presence of challenging susceptibility interfaces and at station boundaries, SliceAdjust (slice-by-slice adjustments) can be selected.
- RESOLVE: high-resolution, low-distortion diffusion-weighted imaging (DWI). In pulse sequences 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=5000 s/mm^2) is possible.

Prostate pulse sequences

- Dedicated prostate pulse sequences for a variety of clinical scenarios
- T1-weighted 3D VIBE pulse sequences with high temporal resolution (VIBE, TWIST[1)] and TWIST-VIBE[1)]) allow time course evaluation
- Prostate spectroscopy (3D CSI[1)] volume scan) with up to 8 sat bands (suppression of water and fat signal)

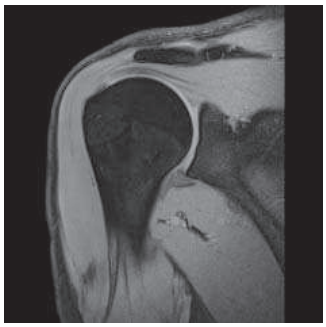
Whole-Body imaging

- TSE STIR pulse sequences for head-to-toe and head-to-pelvis imaging
- Dedicated pulse sequences for focus regions head, neck, thorax, abdomen and pelvis
- Diffusion-weighted imaging with REVEAL including SliceAdjust

[1)] Optional

Tim Application Suite

Ortho Suite



The Ortho Suite is a comprehensive collection of pulse sequences for joint imaging including the spine.

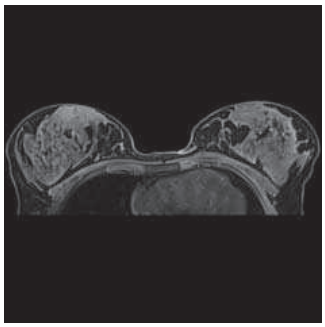
General features

- 2D TSE pulse sequences for PD, T1, and T2-weighted contrast with high in-plane resolution and thin slices
- 3D MEDIC, 3D TrueFISP pulse sequences with water excitation for T2-weighted imaging with high in-plane resolution and thin slices
- High resolution 3D VIBE pulse sequences for MR Arthrography (knee, shoulder, and hip)
- 3D MEDIC, 3D TrueFISP, 3D VIBE pulse sequences with Water Excitation having high isotropic resolution optimized for 3D post-processing
- T1 and PD SPACE 3D imaging with high isotropic resolution optimized for post-processing
- Single-step, and multi-step whole-spine pulse sequences
- Excellent fat suppression in off-center positions, e.g. in the shoulder due to high magnet homogeneity
- Dynamic TMJ pulse sequence (different joint positions)
- Dynamic ilio-sacral joint protocol for contrast dynamics
- Multi Echo SE sequence with up to 32 echoes for T2 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 pulse sequences and View Angle Tilting (VAT), tailored to reduce susceptibility artifacts caused by orthopedic MR Conditional[1)] implants. This helps in evaluation of soft tissue in proximity of the implants. Available pulse sequences 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 technique and is especially useful in the case of hip and knee joint replacements. Available pulse sequences include T1-weighted, proton density, and T2 TSE 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.

Tim Application Suite

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 acquisition times by using iPAT with GRAPPA and CAIPIRINHA.
Customized pulse sequences (e.g. with fat saturation or water excitation or silicone excitation), as well as flexible multiplanar visualization allow a fast, simple and reproducible evaluation of MR breast examinations.

General features

This package includes:

- High-resolution 2D pulse sequences for morphology evaluation
- High-resolution 3D pulse sequences covering both breasts simultaneously
- Pulse sequences to support interventions (fine needle and vacuum biopsies, wire localization)
- Pulse sequences 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.

Tim Application Suite

Breast Suite *(Continued)*	
General features	• iPAT with GRAPPA for maximum resolution in short time • iPAT² with CAIPIRINHA that allows state-of-the-art sagittal breast imaging and further improvement of the temporal resolution in dynamic scans while maintaining spatial resolution • Inline subtraction and MIP display • Offline subtraction, MPR and MIP display • REVEAL: diffusion imaging for breast exams. In pulse sequences with multiple b-values individual numbers of averages may be specified per b-value. • RESOLVE: Diffusion-weighted, readout-segmented (multi shot) EPI sequence for high-resolution susceptibility-insensitive DWI of the breast
RADIANT	Ultrasound-like reconstruction around the nipple
Siemens Technique: VIEWS (Volume Imaging with Enhanced Water Signal)	• Bilateral – both breasts are examined simultaneously • Axial – for visualizing the milk ducts • Fat-saturated or water-excited – fat complicates clinical evaluation and is suppressed • Near-isotropic 3D measurement – using the same voxel size in all three directions for reconstruction in any slice direction • Submillimeter voxel size – highest resolution for precise evaluation

Tim Application Suite

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
- 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, addition, subtraction, multiplication, and division of images

Pediatric Suite[1)]

Tissue relaxation times and examination conditions in pediatrics are very different compared to those in adults. The reasons for these differences range from developing tissues, body size and faster heart rates to non-compliance with breath-hold commands. Pulse sequences 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.

Further standard Tim Suites

Tim Whole Body Suite

MAGNETOM Sola features a full effective Field-of-View of 205

General features

MAGNETOM Sola features a full effective FoV of 205 cm. Table movement to its full extent can be controlled from the *syngo* Acquisition Workplace. The large FoV helps in imaging lesions across extended body regions with sequences such as TIRM (Turbo Inversion Recovery Magnitude). Whole-body MR Angiography is possible on the entire volume with iPAT.

- Max. scan range of 205 cm

Tim Planning Suite

Easy planning of extended Field of View examinations in an efficient way using Set-n-Go pulse sequences. The Tim Planning Suite 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.

General features

- Ready-to-use Set-n-Go pulse sequences for different clinical questions
- Integrated toolbar for fast advanced slice planning: FoV-Plus, FoV-Minus, AlignParallel, AlignFieldOfViews

DotGO

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. DotGO – the latest generation of Dot – is setting the standard in exam configuration. For true flexibility, consistency and efficiency in every aspect of MRI.

Flexibility. Intuitive exam management.

One central user-interface for easy and flexible configuration and maintenance of all exams 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 exam 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 exam management

by providing unprecedented flexibility in MRI configuration.

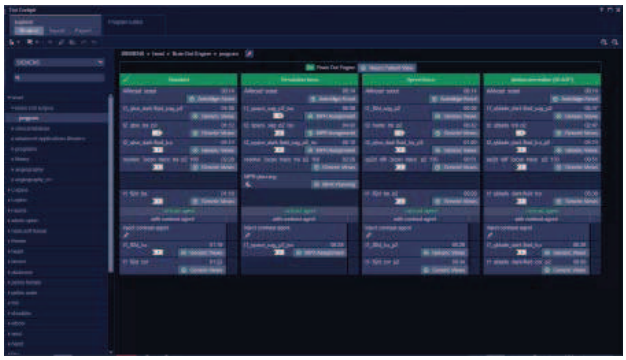
At the heart of this new flexibility is the Dot Cockpit. It is the central exam management platform enabling highly flexible and intuitive configuration, manipulation, organisation and updating of all exams. Whether you are using a Dot engine or not, the Dot Cockpit is the starting point for every exam.

MRI flexibility from the start:

- One central user-interface for every exam
- Fast and intuitive exam configuration (80% better usability)
- User-friendly functionalities like drag&drop, Dynamic Search
- Exam strategies created with one click
- Multiple strategies in one exam
- Change exams on the fly
- Update parameter changes to all or a selection of identically configured exams anywhere in the Dot Cockpit. (Identical Configurations)

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

Dot Cockpit



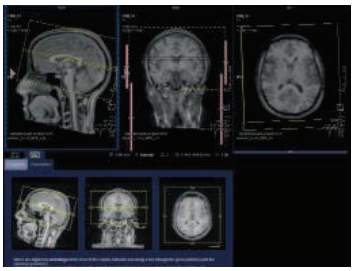
Designed to realize the full potential of the Dot engines. The Dot Cockpit is your central interface for all exam management tasks. This includes flexible configuration of all Dot engines, according to your standards of care. In the following, we introduce the most important features of the new Dot Cockpit.

Dot Cockpit

Dot Cockpit *(Continued)*	
Configure all exams from one central interface	The Dot Cockpit enables you to configure and save all of your MRI exams 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 exams and organize your exams. In the Program Editor, you modify them and you can find protocol histories and compare your exams.
A program overview	With the Dot Cockpit, you can see the whole exam workflow, the different User Trees, Exam, Strategies, Decisions, pulse sequences and AddIns are visualized together on one page.
Dynamic search delivers highlighted results	In the Dot Explorer, searching for pulse sequences is very quick. Just type in your search query, and results are highlighted instantly.
Editing exams instantly	In order to modify an exam 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 pulse sequences 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.

Dot Engines

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 to achieve 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 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 pulse sequence 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.

Dot Engines

Brain Dot Engine	
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 pulse sequences • Resolution focus: Examination with 3D pulse sequences (e.g. SPACE) for detailed views • Speed focus: Examination with fast 2D pulse sequences (e.g. HASTE) for further speeding up the exam • Motion-insensitive: Examination with BLADE pulse sequences 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. BLADE 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.

Dot Engines

Spine Dot Engine

The Spine Dot Engine delivers optimized cervical, thoracic and lumbar spine imaging for all patients 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, enabling automatic preparation of the complete MR examination.
Parameter View	The new streamlined Parameter View displays a user-defined subset of parameters which are available for manual pulse sequence optimization. If desired, the user can switch to the conventional – fully loaded – parameter view at any time.
AutoAlign Spine LS	Automated and highly reliable positioning and alignment of slice groups to the spine anatomy, based 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 as well as suggests and provides guided 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
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.

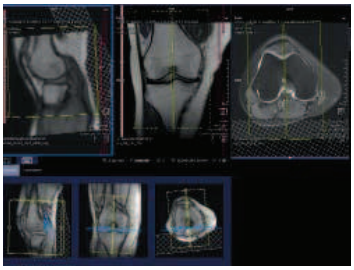
Dot Engines

Spine Dot Engine *(Continued)*	
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[1].
WARP	Susceptibility artifact reduction techniques. 2D TSE sequences combining high-bandwidth pulse sequences and the VAT (View Angle Tilting)-technique, tailored to reduce susceptibility artifacts (e.g. from MR Conditional[1] implants). Available pulse sequences include T1-weighted, T2-weighted, and STIR contrast.
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 • Add 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) • 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.

