



LIS Vendor Interface Document

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Change History

Revision	Date	Pages/Sections	Reason
(A)	10/99	All	New manual release
(B)	3/00	All	New fields added to BD EpiCenter interface to support Phoenix ID/AST instrument data. Added Isolate results reporting for BD EpiCenter. Added additional results for tests. And changed Patient and Specimen user defined fields 4 & 5 to free text fields.
(C)	3/01	All	Added BD Phoenix 100 section. Updated list of antibiotic and organism codes. BD EpiCenter uploads chartable rules and special messages. BD EpiCenter allows blanking of a field. BD EpiCenter adds fields for excluding isolates from statistics and test complete DT.
(D)	5/01	2, 17, 18, 22, 28, 61-63, 65	Updated orders record to incorporate critical panel specification. Updated result record to include resistance markers 4–10. Changed 'resistance mechanism' to 'resistance marker' throughout. Changed "BACTEC9000" to "BT9000" in instrument type result field. Fix Phoenix resistance marker result upload example.
(E)	10/01	All	Formatting changes
(F)	3/02	All	Various updates throughout the document to cleanup references/definitions and lists of information.
(G)	12/03	All	Updates for EpiCenter Version 4 Features
(H)	12/03	18,31,63,65–76	Updates for Phoenix Version 4
(I)	-	-	Skipped
(J)	4/14/04	All	Phoenix Version 4.01Z and EpiCenter 4.10A updates, BD ProbeTec ET and BD Viper SP updates for new configuration options, status, and assay type list.
(K)	03/14/05	All	Various updates throughout the document to cleanup examples.
(L)	04/28/08	13, 16, 22, 25, 28, 31, 32, 38, 39, 41, 42	Updates for FX , Emulating BD BACTEC 9000, addition of ID test source field, addition of isolate upload examples
(M)	9/11/2008	83–98	Added section 14.4 describing BD BACTEC FX standalone

(N)	2/25/2009	22, 30, 66–69	Added new BD Viper XTR assay codes for HSV1 and HSV2
(O)	7/02/2010 06/06/2011	25, 27, 37 23, 30, 33–35, 41,47, 101–109	Add additional value to Time Qualifier field, add note to Admission Date/Time, Collection Date/Time and Received Date/Time fields Updates for Innova instrument
(P)	07/27/2012	72	Added new BD Viper XTR assay codes for HPV and TVQx
(Q)(17)	10/24/2013	69-75	Added additional information for BD Viper LT
18	10/2016	Preface; sections 8, 12, 13, 14	Added information for BD Phoenix M50
19	04/2017	Section 14.6	Added information for BD MAX
20	10/2017	Section 14.6	Added information for BD MAX Version 4.70 and above

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1. Purpose

This document is intended to provide the information necessary for an LIS to exchange medical data with Becton Dickinson (BD) instruments. This document was written to include the specifications for the Becton Dickinson data management system as well as all future BD instruments. Any differences between instrument and data management communication are outlined in this document's appendices.

2. Scope

This document details the interface between a Laboratory Information System and BD instruments and the BD data management system. The interface uses the ASTM E_1381 protocol at the physical layer and the ASTM E_1394 protocol at the logical layer.

3. Definitions

LIS – Laboratory Information System; Computer system present in most microbiology labs responsible for collecting patient and test data.

ASTM – American Society for Testing and Materials; Committee responsible for publishing specification on communication between lab instruments and lab computer systems.

ASTM E_1381 – Protocol published by ASTM describing low-level data exchange across a serial port.

ASTM E_1394 – Protocol published by ASTM describing the logical level formatting of patient and test data.

EpiCenter – Data Management System produced by BD that collects microbiology test results.

LIS Interface Library – Common module responsible for implementing communication protocols. This module is used by both the BD instruments and the BD EpiCenter for LIS communication.

Date/Time – All times will be represented in local time unless otherwise specified.

4. Overview

BD has released several instruments that perform automated microbiology testing. BD has also released a data management workstation that communicates with these instruments and collects test results. It is BD's intention to communicate these results up to the LIS, if one is present in the microbiology lab. The protocols and specifications for exchanging data between BD instruments and an LIS are described in this and subsequent sections.

It is BD's expectation that an LIS vendor will implement the specifications in this document in their entirety. The proper functioning of the BD EpiCenter and BD instruments is dependent on the proper exchange of information with an LIS. An agreement to support LIS communication with BD instruments should be considered an agreement to implement all aspects of this specification.

4.1. Physical Cable Interface

The BD instruments and data management system communicate to the LIS using an RS232 serial port interface. The serial port interface used by the instruments uses only 3 signals in the interface cable, Transmit Data (Pin 2), Receive Data (Pin 3), and Signal Ground (Pin 5). BD does not believe that the inclusion of additional signals will cause any problems for the interface; however, BD has not tested this case.

4.2. Communication Protocols

The American Society for Testing and Materials (ASTM) has published standards for how information should be exchanged between a clinical instrument and lab computer system. BD has implemented communication software to adhere to these specifications. In system configurations that include the BD data management system, the BD EpiCenter plays the role of the instrument.

The ASTM committee has produced standards describing both the logical level formatting and the physical exchange of data across a serial port. The logical level formatting describes how to place individual pieces of medical information into a record string, and how to combine record strings into a properly formatted message string. The physical level protocol describes how logical level message strings can be partitioned and passed across an RS232 line to an LIS.

ASTM E_1394 is the publication that outlines the logical formatting of medical information. This is the logical protocol BD uses to read/write data exchanged with the LIS. The ASTM E_1394 publication should be referred to for implementation details. A later section in this document discusses any deviations from that specification.

ASTM E_1381 is the publication that outlines the physical communication of medical information. This is the physical protocol BD uses to read/write data exchanged with the LIS. A later section in this document discusses any deviations from that specification.

4.3. System Configurations

The BD data management system is designed to communicate with several different types of BD instruments. The system configuration of these instruments is outlined in figure 1. New generation BD instruments have a TCP/IP network capability and use a local network to communicate to the BD EpiCenter. These results are then passed up to an LIS via the protocols described in this document.

Since the BD EpiCenter collects results from several different types of BD instruments, it passes several types of test results up to the LIS. This document specifies several different types of result records (per ASTM E_1394) for handling all of the various types of result data.

BD also has implemented LIS interface software in each of its new generation instruments. This allows the instruments to pass results directly up to the LIS, when a BD EpiCenter is not present in the lab. This configuration is illustrated in figure 2. Each of the instruments sends up the results that they acquire. The types of result messages that they produce (per ASTM E_1394) are expected to be the same as those for the EpiCenter.

Any specifications that relate only to a BD instrument are included in an appendix to this document.

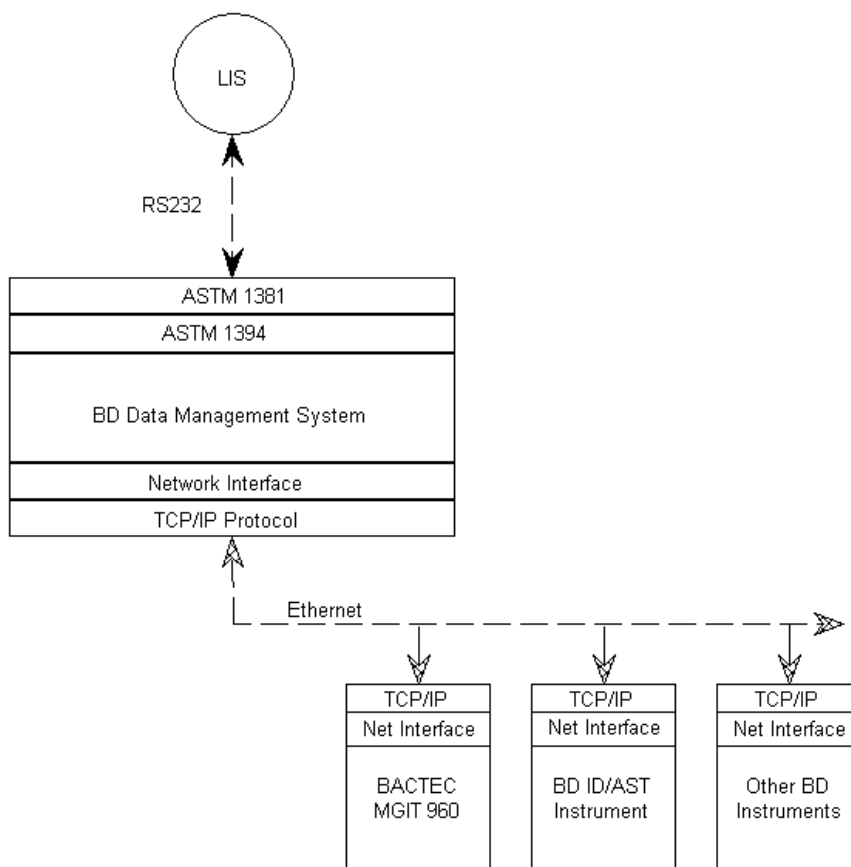


Figure #1

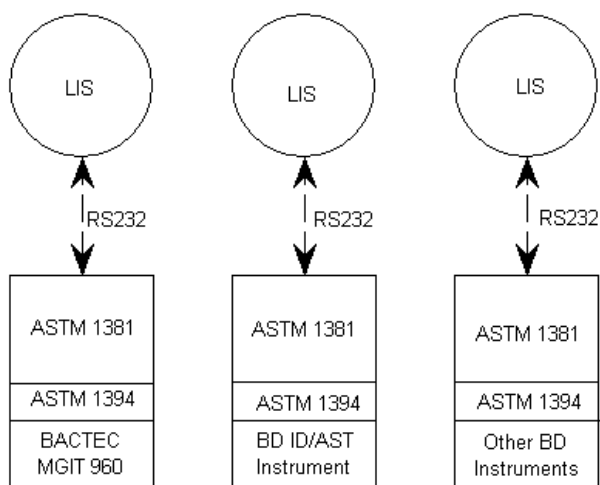


Figure #2

4.4. EpiCenter- LIS Communication

The BD EpiCenter is designed to handle results from several different types of microbiology tests. BD instruments produce a varied set of results including growth and detection, ID, and AST results. In addition, manual off-line tests are often required to supplement the instrumented results. The BD EpiCenter is designed to manage these off-line test results as well as instrumented results.

The BD EpiCenter expects to upload test results, both instrumented and manual, to the LIS. The BD EpiCenter also expects to receive downloaded patient demographics and supplemental test information from the LIS. The test information that is exchanged with an LIS is configurable by the user, as is described in a later section of this document.

The BD EpiCenter is designed to use coded values for communicating data with an LIS. Most fields in the BD database are associated with an "LIS Code" that is configurable at the BD EpiCenter. This is a 20-character string that contains an LIS defined value that uniquely identifies that item. "LIS Codes" are used to represent patient demographic fields, tests, and test results in LIS communications. Later sections of this document outline the fields represented by LIS codes and how they are mapped in an LIS communication.

The most efficient way to implement this interface would be an exchange of configuration information between BD and the LIS vendor. The LIS vendor can provide BD with the LIS Codes necessary to translate message data. The list of tests and results currently defined in the EpiCenter database is included in Appendix B of this document. The BD EpiCenter can also import coded list information (Body site, Hospital Service, Ordering Physician, etc.) The BD EpiCenter can accept this information as a text based comma separated value file or other similar format.

However, most BD instruments are not able to change their LIS codes for LIS vendor convenience. Instead they pass hard coded literal strings for test id's, test status values, etc. The literal values passed by the instruments are restricted to fields related to that instrument. These literal strings used by the instruments are outlined in later sections of this document.

5. Workflow

The BD EpiCenter has a more sophisticated workflow with regard to an LIS than any instrument. Therefore this section concentrates more heavily on BD EpiCenter workflow. Details about BD instrument workflow are provided in an appendix in this document.

5.1. Uploaded Test Results

Each test in the BD EpiCenter database, both manual and instrumented, has a set of results defined for that test. Each test result has a configurable field determining if that status is reportable to the LIS. This field can be set to one of three values, always report to LIS, never report to LIS and report only when finalized. When a test result is changed to a new value, the BD EpiCenter checks this field to determine if the result should be uploaded to the LIS. A status configured to be "Auto Upload only when finalized" is only uploaded when the user has finalized the test. By using the "Auto Upload to LIS" field, the user can tailor the LIS interface to upload only the tests and results the LIS has defined. This configuration option also allows the BD EpiCenter to mimic any LIS workflow defined by a particular instrument.

Test results can be forced over these upload restrictions by first enabling the LIS Forced Upload feature of the BD EpiCenter. Then initiating a manual upload of the test results via the BD EpiCenter user interface, or querying for the associated specimen or test will result in the test results being uploaded to the LIS despite the upload restrictions. The BD EpiCenter can be configured to

enable or disable unsolicited uploads from the BD EpiCenter. If unsolicited uploads are enabled, then when a test is assigned an uploadable status, an upload message is generated to the LIS. If the unsolicited upload option is disabled, then test status changes do not generate upload messages. Instead, the LIS has to query the EpiCenter for test information, and only those tests with an uploadable status are included in the response message. If LIS Forced Uploads is enabled at the BD EpiCenter, all test results matching the query will be uploaded regardless of whether their status is uploadable.

5.2. Uploaded Isolate Results

In an attempt to characterize an organism, a lab may run more than one ID/AST test on a particular isolate. Multiple ID/AST tests may produce conflicting results for either an organism id or antibiotic susceptibility. The BD EpiCenter identifies when two or more tests produce conflicting results and alerts the user that they must select the appropriate results for that isolate. Once the conflict has been resolved, the BD EpiCenter saves the ID and AST results for that isolate separate from the test results. On the BD EpiCenter, these are called Isolate Level Results.

Figure 3 depicts the basic record structures within the BD EpiCenter.

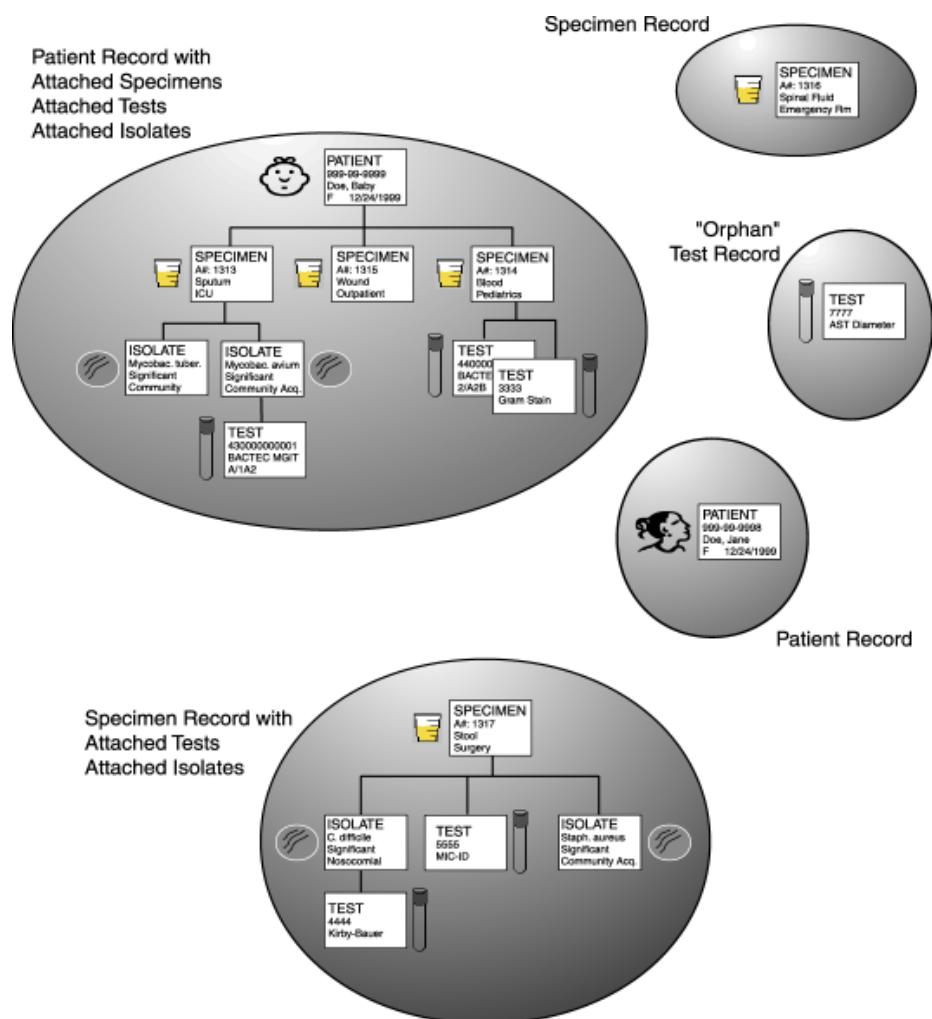


Figure 3

The relationships and hierarchy of the finalization scheme in the BD EpiCenter is depicted in Figure 4.

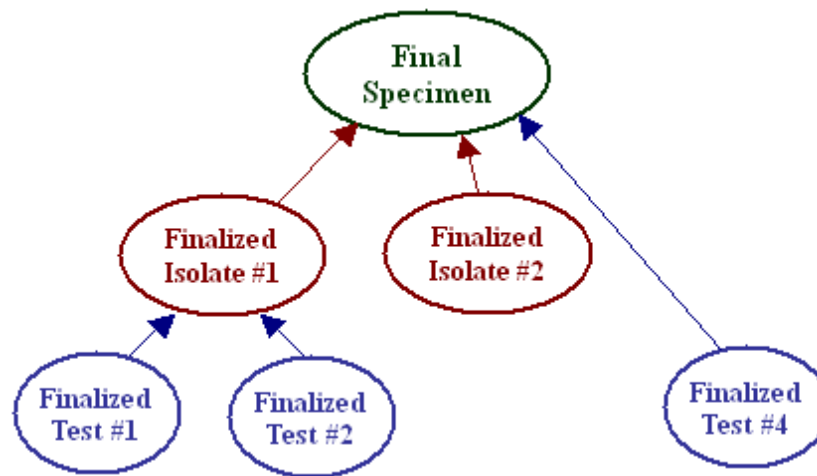


Figure 4

The BD EpiCenter also includes an expert system, which evaluates ID/AST results. The input to the expert system is the results from any ID/AST test. The output of the expert system may be a different isolate AST result. Any expert system changes to AST results are maintained as a separate field, but are included as part of the isolate results. So isolate results provide both the test result and the expert system result, as described in a later section.

