GenMark

transforming multiplex
molecular testing

ePlex™ LIS Specifications

GenMark Dx®

Contents

GenMark Acronyms and Definitions

GLI	GenMark LIS Interchange: The application that controls the LIS functionality for the ePlex
GLIM	GenMark LIS Interchange Manager: A Graphical User Interface (GUI) to configure settings, monitor LIS communication, perform system checks and view transaction logs
GLIS	GenMark LIS Interchange Service: A windows service that runs in the background to provide LIS communication between the instrument software and the LIS interface.
ISW	Instrument Software: The application that provides the high level settings to enable or disable the instrument LIS interface; in addition to other instrument settings
PTO	Pending Test Order: A test request from the LIS/host to be performed by the instrument

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1. Introduction

1.1 Overview

The purpose of this document is to specify the interface for exchanging information between the ePlex™ system and a Laboratory Information System (LIS), provide the required hardware and software configurations for LIS connectivity, and describe a file import/export feature that does not require LIS connectivity. It is intended to be used by GenMark and its customers' LIS professionals to jointly install, test, and implement the interface between systems and assumes that the audience has working knowledge of interface processes and messaging standards.

The intended audience includes:

- LIS Vendors
- Information Technology (IT)
- GenMark Support Personnel (e.g. Molecular Applications Specialists)

This document describes message structures based on both ASTM and HL7 used by the ePlex system. The messaging protocol for ePlex interfaces must be implemented as specified in this document. The document provides the information needed to define messages, panel codes (also referred to as LIS Identifiers) and target result codes for ASTM and HL7 interfaces between the LIS and ePlex.

ASTM standard specification LIS1-A (formerly ASTM E1381-02) for low level protocol and LIS2-A2 (formerly ASTM E1394-97) standard specification for transferring information between the instrument and the Laboratory Information System govern the ASTM interface.

This document describes the HL7 interface message structure that is based on parts of HL7 v2.3 that are required by the ePlex interface. However, ePlex can receive messages if the full HL7 v2.3 structure is used, but will ignore all segments and formats not described in the following specification.

The information in this specification document is applicable to all ePlex systems unless noted otherwise.

1.2 Referenced Documents

- LIS1-A: Refer to the ASTM E1381-02 document, which you can obtain from www.astm.org
- LIS2-A2: Refer to the ASTM E1394-97 document, which you can obtain from www.astm.org
- HL7: See version 2.3 of the Health Level Seven standard for a full description of all messages, segments and fields. You can obtain information regarding HL7 at www.hl7.org

2. Architecture

The LIS connectivity architecture of the ePlex system consists of the ePlex Instrument Software (ISW) and the GenMark LIS Interchange (GLI) application (Figure 1).
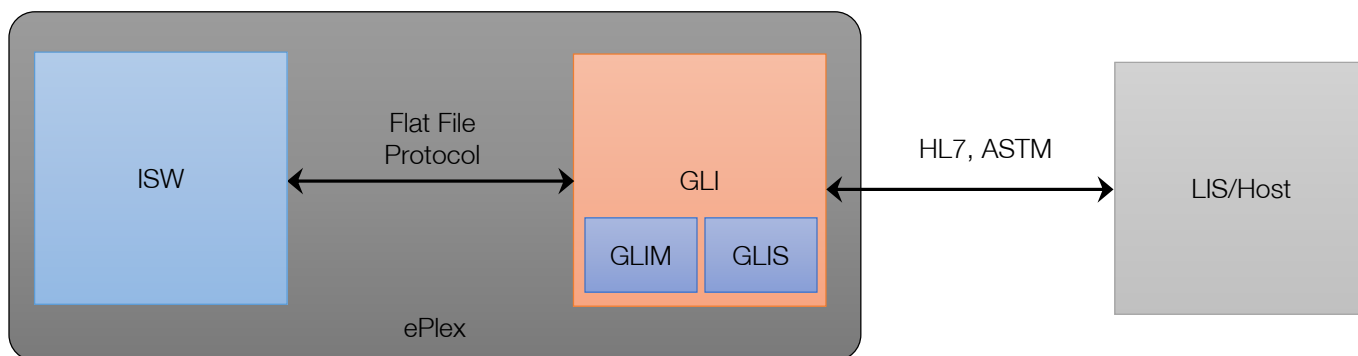
FIGURE 1 - ARCHITECTURE

The ePlex ISW communicates with the GLI and the GLI supports both HL7 v2.3 and ASTM two-way communication with LIS. The GLI is made up of two components, the GenMark LIS Interchange Manager (GLIM) and the GenMark LIS Interchange Service (GLIS) described in detail below. Furthermore, the GLI has the capability of importing and exporting text files to/from network folders without the need for LIS connectivity.

2.1   Instrument Software (ISW)

The ePlex Instrument Software provides the high level settings to enable the LIS and control the results to automatically release to the LIS interface. The LIS must be enabled by a user with supervisor credentials via the LIS tab in the Settings>LIS tab (Figure 2). In order for the ePlex system to accept messages from the LIS, at least one assay must be checked as active under the Active column of the Assays tab in the Settings>Assays tab (Figure 3).

FIGURE 2 – LIS SETTINGS
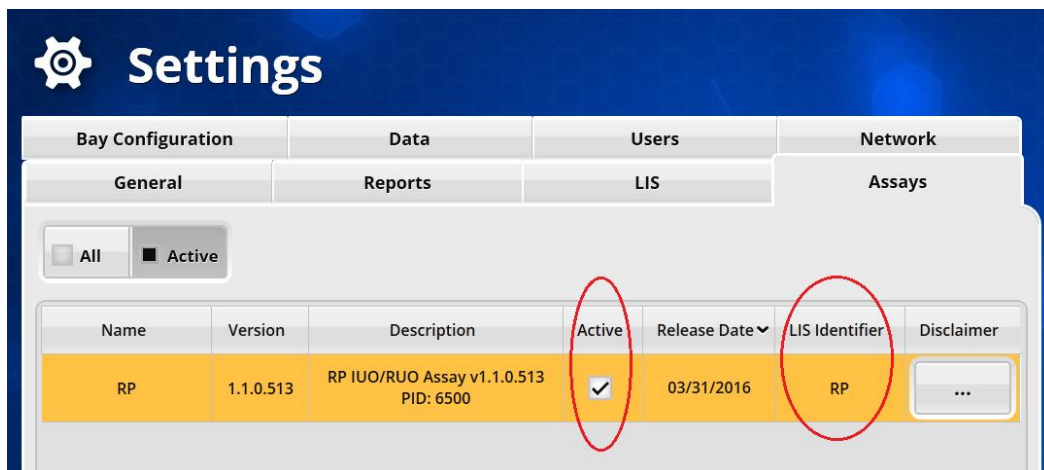
FIGURE 3 – ASSAYS SETTINGS

2.2 GenMark LIS Interface (GLI)

The GLI application monitors low level connectivity, and processes order and result data to convert them into acceptable messages within the guidelines of ASTM and HL7 messaging standards. These guidelines include actions to drive the instrument's behavior to test requests, laboratory workflow, and communicate final result data to the Laboratory Information System.

The GLI application controls the LIS functionality for ePlex by way of the following two components:

- **The GenMark LIS Interchange Manager (GLIM):** A Graphical User Interface for the GLI to configure settings, monitor LIS communication, perform system tests, and view transaction logs (Figure 4)
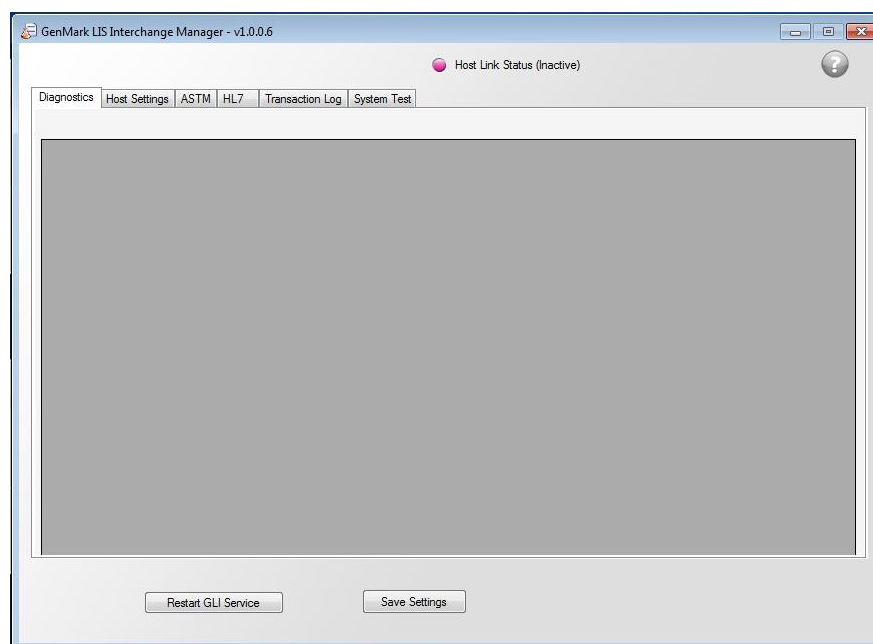
FIGURE 4 – GLIM

- **The GenMark LIS Interchange Service (GLIS):** A Windows Service that runs in the background (invisible to the user) enables LIS communication between the instrument software and the LIS interface. If this process is stopped or disabled, LIS communications will not be active.

Note: In order for the Host Link Status shown in Figure 4 to become active (green light), the ePlex ISW must display at least one active assay in the Settings>Assays tab (Figure 3).

