

Siemens Medical Solutions USA, Inc. Ultrasound Division

DICOM Conformance Statement, G40

Revision Data

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	DICOM Conformance Statement for 1.0 Release	4/12/05

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1.0 Purpose

This document describes the conformance to the ACR-NEMA DICOM 3.0 Standard by the SONOLINE G40 ultrasound system software version 3.0 from Siemens Ultrasound Group Korea, Inc. It shall establish the conformance specifications for this system only, and does not apply to other products offered by Siemens Ultrasound Group Korea, Inc. or its affiliates.

The SONOLINE G40 system is a device that generates ultrasound images that can be sent using DICOM standard protocols and definitions to other DICOM compliant devices that support SOP classes as defined in Table 2 in this document.

2.0 Scope

The DICOM standard provides a well-defined set of structures and protocols that allow inter-operability to a wide variety of medical imaging devices.

When configured with the DICOM option, the SONOLINE G40 system provides support for essential services related to ultrasound scanning and connectivity to DICOM compliant devices. SONOLINE G40 system products will not support all features supported by the DICOM standard. This document clearly states the DICOM services and data classes that are supported by the applications included with the SONOLINE G40. The intent of this document is to allow users and other vendors who also conform to the DICOM standard to exchange information within the specific context of those elements of the DICOM standard that SONOLINE G40 system supports.

This document is written with respect to the adopted portions of the DICOM standard, Revision 3. The following sections of this document follow the outline specified in the DICOM Standard NEMA publication PS3.2.¹

¹ Second part of the DICOM standard: NEMA Standards Publication PS 3.2-2004, Digital Imaging and Communications in Medicine (DICOM), Part 2: Conformance

3.0 Definitions

The following table provides a list of terms, their acronyms (if applicable), and their descriptions.

Table 1 Terms, Acronyms, and Descriptions.

Term	Acronym	Description
American College of Radiology - National Electrical Manufacturer's Association	ACR-NEMA	The American College of Radiology (ACR) and the National Electrical Manufacturers Association (NEMA) formed a joint committee to develop a standard for Digital Imaging and Communications in Medicine (DICOM).
Application Entity	AE	An application that supports DICOM communication with other DICOM applications.
DICOM Conformance Statement	DCS	A formal statement associated with a specific implementation of the DICOM Standard. It specifies the Service Classes, Information Objects, Communications Protocols and Media Storage Application Profiles supported by the implementation.
DICOM Message Service Element	DIMSE	Defines an Application Service Element (both the service and protocol) used by peer DICOM Application Entities for the purpose of exchanging medical images and related information.
Digital Imaging and Communications in Medicine, Version 3.0	DICOM 3.0	A well-defined set of structures and protocols that allow inter-operability to a wide variety of medical imaging devices.
Ethernet	-	Network methodology devised in 1976 by Digital Equipment Corporation, Intel and Xerox which is the most common in practice today. Ethernet is the IEEE standard 802.3
Information Object Definition	IOD	A data abstraction of a class of similar Real-World Objects which defines the nature and attributes relevant to the class of Real-World objects represented.
Integrating the Healthcare Enterprise	IHE	An initiative sponsored by the Radiological Society of North America (RSNA) to document and demonstrate standards-based methods of sharing information in support of optimal patient care. For additional information see www.rsna.org/ihe .
Picture Archiving and Communications Systems	PACS	A DICOM server that accepts medical images from another DICOM system and stores the images for later retrieval.
Protocol Data Unit	PDU	The PDUs are message formats exchanged between peer entities within a layer. A PDU shall consist of protocol control information and user data.

Table 1 Terms, Acronyms, and Descriptions. (Continued)

Term	Acronym	Description
Real-World Activity	RWA	That which exists in the real world which pertains to specific area of information processing within the area of interest of the DICOM Standard. Such a Real-World Activity may be represented by one or more computer information metaphors called SOP Classes.
Request	RQ	A request from one DICOM AE for service from another DICOM AE
Response	RSP	A response from one DICOM AE to the request for service from another DICOM AE
Service Class Provider	SCP	The role played by a DICOM Application Entity (DIMSE-Service-User) which performs operations and invokes notifications on a specific Association.
Service Class User	SCU	The role played by a DICOM Application Entity (DIMSE-Service-User) which invokes notifications and performs operations on a specific Association.
Service-Object Pairs	SOP	The union of a specific set of DIMSE Services and one related Information Object Definition which completely defines a precise context for communication.
Structured Report	SR	Also called Procedure Report. A DICOM object which contains measurement, calculations, diagnoses, image references and other information concerning a patient exam.
Unique identifier	UID	A series of digits and periods (.) used to uniquely identify an object such as an Ultrasound image in DICOM.
VA Hospital Information System Technology Architecture DICOM Conformance Requirements	VISTA	DICOM requirements document of the US Department of Veteran's Affairs (VA) Hospital Information System Technology Architecture. For additional information see www.va.gov/imaging .

4.0 Implementation Model

SONOLINE G40 system users can store images and other data directly on the SONOLINE G40 system hard disk. Images can be exported to a DICOM archive server or workstation on a network. In the following sections, SONOLINE G40 system Real World Activities are indicated by “Real World Activity” name while “G40 AE” indicates the invoked Application Entity. Similarly, the activities associated with service providers are indicated as “Real World Service Activity.”

4.1 Application Data Flow Diagram

Figure 1 illustrates the SONOLINE G40 system's Application Entity (AE), which is shown in the box. Relationships between user invoked activities (in the circles at the left of the AE) and the associated real-world activities provided by DICOM service providers (in the circles on the right side of the diagram) are shown.

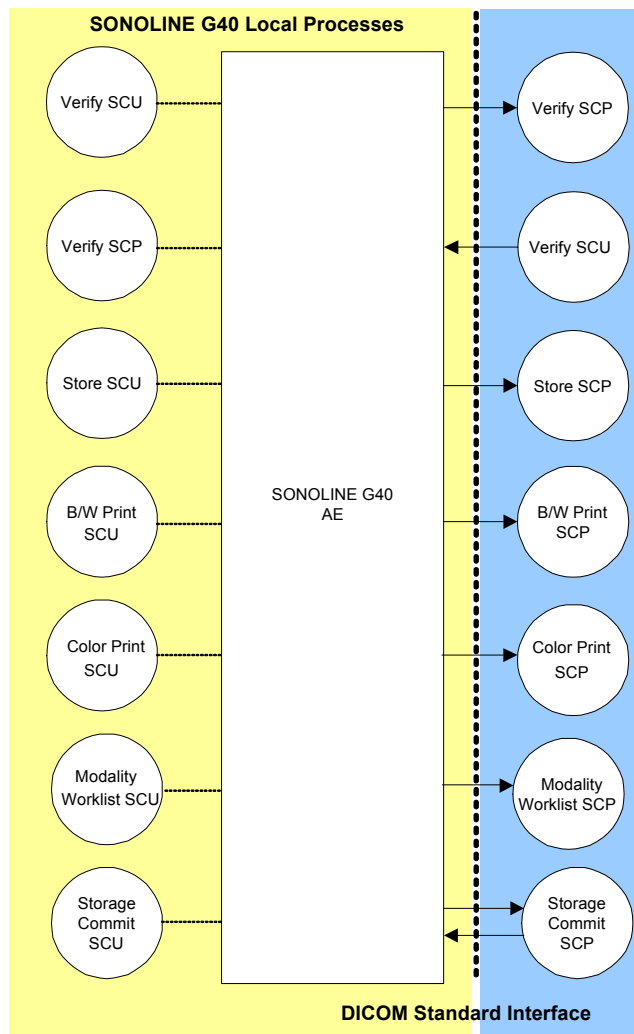


Figure 1 Implementation Model.

4.1.1 Verification

Verification is a part of the DICOM configuration located on the 'DICOM' page of the System Presets. Verification can be used to send a DICOM Verification request to a remote Application Entity (AE) and listen for a response.

