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Siemens Medical Solutions USA, Inc. Ultrasound Division

## **SONOLINE G50/G60 S Product Platform DICOM Conformance Statement**

7847184

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### **Revision Data**

<b>Revision</b>	<b>Description</b>	<b>Printed Name</b>	<b>Effective Date</b>
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## 1.0 Purpose

This document describes the conformance to the ACR-NEMA DICOM 3.0 Standard by the SONOLINE G50/G60S ultrasound system software version 1.3 from Siemens Medical Solutions USA, Inc. Ultrasound Division. It shall establish the conformance specifications for this system only, and does not apply to other products offered by Siemens Medical Solutions USA, Inc., or its affiliates.

The SONOLINE G50/G60 S 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 G50/G60S system provides support for essential services related to ultrasound scanning and connectivity to DICOM compliant devices. SONOLINE G50/G60S 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 G50/G60S. 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 G50/G60 S 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.<sup>1</sup>

<sup>1</sup> Second part of the DICOM standard: NEMA Standards Publication PS 3.2-2001, 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	
Application Entity	AE	
Conformance Statement	-	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 3.0	-	Digital Imaging and Communications in Medicine, Version 3.0
DICOM Message Service Element	DIMSE	
DICOM Message Service Element, Composite Store	DIMSE C-Store	
Ethernet	-	Ethernet is the IEEE standard 802.3
Information Object Definition	IOD	
Picture Archiving and Communications Systems	PACS	
Protocol Data Unit	PDU	
Request	REQ	
Response	RSP	
Real-World Activity	RWA	
Service Class Provider	SCP	
Service Class User	SCU	
Service-Object Pairs	SOP	
Unique identifier	UID	

## 4.0 Implementation Model

SONOLINE G50/G60 S system users can store images and other data directly on the SONOLINE G50/G60 S system hard disk. Images can be exported to a DICOM archive server or workstation on a network. In the following sections, SONOLINE G50/G60 S system Real World Activities are indicated by “Real World Activity” name while “G50/G60 S 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 4.1 illustrates the SONOLINE G50/G60 S system’s Application Entity (AE), which is shown in the box. Relationships between users 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.

The user selects “New Patient” at the start of each new patient examination.

Selecting either “Close Study” or “New Patient” ends the active exam. When a “Close Study” message is presented to the G50/G60 S images queued to destination devices will be transferred.

#### 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 will listen for a response.

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

DICOM - “Successfully contacted system”

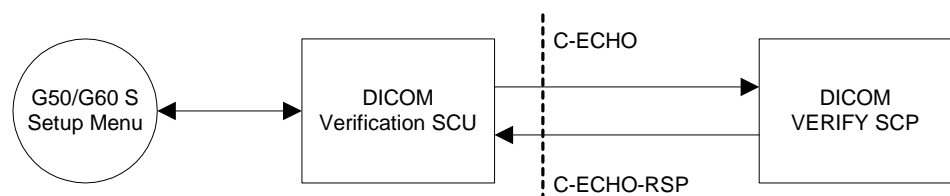


Figure 1 Verification Model.

### 4.1.2 Store to Local Disk

To invoke the DICOM Store, the user selects “Store” (a SONOLINE G50/G60 S system Real World Activity) during a patient exam, causing the image currently displayed on the Ultrasound screen to be captured and saved on the hard disk for transfer later. The destination device (attached to the “Store” key) is selected through System Presets by choosing from a list of configured DICOM devices. Saved images will be held and transmitted at the end of exam or by registering a new patient.

### 4.1.3 Store to Network Device

The user can also select “Store”, another SONOLINE G50/G60 S Real World Activity, to copy one or more selected exams or individual images from the SONOLINE G50/G60 S’s Review screen to a pre-configured DICOM server. When configured to “auto store” in the pre-sets storage page set-up, the SONOLINE G50/G60 S will transfer the current study’s images to the Store server automatically at end of exam. Configured Store devices can be assigned to either Print/Store hard keys.