Isolate results may be a compilation of several ID/AST results. They are also free of any conflicts. Expert system evaluations are also available with isolate level results. For these reasons, some LIS sites may find isolate level results more valuable than test level results. The BD EpiCenter therefore provides a mechanism for uploading isolate level results, test level results, or both.

The configuration section of the BD EpiCenter allows the user to set an LIS Auto Uploadable field for isolates. This field can be set to Always “Auto Upload” to LIS, “Never Auto Upload” to LIS, “Auto Upload When Specimen Finalized” or “Auto Upload When Isolate Finalized”. This works in a similar way as test status results do for tests. When the isolate Auto Upload field is set to “Auto Upload When Specimen Finalized”, isolate level results are only uploaded once the specimen has been finalized by the user. When the isolate Auto Upload field is set to “Auto Upload When Isolate Finalized”, isolate level results are only uploaded once the isolate has been finalized by the user.

Isolate results can be forced over these upload restrictions by first enabling the LIS Forced Upload feature of the BD EpiCenter. Then initiating a manual upload of isolate results via the BD EpiCenter user interface, or querying for the associated specimen will result in the isolate results being uploaded to the LIS despite the upload restrictions.

Isolate results are differentiated from test results as follows:

- The Test Id in Order field (O, 5, 1, 4) is set to “ISOLATE RESULT” instead of a real test id.

- The first result record of an isolate result is always an ID record regardless of test types.
- The ID record will contain the ID test source in field (R, 4, 1, 9).
- Unlike test uploads which have a fixed number of results, the number of results included in an isolate can fluctuate until the isolate is finalized.
- Isolate level AST result records will contain Interpreted (R, 4, 1, 4), Expert (R, 4, 1, 5) and Final (R, 4, 1, 3) AST susceptibility values whereas test level results only contain Interpreted (R, 4, 1, 4) AST susceptibility values.
- Isolate level AST result records will contain the AST test source in field (R, 4, 1, 6).

It is possible to dictate the upload order of individual antimicrobial isolate results from the BD EpiCenter through the use of Antimicrobial Ordering feature.

5.3. Unsolicited Downloads

The BD EpiCenter accepts unsolicited download data from the LIS containing patient demographics and supplemental test information. The fields that the BD EpiCenter are interested in receiving are outlined in section 8 (Message Content) of this document.

Supplemental tests and results are expected to be transmitted in the same logical placement as tests and results that are uploaded. The time/date fields for test results are used to identify LIS test results more recent than BD EpiCenter test results. Also a test/consumable sequence number field can be used as an identifier for a test. This allows the LIS or BD EpiCenter to distinguish between two tests of the same type ordered against a specimen.

An LIS Test Order can also be accepted via unsolicited download without a test/consumable sequence number. In this way the LIS can order tests on specific specimens and isolates without having to format a valid BD instrumented sequence number. These orders will be automatically associated with matching tests in the BD EpiCenter database as they are detected. These orders can also be manually associated with orphan tests by the BD EpiCenter user.

The BD EpiCenter does not accept edits from the LIS to key fields used to identify patients and specimen. A patient ID is the key field identifying a patient. An accession number is the key field identifying a specimen. If either of these fields is received in a download message to the BD EpiCenter, and these values are not matched in the BD EpiCenter database, they are considered new entries. Re-association of a test to a new specimen, or re-association of a specimen to a new patient, must be done at the BD EpiCenter.

For test order and result information, the BD EpiCenter evaluates the time stamps associated with that data to determine which results are more current. If the LIS information is more current, than it is used to override the BD EpiCenter information.

For all other data downloaded from the LIS, which does not include a time stamp, the LIS data is considered correct and overrides any BD EpiCenter data.

Isolate level results are not accepted in a download from the LIS.

5.4. File Import

The BD EpiCenter has the ability to import LIS files containing downloaded information. The user can access a screen in the BD EpiCenter to manually select files to import. Import files must be text files that follow the ASTM 1394

protocol, which describes the serial line interface. The import file text is sent through the same message parser that regular serial communications go through, processing the same fields that are configured for the serial interface.

Currently the BD EpiCenter does not export any upload information to a file.

5.5. Queries

The BD EpiCenter is able to generate request messages (or queries) to the LIS for information. When the BD EpiCenter sees a new accession number, either from user entry or an instrument, the BD EpiCenter uploads a request message. BD EpiCenter request messages, as outlined in section 8 - Message Content, are sent for only a single specimen at a time. Requests for information from the BD EpiCenter should be interpreted as requests for both patient demographics and supplemental test information for that specimen.

The BD EpiCenter can be configured to enable or disable queries sent to the LIS. If BD EpiCenter queries are enabled then the BD EpiCenter generates request messages to the LIS for information. If LIS queries are disabled, then no request messages are uploaded to the LIS.

The BD EpiCenter is also able to respond to a request generated by the LIS. The ASTM E_1394 specification describes several qualifying fields that can be included in the request for a particular set of results. The qualifying fields that the BD EpiCenter can process are a subset of those and are outlined in section 8 (Message Content) of this document.

The fields that are included in an uploaded response message are the same fields that are included in an unsolicited upload message.

The BD EpiCenter only requests information from the LIS one specimen at a time. The BD EpiCenter does not use many of the qualifying fields provided for in the ASTM specifications. An example of a request from the BD EpiCenter is provided in section 8.2.6, outlining request record fields.

5.6. Error Reporting

The LIS interface implemented by BD adheres to all of the error detection and recovery outlined in the physical level protocol. The ASTM E_1381 protocol defines the use of check sums, time outs, etc., for the proper exchange of information. The rules described in that specification should be used to indicate whether or not data was properly sent between the LIS and the BD instruments. In the BD EpiCenter, any errors detected at the physical protocol level are also reported to the user and recorded in an error log.

Information transfers can also contain logical level formatting problems, or errors in message content. These logical errors may be determined after the physical receipt of the message has been acknowledged. The ASTM protocols do not describe a mechanism for reporting logical level errors. Instead, any logical level errors are reported to the user by the BD EpiCenter. The BD EpiCenter has an error log that contains any problems that occurred during the processing of an LIS download. It is the user's responsibility to recognize and resolve logical level problems.

6. Protocol Specifications

Most of the specifications needed for implementing the communication protocols are contained in the published documents referred to in the Overview section of this document. The following sections contain any clarifications or deviations to those specifications.

6.1. Physical Protocols

The BD LIS interface implements the ASTM E_1381 physical level protocol as outlined in the published specification except for the deviations described below.

6.1.1. Memory limitations

The ASTM E_1381 protocol does not place a limit on the total size of the message that can be received by the instrument. Since the BD EpiCenter is software resident on a standard PC, it does not have any significant restrictions on download message sizes. The BD EpiCenter expects to be able to handle any reasonably sized messages downloaded from the LIS. Should any download message exceed the maximum capacity of the EpiCenter, the message is rejected during transmission and an error notification is displayed to the user.

6.1.2. Unpacked Frames

BD interprets the ASTM E_1381 specification to imply that an intermediate frame of a message should be packed to be 240 characters in length. The only frame that should be less than 240 bytes in size is the last frame of a message.

However BD has had feedback from several LIS vendors who interpreted the ASTM E_1381 specification differently. These vendors have requested that the BD LIS interface be able to send and receive frames that contain only a single logical record (i.e. Header, Patient, Order, Result and Terminator records all are sent in separate frames). This implies that most frames are less than 240 bytes in length. However it is still possible that a single logical record could be longer than the 240 bytes limit for a frame. In this case a single logical record is sent in several consecutive intermediate frames. All but the last frame are packed to 240 bytes and the last frame containing that logical record is less than 240 bytes.

The BD LIS interface is configurable to send either packed frames or unpacked frames, which contain a single record per frame. (The BD simulator described in a later section also has this configurable option.)

6.1.3. BDMODEM

The BD LIS Interface can be configured to use the BDMODEM physical layer protocol. This customized protocol has been implemented by BD instrumentation already out in the field. In order to maintain backwards compatibility, the data management system supports this protocol. However, this protocol is not intended to be used for any new LIS connections. BD strongly suggests implementing the industry standard ASTM 1381 protocol for all new LIS connections. A full description of the BDMODEM protocol is provided in other BD documentation. If needed, please contact BD for more information.

6.1.3.1. Emulate BACTEC 9000 LIS Interface

The Emulate BACTEC 9000 LIS Interface option is available when BDMODEM is the selected physical protocol.

This option provides backwards compatibility when a BD EpiCenter is being installed where a BD BACTEC instrument is currently connected directly to an LIS per the BD BACTEC 9000 LIS Vendor Interface Specification.

6.1.3.1.1. Field Map Changes

The following field mappings are changed when the Emulate BACTEC 9000 LIS Interface option is enabled.

BD EpiCenter Default Value	Corresponding BDModem/Emulate 9000 Value
Test Code to O, 5, 1, 4	Test Sequence Number to O, 5, 1, 4 Used for Vial Sequence Number 1
Isolate Source Test 1 to O, 14, 1, 1	Isolate Source Test 1 to O, 5, 2, 4 Used for Vial Sequence Number 2
Isolate Source Test 2 to O, 14, 2, 1	Isolate Source Test 2 to O, 5, 3, 4 Used for Vial Sequence Number 3
Specimen User Text 1 to O, 19, 4, 1	Specimen User Text 1 to O, 5, 4, 4 Used for Vial Sequence Number 4
Specimen User Text 2 to O, 19, 5, 1	Specimen User Text 2 to O, 5, 5, 4 Used for Vial Sequence Number 5
Result Type to R, 3, 1, 4 and enabled	Result Type to R, 3, 1, 3 and disabled
Sequence Number to R, 3, 1, 5	Sequence Number to R, 3, 1, 4
Media Type to R, 14, 1, 2	Media Type to R, 3, 1, 5
Instrument Type to R, 14, 1, 1	Instrument Type to R, 14, 1, 5
Instrument Location to R, 14, 1, 5	Instrument Location to R, 14, 1, 1
Request Test Status Code to Q, 5, 1, 2	Request Test Status Code to Q, 5, 1, 4
Request Instrument Number Q, 5, 1, 4	Request Instrument Number to Q, 5, 1, 2
Comment Text C, 4, 1, 1	Comment Text C, 3, 1, 1

6.1.3.1.2. Test Status LIS Codes

Duplicate LIS Codes are permitted for BACTEC and FX tests when the Emulate BACTEC 9000 LIS Interface option is enabled.

6.2. Logical Protocols

The BD LIS interface implements the ASTM E_1394 logical level protocol as outlined in the published specification except for the deviations described below.

6.2.1. Unprocessed Records

The ASTM E_1394 logical level specification describes the use of Scientific and Manufacturer records. The BD LIS interface accepts these records in a download message, however it does not evaluate the content of these record types. These records are extracted from any messages downloaded from the LIS. Messages generated by a BD LIS interface do not contain any of these records.

6.2.2. Download Only Fields

The ASTM E_1394 specification describes several fields that are divided into components, such as patient address field and patient name. For example, the address field is defined to have the street address, city, state, country, and zip code all separated by component delimiters. However these fields are saved as a single string in the EpiCenter database. The BD LIS interface reads those

individual components from a download message and concatenate them for storage.

The BD LIS interface does parse these fields into their components for upload messages. If a concatenated field is selected for upload, the entire string is placed in the first component of the field. For example, a Patient's address, including city, state and zip code, are all included in the string in the Street Address field of the Patient record. Currently the only two fields that are handled this way are Patient Name and Patient Address.

6.2.3. Communication Errors

The ASTM E_1394 protocol defines a hierarchical relationship to logical records. This protocol states that if a complete message is not successfully transmitted, then only the logical records that complete the hierarchical relationship must be resent. For example, if a message containing several patient records is not received by the instrument properly, then only the logical records from the latest Patient record on must be resent in a new message. However the ASTM E_1381 protocol, in section 6.5.2.3, states that if a message is not received properly, the complete message is resent. The BD LIS interface follows the specification as outlined in the ASTM E_1381 physical level protocol. If a message is not transmitted successfully the BD LIS interface expects the whole message to be resent.

6.2.4. LIS Codes

The BD EpiCenter uses "LIS Codes" to represent many fields in an LIS communication. "LIS Codes" are values defined by the LIS that uniquely identify a field. BD uses these codes for any information that can be configured by the user. These fields include many patient demographic fields, such as Hospital Service. "LIS Codes" are also used as test ID values, and as test status values, as described in the overview section.

"LIS Codes" are used for field values instead of full names, as described in the ASTM E_1394 specification. If an LIS does not have abbreviated codes for these fields, then the "LIS Codes" can be configured to be the same as the field name text. A complete list of fields associated with an LIS code can be found in section 8 (Message Content) of this document.

Again, instruments generally do not communicate using LIS Codes. They send pre-defined literal strings in their ASTM messages. The strings used by the instruments when reporting their results are outlined in the instrument specific Appendices of this document.

LIS codes are NOT case sensitive and have a maximum length of 20 characters, except resistance markers that have a maximum length of 16 characters.

6.2.5. Blanking fields

As per the ASTM 1394 specification, the BD EpiCenter will accept the "" string as an indication that the value of a field should be blanked. Key fields, like Patient Id and Accession Number do not support this feature. When any coded list field in the BD EpiCenter, for example Hospital Service, gets blanked by the LIS, its value will change to the default value of "Unspecified".

The BD EpiCenter can exchange fields with an LIS that include a list of possible values, for example Resistance Markers. When the BD EpiCenter receives data in a download it will replace its entire list with the list provided in the download. In order to blank out all entries of that list, the "" string should be placed in the first field designated for that data.

7. Configurable Options

There are several aspects of the BD LIS interface that are configurable by the user. This allows the BD instruments to tailor their connection to the local LIS. The configurable parts of the BD LIS interface are described below.

In some cases, configuration options are specific to the BD EpiCenter. An appendix at the end of this document lists configuration options specific to each instrument.

7.1. Port parameters

The BD LIS interface is based on serial port communication. The parameters for initializing the serial port are configurable by the user to allow for proper communication. The configurable parameters include the following fields.

Comm Port Number – acceptable values range from 1 to 4.

Baud Rate – acceptable values include 300, 600, 1200, 2400, 4800, 9600, 14400, 19200, 28800, 38400, 57600, and 115200.

Data Bits – acceptable values range from 5 to 8.

Stop Bits – acceptable values include 1 and 2.

Parity – acceptable values include ODD, EVEN, and NONE.

7.2. Auto-Populating Lists

The BD EpiCenter has a configurable option to allow new entries detected in a downloaded message to be automatically added to the BD database. If an unrecognized “LIS Code” is found in a download field, a new entry is made to the database containing that translation code. A notification is then presented to the user suggesting that they complete the proper name, and other fields, for that list entry. This is designed to provide a mechanism for initializing the BD EpiCenter database with all of the relevant values needed for proper LIS communication.

Antibiotics and organisms are considered coded list fields by the BD EpiCenter and have an LIS translation code associated with them. For antibiotics and organisms, the LIS codes are defaulted to BD defined abbreviations. The user has the ability to modify these codes if they do not agree with codes used by the LIS, however the Organism and Antimicrobial coded lists do not support the auto-populate feature. A listing of antibiotics and corresponding BD abbreviations can be found in Appendix C. A listing of organisms and corresponding BD abbreviations can be found in Appendix D.

7.3. Logical Protocol Parameters

The ASTM E_1394 protocol specifies four types of characters to be used to delimit fields in a record, (field, repeat, component, and escape delimiters). The user is able to configure which characters are used as delimiter characters. These characters are defaulted to the ones used in the ASTM E_1394 publication, ‘|’, ‘\’, ‘^’, and ‘&’ respectively.

The user is able to configure whether packed or unpacked frames are uploaded to the LIS. Unpacked frames contain a single logical record per frame.

At the BD EpiCenter, the user is able to configure whether or not a logical record is terminated by a CR character only, or both a CR – LF character sequence.

7.4. ASTM Field Mapping

There are a number of fields contained in the BD EpiCenter database that need to be exchanged with the LIS. BD has made an effort to properly map these

fields, per the ASTM E_1394 specification, to a field position in an appropriate record. However, some LIS vendors may interpret the meaning of these ASTM fields differently. The BD LIS interface allows the user to update the location of any field. This should allow the user to compensate for any inconsistencies between BD and LIS interfaces.

The user is able to identify each field in the BD database as an upload or download field. Fields enabled for upload messages are included in result messages passed up to the LIS. Fields enabled for download messages are parsed from any download messages from the LIS. This allows the BD LIS interface to be tailored to the specific needs of the LIS environment.

Several fields appear to be mapped into multiple locations, including test/consumable sequence number and Organism Code. These fields are mapped into the Order record because they may be needed to define a specific ordered test. These fields are also mapped into the Result record because they may be considered a result of an ID test. These fields are looked for and extracted from either location.

7.5. User Defined Fields

The BD EpiCenter contains five patient and five specimen fields that can be defined by the user. The BD EpiCenter makes no assumptions about what type of information is maintained in these fields. The user is able to use these fields to contain any data that the BD EpiCenter did not account for in its other fields.

Three patient fields and three specimen fields are managed as coded list fields. These are fields whose value is one from a pre-configured list. For example the Specimen Type field can be set to a value from a determined list. The user is able to configure the entries listed in each field and define a label for that field.

Two more patient and 2 more specimen fields are free text fields that need not come from a pre-defined list of values. For example, these fields could be used for data such as a patient's Social Security Number. The user can also define a label for these fields.

