



MAGNETOM ESSENZA

A Tim+Dot System
Tim [25x8]

www.siemens.com/MAGNETOM-ESSENZA

SIEMENS

Preliminary Edition – 2/2013





MAGNETOM ESSENZA

Established 1.5T performance. With Tim+Dot

MAGNETOM® ESSENZA, the established 1.5T performance, with more than 1,000 installations in more than 80 countries all over the world. This ultra-short system delivers the flexibility, accuracy and speed of Tim® (Total imaging matrix) technology with applications from head to toe. Dot® (Day optimizing throughput), the next movement in MRI, multiplies the power of Tim. Complemented by its excellent TCO (Total cost of ownership), it brings a fast break-even and a sustainable value, making it a sound investment with sustainable value.

More productivity. With Tim+Dot.

Tim technology has made fast, flexible and accurate scans the standard in MRI. Dot multiplies the power of Tim resulting in greater image consistency and diagnostic confidence, greater ease of use and a day that's more productive than ever before.

More applications. From head to toe.

MAGNETOM ESSENZA delivers outstanding image quality from head to toe.

The Tim application Suite comprises the Neuro, Ortho, Body, Angio, Cardiac, Breast, Oncology and Pediatric suite to support the complete range of clinical applications. Furthermore, it provides you advanced, cutting edge applications like syngo BLADE, CAIPIRINHA, Inline Diffusion and advanced 3D imaging sequences like syngo SPACE.

More confidence.

Through sustainable value.

MAGNETOM ESSENZA is ready for the future. Based on our latest software platform, it benefits from the joint platform to keep pace with the development in MRI. This makes innovative imaging techniques like CAIPIRINHA already available today and provides access to more advanced applications.

Tim+Dot. Direct response to today's demands of healthcare economics.

Tim (Total imaging matrix Technology)

Around the world, Tim® (Total imaging matrix) technology has become the new standard in MRI. With thousands of installations. Tim seamlessly integrates a high number of coil elements with a high number of RF channels, escalating versatility, image quality and acquisition speed to a whole new level. Think more exams per day. Every day.

Flexibility

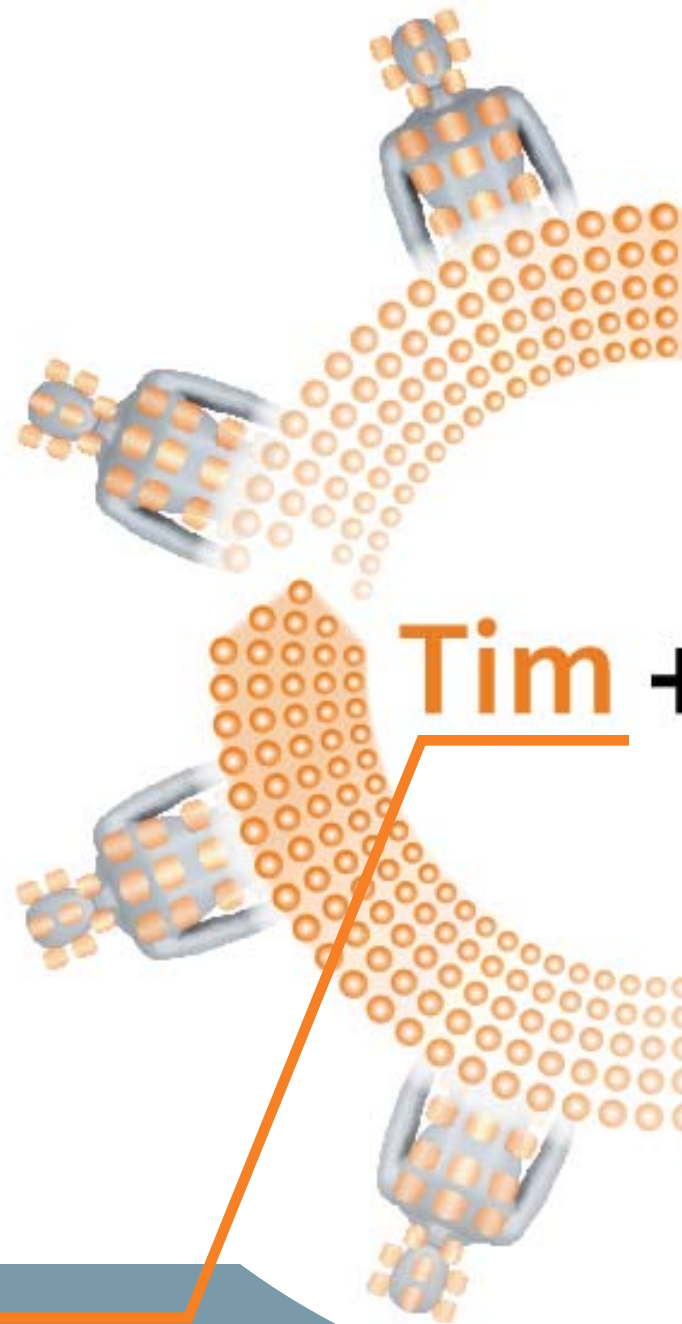
Select exams, not coils. Seamlessly integrated matrix coil elements combined with the independent RF-channels create one Total imaging matrix. A matrix in any way you want, tailored to the anatomy or clinical questions. Improving workflow and increasing productivity.

Accuracy

Local and total. Extreme precision for single organ exams up to whole CNS exams, from 5mm to 140cm FoV, without patient repositioning. For all applications. Enabling you to answer some of the most challenging clinical questions.

Speed

Parallel in all directions, head to toe, front to back, and side to side. With Tim's faster and simpler exam set-up, plus Tim's processing speed, now the daily productivity can really soar.

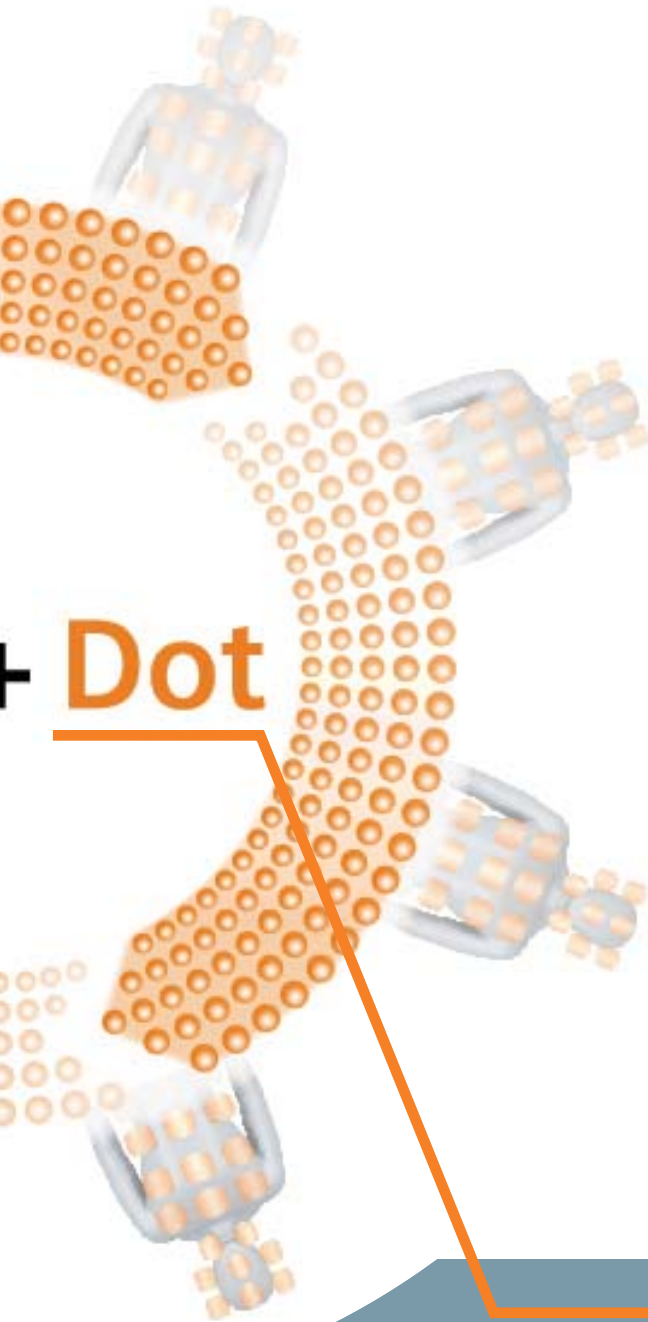


Tim has made fast, flexible and accurate scans the rule, rather than the exception.



Together, they drive
quality and

ending world



Dot (Day optimizing throughput) Engine

Dot®, the world's first MRI "throughput engine", offers patient personalization, user guidance, and exam automation. Dot takes away much of the complexity of MRI scanning, enabling greater image consistency and diagnostic confidence, greater ease of use, and a day that's more productive than ever before. And, with Dot, faster exams are a given. Where once all patient needs were treated the same, Dot personalizes for uniquely tailored, optimized scans for virtually any patient. With its user guidance and automated ease of use, Dot enables faster scan times with unheard-of consistency.

Personalized

Dot makes it easy to get the best possible results for any type of patient. Dot gives you uniquely tailored, perfect scans regardless of patient condition or clinical question.

Guided

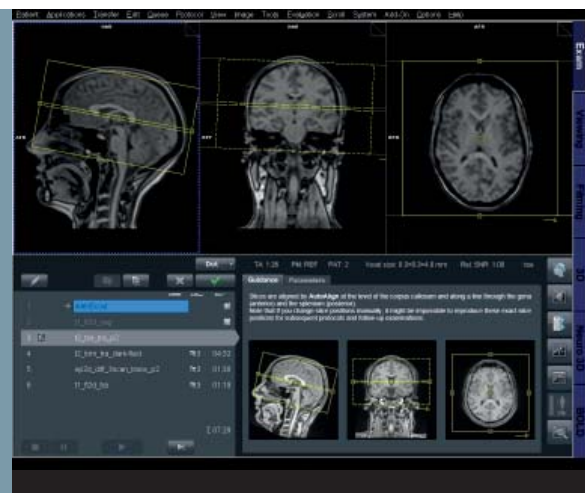
Dot helps you truly optimize all staff resources from every perspective. By indicating critical decision points along the way, Dot brings step-by-step guidance and improved consistency, helping even the novice user to scan more expertly. Highly experienced staff is then freed up for more complicated studies. The result is greater efficiency, consistency and reproducibility.

Automated

Dot delivers automated, intelligent workflows – taking efficiency to a whole new level. Scans are completed faster and more easily, with less chance of error or need for repeats.

Dot helps take the complexity out of MRI, while at the same time enabling up to 50% higher productivity.

Automatically improve efficiency.



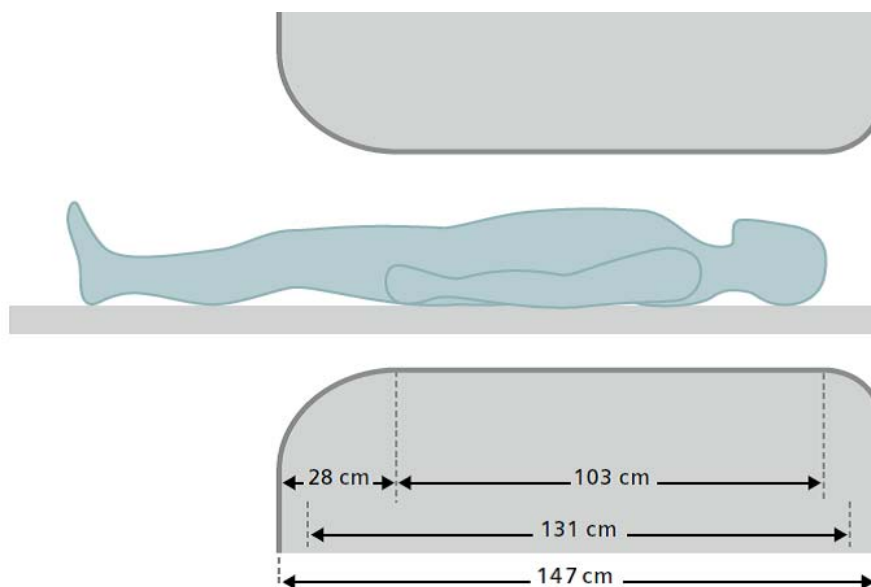
Magnet System

General

Superconducting Magnet	Short bore, patient-friendly design with large flared opening Easy siting due to AS (Active Shielding) and E.I.S. (External Interference Shielding) magnet technology
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Magnet Parameters

Operating field strength	1.5 Tesla
Superconductor	Niobium-Titanium
Field stability over time	<0.1 ppm/h
Magnet length	131 cm
Inner diameter ²⁾	60 cm
System length cover to cover	147 cm



¹⁾ W/o shim coils, gradient coil, RF body coil

²⁾ Incl. shim coils, gradient coil, RF body coil

Homogeneity (based on highly accurate 24 plane plot)		
Volume	Guaranteed	Typical
10 cm DSV	≤0.2 ppm	0.04 ppm
20 cm DSV	≤0.22 ppm	0.16 ppm
30 cm DSV	≤1.2 ppm	1.1 ppm
40x40x30 cm ³	≤2.2 ppm	1.9 ppm
45x45x 30 cm ³	≤7.5 ppm	6.0 ppm
40x40x40 cm ³	≤5 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).

Standard active shim with 3 linear and 1 non-linear channels (2nd order).

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

DEV = Diameter elliptical volume.

