Standard Motion Correction	
syngo BLADE	• Improves image quality by minimizing and correcting for the effects of motion during an MR sequence acquisition. e.g. head, spine, orthopedic imaging and the abdomen • Motion insensitive Turbo Spin Echo sequence • Supports T2-weighted, T1-weighted, STIR, and DarkFluid protocols • Simultaneous in-plane motion correction for arbitrary slice orientations • Versatile sequence e.g. supporting iPAT with GRAPPA, Restore pulses and supports respiratory triggered imaging of the abdomen using 2D PACE
1D PACE (Prospective Acquisition CorrEction)	• Quick and easy acquisition control, e.g. for cardiac imaging • Allows examination of patients with free breathing
2D PACE Precise Motion Correction	• New robust pattern matching to detect and correct respiratory motion of the heart, liver, etc. • Significantly increased image quality • Improved security in the diagnosis of diseases in moving organs and precise slice registration for multi breath-hold studies • Data acquisition during free breathing for high resolution 2D and 3D examinations • Eliminates the need for respiratory belt • PAT averaging for motion artifact suppression using Self-Calibration

| Standard Workflow Enhancements	
AutoCoilDetect	Detects the position and orientation of coils automatically. Shows coils in the user interface right within the graphical slice positioning.
AutoCoilSelect	Automatic detection and selection of all coil elements in the active Field-of-View.
syngo Scan Assistant	Shows parameter constraints and provides possible solutions.
scan@center	Automated movement of table so that the scan is performed in the magnet isocenter – can be activated or deactivated by the user.
AutoVoiceCommands	These multi-language automatic voice commands during the scan assist the user in providing optimal timing of breathing, scanning, and contrast media injection.
Phoenix and PhoenixZIP	Exchange of protocol data (e.g. via Internet) by drag & drop clinical images. PhoenixZIP allows transfer of whole measurement programs.
Online Help Functions	Context sensitive and quick resource for questions about software operation or MR physics.
DirectConnect	Cable-less direct connection for Head/Neck 20, Spine 32, Foot/Ankle 16.
SlideConnect	SlideConnect cable connectors can be securely plugged-in with one hand only.
Inline Technology – Processing Instead of Post-processing	Inline Technology helps to streamline the clinical workflow by automating post-processing steps before image viewing. See the clinical results immediately. Inline functionality is user-configurable. Examples: • Automatic subtraction of images, e.g. pre- and post-contrast enhancements • MIP on-the-fly, e.g. MR Angiography with automatic image subtraction and following MIP in three orthogonal planes • Prospective motion correction (1D and 2D PACE) on-the-fly • Automatic perfusion[1] and diffusion maps • Automatic composing of multi-step images[1] • Automatic on-the-fly calculation of standard deviation, for better differentiation of arterial and venous phases • Inline Display automatically shows reconstructed images. It offers immediate access to the results and opens automatically for e.g. interactive real-time scanning or CareBolus examinations • Inline Movie automatically starts the cine image display

[1] Optional

Tim Application Suite

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

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

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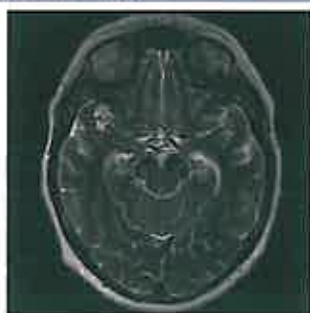
Comprehensive head and spine examinations can be performed with dedicated programs. High resolution protocols and fast protocols for uncooperative patients are provided. The Neuro Suite also includes protocols for diffusion imaging, perfusion imaging, and fMRI

