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Signa® EXCITE™ 1.5T Magnetic Resonance Systems

Technology & Applications

The GE Signa EXCITE™ 1.5T is the industry's leading 1.5T whole-body MR system. It features a long line of industry firsts, including actively shielded magnetic-field gradients, phased-array digital radio-frequency technology, simultaneous image acquisition and reconstruction, and most recently a fully integrated data pipeline known as EXCITE (EXpanding applications with multi-Channel Imaging TEchnology). EXCITE is the first integrated end-to-end solution to moving information rapidly from data acquisition to reconstruction and display. EXCITE is designed to furnish unprecedented clinical flexibility, with deep reserves of speed, resolution and SNR. EXCITE enables the fastest pulse sequence play-out, 8-channel imaging, widest selection of phased-array coils, and fastest image reconstruction. This innovative data-pipeline technology is integrated with a high-homogeneity magnet, the broadest range of high-performance gradients from SmartSpeed™ to HiSpeed Plus™, EchoSpeed Plus™, and TwinSpeed™, and advanced safety features such as an undockable table. With these powerful capabilities integrated into a user-friendly platform designed to maximize productivity, the GE Signa EXCITE 1.5T MR product line offers the ideal solution for every need.

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Signa® EXCITE™ 1.5T Magnetic Resonance Systems

Signa EXCITE 1.5T MR Systems offer:

Technology

CXK4 magnet:
The magnet is designed for low cryogen consumption and high homogeneity for large FOV imaging with superb fat saturation.

High-order shim:
On the TwinSpeed, this optional software corrects for patient-induced magnetic-field distortions.

Mobile patient table:
A fast docking and un-docking patient transport mechanism is critical for patient safety and emergency response.

Widest selection of coils:
The widest range of coils in the industry, particularly 8-channel coils, enables the highest throughput and image quality.

EXCITE data pipeline:
8 independent channels with 16 quadrature inputs and high-bandwidth (1 MHz) receivers enable high image quality and high productivity.

High performance gradients:
The gradients enable the shortest TR, TE, and echo spacing (ESP), ultra-high b–value diffusion-weighted imaging, and diffusion tensor imaging.

Twin gradient technology:
On the TwinSpeed, zoom mode and whole-body mode circumvent the compromise between high amplitude and slew rate versus large field of view.

Quiet technology:
On the TwinSpeed, GE's unique Quiet technology boosts patient tolerance without compromising image quality.

Fastest image reconstruction:
Vector array processors allow simultaneous acquisition and reconstruction and the fastest parallel processing reconstruction of up to 850 2D FFT's per second.

Fastest computing:
The dual processor Intel® Xeon™ workstation running Linux provide unprecedented computational power for advanced applications.

ASSET®:
This parallel imaging option allows the scan time to be shorter or the image to be sharper. The result is either higher productivity or higher image quality.

Applications

Vascular applications:
The EC-TRICKS application adds the fourth dimension to MRA without sacrificing sharpness or requiring guesswork to capture the arterial phase. Fluoro-triggered MRA with automated real-time switching in less than 1 second offers high patient throughput and enhanced image quality. Automated multi-station MRA procedures are achieved with SmartPrep and SmartStep. The iDrivePro applications afford real-time image acquisition.

Body applications:
Excellent image quality is possible using the new 8-channel body array coil and the toolkit of FAME, dual echo FGRE, FRFSE, FGRE, and SSFSE-XL. Optional VIBRANT™ provides the unique capability to acquire sagittal 3D images of both breasts with excellent fat saturation rapidly.

Cardiac applications:
Many optional techniques complement the standard black blood imaging and Fast Cine. At the top of the list is ReportCARD, which is a package designed to facilitate the reporting of cardiac MRI studies. High-resolution coronary artery imaging is now feasible using 3D FatSat FIESTA, either during breath holding or breathing. And there are techniques to study myocardial evaluation, wall motion, and cardiac function.

Spectroscopy applications:
The brain spectroscopy option includes techniques for single-voxel and multi-voxel data acquisition. Optional PROSE allows 3D spectroscopic imaging of the prostate.

Neuro applications:
PROPELLER is a revolutionary technology inherently tolerant of patient motion. BrainWave makes fMRI practical in a clinical setting. Exquisite T1 or T2 weighted images can be acquired with T1-FLAIR and FRFSE. Diffusion Tensor Imaging is available with as many as 55 directions encoded and b-values up to 10,000 s/mm^2.

User friendly FuncTool:
This post-processing package is for creating metabolite maps in spectroscopy, BOLD imaging, diffusion, and dynamic contrast enhanced studies.

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Signa® EXCITE™ 1.5T Magnetic Resonance Systems

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Signa® EXCITE™ 1.5T Magnetic Resonance Systems

1.0 Magnet and Enclosures

1.1 Magnet

The superconducting CXK4-150 is a high-homogeneity wide-open short-bore magnet manufactured by GE, utilizing K4 advanced cryo-cooling technology. This magnet provides industry-leading uniform homogeneity essential for the highest image quality in demanding techniques such as spectroscopy and echoplanar imaging (EPI). By maintaining field uniformity throughout the entire imaging volume, this magnet contributes to consistently high image quality across all imaging applications. Moreover, the magnet provides an open and friendly experience for patients without compromising the clinical performance required for high SNR imaging. And the magnet features the lowest helium consumption rate and longest helium refill interval in the industry, which minimizes operating expenses and maximizes uptime and productivity.

Operating Field Strength	**1.5 Tesla (15,000 Gauss)**
Type	Ultra-low boil off, superconducting short bore magnet
Shim coils	18 superconducting
Magnet shielding	Active shield
EMI shielding	99% shielding factor
Size (length x width x height)	172 cm x 208 cm x 216 cm (w/o enclosures) 196 cm x 208 cm x 241 cm (w enclosures and He port)
Magnet cooling	Liquid helium only
Temporal field stability	< 0.1 ppm/hr
Long term magnet stability of the homogeneity	< 0.1 ppm
Manufacturer	GE Medical Systems
Cryogen refill interval	Typically every 3 years
Boil off rate	~0.03 liters/hour under normal operation
Fringe fields (axial x radial)	5 Gauss = 4.0 m x 2.48 m 1 Gauss = 5.7 m x 3.28 m
Magnet weight (with cryogens and gradient coil)	5155 kg (11340 lbs) 5382 kg (11840 lbs) for Twin Speed

LV-RMS Homogeneity Specifications		
Diameter of Spherical Volume -DSV	Specified Minimum ppm	Typical ppm
10 cm	< 0.05	< 0.025
20 cm	< 0.25	< 0.05
30 cm	< 0.50	< 0.25
40 cm	< 1.00	< 0.50
45 cm	< 1.25	< 0.63
48 cm	< 2.00	< 0.95

Large Volume Root-Mean-Square (LV– RMS) method is rigorous and accurate with over 173,000 measurements collected over spherical volume.

V-RMS Homogeneity Specifications		
Diameter of Spherical Volume -DSV	Specified Minimum ppm	Typical ppm
10 cm	< 0.02	< 0.004
20 cm	< 0.06	< 0.02
30 cm	< 0.14	< 0.06
40 cm	< 0.35	< 0.27
45 cm	< 0.97	< 0.81
48 cm	< 2.00	< 1.65

Volume Root-Mean-Square (V – RMS) method with 24 measurements in each of 13 planes is rigorous and accurate.

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1.2 High-Order Shim (TwinSpeed only, Optional)

In addition to the 18 super-conducting shim coils integrated into the magnet, the TwinSpeed model in the Signa 1.5T product line includes an optional resistive shim set (also known as room temperature shims). Five 2nd order shim coils (XY, XZ, YZ, X^2-Y^2, and Z^2) are intended to compensate for the magnetic field distortion induced by the patient. These shim coils are controlled from the operator's console through an automated shimming program. The resulting higher homogeneity translates directly into higher image quality in spectroscopy, ultra-fast imaging techniques such as Diffusion Tensor Imaging (DTI), and Diffusion-Weighted EPI, and in applications such as orthopedic imaging, in which high quality fat saturation is critical.

1.3 Magnet Enclosure

The Signa EXCITE 1.5T MR system magnet enclosures are designed to maximize patient comfort without compromising the high homogeneity of the magnetic field required for demanding techniques. A patient-friendly appearance results from the Wide Open enclosures, dual-flared design, well-lit, well-ventilated and short inner bore.

Patient Bore	70 cm x 60 cm x 60 cm (L x W x H) 105 cm x 60 cm x 60 cm (L x W x H) (TwinSpeed)
Enclosure length	185 cm total system length
Patient positioning features	Laser alignments for axial, sagittal, coronal reference planes Dual table top panels
Patient comfort module	Dual-flared patient bore 2 way in-bore intercom system In-bore FiberTrack lighting system Interface for music system In-bore patient ventilation system In-bore music system (optional) Look-out head coil mirror Noise reduction with Quiet Technology (TwinSpeed)

This magnet enclosure is designed to provide several benefits for the patient and technologist:

- Patient anxiety is eased, resulting in reduced exam time for uncooperative patients.
- Patients can see outside the magnet bore during head exams.
- Technologists have easy access to the patient.
- Dual-sided controls improve access to cables and IV lines.
- Feet-first positioning facilitates run-off studies and set-up for claustrophobic patients.
- Quiet technology on the TwinSpeed enhances patient comfort.

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2.0 Patient Transport

The Signa EXCITE 1.5T MR system includes a mobile patient table designed for patient comfort and safety and clinical productivity. The patient table can be docked and un-docked easily by a single operator, which is a critical benefit in the case of an emergency evacuation from the magnet room.

An additional patient table (Optional) can contribute to higher productivity by allowing the next patient to be prepared outside the magnet room while the current patient is undergoing an exam. This feature is particularly desirable with sick or uncooperative patients.

The automatic movement of the Signa® MR table also makes it ideally suited for multi-station exams with no scan room intervention, such as full spine imaging and peripheral vascular (run-off) imaging.

