PEACEFULLY QUIET. REMARKABLLY FAST.
MRT-3020

Product Data
No. MPDMR0446EAA

Vantage **Galan** *3T*

APPLICATION

Vantage Galan 3T offers a transformational experience for you and your patients in 3T Magnetic Resonance Imaging.
By prioritizing the patient experience while delivering the 3T imaging performance you expect and the clinical workflow you need to support a busy MRI environment, Vantage Galan 3T is designed to surpass your expectations – all delivered in a small and quiet 3T MRI system.

ADVANTAGES

Achieve high SNR images with intelligence

Utilizing deep learning reconstruction technology, Vantage Galan 3T's advanced MRI technology offers your referring physicians and patients the best 3T MRI services available. Advanced intelligent Clear-IQ Engine (AiCE) is the world's first Deep Learning Reconstruction technology for MRI. Producing stunning MR images that are exceptionally detailed and with the low-noise properties you expect of a high SNR image.

Outstanding patient comfort

A relaxed patient is key to enable stable MRI images. You can be confident that Vantage Galan 3T takes care of this with whisper quiet scan sequences, and the 71 cm[1)] bore opening and MR Theater are designed to put patients at ease. And you can also address challenging patients with free breathing and contrast free applications and ForeSee View for enhanced planning to save preparation time.

Pure image quality

With consistent imaging performance delivered through our unique digital [PURE]RF and Saturn Technology, your facility's 3T imaging performance will meet the needs of referrers, staff and patients alike. High performance gradient technology provides improved SNR and which enhances essential diffusion weighted imaging quality.

Streamlined workflow

Now with Compressed SPEEDER accelerated scanning added to outstanding ForeSee View and EasyTech that reduce scan time and improve workflow, including neuro, MSK and complex cardiac procedures. Vantage Galan addresses the need for efficiency and throughput with ever increasing case loads. And Vantage Galan 3T's small footprint, low power consumption eco features, outstanding reliability and excellent maintenance programs will keep your hospital administrators happy.

1) Patient aperture of 71 cm which is the diameter where cylindrical tunnel meets the front cover.

COMPOSITION

Standard composition (Model: MRT-3020)

- Gantry
  - 3-Tesla Magnet[1)]
  - Active Shield Gradient Coil
  - Whole Body Coil
- Patient Table
- Filter Panel
- Control Cabinet and Gradient Power Supply
- Refrigerator
- Transformer Cabinet
- Fan Box
- Console
  - Host CPU
  - Wide LCD Color Monitor
  - Keyboard and Mouse
  - Control Pad
  - Control Box
  - Microphone
- Software
  - System Software (V6.0)
  - DICOM Software (Standard)
    - Storage SCU
    - Print SCU
    - DICOM Media
    - MWM SCU
- Full Set of Accessories
  - Operation Manuals
  - Service Manuals
  - Phantoms
  - Patient Call
  - Patient Observation Camera
  - Support Devices for Scanning (Tabletop Mats, Wedge Mats, Pads, Belts)
  - Safety Training Video
  - Emergency Run-down Unit
  - Warning Plates
  - Oxygen Monitor
  - Speakers
  - Flow Switch (for Gradient Coil)

Note: Heat exchanger, transformation installation and desk for console are not included in the standard composition.

Optional software[2)]

• mNeuro Package	MSSW-NEURO2
• DTI Application	MSSW-DTI2
• DTT Application	MSSW-DTT
• Single Voxel MRS Application	MSSW-MRSS2
• Multi Voxel MRS Application	MSSW-MRSM2
• NeuroLine+ Application	MSSW-LOCNU2
• mVascular Package	MSSW-VASCU
• Contrast Free MRA Application	MSSW-CFMRA3
• mCardiac Package	MSSW-CFA3
• EasyTech Cardiac Package	MSSW-LOCCA4
• k-t SPEEDER Application	MSSW-KTS1
• mBody Package	MSSW-BODY3
• mBreast Package	MSSW-BRST3
• mOrtho Package	MSSW-ORTHO
• SpineLine+ Application	MSSW-LOCSP1
• EasyTech Knee Package	MSSW-LOCKP
• UTE Application	MSSW-UTE
• Olea Nova™+ Sequence	MSSW-CNV
• Pianissimo Zen Application	MSSW-ZEN
• MultiBand SPEEDER Application	MSSW-SMS1
• Quick Star Application	MSSW-SOS1
• Fast 3D for mVox	MSSW-FST3D
• Compressed SPEEDER Application	MSSW-CS01

DICOM

• Storage Commitment Kit	MSSW-DCCOU1
• MPPS SCU Kit	MSSW-DCPPU1
• Q/R SCP Kit	MSSW-DCQRP1
• Q/R SCU Kit	MSSW-DCQRU1

Second Console

• Second Console	MKDN-013B/S1[3)]
• mNeuro Package for Second Console	MSSW-NEURO2
• MRS Application for Second Console	MSSW-MRSS2
• DTT Application for Second Console	MSSW-DTT

1) Vantage Galan 3T / Encore upgrade utilizes previous existing magnet. Encore upgrade may not be available in all countries. Please consult your local Canon Medical Systems sales representative.
2) The requirements for each package are listed in the product data sheet.
3) Additional software is required to use optional applications for the Second Console.

Optional RF Coils

• 32ch Head SPEEDER	MJAH-152A[4]
• Atlas SPEEDER Head/Neck	MJAH-172A
• Atlas SPEEDER Spine	MJAS-152A
• Atlas SPEEDER Body	MJAB-172A
• Breast SPEEDER	MJAM-132A[5]
• 16ch Tx/Rx Knee SPEEDER	MJAJ-232A
• Extra Large Knee SPEEDER	MJAJ-182A
• 16ch Foot/Ankle SPEEDER	MJAJ-262A
• Shoulder SPEEDER	MJAJ-172A
• Wrist SPEEDER	MJAJ-162A
• 16ch Flex SPEEDER Medium	MJAJ-212A
• 16ch Flex SPEEDER Large	MJAJ-222A
• 4ch Flex SPEEDER	MJAJ-192A
• ϕ100 Flex Coil	MJLC-102F[6]
• ϕ150 Flex Coil	MJLC-152F[6]
• QD Head Coil	MJQH-142A

Optional coil holder

• Coil Holder for TMJ Imaging	MJCA-147A/S2
• Flex Breast SPEEDER	MJCA-177A/S1[7]
• 16ch Flex SPEEDER Pad Kit	MJCA-207A
• Patient Pads for Spine and Extremities	MBPP-1503/S1

Optional equipment

• Receiving Circuit Extension Kit	MKPA-3003/S1
• Wireless Cardiac Gating System	MKSU-ECGU12/S1[8]
• Wireless Peripheral Pulse and Respiratory Gating System	MKSU-PRGK12/S1[8]
• Additional Patient CAMERA Package	MMPM-GP3001/S1
• Higher Order Shim Kit	MZKT-HOSK12/S1[9]
• Foot Switch Unit	MKFS-003A/S1[10]
• Dockable Table	MZPT-3020/S1[11]
• Gantry Ambient Lighting / Original Blue	MZGL-3001/S1
• Gantry Ambient Lighting / Green	MZGL-GN01/S1
• Gantry Ambient Lighting / Pink	MZGL-PK01/S1
• Gantry Ambient Lighting / Yellow	MZGL-YE01/S1
• Gantry Ambient Lighting / White	MZGL-WT01/S1
• Ceiling Routing Kit for Standard (Gmax33, SR200) system	MZCR-3001/S1
• Ceiling Routing Kit for Saturn X Gradient (Gmax45, SR200) system	MZCR-3002/S1
• MR Theater	MZTH-4002/S1
• AiCE Reconstruction Processing Unit for MR	MZDL-010A/S1

4) Receiving Circuit Extension Kit is required.
5) Model number may vary depending on sales area.
6) In the application for approval under relevant national regulations, the coil name "Phi '*XXX*' Flex coil" is used.
7) This is a mat that holds two Flex coils and is used for breast imaging.
8) This option may not be available in all countries. Please consult your local Canon Medical Systems sales representative.
9) Factory option.
10) For fixed couch exclusive use.
11) This is an additional dockable table for the MRI system with dockable table.

HARDWARE SPECIFICATIONS

Magnet

The Vantage Galan 3T uses the industry's shortest self-shielded superconducting magnet. The system combines slim and compact design with a wide patient aperture of 71 cm[1]. This minimizes patient anxiety, ensuring a comfortable examination environment for all patients.

