



Economical Productivity

Philips Intera 1.5T MRI system specifications January 2009

PHILIPS

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1. Introduction

Simplicity for Productivity

Intera features SmartExam - a Philips-exclusive technology for completely automated planning, scanning and processing of core applications, such as brain and knee, with a single mouse click. With SmartExam, these studies can be consistently reproduced with optimized scan quality and reproducibility, independent of patient, positioning and operator.

Exploiting speed, powered by FreeWave

At the heart of the Intera is FreeWave, a Philips' unique data acquisition system with a scalable 32-channel architecture. The power of FreeWave enables ultra-high image resolution and speed. This platform drives innovations such as SENSE parallel imaging technology, now up to a factor of 4 as standard, which provides for high spatial and temporal resolution and can be used for all applications.

Tailored to your business needs

The Intera delivers complete clinical functionality on a system that is designed to meet the needs of high growth imaging centers. The Intera delivers high image quality, outstanding patient comfort and allows a complete range of clinical applications, greatly expanding your business potential. The Intera is cost effective and convenient to install, removing the barriers to increase your patient throughput. It is a powerful and versatile system, featuring state of the art imaging technology.

2. SmartExam

SmartExam is a major breakthrough in MR. Using Philips exclusive technology, SmartExam enables automatic planning, scanning and processing of core applications, with a single mouse click. With SmartExam, scans can be reproduced consistently and effortlessly, with automated and identical scan plane orientation, independent of patient and operator. SmartExam seamlessly integrates with ExamCards and increases the operational efficiency.

SmartExam ensures that:

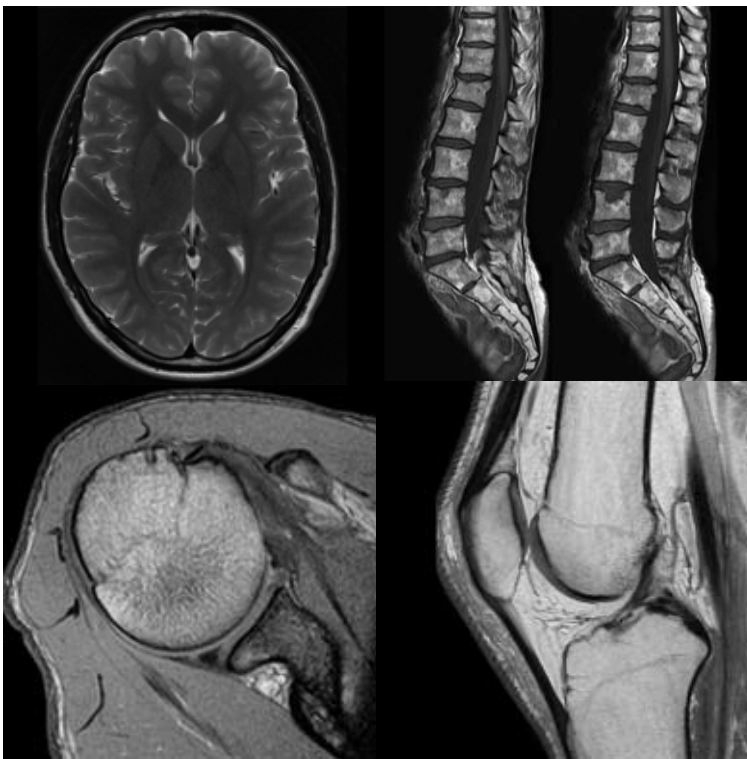
- The patient will spend less time in the system
- The physician gets reproducible, consistent clinical results, without operator variability
- The operator can focus on managing patient throughput
- The administrator gets increased efficiency and throughput as it becomes easier to staff and train.

2.1. SmartExam Brain

With SmartExam Brain, all brain studies can be consistently reproduced with optimized scan quality and reproducibility, independent of patient, patient positioning or operator. SmartExam Brain seamlessly integrates with ExamCards, enabling automatic planning, scanning and processing of complete patient studies according to the ExamCard protocol specifics of your institution.

2.2. SmartExam packages (optional)

In addition to SmartExam Brain, SmartExam packages are available for shoulder, spine and knee imaging. SmartExam can thus be applied to typically 80% of MRI studies, providing excellent reproducibility, significant reductions in overall examination time and the potential for increased patient throughput.