2.2.1 Supported LIS Functionality

This section describes the specific supported functionality the LIS to ePlex GLI interface must include for the instrument to function as expected with the LIS. These standards affect specific interface functionality and the intended processing of order and result messages:

- The LIS must send test requests for panels (also referred to as LIS Identifiers) rather than individual targets. The GLI uses LIS Identifiers, not individual test codes, to populate Pending Test Orders. Test codes sent from the LIS must match those defined in the ePlex ISW. If they do not already match, the LIS vendor or customer must translate them to the codes listed in the following Panel Codes table. Panel Codes are in uppercase letters *(Table 1).*

- The result code for each target in a panel must be defined in the LIS in order to receive result messages from ePlex. The result codes should be defined in the LIS for download only (i.e. result codes should not be transmitted in order messages, they are sent in result messages from the instrument). Individual Target Result Codes per panel (Tables *2, 3, 4).*

TABLE 1 – PANEL CODES

Panel Codes	
Panel Code	**Panel Name**
BCID-GP	Blood Culture Identification Gram-Positive Panel
BCID-GN	Blood Culture Identification Gram-Negative Panel
RP	Respiratory Pathogen Panel

TABLE 2 – RP TARGET RESULT CODES

Respiratory Panel (RP)	
Panel Code	Target Result Code
RP	Adenovirus
RP	Coronavirus 229E
RP	Coronavirus HKU1
RP	Coronavirus NL63
RP	Coronavirus OC43
RP	Middle East Respiratory Syndrome Coronavirus
RP	Human Bocavirus
RP	Human Metapneumovirus
RP	Human Rhinovirus/Enterovirus
RP	Influenza A
RP	Influenza A H1
RP	Influenza A 2009 H1N1
RP	Influenza A H3
RP	Influenza B
RP	Parainfluenza Virus 1
RP	Parainfluenza Virus 2
RP	Parainfluenza Virus 3
RP	Parainfluenza Virus 4
RP	Respiratory Syncytial Virus A
RP	Respiratory Syncytial Virus B
RP	Bordetella pertussis
RP	Chlamydophila pneumoniae
RP	Legionella pneumophila
RP	Mycoplasma pneumoniae

Note: *Middle East Respiratory Syndrome Coronavirus and Human Bocavirus are intended for EU only*

TABLE 3 – BGID-GN TARGET RESULT CODES

Blood Culture Identification Gram-Negative Panel (BCID-GN)	
Panel Code	Target Result Code
BCID-GN	Acinetobacter baumannii
BCID-GN	Bacteroides fragilis
BCID-GN	Citrobacter
BCID-GN	Citrobacter freundii/braakii
BCID-GN	Cronobacter sakazakii
BCID-GN	Enterobacter
BCID-GN	Enterobacter cloacae complex
BCID-GN	Escherichia coli
BCID-GN	Fusobacterium
BCID-GN	Fusobacterium necrophorum
BCID-GN	Haemophilus influenzae

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BCID-GN	Klebsiella oxytoca
BCID-GN	Klebsiella pneumoniae
BCID-GN	Morganella morganii
BCID-GN	Neisseria meningitidis
BCID-GN	Pantoea agglomerans
BCID-GN	Prevotella
BCID-GN	Proteus
BCID-GN	Proteus mirabilis
BCID-GN	Pseudomonas
BCID-GN	Pseudomonas aeruginosa
BCID-GN	Salmonella
BCID-GN	Serratia
BCID-GN	Serratia marcescens
BCID-GN	Stenotrophomonas maltophilia
Resistance Codes	
Panel Code	**Target Result Code**
BCID-GN	CTX-M
BCID-GN	IMP
BCID-GN	KPC
BCID-GN	NDM
BCID-GN	OXA
BCID-GN	VIM

TABLE 4 – BGID-GP TARGET RESULT CODES

Blood Culture Identification Gram-Positive Panel (BCID-GP)	
Panel Code	**Target Result Code**
BCID-GP	Bacillus cereus group
BCID-GP	Bacillus subtilis group
BCID-GP	Corynebacterium
BCID-GP	Enterococcus
BCID-GP	Enterococcus faecalis
BCID-GP	Enterococcus faecium
BCID-GP	Lactobacillus
BCID-GP	Listeria
BCID-GP	Listeria monocytogenes
BCID-GP	Micrococcus
BCID-GP	Propionibacterium
BCID-GP	Staphylococcus
BCID-GP	Staphylococcus aureus
BCID-GP	Staphylococcus epidermidis
BCID-GP	Staphylococcus lugdunensis
BCID-GP	Streptococcus
BCID-GP	Streptococcus agalactiae

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BCID-GP	Streptococcus anginosus
BCID-GP	Streptococcus pneumoniae
BCID-GP	Streptococcus pyogenes

Resistance Codes	
Panel Code	Target Result Code
BCID-GP	mecA
BCID-GP	mecC
BCID-GP	vanA
BCID-GP	vanB

2.3   ePlex LIS Workflow

The ePlex system can import test orders and export results in one of the following ways:

- Automatically using the ASTM interface to communicate with a connected LIS
- Automatically using the HL7 v2.3 interface to communicate with a connected LIS
- Manually using flat files (CSV, TXT, XML) without the need for LIS connectivity

Non-duplicate test orders will be displayed in the Pending Test Orders (PTO) screen (Figure 5).

FIGURE 5 – PENDING TEST ORDERS

2.3.1   ASTM Configuration

Follow these steps to configure ASTM connectivity:

- Prerequisite Checks:
  - Ensure the GLI Service is **started**
  - Ensure LIS is **enabled**

1. Start the GLIM application from the desktop shortcut and click the Host Settings tab
2. Select ASTM under LIS Host Communications Type (Figure 6)
3. Click the Save Settings button (Figure 6)
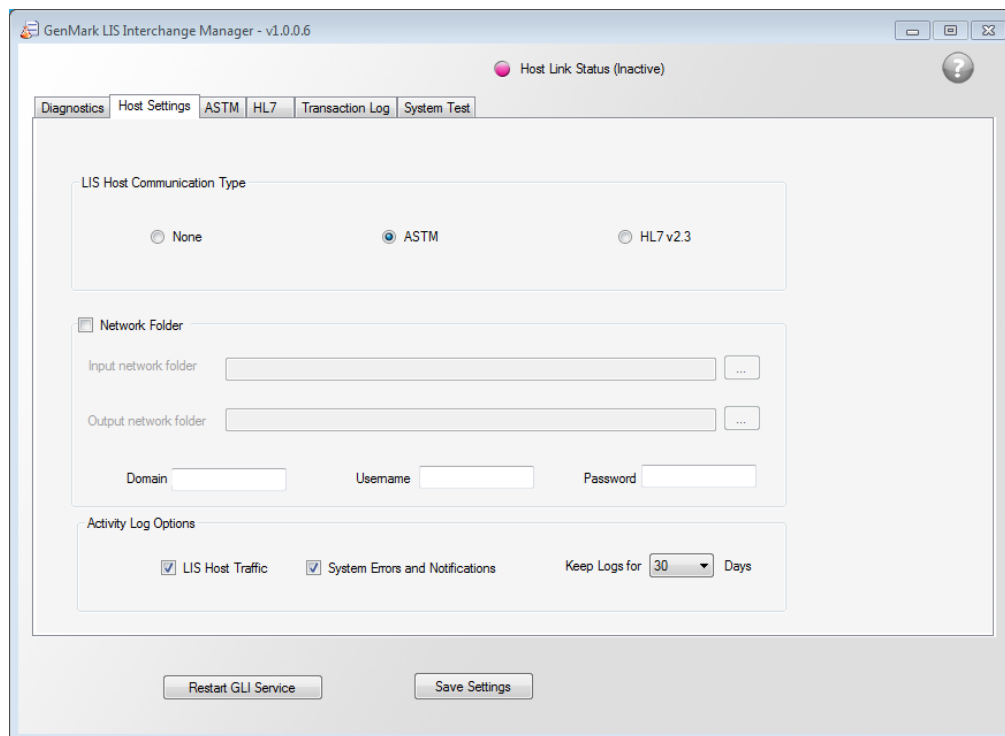
FIGURE 6 – GLI HOST SETTINGS (ASTM)

4. Click the ASTM tab and select the preferred Communication Mode in the ASTM Settings – Serial Port or TCP/IP
5. Configure the Serial Port or the TCP/IP settings based on the selected Communication Mode in (Figure 7)

FIGURE 7 – GLI SERIAL PORT AND TCP/IP PORT SETTINGS

Note: *the serial settings are the recommended default settings*

6. Click the Save Settings button (Figure 8)

FIGURE 8 – GLI ASTM SETTINGS

7. Click the OK button (Figure 9) to dismiss the confirmation dialog. The Host Link Status indicator shown in Figure 8 will turn green upon successful connection to the LIS

FIGURE 9 – GLI LIS RESTART NOTIFICATION WINDOW

8. Click the System Test tab
9. Click the Send Message to LIS button in the ASTM – Send Test Message section and wait until all the steps under the Status column indicate a Pass highlighted in green (Figure 10)
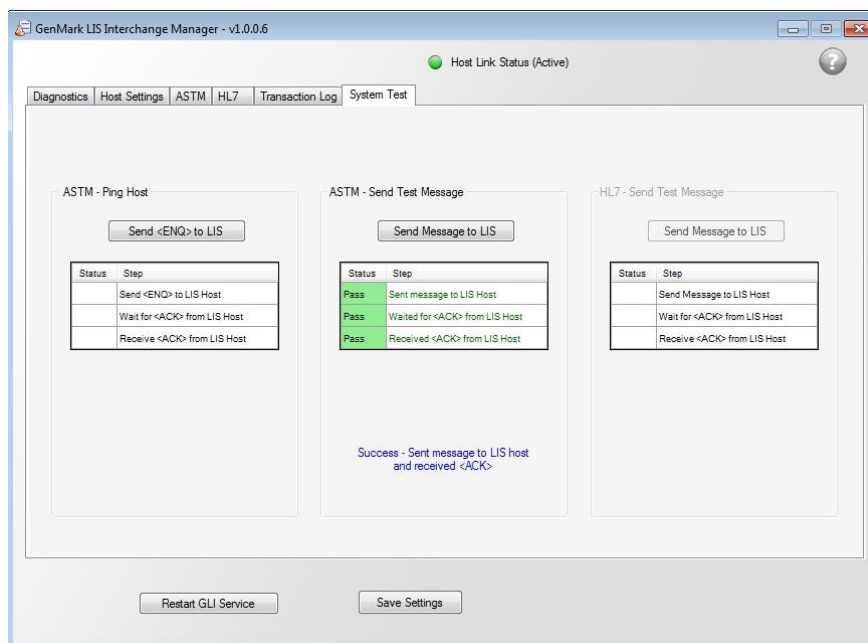
FIGURE 10 – GLI SYSTEM TEST (ASTM)