When used as a diagnostic tool, Verification returns the following messages to the user:

- If the verification succeeds: "DICOM - Successfully contacted system"
- If the verification fails: "DICOM - Unable to communicate with system"

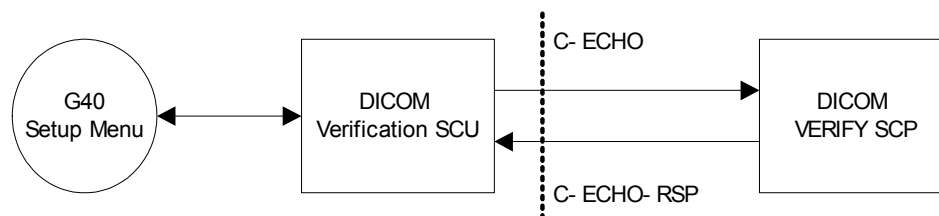


Figure 2 Verification Model.

4.1.2 DICOM Store

When requested the SONOLINE G40 sends images to the preconfigured DICOM Storage server.

DICOM Store can be seen as two sub-operations:

- queueing images for transfer
- transferring images to the storage server.

Queueing images for transfer:

SONOLINE G40 can be configured to automatically queue up images for transfer as they are being created. "AutoStore to DICOM" option in DICOM presets has to be set for this.

Alternatively, user can select exams and manually queue them up from Review mode. When an exam is selected for DICOM store all images will be queued.

Transfer of images to the storage server:

Further, once images are queued they may be immediately transferred or delayed until the end of study using the transfer storage configuration.

SONOLINE G40 supports two storage configurations: "Store At End of Exam" and "Store During Exam".

If the storage configuration is set to “Store At End of Exam” transfer attempts begin when the user selects “Close Study” or “New Patient”.

If the storage configuration is set to “Store During Exam”, transfer attempts to destination devices begin immediately after they are queued.

For both “Store At End of Exam” and “Store During Exam” settings, image will be delayed if the SONOLINE G40 is busy performing another DICOM store.

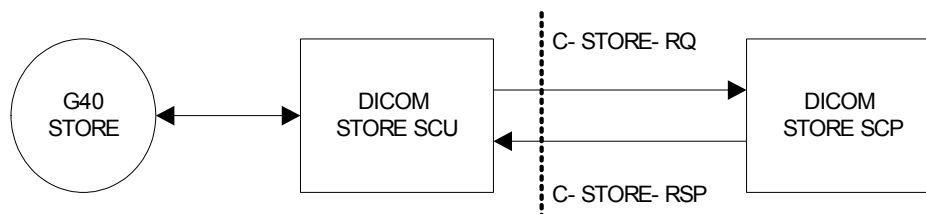


Figure 3 Store Model.

4.1.3 DICOM Print

SONOLINE G40 system is capable of grayscale (B/W) and color printing.

When requested, single frame images will be printed to a pre-configured DICOM network printer.

DICOM Print can be seen as two sub-operations:

- paging images for transfer
- transferring pages to printer

Paging images for transfer:

SONOLINE G40 can be configured to automatically queue up images to be printed on B/W Printer and/or Color printer as they are being created.

Alternatively, user can select exams or individual images and manually queue them up from Review mode for print.

Every image queued up is added into a page in the respective printer layout (DICOM B/W Printer Layout or DICOM Color Printer Layout).

Transfer of pages to the Printer:

Further, pages may be immediately transferred to the printer or delayed until the end of study based on the transfer configuration.

SONOLINE G40 supports two configurations: “Print At End of Exam” and “Print When Page Full”.

If the configuration is set to “Print At End of Exam,” transfer attempts of all pages to the destination DICOM printer begin as a batch when the user ends the exam.

If the configuration is set to “Print When Page Full”, transfer attempt of a page to the destination DICOM printer begins as soon as it becomes full.

For both “Print At End of Exam” and “Print when page full” settings, page transfer will be delayed if the SONOLINE G40 is busy performing another DICOM operation (Store/Print/Echo).

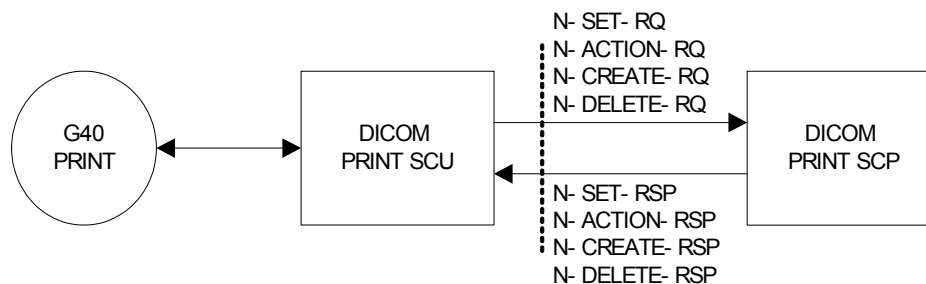


Figure 4 Print Model.

4.1.4 Patient Registration using Worklist

Patient registration can be automated by using the 'Worklist' Real World Activity. Pressing the 'New Patient' key on the keyboard initiates the patient data registration process and closes the previous active study. Pressing the 'Worklist' button on the patient data display screen invokes the Worklist query screen. The Worklist query screen can also be initiated from the Study screen.

Pressing the 'Search' button will attempt to find all matching patient data using the information entered on the Worklist Query screen. Patient name fields that are partially filled or empty will be treated as though an implicit wildcard was appended at the end of each field. Patient ID, Accession number will be exact match only. If no matches are found, a message will be presented to the operator indicating so. If more than one matching patient is found, a pick list of patient procedures will be presented to the user to select from.

The pick list of patient procedures will be limited to a number of preset entries. If more than this number of matching records are found in the query, the search will terminate and the user will be notified. The search list criteria will contain:

- Patient name
- Patient ID
- Accession number
- Exam start date/time range
- US/All modalities

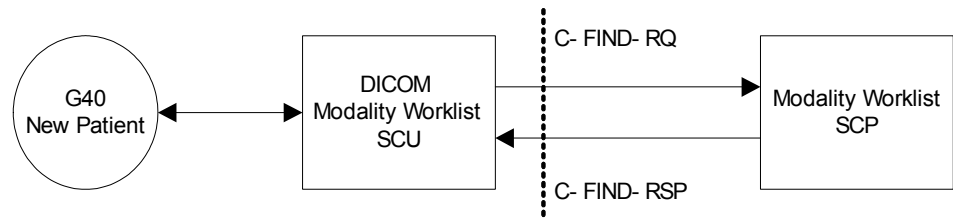


Figure 5 Modality Worklist Model

Once a Worklist query is initiated, a “Retrieving worklist, please wait ...” dialog will be presented to the user. The user will only have one option, “Cancel,” which will abort the query operation.

The following data fields in Modality Worklist Screen are initially populated from the New Patient Screen, if filled in, and can be used for query:

Attribute Name	Tag
Patient’s Full Name	(0010,0010)
Patient ID	(0010,0020)
Accession Number	(0008,0050)

The following data fields will be populated on the worklist screen for each return:

Attribute Name	Tag
Patient’s Full Name	(0010,0010)
Patient ID	(0010,0020)
Accession Number	(0008,0050)
Exam Start Date/Time	(0040,0002), (0040,0003)
Scheduled Procedure Step Sequence	(0040,0100)*
>Scheduled Procedure Step Description	(0040,0007)
>Scheduled Protocol Code Sequence	(0040,0008)
>>Code Value	(0008,0100)
Requested Procedure Description	(0032,1060)
Exam Type	(0008,1030)**

Attribute Name	Tag
*<code1>, ..., <codeN>: <sched1>, ..., <schedn> where: code<i> = Sequence item code value(0008,0100) for a given sequence or value multiplicity sched<i> = Scheduled procedure step(0040,0007) for a given sequence or value multiplicity **if a value exists for (0008,1030). Otherwise, Exam Type is set to value of Scheduled procedure step (0040,0007). If (0040,0007) is also empty, Exam Type is set to Requested procedure Description (0032,1060) if it exists.	