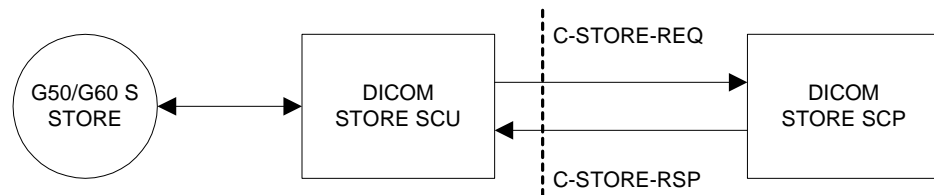


Figure 2 Store Model.

### 4.1.4 Print/Store 1 and Print/Store 2

The system’s Printer or Store devices can be assigned to either “Print/Store 1” or “Print/Store 2” hard keys via the “Customize Keys” preset

To invoke the Print”Real World Activity”, the user selects the “Print/Store 1” or “Print/Store 2” hard key. When configured, print images are sent to the printer following the completion of a full sheet.

### 4.1.5 DICOM Print (Review Screen)

After an image exam is complete, the user has the ability to Print images stored on the hard drive using the Review Screen. Invoking the “Print B/W” or “Print Color” Real World Activity initiates the DICOM Print activity for

selected exams or individual images. “Print B/W and “Print Color” is available through the Review Screen user interface. The SONOLINE G50/ G60 S system is capable of grayscale (B/W) and color printing.

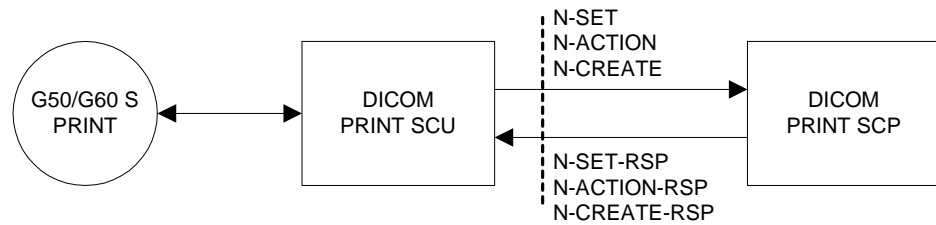


Figure 3 Print Model.

#### 4.1.6 New Patient

Pressing the ‘New Patient’ key on the control panel initiates the patient data registration process and closes the previous active study.

