Philips Medical Systems
DICOM Conformance Statement

Gyroscan Intera
R 7.5.1, R 8.1 and R 9.1

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1 Introduction

This section provides general information about the scope, intended audience and contents of this Conformance Statement and how to use it.

1.1 Scope and field of application

The scope of this DICOM Conformance Statement is to facilitate data exchange between equipment of Philips Medical Systems and with equipment of other vendors. This document specifies the compliance to the DICOM standard, formally called the NEMA PS 3.X standards. It contains a short description of the applications involved and provides technical information about the data exchange capabilities of the equipment. The main elements describing these capabilities are: the supported DICOM Service Object Pair (SOP) Classes, Roles, Information Object Definitions (IOD), Service Elements and Transfer Syntaxes.

The field of application is the integration of the Philips Medical Systems equipment into an environment of medical devices.
This Conformance Statement should be read in conjunction with the DICOM standard and its addenda.

1.2 Intended audience

This Conformance Statement is intended for:
• (potential) clients,
• marketing staff interested in data exchange functionality,
• system integrators and Customer Support Engineers of medical equipment,
• software engineers implementing DICOM interfaces.

It is assumed that the reader is familiar with the DICOM standard.

1.3 Contents and structure

The DICOM Conformance Statement is contained in section 2 through 7 and follows the contents and structuring requirements of DICOM PS 3.2.

1.4 Used definitions, terms and abbreviations

DICOM definitions, terms and abbreviations are used throughout this Conformance Statement. For a description of these, see NEMA PS 3.3.
The word Philips in this document refers to Philips Medical Systems.

1.5 References

[DICOM]   The Digital Imaging and Communications in Medicine (DICOM) standard:
            NEMA PS 3.X (X refers to the part 1 - 13)
            National Electrical Manufacturers Association (NEMA) Publication Sales
            1300 N. 17th Street, Suite 1847
            Rosslyn, Va. 22209, United States of America

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1.6 Important note to the reader

This Conformance Statement by itself does not guarantee successful interoperability of Philips equipment with non-Philips equipment. The user (or user's agent) should be aware of the following issues:

- **Interoperability**
  Interoperability refers to the ability of application functions, distributed over two or more systems, to work successfully together. The integration of medical devices into a networked environment may require application functions that are not specified within the scope of DICOM. Consequently, using only the information provided by this Conformance Statement does not guarantee interoperability. It is the user's responsibility to analyse thoroughly the application requirements and to specify a solution that integrates Philips equipment with non-Philips equipment.

- **Validation**
  Philips equipment has been carefully tested to assure that the actual implementation of the DICOM interface corresponds with this Conformance Statement.
  Where Philips equipment is linked to non-Philips equipment, the first step is to compare the relevant Conformance Statements. If the Conformance Statements indicate that successful information exchange should be possible, additional validation tests will be necessary to ensure the functionality, performance, accuracy and stability of image and image related data. It is the responsibility of the user (or user's agent) to specify the appropriate test suite and to carry out the additional validation tests.

- **New versions of the DICOM Standard**
  The DICOM Standard will evolve in future to meet the user's growing requirements and to incorporate new features and technologies. Philips is actively involved in this evolution and plans to adapt its equipment to future versions of the DICOM Standard. In order to do so, Philips reserves the right to make changes to its products or to discontinue its delivery.
  The user should ensure that any non-Philips provider linking to Philips equipment, also adapts to future versions of the DICOM Standard. If not, the incorporation of DICOM enhancements into Philips equipment may lead to loss of connectivity (in case of networking) and incompatibility (in case of media).

1.7 General Acronyms and Abbreviations.

The following acronyms and abbreviations are used in the document.

- AE   Application Entity
- ANSI   American National Standard Institute
- DICOM   Digital Imaging and Communication in Medicine
- DIMSE   DICOM Message Service Element
- ELE   Explicit VR Little Endian
- EBE   Explicit VR Big Endian
- HIS   Hospital Information System
- HL7   Health Level Seven
- ILE   Implicit VR Little Endian
- IOD   Information Object Definition
- NEMA   National Electrical Manufacturers Association
- PDU   Protocol Data Unit
- RIS   Radiology Information System
- SCP   Service Class Provider
- SCU   Service Class User
- SOP   Service Object Pair
- TCP/IP   Transmission Control Protocol/Internet protocol
- UID   Unique Identifier
- WLM   Worklist Management

2 Implementation model

The Gyroscan Intera (Gyroscan) system of Philips Medical Systems is an MR image generating system.

The system contains:
- a DICOM Radiology Information System (RIS) interface to retrieve the worklist of patients to be examined.
- a DICOM Image Import function to receive DICOM MR images and image related data (originating from the same or other Gyroscan systems) from a remote DICOM node.
- a DICOM Image Export function to transfer DICOM MR images and image related data from the Gyroscan Intera to a remote system.
- a DICOM Image Print function to print MR images on a DICOM Network printer.

These DICOM functions are described in this document.

2.1 Application Data Flow Diagram

Gyroscan Intera is a system with four Application Entities (AE). The related Implementation Model is shown in Figure 2-1 on page 9

The Gyroscan Intera DICOM Modality Worklist function requests the worklist from a DICOM Information System like a RIS. The function is initiated on the Gyroscan by the user selection of the "Next patient from RIS" function key.

The Gyroscan Image Import function can be activated on request of a remote system.
Imported images are to be used for reference only; when these are exported afterwards again no guarantee for consistency or completeness can be given.

The Gyroscan operator can activate the DICOM Image Export function.
The images to be sent are selected from one or more examinations. At export the images will be sent to a user selected remote destination. The images transferred are intended for viewing purposes; planscan information can be calculated from reference images. Graphics and annotations are not included. Post-processing like MPR, MIP, 3D reconstruction and rendering are possible, depending on the capabilities of the workstation receiving the MR images; for more detailed interpretation a large amount of information is stored in private elements.

