# Technical Description
# Xpert 0.4T
# Permanent MRI System

# Hardware Description

## Magnet

The Xpert 0.4T features an Open C-shape magnet with active shielding. The stability of the magnetic field is ensured via patent design of magnet and a specialized magnet constant temperature system.

The magnet's fringe field is small; the 5-G field is contained within 2.5 m or less in all directions
The complete system can be installed in a space of 22.5 m2.
The excellent magnetic field homogeneity is to ensure superior image quality with a 40 cm field of view.

The open, C-arm magnet design is based on the research and clinical feedback in the area of full body imaging. The result is a high resolution, wide field of view magnet optimized to image of different part of body scan.

- Field Strength: 0.4T ±5%
- Type: Permanent
- Field Orientation: Vertical
- Weight: 16000 Kg
- Homogeneity 40cm DSV 2.06ppm
- Gradient Strength: 28.5 mT/m
- Slew Rate: 95 mT/m/ms
- Gap: 40±1 cm
- Horizontal Open Angle: 300°
- Environmental: Internal Thermostatic Control System

## Patient table

The patient table is used for positioning the patient with corresponding RF receiving coils to the iso-center of the magnet for the scanning of MR.

The patient table unit includes two parts: patient table and positioning system. The patient table includes tabletop, tabletop carrier, cushion, etc.
The positioning system includes laser positioning and LED display screen.

- Support Width: 60 cm
- Max. Patient Weight: 240kg

## Gradient System

The Xpert 0.4T gradient system is state-of-the-art, capable of running at 28.5 mT/m with a slew rate of 95 mT/m/ms.

- Maximum Voltage: 150V
- Maximum Current: 150A

More gradient power will support more gradient strength, enable system to provide less slice thickness and smaller minimum FOV, and allows fast (single-shot) TSE sequences with high turbo-factor and heavy T2-weighting.

## Digital RF system

The flat quadrature transmitter coil is integrated in the pole pieces providing a strong uniform field. The 6 kW RF power amplifier allows short pulses to be used, ensuring the execution of fast imaging sequences available now and those of the future.

## Receive platform

The system is equipped with a fully digital two-channel hardware platform. The technology allows the use of phase array coil. These coils provide image acquisition with higher signal to noise ratio and image quality.
RF receiving system adapts quantum optical fiber transmitting technology. The A/D conversion and quantum laser modulation are placed inside the magnet room, that helps to significantly reduce signal loss and avoid interference during transmission. As a result, the image quality is effectively improved.

## RF Receiving Coils

The Xpert 0.4T RF coils provide excellent signal to noise ratio, due to presence of pre-amplifiers in all elements of the coils and other receiver coils, ensuring proper enhancement of the signal. The Xpert 0.4T comes with a comprehensive set of RF receive coils supporting a wide range of clinical applications from head to toe. Dedicated preset procedures are available for all coils.

- Coil Design: Phase Array coil
- RF Receiving Coils: Head
  Cervical
  Shoulder
  Knee
  Body (Large)
  Body (Medium)
  Small Joint (wrist)
  Flexible (Optional)
  Infant Head Coil (Optional)
  Breast Coil (Optional)
- Max. RF Power: 6 kW
- Preamplifiers: All digital Fixed inside magnet
- Positioning: Padding set included providing comfortable patient positioning and restricting movement.

### Phase Array Head Coil

The Phase array Head Coil is optimized for imaging head and upper C-spine. The coil can be opened for fast and easy positioning.
Features:

- Phase array Coil with high signal to noise ratio
- Large coverage for easy positioning.
- Split design for easy positioning

**Phase Array Neck Coil**

The coverage of the Neck coil is uniform from cerebellum to the upper thoracic spine region. The upper part of the coil can be removed for fast and easy positioning.

Features:

- Phase array Coil with high signal to noise ratio
- High uniformity from cerebellum to the upper thoracic spine region.
- Split design for easy positioning

**Phase Array Body Coil**

The Phase array Body/Spine Coil Large has two phased array elements suitable for imaging chest, abdomen, pelvis, thoracic and lumbar spine in large sized patients. The upper part of the coil can be removed for fast and easy positioning. In addition the coil also slides under the patient for easy positioning.

Features:

- Phase array Coil with high signal to noise ratio
- Split design and sliding support for easy positioning.