2.3.2 HL7 Configuration

Follow these steps to configure HL7 connectivity:

- Prerequisite Checks:
  - Ensure the GLI Service is **started**
  - Ensure the LIS is **enabled**

1. Start the GLIM application from the desktop shortcut and click the Host Settings tab
2. Select HL7 v2.3 under LIS Host Communications Type (Figure 11)
3. Click Save Settings (Figure 11)
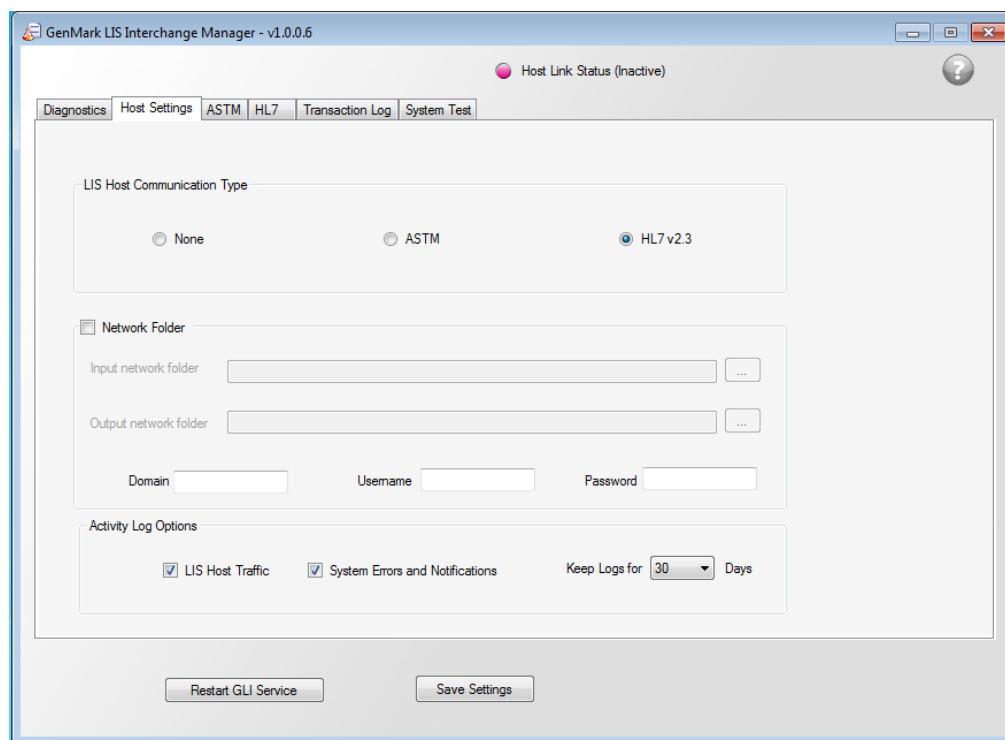
FIGURE 11 – GLI HOST SETTINGS (HL7)

4. Click the HL7 tab and configure the required settings (Figure 12). Click the Save Settings button shown in Figure 12.
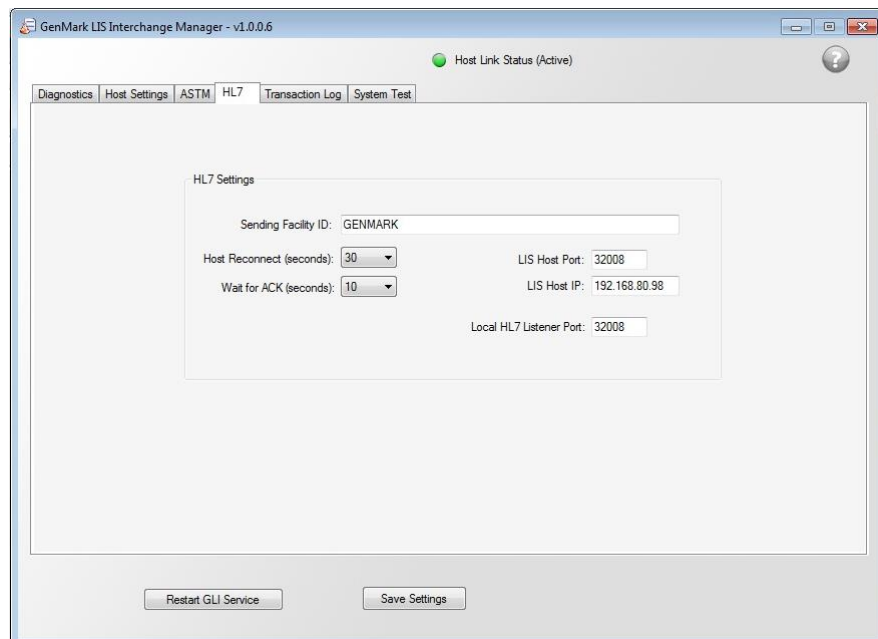
FIGURE 12 – GLI HL7 SETTINGS

Note: The LIS host port is the LIS assigned port to receive results from the instrument. The local HL7 Listener Port is intended for the instrument to receive messages from the LIS. The same port can be used to transmit orders and results if the host assigns a bidirectional port.

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5. Click the OK button shown in Figure 9 to dismiss the confirmation dialog - the Host Link Status indicator will turn green upon successful connection to the LIS
6. Click the System Test tab
7. Click the Send Message to LIS button in the HL7 – Send Test Message section and wait until all the steps under the Status column indicate a **Pass** highlighted in green (Figure 13)

Note: The HL7 Listener Status indicator will appear green (Active) ONLY when the instrument is actively receiving messages from the LIS
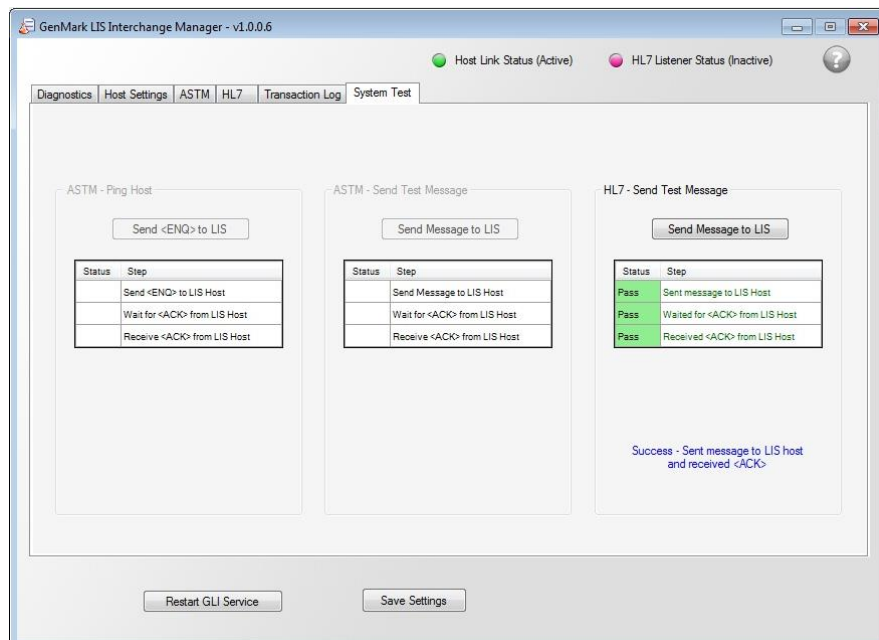
FIGURE 13 – GLI SYSTEM TEST (HL7)

2.3.3 Network Folder

Follow these steps to configure the GLI to utilize a shared network folder to download test requests and upload results in XML format

- Prerequisite Checks:
    - Ensure the GLI Service is **started**
    - Ensure the LIS is **enabled**
    - Ensure the specified network folder is shared

1. Start the GLIM application from the desktop shortcut and click the Host Settings tab
2. Select Network Folder (Figure 14)

   Note: The GLI can use HL7 or ASTM along with the network folder option simultaneously (i.e. along with orders and results being processed in HL7 or ASTM format to the LIS/Middleware) if the Network Folder is selected the results will also be released to the specified network location in XML format.
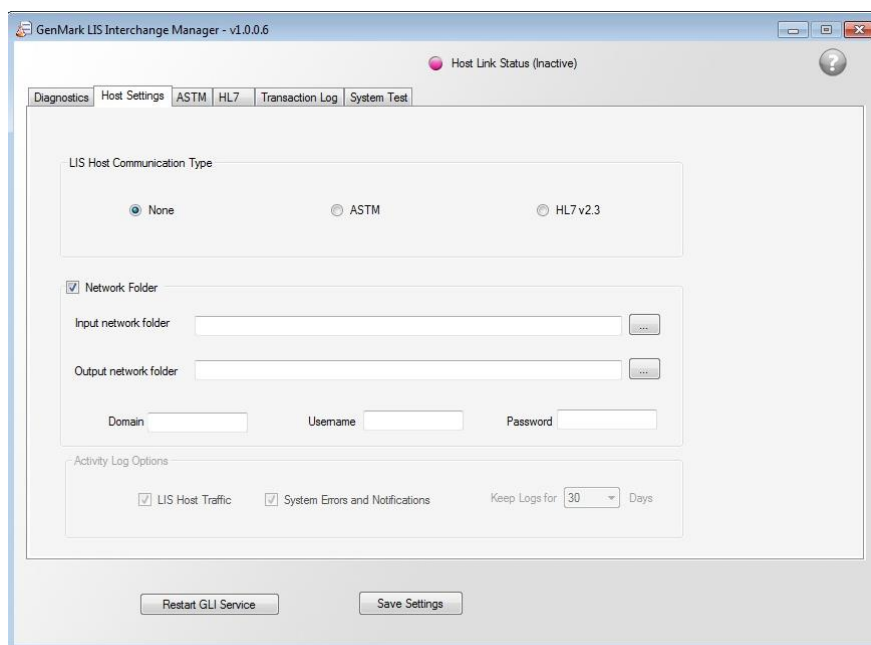
FIGURE 14 – NETWORK FOLDER SETTINGS

Gather the following network information from site IT:

3. Enter the network share location for test requests in the **Input network folder** field
    Example, \\InstrumentServer\EPLEXData\ORDERS
4. Enter the network share location for results release in the **Output network folder** field
    Example, \\InstrumentServer\EPLEXData\RESULTS
5. Enter Network Domain name of the network server.
    Example: genmark
6. Enter Username and Password to access the network server
7. Click Save Settings

3. Hardware/Network Configuration

3.1 Physical Connection Requirements

In order for the ePlex and the LIS to establish low level communication, certain physical connection requirements must be met based on the specific network connection protocol being implemented (i.e. Serial or Ethernet connection).