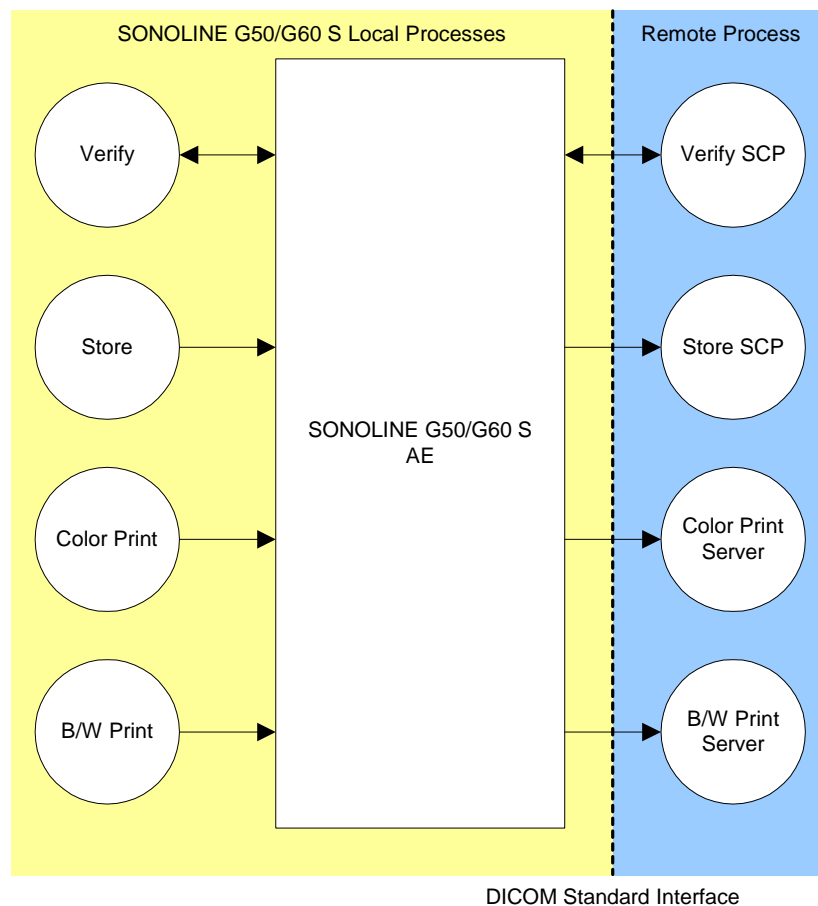


Figure 4 Implementation Model.

## **4.2 AE Functional Definition**

### **4.2.1 Verification Real-World Activities**

The SONOLINE G50/G60 S application entity performs Verification Service Class as SCU allowing the operator to verify the ability of an application on a remote device to receive DICOM messages. (C-ECHO DIMSE)

### **4.2.2 Store Real-World Activities**

The SONOLINE G50/G60 S Application Entity (AE) performs all of the functions to transmit ultrasound image and associated data to network servers and / or workstations. The SONOLINE G50/G60 S AE supports the Ultrasound Image Storage SOP class as an SCU. The SONOLINE G50/G60 S AE initiates a single association for each C-STORE Request to store providers, when the user selects "Store" from the Review Screen or at Close Study if configured.

### **4.2.3 Print Real-World Activities**

The SONOLINE G50/G60 S AE provides all aspects of the Print Management SCU. The AE initiates separate associations to the print servers, when the user selects "Print/Store 1", "Print/Store 2" or "B/W Print" or "Color Print". The SONOLINE G50/G60 S AE accommodates both grayscale and color print servers.

## **4.3 Sequencing of Real-World Activities**

Remote processing of Real World Activity SCP services which the SONOLINE G50/G60 S requests as an SCU occur in sequential fashion based on the order the user has requested. This initiation occurs with the "Store" for image store operations, "B/W Print", "Color Print" for image printing operations.

## 5.0 AE Specifications

The following specifications apply to the SONOLINE G50/G60 S AE as depicted in Figure 2.1.

### 5.1 SONOLINE G50/G60 S AE Specification

The SONOLINE G50/G60 S 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
Ultrasound Multi-Frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3
Ultrasound Multi-Frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
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

#### 5.1.1 Association Establishment Policies

##### 5.1.1.1 General

The SONOLINE G50/G60 S 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 G50/G60 S is:

- Maximum PDU Offered: 28762

##### 5.1.1.2 Association Establishment Order

When configured for the “automatic setting” in the storage pre-sets page, the SONOLINE G50/G60 S AE initiates each C-STORE Request one at a time, one for each transfer request being processed. Store requests are negotiated sequentially in the following order: New Ultrasound IOD, Retired Ultrasound IOD, and Secondary Capture.

The system is also capable of forcing associations negotiations to the New Ultrasound IOD, Retired Ultrasound IOD, and Secondary Capture.

### 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 G50/G60 S system.

### 5.1.1.4 Implementation Identifying Information

- Implementation Class UID: "1.3.12.2.1107.5.5" (See below).
- Implementation Version Name: "MergeCOM3\_310"

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= Fifth SMS-UG product to support DICOM (e.g. SONOLINE G50/G60 S)

## 5.1.2 Association Initiation by Real-World Activities

### 5.1.2.1 Real World Activity – Verification

The SONOLINE G50/G60 S is capable of supporting Verification service class as SCU. 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 G50/G60 S will propose Presentation contexts as shown in table 3.