**Phase Array Shoulder Coil**

The Phase Array Shoulder Coil has a specialized design to fit around the shoulder. Coil loop slides along the arm for easy positioning.

**Phase Array Knee Coil**

The Phase Array Knee Coil is used for knee. The coil can be opened for fast and easy positioning.

**Small Joint Coil (Wrist)**

Dedicated design for wrist application.

**Phase Array Flexible Body Coil (Optional)**

The flexible coil is dedicated for obese patients, and provides wider applicability of Xpert 0.4T system.

**Infant Head Coil (Optional)**

Special design for infants.

**Breast Coil (Optional)**

The Breast Coil is design especially for breast.

## Computer Control System

### Host Computer

Host computer with Intel CORE 3.2GHz or higher CPU and at least 4 GB RAM for overall system control and processing, allowing simultaneous operation of Patient registration/pre-registration, MR scanning and imaging, Image reconstruction, Image review, print and etc. greatly enhanced patient throughput. 500 GB hard disc is used for system software and data storage. CD/DVD RW for data archive, backup and transfer.

- CPU: INTEL CORE 3.2 GHz or higher
- Memory (RAM): 4 Gbyte or higher
- Hard Disk: 500 GB or higher - stores up to 3,000,000, $256^2$ images
- Image Archiving: CD/DVD-RW
- Operating System: Windows 7
- Graphical Interface: Windows based
- Networking: DICOM 3.0 Storage, Media Exchange, Send, Print and Worklist

NOTE: Customer will be required to provide cabling, appropriate interface devices, and network connection from the operator console to the viewing location. Customer is also responsible for all telephone, network and/or internet service provider charges.

### Operator's console

The Xpert 0.4T is designed for operation by a single operator. Patient administration and scan control, image data viewing and transfer, image processing and printing, system control can be performed with user-friendly, intuitive controls. Simple mouse clicks enable routine actions, allowing high patient throughput and operator comfort. The Operator's Console comprises:

- Microsoft Windows 7 operating system for efficiency and ease of operation.
- A desktop with space for equipment and paperwork
- 24" TFT-LCD monitor for professional image quality

## Patient Environment

The Xpert 0.4T is the most patient friendly of open scanners; even the most anxious and claustrophobic patients will feel at ease. The C-arm magnet has a spacious 39 cm opening to allow maximum access to the patient. The magnet poles are small, providing the patient with a full view to the outside of the system in virtually all examinations.

- Patient communication system for bi-directional patient communication.
- A set of soft mattresses ensure patient comfort.
- Low noise system makes patient feel ease during the whole scanning procedure.
- A hand-held nurse call button allows the patient to attract the operator's attention without talking (Optional)
- Patient music system will effectively relieve anxiety and emotional distress (Optional).

## Gating Package (Optional)

### Respiratory Gating

Respiratory gating can be utilized to reduce artifacts caused during respiratory motion by acquisition of data on the basis of the phase in the respiratory cycle. The device relies on the relative humidity differences between inspired and expired air.

The respiratory gating package contains:

- an air ball fixed on the abdomen for pressure sensor
- a convertor from pressure to digital signal
- Software display the respiration wave shape
- Trigger position can be selected by the customer

### Pulse Gating

The use of Pulse Triggering and Gating is to monitoring the pulsating

Features:

- a pressure sensor fixed on the wrist
- a convertor from pressure to digital signal
- Software display the pulse wave shape

## Software Description

The software package is intended for use with Magnetic Resonance Diagnostic Imaging Systems – Xpert 0.4T. The main software, which called To-Station, will help operators and physicians to step patient registering, system adjusting, 2D & 3D image acquisition, processing, analyzing and storage, it also integrates image enhancement, DICOM printing, etc.

### Software Package

- Scanning control software
- Image reconstruction software
- Image processing software
- Image analyzing software
- Image format conversion software (JPEG, BMP, etc.)
- Image view software
- System inspecting software
- Real-time printing software (Standard DICOM 3.0)
- Remote Service Software

### Advanced Features

**Patient Pre-registration**
Support patient pre-registering when scanning, without limitation to amount of pre-registered patients, improves work efficiency.

**9 Slices of Scout Images**
9 slices of scout images in three dimensions by one pilot scan in 25 seconds, provides you 3 choices in each dimension, greatly enhance precision of the scan positioning, and enable a high patient flow.