The following data fields will be populated on the patient data screen:

Attribute Name	Tag
Patient Name (first,middle,last)	(0010,0010)
Patient ID	(0010,0020)
Accession number	(0008,0050)
Exam start date/time	(0040,0002), (0040,0003)
DOB	(0010,0030)
Sex	(0010,0040)
Weight	(0010,1030)
Height	(0010,1020)
Physician	(0008,0090)
Indication	(0080,1080)
LMP	(0010,21D0)

4.1.5 Removable Media Storage

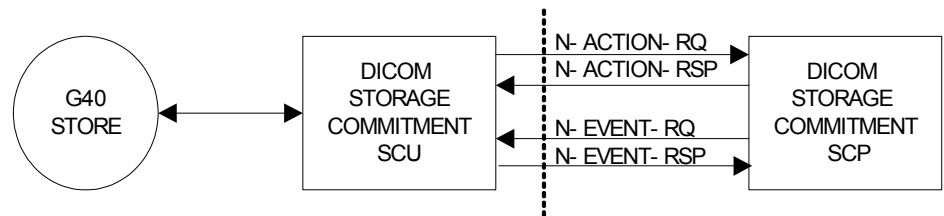
The SONOLINE G40 can perform DICOM operations to its standard on-board 120mm CD disk drive.

The SONOLINE G40 performs only the File Set Creator Role for CD disks. A DICOM conforming CD media is created when the user saves studies in DICOM format to the CD. A DICOM 3.0 conforming DICOMDIR file is created together with the directory structures, image files.

4.1.6 Storage Commitment

The user can exercise the Storage Commitment option by configuring and selecting a Storage Commitment server from the DICOM Presets menu. The SONOLINE G40 system requests commitment of images and upon successful acknowledgment from the Commitment server marks the study on the system hard drive as 'Archived'.

Figure 6 Storage Commitment Model



4.2 AE Functional Definition

4.2.1 Verification Real-World Activities

The SONOLINE G40 application entity performs Verification Service Class as an SCU and SCP allowing the operator to verify the ability of an application on a remote device to receive DICOM messages and allowing the operator of a remote DICOM device to verify the SONOLINE G40 system's ability to receive DICOM messages. (C-ECHO DIMSE)

4.2.2 Store Real-World Activities

The SONOLINE G40 Application Entity (AE) performs all of the functions to transmit ultrasound images, and associated data to network servers or workstations. The SONOLINE G40 AE supports the Ultrasound Image, Ultrasound Image (Retired), and Secondary Capture storage SOP classes SOP classes as an SCU.

The SONOLINE G40 AE initiates an association for C-STORE Requests to store providers when the user invokes "DICOM Store". The association may be used to store multiple images, and is closed when no images are available to be stored to the remote device for five seconds.

4.2.3 Storage Commitment - Push Model Real-World Activities

The SONOLINE G40 AE supports Storage Commitment Push Model SOP class to inform servers when all the store operations for a study have been completed. The Storage Commitment SCU uses the N-ACTION primitive to request safekeeping of a set of SOP Instances. The Storage Commitment SCU also processes the N-EVENT-REPORT primitives that are received from the SCP indicating 'successful' or 'non-successful' commitment status. The N-EVENT-REPORT information is used to mark a study as being successfully archived to a DICOM Storage SCP.

4.2.4 Print Real-World Activities

The SONOLINE G40 AE provides all aspects of the Print Management SCU. The SONOLINE G40 AE initiates an association to the printer when the user invokes "DICOM Print". The association may be used to print multiple pages and is closed when no pages are available to be printed to the remote device for five seconds.

4.3 Modality Worklist Real-World Activities

The SONOLINE G40 AE supports the DICOM Basic Worklist Management Service as an SCU. The AE initiates an association to the active Worklist server when a Worklist query is selected (via the "Worklist" button). The association is closed upon the completion of each query. A preset maximum number of matching results is accepted, at which point, the SONOLINE G40 AE issues a C-CANCEL-RQ request.

4.4 Removable Media Storage Real-World Activities

The SONOLINE G40 AE provides conformant implementation of DICOM Store to CD. The SONOLINE G40 AE selects one or more studies and exports the same to CD. SONOLINE G40 AE creates a DICOM File Format Image File for every image in each of the selected studies.

A DICOMDIR file is created along with the files.

4.5 Sequencing of Real-World Activities

Print, Store, Echo, Worklist, and Storage Commit can be transmitted simultaneously within the limits described below.

Storage Commit

The Storage Commitment (if enabled) command is sent in the following situations:

- a. On series close, when all images have previously stored successfully.
- b. The series is closed before all images are stored successfully, all previous stores have succeeded and the last image stores successfully.
- c. The series is closed before all images are stored successfully, at least one store has succeeded, at least one store has failed and the last store with non-zero retry count fails or succeeds.
- d. A series has been partially committed as in c. Later, due to "Retry Job" button press on the Store Status UI screen the store jobs are retried. Another Storage Commit is sent when at least one store has succeeded and the last store with non-zero retry count fails or succeeds.

5.0 AE Specifications

The following specifications apply to the SONOLINE G40 AE as depicted in Figure 1.

5.1 SONOLINE G40 AE Specification

The SONOLINE G40 AE provides conformance to the following DICOM Service SOP Classes as an SCU.

Table 2 Supported SOP Classes.

Service SOP Class Name	SOP Class UID
Verification	1.2.840.10008.1.1
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Storage Commitment - Push Model	1.2.840.10008.1.20.1
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9
Basic Color Print Management Meta SOP Class	1.2.840.10008.5.1.1.18
Basic Grayscale Image Box SOP Class	1.2.840.10008.5.1.1.4
Basic Color Image Box SOP Class	1.2.840.10008.5.1.1.4.1
Printer SOP Class	1.2.840.10008.5.1.1.16
Modality Worklist Information Model C- FIND	1.2.840.10008.5.1.4.31

5.1.1 Association Establishment Policies

5.1.1.1 General

The SONOLINE G40 system utilizes TCP/IP. The Maximum Length PDU negotiation is included in all association establishment requests. The maximum length PDU offered for an association initiated by SONOLINE G40 is:

- Maximum PDU Offered: 28672

5.1.1.2 Association Establishment Order

SONOLINE G40 initiates each C-Store Request one at a time, one for each transfer request being processed.

Image format on SONOLINE G40 can be set to one of “Automatic”, “Old Ultrasound” or “Secondary Capture”.

For the “Automatic” setting, SONOLINE G40 proposes Ultrasound Image, Ultrasound Image (Retired) and Secondary Capture Image sequentially.

For the “Old Ultrasound” setting, SONOLINE G40 proposes Ultrasound Image (Retired), and Secondary Capture to be negotiated sequentially.

For the “Secondary Capture” setting, SONOLINE G40 proposes only Secondary Capture Image to be negotiated.

5.1.1.3 Asynchronous Nature

All associations use the default synchronous mode of operation. Asynchronous Operations Window negotiations are not supported on the SONOLINE G40 system.

5.1.1.4 Implementation Identifying Information

- Implementation Class UID: “1.3.12.2.1107.5.5.5” (See below).
- Implementation Version Name: “MergeCOM3_330”

Siemens has provided registration for all Siemens Medical Solutions Groups. This unique Class UID is defined as:

“1.3.12.2.1107.5.5.product”

Where the interpretation is:

1. = International Standards Organization (ISO)

3. = International branch of ISO

12.2.1107.5. = Assigned to Siemens-UB MED

5. = Ultrasound Modality (SMS-UG)

Product = 5 - DICOM implementation for SONOLINE G20, G40, G50, G60 S and Acuson CV70

5.1.2 Association Initiation by Real-World Activities

5.1.2.1 Real World Activity – Verification

The SONOLINE G40 is capable of supporting Verification service class as SCU or SCP. Verification can be initiated as a singular event from the Systems Presets menu to any configured SCP that supports Verification.

Proposed Presentation Contexts – Verification

The SONOLINE G40 will propose Presentation contexts as shown in table 3.

Table 3 Verification Presentation Context.