**Table 3** Verification Presentation Context.

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

### 5.1.2.2 Real World Activity – Store

The user selects “New Patient” at the start of each new patient examination. All subsequent images are stored to the hard disk. When images are transferred from the Review Screen to a DICOM Store SCP, the system establishes an association between the SONOLINE G50/G60 S AE and the configured DICOM device (i.e. Network Archive Server, Workstation Server)

All images acquired during the exam are transferred over a single association. After all images are transferred, the association is closed. When configured, the SONOLINE G50/G60 S will transfer all images at “Study Close” or start of “New Patient”.

#### Associated Real World Activities

An association will be opened after a network outage if images are residing in the store queue. After all images have been stored, the association is closed.

If desired, the user may set a flag in the “Save Images” activity, which causes the images to be sent to both a network server and the local archive.

#### Proposed Presentation Context

The following Presentation Context(s) is presented to the SCP in an A-Associate request for DIMSE C-STORE storage services. The storage services utilize C-STORE services, as defined by the DICOM Standard. Table 4 represents all “Store” Real World Activities.

**Table 4** Store Presentation Context.

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Ultrasound Multi-Frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Lossy JPEG 8 Bit Image Compression	1.2.840.10008.1.2.4.50	SCU	None
Ultrasound Multi-Frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
Ultrasound Multi-Frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Ultrasound Multi-Frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
Ultrasound Multi-Frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
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

**Table 4** Store Presentation Context. (Continued)

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
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 G50/G60 S system always acts as an SCU and is the client in a client-server model. The system will negotiate associations in the following order: New US IOD (Multi-Frame / Single Frame), Retired US IOD (Multi-Frame/Single Frame), and Secondary Capture.

### 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 Multi-Frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Standard Extended
Ultrasound Multi-Frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3	Standard Extended
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 IOD.

The following table denotes the attributes included in the Ultrasound Image Object as implemented on the SONOLINE G50/G60 S. Attributes not listed are not used.

**Table 6** US Image IOD Attributes used.

Module	Attribute	Tag	Notes
Patient	Patient's Name	(0010,0010)	G50/G60 S Patient Data Screen – Last Name, First & MI fields.
	Patient ID	(0010,0020)	G50/G60 S Patient Data Screen – ID field. Default is today's date & time (i.e. 0204241022 = Apr. 24, 2002 – 10:22am).
	Patient's Birth Date	(0010,0030)	G50/G60 S Patient Data Screen – DOB field. Default is a zero length attribute.
	Patient's Sex	(0010,0040)	G50/G60 S Patient Data Screen – Gender field. M = male F = female. O= Other Default is a zero length attribute.
General Study	Study Instance UID	(0020,000D)	
	Study Date	(0008,0020)	Date the exam started.
	Study Time	(0008,0030)	Time the exam started.
	Referring Physician's Name	(0008,0090)	G50/G60 S Patient Data Screen – Physician field.
	Study ID	(0020,0010)	
	Accession Number	(0008,0050)	G50/G60 S Patient Data Screen – Accession # field.
General Series	Modality	(0008,0060)	Set to "US".
	Series Instance UID	(0020,000E)	
	Series Number	(0020,0011)	
General Equipment	Manufacturer	(0008,0070)	Set to "Siemens Ultrasound"
	Institution Name	(0008,0080)	G50/G60 S System Presets – Organization Name field.
General Image	Instance Number	(0020,0013)	Image number in series (1 – n)
Image Pixel	Lossy Image Compression	(0028,2110)	"00"
	Samples per Pixel	(0028,0002)	RGB = 3.
	Rows	(0028,0010)	Set to 502.
	Columns	(0028,0011)	Set to 632.
	Bits Allocated	(0028,0100)	Set to 8.
	Bits Stored	(0028,0101)	Set to 8.
	High Bit	(0028,0102)	Set to 7.
	Pixel Data	(7FE0, 0010)	
	Planar Configuration	(0028,0006)	Color-by-pixel. Always set to 0