Patient Transport Type	Mobile patient table with automatic docking capability
Patient Table Height	68.58 cm (27 inches) to 96.52 cm (38 inches) continuous
Patient Table Drive Specifications	Automated, power driven vertical & longitudinal
Longitudinal Speed	10.26 cm/sec (fast) and 1.29 cm/sec (slow)
Vertical Speed	2.58 cm/sec (1.02 inches/sec)
Total Cradle Length	210.8 cm (83 inches)
Total Cradle Travel	244 cm (96.25 inches)
Positioning Accuracy	+/- 0.05 cm (+/- 0.0019 inches)
Maximum Patient Weight for Scanning	159 kg (350 lbs)
Maximum Weight for Patient Guardrails	113.4 kg (250 lbs)
Patient Transport Accessories	Self storing non-ferrous IV pole Positioning pads Immobilization straps Table pad and Head Coil accessory

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3.0 Gradient Subsystem

The Signa EXCITE 1.5T MR gradient family delivers a level of performance matched to a wide range of needs. From the SmartSpeed, to the HiSpeed Plus, EchoSpeed Plus, and TwinSpeed, the right configuration to realize the desired spatial and temporal resolution can be chosen. The following table presents the specifications for maximum amplitude, rise time, and slew rate. Note that the specifications apply separately to each of three orthogonal directions. Consequently, as much as 70% higher maximum amplitude and slew rate are possible for oblique slices when all three gradients are activated concurrently. The impressive specifications shown below enable extremely short values for the minimum TR, TE, and echo spacing (ESP), which translates to superb image quality.

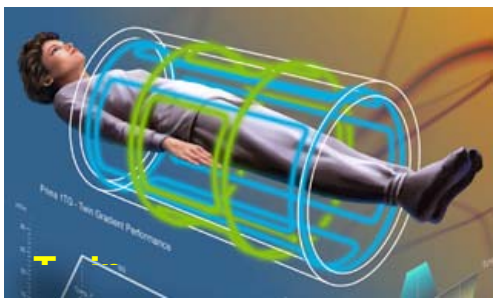
Gradient Performance	SmartSpeed	HiSpeed Plus	EchoSpeed Plus	TwinSpeed (Zoom)	TwinSpeed (Whole-Body)
Maximum Amplitude (in each orthogonal plane) (mT/m)	23	33	33	40	23
Rise Time to Maximum Amplitude (μsec)	460	428	276	267	287
Maximum Slew Rate (T/m/s)	50	77	120	150	77

The Signa EXCITE 1.5T MR system utilizes a unique integrated body module, which combines the gradient and RF body coils into a single module. This module is epoxy-filled and water-cooled for maximum performance. The gradients are non-resonant and actively shielded to avoid eddy currents. The gradients are cooled by chilled water circulating in a closed loop. The electronics, including the Advanced Concept Gradient Driver (ACGD) to power the gradient coils, are housed in a single gradient cabinet to conserve space.

3.1 TwinSpeed Zoom and Whole-Body Gradient Modes

The TwinSpeed model in the Signa EXCITE 1.5T product line features a gradient subsystem with two concentric sets of non-resonant gradient coils. These two sets correspond to two modes of operation, Zoom and Whole Body. The availability of both modes circumvents the compromise between high amplitude and slew rate versus large field of view. This unique capability enables state-of-the-art cardiovascular, neuro-vascular, abdominal, and orthopedic applications.

Zoom mode: The Zoom mode offers high maximum amplitude with high slew rate while avoiding peripheral nerve stimulation. The key is to restrict the high performance to a relatively small field of view (FOV). The Zoom gradient coil is shown in green as the inner set of coils on the right. With maximum amplitude of 40 mT/m and a slew-rate of 150 T/m/sec the Zoom mode delivers ultra-fast imaging techniques for cardio-vascular and neurovascular applications without compromising patient safety or comfort.



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Whole-Body mode: The Whole-Body mode is intended for use when the FOV exceeds approximately 35 cm. Thus, the Whole-Body mode is particularly well suited for certain abdominal protocols, off-center high-resolution orthopedic imaging, and other large FOV applications.

3.2 Quiet Technology (TwinSpeed only)

State-of-the-art clinical imaging demands the routine use of ultra-fast imaging techniques such as DW-EPI, FRFSE, EFGRE3D, and FGRET. Such techniques tend to generate considerable acoustic noise. Quiet Technology is the enabler of patient safety and comfort for such applications. Quiet Technology reduces the level of acoustic noise experienced by the patient inside the magnet bore without compromising the maximum amplitude, slew rate, or duty cycle of the gradients. This means that Quiet Technology preserves image quality.

The reduction in acoustic noise is achieved through the innovative combination of a vacuum chamber and special damping material. The gradient coil is installed inside this vacuum chamber and the vacuum level is monitored with remote diagnostic equipment.

3.3 EXCITE Technology - Transmission

EXCITE, which stands for EXpanding applications with multi-Channel Imaging TEchnology, is GE-exclusive technology for the data pipeline. The power of EXCITE is that it integrates the three major components of the data pipeline, which used to be regarded separately: (1) Transmission, (2) Reception and (3) Processing. This integration enables greater clinical productivity, higher image quality, and data-intensive advanced applications.

EXCITE technology has a major impact on the transmission of the RF pulses and magnetic-field gradient pulses in the MR pulse sequences used to acquire the data for MR images. The technology enables rapid play-out of gradient pulses and RF pulses to realize the shortest TR, TE, and EPI echo-spacing, which in turn translates to faster acquisition, higher SNR, higher spatial resolution, and generally higher image quality.

3.4 Spatial Resolution Parameters

The Signa EXCITE 1.5T MR systems are capable of creating images with superb spatial resolution. This is due in part to the EXCITE data pipeline and also to the performance of the magnetic-field gradients. The table below showcases the minimum slice thickness and minimum field of view (FOV) achievable on Signa EXCITE 1.5T MR systems. Note that these limits are not necessarily embodied in every pulse sequence or every model of MR system in the 1.5T product line. Certain pulse sequences are technically capable of an even larger FOV than listed in the table below. For example, the FOV with the EPI pulse sequence can be as large as 990 mm.

Minimum slice thickness in 2D	0.5 mm
Minimum slice thickness in 3D	0.1 mm
Minimum FOV	10 mm
Maximum FOV	480 mm

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3.5 EPI Sequence Specifications

	SmartSpeed	HiSpeed Plus	EchoSpeed Plus	TwinSpeed (Zoom)
Minimum TR (64x64 matrix)	5.0 ms	4.0 ms	4.0 ms	4.0 ms
Minimum TR (128x128 matrix)	6.0 ms	5.0 ms	5.0 ms	4.0 ms
Minimum TR (256x256 matrix)	6.0 ms	5.0 ms	5.0 ms	5.0 ms
Minimum TE (64x64 matrix)	1.2 ms	1.0 ms	1.0 ms	1.0 ms
Minimum TE (128x128 matrix)	1.3 ms	1.2 ms	1.1 ms	1.1 ms
Minimum TE (256x256 matrix)	1.8 ms	1.5 ms	1.5 ms	1.4 ms
Minimum Slice Thickness	2.0 mm	1.9 mm	1.9 mm	1.6 mm
Minimum FOV	4 cm	4 cm	4 cm	4 cm
Maximum FOV	99 cm	99 cm	99 cm	99 cm
Minimum Echo Spacing at Maximum FOV (64x64 matrix)	0.360 ms	0.300 ms	0.252 ms	0.216 ms
Minimum Echo Spacing at Maximum FOV (128x128 matrix)	0.504 ms	0.408 ms	0.344 ms	0.320 ms
Minimum Echo Spacing at Maximum FOV (256x256 matrix)	0.704 ms	0.596 ms	0.580 ms	0.596 ms
Minimum Number of Shots	1	1	1	1
Maximum b Value	2,500 s/mm^2	4,000 s/mm^2	7,000 s/mm^2	10,000 s/mm^2
Maximum Number of Images per second (64x64 matrix)	28	30	33	35
Maximum Number of Images per second (128x128 matrix)	12	19	21	22
Maximum Number of Images per second (256x256 matrix)	2	6	6	9
Maximum Number of Diffusion Tensor Directions	N/a	N/a	55	55
Maximum Echo Train Length	512	512	512	512

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3.6 Spiral Sequence Specifications

	SmartSpeed	HiSpeed Plus	EchoSpeed Plus	TwinSpeed (Zoom)
Minimum TR (128x128 matrix)	N/a	0.76 ms	0.71 ms	0.71 ms
Minimum TE (128x128 matrix)	N/a	0.50 ms	0.46 ms	0.46 ms
Minimum Slice Thickness	N/a	1.3 mm	1.3 mm	0.7 mm
Minimum FOV	N/a	4 cm	4 cm	2 cm
Maximum FOV	N/a	48 cm	48 cm	44 cm
Maximum Samples per Arm	N/a	32,768	32,768	32,768

TR = Trajectory time * Number of arms / 128
TE = TR – (128/2) * (1/ max bandwidth)

3.7 2D Fast Gradient Echo Sequence Specifications

	SmartSpeed	HiSpeed Plus	EchoSpeed Plus	TwinSpeed (Zoom)
Minimum TR (128x128 matrix)	2.8 ms	2.4 ms	2.3 ms	2.3 ms
Minimum TR (256x256 matrix)	3.3 ms	2.9 ms	2.8 ms	2.7 ms
Minimum TE (128x128 matrix) ^	1.1 ms	0.9 ms	0.9 ms	0.8 ms
Minimum TE (256x256 matrix) ^	1.3 ms	1.1 ms	1.0 ms	1.0 ms
Minimum Slice Thickness	1.0 mm	0.7 mm	0.7 mm	0.5 mm
Minimum FOV	1 cm	1 cm	1 cm	1 cm
Maximum FOV	48 cm	48 cm	48 cm	44 cm
Maximum Echo Train Length	12	12	12	12

^Scan matrix is higher

3.8 3D Fast Gradient Echo Sequence Specifications

	SmartSpeed	HiSpeed Plus	EchoSpeed Plus	TwinSpeed (Zoom)
Minimum TR (128x128 matrix)	1.5 ms	1.3 ms	1.1 ms	1.1 ms
Minimum TR (256x256 matrix)	2.0 ms	1.7 ms	1.6 ms	1.5 ms
Minimum TE (128x128 matrix) ^	0.6 ms	0.5 ms	0.4 ms	0.4 ms
Minimum TE (256x256 matrix) ^	0.8 ms	0.7 ms	0.6 ms	0.5 ms
Minimum Slice Thickness	0.2 mm	0.1 mm	0.1 mm	0.1 mm
Minimum FOV	2 cm	2 cm	2 cm	1 cm
Maximum FOV	48 cm	48 cm	48 cm	44 cm

