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**Candelis, Inc.**

**ImageGrid HL7 Conformance Statement**

Version 2.1.2

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# 1. Introduction

ImageGrid is a medical image and information distribution product designed for integration into a medical institution's existing Information Systems (IS) infrastructure. The product utilizes the medical industry standard HL7 2.3.1 messaging protocol to exchange information with other HL7-compliant applications on the IS network, such as another Electronic Medical Record (EMR) or Radiology Information System (RIS). The primary use of the HL7 protocol in this setting is to exchange patient demographics, orders, and results both in and out of the ImageGrid system.

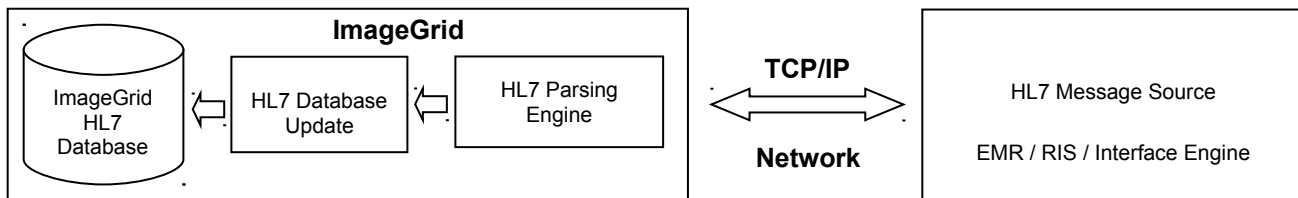
## 2. Implementation Model

The ImageGrid HL7 implementation model consists of a server and one or multiple client components. Clients may include other EMR/RIS, reporting, and/or billing systems. In a typical environment, the server will receive inbound messages from the clients, and use the data contained therein to perform rules-based data updates to the ImageGrid database. The stored data can then be used to provide a modality worklist (MWL) to other DICOM-complaint modalities or to reconcile data inconsistencies that may occur between data from the EMR/RIS and the modality. Depending on a site's workflow requirements, the server may also be called upon to send outbound messages to its clients.

All HL7 messages are exchanged on top of the TCP/IP communication protocol. Following the HL7 standard, acknowledgment messages are sent for each inbound message received by the ImageGrid. Similarly, the ImageGrid HL7 interface expects all outbound messages sent by it to also be acknowledged by the recipient.

### 2.1. Application Data Flow Diagram

Once the ImageGrid HL7 interface is properly installed and configured, a network port is opened to "listen" for incoming HL7 messages. At the same time, processes to parse incoming messages, process them, and log all transactions and error messages are also initialized.



The ImageGrid server process and its integration component operate as daemons; therefore, when the operating system is started, the ImageGrid HL7 integration component and connections activate automatically. There are no user serviceable configurations. ImageGrid Customer Care personnel will perform HL7 changes that are required for message control characters, IP address, port, and custom data mappings (if needed).

### 2.2. Sequencing of Real-World Activities

It is assumed that patient demographics and visit information will be transported via HL7 ADT events, while order and result information will be imported via HL7 ORM and ORU events, respectively. In most cases, the general sequence of HL7 events will be ADT, ORM, and ORU. However, the ImageGrid interface accommodates overlapping or redundant functions within messages. For example, order messages can establish new patients, visits, and providers in the ImageGrid clinical database in addition to creating a new order. Patient demographics are established by the first HL7 message that is received and updated with subsequent ADT messages.

### 3. Message Specifications

The ImageGrid HL7 interface supports the message types, trigger events, segments, and fields outlined in the tables below. Each of their requirements are also included, as is information regarding how various HL7 fields are mapped by ImageGrid to corresponding DICOM data elements.

#### 3.1. Code Tables

The following code tables list the abbreviations that are unique to this document, as well as other HL7-standard or proprietary codes that are likely to appear or are required in supported messages.