Complete studies can be planned, scanned and processed with a single mouse click

3. Magnet system

The Intera system features an ultra-compact, 1.57 m short-bore magnet, the latest generation in a leading line of actively shielded magnet technology. The magnet is designed to deliver high homogeneity, providing excellent image quality and fat suppression over a large field of view (the largest in industry –53 cm– in the z-direction), essential for today's demanding applications, such as off-center body and orthopedic studies.

The system minimizes operational and siting costs thanks to its lightweight design, a small fringe field footprint and efficient cryogen use.



3.1. Magnet type and dimensions

Type	Ultra compact, superconducting magnet
Shield type	Actively shielded
Field strength	1.5T
Length	1.57 m (5 ft. 2 in.)
Width	1.88 m (6 ft. 2 in.)
Height	2.40 m (7 ft. 10 in.)
Weight (with cryogens)	2,900kg (6,400 lbs.)
Fringe field containment	
5G (axial x radial)	3.8 m x 2.4 m (12ft. 6 in. x 7 ft. 10 in.)
1G (axial x radial)	5.2m x 3.3 m (17 ft. 1 in. x 10 ft. 10 in.)

3.2. Cryogenics

Type	Liquid Helium
Vessel capacity	1,650 liters
Boil-off rate	0.03 liter/hour
Refill Interval	3 years

3.3. Field homogeneity

Maximum FOV	53 cm
Shimming	Both passive and active shimming. Passive shimming during installation. Automatic active shim (auto-shim) or Dynamic FOV shimming for each patient.
External interference shimming	Yes
Field homogeneity (V-RMS*)	Typical (ppm)
Volume (cm)	
50 x 50 x 50	0.50
45 x 45 x 45	0.45
40 x 40 x 40	0.20
30 x 30 x 30	0.07
20 x 20 x 20	0.03
10 x 10 x 10	0.01
Long Term Stability	< 0.1 ppm/hour < 876 ppm/year

* Measured in 24 angles on 24 planes.

4. Pulsar gradient system

The Intera 1.5T features high performance whole body, non-resonant, self-shielded gradient technology. With SofTone inside every system, gradients are powerful, yet very quiet. Despite short TEs and TRs, and high spatial and temporal resolution, gradient linearity - critical for geometric accuracy of the images - is not compromised.

4.1. Gradient performance

Type	Non-resonant
Shield type	Actively shielded
Gradient performance	
Max Amplitude*	33 mT/m
(Effective)	57 mT/m
Max Slew rate*	80 mT/m/msec
(Effective)	138 mT/m/msec
Duty cycle	100 %
Gradient linearity (V-RMS **) at 53 cm DSV	1.4 %
Coil cooling	Liquid
Amplifier cooling	Liquid

* On each axis.

** Measured in 12 angles on 19 planes.

Note: All above specifications over full 53 cm FOV. Amplitude deviation over full 53 cm FOV < 8%.

4.2. Acoustic noise reduction

Hardware	Covers and headset.
Software	SofTone



5. FreeWave

At the heart of the Intera is the revolutionary FreeWave data acquisition system. FreeWave supports the latest generation of multi-channel SENSE coils.

The processing power of FreeWave makes it possible to monitor the MR signal in real-time. This allows immediate sampling of the RF signals, avoiding the analogue processing steps that were necessary in conventional MR systems. This Direct Digital Sampling (DDS) results in a greatly improved SNR. FreeWave improves the use of real-time navigators by fine tuning the acquisition almost instantaneously (within a single TR) to correct for patient motion.



5.1. Transmit

Number of channels	1
Output Frequency	63.87 MHz (1.5T)
Bandwidth	610 kHz (\pm 305 kHz around operating frequency)
Amplitude Resolution	16 bits
Frequency Resolution	0.07 Hz/bit
Phase Resolution	16 bits (0.005 degrees)
RF Amplifier Type	Microprocessor controlled, air-cooled, single frequency
Output Power	18 kW
Tuning	Per patient rapid automatic power and frequency optimization

5.2. Receive

Number of Channels	8
Channel Bandwidth	1 MHz per channel (20 ns temporal resolution)
Sampling	Direct Digital Sampling (DDS)
Demodulation Filtering	Digital
Filter Accuracy	2 x 24 bits
Amplitude Resolution	2 x 16 bits (20 ns temporal resolution)
Dynamic Range	Up to 150 dB
Pre-amplifiers	All RF coils include built in dedicated low noise preamplifiers for optimal signal-to-noise.
Pre-amplifier Noise Figure	< 0.5 dB