**Scout Line**
Scout image can be displayed at the lower right corner and the side bar. It makes very simple to know exact slice position, which is significant improved the convenience of clinical diagnosis.

**Image Comparison**
Provide multi-slices comparison on one screen.

**Intelligent Icon Management**
Enhance operator's efficiency by customizing interface icons, re-arranging the position of each icon, grouping your icons.

**Non-film Capability**
A smart image reviewer software called "to viewer" has been integrated into the archive VCD/DVD automatically, which enable to review the archive images in any other PC.

**Abundant Sequence Database**

Provides Sequences upgrade free of charge.

Sequence database can be customized and categorized by operator. System provides operator with reference information and will inspect the validity of parameters automatically.

Parameters can be reset to default

**Standard DICOM 3.0 Interface**

- DICOM Modality Worklist (RIS interface)

  The Radiology Information System Interface option enables automatic transfer of patient information from the hospital's DICOM RIS to the MR Console Operator's Console, thereby eliminating retyping and possible errors.

  Correct data transfer in the first stage setup of the MR scan ensures data-integrity and provides the correct association between images and other patient data in the departmental information system or PACS. The functionality is according to the DICOM definitions.

  It provides work lists for predefined time-windows, sorted by time slot and automatic transfer of:

  - Accession number
  - Scheduled procedure step
  - Patient name
  - Patient identification
  - Patient sex
  - Patient weight (if known on RIS)
  - Referring physician's name

- DICOM Query/Retrieve Service Class as a Provider

  Supports database browsing from a DICOM workstation and sends a copy of requested images in DICOM format

  The Xpert 0.4T DICOM conformance statement provides full details on the implementation of the DICOM standard.

## Imaging Sequences and Parameters

Pulse Sequences:

- Scout image with Spin Echo (3 x 3 scout images, each view has 3 scout images for orientation)
- Spin Echo (SE)
- T1 weighted image with Spin Echo
- Proton density weighted image with Spin Echo
- T2 weighted image with Fast Spin Echo
- Proton density weighted image with Fast Spin Echo
- Dual Contrast image with Fast Spin Echo
- 3D Fast Spin Echo
- Gradient Echo (GE)
- T1 weighted image with Gradient Echo
- T2 weighted image with Gradient Echo
- Fast dephase Gradient Echo
- Fast rephase Gradient Echo
- Fast dephase Gradient Echo with breath hold
- 3D Fast dephase Gradient Echo
- Inversion Recovery (IR)
- Fat suppress with Inversion Recovery
- Water suppress with Inversion Recovery
- Fat suppress with Fast Inversion Recovery (STIR)
- Water suppress with Fast Inversion Recovery (FLAIR)
- Heavy T1 weighted image with Inversion Recovery
- 2D/3D Time of Flight for Angiography (TOF)
- Magnetic Resonance Cholangiopancreatography (MRCP)
- Magnetic Resonance Urography (MRU)
- Magnetic Resonance Myelography (MRM)
- Magnetization Transfer Contrast (MTC)
- line-Scan Diffusion Weighted Imaging (LSDWI)

| | |
|---|---|
| Image Reconstruction: | 2D Fourier Transform |
| | 3D Fourier Transform |
| | Half Scan |
| Slice Thickness: | 2-D: From 1.0 mm to 10 mm, 0.1 mm increments |
| | 3-D: From 0.4 mm to 10 mm, 0.1 mm increments |
| Interslice Spacing: | Contiguous slices available, system default is 10% slice gap |
| Slice Orientation: | Transverse |
| | Sagittal |
| | Coronal |
| | Oblique and double oblique |
| | Off center |

| | |
|---|---|
| Acquisition Matrix: | 2-D: from 128 x 128 to 256 x 256 |
| | 3-D: from 128 x 128 x 24 to 256 x 256 x 128 |
| Field of View: | 40 mm to 400 mm, 1 mm increments |
| Number of Slices: | 2-D: 1 – 256 |
| | 3-D: 1 - 500 (maximum 50 slices x 10 slabs) |

## Imaging Processing and Manipulation

Xpert'ToStation' provides powerful and easy to use image manipulation tools.

