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## HiSpeed FX/i

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### Introduction

The HiSpeed FX/i System supplies unsurpassed computer and image processing power that significantly enhances clinical productivity.

#### HiSpeed FX/i System includes :

- **70 cm** Gantry Aperture
- **Gantry tilt:** +/- 30 degree with Remote control from Operator console
- **HiLight Solid State Detector**
- **1024 Localizer** for easy scan location set up
- **0.8 second scan time** (360 degree acquisition)
- **1.6 second scan-to-scan cycle** for axial acquisition
- **120 seconds** single helical scan time
- **Solarix™ tube** with 3.5 MHU of heat storage
- Wide range of technique factors (**10 mA to 350 mA**, in 5 mA increments) gives operator and physician flexibility to tailor technique to specific needs, optimizing patient dose, and providing the power needed to perform a broad spectrum of axial and helical examinations.
- **Auto mA** : Dose(mA) management by slice based on X-ray attenuation.
- **CTDI** provides patient dose information to the operator.
- **SmartPrep\*** contrast monitoring software
- **SmartRecon** – “real time” imaging up to 6 frames per sec.

- **1.5 second reconstruction time** for prospective or retrospective image
- **100 baseT Ethernet** network interface for fast images communication inside and outside the Medical Imaging Department
- Truly **multi-tasking** environment where even advance image processing can take place quickly, simultaneously with other processes underway
- Completely **protocol-driven** scan control with a dramatic reduction in number of screens
- **Large on-screen** controls and attractive color palette provide comfortable viewing over extended periods
- Very high degree of **automation**, yet allow patient-specific changes to be easily made, with virtually no restrictions
- Highly **flexible** editing tools that allow easy tailoring of the exam to the patient
- Auto-Filming, AutoStore, Auto-Archive, Auto-Transfer
- Computer, image processor and image reconstruction hardware completely integrated in base of console – no separate computer cabinet to site
- Large, 1280 x 1240 color display
- **Real-time** image processing : MPR, MPVR (Standard)
- Color 3D\*, Navigator\*, Perfusion\* - powerful CT software packages available on Operator Console

### Scan Modes

Although the HiSpeed FX/i System can perform many clinical applications, scanning has been simplified to three basic modes

### Helical

- Multiple 360 degree scans with no Interscan delay
- Scan can be acquired with (helical) or without (cine mode) table increment

### Axial

- Single scans with the time between scans set by the user-selected interscan delay (ISD) or intergroup delay (IGD)
- Scans may be easily clustered in groups to allow multiple scans in a single breath hold
- Minimum ISD of 0.8 sec. with table moves of less than or equal to 10 mm

### Scout

- Single radiographic plane scan for localization
- Wide coverage up to 1000 mm anatomy

### Helical Scan Parameters:

- Helical acquisition might be set up with Gantry tilted and whatever Z-axis direction
- In Multi Helical Mode, HiSpeed FX/i allows to set up for each group of helical scan, same acquisition parameters (slice thickness, scan time, KV, mA, scan FOV) and same reconstruction parameters (Reconstruction FOV, reconstruction algorithm) OR different parameters for each group

### Scan Technique:

- Scan Thicknesses: 1, 2, 3, 5, 7 and 10 mm
- Scan Speed: Full 360° rotational scans in 0.8, 1, 1.5, 2, 3 sec.
- kVp: 80, 120, 140 kVp
- mA: 10 to 350 mA  
5 mA increments
- Power: 1.2 to 42 kW
- Focal Spot Selection:
  - Small spot for up to 24 kW
  - Larger spot for greater than 24 kW

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- Single Acquisition Max. Scan Time: 120 sec
- Maximum Helical length : 156 cm
- Helical Scan Pitch: Variable between **0.5:1 and 3:1**, in 0.1 increments. (2,3,5,7,10 mm slice thickness) For 1-mm slice thickness, pitch variable between 1:1 and 3:1, in 0.1 increments
- Minimum Inter-Group Delay (IGD): 5 sec between adjacent helical scans
- Scan Fields of View:  
18 cm for pediatric head  
25 cm for adult head  
25, 35, 50 cm for body

### Helical Scan Protocols

All protocols assume 120 kVp scans under typical clinical conditions.

### Single Helical Scans:

- Single Helical 120 kV/1 sec scan from cold start:

Maximum mA	Seconds of Scanning
150 mAs	120 Sec.
160 mAs	117 Sec.
200 mAs	81 Sec.
230 mAs	64 Sec.
250 mAs	56 Sec.
280 mAs	46 Sec.
300 mAs	39 Sec.
330 mAs	31 Sec.
350 mAs	26 Sec.