Since the BD EpiCenter has no knowledge of the type of information being maintained in these fields, it cannot assign a meaningful default mapping in an ASTM record. These fields are mapped by default to an unused ASTM location. They are also disabled by default for both upload and download messages. The user can populate these fields and re-map them to an ASTM location agreed upon with the local LIS.

8. Message Content

The following sections describe which fields are exchanged with each instrument and the BD EpiCenter.

8.1. Field List

This section lists all of the fields by name BD EpiCenter can exchange with the LIS.

Each field is displayed with its default mapping in the ASTM E_1394 records. This position consists of a record type (Patient, Order, Result, Query, or Comment), a field delimiter counter, repeat delimiter counter, and component delimiter counter. The fields are grouped according to the ASTM E_1394 record type they are mapped to.

The field list also indicates if that field is defaulted as an upload (U) or download (D) field, or both (U/D). A blank column indicates that the field is not to be exchanged with an LIS. Fields not configured to be exchanged with the LIS are ignored in a download message.

The first two fields of every record include the Record Type indicator and a record index value. These fields are considered part of every record but are not listed in these tables. The following section describes these fields in more detail, including the expected values for each field.

Result records have data fields with multiple definitions, such as Result Data 1, Result Data 2, etc. The data contained in these fields depends on the type of results being reported. ID tests may have organism data in those fields, while AST tests have antibiotic data in those fields. The following sections describe in more detail what data can be expected in a result record.

Header Record Field Name	ASTM Pos.	Direction
Sender Name	H, 5, 1, 1	U
Version Number	H, 13, 1, 1	U
Message Date/Time	H 14, 1, 1	U

Patient Record Field Name	ASTM Pos.	Direction
Patient ID	P, 4, 1, 1	U/D
Patient Name (Last)	P, 6, 1, 1	U/D
Patient Name (First)	P, 6, 1, 2	D
Patient Name (Middle)	P, 6, 1, 3	D
Patient Name (Suffix)	P, 6, 1, 4	D
Patient Name (Title)	P, 6, 1, 5	D
Date of Birth	P, 8, 1, 1	U/D
Patient Sex	P, 9, 1, 1	U/D
Address (Street)	P, 11, 1, 1	U/D
Address (City)	P, 11, 1, 2	D
Address (State)	P, 11, 1, 3	D
Address (Zip Code)	P, 11, 1, 4	D
Address (Country)	P, 11, 1, 5	D
Patient Phone Number	P, 13, 1, 1	U/D
Admitting Physician	P, 14, 1, 1	U/D
Patient User Field 1	P, 15, 1, 1	
Patient User Field 2	P, 15, 2, 1	
Patient User Field 3	P, 15, 3, 1	
Patient User Field 4	P, 15, 4, 1	
Patient User Field 5	P, 15, 5, 1	
Patient Diagnosis	P, 19, 1, 1	U/D
Patient Therapy (1-5)	P, 20, 1-5, 1	U/D
Admit Date/Time	P, 24, 1, 1	U/D
Room Number	P, 26, 1, 1	U/D
Hospital Service	P, 33, 1, 1	U/D
Hospital Client	P, 34, 1, 1	U/D

Order Record Field Name	ASTM Pos.	Direction
Accession Number	O, 3, 1, 1	U/D
Isolate Number	O, 3, 1, 2	U/D
Organism	O, 3, 1, 3	U/D
Exclude Isolate from Statistics	O, 3, 1, 4	U/D
Test ID	O, 5, 1, 4	U/D
Test/Consumable Sequence Number	O, 5, 1, 5	U/D
Priority	O, 6, 1, 1	U/D
Collection Date/Time	O, 8, 1, 1	U/D
Collected By	O, 11, 1, 1	U/D

Order Record Field Name	ASTM Pos.	Direction
Received By	O, 11, 1, 2	U/D
Specimen Action Code	O, 12, 1, 1	U
Isolate Source Test (1-3)	O, 14,1-3,1	U/D
Isolate Source Test Start Time (1-3)	O, 14,1-3,2	U/D
Receipt Date/Time	O, 15, 1, 1	U/D
Specimen Type	O, 16, 1, 1	U/D
Body Site	O, 16, 1, 2	U/D
Ordering Physician	O, 17, 1, 1	U/D
Ordering Physician Phone	O, 18, 1, 1	U
Ordering Physician Fax	O, 18, 1, 2	U
Ordering Physician Pager	O, 18, 1, 3	U
Specimen User Field 1	O, 19, 1, 1	
Specimen User Field 2	O, 19, 2, 1	
Specimen User Field 3	O, 19, 3, 1	
Specimen User Field 4	O, 19, 4, 1	
Specimen User Field 5	O, 19, 5, 1	
Finalized Date/Time*	O, 23, 1, 1	U/D
Specimen Reimbursement Value	O, 24, 1, 1	U
Test Reimbursement Value	O, 24, 2, 1	U
Isolate Classification/Nosocomial	O, 29, 1, 1	U/D

Result Record Field Name	ASTM Pos.	Direction
Result Type Code	R, 3, 1, 4	U/D
Test/Consumable Sequence Number	R, 3, 1, 5	U/D
Antibiotic	R, 3, 1, 6	U/D
Antibiotic Concentration	R, 3, 1, 7	U/D
Antibiotic Concentration Units	R, 3, 1, 8	U/D
Test Status	R, 4, 1, 1	U/D
Result Data 1		
BACTEC MGIT 960 Growth Units	R, 4, 1, 2	U
ProbeTecET/Viper XTR Alg.Results	R, 4, 1, 2	
AST MIC for AST MIC test	R, 4, 1, 2	U/D
AST Diameter for AST Dia. test	R, 4, 1, 2	U/D
Organism ID for ID test	R, 4, 1, 2	U/D
Result Data 2		
AST susceptibility (Final)	R, 4, 1, 3	U/D
Profile Number for ID Test	R, 4, 1, 3	U/D
Profile Number for Isolate ID	R, 4, 1, 3	U/D
Result Data 3		
AST susceptibility (Interpreted)	R, 4, 1, 4	U
Resistance Marker 1	R, 4, 1, 4	U
Result Data 4		
AST susceptibility (Expert)	R, 4, 1, 5	U
Resistance Marker 2	R, 4, 1, 5	U
Result Data 5		
AST Source test	R, 4, 1, 6	U
Resistance Marker 3	R, 4, 1, 6	U
Result Data 6		
Resistance Marker 4	R, 4, 1, 7	U
Result Data 7		
Resistance Marker 5	R, 4, 1, 8	U

Result Record Field Name	ASTM Pos.	Direction
Result Data 8		
ID Source Test	R, 4, 1, 9	U
Preliminary/Final Status	R, 9, 1, 1	U/D
Test Start Date/Time	R, 12, 1, 1	U/D
Result/Status Date/Time	R, 13, 1, 1	U/D
Test Complete Date/Time	R, 13, 2, 1	U
Media Setup Date/Time	R, 13, 1, 2	U
Instrument Type	R, 14, 1, 1	U
Media/Assay Type	R, 14, 1, 2	U
Protocol Length	R, 14, 1, 3	U
Instrument Number	R, 14, 1, 4	U
Instrument Location	R, 14, 1, 5	U
Protocol Name	R, 14, 1, 8	U
Additional Result Quantity (1-5)	R, 15, 1-5,1	U/D
Additional Result (1-5)	R, 15,1-5,2	U/D

Comment Record Field Name	ASTM Pos.	Direction
Comment Text	C, 4, 1, 1	U/D
Comment Type	C, 5, 1, 1	U/D

Request Record Field Name	ASTM Pos.	Direction
Request Starting Patient Id	Q, 3, 1, 1	D
Request Starting Accession Number	Q, 3, 1, 2	U/D
Request Starting Sequence Number	Q, 3, 1, 3	D
Request Ending Patient Id	Q, 4, 1, 1	D
Request Ending Accession Number	Q, 4, 1, 2	D
Request Ending Sequence Number	Q, 4, 1, 3	D
Request Test Id	Q, 5, 1, 1	D
Request Test Status	Q, 5, 1, 2	D
Request Instrument Type	Q, 5, 1, 3	D
Request Instrument Number	Q, 5, 1, 4	D
Request Result Qualifier	Q, 5, 1, 5	D
Request Time Qualifier	Q, 6, 1, 1	D
Starting Date/Time	Q, 7, 1, 1	D
Ending Date/Time	Q, 8, 1, 1	D
Request Information Status Code	Q, 13, 1, 1	U/D

Terminator Record Field Name	ASTM Pos.	Direction
Termination Code	L, 3, 1, 1	U/D

8.2. Field Descriptions

This section provides detailed information for each field listed in the previous section.

8.2.1. Header Fields

The header records that start each logical message are the same from all BD instruments. An example record is provided below. For examples of Header records used in the context of a message, please refer to Appendix A of this document.

H|^&| |Becton Dickinson| || || ||V1.00|19981019184200

Delimiter Fields (H, 2, 1, 1) – These single characters can be used to process the remainder of the message. These characters denote the field, repeat, component and escape delimiters as described in the ASTM E_1394 specification. These fields are defaulted to “|”, “\”, “^”, and “&” respectively, as shown above.

Sender Name (H, 5, 1, 1) – Messages coming from a BD instrument have the BD identifier in this field as shown above.

Version Number (H, 13, 1, 1) – This version number represents the version of the BD LIS interface used for communications.

Message Date/Time (H, 14, 1, 1) – BD includes the current time and date when constructing this message, formatted as described in the ASTM E_1394 specification in section 6.6.2.

8.2.2. Patient Fields

A full patient record is shown below. The fields used in this example are referred to in the field explanations. For examples of Patient records used in the context of a message, please refer to Appendix A of this document.

P|1| |PatId123| |Doe^John^R^Jr.^Dr.| |19651029|M| |2 Main
St.^Baltimore^ MD^21211^USA| |(410) 316 - 4000|JSMITH| |
| |PNEU|P\AM\AMX| | |19981015120000| |324| | | |ER|St.
Josephs Hospital

Patient ID (P, 4, 1, 1) - Identifier that uniquely identifies a patient. **This is a required field for patient demographic downloads.** This field can be up to 16 characters long (e.g. PatId123).

Patient Name (P, 6, 1, 1-5) – Patient name is divided into 5 components in the ASTM E_1394 specification. The BD EpiCenter stores these fields as a single string in its database. Therefore the BD LIS Interface concatenates these fields from a download message. The patient name can be up to 40 characters long. If these fields are selected for upload on the BD EpiCenter the whole name is placed in the first component of this field (P, 6, 1, 1). Patient name shown in the sample record is Dr. John R Doe Jr.

Date of Birth (P, 8, 1, 1) – Patient date of birth formatted as described in ASTM E_1394 section 6.6.2. The date shown in the sample record is Oct. 29, 1965.

Patient Sex (P, 9, 1, 1) – There are 3 predefined values accepted for this field in the BD EpiCenter database, Male, Female, and Unspecified. If the value does not match the code for either Male or Female then the sex is set to Unspecified. (This is an LIS coded field for the BD EpiCenter.)

Patient Address (P, 11, 1, 1-5) – The ASTM E_1394 specification suggests that the address field be divided into 5 separate components. The BD EpiCenter concatenates all 5 address fields into one before saving it in the database. The patient address can be up to 255 characters long. If this field is selected for upload on the EpiCenter, the whole address is placed in the first component of this field (P, 11, 1, 1).

Patient Phone Number (P, 13, 1, 1) – This field is defined as a free text field that can be up to 25 characters long.

Admitting Physician (P, 14, 1, 1) – The physician admitting the patient into the hospital. In the example above “JSMITH” could be used as an LIS defined abbreviation for Dr. Jane T. Smith, who may work in the hospital. (This is an LIS coded field for the BD EpiCenter.)

Patient Diagnosis (P, 19, 1, 1) – The diagnosis assigned to the patient for the current visit. In the example above “PNEU” could be used as an LIS defined abbreviation for Pneumonia. (This is an LIS coded field for the BD EpiCenter.)

Patient Therapy (P, 20, 1-5, 1) – This field contains up to 5 antibiotics that the patient may be receiving at the time the specimen is being processed. A repeat delimiter as per ASTM E_1394 specifications separates each antibiotic. The above example indicates that the patient is currently receiving Penicillin (P), Ampicillin (AM), and Amoxicillin (AMX). (This is an LIS coded field for the BD EpiCenter.)

Admission Date/Time (P, 24, 1, 1) – This is the time and date that the patient was admitted to the hospital. This field is formatted as specified in the ASTM E_1394 specification, in section 6.6.2. The time portion of this field is assumed to be local time. The optional time zone is deemed unnecessary and is not evaluated.

Note: If the Date/Time string is less than fourteen-characters, the time shall be set to 12:00:00 AM.

Room Number (P, 26, 1, 1) – This is a text field containing the patient’s room number and can be up to 10 characters long.

Hospital Service (P, 33, 1, 1) – The ward or hospital service involved in caring for this patient. (This is an LIS coded field for the BD EpiCenter, e.g. ER may represent the Emergency Room.)

Hospital Client (P, 34, 1, 1) – This field is used by reference laboratories that accept specimens from client hospitals. (This is an LIS coded field for the BD EpiCenter.)

User Defined Patient Fields 1-3 (P, 15, 1-3, 1) – In the BD EpiCenter, the user has the ability to configure the values for 3 coded lists related to patient fields. These fields are mapped to unused fields in the patient record by default. The user may fill these fields and remap them to a field agreed upon by the local LIS. (These are LIS coded fields for the BD EpiCenter.)

User Defined Patient Fields 4-5 (P, 15, 4-5, 1) – In the BD EpiCenter, the user has 2 free text fields that can hold any alpha-numeric information. These fields are mapped to unused fields in the patient record by default. The user may fill these fields and remap them to a field agreed upon by the local LIS.

8.2.3. Order Fields

A full order record is shown below to provide examples for the content of each field. For examples of Order records used in the context of a message, please refer to Appendix A of this document.

```
O|1|Acc123^1^MYCBTUB || ^ ^ ^ MGIT_960_GND ^Seq123|
||19981019023300|| |SJB^MMF|A| ||19981019045200
|Blood^Arm|MJones|(410) 555 – 1234^(410) 555 – 9876^(410)
555 – 7777| || |19981020053400|62| |O| | |Nos
```

Accession Number (O, 3, 1, 1) – The unique alphanumeric string that identifies a specimen. This field can be up to 20 characters long (e.g. Acc123). This is a required field for processing specimen and test information.

Isolate Number (O, 3, 1, 2) – The number associated with an isolate that the test should be performed on. This field should only be used when ordering isolate based tests, otherwise this field should be left blank. Isolate numbers can range from 1 to 20.

Organism (O, 3, 1, 3) – The organism assigned to a particular isolate. The organism code shown in the example above, MYCBTUB, is the code for Mycobacterium tuberculosis. (This is an LIS coded field for the BD EpiCenter).

If an organism is indicated when ordering a BD Phoenix 100 or BD Phoenix M50 ID/AST combo panel, then the ID portion of the panel will automatically be disabled. As a result, only the AST portion of the panel will report results.

Exclude Isolate from Statistics (O, 3, 1, 4) – This field will explicitly indicate if this isolate should be included or excluded from statistic reporting. If this field contains an “I”, then the isolate will be included in statistical reporting. If this field contains an “E”, then the isolate will be excluded from statistical reporting. If this field is left empty, then the BD EpiCenter will use its internal logic to make this decision.

Test Id (O, 5, 1, 4) – The unique code used to represent a particular test. This is an LIS coded field for the BD EpiCenter. For BD instrumented tests, the test ID is the pre-defined test name provided in appendix B (e.g. MGIT_960_GND).

For isolate level results coming from the BD EpiCenter, this field will contain the string “ISOLATE RESULT”.

As noted in Appendix B, tests common to the BD BACTEC 9000 and BD BACTEC FX have the same LIS code.

Test/Consumable Sequence Number (O, 5, 1, 5) – The value that identifies a test ordered. For tests originating from an instrument, this field is set with the consumable id value. For manual tests ordered at the BD EpiCenter, this field contains any test id entered by the user at test order time. In downloads from the LIS, this field is used to distinguish between multiple tests (of the same type) ordered against a specimen. If this field is blank, the BD EpiCenter assumes that this is an LIS Test Order and creates a blank test in the BD EpiCenter database. These orders will be automatically associated with matching tests in the BD EpiCenter database as they are detected. These orders can also be manually associated with orphan tests by the BD EpiCenter user.

This value can be up to 17 characters long.

Priority (O, 6, 1, 1) – This field is defined in the ASTM E_1394 specification. Currently only the values ‘A’ for Critical, ‘R’ for Normal, and blank for default normal or no change are supported.

Collection Date/Time (O, 8, 1, 1) – Date and time that the specimen was collected from the patient, formatted as described in ASTM E_1394 section 6.6.2. The date/time shown in the sample record is 2:33 am on Oct. 19, 1998.

Note: If the Date/Time string is less than fourteen-characters, the time shall be set to 12:00:00 AM.

Collected By (O, 11, 1, 1) – The hospital personnel that collected the specimen from the patient. The example above shows that the specimen was collected by SJB which could be the initials for Sarah J Baker. (This is an LIS coded field for the BD EpiCenter).

Received By (O, 11, 1, 2) – The lab technician that received the specimen. The example above shows that the specimen was received by MMF, which could be the initials for Mike M Ferris. (This is an LIS coded field for the BD EpiCenter).

Specimen Action Code (O, 12, 1, 1) – This field is defined in the ASTM E_1394 specification. Currently only the value Q is supported, for QC tests. Normal tests leave this field blank.

Isolate Source Test (1-3) (O, 14, 1-3, 1) – The isolate source test is the specimen level test that produced the isolate. Often growth and detection tests are sub-cultured to produce several isolates. This field will contain test ids for up to 3 tests that yielded an isolate. This field only applies to Order records containing isolate information.

Isolate Source Test Start Time (1-3) (O, 14, 1-3, 2) – This is the start date and time of the isolate source test described above. It is possible that two of the same test type will be run on a specimen. This field is used to uniquely identify the isolate source test. This field only applies to Order records containing isolate information. This field is formatted as described in ASTM E_1394 section 6.6.2.