3.2 Serial Port

A serial port (RS232 DB9 male connector), adhering to the CLSI LIS1-A standard for bit-by-bit transmission, is located on the back of the ePlex system. Utilizing the Serial Port to connect to the LIS will enable ASTM messaging protocol only.

ePlex CPU Serial COM Port		
Male DB9 (RS232)		
Pin #	Signal Name	
1	DCD	Data Carrier Detect
2	RXD	Received Data
3	TXD	Transmit Data
4	DTR	Data Terminal Ready
5	GND	Signal Ground
6	DSR	Data Set Ready
7	RTS	Request to Send
8	CTS	Clear to Send
9	RI	Ring Indicator

LIS Cable Adapter	
Female DB9	
Pin #	Required Pinouts
1	
2	Yellow
3	Black
4	
5	Green
6	
7	
8	
9	
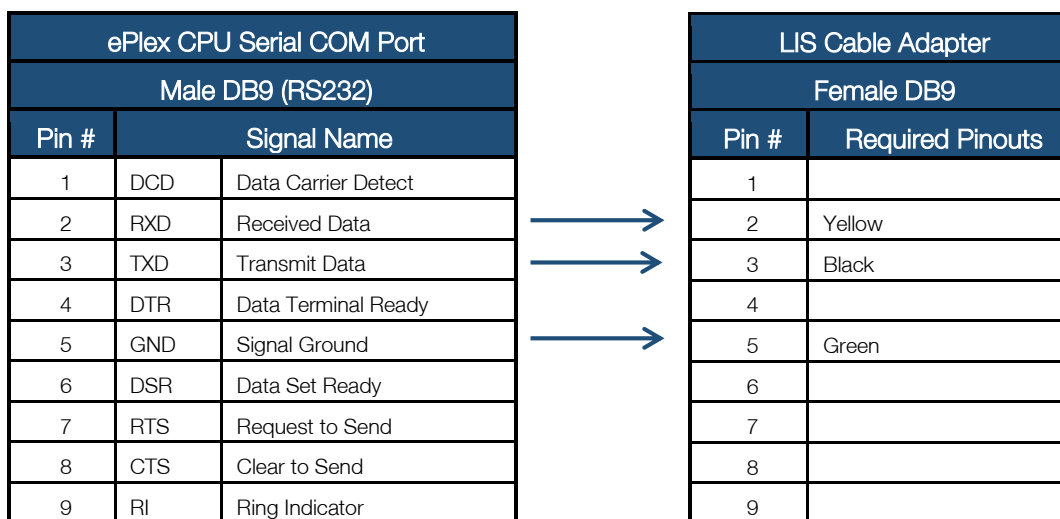
FIGURE 15 – DB9 PINOUT ASSIGNMENT

3.3 Ethernet

The ePlex system is equipped with a Network Interface Card (NIC) supporting the Ethernet protocol. Use the RJ-45 jack on the back of the ePlex system and configure the standard Windows Network TCP/IP adapter settings, if necessary, in order to add the ePlex system to a network.

3.4 Low Level Connectivity Protocol

This section provides details on the lower level network protocol, which enables the interface between the ePlex GLI and the LIS.

The ePlex interface is bidirectional, which allows for test requests and test request cancellation messages to be transmitted to the instrument, as well as result messages transmitted to the connected LIS. The information flows in only one direction at a time, which enables one system to transmit while the other monitors the communication link. The system that wants to transmit information, tries to establish the communication.

The low level connectivity protocol for the ePlex GLI HL7 interface differs from the ASTM message protocol and is described in the Health Level Seven Implementation Support Guide for HL7 Standard Version 2.3. The transfer protocol is TCP/IP only, within which each HL7 message is preceded and followed by start and end of block characters. Using this protocol, an HL7 data message is framed with a single character to start the data message and two characters to terminate it; the <CR> carriage return character.

The low-level protocol has the following three communication phases:

- Establishment phase
- Transfer phase
- Termination phase

3.4.1 Establishment Phase

The communication link is established between ePlex and the LIS, and determines the direction of the information flow as well as prepares the receiver to accept information.

After the sending system determines the data link layer state (neutral or idle), it sends an <ENQ> transmission control character to the receiving system. The sender ignores all transmission control characters other than the following: <ACK>, <NAK> or <ENQ>. Upon receiving an <ENQ>, the receiving system prepares to receive information, ignoring all other transmission control characters, then replies with <ACK> when it is ready to receive the message. Both systems move into the Transfer phase, where the sender transmits messages to the receiving system until all messages have been sent.

The following cases can occur during the Establishment phase:

- Sending <ENQ> Receiving <ACK> means that the receiver is ready to accept information, and both systems are moved to transfer phase.
- Sending <ENQ> Receiving <NAK> means that the receiver is not ready to accept information. The sender must wait at least 10 seconds (default wait time) before sending a new <ENQ>
- Sending <ENQ> Receiving <ENQ> means that both systems are in contention. ePlex GLI data manager has first priority and will resend an <ENQ> after 1 second. The LIS/host must stop trying to transmit and prepare to receive. When the next <ENQ> is received, the instrument will wait 10 seconds for the LIS to reply with a <ACK> or <NAK> to notify the instrument of its readiness state.

3.4.2 Transfer Phase

During this phase messages are sent in frames. After a frame is sent, the sender stops transmitting and waits for a respond from the receiver. The following are the possible responses at this phase:

- <ACK> Message Acknowledged – A reply of <ACK> acknowledges that the last frame was received successfully and that the receiver is ready for another frame. The sender sends the next frame, or terminates the transfer.
- <NAK> Message not Acknowledged; not ready to receive - A reply of <NAK> means that the last frame was not received successfully and that the receiver is ready to receive the frame again. Retransmission must be done by the sender.
- <EOT> End of transmission - A reply of <EOT> acknowledges that the last frame was received successfully and that the receiver is ready for another frame, but the receiver is requesting that the sender stops transmitting.

TABLE 5 – ASTM DATA LINK LAYER

ASTM Data Link Layer	
Transmission Control Codes	
Transmission Control Code Name	Description
<STX>	Beginning of text
<ETB>	Interruption of text – when the transmitted message is too large, the text is split into multiple frame, using code <ETB>
<ETX>	End of text
<CR>	Carriage return
<LF>	Line feed
<FN>	Frame number (ASCII numbers from 0 to 7. The first frame begins with 1

3.4.3 Termination Phase

During the termination phase the sender transmits the <EOT> transmission control character, notifying the receiver that all of the information has been sent.

4. ASTM Message Structure

4.1 ASTM Order Message Record Fields

This section provides the ASTM message structure specifications, including the definition for each record to be transmitted from the LIS/host to ePlex and the acceptable ASTM records and fields required by the GLI to process test order (or cancellation) messages.

4.1.1 Message Header Record

The Message Header or <H> record is used in all message types. It must always be the first record in a message transmission. The Message Header is the first record (level zero) in the message and must be followed at some point by a Message Terminator record before the data transmission session is ended or another Message Header record is transmitted.

Field #	Field Name	Value	Field Description	Required/Optional
1	Record Identifier	H	The single character to identify this record	Required
2	Delimiters	|\^&	Contains 4 characters: Field delimiter, Repetition, Component delimiter, Escape delimiter in that order	Required
3	Message Control ID	Blank	This value is the unique identifier that identifies the transmission for use in network systems that has a defined acknowledgment protocol	Optional
4	Access Password	Blank		Not Supported
5	Sender name or ID	Blank	System ID or name of sender	Optional
6	Sender Street Address	Blank		Optional
7	Reserved	Blank		Not Supported
8	Sender Telephone #	Blank		Optional
9	Characteristics of Sender	Blank		Not Supported
10	Receiver ID	Blank	System ID of receiver	Optional
11	Comment	Blank		Not Supported
12	Processing ID	Blank	How the message is to be processed. Example "P" = Production	Optional
13	Version #	Blank	ASTM version	Optional
14	Date and Time of Message	Blank	In format YYYYMMDDHHMMSS	Optional

Example: H|\^&|<CR>

4.1.2 Patient Information Record

The Patient Information or P record can be used in all message types. It contains sender and receiver identifiers, and must always be the second record in a message transmission. The P record is used to communicate patient demographics. Only the fields shown in Table 7 are required by the GLI to process test order messages from the LIS/host.