Magnet type	Superconducting magnet		
Field strength	3T		
Magnet length	163 cm		
Magnet weight	Approx. 6,375 kg (incl. 70% liquid helium)		
Cryogen	Zero helium boil-off		
Magnetic field stability (bare magnet)	0.1 ppm/hr or better		
Fringe Field	The magnet employs active shielding. The fringe field line at 0.5 mT (5 gauss) is at 2.6 m in radial distance and at 4.6 m in the axial direction from the center of the magnet.		
Shimming method	• Passive shimming Homogeneity is optimized on site by the addition of ferromagnetic material inside the magnet bore during installation using a computerized procedure. This is a very stable optimization method that does not require regular maintenance.		
	• AAS (Auto-Active Shimming) When a patient is placed in the magnet, the patient's body will affect the magnetic field homogeneity. AAS adjusts the homogeneity to ensure the optimal field uniformity for each patient and/or pulse sequence such as FatSAT, PASTA, and EPI.		
Homogeneity with passive shimming (24 plane plot method)	at 100 mm DSV	Guaranteed:	0.01 ppm
		Typical:	0.003 ppm
	at 200 mm DSV	Guaranteed:	0.05 ppm
		Typical:	0.03 ppm
	at 300 mm DSV	Guaranteed:	0.3 ppm
		Typical:	0.2 ppm
	at 400 mm DSV	Guaranteed:	1.4 ppm
		Typical:	1.2 ppm
	at max. FOV	Guaranteed:	4 ppm
	(50 cm x 50 cm x 45 cm)	Typical:	3.6 ppm
Operation panel on the magnet	The operating panel supports the following operations to facilitate patient set-up and scanning. – Scan start/abort and pause/resume – Emergency stop – Laser light localizer ON/OFF – Ventilation adjustment – Lighting adjustment – Patient table operation incl. Auto-in/Auto-home The panel is also provided with a table position display.		
Intelligent monitor on the magnet	The gantry monitor provides the following information. – Patient table information – Patient information – Connecting RF coils status – ECG information		

1) The diameter where cylindrical tunnel meets the front cover.

RF coils

Atlas SPEEDER COMPASS

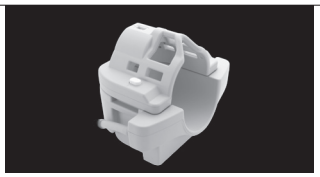
This is an automatic receive coil setting function that determines the position of the connected Atlas SPEEDER coil and automatically ON the coil sections that are positioned near the magnetic field center. This function is useful for spine imaging and body imaging in which the coil sections to be selected differ depending on the coil setting and target region and for scanning in which data is acquired at multiple tabletop positions.

Standard RF coils

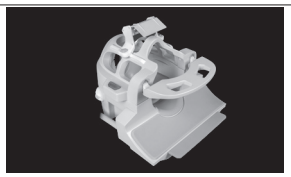
QD whole-body coil	
Type of coil	Transmit RF, Receive signals
The Vantage Galan 3T features a full range of RF array coils to cover a wide range of clinical requirements. This coil is integrated into the magnet cover. It provides a uniform RF field with QD transmission and a high SNR with QD reception.	

Optional RF coils

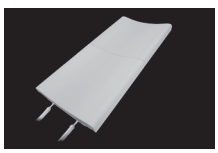
32ch Head SPEEDER	
Model number	MJAH-152A
Type of coil	Receive signals
Applicable Regions	Head
Number of elements	32
A detachable mirror is provided to minimize patient anxiety.	



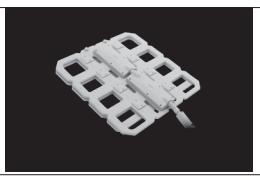
Atlas SPEEDER Head/Neck	
Model number	MJAH-172A
Type of coil	Receive signals
Applicable Regions	Head, Neck and Feet
Number of elements	16
A detachable mirror is provided to minimize patient anxiety.	



Atlas SPEEDER Spine	
Model number	MJAS-152A
Type of coil	Receive signals
Applicable Regions	Thoracolumbar spine, Trunk
Number of elements	40
This integrated coil design features the unique ability to slide up to 380 mm to permit routine feet-first imaging of the lumbar and thoracic spine.	

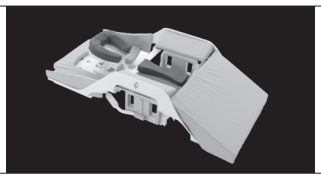


Atlas SPEEDER Body	
Model number	MJAB-172A
Type of coil	Receive signals
Applicable Regions	Trunk
Number of elements	16



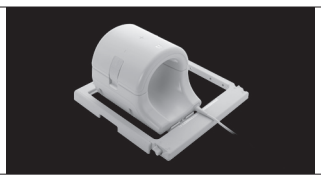
Breast SPEEDER

Model number	MJAM-132A
Type of coil	Receive signals
Applicable Regions	Breast
Number of elements	8



16ch Tx/Rx Knee SPEEDER

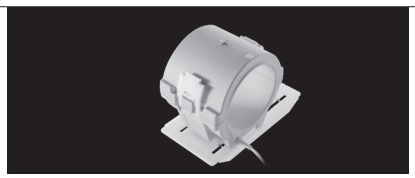
Model number	MJAJ-232A
Type of coil	Transmit RF, Receive signals
Applicable Regions	Knee, Wrist, Hand, Forefoot
Number of elements	16



Extra Large Knee SPEEDER

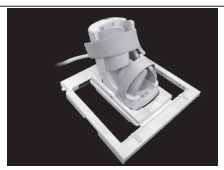
Model number	MJAJ-182A
Type of coil	Transmit RF, Receive signals
Applicable Regions	Knee
Number of elements	7

Its large internal diameter improves patient comfort, especially for large patients.



16ch Foot/Ankle SPEEDER

Model number	MJAJ-262A
Type of coil	Receive signals
Applicable Regions	Foot, Ankle
Number of elements	16



Shoulder SPEEDER

Model number	MJAJ-172A
Type of coil	Receive signals
Applicable Regions	Shoulder
Number of elements	6

Wrist SPEEDER

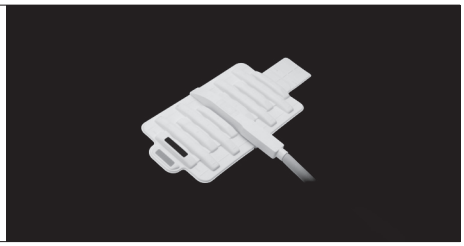
Model number	MJAJ-162A
Type of coil	Receive signals
Applicable Regions	Wrist, Hand
Number of elements	6

16ch Flex SPEEDER Large

Model number	MJAJ-222A
Type of coil	Receive signals
Applicable Regions	Shoulder, Hip, Upper and Lower extremities (Elbow, Wrist, Knee, Foot, Ankle, Thigh), Head, Spine, Torso, Cardiac applications.
Number of elements	16

16ch Flex SPEEDER Medium

Model number	MJAJ-212A
Type of coil	Receive signals
Applicable Regions	Shoulder, Hip, Upper and Lower extremities (Elbow, Wrist, Knee, Foot, Ankle, Thigh), Head, Spine, Torso, Cardiac applications.
Number of elements	16



4ch Flex SPEEDER

Model number	MJAJ-192A
Type of coil	Receive signals
Applicable Regions	Extremities, Joints, Trunk
Number of elements	4

ϕ100 Flex Coil

Model number	MJLC-102F
Type of coil	Receive signals
Applicable Regions	Extremities, Joints
Number of elements	1

The diameter of the coil loop is 100 mm. The circular loop section is cushioned and flexible.

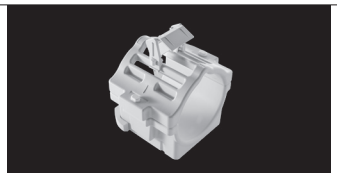
ϕ150 Flex Coil

Model number	MJLC-102F
Type of coil	Receive signals
Applicable Regions	Extremities, Joints
Number of elements	1

The diameter of the coil loop is 150 mm. The circular loop section is cushioned and flexible.

QD Head Coil

Model number	MJQH-142A
Type of coil	Transmit RF, Receive signals
Applicable Regions	Head
Number of elements	1



Its large internal diameter improves patient comfort, especially for large patients.

Provides a uniform RF field with QD transmission and optimizes SNR with QD reception. A detachable mirror is provided to minimize patient anxiety.

Console

The console features a widescreen LCD color monitor, permitting multiple windows to be clearly displayed for true multitasking operation. It is ergonomically designed to allow operation by a single technician, either standing or seated.

Display Monitor	The console features a high-resolution 24" LCD color monitor. The display matrix is 1,920 × 1,200 with 256 B/W gradation levels.
Control Pad and Control Box	The following operations can be performed using the hardware controls at the console: • System power ON/OFF • Emergency stop • Scan start • Scan abort • Scan pause/resume • Tabletop movement • Intercom talk and volume.
Mouse	Optical two-button scroll mouse. All interfaces can be accessed by simple point-and-click operation except for registration of patient information and comments for image annotation.
Keyboard	The keyboard is used to register patient information and comments for image annotation.

Computer system

The computer system is designed to provide outstanding multitasking performance, permitting image reconstruction and advanced image processing to be performed simultaneously with scanning.
This helps to increase examination productivity. In addition, the computer system is provided with network connectivity for expandability.

Host computer	Operating system	Windows® 10 IoT Enterprise	
	CPU	8-core dual-processor system (16 CPUs)	
	Clock speed	2.1 GHz	
	Main memory capacity	32 GB	
	Solid state drive (unformatted)	For system use: 240 GB	
		For image data: 960 GB	
	Image capacity	Approximately 1,120,000 images (256 × 256 images, raw data not saved)	
Hardware control system	Real-time manager (RM) CPU	32 bit	
	Memory capacity	256 MB	
	System control method	Distributed control	
Reconstruction system	CPU	10-core dual-processor system (20 CPUs)	
	Clock speed	2.8 GHz	
	Main memory capacity	128 GB	
	Maximum reconstruction speed	25,000 images/second or more (256 x 256, FFT, potential)	
	Hard disk drive capacity	7 TB (unformatted) 2.7 TB (RAID 10)	
	Reconstruction matrix	2,048 x 2,048 (maximum)	
	Simultaneous image reconstruction during scanning	Possible	
DVD and Blu-ray™ drive unit		Storage capacity (unformatted)	Saved image capacity (Approx. 256 × 256 images, raw data not saved)
	DVD (single side)	4.7 GB	22,000 images
	DVD-RAM (single side)	4.7 GB	22,000 images
	DVD-RAM (both side)	9.4 GB	44,000 images
	Blu-ray (Single layer)	25 GB	110,000 images
	Blu-ray (Double layer)	50 GB	220,000 images
	Note: DICOM format data can not be archived in Blu-ray Disc™.		
Connection with external devices	Interface	Ethernet (100BASE-TX/1000Base-T)	
	DICOM 3.0		

RF system

The Vantage Galan 3T has digital RF design which improves SNR and achieves high RF stability.