5.3. Parameter values, Pulsar gradients

Sequence	Matrix	2D Min TE (ms)	2D Min TR (ms)	2D Min Spin Echo Spacing (ms)	2D Min Gr. Echo Spacing (ms)	3D Min TE (ms)	3D Min TR (ms)	3D Min Spin Echo Spacing (ms)	3D Min Gr. Echo Spacing (ms)	3D Max no of slices
SE /IR	128	3.66	13.3			4.66	16.50			
	256	3.79	13.3			4.75	16.50			
TSE / IR-TSE	128	2.58		2.58		4.81		4.81		
	256	3.51		3.51		5.71		5.71		1024
	512	5.41		5.41		7.60		7.60		
	1024	9.04		9.04		11.2		11.2		
Ssh TSE	256	152						minimum shot duration		1024
FFE / TFE	64	0.69	1.76			0.69	1.76			
	128	0.76	1.83			0.76	1.83			1024
	256	0.91	2.25			0.91	2.25			
GRASE	128	7.05	27.4	7.05	0.98	0.98	28	9.25	0.98	
	256	10.5	40.7	10.5	1.87	1.87	40	12.7	1.87	1024
FFE-EPI	64	1.58	4.17		0.90	1.58	4.17		0.81	
	128	1.69	4.37		0.80	1.69	4.37		0.84	1024
	256	2.12	5.69		1.04	2.12	5.69		1.14	
Ssh EPI	128	28.00	minimum shot duration							
SE-EPI	64	4.60	13.3		0.81	6.81	18		0.81	
	128	4.90	13.3		0.99	7.10	18		0.99	1024
	256	6.63	16.4		1.87	8.83	18		1.87	
DWI	128	Single-shot, b=1000, minimum TE = 66.5 ms Single-shot, b=7000, minimum TE = 145 ms								

Notes: This table is limited to commonly used matrices.

A combination of stated parameters is not always possible; some parameters may require optional packages. Scan parameters are compliant with I.E.C. S.A.R. regulations.

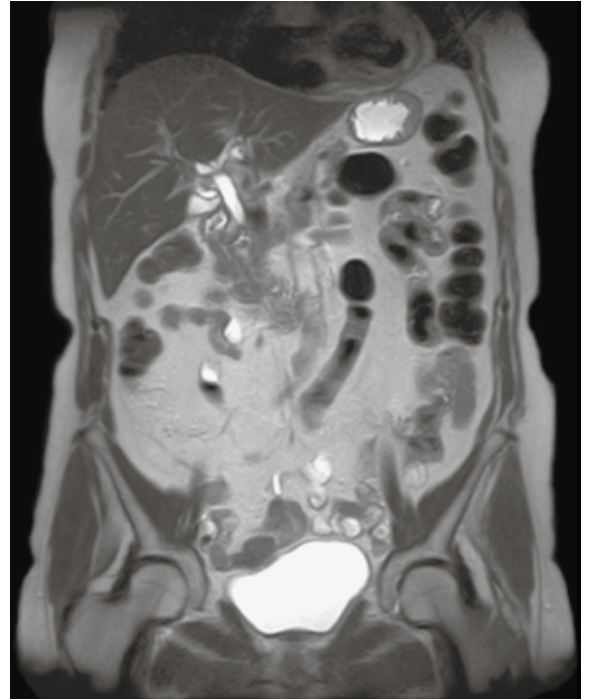
6. Standard RF coils

The Intera 1.5T has built-in preamplifiers in all receiver coils for excellent signal-to-noise ratio. RF coil matching is not required prior to a scan. The coils described below come standard with the system. A full range of optional SENSE compatible coils are also available.

6.1. Quadrature Transmit/Receive Body Coil



- A built-in transmit/receiver Quadrature coil.
- Applications: Large body parts including neck, spine, abdomen and extremities
- Number of elements: 16
- Number of channels: 1
- Aperture dimensions: 60 cm length x 60 cm opening.



Large 53 cm FOV.

6.2. Quadrature Head Coil



- Receive-only Quadrature coil.
- Applications: Head and foot.
- Number of elements: 12
- Number of channels: 1
- Coil dimensions: 28 cm length x 26 cm free height from headrest.