Help: Tutorial off-line

Multi-tasking:

- All operations can be performed in parallel.
- Support patient pre-registering when scanning, without limitation to amount of pre-registered patients, improves work efficiency.
- Indicator of background task

Exam Queue:

- Management and planning of scan queue for a complete examination
- Customization of protocols with archiving

Positioning:

- Visualize current image with geometrical references on the scout image
- Graphic positioning by using the mouse

Image Tools (On single image or complete series):

- Window width/level
- Zoom
- Pan
- Rotate
- Mirror
- Measurements
- Distances
- ROI (manual, rectangular, oval), size, media, standard deviation
- Annotation on images
- Comparison of multi-slices on one screen

Database Functions:

- Search (alphabetic, chronological, patient ID, Body part, Sex, Age, etc.)
- Sort
- Archiving and export functions for CD/DVD-ROM

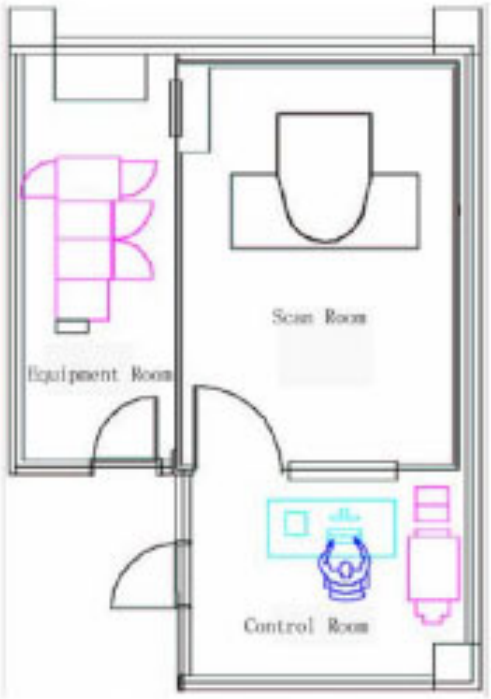
Archiving in CD/DVD: To enable the images archived in CD/DVD can be reviewed in any windows PC, 'ToViewer' – a smart image browser will be automatically burned into each disk

## System Siting Requirements

RF shielding solutions and site planning support is provided
Buyer accepts responsibility for all site modifications, permits and approvals.

Magnet room requires 24hr isolate Air Conditioning to stabilize the room temperature at 23 centi-degree with deviation of ±1 centi-degree per hour. Humidity: 40 – 60%.
Electronics room requires air-conditioning, room temperature: 15 - 20 centidegree with deviation less than 3 centidegree per hour. Humidity: 40 ~ 80%.
Air Conditioning Machines are to be provided by customer

- Magnet & table weight: 16000 kg.
- Electronics Cabinet Weight: 500 kg.
- Recommended Magnet Room Dimensions: 4m x 5m x 3m
- Recommended Room Space for electronics: 6 sqm
- RF Shielding: Required
- Power Requirement: 220VAC single phase, ±10%, 10 Amp Service
- Power Consumption: 15 KVA (Not including consumption of Air Conditioning Machine)
- Internet: A customer supplied and maintained dedicated high speed internet connection (ADSL or cable modem) is required for Remote Assistance.



## System Configuration

| Number | Description | | Quantity |
|---|---|---|---|
| | **HARDWARE** | | |
| 1 | C shape super open permanent magnet | | 1 |
| 2 | Magnet constant temperature system | | 1 |
| 3 | X、Y、Z gradient coil set | | 1 |
| 4 | Gradient amplifier modules for X, Y and Z axes<br>Gradient amplifier power module | | 1 |
| 5 | QD Flat transmitting coil | | 2 |
| 6 | RF power amplifier | | 1 |
| 7 | RF power splitter | | 1 |
| 8 | Two channel digital spectrometer | Network Communication Module(NCM) | 1 |
| | | Two Channel Data Acquisition Module (MC-DAM) | 1 |
| | | Digital Control Module(DCM) | 1 |
| | | Gradient Calculation Module(GCM) | 1 |
| | | Gradient Output Module(GOM) | 1 |
| | | RF Output Module(ROM) | 1 |
| | | Gain-Adjust RF Amplifier Module(GAAM) | 2 |
| | | Power Module | 1 |
| 9 | Receiving coil | Two channel phase array head coil | 1 |
| | | Two channel phase array neck coil | 1 |
| | | Two channel phase array knee coil | 1 |
| | | Two channel phase array body coil (Large) | 1 |
| | | Two channel phase array body coil (Medium) | 1 |
| | | Two channel phase array shoulder coil | 1 |
| | | Two channel phase array small joint coil (Wrist) | 1 |
| | | Pre amplifier | 2 |