RF Transmit system

PURE RF Tx	Optimized RF design improves SNR. State-of-the-art RF shielding design to minimize gradient eddy current which affects image sharpness and maximize the efficiency of RF transmission.
Multi-phase Transmission	A 2-channel RF amplifier with 4 transmission points is used to improve B1 homogeneity. This technology effectively suppresses the image quality degradation resulting from the nonuniform transmission caused by the dielectric effect.
Frequency stability	$\pm 3.8 \times 10^{-6}$ Hz/min
Frequency control	32 bit, 0.64 Hz
Phase control	16 bit, 0.0055 degree
Amplitude resolution	16 bit, 10 ns
Gain stability	<0.15 dB (5 min)
Optical signal transmission	Possible
Transmit peak power	36 kW (18 kW x 2)
Transmit bandwidth	1,300 kHz

RF Receiver system

PURE RF Rx	Enhanced SNR by unique noise-suppression technology which reduces the electrical noise received with MR signal. High- performance amplifier and digitizer for each receiver makes faster sampling which results in higher SNR.
Atlas SPEEDER technology	Atlas SPEEDER technology easily handles multiple studies by allowing you to position and utilize the coils you need in one easy step. Maximum 7 coils is combinable at same time.
Receiver bandwidth	1 MHz (for each channel)
Sampling rate of ADC	100 MHz
Receiver signal resolution (ADC resolution in bits)	16 bit
Receiver signal resolution	32 bit
Pre-amplifier noise figure	< 0.7 dB (typical 0.5)
Pre-amplifier total gain	27 dB
Dynamic range	157 dB/Hz
Number of independent receiver channels	128 [2)]

2) The number of channels for simultaneous image reconstruction is selectable at sales. It may vary depending on sales area. Please consult your local sales representative.

Gradient subsystem (Selectable)

The combination of a powerful gradient power supply unit and a high-precision active shield gradient coil ensures stable image quality with all sequences, eliminating eddy currents.

	Standard Gradient	Saturn X Gradient
Maximum Gradient amplitude (Each axis)	33 mT/m	45 mT/m
Maximum Slew rate (Each axis)	200 T/m/s	200 T/m/s
Gradient duty cycle	100%	100%
Maximum Output voltage (Each axis)	1,925 V	1,925 V
Maximum Output current (Each axis)	600 A	900 A

Patient table (Selectable)

The patient table is ergonomically designed to maximize both patient comfort and patient throughput. Hydraulic drive ensures smooth and quiet vertical tabletop movement.

		Fixed table	Dockable table
Minimum table height from floor		430 mm	550 mm (Dock)
			535 mm (Undock)
Maximum table height		845 mm	845 mm (Dock)
			875 mm (Undock)
Maximum patient load		254 kg	254 kg
Scanning range		205 cm	205 cm
Positional accuracy of patient table		0.5 mm or less	0.5 mm or less
Vertical Table speed	Up: Down (typical):	16 sec 15.5 sec	12 sec 12.5 sec
Horizontal Table speed	Normal (selectable): Slow:	250/200/150 mm/s 20 mm/s	300/200/150 mm/s 20 mm/s

- Dockable table
  Vantage Galan 3T can apply dockable table. It allows seamless patient handling as preparation can be achieved in advance outside the scan room, enhancing workflow and allowing medical staff to respond to any patient requirements quickly and easily.

Patient comfort and safety

Open bore	The industry's shortest open gantry (1.6 m magnet) with the large clinical FOV and wide patient aperture of 71 cm significantly reduce patient anxiety and ensures comfort during examination.
Pianissimo	Pianissimo technology dramatically reduces the level of acoustic gradient noise, thus substantially enhancing patient comfort, especially during scanning with fast sequences.
Pianissimo Zen‡	The Pianissimo Zen silent sequence package reduces noise by up to 99%, down to as little as 2 dB above ambient noise. The combination of Pianissimo and Pianissimo Zen make our Vantage series the quietest MR system in its class, providing comfortable examination for your patients.
MR Theater‡	In-bore immersive virtual experience enhances patient comfort. The MR Theater encourages patients to relax and stay still, enabling clinicians to produce stable.
Lighting/Ventilation of the patient bore	Adjustable lighting/ventilation improves patient comfort in the magnet during scanning.
SAR calculation	The system always calculates SAR before scanning. If the calculation result indicates that the preset limit will be exceeded, scanning cannot be started.
Patient call system	The patient call system allows the patient to signal an emergency during scanning. The system includes a hand- switch that is actuated by the patient.
Intercom system	The integrated intercom system allows two-way communication between the patient and the operator.
Patient observation system	A CCD camera is used to observe the patient during scanning.
Oxygen monitor[3)]	The oxygen monitor automatically activates the customer-supplied ventilation system if the oxygen level falls in the scan room.
Emergency rundown unit	This safety switch allows automatic ramp-down of the magnetic field in the event of an emergency.

3) Option for Europe

‡ Option

SCAN SPECIFICATIONS

Acquisition parameters

The Vantage Galan 3T digital architecture offers extremely flexible acquisition parameters for optimizing image quality and scan times.

Imaging method[1)]	2DFT, 3DFT
Imaging nucleus	Proton (hydrogen nucleus)
Slice orientations[1)]	Axial, sagittal, coronal, oblique (single and double) Refer to the scan parameter table.

Sequences[2)] / Standard Gradient

			64 Matrix	128 Matrix	256 Matrix	512 Matrix
2D Spin Echo	min. TR	[ms]	9	9	9	18
	min. TE	[ms]	3.7	3.7	3.7	8
2D Fast Spin Echo	min. TR	[ms]	19	26	26	26
	min. TE	[ms]	5.0	5.0	5.0	5.0
	min. ETS	[ms]	2.6	5.0	5.0	5.0
	max. ETL	–	1,024	1,024	1,024	1,024
3D Fast Spin Echo	min. TR	[ms]	27	27	37	57
	min. TE	[ms]	5.0	5.0	5.0	5.0
	min. ETS	[ms]	4.5	4.5	4.5	4.5
	max. ETL	–	1,024	1,024	1,024	1,024
2D Fast Field Echo	min. TR	[ms]	2.8	2.8	3.8	5.2
	min. TE	[ms]	1.2	1.2	1.3	2.3
3D Fast Field Echo	min. TR	[ms]	2.0	2.0	2.4	4.3
	min. TE	[ms]	0.9	0.9	0.9	2.3
True SSFP	min. TR	[ms]	3.0	3.0	3.0	–
	min. TE	[ms]	1.5	1.5	1.5	–
Inversion Recovery	min. TR	[ms]	3.5	51	51	51
	min. TE	[ms]	7.8	7.5	7.5	7.5
	min. TI	[ms]	10	19	19	19
Echo Planar Imaging	min. TR	[ms]	14	14	14	42
	min. TE	[ms]	7	7	7	10
	min. ETS	[ms]	0.28	0.28	0.70	3.0
	min. acquisition time	[ms]	46	59	117	4,000
	max. EPI Factor	–	296	296	296	296
Diffusion Imaging	max. b-value	[s/mm^2]	10,000	10,000	10,000	–
	min. TE with b=1000	[ms]	52	52	62	–
Diffusion Tensor Imaging	max. diffusion tensor directions	–	192	192	192	192

1) Specifications vary depending on the pulse sequence.
2) Some parameters may require an optional package.

Sequences[2] / Saturn X Gradient

			64 Matrix	128 Matrix	256 Matrix	512 Matrix
2D Spin Echo	min. TR	[ms]	9	9	9	18
	min. TE	[ms]	3.7	3.7	3.7	8
2D Fast Spin Echo	min. TR	[ms]	19	26	26	26
	min. TE	[ms]	5.0	5.0	5.0	5.0
	min. ETS	[ms]	2.6	5.0	5.0	5.0
	max. ETL	–	1,024	1,024	1,024	1,024
3D Fast Spin Echo	min. TR	[ms]	27	27	37	57
	min. TE	[ms]	5.0	5.0	5.0	5.0
	min. ETS	[ms]	4.5	4.5	4.5	4.5
	max. ETL	–	1,024	1,024	1,024	1,024
2D Fast Field Echo	min. TR	[ms]	2.8	2.8	3.8	5.2
	min. TE	[ms]	1.2	1.2	1.3	2.3
3D Fast Field Echo	min. TR	[ms]	2.4	2.4	2.4	3.4
	min. TE	[ms]	0.9	0.9	0.9	1.5
True SSFP	min. TR	[ms]	2.8	2.8	2.8	–
	min. TE	[ms]	1.4	1.4	1.4	–
Inversion Recovery	min. TR	[ms]	35	51	51	51
	min. TE	[ms]	7.8	7.5	7.5	7.5
	min. TI	[ms]	10	19	19	19
Echo Planar Imaging	min. TR	[ms]	14	14	14	42
	min. TE	[ms]	7	7	7	10
	min. ETS	[ms]	0.28	0.28	0.70	3.0
	min. acquisition time	[ms]	43	52	117	4,000
	max. EPI Factor	–	296	296	296	296
Diffusion Imaging	max. b-value	[s/mm^2]	10,000	10,000	10,000	–
	min. TE with b=1000	[ms]	44	44	51	–
Diffusion Tensor Imaging	max. diffusion tensor directions	–	256	256	256	256

2) Some parameters may require an optional package.