General features

- EPI sequences and protocols for diffusion imaging, perfusion imaging, and fMRI 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 MPRAGE/3D FLASH, SPACE DarkFluid, T2 SPACE, and 3D TSE T2-weighted high resolution 3D Restore protocols optimized for inner ear examinations
- Whole-spine protocols in multiple steps with software controlled table movement
- 2D and 3D MEDIC protocols for T2-weighted imaging, particularly for C-spine examinations in axial orientation where reproducibility is difficult due to CSF pulsations and blood flow artifacts
- 3D Myelo with 3D HASTE and 3D True-FISP for anatomical details
- Dynamic sacro-iliac joint imaging after contrast administration using a fast T1-weighted FLASH 2D sequence
- Spine diffusion protocols to differentiate osteoporosis versus tumor infiltration and post-radiotherapy changes versus residual tumor with PSIF sequence
- Precision filter for high spatial accuracy e.g. for neuro intra-operative imaging and stereotactic planning
- 3D CISS (Constructive Interference in Steady State) for excellent visualization of fine structures such as cranial nerves. High resolution imaging of inner ear and spine
- AutoAlign Head LS providing a fast, easy, standardized, and reproducible patient scanning supporting reading by delivering a higher and more standardized image quality

Angio Suite

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

Contrast-enhanced MRA	• 3D contrast-enhanced MRA protocols for e.g. single step, dynamic, peripheral, whole body MRA with the shortest TR and TE. The strong gradients make it possible to separate the arterial phase from the venous phase • TestBolus workflow for optimal bolus timing and superb image quality • CareBolus functionality for accurate determination of the bolus arrival time and the "Stop and Continue" of the 3D ce-MRA protocol after the 2D bolus control scan • Dynamic ce-MRA for 3D imaging over time
Non-contrast MRA and venography	• 2D or 3D Time-of-Flight (ToF) protocols for MRA for the Circle of Willis, carotids, neck vessels, and breath-hold protocols for abdominal vessels • Triggered 2D ToF sequences for non-contrast MRA, particularly in the abdomen and the extremities • 2D/3D Phase-Contrast • MR venography with 2D/3D Time-of-Flight (ToF) and Phase-Contrast • TONE (Tilted optimized non-saturating excitation) and MTC (Magnetization Transfer Contrast) techniques for improved Contrast-to-Noise Ratio (CNR)
Image processing tools	• MPR, MIP, MinIP, and 3D SSD • Inline MIP for immediate results • Inline subtraction of pre- and post-contrast measurements • Inline standard deviation maps of Phase-Contrast measurements for delineation of arteries and veins

The cardiac suite covers comprehensive 2D routine cardiac applications, ranging from morphology and ventricular function to tissue characterization. Featuring *syngo* BEAT 2D in conjunction with iPAT and T-PAT techniques

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

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

Body Suite

The Body Suite is dedicated for clinical body applications. Ultra-fast high resolution 2D and 3D protocols are provided for abdomen, pelvis, MR Colonography, MRCP, dynamic kidney, and MR Urography applications. 2D PACE technique makes body imaging easy allowing for multi-breath-hold examinations as well as free breathing during the scans. Motion artifacts are greatly reduced with 2D PACE Inline technology.
This package includes:
- Free breathing 2D PACE applications with 2D/3D HASTE (RESTORE) and 2D/3D TSE (RESTORE)
- Optimized fast single shot HASTE protocols and high-resolution 3D RESTORE protocols based on SPACE and TSE for MRCP and MR Urography examinations

Abdomen	**2D:** • T1 (FLASH) breath-hold scans with and without FatSat (SPAIR, Quick FatSat, in-/opp-phase) • T2 (HASTE, TSE/BLADE, EPI) breath-hold scans with and without FatSat (SPAIR, FatSat, STIR) • T1 (TFL) triggered scans (2D PACE free breathing) in-/opp-phase • T2 (HASTE, TSE/BLADE, EPI) triggered scans (2D PACE free breathing) with and without FatSat (SPAIR, FatSat, STIR) as well as HASTE- and TSE-multi-echo • Optimized fast single shot HASTE protocols and high-resolution 3D RESTORE protocols based on SPACE and TSE for MRCP and MR urography examinations **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 with Inline motion correction for best visualization of focal lesions with high spatial and temporal resolution • Colonography dark lumen with T1-weighted VIBE
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 • *syngo* REVEAL: diffusion imaging for liver and whole body exams with 2D PACE for respiratory synchronized measurements