Receipt Date/Time (O, 15, 1, 1) – Date and time that the specimen was received into the lab, formatted as described in ASTM E_1394 section 6.6.2. The date/time shown in the sample record is 2:33 am on Oct. 19, 1998.

Note: If the Date/Time string is less than fourteen-characters, the time shall be set to 12:00:00 AM.

Specimen Type (O, 16, 1, 1) – The type of specimen collected from the patient. (This is an LIS coded field for the BD EpiCenter, e.g. Blood.)

Body Site (O, 16, 1, 2) – The body area that the specimen was taken from. (This is an LIS coded field for the BD EpiCenter, e.g. Arm.)

Ordering Physician (O, 17, 1, 1) – The physician that ordered this test. (This is an LIS coded field for the BD EpiCenter, e.g. MJones could represent Mark Jones.)

Ordering Physician Phone Numbers (O, 18, 1, 1-3) – The phone numbers that can be used to reach the ordering physician. Three numbers are accepted in this field, phone number, fax number and pager number. A component delimiter separates each phone number. These fields are free text fields that can be up to 25 characters in length.

User Defined Specimen Fields 1-3 (O, 19, 1-3, 1) – In the BD EpiCenter, the user has the ability to configure the values for 3 coded lists related to specimen fields. These fields are mapped to unused fields in the patient record by default. The user may fill these fields and remap them to a field agreed upon by the local LIS. (This is an LIS coded field for the BD EpiCenter.)

User Defined Specimen Fields 4-5 (O, 19, 4-5, 1) – In the BD EpiCenter, the user has 2 free text fields that can hold any alphanumeric information. These fields are mapped to unused fields in the order record by default. The user may fill these fields and remap them to a field agreed upon by the local LIS.

Finalized Date/Time (O, 23, 1, 1) – The ASTM specification describes this field as containing the time the results were last modified. The BD EpiCenter places this information in the result record to be evaluated for each result. This field

contains the date/time, formatted as described in ASTM E_1394 section 6.6.2, that the results for this test were finalized. This field is blank if the test results are not yet finalized. The time shown in the example record is 5:34 am on Oct 20, 1998.

For isolate level results, this field contains the date/time the specimen was finalized.

Specimen Reimbursement Value (O, 24, 1, 1) – The value used for insurance reimbursement based on the specimen type. This number can be between 0 and 10,000. The value of 62 is used in the example record above.

Test Reimbursement Value (O, 24, 2, 1) – The value used for insurance reimbursement based on this test type. This number can be between 0 and 10,000. The example record above does not have a test reimbursement value.

Report Type (O, 26, 1, 1) – This field is defined in the ASTM E_1394 specification. When a cancelled order is sent back to the LIS the report type is 'X'.

Isolate Classification/Nosocomial (O, 29, 1, 1) – This field contains the BD EpiCenter LIS code for the isolate classification. The BD EpiCenter has a pre-defined list of classifications for an isolate. The complete list is as follows: Significant/Nosocomial, Significant/Community Acquired, Significant/Unknown, Contaminate, Not Determined. If a downloaded code is not recognized, then the Isolate Classification is set as Significant/Unknown.

8.2.4. Result Fields

The BD EpiCenter uploads results from several different types of tests. This causes several different types of result records to be passed to the LIS. The information contained in the generic "Data Fields" depends on the type of result being reported. AST Result records contain antibiotic and susceptibility information. ID Result records contain organism and Resistance Marker information. Growth and Detection result records contain a Positive or Negative status. Below are several different examples of result records, each one passing up a different type of result.

For AST sets, several result records may be sent to the LIS in a single message. Each result record would report the results for a single drug in the AST set. For ID/AST combo tests, an ID result record is sent as the first result record, and the AST result records follow. An example AST set result message is shown in the Appendix A of this document.

Isolate results are also exchanged using these records. Isolate results are exchanged using the same format as an ID/AST combo tests with an ID record first, then followed by several AST result records. **Since isolate results are not associated with a particular test, the test code field in the Order record is replaced with the literal string "ISOLATE_RESULT".**

For examples of Results records used in the context of a message, please refer to Appendix A of this document.

BACTEC MGIT 960 growth and detection test level result example

```
R|1|^ ^ ^GND_MGIT^430100001234|INST_POSITIVE
^87| ||| |P| ||19981019153400|19981020145000|
MGIT960^^42^3^B/A12
```

BACTEC MGIT 960 AST test level result example:

```
R|1| ^ ^ ^AST_MGIT^439400005678^P^0.5^ug/ml|
INST_COMPLETE^105^S| | | |P| | |19981019153400|
19981020145000|MGIT960^^42^3^ B/A12
```

Phoenix AST MIC test level result example:

```
R|1| ^ ^ ^AST_MIC^429530000002^P|
INST_COMPLETE^0.5^S| | | |F| | |19981019153400|
19981020145000
```

Diameter based AST test level result example:

```
R|1|^ ^ ^AST_DIA^Seq123^P^0.5|COMPLETE^15^S| |
|F| | |19981019153400| 19981020145000
```

Identification test level result example:

```
R|1| ^ ^
^ID^Seq123|Complete^MYCBTUB^45678^RM_VRE| |
|F| | |19981019153400|19981020145000
```

For all other tests:

```
R|1| ^ ^ ^OTHER^Seq123|Complete| | |F| |
|19981019153400|19981020145000|
|Many^GPOS_Bac\Few^GNEG_Rods
```

Isolate level result example:

```
R|1| ^ ^ ^AST^P^100.0^ug/mL|
^^R^R^^MGIT_960_AST92| | |F
```

“Universal Test ID” ASTM E_1394 Result field 3

Result ID Code (R, 3, 1, 4) – This is a BD defined code that indicates the type of information being exchanged in the result record. The interpretation of several fields may vary depending on which type of result is being passed. The possible values for this field include the following.

GND – indicates results for a BD BACTEC FX, BD BACTEC 9000, or generic growth and detection test.

GND_MGIT – indicates results for a BD BACTEC MGIT 960 growth and detection test.

GND_PROBETEC – indicates results for a BD ProbeTec ET test.

AST – indicates results for a generic AST test not included in the other AST categories.

AST_MGIT – indicates results for a BD BACTEC MGIT 960 Antibiotic Susceptibility Test.

AST_MIC – indicates results for an MIC based Antibiotic Susceptibility Test.

AST_DIA – indicates results for a diameter based Antibiotic Susceptibility Test, e.g. Kirby Bauer tests.

ID – indicates identification results.

STREAK – indicates Innova Protocol results.

OTHER – indicates test results not included in the above categories.

Test/Consumable Sequence Number (R, 3, 1, 5) – The value that identifies the media/consumable used for generating these results. This field may be blank for manual test results where a sequence number is not known. This value can be up to 17 characters long. The example records above show the results being reported for sequence number “Seq123”.

A test/consumable sequence number is required for all instrumented test results downloaded to the BD EpiCenter. For manual or supplemental test results downloaded to the BD EpiCenter this field is optional. If no sequence number is included with the results the BD EpiCenter searches on the current access number for any test matching the test code provided in the order record. If a match is found, the BD EpiCenter updates the results for that test. If no test match is found, then the BD EpiCenter orders a new test. **Be aware that unwanted consequences could occur if more than one of a particular test type are ordered for an access number and test sequence numbers are not used.**

Antibiotic (R, 3, 1, 6) (AST Results) – The antibiotic tested in this AST test. The antibiotic code shown in the above AST examples is “P” for Penicillin. (This is an LIS coded field for the EpiCenter).

Concentration (R, 3, 1, 7) (AST Results) – Several AST tests, such as Kirby Bauer tests, are done with antibiotics at a specific concentration. For these tests the antibiotic concentration is needed to define the test that results are being provided for. When no concentration units are provided it is assumed to be in ug/ml. This field can be up to 15 characters long. The antibiotic concentration shown in the AST (MGIT960) example above is “0.5”.

Concentration Units (R, 3, 1, 8) (AST Results) – The BD BACTEC MGIT 960 results include the concentration units of the concentration provided in the previous field. This field can be up to 15 characters long. The concentration units shown in the AST example above is “ug/mL” for micrograms per milliliter. This is also assumed to be the default if no other value is provided.

“Data or Measurement Values” ASTM E_1394 Result field 4

The contents of the Result Data fields vary depending on the type of test result being reported, as described below.

Test Status (R, 4, 1, 1) – The status value for a particular test. This field is filled for all test results. This is an LIS coded field for the BD EpiCenter. For BD instrumented tests, the status code is one of the pre-defined values listed in Appendix B of this document. The GND example record shown above has a test status value of INST_POSITIVE.

Result Data Field 1

Growth Units (R, 4, 1, 2) (*BACTEC MGIT 960 Results Only*) – See Appendix E for instrument specific information. The Positive GND tube listed above indicates 87 growth units. The AST example record shows a growth value of 105. This field is never more than 5 characters long.

ProbeTecET Algorithmic Result (R, 4, 1, 2) (*BD ProbeTec ET/Viper XTR Result Only*) – See Appendix E for instrument specific information. (future)

Minimum Inhibitory Concentration (R, 4, 1, 2) (*MIC based AST Result*) – For AST tests that produce MIC values, this field contains the minimum antibiotic concentration that inhibits growth of the tested organism. The example above for an MIC based AST test contains an MIC value of “0.5”. This field can be up to 20 characters long and is assumed to contain a number in ug/ml.

This field may contain signed MIC values such as “<=4” or “>8”, MIC values for compound antimicrobials such as “0.5/4” or “<=0.5/16” as well as the following:

“?” - Ongoing

“C” - Antimicrobial is Rapid Completed (*For nonQC tests in BD EpiCenter V4 and later*)

“X” - Error

Diameter (R, 4, 1, 2) (*Diameter based AST Results*) – For Kirby Bauer type tests, this field contains the diameter of the inhibited growth region caused by the antibiotic. The diameter based AST example above shows a diameter value of 15. This number is assumed to be in millimeters.

Organism (R, 4, 1, 2) (*ID Results Only*) – The organism assigned to a particular isolate. The organism code shown in the example above, MYCBTUB, is the code for Mycobacterium tuberculosis. (This is an LIS coded field for the BD EpiCenter).

Result Data Field 2

AST Susceptibility, Final (R, 4, 1, 3) (*Isolate AST results only*) – This is a code that indicates the organism is susceptible to the antibiotic specified in this record. The acceptable values for this field are **S, I, R, N, and X**, representing susceptible, intermediate, resistant, not-susceptible and error respectively. This field is only uploaded by the BD EpiCenter as part of an isolate level result (see earlier section). The isolate AST example record shows that the user decided to override the expert system results and say that the organism was susceptible to the antibiotic, indicated by “S” in the Final field.

Profile Number (R, 4, 1, 3) (*ID results and Isolate ID results*) – This is a text field that holds the profile number associated with an ID test. This value can be up to 16 characters long. The ID result record example above indicates a profile number of 45678.

Result Data Field 3

AST Susceptibility, Interpreted (R, 4, 1, 4) (*All AST results*) – This is a code that indicates is the organism is susceptible to the antibiotic specified in this record. The acceptable values for this field are **S, I, R, N, and X**, representing susceptible, intermediate, resistant, not-susceptible and error respectively. This field contains the AST interpretation from the instrument or user before being processed by the Expert System. The isolate AST example record shows that the organism has intermediate susceptibility to the specified antibiotic, indicated by “I”.

Resistance Marker 1 (R, 4, 1, 4) (*Isolate ID results*) – This represents a Resistance Marker associated with the organism identified in the ID result record. The BD EpiCenter generates this data as part of the expert system and are only included for Isolate uploads. The first Resistance Marker in the ID example above is RM_VRE, which may be an LIS code used for Vancomycin resistant Enterococci. (This is an LIS coded field for the BD EpiCenter).

Result Data Field 4

AST Susceptibility, Expert (R, 4, 1, 5) (*Isolate AST results only*) – This is a code that indicates if the organism is susceptible to the antibiotic specified in this record. The acceptable values for this field are **S, I, R, N, and X**, representing susceptible, intermediate, resistant, not-susceptible and error respectively. This field is only uploaded by the BD EpiCenter as part of an isolate level result (see earlier section). The BD Phoenix 100, the BD Phoenix M50, and the BD EpiCenter have an expert system that can produce a secondary evaluation of susceptibility. The isolate AST example record shows that the expert system decided that the organism is resistant to the specified antibiotic, indicated by “R”.

Resistance Marker 2 (R, 4, 1, 5) (*Isolate ID results*) – This represents a Resistance Marker associated with the organism identified in the ID result record. The BD EpiCenter generates this data as part of the expert system and are only included for Isolate uploads. The example record above contains only one Resistance Marker. (This is an LIS coded field for the BD EpiCenter).

Result Data Field 5

AST Source Test (R, 4, 1, 6) (*Isolate AST results*) – This represents the Test Id for the source test that included this AST result. This is included because Isolate results may be compiled from several different AST tests. The example Isolate upload record above contains the Test Id of MGIT_960_AST. (This is an LIS coded field for the BD EpiCenter).

It is possible that there can be results on the isolate upload that have been inferred by the BD EpiCenter BDxpert system and are not associated with a test. When this condition occurs, BD EpiCenter uploads a “blank”, or an empty field in the AST Source Test field(R, 4, 1, 6) as well as the MIC field(R, 4, 1, 2).

Results example with AST Source Test:

R|2|^AST^CTX|^<=1^S^S^NMICID4 ||||F

Inferred results example without AST Source Test:

R|3|^AST^CZ|^R^R|| |||F

Resistance Marker 3 (R, 4, 1, 6) (*Isolate ID results*) – This represents a Resistance Marker associated with the organism identified in the ID result record. The BD EpiCenter generates this data as part of the expert system and are only included for Isolate uploads. The example record above contains only one Resistance Marker. (This is an LIS coded field for the BD EpiCenter).

Result Data Field 6

Resistance Marker 4 (R, 4, 1, 7) (*Isolate ID results*) – This represents a Resistance Marker associated with the organism identified in the ID result record. The BD EpiCenter generates this data as part of the expert system and are only included for Isolate uploads. The example record above contains only one Resistance Marker. (This is an LIS coded field for the BD EpiCenter).

Result Data Field 7

Resistance Marker 5 (R, 4, 1, 8) (*Isolate ID results*) – This represents a Resistance Marker associated with the organism identified in the ID result record. The BD EpiCenter generates this data as part of the expert system and are only included for Isolate uploads. The example record above contains only one Resistance Marker. (This is an LIS coded field for the BD EpiCenter).

Result Data Field 8

ID Source Test (R, 4, 1, 9) (*Isolate ID results*) – This represents the Test Id for the source test that produced this ID result. (This is an LIS coded field for the BD EpiCenter.)

Preliminary/Final Status (R, 9, 1, 1) – This field contains either a “P” or an “F” as defined in the ASTM E_1394 specification. The result status shown in the examples above are final. ***For isolate level results, this indicates the status of the isolate.***

Start Date/Time (R, 12, 1, 1) – This is the date and time that the test was first started or entered into an instrument. This field is formatted as described in the ASTM E_1394 specification in section 6.6.2. The test start time shown above is 3:34 pm on Oct 19, 1998. **This field has special significance for BD BACTEC MGIT 960 AST tests. Please read the instrument specific section for more details.**

Result/Status Date/Time (R, 13, 1, 1) – This is the date and time that the test received the status being reported in this record. This is a required field and is used to identify when results downloaded from the LIS are more recent than those contained in the BD EpiCenter. This field is formatted as described in the ASTM E_1394 specification in section 6.6.2. The test status time shown above is 2:50 p.m. on Oct 20, 1998.

Test Complete Date/Time (R, 13, 2, 1) – This is the date and time that an instrumented test finished its results. This is different than the Result Date/Time in that this time will not change if the user assigns a new status to a test. For a growth and detection result record, this field will hold the Positivity Date/Time. For an ID result record, this field will hold the time that the Id portion of a BD Phoenix 100 or BD Phoenix M50 panel completed. For an AST result from a BD Phoenix 100 or BD Phoenix M50 panel, this field will hold the time that a valid MIC was produced. This field is formatted as described in the ASTM E_1394 specification in section 6.6.2.

Media Setup Date/Time (R, 13, 1, 2) – For Innova tests this field indicates the time that the specimen was successfully streaked. If the specimen was not successfully streaked, this field will be blank.

Instrument Type (R, 14, 1, 1) (*Instrumented Results Only*) – This field indicates which BD instrument produced the result. This field is filled with one of several BD defined values listed below.

“**BT9000**” – BD BACTEC 9000 series instrument

“**MGIT960**” – BD BACTEC MGIT 960 instrument

“**PHOENIX**” – BD BD ID/AST instrument

“**PROBETEC**” – BD ProbeTec ET instrument

“**BACTECFX**” - BD BACTEC FX instrument

“**INNOVA**” – BD Innova instrument

Media Type (R, 14, 1, 2) (*Instrumented Results Only*) – This field indicates the type of media or consumable used to perform this test. See Appendix E for instrument specific information.

Protocol Length (R, 14, 1, 3) (*Instrumented Results Only*) – This field indicates the length of time (in hours or days) required to complete the test. For growth and detection tests, this number represents the number of days before a tube can be considered negative.

Instrument Number (R, 14, 1, 4) (*Instrumented Results Only*) – This is the user number assigned to the instrument that ran the test. This value can be between 1 and 99.

Instrument Location (R, 14, 1, 5) (*Instrumented Results Only*) – This value indicates the position inside of the instrument where the test was performed.

For BD BACTEC MGIT 960 tests this value indicates a drawer number, row number and well number. In the GND example above, the location B/A12 indicates that the test was performed in drawer B, row A well number 12.

For Innova tests this value indicates a drawer number, canoe number, and position in canoe and is represented as **3-1-8**.

BD ProbeTec ET QC Type (R, 14, 1, 6) (*BD ProbeTec ET Result Only*) – See Appendix E for instrument specific information.