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU/ SCP	None
Verification	1.2.840.10008.1.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU/ SCP	None
Verification	1.2.840.10008.1.1	Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU/ SCP	None

5.1.2.2 Real World Activity – Store

The SONOLINE G40 facilitates users to store images as they are being created or later in review mode.

Queueing images during acquisition:

“Autostore to DICOM” option in DICOM presets has to be set. One or more of “Print” and “Print/Store” keys on the control panel can be configured for Store (Disk Store). When the user presses one of the configured keys, an image is acquired, stored on the hard disk and queued up to be transferred to the storage server.

Queueing images in Review mode:

User can select one or more closed studies and queue them up for Storage. The DICOM Store button is available in Review screen for this operation. All images are stored.

Transfer of images to the storage server:

See section 4.1.2.

Associated Real World Activities

When images are transferred from the hard disk to a DICOM Store SCP, the system establishes an association between the SONOLINE G40 AE and the configured DICOM device. The association may be used to store multiple images is closed when no images are available to be stored to the remote device for five seconds.

Proposed Presentation Context

The following Presentation Contexts are presented to the SCP in an A-ASSOCIATE-RQ for DIMSE C-STORE storage services. The storage services utilize C-STORE services, as defined by the DICOM Standard. Table 4 represents all "Store" presentation contexts.

Table 4 Store Presentation Context.

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

The SONOLINE G40 system always acts as an SCU for store and is the client in a client-server model.

SOP Specific Conformance to Storage Service SOP Classes

The Store Real World Activity provides standard extended conformance as an SCU for the following standard Storage Service Class SOP:

Table 5 Supported SOP Classes.

Service SOP Class Name	SOP Class UID	Conformance Level
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Standard Extended
Ultrasound Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	Standard Extended
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Standard Extended

This is accomplished using the DIMSE C-STORE Service. The SCU issues a service request with a SOP instance that meets the requirements of the desired ultrasound, or secondary capture IOD.

The following table denotes the attributes included in the Ultrasound Image Object as implemented on the SONOLINE G40. Attributes not listed are not used.

Table 6 Ultrasound Image and Ultrasound Retired Image IOD Attributes

Module	Attribute	Tag	Notes
	Specific Character Set	(0008,0005)	Always set to "ISO_IR 100"
Patient Identification	Patient's Name	(0010,0010)	G40 Patient Data Screen – Last Name, First & Middle fields. Populated from Modality Worklist if used.
	Patient ID	(0010,0020)	G40 Patient Data Screen – ID field. Default is today's date & time (e.g., 03_04_2003_17_54_43 = Apr. 3, 2003 at 5:54:43 PM). Populated from Modality Worklist if used.
Patient Demographic	Patient's Birth Date	(0010,0030)	G40 Patient Data Screen – DOB field. Default is a zero length attribute. Populated from Modality Worklist if used.
	Patient's Sex	(0010,0040)	G40 Patient Data Screen – Gender field. M = male F = female. O = Other Default is a zero length attribute. Populated from Modality Worklist if used.
	Patient's Age	(0010,1010)	Calculated from Patient Data Screen DOB field.
	Patient's Size	(0010,1020)	G40 Patient Data Screen – Height field. Populated from Modality Worklist if used.
	Patient's Weight	(0010,1030)	G40 Patient Data Screen – Weight field. Populated from Modality Worklist if used.
Patient Study	Admitting Diagnosis Description	(0008,1080)	G40 Patient Data Screen – Indication field. Populated from Modality Worklist if used.
General Study	Study Instance UID	(0020,000D)	Populated from Modality Worklist if used; generated by G40 otherwise
	Study Date	(0008,0020)	Date the exam started.
	Study Time	(0008,0030)	Time the exam started.
	Referring Physician's Name	(0008,0090)	G40 Patient Data Screen – Physician field. Populated from Modality Worklist if used.
	Study ID	(0020,0010)	Populated from Requested Procedure ID in Modality Worklist if provided; Generated by G40

Module	Attribute	Tag	Notes
	Accession Number	(0008,0050)	G40 Patient Data Screen – Accession # field. Populated from Modality Worklist if used.
	Study Description	(0008,1030)	Populated with the first attribute from Modality Worklist in this list that contains a valid value: Study Description (0008,1030), Scheduled Procedure Step Description (0040,0007), Requested Procedure Description (0032,1060). If Modality Worklist was not used or none of the attributes contains a valid value G40 Patient Data Screen – Indication field is used.
General Series	Modality	(0008,0060)	Always set to “US”
	Series Instance UID	(0020,000E)	Generated by G40
	Series Number	(0020,0011)	Series Number in study (1-n).
	Laterality	(0020,0060)	Always sent as 0 length attribute
	^(b) Series Date	(0008,0021)	Date the series started.
	^(b) Series Time	(0008,0031)	Time the series started.
	^(b) Series Description	(0008,103E)	Populated with Scheduled Procedure Step Description if a value was provided by Modality Worklist.
	^(b) Protocol Name	(0018,1030)	The exam type of the most recent image stored in a particular series. If no images are stored for a series then the value is set to “Ultrasound”.
	^(b) Request Attributes Sequence	(0040,0275)	Populated with Scheduled Procedure Step Sequence (0040,0100) if provided by Modality Worklist.
	> ^(b) Scheduled Procedure Step Description	(0040,0007)	Populated with Scheduled Procedure Step Description (0040,0007) from Scheduled Procedure Step Sequence (0040,0100) if provided by Modality Worklist.
	> ^(b) Scheduled Protocol Code Sequence	(0040,0008)	Populated with Scheduled Protocol Code Sequence (0040,0008) from Scheduled Procedure Step Sequence (0040,0100) if provided by Modality Worklist.

Module	Attribute	Tag	Notes
	> ^(b) Scheduled Procedure Step ID	(0040,0009)	Populated with Scheduled Procedure Step ID (0040,0009) from Scheduled Procedure Step Sequence (0040,0100) if provided by Modality Worklist.
	> ^(b) Requested Procedure ID	(0040,1001)	Populated with Requested Procedure ID (0040,1001) from Scheduled Procedure Step Sequence (0040,0100) if provided by Modality Worklist.
	^(b) Performed Procedure Step ID	(0040,0253)	Populated with Scheduled Procedure Step ID (0040,0009) if provided by Modality Worklist.
	^(b) Performed Procedure Step Description	(0040,0254)	Populated with Scheduled Procedure Step Description (0040,0007) if provided by Modality Worklist.
	^(b) Performed Procedure Protocol Code Sequence	(0040,0260)	Populated with Scheduled Protocol Code Sequence (0040,0008) if provided by Modality Worklist.
General Equipment	Manufacturer	(0008,0070)	Set to "Siemens Ultrasound"
	Institution Name	(0008,0080)	G40 System Presets – Organization Name field.
	Software Versions	(0018,1020)	Set to the DICOM Software Version
	Manufacturer's Model Name	(0008,1090)	Set to "G40"
General Image	Instance Number	(0020,0013)	Image number in study (1 – n)
	Patient Orientation	(0020,0020)	Always sent as 0 length attribute
Image Pixel	Samples per Pixel	(0028,0002)	3 (RGB images).
	Photometric Interpretation	(0028,0004)	RGB
	Planar Configuration	(0028,0006)	0 (color-by-pixel)
	Rows	(0028,0010)	Set to 600
	Columns	(0028,0011)	Set to 800-
	Bits Allocated	(0028,0100)	Set to 8.
	Bits Stored	(0028,0101)	Set to 8.
	High Bit	(0028,0102)	Set to 7.
	Pixel Representation	(0028,0103)	Set to 0
	Pixel Data	(7FE0, 0010)	
US Image	Image Type	(0008,0008)	Always sent as a 0 length attribute.
	Lossy Image Compression	(0028,2110)	"00"