**Table 6** US Image IOD Attributes used. (Continued)

Module	Attribute	Tag	Notes
	Photometric Interpretation	(0028,0004)	RGB
	Pixel Representation	(0028,0103)	0000H = unsigned integer.
US Image	Image Type	(0008,0008)	The Defined Terms for Value 3 are the current Application type (e.g. ABDOMIN, OB, etc.).
SOP Common	SOP Class UID	(0008,0016)	Always US Image – 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)	
Image Plane	Pixel Spacing	(0028,0030)	Pixel Spacing information is only sent for single, full screen, 2d image types (2d image types are b-mode, b-mode with color, b-mode with power).

**Table 7** USMF Image IOD Attributes used.

Module	Attribute	Tag	Notes
Patient	Patient's Name	(0010,0010)	G50/G60 S Patient Data Screen – Last Name, First & MI fields.
	Patient ID	(0010,0020)	G50/G60 S Patient Data Screen – ID field. Default is today's date & time (i.e. 9804241022 = Apr. 24, 1998 – 10:22am).
	Patient's Birth Date	(0010,0030)	G50/G60 S Patient Data Screen – DOB field. Default is a zero length attribute.
	Patient's Sex	(0010,0040)	G50/G60 S Patient Data Screen – Gender field. M = male F = female. O= Other Default is a zero length attribute.
General Study	Study Instance UID	(0020,000D)	
	Study Date	(0008,0020)	Date the exam started.
	Study Time	(0008,0030)	Time the exam started.
	Referring Physician's Name	(0008,0090)	G50/G60 S Patient Data Screen – Physician field.
	Study ID	(0020,0010)	
	Accession Number	(0008,0050)	G50/G60 S Patient Data Screen – Accession # field.
General Series	Modality	(0008,0060)	Set to "US".
	Series Instance UID	(0020,000E)	
	Series Number	(0020,0011)	
General Equipment	Manufacturer	(0008,0070)	Set to "Siemens Ultrasound"

**Table 7** USMF Image IOD Attributes used. (Continued)

Module	Attribute	Tag	Notes
	Institution Name	(0008,0080)	G50/G60 S System Presets – Organization Name field.
General Image	Instance Number	(0020,0013)	Image number in series (1 – n)
Image Pixel	Lossy Image Compression	(0028, 2110)	“00” (no) or “01” (yes)
	Samples per Pixel	(0028,0002)	RGB = 3.
	Rows	(0028,0010)	Set to 502
	Columns	(0028,0011)	Set to 632.
	Bits Allocated	(0028,0100)	Set to 8.
	Bits Stored	(0028,0101)	Set to 8.
	High Bit	(0028,0102)	Set to 7.
	Pixel Data	(7FE0, 0010)	
	Planar Configuration	(0028,0006)	Color-by-pixel. Always set to 0
	Photometric Interpretation	(0028,0004)	YBR_FULL_422
	Pixel Representation	(0028,0103)	0000H = unsigned integer.
US Image	Image Type	(0008,0008)	The Defined Terms for Value 3 are the current Application type (e.g. ABDOMIN, OB, etc.).
	Frame Increment Pointer	(0028, 0009)	0x00181063
SOP Common	SOP Class UID	(0008,0016)	Always US Image – 1.2.840.10008.5.1.4.1.1.3.1 or 1.2.840.10008.5.1.4.1.1.3
	SOP Instance UID	(0008,0018)	
Image Plane	Pixel Spacing	(0028,0030)	Pixel Spacing information is only sent for single, full screen, 2d image types (2d image types are b-mode, b-mode with color, b-mode with power).
Cine	Frame Time	(0018,1063)	
Multi- Frame	Number of Frames	(0028, 0008)	

### Error Handling

The following table indicates the response status codes, that are handled by the SONOLINE G50/G60 S AE, which a SCP may return following the SCU's C-STORE-RSP command. Only those status codes that indicate some form of error condition are presented to the user.