Test Protocol (R, 14, 1, 8) - This value indicates the name of the protocol with which the specimen was processed on the Innova instrument.

BD ProbeTec ET QC Kit Lot Number (R, 14, 1, 7) (*BD ProbeTec ET Result Only*) – See Appendix E for instrument specific information.

Additional Results Quantity 1-5 (R, 15, 1-5, 1) (*BD EpiCenter Additional Results Only*) – This field contains a text value that associates a quantity to the additional result reported in the next ASTM component field. The quantities Many and Few are used in the example record for other tests. See the Additional Results field description for more detail. (This is an LIS coded field for the BD EpiCenter).

Additional Results (R, 15, 1-5, 2) (*BD EpiCenter Additional Results Only*) – There are several tests that can be assigned multiple results at one time. An example of such a test is a Gram Stain test, which can be assigned results such as “Gram Negative Rod Seen” AND “Gram Positive Bacillus Seen”. These results differ from Gnd test results of simply Positive or Negative. The BD EpiCenter maintains a user configurable list of additional test results that can apply to a test. Each additional result can also be associated with a quantity value, which precedes the additional result in the record. In the example above for other tests, the additional results and quantities reported are Many GP_BAC and Few GN_RODS. (These are LIS coded fields for the BD EpiCenter).

8.2.5. Comment Fields

The BD EpiCenter accepts and sends comment strings for patients, specimen, and isolates. Patient comments are exchanged in a comment record following a patient record, and include the patient type identifier. Specimen and isolate comments are exchanged in a comment record following the order record, and include either the specimen or isolate type identifier. An order record with both a specimen and isolate comment is shown below.

If multiple comment records are received for a patient, specimen, or isolate, then all comments of the same type are appended together and saved in the BD EpiCenter.

The BD EpiCenter can upload the description for chartable rules. This is the descriptive text for expert system rules that have been run against an isolate. The user has the ability to configure individual rules as reportable on a patient's chart report. If a rule is configured to be chartable, the rule description will be included in an upload Comment record. These comment records will follow after an Order record. Since the BD EpiCenter expert system rules only apply to isolates, these types of comments will only be part of Isolate Uploads as described in section 5.2.

The following is an example of a comment record containing a rule where <310> is the rule number and (AMX, ATM, CAZ) is a list of the affected antimicrobials.

C|1| |<310> BDXpert Rule 310 text.(AMX, ATM, CAZ)|E

Special Messages are messages that indicate a special condition for a BD Phoenix 100 or BD Phoenix M50 panel. These will be uploaded in a Comment record as part of the test results for the panel. The following is an example of a comment record containing a special message with a list of the affected antimicrobials.

C|1| | Special message text. (AM, CAZ)|T

Comment records not appearing after the Patient or Order records are ignored. Comments not containing the appropriate type indicator are ignored.

O|1|Acc123^1^MYCBTUB|

C|1| |This is a specimen comment |S

C|2| |This is an isolate comment |I

Comment Text (C, 4, 1, 1) – The text to be used for the patient, specimen or isolate comment. This field can be up to 1600 characters long.

Comment Type (C, 5, 1, 1) – The type of comment record. This field should be a **P, S, I, E, T or R** for patient, specimen, isolate, chartable rule, special message or result comment respectively.

8.2.6. Request Fields

The ASTM E_1394 defines a Request record with several fields for qualifying the requested data. Data requests can be made by specifying ranges of patient IDs, accession numbers, or sequence numbers. Data requests can also be qualified by date/time ranges.

All of these fields are supported by the BD EpiCenter interface for requests originating FROM the LIS. The field mapping table on the previous pages correctly indicates the support query fields. Examples can also be found in the Sample Messages section of this document.

Q|1|^Acc123||MGIT_960_GND^INST_POSITIVE^MGIT_960
^2|R|19981019120000|19981020120000

The sample record shown above is evaluated to request the result information for positive MGIT_960_GND tests, on instrument 2, for the specimen with an accession number of Acc123 between the dates specified. Note that all query criteria are ANDed together, so that only records that meet ALL criteria will be uploaded in response to a query from the LIS.

The BD EpiCenter only requests information from the LIS on a per specimen basis. The request records generated by the BD EpiCenter contains only the accession number as a qualifying field as shown below. The BD EpiCenter request should be interpreted as requesting both patient demographics and all ordered tests for that specimen.

Q|1|^Acc123| |R

Starting Patient ID (Q, 3, 1, 1) – A patient ID value. This field should be filled if the data request is for either a single patient or for a range of patients. If patient ID is not to be used as a search criterion for requested data, then this field can be left blank. This field can be up to 16 characters long. In the example above, a range of patients is specified, beginning with patient ID “Pat123”.

Starting Access Number (Q, 3, 1, 2) – A specimen ID value. This field should be filled if the data request is for either a single specimen or for a range of specimen. If accession number is not to be used as a search criterion for requested data, then this field can be left blank. This field can be up to 20 characters long. In the example above, a range of specimen is specified, beginning with Accession number “Acc123”.

Starting Sequence Number (Q, 3, 1, 3) – A consumable ID value. This field should be filled if the data request is for either a single test or for a range of tests. If sequence number is not to be used as a search criterion for requested data, then this field can be left blank. This field can be up to 17 characters long. In the example above, no specific sequence numbers are requested.

Ending Patient ID (Q, 4, 1, 1) – The patient ID that ends the alphanumeric range of ID values requested. If only data for a single patient ID is requested, then this field can be left blank. This field can be up to 16 characters long. This field contains “Pat456” in the example shown above.

Ending Accession Number (Q, 4, 1, 2) – The specimen ID that ends the alphanumeric range of ID values requested. If only data for a single accession number is requested, then this field can be left blank. This field can be up to 20 characters long. This field contains “Acc456” in the example shown above.

Ending Sequence Number (Q, 4, 1, 3) – The consumable ID that ends the alphanumeric range of ID values requested. If only data for a single test is requested, then this field can be left blank. This field can be up to 17 characters long. In the example above, no specific sequence numbers are requested.

Test ID (Q, 5, 1, 1) – This is the code used to represent a particular test, and is used to request the results for this test type. This is an LIS coded field for the BD EpiCenter. For BD instrumented tests, the test id is the pre-defined test name listed in appendix B.

Test Status (Q, 5, 1, 2) – The status for a particular test. This field is only evaluated if the Test ID field contains valid data. This is an LIS coded field for the BD EpiCenter. For BD instrumented tests the status value is one of the pre-defined values listed in Appendix B. The example record requests result information for XXX tests with a status of INST_POSITIVE.

Instrument Type (Q, 5, 1, 3) – This field indicates the type of instrumented test requested by the LIS. The BD EpiCenter may be connected to several instruments of different types. This field allows the LIS to request all tests run in a particular instrument type. The appropriate values for this field are listed for the Instrument Type in the result record (R, 14, 1, 1). If the value MGIT960 is used in this field, all MGIT_960_GND and all MGIT_960_AST tests are returned.

Instrument Number (Q, 5, 1, 4) – This field allows the LIS to request results for a particular instrument number. This field is only evaluated if the instrument type field is also set.

Result Qualifier (Q, 5, 1, 5) – This field allows the LIS to request results that have been modified since the last request. The only acceptable value for this field is MOD, to indicate modified results. If this field is left blank, all results that meet the remaining criteria are included. The BD EpiCenter will not accept other criteria in a query containing the MOD result qualifier.

Time Qualifier (Q, 6, 1, 1) – The use of this field is described in the ASTM E_1394 specification. The acceptable values for this field are **S**, **R**, and **T** which identify the content in the Starting and Ending Date/Time fields as follows:.

(S) - Specimen Collection Time

(R) – Result Time

(T) – Test Start Time

BD EpiCenter NOTE: If no Time Qualifier is specified, the Starting and Ending Times will, by default, refer to Result times.

In the example record times refer to result dates.

Starting Date/Time (Q, 7, 1, 1) – The starting date/time (inclusive) of the data requested. This field is formatted as specified in ASTM E_1394 specifications section 6.6.2. The date/time requested in example above is 12 pm on Oct 19, 1998.

BD EpiCenter NOTE: If a Starting Date/Time is specified and no Ending Date/Time is specified, data will be delivered whose Collection or Result Time is **since** the specified Starting Date/Time.

BD EpiCenter NOTE: If a Starting Date/Time specifies only the Date portion, the time will default to midnight 00:00:00.

Ending Date/Time (Q, 8, 1, 1) – The ending date/time (inclusive) of the data requested. This field is formatted as specified in ASTM E_1394 specifications section 6.6.2. The date/time requested in example above is 12 pm on Oct 20, 1998.

BD EpiCenter NOTE: If an Ending Date/Time specifies only the Date portion, the time will default to 23:59:59.

Request Information Status Code (Q, 13, 1, 1) – This field cancels an outstanding query. The only acceptable value for this field is 'A'. The BD EpiCenter will ignore any other Request criteria fields when they appear in the same query record as a Query Cancel command.

If the string 'ALL' appears in any Request Field, and no other Criteria are present, the BD EpiCenter will attempt to upload all test data in its database to the LIS.

If the string 'ALL' appears in any Request Field, and any other Criteria are present, the BD EpiCenter will ignore it because an empty criteria field is an implied 'ALL'.

8.2.7. Terminator Fields

Below is an example terminator record.

L|1|N

Termination Code (L, 3, 1, 1) – The termination code provides an explanation of the end of session as described in the ASTM E_1394 specification. The BD EpiCenter supports codes of N, Q, F and I in request responses downloaded from the LIS, as described in the ASTM specifications. However the BD EpiCenter and all of the BD instruments upload either N, Q or F. All other codes are ignored and treated as a normal message. Normal result uploads are indicated with N and request response uploads are indicated by F. Requests that contain an error are replied to with an empty message containing the code 'Q' in the terminator record. Requests that have no data satisfying the request, are responded to with a message containing only a Header and Terminator record.

The BD interface sends the results for a single test in a message. However there may be several tests that satisfy a data request downloaded by the LIS. In this instance, the BD interface uploads all tests but the last as single tests in separate messages marked as normal uploads (N). Only the last test that satisfies the request is marked as query response (F). Once the LIS receives the query response indicator (F), it has received all of the data it requested.

9. Simulator

BD has developed a simulator for testing the physical level LIS interface. This simulator can be configured to emulate either the LIS or instrument in the ASTM E_1381 protocol.

The simulator accepts ASTM E_1394 message strings from a file and transmit them across the serial port interface. The simulator also receives messages across the serial port interface and saves the message text into a file. A full description of the simulators specifications can be found in a separate document.

BD intends to make the simulator and supporting document available to LIS vendors to help facilitate interface development.

10. Appendix A - Sample BD EpiCenter Messages

10.1. LIS Order

BD BACTEC MGIT 960 GND tube ordered at the LIS for a new patient. Patient and test information is downloaded to the BD EpiCenter.

```
H|\^&|||||19981019184200
P|1||PatId123||Doe^John^R^Jr.^Dr.||19651029|M||2 Main
St.^Baltimore^ MD^21211^USA||(410) 316 - 4000|JSMITH||||
|P\AM\AMX||||19981015120000||324|||||ER|St. Josephs
Hospital
O|1|Acc123^ ^ ^Seq123|| ^ ^ ^MGIT_960_GND||
|19981019023300|||SJB^MMF|A|||19981019045200
|Blood^Arm|MJones|(410) 555-1234^(410) 555-9876^(410) 555-
7777||||19981020053400|62||O||Nos
L|1|N
```

10.2. Host Query

The BD EpiCenter can receive a new accession number from a barcode on an instrumented test. The BD EpiCenter requests information from the LIS about that specimen.

```
H|\^&|||Becton Dickinson|||||V1.00|19981019184200
Q|1|^Acc123|||R
L|1|N
```

The LIS should respond to this request with patient demographics and ordered test information. Patient Demographics may not be included if they are not yet known. The terminator record should indicate that this is a message in response to a request.

```
H|\^&|||||19981019184200
P|1||PatId123||Doe^John^R^Jr.^Dr.||19651029|M||2 Main
St.^Baltimore^ MD^21211^USA||(410) 316 - 4000|JSMITH||||
|P\AM\AMX||||19981015120000||324|||||ER|St. Josephs
Hospital
O|1|Acc123^ ^ ^Seq123|| ^ ^ ^MGIT_960_GND||
|19981019023300|||SJB^MMF|A|||19981019045200
|Blood^Arm|MJones|(410) 555-1234^(410) 555-9876^(410) 555-
7777||||19981020053400|62||O||Nos
L|1|F
```

10.3. LIS Requests Results

The LIS can request result information from the BD EpiCenter.

```
H|\^&|||||19981019184200
Q|1|^Acc123|^Acc125|MGIT_960_GND^INST_POSITIVE^MGIT960^2|R
L|1|N
```

10.4. Results

BD EpiCenter will report results to the LIS in response to a request for results or as an unsolicited upload message. When results are uploaded in response to a request, the termination code in the terminator record will indicate that this is a message in response to a request.

```
H|\^&|||Becton Dickinson||||||| V1.00 |19981019184200
P|1||PatId123
O|1|Acc123||^ ^ ^MGIT_960_GND^430100065178
R|1|^ ^ ^GND^430100065178|INST_POSITIVE^87|||||P||
|19981019153400|19981020145000|MGIT960^ ^ 42^3^B/A12
L|1|F
```

10.4.1. BACTEC G&D Test Results

```
H|\^&|||Becton Dickinson|||||||V1.0|20060223115749
P|1||P0001||Patient
Name||20040229|M|||||ADMIT_PHYS|||||||20060221092800||||
||||HOSP_SERV|CLIENT
O|1|20060223001||^ ^ ^PLUSAEF^449200917642|R||20060222092300|
||COLL_BY^RECD_BY|||20060223092300|SAMP_TYPE^BODY|ORD_PHYS
|||||20060223105527
R|1|^ ^ ^GND^449200917642|INST_NEGATIVE|||||F|||2005020112304
6|20050208124106|BT9000^92^32^7^A1
L|1|N
```

10.4.2. MGIT 960 G&D Test Results

```
H|\^&|||Becton Dickinson|||||||V1.0|20050316152953
P|1||PatXYZ||Mr. Fred A. Stare
O|1| Acc456||^ ^ ^MGIT_960_GND^430100065177|R||
20041104082700|||||20041104082750||||||20050316152949
R|1|^ ^ ^GND_MGIT^430100065177|INST_NEGATIVE^0|||||F|
||20041029112243|20041103110237|MGIT960^ ^ 5^1^B/C17
L|1|N
```

10.4.3. MGIT AST Test Results

```
H|\^&|||Becton Dickinson||||||| V1.00 |19981019184200
P|1||PatId123
O|1|Acc123||^ ^ ^MGIT_960_AST
R|1|^ ^ ^AST_MGIT^439400001234^P^0.5^ug/ml|
INST_COMPLETE^105^ ^ S|||||||19981019153400|19981020145000|
MGIT960^ ^ 42^3^ B/A13
R|2|^ ^ ^AST_MGIT^439400001234^AMX^0.5^ug/ml|
INST_COMPLETE^142^ ^ I|||||||19981019153400|19981020145000|
MGIT960^ ^ 42^3^ B/A14
R|3|^ ^ ^AST_MGIT^439400001234^AM^0.5^ug/ml|
INST_COMPLETE^130^ ^ R|||||||19981019153400|19981020145000|
MGIT960^ ^ 42^3^B/A15
L|1|N
```


10.4.4. Innova Results

```
H|\^&|||Becton Dickinson|||||||V1.0|20110512155503
P|1||PatID1||Smith Billy Bob
B||20110405|M|||||||||||||||||ER|Client
O|1|Acc055||^INNOVA|R||20110422010000|||collecby^recby|||
|20110423102935|RESP^bdysite|phys|||||20110512113329
R|1|^STREAK|INST_COMPLETE|||||F|||20110512113327|
20110512113329|INNOVA^^^1-1-1^^^Protocol 2_1
L|1|N
```

10.4.5. Isolate Results

Isolate results are different from test results as follows:

- The Test Id in Order field (O, 5, 1, 4) is set to "ISOLATE RESULT" instead of a real test id.
- The first result record of an isolate result is always an ID record regardless of test types.
- The ID record will contain the ID test source in field (R, 4, 1, 9).
- Unlike test uploads which have a fixed number of results, the number of results included in an isolate can fluctuate until the isolate is finalized.
- Isolate level AST result records will contain Interpreted (R, 4, 1, 4), Expert (R, 4, 1, 5) and Final (R, 4, 1, 3) AST susceptibility values whereas test level results only contain Interpreted (R, 4, 1, 4) AST susceptibility values.
- Isolate level AST result records will contain the AST test source in field (R, 4, 1, 6).

```
H|\^&|||Becton Dickinson|||||||V1.0|20060223111210
P|1||P0001||Patient Name||20040229|M|||||ADMIT_PHYS|||
|||||20060221092800|||||||HOSP_SERV|CLIENT
O|1|20060223001^1^ESCCOL|^ISOLATE RESULT|
|20060222092300|||COLL_BY^RECD_BY|||
|20060223092300|SAMP_TYPE^BODY|ORD_PHYS|
||||20060223105534|||||UNK
R|1|^ID|^ESCCOL^0000031BF0000021^^^^^NMIC/ID-14|||||F
R|2|^AST^AM|^8^S^S^NMIC/ID-14|||||F
R|3|^AST^AMC|^8/4^S^S^NMIC/ID-14|||||F
R|4|^AST^AN|^<=2^S^S^NMIC/ID-14|||||F
R|5|^AST^ATM|^<=2^S^S^NMIC/ID-14|||||F
R|6|^AST^CAZ|^<=1^S^S^NMIC/ID-14|||||F
R|7|^AST^CIP|^<=0.25^S^S^NMIC/ID-14|||||F
R|8|^AST^CTX|^<=2^S^S^NMIC/ID-14|||||F
R|9|^AST^CXM|^8^S^S^NMIC/ID-14|||||F
L|1|N
```

10.4.5.1. Isolate with Expert system changes - Blank MIC, modified SIR

The BDxpert system may change either the MIC value or the SIR value calculated on the instrument based on rules that implement generally accepted microbiology principles or suppressed reporting requirements. In the example below, 4 result values have been impacted.