3D Shim

Patient-specific automated shim

For optimization of the magnetic field homogeneity

Time to shim	Approx. 22 s
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Shielding

Active Shielding (AS)	5th generation active shielding (AS) technology with counter coils	
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Fringe field (axial × radial)	0.5 mT ¹⁾	4.0 m × 2.5 m
	0.1 mT	5.8 m × 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)	Not applicable ²⁾
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Boil-off rate (typical)	0.0 liter / year ²⁾
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Max. helium capacity	approx. 1400 liters
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¹⁾ Pacemaker safety limit

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

Gradient System

General		
Gradient Duty Cycle	100%	
Gradient performance	Max. amplitude	30 mT/m
	Min. rise time	300 us
	Max. slew rate	100 T/m/s
Vector gradient performance (vector summation of all 3 gradient axes)	Max. eff. amplitude	52mT/m
	Max. eff. slew rate	173 T/m/s
Gradient Amplifier		
Water-cooled, highly compact, modular design		
Ultra-fast solid-state technology with very low switching losses		
Max. output voltage ¹⁾	1350 V	
Max. output current ¹⁾	150 A	
Resolution Parameters		
FoV	Min. 5 mm Max. ²⁾ 450 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. 5.12 mm Max. 450 mm	
Max. matrix	1024	
Highest in-plane resolution	16 μm	

¹⁾ Values for each of the 3 gradient axes

²⁾ Depending on the application, the maximum FoV may be smaller (e.g. up to 35cm in z-direction)

Sequences				
		Matrix		
		128	256	
Spin Echo	min. TR [ms]	6.9	7.6	
	min. TE [ms]	1.9	2.4	
2D GRE (TurboFLASH)	min. TR [ms]	0.96	1.37	
	min. TE [ms]	0.32	0.42	
	min. measurement time [ms]:	24	34	
3D GRE (ceMRA)	min. TR [ms]	0.96	1.37	
	min. TE [ms]	0.32	0.32	
TrueFISP	min. TR [ms]	2.31	3.1	
	min. TE [ms]	0.96	1.28	
	min. measurement time [ms]:	49	72	
TSE (HASTE)	min. Echo Spacing [ms]	1.96	2.36	
	min. TR [ms]	9	11	
	min. TE [ms]	2	2.6	
	min. measurement time [ms]:	70	81	
	max. Turbo Factor = 512			
		Matrix		
		64	128	256
EPI (single-shot and multi-shot)	min. Echo Spacing [ms]	0.43	0.63	1.05
	min. TR [ms]	10	12	17
	min. TE [ms]	5.1	6.6	9.3
	min. Measurement time	10	12	17
	max. EPI Factor = 256			
Diffusion Imaging	Max. b-value = 10 000 s/mm ²			
	Min. TE [ms] with b = 1000 [s/mm ²]	60	62	66

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

RF System

Digital Signal Processing System

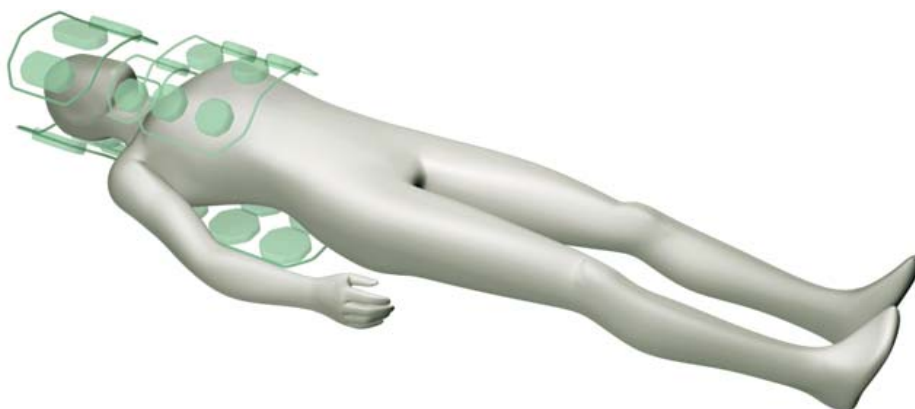
- Solid-state amplifier, maintenance-free
- Digital filtering
- Digital quadrature demodulation
- Receiver with high dynamic range without adjustments

RF Transmit Technology

Frequency stability (5 min)	$\pm 2 \times 10^{-10}$	
Frequency control	32 bits (0.015 Hz)	
Phase control	16 bits (0.006 degrees)	
Transmitter path	Transmit amplitude	16 bit control 50 ns resolution
	Gain stability (5 min)	<0.15 dB (low signal path)
		<0.40 dB (power amplifier)
Transmit amplifier	Extremely compact, water-cooled solid state amplifier	
	Transmit amplifier bandwidth	500 kHz
	Peak power	15 kW

RF Receiver Technology

The MAGNETOM ESSENZA equipped with Tim [25x8] facilitates the integration of up to combination of up to 25 seamlessly integrated coil elements and 8 independent RF channels. Two coil connectors integrated in the patient table enable the simultaneous use of a large number of coils simultaneously with the integrated, 9-element IsoCenter Matrix. All coil elements of all connected coils can be flexibly selected for each scan.



Receive path

Receiver bandwidth	500 Hz – 1 MHz (for each channel)
Receiver signal resolution	32 bits
Number of independent receiver channels	8
Sampling rate (Sampling resolution)	10 MHz (100 ns)
Preamplifier noise figure	<0.5 dB
Total gain	35dB/50 dB with automatic control
Dynamic range (referred to 1 Hz resolution bandwidth)	162 dB instantaneous at receiver 169 dB with automatic gain control at local coil connector

Coils

Standard Integrated CP Body Coil

- No-tune transmit/receive coil
- Circularly polarized (CP)
- Optimized RF efficiency and signal-to-noise ratio (SNR)

1.5T Tim Matrix Coil

The multi-element Matrix coil technology is an essential part supplementing the Total imaging matrix. The Matrix coil design has an intelligent logic that combines signals in various permutations and combinations to yield best SNR from the numerous coil elements.

- Automatic detection of the exact coil position on the patient table
- What you see is what you get: graphical visualization of coils at their current position within the user interface
- Choice of coil setting via software buttons at the *syngo* Acquisition Workplace
- Storage of coil settings within the protocols and adaptation when the protocol is recalled
- AutoCoil Select for dynamic, automatic or interactive selection of the coil elements within the Field-of-View

IsoCenter Matrix Coil

9-element Matrix coil integrated at the center of the magnet underneath the patient table. It is always in position and ready to scan enabling pristine image quality as it is always in the optimal position, the isocenter of the magnet.

It speeds up patient setup and increases throughput thanks to this unique, integrated design. The IsoCenter Matrix can be used flexibly as a spine coil or in combination with other anterior coils. It effectively works as a 140 cm coil without patient repositioning in multi-step examinations.

Customer's advantage:

Clarity, comfort, and convenience

Standard Tim Coils		
Head Matrix Coil	Application area	Head examination
	Dimensions (L×W×H)	359 mm x 385 mm x 307 mm
	Weight	4.6 kg
Neck Matrix Coil	Application area	• Cervical Spine • Neck examination
	Dimensions (L×W×H)	230 mm x 398 mm x 306 mm
	Weight	2.4 kg
4-Channel Flex Coil, large	Application area	Multi purpose
	Dimensions (L×W)	516 mm x 224 mm
	Weight	550 g
4-Channel Flex Coil, small	Application area	Multi purpose
	Dimensions (L×W)	366 mm x 174 mm
	Weight	450 g
Accessories	Flex Coil Interface 1.5 T	

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

Optional Tim Coils
• Body Matrix coil • PA Matrix Coil • Breast Matrix • Focus Shoulder Array Coil, large • Focus Shoulder Array Coil, small • Extremity Matrix Coil • Endorectal Coil • 8-Channel Foot-Ankle coil • 8-Channel Wrist coil • 4-Channel Special-Purpose coil • 2/4-Channel Sentinelle Breast coil

Patient Handling

General

Tim ensures increased patient comfort and optimized workflow efficiency.

- Only one patient setup, no repositioning, no changing of coils
- Ultralight weight coils
- Imaging with optimized surface coil quality
- Remote table move
- Feet-first examinations for many applications

The majority of applications can be performed in the feet first position, e.g., cardiac, liver, upper abdomen, pelvis, colonography, body angio, reducing the level of anxiety experienced by highly claustrophobic patients.

The scan range of 140 cm allows examinations such as whole CNS, whole Abdomen, and peripheral MRA with full usage of SNR of Matrix surface coils without patient or coil repositioning. This saves time without compromising image quality.

Patient Positioning Aids

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

Tim Table

Free-floating table	Free foot room for the attending staff and better access to the patient (cantilevered table design)
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Optional: vertical table drive to lower patient to 55cm for easy access.

Max. patient weight (including vertical movement)	200 kg (440 lbs)
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Max. scan range	140 cm
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Vertical table movement ¹⁾	Range	55–89 cm
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Max. vertical table movement time	13 s
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Horizontal table movement	Max. range	205.5 cm
	Max. speed	20 cm/s

Position accuracy	+/- 0.8 mm
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Patient Comfort Facilities

Facilities at the tableside control unit and at the *syngo* Acquisition Workplace

- In-bore lighting (3 levels)
- In-bore ventilation (3 levels)
- In-bore intercom via loudspeaker, microphone and earphones
- Look-out mirror 90°

¹⁾ Optional

Physiological Measurement Unit (PMU) – Wireless Physio Control

Synchronizes the measurement with the physiological cycles (triggering to minimize motion artifacts caused by cardiac and respiratory movements)

Wireless Sensors	Wireless Vector ECG / respiration and pulse sensors for physiologically synchronized imaging, rechargeable battery-powered – for optimized patient handling	
	• VCG acquires ECG signal from two projection directions, for easy identification of the R-wave • ECG – disposable electrodes • Pneumatic cushion to be placed on the chest or abdomen	
Physiological Signals	Physiological Signals Display	• ECG (2 channels I and/or aVF) • Pulse • Respiration
External Trigger Input Display	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	• 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. pulse generator) • Retrospective gating for ECG, peripheral pulse and external trigger input

¹⁾ Optional

Tableside Control Units

One ergonomically designed control unit integrated into the front cover on the left side.

Controls	• Table in / out in 2 speed levels • Table stop • Laser light localizer (peak power <3 mW, wave length 540–700 nm, Class II laser product) • Automatic transfer to isocenter • Home position (auto transfer) • Ventilation within the patient tunnel (adjustable in 3 levels) • Lighting within the patient tunnel (adjustable in 3 levels) • Scan start, scan stop • Volume of speaker and headphones in examination room for external audio system
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Table functions can also be controlled via software from the *syngo* Acquisition Workplace.

Patient Communication

Assistance call via squeeze-bulb for the patient. Ergonomically designed patient communication unit – may be placed at any convenient location on the Workplace table.

- Intercom communication with the patient
- Response to the patient's activation of the squeeze-bulb
- Table 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 headphones
- Loudspeaker
- Microphone

Automatic and freely programmable voice commands for breath-hold examinations.

Acquisition Parameters

Acquisition Parameters ¹⁾		
2D Slices	Number of slices	
	per single slice stack	1 – 128 (steps of 1)
	per series (total number of slices in one dynamic measurement)	up to 262 144 (depending on matrix size)
	Slice order	Ascending, descending or interleaved
3D Slabs/Partitions	Number of 3D partitions per single slab	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 64)
	Phase encoding	32–1024 (in steps of 1)
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)	6/8–1 (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 1%)
	Slice oversampling (3D volumes)	0–100% (steps depending on slice per slab)

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

Acquisition Parameters (Continued)			
Interpolation	In plane interpolation in frequency-encoding and phase-encoding direction	Selectable (factor of 2)	
	3D interpolation (3D volumes)	Selectable (up to factor of 2)	
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	
Off-center Shift	Longitudinal direction (head-feet)	–150 mm to +150 mm	
	Horizontal direction (left-right)	–200 mm to +200 mm	
	Vertical direction (anterior-posterior)	–200 mm to +200 mm	
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	

Standard Acquisition and Reconstruction Techniques

Standard techniques

- True Inversion Recovery to obtain strong T1-weighted contrast
- Dark Blood inversion recovery technique that nulls fluid blood signal
- Saturation Recovery for 2D TurboFLASH, gradient echo, and T1-weighted 3D TurboFLASH with short scan time (e.g., MPRAGE)
- Freely adjustable receiver bandwidth, permitting studies with increased signal-to-noise ratio
- Freely adjustable flip angle. Optimized RF pulses for image contrast enhancement and increased signal-to-noise ratio
- MTC (Magnetization Transfer Contrast). Off-resonance RF pulses to suppress signal from certain tissues, thus enhancing the contrast. Used e.g., in MRA
- Argus viewer for reviewing cine studies
- Report Viewer for DICOM structured reports including report editing
- Dynamic Analysis for addition, subtraction, division, standard deviation, calculations of ADC maps, T1 and T2 values, TTP etc.
- Image Filter
- 3D post-processing MPR, MIP, MinIP, SSD
- Flexible film formats and paper print
- Data storage of images and cine avi files on CD / DVD with DICOM viewer as the viewing tool
- Selectable centric elliptical phase reordering via the user interface
- Inversion Recovery to nullify the signal of fat, fluid or any other tissue

Sequences

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| Spin Echo family of sequences | <ul style="list-style-type: none">• Spin Echo (SE) – Single, Double and Multi Echo (up to 32 echoes); Inversion Recovery (IR)• 2D / 3D Turbo Spin Echo (TSE) – Restore technique for shorter TR times while maintaining excellent T2 contrast; TurboIR: Inversion Recovery for STIR, DarkFluid T1 and T2, TrueIR; Echo Sharing for dual-contrast TSE• 2D / 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 |
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Sequences (Continued)