6.3. SENSE Head coil (optional alternative for Quadrature Head coil)



- Receive-only phased array coil.
- Applications: Head. Optimized crown design for improved SNR in lateral and cortex areas and shorter scan times.
- Number of channels: 8.
- Max SENSE factor: 8 with ScanTools Pro, factor 4 with ScanTools.

6.4. 17 cm Circular Flex Coil



- Receive-only flexible surface coil.
- Applications: General purpose. Spine, orbits, knee, shoulder, foot and kidney.
- Number of channels: 1
- Coil dimensions: 17 cm

7. Patient environment

Improved patient comfort during examinations results in less motion and fewer repeated scans. The Intera is designed for enhanced patient comfort with an ultra-compact, short-bore magnet with a wide flared opening, soft lines and soothing colors. The patient environment is open and spacious. The straight central section of the patient bore is only 60 cm long, and quickly flares from 60 cm to 110 cm. The state-of-the-art design allows easy access to the patient and good patient visibility for the operator. During many examinations the patient can easily see outside the magnet. Intera's unique SoftTone feature ensures that gradient induced acoustic noise is kept to a minimum for all imaging sequences. An acoustic noise suppression headset further decreases the acoustic noise perceived by the patient.



7.1. Patient comfort

Patient Aperture	60 cm
Tunnel Length	60 cm
Tunnel Flare	110 cm
Illumination	Adjustable indirect DC lighting
Air Flow	Adjustable
Patient Headset	Operator-patient communication, acoustic noise reduction up to 25 dB(A), can provide music for patient comfort (option).
Communication	Two-way intercom communication with the patient. Patient call button. Optional camera and monitor are available (up to four cameras can be connected.).
Comfort Accessories	Soft mattress with headrest. Head coil mirror. Patient position and comfort pad kit including knee bolster, positioning wedges, sandbags, and patient restraint straps of various sizes.

Patient support

Type	Removable tabletop with optional trolley.
Patient Controls	Magnet front: located on left or right side. Magnet rear: subset of controls.
Coil Connections	Integrated into front Patient Control Unit.
Patient Positioning	Laser light reference cross for accurate patient positioning.
Horizontal Drive	Patient Control Unit or console operation. Automatic movement for selected slice to the isocenter of the magnet and also for multi-station imaging (MobiTrak).
Vertical Drive	Electrically powered with the Patient Control Unit.
Tabletop Travel	215 cm (7 ft. 1 in.)
Tabletop Speed	Three speeds: 20, 80 & 180 mm/sec (0.8, 3 & 7 in./sec)
Tabletop Accuracy	± 0.5 mm (0.02 in.)
Weight Capacity	250 kg (550 lbs) with horizontal motion. 150 kg (330 lbs) with vertical motion.
Patient Table Height	Working position 89 cm (35.2 in.) Min. 52 cm (20.5 in.)
Docking Patient Trolley	Optional mobile tabletop on lightweight, maneuverable trolley docks quickly and easily docks with patient support.

7.2. Physiology synchronization

Type	Peripheral Pulse (PP), Respiratory, Vector ECG (VCG) (Vector ECG)
Imaging Methods	Gating, Triggering
Waveform Display	On Operator's Console. Optional LCD Physiology Display monitor mounted on the system displays waveforms in the examination room.

8. Computer system

The Intera computer utilizes an innovative parallel multiprocessor design to deliver the performance and capacity for advanced levels of clinical operation. Separate processors control scanning, reconstruction and the operators' console. This allows simultaneous operation for improved efficiency, flexibility and streamlined data management. Intera provides full parallel scanning and reconstruction capabilities. Advanced software functionality on the console reduces the workload on the operator.

8.1. Host computer

Processor	≥ 2.6 GHz Quad core Intel processor
Processor Memory	8 Gbyte
Image Disk	≥ 140 Gbyte Approx. ≥ 250,000 uncompressed images (256 x 256)
Software Disk	≥ 140 Gbyte
Image storage	External storage via USB Port DVD+RW 4.7 Gbyte (optional) Approx. 40,000 uncompressed images (256 x 256) DICOM STD-CTMR format
Parallel scanning and saving images	Yes



8.2. Rapidview reconstructor

Processor	≥ 2.6 GHz Quad core Intel processors
Processor Memory	8 Gbyte
Reconstruction speed	
256 x 256 (full FOV)	1,300 images/sec
512 x 512 (full FOV)	630 images/sec
256 x 256, 4 coil elements, SENSE factor 2	560 images/sec
256 x 256, 4 coil elements, SENSE factor 4	595 images/sec
Parallel scanning and reconstruction	Yes

8.3. Console

Display size	≥ 23 inch
Resolution	1900 x 1200 pixels

8.4. Connectivity

Protocol	Ethernet TCP/IP standards-based image transfer with DICOM 3.0 over standard Ethernet IEEE 903.
Network Connection	10BaseT / 100BaseT / 1 Gbyte
VCR Interface	Transmits series of images to standard VHS connection. Supports color PAL or NTSC color.