Result record 2 and 14 have had the MIC removed and the SIR value set to "R" due to intrinsic resistance of this organism to the drugs. Note that the MIC field is empty. A blank value should be posted in the LIS system for this MIC.

Result record 5 has had the SIR value modified from S to X indicating that the drug result cannot be reported.

Result record 17 has had the SIR value modified from S to R, indicating the drug should be reported as resistant even though it appeared susceptible in vitro.

```
H|\^&|||Becton Dickinson|||||||V1.0|20060223111330
P|1||P0001||Patient Name||20040229|M||||ADMIT_PHYS
|||||||20060221105100||Room|||||HOSP_SERV|CLIENT
O|1|20060223002^2^STAWAR||^ ^ ISOLATE RESULT||
20060222105100|||COLL_BY^RECD_BY|||20060223105100|
SAMP_TYPE^BODY|ORD_PHYS|||||20060223105622|||||UNK
R|1|^ ^ ID|^STAWAR^00000010002DD000^ ^ ^ PMIC/ID-14||||F
R|2|^ ^ AST^AM|^R^R^PMIC/ID-14||||F
R|3|^ ^ AST^AMC|^8/4^R^R^PMIC/ID-14||||F
R|4|^ ^ AST^C|^4^S^S^PMIC/ID-14||||F
R|5|^ ^ AST^CC|^<=0.25^X^S^X^PMIC/ID-14||||F
R|6|^ ^ AST^CIP|^<=0.5^S^S^PMIC/ID-14||||F
R|7|^ ^ AST^E|^>4^R^R^PMIC/ID-14||||F
R|8|^ ^ AST^FM|^<=16^S^S^PMIC/ID-14||||F
R|9|^ ^ AST^GM|^<=2^S^S^PMIC/ID-14||||F
R|10|^ ^ AST^LVX|^<=1^S^S^PMIC/ID-14||||F
R|11|^ ^ AST^LZD|^2^S^S^PMIC/ID-14||||F
R|12|^ ^ AST^MXF|^<=1^S^S^PMIC/ID-14||||F
R|13|^ ^ AST^OX|^>2^R^R^PMIC/ID-14||||F
R|14|^ ^ AST^P|^R^R^PMIC/ID-14||||F
R|15|^ ^ AST^RA|^<=0.5^S^S^PMIC/ID-14||||F
R|16|^ ^ AST^SXT|^<=0.5/9.5^S^S^PMIC/ID-14||||F
R|17|^ ^ AST^VA|^2^R^S^R^PMIC/ID-14||||F
L|1|N
```

10.4.5.2. Isolate with Resistance Markers

If an organism is identified with resistance mechanism, then the resistance mechanism code is reported as part of the identification result. Up to 5 resistance marker codes can be sent.

```
H|\^&|||Becton Dickinson|||||||V1.0|20060223111330
P|1||P0001||Patient Name
||20040229|M||||ADMIT_PHYS|||||||20060221105100||Room||
||||HOSP_SERV|CLIENT
O|1|20060223002^2^STAWAR||^ ^ ISOLATE RESULT
||20060222105100|||COLL_BY^RECD_BY|||20060223105100|
SAMP_TYPE^BODY|ORD_PHYS|||||20060223105622|||||UNK
R|1|^ ^ ID|^STAWAR^00000010002DD000^RM_MRSA^RM_GP_BL^ ^
PMIC/ID-14 ||||F
R|2|^ ^ AST^AM|^R^R^PMIC/ID-14||||F
R|3|^ ^ AST^AMC|^8/4^R^R^PMIC/ID-14||||F
R|4|^ ^ AST^C|^4^S^S^PMIC/ID-14||||F
L|1|N
```

10.4.5.3. Isolate with Expert Comments

Certain rules in BD EpiCenter can produce chartable comments. These comments appear after the Order record and have a Comment Type of "E".

There is no limit to the number of comments that could be reported.

```

H|\^&|||Becton Dickinson|||||||V1.0|20060223115915
P|1||P0001||Patient Name
|20040229|M||||ADMIT_PHYS|||||||20060221105100||Room||
||||HOSP_SERV|CLIENT
O|1|20060223002^2^STAWAR||^ISOLATE
RESULT|||20060222105100||COLL_BY^RECD_BY|||20060223105100
|SAMP_TYPE^BODY|ORD_PHYS|||||20060223112842|||||UNK
C|1|<132>Staphylococcal isolates that are resistant to
oxacillin (MRS) should not be treated with penicillins,
beta-lactam/beta-lactamase inhibitor combinations,
cephalosporins and carbapenems.( AM, P )|E
C|2|<335>Macrolide-resistant staphylococci with an
interpretation of susceptible or intermediate for
clindamycin may have inducible resistance to clindamycin
(MLSb resistance) or may be resistant only to macrolides
(efflux-mechanism). User must perform a clindamycin
induction test (disk approximation test). If positive,
isolate should be reported as clindamycin resistant.
However, clindamycin may still be effective in some
patients. If "D" zone is not observed, isolate should be
reported as susceptible.( CC )|E
R|1|^ID|^STAWAR^00000010002DD000^RM_MRSA^^^^^
PMIC/ID-14||||F
R|2|^AST^AM|^R^R^PMIC/ID-14||||F
R|3|^AST^AMC|^8/4^R^R^PMIC/ID-14||||F
R|4|^AST^C|^4^S^S^PMIC/ID-14||||F
R|5|^AST^CC|^<=0.25^X^S^X^PMIC/ID-14||||F
R|6|^AST^CIP|^<=0.5^S^S^PMIC/ID-14||||F
R|7|^AST^P|^R^R^PMIC/ID-14||||F
L|1|N

```

10.4.5.4. Isolate with inferred results

The Expert system is able report results for drugs that were not actually tested on the instrument. This may be used where the drug on the test is not commonly prescribed, but is used as an indicator for drugs available in the pharmacy.

In this case, because the drug was not tested in the instrument, the inferred result records do not have MIC or test source values. In this case a blank should be posted for the MIC. Result record 6 is an inferred result in the example below.

```

H|\^&|||Becton Dickinson|||||||V1.0|20060223115845
P|1||P0001||Patient Name
|20040229|M|||||ADMIT_PHYS|||||||20060221105100||Room||
||||HOSP_SERV|CLIENT
O|1|20060223002^1^ENTCFAA|^|^ISOLATE
RESULT|||20060222105100|||COLL_BY^RECD_BY|||20060223105100
|SAMP_TYPE^BODY|ORD_PHYS|||||20060223112842|||||UNK
R|1|^ID|^ENTCFAA^000017F82CD064C0^PMIC/ID-14||||F
R|2|^AST^AM|^<=2^S^S^PMIC/ID-14||||F
R|3|^AST^C|^8^S^S^PMIC/ID-14||||F
R|4|^AST^E|^2^I^I^PMIC/ID-14||||F
R|5|^AST^GMS|^<=500^S^S^PMIC/ID-14||||F
R|6|^AST^IPM|^S^S^S||||F
R|7|^AST^LVX|^<=1^S^S^PMIC/ID-14||||F
R|8|^AST^LZD|^2^S^S^PMIC/ID-14||||F
R|9|^AST^MXF|^<=1^S^S^PMIC/ID-14||||F
L|1|N

```

10.4.5.5. Isolate with multiple test sources

The Isolate results in BD EpiCenter are a consolidation of all AST results for an organism. As a result, if more than one test is used to generate these susceptibility results, more than one test source code could be reported back to the LIS system.

In the example below, the result record 16 is a drug not available on the panels tested, and was thus a supplemental test with test code "KB".

```

H|\^&|||Becton Dickinson|||||||V1.0|20060223120400
P|1||P0001||Patient Name
|20040229|M|||||ADMIT_PHYS|||||||20060221092800|||||||
|HOSP_SERV|CLIENT
O|1|20060223003^1^KLEPNEP|^|^ISOLATE
RESULT|||20060222092300|||COLL_BY^RECD_BY|||20060223092300
|SAMP_TYPE^BODY|ORD_PHYS|||||20060223120336|||||UNK
R|1|^ID|^KLEPNEP^000012DFF9412020^NMIC/ID-14||||F
R|2|^AST^AM|^>16^R^R^NMIC/ID-14||||F
R|3|^AST^AMC|^16/8^I^I^NMIC/ID-14||||F
R|4|^AST^AN|^32^I^I^NMIC/ID-14||||F
R|5|^AST^ATM|^<=2^S^S^NMIC/ID-14||||F
R|6|^AST^CF|^<=1^S^S^NMIC-2||||F
R|7|^AST^CIP|^2^I^I^NMIC/ID-14||||F
R|8|^AST^CTX|^<=2^S^S^NMIC/ID-14||||F
R|9|^AST^CXM|^16^I^I^NMIC/ID-14||||F
R|10|^AST^CZ|^16^I^I^NMIC/ID-14||||F
R|11|^AST^FOX|^<=1^S^S^NMIC-2||||F
R|12|^AST^FM|^64^I^I^NMIC/ID-14||||F
R|13|^AST^LVX|^2^S^S^NMIC/ID-14||||F
R|14|^AST^MEM|^<=1^S^S^NMIC/ID-14||||F
R|15|^AST^NN|^8^I^I^NMIC-2||||F
R|16|^AST^OX|^4^R^R^KB||||F
R|17|^AST^PIP|^>64^R^R^NMIC/ID-14||||F
L|1|N

```

10.4.5.6. Isolate with multiple instruments

A BD EpiCenter is configured with mixed instruments, BD Phoenix and BD BACTEC MGIT 960.

```
H|\^&|||Becton Dickinson|||||||V1.0|20050316152604
P|1||PatXYZ||Mr. Fred A. Stare
O|1|Acc456^2^STACOH|^ ^^ISOLATE RESULT||
20041104082700||||| 20041104082750|||||||UNK
R|1|^ ^^ID|^STACOH^00001C71C71C71C7^ ^^GPIDAST 954|||||F
R|2|^ ^^AST^AM|^X^X^GPIDAST 954|||||F
R|3|^ ^^AST^AMC|^>16/8^X^R^X^GPIDAST 954|||||F
R|4|^ ^^AST^CF|^>0.125^X^R^X^GPIDAST 954|||||F
R|5|^ ^^AST^CIP|^<=2^S^S^GPIDAST 954|||||F
R|6|^ ^^AST^CRO|^>1^X^X^GPIDAST 954|||||F
R|7|^ ^^AST^FEP|^<=4^X^S^X^GPIDAST 954|||||F
R|8|^ ^^AST^GM|^>32^R^R^GPIDAST 954|||||F
R|9|^ ^^AST^INH^0.10 ug/mL|^R^R^MGIT_960_AST94|||||F
R|10|^ ^^AST^INH^0.40 ug/mL|^S^S^MGIT_960_AST94|||||F
R|11|^ ^^AST^IPM|^4^X^S^X^GPIDAST 954|||||F
R|12|^ ^^AST^LVX|^S^S|||||F
R|13|^ ^^AST^MEM|^<=1^X^S^X^GPIDAST 954|||||F
R|14|^ ^^AST^OFX|^S^S|||||F
R|15|^ ^^AST^P|^>1^X^X^GPIDAST 954|||||F
R|16|^ ^^AST^RA^1.0 ug/mL|^I^I^MGIT_960_AST94|||||F
R|17|^ ^^AST^SXT|^ ^^GPIDAST 954|||||F
R|18|^ ^^AST^TE|^ ^^GPIDAST 954|||||F
R|19|^ ^^AST^TZP^0.5|^R^R^ASTDIA1|||||F
L|1|N
```

11. Appendix B – Tests and Results

The following appendix lists test names and test status values. If the LIS code for a test name or test status is different than the name, it is in parenthesis next to the name. Instrumented tests and their status values appear in **bold**. At the BD EpiCenter the non-instrumented tests can be reconfigured by the user. *Note: This list is not intended to be an exhaustive list, for example only some of the Test Names are listed for the Phoenix Gram Negative and Gram Positive panel types.*

Test Type	Test Name (LIS Code)	Test Status (LIS Code)
Growth and Detection Tests	30 degree MGIT 960 G&D Tube (30MGT)	False Positive
		Incomplete
		Negative
		Positive
	Acid Fast Smear (AFS)	Incomplete
		Acid Fast Bacilli Seen (AFB Seen)
		No Acid Fast Bacilli Seen (No AFB Seen)
	ProbeTec ET Assay (BD_PROBETEC_GND)	Positive (INST_POSITIVE)
		Negative (INST_NEGATIVE)
		Indeterminate (INST_INDETERMINATE)
		Equivocal (INST_EQUIVOCAL)
		QC Pass (INST_QC_PASS)
		QC Fail (INST_QC_FAIL)
	Colistin (COLIS)	Incomplete Negative Positive
	Gram Stain (GRMSTN)	
	Lowenstein-Jensen Medium (LJ)	
	Myco/F Lytic (MYFLTC)	
	MGIT 960 G&D Tube (MGIT_960_GND)	Pending (Pending)
		False Positive (False Positive)
		Manual Negative (Manual Negative)
		Manual Positive (Manual Positive)
		Threshold Positive (Threshold Positive)
		Negative (INST_NEGATIVE)
		Ongoing (INST_ONGOING)
		Removed Ongoing (INST_REMOVED)
		Positive (INST_POSITIVE)
		Complete (INST_COMPLETE)
	Middlebrook 7H11 Medium (7H11)	Contaminate
		Incomplete
		Negative
		Positive
ID Tests	Indirect Acid Fast Smear (INDAFS)	Complete Incomplete
	Indirect Gram Stain (INDGRMSTN)	
	ProbeTec ET MAC (ETMAC)	
	ProbeTec ET Mtb (ETMTB)	
AST – Diameter Tests	Ampicillin Disk (AMDISK)	Complete Incomplete
	Cephalothin Disk (CFDISK)	
	Gentamicin Disk (GMDISK)	
	Penicillin Disk (PDISK)	

Test Type	Test Name (LIS Code)	Test Status LIS Code
AST – MGIT 960	MGIT 960 AST Carrier Set (MGIT_960_AST)	Pending (Pending)
		Manual Complete (Manual Complete)
		AST Error (INST_ERROR)
		Complete (INST_COMPLETE)
		Ongoing (INST_ONGOING)
AST-MIC Tests	460TB AST (460TB)	Complete Incomplete
	Ethambutol AST Test (ETHM)	
	Isoniazid AST Test (INH)	
	Pyrazinimide AST Test (PZA)	
	Rifampin AST Test (RIF)	
	Streptomycin AST Test (STREPM)	
Phoenix Gram Negative	NID	Complete (INST_COMPLETE)
	NQC01	Rapid Complete (INST_RAPID_COMPLETE)
	NMIC/ID-1	Ongoing (INST_ONGOING)
	NMIC/ID-13	Partially Complete (INST_PARTIAL_COMPLETE)
	NMIC/ID-14	In Attention Complete (INST_ATTN_COMPLETE)
	NMIC/ID-15	In Attention Ignored (INST_ATTN_IGNORED)
Phoenix Gram Positive	PID	Pending (INST_PENDING)
	PQC01	QC Status see section 14.3.3
	PMIC/ID-1	Complete (INST_COMPLETE)
	PMIC/ID-17	Rapid Complete (INST_RAPID_COMPLETE)
	PMIC/ID-18	Ongoing (INST_ONGOING)
	PMIC/ID-20	Partially Complete (INST_PARTIAL_COMPLETE)
BD Sceptor Panels		In Attention Complete (INST_ATTN_COMPLETE)
BACTEC 9000	DVE PLUS Aerobic/F (96AER) DVE PLUS Anaerobic/F (97ANA) Lytic/10 Anaerobic/F (LYTIC10ANF) Myco/F Lytic (MYCFLYTIC) Mycosis-IC/F (MYCOSISIC) PEDS Plus/F (PEDPLUSF) PLUS Aerobic/F (PLUSAEF) Plus Aerobic/F (82) (PLUS_A) Plus Aerobic/F(DVE)(80) (DVE_A) Plus Anaerobic/F (PLUSANF) Plus Anaerobic/F(83) (PLUS_N) Plus Anaerobic/F(DVE)(81) (DVE_N) Standard 10 Aerobic/F (STD10AEF) Standard Aerobic/F(90) (STDAER) Standard Anaerobic/F (STDANF)	In Attention Ignored (INST_ATTN_IGNORED) Pending (INST_PENDING) QC Status see section 14.3.3
BACTEC FX	Lytic/10 Anaerobic/F (LYTIC10ANF) Myco/F Lytic (MYCFLYTIC) Mycosis-IC/F (MYCOSISIC) PEDS Plus/F (PEDPLUSF) PLUS Aerobic/F (PLUSAEF) Plus Anaerobic/F (PLUSANF) Standard 10 Aerobic/F (STD10AEF) Standard Anaerobic/F (STDANF)	Confirmed Positive(Confirmed Positive) Manual Negative(Manual Negative) Manual Positive(Manual Positive) Negative(INST_NEGATIVE) Ongoing (INST_ONGOING) Pending (Pending) Positive(INST_POSITIVE) Removed Ongoing(INST_REMOVED)

Test Type	Test Name (LIS Code)	Test Status LIS Code
Innova	Innova Protocol (INNOVA)	Complete (INST_COMPLETE) Error (INST_ERROR)
Other Tests	Blood Agar Plate (TSA)	Complete Incomplete
	Blood Agar Plate Anaerobic (BAPANA)	
	CDC Anaerobe 5% Sheep Blood Agar (CDC)	
	CDC Anaerobe Laked Sheep Blood Agar with KV (KV)	
	Cefinase (CEFINASE)	
	Choc Plate (CHOC)	
	Indole (INDOLE)	
	MacConkey II Agar (MAC)	

12. Appendix C – Antibiotic Abbreviations

The following is a list of the antibiotics in the BD database, with the associated LIS Code. On the BD EpiCenter, BD Phoenix 100, and BD Phoenix M50, these codes are configurable by the user. However on the BD BACTEC MGIT and BD ProbeTec ET instruments these values are not configurable. Therefore a direct instrument interface sends these values as AST results.