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; 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 TrueFISP – Shared Phases Real-time TrueFISP (w / o ECG gating)
- ce-MRA sequence with Inline subtraction and Inline MIP
- 2D / 3D Time-of-Flight (ToF) Angio- graphy – single slab and multi slab; triggered and segmented
- 2D / 3D Phase Contrast Angiography – multiple velocity encoding; triggered

Standard Fat/Water Imaging

- Fat and Water Saturation. Additional frequency selective RF pulses, used to suppress bright signal from fatty tissue. Two selectable modes: weak, strong
- Quick FatSat
- SPAIR: robust fat suppression for body imaging using a frequency selective inversion pulse
- Fat/Water Excitation. Spectral selective RF pulses for exclusive fat 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 for motion and flow artifact reduction without increasing scan time
- Presaturation Technique. RF saturation pulses to suppress flow and motion artifacts. Up to six saturation bands may be positioned in any orientation
- Tracking SAT Bands maintain constant saturation of venous and / or arterial blood flow, e.g., for 2D / 3D sequential MRA
- TONE (Tilted Optimized Non-saturating Excitation). Variable excitation flip angle to compensate inflow saturation effects in 3D MRA. TONE pulse selectable depending on the desired flow direction and speed
- GMR (Gradient Motion Rephasing). Sequences with additional bipolar gradient pulses, permitting effective reduction of flow artifacts

Standard Scan Time Reduction

Elliptical scanning reduces scan time for 3D imaging

iPAT – integrated Parallel Acquisition Technique, high-performance and flexible Parallel Imaging with integrated AutoCalibration	GRAPPA included for maximum quality for all applications iPAT is compatible with all relevant sequence techniques (e.g., SE, TSE, Restore, SPACE, MEDIC, TIRM DarkFluid, HASTE, EPI, MPRAGE, 3D VIBE, FLASH, TrueFISP, TurboFLASH, FLASH Phase Contrast, etc) iPAT is compatible with all Matrix coils, all array coils, as well as coil combinations Tim Assistant facilitates optimized iPAT settings. Higher speed and temporal resolution can be used for: • Improved image resolution • Improved image quality due to reduced artifacts 3 different calibration techniques can be used: • AutoCalibration with an integrated reference (calibration) scan to additionally save on total scan time • TurboCalibration uses a separate measurement directly before the actual measurement. Images measured using TurboCalibration are characterized by reduced PAT artifacts. TurboCalibration is only used in conjunction with GRAPPA. • PAT averaging for motion artifact suppression using Self-Calibration
iPAT ²	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. A new iPAT² sequence technique named CAIPIRINHA (Controlled Aliasing In Parallel Imaging Results IN Higher Acceleration) has been added. It can be applied to simultaneous multi-slice imaging techniques and volumetric 3D imaging e.g. in the abdominal region or in angiographic examinations.

Standard Motion Correction	
<i>syngo</i> BLADE	• Motion and flow insensitive Turbo Spin Echo sequence • Supports T2-weighted, T1-weighted, STIR and DarkFluid protocols • Optional in-plane motion correction for head applications • Versatile sequence, e.g., supporting iPAT with GRAPPA and Restore pulses • Improves image quality for uncooperative patients, e.g., children in head, spine and orthopedic imaging
1D PACE (Prospective Acquisition Correction)	Quick and easy acquisition control for free breathing examinations, e.g. for cardiac imaging
2D PACE Precise Motion Correction	• Detects and corrects respiratory motion of the heart, liver, etc. for free breathing high resolution 2D and 3D examinations • Significantly increased image quality • Improved security in the diagnosis of diseases in moving organs and precise slice registration for multi breath-hold studies • Eliminates the need for respiratory belt • PAT averaging for motion artifact suppression using Self-Calibration
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	Dynamic, automatic and interactively selects the coil elements within the Field-of-View
<i>syngo</i> Scan Assistant	Shows parameter constraints and offers possible solutions.
scan@center	• Automatically moves the table so that the scan is performed in the magnet isocenter. • Best image quality especially for fat saturation techniques. • Extended Field-of-View examinations benefit from this functionality as well as multi-stage examinations.

Standard Workflow Enhancements *(Continued)*

AutoVoiceCommands	Records and plays freely programmable language-independent voice commands, e.g., for breath-hold instructions to the patient.
Phoenix and PhoenixZIP	Exchange of protocol data (e.g. via Internet) by drag & drop clinical images. PhoenixZIP allows transfer of whole measurement programs.
Online Help Functions	Context-sensitive and quick resource for questions about software operation or MR physics.
Inline Technology – Processing Instead of Post-processing	• Inline Technology helps to streamline the clinical workflow by automating mundane post-processing steps before image viewing. See the clinical results immediately. • Automatic subtraction of images, e.g., pre- and post-contrast enhancements • Automatic on-the-fly calculation of standard deviation, for better differentiation of arterial and venous phases • MIP on-the-fly, i.e., MR Angiography with automatic image subtraction and following MIP in three orthogonal planes, stored as a separate study • Automatic diffusion and perfusion imaging¹⁾ • Automatic soft tissue evaluation • Inline Display automatically shows reconstructed images. It offers real-time control of the results and opens automatically for e.g. interactive real-time scanning for CareBolus examinations • Inline Movie automatically starts the cine image display

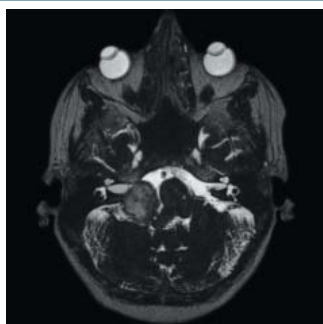
¹⁾ Optional

Tim Application Suite

The Tim Application Suite has a complete range of clinically optimized examinations for all regions. Excellent head-to-toe imaging can be accomplished with the sequences and features included in this Application Suite. The Tim Application Suite – which exploits fully the benefits of Tim – is provided as standard on the MAGNETOM ESSENZA.

- Neuro Suite
- Angio Suite
- Cardiac Suite
- Body Suite
- Onco Suite
- Breast Suite
- Ortho Suite and
- Pediatric Suite

Neuro Suite



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

General features

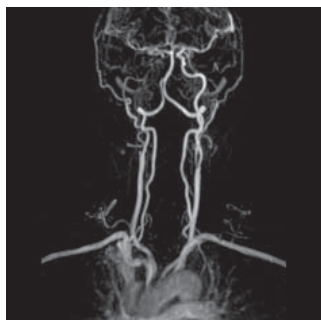
- EPI sequences and protocols for diffusion imaging, and perfusion imaging, for advanced neuro applications. Diffusion-weighted imaging is possible with up to 16 b-values in the orthogonal directions
- 3D isotropic resolution volume imaging using T1 3D MPAGE / 3D FLASH, SPACE DarkFluid, T2 SPACE and 3D TSE
- T2-weighted high resolution 3D Restore protocols optimized for inner ear examinations

²⁾ Option

Neuro Suite (Continued)

- Whole-spine protocols in multiple steps with software controlled table movement
- 2D and 3D MEDIC protocols for T2-weighted imaging, particularly for C-spine examinations in axial orientation where reproducibility is difficult due to CSF pulsations and blood flow artifacts
- 3D Myelo with 3D HASTE and 3D TrueFISP for excellent depiction of small anatomical details
- Dynamic sacroiliac joint imaging after contrast administration using a fast T1-weighted FLASH 2D sequence
- Spine diffusion protocols to differentiate osteoporosis versus tumor infiltration and post-radiotherapy changes versus residual tumor with PSIF sequence
- Dixon – 2 point Dixon, based on Turbo Spin Echo, for improved separation of fat/water signal
- 3D CISS (Constructive Interference in Steady State) for excellent visualization of fine structures such as cranial nerves. High resolution imaging of inner ear and spine

Angio Suite



Excellent MR Angiography can be performed to visualize arteries and veins with or without contrast agent

Contrast-enhanced MRA

- 3D contrast-enhanced MRA protocols with or without iPAT for head, neck, thorax, abdomen, peripheral regions with the shortest TR and TE. It is possible to separate the arterial phase from the venous phase. No venous contamination is seen due to the fast ce-MRA protocols
- CareBolus functionality for excellent results. It supports accurate determination of the bolus arrival time and the "Stop and Continue" of the 3D ce-MRA protocol after the 2D bolus control scan
- Excellent peripheral ce-MRA can be acquired with Tim's flexible coil combinations

Non-contrast MRA and venography

- 2D and 3D Time-of-Flight (ToF) protocols for MRA of the Circle of Willis, carotids, neck vessels, and breath-hold protocols for abdominal vessels
- Triggered 2D / 3D ToF sequences for non-contrast MRA, particularly in the abdomen and the extremities
- 2D / 3D Phase-Contrast
- MR venography with 2D / 3D Time-of-Flight (ToF) and Phase-Contrast
- Tilted optimized non-saturating excitation (TONE) and MTC techniques for improved Contrast-to-Noise Ratio (CNR)

Image processing tools

- MIP, MinIP, and 3D SSD
- Inline MIP for immediate results
- Inline subtraction of pre- and post-contrast measurements
- Inline standard deviation maps of Phase-Contrast measurements for delineation of arteries and veins

Cardiac Suite



The Cardiac Suite covers the complete application range from morphology, ventricular and valvular functions to tissue characterization. The utilization of triggering requires the optional PMU Bluetooth Physio Control.

Cardiac views

- Fast acquisition of the basic cardiac views 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

Morphology – heart and vessel structure and valve function

- Various breath-hold techniques for strong contrast between the blood and vascular structures.
- Dark Blood TSE and HASTE imaging are available for the structural evaluation of the cardio- thoracic anatomy, including vessels or heart valves.
- Standard cine techniques (FLASH) can also be used to visualize functions of the heart valves

Cardiac Suite (Continued)

Tools for rapid evaluation of left or right ventricular function	• Acquisition of a stack of short-axis slices (standard segmented FLASH, or advanced segmented TrueFISP) • Automatic adjustment of the acquisition window to the current heart rate • Use of the Inline ECG for graphical ECG triggering setup • Retrospective gating with cine sequences (TrueFISP, FLASH) • Protocols for coverage of the whole heart • iPAT integration for higher temporal /spatial resolution
Protocols for high contrast and high resolution tissue characterization	• Ultra-fast protocols for dynamic imaging, e.g., for 4 arbitrarily oriented slices per heart beat. These protocols provide multi-slice information for the assessment of coronary heart disease (TurboFLASH, TrueFISP) • Segmented IR TrueFISP / FLASH • TI scout for optimization of contrast between tissues • Robust and reproducible contrast between tissues with 2D phase sensitive inversion recovery, eliminating the need of TI adjustment (TrueFISP, Turbo- FLASH)

Body Suite



The Body Suite is dedicated for clinical body applications. Ultrafast high resolution 2D and 3D protocols are provided for abdomen, pelvis, MRCP, dynamic kidney, and MR Urography applications.

This package includes:

- 2D / 3D HASTE (Restore) and D / 3D TSE (Restore)
- Optimized fast single-shot HASTE protocols and high resolution 3D Restore protocols for MRCP and MR Urography examinations
- syngo REVEAL (diffusion-weighted imaging for liver and more)

Abdomen

2D:

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

Abdomen

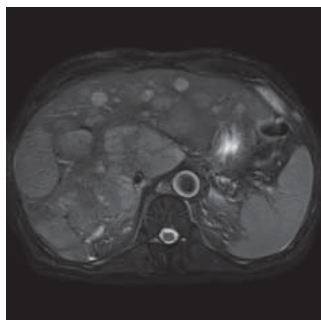
3D:

- 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) protocols for best visualization of focal lesions with high spatial and temporal resolution

Pelvis

- High-resolution T1, T2 pelvic imaging (prostate, cervix)
- Isotropic T2 SPACE 3D protocols for tumor search in the pelvis
- Dynamic volume examinations with 3D VIBE

Onco Suite

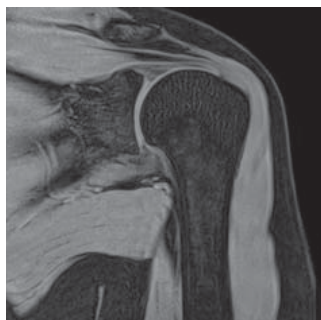


MR imaging has an excellent advantage of soft tissue contrast, multiplanar capabilities and the possibility of selectively suppressing specific tissue e.g. fat or water. This helps in the detection of pathologies, particularly metastases. The Onco Suite features a collection of sequences as well as protocols and evaluation tools that may be used in a detailed screening of clinical indications, such as in hepatic neoplasms.

General features

- 3D VIBE, FLASH and STIR-TSE in-phase / opposed-phase protocols with a high sensitivity to metastases visualization
- Dynamic imaging protocols for assessment of the kinetic behaviour for lesion visualization and characterization
- 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 or for offline calculation
- Display and analysis of the temporal behavior in selected regions of interest with the included MeanCurve post- processing application. This includes the capability of using additional datasets as a guide for defining regions of interest even faster and easier than before
- *syngo* REVEAL (diffusion-weighted imaging for liver and more)
- 2D PACE eliminates the need for respiratory belt

Ortho Suite

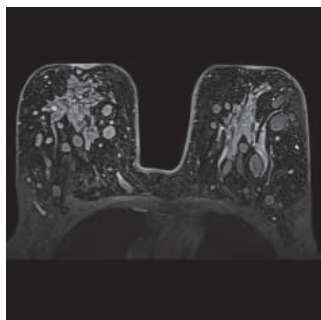


The Ortho Suite is a comprehensive collection of protocols for joint imaging including the spine. Also in case of tumors, infections, or vascular necrosis, a large amount of additional information can be acquired using the protocols provided as standard in this suite.