Dot Engines

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 specific 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 pulse sequences, VAT and SEMAC) provide susceptibility artifact reduction functionality (e.g. from MR Conditional[1)] metal implants), and include optimized pulse sequences for knee and hip examinations. High resolution 3D imaging programs together with user-configurable automatic Inline MPR (Multi Planar Reconstruction) calculations provide increased efficiency, 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 can be integrated. With one mouse-click you simply choose the most appropriate scan strategy, and then the queue is automatically loaded and filled with the complete scan setup.
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. 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 pulse sequence optimization. If desired, the user can switch to the conventional – fully loaded – parameter view at any time.
Dot Exam Strategies	The workflow can be personalized to the individual patient condition and clinical need. The Large Joint Dot Engine comes with the following predefined 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 pulse sequences • Speed focus: Examine patients in the shortest possible time with pulse sequences being accelerated to the maximal extent • Motion Insensitive (BLADE): Compensate for the effects of motion with motion insensitive BLADE pulse sequences. • WARP: Optimized strategy for the reduction of susceptibility artifacts[1)].

[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.

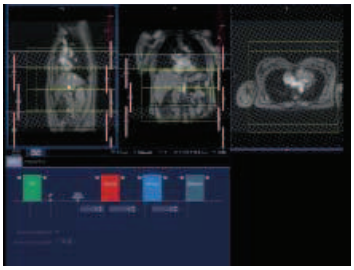
Dot Engines

Large Joint Dot Engine *(Continued)*	
AutoAlign	Automated, localizer based positioning and alignment of slice groups to the anatomy, relying on anatomical landmarks. Providing fast, easy, and reproducible patient scanning and supporting 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 uses the position information from the AutoAlign algorithm and can be easily configured to automatically generate any required 2D images from high resolution 3D acquisitions.
GOKnee3D	GOKnee3D is a fast, push-button examination for diagnostic imaging of the knee developed and clinically validated by the US board certified MSK radiologists at John Hopkins University Hospital. GOKnee3D exam consists of AutoAlign localizer in the knee, PD weighted contrast and T2 weighted contrast with fat suppression. The AutoAlign technology provides a push-button functionality and ensures consistency in imaging. The 3D protocols are high-resolution and isotropic, enabled by SPACE sequence with CAIPIRINHA technique.
WARP Susceptibility Artifact Reduction	WARP and adavanced WARP (SEMAC) integrates different techniques tailored to reduce susceptibility artifacts caused by orthopedic MR Conditional[1)] implants. 2D TSE sequence combining optimized high-bandwidth pulse sequences 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 pulse sequences 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

[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.

Dot Engines

Abdomen Dot Engine[1)]



The Abdomen Dot Engine offers standardized, efficient, and comprehensive workflows for the upper abdomen with excellent image quality. The workflow covers the liver, biliary and pancreatic system and, if slightly adapted, kidneys as well. The workflow is prepared for easy reading and reporting together with *syngo*.via.[1)]

Patient View	Within the Patient View the user can easily tailor the exam to each individual patient. Several pre-defined Dot Exam Strategies can be integrated. The user just selects the appropriate strategy with one click, and the queue and the complete scan set-up are automatically updated. Furthermore protocols tailored for use of contrast media can be integrated.
Guidance View	Step-by-step user guidance is seamlessly integrated. Sample images and guidance text are displayed for each individual step of the scanning workflow. Both images and text are easily configurable by the user.
Parameter View	The new streamlined Parameter View displays the parameters that are really needed for the scan set-up. 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 and AutoCoverage	Automated adaptation of scanning parameters according to anatomical and physiological characteristics (including breath-hold adaptations)
AutoNavigator	Automatic breathing pattern detection and scaling of triggered scans
AutoFoV (automatic Field of View calculation)	Based on the localizer images the optimal FoV is automatically estimated. In case the patient moves during the examination, this step can be repeated at any time.
Abdomen Dot Library	A storage folder for individual sequences optimized with Dot functionality. StarVIBE[1)], TWIST-VIBE[1)] and Compressed Sensing GRASP-VIBE[1)] pulse sequences are integrated into the Abdomen Dot library.
4D Movie toolbar	With the 4D Movie toolbar the user can navigate in an optimized way through space and time of multiphase data.

[1)] Optional

Dot Engines

Abdomen Dot Engine *(Continued)*	
Dot Exam Strategies	The workflow can be personalized to the individual patient's condition and clinical need. The following predefined strategies are included. They can be changed at any time during the workflow: • Breath-hold (fast with robust image quality) • Respiratory Synchronized (using PACE triggering, high image resolution) • Motion-insensitive (fast, using BLADE and PACE triggering)
Dot Decisions	Decisions can be seamlessly integrated into the scanning workflow. The user just selects the queue, and the appropriate pulse sequence or set of pulse sequences are added automatically. For the abdomen, pre-configured decision points are offered for MRCP and Diffusion.
MRCP decision point	Dot provides comprehensive guidance, including positioning help. MRCP is measured and Inline Radial Ranges are generated in-line.
Timeline monitoring	For best overview of multi-phase breath-hold examinations, the contrast media enhancement curve is visualized.
Automatic timing	Liver dynamics is done using the Care Bolus approach. Auto Bolus Detection enables the system to monitor the arrival of contrast agent in a user defined ROI. When "Auto Bolus Detection" is enabled, Auto ROI can be enabled in the patient view, which allows the system to perform an automatic ROI positioning on the descending aorta at the level of the diaphragm. The ROI positioning can be confirmed and adjusted by the user.
Bolus Timing	An alternative way of performing liver dynamics. The optimal time window for data acquisition is derived by the system after the application of a test bolus. Visual guidance and interactive evaluation during the setup provide ease-of-use.
AutoVoiceCommands	Seamlessly integrated into the scanning workflow. The system plays them automatically at the desired time point. This assists the user in providing the optimal timing of scanning, breathing and contrast media. The user can monitor which breath-hold or pauses are actually played, and could add pauses between the automatic breath-hold commands if necessary.
Inline Subtraction	Within the contrast-enhanced abdomen exam, multiple phases are acquired: native, arterial phase, portal-venous phase and late-phase. The scanner automatically subtracts the native measurement from the arterial, portal-venous and late phase.

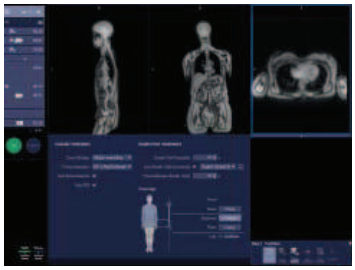
Dot Engines

Abdomen Dot Engine *(Continued)*	
Inline Registration	For best visualization of lesions the system can be set to automatically perform a registration/alignment of the anatomy for the different dynamic phases. The importance of registration/correction can be seen when examining nodular enhancing pathologies.
Customization	Taking full advantage of the new Dot configuration platform. Providing various guidance and customization options, featuring “AutoTiming”, “Auto Coverage”, “Local Voice Command”, etc. Existing Dot Engines can be adapted 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 and Decision Points • Modify the Parameter View • Dot Library – alternative pulse sequences with preconfigured add-ins. Only simple drag&drop needed.
LiverLab[1)]	LiverLab is a system guided workflow to examine the hepatic fat and iron status, as part of the Abdomen Dot Engine.
	Main Features: The inline First look Dixon 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: • Multi-echo Dixon VIBE is an image-based method to calculate maps such as water, fat, fat signal fraction, and R2[1)]. • HISTO is a single-breath-hold single-voxel spectroscopy method to calculate fat fraction as well as water R2.

[1)] Optional

Dot Engines

Whole-Body Dot Engine[1)]



The Whole-Body Dot Engine allows easy, seamless planning of multiparametric multistation exams with automated recognition of individual anatomy and consistent settings for spatial resolution, image contrast, and breath-hold capacity.

- Landmark-based automatic segmentation of the anatomical regions based on FastView scan
- AutoCoverage: scan range across the chest, abdomen and pelvis can be easily defined with a coverage slider
- Automatic overlap of stations
- Additional stations for head and leg coverage can be added using the coverage slider
- Two exam strategies are available: Standard and Motion-insensitive
- Core Protocol with WB T2 HASTE, WB T1 VIBE, WB DWI, and whole-spine exam
- Protocol can be extended with dedicated scans of the focus regions Chest, Abdomen, Pelvis with dynamic exams of the respective region
- AutoBolus detection for focus region Abdomen (liver)
- Supports 2D and 3D acquisitions in axial and coronal orientation
- Option to repeat stations flexibly (results are integrated accordingly during composing)

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. Both images and text are easily configurable by the user.
Parameter View	The new streamlined Parameter View displays the parameters that are really needed for the scan set-up. If desired, the user can switch to the conventional – fully loaded – parameter view at any time.
iPAT compatibility	Enabled by Tim 4G
Customization	Existing Dot Engines can be adapted 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 and Decision Points • Modify the Parameter View • Use the Whole-Body Dot library (a set of optimized pulse sequences for alternative sequences, such as Compressed Sensing GRASP-VIBE[2)])

[1)] Optional; prerequisites: Abdomen Dot Engine and FREEZEit+
[2)] Optional

syngo MR Software

syngo MR XA11 offers a single monitor acquisition workplace as default and dual monitor as optional with one keyboard and one mouse. This dual monitor setup, with separated scan and viewing monitors, makes for a more natural working environment in which the technologist has a complete overview of the examination and results. Constant context switches are reduced, enabling multitasking for increased quality and productivity.
The scanning side is primarily responsible for the act of scanning and light quality assurance. The viewing side is responsible for additional results generation in the form of basic and advanced post processing as well as data handling (DICOM – Export, Import, Transfer, Record to media) Several applications can be opened in parallel. The acquisition workplace can host one MR View&GO and up to three post-processing applications in parallel. An attached MR workplace can host up to four additional applications.

syngo MR Examination	
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 • Inline Display 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 • Multiselect GSP segements for synchronized interaction (e.g. scrolling)

syngo MR Software

MR View&GO – Image Viewing, basic post-processing, filming, and distribution

The MR View&GO is the central application for image viewing, quality assurance, basic post-processing, filming, and result distribution. The functionality is provided in 7 dedicated workflow steps which provide guidance, allow independent work, and do not require any reloading of data.