Module	Attribute	Tag	Notes
SOP Common	SOP Class UID	(0008,0016)	1.2.840.10008.5.1.4.1.1.6.1 or 1.2.840.10008.5.1.4.1.1.6
	SOP Instance UID	(0008,0018)	Generated by G40
Image Plane	Pixel Spacing	(0028,0030)	Pixel Spacing information is only provided for single, full screen, 2D image types (2D image types are B-mode, B-mode with color, B-mode with power).
Region Calibration	(^c)Sequence of Ultrasound Regions	(0018,6011)	
	>(^c)Region Spatial Format	(0018,6012)	B-Mode (Tissue or Color) = 0001H M-Mode (Tissue or Color) = 0002H Spectral (CW/PW) Doppler = 0003H
	>(^c)Region Data Type	(0018,6014)	B-Mode, M-Mode = 0001H (Tissue) Spectral Doppler = 0004H (CW Spectral Doppler) Spectral Doppler = 0003H (PW Spectral Doppler)
	>(^c)Region Flags	(0018,6016)	1st Bit (LSB) = 1 (All images acquired are transparent) 2nd Bit = 1 (All images acquired are automatically scaled) 3rd Bit = 1 for frequency scale 3rd Bit = 0 for velocity scale. The value of the 3rd bit is undefined for any mode other than Doppler. The value for 3rd bit is undefined if both frequency and velocity scales are selected on the Doppler image. 4th Bit is Reserved and value is always 0
	>(^c)Region Location Min X0	(0018,6018)	
	>(^c)Region Location Min Y0	(0018,601A)	
	>(^c)Region Location Max X1	(0018,601C)	
	>(^c)Region Location Max Y1	(0018,601E)	
	>(^c)Physical Units X direction	(0018,6024)	B-Mode (Tissue or Color) = 0003H (cm) M-Mode (Tissue or Color) = 0004H (seconds) Spectral (CW/PW) Doppler = 0004H (seconds)

Module	Attribute	Tag	Notes
	> ^(c) Physical Units Y direction	(0018,6026)	B-Mode (Tissue or Color) = 0003H (cm) M-Mode (Tissue or Color) = 0003H (cm) Spectral (CW/PW) Doppler = 0007H (cm/sec)
	> ^(c) Physical Delta X	(0018,602C)	
	> ^(c) Physical Delta Y	(0018,602E)	
	> ^(c) Reference Pixel X0	(0018,6020)	Attribute only set for Spectral Doppler Regions
	> ^(c) Reference Pixel Y0	(0018,6022)	Attribute only set for Spectral Doppler Regions
	> ^(c) Reference Pixel Physical Value X	(0018,6028)	Attribute only set for Spectral Doppler Regions When provided, value is always 0.
	> ^(c) Reference Pixel Physical Value Y	(0018,602A)	Attribute only set for Spectral Doppler Regions When provided, value is always 0.

^(b)The Attribute is only provided if the procedure step is queried from the MWL server.

^(c)Region Calibration is provided only for 2D (B-Mode), M-Mode and Spectral Doppler Regions. Region Calibration is not supported on Ultrasound RETIRED images, Screen Captures and post-processed images.

Table 7 Secondary Capture Image IOD Attributes

Module	Attribute	Tag	Notes
	Specific Character Set	(0008,0005)	Always set to "ISO_IR 100"
Patient Identification	Patient's Name	(0010,0010)	G40 Patient Data Screen – Last Name, First & Middle fields. Populated from Modality Worklist if used.
	Patient ID	(0010,0020)	G40 Patient Data Screen – ID field. Default is today's date & time (e.g., 03_04_2003_17_54_43 = Apr. 3, 2003 at 5:54:43 PM). Populated from Modality Worklist if used.
Patient Demographic	Patient's Birth Date	(0010,0030)	G40 Patient Data Screen – DOB field. Default is a zero length attribute. Populated from Modality Worklist if used.
	Patient's Sex	(0010,0040)	G40 Patient Data Screen – Gender field. M = male F = female. O= Other Default is a zero length attribute. Populated from Modality Worklist if used.
	Patient's Age	(0010,1010)	Calculated from Patient Data Screen DOB field.
	Patient's Size	(0010,1020)	G40 Patient Data Screen – Height field. Populated from Modality Worklist if used.
	Patient's Weight	(0010,1030)	G40 Patient Data Screen – Weight field. Populated from Modality Worklist if used.
Patient Study	Admitting Diagnosis Description	(0008,1080)	G40 Patient Data Screen – Indication field. Populated from Modality Worklist if used.
General Study	Study Instance UID	(0020,000D)	Populated from Modality Worklist if used; generated by G40 otherwise.
	Study Date	(0008,0020)	Date the exam started.
	Study Time	(0008,0030)	Time the exam started.
	Referring Physician's Name	(0008,0090)	G40 Patient Data Screen – Physician field. Populated from Modality Worklist if used.
	Study ID	(0020,0010)	Generated by G40
	Accession Number	(0008,0050)	G40 Patient Data Screen – Accession # field. Populated from Modality Worklist if used.

Module	Attribute	Tag	Notes
	Study Description	(0008,1030)	Populated with the first attribute from Modality Worklist in this list that contains a valid value: Study Description (0008,1030), Scheduled Procedure Step Description (0040,0007), Requested Procedure Description (0032,1060). If Modality Worklist was not used or none of the attributes contains a valid value G40 Patient Data Screen – Indication field is used.
General Series	Modality	(0008,0060)	Always set to "US"
	Series Instance UID	(0020,000E)	Generated by G40
	Series Number	(0020,0011)	Series Number in study (1-n).
	Laterality	(0020,0060)	Always sent as 0 length attribute
	^(b) Series Date	(0008,0021)	Date the series started.
	^(b) Series Time	(0008,0031)	Time the series started.
	^(b) Series Description	(0008,103E)	Populated with Scheduled Procedure Step Description if a value was provided by Modality Worklist.
	^(b) Protocol Name	(0018,1030)	The exam type of the most recent image stored in a particular series. If no images are stored for a series then the value is set to "Ultrasound".
SC Equipment Module	Conversion Type	(0008,0064)	Set to "WSD"
General Equipment	Manufacturer	(0008,0070)	Set to "Siemens Ultrasound"
	Institution Name	(0008,0080)	G40 System Presets – Organization Name field.
	Software Versions	(0018,1020)	Set to the DICOM Software Version
	Manufacturer's Model Name	(0008,1090)	Set to "G40".
General Image	Instance Number	(0020,0013)	Image number in study (1 – n)
	Patient Orientation	(0020,0020)	Always sent as 0 length attribute.
Image Pixel	Samples per Pixel	(0028,0002)	3(RGB images)
	Photometric Interpretation	(0028,0004)	Set to "RGB "
	Planar Configuration	(0028,0006)	0 (color-by-pixel).
	Rows	(0028,0010)	Set to 600.
	Columns	(0028,0011)	Set to 800.
	Bits Allocated	(0028,0100)	Set to 8.

Module	Attribute	Tag	Notes
	Bits Stored	(0028,0101)	Set to 8.
	High Bit	(0028,0102)	Set to 7.
	Pixel Representation	(0028,0103)	Set to 0.
	Pixel Data	(7FE0,0010)	
SOP Common	SOP Class UID	(0008,0016)	1.2.840.10008.5.1.4.1.1.7
	SOP Instance UID	(0008,0018)	Generated by G40

^(b)The Attribute is only provided if the procedure step is queried from the MWL server.

Error Handling

The following table indicates the response status codes that are handled by the SONOLINE G40 AE, which an SCP may return following the SCU's C-STORE-RSP command.

A successful C-STORE operation will allow the SONOLINE G40 AE to continue to the next action desired by the user.

Table 8 C-STORE Status Responses.

Service Status	Further Meaning	Protocol Codes	Related Fields
Refused	Out of resources.	A7xx	None
Error	Data set does not match SOP Class. Cannot understand.	A9xx Cxxx	None
Warning	Coercion of data Elements. Data set does not match SOP Class. Elements discarded.	B000 B007 B006	None
Success		0000	None

If the C-STORE operation is not successful, the image(s) are spooled on the SONOLINE G40 hard drive. A user-configured number of additional attempts are made to store the image(s). If these attempts fail, the user must select the job and press "Retry Job" on the Store Status page to complete the C-STORE operation.