Resolution

FOV[3] *Adjustable in increments of 1 mm.	min. max.	[mm] [mm]	5 550
Slice thickness 2D *Adjustable in increments of 0.1 mm.	min. max.	[mm] [mm]	0.5 100
Slice thickness 3D *Adjustable in increments of 0.1 mm.	min. max.	[mm] [mm]	0.05 50
Slab thickness 3D	min. max.	[mm] [mm]	6 390
Matrix size	min.[4] min.[4] max.	– – –	32 (Phase encoding) 64 (Frequency encoding) 1,024
Highest in plane resolution		[µm]	20
Number of slices 2D	max.	–	128
Number of slices 3D	max.	–	256
Flip angle		[deg]	1° to 180°
Flop angle		[deg]	30° to 180°
Number of acquisitions (NAQ)	Integer NAQ		From 1 to 64 *Adjustable in increments of one (1, 2, 3, 4, 5, 6, and 7, etc.)
	Variable NAQ		Available *Adjustable increments of 0.1 from NAQ=1 (NAQ = 1.1, 1.2, etc)
	AFI (Advanced Fourier Imaging)		Available *Scan time reduced by approximately NAQ=0.5

SPEEDER function

SPEEDER factor	Max. 6[5]
Combination with SPEEDER and DRKS	Max. 16
Combination with SPEEDER and MultiBand	Max. 4

3) The 550-mm FOV (550 mm in the X and Y directions) is used for purposes such as locator scanning.
4) Independently adjustable in 16 or 32 steps in both the frequency and phase encoding directions.
5) The factor depends on the coil and the number of RF channels used.

Imaging techniques and parameters

A wide range of imaging techniques are provided to complement the Vantage Galan 3T's precise and powerful digital RF system, computer platform, and high-performance gradient subsystem.

Conventional pulse sequences

- SE (Spin Echo)
- FE (Field Echo)

Fast scan techniques

FastSE	The flop angle for 180° RF pulses can be varied to reduce saturation transfer contrast (STC) effects and the specific absorption rate (SAR) to ensure patient safety. FastSE is compatible with both 2DFT and 3DFT. Flow compensation and presaturation are available.
FastIR	An inversion pulse is added to the 2DFT FastSE technique to enhance T1 contrast. This results in a much shorter scan time than in conventional IR. Multislice is available.
FastFLAIR (FLuid-Attenuated IR)	Increases contrast between fluids, such as CSF, and lesions to improve specificity using FastIR with a long TI, TE, and TR. This results in a much shorter scan time than in conventional IR. Multislice is available.
FastFE	A pre-pulse is applied prior to FE pulse sequences to enhance T1 contrast with short scan times. Segmentation of scans is available to increase spatial resolution. FastFE is applicable to both 2DFT and 3DFT.

Advanced fast scan techniques

FASE (Fast Advanced Spin Echo)	This pulse sequence, which is based on FastSE with a large number of echoes (max. 276 ETL), is combined with advanced Fourier imaging (AFI) to reduce the scan time significantly with an echo factor of 512 (scan time reduction factor) in the standard configuration or 1,024 with optional software. A single shot is sufficient to generate an image in a few seconds. A pre-pulse is available for fat suppression. This technique is compatible with both 2DFT and 3DFT. T2-weighted images with short scan times can be used to clearly depict the gallbladder, hepatic ducts, and pancreatic duct without contrast agent. FASE expands the range of clinical applications of MRI, supporting magnetic resonance cholangiopancreatography (MRCP), MR urography, and MR myelography.
Contrast Free MRA‡	This application supports an expanded range of clinical applications such as fresh blood imaging (FBI) or swap phase encode extended data acquisition (SPEED).
Multi-Shot EPI	Utilizes gradient echoes for SE-EPI, which are divided by up to 15 echo factors for one acquisition. Multislice is available.
Single-Shot EPI	Both SE type and FE type are available. FE-type Single-Shot EPI requires the optional mNeuro package.
TrueSSFP‡	T2/T1-contrast images can be obtained quickly using the steady-state free precession technique. This is suitable for scanning relatively longer T2 tissues such as CSF, synovial fluid, and vascular structures during breath-holding. Fat saturation is possible by dividing scans into multiple segments. The slice thickness can be reduced by 3DFT scanning.
FSE/FASE T2 Plus	By promoting transverse magnetization recovery in FSE and FASE, the scan time can be reduced and the resolution can be increased with no loss of T2 contrast and SNR.

‡ Option

UTE (Ultra short TE)‡	This technique depicts short T2* tissues by radially acquiring k-space data. It can be applied to FFE3D sequences.
mUTE[6] (minimized acoustic noise utilizing UTE)‡	The mUTE applications suppress high-speed gradient field switching, making it possible to provide even quieter scanning.
FASE3D mVox‡	Enables acquisition of clear images with reduced SAR by changing the refocusing flip angle for each echo.
FFE3D MP2RAGE‡	This sequence uses FFE3D and images at two different TI values, and FA values are acquired for the same slab at the same time. The image data is acquired at each TI value, and one T1W image is obtained in the last result. T1W images acquired with this sequence are not affected by nonuniformity of B1 or coil sensitivity. T1W images acquired with this sequence are not affected by nonuniformity of B1 or coil sensitivity. T1map can also be calculated at the console using T1calcmp2.
FSE2D mEcho‡	This sequence uses FSE2D and images at four different TE values are acquired for the same position at the same time. T2map is then calculated on the workstation using these images. T2map can also be calculated at the console using T2calc.
MultiBand SPEEDER‡	This application allows reducing the scan time for diffusion imaging, expanding the range of its clinical applications. Scan time reduction is achieved by simultaneously exciting and acquiring multiple slices using multiband RF pulses. As the results, scan time for diffusion imaging can be reduced to less than half. With this technique, a whole liver diffusion weighted scan can be acquired in a single breath holding of 15 seconds or less. It can be applied to SEEPI2D sequences.
k-t SPEEDER‡	This sequence enables scanning with a higher acceleration factor than the conventional SPEEDER scan by changing the sampling pattern in the time direction during data acquisition. Up to x8 accelerated k-t SPEEDER allows high frame rate cardiac cine and perfusion imaging in free breathing without training scan required. It can be applied in cine imaging with SSFP2D sequences (3 phases or more).
Fast 3D mode‡	This application allows reducing the scan time while maintaining image quality by up to half for T1, PD, T2, FLAIR, STIR weighted images by adjusting data acquisition ratio. It can be applied to FASE3D sequences.
Compressed SPEEDER‡	This application allows up to x4 accelerated fast scan while maintaining image quality that combines a parallel imaging by using multi-sensitivity map and a compressed sensing. It can be applied to FSE2D sequences.

6) minimized acoustic noise utilizing Ultrashort TE.

‡ Option

Vascular imaging techniques

2D-TOF (Time of Flight)	The time of flight effect is induced by the in-flow of fresh spins into the imaging slice to differentiate blood flow from tissue. Slices are acquired sequentially through the imaging volume. This technique functions optimally when the vessels are perpendicular to the acquired slices. It depicts relatively slower blood flow and is suitable for cervical, abdominal, and extremity applications. Maximum intensity projection (MIP) images can be displayed from multiple viewing angles. An overlapping scanning technique improves the visualization of vessels. A moving presaturation band can also be applied to differentiate between arterial and venous flow in certain body areas. ECG gating is applicable for 2D-TOF‡.
3D-TOF (Time of Flight)	3DFT with TOF is used to depict multidirectional vascular structures and faster blood flow. MIP images can be displayed from multiple viewing angles. SORS-STC and ISCE RF pulses can be combined with 3D-TOF to improve vessel detail.
3D-CE (Contrast Enhanced)	Contrast agent is injected in order to enhance blood signals, followed by a 3D-FE or 3D-FastFE sequence.
SORS-STC (Slice-selective Off-Resonance Sinc pulse Saturation Transfer Contrast)	Enhances blood flow and suppresses background signals by using a slice-selective off-resonance pulse. SORS-STC is more effective than conventional spatially nonselective STC (or MTC) because it suppresses background tissues without reducing the signals from blood flow.
ISCE (Inclined Slab for Contrast Enhancement)	Provides increased vessel detail by using an RF pulse with a different flip angle in combination with 3D-TOF to enhance signals from blood flow throughout the imaging volume.
Multi coverage	Separates the data acquisition area of 3D TOF MRA into a few regions in order to limit signal reduction due to saturation effects.
2D-PS (Phase Shift)	The phase shift effect is generated by applying a flow encoding gradient pulse. The phase shift is proportional to the flow velocity. 2D-PS can be used with a volume slice to increase coverage of vessels and shorten scan times. Selecting the flow velocity allows specific vessels to be depicted.
Cine 2D-PS (Phase Shift)	2D-PS can be used with an optional cardiac-gating unit for cine imaging.
Flow Quantification	Blood flow velocity can be measured using cine 2D-PS with an optional cardiac-gating unit.
3D-PS (Phase Shift)	The phase shift effect, when used with 3DFT, is suitable for showing multidirectional vascular structures. Selecting the flow velocity allows specific vessels to be visualized. MIP images can be displayed from multiple viewing angles.
BEST (Blood vessel Enhancement by Selective suppression Technique)	A postprocessing algorithm that selectively enhances small vessel detail and suppresses background tissue signals.
Cardiac tagging‡	Allows myocardial movement to be visualized by applying several presaturation bands. Optional ECG gating is required. The number and positions of tags can be selected.
Flow imaging	Various flow dynamics can be observed by sequentially acquiring images with tagging pulses.