1st gen cephalosporin	CEFG1	Framycetin	SO
1st gen cephalosporins	CEF_G1	Furazolidone	FX
1st gen cephalosporins w/ anti-pseudomona	CEF_H1AP	Fusidic Acid	FA
2nd gen cephalosporin; grp 1	GRP1	Gatifloxacin	GAT
2nd gen cephalosporin; grp 2 (cephamycins)	GRP2	Gemifloxacin	GEM
2nd gen cephalosporin; grp 3	GRP3	Gentamicin	GM
2nd gen cephalosporins	CEF_G2	Gentamicin-Syn	GMS
3rd gen cephalosporin w/ aerobic GNR acti	CEF_MAP	Glycopeptides	GLYCPEP
3rd gen cephalosporin w/ anti-pseudomonal	CEF_AP	Grepafloxacin	GRX
3rd gen cephalosporins	CEF_G3	High level aminoglycosides	HLAR
4th gen cephalosporin	CEFG4	Hydrolyzable Penicillins	PEN_GRP
4th gen cephalosporins	CEF_G4	Imidazole	IMIDAZ
6' methoxypenicillin	MO_PEN	Imipenem	IPM
Amdinocillin	AMD	Isepamicin	ISP
amdinopenicillins	AMDINO_PEN	Isoniazid	INH
Amikacin	AN	Josamycin	JM
Aminocyclitols	AMNCYC	Kanamycin	K
Aminoglycosides	AMNGLY	Kanamycin Synergy	KS
aminopenicillins	AM_PEN	Levofloxacin	LVX
aminopenicillins w/ Beta-lact. Inhib.	AM_PEN_BLI	Lincomycin	L
Amoxicillin	AMX	Lincosamides	LINCO
Amoxicillin/Clavulanate	AMC	Linezolid	LZD
Amoxicillin/Clavulanate (f)	AXC	Lividomycin	LV
Ampicillin	AM	Lomefloxacin	LOM
Ampicillin/Sulbactam	SAM	Loracarbef	LOR
Ampicillin/Sulbactam (f)	SXA	Lymecycline	LYM
Antimycobacterial drugs	AMYCOB	Macrolides	MACRO
Apalcillin	APL	Macrolides Lincosam. Strepto	MLS
Apramycin	AP	Mecillinam	MEC
Arbekacin	ARB	Meropenem	MEM
Aspoxicillin	APX	Methacycline	MC
Astromycin	AST	Methicillin	DP
Azithromycin	AZM	Metronidazole	MET
Azlocillin	AZ	Mezlocillin	MZ
Aztreonam	ATM	Mezlocillin/Sulbactam	MZS
Bacitracin	B	Micronomycin	MCR
Benzylpenicillin	BZP	Midecamycin	MID
Beta-lactams	BETA_LAC	Minocycline	MI
Biapenem	BPM	Monobactams	MONOBAC
Capreomycin	CAP	Moxalactam	MOX
Carbacephem	CARBACEF	Moxifloxacin	MXF
Carbenicillin	CB	Mupirocin	MUP
Carbepenems	CARBAPEN	Nafcillin	NF
carboxypenicillins	CO_PEN	Nalidixic Acid	NA
carboxypenicillins w/ Beta-lact. Inhib.	CO_PEN_BLI	Neomycin	N
Carumonam	CAR	Netilmicin	NET
Cefaclor	CEC	Nifuroazide	NFX
Cefadroxil	CFR	Nifurzide	NZD
Cefamandole	MA	Nitrofurantoin	FM
Cefatrizine	FAT	Nitroxoline	NIT
Cefazolin	CZ	Non-hydrolyzable Penicillins	PEN_M
Cefbuperazone	CFB	Norfloxacin	NOR
Cefdinir	CDR	Novobiocin	NB
Cefditoren	CDN	Nystatin	NY
Cefditoren pivoxil	CDNp	Ofloxacin	OFX
Cefepime	FEP	Olandeomycin	OL
Cefepime/Sulbactam	SFP	Ornidazole	ORN
Cefetamet-pivoxil	CAT	Others	OTHER

Cefixime	CFM	Oxacillin	OX
Cefmenoxime	CMX	Oxolinic Acid	OA
Cefmetazole	CMZ	Oxytetracycline	T
Cefminox	CNX	p-Aminosalicylic acid	PAS
Cefodizime	CDZ	Panipenem	PAN
Cefonicid	CID	Paromomycin	PAR
Cefoperazone	CFP	Pefloxacin	PEF
Cefoperazone/Sulbactam	SCP	Penamycin	PENAMYCIN
Ceforanide	CND	Penicillin G	P
Cefotaxime	CTX	Penicillin V	PV
Cefotaxime/Clavulanate	CCX	Penicillin w/ Beta-lact. inh	PEN_BLI
Cefotaxime/Sulbactam	SCT	Penicillins	PENS
Cefotetan	CTT	Penicillins w/ Beta-lact. inh	PENS_BLI
Cefotiam	CFT	Phenoxymethylpenicillin	PXM
Cefotiam-hexiteil	CFTh	Pipemidic Acid	PI
Cefoxitin	FOX	Piperacillin	PIP
Cefozopran	CFZ	Piperacillin/Sulbactam	SPI
Cefpimazole	CPZ	Piperacillin/Tazobactam	TZP
Cefpiramide	CPM	Pirlimycin	PRL
Cefpirome	CPO	Piromidic Acid	PIR
Cefpirome/Sulbactam	SCO	Pivampicillin	PAM
Cefpodoxime-proxetil	CPD	Pivmecillinam	PMC
Cefpodoxime/Clavulanate	CCP	Polymyxin B	PB
Cefprozil	CFR	Primary aminoglycosides	PRI_AMN
Cefroxadine	CFX	Primary penicillin	PRI_PEN
Cefsulodin	CFS	Primary quinolones	PRI_QUIN
Ceftazadime/Sulbactam	SCZ	Pristinamycin	PR
Ceftazidime	CAZ	Pyrazinamide	PZA
Ceftazidime/Clavulanate	CCZ	Quinolones	QUIN
Cefteram	CEM	Quinupristin/dalfopristin	SYN
Ceftibuten	CTB	Rifabutin	RBN
Ceftiofur	XNL	Rifampin	RA
Ceftizoxime	ZOX	Rifamycin	RF
Ceftriaxone	CRO	Rifamycins	RIFAMYC
Ceftriaxone/Clavulanate	CCR	Rokitamycin	ROK
Cefuroxime sodium	CXM	Rosoxacin	R
Cefuroxime-axetil	CXMa	Roxithromycin	RXT
Cefuzonam	CZN	Sarafloxacin	SRF
Cephalexin	CN	Sisomycin	SIS
Cephaloridine	CD	Sparfloxacin	SPX
Cephalosporins	CEPHEM	Spectinomycin	SPT
Cephalosporins w/ Beta-lactamase inhib.	CEPHEM_BLI	Spiramycin	SP
Cephalosporins w/ Beta-lactamase inhib.	CEF_BLI	Streptogramins	STREPTO
Cephalthin	CF	Streptomycin	S
Cephapirin	CP	Streptomycin-Syn	STS
Cephradine	CH	Sulbenicillin	SBC
Chloramphenicol	C	Sulfadiazine	SD
Chlortetracycline	A	Sulfamethizole	TH
Cinoxacin	CIN	Sulfamethoxazole	SMZ
Ciprofloxacin	CIP	sulfapenicillin	SU_PEN
Clarithromycin	CLR	Sulfathiazole	ST
Clinafloxacin	CLX	Sulfisoxazole	G
Clindamycin	CC	Systemic fluoroquinilones	SYS_FQUIN
Clofazimine	CLO	Teicoplanin	TEC
Cloxacillin	CX	Telithromycin	TEL
Colistin	CL	Temafoxacin	TMA
Cyclic peptides	CYC_PEP	Temocillin	TEM
Cycloserine	CS	Tetracycline	TE
Daptomycin	DAP	Tetracyclines	TET
Dibekacin	DKB	Thiacetazone	TB1
Dicloxacillin	DX	Thiamphenicol	TP
Difloxacin	DFX	Ticarcillin	TIC
Dihydrofolate reductase inhibitor	DHFR_INH	Ticarcillin/Clavulanate	TIM
Dihydrofolate reduct./Dihydropteroate syn	DHFR_DHPS_INH	Tilmicosin	TIL
Dihydropteroate synthetase inhibitor	DHPS_INH	Tobramycin	NN
Dirithromycin	DTM	Tosufloxacin	TFX
Doxycycline	D	Trimeth/Sulfa (DIN)	STG

Enoxacin	ENX	Trimethoprim	TMP
Enrofloxacin	EFX	Trimethoprim/Sulfadiazine	SDT
Epicillin	EP	Trimethoprim/Sulfamethoxazole	SXT
Erythromycin	E	Triple Sulfa	SSS
Ethambutol	EM	Trospectinomycin	TRP
Ethionamide	EA	Trovafloxacin	TVA
Fleroxacin	FLE	Tylosin	TYL
Flomoxef	FLO	Unspecified	UNS
Flucloxacillin	FO	ureidopenicillins	UR_PEN
Flumequine	FLQ	ureidopenicillins w/ B-lact.	UR_PEN_BLI
Fluoroquinilones	FQUIN	Urinary fluoroquinilones	UR_FQUIN
Folate antagonists	FOL_ANT	Vancomycin	VA
Fosfomycin w/G6PD	FF	Virginiamycin	VRG

13. Appendix D – Organism Abbreviations

The following is a list of the organisms in the BD database, with the associated LIS Code. On the BD EpiCenter, BD Phoenix 100, and BD Phoenix M50, these codes are configurable by the user. However on the BD BACTEC MGIT and BD ProbeTec ET instruments these values are not configurable. Therefore a direct instrument interface sends these values as AST results.

Abiotrophia	ABI	Lactobacillus cateniformis	LACBCAT
Abiotrophia defectiva	STRDEF	Lactobacillus crispatus	LACBCRI
Acholeplasma	ACHO	Lactobacillus delbrueckii ssp bulgaricus	LACBDELB
Acholeplasma laidlawii	ACHOLAI	Lactobacillus delbrueckii ssp delbrueckii	LACBDELD
Achromobacter	ACHR	Lactobacillus delbrueckii ssp lactis	LACBDELL
Achromobacter piechaudii	ALCPPIE	Lactobacillus fermentum	LACBFER
Achromobacter species	ACHRSPE	Lactobacillus gasseri	LACBGAS
Achromobacter xylosoxidans ssp denitrificans	ALCDEN	Lactobacillus jensenii	LACBJEN
Achromobacter xylosoxidans ssp xylosoxidans	ALCXYL	Lactobacillus johnsonii	LACBJOH
Acid Fast Bacilli	AFB	Lactobacillus kefir	LACBKEF
Acid Fast Bacilli (Group)	AFBG	Lactobacillus paraplantarum	LACBPAR
Acidaminococcus	ACIA	Lactobacillus plantarum	LACBPLA
Acidaminococcus fermentans	ACIAFER	Lactobacillus reuteri	LACBREU
Acidovorax	ACID	Lactobacillus rhamnosus	LACBRHA
Acidovorax delafieldii	ACIDDEL	Lactobacillus salivarius	LACBSAL
Acidovorax facilis	ACIDFAC	Lactobacillus species	LACBSPE
Acidovorax temperans	ACIDTEM	Lactobacillus uli	LACBULI
Acinetobacter	ACIN	Lactococcus	LACC
Acinetobacter baumannii	ACINBAU	Lactococcus garvieae	LACCGAR
Acinetobacter baumannii/calcoaceticus complex	ACINBCX	Lactococcus lactis ssp cremoris	LACCLACC
Acinetobacter baumannii/haemolyticus	ACINBAUHA	Lactococcus lactis ssp hordniae	LACCLACH
Acinetobacter calcoaceticus	ACINCAL	Lactococcus lactis ssp lactis	LACCLACL
Acinetobacter haemolyticus	ACINHA	Lactococcus plantarum	LACCPLA
Acinetobacter johnsonii	ACINJOH	Lactococcus raffinolactis	LACCRAF
Acinetobacter junii	ACINJUN	Lactococcus species	LACCSPE
Acinetobacter lwoffii	ACINLWO	Lautropia	LAU
Acinetobacter lwoffii/haemolyticus	ACINLWOHA	Lautropia mirabilis	LAUMIR
Acinetobacter radioresistens	ACINRAD	Leclercia	LEC
Acinetobacter species	ACINSPE	Leclercia adecarboxylata	LECADE
Actinobacillus	ACTB	Legionella	LEG
Actinobacillus actinomycetemcomitans	ACTBACT	Legionella anisa	LEGANI
Actinobacillus capsulatus	ACTBCAP	Legionella birminghamensis	LEGBIR
Actinobacillus equuli	ACTBEU	Legionella bozemaniae	LEGBOZ
Actinobacillus hominis	ACTBHOM	Legionella cincinnatiensis	LEGCIN
Actinobacillus lionnensis	ACTBLIG	Legionella dumoffii	LEGDUM
Actinobacillus muris	ACTBMUR	Legionella feeleyi	LEGFEE
Actinobacillus pleuropneumoniae	ACTBPLE	Legionella gormanii	LEGGOR
Actinobacillus rossii	ACTBROS	Legionella hackeliae	LEGHAC
Actinobacillus seminis	ACTBSEM	Legionella israelensis	LEGISR
Actinobacillus species	ACTBSPE	Legionella jordanis	LEGJOR
Actinobacillus suis	ACTBSUI	Legionella lansingensis	LEGLAN
Actinobacillus ureae	ACTBURE	Legionella longbeachae	LEGLOL
Actinobaculum	ACTC	Legionella maceachernii	LEGMAC
Actinobaculum schaalii	ACTCSCH	Legionella micdadei	LEGMIC
Actinobaculum suis	ACTMSUI	Legionella oakridgensis	LEGOAK
Actinomadura	ACTA	Legionella pneumophila	LEGPNE
Actinomadura madurae	ACTAMAD	Legionella pneumophila ssp fraseri	LEGPNEF
Actinomadura pelletieri	ACTAPEL	Legionella pneumophila ssp bascullei	LEGPNEPA
Actinomycetes	ACTM	Legionella pneumophila ssp pneumophila	LEGPNEPN
Actinomycetes bovis	ACTMBOV	Legionella saintelensis	LEGSAI
Actinomycetes denticolens	ACTMDEN	Legionella species	LEGSPE
Actinomycetes europaeus	ACTMEUR	Legionella tudsonensis	LEGTUC
Actinomycetes georgiae	ACTMGEO	Legionella wadsworthii	LEGWAD
Actinomycetes gerencseriae	ACTMGER	Leifsonia	LEI
Actinomycetes graevenitzii	ACTMGRA	Leifsonia aquatica	CORAOU
Actinomycetes hordeovulneris	ACTMHOR	Lemnorella	LEM
Actinomycetes howellii	ACTMHOW	Lemnorella grimontii	LEMGRI
Actinomycetes hvovaginalis	ACTMHYO	Lemnorella richardii	LEMRIC
Actinomycetes israelii	ACTMISR	Lemnorella species	LEMSPE
Actinomycetes meyeri	ACTMMEY	Leptotrichia	LEP
Actinomycetes naeslundii	ACTMNAE	Leptotrichia buccalis	LEPBUC
Actinomycetes neuii ssp anitrat	ACTMNEUA	Leuconostoc	LEU
Actinomycetes neuii ssp neuii	ACTMNEUN	Leuconostoc argentinum	LEUARG
Actinomycetes odontolyticus	ACTMODO	Leuconostoc carnosum	LEUCAR
Actinomycetes radiniae	ACTMRAD	Leuconostoc citreum	LEUCIT
Actinomycetes slackii	ACTMSLA	Leuconostoc gelidum	LEUGEL
Actinomycetes species	ACTMSPE	Leuconostoc lactis	LEULAC
Actinomycetes turicensis	ACTMTUR	Leuconostoc mesenteroides	LEUMES
Actinomycetes viscosus	ACTMVIS	Leuconostoc mesenteroides ssp cremoris	LEUMESC
Aerococcus	AERC	Leuconostoc mesenteroides ssp dextranicum	LEUMESD
Aerococcus species	AERCSPE	Leuconostoc mesenteroides ssp mesenteroides	LEUMESM
Aerococcus urinae	AERCURI	Leuconostoc pseudomesenteroides	LEUPSE
Aerococcus viridans	AERCVR	Leuconostoc species	LEUSPE
Aeromonas	AERM	Listeria	LIS
Aeromonas allosaccharophila	AERMALL	Listeria grayi	LISGRA
Aeromonas caviae	AERMCAV	Listeria innocua	LISINN
Aeromonas hydrophila	AERMHYD	Listeria ivanovii	LISIVA
Aeromonas hydrophila group	AERMHYDGR	Listeria ivanovii ssp ivanovii	LISIVAI