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3.9 2D Spin Echo Sequence Specifications

	SmartSpeed	HiSpeed Plus	EchoSpeed Plus	TwinSpeed (Zoom)
Minimum TR	13.0 ms	10.0 ms	10.0 ms	7.0 ms
Minimum TE	3.0 ms	2.5 ms	2.5 ms	2.5 ms
Minimum Slice Thickness	1.2 mm	0.9 mm	0.9 mm	0.5 mm
Minimum FOV	1 cm	1 cm	1 cm	1 cm
Maximum FOV	48 cm	48 cm	48 cm	44 cm

3.10 Fast Spin Echo Sequence Specifications

	SmartSpeed	HiSpeed Plus	EchoSpeed Plus	TwinSpeed (Zoom)
Minimum TR (128x128)	13.0 ms	10.0 ms	10.0 ms	10.0 ms
Minimum TR (256x256)	13.0 ms	11.0 ms	10.0 ms	10.0 ms
Minimum TE (128x128)	3.0 ms	2.5 ms	2.5 ms	2.5 ms
Minimum TE (256x256)	3.0 ms	2.6 ms	2.5 ms	2.5 ms
Minimum Slice Thickness (2D)	1.2 mm	0.8 mm	0.8 mm	0.6 mm
Minimum Slice Thickness (3D)	0.3 mm	0.3 mm	0.3 mm	0.3 mm
Minimum FOV	2 cm	1 cm	1 cm	1 cm
Maximum FOV	48 cm	48 cm	48 cm	44 cm
Minimum Echo Spacing (128x128)	3.0 ms	2.5 ms	2.5 ms	2.5 ms
Minimum Echo Spacing (256x256)	3.1 ms	2.6 ms	2.5 ms	2.5 ms
Minimum Shots	1	1	1	1
Maximum Echo Train Length for SSFSE	264	264	264	264

Note: Optional software packages may be required to achieve certain specifications above.

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4.0 EXCITE Radio Frequency Subsystem

The Digital RF subsystem in the EXCITE data pipeline provides excellent RF power and uniformity for image acquisition. The excellent image uniformity is the result of quadrature transmission technology integrated with the other components in the EXCITE data pipeline.

The EXCITE technology is designed to be scalable. The current implementation includes 8 independent channels capable of digitizing 16 quadrature signal inputs simultaneously. The EXCITE receiver interface allows a wide variety of phased-array coils with independent integrated pre-amplifiers to be used. In fact, the interface allows 65K possible combination of coil controls.

Resonance Frequency	63.86 MHz (1.5T)
Maximum RF Amplifier Capability (R.M.S.)	21 kW
Maximum number of simultaneous RF quadrature signal paths	16
Maximum number of independent receivers	8
Sampling bandwidth of each receiver	1 MHz
Quadrature demodulation	Digital
RF Filtering	Digital Non-recursive
Transmit Bandwidth	> 0.6 MHz with automatic control
Transmit Amplitude	>100dB dynamic range and 50 nsec resolution
Frequency Resolution	< 0.6 Hz/Step
Phase resolution	< 0.1 degree/step
Amplitude resolution	16 bit control
Number of RF preamplifiers	8
Preamplifier Gain	36 dB
Noise Rating	< 0.5 dB
Receiver Bandwidth	1000 Hz to 1 MHz
Receiver Dynamic Range	>135 dB with automatic control
Receiver Signal Resolution	Up to 32 bits
Instantaneous Dynamic Range	96 dB (16 bit)
Converter Sampling Resolution	16 bit
Sampling Resolution Alignment	50 ns

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5.0 RF Coils

The Signa EXCITE 1.5T MR System comes standard with two coils:

- Standard Quadrature Transmit and Receive Head Coil for neurological applications
- Integrated Quadrature Transmit and Receive Body Coil for general body applications.

There are many optional receiver coils available to configure a Signa EXCITE 1.5T MR system to meet specific applications requirements. In particular, there are several 8-channel coils that provide both high SNR and extensive coverage without any patient repositioning. Moreover, the Signa EXCITE 1.5T MR system features an open RF architecture, which greatly facilitates the development of coils by other companies. As shown below, these attributes lead to the widest range of coils for each clinical application and ensure a steady supply of new coils in the future.

5.1 Standard Coils with each MR System

Quadrature T/R Head	Applications	Features / Benefits
	▪ Head and Brain ▪ Pediatric imaging ▪ MRA ▪ Head and Neck ▪ Spectroscopy ▪ Ankles and Feet	▪ 16-pin birdcage transmit / receive coil ▪ Patient friendly & open ▪ 28 cm (11 in) diameter x 38 cm (15 in) ▪ Look-out mirror for patient comfort

Quadrature T/R Body	Applications	Features / Benefits
	▪ General imaging when a dedicated receiver coil is unavailable	▪ 32-element birdcage transmit / receive coil ▪ Integrated into MR system ▪ 60 cm diameter

5.2 Optional coils for Neurological Applications

8-Channel Brain Phased-Array	Applications	Features / Benefits
	▪ Brain Imaging ▪ Intra-cranial MRA ▪ Pediatric Imaging	▪ 8-element phased-array coil ▪ ASSET X2 optimized ▪ Patient friendly & open ▪ 24 cm (10 in) S/I coverage ▪ Look-out mirror for patient comfort ▪ High SNR to allow high spatial resolution or short scan times.

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8-Channel CTL Array	Applications	Features / Benefits
	▪ Complete spine ▪ Soft tissue neck ▪ Carotids	▪ 12-element phased-array coil ▪ Very high SNR, high uniformity, and extensive coverage ▪ Feet-first or head-first positioning ▪ High productivity for multi-station exams ▪ Built-in volume neck coil ▪ Conforms to natural curvature of spine ▪ Patient comfort pad and restraint included ▪ 75-cm (29.5-in) in the S-I direction for coverage of the entire spine

4-Channel CTL Array	Applications	Features / Benefits
	▪ Complete spine ▪ Soft tissue neck ▪ Carotids	▪ 6-element quadrature phased-array receive coil ▪ High SNR and extensive coverage ▪ High productivity for multi-station exams ▪ Built-in volume neck coil ▪ Conforms to natural curvature of spine ▪ Patient comfort pad and restraint included ▪ 75-cm (29.5-in) in S-I direction for coverage of entire spine

8-Channel Neurovascular Array	Applications	Features / Benefits
	▪ Carotids ▪ Soft tissue neck ▪ Cervical spine ▪ Brain ▪ MRA from aortic arch to circle of Willis	▪ 13-element coil ▪ Very high SNR in head ▪ ASSET X2 optimized ▪ Extensive coverage & uniformity ▪ Higher productivity with head and neck imaging without repositioning ▪ Up to 40 cm FOV without repositioning patient or coil

4-Channel Neurovascular Array	Applications	Features / Benefits
	▪ Carotids ▪ Soft tissue neck ▪ Cervical spine ▪ Brain ▪ MRA from aortic arch to circle of Willis	▪ Extensive coverage & uniformity ▪ Higher productivity with head and neck imaging without repositioning ▪ Up to 44 cm FOV without repositioning patient or coil

Anterior Neck Coil	Applications	Features / Benefits

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	▪ Soft tissue neck ▪ Pharynx ▪ Para pharyngeal ▪ Sternoclavicular area ▪ Carotids	▪ Single-element receive-only coil ▪ Packaged in housing that conforms to anterior portion of neck and upper chest ▪ Includes an image quality phantom ▪ Can be combined with posterior neck coil for volume neck imaging ▪ 30 cm S/I coverage

Quad C-spine Coil	Applications	Features / Benefits
	▪ Cervical spine ▪ Coverage of 4th ventricle to 2nd thoracic vertebra	▪ Quadrature receive coil ▪ Uniform signal intensity ▪ Ergonomically designed to conform to curvature of the neck. ▪ 30 cm S/I coverage

Quad Thoracic / Lumber Spine Coil	Applications	Features / Benefits
	▪ Lumber Spine ▪ Thoracic Spine	▪ Quadrature receive coil ▪ Movable coil that provides 81 cm of coverage without patient repositioning ▪ Coverage 30 cm (12 in) superior to inferior ▪ Can be combined with Quad C-spine coil for full spine imaging

5.3 Optional Coils for Body Applications

8-Channel Body Array	Applications	Features / Benefits
	• Thorax • Abdomen • Male and female pelvis	• 12-element coil • Very high SNR • ASSET optimized • Extensive longitudinal coverage of 50 cm (20 in) for imaging of abdomen and pelvis without repositioning

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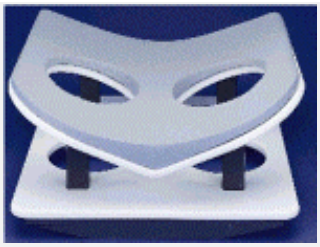
4-Channel Torso Array	Applications	Features / Benefits
	▪ Thorax ▪ Abdomen ▪ Male and female pelvis ▪ Prostate	▪ 4-element coil ▪ ASSET compatible ▪ S/I coverage of 32 cm (12.5 in); R/L coverage of 34 cm (13.4in) ▪ Flexible and light for patient comfort

4-Channel Breast Array	Applications	Features / Benefits
	▪ Single breast Imaging ▪ Bilateral breast imaging ▪ Breast biopsy (using immobilization device available elsewhere)	▪ 4-element coil ▪ Compatible with VIBRANT ▪ High uniformity ▪ Open design

5.4 Optional Coils for Spectroscopy Applications

Auto Tune Device	Applications	Features / Benefits
	▪ Prostate imaging ▪ Prostate spectroscopy	▪ Auto Tune Device (ATD) –T allows combination of Endorectal coil with Torso Array Coil ▪ ATD-III allows combination of Endorectal coil with Pelvic Array Coil ▪ May require interface cable when used with the Low Profile Carriage Cover

Endorectal Coil	Applications	Features / Benefits
	▪ Prostate imaging ▪ Prostate spectroscopy ▪ Rectum ▪ Cervix	▪ Provides very high SNR for structures near probe ▪ Disposable 5 units per package ▪ Can be combined with Torso Array using ATD-T device and Pelvic Array using ATD-III

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5.5 Optional Coils for Cardiovascular Applications