General features

- 2D TSE protocols for PD, T1, and T2-weighted contrast with high in-plane resolution and thin slices
- 3D MEDIC, 3D TrueFISP protocols with water excitation for T2-weighted imaging with high in-plane resolution and thin slices
- High resolution 3D VIBE protocols for MR Arthrography (knee, shoulder and hip)
- 3D MEDIC, 3D TrueFISP, 3D VIBE protocols with Water Excitation having high isotropic resolution optimized for 3D post-processing
- 3D imaging with high isotropic resolution optimized for post-processing
- Whole-spine, single-step and multi-step protocols
- SPACE for 3D imaging with high isotropic resolution for shoulder, hip, knee, wrist or ankle
- High resolution 3D DESS (Double Echo Steady State): T2 / T1-weighted imaging for excellent fluid-cartilage differentiation
- Dixon – 2 point Dixon, based on Turbo Spin Echo, for improved separation of fat/water signal
- Excellent fat suppression in off-center positions, e.g., the Focus Shoulder Array* with an attached shim device focuses the homogeneity volume of the system to the region of interest
- Dynamic TMJ protocol (different joint positions)
- Dynamic iliosacral joint protocol for contrast dynamics
- Susceptibility-insensitive protocols

Breast Suite



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

General features

- High-resolution 2D protocols for morphology evaluation
- High-resolution 3D protocols covering both breasts simultaneously
- Protocols for evaluating breasts with silicone implants
- Automatic and manual frequency adjustment, taking into account the silicone signal
- Detection of the silicone signal either to suppress the silicone signal, if the surrounding tissue is to be evaluated, or to suppress the tissue signal in order to detect an implant leakage

Breast Suite (Continued)

General features

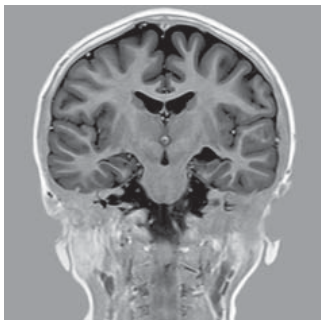
- SPAIR – robust fat sat (robust fat suppression using an adiabatic frequency selective inversion pulse)
- DIXON – 2-point Dixon with 3D VIBE, the following contrasts can be obtained: in-phase, opposed phase, fat and water image
- iPAT with GRAPPA for maximum resolution in short time
- iPAT² that allows state-of-the-art sagittal breast imaging
- Inline subtraction and MIP display
- Offline subtraction, MPR, MIP and SSD display
- syngo REVEAL: diffusion-weighted imaging for breast exams.

Including RADIANT (ultra-sound like reconstruction around the nipple)

Siemens Technique: syngo VIEWS (Volume Imaging with Enhanced Water Signal)

- Bilateral – both breasts are examined simultaneously
- Axial – the milk ducts are directly displayed
- Fat-saturated or water-excited – fat complicates clinical evaluation and is suppressed
- Near-isotropic 3D measurement – the same voxel size in all three directions for reconstruction in any slice direction
- Submillimeter voxel – highest resolution for precise evaluation

Pediatric Suite



Tissue relaxation times in pediatrics are very different compared to those of adults. The reasons for these differences are: developing tissues, body size, faster heart rates and compliance with breath-hold commands. The Pediatric Suite provides dedicated protocols with optimized contrasts for pediatric imaging.

Neuro

- Head protocols divided according to age groups and providing best contrast-to-noise ratio with optimized parameters
- Excellent T1-weighted contrast with optimized TR, TE and flip angles
- Protocols with MTC pulse for postcontrast T1-weighted imaging that provides excellent contrast-to-noise ratio resulting in improved conspicuity of lesions / pathologies

Dot Engines

Dot is personalized.

Dot makes it easy to get the best possible results for virtually any type of patient. Dot gives you uniquely tailored, optimized scans configurable to patient condition or clinical question.

- **Optimized exam strategies.** Dot provides scan strategies based on the patient's condition and clinical indication. Your protocols are automatically selected. Just confirm and start scanning.
- **Optimized to patient condition.** Dot adapts to each patient's breath-hold capacity and then links to your best scanning protocol to match.
- **Consistent, high quality exams.** High quality exams are easily reproduced, even when conditions change. Now every patient gets the same consistent exam every time.
- **Dot speaks your clinical language.** Customize Dot to create your own strategies tailored to your clinical practice. Display only the parameters you need.

Dot is guided.

Dot helps you truly optimize staff resources from every perspective. By allowing you to add critical decision points along the way, Dot guides the novice user, helping them to scan more expertly. Highly experienced staff is then freed up for more complicated studies. The result is greater efficiency at all levels and a dramatic improvement in image consistency.

- **Real-time onboard guidance.** Dot guides you, intuitively, through even the most complicated exams, step by step. Instant help, how-to descriptions, and example images are readily within view.

- **Integrated decision points.** At critical steps in the scanning process, your decision points are presented. The user can add or eliminate protocols or groups of protocols with the click of a button.
- **Customizable to your standards.** Dot can be easily customized to your steps, images, text, and protocols to follow your standards of care.
- **Dot Display.** Patient data and positioning information is provided at the scanner for accurate and fast patient set-up.

Dot is automated.

With intelligent automated workflows customized to your standards, Dot takes efficiency to a whole new level. Scans are completed faster and more easily, with less chance of errors or repeats.

- **Intelligent, automated workflows.** Dot Engines can be tailored to your clinical needs with simplified workflows that literally take the complexity out of MRI exams – even for cardiac and abdomen.
- **Effortless set-up.** Dot links your protocols and procedures. Optimal Field-of-View (FoV) is instantly estimated. And automated positioning and alignment of slices ensure fast and robust image quality across all patients.
- **Timing is never off.** Dot integrates AutoVoiceCommands into the scan process, ensuring the synchronized timing of breathing and scanning. In addition, contrast timing is more accurate due to AutoBolusDetection.

Brain Dot Engine



The Brain Dot Engine simplifies general brain examinations with guided and automated workflows customized to your standards of care. The Brain Dot Engine supports the user in achieving reproducible image quality with increased ease of use and time efficient exams.

Patient View	The user simply easily tailors the exam to each individual patient. Several customizable Dot Exam Strategies can be easily selected with one click and the measurement program automatically updates. Your protocols tailored for use of contrast media can be integrated.
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.
AutoPosition	The head of the patient is automatically placed at the isocenter without any laser marking required.
AutoAlign Head LS	All following protocols automatically position and align on the anatomically derived sagittal, coronal, and axial slices of the localizer. The alignment anatomical marking is independent of patient age, head position, or disease. AutoAlign Head LS provides a fast, easy, and reproducible patient scanning by delivering standardized image quality.

Brain Dot Engine (Continued)

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 Exam Strategies	The brain workflow can be personalized to the individual patient condition and clinical need. The following customizable strategies are included. They can be changed at any time during the brain workflow: • Standard: Standard examination with 2D protocols • Resolution focus: Examination with 3D protocols (with e.g. SPACE) for detailed views • Speed focus: Examination with fast 2D protocols (with e.g. HASTE) for further speeding up the exam • Motion-insensitive (BLADE): Examination with <i>syngo</i> BLADE protocols to minimize and correct for the effects of motion automatically
<i>syngo</i> BLADE	Motion insensitive Turbo Spin Echo sequence. Improves image quality by correcting for the effects of motion during an MR acquisition. (Can be used in head, spine, and other body regions).
Inline Diffusion	Automatic real-time calculation of trace-weighted images and ADC maps with Inline Technology. Compatible with single-shot diffusion-weighted EPI. Inline Diffusion enables <i>syngo</i> REVEAL body diffusion applications.
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.
Customization	Existing Dot Engines can be 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 and Decision Points • Modify the Parameter View

Knee Dot Engine¹⁾



With Knee Dot Engine the user can adapt the scan strategy by a single mouse-click, even during the scan in case patient conditions change – e.g. speeding up the scan if the patient starts to move.

Knee Dot Engine includes AutoAlign to assist the user in the process of slice orientation, based on a 3D-localizer. Dot guides through the workflow step-by-step with image and text information. And in most routine cases, user interaction is only required for the very first scan after which the user needs only to confirm the selection.

With its new 3D functionality, Dot assists the user to dramatically speed up scan time and generate 3D datasets for interactive 3D reading, while at the same time providing Inline MPR's for conventional 2D reading.

Patient View	Within the Patient View the user can easily tailor the exam to an individual patient. Dot Exam Strategies can be integrated. With one mouse-click you simply choose the most appropriate scan strategy, 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 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	Positions the knee automatically into the optimal scanning position
AutoAlign Knee	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 the highest possible image quality with a standardized and customizable slice orientation.

¹⁾ Optional

Knee Dot Engine¹⁾ (Continued)

Dot Exam Strategies	The workflow can be personalized to the individual patient condition and clinical need. Dot comes with the following predefined strategies, which the user can select or change at any time during the workflow: • Standard: Achieve highest image quality in a reasonable scan time with 2D protocols. • Speed focus: Examine e.g. claustrophobic patients or children in the shortest possible time with protocols being accelerated to maximal extend • Motion-insensitive(BLADE): Compensate for the effects of motion with <i>syngo</i> BLADE protocols • High Bandwidth (WARP): Protocols optimized for metal artifact reduction.
New 3D workflow	Fast SPACE program together with Inline MPR calculation for highly reproducible and fast workflow. Easy to understand user guidance. E.g. the user can acquire 3D datasets and reconstructed conventional 2D slices simultaneously in one step and in TSE contrast. Supported with easy to follow guidance information, the planning of required 2D MPR orientations is done simultaneously when the 3D scan is running.
Customization	Existing Dot Engines can be 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 and Decision Points • Modify the Parameter View

¹⁾ Optional

Abdomen Dot Engine¹⁾



The Abdomen Dot Engine offers a comprehensive and customizable workflow so that robust image quality can be achieved.

The Abdomen Dot covers workflows for the upper abdomen. Imaging for lesion detection and for lesion characterization can be configured. All oncologic examinations in this anatomical region including grading and staging of liver tumors plus metastasis screening are covered, as well as other upper abdomen indications.

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. 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.
AutoPosition	After registration the patient is positioned automatically into the optimal scanning position.
Automatic sequence	According to physiological characteristic (AutoFoV, AutoNavigator, breathhold scaling 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

¹⁾ Optional

Abdomen Dot Engine <i>(Continued)</i>	
Dot Exam Strategies	The workflow can be personalized to the individual patient condition and clinical need. The following predefined strategies are included. They can be changed at any time during the workflow: • Breath-hold: default strategy, robust breathhold protocols • Resp synchronized: robust protocols with syngo PACE triggering • Motion-insensitive: designed for “uncooperative” patients
Dot Decisions	Your decisions can be seamlessly integrated into the scanning workflow. The user just selects the queue and the appropriate protocol or set of protocols are automatically added. For the abdomen MRCP and Diffusion decision points are offered.
MRCP decision point	Dot provides comprehensive guidance, including positioning help. MRCP is measured and Inline Radial Ranges are generated in-line.
Timeline setup and Monitoring	For best overview of multi-phase breath-hold examinations, CM enhancement curve visualization
Automatic timing	For different phases
AutoBolusDetection	With override function to initiate the dynamic upper abdomen examination

Abdomen Dot Engine *(Continued)*

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
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	Existing Dot Engines can be 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 and Decision Points • Modify the Parameter View

Angio Dot Engine¹⁾



The timing of contrast injection and scan is commonly stated the most challenging part of an angiographic exam. The Angio Dot Engine guides the user through angiographic single or multi station examinations by providing visualization arterial and venous timing windows using a test bolus technique. This information is fed back into the next planning steps so scan parameters can be adapted to the individual patient and patient's condition. Where needed, automatic voice commands support the communication with the patient

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.
Test bolus	Visual display of of arterial / venous timing window
Feedback of bolus timing information	Timing information is fed back into planning steps and parameters can be adapted automatically
AutoVoiceCommands	Integrated into the scanning workflow. The system plays them automatically at the right point in time. This ensures 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
Customization	Existing Dot Engines can be 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 and Decision Points • Modify the Parameter View

¹⁾ Optional

Cardiac Dot Engine¹⁾



Cardiac examinations used to be the most complex exams in MR. Now The Cardiac Dot Engine supports the user in many ways. Using anatomical landmarks, standard views of the heart, such as dedicated long axis and short-axis views are easily generated and can easily be reproduced using different scanning techniques. Scan parameters are adjusted to the patient's heart rate and automatic voice commands are given. All of this takes most of the complexity out of a cardiac exam and supports customized workflows that are easy to repeat.