A successful C-STORE operation will allow the SONOLINE G50/G60 S 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 G50/G60 S hard drive. Transfer attempts continue at 120-second intervals until either a successful completion of the C-STORE operation occurs, or the image(s) are removed from the DICOM Store queue list.

All image storage on the SONOLINE G50/G60 S system hard drive is temporary in nature. The oldest transferred exams are automatically deleted to make room for new exams, on a need to basis. If an attempt is made to store images on a full SONOLINE G50/G60 S system hard drive, the system will attempt to delete the oldest transferred exam data. If no deleteable data exists, a "DISK FULL" message is displayed on the SONOLINE G50/G60 S system display. The user must then delete exams not transferred in order to temporarily store additional images.

### 5.1.2.3 Real World Activity - Print

The user selects "New Patient" at the start of each patient examination. When configured for DICOM printers, and the "Print1" or "Print 2" key is pressed, the SONOLINE G50/G60 S saves each image to the hard disk until the last image of the film sheet is saved. When the first image of the next film sheet is saved, an association is opened, for the previous completed film sheet.

If the user terminates the exam by either "Close Exam" or "New Patient", all partially completed film sheets will be transferred to the printer.

#### 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 opened when the first image of each selected exam is transferred and

closed when the last image transfer is complete. An association is also opened after a network outage, or if images are queued to be printed, or when the system is powered-on and the 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 G50/G60 S 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	Not used.
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** Optional Attributes set for the Basic Film Box SOP Class.

Attribute Name	Attribute Tag	Usage	Range	Description
Image Display Format	(2010,0010)		STANDARD\ X,Y	Where X, Y can be configured/ selected as <...values...>
Film Orientation	(2010,0040)	U	PORTRAIT LANDSCAPE	Range may be limited by print server/printer.
Film Size ID	(2010,0050)	U	8INX10IN 8.5X11IN 10X12IN 10X14IN 14INX17IN 20CMX25CM 35CMX43CM	Range may be limited by print server/printer.
Magnification Type	(2010,0060)	U	REPLICATE BILINEAR CUBIC NONE	Used.
Min. Density	(2010,0120)	U	0-99999	Used - printer specific
Max Density	(2010,0130)	U	0-99999	Used - printer specific
Configuration Information	(2010,0150)	U	Limited by Print server/printer.	Used.
Smoothing Type	(2010,0080)	U	Values depend on Printer	Used.
Border Density	(2010,0100)	U	BLACK WHITE i	where i represents the desired image density in hundredths of OD
Empty Image Density	(2010,0110)	U	BLACK WHITE i	where i represents the desired image density in hundredths of OD
Trim	(2010,0140)	U	YES NO	Used.

## 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** Optional Attributes set for the Basic Grayscale Image Box SOP Class.

Name	Attribute	Range	Description
Image Position	(2020,0010)	1-???	Value according to Image Display Format
Polarity	(2020,0020)	NORMAL REVERSE	Intensity mapping between display and print
Magnification Type	(2010,0060)	REPLICATE, BILINEAR, CUBIC, NONE	Used. Note that Magnification Type is always set to the same value as FILM BOX
Smoothing Type	(2010,0080)	Values depend on Printer	Used. Note that Smoothing Type is always set to the same value as FILM BOX

**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	NORMAL WARNING FAILURE	During a "Failure" the Print job will be displayed as "Failed, awaiting retry"
Printer Status Information	U	Vendor specific	Reported to user if printer status = WARNING.
Printer Name	U		Used (not reported to user)
Manufacturer	U		Used (not reported to user)
Manufacturers Model Name	U		Used (not reported to user)
Device Serial Number	U		Used (not reported to user)
Software Versions	U		Used (not reported to user)
Date of Last Calibration	U		Used (not reported to user)
Time of Last Calibration	U		Used (not reported to user)

## Proposed Presentation Context to a Color Print Server

**Table 18** Color Print Server Presentation Context.

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	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 G50/G60 S 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** Optional 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 G50/G60 S 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	All	B60x
Failure	Printing not successful	C60x

## 6.0 Communication Profiles

All SONOLINE G50/G60 S 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.