The Gyroscan DICOM Print function allows the Gyroscan operator to sent/print images on a DICOM network printer.
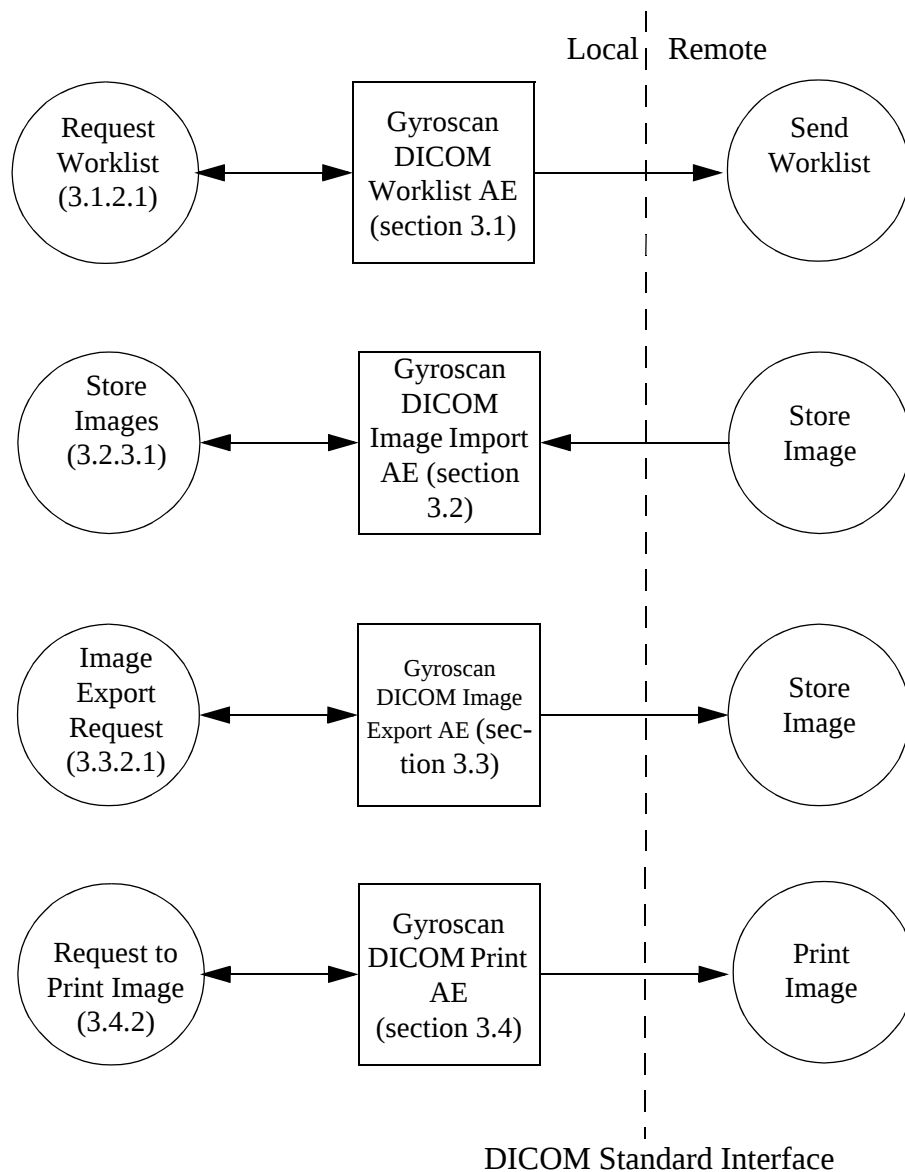
Figure 2-1: The Gyroscan DICOM Implementation Model

2.2 Functional definition of Application Entities

The Gyroscan DICOM Worklist AE acts as a Service Class User (SCU) of the Basic Worklist Management Service Class. It will subsequently request the Worklist of "Today" and "Tomorrow", it will receive the data from the configured RIS and display some of the received data on the user interface and store all data with the images resulting from the subsequent examinations.

The Gyroscan DICOM Image Import AE acts as a Service Class Provider (SCP): the Gyroscan will respond to a remote request and store the images in the patient database.

The Gyroscan DICOM Image Export AE acts as a Service Class User (SCU) of the Storage Service Class. The selected images and related image data are converted into a DICOM message to be sent to the remote system.

The DICOM images will contain additional private elements, which have to be discarded by another DICOM system when modifying the images. These DICOM nodes are then responsible for data consistency.

The Gyroscan DICOM Print AE acts as a Service Class User (SCU) of the Basic Grayscale Print Management Meta SOP Class. After selecting the images these can be sent to a DICOM network printer.

2.3 Sequences of Real World Activities
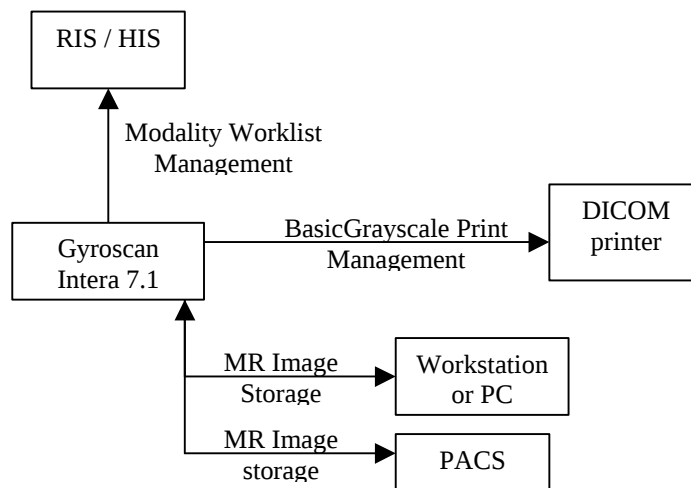
Table 2-1: The Gyroscan Intera 8.1 in a DICOM network

When a RIS interface is configured, the worklist data can be requested from the RIS. After import of the data, the user can add missing data.

Before or after this action a remote system can (be instructed to) send related images of one or more of the scheduled patients to the Gyroscan, for reference purposes only.

Now the examination scan(s) are performed. After reconstruction the resulting images can be exported via DICOM (manually or by acquisition protocol). The DICOM node can be selected by the operator from the internal node list.

The images can also be sent to a DICOM network printer.

3 AE Specifications

Gyroscan contains four independent Application Entities.

3.1 Gyroscan DICOM Worklist AE Specification

The Worklist AE provides Standard Extended Conformance to the following DICOM 3.0 SOP class as an SCU:

Table 3-1: Supported SOP class by the Gyroscan DICOM Worklist AE as SCU

SOP class Name	UID	DIMSE
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	C-FIND

3.1.1 Association Establishment Policies

3.1.1.1 General

The Worklist AE has a PDU size of 16k.