### Multiple Helical Scans:

Multiple Helical 120 kV/1 sec. scan from cold start

Scan Time	IGD	No. Groups	Max mA
10 sec	10 sec	4	300
		5	270
		6	240
		7	220
		8	200
15 sec	10 sec	10	180
		2	300
		3	280
		4	240
20 sec	10 sec	5	210
		6	180
		2	290
30 sec	10 sec	3	230
		4	190
		5	170
		2	230
		3	180
		4	150

### Auto mA (SmartTechnique)

- Dose(mA) management by slice based on X-ray attenuation. Improvement on signal-to-noise ratio
- Automatic change between low range & high range in one series
- Four modes of IQ, Normal, Low Dose, Max mA

### SmartHelical\*

- SmartHelical\* is a helical reconstruction algorithm that provide Image Quality as same level as scanned with up to 33% higher mAs

### Axial Scan Parameters:

#### Scan Technique:

- Partial Scan Time : 0.5 sec. (235 degree acquisition)
- Full scans (360 degree acquisition) : 0.8, 1, 1.5, 2, 3 sec
- kVp: 80, 120, 140kVp
- mA: 10 to 350 mA @ 120 kVp  
60 to 350 mA @ 80 kVp  
10 to 300 mA @ 140 kVp
- Power: 1.2 to 42 kW
- Scan Thickness : 1, 2, 3, 5, 7, and 10 mm

- Scan Fields of View:  
18 cm for pediatric head  
25 cm for adult head  
25, 35, 50 cm for body
- Scan Plane Geometry :  
+/- 30 degree angulation via gantry tilt, in 0.5 degree increments  
Longitudinal positioning from 0.5 mm in 0.5 mm increments
- Minimum InterScan Delay with table moves of 0 to 10 mm : 1 sec.

#### Scan Time Min ISD

0.8 sec.	0.8 sec.
1 sec.	1 sec.
1.5 sec.	1.5 sec.
2 sec.	1 sec.
3 sec.	1.5 sec.

- InterScan Delay (ISD) user selectable
- Scan To Scan Cycle : 1.6 sec. for 0.8 Scan Time
- Minimum InterGroup Delay (IGD) same as ISD and also user selectable

### Scout Scan Parameters:

- ScoutView scans provide excellent detail for anatomical localization
- Axial or helical scan locations may be prescribed explicitly (manual entry), or graphically (by mouse) from a Scout scan
- Prescription of axial or continuous scans with multiple gantry angles are also available on a single Scout

### Scan Technique:

- Scan Aperture: 1mm
- Scan Range: 50 mm to 1000 mm
- 1024 Localizer for easy scan location set up even for small anatomy

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- Table Speed: 75 mm/sec
- kVp: 80, 120, 140kVp
- mA: 10 to 350 mA @ 120 kVp  
 60 to 350 mA @ 80 kVp  
 10 to 300 mA @ 140 kVp
- Orientation: AP, RLAT, PA, LLAT (preset); or any angle from 0 – 355 degree in 5 degree increments (manually selected)
- Axial scan prescription lines indicate scan location to nearest 1 mm table position

### Image Reconstruction:

Minimum cycle time is 1.5 sec. ± 10% for prospective or retrospective image display to image display for 512 recon with any scan time and any display FOV in AutoView with concurrent filming and image archival.

1.5 second reconstruction time for prospective or retrospective images

Iterative Bone Option (IBO) add 1 sec. to minimum recon cycle time

Reconstruction Algorithms: Soft Tissue, Standard, Standard+, Detail, Chest, Bone, Edge and Performance

Edge and Performance are not available for partial scans or segmented recons

Reconstruction Matrix: 512 x 512

Display Matrix: 512 x 512 (up to 4 images), 768 x 768 (1 image), 1024 x 1024 (1 image).

Display FOV: 48 to 500 mm, 1mm increment

Minimum Pixel Size: 0.10 mm for 50 mm DFOV @ 512 x 512 matrix

Freely variable center/off-center, prospective/retrospective target selection.

Number Range: -32767 to 32767

**Segmented Recon** : Up to six images from single 360 degree scan rotation CT

**Queued Recon** : Requests will be processed continuously and

simultaneously with other processes on the system including scanning. Prospective recon will be prioritized over retrospective recon

**Priority Recon** : One click selection from scan screen marks most recent rotation for next available recon. Available during, or after scanning

**Prospective Multiple Reconstruction (PMR): Up to 3 sets of reconstructions can be pre-programmed as part of the scan protocol prior to acquisition.** The operator can select different reconstruction algorithms and display fields of view for each reconstruction. This frees the operator from sitting at the console and directly contributes to increased productivity.