Onco Suite

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

|	
General features	• STIR TSE, HASTE, and FLASH in-phase and opposed-phase protocols with a high sensitivity to metastases visualization • Dynamic imaging protocols for assessment of the kinetic behavior 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, MIPtime and combination maps with Inline technology or for offline calculation • Display and analysis of the temporal behavior in selected regions of interest with the included MeanCurve postprocessing application. This includes the capability of using additional datasets as a guide for defining regions of interest even faster and easier than before • *syngo* REVEAL: diffusion imaging for liver and whole body exams
Prostate protocols	• Dedicated prostate protocols for detection, localization, and staging of tumors and recurrences • *syngo* REVEAL (diffusion-weighted imaging) • Protocols with high temporal resolution allow time course evaluation based on pharmacokinetic modeling • Prostate spectroscopy (3D CSI) with up to 8 sat bands supports tumor diagnosis[1]

[1] Option

Ortho Suite

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

General features

- 2D TSE protocols for PD, T1, and T2-weighted contrast with high in-plane resolution and thin slices
- 3D MEDIC, 3D TrueFISP protocols with water excitation for T2-weighted imaging with high in-plane resolution and thin slices
- High resolution 3D VIBE protocols for MR Arthrography (knee, shoulder, and hip)
- 3D MEDIC, 3D TrueFISP, 3D VIBE protocols with Water Excitation having high isotropic resolution optimized for 3D post-processing
- T1, T2, and PD SPACE, 3D imaging with high isotropic resolution optimized for post-processing
- Whole-spine, single-step, and multi-step protocols
- Excellent fat suppression in off-center positions, e.g. in the shoulder due to high magnet homogeneity
- Dynamic TMJ protocol (different joint positions)
- Dynamic ilio-sacral joint protocol for contrast dynamics
- Multi Echo SE sequence with up to 32 echoes for T2 time mapping
- High resolution 3D DESS (Double Echo Steady State): T2/T1-weighted imaging for excellent fluid-cartilage differentiation
- 3 point Dixon technique for fat and water separation – Turbo Spin Echo sequence

Breast Suite
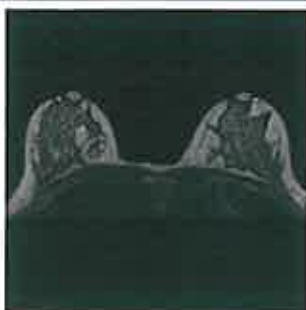
MR imaging provides excellent tissue contrast that may be useful in the evaluation of the breasts. Extremely high spatial and temporal resolution can be achieved in very short measuring times by using iPAT with GRAPPA. Excellent soft tissue differentiation, customized protocols (e.g. with fat saturation 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	This package includes:
	• High-resolution 2D protocols for morphology evaluation
	• High-resolution 3D protocols covering both breasts simultaneously
	• Protocols to support interventions (fine needle and vacuum biopsies, wire localization)
	• Protocols for evaluating breasts with silicone implants
	• Automatic and manual frequency adjustment, taking into account the silicone signal
	• Detection of the silicone signal either to suppress the silicone signal, if the surrounding tissue is to be evaluated, or to suppress the tissue signal in order to detect an implant leakage
	• SPAIR – robust fat sat (robust fat suppression using an adiabatic frequency selective inversion pulse)
	• DIXON – 2-point Dixon with 3D VIBE, the following contrasts can be obtained: in-phase, opposed phase, fat and water image
	• iPAT with GRAPPA for maximum resolution in short time
	• iPAT Extension that allows state-of-the-art sagittal breast imaging
	• Inline subtraction and MIP display
	• Offline subtraction, MPR and MIP display
	• *syngo* REVEAL: diffusion 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

Scientific Suite

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

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

Pediatric Suite

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. Protocols can be easily adapted for imaging infants.