Patient View	Within the Patient View the user can easily tailor the exam to each individual patient (e.g. patient with arrhythmia, breath hold capability). Several pre-defined Dot Exam Strategies are integrated. The user just selects the appropriate strategy with one click and the queue and the complete scan set-up are automatically updated to the users pre-defined standard of care.
Guidance View	Step-by-step user guidance is seamlessly integrated. Example images and guidance text are displayed for the individual steps of the scanning workflow. Both images and text are easily configurable by the user
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
Automated parameter Adaptation	Scan parameters are automatically adapted to the patient's condition (heart rate etc.)
Novel heart localization Method	On-board guidance visually facilitates anatomic landmark settings which are used for calculation of standard long-axis views
Automated localization	Automated localization of short-axis views
Guided slice positioning	Easy way to match slice positions (short-axis) between cine, dynamic imaging, tissue characterization

¹⁾ Optional

Cardiac Dot Engine (Continued)	
Cardiac Views	Easy selection of cardiac views (e.g. 3 chamber view) during scan planning
Inline Ventricular Function Evaluation	<i>syngo</i> Inline VF performs volumetric evaluation of cardiac cine data fully automatically right after image reconstruction. There is no user input necessary. If desired, inline calculated segmentation results can be loaded to 4D Ventricular Function Analysis for further review or processing
Inline Time Course Evaluation	Automatic, real-time and motion corrected calculation of parametric maps with inline technology
Cardiac specific layout for the Exam task	Automatically chosen layouts show the new physio display and are configured for every step of the exam
Automatic display of images	Automatic display of image in dedicated cardiac image orientations instead of the standard DICOM orientations.
Adaptive triggering	Acquisition adapts in realtime to heart rate variations for non-cine applications.
Automated Naming	Automated naming of series depending on cardiac views and contrast.
AutoVoiceCommands	AutoVoiceCommands are seamlessly integrated into the scanning workflow. The system plays them automatically at the desired time point. This ensures synchronized 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.
Dot Exam Strategies	The workflow can be personalized to the individual patient condition and clinical need. The following predefined strategies are included. They can be changed at any time during the workflow: • Breath-Hold: For patients with good breathhold capability • Realtime: For patients with arrhythmias and/or poor breathhold capability
Customization	Existing Dot Engines can be 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 and Decision Points • Modify the Parameter View

syngo MR Software

syngo MR Examination

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

syngo MR Image Viewing and Filming

Image Recall	• Images are stored in DICOM format, allowing fast image access and recall. • Combines images in new series, e.g. post-processed images • Loads images automatically • Inline Display
Image Display	• Various display layouts selectable • Up to 3 patients can be simultaneously active in the viewer • Image annotation and labeling • Non-interpolated display • Fast paging through up to 500 images with 15 images / s for full screen display
Windowing	• Freely selectable window width and center • Windowing on succeeding images • Auto-windowing for optimized contrast • Saves and sends window values
Automatic Movie for cine display	
Interactive movie paging by dragging the mouse or Automatic Movie mode by clicking the icon	
Evaluation	Parallel evaluation of up to 40 regions of interest • Circle • Rectangle • Freehand ROI • Pixel lens with position marker • Statistical evaluation • Area • Standard deviation • Mean value • Min/max values • Image scrolling • Magnification • Distance • Angle

syngo MR Image Viewing and Filming *(Continued)*

2D Post-processing	Image manipulations • Reversal of gray-scale values • Image rotation by 90° or by user-defined angle • Flip horizontally/vertically • Image zoom and pan • Shutter • Annotation
Position display	Displays measured slice positions on localizer image and selected series.
Argus Viewer	Viewing software for cardiac MR studies and large data sets • Efficient cine review of cardiac and other dynamic data sets • Multiple sorting options • Single movie as well as 2, 4, or 8 simultaneous slices together in movie mode • Rapid avi creation of 1 to 8 slices simultaneously • Creates and edits DICOM structured reports
Mean Curve	Time-intensity analysis for contrast-enhanced examinations • Creates and edits DICOM structured reports
Filming	• Connection via DICOM Basic Print • Interactive filming • Filming parallel to other activities • Independent scanning and documentation – no wait time due to camera delays • Freely selectable positioning of images onto virtual film sheet • Selectable various film layouts • Mother-in-Child display • Windowing, image zoom and pan on film sheet • Configurable image text • Simultaneous handling of multiple film jobs • Up to 100 virtual film sheets

syngo MR Image Viewing and Filming (Continued)

Dynamic Analysis	Arithmetic operations on images and series (e.g. for evaluation of contrast media studies) • Addition, subtraction, multiplication, division of single images and whole series • Arithmetic mean and standard deviation across a range of selected images • Calculation of T1 and T2, and logarithmic images • Differentiation/integration of selected images • Calculation of a mean slope image from a range of selected images • Calculation of z-score (t-test) images for evaluation of BOLD imaging data (Blood Oxygenation Level Dependent) • Time-to-peak evaluation (TTP) • ADC maps Several evaluation functions may be started consecutively in the background	
Printing on Paper	Interface and software for printing images on paper (laser printer not included)	
	Supported printing	Grey levels and color
	Data format	PostScript Level 2

syngo MR 3D Post-processing

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

syngo MR Network Communication

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

<i>syngo MR Network Communication (Continued)</i>		
syngo MR Network Communication	Exchange Media Storage of images and additional data (e.g. avi files) on CD/DVD	
DICOM Viewer	A viewing tool which can be stored together with images on a DICOM CD/DVD to be handed out to the patient	
Virus Protection	• Permanent scanning for malicious software in the background to provide maximum security • Via Remote Access over secure network connection the latest virus scanner updates and operating system hotfixes are installed automatically • Provided in conjunction with a service contract with Siemens (UPTIME Services)	
Image Transfer	Local network	Ethernet
	Data transfer rate	Max. 1 Gbit/s
	Transfer rate (256×256 image)	Approx. 20 images/s

Computer System

syngo Acquisition Workplace		
General	Full multi-tasking for simultaneous functionality, e.g.: • Patient registration and pre-registration • Scanning • Reconstruction • Viewing • Post-processing • Filming • Data storage	
Color LCD Monitor	High resolution flicker-free flat-screen monitor Horizontally tiltable, forward and backward Automatic backlight control for long-term brightness stability	
	Screen size (diagonal)	19"
	Horizontal frequency	31–82 kHz
	Vertical frequency	56–75 Hz
	Screen matrix	1280 × 1024
Host computer	Processor	Quad Core Intel Xeon™ CPU
	Clock rate	≥ 2.6 GHz
	RAM	≥ 6 GB
	1 st hard disk (system SW)	≥ 300 GB
	2 nd hard disk (data base)	≥ 300 GB
	3 rd hard disk (images)	≥ 300 GB
	CD-R writer	Approx. 4000 images 256 ² DICOM Standard, ISO 9660
	DVD-R writer	Approx. 25 000 images 256 ² DICOM Standard, ISO 9660
	Media drives	CD/DVD drive

syngo Acquisition Workplace (Continued)		
Measurement and reconstruction system	Processor	Quad Core Xeon™
	Clock rate	≥ 3.1 GHz
	Main memory (RAM)	≥ 12 GB
	Hard disk for raw data	≥ 500 GB
	Hard disk for system software	≥ 500 GB
	Parallel Scan and Recon	Simultaneous scan and reconstruction of up to 8 data sets
	Reconstruction speed	≥ 8968 recons per second (256x256 PeFT, Full FoV) ≥ 38000 recons per second (256x256 PeFT, 25% FoV)
syngo MR Workplace¹⁾		
Color LCD Monitor	High resolution flicker-free flat-screen monitor Horizontally tiltable, forward and backward Automatic backlight control for long-term brightness stability	
	Screen size (diagonal)	19"
	Horizontal frequency	31–82 kHz
	Vertical frequency	56–75 Hz
	Screen matrix	1280 × 1024
Host computer	Processor	Quad Core Intel Xeon™ CPU
	Clock rate	≥ 2.6 GHz
	RAM	≥ 6 GB
	1 st hard disk (system SW)	≥ 300 GB
	2 nd hard disk (data base & images)	≥ 300 GB
	CD-R writer	Approx. 4000 images 256 ² DICOM Standard, ISO 9660
	DVD-R writer	Approx. 25 000 images 256 ² DICOM Standard, ISO 9660
	Media drives	CD/DVD drive

¹⁾ Optional

Installation

Radio Frequency Shielding

For shielding the examination room from external RF sources

RF attenuation factor	>90 dB
Frequency range	15–65 MHz

Magnet 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
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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
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System Electronics Cabinets

Two cabinets which may be placed directly against the wall or even in a corner

Require service access only from the front, saving considerable space

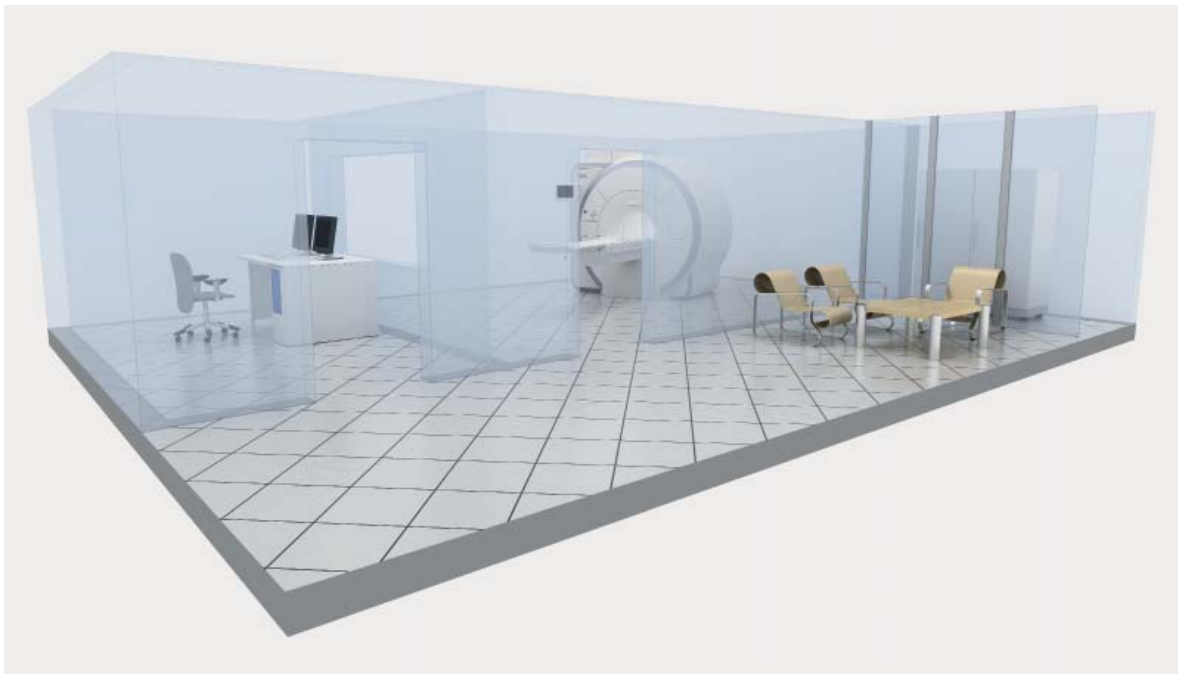
Integrated water cooling cabinet may eliminate the need for a dedicated computer room

Power Requirements

Line voltage	380, 400, 420, 440, 460, 480 V
Stability tolerances	±10%
Line frequency	50/60 Hz, ±1 Hz
Connection value ¹⁾	45 kVA

¹⁾ Long-term average in full operation

Cooling Water Requirement		
Water cooled cabinet	Water consumption	>30 l/min ¹⁾
	Heat dissipation to water	≤21 kW
Power Consumption		
System off		≤6.5 kW
Stand-by		≤6.7 kW
Ready for measurement		≤9.0 kW
Typical examination		≤9.9 kW
Space Requirements		
Min. total space requirement (for magnet, electronics, and console room)		30 m ²



¹⁾ Water temperature: 6°C – 12°C (43°F – 54°F)

Dimensions					
	Component	Width [cm]	Depth [cm]	Height [cm]	Weight [kg]
Examination Room	Magnet 1.5 Tesla AS (incl. Helium)	211.4	131	214	3150
	Magnet in operation, incl. gradient coil, body coil, patient table, and covers	231	411	218	4365
	Patient table	55.5	210.5	55-89	270
	Required min. room height clearance			240 ³⁾	
	Min. transport dimensions	226*	183*	216*	
Control Room	<i>syngo</i> Acquisition Workplace (table + monitor)	120	80	117 (72+45)	
	Host computer	17	45	46	
	<i>syngo</i> MR Workplace (optional) (table + monitor)	120	80	117 (72+45)	
Equipment Room	Electronics cabinet, incl. system control, RF system, gradient power system, image processor	95	65	189**	700
	Active Cooling System	100	65	189**	435
	Passive Cooling System	80	65	189**	280

* Without electronics, table and table bracket

** Without attachments

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MAGNETOM ESSENZA

A Tim+Dot System
Tim [46x16]

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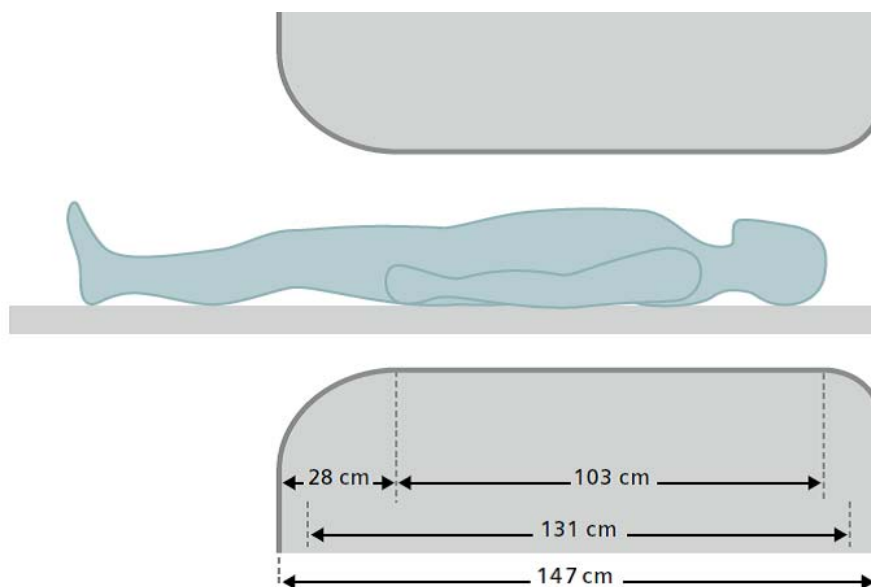
Magnet System

General

Superconducting Magnet	Short bore, patient-friendly design with large flared opening
	Easy siting due to AS (Active Shielding) and E.I.S. (External Interference Shielding) magnet technology

Magnet Parameters

Operating field strength	1.5 Tesla
Superconductor	Niobium-Titanium
Field stability over time	<0.1 ppm/h
Magnet length	131 cm
Inner diameter ²⁾	60 cm
System length cover to cover	147 cm



¹⁾ W/o shim coils, gradient coil, RF body coil

²⁾ Incl. shim coils, gradient coil, RF body coil

Homogeneity (based on highly accurate 24 plane plot)		
Volume	Guaranteed	Typical
10 cm DSV	≤0.2 ppm	0.04 ppm
20 cm DSV	≤0.22 ppm	0.16 ppm
30 cm DSV	≤1.2 ppm	1.1 ppm
40x40x30 cm ³	≤2.2 ppm	1.9 ppm
45x45x 30 cm ³	≤7.5 ppm	6.0 ppm
40x40x40 cm ³	≤5 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).