8-Channel Cardiac Array	Applications	Features / Benefits
	▪ Whole heart imaging ▪ Coronary Vasculature ▪ Thorax ▪ Abdomen	▪ 8-element, 8-channel array coil ▪ High SNR ▪ ASSET optimized, even for double-oblique slices ▪ Whole-heart coverage ▪ Open design for patient comfort and greater access to ECG leads ▪ Extensive coverage of 30 cm in S/I and R/L directions

4-Channel Cardiac Array	Applications	Features / Benefits
	▪ Coronary Vasculature ▪ Whole heart imaging ▪ Thorax ▪ Abdomen	▪ 4-element array coil ▪ Whole-heart coverage ▪ Accommodates wide range of chest sizes

Peripheral Vascular Array Coil	Applications	Features / Benefits
	▪ Multi-station MR angiography of peripheral vasculature	▪ 4-channel, 12-element phased array coil ▪ Anatomical coverage from renal arteries to feet for 95% of population ▪ Flexible coated foam is comfortable for patient and easy to clean ▪ Dimensions are 166 x 71 x 5 cm (65.5 x 27.9 x 2.1 inches)

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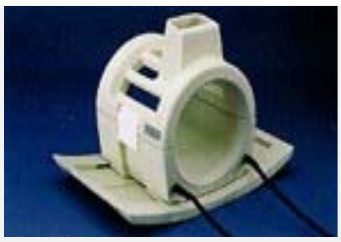
5.6 Optional Coils for Orthopedic and General Applications

Shoulder Phased Array	Applications	Features / Benefits
	▪ Comprehensive shoulder imaging ▪ Humeral head and neck ▪ Rotator cuff ▪ Glenoid labrum ▪ Acromium process ▪ Glenohumeral articular surfaces	▪ Offers increased SNR over linear or quadrature coils

Quad Lower Extremity Coil	Applications	Features / Benefits
	▪ Knee ▪ Ankle ▪ Foot	▪ 12-element, transmit / receive birdcage coil ▪ Unique “chimney” design adds versatility for ankle and foot imaging ▪ Sensitive volume covers up to 22 cm FOV for knee imaging and up to 28 cm FOV for foot imaging ▪ Eliminates need to perform compound obliques, leading to higher productivity

Wrist Array Coil	Applications	Features / Benefits
	▪ Imaging of wrist, including distal portions of radius and ulna, carpals and metacarpals ▪ Triangular fibrocartilage ▪ Ligaments ▪ Hand	▪ 4-channel phased array design ▪ High SNR at small FOVs, which enables high spatial resolution images ▪ Coil can be used overhead or at the patient’s side, vertically or horizontally ▪ Superior / Inferior coverage: 12 cm

Shoulder Coil	Applications	Features / Benefits
	▪ Imaging of humeral head and neck ▪ Glenoid fossa ▪ Acromion process ▪ Rotator cuff ▪ Glenoid labrum ▪ Shoulder	▪ Single-element receive coil ▪ Uniform signal intensity allows for superior fat suppression and depiction of soft tissues ▪ Housing contoured to rest easily on shoulder joint

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Dual Array Adapter

Applications

- Intended for simultaneous imaging of anatomical sites with bilateral symmetry
- Bilateral TMJ
- Bilateral hip
- Wrists
- Ankles
- Neck

Features / Benefits

- Allows two receive-only non-phased array coils to be combined
- Allows extension of FOV through use of two coils
- Includes patient comfort pad and restraint

Dual Array Package

Applications

- Simultaneous bilateral imaging
- Temporal mandibular joint
- Internal auditory canal
- Orbits

Features / Benefits

- Combined capability of 7.5 cm (3-inch) coils and General Purpose Flex Coils
- Package includes the following:
  - Dual Coil combiner
  - TMJ Positioning Device
  - Two 7.5 cm (3 inch) Coils
  - Two General Purpose Flex Coils
  - Eye/TMJ/IAC surface coil positioning device

TMJ Kit

Applications

- Simultaneous bilateral imaging
- Temporal mandibular joint
- Internal auditory canal
- Orbits

Features / Benefits

- Combined capability of 7.5 cm (3-inch) coils
- Package includes the following:
  - Dual Coil Combiner
  - TMJ Positioning Device
  - Two 7.5 cm (3 inch) Coils
  - Eye/TMJ/IAC surface coil positioning device

Dual Coil Accessory

Applications

- Simultaneous bilateral imaging

Features / Benefits

- Capability to combine two receive-only non-phased array coils (not included)
- Package includes the following:
  - Dual Coil Combiner
  - TMJ Positioning Device
  - Eye/TMJ/IAC surface coil positioning device

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3-inch General Purpose Circular Coil	Applications	Features / Benefits
	▪ Orbits ▪ Ankle ▪ Internal auditory canal ▪ Wrist ▪ Small structures	▪ Single-element receive-only coil ▪ Offers high SNR over small FOV ▪ 7.5 cm (3 inches) in diameter ▪ Patient friendly ▪ Can be combined with a similar coil using Dual Array Adapter for bilateral imaging

5-inch General Purpose Circular Coil	Applications	Features / Benefits
	▪ Intended for medium-sized anatomical structures ▪ Cervical Spine ▪ Thoracic Spine ▪ Lumbar Spine ▪ Shoulder ▪ Ankle ▪ Foot	▪ Single-element receive-only coil ▪ Offers high SNR over moderate FOV ▪ 12.5 cm (5 inches) in diameter ▪ Patient friendly ▪ Can be combined with a similar coil using Dual Array Adapter for bilateral imaging

General Purpose Flex Coil	Applications	Features / Benefits
	▪ Well suited for irregular-shaped regions ▪ Hip ▪ Shoulder ▪ Brachial plexus ▪ Large knee ▪ Ankle ▪ Thigh ▪ Elbow ▪ Neck	▪ Single-element, receive-only coil ▪ Versatile ▪ Coil wraps around anatomy of interest

The coils listed above were available at the time of printing. New coils are added regularly. Contact your local GE sales representative for an updated list of currently available coils.

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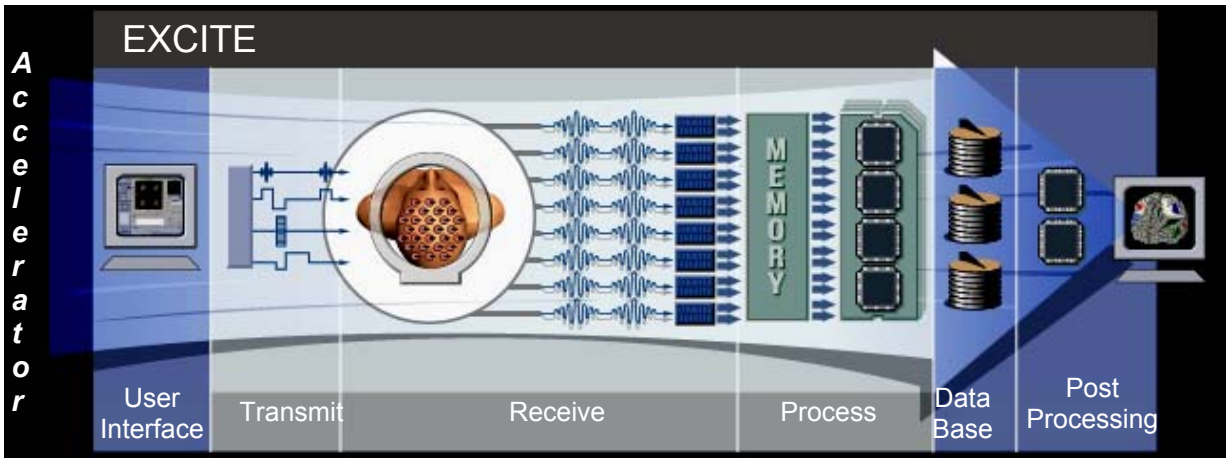
6.0 Computer System

The Signa EXCITE 1.5T MR platform features a high performance computer and a massively parallel image reconstruction and image processing engine that when integrated in the EXCITE data pipeline, allow unprecedented clinical productivity. The architecture helps insure that image display and processing speeds remain consistent regardless of other processes running simultaneously (such as scan, reconstruction, film, network, and archive). It also allows computationally intensive image processing applications such as MPR, MPVR, IVI, 3D/MIP, 3D Surface Rendering, and FuncTool to reach completion quickly.

6.1 Data Management Accelerator

An integral part of EXCITE, the Data Management Accelerator manages information into and out of the pipeline. It consists of three components. First is a state-of-the-art computer, which provides the computational power to satisfy the most demanding clinical workflow. Second is a rapid-access image database, capable of storing more than 490,000 images of size 256x256 pixels and inserting images at a rate as rapid as 75 MB per second. The database accommodates up to 20,000 images per series for fMRI. Third is an operating system that has been optimized to allow end-to-end MRI applications.

The Accelerator confers significant benefits for clinical MR scanning. It allows for faster scan prescription, faster pre-scanning, greater image storage, faster image manipulation, faster archiving, and faster networking – all with true simultaneity. This provides unprecedented opportunities to realize significant productivity improvements.



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6.2 Vector Array Processor

EXCITE has a fully scaleable state-of-the-art Vector array processor reconstruction engine. It includes up to 8 separate processors in a fully distributed/massively parallel processing architecture. The array processor and the associated software for image reconstruction provide true simultaneity along with ultra-fast reconstruction of up to 850 2D FFT operations per second on a matrix of size 256 x 256. The result is unsurpassed clinical productivity.