MR View&Go steps:	Viewing	Overview of all available data with automatic loading of newly acquired or received images. Multi-modal image viewing and comparison are possible.
	3D	Specialized layouts for MPR, MIP, and VRT.
	Calculation	Analysis, Correction, and Filter tools
	Mean Curve	Spatial and temporal analysis of images
	Composing	Composing and combining of images from different table positions
	Filming	Preparation of virtual film sheets for DICOM printer
	Distribution	Central place to select data sets for archiving and DICOM transfer

Image Display

- Various display layouts selectable incl. time point comparison
- Multi-modality viewing
- Image zoom and pan
- Image annotation and marker
- Non-interpolated display
- Free interactive definition of cut planes in axial, sagittal, coronal, oblique, and double oblique orientations
- Mosaic View
- Predefined Views of certain anatomical regions (AutoViews)[1)]
- Free interactive image rotation of MIP and VRT
- Interactive 3D reference point for spatial localization on different orientations
- Interactive slice thickness adjustment
- Interactive selection of relevant parts of MIP and VRT volumes by 3D shutters or freehand cut out
- Fast scrolling through data sets (500 images) with 15 frames per second
- 4D viewing with intuitive temporal (phase navigation in 4D data sets) and spatial scrolling extended by the 4D movie toolbar with phase tags
- Movie Mode for cine display with spatial navigation during running movie

Windowing

- Freely selectable window width and center
- Auto-windowing for optimized contrast
- Saves window values
- Various color LUTs incl inversion of gray-scale values

[1)] Optional

syngo MR Software

MR View&GO – Image Viewing, basic post-processing, filming, and distribution *(Continued)*	

Evaluation	Parallel evaluation of multiple regions of interest
	• ROI (Freehand, Circle)
	• VOI (Freehand, Sphere)
	• Statistical evaluation of ROI / VOI
	  • Area or Volume
	  • Standard deviation
	  • Mean value
	  • Min/max values
	  • Number and sum of pixels or voxels
	• Interactive segmentation (Region Growing)
	• Pixel lens with position marker
	• Distance (line and polyline)
	• Angle

Range creation and curved reconstructions	Free definition (slice thickness, spacing, numbering, ...) of parallel, radial, radial sliced, MPR, MIP, MinIP, MIP thin, VRT, VRT thin, and Fusion are available as output display types • Configurable reconstruction presets • Anatomical Ranges Presets[1)] of certain body regions
Position display	Displays measured slice positions on localizer image or selected series
Corrections	• Motion Correction 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 • 2D and 3D distortion correction • Undo 2D distortion correction
Image filter	Smoothing or edge enhancement of image stacks
Mean Curve	Time-intensity analysis for contrast-enhanced examinations • on-the-fly analysis with pixel lens • interactive mean curve segment to navigate to a specific phase and slice position of the 4D dataset • configurable settings • export to .CSV functionality
Spine Labeling	Automatic calculation of spine labels or take-over of labels from Spine Dot Engine

[1)] Optional

syngo MR Software

MR View&GO – Image Viewing, basic post-processing, filming, and distribution *(Continued)*	
Filming	• Connection via DICOM Basic Print or with locally connected printer • Interactive filming • Support of virtual film sheets • Filming parallel to other activities • Independent scanning and documentation – no wait time due to camera delays • Simultaneous handling of multiple film jobs • Freely selectable positioning of images onto virtual film sheet • Selectable various film layouts • Windowing, image zoom and pan, and annotations on film sheet • Configurable image text
Analysis Tools	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 across a range of selected images • ADC maps and calculated b-values with interactive preview Several evaluation functions may be started consecutively in the background
MPR – Multi-Planar Reconstruction	Real-time multi-planar reformatting of secondary views
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) • MIP thin/MIP thick
MinIP – Minimum Intensity Projection	Similar to MIP but reconstructs the minimum intensity (e.g. for Dark Blood techniques)
VRT Volume Rendering Technique	• 3D rendering with free definition of multiple trapezes for opacity and color • User specific preset creation • VRT thick and thin
Cinematic VRT (CRT)[1)]	Cinematic Rendering Technique is a rendering technology based on a physically accurate simulation of how light interacts with matter. It aims at providing a photo-realistic rendering of anatomical regions
Image Fusion	MPR image fusion with interactive adjustment of mixing ratio and various (color) LUTs, as well as interactive adjustment of alignment (visual alignment)
Result Handling and sending (Distribution)	• Overview over all acquired data and easy selection of target DICOM nodes for archiving • 4D support with archiving of sub-sets of 4D data sets • Status information about distribution state for each data set • Series Saving: for data within a selected viewing segment the current representation can be saved as new result series. In case the segment contains MPR data, automatically parallel ranges are generated.

[1)] Optional

syngo MR Software

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 • DICOM Structured Reports • DICOM Study Split Enhanced MR Images (Multiframe) • Loading time decrease due to reduced header information redundancy • Reduced object size • Reduced memory consumption and archive (On average 40%[1)] reduction in data storagerequirement with Multiframe DICOM) resulting in archive costs reduction, extended online period of exams in the STS and faster image availability at the target nodes. • Better application support due to usage of DICOM standard attributes • Color support within the MR modality image • MR quantification by support of RealWorldValueMapping • Archiving and application support of MR Spectroscopy objects • Archiving support of DTI and other non-image data with Raw Data objects
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
DICOM interoperability	For remote DICOM nodes (e.g. PACS systems) which doesn't support the DICOM Enhanced MR Image format an conversion to DICOM MR Images can be activated.

[1)] Data on file, Results may vary.

syngo MR Software

syngo MR Network Communication		
Expert-i	Interactive real-time access to imaging data and exam information from any PC within the hospital network during the MR exam.	
***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	
Image Transfer	Local network	Ethernet
	Data transfer rate	Max. 1 Gbit/s
	Transfer rate (DICOM Enhanced MR Images with 80 frames per instance)	Approx. 160–250 frames/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 widescreen monitor Horizontally tiltable, forward and backward Automatic backlight control for long-term brightness stability Dual Monitor configuration optional	
	Screen size (diagonal)	24" (61 cm)
	Digital Signal Input: Horizontal input frequency	31–76 kHz
	Vertical input frequency	59–61 Hz
	Screen matrix	1920×1200
Host computer	Processor	Intel Xeon ≥ E5-1650 v4 (6 Core)
	Clock rate	3.6 GHz, or comparable
	RAM	64 GB
	Hard disk	SSD: ≥480 GB
	CD/DVD writer (DICOM Standard, ISO 9660)	CD-R: Approx. 4000 images 256^2 DVD-R: Approx. 25 000 images 256^2
	Media drives	CD/DVD drive Media Card Reader
Advanced Host computer	Processor	2x Intel Xeon ≥ E5-2637 v4 (Quad-Core)
	Clock rate	3.5 GHz, or comparable
	RAM	96 GB
	Hard disk	SSD: ≥480 GB
	CD/DVD writer (DICOM Standard, ISO 9660)	CD-R: Approx. 4000 images 256^2 DVD-R: Approx. 25 000 images 256^2
	Media drives	CD/DVD drive SDHC Card Reader

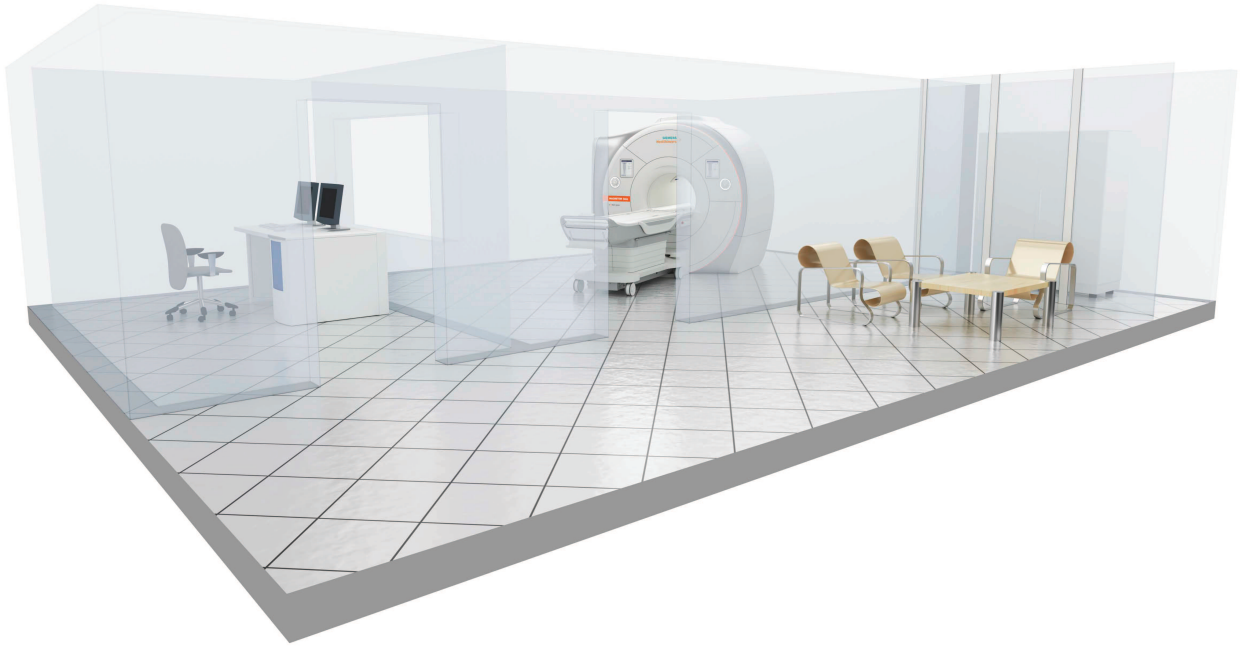
Computer System

***syngo* MR Workplace**[1)]		
General	Additional workplace connected to the AWP (Advanced Host)	
Color LCD Monitor	High resolution widescreen monitor Horizontally tiltable, forward and backward Automatic backlight control for long-term brightness stability Dual Monitor configuration optional	
	Screen size (diagonal)	24" (61 cm)
	Digital Signal Input: Horizontal input frequency	31–76 kHz
	Vertical input frequency	59–61 Hz
	Screen matrix	1920×1200
MRWP	Processor	Intel Xeon ≥E3-1230
	Clock rate	3.4 GHz, or comparable
	RAM	8 GB
	Hard disk	500 GB
	CD/DVD writer (DICOM Standard, ISO 9660)	CD-R: Approx. 4000 images 256[2] DVD-R: Approx. 25 000 images 256[2]
	Media drives	CD/DVD drive SDHC Card Reader

[1)] Optional

Installation

Radio Frequency Shielding	
For shielding the examination room from external RF sources	
RF attenuation factor	>90 dB
Frequency range	15–128 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	
Space Requirements	
Min. total space requirement (for magnet, electronics, and console room)	28 m^2