3.1.1.2 Number of Associations

The Worklist AE will attempt to establish one association at a time.

3.1.1.3 Asynchronous Nature

The Gyroscan AE does not support asynchronous operations and will not perform asynchronous window negotiation.

3.1.1.4 Implementation Identifying Information

The Implementation Class UID is: "1.3.46.670589.11.0.0.51.4.1.2
The implementation version name is: "MR WLM 1.2"

3.1.2 Association Initiation Policy

The Worklist AE initiates associations as a result of one Real-World Activity: the Gyroscan Intera operator requests for a new worklist.

3.1.2.1 Worklist Request

3.1.2.1.1 Associated Real-World Activity

The Worklist AE function will be accessible through the Gyroscan User Interface. An association will be set-up to the configured remote system (usually a RIS). Two worklists will be queried in one association: one for "today" and one for "tomorrow". After receiving Both worklists the association is released.

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3.1.2.1.2 Proposed Presentation Contexts

The Worklist AE will propose the following presentation contexts:

Table 3-2: Proposed Presentation Contexts for the Worklist

Presentation Context table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	ILE	1.2.840.10008.1.2	SCU	None
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	ELE	1.2.840.10008.1.2.1	SCU	None
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	EBE	1.2.840.10008.1.2.2	SCU	None

3.1.2.1.3 SOP Specific Conformance to Modality Worklist Management

Gyroscan provides standard conformance.

An indication of the status of the C-FIND Responses (Success, Refused, Error) is displayed on the user interface in a message window.

Table 3-3 gives an overview of the optional Return Keys that a WLM SCP (for instance a RIS) can return.

Table 3-3: The applied optional WLM SCP Return Keys

Module	Applied optional Return Keys
Scheduled Procedure Step	Scheduled Procedure Step Description
	Scheduled Procedure Step Status

Section 3.1.4 on page 13 gives a detailed overview of all applied Matching and Return Keys and additional notes.

3.1.3 Association Acceptance Policy

The Gyroscan DICOM Worklist AE does not accept associations.

3.1.4 Overview applied Modality Worklist Information Model

This chapter specifies in detail the applied attributes in the C-FIND Service Element of this supported SOP Class.

Note:
* Attribute is used as a matching key.

Table 3-4: Modality Worklist Information Model - FIND SOP Class - SOP Common Module

Attribute Name	Tag	Note
Specific Character Set	0008,0005	

Table 3-5: Modality Worklist Information Model - FIND SOP Class - Patient Identification Module

Attribute Name	Tag	Note
Patient's Name	0010,0010	Can not handle '=' and '\'.
Patient ID	0010,0020	

Table 3-6: Modality Worklist Information Model - FIND SOP Class - Patient Demographic Module

Attribute Name	Tag	Note
Patient's Birth Date	0010,0030	
Patient's Sex	0010,0040	
Patient's Weight	0010,1030	

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Table 3-7: Modality Worklist Information Model - FIND SOP Class - Scheduled Procedure Step Module

Attribute Name	Tag	Note
Scheduled Procedure Step Sequence	0040,0100	
> Scheduled Station AE Title *	0040,0001	Applied value(s): The Gyroscan WLM AE Title is used.
> Scheduled Procedure Step Start Date *	0040,0002	Applied value(s): <Today> or <Tomorrow> Old ACR_NEMA date formats (having ".") are not supported.
> Scheduled Procedure Step Start Time	0040,0003	Old ACR_NEMA time formats (having ":") are not supported.
> Scheduled Procedure Step Description	0040,0007	
> Scheduled Procedure Step ID	0040,0009	
> Scheduled Procedure Step Status	0040,0020	

Table 3-8: Modality Worklist Information Model - FIND SOP Class - Requested Procedure Module

Attribute Name	Tag	Note
Study Instance UID	0020,000D	

Table 3-9: Modality Worklist Information Model - FIND SOP Class - Imaging Service Request Module

Attribute Name	Tag	Note
Accession Number	0008,0050	
Referring Physician's Name	0008,0090	

3.2 Gyroscan DICOM Image Import AE Specification

The Image Import AE provides Standard Conformance to the following DICOM V3.0 SOP Classes as an SCP:

Table 3-10: Supported SOP Classes by the Gyroscan DICOM Image Import AE as SCP.

SOP Class Name	*UID*	*DIMSE*
MR Image Storage - STORE	1.2.840.10008.5.1.4.1.1.4	C-STORE

3.2.1 Association Establishment Policy

The Import AE accepts association with the following purpose:
• To allow remote applications to store images in the Gyroscan database.

3.2.1.1 General

The Image Import AE has a PDU size of 32k.

3.2.1.2 Number of Associations

The Import AE will accept one association at a time.

3.2.1.3 Asynchronous Nature

The Import AE does not support asynchronous operations and will not perform asynchronous window negotiation.

3.2.1.4 Implementation Identifying Information

The Implementation Class UID is: "1.3.46.670589.11.0.0.11.4.1.3"
The implementation version name is: "MR Store 1.3"

3.2.2 Association Initiation Policy

The Gyroscan DICOM Worklist AE does not tries to establish any associations.

3.2.3 Association Acceptance Policy

The Import AE accepts associations as a result of one Real-World activity: a remote station will request to store images on the Gyroscan.

3.2.3.1 Image Import Request

3.2.3.1.1 Associated Real-World Activity

After selection at a remote station and after selection of one of more images, these images can be sent to the Gyroscan Import AE.

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3.2.3.1.2   Accepted Presentation Contexts

The Import AE will accept the following presentation contexts: .

Table 3-11: Acceptable Presentation Contexts for Image Export Request

Presentation Context table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
MR Image Storage - STORE	1.2.840.10008.5.1.4.1.1.4	ILE	1.2.840.10008.1.2	SCP	None
MR Image Storage - STORE	1.2.840.10008.5.1.4.1.1.4	ELE	1.2.840.10008.1.2.1	SCP	None
MR Image Storage - STORE	1.2.840.10008.5.1.4.1.1.4	EBE	1.2.840.10008.1.2.2	SCP	None

3.2.3.1.3   SOP Specific Conformance C-STORE SCP

DICOM MR Images with sequence attributes that were encoded as undefined length can not be imported.