Performance Parameters	Reflex 200	Reflex 400
Maximum BAM	1 GB	2 GB
Reconstruction Speed (256 X 256 2D FFT operations per second)	425	850

6.3 Productivity Enhancements

The Signa EXCITE 1.5T MR system is designed to allow the highest clinical productivity. It includes the following features to enhance productivity:

- Virtual desktops that organize tasks in the logical groups shown below to reduce clutter

ScanRx™	MRWorks™	Exchange™
Director	Tools	Futures

- Intuitive scan control user interface
- 3-Plane Localizer
- View/Edit Advisor™, which identifies incompatible parameter choices and offers alternatives
- Protocols, either recommended by GE or customized by the site
- Schedule Patient, for designating patient information and the protocol before exam
- JumpStart™, to initiate scanning with minimal effort
- FastForward™ prescan, which allows operators to proceed to another task during prescan, such as prescription of a subsequent series
- AutoView window
- Copy/Paste Series, designed to facilitate minor modifications to an existing series
- Automated Table Motion and Automated Coil Switching for Multi-Station MRA
- OneTouch™ filming to film an entire series, multi-image display or page

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6.4 Host Computer Specifications

Main CPU	Intel® Xeon™ Dual Processor based Workstation with Hyperthreading ▪ Dual 2.66 GHz Processors ▪ AGP 8X Pro 50 Graphics ▪ 533MHz System Bus ▪ 512 KB full Speed L2 Advanced Transfer Cache
SpecMark	SPECfp2000 > 900 SPECint2000 > 900
Word Size	32 Bit
Host Memory	2 GB ECC DDR 266
Graphics Subsystem	Main Display: NVidia® Quadro®4 980XGL ▪ 128 MB DDR Graphics Memory ▪ proe-01: 21.6 ▪ ugs-01: 20.2 ▪ 3dsmax-01: 17.3 Waveform Display: NVidia® PCI GForce4™ MX-420 64MB
Cabinet	Single tower situated under table of Operator Console
Disk Subsystem	108 GB capacity for more than 490,000 uncompressed images of size 256 x 256 ▪ 15K RPM, Dual Channel Ultra 320 SCSI Controller, Raid 0 ▪ Sustained rates to 75 MB/s
Archive and Interchange	Maxoptix™ Magnetic Optical Disk Drive ▪ Erasable, rewritable media 1.3 or 2.3 GB unformatted, 5.25 inch ▪ Assigned to DICOM 3.0 format image file and protocol file storage/retrieval ▪ Capacity of 15,000 or 30,000 images of size 256x256 pixels on 1.3 GB or 2.3 GB MOD, respectively using lossless JPEG compression ▪ Approximately 1.5 sec storage/retrieval per image of size 256x256 ▪ Each image can be viewed as soon as it is restored from MOD
Network	3 x Gigabit (10/100/1000) Ethernet Ports
Operating System	Linux

6.5 Display Monitor

45.83 cm (18” inch) Color LCD Flat Panel Monitor
1280 x 1024 Dot Resolution
Capable of displaying images of 1024 pixels
300:1 contrast ratio
Non-interlaced, flicker free with 72 Hz refresh rate
89kHz Horizontal deflection frequency
Wide Viewing Angle Technology for viewing at orientations within 170 degrees
Undistorted image display in magnetic field up to 50 Gauss

6.6 Standard Operator Console

Scan control keyboard assembly with intercom speaker, microphone and volume controls, and emergency stop switch. Keyboards with a 3-button ball-style mouse are available in English, French, German, Scandinavian, Italian, Portuguese, and Spanish.

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6.7 Desktop User Interface

The user interface is based on the virtual desktops shown below to facilitate the most intuitive clinical workflow possible. Operators can switch back and forth between the four virtual desktops simply by clicking on an icon. No work is lost or disrupted when desktops are switched. Moreover, the user interface can be configured in 6 different languages, which are English, French, German, Italian, Portuguese, and Spanish.

Scan Rx

Desktop for set-up of scanning, featuring:

- Patient data entry
- Protocol selection
- Protocol viewing
- Scan data acquisition
- Image reconstruction
- AutoView image display

Director

Desktop for entry of patient information and scanning protocols, featuring:

- Patient scheduling
- Patient data entry
- Preprogrammed patient demographics
- Protocol selection tools
- Download from HIS/RIS using optional ConnectPro Plus

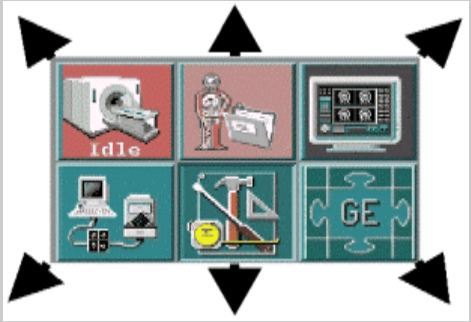
MRWorks

Desktop for image display and processing, featuring:

- Many display formats
- Many filming formats
- Multi-planar reconstruct-tion, and 3D rendering
- Image addition and subtraction

Exchange

Desktop for DICOM 3.0 image transactions, either through a local area network or via DICOM-formatted MOD media.



Service Tools

Desktop for MR system calibration, configuration and diagnostics tools.

Futures

Desktop for customer productivity options such as

- iCenter, ScanPath, iLinq
- IntelliMotion, SYNERGE
- Vitality Services
- GE CHOICE
- CompreCare
- Biomedical Services
- eFlexTrial

6.8 Full Simultaneity

This unique feature allows scan and reconstruction to work in parallel with image display, processing and analysis. Even computationally intensive features like MPR, MPVR, IVI, 3D/MIP, 3D Volume Rendering and FuncTool can run efficiently in concert with image archival, filming, and networking processes.

6.9 Display

AutoView Specifications	256 x 256 Image Window (standard) 512 x 512 Image Window (maximized)
Window/Level (W/L) Features	7 user-programmable keys on the scan control keyboard (F6 - F12), plus one key for returning to the prior setting (F5) 6 user-programmable buttons in the image viewer Arrow keys on the scan control keyboard On-image through middle mouse button Save State to store user-selected image orientation and window level

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Image Display Features	Zoom / Roam / Flip / Rotate / Scroll Explicit Magnify & Magnifying Glass Image Measurement Tools (Measure Distance, ROI, Measure Angle, Measure Pixel Intensity) Grid On / Off Cross Reference \ User Annotation Exam / Series Page Hide Graphics \ Erase Annotation \ Screen Save Accelerator Command Bar Compare Mode \ Reference Image \ Image Enhance ClariView Image Filtering Smooth and Sharpen Edge Filters Minified Reference Scoutview Grayscale Stretch Cine Paging (up to 4 windows, each with as many as 128 images) Add/Subtract and Edit Patient Data
Image Display	256 x 256 pixel image buffer at 30fps
Image Annotation Features	Shadowed to facilitate reading Two Graphic/Text planes overlay entire screen Grid placement with anatomical reference on image Drawing or annotation may be added

6.10 Standard Image Post Processing

Multi-Projection Volume Reconstruction (MPVR)	Quick and easy way to generate volumetric images for MR or CT Angiography without thresholding data or removing unwanted anatomy. Images in any plane can be created from this volume.
Multi-Planar Reformation (MPR)	Allows for real time assessment of anatomy in planes at any orientation Curved reformations also possible
Other standard analysis features	Curved reformations Batch reformations Interactive Vascular Imaging (IVI) Comparison Mode Multi-image ROI 3D Surface Rendering

6.11 Standard Imaging Parameters

ScanTools 11.0 provides a comprehensive applications package for scanning the brain, spine, orthopedic, abdomen, pelvis, heart, carotid arteries, and peripheral vasculature.	3-plane graphic prescription including double-oblique slices Basic Cardiac Sequences for routine morphological, basic ventricular function using Double/Triple IR, FastCard and FastCine Fast Recovery FSE (FRFSE) breath-hold imaging, dual-echo Fast Fradient Fcho (FGRE) breath-hold, and Extended ETL SSFSE Surface coil intensity correction (SCIC) of images while preserving high resolution anatomic details for wide range of coils FRFSE with complete flexibility and access to scanning parameters for routine T2-weighted contrast improvement T1-FLAIR for strongly T1-weighted imaging of brain, spine, and abdomen SSFSE-XL for high SNR and high spatial resolution MRCP 2D Fast Gradient Echo, 3D enhanced Fast Gradient Echo, Echo Planar Imaging, and FSE-XL pulse sequences

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	Adaptive phased-array imaging mode for spine applications 2D Multi-Slice Imaging with as many as 120 slices 3D Fourier imaging with 12 to 124 slices possible in increments of 2 Direct axial, sagittal, coronal, oblique and double-oblique plane imaging 3 Plane Localizer pulse sequence 2D Inversion Recovery (IR) Sequential and non-sequential acquisitions 2D Spin Echo (SE) with 1, 2, or 4 symmetrical echoes or 2 asymmetrical echoes and Standard, Classic or Contiguous Slices 2D Sequential Gradient Echo (GRE) 2D and 3D Multi-Planar Gradient Recalled (GRE) with 1 or 2 echoes 2D/3D Spoiled Gradient Recalled (SPGR) 2D/3D Fast Spin Echo (FSE) including FSE-XL with 352 echo train length (ETL) Single Shot Fast Spin Echo (SSFSE) 2D/3D Fast Gradient Echo FGRE with oblique capabilities SPECIAL (SPECtral Inversion At Lipid) fat suppression technique Single-shot and Multi-shot Echo Planar Imaging (EPI) FLAIR 2D/3D Fast Spoiled Gradient Echo (FSPGR) 1024 ZIP Reconstruction FAME (Fast Acquisition with Multiphase EFGRE-3D) 3D Multi-Step MR Angiography utilizing ZIP™ 2D/3D Time of Flight (TOF) MR Angiography featuring ramped RF pulses Enhanced 3D-TOF utilizing ZIP™ reconstruction 2D Fast Gated TOF and Oblique capabilities 2D/3D Phase Contrast MR Angiography 2D Fast Phase Contrast Angiography 3D Surface Rendering FuncTool Performance, which offers specialized image post processing for MR. Results are displayed in various formats including time-intensity curves, parametric color overlays and metabolite ratio maps. These include ADC and eADC maps, correlation coefficients for mapping of motor strip and visual/auditory stimuli, NEI (Negative Enhancement Integral), MTE (mean time to enhance), Positive Enhancement Integral, Signal Enhancement Ratio, Maximum Slope Increase, Maximum Difference Function, and Difference Function.
Standard Cardiac Features	Cardiac Compensated GRE/FGRE Cardiac ECG Gating CINE Plus Cardiac Imaging 2D CINE PC MR Angiography
Imaging Parameters	Flow Compensation Respiratory Compensation and Respiratory Triggering Cardiac and Peripheral Pulse Gating Graphic Prescription Explicit Saturation (SAT outside and inside the FOV and concatenated SAT) Graphic Saturation (oblique and cursor placement SAT inside the FOV) No Phase Wrap Fat/Water (Spectral Chem-Sat) Saturation Variable Bandwidth Surface Coil Intensity Correction Extended Dynamic Range Phase and Frequency Offset Asymmetric FOV Fluoro Trigger and SmartPrep Square Pixel

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	Magnetization Transfer Multi Phase ZIP X 2, X 4, 512 and 1024 Tailored RF Blood Suppression DE and IR Prepared

6.12 Filming

Image Filming Features	3M-952 protocol Drag & Drop filming One button Print Series One button Print Page Multi-image formats - 1:1, 2:1, 4:1, 6:1, 9:1, 12:1, 15:1, 16:1, 20:1, 25:1 and 35 mm slide DICOM 3.0 Basic Grayscale Print Service Class
Image Storage/ Retrieval Specifications	Images may be stored and retrieved via Maxoptix Magnetic Optical Drive (MOD) media using DICOM 3.0 format. This permits interchange with other imaging systems supporting DICOM 3.0 MOD media. Off-line retrieval of all image files, with each image available for viewing as soon as it is retrieved. Image storage or retrieval time using Maxoptix MOD media is approximately 2 seconds per 512 x 512 pixel image.