All image storage on the SONOLINE G40 system hard drive is temporary in nature. If an attempt is made to store images on a full SONOLINE G40 system hard drive, the system will attempt to delete studies archived to CD or DICOM. If no deleteable data exists, a "DISK FULL" message is displayed on the SONOLINE G40 system display. The user must then delete studies not archived in order to store additional images.

5.1.2.3 Real World Activity - Print

SONOLINE G40 facilitates user to print images as they are being created or later in review mode.

Paging images during acquisition

One or more of “Print” and “Print/Store” keys on the control panel can be configured for Print (DICOM B/W Print and/or DICOM Color Print). When the user presses one of the configured keys on the control panel, the image is acquired, stored on the hard disk and placed in a page under the respective printer layout (DICOM B/W Printer Layout or DICOM Color Printer Layout).

Paging images in Review mode

User can select either individual images from open or closed studies, or one or more closed studies and queue them up for print. DICOM B/W Printer and DICOM Color Printer buttons are available in Review screen for this operation. When a study is selected for print, all single-frame images belonging to the study will be printed.

Transfer of pages to the Printer

Pages may be immediately transferred or delayed until the end of study using the transfer configuration.

SONOLINE G40 supports two configurations: “Print At End of Exam” and “Print When Page Is Full”.

If the configuration is set to “Print At End of Exam”, all pages queued to destination devices will be transferred as a batch when the user selects “Close Study” or “New Patient”.

If the configuration is set to “Print When Page Is Full”, a page is transferred to destination devices immediately after it is full.

For both “Print At End of Exam”, and “Print When Page Is Full” settings, image transfer will be delayed if the SONOLINE G40 is busy performing another DICOM Print.

Associated Real World Activities

An association is established when the user initiates a “B/W Print” or “Color Print” operation from the Review screen. Individual images or entire exams can be transferred to the selected DICOM Print device. The association is closed when no pages are available to be printed for five seconds. An association may also be opened after a network outage or when the system is powered-on if images are queued to be printed.

Proposed Presentation Context to a Grayscale Print Server

Table 9 Grayscale Print Presentation Context.

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

SOP Specific Conformance to Basic Grayscale Print Management Meta SOP Class

The SONOLINE G40 AE provides standard conformance of the Grayscale Meta SOP classes as an SCU. Specifically, with respect to the Basic Grayscale Print Management Meta SOP Class this means conformance to the underlying SOP classes:

Table 10 Conformance to Grayscale Print Meta SOP Class.

SOP Class Name	SOP Class UID	Conformance Level
Basic Film Session SOP Class	1.2.840.10008.5.1.1.1	Standard
Basic Film Box SOP Class	1.2.840.10008.5.1.1.2	Standard
Basic Grayscale Image Box SOP Class	1.2.840.10008.5.1.1.4	Standard
Printer SOP Class	1.2.840.10008.5.1.1.16	Standard

All mandatory elements of these classes are supported.

Specific Conformance to Basic Film Session SOP Class

DICOM specified usage - M = Mandatory; U = User Option

Table 11 Supported DIMSE Services for Basic Film Session SOP Class.

Name	Usage	Description
N-Create	M	Creates the Film Session.
N-Set	U	Not used.
N-Delete	U	Deletes the Film Session.
N-Action	U	Not used.

SOP Specific Conformance to Basic Film Box SOP Class

Table 12 Supported DIMSE Services for Basic Film Box SOP Class.

Name	Usage	Description
N-Create	M	Creates the Film Box.
N-Set	U	Not used.
N-Delete	U	Deletes the Film Box. Issued after each film is printed.
N-Action	M	PRINT. Sent after each Film Box is filled, and at the end of the exam to force a print of partially filled Film Box.

Table 13 Attributes set for the Basic Film Box SOP Class.

Attribute Name	Attribute Tag	Usage	Range	Description
Image Display Format	(2010,0010)	M	STANDARD\ X,Y	Where X, Y can be configured/ selected as 1*1, 1*2, 2*2, 2*3, 3*2, 3*3, 3*5, 4*5, 4*6, 5*6
Film Orientation	(2010,0040)	U	PORTRAIT LANDSCAPE	Range may be limited by print server/printer.
Film Size ID	(2010,0050)	U	8INX10IN 8.5INX11IN 10INX12IN 10INX14IN 11INX14IN 11INX17IN 14INX14IN 14INX17IN 24CMX24CM 24CMX30CM A3 A4	Range may be limited by print server/printer.
Magnification Type	(2010,0060)	U	REPLICATE BILINEAR CUBIC NONE	
Min. Density	(2010,0120)	U	0-99,999,999	Printer specific
Max Density	(2010,0130)	U	0-99,999,999	Printer specific
Configuration Information	(2010,0150)	U		Printer specific
Smoothing Type	(2010,0080)	U		Printer specific
Border Density	(2010,0100)	U	BLACK WHITE	
Empty Image Density	(2010,0110)	U	BLACK WHITE	
Trim	(2010,0140)	U	YES NO	

SOP Specific Conformance to Basic Grayscale Image Box SOP Class

Table 14 Supported DIMSE Services for the Basic Grayscale Image Box SOP.

Name	Usage	Description
N-Set	M	The SCP for each potential image of the film box creates an image box instance. Only those instances, which actually contain images, will be updated with the N-SET message.

Table 15 Attributes set for the Basic Grayscale Image Box SOP Class.

Name	Attribute	Range	Description
Image Position	(2020,0010)	1-30	Value according to Image Display Format
Polarity	(2020,0020)	NORMAL, REVERSE	Intensity mapping between display and print

Table 16 Supported DIMSE Services for the Printer SOP.

Name	Usage	Description
N-Event-Report	M	Ignored and not handled.
N-Get	U	May be issued by this device at any time to get printer status.

Table 17 Supported Printer SOP Class Elements.

Name	Usage	Range	Description
Printer Status	U	WARNING FAILURE	During a "Failure" the Print job will be displayed as "Failed"
Printer Status Information	U	Vendor specific	Reported to user if printer status = WARNING or FAILURE.

Proposed Presentation Context to a Color Print Server

Table 18 Color Print Server Presentation Context.

Name	Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
	UID	Name List	UID List			
Basic Color Print Management Meta SOP Class	1.2.840.10008.5.1.1.18	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1		SCU	None
Basic Color Print Management Meta SOP Class	1.2.840.10008.5.1.1.18	DICOM Implicit VR Little Endian	1.2.840.10008.1.2		SCU	None

SOP Specific Conformance to Basic Color Print Management Meta SOP Class

The SONOLINE G40 Print AE provides standard conformance to the color printing Meta SOP classes as an SCU. Specifically, with respect to the Basic Color Print Management Meta SOP Class this means conformance to the underlying SOP classes:

Table 19 Conformance to Color Print Meta SOP Class.

SOP Class Name	SOP Class UID	Conformance Level
Basic Film Session SOP Class	1.2.840.10008.5.1.1.1	Standard
Basic Film Box SOP Class	1.2.840.10008.5.1.1.2	Standard
Basic Color Image Box SOP Class	1.2.840.10008.5.1.1.4.1	Standard
Printer SOP Class	1.2.840.10008.5.1.1.16	Standard

SOP Specific Conformance to Basic Color Image Box SOP Class

The Basic Color Print Management Meta SOP Class makes identical use of the *Basic Film Session SOP Class*, *Basic Film Box SOP Class* and *Printer SOP Class* elements, which have been previously described for grayscale image printing. Therefore, these will not be described again in this section on color printing. However, it should be noted that certain attributes, such as Medium Type which is defined in the Basic Film Session SOP Class, are highly likely to require printer/print server specific media.

Table 20 Supported DIMSE Services for the Basic Color Image Box SOP Class.

Name	Usage	Description
N-Set	M	The SCP for each potential image of the film box creates an image box instance. Only those instances, which actually contain images, will be updated with the N-SET message.

Table 21 Attributes set for the Basic Color Image Box SOP Class.

Name	Attribute	Range	Description
Planar Configuration	(0028,0006)	Color-by-plane	Red plane, Green plane, Blue plane.