Dimensions

		Width [mm]	Depth [mm]	Height [mm]	Weight [kg]
Examination Room	Magnet 1.5 Tesla AS (incl. Helium)	1915	1450	2125	2700
	Magnet in operation, incl. gradient coil, body coil, Tim Table and covers	2148	4345	2150	4204
	Tim Table	800	2480	520 – 970+50 mm[1] +13 mm[2]	
	Required min. room height clearance			2400[3]	
	Min. transport dimensions	2335	1926	2176	
Control Room	*syngo* Acquisition Workplace (table + monitor)	1200	800	1140 (720+420)	
	Host computer	170	450	440	
	syngo MR Workplace (optional)	1200	800	1140 (720+420)	
Equipment Room	Electronics cabinet, incl. system control, RF system, gradient power system, image processor	1600	650	1980[4]	1500
	Heat dissipation	≤5 kW, only ventilation might be required			
	Cooling system	650	650	1890	500

[1] Including Heightening Kit, if necessary
[2] Depending on the floor conditions
[3] Finished floor to finished ceiling
[4] Without attachments

System Cover

Different design variants are available for customer specific needs

Standard variant:
Silver & White Design

Optional:
Illumination MoodLight™ featuring the following colors:

white, yellow, green, dark blue, bright blue, orange, rose







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MAGNETOM Sola

Tim [204x48] XQ Gradients

siemens.com/sola

SIEMENS Healthineers

Magnet System

General		
Superconducting Magnet	Short bore, patient-friendly design, high homogeneity 1.5 Tesla with 70 cm Open Bore design	
	Easy siting due to AS (Active Shielding) and E.I.S. (External Interference Shielding) magnet technology	
Magnet Parameters		
Operating field strength	1.5 Tesla	
Magnet type	Superconductor	
Field stability over time	< 0.1 ppm/h	
Weight (with cryogens)	2700 kg	
Magnet length	1.45 m	
Open Bore design[1)]	70 cm	
System length cover to cover	1.57 m	
Homogeneity (based on highly accurate 24 plane plot)		
10 cm DSV	Guaranteed	0.006 ppm
	Typical	0.004 ppm
20 cm DSV	Guaranteed	0.05 ppm
	Typical	0.03 ppm
30 cm DSV	Guaranteed	0.20 ppm
	Typical	0.11 ppm
40 cm DSV	Guaranteed	0.75 ppm
	Typical	0.65 ppm
50 cm DSV	Typical	5.5 ppm
50 × 50 × 45 cm³ DEV	Guaranteed	3.0 ppm
	Typical	2.8 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; DEV = Diameter elliptical volume (x, y, and z directions).

[1)] Incl. shim coils, gradient coil, RF body coil

Magnet System

Shimming		
Both: passive and active shimming. Passive shimming during installation		
Standard active shim with 3 linear channels (1st order) and 5 non linear channels (2nd order)		
3D Shim	Patient-specific automated shim	
	Time to shim	Approx. 15 s
Shielding		
Active Shielding (AS)	5th generation active shielding (AS) technology with counter coils	
Fringe field (axial × radial)	0.5 mT[1)]	4.00 × 2.50 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	

[1)] Pacemaker safety limit
[2)] For typical clinical use, depending on pulse 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.

XQ 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	45 mT/m
Min. rise time	225 µs
Max. slew rate	200 T/m/s

Vector Gradient Performance (vector addition of all 3 gradient axes)

Max. eff. amplitude	78 mT/m
Max. eff. slew rate	346 T/m/s
Gradient duty cycle	100%

Resolution Parameters

Min. FoV	5 mm
Max. FoV[1)]	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	12 µm

[1)] Depending on the application, the maximum FoV in the z-direction can be up to 50 cm

XQ Gradients

Power Consumption[1]	
System Off	4.3 kW
System ready to measure[1]	8.7 kW
Scan[1]	22.7 kW

Gradient Amplifier	
Water-cooled, highly compact, modular design	
Ultra-fast solid-state technology with very low switching losses	
Max. output voltage[2]	2250 V
Max. output current[2]	900 A
Max. power[2]	2.025 MVA

Power Requirements	
Line Voltage	380V, 400V, 420V, 440V, 460V, 480V
Stability tolerance	± 10 %
Line frequency	50/60 Hz, ± 1Hz
Connection Value	88 kVA

Cooling	
Two different customer specific cooling alternatives (Separator or Eco Chiller) available	
Eco Chiller option with automatic adaptation to the required cooling demands (e.g. different night/day mode) to decrease energy cost	
GREEN Cooling Package[3]: The Free Cooling Unit reduces energy consumption by up to 39%. It automatically starts if the surrounding temperature is 18°C (64°F) or less and reduces the chiller energy consumption. If the temperature is less than –10 °C (14°F), the chiller is switched off[4].	

Cooling with seperator	
Water consumption	100 l/min +/- 10 l/min[5]
Heat dissipation to water	60 kW

[1] All values are typical values, applicable for 400V/50Hz.
The power consumption measurement is based on the COCIR methodology – MRI – Measurement of energy consumption.
Many variables impact power consumption, thus there can be no guarantee that each customer will achieve the same values.
[2] Values for each of the 3 gradient axes
[3] Optional: based on climatic dates of Munich; data on file; results may vary
[4] In case of clinical routine measurement conditions
[5] Water temperature 6°-14°C; allowed delta T: +/- 2K with max. 1K/30s

XQ Gradients

Sequences:				
		Matrix		
		64	128	256
Spin Echo	min. TR [ms]	5	5	5.5
	min. TE [ms]	1.5	1.5	1.8
Inversion Recovery	min. TR [ms]	26	26	26
	min. TE [ms]	1.5	1.5	1.8
	min. TI [ms]	21	21	21
2D GRE	min. TR [ms]	0.59	0.7	0.97
	min. TE [ms]	0.22	0.22	0.22
3D GRE	min. TR [ms]	0.59	0.7	0.97
	min. TE [ms]	0.22	0.22	0.22
TrueFISP	min. TR [ms]	1.66	1.81	2.28
	min. TE [ms]	0.76	0.77	0.98
TSE (HASTE)	min. Echo Spacing [ms]	1.54	1.54	1.84
	min. TR [ms]	5	5	5.5
	min. TE [ms]	1.5	1.5	1.8
	max. Turbo Factor = 512			
Turbo GSE	min. Echo Spacing [ms]	0.78	0.82	0.86
	min. TR [ms]	5.7	6.3	6.4
	min. TE [ms]	3	3.5	3.5
	max. Turbo Factor = 65			
	max. EPI Factor = 21			
EPI (single-shot and multi-shot)	min. Echo Spacing [ms]	0.28	0.49	0.66
	min. TR [ms]	10	10	10
	min. TE [ms]	2.1	2.3	2.7
	min. Measurement time	11	17	26
	max. EPI Factor = 256			
Diffusion Imaging	Max. b-value [s/mm^2]	10 000	10 000	10 000
	Min. TE [ms] with b = 1000 s/mm^2	40	42	46

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

Coils

1.5T BioMatrix Coils

A new ultra-high density BioMatrix coil (BioMatrix Spine 32) utilizes seamlessly integrated sensors to acquire and display the patient's respiration data without need for user interaction.
The integrated CoilShim technology in the BioMatrix Head/Neck 20 ensures that the challenging head/neck region is automatically and optimally shimmed for reproducible quality in every patient.

1.5T Tim 4G Coils

The Tim 4G coils are designed for highest 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 Coil Package - Tim [204 x48]

BioMatrix Head/Neck 20 tiltable with CoilShim (DirectConnect)	Application area	Head and Neck
	Dimensions (L × W × H)	425 mm × 370 mm × 385 mm
	Weight	5.7 kg
BioMatrix Spine 32 with Respiratory Sensors (DirectConnect)	Application area	Spine
	Dimensions (L × W × H)	1200 mm × 489 mm × 63 mm
	Weight	10.5 kg
Body 18 (SlideConnect)	Application area	• Thorax • Heart • Abdomen • Pelvis • Hip
	Dimensions (L × W × H)	385 mm × 590 mm × 65 mm
	Weight	1.6 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.

Computer System

syngo Acquisition Workplace - Tim [204 x 48]		
Standard measurement and reconstruction system[1)]	Processor	2x Intel Xeon ≥ E5-2609v4 (8 Core)
	Clock rate	2x ≥ 1.7 GHz, or comparable
	Main memory (RAM)	64 GB
	SSD for raw data	≥ 480 GB
	SSD for system software	≥ 240 GB
	Parallel Scan & Recon	Simultaneous scan and reconstruction of up to 12 data sets
	Reconstruction speed	32 854 recons per second (256^2 FFT, full FoV) 122 137 recons per second (256^2 FFT, 25% recFoV)
Highend measurement and reconstruction system[1)]	Processor	2x Intel Xeon ≥ E5-2620v4 (8 Core)
	Clock rate	2x 3.3 GHz, or comparable
	Main memory (RAM)	96 GB
	SSD for raw data	≥ 480 GB
	SSD for system software	≥ 240 GB
	Parallel Scan & Recon	Simultaneous scan and reconstruction of up to 12 data sets
	Reconstruction speed	40 404 recons per second (256^2 FFT, full FoV) 149 532 recons per second (256^2 FFT, 25% recFoV)
	GPGPU	1× Nvidia Quadro P2000

[1)] Optional

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BioMatrix Head/Neck 20 tiltable with CoilShim[1)]

General

The BioMatrix Head/Neck 20 tiltable with CoilShim[1)] is part of the Standard Coil Package Tim [204x48] and Standard Coil Package Tim [204x64]

- 20-channel design with 20 integrated pre-amplifiers, two rings of 8 elements each and one ring with 4 elements
- First cable-less tiltable coil with DirectConnect™ technology, with 3 different angular positions (0°, 9° and 18°)
- Integrated BioMatrix Tuners: First coil with CoilShim technology offering integrated shim elements
- Combined coil for head and neck examination for optimized workflow
- Upper coil part easily 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 BioMatrix Spine 24, BioMatrix Spine 32 or BioMatrix Spine 48
- 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 angiography of the head/neck
- Combined head/neck examination
- Cervical spine
- TMJ (temporomandibular joints)

Typically combined with

- BioMatrix Spine 24, BioMatrix Spine 32[2)], BioMatrix Spine 48[3)4)]
- BioMatrix Body 12, Body 18
- Peripheral Angio 36[4)]
- Flex Large 4
- Flex Small 4
- UltraFlex Large 18[4)]
- UltraFlex Small 18[4)]