Field #	Field Name	Value	Field Description	Required/Optional
1	Record Identifier	P	The character P to identify the record	Required
2	Sequence Number	Any digit	Sequence number of the patient record occurrence in the message	Required
3	Practice Assigned Patient ID	Blank	Unique ID assigned by the Practice	Optional
4	Laboratory Assigned Patient ID	Blank	Unique ID assigned by the Laboratory	Optional
5	Patient ID Number	Blank		Optional
6	Patient Name	Blank	<Last Name>^<First Name>	Optional
7	Mother's Maiden Name	Blank		Optional
8	Birthdate	Blank	In format YYYYMMDD	Optional
9	Patient Sex	M, F or U	(M)ale; (F)emale; (U)nknown	Optional

Example: P|1|J962798|SERLAB001||TESTER^BOB||19600303|M|||||Wilson^Ned^P|||||||||||||ED West<CR>

4.1.3 Test Order Record

The Test Order or O record is used in all message types. It defines the attributes of an individual test request and contains all specimen information that is needed by the instrument to identify patient samples and perform appropriate tests.

The information in a test order record is usually associated with a single specimen; however, there may be a one-to-many relationship, where a single specimen has multiple test requests. In that case, different test IDs (or panels) are usually ordered within different order records even when they can be performed on a single specimen; the specimen information is repeated in each order record that uses that specimen.

Field #	Field Name	Value	Field Description	Required/Optional
1	Record Identifier	O	Test Order record	Required
2	Sequence Number	Any digit	Identifies the number of times the O record occurs in the message	Required
3	Specimen ID/ Control ID	Accession ID	The unique specimen ID assigned by the LIS to identify the sample	Required
4	Instrument Specimen ID	Unique instrument ID		Optional
5	Universal Test ID			
	Name	Blank		Optional
	Type	Blank		Optional
	Test ID or Name	Any value in Table 1	Identifies panel or battery to be performed on the sample	Required
6	Priority	Blank		Optional
7	Requested Date and Time	Blank	Date and time of the test request in the format YYYMMDDHHMMSS	Optional
8	Specimen Collection Date and Time	Blank	Date and time of the specimen collection in the format YYYYMMDDHHMMSS	Optional
9	Collection End Time	Blank	Collection End Time	Optional
10	Collection Volume	Blank	Collection Volume	Optional
11	Collected by (ID or Name)	Blank	Collector ID	Optional
12	Action Code	N	The action to be taken on the specimen N = New Test Order; C = Cancel Test Order	Required

Example: O|1|1444024||^^^RP|S||20110825155000||||N|<CR>

4.1.4 Message Terminator Record

The Message Terminator or L record is used in all message types, as the last record in the message. A Header record transmitted after this record signifies the start of the next message.

Field #	Field Name	Value	Field Description	Required/Optional
1	Record Identifier	L	Message Terminator	Required
2	Sequence Number	1	The number of times the L record appears in the message	Required

Example: L|1|<CR>

Table 6 shows records that are not required but can be accepted by the GLI

TABLE 6 – ACCEPTED MESSAGE RECORDS

Record	#	Value
Request Information Segment	1	Q
Scientific Record	1	S
Comment Record	1	C
Manufacturer Information Record	1	M

4.2 ASTM Result Message Record Fields

This section provides the ASTM specifications for the records generated by GLI to be transmitted to the LIS/host.

4.2.1 Message Header Record

Field #	Field Name	Value
1	Record Identifier	H
2	Delimiters	\^&|
3	Message Control ID	Blank
4	Password	Blank
5	Sender Name or ID	EPLEX^0059641
6	Sender Street Address	Blank
7	Reserved Field	Blank
8	Sender Telephone Number	Blank
9	Characteristics of Sender	Blank
10	Receiver ID	Blank
11	Comments	Blank
12	Processing ID	Blank
13	Version Number	LIS2-A2
14	Date and Time of Message	Date and time of message in the format YYYYMMDDHHMMSS

Example: H|\^&|||EPLEX^1||||||||LIS2-A2|20150518091642<CR>

4.2.2 Patient Information Record

Field #	Field Name	Value
1	Record Identifier	P
2	Sequence Number	Any digit
3	Practice Assigned Patient ID	Blank
4	Patient ID	Blank
5	Patient ID # 3	Blank
6	Patient Name	Blank
7	Mother's Maiden Name	Blank
8	Birth date, Age, Age Unit	Blank
9	Sex	Blank
10	Patient Race	Blank
11	Patient Address	Blank
12	Reserved Field	Blank
13	Patient Telephone	Blank
14	Attending Physician Name	Blank
15	Special Field 1	Blank
16	Body Surface Area (M2)	Blank
17	Patient Height	Blank
18	Patient Weight	Blank
19	Patient Diagnosis	Blank
20	Patient Medications	Blank
21	Patient Diet	Blank
22	Practice Field # 1	Blank
23	Practice Field # 2	Blank
24	Admission and discharge dates	Blank
25	Admission Status	Blank
26	Location	Blank
27	Nature of Alternate Diagnosis Code and Class	Blank
28	Alternate Dialog Code and Class	Blank
29	Patient Religion	Blank
30	Marital Status	Blank
31	Isolation Status	Blank
32	Language	Blank
33	Hospital Service	Blank
34	Hospital Institution	Blank
35	Dosage Category	Blank

Example: P|1|PID|||||||||||||||||||||||||||||||||<CR>

4.2.3 Test Order Record

Field #	Field Name	Value
1	Record Identifier	O
2	Sequence Number	1
3	Specimen ID/ Control ID	Accession ID
4	Instrument Specimen ID	Blank
5	Universal Test ID	
	Name	Blank
	Type	Blank
	Test ID or Name	Any of the values in Table 1
6	Priority	R=Routine
7	Requested Date and Time	Blank
8	Specimen Collection Date and Time	Blank
9	Specimen Collection end Date and Time	Blank
10	Collection Volume	Blank
11	Collected by (ID or Name)	Blank
12	Action Code	Blank

Example: O|1|ACCID||^^^TESTID|R|||||||||||||||||||||O<CR>

4.2.4 Result Record

Field #	Field Name	Value	Field Description
1	Record Identifier	R	
2	Sequence Number	Any digit	Sequence number of measurement result record
3	Universal Test ID:		
	Name	Blank	
	Type	Blank	
	Test ID or Name (UDR) or Manufacturers Code	Test item code	Target Result Code (see result codes in tables 2 to 4)
4	Measurement:		
	Data or Measurement Value	Test result	Test Result (Not Detected, Detected, N/A, Invalid, or ---)
	Interpretation	Measurement raw value	Current signal in amperes or -1 if signal is Invalid
5	Units	Blank	
6	Reference Range and Type	Blank	
7	Result Abnormal Flag	Blank	In case of measurement flag
8	Nature of Abnormality Testing	Blank	
9	Result Status	F	F= Final Result
10	Date of change	Blank	
11	Operator Identification	Blank	
12	Date/Time Test Started	Blank	
13	Date/Time Test Completed	Sample Run Timestamp	
14	Instrument Identification (Sender Name)	EPLEX	
	Device ID	ePlex ID	Instrument ID

Example: R|1|TESTID|NOT DETECTED^|||||F||||20150518091642|EPLEX^1<CR>

4.2.5 Comment Record

The Comment (or C) record is used to transmit comments or informational text associated with samples; such as text description associated with errors.

Field #	Field Name	Value	Field Description
1	Record ID	C	Comment Record
2	Sequence Number	1	Sequence number of the comment record
3	Comment Source	I	I: Clinical Instrument System
4	Comment Text	Text	Text description associated with comment
5	Comment Type	Any of the following: G, T, P, N, I	G: General text comment; T: Text name comment; P: Positive text comment; N: Negative text comment; I: System flag comment

Example: C|1|I|(110) Specimen ID for this order is invalid.|G<CR>

4.2.6 Message Terminator Record

Field #	Field Name	Value	Field Description
1	Record Identifier	L	
2	Sequence Number	1	
3	Termination Code	N	N:Normal termination

Example: L|1|N<CR>

4.2.7 Unknown Message

If the GLI receives a message containing a frame that is not supported, the GLI will reply with a Negative Acknowledgement (NAK) massage. The following is an example of an unknown message created by the GLI.

Example: 4M|1|1000003||^^^BC-GN|S||20110825155000||||A||||U|A Gonzalez||||||||O

5. HL7 Message Structure

5.1 HL7 Order Message Segment

This section provides the HL7 message structure specification used by the ePlex GLI interface. HL7 messages are comprised of message segments that are transmitted over the interface in a particular order using a specific message structure. Message segments are made up of data elements or fields in a particular delimited order. Fields may be comprised of a single data component or multiple data sub-components.

The messages transmitted between the LIS and the ePlex GLI must be defined using the specifications in this section. All required fields must be included in all messages, however, acceptable optional fields may be included in messages, but will be ignored by the GLI.

The section provides the specification for test order messages sent by the LIS/host - These segments and data elements are required by the GLI to process test order messages.

5.1.1 Message Header (MSH) Segment

The MSH segment contains details about the message. This includes the intent of the message, sending system, receiving system, and some details of the message syntax, such as dates and message type.

Sequence	Field Name	Value	Field Description	Required/Optional
1	Field Separator	"|"	The separator between the segment ID and the first field (MSH-2), encoding characters and the separator character for the remainder of the message	Required
2	Encoding Characters	"^~\&"	Contains 4 characters: component separator, repetition separator, escape separator and subcomponent separator, in that order	Required
3	Sending Application	Name of the sending application	Site-defined field identifying the sending application	Optional
4	Sending Facility	Name of the sending facility	Site-defined address of one of several occurrences of the same application within the sending system	Optional
5	Receiving Application	EPLEX		N/A
6	Receiving Facility	GenMarkDx		N/A
7	Date/Time of Message	Test Order Timestamp	Date/Time stamp of message in this format YYYYMMDDHHMMSS	Required
8	Security	Blank		Not Supported
9	Message Type	ORM^001	This field acts as a trigger event for the receiving system to identify which data segments to recognize	Required
10	Message Control ID	Unique ID for each message	Allows for Message Acknowledgment (MSA) handling	Required
11	Processing ID	A string of characters		Optional
12	Version ID	2.3	The HL7 version number	Required

Example:MSH|^~\&|HIS|MedCenter|EPLEX|GenMarkDx|20060307110114||ORM^O01|MSGID200603071
10114|P|2.3

5.1.2 Patient Identification (PID) Segment

The PID segment communicates permanent patient identifying and demographic information.