Helical Prospective or Retrospective Recon at any table location in increments of 1/10 cradle interval or at any or at any temporal location with minimum increment of 1/10 x scan time for cine scans (stationary cradle)s.

Reconstruction across the boundary between multiple helical scans is not available. Prospective overlapping prescription effectively achieves contiguous reconstruction across boundaries.

**SmartAddition** : Image addition is prospectively and retrospectively available in axial and helical.

### Image Quality:

#### High-Contrast Spatial Resolution – visual

Scan Technique: 120 kVp, **200 mAs**, 2 mm thickness, 25 cm body scan FOV, 10 cm display FOV, 512 recon, standard algorithm

Standard

- 0.64 mm limiting resolution
- 2.8 lp/cm @ 50% MTF
- 5.6 lp/cm @ 10% MTF
- 6.5 lp/cm @ 5% MTF
- 9.5 lp/cm @ 0% MTF

Hi-Res (Performance Algorithm):

- 0.38 mm limiting resolution

- 8.5 lp/cm @ 50% MTF
- 13.0 lp/cm @ 10% MTF
- 15.0 lp/cm @ 0% MTF

Measurement Basis: Limiting resolution is demonstrated on GE Performance Phantom.

#### High Contrast Resolution - statistical

15.0 lp/cm @ 0% MTF @ 60mAs (Radcal dose meter)

#### Low Contrast Detectability - visual

3.0 mm @ 0.3 % contrast @ 30 mGy (3 Rad)

Scan Technique:

120 kVp, **230 mAs** as measured on 20 cm CATPHAN phantom with 25 cm FOV, Standard Algorithm 512 recon matrix, axial and helical scanning, Radcal 9015 & 9060.

#### Low Contrast Detectability – statistical

5.0 mm @ 0.3 % contrast @ 9 mGy (0.9 Rad)

Scan Technique:

120 kVp, **80 mAs** as measured on 20 cm CATPHAN phantom with 25 cm FOV, Standard Algorithm 512 recon matrix, axial and helical scanning, Radcal 9015 & 9060.

#### Noise

**0.26%** at less than or equal to 24.1 mGy (2.41 Rad)

Scan Technique:

120 kVp, 230 mAs, 10 mm aperture, 25 cm body scan FOV, 25 cm display FOV, 512 recon, standard algorithm.

Measurement Basis: Noise is demonstrated on 8.5 inch water phantom. Dose is measured on top surface of the phantom using a pencil probe with a 10 cm chamber length (+/- 15% tolerance) & Radcal 9015 & 9060

#### CTDI Dose

Scan techniques for all CTDI dose expressed in mGy (Rad)/100mAs

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Head 14.7 mGy (1.47 Rad)/100 mAs

Body 4.6 mGy (0.46 Rad)/100 mAs

### Surface

Head 14.2 mGy (1.42 Rad)/100 mAs

Body 7.4 mGy (0.74 Rad)/100 mAs

Measurement Basis: Dose is demonstrated with CTDI methodology in compliance with Federal Regulation 21 CFR 1020.33(c)



### Operator Console:

The HiSpeed FX/i CT Scanner System Operator Console includes:

- Silicon Graphics, Inc.™ O2 Workstation
- GE-Proprietary Image Generator
- Analog or Digital Filming Interface\*
- 2.3 GB MOD drive
- CD-ROM drive
- Color Monitor or LCD Monitor\*
- Scan control keyboard assembly with intercom speaker, microphone and volume controls
- Three button mouse with mouse pad
- DICOM Print

The HiSpeed FX/i CT Scanner System computer, image processor, peripherals, image reconstruction hardware, and camera interface are completely integrated into the base of the console for ease in siting and comfortable operator access to image archive drives.

### Desktop Overview

The user interface utilizes the paradigm of managed work environments for a more intuitive clinical workflow.

Virtually all clinical operations are managed through three “virtual desktops” or applications managers - Scan Desktop, Display Desktop and Image Works . Operators can effortlessly move back and forth between these environments simply by clicking on an icon. An enhanced multi-tasking architecture maintains all processes so no work is lost or disrupted as desktops are switched.

### Scan Desktop

The scan desktop environment provides the clinical tools necessary for comfortable, efficient control of patient studies.

#### Patient Scheduling:

Patient demographics and exam protocols can be pre-programmed in advance of patient arrival. This productivity enhancement allows entry of all or some of a patient’s demographic data, as well as pre-selection of the exam protocol.

This feature uses the same interface as New Patient selection for simplified, consistent programming.

Pre-programmed patient exams can be recalled from the New Patient screen automatically by entering the patient ID number.

#### Patient Data Entry:

Patient data can be entered as part of New Patient set-up, or can be recalled from the list of pre-scheduled patients.