Code Type	Code	Meaning	Description/Comments
Patient Status	C	Clinic	
Patient Status	D	Discharged	
Patient Status	E	Emergency	
Patient Status	I	Inpatient	
Patient Status	O	Outpatient	

Code Type	Code	Meaning	Description/Comments
Exam Status	S	Scheduled	An exam has been scheduled but not yet started. This is the default code when none is received in an order (ORM) message.
Exam Status	I	In Progress	The exam is in progress; the patient has arrived and the exam has begun.
Exam Status	C	Completed	The exam is complete and is pending a diagnostic report.
Exam Status	D	Dictated	A report has been dictated for the exam through a dictation system; but has not been transcribed.
Exam Status	P	Preliminary	The diagnostic report has been transcribed for the exam. This is the default code when none is received in a results (ORU) message.
Exam Status	F	Finalized	The diagnostic report has been signed.
Exam Status	A	Addendum	An addendum has been received and the report needs to be finalized again.

Code Type	Code	Meaning	Description/Comments
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Order Status	IP	In Progress	The order is in progress. The corresponding modality worklist item will be updated to reflect the new status.
Order Status	CM	Completed	The order has been completed. The corresponding modality worklist item will be updated to reflect the new status.
Order Status	DC	Discontinued	The order has been cancelled. The corresponding modality worklist item will be updated to reflect the new status.

Code Type	Code	Meaning	Description/Comments
Data Requirement	R	Required (for ImageGrid)	The element or attribute must be present. Data must be provided in this position.
Data Requirement	C	Conditional (for ImageGrid)	The element or attribute must be present under some circumstances. Data must be provided to enable specified software functions.
Data Requirement	O	Optional (for ImageGrid)	The element or attribute is supported, but not required. Data will be imported if provided in the message.

Code Type	Code	Meaning	Description/Comments
Sex	M	Male	
Sex	F	Female	
Sex	U	Unknown	

Code Type	Code	Meaning	Description/Comments
HL7 Delimiter Character	<11>	0x0B (Vertical Tab)	Delimiter character for the start of an HL7 message. The ImageGrid interface can read this character when presented as shown or as a non-printable character.
HL7 Delimiter Character	<13>	0x0D (Carriage Return)	Delimiter character for HL7 message segments. The ImageGrid interface can read this character when presented as shown or as a non- printable character..
HL7 Delimiter Character	<28><13>	0x1C, 0x0D (File Separator, Carriage Return)	Delimiter characters for the end of an HL7 message. The ImageGrid interface can read this character when presented as shown or as a non-printable character. (Note, the final set of characters in a message would be <13><28><13> as a result of terminating the last segment as well as terminating the message.)

### 3.2. Supported Message Types and Trigger Events

ImageGrid supports the following HL7 message types and events. When unrecognized message types/events are received, the message will be logged by the ImageGrid HL7 service and a negative acknowledgment will be returned. All HL7 messages are recognized by the combination of supported message start and termination delimiter characters, and a valid MSH segment.

Type / Trigger	Description	Comments
ADT^A01	Admit a patient.	This event can be used to record a new visit; not limited to inpatients. May be used for inpatients or outpatients. See Patient Status codes and segment PVI-2.
ADT^A04	Register a patient.	
ADT^A05	Pre-admit a patient.	
ADT^A08	Update patient demographics.	
ADT^A40	Merge patients.	
ORM^O01	Order message.	The following order control codes are supported: CA – Cancel Order DC – Discontinue Order NW – New Order OC – Order Cancelled RO – Replace Order SC – Status Changed XO – Change Order
ORU^R01	Unsolicited result.	Results are sent to the target application without a query or request (unsolicited).
DFT^P03	Detailed financial transaction.	Outbound only.

### 3.3. Support Segments and Fields

Note that unsupported segments will be ignored by the ImageGrid HL7 interface. Also, not all fields are supported for the segments below; please see the individual segment tables for more details.