Field #	Field Name	Value	Field Description	Required/Optional
1	Set ID	1	Identifies the occurrence in the segment	Optional
2	Patient ID	Blank		Optional
3	Patient Identifier	Blank	Patient Identifier, such as medical record number	Optional
4	Alternate Patient ID	Blank		Optional
5	Patient Name	Blank	In this order: <family name> ^ <given name> ^ <middle initial or name^ <suffix> ^ <prefix> ^	Optional
6	Mother's Maiden Name	Blank		Optional
7	Date/Time of Birth	Blank	Patient birth date and time in format YYMMDDHHMMSS	Optional
8	Sex	Blank	Patient sex: (F)emale, (M)ale, (U)nknown	Optional
9	Patient alias	Blank		Optional
10	Race	Blank		Optional
11	Patient Address	Blank		Optional
12	Country code	Blank		Optional
13	Phone number – Home	Blank		Optional
14	Phone number – Business	Blank		Optional
15	Primary language	Blank		Optional
16	Marital Status	Blank		Optional

Example: PID|||12001||Jones^John^^^Mr.||19670824|M|||123 West St.^^Denver^CO^80020^USA|||||||

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5.1.3 Common Order (ORC) Segment

The ORC segment is used to transmit fields common to all orders, and is required in the ORM.

Field #	Field Name	Value	Field Description	Required/Optional
1	Order Control	NW = New Order CA = Cancel Order	Identifies the trigger event for orders and determines the function of the order segment	Required
2	Placer Order Number	Accession ID – Must match the value for field 2 in the OBR Segment	Order number of the placer application	Required

Example: ORC|NW|ACC1000

5.1.4 Observation Request (OBR) Segment

The OBR segment defines the attributes of a particular test request and is used to request a particular test or battery of tests.

Sequence	Field Name	Value	Field Description	Required/Optional
1	Set ID	1	Sequence indicator	Required
2	Placer Order Number	Accession ID	Order number of the placer's application, which uniquely identifies the order Must match the value for field 2 in the ORC Segment	Required
3	Filler Order Number	Blank	Not Supported	Not Supported
4	Universal Service ID			Required
	Assay Code	One of the values in Table 1	Order code for the panel	Required
	Assay Name	Name of the panel		Optional
5	Priority	Blank	Not supported	Optional
6	Requested Date/Time	Blank	Not supported	Optional
7	Observation Date/Time	Blank	Test Order Timestamp	Required

Example: OBR|1|ACC1000||RP^Respiratory Panel^|||20060307110114

5.2 HL7 Result Message Segment

This section provides examples of the HL7 segments and fields in test result messages created by the GLI.

5.2.1 MSH Segment

Field #	Field Name	Value
1	Field Separator	"|"
2	Encoding Characters	"^~\&"
3	Sending Application	EPLEX
4	Sending Facility	ePlex Facility Name
5	Receiving Application	Blank
6	Receiving Facility	Blank
7	Date/Time of Message	Test Result Timestamp
8	Security	Blank
9	Message Type	ORU^R01
10	Message Control ID	Unique ID for each message
11	Processing ID	A string of characters

Field #	Field Name	Value
12	Version ID	2.3

Example:

MSH|^~\&|EPLEX|TESTBED3|||20140403142735||ORU^R01|MSGID20140403142735.577|P|2.3

5.2.2 PID Segment

Field #	Field Name	Value
1	Set ID	1
2	Patient ID (External ID)	Blank
3	Patient ID (Internal ID)	Blank
4	Alternate Patient ID – PID	Blank
5	Patient Name	Blank
6	Mother's Maiden Name	Blank
7	Date/Time of Birth	Blank
8	Sex	Blank
9	Patient Alias	Blank
10	Race	Blank
11	Patient Address	Blank
12	County Code	Blank
13	Phone Number – Home	Blank
14	Phone Number – Business	Blank
15	Primary Language	Blank
16	Marital Status	Blank
17	Religion	Blank
18	Patient Account Number	Blank
19	SSN Number - Patient	Blank

Example: PID|1||||||||||||||||||

5.2.3 ORC Segment

Field #	Field Name	Value
1	Order Control	RE = Results
2	Placer Order Number	Accession ID followed by "^" followed by EPLEX
3	Filler Order Number	Accession ID followed by "^" followed by EPLEX

Example: ORC|RE|ACC100021^EPLEX|ACC100021^EPLEX

5.2.4 OBR Segment

Field #	Field Name	Value
1	Set ID	1
2	Placer Order Number	Accession ID followed by "^" followed by EPLEX
3	Filler Order Number	Accession ID followed by "^" followed by EPLEX
4	Universal Service ID	
	Assay Code	One of the values in Table 1
	Reserved	Blank

Field #	Field Name	Value
	Reserved	Blank
5	Priority	Blank
6	Requested Date/Time	Blank
7	Observation Date/Time	Test Order Timestamp
8	Observation End Date/Time	Blank
9	Collection Volume	Blank
10	Collector Identifier	Blank
11	Specimen Action Code	Blank
12	Danger Code	Blank
13	Relevant Clinical Info	Blank
14	Specimen Received Date/Time	Blank
15	Specimen Source	Blank
16	Ordering Provider	Blank
17	Order Callback Phone Number	Blank
18	Placer Field 1	Blank
19	Placer Field 2	Blank
20	Filler Field 1	Blank
21	Filler Field 2	Blank
22	Results Report/Status Change Date/Time	Blank
23	Charge To Practice	Blank
24	Diagnostic Service Sector ID	Blank
25	Result Status	F = Final Result

Example: OBR|1|ACC100021^EPLEX|ACC100021^EPLEX|RP^^|||20140321061521||||||||||||||||||F

5.2.5 OBX Segment

The Observation/Result or OBX segment is used to transmit information about observations in result messages from the instrument to the LIS.

Sequence	Field Name	Value	Field Description
1	Set ID	Sequence number within assay	Observation sequence number
2	Value Type	ST = String Data	The format of the observation value in the OBX
3	Observation Identifier		Unique identifier for the observation
	Reserved	Blank	
	Reserved	Blank	
	Reserved	Blank	
	Test Code	Target Name in panel	
4	Observation Sub-ID	Blank	
5	Measurement:		
	Observation Value	Test Result (Not Detected, Detected, N/A, Invalid, or ---)	Value observed by the instrument
	Interpretation	Blank	Measurement raw value Current signal in amperes or -1 if signal is invalid (Not currently transmitted)
6	Units	Blank	

Sequence	Field Name	Value	Field Description
7	Reference Range	Blank	
8	Abnormal Flags	Blank	Indicates any errors associated with the run of the sample
9	Probability	Blank	
10	Nature of Abnormal Test	Blank	
11	Result Status	F = Final Result	Indicates the completion status of the results
12	Date Last Observed Normal Values	Blank	
13	User Defined Access Checks	Blank	
14	Observation Date/Time	Sample Run Timestamp	

Example: OBX|1|ST|^^^Influenza A^||Not Detected^|||||F|||20140321061521

5.2.6 Message Acknowledgment (MSA) Segment

The MSA segment contains the information that is sent when acknowledging another message. If the GLI receives a message with a segment that is not supported, it will reject it with an Application Reject (AR) Acknowledgement Segment (MSA).

Sequence	Field Name	Value	Field Description
1	Acknowledgment Code	AR = Application Rejection	
2	Message Control ID	Unique Message Identifier	Control ID of the rejected message
3	Error Text	ePlex Error Message	Text description of error

Example: MSA|AR|MSGID20060307110114|ERROR DETAIL IN INSTRUMENT LIS INTERFACE LOG

5.3 File Import/Export

This section provides the specifications for structured electronic messages containing non-standardized data.

5.3.1 Test Order File

If there is no ePlex LIS connectivity, test orders can be manually loaded into the ePlex system by importing comma-separated values (CSV) files in the following manner:

1. Click the Pending Test Orders (PTO) icon next to the ePlex navigation icon on the ePlex toolbar to display the Pending Test Orders screen shown in Figure 5
2. Click the Import button and use the file browser to select the test order CSV file
3. Click Select and click the OK button to import the test order(s)

Note: A CSV file is a plain text file in which the content is separated by commas. It must be created by an external source and have the .csv file extension in order to be successfully imported by the ePlex software.