Trauma Patient ID allows patient scans and image display/analysis without entering patient data before scanning.

#### Exam Protocol Selection:

One of the main contributions of the HiSpeed FX/i CT Scanner System to department productivity is its simplified exam set-up.

- Exam parameter set-up has been greatly simplified through the exclusive use of protocols
- Protocols can be easily selected in one of three convenient ways:

- A large, graphical Anatomical Programmer located on the Patient screen
- A default list of the “top 10” most commonly used protocols located near the anatomical programmer
- A numerical entry
- Two Anatomical Programmers - one for adults and one for pediatrics - provide quick and easy access to **300 user-programmable protocols** (total). Each programmer has ten anatomical regions with 15 protocols for each region

Each Protocol includes :

- Acquisition Mode
- Gantry Tilt with or without adjustment on 1024 Localizer.
- KV, mA, Scan Time
- Acquisition slice Thickness
- Slice Locations with or without adjustment on 1024 Localizer.
- Inter scan Delay, Inter Group Delay.
- Scan field-of-view.
- Display field-of-view and center with or without adjustment on 1024 Localizer.
- Recon types
- Breath timing parameters
- AutoVoice
- Prospective Multiple Reconstruction (PMR): Up to 3 sets of reconstructions can be pre-programmed as part of the scan protocol prior to acquisition. The operator can select different Retro Recon Slice Thickness, Retro Recon Slice Location, reconstruction algorithms and display fields of view for each reconstruction.
- AutoFilm with pre-selection of two different window / level settings per image for AutoFilm
- AutoStore
- AutoTransfer

Any scan parameter can be edited for each scan or all scans either before or during an

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exam. Scans can be easily added or removed from the prescription

### Protocol View/Edit:

- A single, full screen View/Edit table allows fast and easy examination and modification of exam parameters before scanning begins
- Exam parameters can be changed for just one scan, or for all scans in a series
- When used in conjunction with the 1024 Localizer, changes made in the View/Edit table that affect the number of scans, image interval, starting/ending locations, tilt, or display FOV are automatically shown on the 1024 Localizer
- Any changes made directly on the 1024 Localizer display using the mouse and the on-screen cursor controls are also reflected automatically in the View/Edit table
- View/Edit Wizard intuitively adjusts dependent parameters automatically in response to operator-initiated changes and highlights them for quick review; also alerts the operator to incompatible dependencies requiring operator intervention
- Tab card groupings for Timing, Recon and Filming help organize the large number of parameters available within each protocol

### Scan Data Acquisition:

- Full screen DynaPlan Plus display illustrates scan status graphically, with real-time feedback while the exam is underway. Scans, programmed delays (prep, breathing, inter-group), and even AutoVoice announcements are clearly shown before and during scanning.
- AutoScan: Fully automates longitudinal table movement and the start of each scan
- AutoVoice: Preset (English) and user-recorded messages automatically deliver patient breathing instructions; especially useful for multiple or multi-pass helical scans

**Full Simultaneity** allows scan and recon to work concurrently with image display, processing and analysis (including computationally intensive features like MPR, MPVR and 3D\*/MIP) while still running image archival, filming, and networking processes

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### Dose Computation & Display

CTDI<sub>w</sub> (Weighted CTDI<sub>100</sub>) provides patient dose information to the operator.

CTDI<sub>w</sub> is a dose index defined by IEC 601-2-44 CDV. This index is computed automatically by the LightSpeed Advantage CT Scanner System and reported on the Exam Rx screen. CTDI<sub>w</sub> is a single number that consists of 2/3 of the CTDI<sub>100</sub> peripheral dose plus 1/3 of the CTDI<sub>100</sub> central dose.

CTDI<sub>100</sub> is a dose index based upon CTDI dose measurements over a 100mm volume, as defined in IEC 601-2-44 CDV.

### AutoView Layouts:

- AutoView Layouts provide exceptional flexibility in tailoring the 1024 image display to the user or the application at hand.
- AutoView Layouts include:
  - 1024 AutoView image
  - 768 AutoView image
  - 512 AutoView image + 512 Localizer Scout with cut lines automatically showing the location of the AutoView image on the Scout
  - Two 512 AutoView images (same image but at different window/level settings) + 512 Localizer Scout with cut lines automatically showing the location of the AutoView images on the Scout
  - 512 AutoView image + 512 AutoFilm image
  - Last two 512 AutoView images
  - Last four 512 AutoView images
  - AutoLink which links the current series to a view port
  - Basic image review features like window/level, magnification and flip/rotate are available for AutoView images
- Any 512 windows not used for AutoView are available to independent, simultaneous review of other exams