6.13 Networking

Image Networking	100baseT Ethernet (AUI connector) standard
Networking Protocols supported	DICOM 3.0 Basic Grayscale Print Service Class DICOM 3.0 send, receive, and query/retrieve InSite point-to-point TCP/IP (for system administration)
Image Transfer	37 images per second for size 256x256 pixels
DICOM Conformance Standards	DICOM 3.0 Modality Work List Service Class supported with optional Connect Pro software DICOM 3.0 Storage Service Class Service Class User (SCU) for image send Service Class Provider (SCP) for image receive DICOM 3.0 Query / Retrieve Service Class DICOM 3.0 2.3 GB/5.2GB MOD Media Service Class DICOM 3.0 Storage Commitment Service Class DICOM 3.0 Basic Grayscale Print Service Class
Computer Industry Standards	POSIX (1003.1, 1003.2, 1003.4) X-Windows (X11/R5) Motif (1.2) OpenGL ANSI C ANSI Draft Standard C++

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7.0 Standard Imaging Specifications

7.1 Slice Thickness and Spacing

- In 2D mode, slice thickness ranges from 0.5 mm to 100 mm in 0.1 mm increments (depending on gradient platform) with operator variable inter-slice spacing in increments as small as 0.1 mm
- In 3D mode, slice thickness ranges from 0.1mm to 5.0 mm slice thickness in 0.1 mm increments. The slices are contiguous and range in number from 12 to 124.

7.2 Field Of View (FOV)

- Head Coil: 1 to 28 cm in 1 cm increments in all planes
- Body Coil: 1 to 48 cm in 1 cm increments in all planes
- Ability to scan off-center FOV and Asymmetric FOV

7.3 Cardiac Adaptive Digital Gating

GE's innovative adaptive digital signal processing technique reduces the effects of gradient activity on the ECG signal, which greatly enhances the reliability of cardiac gating. This technique provides consistently reliable R-peak detection to minimize the effects of heart, vascular, or CSF motion. The gating package allows the user the flexibility to trigger from the amplitude of the R-wave, or from the upslope of the QRS complex. Additional functionality permits the following:

- Automatic detection of the best ECG lead selection
- A lockout to improve accuracy during arrhythmic patients or couplet waveforms
- Digital filters that reduce the effects of gradient noise upon the ECG trace
- Easy adjustment of trigger level to accommodate T-wave changes caused by magnetic field
- Continuous monitoring of ECG leads with capability to swap leads in mid-scan.
- Capability to switch from ECG gating to peripheral gating (PPG) without interrupting image acquisition
- Automatic calculation of maximum allowable slices for specified number of cardiac phases
- Automatic calculation of estimated time to scan completion, based upon number of views remaining to be collected.
- Automatic calculation of beats per minute (BPM) and real-time updates throughout image acquisition
- Capability to invert waveforms and control trigger windows and trigger delay

The integrated waveform plots cardiac signals and provides a patient heart rate histogram that quantifies the effect of heart rate variation on image quality.

The following choices are available for gated image acquisition:

- Multi-Slice Single-Phase
- Multi-Slice Multi-Phase
- Single-Slice Multi-Phase

The gating package includes the software, one set of high-impedance patient lead wires, one carton of adult-sized electrodes and one fiber optic peripheral gating probe.

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7.4 Acquisition Matrix Size and Reconstruction Techniques

- Phase encoding from 64 to 1024 in steps of 32. Frequency encoding of 64 to 1024.
- Respiratory Triggering concurrent with ECG gating
- ZIP™ (Zero Filled Interpolation Processing) is applicable through-plane and in-plane
- Through-plane ZIP reconstructs images interpolated between acquired slices to permit higher-resolution 3D reformations without increasing scan time
- In-plane ZIP reconstructs image at higher resolution matrix than acquired (512 or 1024 pixels)

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8.0 Standard & Optional Pulse Sequences / Packages

8.1 Pulse Sequences and Clinical Applications

Pulse Sequence	Neurological	Body	Cardiac	Vascular	Orthopedics	Pediatric
FRFSE	T2-weighted brain IAC's and spine imaging. High-resolution anatomical imaging with improved contrast and shorter scan time or more slices	T2-weighted breath-hold imaging in abdomen, pelvis			Meniscal abnormalities, cystic lesions, bone bruises	T2-weighted, joints. High-resolution anatomical imaging with decreased scan time due to fast recovery
Dual Echo FGRE, FSPGR		T1 weighted breath-hold imaging throughout the body, particularly for adrenals and liver, with fat-water in-phase and opposed-phase images				
SSFSE, SSFSE-XL	Fast T2 weighted brain imaging to freeze motion for uncooperative and pediatric patients	MR cholangiopancreatography (MRCP) and other MR hydrography applications and also T2-weighted images in patients who cannot hold their breath				T2-weighted images of the fetal anatomy, fast technique freezes motion
FSE, FSE-XL	PD, T1, T2 for brain and spine.	T2-weighted imaging in abdomen, pelvis, and breast			High-resolution anatomic imaging of joints and cartilage	Standard anatomical imaging: Neuro/Spine T1/T2/PD, joints
FGRE-ET*			Rapid imaging of myocardium			
EFGRE 3D		T1 weighted breath-hold images in abdomen, pelvis, and breast		3D Contrast Enhanced MR Angiography with Elliptic Centric	Cartilage imaging when used with fatsat or SPECIAL	Vascular imaging, contrast enhanced MR angiography studies
IR Prepared FGRE*			IR prepared gated FGRE imaging for myocardial evaluation			
Spiral*			Coronary artery imaging			Coronary artery imaging

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Pulse Sequence	Neurological	Body	Cardiac	Vascular	Orthopedics	Pediatric
T1 FLAIR	T1-weighted Brain and Spine. Improved contrast between W/G matter with CSF suppression.					Neuro/Spine T1 weighted. CSF suppressed high resolution T1-weighted images of neuroanatomy
FAME		Three-dimensional coverage of liver within breath hold for contrast-enhanced dynamic imaging				
3D FIESTA*	IAC & cervical spine. Excellent contrast between nerves and fluid, T2/T1 contrast	T2 weighted breath hold abdominal images	Left Ventricular Function With Fat-Sat for coronary artery imaging			Left Ventricular Function
2D FIESTA*		Imaging during free breathing	Imaging of myocardium with bright blood			Imaging of myocardium with bright blood
PROSE*		MR spectroscopic imaging of prostate gland				
EPI (SE, GRE)	Rapid imaging and uncooperative patient imaging					Rapid imaging and uncooperative patient imaging
EPI – Diffusion*	Ultra-fast imaging of stroke and other lesions					Ultra-fast imaging of stroke and other lesions
Diffusion TENSOR*	Ultra-fast imaging of white matter diseases					Ultra-fast imaging of white matter diseases
PROPELLER*	Motion intolerant imaging in T2 brains and magnetic distortion intolerant in DWI					
TRICKS*				Temporal MRA imaging of lower extremities		

* Optional pulse sequences

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8.2 Optional Software for General Applications:

8.2.1 ASSET (Array Spatial Sensitivity Encoding Technique)

Reducing scan times is often a critical patient-comfort consideration. ASSET (Array Spatial Sensitivity Encoding Technique) is a parallel-imaging technique designed to reduce scan time, increase in-plane spatial resolution, or acquire more slices. ASSET also minimizes RF deposition. It can be used in conjunction with phased-array coils and any of the following pulse sequences:

- 2D Fast Gradient Echo (2D FGRE)
- 2D Fast Spoiled GRadient-echo (2D FSPGR)
- Enhanced Fast Gradient Echo 3D (eFGRE3D)
- 3D Time-Of-Flight Spoiled GRadient-echo (3D TOF-SPGR)
- 3D Time-Of-Flight GRadient Echo (3D TOF-GRE)
- 2D Fast Spin Echo-XL (2D FSE-XL)
- 2D Fast Recovery Fast Spin Echo (2D FRFSE)
- 2D Fast-Spin Echo-Inversion Recovery (2D FSE-IR)
- 2D T1-FLuid Attenuated Inversion Recovery (T1-FLAIR)
- Single Shot Fast Spin Echo (SSFSE)
- Diffusion-weighted EPI
- Diffusion Tensor Imaging
- VIBRANT (ASSET in slice direction)

ASSET is compatible with the following receiver coils:

- 8-Channel Brain Array Coil
- 8-Channel Neurovascular Array Coil
- 4-Channel Torso Array Coil
- 8-Channel Body Array Coil
- 8-Channel Cardiac Coil
- 4-Channel Breast Array Coil

8.2.2 ConnectPro Plus

ConnectPro is software that enables the DICOM 3.0 worklist server class for the Signa Operator's Console, making it possible for the console to query the HIS/RIS by name, modality, or scheduled date, and to download patient demographics directly to the scanner. This may require separate gateway hardware to connect non-DICOM-compatible HIS/RIS systems to the MR system.

8.2.3 Performed Procedure Step

Performed Procedure Step (PPS) is a key step towards a film-less and paperless environment. Used in conjunction with the GE PACS broker, it automatically notifies the HIS/RIS and PACS systems of procedure status – in effect, closing the loop on the information gathered from patient arrival through billing.

8.2.4 Bar Code Reader

This bar-code reader allows the download of pre-coded patient demographics directly to the scanner.