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.

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 • Limited patient capabilities: Examination with *syngo* BLADE protocols to minimize and correct for the effects of motion automatically
syngo 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 calculation of trace-weighted images and ADC maps with Inline Technology.
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 Engine[1]

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 work-flow 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

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 • Limited patient capabilities: Compensate for the effects of motion, e.g. with *syngo* BLADE protocols. • Metal: Reduce artifacts with protocols being tailored to patients carrying metal implants.
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

Abdomen Dot Engine[1]

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 scaling	According to physiological characteristic (AutoFoV, AutoNavigator, breath-hold adaptations)
AutoNavigator	Automatic breathing pattern detection and scaling of triggered scans
AutoFoV (automatic Field of View calculation)	Based on the localizer images the optimal FoV is automatically estimated. In case the patient moves during the examination, this step can be repeated at any time
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: • Standard with breath-hold • Standard with PACE triggering • Limited patient capabilities using *syngo* BLADE and PACE triggering

[1] Optional

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
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 Engine[1]

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 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
Cardiac Views	Easy selection of cardiac views (e.g. 3 chamber view) during scan planning
Inline Ventricular Function Evaluation	syngo 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

[1] Optional

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: • Standard: Segmented acquisition • Limited patient capabilities: switch to realtime and single shot imaging if breath-hold is not possible or arrhythmias occur
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

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 • Allows for arbitrary orientations (multi-slice multi-angle) • Automatically loads images into Graphical Slice Positioning
Graphical Slice Positioning	Simultaneous use of three arbitrary localizer images from possibly different measurements for graphically positioning slices and sat regions. Interactive modification of measurement parameters (slice thickness, distance factor, oversampling etc.): • Automatic selection of relevant coil elements • Graphical selection of coil elements • Off-center positioning (shift of FoV within the selected slice position) • True multi-slice multi-angle, e.g. simultaneous measurement of multiple images (stacks with different orientation) • Recall of previous slice and/or sat region positioning • Paging through all images during graphical positioning • Inline Movie, allowing positioning of slices on e.g. the beating heart • Loads images immediately when they are available, e.g. during image reconstruction • Allows quick overview via image stamps. Loads entire series of planning images with drag-and-drop • Slice positioning (GSP) on 3D reconstructed images • Slice positioning (GSP) on 2D and 3D distortion corrected images • Slice positioning (GSP) on composed images

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

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

	Supported printing	Grey levels and color
	Data format	PostScript Level 2

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

syngo MR Network Communication

DICOM Services (Digital Imaging and Communications in Medicine)	Interface for transmitting medical images and information in the DICOM 3.0 industrial standard. Allows for communication between devices from different manufacturers • DICOM Send/Receive • DICOM Query/Retrieve • DICOM SC Storage commitment • DICOM Basic Print • DICOM Modality Worklist • DICOM MPPS Modality performed procedure steps. Communication back to information system • DICOM Structured Reports • DICOM Study Split
DICOM Study Split	DICOM Study Split provides the mapping of one study acquired based on multiple requests to multiple studies directly at the scanner. For example, two requests for head and neck acquisition can be registered once, scanned once and immediately mapped to two separate studies for individual reading.
	Multiple requested procedures can be combined in a time saving manner by scanning a larger body region and then splitting them to individual billing relevant studies for separate reading.
	This package allows: • Time saving simple mapping of multiple requested procedures to multiple acquired series with one scan • Simple creation of studies with individual billing based on one scan workflow • Improvement for departmental workflow by eliminating need to load/change and to request/execute splitting on a separate workstation after the scan • Immediate visual selection, check and correction of images to study assignments. • Overlapping region images can be copied to both studies
syngo MR Network Communication	Exchange Media Storage of images and additional data (e.g. avi files) on CD/DVD
DICOM Viewer	A viewing tool which can be stored together with images on a DICOM CD/DVD to be handed out to the patient
Virus Protection	• Permanent scanning for malicious software in the background to provide maximum security • Via Remote Access over secure network connection the latest virus scanner updates and operating system hotfixes are installed automatically • Provided in conjunction with a service contract with Siemens (UPTIME Services)
Image Transfer	Local network	Ethernet
	Data transfer rate	Max. 1 Gbit/s
	Transfer rate (256×256 image)	Approx. 60 images/s