### Image Review Layouts:

- Image Review Layouts include:
  - 1024 single image display
  - 768 single image display
  - Two 512 image display, horizontal format
  - Two 512 image display, vertical format
  - Four 512 image display

- Each image display window can be further subdivided into four more images, increasing to 16 the total number of images that can be displayed at once

### Image Access:

- Point and click interface along with a pictorial directory (browser) allows for easy selection by exam, series or image

### Routine Image Display:

- Image display features provided within Exam Rx:
  - Zoom / Roam
  - Explicit Magnify
  - Flip / Rotate
  - ProView
  - Display Normal
  - List / Select
  - Ellipse ROI
  - Measure Distance
  - Grid On / Off
  - Cross Reference
  - User Annotation
  - Exam / Series Page
  - Hide Graphics
  - Erase
  - Screen Save
  - Gray Scale Enhancement
- ProView visualization algorithms are available to enhance anatomical structures without additional reconstruction time:
  - 6 Selections for enhancement of high contrast objects where fine detail is required
  - 5 Selections for modifying perceived levels of noise and low contrast discrimination
  - 3 Selections for lung
- Three ways are provided to adjust window and level of images :
  - 6 user-programmable keys on the scan control keyboard (F6 - F11), plus one key for returning to prior setting (F5)
  - On-image through middle mouse button
  - Type in accelerator bar

### Routine Measurements:

- Image measurement features provided within Exam Rx:
  - Box ROI
  - Ellipse ROI



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- Trace ROI
- Measure Distance
- Measure Angle
- Grid On / Off
- Hide Graphics
- Erase
- Screen Save

### Display Preferences:

- A set of 8 Display settings are available to tailor the overall display (settings apply to all images in all exams):
  - Annotation Levels
  - Maintain User Annotation
  - Auto Minify
  - Auto Enlarge
  - Inverse Video
  - Next / Prior Each View Port
  - Next / Prior Series Binding
  - Continuous Report Cursor

### Auto Image Management:

The Exam Rx work environment conveniently provides for selection of AutoFilm, AutoStore (to local MOD), and AutoTransfer (across a network).

An AutoFilm Composer provides a simple programming interface for automated filming set-up.

Batch Filming is accomplished through a single keystroke that automatically prints an entire series at a time

### Manual Image Filming:

- On-screen filming is available for any analog or digital camera using a 3M-952 protocol
- Images may be individually filmed manually via "drag and drop" to the on-screen Film Composer
- Print Series permits automatic printing of an entire series with one keystroke
- Page filming permits creation of an entire film with one keystroke
- Multiple Image formatting allows filming of multiple images in a single film frame
- Film Formats supported are 1:1, 2:1, 4:1, 6:1, 8:1, 9:1, 12:1, 15:1, 16:1, 20:1, 24:1 and 35-mm slide (available film formats made be limited by the laser camera)

**Important note: Filming requires a filming interface. DICOM print is included standard with HiSpeed FX/i.**

**Analog or digital filming interfaces are also available (purchased separately).**

### ImageWorks

This desktop environment includes image management and networking.

Because some of the image analysis and display features of ImageWorks replicate those in Exam Rx, the next section describes only features that are incremental or significantly different.

### Image Analysis:

#### Multi-Projection Volume

**Reconstruction (MPVR)** is a selective volume's projection on a cut plan. This technique allows to create oblique slices with variable thickness and orientation, and select a volume of interest. This volume can be treated by 3 algorithms. MPVR is a 3D technique study which preserves the entire acquisition densities. It allows however the visualization from the same oblique with 3 possibilities of densities reinforcement.

- MIP - enhances contrast and improves visualization of calcifications
- Average - generates 2D radiographic images
- MinIP - enhances low contrast

- **Multi-planar Reformation (MPR):** Provides real-time assessment of anatomy in off-axis planes. Sagittal, coronal, oblique and curved planar reformations available.

- **Batch reformatting** can also be defined and executed for later viewing if desired.

- **Image Addition and Subtraction:** Includes image addition of more than two images at a time

- **Comparison mode** allows display of two series simultaneously

### Image Display:

- Image Scroll moves an image within its' own window
- Groupings allow application of window / level values, magnification / minification, image scroll or flip and rotate to a user-defined image set
- Save State stores user-selected image orientation and window / level with each data set
- Window / level values may be:

- Preset to provide six on-screen instant window / level settings
- Set independently for up to 16 images on the screen
- User-modified in discrete or variable steps
- Adjusted real-time on-image by holding down the middle mouse button and moving the mouse

- Cine mode provides paging in up to 1 or 2 windows of up to 128 previously-stored CT or MR images at full selected display frame rate. For more than 128 images, display frame rate may be reduced.