[1)] also referred to as BioMatrix Head/Neck 20 or BM Head/Neck 20
[2)] Prerequisite: Tim [204 x 48] and Tim [204 x 64]
[3)] Prerequisite: Tim [204 x 64]
[4)] Optional

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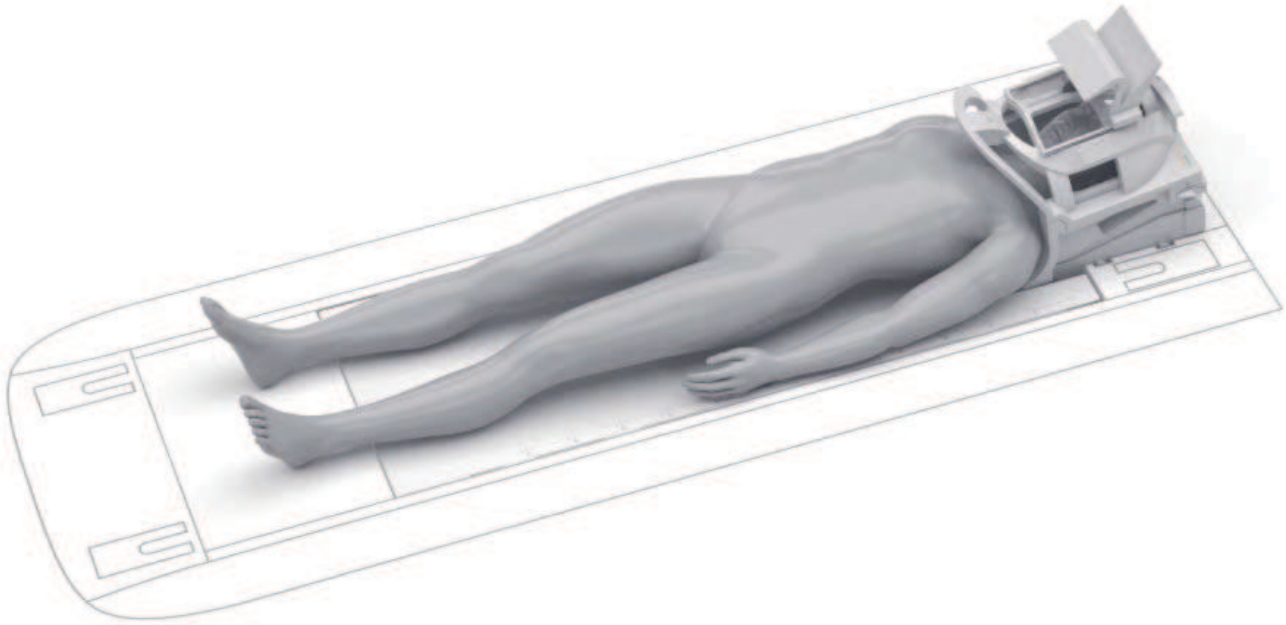
BioMatrix Head/Neck 20 tiltable with CoilShim



Weight	
Total	5.7 kg
Anterior part	1.7 kg

Dimensions (L × W × H)
425 mm × 370 mm × 385 mm (incl. baseplate)

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BioMatrix Spine 32 with Respiratory Sensors[1)]

General

The BioMatrix Spine 32 with integrated BioMatrix Sensors[2)] is part of the Standard Coil Package Tim [204x48] and Standard Coil Package Tim [204x64].

- 32-channel design with 32 integrated pre-amplifiers, 8 rows of 4 elements each
- Cable-less coil with DirectConnect™ technology
- Integrated BioMatrix Sensors: sensors measuring the patients respiratory signal in head-first and feet-first position
- Smoothly integrated into the patient table and streamlined with BioMatrix Head/Neck 20
- 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 18
- BioMatrix Head/Neck 20
- Peripheral Angio 36[3)]
- Flex Large 4, Flex Small 4
- UltraFlex Large 18[3)]
- UltraFlex Small 18[3)]

[1)] also referred to as BioMatrix Spine 32 or BM Spine 32
[2)] Prerequisite: Tim [204x48], Tim [204 x 64]
[3)] Optional

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BioMatrix Spine 32 with Respiratory Sensors[1)]

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

[1)] Prerequisite: Tim [204x48], Tim [204 x 64]

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BioMatrix Body 12/BioMatrix Body 12 Long[3] with Beat Sensor[4]

General

The BioMatrix Body 12 with Beat Sensor[4] coil is part of the Standard Coil Package Tim [204x32].

- 12-channel design with 12 integrated pre-amplifiers, with 3 rows of 4 elements each
- Operates in an integrated fashion with the BioMatrix Spine 24, BioMatrix Spine 32 and BioMatrix Spine 48 for body imaging
- Can be combined with further Body 18 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
- The Beat Sensor is seamlessly integrated into the BioMatrix Body 12.

Applications

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

Typically combined with

- BioMatrix Head/Neck 20
- BioMatrix Spine 32[1], BioMatrix Spine 48[2][3]
- Additional Body 18 coils[3]
- Peripheral Angio 36[3]
- Flex Large 4, Flex Small 4
- UltraFlex Large 18[3], UltraFlex Small 18[3]
- Loop 1.5T coils[3]

[1] Prerequisite: Tim [204x48] and Tim [204x64]
[2] Prerequisite: Tim [204x64]
[3] Optional
[4] also referred to as BioMatrix Body 12 or BM Body 12

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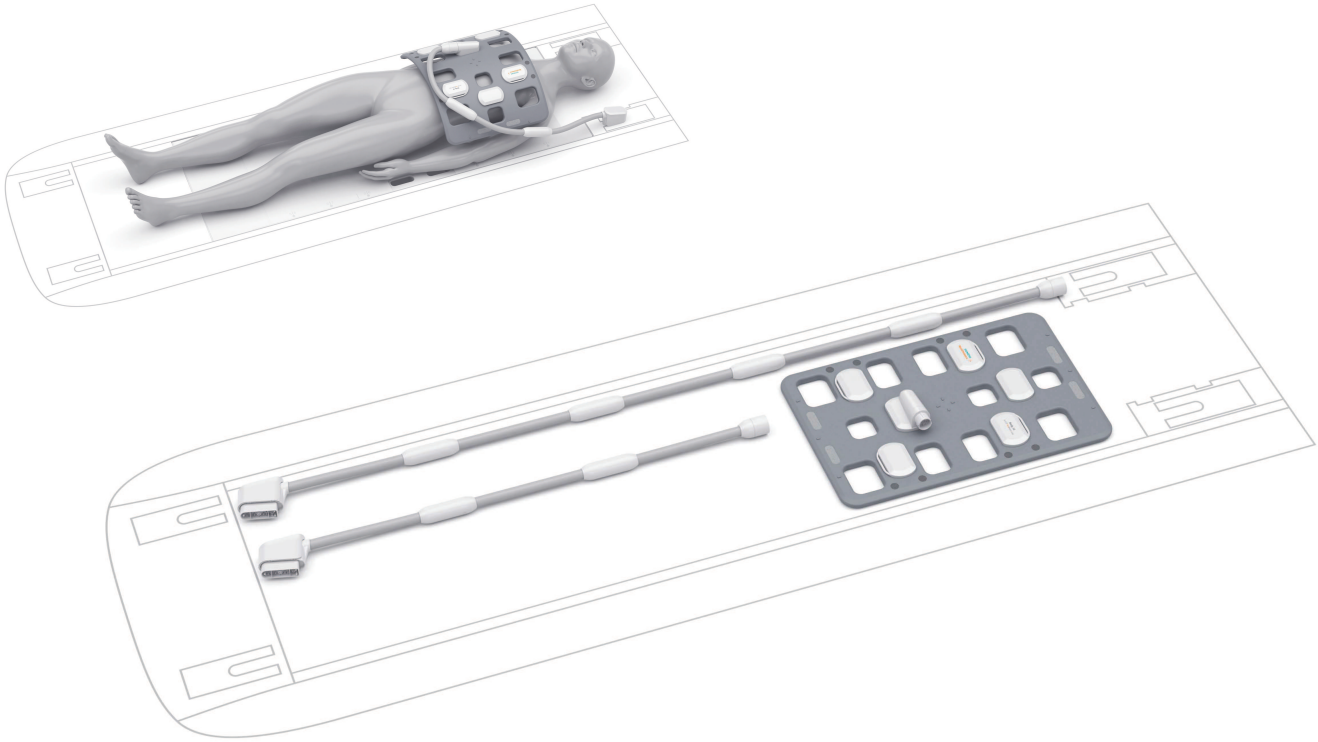
BioMatrix Body 12 with Beat Sensor



Weight	
Coil[1)]	730 g
Cable	570 g
Cable long[2)]	850 g

Dimensions (L × W × H)	
Coil[1)]	589 mm × 385 mm × 63 mm
Cable	950 mm
Cable long[2)]	1650 mm

[1)] Without detachable coil cable
[2)] Optional

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MAGNETOM Sola

Body 18

General

The Body 18 is part of the Standard Coil Package Tim [204x48] and Standard Coil Package Tim [204x64].