Computer System

syngo Acquisition Workplace		
General	Full multi-tasking for simultaneous functionality, e.g.: • Patient registration and pre-registration • Scanning • Reconstruction • Viewing • Post-processing • Filming • Data storage	
Color LCD Monitor	High resolution flicker-free flat-screen monitor Horizontally tiltable, forward and backward Automatic backlight control for long-term brightness stability Optional second monitor	
	Screen size (diagonal)	19"
	Horizontal frequency	30–100 kHz
	Vertical frequency	50–75 Hz
	Screen matrix	1280×1024
Host computer	Double Processor	Intel Xeon CPU
	Clock rate	≥ 2.6 GHz
	RAM	≥ 6 GB
	1st hard disk (system SW)	≥ 146 GB SAS
	2nd hard disk (data base)	≥ 146 GB SAS
	3rd hard disk (images)	≥ 146 GB SAS
	CD-R writer	Approx. 4000 images 256^2 DICOM Standard, ISO 9660
	DVD-R writer	Approx. 25 000 images 256^2 DICOM Standard, ISO 9660
	Media drives	CD/DVD drive

Measurement and reconstruction system	Processor	Intel ≥ E5540 2.53 GHz (Quadcore)
	Clock rate	≥2×2.53 GHz
	Main memory (RAM)	48 GB
	Hard disk for raw data	≥300 GB
	Hard disk for system software	≥100 GB
	Parallel Scan & Recon	Simultaneous scan and reconstruction of up to 8 data sets
	Reconstruction speed	12195 recons per second (256^2 FFT, full FoV) 37914 recons per second (256^2 FFT, 25 % recFoV)

syngo MR Workplace[1]

Color LCD Monitor and host computer as for *syngo* Acquistion Workplace

[1] Optional

Installation

Siting and Installation	
Short installation time due to integrated digital DirectRF technology	
Typical installation time	Less than 7 working days

Radio Frequency Shielding	
For shielding the examination room from external RF sources	
RF attenuation factor	>90 dB
Frequency range	15–128 MHz

Magnetic Shielding	
Room shielding	For additional reduction of the magnetic fringe field, suitable iron shielding can be installed in the walls of the examination room. The room shielding can be used to create a magnetic shielding enclosure
One-Floor Installation	A combination of active shielding and a special shielding (installed on the ceiling of the magnet room or below it) will keep the 0.5 mT line within the same floor as the MRI scanner installation, even in case of very low room heights

System Electronics Cabinets	
Two cabinets which may be placed directly against the wall or even in a corner	
Require service access only from the front, saving considerable space	
Integrated water cooling cabinet may eliminate the need for a dedicated computer room	

Power Requirements	
Line voltage	380, 400, 420, 440, 460, 480 V
Stability tolerances	+/–10%
Line frequency	50/60 Hz, +/–1 Hz
Connection value	60 kVA (passive separation) 100 kVA (Eco Chiller)