Standard active shim with 3 linear and 1 non-linear channels (2nd order).

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

DEV = Diameter elliptical volume.

3D Shim

Patient-specific automated shim

For optimization of the magnetic field homogeneity

Time to shim	Approx. 22 s
--------------	--------------

Shielding

Active Shielding (AS)	5th generation active shielding (AS) technology with counter coils	
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Fringe field (axial × radial)	0.5 mT ¹⁾	4.0 m × 2.5 m
	0.1 mT	5.8 m × 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)	Not applicable ²⁾
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Boil-off rate (typical)	0.0 liter / year ²⁾
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Max. helium capacity	approx. 1400 liters
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¹⁾ Pacemaker safety limit

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

Gradient System

General		
Gradient Duty Cycle	100%	
Gradient performance	Max. amplitude	30 mT/m
	Min. rise time	300 us
	Max. slew rate	100 T/m/s
Vector gradient performance (vector summation of all 3 gradient axes)	Max. eff. amplitude	52mT/m
	Max. eff. slew rate	173 T/m/s
Gradient Amplifier		
Water-cooled, highly compact, modular design		
Ultra-fast solid-state technology with very low switching losses		
Max. output voltage ¹⁾	1350 V	
Max. output current ¹⁾	150 A	
Resolution Parameters		
FoV	Min. 5 mm Max. ²⁾ 450 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. 5.12 mm Max. 450 mm	
Max. matrix	1024	
Highest in-plane resolution	16 µm	

¹⁾ Values for each of the 3 gradient axes

²⁾ Depending on the application, the maximum FoV may be smaller (e.g. up to 35cm in z-direction)

Sequences				
		Matrix		
		128	256	
Spin Echo	min. TR [ms]	6.9	7.6	
	min. TE [ms]	1.9	2.4	
2D GRE (TurboFLASH)	min. TR [ms]	0.96	1.37	
	min. TE [ms]	0.32	0.42	
	min. measurement time[ms]:	24	34	
3D GRE (ceMRA)	min. TR [ms]	0.96	1.37	
	min. TE [ms]	0.32	0.32	
TrueFISP	min. TR [ms]	2.31	3.1	
	min. TE [ms]	0.96	1.28	
	min. measurement time[ms]:	49	72	
TSE (HASTE)	min. Echo Spacing [ms]	1.96	2.36	
	min. TR [ms]	9	11	
	min. TE [ms]	2	2.6	
	min. measurement time[ms]:	70	81	
	max. Turbo Factor = 512			
		Matrix		
		64	128	256
EPI (single-shot and multi-shot)	min. Echo Spacing [ms]	0.43	0.63	1.05
	min. TR [ms]	10	12	17
	min. TE [ms]	5.1	6.6	9.3
	min. Measurement time	10	12	17
	max. EPI Factor = 256			
Diffusion Imaging	Max. b-value = 10 000 s/mm ²			
	Min. TE [ms] with b = 1000 [s/mm ²]	60	62	66

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

RF System

Digital Signal Processing System

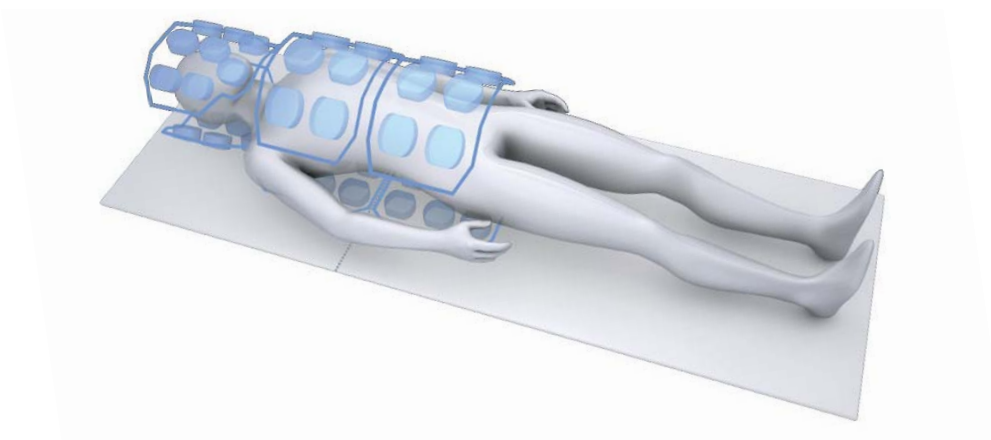
- Solid-state amplifier, maintenance-free
- Digital filtering
- Digital quadrature demodulation
- Receiver with high dynamic range without adjustments

RF Transmit Technology

Frequency stability (5 min)	$\pm 2 \times 10^{-10}$	
Frequency control	32 bits (0.015 Hz)	
Phase control	16 bits (0.006 degrees)	
Transmitter path	Transmit amplitude	16 bit control 50 ns resolution
	Gain stability (5 min)	<0.15 dB (low signal path)
		<0.40 dB (power amplifier)
Transmit amplifier	Extremely compact, water-cooled solid state amplifier	
	Transmit amplifier bandwidth	500 kHz
	Peak power	15 kW

RF Receiver Technology

The MAGNETOM ESSENZA equipped with Tim [46x16] facilitates the integration of up to combination of up to 46 seamlessly integrated coil elements and 16 independent RF channels. Two coil connectors integrated in the patient table enable the simultaneous use of a large number of coils simultaneously with the integrated, 9-element IsoCenter Matrix. All coil elements of all connected coils can be flexibly selected for each scan.



Receive path

Receiver bandwidth	500 Hz – 1 MHz (for each channel)
Receiver signal resolution	32 bits
Number of independent receiver channels	16
Sampling rate (Sampling resolution)	10 MHz (100 ns)
Preamplifier noise figure	<0.55 dB
Total gain	365dB/50 dB with automatic control
Dynamic range (referred to 1 Hz resolution bandwidth)	162 dB instantaneous at receiver 169 dB with automatic gain control at local coil connector

Coils

Standard Integrated CP Body Coil

- No-tune transmit/receive coil
- Circularly polarized (CP)
- Optimized RF efficiency and signal-to-noise ratio (SNR)

1.5T Tim Matrix Coil

The multi-element Matrix coil technology is an essential part supplementing the Total imaging matrix. The Matrix coil design has an intelligent logic that combines signals in various permutations and combinations to yield best SNR from the numerous coil elements.

- Automatic detection of the exact coil position on the patient table
- What you see is what you get: graphical visualization of coils at their current position within the user interface
- Choice of coil setting via software buttons at the *syngo* Acquisition Workplace
- Storage of coil settings within the protocols and adaptation when the protocol is recalled
- AutoCoil Select for dynamic, automatic or interactive selection of the coil elements within the Field-of-View

IsoCenter Matrix Coil

9-element Matrix coil integrated at the center of the magnet underneath the patient table. It is always in position and ready to scan enabling pristine image quality as it is always in the optimal position, the isocenter of the magnet.

It speeds up patient setup and increases throughput thanks to this unique, integrated design. The IsoCenter Matrix can be used flexibly as a spine coil or in combination with other anterior coils. It effectively works as a 140 cm coil without patient repositioning in multi-step examinations.

Customer's advantage:

Clarity, comfort, and convenience

Standard Tim Coils		
16-channel Head/Neck coil	Application area	Head examination
	Dimensions (L×W×H)	470 mm x 470 mm x 330 mm
	Weight	5.4 kg
4-Channel Flex Coil, large	Application area	Multi purpose
	Dimensions (L×W)	56 mm x 224 mm
	Weight	550 g
4-Channel Flex Coil, small	Application area	Multi purpose
	Dimensions (L×W)	366 mm x 174 mm
	Weight	450 g
Accessories	Flex Coil Interface 1.5 T	

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

Optional Tim Coils
• Body Matrix coil • PA Matrix Coil • Breast Matrix • Focus Shoulder Array Coil, large • Focus Shoulder Array Coil, small • Extremity Matrix Coil • Endorectal Coil • 8-Channel Foot-Ankle coil • 8-Channel Wrist coil • 4-Channel Special-Purpose coil • 2/4-Channel Sentinelle Breast coil • 14-Channel Extremity coil

Computer System

syngo Acquisition Workplace		
General	Full multi-tasking for simultaneous functionality, e.g.: • Patient registration and pre-registration • Scanning • Reconstruction • Viewing • Post-processing • Filming • Data storage	
Color LCD Monitor	High resolution flicker-free flat-screen monitor Horizontally tiltable, forward and backward Automatic backlight control for long-term brightness stability	
	Screen size (diagonal)	19"
	Horizontal frequency	31–82 kHz
	Vertical frequency	56–75 Hz
	Screen matrix	1280 × 1024
Host computer	Processor	Quad Core Intel Xeon™ CPU
	Clock rate	≥ 2.6 GHz
	RAM	≥ 6 GB
	1 st hard disk (system SW)	≥ 300 GB
	2 nd hard disk (data base)	≥ 300 GB
	3 rd hard disk (images)	≥ 300 GB
	CD-R writer	Approx. 4000 images 256 ² DICOM Standard, ISO 9660
	DVD-R writer	Approx. 25 000 images 256 ² DICOM Standard, ISO 9660
	Media drives	CD/DVD drive

syngo Acquisition Workplace (Continued)		
Measurement and reconstruction system	Processor	Quad Core Xeon™
	Clock rate	≥ 3.1 GHz
	Main memory (RAM)	≥ 16 GB
	Hard disk for raw data	≥ 500 GB x2
	Hard disk for system software	≥ 500 GB
	Parallel Scan and Recon	Simultaneous scan and reconstruction of up to 16 data sets
	Reconstruction speed	≥ 9174 recons per second (256x256 PeFT, Full FoV)
syngo MR Workplace¹⁾		
Color LCD Monitor	High resolution flicker-free flat-screen monitor Horizontally tiltable, forward and backward Automatic backlight control for long-term brightness stability	
	Screen size (diagonal)	19"
	Horizontal frequency	31–82 kHz
	Vertical frequency	56–75 Hz
	Screen matrix	1280 × 1024
Host computer	Processor	Quad Core Intel Xeon™ CPU
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	DVD-R writer	Approx. 25 000 images 256 ² DICOM Standard, ISO 9660
	Media drives	CD/DVD drive

¹⁾ Optional

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MAGNETOM ESSENZA

IsoCenter Matrix Coil

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IsoCenter Matrix Coil

General	The IsoCenter Matrix Coil is part of the standard system configuration. • 9-element design integrated at isocenter into the bore of the magnet • Operates as spine coil, in single and multi-step examinations and as posterior coil together with Body Matrix or PA Matrix coils • Workflow optimized setup with a coil that never needs to be positioned on the table • No coil tuning • iPAT-compatible
Applications	• T- and L-spine examinations • Whole spine and whole CNS • Bilateral peripheral MRA • Bilateral examination of long bone and legs • Pelvic and abdominal imaging • Thorax and cardiac imaging
Can be combined with	• Body Matrix Coil • Head Matrix Coil • Neck Matrix Coil • 16 channel Head/Neck Coil¹⁾ • PA Matrix Coil • 4-channel Flex coil large • 4-channel Flex coil small • Endorectal coils
Matrix Coil Mode	• 3-channel CP Mode • 6-channel Dual Mode
Weight	4.8 kg
Dimensions (L × W × H)	300 mm × 300 mm × 280 mm

¹⁾ Only for Tim [46x16]

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MAGNETOM ESSENZA

Head Matrix Coil

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Head Matrix Coil

General	The Head Matrix Coil is part of the standard system configuration • 6-element design with 6 integrated preamplifiers • Upper coil part 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 Neck Matrix coil and IsoCenter Matrix coil • Open patient-friendly design • Cushioned head stabilizers (removable) • No coil tuning • iPAT-compatible • Detachable double mirror
Applications	• Head examination • MR Head/Neck Angiography • Combined head/neck examination • TMJ (temporomandibular joints)
Can be combined with	• Neck Matrix coil • IsoCenter Matrix coil • Body Matrix coil • All flexible coils (e.g. 4-Channel Flex coil small/large)
Matrix Coil Mode	• 4-channel CP Mode • 8-channel Dual Mode • 12-channel Triple Mode
Weight	4.6 kg
Dimensions (L × W × H)	359 mm × 385 mm × 307 mm

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MAGNETOM ESSENZA

Neck Matrix Coil

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Neck Matrix Coil

General

The Neck Matrix coil is part of the standard system configuration.