‡ Option

Fat suppression techniques

STIR (Short TI inversion Recovery)	A short TI 180° pre-pulse with IR suppresses fat signals to enhance water-proton images. It can be applied to FastSE and FASE sequences.
FastSTIR	STIR with FastIR to reduce scan times.
WFOP (Water/Fat Opposed Phase)	An asymmetric SE technique in which image acquisition is performed at the instant. The signals from water and fat go out of phase.
FatSAT (Fat Saturation)	Fat saturation pulses are applied to presaturate fat only. The multislice off-resonance fat suppression technique (MSOFT), an innovative our technology, ensures uniform fat suppression over all slices by using an offset RF pulse for each slice. Offset values are determined based on data acquired by auto-active shimming.
PASTA (Polarity Altered Spectral and spaTial selective Acquisition)	Another innovative technique for suppressing fat signals in SE and FastSE sequences to obtain uniform water images over all slices. It consists of a narrow-bandwidth 90° RF pulse to separate water from fat. Opposing slice gradient polarity is used for 90° and 180° RF pulses to refocus water signals.
SPAIR (SPectral Attenuated Inversion Recovery)	A 180° adiabatic pulse is used to invert the fat signals inside the imaging plane uniformly regardless of B1 inhomogeneity and imaging is started at the null point of fat after TI in order to obtain fat-suppressed images with minimal fat suppression nonuniformity.
Enhanced fat Free	Multiple fat suppression pulses are applied in order to obtain a more stable fat suppression effect.
WET (Water Excitation Technique)	WET enables the spatial-position-selective and frequency-selective excitation of water. This technique can be applied to many types of sequences.
WFS (Water Fat Separation) DIXON‡	WFS DIXON provides water based images and fat based images by calculating images acquired with two different echo time. It can be applied to FSE2D and FE3D sequences.

‡ Option

Imaging modes

Multislice	Multiple slices can be acquired during a scan.
Multi-echo	Multiple echo data can be acquired within a single TR.
Multi-coverage	If the specified number of slices cannot be acquired within the designated TR, the system automatically repeats the scan to cover the required area.
Interleaved scan	Excites odd slices first and even slices second to eliminate interslice interference.
Excitation order for multislice	The user can select the order of excitation in multislices as follows. • Forward (from small to large numbers) • Reverse (from large to small numbers) • Concentric (from center to outside)
Dynamic scan	Sets up to five continuous dynamic scans in one study. Each dynamic scan is specified independently according to the delay time, scan interval, and number of scans. The minimum scan interval is zero.
Gating	• Cardiac gating: Multislice/single-phase and single-slice/multiphase imaging techniques are available. Cardiac images can be displayed in cine mode. Retrospective gating is also available as an option. • Peripheral pulse gating‡: Reduces CSF pulsation artifacts. • Respiratory gating‡: Reduces respiratory motion artifacts. • Retrospective gating‡

‡ Option

Artifact suppression techniques

Flow compensation	Utilizes gradient moment nulling techniques to reduce flow artifacts.
Presaturation	Up to seven presaturation bands can be set to reduce motion, flow, and wrap-around artifacts. The Vantage Galan's graphical user interface allows multiple bands in the orthogonal and oblique directions to be set with ease. The following preset presaturation bands are available. • Anti-phase aliasing • Anti-frequency aliasing • Flow suppression • Leading or following slices
Skipping SAT	Reduces the number of presaturation pulses in order to increase the number of slices.
No wrap (frequency and phase directions)	2D: frequency and phase directions 3D: frequency, phase, and slice directions Eliminates wrap-around artifacts by increasing the sampling data points in frequency or encoding steps in phase. The no wrap function is applicable up to a 512 × 512 matrix with 3DFT.
Phase swap	The phase and frequency encoding directions can be swapped to minimize flow and respiratory motion artifacts.
Breath-hold imaging	An optional Auto-Voice function instructs patients when to hold their breath.
JET technique‡	JET acquires the data for the k-space in non-Cartesian mode and suppresses motion artifacts by detecting and correcting for in-plane motion using the data for the central part of the k-space, which is acquired repeatedly. This application can suppress not only image artifacts in patients who are unable to remain still during scanning, but also artifacts due to involuntary motion such as CSF flow. This technique is based on FastSE 2D, and uses T2W and FLAIR contrast enhancement.
2D-RMC (2D-Real-time Motion Correction)‡	An image with reduced respiratory motion artifacts can be obtained by following the scanning cross section and acquisition timing relative to diaphragm motion. FASE 3D and FFE3D are applied.
VAT (View Angle Tilting)‡	VAT technique reduces metal related artifact caused by high off-resonance frequency. It applies extra slice direction gradient during readout to cancel the readout direction shift.
Quick Star‡	Quick Star allows high resolution image for liver examination with free breathing.

‡ Option

USER INTERFACE

Basic operations

System startup	System startup	Possible
	The initial screen display	Possible
	The system status can be checked at the time of system startup. If the system status is determined to be abnormal, data acquisition is disabled or the system is shutdown.	
	The system check is executed at the time of system startup. If an abnormality is detected, system operation is disabled.	
	Registration and control of authorized users	Possible
Page control	A processing switching function that allows multiple processing tasks to be performed simultaneously	Possible
	Display of errors and warnings	Possible
System shutdown	System shutdown	Possible

Patient scheduling and registration

Patient information and scanning conditions for examinations can be scheduled and registered. The scanning conditions can be registered simply by selecting a set of conditions preregistered in the database for individual anatomies (PAS function).

Patient Registration

Scheduling and registration items	Patient ID, patient name, height, weight, sex, birth date (automatic age calculation), date of scanning (selection from calendar is possible), time of scanning, ordering department, name of ordering physician, name of radiologist, name of radiographic technologist
Search function	Provided (patient name, date and time of scanning, etc.)
Sorting function	Provided (by patient name, by date and time of scanning, etc.)
DICOM MWM	IHE is supported as the standard.
Adaptive Scan Mode	Scanning conditions are preset available (Patient Orientation, SAR operating mode, B1+RMS limit, CP mode).

Scanning condition selection and registration: PAS (Programmable Anatomical Scan)

Preset items	PAS name (name of a set of scans)
	Scanning region (graphic icon), etc.
	Type of RF coil
	Scan name (names of individual scans)
	Scanning conditions (imaging parameters), etc.

Scanning

A pilot scan (initial scan) is performed, scans are planned using the acquired data, and the scans are run. Progress of the scans is controlled using the scan list displayed in the Sequence Queue window.

Sequence Queue operations

Queuing	Scans can be copied, added, or deleted, and acquisition order can be changed.	
Scan start control	Auto	Multiple specified scans can be run in succession automatically.
	Breath hold	Each scan is started by pressing the Scan Start button. Combination with the AutoVoice function is possible.
	Pause/resume function, abort function	
Automatic tabletop movement	Possible	

Pilot scan

Prescan	Automatic (manual control is possible for some types of prescan)
Simultaneous multiplane scan	Maximum three planes (axial, sagittal, coronal) Combination with multislice scan is possible.

Scan planning

Multiplane scan planning	Three-plane scan planning is possible.
Image switching during planning	Possible
Oblique plan	Possible (sequential, multiangle)
Graphical plan	Plan items
	Slice position and angle, slice thickness, slice gap, FOV, phase encode direction/ readout direction, presaturation area, etc.
Multiple scan planning	Possible (multiple scans can be planned during scanning)
Plan duplication	A set of planned scanning conditions can be applied to the other scan by a simple operation (scan plan condition history function).
Autopositioning assistance	Autopositioning assistance is available‡. (CardioLine+, NeuroLine+, SpineLine+, KneeLine+)
MPR display for locating	Foresee and display in real-time (ForeSee View)

Scanning

Safety functions	SAR limitation function, dB/dt limitation function
Wide-area scanning function	The center of the target region can be moved to the magnetic field center automatically for each scan.
Move table function	The tabletop can be moved so that the slice center is positioned at the magnetic field center.
Remaining scan time display function	Provided
SAR display	The estimated SAR value is displayed before scanning.
Gating signal display	The ECG gating, peripheral pulse gating, and respiratory gating waveforms can be displayed.

Reconstruction and AutoView

AutoView function	Provided (all images are displayed in the Image Matrix)	
Auto windowing function	Provided	
Automatic postprocessing	Automatic dynamic subtraction (absolute value)	Possible
	Automatic dynamic subtraction (complex value)	Possible
	Automatic MIP preview (three directions)	Possible
	Automatic Diffusion postprocessing (ADC image, Isotropic image)	Possible

Image display and processing

Images acquired in scanning are displayed, various processing is applied to these images as required, and the images are printed onto film. Image Matrix, which displays thumbnails of actually acquired images, allows the user to quickly search for and select the desired images. A variety of image processing functions are provided to serve different purposes. The excellent parallel processing capability of Vantage Galan 3T allows image processing to be performed in parallel with scanning.