- Cine mode also provides temporal, spatial or manual playback loops

- Text Page of exam and / or series information is available

### Image Management:

- Images may be stored and retrieved via Magnetic Optical Drive (MOD) media using DICOM 3.0 format. This allows interchange with other imaging systems supporting DICOM 3.0 MOD media. Not all vendors' implementations of DICOM 3.0 are identical, so please check with the manufacturer for compatibility.
- Off-line retrieval of all image files. Images may be viewed as soon as they are restored from MOD.
- Images may be retrieved via Pioneer Magnetic Optical Drive\* (MOD) media from any imaging system supporting the proprietary Genesis format or GEYMS format.(Read only).

### Image Networking:

- Exams can be selected and moved from Signa Advantage, CT Advantage, Advantage IC, Advantage Windows systems to the HiSpeed FX/i CT Scanner System operator console via the AdvantageNet (GenesisNet) point-to-point protocol. This protocol supports send, receive and pull/query (no broadcast).
- Exams can also be selected and moved between the HiSpeed FX/i CT Scanner System and any imaging system supporting the DICOM 3.0 protocol for network send, receive and pull/query.

### Industry Standards

The HiSpeed FX/i CT Scanner System complies with a wide variety of industry standards to facilitate more rapid

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adoption of features and performance improvements as the computing and medical imaging industry evolves.

Computer Industry Standards for Workstation Class Products:

- POSIX (1003.1, 1003.2, 1003.4)
- X-Windows (X11/R5)
- Motif (1.2)
- ANSI C
- ANSI Draft Standard C++

## DICOM Conformance Standards:

- DICOM 3.0 Storage Service Class
  - Service Class User (SCU) for image send
  - Service Class Provider (SCP) for image receive
  - Service Class User (SCU) for Storage Commitment Class
- DICOM 3.0 Query / Retrieve Service Class
- DICOM 3.0 MOD Media Service Class on 1.2- and 2.3-GB MOD media
- DICOM 3.0 Storage Commitment Class Push
- DICOM 3.0 Modality Worklist (option)
- DICOM Print

## German Dose Standard

DIN 6868-53

## Filming Protocol

3M-952 Standard



## System Components

### Gantry:

Advanced slip ring design continuously rotates generator, tube, detector and data acquisition system around the patient.

- Aperture: 70 cm
- Tilt:  $\pm 30^\circ$
- Tilt Speed: 1  $^\circ$ /sec.
- Focus to Detector: 949 mm
- Focus to Isocenter: 541 mm
- Maximum SFOV: 50 cm
- Rotational Speeds: 360 $^\circ$  in 0.8, 1.0, 1.5, 2.0 and 3.0 sec.

Scan plane towards front of gantry for improved positioning access.

Biopsy and interventional studies have been facilitated through a more streamlined gantry shroud, and bilateral table/gantry controls and gantry display that maximize maneuverability while working next to the gantry.

Laser Alignment Lights:

- Define both internal and external scan planes.
- Operate over full range of gantry tilt; activated any time during exam (with tube stationary).

- Coronal light remains perpendicular to axial light as gantry tilts.

Stand alone visual readout

Gantry tilt controls are located on the side of the gantry.



### Gantry Tilt Remote

Tilt control from the operation console

- Front table/gantry controller
- Front touch sensor\*

The front touch sensor option must be used in case that it is hard to see the front gantry cover from the operator console for safety.

### Rear table/gantry controller\*

### Breathing Light:

Show breathing & breath-hold timing and the remaining time for young children, senior citizens and hearing-impaired patients

### Table:

- Single table, cantilever design with wide height range
- Vertical Range: 40 cm to 95 cm cradle height from floor)
- Vertical Range inside Gantry: 81 cm to 95 cm
- Cradle Width: 42 cm
- Vertical Elevation Speed : 18.3mm/ sec. average (30 sec. from Bottom to Top)