Only images made on a Gyroscan are allowed to be imported again (Manufacturer (0008,0070) should contain "Philips"), these imported images are used for reference only, it is not intended to Export them again.

3.3 Gyroscan DICOM Image Export AE Specification

The Image Export AE provides Standard Conformance to the following DICOM V3.0 SOP Classes as an SCU:

Table 3-12: Supported SOP Classes by the Gyroscan DICOM Image Export AE as SCU.

SOP Class Name	UID	DIMSE
MR Image Storage - STORE	1.2.840.10008.5.1.4.1.1.4	C-STORE

3.3.1 Association Establishment Policies

3.3.1.1 General

The PDU size of the Image Export AE is set to unlimited (0), this means that the PDU size of C-Store SCP is taken.

3.3.1.2 Number of Associations

The Image Export AE will attempt to establish one association at a time.

3.3.1.3 Asynchronous Nature

The Image Export AE does not support asynchronous operations and will not perform asynchronous window negotiation.

3.3.1.4 Implementation Identifying Information

The Implementation Class UID is: "1.3.46.670589.11.0.0.11.4.1.3"
The implementation version name is: "MR Store 1.3"

3.3.2 Association Initiation Policy

The Image Export AE initiates associations as a result of one Real-World activity: the Gyroscan operator requests for Image Export, i.e. send the selected images from the Gyroscan to a remote system.

3.3.2.1 Image Export Request

3.3.2.1.1 Associated Real-World Activity

After selection of a remote station and after selection of one of more images, these images will be sent when initiating the Export command. Gyroscan initiates one association to the selected remote entity and uses it to send the selected images via C-STORE requests (and receives the associated C-STORE Responses).

The association is released by the Gyroscan after successful transfer of the images or when an error occurs.

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3.3.2.1.2   Proposed Presentation Contexts

The Image Export AE will propose the following presentation contexts:

Table 3-13: Proposed Presentation Contexts for Image Export Request

Presentation Context table					
Abstract Syntax		*Transfer Syntax*		*Role*	*Extended Negotiation*
Name	*UID*	*Name List*	*UID List*		
MR Image Storage - STORE	1.2.840.10008.5.1.4.1.1.4	ILE	1.2.840.10008.1.2	SCU	None
MR Image Storage - STORE	1.2.840.10008.5.1.4.1.1.4	ELE	1.2.840.10008.1.2.1	SCU	None
MR Image Storage - STORE	1.2.840.10008.5.1.4.1.1.4	EBE	1.2.840.10008.1.2.2	SCU	None

3.3.2.1.3   SOP Specific Conformance C-STORE SCU

The Image Export AE provides standard conformance.

The behaviour on successful and unsuccessful transfer of images is given in the table below.

Table 3-14: C-STORE STATUS

Service Status	*Codes*	*Further Meaning Status*
Refused	A7xx	Message on console.
Error	A9xx	Message on console.
	Cxxx	Message on console.
Warning	B00x	Message on console..
Success	0000	Message on console.

Table 3-15 lists the applied Conditional (DICOM Type 1C and 2C) and Optional (DICOM Type 3) attributes of the standard MR Image IOD. A detailed overview of all applied attributes and additional notes are given in Table 3-15.

Table 3-15: Applied Conditional and Optional Attributes of the MR Image IOD

Information Entity	*Module*	*Conditional Attributes*	*Optional Attributes*
Patient	Patient	-	-
Study	General Study	-	Study Description
	Patient Study	-	Patient Weight
	Study Classification	-	-
Series	General Series		Series Date, Series Time, Series Description, Protocol Name, Request Attributes Sequence, Scheduled Procedure Step Description
Frame of Reference	Frame of Reference	-	-
Equipment	General Equipment	-	Institution Name, Manufacturer's Model Name, Device Serial Number, Software Version(s), Station Name
Image	General Image	Image Date, Image Time	Referenced Image Sequence, Acquisition Number.
	Image Plane	-	-
	Image Pixel	-	-
	MR Image	Repetition Time, Inversion Time, Trigger Time	Number of Averages, Imaging Frequency, Imaged Nucleus, Echo Number(s), Magnetic Field Strength, Spacing Between Slices, Number of Phase Encoding Steps, Percent Sampling, Percent Phase Field of View, Low R-R Value, High R-R Value, Intervals Acquired, Intervals Rejected, Heart Rate, Receiving Coil, Transmitting Coil, Phase Encoding Direction, Flip Angle, Temporal Position Identified, Number of Temporal Positions, Reconstruction Diameter.
	Modality LUT	Rescale Intercept, Rescale Slope, Rescale Type.	
	VOI LUT	Window Width	Window Center
	SOP Common	Specific Character Set	Instance Creation Date, Instance Creation Time, Instance Creator UID
Private	MR Module Private	-	-

3.3.3 Association Acceptance Policy

The Gyroscan DICOM Image Export AE does not accept associations.

3.3.4 Overview applied MR Image IOD

The modules selected from the MR Image IOD module table of DICOM and the modules extended are given in the table below.

Table 3-16: Applied Modules in the MR Image IOD

Information Entity	Module	Reference
Patient	Patient	Table 3-17
Study	General Study	Table 3-18
	Patient Study	Table 3-19
	Study Classification	Table 3-20
Series	General Series	Table 3-21
Frame of Reference	Frame of Reference	Table 3-22
Equipment	General Equipment	Table 3-23
Image	General Image	Table 3-24
	Image Plane	Table 3-25
	Image Pixel	Table 3-26
	MR Image	Table 3-27
	Modality LUT	Table 3-29
	VOI LUT	Table 3-30
	SOP Common	Table 3-31
Private	MR Module Private	Table 3-32

The details of these applied modules are given in the tables below. The situation that an attribute is present conditionally/optionally or that an attribute may contain a zero length value, is indicated too. Conditions and Defined/Enumerated Values of DICOM 3.0 are applicable but are not shown in the tables. The specified attributes are present and filled except for what is specified in the notes.