Segment	REQ	Description	Comments
MSH	R	Message Header	
MSA	C	Message Acknowledgment	Returned by ImageGrid in all ACK messages.
PID	R	Patient Identification	
PV1	C	Patient Visit	Required for ADT messages.
PV2	O	Patient Visit, Additional Information	
PD1	O	Patient Demographics	
MRG	C	Merge Patient Information	Required for ADT^A40 messages.
ORC	C	Common Order	Required for ORM and ORU messages.
OBR	C	Observation Request	Required for ORM orders and ORU results.
OBX	C	Observation/Result	Required for ORU results.
ZDS	O	Custom Data	

#### 3.3.1. MSH Segment – Message Header

SEQ	LEN	REP	REQ	Element Name	Meaning	Comments
1	1	N	R	Field Separator	Field Separator	Value:
2	4	N	R	Encoding Characters	Encoding characters	Value: ^~\& These characters cannot appear as data in any part of the message.
3	180	N	R	Sending Application	Sending Application	Returned in ACK.
4	180	N	R	Sending Facility	Sending Facility	Returned in ACK.
7	26	N	R	Date/Time of Message	Date/Time of Message	Returned in ACK.
9	7	N	R	Message Type	Message Type	Returned in ACK. Required to identify message.
10	20	N	R	Message Control ID	Message Control ID	Returned in ACK.

### 3.3.2. MSA Segment – Message Acknowledgment

SEQ	LEN	REP	REQ	Element Name	Meaning	Comments
1			R	Acknowledgment Code	Acknowledgment Code	'AA' for positive acknowledgments. 'AE' for negative acknowledgments.
2			R	Message Control ID	Message Control ID	Taken from MSH-10.
3			R	Text Message	Text Message	Error message, if negative acknowledgment.
4			O	Expected Sequence Number	Expected Sequence Number	
5			O	Delayed Acknowledgment Type	Delayed Acknowledgment Type	
6			O	Error Condition	Error Condition	

### 3.3.3. PID Segment – Patient Identification

SEQ	LEN	REP	REQ	Element Name	Meaning	Comments
2	20	N	O	Patient ID	MPI Number	Equates to DICOM (0010, 0021).
3^1	20	N	R	Patient Identifier List	MRN	Used for primary patient matching. Equates to DICOM (0010, 0020).
3^6	10	N	O		Organization Code / Visit Organization	
4	20	N	O	Alternate Patient ID	Department Number	Used for secondary patient matching.
5^1	35	N	R	Patient Name	Last Name	Used for secondary patient matching. Equates to DICOM (0010, 0010).
5^2	35	N	R		First Name	Used for secondary patient matching. Equates to DICOM (0010, 0010).
5^3	35	N	O		Middle Name	Used for secondary matching. Equates to DICOM (0010, 0010).
5^4	5	N	O		Suffix Name	
5^5	5	N	O		Prefix Name	
5^6	20	N	O		Title Name	
6	35	N	O	Mother's Maiden Name	Mother's Maiden Name	
7		N	R	Date/Time of Birth	Date/Time of Birth	Format: CCYYMMDDHHMMSS Used for secondary patient matching. Equates to DICOM (0010, 0030).
8	1	N	R	Sex	Sex	Values: M, F, U. Used for secondary patient matching. Equates to DICOM (0010, 0040).



### 3.3.3. PID Segment – Patient Identification (Continued)

SEQ	LEN	REP	REQ	Element Name	Meaning	Comments
9^1	35	N	O	Patient Alias	Alias Last Name	
9^2	35	N	O		Alias First Name	
9^3	35	N	O		Alias Middle Name	
9^4	5	N	O		Alias Suffix Name	
9^5	5	N	O		Alias Prefix Name	
9^6	20	N	O		Alias Title	
11^1	50	N	O	Patient Address	Address Line 1	
11^2	50	N	O		Address Line 2	
11^3	35	N	O		City	
11^4	2	N	O		State	
11^5	10	N	O		Postal Code	
11^6	10	N	O		Country	
13	30	N	O	Phone Number -Home	Phone Area, Exchange, and Last 4	Format: (XXX) XXX-XXXX
14	30	N	O	Phone Number -Business	Work Phone Area, Exchange, Last 4, and extension	Format: (XXX) XXX-XXXX
18	20	N	C	Patient Account Number	Visit Number	Needed to update patient location and status. Equates to DICOM (0038, 0010).
19	11	N	O	SSN Number -Patient	SSN Number	Used for secondary matching.
23	35	N	O	Birth Place	Place of Birth	