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8.3 Optional Software for Neurological Applications

8.3.1 PROPELLER

PROPELLER (Periodically Rotated Overlapping ParallEL Lines with Enhanced Reconstruction) is a revolutionary image data collection method based on Fast Spin Echo. The name reflects the unique pattern it follows in acquiring data and filling k-space – a pattern that resembles radial blades rotating in sequence until the image acquisition is complete. Since each blade passes through the center of k-space, PROPELLER has unusually low sensitivity to motion artifacts and unusually high contrast-to-noise properties. It can create high-quality T2-weighted images even when the patient fails to remain still. When applied to diffusion-weighted imaging, PROPELLER is tolerant of the magnetic susceptibility artifacts that challenge traditional EPI-based Diffusion Weighted Imaging, specifically near the skull base and in the presence of dental work, craniotomies, or other abnormalities that disturb the magnetic field.

8.3.2 EchoPlus Software for Diffusion-Weighted Imaging

The EchoPlus software introduces a diffusion-weighted Single Shot EPI technique that may be used to improve the detection of acute and hyper-acute stroke. This package features, Single Shot EPI and FLAIR EPI, multi-NEX capability, b-values up to 10,000 s/mm^2 (depending on gradient performance), and on-line image processing using FuncTool.

8.3.3 Diffusion Tensor Imaging

This package expands the capability of EchoPlus EPI to include isotropic Diffusion Tensor Imaging (DTI) – a special technique that provides excellent image contrast, based on the degree of diffusion anisotropy in cerebral tissues such as white matter. DTI works by simultaneously applying diffusion-sensitizing gradients along the frequency, phase and slice-selection axes. Echo Planar Imaging readouts are performed on diffusion data along 6 to 55 diffusion orientations at each prescribed slice location. The system then generates component diffusion images for estimating the diffusion tensor at each pixel and to map regions of isotropic and anisotropic diffusion in the tissue. This package also expands the capability of FuncTool on the Operator's Console to generate Fractional Anisotropy (FA) Maps and Volume Ratio Anisotropy (VRA) Maps.

8.3.4 BrainWave Real-Time Acquisition

This software package allows a technologist to acquire, process, and display BOLD (Blood Oxygen Level Dependent) fMRI studies acquired with synchronized stimuli. Frame rates of up to 25 fps are possible. It interfaces with the Terra database on the host computer and allows paradigm development and real-time paradigm control and display of color activation maps.

8.3.5 BrainWave Post- Acquisition

This software package allows the processing, analysis, 3D rendering, and display of results from BOLD (blood oxygen level dependent) MRI scans – entirely on the Operator Console. The BrainWavePA software is the perfect complement to the powerful acquisition capabilities in BrainWaveRT.

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8.3.6 3D FIESTA

3D FIESTA (Fast Imaging Employing STeady-state Acquisition is a technique that uses an extremely short repetition time (TR) between RF pulses such that high-resolution 3D volume images can be acquired rapidly. The 3D FIESTA technique is especially useful for the rapid acquisition of high-spatial-resolution images of static structures such as cochlea, internal auditory canal, or joints.

8.3.7 FIESTA-C

The Phase-Cycled Fast Imaging Employing STeady-state Acquisition (FIESTA-C) is 3D FIESTA technique that overcomes the band artifacts characteristic of magnetic field inhomogeneities. It is intended as a rapid MRI technique in which fluids have high intensity for identifying protrusions of the intervertebral disc, obstruction in hydrocephalus, and imaging of small structures in the internal auditory canal (IAC), cranial nerves in the cerebellar-pontine angle (CPA) and the cervical spine.

8.4 Optional Software for Body Applications:

8.4.1 VIBRANT

VIBRANT (Volume Imaging for Breast AssessmeNT) integrates ASSET technology with a patented fat-suppression technique developed specifically for breast imaging. VIBRANT permits high-resolution bilateral imaging of both breasts in the time it once took to image a single breast. VIBRANT incorporates fat suppression in combination with automatic subtraction of pre-contrast and post-contrast images to yield the most robust image quality.

8.4.2 3D FRFSE for high resolution MRCP

Compatible with all gradient platforms, this package allows gated or breath-held 3D volume FRFSE (Fast Recovery Fast Spin Echo) for MRCP studies.

8.5 Optional Software for Spectroscopy Applications

8.5.1 Probe 2000 Software

The Probe 2000 image-guided clinical spectroscopy package allows evaluation of the relative concentrations of *in-vivo* metabolites non-invasively. It enables the acquisition and display of volume-localized, water-suppressed H-1 spectra in single or 2D multi-voxel (CSI) mode and with the capability to create parametric metabolite maps. This package includes the PROBE-P (PRESS) pulse sequence, as well as automated acquisition set-up and graphic prescription of spectroscopic volumes.

8.5.2 Probe 3D Brain

This option extends the capability of Probe 2000 through the addition of 3D CSI acquisitions.

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8.5.3 SAGE 7

SAGE 7 (Spectroscopy Analysis by General Electric, Version 7) allows one to process, display, manipulate, analyze, manage and print *in- vivo* spectroscopy data via an easy-to-use, graphical interface. This powerful toolkit furnishes a wide array of filters, transformations, correction algorithms, and segmentation and measurement tools to extract the information contained in spectroscopy data. The results of the analysis can be output to a postscript printer and in electronic formats ranging from BMP, EPS and GIF to JPEG, PICT and TIF. And the steps can be customized and saved in macros to streamline application of even the most sophisticated routines.

8.5.4 Prostate Spectroscopy (PROSE)

PROSE (PROstate Spectroscopy and Imaging Exam) is an image-guided clinical imaging and spectroscopy package that allows users to acquire high-resolution prostate-gland images using Surface Coil Intensity Correction (SCIC) – as well as volume-localized water/lipid-suppressed hydrogen spectra and multi-voxel spectroscopic images via endorectal and phased-array coils. The result is data about the relative concentrations of *in vivo* metabolites acquired non-invasively. The data can be displayed as individual spectra or as multi-voxel spectroscopic images. This easy-to-use package features FuncTool CSI (3D Multi-voxel Proton Spectroscopy processing), Very selective suppression (VSS) pulses, PRESS pulse sequence, Torso PA Coil, ATD-T, and endorectal coils.

8.5.5 Multi-Nuclear Spectroscopy

A package of hardware and software to enable the detection of nuclei in the range of 10 to 130 MHz is offered.

8.6 Optional Software for Cardiovascular Applications

8.6.1 EC-TRICKS

Elliptical-Centric TRICKS (Time Resolved Imaging of Contrast KineticS) technology combines intricate temporal sampling with complex data recombination to accelerate the temporal resolution of 3D dynamic imaging without compromising spatial resolution. This TRICKS technology is integrated with Elliptical-Centric data-sampling technology to create an ideal imaging technique for challenging contrast-enhanced MRA of the lower extremities. Easy to set up and easy to use, EC-TRICKS rapidly generates time-resolved 3D images of blood vessels to meet the challenge of capturing peak arterial phases with minimal venous contamination. With EC-TRICKS, the different vascular phases can be extracted, quickly and easily, after image acquisition.

8.6.2 SmartPrep 2000

SmartPrep 2000 allows users to automate multi-station, contrast-enhanced MRA as well as peripheral angio run-off studies. It uses a special tracking pulse sequence to monitor the MR signal produced by an injected contrast bolus through a user-prescribed volume to detect its arrival and to trigger the acquisition at the proper time. The package includes efficient multi-station scouting capabilities, flexible multi-station graphic prescription, precise multi-station RF

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tuning with Prescan Ahead, automated triggering, table motion and coil switching, and robust fat-suppression with SPECIAL (SPECtral Inversion At Lipid).

8.6.3 Fluoro-Triggered MRA

Fluoro-triggered MRA (FT MRA) is a capability to capture angiographic images at the precise moment of peak opacification. FT MRA allows the operator to manually trigger each acquisition coincident with the desired level of vessel enhancement. The switchover takes less than one second.

8.6.4 2D FIESTA

FIESTA (Fast Imaging Employing STeady-state Acquisition) is designed to produce high SNR images extremely rapidly. The technique features an extremely short TR and fully balanced gradients to rephase the transverse magnetization at the end of each TR interval. For very short TR sequences, the signal intensity depends strongly on the ratio T2/T1 and is largely independent of TR. As a result, this pulse sequence accentuates the contrast of spins with a high T2/T1 ratio -- such as CSF, water and fat -- while suppressing the signal from tissues with low T2/T1 ratio, such as muscle. This property enables high contrast between the myocardium and blood pool. 2D FIESTA is also useful for imaging the abdomen during free breathing.

8.6.5 Fast GRadient Echo using an EPI Echo Train

This technique combines a short-TR FGRE (Fast GRadient Echo) pulse sequence with an EPI echo train to acquire multiple views, or phase encoding steps, per TR. It features uniform RF excitation, centric phase encoding, segmented k-space filling, retrospective gating in FastCARD-ET, EPI-caliber interleaving, and EPI-like acquisition of multiple views in one TR. Multi-phase FGRET is useful for applications such as multi-slice, multi-phase imaging of myocardial function.

8.6.6 Real Time Fast GRadient Echo using an EPI Echo Train

Real Time FGRET (Fast GRadient Echo using an EPI Echo Train) uses a short TR FGRE pulse sequence with the ability to acquire multiple views, or phase-encoding steps, per TR via an EPI echo train. The result is a useful combination of gradient-echo and EPI features, such as, uniform RF excitation, centric phase encoding, segmented k-space filling, retrospective gating in FastCARD-ET, EPI-caliber interleaving, and EPI-like acquisition of multiple views in one TR. Used in conjunction with iDrive Pro Plus, Real Time FGRET is useful for obtaining higher-resolution interactive cardiac images.

8.6.7 Hi-Resolution Spiral Imaging

Developed to acquire high-resolution images in less than one second, Spiral Imaging is ideally suited for imaging moving structures such as the coronary arteries. Instead of collecting data in the conventional rectilinear grid pattern, it simultaneously applies the x and y gradients in conjunction with a 2D GRE or SPGR pulse sequence, quickly gathers the data in a spiral pattern, and then interpolates the data onto a rectilinear grid for image generation. Non-gated sequences can be used with one or more slice locations; gated acquisitions can be conducted in sequential or non-sequential mode. The advantages of Spiral Imaging include faster acquisition from the more efficient k-space data collection, higher SNR from oversampling of the center of k-space, and intrinsic flow- and motion-compensation from the short echo times.