Table 3-17: MR Image Storage SOP Class - Patient Module

Attribute Name	Tag	Note
Patient's Name	0010,0010	The characters '=' and '\' are not used. Received from RIS or entered by the operator
Patient ID	0010,0020	Received from RIS or entered by the operator (this is the Registration Number)
Patient's Birth Date	0010,0030	Received from RIS or entered by the operator
Patient's Sex	0010,0040	Received from RIS or entered by the operator Applied value(s): F, M, O

Table 3-18: MR Image Storage SOP Class - General Study Module

Attribute Name	Tag	Note
Study Date	0008,0020	Received from RIS or entered by the operator.
Study Time	0008,0030	Received from RIS or entered by the operator.
Accession Number	0008,0050	Received from RIS, entered by the operator or has a zero length value.
Referring Physician's Name	0008,0090	Received from RIS, entered by the operator or has zero length value.
Study Description	0008,1030	This is the Exam Name. Default value may be received from RIS (as Return Key Scheduled Procedure Step Description).
Study Instance UID	0020,000D	From RIS or created by Gyroscan for locally created images.
Study ID	0020,0010	From RIS or created by Gyroscan for locally created images.

Table 3-19: MR Image Storage SOP Class - Patient Study Module

Attribute Name	Tag	Note
Patient's Weight	0010,1030	Received from RIS or entered by the operator

Table 3-20: MR Image Storage SOP Class - Study Classification Module

Attribute Name	Tag	Note
Study Comments	0032,4000	User defined comments about the Study.

Table 3-21: MR Image Storage SOP Class - General Series Module

Attribute Name	Tag	Note
Series Date	0008,0021	Date of the scan or reconstruction.
Series Time	0008,0031	Time of the scan or reconstruction.
Modality	0008,0060	Applied value(s): MR
Series Description	0008,103E	Short description of the scan.
Protocol Name	0018,1030	This is the Scan Name.
Patient Position	0018,5100	Applied value(s): FFDL, FFDR, FFP, FFS, HFDL, HFDR, HFP, HFS
Series Instance UID	0020,000E	Generated by Gyroscan.

Table 3-21: MR Image Storage SOP Class - General Series Module (Continued)

Attribute Name	Tag	Note
Series Number	0020,0011	Created dynamically at export. Contains the concatenation of the acquisition number and the private reconstruction number.
Request Attributes Sequence	0040,0275	Only send if received from RIS.
> Scheduled Procedure Step Description	0040,0007	Only send if received from RIS.
> Scheduled Procedure Step ID	0040,0009	Only send if received from RIS.

Table 3-22: MR Image Storage SOP Class - Frame of Reference Module

Attribute Name	Tag	Note
Frame of Reference UID	0020,0052	
Position Reference Indicator	0020,1040	Has a zero length value.

Table 3-23: MR Image Storage SOP Class - General Equipment Module

Attribute Name	Tag	Note
Manufacturer	0008,0070	For locally created images this equals "Philips Medical Systems".
Institution Name	0008,0080	"Hospital Name" as configured on the system.
Station Name	0008,1010	For locally created images, Host name.
Manufacturer's Model Name	0008,1090	For locally created images this is "Gyroscan Intera".
Device Serial Number	0018,1000	For locally created images this is the SRN.
Software Versions	0018,1020	Release text of original Image.

Table 3-24: MR Image Storage SOP Class - General Image Module

Attribute Name	Tag	Note
Image Date	0008,0023	Present if image is part of a dynamic scan.
Image Time	0008,0033	Present if image is part of a dynamic scan.
Referenced Image Sequence	0008,1140	Planscan information, a maximum of 3 earlier images on which the orientation of the current image has been defined.
> Referenced SOP Class UID	0008,1150	Uniquely identifies the referenced SOP Class.
> Referenced SOP Instance UID	0008,1155	Uniquely identifies the Referenced SOP Class.
Acquisition Number	0020,0012	This is the Scan Number.

Table 3-24: MR Image Storage SOP Class - General Image Module (Continued)

Attribute Name	Tag	Note
Image Number	0020,0013	Unique within the Series, implies a logical order of the Images (for viewing).
Image comments	0020,4000	

Table 3-25: MR Image Storage SOP Class - Image Plane Module

Attribute Name	Tag	Note
Slice Thickness	0018,0050	
Image Position (Patient)	0020,0032	
Image Orientation (Patient)	0020,0037	
Pixel Spacing	0028,0030	

Table 3-26: MR Image Storage SOP Class - Image Pixel Module

Attribute Name	Tag	Note
Rows	0028,0010	This is the Reconstructed Value.
Columns	0028,0011	This is the Reconstructed Value.
Pixel Aspect Ratio	0028,0034	
Bits Stored	0028,0101	Applied value(s): 12, 8
High Bit	0028,0102	Applied value(s): 11, 7
Pixel Representation	0028,0103	Applied Value(s): 0 = unsigned integer.
Pixel Data	7FE0,0010	

Table 3-27: MR Image Storage SOP Class - MR Image Module

Attribute Name	Tag	Note
Image Type	0008,0008	The element is extended with a fourth and fifth field, which contain the MR image type (R,I,M,P,CR etc.) and the MR scanning sequence. Table 3-28 on page 25 gives an overview of the valid combinations of Image Type values. Additionally to this list, for field 3 the values: PROJECTION IMAGE and MPR.
Scanning Sequence	0018,0020	Applied value(s): GR, IR, RM, SE
Sequence Variant	0018,0021	Applied value(s): MTC, OTHER, SK, SS
Scan Options	0018,0022	
MR Acquisition Type	0018,0023	Applied value(s): 2D, 3D

Table 3-27: MR Image Storage SOP Class - MR Image Module (Continued)