Image display

Image selection	Selection from Image Matrix	
	Skipped selection function	Provided
Display template	Multiframe display is possible. Images for two different patients can be switched easily.	
Automatic display function	Provided (multiple images selected in the Image Matrix are displayed in sequence)	
Window adjustment	WW/WL adjustment by mouse operation	
	Auto windowing	Possible
	Apply Contrast function	Provided
Image-related information	Patient information, imaging parameters, RF coil type, etc.	
	Graphics & annotation function	Provided
	Image-related information display ON/OFF	Possible
Reference display	All positioning ROIs can be displayed on the image used for scan planning. ROI corresponding to an arbitrary image slice can be displayed on an arbitrary image.	
Inset display	Possible	
	Size change	Possible in three levels or more
	Display position selection	Possible
Cine display	Possible	
	Multiframe display	Possible
	Playback/switching speed	Variable
	Storage of moving images	Possible
Various display functions	Black/white reversal, rotation, flipping, grid, zooming (interactive enlargement and reduction), scrolling (interactive scroll), Apply View function	

ROI calculation

Calculation functions	Distance, angle, area, pixel value, profile, histogram, TIC (Time Intensity Curve)

Post processing

Image filters	Smoothing, edge enhancement, etc.	
MIP (Maximum Intensity Projection, Minimum Intensity Projection)	Projection direction	Specified using ROI (specification of multiple projection directions is possible)
	Target MIP	MIP target region can be specified in three directions.
MPR	Interactive MPR, batch MPR	
	Double oblique	Possible
	Slice thickness change function	Available
	Image storage function	Available
Image calculation	Addition, subtraction, multiplication, division, and other functions	
	Automatic dynamic subtraction	Subtraction image is generated automatically after dynamic scan.
Intensity correction	Provided as standard for both 2D and 3D.	
Distortion correction	Provided as standard for both 2D and 3D.	
3D post-process	Provided as standard.	
Fusion processing	Provided as standard.	
Temporal Filter	The temporal filter is used for images of R-space (real space) in image reconstruction. For images acquired with cine mode or retrospective mode, minor intensity variation of the noise components is suppressed while maintaining the myocardial motion and physiological tissue structures in the image, improving visibility.	

Filming

Virtual filming	The dedicated Virtual film window is provided.
Support of multiple imagers	Possible

Data management

Temporary storage of patient data	Solid state drive
Long-term storage of patient data	DVD-R, DVD-RAM, and Blu-ray Disc
Patient data search	Possible

Security Settings

Meets the requirements of Risk Management Framework (RMF), governed by the Defense Health Agency (DHA)	Provided as a standard. RMF tested and verified.
HIPPA compliance	Provided as a standard. The requirements of US Health Insurance Portability and Accountability Act are met.
White list type antivirus software	Utilizing the highly secure White List security software embedded control security solution that provides a high level of protection against malicious attacks, advanced persistent threats, viruses, and malware.

Utilities

LHe level indication	The LHe level data is read from the supervisory unit.
	Logging is possible.
Quality control	Daily QA(absolute value)
	Logging is possible.
Errors	Logging is possible.

Image processing

Reconstruction	The maximum reconstruction matrix	1,024 x 1,024
	FINE	Doubles the reconstruction matrix to improve the inplane spatial resolution without increasing scan times for both 2D and 3D images. This technique can also be applied to the slice encoding direction for 3D images.
	Refine filter	User-selectable reconstruction filter to enhance image quality.
	Advanced intelligent Clear-IQ Engine (AiCE)‡	AiCE intelligently removes only noise from images which results in high SNR and leads to enhanced anatomical and spatial resolution utilizing the power of Deep Learning.
Batch multiplanar reconstruction	Provides oblique as well as interactive MPR.	

‡ Option

Networking

DICOM 3.0	Storage SCU, Print SCU, DICOM Media, and MWM SCU	Available
	Storage Commitment, Q/R SCU, Q/R SCP, and MPPS SCU	Available‡
	IHE profiles	SWF, CPI, PDI and CT are Supported. Only DVD media is supported for PDI.
	Two more DICOM service classes	Available
Laser Imager	DICOM print	Available
Second Console‡	This console includes an independent computer platform and supports all of the functions of the main system console except for scanning and reconstruction.	
	This console is connected to the system console by Ethernet. The use of an independent platform means that the main and second consoles can be used simultaneously for different tasks.	
	DICOM	Supported
Remote Service Maintenance	The InnerVision remote service system permits system diagnosis over a digital connection to the Canon Medical systems Technical Support Center. Please consult your Canon Medical systems representative for details.	

‡ Option

SPECIFICATIONS OF CLINICAL APPLICATIONS

TOF MRA method

Blood vessels can be visualized without contrast medium using the time of flight effect.

2D TOF method	Artery/vein simultaneous acquisition:	Available	
	Artery/vein separate:	MovingSAT available	
	Fat saturation method:	Can be used in combination	
	Presaturation method:	Can be used in combination	
	Quiet Scan:	Standard	
3D TOF method	Fat saturation method:	Can be used in combination	
	Presaturation method:	Can be used in combination	
	Quiet Scan:	Standard	
	Multicoverage method:	This is a wide-range imaging method taking advantage of the TOF effect using a thin slab.	
		Coverage joint suppression method:	Available
	SORS-STC method:	The imaging capabilities for blood vessels are improved by selectively suppressing the signals from tissues.	
		Flip angle of SORS-STC pulse:	Available
	ISCE method:	Degradation in peripheral blood vessel images is suppressed.	
		Selection of flip angle distribution in slab:	Available
		Combined use of SORS-STC method:	Available (inclined slab for contrast enhancement)

Non-contrast MRA

FSBB (Flow Sensitive Black Blood)	FSBB depicts more details of arteries and veins by utilizing the flow dephasing effect. Weak MPG pulses are applied to FE sequence, clearly depicting small vessels with slow blood flow that is difficult to depict by TOF.	
FBI (Fresh Blood Imaging) method	This is a vascular imaging method in which new blood ejected from the heart is visualized by setting an appropriate delay time from the R wave using ECG gating and peripheral pulse gating and performing data acquisition synchronized for each shot.	
	ECG-Prep method‡:	ECG-gated scanning or peripheral-pulse-gated scanning is performed with multiple delay times set in order to acquire images of the same plane in different cardiac phases so that the optimal delay time for visualizing the target vessels in FBI can be determined.
	Intermittent breath-hold method in ECG-gated scanning:	ECG-gated scanning is performed during breath-holding, with the patient permitted to breathe at regular intervals corresponding to a certain number of slice-encoding steps.
	Sequential FASE method:	Images for different slices are acquired sequentially to provide multislice images in the same cardiac phase.
	FlowSpoiled FBI method:	The optimal dephase pulse is applied in the readout direction in order to permit the arteries and veins to be visualized separately for low-velocity blood vessels such as peripheral vessels and collateral vessels, which is difficult with standard FBI.
SPEED (Swap Phase Encode Extended Data) method	Blood vessels that run through multiple orientations are observed on one image by acquiring two images in which the phase encode direction is rotated by 90°.	
Time-SLIP (Time-Spatial Labeling Inversion Pulse)	The inversion pulse is applied space-selectively and after an appropriate wait time to permit the blood or cerebrospinal fluid flowing into or out of the slice to be visualized. This method can be used in combination with FASE or TrueSSFP.	
mASTAR	Non-contrast MRA is performed using ASTAR pulses. After uniform Tag pulses are applied, sequential acquisition is performed at different TI timings to acquire MRA images at the different TI timings, allowing hemodynamics to be observed.	
mUTE 4D MRA	UTE sequences allow for less dephasing and more homogeneous vessel signals. At the same time, the use of multiple inversion times (TIs) allows generation of dynamic images (4D) visualizing the blood flow without the need for contrast agents.	

Contrast-enhanced MRA

Blood vessels can be visualized at high temporal resolution with a short TR/TE using contrast medium.

Dynamic scan	Scanning is performed automatically according to the specified time sequence.		
	Application:	FE (2DFT/3DFT) FastFE (2DFT/3DFT)	
	FastFE data acquisition method:	2DFT:	Interleave, Sequential
		3DFT:	Interleave, Slice Centric, Sequential, Swirl, Reverse Centric
Dynamic subtraction	Subtraction images between the image in the specified base phase and subsequent images are generated.		
	Automatic processing after dynamic scan:	Available (absolute and complex)	
VisualPrep method	Data acquisition, image reconstruction, and display are performed repeatedly for the same plane.		
	Fat suppression:	Can be used in combination	
	Complex subtraction:	Available	
MovingBed	The tabletop is moved between scans to allow a wide range of the patient to be acquired.		
	Specification of tabletop movement distance:	Available	
Advanced MovingBed	Individual scan setting can be set for each scan in MovingBed.		
	Specification of tabletop movement distance:	Available	
	Scan setting:	Available	

PS MRA method

The PS (Phase Shift) method performs visualization based on the phase differences between moving parts and stationary parts.

2D PS method	IVisualizes the blood vessels in a short time.	
	Scan cross section:	Arbitrary planes
3D PS method	Covers the slice range continuously without slice gaps.	
	Scan cross section:	Arbitrary planes

Flow velocity measurement method

Scan for flow velocity measurement	Method:	2D cine PS method
	Cross section:	Arbitrary planes
	Direction:	Slice/readout/phase encode

Diffusion Imaging

Isotropic diffusion-weighted images and ADC images can be obtained using the EPI and the FASE method.