| | | | |
|---|---|---|---|
| 10 | Workstation | CPU: Intel® Core™ ≥ 3.2GHz<br>Memory: ≥4GB<br>Hard disk: ≥500GB | 1 |
| | | DVD+/-RW | |
| | | USB Keyboard, USB optical mouse | |
| | | High performance graphic card | |
| | | Windows 7 Business | |
| 11 | TFT-LCD monitor ≥ 24 inch | | 1 |
| 12 | 10/100M Switch | | 1 |
| 13 | 15KVA UPS | | 1 |
| 14 | Electric cabinet | | 1 |
| 15 | Magnet cover | | 1 |
| 16 | Patient table | | 1 |
| 17 | Laser position system | | 1 |
| 18 | Dual-way communication system | | 1 |
| 19 | Patient cushion | | 1 |
| 20 | Operating table | | 1 |
| 21 | Receiving coils interface | | 1 |
| 22 | Phantom | Cube(Large) | 1 |
| | | Cube(Small) | 1 |
| | | Cylinder | 1 |
| | | Hemisphere(Optional with breast coil) | 1 |
| 23 | Supporting system | Filter panel | 1 |
| | | Filter set | 1 |
| | | Connecting cable set | 1 |
| | | Other auxiliary parts set | 1 |
| 24 | RF cage | | 1 |
| 25 | User manual | | 1 |

| SOFTWARE | | | |
|---|---|---|---|
| 1 | System software | Patient register software | 1 |
| | | Scanning control software | |
| | | Sequence management software | |
| | | Image reconstruction software | |
| | | Image viewing software | |
| | | Image processing software | |
| | | Image analyzing software | |
| | | Image format conversion software(BMP,JPG) | |
| | | Multi function image searching software | |
| | | Image DVD archive software | |
| | | DICOM 3.0 printing software | |
| | | System quality assurance software | |
| 2 | Pulse sequence | | |
| Spin Echo And Fast Spin Echo | Scout image with Spin Echo | | 1 |
| | T1 weighted image with Spin Echo | | |
| | Proton density weighted image with Spin Echo | | |
| | T2 weighted image with Fast Spin Echo | | |
| | Heave T2 weighted image with Fast Spin Echo | | |
| | Proton density weighted image with Fast Spin Echo | | |
| | 3D Spin echo | | |
| | 3D Fast Spin Echo | | |
| Inversion Recovery | Fat suppress with Inversion Recovery | | 1 |
| | Water suppress with Inversion Recovery | | |
| | Fat suppress with Fast Inversion Recovery(STIR) | | |
| | Water suppress with Fast Inversion Recovery(FLAIR) | | |
| | Heave T1 weighted image with Inversion Recovery | | |

| | | | |
|---|---|---|---|
| Gradient Echo | Scout image with Gradient Echo | | 1 |
| | T1 weighted image with Gradient Echo | | |
| | T2* weighted image with Gradient Echo | | |
| | Fast dephase Gradient Echo | | |
| | Fast rephase Gradient Echo | | |
| | Fast dephase Gradient Echo with breath hold | | |
| | 3D Fast dephase Gradient Echo | | |
| | 3D Fast rephase Gradient Echo | | |
| 3 | TOF for Angiography | 2D TOF | 1 |
| | | 3D TOF | 1 |
| | | MRCP | 1 |
| 4 | Water imaging | MRU | 1 |
| | | MRM | 1 |
| 5 | LSDWI | | 1 |
| 6 | MTC | | 1 |
| 7 | Movement compensation | | 1 |
| 8 | Flow compensation | | 1 |
| 9 | Multi slice multi angle imaging technology | | 1 |
| 10 | Track pre-saturation band | | 1 |
| 11 | Image filter software | | 1 |
| 12 | Advanced 3D MRI | MIP | 1 |
| | | MPR | 1 |
| 13 | DICOM 3.0 | DICOM Storage | 1 |
| | | DICOM Transfer ( to PACS ) | 1 |