Attribute Name	Tag	Note
Repetition Time	0018,0080	
Echo Time	0018,0081	
Inversion Time	0018,0082	
Number of Averages	0018,0083	
Imaging Frequency	0018,0084	
Imaged Nucleus	0018,0085	Applied value(s): 1H, 31P.
Echo Number(s)	0018,0086	
Magnetic Field Strength	0018,0087	
Spacing Between Slices	0018,0088	
Number of Phase Encoding Steps	0018,0089	
Echo Train Length	0018,0091	This is the Turbo Factor.
Percent Sampling	0018,0093	This is the Reduction Factor or Scan Percentage.
Percent Phase Field of View	0018,0094	This is the percentage in case of Rectangular FOV.
Trigger Time	0018,1060	Present for Scan Options which include triggering (e.g. CG).
Low R-R Value	0018,1081	
High R-R Value	0018,1082	
Intervals Acquired	0018,1083	
Intervals Rejected	0018,1084	
Heart Rate	0018,1088	Heart Rate as established as scan parameter prior to scan.
Reconstruction Diameter	0018,1100	Filled with field of view in [mm]
Receiving Coil	0018,1250	Only send if value applied. String on User Interface.
Transmitting Coil	0018,1251	
Phase Encoding Direction	0018,1312	This is the Preparation Direction or Foldover Direction.
Flip Angle	0018,1314	
Temporal Position Identifier	0020,0100	Dynamic Scan Number.
Number of Temporal Positions	0020,0105	No. of Dynamic Scans.
Samples per Pixel	0028,0002	Applied value(s): 1
Photometric Interpretation	0028,0004	Applied value(s): MONOCHROME2
Bits Allocated	0028,0100	Applied value(s): 16

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The next table describes the valid combinations of the image type values 1 to 5 and Scanning Sequence.

Table 3-28: Valid combinations of Image Type applied values

Image Type Value (1)	Image Type Value (2)	Image Type value (3)	Image Type Value (4)	Image Type value (5)	Scanning Sequence
ORIGINAL	PRIMARY	R_SE	R	SE	SE
ORIGINAL	PRIMARY	M_SE	M	SE	SE
ORIGINAL	PRIMARY	PHASE MAP	P	SE	SE
ORIGINAL	PRIMARY	R_IR	R	IR	IR
ORIGINAL	PRIMARY	I_IR	I	IR	IR
ORIGINAL	PRIMARY	M_IR	M	IR	IR
ORIGINAL	PRIMARY	PHASE MAP	P	IR	IR
ORIGINAL	PRIMARY	OTHER	CR	IR	IR
DERIVED	PRIMARY	T0	T0	DERIVED	RM
ORIGINAL	PRIMARY	T1 MAP	T1	US	RM
ORIGINAL	PRIMARY	T2 MAP	T2	US	RM
ORIGINAL	PRIMARY	DENSITY MAP	RHO	US	RM
ORIGINAL	PRIMARY	R_FFE	R	FFE	GR
ORIGINAL	PRIMARY	I_FFE	I	FFE	GR
ORIGINAL	PRIMARY	M_FFE	M	FFE	GR
ORIGINAL	PRIMARY	PHASE MAP	P	FFE	GR
ORIGINAL	PRIMARY	R_SI	R	SI	RM
ORIGINAL	PRIMARY	I_SI	I	SI	RM
ORIGINAL	PRIMARY	M_SI	M	SI	RM
ORIGINAL	PRIMARY	M_PCA	M	PCA	GR
ORIGINAL	PRIMARY	VELOCITY MAP	P	PCA	GR
DERIVED	PRIMARY	DERIVED	DERIVED	DERIVED	RM
DERIVED	PRIMARY	R	R	DERIVED	RM
DERIVED	PRIMARY	I	I	DERIVED	RM
DERIVED	PRIMARY	M	M	DERIVED	RM
DERIVED	PRIMARY	PHASE MAP	P	DERIVED	RM

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Table 3-28: Valid combinations of Image Type applied values (Continued)

Image Type Value (1)	Image Type Value (2)	Image Type value (3)	Image Type Value (4)	Image Type value (5)	Scanning Sequence
DERIVED	PRIMARY	DIFFUSION MAP	ADC	DERIVED	RM
DERIVED	PRIMARY	RCBV	RCBV	DERIVED	RM
DERIVED	PRIMARY	RCBF	RCBF	DERIVED	RM
DERIVED	PRIMARY	MTT	MTT	DERIVED	RM

Table 3-29: MR Image Storage SOP Class - Modality LUT Module

Attribute Name	Tag	Note
Rescale Intercept	0028,1052	Present if enabled in Gyroscan configuration file.
Rescale Slope	0028,1053	Present if enabled in Gyroscan configuration file.
Rescale Type	0028,1054	Present if enabled in Gyroscan configuration file. Applied value(s): US, normalised, milliseconds, millira-dials, cm/sec, mm^2/sec

The modality LUT Module data-elements are only sent in case this is configured on the scanner. If the modality LUT is present, the Rescale Intercept and Rescale Slope must be applied before the VOI LUT data is applied. Otherwise the window and level settings will not be correct
.

Table 3-30: MR Image Storage SOP Class - VOI LUT Module

Attribute Name	Tag	Note
Window Center	0028,1050	To be applied after Modality LUT (=Rescaling).
Window Width	0028,1051	See Window Center.

Table 3-31: MR Image Storage SOP Class - SOP Common Module

Attribute Name	Tag	Note
Specific Character Set	0008,0005	Applied value(s): ISO_IR 100
Instance Creation Date	0008,0012	
Instance Creation Time	0008,0013	
Instance Creator UID	0008,0014	
SOP Class UID	0008,0016	Applied value(s): 1.2.840.10008.5.1.4.1.1.4
SOP Instance UID	0008,0018	

The following "MR Module private" contains private attributes on the Image and Series levels. Not all values are required in every image.

Table 3-32: MR Image Storage SOP Class - MR Module Private

Attribute Name	Tag	Note
Private Creator Group 2001	2001,00xx	VR = LO, VM = 1 Applied value(s): PHILIPS IMAGING DD 001
Chemical Shift	2001,xx01	VR = FL, VM = 1 Dimension: ppm
Chemical Shift Number MR	2001,xx02	VR = IS, VM = 1 Applied value(s): 0.. 20
Diffusion B-Factor	2001,xx03	VR = FL, VM = 1 Dimension: s/mm^2 Indicates the Diffusion coefficient.
Diffusion Direction	2001,xx04	VR = CS, VM = 1 Indicates the Diffusion sensitive direction. Applied value(s): P, M, S, MP, PS, MS, I
Image Enhanced	2001,xx06	VR = CS, VM = 1 Applied value(s): N, Y
Image Type ED ES	2001,xx07	VR = CS, VM = 1 Indicates, whether an image is End Diastole or End Systole. Applied value(s): ED, ES, U
Phase Number	2001,xx08	VR = IS, VM = 1 Identifies a phase interval of the cardiac cycle. Applied value(s):1.. (value tag 2001,xx17)
Slice Number MR	2001,xx0A	VR = IS, VM = 1 Identifies a slice within an acquisition and/or a reconstruction. Applied value(s):1.. (value tag 2001,xx18)
Diffusion Echo Time	2001,xx11	VR = FL, VM = 1 Dimension: ms Indicates the Diffusion Echo time. The normal echo time is still valid for Diffusion.
Dynamic Series	2001,xx12	VR = CS, VM = 1 Indicates a dynamic series. Applied value(s): Y (dynamic), N (standard)
EPI Factor	2001,xx13	VR = SL, VM = 1 Echo Planar Imaging factor.
Number of Echoes	2001,xx14	VR = SL, VM = 1
Number of Locations	2001,xx15	VR = SS, VM = 1 Gives the number of locations (chunks) used during acquisition of this scan, i.e. the distinct areas that have been excited.
Number of PC Directions	2001,xx16	VR = SS, VM = 1 Specifies Phase Contrast Angio.