EPI Diffusion	Single-Shot EPI:	Available
	Three-axis continuous acquisition:	Available‡
	Multi b-value:	Available
FASE Diffusion‡	Three-axis continuous acquisition:	Available‡
Diffusion postprocessing‡	Diffusion ADC image (apparent diffusion coefficient image)	
	Diffusion isotropic image (isotropic diffusion-weighted image)	
	Dynamic averaging function:	Available
	Automatic postprocessing:	Available (ADC, isotropic)

Diffusion Tensor Imaging (DTI)‡

Continuous white matter tracts running in various directions in the head can be visualized using the EPI method.

EPI Diffusion	Single-Shot EPI:	Available
Diffusion postprocessing	Isotropic image (Isotropic diffusion weighted image)	
	ADC image	
	Fractional anisotropy image (indicating the degree of diffusion anisotropy)	
	Lambda image (characteristic value image)	
	Lambda image (vector image of characteristic value)	
	MAP image (scalar and vector MAP image)	
	Fusion image (Anatomical (T1, T2, FLAIR etc.) and MAP image)	
	MPR image	
	3D image (SVR + Plan cut + MAP image + Fiber or Cross section + MAP image + Fiber)	

‡ Option

Perfusion Imaging

Various types of perfusion imaging are supported.

EPI Diffusion	Single-Shot EPI:	Available
Perfusion postprocessing	ΔR2* image	
	Curve fitting:	Available
	Functional parameters:	Peak Height, Peak Time, Area under Curve, 1st Moment, etc
	Map and color display:	Available
ASL (Arterial Spin Labeling)	The ASTAR method is used to cancel out the MTC effect by setting the IR pulse application position for the control image and that for the tag image asymmetrically with respect to the imaging slice, while the blood flow signal on one side of the imaging slice is suppressed. As a result, images in which the MR signals from stationary tissues are suppressed can be obtained. This technique can be applied to both 2D and 3D. (ASTAR: Modified Signal Targeting Alternating Radiofrequency using Asymmetric Inversion Slabs) (MTC: Magnetization Transfer Contrast)	
	Control IR position:	Variable
	Tag IR position:	Variable
	Tag IR thickness:	Variable

Cardiac Imaging

Various types of cardiac imaging can be performed by the combined use of the ECG-gating method.

Cine imaging	Application:	FE2D, FFE2D (support for TrueSSFP)	
	Sequential multislice multiphase		
	Number of phases:	Variable (depending on the R-R interval)	
	ECG-gating:	Prospective, retrospective‡	
		Viewshare reconstruction:	Available
	Tagging scan:	Freehand tag:	Tag thickness can be set.
		Parallel tag:	Tag pitch can be set.
		Radial tag:	Number of tags and tag angle can be set.
Gate-free Cine imaging	Application:	FFE2D (support for TrueSSFP)	
	Taking images without gating in the breath-hold state.		
BB (Black Blood) method‡	Application:	FASE and FFE	
	Sequential multislice		
	Number of slices per breath-hold can be specified.		
	BB pulse application time can be changed sequentially.		
	Fat saturation pulse can be used in combination.		
Retrospective gating mode‡	Application:	FFE2D (support for TrueSSFP)	
	Acquires continuous cine images.		
	An image of the entire cardiac cycle, including diastole, can be obtained.		
Tissue characterization imaging‡	Application:	FFE2D, FFE3D	
	A T1-weighted image obtained using the inversion recovery method.		
	Analysis of delayed myocardial enhancement is available.		
Time course imaging‡	Application:	FFE2D	
	Multi-slice ECG-gated dynamic scan to acquire images of first pass of contrast.		
	Temporal change of signal intensity can be analyzed		
RMC (Real-time Motion Correction)‡	Application:	FFE3D, FASE3D, SEEPI2D	
	An image with reduced respiratory motion artifacts can be obtained by following the scanning cross section relative to diaphragm motion.		
R-wave monitoring‡	Application:	SSFP2D, SSFP3D	
	Reacquiring the ECG waveform when RR interval offed a preset threshold during ECG-gated scanning.		
MOLLI (MOdified Look-Locker Inversion recovery)‡	In ECG-gated scanning with the FFE2D sequence, MOdified Look-Locker Inversion recovery method is used for image acquisition. In this mode, the TI timing and delay time for the next IR pulse are specified based on the cardiac cycle, in addition to setting of the number of IR pulses and number of acquisitions, and image acquisition is performed.		
PSIR (Phase Sensitive Inversion Recovery)‡	In ECG-gated scanning with the FFE2D sequence, T1 contrast-weighted real images are acquired in this mode. After single IR pulse is applied, acquisition is performed with two different TI timings. Using the image data with a longer TI value which is less affected by T1 contrast, phase correction is performed for the image acquired with another TI value in order to enhance T1 contrast.		
T2 map‡	ECG gating or peripheral pulse gating is used in scanning with FFE2D sequences, and different Pre-contrast pulses are used to obtain multiple TE_{eff} images. The calcRelaxPrep function is then applied to the obtained TE_{eff} images to create T2 map images.		

‡ Option

Imaging Processing for BOLD Imaging‡

Friendly user interface for BOLD Image (functional MRI) processing
Alignment process using 3-dimensional motion correction
Statistically processed images (t-value, correlation coefficient)

UTE Imaging‡

Data is acquired with a very short TE by starting radial scan (in which data is acquired in a radial pattern from the center of the k-space) immediately after the RF excitation pulse is applied, without using a phase encode gradient pulse. Because UTE enables observation of signals with short T2* values and acquires the data starting from the center of the k-space for each TR, this technique is less susceptible to motion.

‡ Option

INSTALLATION CONDITIONS

Power requirements

A continuous and stable power supply is required for reliable operation of the system
Frequent power failures may damage the system.
The power line shall be free of rapid variations and must not be shared by other equipment.

Line voltage[1)]	400V
Phase	Three-phase
Voltage fluctuation	±10%
Frequency	50/60 Hz±1Hz

	Standard Gradient	Saturn X Gradient
Power requirements[2)]	70 kVA	90 kVA

Grounding

Independent grounding is required. Grounding must be provided in accordance with all applicable legal requirements for medically used electrical equipment.

Power consumption and heat dissipation[3)]

		Standard Gradient		Saturn X Gradient	
Power consumption (Average)		50 Hz	60 Hz	50 Hz	60 Hz
	During scan	19.7 kW	21.4 kW	26.6 kW	27.9 kW
	Low-power mode	9.3 kW	10.6 kW	10.0 kW	11.3 kW
	System power off	6.5 kW	7.8 kW	6.5 kW	7.8 kW
Max. System heat dissipation		7.9 kW	8.0 kW	9.8 kW	9.9 kW

Air conditioning

An appropriate air conditioning system is required to maintain the specified temperature and humidity.
Continuous air conditioning (day and night) is required for some equipment.

1) Other line voltages may be supported with the use of an additional step-down or step-up transformer.
2) An additional 40-50 kVA is required for the watercooling system.
   Continuous power (day and night) is required for some equipment.
3) Power consumption is calculated based on COCIR Self-Regulatory Initiative for medical imaging equipment (2011). The heat dissipation value does not include the external heat exchanger.

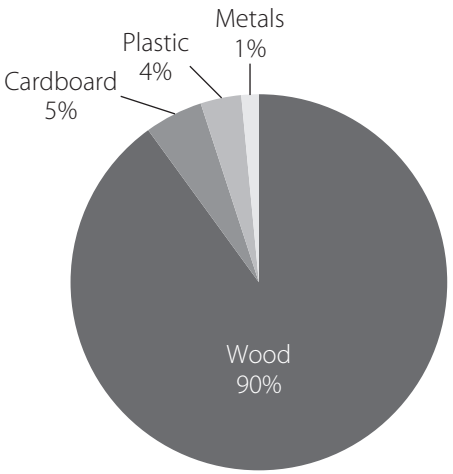
Environmental requirements

Temperature and humidity: No condensation	Scan room	16°C to 24°C	40% to 60% R.H.
	Operator's room	16°C to 30°C	40% to 75% R.H.
	Computer room	20°C to 24°C with fluctuation +/-3°C/day or less	40% to 75% R.H.
Magnetic field	Less than 1.0 µT peak-to-peak		
Electric field	Less than - 5 dB µV/m (0.56 µV/m) over 123.1 MHz +/- 0.5 MHz An RF shield room with more than 90-dB shielding is required.		
Emergency ventilation	30 m^3 /min or more for the scan room		
Ventilation pipe	A ventilation pipe must be provided in the scan room for emergency quenching of the magnet.		
Minimum rigging clearance	2.2 m (W) x 2.7 m (H) or more		
Minimum installation area[4)]	27 m^2		
	Scan room	5.80 m × 3.20 m = 18.56 m^2	
	Operator's room	1.60 m × 1.30 m = 2.08 m^2	
	Computer room	3.14 m × 2.00 m = 6.28 m^2	
Ceiling height	2.8 m		
Maximum floor loading	8.2 tons for the scan room		
Installation altitude	Less than 2,000 m above sea level		

		Standard Gradient	Saturn X Gradient
Cooling water	Flow rate	67 L/min or more	87 L/min or more
	Temperature	18°C to 22°C	18°C to 22°C

Packaging materials

	Mass kg (Average)
Wood	458
Cardboard	26
Plastic	18
Metals	8



4) Minimum room inside clear space dimensions. These dimensions may not be applied to some cases depending on each site situation.