- 18-channel design with 18 integrated pre-amplifiers, with 3 rows of 6 elements each
- Operates in an integrated fashion with the BioMatrix Spine 24, BioMatrix Spine 32 and BioMatrix Spine 48 for body imaging
- Can be combined with further Body 18 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

- BioMatrix Head/Neck 20
- BioMatrix Spine 32[1)], BioMatrix Spine 48[2)3)]
- Additional Body 18 coils[3)]
- Peripheral Angio 36[3)]
- Flex Large 4, Flex Small 4
- UltraFlex Large 18[3)], UltraFlex Small 18[3)]
- Loop 1.5T coils[3)]

[1)] Prerequisite: Tim [204x48] and
[2)] Prerequisite: Tim [204x64] Tim [204x64]
[3)] Optional

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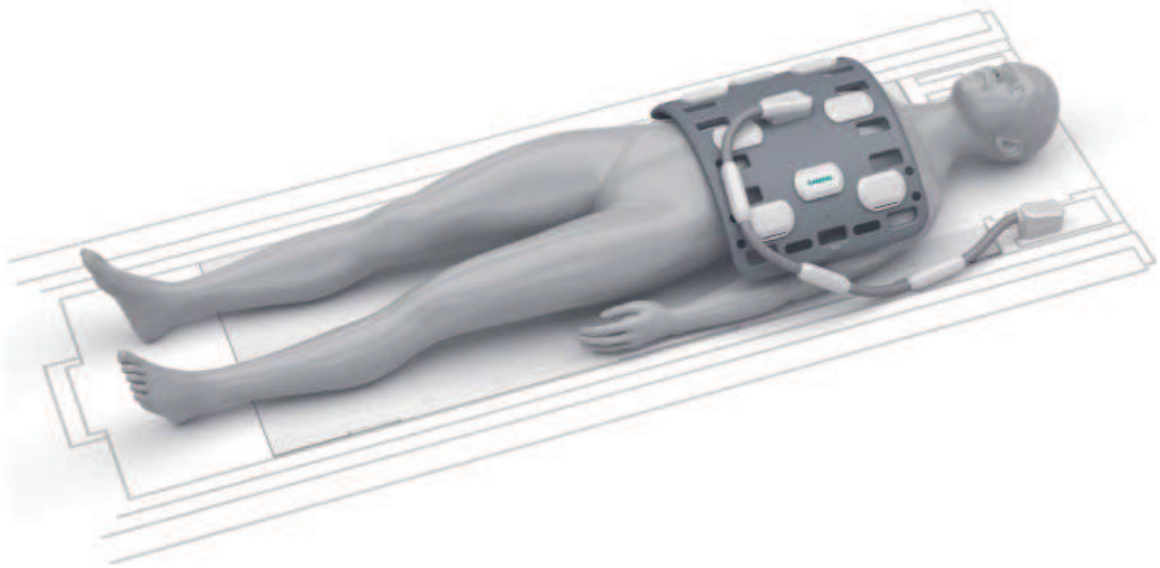
Body 18



Weight
1.6 kg “patient-felt” weight of coil only – 1.1 kg

Dimensions (L × W × H)
385 mm × 590 mm × 65 mm

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MAGNETOM Sola

Flex Large 4
Flex Small 4

General

The Flex Large 4 and Flex Small 4 are part of the Standard Coil Package Tim [204x32], Standard Coil Package Tim [204x48] and Standard Coil Package Tim [204x64].

- 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 3T

Features

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

Applications

Flex Large 4	Flex Small 4
Imaging of large regions such as shoulder, hand, hip, knee, and ankle	Imaging of small regions such as wrist and elbow

Typically combined with

- Head/Neck 16, BioMatrix Head/Neck 20
- BioMatrix Body 12, Body 18
- BioMatrix Spine 48[2)3)]
- Peripheral Angio 36[2)]
- Flex Small 4[1)], Flex Large 4[1)]
- UltraFlex Large 18[2)], UltraFlex Small 18[2)]
- Loop 1.5T coils

[1)] Second Flex Coil Interface required (optional)
[2)] Optional
[3)] Prerequisite: Tim [204 x48], Prerequisite: Tim [204x64]

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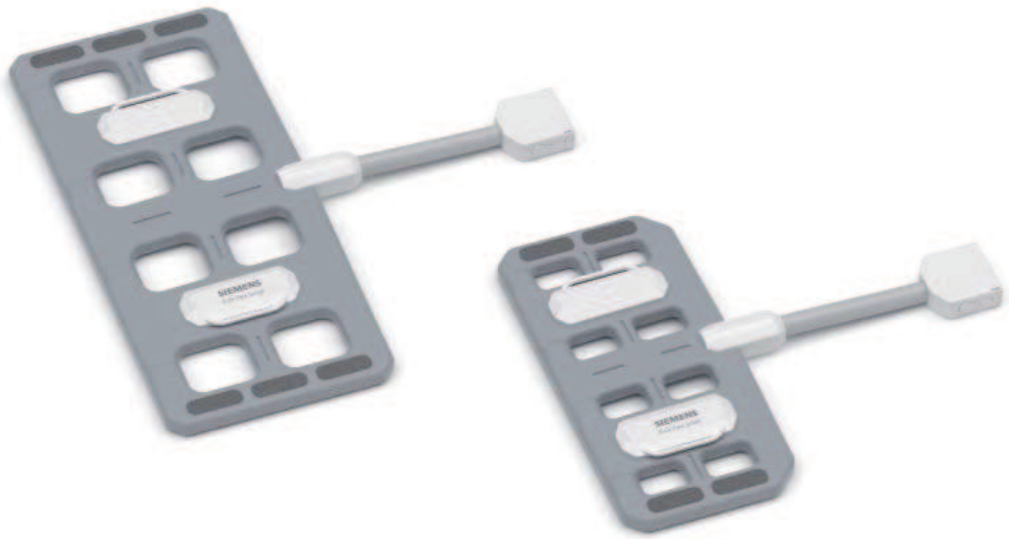
Flex Large 4 and Flex Small 4



Weight	
Flex Large 4	Flex Small 4
550 g	450 g

Dimensions (L × W)	
Flex Large 4	Flex Small 4
516 mm × 224 mm	366 mm × 174 mm

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MAGNETOM Sola

Peripheral Angio 16

General

- 16-channel design with 16 integrated preamplifiers, distributed over 4 planes with 4 elements each
- Operates in an integrated fashion with the BioMatrix Body 12 / Body 18 coil and the integrated Spine coil and for whole-body examinations also with the BioMatrix Head/Neck 20
- Can be utilized head and feet first
- Both legs are independently covered with coil elements, maximizing the coil filling factor and the signal-to-noise ratio
- No coil tuning
- iPAT-compatible in all directions
- SlideConnect® technology for easy coil set up
- One cable only for easy handling

Applications

- High resolution angiography of both legs with highest signal-to-noise ratio
- Bilateral examinations of long bones of the legs

Typically combined with

- Head/Neck 16, BioMatrix Head/Neck 20
- BioMatrix Body 12, Body 18
- BioMatrix Spine 24[1], BioMatrix Spine 32[1], BioMatrix Spine 48[2]
- Flex Large 4, Flex Small 4
- UltraFlex Large 18[3], UltraFlex Small 18[3]

[1] Prerequisite: Tim [204 x 48], Tim [204x64]

[2] Prerequisite:Tim [204x64]

[3] Optional

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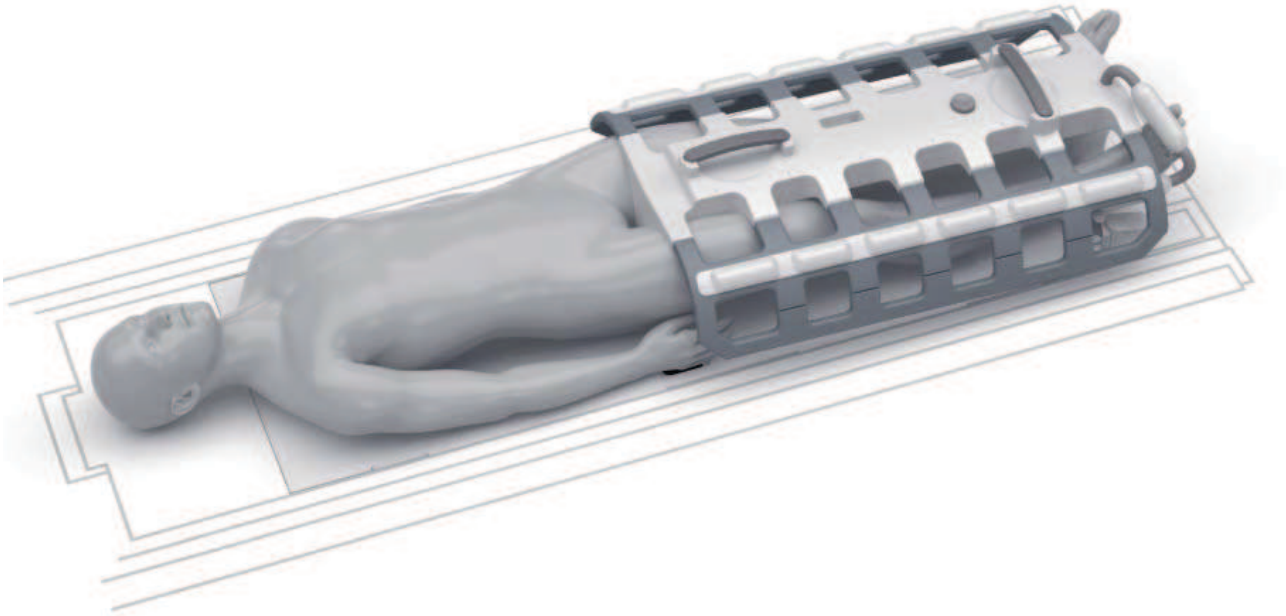
Peripheral Angio 16



Weight	Dimensions (L × W × H)
6.1 kg	970 mm × 650 mm × 260 mm

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MAGNETOM Sola

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
- 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

Typically combined with

- Flex Large 4 , Flex Small 4
- UltraFlex Large 18[1)], UltraFlex Small 18[1)]
- BioMatrix Spine 24[1)], BioMatrix Spine 32[2)], BioMatrix Spine 48[3)]
- Loop 1.5T coils[1)]

[1)] Optional

[2)] Prerequisite: Tim [204x48], Tim [204x64]

[3)] Prerequisite: Tim [204x64]

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Hand / Wrist 16

Weight	
Coil	2.8 kg
Base plate	1.6 kg

Dimensions (L × W × H)	
Coil	322 mm × 215 mm × 115 mm
Base plate	524 mm × 313 mm × 30.5 mm

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MAGNETOM Sola

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

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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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Datasheet

MAGNETOM Sola

Shoulder Shape 16

General

- A 16-channel coil with flexible wings to shape around small and large shoulder anatomy – with 16-channel coil design with 16 integrated preamplifiers
- Includes pads 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 anatomic structures (e.g. labrum)
- Higher SNR and better field homogeneity
- Reduced slice thickness and measurement times