Table 3-32: MR Image Storage SOP Class - MR Module Private (Continued)

Attribute Name	Tag	Note
Number of Phases MR	2001,xx17	VR = SL, VM = 1 Number of phases measured in a triggered acquisition.
Number of Slices MR	2001,xx18	VR = SL, VM = 1 Number of different slice positions in one scan.
Partial Matrix Scanned	2001,xx19	VR = CS, VM = 1 Applied value(s): N, Y
PC Velocity	2001,xx1A	VR = FL, VM = 1-n Dimension: cm/s Applied value(s): 1.. 3 Velocity in L, P, H direction.
Prepulse Delay	2001,xx1B	VR = FL, VM = 1 Time between TFE prepulse and k=0 acquisition in subsequent TFE shot.
Prepulse Type	2001,xx1C	VR = CS, VM = 1 TFE prepulse type. Applied value(s): NO, Inv, SAT, ECHO, BBI
Reconstruction Number MR	2001,xx1D	VR = IS, VM = 1 Rank number of the reconstruction for a given scan.
Respiration Sync	2001,xx1F	VR = CS, VM = 1 Defines whether a measurement is respiration triggered and how it is triggered. Applied value(s): NO (no triggering), TRIGGERED (triggered), HOLD (breath hold), PEAR (Phase Encoded Artefact Reduction), GATE (gated)
SPIR	2001,xx21	VR = CS, VM = 1 Applied value(s): NO, YES
Water-Fat Shift	(2001,xx22)	VR = FL, VM = 1
Number of Slices in Stack	2001,xx2D	VR = SS, VM = 1 The number of slices per stack.
Stack Sequence	2001,xx5F	VR = SQ, VM = 1-n Number of items is equal to value tag 2001,xx60
> Stack Radial Angle	2001,xx32	VR = FL, VM = 1 Dimension: deg Angle of two slices.
> Stack Radial Axis	2001,xx33	VR = CS, VM = 1., Applied value(s): RL, AP, FH
> Stack Slice Number	2001,xx35	VR = SS, VM = 1 Applied value(s): 1.. (value tag 2001,xx2D)
> Stack Type	2001,xx36	VR = CS, VM = 1 Applied value(s): PARALLEL, RADIAL, ORTHOGONAL
Number of Stacks	2001,xx60	VR = SL, VM = 1

Table 3-32: MR Image Storage SOP Class - MR Module Private (Continued)

Attribute Name	Tag	Note
Private Creator Group 2005	2005,00xx	VR = LO, VM = 1 Applied value(s): PHILIPS MR IMAGING DD 001
Synergy Reconstruction Type	2005,xx05	VR = CS, VM = 1 Applied Value(s): SYN_CLASSIC (for Synergy techniques) SYN_COCA (for the "Clear" technique) SENSE (for Sense technique) When this attribute contains the value SENSE the Element "Protocol Name" (0018,1030) contains the "scan name" from the User interface extended with the text-string "SENSE". This attribute can be created from release 8 onwards.

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3.4 Gyroscan DICOM Print AE Specification

The Print AE can support printing to one DICOM printer.

The Print AE provides Standard Extended Conformance to the following DICOM 3.0 SOP class as an SCU:

Table 3-33: Supported SOP Classes as SCU

SOP Class Name	UID	DIMSE
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9	
> Printer SOP Class	1.2.840.10008.5.1.1.16	N-GET
> Basic Film Session SOP Class	1.2.840.10008.5.1.1.1	N-CREATE
> Basic Film Box SOP Class	1.2.840.10008.5.1.1.2	N-CREATE N-ACTION
> Basic Grayscale Image Box SOP Class	1.2.840.10008.5.1.1.4	N-SET

3.4.1 Association Establishment Policies

3.4.1.1 General

The Print AE has a fixed PDU size, this value is 64.

3.4.1.2 Number of Associations

Always one at the time. It releases the association with DICOM SCP if no operation is done on the association within 120 s. or by user cancellation.

3.4.1.3 Asynchronous Nature

The Print AE does not support asynchronous operations and will not perform asynchronous window negotiation.

3.4.1.4 Implementation Identifying Information

The AE implementation class UID is 2.16.124.113531.1.1.1
The implementation version name is "MR Print 1.2".

3.4.2 Association Initiation Policy

When the application submits a print job designated for a listed print server to the AE, the AE will request an association with the configured print server.For every supported printer the Association Initiation Policy can be configured, a list of attribute values can be configured.

3.4.2.1 Print Request

3.4.2.1.1 Associated Real-World Activity

The Print AE request causes the AE to initiate an Association.

3.4.2.1.2 Proposed presentation Contexts

The Print AE will propose one of the presentation context listed in the next table.

Table 3-34: Proposed Presentation Contexts for Print

Presentation Context table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Basic Grayscale Print Management SOP Class	1.2.840.10008.5.1.1.9	ILE	1.2.840.10008.1.2	SCU	None

3.4.2.1.3 SOP Specific Conformance to Print Management

The N-EVENT-REPORT DIMSE Service is not supported for the Printer SOP Class by the Gyro-Scan system. When the system receives a N-EVENT-REPORT FAILURE a deadlock situation between the printer and the Gyroscan system can occur.

The Gyroscan system does not detect the Printer Status FAILURE (N-GET). Instead of Releasing the Association the Print Job is continued.

3.4.3 Association Acceptance Policy

The Gyroscan DICOM Worklist AE does not accept associations.