The Printer SOP Class behavior is identical to that used for grayscale printing.

Error Handling

The SONOLINE G40 Print AE supports the following error codes and reports failures to the user.

Table 22 Supported Error Codes for Printer Classes.

Service Status	Further Meaning	Protocol Codes
Success	Film accepted for Printing	0000
Warning	Film accepted for Printing, one or more settings ignored.	107,116,B600,B605
Failure	Printing not successful	C602, C603, C613

If the print operation is not successful, the image(s) are spooled on the SONOLINE G40 hard drive. A user-configured number of additional attempts are made to print the image(s). If these attempts fail, the user must select the job and press "Retry Job" on the Print Status page to complete the print operation.

5.1.2.4 Real World Activity - Worklist

A separate Network association is established by the AE for each Worklist query operation, with only one active query at a time. The association is closed at completion of the query.

Table 23 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	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

The SONOLINE G40 will always act as an SCU and as the client in a client-server model.

SOP Specific Conformance to Modality Worklist Service SOP Classes

The Worklist AE provides conformance to the following DICOM Service SOP Classes as an SCU all at a standard extended level of conformance:

Table 24 Supported SOP Classes

Supported SOP Class Name	SOP Class UID	Conformance Level
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	Standard Extended

The following table provides the list of attributes requested in the Modality Worklist Query.

Table 25 Modality Worklist Information Model Attributes

Attribute Name	Tag
Specific Character Set	(0008,0005)
Accession number	(0008,0050)*
Referring Physician's Name	(0008,0090)
Study Description	(0008,1030)
Admitting Diagnoses Description	(0008,1030)
Referenced Study Sequence	(0008,1110)
>Referenced SOP Class UID	(0008,1150)
>Referenced SOP Instance UID	(0008,1155)
Patient's Name	(0010,0010)*
Patient ID	(0010,0020)*
Patient's Birth Date	(0010,0030)
Patient's Sex	(0010,0040)
Patient's Size	(0010,1020)
Patient's Weight	(0010,1030)
Medical Alerts	(0010,2000)
Contrast Allergies	(0010,2110)
Pregnancy Status	(0010,21C0)
Last Menstrual Date	(0010,21D0)
Patient Comments	(0010,4000)
Study Instance UID	(0020,000D)
Requesting Physician	(0032,1032)
Requested Procedure Description	(0032,1060)
Requested Procedure Code Sequence	(0040,0008)
>Code Value	(0008,0100)
>Coding Scheme Designator	(0008,0102)
>Coding Scheme Version	(0008,0103)
>Code Meaning	(0008,0104)
Special Needs	(0038,0050)
Patient State	(0038,0500)
Scheduled Procedure Step Sequence	(0040,0100)
>Modality	(0008,0060)
>Scheduled Station AE Title	(0040,0001)*
>Scheduled Procedure Step Start Date	(0040,0002)
>Scheduled Procedure Step Start Time	(0040,0003)
>Scheduled Performing Physician's Name	(0040,0006)
>Scheduled Procedure Step Description	(0040,0007)
>Scheduled Protocol Code Sequence	(0040,0008)
>>Code Value	(0008,0100)

Attribute Name	Tag
>>Coding Scheme Designator	(0008,0102)
>>Coding Scheme Version	(0008,0103)
>>Code Meaning	(0008,0104)
>Scheduled Procedure Step ID	(0040,0009)
>Comments on the Scheduled Procedure Step	(0040,0400)
Requested Procedure ID	(0040,1001)*
Reason for the Requested Procedure	(0040,1002)
*Indicates parameter may be populated for query.	

5.1.2.5 Real-World Activity Storage Commitment

This operation allows the AE to create an instance of the Storage Commitment SOP Class and to provide information about a specific Real World Activity that is under the control of the SCU. The AE invokes a request for safekeeping of images by the N-ACTION REQUEST. Referenced in the N-ACTION Request are the SOP class UID(s) and SOP instance UID(s) for all STORE Class objects requesting commitment by the SCU.

Storage Commit

The Storage Commitment (if enabled) command is sent in the following situations:

- a. On series close, when all images have previously stored successfully.
- b. The series was previously closed, all previous stores have succeeded and the last image or Structured Report stores successfully.
- c. The series was previously closed, at least one store has succeeded, at least one store has failed and the last store with non-zero retry count fails or succeeds.
- d. A series has been partially committed as in c. Later, due to "Retry Job" button press on the Store Status UI screen the store jobs are retried. Another Storage Commit is sent when at least one store has succeeded and the last store with non-zero retry count fails or succeeds.

The SONOLINE G40 waits for the return of a successful N-ACTION RESPONSE Status Code applicable for the associated request indicating whether the commitment request was successful or a failure. The SONOLINE G40 waits for the N-EVENT REPORT from the SCP for at most 48 hours. The SONOLINE G40 is capable of accepting the N-EVENT REPORT on the association it initiates for the N-ACTION or one initiated by the SCP. Studies with all SOP instances marked as 'successful' in the N-EVENT REPORT will be eligible for deletion from the system hard drive before studies that have not been committed or written to CD.

The SONOLINE G40 allows the user to configure a Storage Commitment Server which may be different from the Storage Server. Thus, the Storage Commitment SCP must wait for an appropriate time for the stored images to arrive from the Storage server.

Image-By-Image and Batch Storage Commitment are supported as specified in “Vista DICOM Conformance Requirements for Image Modalities in radiology, Cardiology, Dental, Ophthalmology and other specialties” (Version 2.3).

Proposed Presentation Context

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Storage Commitment Push Model	1.2.840.10008.1.20.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

Table 26 Storage Commitment Presentation Context Table

The SONOLINE G40 system will act as an SCU in the ‘Push Model’ Storage Commitment SOP Class.

SOP Specific Conformance to Storage Commitment SOP Class

The Storage Commitment AE provides conformance to the following DICOM Service SOP Class as an SCU at a standard level of conformance.

Supported SOP Class Name	SOP Class UID	Conformance Level
Storage Commitment Push Model	1.2.840.10008.1.20.1	Standard

Storage Commitment to Storage Media (CD) is not supported.

Table 27 Supported SOP Class

The following table provides the list of attributes supported by the AE in the implementation of Storage Commitment SOP Class:

Table 28 Storage Commitment Request Attributes in N-ACTION REQUEST

Attribute	Tag	Notes
Transaction UID	(0008,1195)	Generated by G40
Referenced SOP Sequence	(0008,1199)	
>Referenced SOP Class UID	(0008,1150)	
>Referenced SOP Instance UID	(0008,1155)	

5.1.2.6 Error Handling

If the storage commitment operation is not successful, a user-configured number of additional attempts are made. If these attempts fail, the user must select the job and press “Retry Job” on the DICOM Store Queue page to complete the storage commitment operation.

6.0 Removable Media Interchange Specifications

This implementation supports 120mm CD-R medium.

6.1 Supported Application Profiles

SONOLINE G40 provides standard conformance to the following four Ultrasound Application Profiles. A DICOM 3.0 conformant DICOMDIR file is created together with the directory structures and image files.

Table 29 Application Profiles, Real-World Activities, and Roles

Supported AP	Real-World Activity	Roles	SC Option
STD-US-ID-SF-CDR	Create CD-R	FSC	Interchange
STD-US-SC-SF-CDR	Create CD-R	FSC	Interchange

6.2 Supported SOP Classes

6.2.1 Supported SOP Classes and Transfer Syntaxes

This implementation provides standard conformance to the following DICOM 3.0 SOP Class.