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- Horizontal Scannable Range:
    - 160cm for Axial mode
    - 156cm for Helical mode
    - 100cm for Scout mode
    - Metal-free at 15cm below ISO center with Extender
  - Horizontal Speed: Slow 20 mm/sec. or Fast 100 mm/sec
  - Table automatically recenters on scan plane with changes in vertical position (after setting internal landmark with alignment lights on)
  - Table Load Capacity:
    - 205 kg (450 lb) maximum allowed with normal operation with +/- 1 mm positional accuracy
    - 180 kg (400 lb) with +/- 0.25 mm positional accuracy.
  - Controls on gantry for elevation and cradle incrementation. Foot pedals on both sides of table for fast elevation. Cradle position controlled from OC for prescribed scans.
  - Coronal Head Holder
- X-Ray Tube:**
- Design optimized for exams requiring a large number of scans without tube cooling.
- Heat Storage Capacity: 3.5 MHU
  - Heat Dissipation:
    - Anode (max) 820 KHU/min
    - Casing (cont) 300 KHU/min
  - On-board oil-to-air heat exchanger
  - Dual Focal Spots: 0.5 mm x 0.7 mm and 1.0 mm x 1.0 mm Focal spot size is dependent on slice thickness and mA
  - Maximum Power: 1.2 to 30 kW
  - Beam collimated to 57.6° fan angle.
- High Voltage Generation**
- High-frequency on-board generator. Continuous operation during scans.
  - Output power: 1.2 to 42kW
  - kVp: 80, 120, 140 kVp.
  - mA: 10 to 350 mA, 5 mA increments
- Maximum mA for each kVp selection:
- 60 to 350 mA @ 80 kVp
  - 10 to 350 mA @ 120 kVp
  - 10 to 300 mA @ 140 kVp
- HiLight Detector:**
- 816 elements (793 active patient elements; 23 reference elements)
  - 1.15 mm detector element spacing
  - 972 views/second
  - 1215 views/sec. with 0.8 sec. scan
  - Effective low noise analog to digital conversion range greater than one million to one
- Operator Console:**
- Size: 1100 mm (wide) x 860 mm (deep) x 830 mm high (without CRT or Keyboard)
- Host Computer:**
- Silicon Graphics, Inc. O2 Workstation
  - 64-bit CPU
  - RISC architecture
  - 512 MB RAM
- Image Reconstruction Engine:**
- Custom-designed special purpose CT Image Reconstruction Engine (RE 1344 MFLOPS geometry engine)
  - 32-bit floating point data format
- Peripherals:**
- Standard system (host) disk drive:
    - High Performance Drive
    - 18 GB, 3.5 inch form factor
    - Stores 20000 uncompressed 512 images files; can be expanded through second disc drive
  - Standard scan data disk drive:
    - High Performance Drive
    - 9 GB, 3.5 inch form factor
    - Assigned to 3000 scan data files and calibration files
  - Standard MOD drive:
    - Magnetic Optical Disk Drive
    - Erasable, rewritable media
    - 2.3 GB, 5.25 inch form factor
    - Assigned to DICOM 3.0 format image file,
    - Stores no less than 6000 JPEG compressed 512x512 image files per side
    - Stores 300 uncompressed scan data files per side
- Off-line retrieval of image and scan files. Images may be viewed as soon as they are restored from MOD
  - Secondary MOD drive\*: (Read Only)
    - Pioneer 9101 Magnetic Optical Disk Drive
    - Integrated in front of operator console for easy access
    - Erasable, rewritable media
    - 0.654 GB, 5.25 inch form factor
    - Assigned to proprietary Genesis format image file storage/retrieval
    - Also reads CT and MR Advantage system MOD's and Advantage Windows MOD's
    - Stores 1100 compressed 512x512 image files per side
    - Off-line retrieval of image and scan files. Images may be viewed as soon as they are restored from MOD
  - CD-ROM drive:
    - Integrated in front of operator console for easy access
    - More than 8X rotational mode
    - 0.65 GB, 5.25 inch half height form factor
  - CRT color monitor:
    - 21 inch diagonal width
    - 1280 x 1024 dot resolution
    - Non-interlaced, flicker-free presentation
  - Scan control keyboard assembly with intercom speaker, microphone and volume controls; English language keyboard
  - 3-Button Mouse
- Image Networking:**
- Standard auto-configuring 100BaseT/10BaseT Ethernet
  - Direct network connection; multi-suite Ethernet card not required for gateway out of suite
  - Protocols supported:
    - DICOM 3.0 network send (one IP address at a time) & receive, pull/query
    - AdvantageNet (GenesisNet) point-to-point send, receive and pull/query (no broadcast)
    - InSite point-to-point
    - TCP/IP (for system administration)





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## HiSpeed FX/i

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### Accessories:

Operator manual, Wrist strap, Bony strap, Mouse pad, Cradle pad, Knee pad, Knee pad strap, GE QA phantom, Arm board, Cradle extender, Water phantom, 42 cm phantom, Axial head holder, coronal head holder, phantom holder, Chair, Service tool set, etc.