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3.4.4 Overview applied Print management

Note:
Applied values other than mentioned below are NOT supported.

Table 3-35: Basic Film Box SOP Class - Basic Film Box Presentation Module

Attribute Name	Tag	Note
Image Display Format	2010,0010	Applied value(s): COL, CUSTOM, CUSTOM\1, ROW, SLIDE, STANDARD, STANDARD\1,1, SUPERSLIDE
Film Orientation	2010,0040	Applied value(s): PORTRAIT
Film Size ID	2010,0050	Applied value(s): 8INX10IN, 10INX12IN, 10INX14IN, 11INX14IN, 14INX14IN, 14INX17IN, 24CMX24CM, 24CMX30CM
Magnification Type	2010,0060	Applied value(s): CUBIC
Smoothing Type	2010,0080	SCP specific.
Border Density	2010,0100	Applied value(s): BLACK
Empty Image Density	2010,0110	Applied value(s): BLACK
Min Density	2010,0120	Minimum density of the images on the film, expressed in hundredths of OD.
Max Density	2010,0130	Maximum density of the images on the film, expressed in hundredths of OD.
Trim	2010,0140	Applied value(s): NO
Configuration Information	2010,0150	SCP Specific LUT.

Table 3-36: Basic Film Box SOP Class - Basic Film Box Relationship Module

Attribute Name	Tag	Note
Referenced Film Session Sequence	2010,0500	Parent Film Session.
> Referenced SOP Class UID	0008,1150	
> Referenced SOP Instance UID	0008,1155	

Table 3-37: Basic Film Session SOP Class - Basic Film Session Presentation Module

Attribute Name	Tag	Note
Number of Copies	2000,0010	Between 1 and 99.
Print Priority	2000,0020	Attribute not present or the applied value is as given. Applied value(s): MED
Medium Type	2000,0030	Applied value(s): BLUE FILM
Film Destination	2000,0040	Applied value(s): MAGAZINE, PROCESSOR
Film Session Label	2000,0050	

Table 3-38: Basic Grayscale Image Box SOP Class - Image Box Pixel Presentation Module

Attribute Name	Tag	Note
Magnification Type	2010,0060	Applied value(s): CUBIC
Smoothing Type	2010,0080	SCP specific.
Image Position	2020,0010	Applied value(s): 1
Polarity	2020,0020	Applied value(s): NORMAL
Preformatted Grayscale Image Sequence	2020,0110	
> Samples per Pixel	0028,0002	Applied value(s): 1
> Photometric Interpretation	0028,0004	Applied value(s): MONOCHROME2
> Rows	0028,0010	Depending on the selected printer type and film size.
> Columns	0028,0011	Depending on the selected printer type and film size.
> Pixel Aspect Ratio	0028,0034	
> Bits Allocated	0028,0100	Applied value(s): 8
> Bits Stored	0028,0101	Applied value(s): 8
> High Bit	0028,0102	Applied value(s): 7
> Pixel Representation	0028,0103	Applied value(s): 0x0000
> Pixel Data	7FE0,0010	

4 Communication Profiles

4.1 Supported Communication Stacks

Gyroscan provides DICOM V3.0 TCP/IP Network Communication Support as defined in Part 8 of the DICOM Standard. No OSI stack communications are provided with this implementation.

4.1.1 Physical Media Support

Gyroscan support Ethernet v2.0 and IEEE 802.3, 10/100 BASE-T.

5 Extensions/Specializations/Privatizations

The following Standard Extensions are applied for the MR Image Storage SOP Class. See also the overview of the applied MR Image IOD in section 3.3.4 on page 20.

Table 5-1: Applied Standard Extensions

Module	Attribute	Note
Study Classification	Study Comments	
Modality LUT	Rescale Intercept	Present if configured. Must be applied when viewing the image.
	Rescale Slope	See note Rescale Intercept above.
	Rescale Type	See note Rescale Intercept above.
MR Module Private	see Table 3-32 on page 27	

The modality LUT Module data-elements are only sent in case this is configured on the scanner.

If the modality LUT is present, the Rescale Intercept and Rescale Slope must be applied before the VOI LUT data is applied.Otherwise the window and level settings will not be correct.

6 Configuration

The Gyroscan system is configured by a Philips engineer only.

The IP address and AE Titles of the Gyroscan are configurable. All are allowed to be equal.The listening port is for the DICOM Import Server is defined at 104.

6.1 AE Title/Presentation Address

6.1.1 Configurable remote AE Titles and Presentation Addresses

The following information of remote systems (acting as Service Class Provider) must be configured on the Gyroscan:
* The AE title. Default character Repertoire excluding control characters LF, FF, CR and ESC, maximum 16 bytes.
* The host name and IP addresses.
* The port number at which the remote system accepts association requests.

6.1.2 Configurable local parameters

* AE Titles
* The host name and IP addresses.
* "export" or "do not export" the Rescale attributes, see Table 5-1 on page 35.
* Institution Name, Table 3-23, (0008,0080).
* "RIS Worklist TimeOut", timeout for Worklist response: 0-30 sec.
* "RIS Worklist Prefetch" mode: no/yes. If yes, the RIS Worklist is requested again and kept for the next time. Depending on the frequency of use the RIS Worklist may run behind the actual situation. The user can refresh the RIS Worklist.
* Export TimeOut 30-600 Sec.Default is 300 sec.

6.2 AE Title/Presentation Address mapping for Print

A DICOM print server is identified by a "printer name" with associated parameters such as AE title, host name and port number. The IP address corresponding to a given host name is determined using the name look up database mechanisms provided on the hosting platform.

7 Support of Extended Character Sets

Gyroscan supports Extended Character Set "ISO_IR 100" which is the Latin alphabet No 1, supplementary set.

If the RIS Worklist contans characters that are not ISO_IR 100 characters, the system will send a C-Cancel_RQ to RIS and a "RIS ERROR" message will be displayed. The Gyroscan will reject the RIS import.

For Print the server provides no support for extended character sets in the communication with DICOM SCP's.

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8 Remarks, Implementation restrictions and choices.

- The conditional Contrast Module is not implemented.
  Protocol Name (0018,1030) can be filled by the operator to contain the information relevant for MR. Future developments in user-interface with scanner controlled injectors will provide more detailed contrast information.

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