### 3.3.4. PV1 Segment – Patient Visit

SEQ	LEN	REP	REQ	Element Name	Meaning	Comments
2	1	N	R	Patient Class	Patient Status Patient Type	I, E, O, C, or D (as per Patient Status code table)
3^2	10	N	O	Assigned Patient Location	Patient Location	Room Number component. Equates to DICOM (0038, 0300).
4		N	R	Admission Type	Is Pregnant Flag	Allowable values are 'Y', 'N', and 'U'. 'U' is inserted when no value is provided or value is unrecognized. Pregnancy status equates to DICOM (0010, 21C0).
7^1	20	N	O	Attending Doctor	Attending ID	
7^2	35	N	C		Attending Last Name	Last and First Names are required when ID is present.
7^3	35	N	C		Attending First Name	Last and First Names are required when ID is present.
7^4	35	N	O		Attending Middle Name	
44		O	O	Admit Date/Time	Admit Date and Time	Format: CCYYMMDDHHMMSS
45		O	O	Discharge Date/Time	Discharge Date and Time	Format: CCYYMMDDHHMMSS

### 3.3.5. PV2 Segment – Patient Visit, Additional Information

SEQ	LEN	REP	REQ	Element Name	Meaning	Comments
3	255	N	O	Admit Reason	Signs and Symptoms	

### 3.3.6. PD1 Segment – Patient Demographics

SEQ	LEN	REP	REQ	Element Name	Meaning	Comments
4^1	20	N	O	Patient Primary Care Provider Name and ID	PCP ID	
4^2	35	N	C		PCP Last Name	Last and First Names are required when ID is present.
4^3	35	N	C		PCP First Name	Last and First Names are required when ID is present.
4^4	35	N	O		PCP Middle Name	
4^5	5	N	O		PCP Suffix Name	
4^6	20	N	O		PCP Title Name	

### 3.3.7. MRG Segment – Merge Patient Information

SEQ	LEN	REP	REQ	Element Name	Meaning	Comments
1	20	N	R	Merge Patient Identifier List	MRN	Used to identify the patient to merge from. The patient to merge to should be indicated in the PID segment.

### 3.3.8. ORC Segment – Common Order

SEQ	LEN	REP	REQ	Element Name	Meaning	Comments
1	2	N	R	Order Control		Applies to ORM messages only.  Supported values: CA – Cancel Order DC – Discontinue Order NW – New Order OC – Order Cancelled RO – Replace Order SC – Status Changed XO – Change Order
5	2	N	R	Order Status	Order Status	Applies to ORM/SC messages only.  Supported values: IP – In Progress CM – Completed DC – Discontinued
10^1			C	Entered By ID	Entered By	Required for Order Cancel messages (ORM: ORC-1 = 'CA', 'DC', or 'OC').  Customer may elect to use Ordering Provider (OBR-16 or ORC-12) or default to a fixed value such as 'RIS Entry'.  Equates to DICOM (0040, 2008).
10^2			C	Entered by Last Name	Provider Last Name	Last and First Names are required when ID is present.
10^3			C	Entered by First Name	Provider First Name	Last and First Names are required when ID is present.
16	10	N	C	Order Control Code Reason	Cancel Reason	Required for Order Cancel messages (ORM: ORC-1 = 'CA', 'DC', or 'OC').  Interface inserts the value 'DEFAULT' but customer may elect to map to a defined set of values presented in messages.