TABLE 7 – COMPATIBLE ORDER FILE FIELDS

Field	Description
Request Type	NEW = New Test Order; CANCEL = Cancel Test Order
Accession ID	Accession ID
Host Code	One of the values in Table 1

Figure 16 shows an example of a test order import file.

```
CANCEL,ACC1000,RP
NEW,ACC1012,BCID-GN
NEW,ACC1013,BCID-GP
NEW,ACC1014,RP
```

FIGURE 16 – TEST ORDER IMPORT FILE

5.3.2 Test Result File

If there is no ePlex LIS connectivity, test results can be manually exported from the ePlex system by configuring the automatic report to a mapped network folder in the Instrument Software, in the following flat file formats:

1. Comma-separated Values (.csv)
2. Extensible Markup Language (.xml)
3. Text File (.txt)

TABLE 8 – CSV FILE STRUCTURE

Column	Field	Descriptions
1	Site Name	Site or Laboratory name
2	Address	Site or Laboratory address
3	Report Name	Report Name
4	Accession ID	Accession or Sample ID
5	Patient ID	Patient ID
6	Protocol	Protocol or Assay version
7	Software Version	Instrument Software version
8	Operator	Operator username
9	Instrument Serial Number	Instrument Serial Number
10	Date/Time Completed	Date/Time Completed
11	Bay Location	Bay Location of Cartridge/sample
12	Cartridge ID	Cartridge ID
13	Cartridge Lot Number	Cartridge Lot Number
14	Cartridge Expiration Date	Cartridge Expiration
15	Summary	Report summary
16	Target	Target
17	Result	Result
18	Comment	Comment
19	Flags	Flag code and description
20	Report Disclaimer	Report Disclaimer
21	Regulatory Disclaimer	Regulatory Disclaimer

TABLE 9 – XML FILE FIELDS DESCRIPTION

Field	Descriptions
AccessionID	Accession ID
LISIdentifier	Code name of the assay for the test order
ProtocolID	The protocol ID of the assay protocol used
Operator	The username of the operator who ran the test
InstrumentSerialNumber	The instrument serial number
DateTimeCompleted	The date & time when the test was completed (local time) Format: MM/DD/YYYY HH:MM:SS where HH is 24-hr
CartridgeSerialNumber	The serial number of the cartridge
CartridgeLotNumber	The cartridge lot number
CartridgeExpirationDate	The expiration date of the cartridge Format: MM/DD/YYYY HH:MM:SS where HH is 24-hr
Summary	The summary of the target results
TargetResult	The result of each target (Not Detected, Detected, N/A, Invalid or ---)
Comments	Alphanumeric string
Flag	Error code and message

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```xml
<?xml version="1.0" encoding="utf-8" ?>
<LISTestResult>
  <Header>
    <AccessionID>ACC100021</AccessionID>
    <LISIdentifier>RP</LISIdentifier>
    <ProtocolID>2501</ProtocolID>
    <Operator>JSmith</Operator>
    <InstrumentSerialNumber>10005</InstrumentSerialNumber>
    <DateTimeCompleted>10/15/2003 06:15:21</DateTimeCompleted>
    <CartridgeSerialNumber>2501</CartridgeSerialNumber>
    <CartridgeLotNumber>51620480</CartridgeLotNumber>
    <CartridgeExpirationDate>12/31/2014 12:00:00</CartridgeExpirationDate>
  </Header>
  <Summary>Parainfluenza Virus (PIV) 3, Coronavirus NL63 and Coronavirus OC43 positive result</Summary>
  <Results>
    <TargetResult Target="Influenza A" Result="Not Detected" />
    <TargetResult Target="Influenza A H1" Result="---" />
    <TargetResult Target="Influenza A H3" Result="---" />
    <TargetResult Target="Influenza A 2009 H1N1" Result="Detected" />
    <TargetResult Target="Influenza B" Result="Not Detected" />
    <TargetResult Target="Respiratory Syncytial Virus (RSV) A" Result="Not Detected" />
    <TargetResult Target="Respiratory Syncytial Virus (RSV) B" Result="Detected" " />
    <TargetResult Target="Parainfluenza Virus (PIV) 1" Result="Not Detected" />
    <TargetResult Target="Parainfluenza Virus (PIV) 2" Result="Not Detected" />
    <TargetResult Target="Parainfluenza Virus (PIV) 3" Result="Not Detected" />
    <TargetResult Target="Human Metapneumovirus (hMPV)" Result="Not Detected" />
    <TargetResult Target="Human Rhinovirus/Enterovirus" Result="Not Detected" />
    <TargetResult Target="Adenovirus" Result="Not Detected" />
    <TargetResult Target="Internal Control" Result="Fail" />
  </Results>
  <Comments>Accession ID was manually entered. Negative controls were used.</Comments>
  <Flags>
    <Flag Code="1234" Message="This is flag" />
  </Flags>
</LISTestResult>
```

FIGURE 17 – XML FILE

6. Example Messages

6.1 Order Messages

The order or test request message is a message from the LIS to inform the ePlex of the panel to be performed on the sample. The order messages to ePlex allow for new test requests.

6.1.1 Examples of test request messages from the LIS

- ASTM

<STX>1H|\^&|<CR><ETX>61<CR>
<STX>2P|1|J962798|SERLAB001||TESTER^BOB||19600303|M|||||Wilson^Ned^P||||||||||||ED West<CR><ETX>92<CR>
<STX>3O|1|5596384||^^^RP|S||20110825155000||||N||||U|A Gonzalez|||||||||O<CR><ETX>C1<CR>
<STX>4L|1|<CR><ETX>B9<CR>

- HL7

MSH|^~\&|HIS|MedCenter|EPLEX|GenMarkDx|20060307110114||ORM^O01|MSGID20060307110114|P|2.3|
PID|||87399||Hanson^Luis^^^Mr.||19670824|M|||123 West St.^^Denver^CO^80020^USA|
ORC|NW|1165453|
OBR|1|1165453||RP^Respiratory Panel|||20060307110114|

6.1.2 Rejection of test request messages

1. The test ID for the requested panel is invalid:
   - ASTM

   Message from LIS

   <STX>1H|\^&|<CR><ETX>61<CR>
   <STX>2P|1|J962798|SERLAB001||TESTER^BOB||19600303|M|||||Wilson^Ned^P||||||||||||ED West<CR><ETX>92<CR>
   <STX>3O|1|2080969||^^^RESP|S||20110825155000||||N||||U|A Gonzalez|||||||||O<CR><ETX>53<CR>
   <STX>4L|1|<CR><ETX>B9<CR>

   Response from ePlex GLI to LIS

   <STX>1H|\^&|||EPLEX^|||||||LIS2-A2|20150602114416<CR><ETX>
   <STX>2P|1|||||||||||||||||||||||||||||||||||<CR><ETX>
   <STX>3O|1|2080969||^^^RESP||||||||||||||||||||||X<CR><ETX>
   <STX>4C|1|I|(111) Assay (Test Code) is invalid.|G<CR><ETX>
   <STX>5L|1|N<CR><ETX>

   - HL7

   Message from LIS

   MSH|^~\&|HIS|MedCenter|EPLEX|GenMarkDx|20060307110114||ORM^O01|MSGID20060307110114|P|2.3|

PID|||97151||Jenkins^Neal^^^Mr.||19670824|M|||123 West St.^^Denver^CO^80020^USA|
ORC|NW|2140633|
OBR|1|2140633||BCIDGP^Blood Culture Gram Positive|||20060307110114|

Response from ePlex GLI

Rejected this message from LIS. Responded with MSA|AR

Error Text: Assay (Test Code) is invalid. Test Code submitted: BCIDGP

2. Specimen ID is NULL:
   - ASTM

Message from LIS

<STX>1H|\^&|<CR><ETX>61<CR>
<STX>2P|1|J962798|SERLAB001||TESTER^BOB||19600303|M|||||Wilson^Ned^P|||||||||||||ED
West<CR><ETX>92<CR>
<STX>3O|1|||^^^RP|S||20110825155000||||N||||U|A Gonzalez|||||||||O<CR><ETX>49<CR>
<STX>4L|1|<CR><ETX>B9<CR>

Response from ePlex GLI to LIS

<STX>1H|\^&|||EPLEX^|||||||||LIS2-A2|20150602112811<CR><ETX>
<STX>2P|1|||||||||||||||||||||||||||||||||||||<CR><ETX>
<STX>3O|1|||^^^RP|||||||||||||||||||||||X<CR><ETX>
<STX>4C|1|I|(110) Specimen ID for this order is invalid.|G<CR><ETX>
<STX>5L|1|N<CR><ETX>08<NL>

   - HL7

Message from LIS

MSH|^~\&|HIS|MedCenter|EPLEX|GenMarkDx|20060307110114||ORM^O01|MSGID2006030
7110114|P|2.3|
PID|||86609||Hamilton^Louis^^^Mr.||19670824|M|||123 West St.^^Denver^CO^80020^USA|
ORC|NW|1086462|
OBR|1|||RP^Respiratory Panel|||20060307110114|

Response from ePlex GLI to LIS

Rejected this message from LIS. Responded with MSA|AR
Error Text: Specimen ID for this order is invalid. A NULL accession was sent by host.

6.2 Order Cancellation Messages

Cancellation messages allow for the cancellation of all pending test requests associated with an accession ID. Completed test requests or requests that are in progress on the instrument cannot be cancelled; any test requests message that does not satisfy these requirements will be rejected.

Examples of test request cancellation messages from the LIS:

- ASTM

  <STX>1H|\^&|<CR><ETX>
  <STX>2P|1|J962798|SERLAB001||TESTER^BOB||19600303|M|||||Wilson^Ned^P|||||||||||ED West<CR><ETX>
  <STX>3O|1|402449||^^^BCID-GN|S||20110825155000||||C||||U|A Gonzalez||||||||||O<CR><ETX>
  <STX>4L|1|<CR><ETX>

- HL7

  MSH|^~\&|HIS|MedCenter|EPLEX|GenMarkDx|20060307110114||ORM^O01|MSGID20060307110114|P|2.3|
  PID|||91650||Hinson^Martha^^^Mr.||19670824|M|||123 West St.^^Denver^CO^80020^USA|
  ORC|CA|1590521|
  OBR|1|1590521||BCID-GN^Blood Culture Gram Negative|||20060307110114|

6.3 Result Messages

The result message or measurement result message transmits the results of a sample processed on the instrument with all applicable targets.

Examples of result messages from the ePlex

- ASTM
  Example 1:
  1H|\^&|||EPLEX^10005|||||||||LIS2-A2|20150602172041
  2P|1||||||||||||||||||||||||||||||||
  3O|1|ACC100024||^^^GI|R|||||||||||||||||||||||O
  4R|1|Influenza A|Not Detected^|||||F||||20140321061521|EPLEX^10005
  5R|2|Influenza A H1|---^|||||F||||20140321061521|EPLEX^10005
  6R|3|Influenza A H3|---^|||||F||||20140321061521|EPLEX^10005
  7R|4|Influenza A 2009 H1N1|Detected^|||||F||||20140321061521|EPLEX^10005
  0R|5|Influenza B|Not Detected^|||||F||||20140321061521|EPLEX^10005
  1R|6|Respiratory Syncytial Virus (RSV) A|Not Detected^|||||F||||20140321061521|EPLEX^10005
  2R|7|Respiratory Syncytial Virus (RSV) B|Detected^|||||F||||20140321061521|EPLEX^10005
  3R|8|Parainfluenza Virus (PIV) 1|Not Detected^|||||F||||20140321061521|EPLEX^10005
  4R|9|Parainfluenza Virus (PIV) 2|Not Detected^|||||F||||20140321061521|EPLEX^10005
  5R|10|Parainfluenza Virus (PIV) 3|Not Detected^|||||F||||20140321061521|EPLEX^10005
  6R|11|Human Metapneumovirus (hMPV)|Not Detected^|||||F||||20140321061521|EPLEX^10005
  7R|12|Human Rhinovirus/Enterovirus|Not Detected^|||||F||||20140321061521|EPLEX^10005
  0R|13|Adenovirus|Not Detected^|||||F||||20140321061521|EPLEX^10005
  1R|16|Internal Control|Fail^|||||F||||20140321061521|EPLEX^10005
  2L|1|N

Example 2:

```
1H|\^&|||EPLEX^000000||||||||LIS2-A2|20150603150623
2P|1||||||||||||||||||||||||||||||||
3O|1|d1||^^^BCID-GN|R|||||||||||||||||||||O
4R|1|Acinetobacter baumannii|Detected^|||||F||||20150602160527|EPLEX^000000
5R|2|Bacteroides fragilis|Detected^|||||F||||20150602160527|EPLEX^000000
6R|3|Citrobacter|Detected^|||||F||||20150602160527|EPLEX^000000
7R|4|Citrobacter freundii/braakii|Detected^|||||F||||20150602160527|EPLEX^000000
0R|5|Cronobacter sakazakii|Detected^|||||F||||20150602160527|EPLEX^000000
1R|6|Escherichia coli|Detected^|||||F||||20150602160527|EPLEX^000000
2R|7|Fusobacterium|Detected^|||||F||||20150602160527|EPLEX^000000
3R|8|Fusobacterium necrophorum|Detected^|||||F||||20150602160527|EPLEX^000000
4R|9|Haemophilus influenzae|Detected^|||||F||||20150602160527|EPLEX^000000
5R|10|Klebsiella oxytoca|Detected^|||||F||||20150602160527|EPLEX^000000
6R|11|Klebsiella pneumoniae|Detected^|||||F||||20150602160527|EPLEX^000000
7R|12|Morganella morganii|Detected^|||||F||||20150602160527|EPLEX^000000
0R|13|Neisseria meningitidis|Detected^|||||F||||20150602160527|EPLEX^000000
1R|14|Pantoea agglomerans|Detected^|||||F||||20150602160527|EPLEX^000000
2R|15|Prevotella|Detected^|||||F||||20150602160527|EPLEX^000000
3R|16|Proteus|Detected^|||||F||||20150602160527|EPLEX^000000
4R|17|Proteus mirabilis|Detected^|||||F||||20150602160527|EPLEX^000000
5R|18|Pseudomonas|Detected^|||||F||||20150602160527|EPLEX^000000
6R|19|Pseudomonas aeruginosa|Detected^|||||F||||20150602160527|EPLEX^000000
7R|20|Salmonella|Detected^|||||F||||20150602160527|EPLEX^000000
0R|21|Serratia|Detected^|||||F||||20150602160527|EPLEX^000000
1R|22|Serratia marcescens|Detected^|||||F||||20150602160527|EPLEX^000000
2R|23|Stenotrophomonas maltophilia|Detected^|||||F||||20150602160527|EPLEX^000000
3R|24|KPC|Detected^|||||F||||20150602160527|EPLEX^000000
4R|25|NDM|Detected^|||||F||||20150602160527|EPLEX^000000
5R|26|VIM|Detected^|||||F||||20150602160527|EPLEX^000000
6R|27|Enterobacter|Detected^|||||F||||20150602160527|EPLEX^000000
7R|28|Enterobacter cloacae complex|Detected^|||||F||||20150602160527|EPLEX^000000
0R|29|CTX-M|Detected^|||||F||||20150602160527|EPLEX^000000
1R|30|IMP|Detected^|||||F||||20150602160527|EPLEX^000000
2R|31|OXA|Detected^|||||F||||20150602160527|EPLEX^000000
3R|32|Internal Control||PASS^|||||F||||20150602160527|EPLEX^000000
4L|1|N
```

- HL7
  Example 1:
  ```
  MSH|^~\&|EPLEX|GENMARK|||20150602164805||ORU^R01|MSGID20150602164805.039|P|2.3|||
  AL|AL
  PID|1|||||||||||||||||||
  ORC|RE|ACC100022^EPLEX|ACC100022^EPLEX
  OBR|1|ACC100022^EPLEX|ACC100022^EPLEX|BCID-GP^^|||20140321061521|||||||||||||||||||||F
  OBX|1|ST|^^^Influenza A^||Not Detected^|||||F|||20140321061521|
  ```

OBX|2|ST|^^^Influenza A H1^||---^||||||F|||20140321061521|
OBX|3|ST|^^^Influenza A H3^||---^||||||F|||20140321061521|
OBX|4|ST|^^^Influenza A 2009 H1N1^||Detected^||||||F|||20140321061521|
OBX|5|ST|^^^Influenza B^||Not Detected^||||||F|||20140321061521|
OBX|6|ST|^^^Respiratory Syncytial Virus (RSV) A^||Not Detected^||||||F|||20140321061521|
OBX|7|ST|^^^Respiratory Syncytial Virus (RSV) B^||Detected^||||||F|||20140321061521|
OBX|8|ST|^^^Parainfluenza Virus (PIV) 1^||Not Detected^||||||F|||20140321061521|
OBX|9|ST|^^^Parainfluenza Virus (PIV) 2^||Not Detected^||||||F|||20140321061521|
OBX|10|ST|^^^Parainfluenza Virus (PIV) 3^||Not Detected^||||||F|||20140321061521|
OBX|11|ST|^^^Human Metapneumovirus (hMPV)^||Not Detected^||||||F|||20140321061521|
OBX|12|ST|^^^Human Rhinovirus/Enterovirus^||Not Detected^||||||F|||20140321061521|
OBX|13|ST|^^^Adenovirus^||Not Detected^||||||F|||20140321061521|
OBX|14|ST|^^^Internal Control^||Pass^||||||F|||20140321061521|

Example 2:
MSH|^~\&|EPLEX|GENMARK|||20150603151904||ORU^R01|MSGID20150603151904.915|P|2.3|||AL|AL
PID|1||||||||||||||||||
ORC|RE|a6^EPLEX|a6^EPLEX
OBR|1|a6^EPLEX|a6^EPLEX|BCID-GN^^^|||20150602163647||||||||||||||||||||F
OBX|1|ST|^^^Escherichia coli^||Not Detected||||||F|||20150602163647|
OBX|2|ST|^^^Fusobacterium^||Not Detected||||||F|||20150602163647|
OBX|3|ST|^^^Fusobacterium necrophorum^||Not Detected||||||F|||20150602163647|
OBX|4|ST|^^^Haemophilus influenzae^||Not Detected||||||F|||20150602163647|
OBX|5|ST|^^^Klebsiella oxytoca^||Not Detected||||||F|||20150602163647|
OBX|6|ST|^^^Klebsiella pneumoniae^||Not Detected||||||F|||20150602163647|
OBX|7|ST|^^^Morganella morganii^||Not Detected||||||F|||20150602163647|
OBX|8|ST|^^^Neisseria meningitidis^||Not Detected||||||F|||20150602163647|
OBX|9|ST|^^^Pantoea agglomerans^||Not Detected||||||F|||20150602163647|
OBX|10|ST|^^^Prevotella^||Not Detected||||||F|||20150602163647|
OBX|11|ST|^^^Proteus^||Not Detected||||||F|||20150602163647|
OBX|12|ST|^^^Proteus mirabilis^||Not Detected||||||F|||20150602163647|
OBX|13|ST|^^^Pseudomonas^||Not Detected||||||F|||20150602163647|
OBX|14|ST|^^^Pseudomonas aeruginosa^||Not Detected||||||F|||20150602163647|
OBX|15|ST|^^^Salmonella^||Not Detected||||||F|||20150602163647|
OBX|16|ST|^^^Serratia^||Not Detected||||||F|||20150602163647|
OBX|17|ST|^^^Serratia marcescens^||Not Detected||||||F|||20150602163647|
OBX|18|ST|^^^Stenotrophomonas maltophilia^||Not Detected||||||F|||20150602163647|
OBX|19|ST|^^^KPC^||N/A||||||F|||20150602163647|
OBX|20|ST|^^^NDM^||N/A||||||F|||20150602163647|
OBX|21|ST|^^^VIM^||N/A||||||F|||20150602163647|
OBX|22|ST|^^^Enterobacter^||Not Detected||||||F|||20150602163647|
OBX|23|ST|^^^Enterobacter cloacae complex^||Not Detected||||||F|||20150602163647|
OBX|24|ST|^^^CTX-M^||N/A||||||F|||20150602163647|
OBX|25|ST|^^^IMP^||N/A||||||F|||20150602163647|
OBX|26|ST|^^^OXA^||N/A||||||F|||20150602163647|

OBX|27|ST|^^^Internal Control^||PASS||||||F|||20150602163647|
OBX|28|ST|^^^Acinetobacter baumannii^||Not Detected||||||F|||20150602163647|
OBX|29|ST|^^^Bacteroides fragilis^||Not Detected||||||F|||20150602163647|
OBX|30|ST|^^^Citrobacter^||Not Detected||||||F|||20150602163647|
OBX|31|ST|^^^Citrobacter freundii/braakii^||Not Detected||||||F|||20150602163647|
OBX|32|ST|^^^Cronobacter sakazakii^||Not Detected||||||F|||20150602163647|

GNMK-IMC-1045-B