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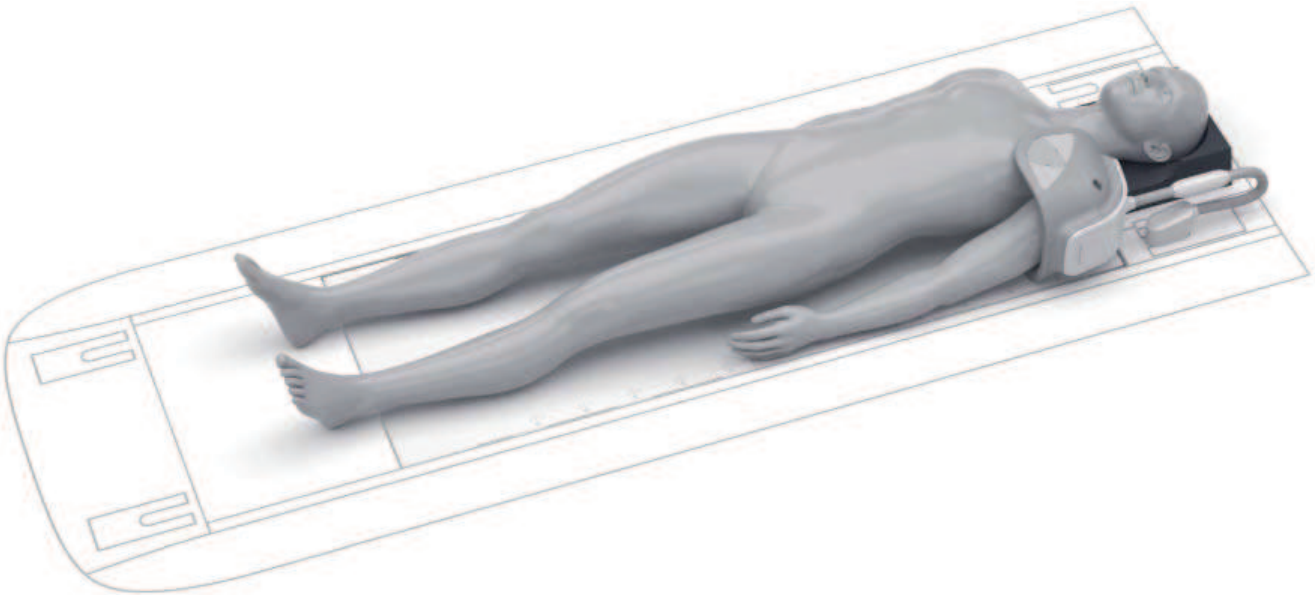
Shoulder Shape 16



Weight
1.4 kg

Dimensions (L × W × H)
262mm × 214 mm × 214 mm

Opening
160–270 mm

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MAGNETOM Sola

Tx/Rx Knee 18

General

- 18-channel transmit/receive coil
- 18-channel coil with 18 integrated preamplifiers, elements arranged in 3 rungs by 6 elements
- iPAT-compatible in all directions
- Upper coil part removable
- Flared opening towards the thigh
- Holder allows off-center positioning to ensure a comfortable position for the patient
- Cushions for patient comfort and stabilization of the anatomy

General *(Continued)*

- 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

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Tx/Rx Knee 18

Weight
6.2 kg
Dimensions (L × W × H)
282 mm × 528 mm × 262 mm (incl. baseplate)

Inner Diameter
170 mm; 190 mm flaring towards thigh

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Datasheet

MAGNETOM Sola

Breast BI 7

General

- 7-ch design for imaging and biopsy with high SNR both in diagnostic and interventional set-up
- Height-adjustable head rest
- Compact design
- Single-plug connect
- Plug parking position
- BioMatrix Spine 24[1]/ BioMatrix Spine 32[2] coil/ BioMatrix Spine 48[2] coil can remain on the table
- Head or feet first measurement possible
- iPAT compatible in all directions
- Abdominal cushion with mechanical lock to coil
- Supports cranio-caudal compression[3]
- Biopsy kit[3] for grid and post/pillar biopsy, including lateral and medial grids, a post/pillar fixation unit, markers, and a needle kit for training purposes
- LED lights provide excellent visibility for breast positioning and biopsy

Applications

- Simultaneous imaging of both breasts in all directions
- Biopsy imaging for lateral and medial access
- High-resolution 2D and 3D imaging
- For quantitative spectroscopy (SVS[3]) a reference bottle can be inserted.

Typically combined with

- BioMatrix Body 12, Body 18

[1] Prerequisite: Tim [204 x 48], Tim [204x64]

[2] Prerequisite:Tim [204x64]

[3] Optional

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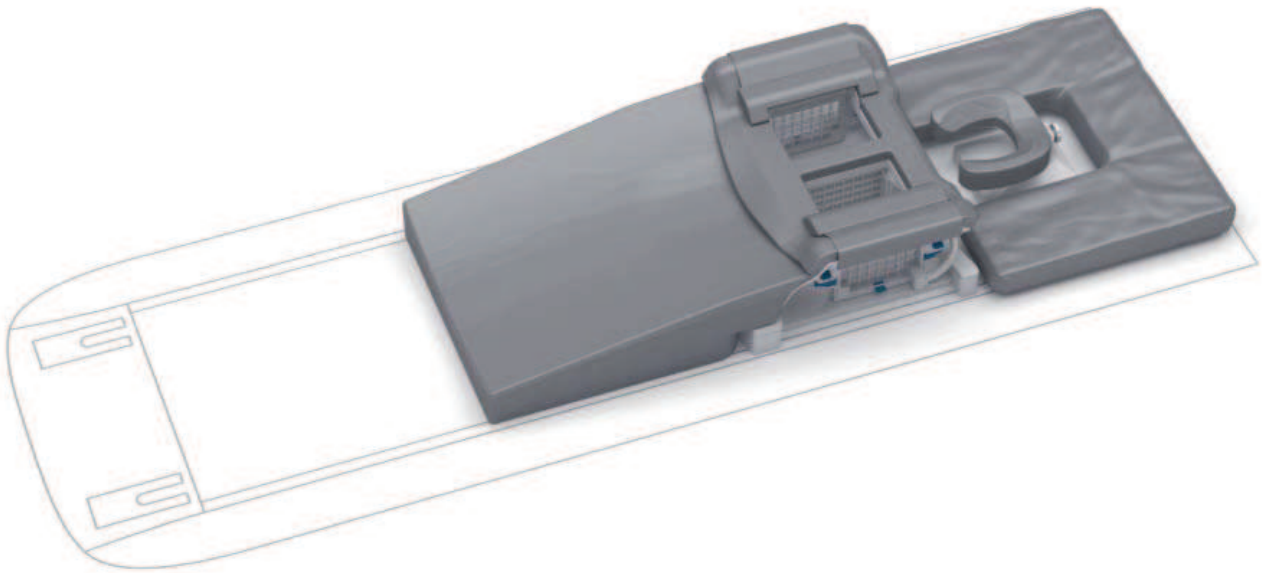
Breast BI 7



Weight	Dimensions (L × W × H)
7.2 kg	566 mm × 499 mm × 223 mm

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MAGNETOM Sola

Application Packages

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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. When used with a Tx/Rx coil, PETRA is inaudible.

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

FREEZEit+[1)]

FREEZEit+ combines the applications TWIST, 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. Next to that, FREEZEit+ includes the high spatiotemporal dynamic imaging of TWIST.

TWIST	TWIST is an advanced, very fast GRE acquisition technique for 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.
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.
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 breath-hold capabilities.

[1)] Optional
[2)] Prerequisite: SWI license (optional)

Application Packages

Compressed Sensing GRASP-VIBE[1)]

Compressed Sensing GRASP-VIBE (Golden-Angle RAdial Sparse Parallel) makes it possible to conduct dynamic contrast-enhanced abdominal exams in free breathing. Acquisition is performed in one continuous run, using a golden-angle stack-of-stars radial scheme that confers robustness towards motion and the flexibility to choose the temporal resolution at reconstruction time. The temporal resolution may even vary over the duration of the scan. Reconstruction is performed using a Compressed Sensing accelerated iterative algorithm with per-voxelthrough-time regularization. The algorithm also automatically recognizes the typical phases in liver dynamics and therefore has the capablilty to only reconstruct a subset of clinically relevant images with respective labeling.

Additional features:

- Auto Bolus Detection at reconstruction time
- Configuration of exam phases in terms of start time relative to the auto-detected bolus arrival, duration, temporal resolution, and pre-selection for export to PACS
- Self-gating for further reduction of residual motion blur
- Includes FREEZEit+

LiverLab[2)]

Within the Abdomen Dot Engine, LiverLab is a system guided workflow to examine the hepatic fat and iron status. The Inline First-Look Dixon 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:

- Multi-echo Dixon VIBE is an image-based method to calculate maps such as water, fat, fat signal fraction, and R2[1)].
- HISTO is a single-breath-hold single-voxel spectroscopy method to calculate fat signal fraction as well as water R2.

WARP Susceptibility Artifact Reduction

WARP and Advanced WARP (SEMAC) integrates different techniques tailored to reduce susceptibility artifacts caused by orthopedic MR Conditional[3)] implants.
2D TSE sequence combining optimized high bandwidth pulse sequences 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 pulse sequences include T1-weighted, T2-weighted, proton density and STIR contrast.

Advanced Diffusion

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

[1)] Optional
[2)] Optional, prerequisite: Abdomen Dot Engine (optional)
[3)] 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.

Application Packages

Tim Whole Body Suite

MAGNETOM Sola features a full effective Field of View of 205 cm.

General features

Table movement to its full extent can be controlled from the *syngo* Acquisition Workplace. The large FoV helps in imaging lesions across extended body regions with sequences such as TIRM (Turbo Inversion Recovery Magnitude). Whole body MR Angiography is possible on the entire volume with iPAT.

- Max. scan range of 205 cm

Tim Planning Suite

Easy planning of extended Field of View examinations in an efficient way using Set-n-Go pulse sequences. 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.

General features

- Tim Planning UI with optimized layout for slice positioning
- Ready to use Set-n-Go pulse sequences for different clinical questions
- Integrated toolbar for fast advanced slice

MapIt[1)]

MapIt provides pulse sequences 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
- Pulse sequences 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)
- 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

[1)] Optional

Application Packages

Simultaneous Multi-Slice (SMS)[1]

Simultaneous Multi-Slice is a revolutionary method to significantly reduce imaging times for diffusion, BOLD, and TSE 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.
- For TSE sequence, SMS is available for reducing scan time, and/or to increase slice coverage/resolution.
- SMS accelerated BOLD and diffusion-weighted pulse sequences for the brain are provided
- SMS accelerated TSE pulse sequences for MSK imaging is provided.

Inline Perfusion[1]

Automatic real-time calculation of Global Bolus Plot (GBP), Percentage of Baseline at Peak map (PBP) and Time-to-Peak map (TTP) with Inline technology

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
- Substantially reduced 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)

DSI (Diffusion Spectrum Imaging)[2]

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
[2] Part of DTI (optional)

Application Packages

TWIST[1)]

This package contains Siemens-unique pulse sequences 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.

Reconstruction algorithms for iPAT[2] enable highly efficient multi-directional parallel imaging.

NATIVE[1)]

Integrated software package with pulse sequences 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.