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8.6.8 Real-Time Spiral Imaging

Developed to generate images at high temporal resolution, Real-Time Spiral Imaging is ideally suited for rapid localization of moving anatomy, such as the heart. Instead of collecting data in the conventional rectilinear grid pattern, it simultaneously applies the x and y gradients in conjunction with a 2D GRE or SPGR pulse sequence to quickly gather the data in a spiral pattern – and then interpolates the data onto a rectilinear grid for image generation.

8.6.9 iDrive Pro

iDrive Pro brings real-time interactive imaging to the MRI suite. The user can change scan parameters during scanning and evaluate the results immediately from data acquired at up to 8 frames/sec using a 2D FGRE/FSPGR pulse sequence. The iDrive Pro package provides real-time control over geometric variables such as image plane location, obliquity, rotation, center FOV and FOV size, and contrast parameters such as pre-saturation, flow comp, and RF spoiling. And iDrive Pro has an intuitive point-and-click user interface and live, on-image navigation icons. It includes image book marking, a suite of localization and drawing tools, and additional capabilities from 10-level undo/redo, built-in time, autoNEX and click-of-the-mouse display/review/save, all to streamline even the most complex exams and manipulations.

8.6.10 iDrivePro Plus

iDrive Pro Plus adds to the capability of iDrivePro to bring real-time interactive imaging to the MRI suite. This enhanced package features a separate window for scout images, additional bookmarks, greater real-time control over scan parameters, including field of view, slice thickness, and TR.

8.6.11 Cardiac Tagging

Used to improve visualization of contractile function, this tagging application combines cardiac-gated FastCINE gradient-recalled echo to acquire data throughout the cardiac cycle, with spatial SAT pulses applied throughout the FOV. Using the operator's choice of diagonal stripes or a grid pattern, tagging is applied once per R-R interval immediately following the R-wave ECG trigger, just before the start of data acquisition.

8.6.12 3D FatSat FIESTA for Cardiac Imaging

3D FatSat FIESTA is software designed for imaging of the coronary arteries. The software acquires 3D images using FIESTA (Fast Imaging Employing STeady-state Acquisition). Fat suppression is applied to accentuate the coronary arteries. The use of VAST (Variable Sampling in Time) technology greatly shortens breath-holding requirements or allows for higher spatial resolution.

8.6.13 2D IR Prepared gated FGRE for myocardial evaluation

Vital to MRI myocardial assessments, this technique can help distinguish living tissue from dead and therefore have a major impact on patient management – particularly on revascularization strategies. This pulse sequence uses an IR prepared, cardiac-gated fast gradient echo sequence to acquire images whose appearance depends on the tissue's T1 relaxation time. The IR-preparation step allows various tissues to be suppressed or enhanced. The IR prep pulse in this

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sequence is non-selective; i.e., it excites the entire volume inside the body coil, rather than a specific slice. That means that it can suppress both the myocardium and the blood flowing into the slice.

8.6.14 3D IR Prepared gated FGRE for myocardial evaluation

3D IR Prepared gated FGRE is an advanced tool for myocardial assessment. It uses VAST (Variable Sampling in Time) technology to acquire extensive volumes of data, rather than merely single slices, during breath holds, with acquisitions gated to the cardiac cycle. The software applies a non-selective inversion-recovery magnetization preparation step to create T1-weighted tissue contrast and suppress the signal from certain tissues.

8.6.15 Navigators for 3D Cardiac Imaging

This software package is designed for use in conjunction with 3D IR Prepared FGRE or 3D FatSat FIESTA for Cardiac Imaging. It consists of navigators that make it possible to track the diaphragm and use the information to acquire crisp 3D gradient-echo images of the heart even while the patient breathes.

8.6.16 ReportCARD Package for Viewing, Analysis, and Reporting of Cardiac MR Images:

ReportCARD is a package designed especially for the clinical practice of cardiac MRI. It consists of software that greatly accelerates the viewing and analysis of cardiac images and generation of a report that communicates precisely the information desired by the referring physician. The software comes loaded on a standalone computer.

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9.0 Siting and Other Specifications

9.1 System Siting Requirements

This section provides a basic overview of the siting requirements for the Signa EXCITE 1.5T MR System. More detailed information is available on request.

	System Configuration Minimum Values
Room	CX150 with K4 Technology and WideOpen Enclosure Active Shield (1.5T)
Magnet W x D m (ft-in) Area m^2 (ft^2) Ceiling Height m (ft-in)	 3.33 x 6.00 (10-11.3 x 19-4) 19.98 (211.4) 2.5 (8-2.4)
Magnet (TwinSpeed) W x D m (ft-in) Area m^2 (ft^2) Ceiling Height m (ft-in)	 3.33 x 6.00 (10-11.3 x 19-4) 19.91 (214.3) 2.5 (8-2.4)
Equipment W x D m (ft-in) Area m^2 (ft^2)	 3.65 x 2.74 (12 x 9) 10.00 (108)
Control W x D m (ft-in) Area m^2 (ft^2)	 1.52 x 2.13 (5 x 7) 3.24 (35)
Total System Area m^2 (ft^2)	33.22 (354)

9.2 Fringe Field

	0.5 mT (5 Gauss)			**0.1 mT (1 Gauss)**	
	Axial	Radial		Axial	Radial
CX150 with K4 technology Active Shield Magnet (1.5T)	4.00 m (13.12 ft.)	2.48 m (8.13 ft.)		5.70 m (18.7 ft.)	3.28 m (10.76 ft.)

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9.3 Dimensions and Weight at Installation

	Width	Height	Weight	
Magnet Assembly CX150 with K4 Technology Active Shield (1.5T) with WideOpen Enclosure	212 cm (83.27 in.)	241 cm (94.96 in.)	5155 kg (11340 lbs.)	Note 1
TwinSpeed Magnet Assembly CX150 with K4 Technology Active Shield (1.5T) with WideOpen Enclosure, Quiet Technology and RF Body coil	212 cm (83.27 in.)	241 cm (94.96 in.)	5382 kg (11840 lbs.)	
Patient Transport	67 cm (26.13 in.)	97 cm (37.83 in.)	286 kg (629 lbs.)	Note 2
Control Room Equipment			80 kg (175 lbs.)	Note 3
Equipment Room				
MR Equipment			1492 kg (3282 lbs.)	
MR Equipment (HiSpeed Plus)			1781 kg (3918 lbs.)	
MR Equipment (EchoSpeed Plus)			1781 kg (3918 lbs.)	

Note 1: Full weight includes magnet, enclosure, RF/Gradient body coil assembly and cryogens.
Note 2: Full weight includes 159 kg (350 lbs.) patient.
Note 3: Full weight includes optional LCD Flat Panel Monitor.

9.4 Electrical Supply Requirements

Supply System	Recommended Configuration	3 phase Grounded WYE with Neutral and Ground (5 wire system). Note: Neutral must be terminated inside the Main Disconnect Control.
	Alternate Configuration	3 phase DELTA with Ground (4 wire). Recommend corner Grounded Delta configuration.
Voltage	480 Vrms or 380 / 400 / 415 Vrms	
Frequency	50 ± 0.5 Hz or 60 ± 0.5 Hz. (Local voltage adaptation may be required)	

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9.5 Power Consumption

Power consumption depends on actual usage. The following values are an approximation. They exclude consumption by Shield Cooler Compressor (9 kVA)

Standby (no scan)	8 kVA
Standby (no scan) (TwinSpeed)	9 kVA
Average Power	18kVA
Continuous Sustained Power (> 5 seconds)	45 kVA
Peak Instantaneous Power (in< 5 seconds)	56.2 kVA

TwinSpeed system cooling cabinet options

System cooling cabinet options	Continuous Power Draw
Indoor / Outdoor Single Loop Chiller	6.2 kVA
Heat Exchanger	1.4 kVA

9.6 RF Shielding

100 db for 10 - 100 MHz planewave.

9.7 Workspace Monitor Position

	Maximum Field Strength
LCD Flat Panel Monitor (optional)	5 mT (50 Gauss)

9.8 Temperature & Humidity Requirements

	Magnet Room	Control Room	Equipment Room
Temperature	15 - 21 °C	15 - 32 °C	15 - 32 °C
Max. Temperature Change Rate	3 °C / hour	3 °C / hour	3 °C / hour
Humidity (non-condensing)	30 - 60 %	30 - 75 %	30 - 75 %

9.9 Alternative Environments

Mobile, Relocatable - modular buildings and transportable configurations may also be available (including air-conditioning, heating, chiller, RF shielding, additional magnetic shielding in walls). Contact your local GE representative for GE certified designs and vendors.

For detailed information regarding site planning, and pre-installation requirements, please consult publication Signa Infinity 1.5T MR & CV/*i* Pre-Installation, Direction 2223170 (available from your local GE sales representative).

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9.10 Important Notes

Filming requires the Signa Infinity 1.5T MR Digital Filming Interface (purchased separately) unless DICOM Print will be used exclusively for software filming to DICOM Print peripheral devices. A Digital/LCAM Camera Interface is typically required for most installations.

Exams can be selected and moved between Signa EXCITE 1.5T and any imaging system supporting the DICOM 3.0 protocol for point-to-point send, receive and query/retrieve. In addition, images can be received from Signa LX MR systems configured with software released prior to the introduction of EXCITE.

9.11 Accessory Package

- SPT Phantom Set with Storage Cart
- Customer Diagnostic Software
- Operator Manuals
- Patient Log books

9.12 Emergency stop

Disconnects electrical power from RF, gradient and patient handling components in the magnet room (duplicate control at the magnet).

9.13 Warranty

The published Company warranty in effect on the date of shipment shall apply. The Company reserves the right to make changes.

9.14 InSite Remote Diagnostics

GE's unique remote service and applications support including magnet monitoring. Also allows downloading of applications software such as eFlex trials program.

9.15 Regulatory Compliance

The Signa EXCITE 1.5T MR System is a CE-complaint device that satisfies Electro Magnetic Compatibility (EMC) and Electro Magnetic Interference (EMI) regulations, pursuant to IEC-601. Laser alignment devices contained within this product are appropriately labeled according to the requirements of the Center for Devices and Radiological Health.

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