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

[1] Water temperature 12 °C/45 °F

Min. total space requirement (for magnet, electronics, and console room)	$< 31\ m^2$
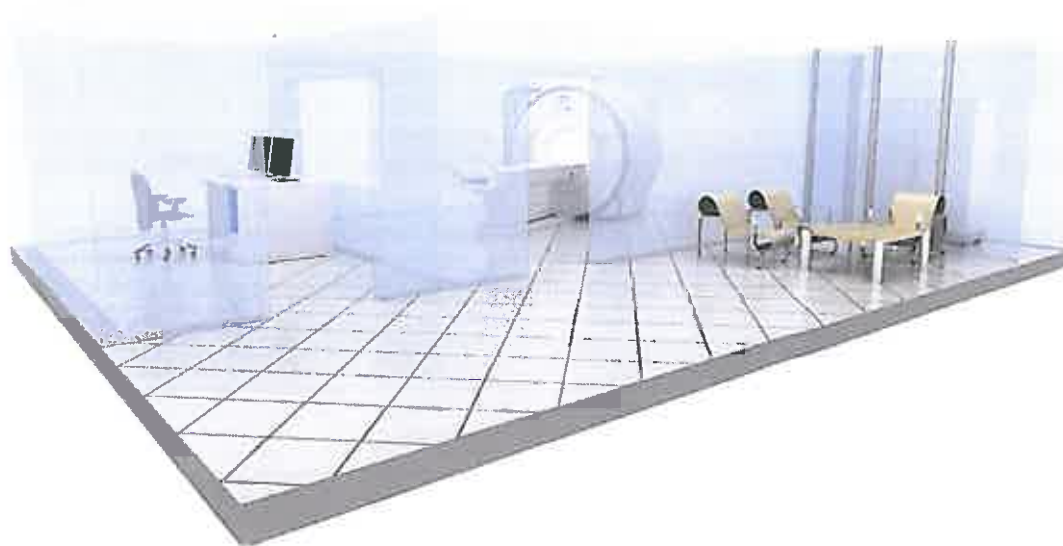
Dimensions		Width [cm]	Depth [cm]	Height [cm]	Weight [kg]
Examination Room	Magnet 3 Tesla AS (incl. Helium)	205	163	215	5500
	Magnet in operation, incl. gradient coil, body coil, Tim Table and covers	231	433 461[1]	219	7350
	Tim Table	76	249	52–89 (+12)[2][5]	
	Required min. room height clearance			240[3]	
	Min. transport dimensions	231	182	227	
Control Room	*syngo* Acquisition Workplace (table + monitor)	120	80	117 (72+45)	
	Host computer	22	46	47	
	syngo MR Workplace (optional)	120	80	117 (72+45)	
Equipment Room	Electronics cabinet, incl. system control, RF system, gradient power system, image processor	160	65	198[4]	1400
	Heat dissipation	≤5 kW, only ventilation might be required			
	Cooling system	65	65	189	340

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

Local Contact Information

In the USA
Siemens Medical Solutions USA, Inc.
51 Valley Stream Parkway
Malvern, PA 19355
Phone: +1 888-826-9702
Phone: +1 610-448-4500
Fax: +1 610-448-2254

In Japan
Siemens-Asahi
Medical Technologies Ltd.
Takanawa Park Tower 14F
20-14, Higashi-Gotanda 3-chome
Shinagawa-ku
Tokyo 141-8644
Phone: +81 3 5423 8411

In Asia
Siemens Healthcare Sector
Asia Pacific Headquarters
The Siemens Center
60 MacPherson Road
Singapore 348615
Phone: +65 6490 6000
Fax: +65 6490 6001

Global Business Unit

Siemens Healthcare Sector
Magnetic Resonance
Henkestr. 127
DE-91052 Erlangen
Germany
Phone: +49 9131 84-0

Global Siemens Headquarters

Siemens AG
Wittelsbacherplatz 2
80333 Muenchen
Germany

**Global Siemens
Healthcare Headquarters**

Siemens AG
Health care Sector
Henkestr. 127
91052 Erlangen
Germany
Phone: +49 9131 84-0
www.siemens.com/healthcare

Legal Manufacturer

Siemens Shenzhen Magnetic
Resonance Ltd. (SSMR)
Siemens MRI Center,
Gaoxin C. Ave. 2nd,
Hi-Tech Industrial Park
Shenzhen 518057
P.R. China
Phone: + 86 755-26525421
Fax: + 86 755-26549253

www.siemens.com/healthcare