- 4-element design with 4 integrated preamplifiers, 2 clusters of 2 elements each
- Upper coil part 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
- Operates in an integrated fashion with the Head Matrix coil and IsoCenter Matrix coil, for coverage of the posterior and anterior neck region
- No coil tuning
- iPAT-compatible



Applications

- Cervical spine
- Neck
- Larynx/Esophagus
- MR Angiography
- Mediastinum
- Combined head/neck examination

Can be combined with

- Head Matrix coil
- IsoCenter Matrix coil
- Body Matrix coil

Matrix Coil Mode

- 2-channel CP Mode
- 4-channel Dual Mode

Weight

2.4 kg

Dimensions (L × W × H)

230 mm × 398 mm × 306 mm

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MAGNETOM ESSENZA

Body Matrix Coil

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Body Matrix Coil

General	• 6-element design with 6 integrated preamplifiers, with 2 clusters of 3 elements each • Operates in an integrated fashion with the IsoCenter Matrix coil (2 rings of 6 elements each = 12-element design) • Can be combined with further Body Matrix coils for larger coverage • No coil tuning • iPAT-compatible
Applications	• Thorax • Abdomen • Pelvis • Hip
Can be combined with	• Head Matrix coil • Neck Matrix coil • IsoCenter Matrix coil • Additional Body Matrix coil • PA Matrix coil • All flexible coils (e.g. 4-Channel Flex coil small/large) • Endorectal coils
Matrix Coil Mode	• 2-Channel CP Mode • 4-Channel Dual Mode which results in 4- or 8-channel body imaging in combination with the IsoCenter Matrix coil. • 6-Channel Triple Mode
Weight	1.5 kg; "patient-felt" weight of coil only 950g
Dimensions (L × W × H)	322 mm × 520 mm × 40 mm



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PA Matrix Coil

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PA Matrix Coil

General	• 16-element design with 16 integrated preamplifiers, in 8 CP pairs, i.e., 4 levels with 2 CP elements each • Operates in an integrated fashion with the Body Matrix coils and IsoCenter Matrix coil • Automatic table feed and active coil switch • Both legs are independently covered with coil elements, maximizing the coil filling factor and the signal-to-noise ratio • No coil tuning • iPAT-compatible
Applications	• High resolution angiography of both legs incl. pelvis with highest signal-to-noise ratio • Visualization of the iliac arteries and aorta • Bilateral examinations of long bones of the legs
Can be combined with	• IsoCenter Matrix coil • Body Matrix coils • All flexible coils (e.g. CP Flex coil small/large)
Matrix Coil Mode	• 8-channel CP Mode
Weight	5.75 kg
Dimensions (L × W × H)	970 mm × 300–600 mm × 270 mm

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MAGNETOM ESSENZA

Focus Shoulder Array Coil

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Focus Shoulder Array Coil

General

- 6-element design with 6 integrated preamplifiers
- Two coils are included, one for small and one for large shoulders
- For narrow or wide shoulders the coil can be attached at different positions on the base plate
- Includes one base plate pad and one head rest for high patient comfort
- No coil tuning
- iPAT-compatible
- Focus Wing with integrated shim device focuses the homogeneity volume of the magnet to the off-center anatomy

Applications

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



	Focus Shoulder Array coil, large	Focus Shoulder Array coil, small
Opening	200 mm	165 mm
Weight	2.2 kg	2.1 kg
Base Plate Weight	2.8 kg	
Dimensions (L × W)	525 mm × 200 mm	

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MAGNETOM ESSENZA

Extremity Matrix Coil

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Extremity Matrix Coil

General	• 8-channel receive coil only • CP coil with 12 integrated preamplifiers • Upper coil part removable • Two different-sized cushions to comfortably position different-sized knees • No coil tuning
Applications	• Knee • Ankle • Peripheral MR Angiography
Weight	6.5 kg
Dimensions (L × W × H)	536 mm × 240 mm × 297



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MAGNETOM ESSENZA

4-Channel Flex Coil

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Flex Large 4 and Flex Small 4		
	4-Channel Flex Coil, large	4-Channel Flex Coil, small
General	• 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 • Dual-Density Signal Transfer enables ultra-high density coil	
Features	• Wrap-around coil made from soft and flexible material • 4 linear polarized elements • iPAT-compatible • No coil tuning	
Applications	Imaging of large regions such as medium to large shoulder, hip and knee	Imaging of small regions such as small to medium shoulder, wrist, elbow and ankle
Can be combined with	• Matrix coils • All flexible coils (second Flex Coil Interface required) • Endorectal coil	• Matrix coils • All flexible coils (second Flex Coil interface required) • Endorectal coil
Weight	550 g	450 g
Dimensions	516 mm × 224 mm	366 mm × 174 mm

¹⁾ Second Flex Coil Interface 3T required (option)



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MAGNETOM ESSENZA

8-Channel Wrist Coil

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8-Channel Wrist Coil

General	• 8-element coil with 8 integrated preamplifiers; true 8-channel phase array coil • iPAT-compatible in all directions • Hinged design of the upper part for quick and easy patient positioning • No coil tuning
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Applications	High resolution hand and wrist imaging
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Weight	2.1 kg
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Dimensions (L × W × H)	280 mm × 189 mm × 126 mm
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MAGNETOM ESSENZA

8-Channel Foot-Ankle Coil

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8-Channel Foot-Ankle Coil

- | | |
|---------|---|
| General | <ul style="list-style-type: none">• 10-element coil with 8 integrated preamplifiers• iPAT-compatible• Boot-like coil design• Fast patient setup with user-friendly slide mechanism• Stabilization pads for comfortable patient positioning• No coil tuning |
|---------|---|

Applications	High resolution foot and ankle imaging
--------------	--

Weight	3.2 kg
--------	--------

Dimensions (L × W × H)	315 mm × 213 mm × 286 mm
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MAGNETOM ESSENZA

4-Channel Special-Purpose Coil

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4-Channel Special-Purpose Coil

General	• 4-channel • No coil tuning • iPAT-compatible
Applications	• Carotids • Examinations with small Field-of-Views • Small structures near the surface
Weight	300 g
Dimensions (L × W × H)	418 mm × 127 mm × 52 mm



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MAGNETOM ESSENZA

Breast Matrix Coil

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Breast Matrix Coil

General	• 4-element design with 4 integrated preamplifiers, 2 clusters with 2 elements each • Padded for imaging in prone position • Stabilizing pads for wide anatomical variations • Mediolateral compression capability • No coil tuning • iPAT-compatible
Applications	• Simultaneous high resolution imaging of both breasts in all directions • Uni- or bi-lateral imaging of the breasts in sagittal direction • Visualization of axilla region
Can be combined with	• Body Matrix coils • All flexible coils for even more axillary coverage (e.g. CP Flex Coil small/large)
Matrix Coil Mode	• 2-channel CP Mode • 4-channel Dual Mode
Weight	7.5 kg
Dimensions (L x W x H)	500 mm x 520 mm x 135 mm



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MAGNETOM ESSENZA

2-/4-Channel Sentinelle Breast Coil

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2-/4-Channel Sentinelle Breast Coil

- | | |
|---------|---|
| General | <ul style="list-style-type: none">• Patient frame• Two 1-channel insert coils, one 2-channel medial coil• The coil can be used in the following configurations:<ul style="list-style-type: none">4-channel biopsy2-channel biopsy• Breast cushion set• Height adjustable head rest• Head rest cushion• Contra-lateral support plate for use in unilateral biopsy |
|---------|---|

- | | |
|--------------|--|
| Applications | <ul style="list-style-type: none">• Simultaneous imaging of both breasts in all directions• Breast biopsy with medial and lateral access• High-resolution 2D and 3D imaging• Good iPAT capabilities, iPAT factors up to 2 |
|--------------|--|

Weight	10 kg
--------	-------

Dimensions (L x W x H)	870 mm x 550 mm x 145 mm
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MAGNETOM ESSENZA

14-Channel Extremity Coil

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14-Channel Extremity Coil

General

- 14-channel extremity coil
- Transmission layer integrated working as inductivecoupled local transmit coil with body coil brings higher transmit efficiency and lower whole body SAR
- 18-element design with 14 integrated preamplifiers, 3 rings of 6 elements each (i.e. 6 cluster of 3 elements each)
- Upper coil part removable
- Cushions for patient comfort and stabilization of the anatomyiPAT-compatible in all 3 directions
- No coil tuning

Applications

- Examinations of knee, foot, ankle, hand and wrist
- High SNR of the coil supports high resolution imaging, small FOV imaging and fast imaging.

Weight

7.5 kg

Dimensions (L x W x H)

536 mm x 240 mm x 313 mm

Minimum inner diameter

170 mm



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MAGNETOM ESSENZA

16-Channel Head/Neck Coil

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16-Channel Head/Neck Coil*

General

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

- 16-element design with 16 integrated preamplifiers upper and lower part, each with 3 rings, 2 upper rings with 3 elements for head imaging and lower rings with 2 elements for neck imaging. (i.e. 4 cluster of 3 and 2 clusters of 2 elements each)
- 2 extra sockets on the coil, to connect up to 2 Body Matrix coils or 1 Body Matrix coil and one 4-Channel Flex coil for large coverage
- Combined coil for head and neck examination for optimized workflow
- Upper coil part 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
- Cushions for patient comfort and stabilization of the anatomy iPAT-compatible in all 3 directions
- No coil tuning

Applications

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

Can be combined with

- IsoCenter Matrix Coil
- Body Matrix coils (up to 2)
- All flexible coils (e.g. 4-Channel Flex coil, small, 4-Channel Flex coil, large)

Weight

5.4 kg

Dimensions (L x W x H)

470 mm x 470 mm x 330 mm

* The product might not be approved in some countries or, for other reasons, not yet commercially available.



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MAGNETOM ESSENZA

Endorectal Coil

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Endorectal Coil

Flex Coil Interface	• Integrated dual ultra low-noise preamplifiers • Allows flexible coil positioning • Only one interface necessary for all flexible coils • Several Flex Coil Interfaces can be used simultaneously to connect several flexible coils
General	• Interface device for connecting either the prostate, colon, or cervix receive coil • The endo coil is plugged into the endo interface which is then plugged into the Flex Coil Interface • No coil tuning • Disposable
Applications	• Excellent visualization of the prostate, colon, rectum and cervix without the risk of invasive procedures • Non-invasive preoperative diagnostic evaluation and treatment planning
Can be combined with	• Body Matrix coil • All additional flexible coils (second Flex Coil Interface required) • Spine Matrix Coil
Weight	200 g



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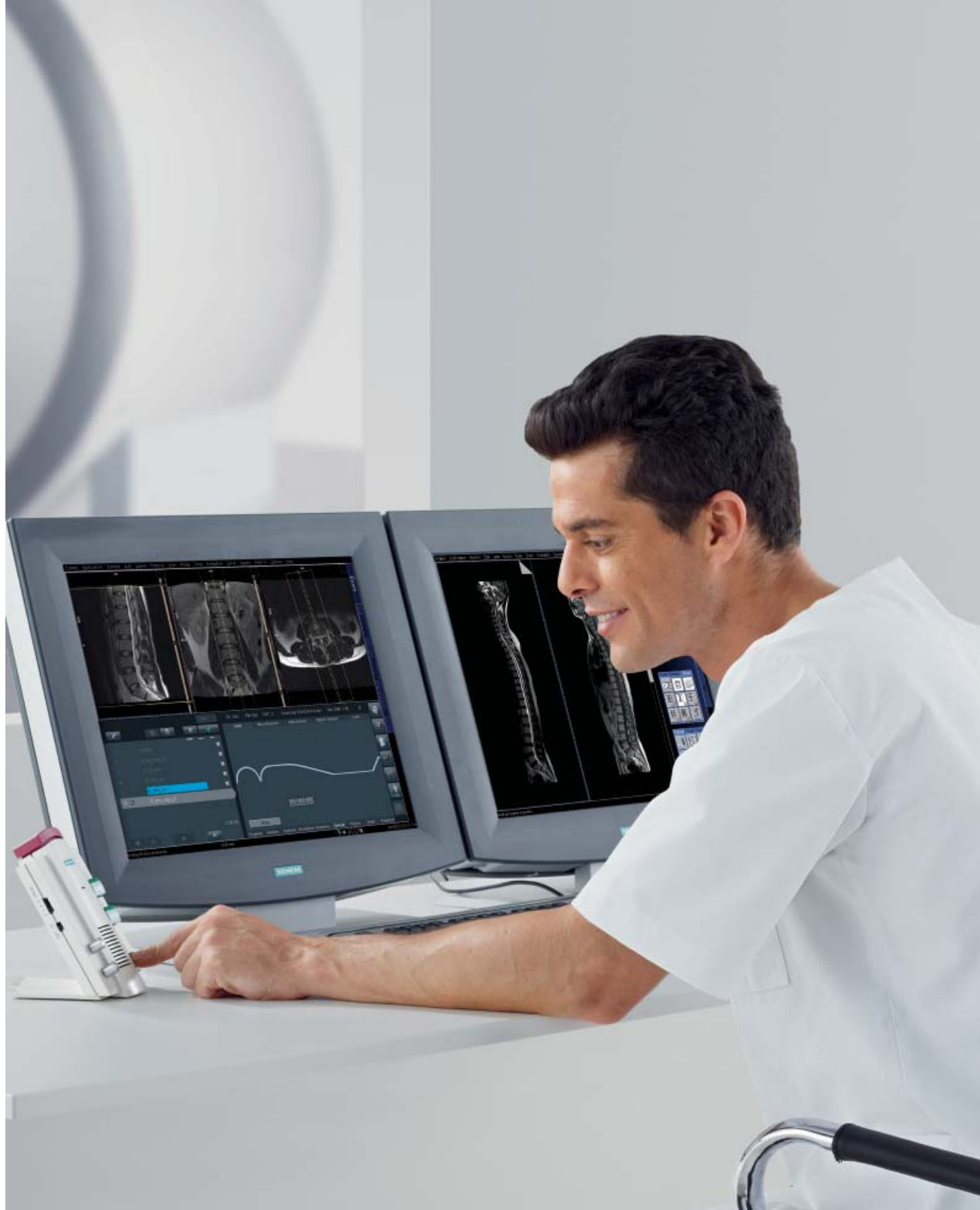
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MAGNETOM ESSENZA

Application Packages

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Application Packages

Tim Planning Suite

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

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

syngo MapIt

syngo MapIt provides the protocols and Inline calculation of parametric maps of T1, T2, and T2* properties of the imaged tissue. The application range includes cartilage evaluation of joints, as well as the examination of abdominal organs, such as liver or kidney.

syngo MapIt (Continued)

In particular, *syngo* MapIt MapIt supports the user in detecting osteo arthritis of the joint based on the T1, T2, and T2* properties of the cartilage.