Table 30 Transfer Syntaxes for Media Interchange

Service SOP Class Name	SOP Class UID	Transfer Syntax Name	Transfer Syntax UID List
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1

6.3 Information Object Definition and DICOMDIR Keys

6.3.1 DICOM File Meta Information

Table 31 US Image Attributes Used (Refer Table 6 for additional attributes used)

Attribute Name	Tag	Notes
File Preamble	No Tag or Length fields	All bytes are set to 00H
DICOM Prefix	No Tag or Length fields	Set to DICOM Prefix "DICM"
Group length	(0002,0000)	
File Meta Information Version	(0002,0001)	Always set to 0001H
Media Storage SOP Class UID	(0002,0002)	Always Ultrasound Image 1.2.840.10008.5.1.4.1.1.6.1
Media Storage SOP Instance UID	(0002,0003)	
Transfer Syntax UID	(0002,0010)	Always Explicit VR Little Endian 1.2.840.10008.1.2.1
Implementation Class UID	(0002,0012)	Always set to 1.3.12.2.1107.5.5.5
Implementation Version Name	(0002,0013)	Always set to MergeCOM3_330

6.3.2 Basic Directory Information Object Definitions - File-set Identification Module

Attribute	Tag	Notes
File-Set ID	(0004,1130)	Always Set

6.3.3 Basic Directory Information Object Definitions - Directory Identification Module

Attribute	Tag	Notes
Offset of the First Directory Record of the Root Directory Entry	(0004,1200)	
Offset of the Last Directory Record of the Root Directory Entry	(0004,1202)	
File-set Consistency Flag	(0004,1212)	
Directory Record Sequence	(0004,1220)	
>Offset of the Next Directory Record	(0004,1400)	
>Record In-use Flag	(0004,1410)	
>Offset of Referenced Lower-Level Directory Entity	(0004,1420)	
>Directory Record Type	(0004,1430)	
>Referenced File ID	(0004,1500)	
>Referenced SOP Class UID in File	(0004,1510)	
>Referenced SOP Instance UID in File	(0004,1511)	

6.3.4 Physical Storage Media and Media Formats

The physical storage media supported is 120mm CD-R Medium.

7.0 Communication Profiles

All SONOLINE G40 system application entities utilize the DICOM 3.0 TCP/IP communication support as defined in PS3.8 (Part 8) of the DICOM 3.0 Standard.

7.1 TCP/IP Stack Supported

Each process inherits its TCP/IP stack from the SONOLINE G40's operating systems TCP/IP stack. The local AE Port number is always set to 104.

7.1.1 Physical Media Supported

Standard representations of IEEE 802.3 10BaseT/100BaseT (“twisted pair”) is supported

7.1.2 Chapter Extensions/Specializations/Privatizations

Pixel Spacing information is only provided for single, full screen, and 2D image types (B-mode, B-mode with color, and B-mode with power).

8.0 Configuration

SONOLINE G40 Networking and DICOM parameters can be configured through the SONOLINE G40 System Presets Menu screens. The following configuration is supported:

- General system
- Network (local and remote)
- DICOM Store
- DICOM Print
- DICOM Modality Worklist
- DICOM Storage Commitment

8.1 General System Configuration

The following system parameter can be configured via the SONOLINE G40 System Presets Basic Menu screens. This parameter is mapped to a DICOM image attribute:

- Hospital Name

8.1.1 Hospital Name

The user can enter the organization (i.e. hospital, clinic, etc.) as a text string in the Hospital Name field of the System Presets - General menu. The Organization Name field is transferred to DICOM devices as Institution Name - DICOM data element (0008, 0080).

8.2 DICOM Network Configuration

DICOM and networking parameters can be configured for both the local SONOLINE G40 device and remote DICOM service class providers through the System Presets DICOM Menu.

8.2.1 Local

The SONOLINE G40 local network parameters are configurable. The following network parameters can be configured for a SONOLINE G40 device:

- Host Name
- IP address
- Subnet IP mask
- Default Gateway

- DICOM Application Entity Title

8.2.2 Remote

Multiple DICOM service class providers can be configured through the system presets. The following network parameters can be configured for each remote device:

- DICOM Device Application Entity Title
- IP address
- Port Number

8.2.2.1 DICOM Store Configuration

One configuration setting is provided in addition to those described in Section 8.2.2.

The Image Format setting provides control over the Presentation Contexts proposed during Association negotiation. This is documented in Section 5.1.1.2.

8.2.2.2 DICOM Storage Commitment Configuration

Configuration of DICOM Storage Commitment remote devices must be performed separately from DICOM Store Configuration. The SONOLINE G40 supports Storage Commitment to the same remote device as Store or to a different device.

8.2.2.3 DICOM Modality Worklist Configuration

The only setting specific to Modality Worklist servers is for the maximum number of worklist items. This allows the user to set a maximum number of Scheduled Procedure Steps that are accepted by the SONOLINE G40. If the maximum is exceeded that additional Scheduled Procedure Steps are discarded and a cancel is sent.

8.2.2.4 DICOM Print Configuration

For each DICOM Print server, the following data is configurable by the user using the System Presets DICOM Print User Interface. The effect of changing parameters of the DICOM Print server will be seen at the next created film sheet. The current film sheet is not affected by changing these parameters.

Table 32 User-configurable printer parameters.



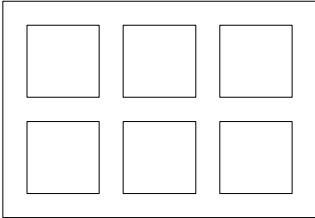
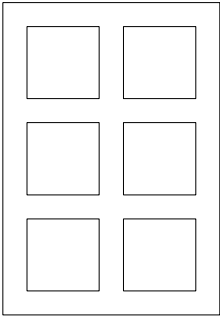
Parameter	Description
Printer Type:	Color or Black and White - depends on printer
Film Size	Select the size of the film - 8x10 inches, 8.5x11 inches, 10x12 inches, 10x14 inches, 11x14 inches, 11x17 inches, 14x14 inches, 14x17 inches, 24x24 centimeters, 24x30 centimeters, A3, or A4.
Film Orientation	Select from Portrait: <div style="text-align: center; margin: 10px 0;">  </div> or Landscape: <div style="text-align: center; margin: 10px 0;">  </div>

Table 32 User-configurable printer parameters. (Continued)

Parameter	Description
Display Format	<p>You must supply the number of rows and columns of images on the printed sheet. For example, a 6 on 1 print with Landscape mode should have 3 columns and 2 rows:</p>  <p>A 6 on 1 with Portrait mode would have 2 columns and 3 rows:</p> 
Print Priority	HIGH, MEDIUM or LOW
Medium Type	PAPER, CLEAR FILM, BLUE FILM, TRANSPARENCY or CURRENT (to use the currently loaded media)
Film Destination	MAGAZINE, PROCESSOR or CURRENT
Max. Density	Used to define the Black value - printer specific
Min. Density	Used to define the White value - printer specific
Smoothing Type	Printer specific value
Border Density	BLACK or WHITE
Empty Image Density	BLACK or WHITE
Trim	YES/NO to having a border around each image
Polarity	Normal/reverse. Normal means black is printed as black. Reverse means the grayscale is inverted so that black comes out as white and white as black.
Configuration Information:	Printer Specific values

8.3 External Equipment Configuration

The SONOLINE G40 user can configure “Hard Key” to “Output Device” mapping through the System Presets - Key Destination. Print images are acquired and sent to the assigned device when the user presses the associated key. The following key assignments are supported:

- **Print** – This key can be assigned to any configured DICOM Printer, DICOM Store or OEM printer device.
- **Print/Store 2** – This key can be assigned to any configured DICOM Printer, DICOM Store or OEM printer device.

8.4 Support of Extended Character Sets

The “ISO-IR 100” Latin Alphabet 1 Extended character set is supported by the SONOLINE G40 system.

9.0 Security

9.1 Security Profiles

None supported.

9.2 Association Level Security

None supported.

9.3 Application Level Security

None supported.

9.4 Virus Protection

The SONOLINE G40 computer system's networking has been configured to significantly reduce the possibility of virus and hacking vulnerabilities. On the G40 computer system, all ingress TCP and UDP ports are closed and/or absent of any type of server. The only exception to this is due to the necessity of a DICOM server available at ingress TCP port 104. Additionally, all non-essential computer services and components are disabled to minimize G40 egress network footprint.

Outside of some minimal network exchanges required by the G40's commercial computer operating system, the only network connections initiated by the G40 are for DICOM connectivity and network-share export function.