### 6.1 TCP/IP Stack Supported

Each process inherits its TCP/IP stack from the SONOLINE G50/G60 S's operating systems TCP/IP stack. Port number 104 is used for DICOM communication with the SONOLINE G50/G60 S.

#### 6.1.1 Physical Media Supported

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

#### 6.1.2 Chapter Extensions/Specializations/Privatizations

No private elements are used by the SONOLINE G50/G60 S AE.

Pixel Spacing (0028,0030) is provided in Single Frame images

## 7.0 Configuration

SONOLINE G50/G60 S Networking and DICOM parameters can be configured through the SONOLINE G50/G60 S System Presets Menu screens. The following configuration is supported:

- General system
- Network (local and remote)
- DICOM Store
- DICOM Print

### 7.1 General System Configuration

The following system parameter can be configured via the SONOLINE G50/G60 S System Presets Basic Menu screens. This parameter is mapped to DICOM image attributes:

- Hospital Name

#### 7.1.1 Hospital Name

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

### 7.2 DICOM Network Configuration

DICOM and networking parameters can be configured for both the local G50/G60 S device and remote DICOM service class providers through the System Presets DICOM Network Menu.

#### 7.2.1 Local

The SONOLINE G50/G60 S local network parameters are configurable. The following network parameters can be configured for SONOLINE G50/G60 S device:

- Host Name (i.e. G50/G60 S)
- IP address
- Network IP mask
- DICOM Application Entity Title

### 7.2.2 Remote

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

- Host name
- IP address
- Router/Gateway Host Name
- Router/Gateway IP address

### 7.3 DICOM Store Configuration

Remote DICOM Storage service class providers are configured through the DICOM - Store page of the System Presets menu. The following parameters can be configured:



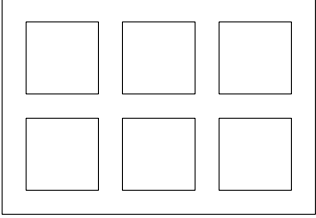
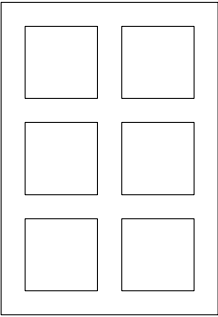
- Alias
- IP Address
- AET - Application Entity Title
- Port number
- Write Time
- Connect Time

### 7.4 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 user can change each element at any time during the operation of the SONOLINE

G50/G60 S. 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 23** 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, 14x17 inches, 20x25 cm., and 35x43 cm.
Film Orientation	Select from Portrait: <div style="text-align: center;"></div> or Landscape: <div style="text-align: center;"></div>
Display Format	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: <div style="text-align: center;"></div> A 6 on 1 with Portrait mode would have 2 columns and 3 rows: <div style="text-align: center;"></div>
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

**Table 23** User-configurable printer parameters. (Continued)

Parameter	Description
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, WHITE or i border around film
Empty Image Density	BLACK, WHITE, or i empty image segments on film
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

## 7.5 External Equipment Configuration

The SONOLINE G50/G60 S user can configure “Hard Key” to “Output Device” mapping through the System Presets - Customize Keys. Print images are acquired and sent to the assigned device when the user presses the associated key. The following key assignments are supported:

- **Digital Store** – This key can be assigned to Multi-frame Store Capture, Cine Store or Disk Store
- **Print/Store 1** – 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.

## 7.6 Support of Extended Character Sets

The “ISO-IR 100” Latin Alphabet 1 Extended character set is supported by the SONOLINE G50/G60 S system.