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

syngo SWI (Susceptibility Weighted Imaging)

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 to increase sensitivity to intracerebral hemorrhage

Inline BOLD Imaging (Blood Oxygen Level Dependent)

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

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

syngo RESOLVE

syngo RESOLVE (Readout Segmentation Of Long Variable Echo-trains) delivers high resolution diffusion weighted imaging (DWI) for visualizing the diffusion properties of fine anatomical structures, enabling more accurate lesion evaluation. 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 *syngo* DTI Tractography package, *syngo* RESOLVE enables excellent white-matter tract imaging even in the most challenging areas, such as the cervical spine.

syngo RESOLVE (Continued)

- 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.

Neuro Perfusion

Inline Perfusion helps to streamline the clinical workflow by automating post-processing perfusion data during data acquisition. This makes it possible to see the clinical results immediately and facilitates instantaneous image quality assurance. Inline perfusion functionality is user-configurable. Neuro Perfusion measures perfusion deficits and assist in the diagnosis and grading of e.g. vascular deficiencies and brain tumors.

Neuro Perfusion provides the inline calculation of relative Cerebral Blood Volume (rel CBV), corrected relative CBV, relative Cerebral Blood Flow (rel CBF), relative Mean Transit Time (MTT), Global Bolus Plot, Percentage of Baseline at Peak and a task card for detailed post-processing of brain perfusion data sets. It also features retrospective motion correction of the time series. Color display of the relMTT, relCBV, and relCBF is supported. Flexible selection of the Arterial Input Function (AIF) for more reliable analysis taking into account the dynamics over time of the contrast agent enrichment, as well as the use of automated local AIFs are available.

syngo DTI (Diffusion Tensor Imaging)

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

- Measurement of up to 192 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-value as well as color-coded for principle diffusion direction), Apparent Diffusion Coefficient (ADC) maps and trace-weighted images based on the tensor

AutoAlign Head – Landmark Survey (LS)

Automated positioning and alignment of the anatomy-related sagittal, coronal and axial localizer slices using anatomical landmarks. Independent of patient age, head position, disease or user selected positioning standards, the system automatically finds the correct position.

AutoAlign Head LS is independent of the coil setup or the sequence.

AutoAlign assists the user in positioning slices with:

- high cross-patient robustness
- inpatient reproducibility

This provides a fast, easy, standardized and reproducible patient scanning and supports reading by delivering a higher and more standardized image quality.

AutoAlign Spine

Single mouse click double oblique positioning of transverse slice packages in spine imaging. AutoAlign Spine localizes the intervertebral disk on sagittal images and positions the transverse slice packages parallel to the disk in a standardized way. This allows for a faster and easier exam and supports reading by delivering a higher and more standardized image quality.

Inline Composing

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

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

syngo TWIST

This package contains a Siemens-unique sequence and protocols for advanced time-resolved (4D) MR angiography and dynamic imaging in general with high spatial and temporal resolution. *syngo* 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. *syngo* TWIST can be combined with water excitation.

syngo NATIVE

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

NATIVE offers:

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

The syngo NATIVE package comprises:

- syngo NATIVE TrueFISP
- syngo NATIVE SPACE

Flow Quantification

Special sequences for quantitative flow determination studies

Measuring blood/ CSF flow non-invasively

Requires Physiological Measurement Unit (PMU) option

RetroGated Flow:

- Retrogated flow measurement for dynamic representation of temporally changing flow

Single Voxel Spectroscopy

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

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

SVS Techniques SE and STEAM

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

syngo CSI 2D: Chemical Shift Imaging

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

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

- Matrix Spectroscopy – phase-coherent signal combination from several coil elements for maximum SNR with configurable prescan-based normalization for optimal homogeneity
- 2D Chemical Shift Imaging
- Hybrid CSI with combined volume selection and Field-of-View (FoV) encoding
- Short TEs available (30ms for SE, 20ms for STEAM)
- Automated shimming of the higher order shim 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

syngo CSI 3D: Chemical Shift Imaging – for Prostate

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

Extension of the SVS package, offering the same level of user-friendliness and automation

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

syngo Security

Security package for general regulatory security rules

The option supports customers to achieve compliance with HIPAA (Health Insurance and Accountability Act)

- User authentication
- Restricts access to functions and data through privileges and permissions
- Logs relevant data security information in audit

syngo Expert-i¹⁾

Interactive real-time access to imaging data and exam information from any PC within the hospital network during the MR exam.

Until now, radiologists or other experts had to stop what they were doing and go to the MR scanner to see the acquired images, help with the scan set-up, or answer an open question. Now, questions can be addressed quickly and efficiently via remote PC.

Benefits of syngo 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

syngo Remote Assist

Direct computer link to the local Siemens service department or the Siemens service centers (via router with telephone connection)

Image transfer for further evaluation

- Image and file transfer in batch mode
- Reading of entries in the error logbook
- Remote trouble shooting
- Remote access to service manuals written in easy-to-use HTML format
- Remote access to Service Site Database
- Start of preventive maintenance and quality assurance routines.
- Provided in conjunction with a service contract with Siemens (UPTIME Services)
- Remote access granted only with permission of the institution. Data security is ensured by secure access

¹⁾ Within the hospital enterprise

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MAGNETOM ESSENZA

Post-processing Packages

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Post-processing Packages

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

***syngo* Argus 4D Ventricular Function**

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

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

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

Argus Flow

Automated tool for analysis of blood and CSF flow.

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

Vessel View

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

Viewing with VRT, MPR, or MIP mode.

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

Vessel View Artery-Vein-Separation

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

3D VRT Volume Rendering Technique

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

More productive surgical planning and discussion with referring physicians.

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

syngo BOLD Evaluation

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

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

DTI Evaluation

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

DTI Evaluation

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

syngo DTI Tractography

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

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

Neuro Perfusion Evaluation

Dedicated task card for quantitative processing of neuro perfusion data.

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

Composing

Composing of images from different table positions.

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

Fly Through

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

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

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

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

syngo Tissue 4D

syngo Tissue 4D facilitates the detection of tumor tissues in organs such as the prostate or the liver. It is an application card for visualizing and post-processing dynamic contrast-enhanced 3D datasets.

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

Spectroscopy Evaluation

Integrated software package with extensive graphical display functionality

Comprehensive and user-friendly evaluation of spectroscopy data

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

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

Image Fusion

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

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

Soft Tissue 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

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

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

syngo BreVis

Task card for optimized visualization of multi-modal breast images and for processing dynamic 3D data sets.

- Display of customized layouts
- Multi-modality viewing capabilities
- Reporting according to BI-RADS standard
- On-the-fly reconstruction of subtracted images, multiplanar reformatted images
- Elastic image registration to correct for patient motion
- Display and analysis of kinetic parameters (time-course evaluation, color overlay maps to visualize angiogenesis or curve types)
- Graphical volume statistics of lesion Enhancement

syngo BreVis Biopsy

syngo BreVis Biopsy is a task card for easy and effective breast biopsy planning.

- User interface for MR interventional planning
- Guidance through the complete
- MR image based breast biopsy is provided
- syngo BreVis Biopsy
- Support of the 2 /4-channel Sentinelle Breast Coil and MR interventional accessories

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***syngo.via* and MAGNETOM ESSENZA networked**

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syngo.via and MAGNETOM ESSENZA networked

syngo.via is the new imaging software, creating an exciting experience in efficiency and ease of use – anywhere¹⁾. syngo.via is your agent for productivity throughout your radiology workflow. No other solution supports and integrates all MR tasks in a comparable way – from planning and scanning to result sharing.

Integrated Engine concept

The Engine concept integrates the scanning and reading processes into one holistic workflow and enables you to maximize your scanner and application investment.

Key features	The Dot (Day optimizing throughput) Engines optimize the performance of MAGNETOM ESSENZA and offer patient personalization, user guidance, and exam automation.
	syngo.via offers reading workflows, which are optimally adjusted to the Dot Engines for the best reading outcomes
	The scanning and reading workflows are easily customizable to the user's standards of care.
	Results from the scanner are optimally displayed in the reading workflows.
Key benefits	Guidance, standardization and flexibility is offered for every step of the workflow, reducing the need for further inquiry
	Increasing throughput, minimizing recalls, and enhancing quality of care.

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

Networked Scanner – the scanner workplace for optimized productivity

syngo.via handles images from any MR system. With MAGNETOM scanners, the integration is perfect. The networking capabilities of the MAGNETOM scanners and *syngo.via* will transform the technologist workplace of today. One consistent workflow is offered, from planning, to scanning to viewing, and processing.

Key features	Host computer of the MAGNETOM ESSENZA is rich-thin-client enabled. The <i>syngo.via</i> client can be run with only one keyboard and one mouse – no cumbersome change of devices necessary. <i>syngo.via</i> offers unique workflows to support the technologist: • Check Protocol: pre-defined protocols are automatically displayed • Initiate Scan: get guidance by additional text info for the optimal scan and patient set-up. Start patient registration directly out of <i>syngo.via</i> • Check images: immediate availability of images, easy quality check of images Automatic transfer of the patient data and planned protocols from <i>syngo.via</i> to the scanner. No need for double entry of information. Automatic selection of the appropriate <i>syngo.via</i> reading workflow <i>syngo.via</i> and MAGNETOM ESSENZA UI – both based on the proven <i>syngo</i> UI concept.
Key benefits	Work with different patients side-by-side without any screen overlays and possible confusions. E.g. begin with patient registration of one patient, while other patient is still scanned. Automatic transfer of information – reduced need for clarifications Higher throughput, reliable results, and reduced costs.
Pre-requisites	Additional monitor and one <i>syngo.via</i> license

Direct Protocol Transfer (DPT)

syngo.via redefines protocol management – providing remote protocol planning, and automated selection of the right protocols at the scanner. *syngo.via* offers a dedicated workflow for protocol planning and distribution. The radiologist can plan the protocols from anywhere in the institutional network.

Key features	Remote protocol planning from any <i>syngo.via</i> client to select or modify a planned protocol (and perhaps add further explanations) for a patient examination before the patient is registered at the MR system. The planned protocol will be automatically transferred to the scanner via DICOM Modality Worklist.
	The technologist works with the same <i>syngo.x</i> view directly at the scanner – accessing the same information, without any further handwritten notes or need for clarifications.
	Automatic transfer of the patient data and planned protocols from <i>syngo.via</i> to the scanner. No need for double entry of information.
	In addition: Remote Protocol distribution: • upload, change and/or delete any protocol from your MAGNETOM scanners (available for all Tim Systems) • send examination protocols to every other connected scanner
Key benefits	Define standards of care and easily distribute the related protocols among your Tim systems.
	Save time for clarifications – while minimizing re-scans
	Easy, automated, and efficient protocol handling – from anywhere
	DPT works with MAGNETOM ESSENZA and any other Tim system.

Direct Image Transfer (DIT)

After completion of a series of images, they are transferred automatically to *syngo.via*. Easily view the images with any *syngo.via* client immediately after they were acquired.

Key features	This data will be automatically transferred to the <i>syngo.via</i> data base and loaded into the related workflow. Enhanced DICOM MR enables to transfer fMRI data and spectroscopy raw data in new DICOM standard format. In <i>syngo.via</i> and any PACS supporting this standard, these data can be handled.
Key benefits	Images are immediately available throughout the institution. This enables fast and convenient feedback from everywhere.
Direct Image Transfer Pro	A direct cable connection is build between the MAGNETOM scanner and the <i>syngo.via</i> server. This ensures a guarantied performance for image transfer.

Seamless workstation integration

syngo.via. integrates smoothly with *syngo* MultiModality Workstation (MMWP). Open MMWP directly out of *syngo.via*, and vice versa.

Key features	Remotely open the same patient at the MMWP easily with <i>syngo</i> Expert-i The MMWP results can then be easily integrated into the <i>syngo.via</i> report <i>syngo.via</i> client can be opened from any MMWP with one click
Key benefits	Remote and easy access of all MMWP applications Smooth integration of results into <i>syngo.via</i>

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Parts & Accessories

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Parts & Accessories

Patient Video Monitoring

Special video camera integrated in the back of the magnet cover for patient observation in the examination room.

- Color 640×480 pixel LCD monitor may be positioned at the *syngo* Acquisition Workplace or at a convenient wall location.

Remote Viewing Monitor

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

- Data transfer via fiber optic cables for high signal quality over a long distance.
- Max. distance from Workplace – 150m (492 feet)

syngo MR Workplace

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

- Same user interface as the *syngo* Acquisition Workplace, except for scan control.
- Shared database with *syngo* Acquisition Workplace, therefore eliminating image copy time.

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

PMU Examination Room Display

LCD monitor mounted on the magnet cover for display of physiological signals in the examination room

- Provides for the display of the 2 ECG channels I and aVF, for optimal signal quality, pulse signal, respiratory signal and external trigger input

Workplace Table

Ergonomically designed table for:

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

Vertical Table Move

Enables lowering of the patient table down to 55cm for easy set-up of elderly or very sick patients.

- Non-ferromagnetic, height-adjustable design

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