### Compatible Options

- Analog/VDB Camera Interface (B77402AA)
- Digital/LCAM Camera Interface (B76222GE)
- SmartHelical (B76042SE)
- Rear Side Controller (B76012GE)
- 3D/MIP Analysis Package (B76072SE)
- Navigator (B76092SE)
- SmartPrep (B76022SE)
- DentaScan (B76132SE)
- Slave Monitor (B76192GE)
- Front Touch Sensor (B76042KE)
- Second MOD (Pioneer read only) (B76312GE)
- Intercom Foot Switch (76332GE)
- ConnectPro (B76262GE)
- Flat table top for RTP (B76272GE)
- SmartView: LCD:  
B76542GE / CRT: B76552GE  
Requires: Rear side controller (B76012GE)
- Perfusion for R5200 (B79082AA)
- CRT Monitor (B78622AA) or LCD Monitor (B78632AA)
- Gantry Interface for CACS (B75352AA)
- i-Center

### For IB

- SmartPrep (B76022SE) : Requires 4 to 2 sec. Recon (B76142GE).

- SmartView: LCD:  
B76542GE / CRT: B76552GE  
Requires: 2sec recon(B76142GE), SmartRecon(B76032SE), 0.8 sec scan(B76092GE), 512MB Memory opt.(B76992GE), Image disk:more than 4GB(B77712AA, B79142AA), Rear side controller(B76012GE)
- Perfusion for R5200 (B79082AA) : Requires presence of 512MB memory (B76992GE).
- Perfusion for R5000 (B79092AA) : Requires presence of 512MB memory (B76992GE).
- Gantry Interface for CACS (B75352AA) : Requires 0.8sec scan opt.(B76092GE).

### e-FlexTrial:

- Download probational software options through Internet for trial before expiration. After that, may contact local GE representatives for formal version software purchasing
- Available options for E-Flextrial:  
3D/MIP  
Navigator  
SmartHelical  
Perfusion  
For IB  
Fast Scan 0.8 sec.  
Extended helical 120 sec.  
SmartAddition

### Siting Requirements

Minimum Suite Size: 18 m<sup>2</sup>

System Components	Dimensions	
	mm	inches
Gantry:	Width:	1820 71.7
	Depth:	911 35.8
	Height:	1850 72.8
	Weight:	1090 kg
Table:	Width:	650 25.6
	Depth:	2240 88.2
	Height:	995 39.2
	Weight:	295 kg

Power Distribution Unit:

	Width:	550 21.7
	Depth:	700 27.6
	Height:	820 32.3
	Weight:	157 kg
Operator Console:	Width:	1100 43.3
	Depth:	860 33.8
	Height:	830 32.7
	Weight:	170 kg

### Temperature and Humidity:

Scan Room: 20 to 28 degree C (68 to 82 degree F) at 30%–70% RH (non-condensing).  
Operation Room: 15 to 30 degree C (59 to 86 degree F) at 20%–80% RH (non-condensing).

### Power Requirements:

The only facility input to the system is a 380/400/415/440/460/480 V nominal, 3 phase Delta or Wye, 50/60 Hz, 65 kVA service, 23 kVA average power. The facility must also provide a protective disconnect device with low voltage, Tow energy local and multi-point remote capability, in the line feeders to the PDU. Complete, detailed specifications of all power requirements are available upon request. For many installations, the HiSpeed FX/i System does not require any power conditioning equipment to be used in conjunction with the PDU. Regulators are not recommended for use with this system. For those sites with known large power line transients, a suppressor filter for the system computer and peripherals may be useful. In general, suppressor filters are not recommended. There is no longer a power strip within the operator console for ancillary devices. These devices must now be powered from facility supplies. Power/ground is available for GE-supplied peripheral options (e.g. VCR, remote monitor, video printer, line printer).

### Cooling Requirements:

The cooling requirements do not include cooling for the room lighting, personnel or non-CT equipment present. Cooling requirements are listed by subsystem to allow planning for each room of the CT suite.

Cooling requirements are given for minimum, recommended, and growth allowance scenarios.



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The minimum cooling figures assume patient throughput of six patients per hour and 40 scan rotations per patient at 250 mAs.

The recommended cooling requirements assume patient throughput limited by the tube-cooling algorithm.

The suite cooling can be sized for future developments by using the growth allowance figures. This cooling will accommodate more patients per hour and/or potential future system enhancements.

<b>Subsystem</b>	<b>Growth Allowance (Watts / BTU/hr)</b>	
Gantry	3868	/ 13241
Table	100	/ 318
PDU	180	/ 616
Operator Console	860	/ 2900

<b>Subsystem</b>	<b>Growth Allowance (kW)</b>	
Gantry	5000	
Table	100	
PDU	180	
Operator Console	860	

Recommended cooling values should not be used for calculating system input power requirements.

## Warranty

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

**All specifications subject to change**

## Regulatory Compliance

This product was designed to comply with applicable standards under the Radiation Control for Health and Safety Act of 1968

Laser alignment devices contained within this product are appropriately labeled according to the requirements of the Center for Devices and Radiological Health.

\* Option