### 3.3.9. OBR Segment – Observation Request

SEQ	LEN	REP	REQ	Element Name	Meaning	Comments
1				Set ID - OBR		Not processed.
3	20	N	R	Filler Order Number	Accession number	Note: this is usually provided by the RIS. Accession numbers must be unique. Messages that update orders (status changes, cancels, and results) must contain a match for the original accession and MRN.  Equates to DICOM (0008, 0050).
4^1	10	N	R	Universal Service ID	Exam Code	Equates to DICOM (0040, 1001).
4^2	255	N	R		Exam Description, Exam Mod 1 Code, Exam Mod 2 Code, Exam Mod 3 Code.	Exam Mod codes are delimited by '/' by default; this should be reviewed at each site. Equates to DICOM (0032, 1060).
7		N	O	Observation Date/Time	Exam Date/Time	Format: CCYYMMDDHHMMSS Customer should verify the meaning of the data that is provided. Expected to be Acquisition Time. Note that this value is overwritten by the DICOM Study Date/Time tag when exception resolution occurs.
13	255	N	O	Relevant Clinical Info	Diagnosis	Free text entry. Equates to DICOM (0010, 2000).
16^1	20	N	R	Ordering Provider	Ordering Number	Equates to DICOM (0032, 1032).
16^2	35	N	R		Ordering Last Name	Last and First Names are required when ID is present. Equates to DICOM (0032, 1032).
16^3	35	N	R		Ordering First Name	Last and First Names are required when ID is present. Equates to DICOM (0032, 1032).
16^4	35	N	O		Ordering Middle Name	Last and First Names are required when ID is present. Equates to DICOM (0032, 1032).
24	10	N	R	Diagnostic Service Section ID	Performing Resource	Describes the Performing Resource that will be used such as a room or area.
25	10	N	R	Result Status	Exam Status	If OBR-25='F' then NOW used for Final Date/Time. See the exam status code table for allowable values.
27^4		N	R	Quantity/Timing	Scheduled Date/Time	Date and Time that Image Acquisition is expected to be performed. CCYYMMDDHHMMSS.
27^6		N	O		Stat Codes-Priority	ConnectR translation to Stat='Y' or Stat='N'.

### 3.3.9. OBR Segment – Observation Request (Continued)

SEQ	LEN	REP	REQ	Element Name	Meaning	Comments
31	255	N	O	Reason For Study	History	Equates to DICOM Reason for Imaging Service Request (0040, 2001)
32^1	20	N	C	Principal Result Interpreter	Interpreter 1 Number	If OBR-25 = 'F', Signing Provider 1 Number instead of Interpreter 1 Number. Required if OBR-25='F'.
32^2					Interpreter 1 Last Name	Last and First Names are required when ID is present.
32^3					Interpreter 1 First Name	Last and First Names are required when ID is present.
32^4					Interpreter 1 Middle Name	
33^1	20	Y-1	O	Assistant Result Interpreter	Interpreter 2 Number for first occurrence, Interpreter 3 Number for second occurrence.	If OBR-25 = 'F', Signing Provider 2 or 3 Number instead of Interpreter 2 or 3 Number.
33^2					Interpreter 2 or 3 Last Name	Last and First Names are required when ID is present
33^3					Interpreter 2 or 3 First Name	Last and First Names are required when ID is present
33^4					Interpreter 2 or 3 Middle Name	

### 3.3.10. OBX Segment – Observation / Result

SEQ	LEN	REP	REQ	Element Name	Meaning	Comments
1		N	R	Set ID - OBX		Used to identify the correct placement of lines of transcribed text.
2		N	R	Value Type		Specifies the type of data included in OBX-5. Use 'TX' for text, 'ED' for encapsulated data, and 'RP' for reference pointer.
5	No limit	Y	R	Observation Value	Report Text	<p>If OBX-2 = 'TX', transcribed result text can be presented as one line of text per OBX segment, or as a single OBX segment with repetition separators (the '~' character).</p> <p>If OBX-2 = 'ED', data is byte-64 encapsulated data (outbound only).</p> <p>If OBX-2 = 'RP', data contains a URL to open an image using the ImageGrid viewer (outbound only).</p>
11		N	R	Observation Result Status		'D' for draft, 'F' for final report.

### 3.3.11. ZDS Segment – Custom Data

SEQ	LEN	REP	REQ	Element Name	Meaning	Comments
1		N	C	Study Instance UID	Study Instance UID	Equates to DICOM (0020, 000D).

## 4. Extended Character Set Support

The current implementation of the ImageGrid HL7 interface has only been tested for compatibility with the standard ANSI (ASCII) character set.