- 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) uses the water in arterial blood as an endogenous contrast agent to evaluate perfusion noninvasively.
ASL assists in the evaluation of human brain perfusion and function physiology 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.

- iPAT compatible
- Includes 3D PACE motion correction for increased reliability
- Fully automated Inline calculation of relCBF color maps
- Supports the “Pulsed Arterial Spin Labeling” – technique (PASL)
- Supports the "Pseudo Continuous Arterial Spin Labeling" - technique (PCASL)

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 enables the physician to qualitatively assess perfusion throughout the whole brain without the use of a contrast agent.

ASL 3D is a tool to acquire 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)].
- Supports the "Pulsed Arterial Spin Labeling" - technique (PASL)
- Supports the "Pseudo Continuous Arterial Spin Labeling" - technique (PCASL)

[1)] Optional

Application Packages

Advanced Cardiac Package including PSIR HeartFreeze

This package contains special pulse sequences for advanced cardiac imaging including 3D and 4D BEAT functionalities. It supports advanced techniques for ventricular function imaging, 4D 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 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)
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
PSIR HeartFreeze	Motion correction/averaging of multiple measurements with iPAT or tPAT accelerated single-shot TrueFISP or GRE images of the heart, for free-breathing acquisition
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)

Compressed Sensing Cardiac Cine[1)]

Highly accelerated functional Cardiac 2D Cine imaging based on the BEAT sequence with Compressed Sensing and Iterative Reconstruction

- Spatial and/or temporal resolution can be improved and scan time substantially reduced
- Real-time Cine or single breath-hold Cine for full heart coverage in patients with limited breath-hold capability or with arrhythmia
- Adaptive triggering is available to cover the full cardiac cycle.
- Retrogating available for segmented acquisitions

MyoMaps[1)]

On the basis of fully system guided HeartFreeze Inline Motion Correction, MyoMaps provides pixel-based T1 and T2 myocardial tissue quantification maps. 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

Application Packages

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

Advanced 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
- Capability for multislice acquisition, definition of acquisition order, pausing, mosaic display, and skipping of the physiology trigger

Single Voxel Spectroscopy[1)]

Integrated software package with pulse sequences for proton spectroscopy.

- Matrix Spectroscopy – phase-coherent signal combination from several coil elements for maximum SNR based on the Head/Neck 20
- Spectral suppression (user definable parameter) to avoid lipid superposition in order to reliably detect e.g. choline in the breast
- Spectroscopy can be combined with Free-Breath Prospective Acquisition Correction (2D-Phase navigator) when needed
- 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

Single Voxel Spectroscopy *(Continued)*

- Physiological triggering (ECG, pulse, respiratory or external trigger) in order to avoid e.g. breathing artifacts.
- Spectroscopy relevant GRE-based shim pulse sequences 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 pulse sequences for brain applications

Includes GRACE (GeneRAlized breast speCtroscopy Exam), an 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.

[1)] Optional

Application Packages

CSI 2D: Chemical Shift Imaging[1)]

Integrated software package with pulse sequences 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 pulse sequences 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

CSI 3D: Chemical Shift Imaging *(Continued)*

- 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
- Pulse sequences for prostate spectroscopy

[1)] Optional

Application Packages

Security Features

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

- User management with authentication to prohibit unauthorized access
- Privileges to grant rights and define functionality based on user/role
- Hardened operating system and restricted network communication
- Whitelisting (Embedded Control) against manipulation of scanner software
- Security Delivery process to frequently distribute security updates
- Option to protect customer pulse sequence trees against unauthorized modifications
- Audit trail to log system and data access by the defined users and service
- Support of customers to implement their security policy including compliance with HIPAA (Health Insurance 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.[2)]
- Pulse sequences with 2D gradient-echo sequences with cyclic motion-encoding gradients (MEG)

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

Breast Biopsy Software[1)]

The Breast Biopsy Software guides breast interventions such as vacuum-assisted biopsy and wire localization.

- Guidance for intervention planning and execution for both grid method and post/pillar method.
- Workflow guides through the process of marker identification and target selection
- Automatic extraction of coordinates for the selected target and calculation of required point of entry, angulation (for post/pillar method) and penetration depth.
- Projection of needle path on the planning images for control.
- Support of coil-specific guidance with graphical instructions on both the console and the touch display at the scanner.
- Typical, site-specific settings (e.g. grid method, biopsy device, marker position) can be set as default to minimize user interaction).
- Supported by Breast Dot Engine[1)]
- Support of commonly used breast MR biopsy devices e.g. Bard EnCor, Bard Vacora, Hologic ATEC, Mammotome
- Support of following MR breast coils:
  Breast BI7, 2-/4-/8-Channel Sentinelle Breast Coil and 2-/10-/16-Channel Sentinelle Breast Coil

[1)] Optional
[2)] Please note that this functionality can only be used in combination with a dedicated hardware, which is not part of the MR Elastography package.

Application Packages

Expert-i

Interactive real-time access to imaging data and exam information from any PC within the hospital network[1] 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[2]

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.
- Remote access granted only with permission of the institution.
  Data security is ensured by secure access

IDEA (Integrated Development Environment for Applications)[3],[4]

Extensive programming environment used to create and modify pulse sequences, offering a maximum of flexibility

Based on C++ for Windows 10. Sequences and RF pulses are displayed in a visual interface

Features

- Allows direct access to the Image Calculation Environment (ICE), and to all pulse sequences
- Testing the generated code is extensively supported by the debugger and the simulation program
- IDEA is also usable on any standard PC with operating system Windows 10 making developments independent of the MR system

Processing plug-ins

For development or modification of user-defined image processing steps which may be integrated into the measurement pulse sequences

- Individual processing is secured by a number of functions (e.g. TTP and MTT), useful for neuro or perfusion imaging

Prerequisite

IDEA training course

[1] minimum bandwidth 30Mbit/s, recommended 100Mbits
[2] In conjunction with a Siemens service contract
[3] Optional
[4] Within hospital enterprise

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MAGNETOM Sola

Post-processing Applications & Features

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Post-processing Applications & Features

MR relevant post-processing functionalities from *syngo*.via are available in *syngo* MR XA11 as well. They are optional and medical devices (or parts of them) in their own rights.

If an MR Workplace (secondary console) is available an application can be flexibly used on one of the workplaces (Acquisition vs. MR Workplace).
In case a dual user package is available the application can be used in parallel (for different patients) on the two workplaces.

The integrated reporting, RadLex and trending support as known from *syngo*.via are not available in *syngo* MR XA11.

Post-processing results will be available as result images at remote DICOM nodes.[1)]

Applications & Features

- *syngo*.MR Onco[2)]
- *syngo*.MR 3D Lesion Segmentation[2)]
- *syngo*.MR OncoCare[2)]
- *syngo*.MR Tissue 4D[2)]
- *syngo*.MR BreVis[2)]

- *syngo*.MR Neuro Perfusion[2)]
- *syngo*.MR Neuro Perfusion Mismatch[2)]

- *syngo*.MR Neuro fMRI[2)]
- *syngo*.MR Tractography[2)]

- *syngo*.MR Spectro SVS[2)]
- *syngo*.MR Spectro CSI[2)]
- *syngo*.MR Spectro Extension[2)]
- *syngo*.MR Spectro Research[2)]

- *syngo*.MR Vascular Analysis[2)]
- *syngo*.MR Cardiac 4D Ventricular Function[2)]
- *syngo*.MR Cardiac Flow[2)]
- *syngo*.MR Cardiac Perfusion[2)]

- *syngo*.MR Composing
- *syngo*.MR Cinematic VRT[2)]
- *syngo*.MR Anatomic Intelligence[2)]

For a more detailed application and feature description please refer to the *syngo*.via VB30A data sheet.

[1)] Specical post-processing DICOM objects like segmentations or structured reports won't be sent out
[2)] Optional

Post-processing Applications & Features

Engines

The following Engines are available:

- *syngo*.MR General Engine
- *syngo*.MR Onco Engine[1)]
- *syngo*.MR Onco Engine Pro[1)]
- *syngo*.MR Neuro Perfusion Engine[1)]
- *syngo*.MR Neuro 3D Engine[1)]
- *syngo*.MR Spectro Engine[1)]
- *syngo*.MR Cardio Engine[1)]

For a more detailed description of the engines please refer to the *syngo*.via VB30A data sheet.

[1)] Optional

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MAGNETOM Sola

Parts & Accessories

siemens.com/sola

SIEMENS Healthineers

Parts & Accessories

Patient Video Monitoring

Dedicated MAGNETOM Sola video camera for comprehensive patient observation in the examination room and waiting room observation.

- Up to two in-room cameras for optimized patient observation from front end and rear-end
- Up to two waiting room cameras for observing the situation in the waiting room
- Color 640×480 pixel LCD monitor may be positioned at the *syngo* Acquisition Workplace or at a convenient wall location
- Possibility to switch between 4 camera layout and single camera layout

BioMatrix Kinetic Sensor / In-bore camera

The BioMatrix Kinetic Sensor enables the operator to monitor head movement visually during head examinations. It is a wing-shaped 4-camera solution with a slim profile, which is mounted to the bore ceiling inside the MR scanner close to the isocenter and consists of four greyscale CCD cameras that are focused on the patient's head. The acquired images can be viewed on a 640 x 480 pixel LCD monitor located in the operator room close to the MR console.

Remote Viewing Monitor

Color LCD monitor (1920×1200) 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.

Additional Select&GO Control Center Rear

Additional Dot Display and Dot Control Center Rear, e.g. for interventional procedures. Located at the rear end of the system.

Foot Switch

In-room foot switch with two pneumatic buttons for start and stop of a preset MR sequence. The foot switch is MR compatible and is positioned near the patient table on the examination room floor.

syngo MR Workplace

Additional integrated Workplace connected to the host computer of the *syngo* Acquisition Workplace 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

System Start Timer

Timer clock that can be installed together with the MAGNETOM Sola to start the system automatically at user-definable times, eliminating waiting times during system boot up.
It allows the definition of three different startup times for different days.

Parts & Accessories

Comfort Kit			
Vacuum cushions for stable and comfortable positioning of the patient during the examination			
Vacuum pump connection at the Tim Table			
3 anatomically shaped cushions of different size for patient stabilization and comfort (spine, head, multi-purpose)			
May significantly reduce patient set-up times and improve image quality by minimizing the occurrence of motion artifacts			
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: siemens.com/healthcare-accessories

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MAGNETOM Sola **Datasheet-Box Content** ***syngo* MR XA11A**	**Sales Project / Customer**

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