9. Siting

Philips site-planning specialists will assist in all aspects of site and installation planning. Detailed data concerning installation requirements is given in specific site planning documentation (Planning Reference Book). Please refer to the local Philips organization for detailed specifications for the installation.

9.1. Examination room

Floor space (Recommended)	33.6 m ² (4.8 m x 7 m) 362 sq. ft. (15 ft. 9 in. x 23 ft.)
Floor space (Minimum)	19.5 m ² (3.6 m x 5.4 m) 210 sq. ft. (12 ft. 0 in. x 17 ft. 9 in.)
Ceiling height (Recommended)	3.0 m (9 ft. 10 in.)
Ceiling height (Minimum)	2.65 m (8 ft. 8 in.)
Temperature	20 – 24 °C
Humidity (Non-condensing)	40 – 60 %
Heat dissipation	2 kW

Note: The examination room must be RF-shielded.

9.2. Control room

Temperature	18 – 24 °C
Humidity (Non-condensing)	30 – 70 %
Heat dissipation	0.5 kW

9.3. Technical room

Floor space (Recommended)	10 m ² (5 m x 2 m) 108 sq. ft. (16 ft. 5 in. x 6 ft. 7 in.)
Floor space (Minimum)	4.3 m ² (2.4 m x 1.8 m) 46.5 sq. ft. (7 ft. 10 in. x 5 ft. 11 in.)
Ceiling height (Recommended)	3.2 m (10 ft. 6 in.)
Ceiling height (Minimum)	2.6 m (8 ft. 6 in.)
Temperature	15 – 24 °C
Humidity (Non-condensing)	30 – 70 %
Heat dissipation	
Standby	2 kW
Peak	7 kW

Note: The compressor for the cryocooler (used for minimizing the Helium boil-off) requires cooling either by tap water or through a water chiller.

9.4. Power requirements

Mains voltage	400 or 480 V +/- 10 %, 3 phase, neutral & earth
Mains frequency	50 or 60 Hz +/- 1%
Power ratings	
Standby	5.5 kW
Ready for measurement	8.3 kW
Average *	15 kW
Peak	27 kW

* Estimated power consumption during measurement.

10. Safety

10.1. Controlled Access Area

A Controlled Access Area around the MR equipment has to be defined and permanently installed such that outside this area:

- The magnetic fringe field strength is always limited to 0.5 mT and
- Electromagnetic interference level complies to IEC 60601-1-2: 2nd ed.

The controlled access area should comply with IEC 60601-2-33, 2nd ed.

10.2. Liquid Cryogen and Cryogenic Gases

A venting system for cryogen gasses is connected to the outside of the examination room and is designed to withstand a quench and to protect nearby persons in the case of a quench. This provision assures that the oxygen concentration in the accessible area remains at acceptable levels during a quench. Means are to be provided so that - should the venting fail to work adequately - the pressure buildup during a quench will not prevent the door of the examination room from being opened.

10.3. Decay Characteristics of Magnetic Field

Decay characteristics of the magnet in case of a quench or an emergency field shut-down are given to enable the user to implement adequate life supporting and other safety procedures. In case of an emergency field shut down, the magnetic field strength in the centre of the magnet decreases to 10 mT in less than 20 seconds. The installation manual gives information where and how to install the actuator of the emergency field shut-down unit.

10.4. Emergency RunDown Switches

The two Emergency RunDown (ERDU) Switches are wall-mounted units. The ERDU buttons must be mounted at easily accessible and highly visible locations, one in the examination room and one in the control room. Warning plates in different languages are delivered with the ERDU buttons.

The following items will be delivered with the system:

- Remote Magnet Monitoring Unit (RMMU)
- ERDU button inside examination room
- ERDU button inside control room
- Mains cable 15 m (to Mains Distribution Unit).

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