COMPATIBILITY WITH INTERNATIONAL STANDARDS

IEC 60601-1: 2005 + Amd.1:2012
IEC 60601-1-2: 2014
IEC 60601-1-6: 2010 + Amd.1: 2013
IEC 60601-1-9: 2007 + Amd.1: 2013
IEC 60601-2-33: 2010 + Amd.1: 2013 + Amd.2: 2015
IEC 60825-1: 2007
IEC 62304: 2006 + Amd.1: 2015
IEC 62366: 2007 + Amd.1: 2014

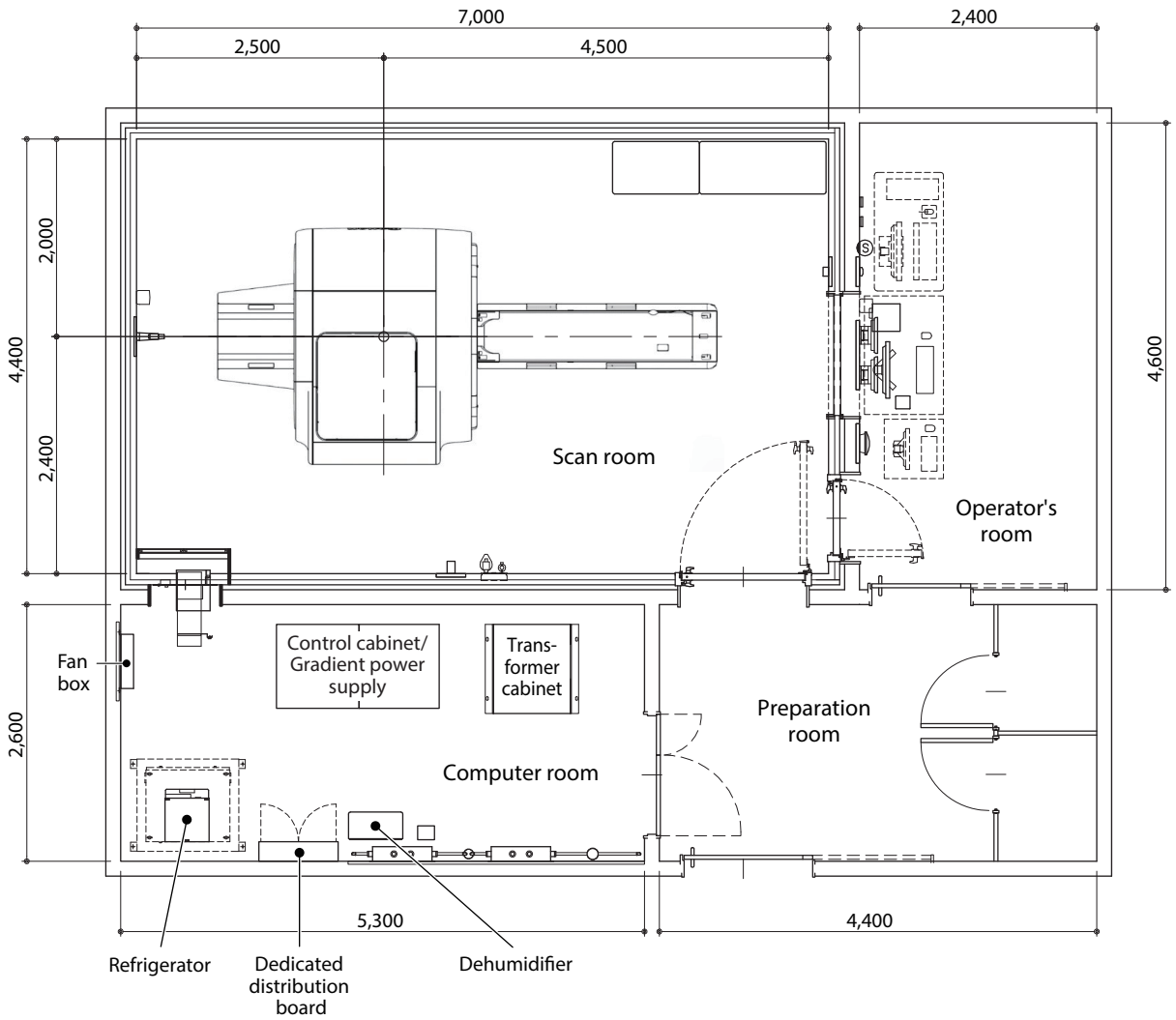
DIMENSIONS AND MASS

Unit	Dimensions W x D x H mm	Mass kg	Recycling rate %
Magnet assembly			
For fixed couch	2,400 × 2,618 × 2,320	8,310	80
For dockable table	2,400 × 3,005 × 2,320	8,310	80
Entire bore length (including covers)	1,848	–	–
Patient bore length	1,619	–	–
Patient Table			
Fixed couch	660 × 2,420 × 430 to 845	250	80
Dockable table	660 × 2,470 × 550 to 845 (Dock) 660 × 2,470 × 535 to 875 (Undock)	260	80
Console			
Host PC	178 × 541 × 425	19	63
Monitor	575 × 245 × 423 to 553	8.7	35
Control box	280 × 310 × 85	4	98
Control pad	130 × 145 × 75	0.4	25
Gradient Power Supply and control cabinet‡	1,645 × 850 × 1,945	1,315	89
Refrigerator	445 × 530 × 625	100	90
Transformer cabinet	778 × 902 × 1,870	600	98
Fan Box	627 × 145 × 518	17	71
Filter Panel‡	1,150 × 770 × 650	67	70
Accessories	–	130	31

‡ When the Saturn X Gradient system is applying, the dimensions and configurations of these units change to the followings.

Unit	Dimensions W × D × H mm	Mass kg	Recycling rate %
Gradient Power Supply and control cabinet	1,623 × 850 × 1,980	1,360	89
Filter Panel	1,150 × 770 × 650	67	70
	390 × 750 × 400	30	83

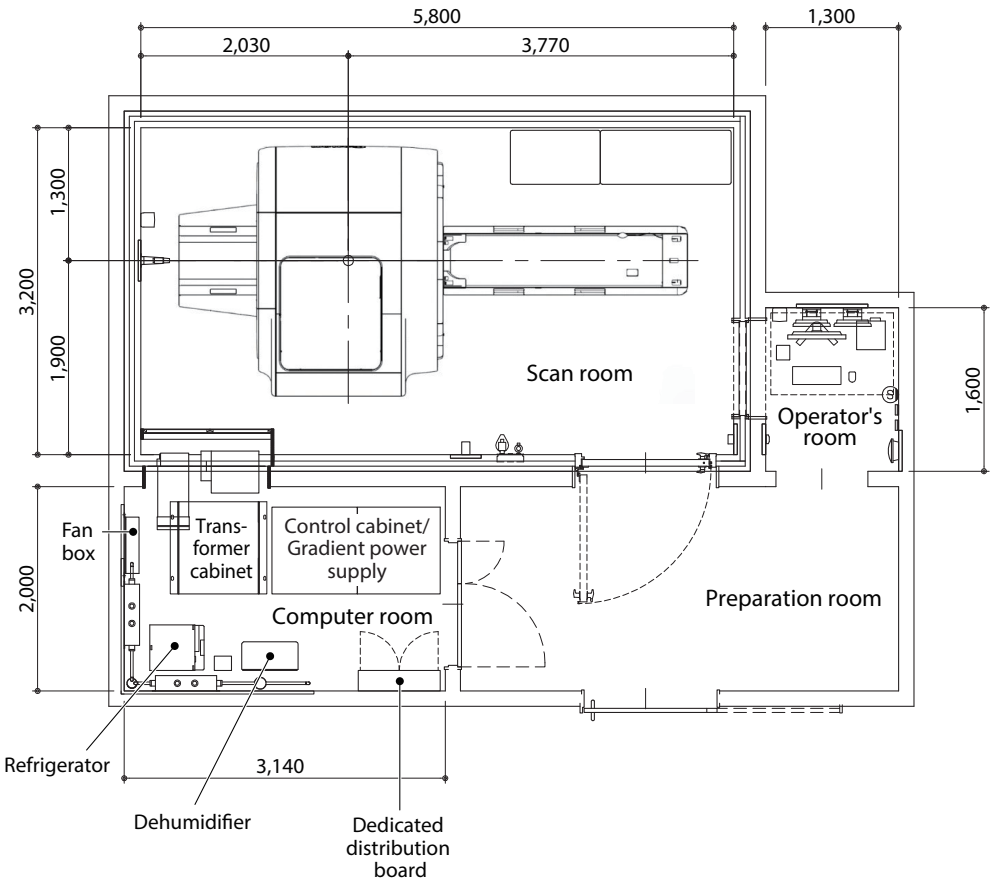
STANDARD LAYOUT EXAMPLE



1) Units drawn in dotted line are not included in the standard composition

Unit: mm

MINIMUM LAYOUT EXAMPLE



1) Units drawn in dotted line are not included in the standard composition

Unit: mm

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Canon Medical Systems Corporation meets internationally recognized standards for Quality Management System ISO 9001, ISO 13485.
Canon Medical Systems Corporation meets the Environmental Management System standard ISO 14001.

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