Aeromonas iandaei	AERMJAN	Listeria ivanovii ssp londoniensis	LISIVAL
Aeromonas media	AERMED	Listeria monocytogenes	LISMON
Aeromonas salmonicida	AERMSAL	Listeria monocytogenes/innocua	LISMONINN
Aeromonas salmonicida ssp achromogenes	AERMSALA	Listeria murrayi	LISMUR
Aeromonas salmonicida ssp masoucida	AERMSALM	Listeria murrayi/gravi	LISMURGRA
Aeromonas salmonicida ssp salmonicida	AERMSALSA	Listeria seeligeri	LISSEE
Aeromonas salmonicida ssp smithia	AERMSALSM	Listeria species	LISSEE
Aeromonas schubertii	AERMSCH	Listeria welshimeri	LISWEL
Aeromonas sobria	AERMVERS	Listonella	LISO
Aeromonas species	AERMSPE	Listonella anguillarum	LISOANG
Aeromonas trota	AERMTR	Listonella pelagia	LISOPEL
Aeromonas veronii	AERMVERV	Macrocooccus	MAC
Afibia	AFI	Macrocooccus caseolyticus	STACAS
Afibia broomeae	AFIBRO	Malassezia	MAL
Afibia clevelandensis	AFICLE	Malassezia furfur	MALFUR
Afibia felis	AFIFEL	Malassezia globosa	MALGLO
Acrobacterium	AGR	Malassezia obtusa	MALGBT
Acrobacterium radiobacter	AGRRAD	Malassezia pachydermatis	MALPAC
Acrobacterium tumefaciens	AGRTUM	Malassezia restricta	MALRES
Alcaligenes	ALC	Malassezia slooffiae	MALSLO
Alcaligenes faecalis	ALCFAE	Malassezia species	MALSPE
Alcaligenes faecalis ssp faecalis	ALCFAEF	Malassezia symbodialis	MALSYM
Alcaligenes faecalis type II	ALCFAEII	Mannheimia	MAN
Alcaligenes species	ALCSPE	Mannheimia haemolytica	PASHAE
Alloioococcus	ALL	Megamonas	MEGM
Alloioococcus otitidis	ALLOTI	Megamonas hybrimergale	MEGMHYP
Anaerobiospirillum	ANAB	Megasphaera	MEGS
Anaerobiospirillum succiniciproducens	ANABSUC	Megasphaera elsdenii	MEGSELS
Anaerobiospirillum thomasi	ANABTHO	Methylobacterium	MET
Anaerorhabdus	ANAR	Methylobacterium extorquens	METEXT
Anaerorhabdus furcosa	ANARFUR	Methylobacterium fuisawaense	METFUJ
Arcanobacterium	ARCA	Methylobacterium mesophilicum	METMES
Arcanobacterium bernardiae	ARCABER	Methylobacterium species	METSPE
Arcanobacterium haemolyticum	ARCAHAE	Microbacterium	MICB
Arcanobacterium ovovivens	ACTMPO	Microbacterium arborescens	MICBARB
Arcobacter	ARCO	Microbacterium imperiale	MICBIMP
Arcobacter butzleri	ARCOBUT	Micrococcus	MIC
Arcobacter cryaerophilus	ARCOCRY	Micrococcus luteus	MICLUT
Arcobacter nitrofigilis	ARCONIT	Micrococcus lyvae	MICLYL
Arcobacter skirrowii	ARCOSKI	Micrococcus species	MICSP
Arthrobacter	ART	Micromonas	MICM
Arthrobacter acilis	ARTAGI	Micromonas micros	PEPSMIC
Arthrobacter creatinolyticus	ARTCRE	Mitsuokella	MIT
Arthrobacter cummingsii	ARTCUM	Mitsuokella multiacida	MITMUL
Arthrobacter woluwensis	ARTWOL	Mobiluncus	MOB
Aspergillus	ASP	Mobiluncus curtisii	MOBCUR
Aspergillus fumigatus	ASPFUM	Mobiluncus mulieris	MOBMUL
Aspergillus species	ASPSPE	Mobiluncus species	MOBSPE
Atopobium	ATO	Moellerella	MOE
Atopobium minutum	ATOMIN	Moellerella wisconsensis	MOEWIS
Atopobium parvulum	ATOPAR	Mogibacterium	MOG
Atopobium rimae	LACBRIM	Mogibacterium timidum	EUBTIM
Aureobacterium	AURC	Moraxella	MORA
Aureobacterium resistens	AURCRES	Moraxella (Branhamella) catarrhalis	MORABRACAT
Aureobasidium	AUR	Moraxella atlantiae	MORAAATL
Aureobasidium pullulans	AURPUL	Moraxella bovis	MORABOV
Bacillus	BACI	Moraxella canis	MORACAN
Bacillus amyloliquefaciens	BACIAMY	Moraxella caviae	MORACAV
Bacillus anthracis	BACIANT	Moraxella cuniculi	MORACUN
Bacillus cereus	BACICER	Moraxella lacunata	MORALAC
Bacillus circulans	BACICIR	Moraxella lincolni	MORALIN
Bacillus coagulans	BACICOA	Moraxella nonliquefaciens	MORANON
Bacillus firmus	BACIFIR	Moraxella osloensis	MORAOSL
Bacillus licheniformis	BACILIC	Moraxella ovis	MORAОВ
Bacillus mediterianus	BACIMEG	Moraxella species	MORASPE
Bacillus mycoides	BACIMYC	Morganella	MORG
Bacillus pasteurii	BACIPAS	Morganella morganii	MORMGMR
Bacillus pumilus	BACIPUM	Morganella morganii ssp morganii	MORMGMRM
Bacillus species	BACISPE	Morganella morganii ssp morganii biogroup 1	MORMGMRM1
Bacillus sphaericus	BACISPH	Morganella morganii ssp sibonii	MORMGMRM2
Bacillus stearothermophilus	BACISTE	Mycobacterium	MYCB
Bacillus subtilis	BACISUB	Mycobacterium abscessus	MYCBABS
Bacillus subtilis ssp spizizenii	BACISUBSP	Mycobacterium africanum	MYCBAFR
Bacillus subtilis ssp subtilis	BACISUBSU	Mycobacterium asiaticum	MYCBASI
Bacillus thuringiensis	BACITHU	Mycobacterium aurum	MYCBAUR
Bacteroides	BACT	Mycobacterium avium	MYCBAVI
Bacteroides caccae	BACTCAC	Mycobacterium avium complex	MYCBMAC
Bacteroides cabillosus	BACTCAP	Mycobacterium avium ssp avium	MYCBAVIA
Bacteroides coagulans	BACTCOA	Mycobacterium avium ssp paratuberculosis	MYCBAVIP
Bacteroides distasonis	BACTDIS	Mycobacterium avium ssp silvaticum	MYCBAVIS
Bacteroides distasonis group	BACTDISGR	Mycobacterium bovis	MYCBBOV
Bacteroides edgworthii	BACTEGG	Mycobacterium branderi	MYCBBRA
Bacteroides forsythus	BACTFOR	Mycobacterium celatum	MYCBCEL
Bacteroides fragilis	BACTFRA	Mycobacterium chelonae	MYCBCHE
Bacteroides fragilis group	BACTFRAGR	Mycobacterium confluentis	MYCBCON
Bacteroides merdae	BACTMER	Mycobacterium farcinogenes	MYCBFAR
Bacteroides ovatus	BACTOVA	Mycobacterium flavescens	MYCBFLA
Bacteroides putredinis	BACTPUT	Mycobacterium fortuitum	MYCBFOR
Bacteroides solanchnicus	BACTSPL	Mycobacterium fortuitum complex	MYCBFORC
Bacteroides stercoris	BACTSTI	Mycobacterium gadium	MYCBGAD

Buttiauxella	BUTT	Nocardia seriolae	NOCASER
Buttiauxella agrestis	BUTTAGR	Nocardia species	NOCASPE
Buttiauxella ferrugutiae	BUTTFER	Nocardia transvalensis	NOCATRA
Buttiauxella gaviniae	BUTTGAU	Nocardia vaccini	NOCAVAC
Butyrivibrio	BUTY	Nocardiosis	NOCO
Butyrivibrio crossotus	BUTYCRO	Nocardiosis dassonvillei	NOCODAS
Butyrivibrio fibrisolvens	BUTYFIB	Obesumbacterium	OBE
Calymmatobacterium	CALY	Obesumbacterium proteus	OBEPRO
Camvlobacter	CAM	Ochrobactrum	OCH
Camvlobacter coli	CAMCOL	Ochrobactrum anthropi	OCHANT
Camvlobacter concisus	CAMCON	Oenococcus	OEN
Camvlobacter curvus	CAMCUR	Oenococcus oeni	OENOE
Camvlobacter fetus	CAMFET	Oerskovia	OER
Camvlobacter fetus ssp fetus	CAMFETF	Oerskovia species	OERSPE
Camvlobacter fetus ssp venerealis	CAMFETV	Oerskovia xanthineolytica	OERXAN
Camvlobacter gracilis	CAMGRA	Oligella	OLI
Camvlobacter helveticus	CAMHEL	Oligella species	OLISPE
Camvlobacter hvointestinalis ssp hvointe	CAMHYOH	Oligella ureolytica	OLIURO
Camvlobacter hvointestinalis ssp lawsoni	CAMHYOL	Oligella urethralis	OLIURT
Camvlobacter ieiuni	CAMJEJ	Ornithobacterium	ORN
Camvlobacter ieiuni ssp dovlei	CAMJEJD	Ornithobacterium rhinotracheale	ORNRHI
Camvlobacter ieiuni ssp ieiuni	CAMJEJJ	Paenibacillus	PAE
Camvlobacter lari	CAMLAR	Paenibacillus alvei	PAEALV
Camvlobacter mucosalis	CAMMUC	Paenibacillus durus	PAEDUR
Camvlobacter rectus	CAMRET	Paenibacillus macerans	PAEMAC
Camvlobacter rectus/curvus	CAMRETCUR	Paenibacillus polymvxa	BACIPOL
Camvlobacter showae	CAMSHO	Pantoea	PAN
Camvlobacter species	CAMSPE	Pantoea agglomerans	PANAGG
Camvlobacter sputorum ssp bubulus	CAMSPUB	Pantoea ananatis	ERWANA
Camvlobacter sputorum ssp fecalis	CAMSPUF	Pantoea dispersa	PANDIS
Camvlobacter sputorum ssp paraureolyticu	CAMSPUP	Pantoea stewartii ssp indologenes	PANSTEI
Camvlobacter sputorum ssp sputorum	CAMSPUS	Pantoea stewartii ssp stewartii	PANSTES
Camvlobacter upsaliensis	CAMUPS	Pasteurella	PAS
Candida	CAN	Pasteurella aerogenes	PASAER
Candida aaseri	CANAAS	Pasteurella bettuae	PASBET
Candida albicans	CANALB	Pasteurella caballi	PASCAB
Candida boidinii	CANBOI	Pasteurella canis	PASCAN
Candida catenulata	CANCAT	Pasteurella dagmatis	PASDAG
Candida ciferrii	CANCIF	Pasteurella gallinarum	PASGAL
Candida colliculosa	CANCOL	Pasteurella multocida	PASMUL
Candida dubliniensis	CANDUB	Pasteurella multocida ssp gallicida	PASMULG
Candida famata	CANFAM	Pasteurella multocida ssp multocida	PASMULM
Candida glabrata	TORGLA	Pasteurella multocida ssp septic	PASMULS
Candida guilliermondii	CANGUI	Pasteurella pneumotropica	PASPNE
Candida haemulonii	CANHAE	Pasteurella species	PASSPE
Candida holmii	CANHOL	Pasteurella stomatis	PASSTO
Candida inconspicua	CANINC	Pasteurella trehalosi	PASTRE
Candida kefyr	CANKEF	Pasteurella volantium	PASVOL
Candida krusei	CANKRU	Pediococcus	PED
Candida lambica	CANLAM	Pediococcus acidilactici	PEDACI
Candida lipolytica	CANLIP	Pediococcus damnosus	PEDDAM
Candida lusitanae	CANLUS	Pediococcus dextrinicus	PEDDEX
Candida macmoliae	CANMAG	Pediococcus parvulus	PEDPAR
Candida melibiosica	CANMEL	Pediococcus pentosaceus	PEDPEN
Candida norvegensis	CANNOR	Pediococcus species	PEDSPE
Candida parakrusei	CANPARK	Pentococcus	PEPC
Candida parapsilosis	CANPARP	Pentococcus niger	PEPCNIG
Candida pelliculosa	CANPEL	Pentostreptococcus	PEPS
Candida pintoalopesii	CANPIN	Pentostreptococcus anaerobius	PEPSANA
Candida pulcherrima	CANFUL	Pentostreptococcus asaccharolyticus	PEPSASA
Candida rugosa	CANRUG	Pentostreptococcus barnesae	PEPSBAR
Candida species	CANSPE	Pentostreptococcus harei	PEPSHAR
Candida spheerica	CANSPH	Pentostreptococcus hydrogenalis	PEPSHYD
Candida stellatoidea	CANSTE	Pentostreptococcus indolicus	PEPSIND
Candida tropicalis	CANTRO	Pentostreptococcus ivorii	PEPSIVO
Candida utilis	CANUTI	Pentostreptococcus lacrimalis	PEPSLAR
Candida valida	CANVAL	Pentostreptococcus lactolyticus	PEPSLAT
Candida viswanathii	CANVIS	Pentostreptococcus octavius	PEPSOCT
Candida zeylanoides	CANZEY	Pentostreptococcus prevotii	PEPSPRE
Capnocytophaga	CAP	Pentostreptococcus species	PEPSSPE
Capnocytophaga canimorsus	CAPCAN	Pentostreptococcus tetradius	PEPSTET
Capnocytophaga cynodecimi	CAPCYN	Pentostreptococcus vaginalis	PEPSVAG
Capnocytophaga gingivalis	CAPGIN	Photobacterium	PHOB
Capnocytophaga granulosa	CAPGRA	Photobacterium damsela	PHOBDAM
Capnocytophaga haemolytica	CAPHAE	Photobacterium damsela ssp damsela	PHOBDAMD
Capnocytophaga ochracea	CAPOCH	Photobacterium damsela ssp piscicida	PHOBDAMP
Capnocytophaga species	CAPSPE	Photobacterium	PHOR
Capnocytophaga sputigena	CAPSPU	Photobacterium luminescens	PHORLUM
Cardiobacterium	CAR	Pichia	PIC
Cardiobacterium hominis	CARHOM	Pichia angusta	PICANG
Catonella	CATO	Pichia anomala	HANANO
Catonella morbi	CATOMOR	Pichia fermentans	PICFER
CDC	CDC	Plesiomonas	PLE
CDC group DF-3	CDCDF3	Plesiomonas shigelloides	PLESHI
CDC group EF-4	CDCEP4	Porphyromonas	POR
CDC group EF-4a	CDCEP4a	Porphyromonas asaccharolytica	PORASA
CDC group EF-4b	CDCEP4b	Porphyromonas canoris	PORCAN
CDC group EO-2	CDCEO2	Porphyromonas catoniae	PORCAT
CDC group EO-3	CDCEO3	Porphyromonas circumdentaria	PORCIR
CDC group II b	CDCIIB	Porphyromonas endodontalis	POREND

CDC group II g	CDCIIg	Porphyromonas gingivalis	PORGIN
CDC group II h	CDCIIh	Porphyromonas levii	PORLEV
CDC group II i	CDCIIi	Porphyromonas macacae	PORMAC
CDC group IV	CDCIV	Pradia	PRA
CDC group NO-1	CDCNO1	Pradia fontium	PRAFON
CDC group O-1	CDCO1	Prevotella	PRE
CDC group O-2	CDCO2	Prevotella albensis	PREALB
CDC group OFBA-1	CDCOFBA1	Prevotella bivia	PREBIV
CDC group Vb-3	CDCVb3	Prevotella brevis	PREBRE
CDC group WO-1	CDCWO1	Prevotella brvanti	PREBRY
Cedecea	CED	Prevotella buccae	PREBUE
Cedecea davisae	CEDDAV	Prevotella buccalis	PREBUL
Cedecea labadei	CEDLAP	Prevotella corporis	PRECOR
Cedecea neteri	CEDNET	Prevotella dentalis	PREDEA
Cedecea species	CEDSPE	Prevotella denticola	PREDEI
Cedecea species 3	CEDSPE3	Prevotella disiens	PREDIS
Cedecea species 5	CEDSPE5	Prevotella enoea	PREENO
Cellulomonas	CEL	Prevotella heparinolytica	PREHEP
Cellulomonas humilata	ACTMHUM	Prevotella intermedia	PREINT
Cellulomonas turbata	OERTUR	Prevotella loeschei	PRELOE
Centipeda	CEN	Prevotella melaninogenica	PREMEL
Centipeda periodontii	CENPER	Prevotella nigrescens	PRENIG
Chromobacterium	CHRO	Prevotella oralis	PREORA
Chromobacterium violaceum	CHROVIO	Prevotella oris	PREORI
Chryseobacterium	CHRB	Prevotella oulorum	PREOUL
Chryseobacterium gleum	CHRBGLE	Prevotella ruminicola	PRERUM
Chryseobacterium indologenes	CHRBIND	Prevotella tanneriae	PRETAN
Chryseobacterium meningosepticum	CHRBMEN	Prevotella veroralis	PREVER
Chryseobacterium scophthalmum	CHRBSCO	Prevotella zoogloeiformans	PREZOO
Chryseomonas	CHRM	Propionibacterium	PROB
Citrobacter	CIT	Propionibacterium acidipropionici	PROBACI
Citrobacter amalonaticus	CITAMA	Propionibacterium acnes	PROBACN
Citrobacter braakii	CITBRA	Propionibacterium avidum	PROBAVI
Citrobacter farmeri	CITFAR	Propionibacterium avidum ssp granulosum	PROBAVIG
Citrobacter freundii	CITFRE	Propionibacterium freundenreichii ssp freundenr	PROBFREF
Citrobacter freundii complex	CITFRECX	Propionibacterium freundenreichii ssp shermanii	PROBFRES
Citrobacter gillenbergii	CITSPE10	Propionibacterium granulosum	PROBGR
Citrobacter koseri	CITKOS	Propionibacterium jensenii	PROBJEN
Citrobacter murlinae	CITSPE11	Propionibacterium lymphophilum	PROBLYM
Citrobacter rodentium	CITSPE9	Propionibacterium propionicum	PROBPRO
Citrobacter sedlakii	CITSED	Propionibacterium species	PROBSPE
Citrobacter species	CITSPE	Propioniferax	PROF
Citrobacter werkmanii	CITWER	Propioniferax innocua	PROFINN
Citrobacter yooniae	CITYOU	Proteus	PROT
Clostridium	CLO	Proteus mirabilis	PROTMIR
Clostridium acetobutylicum	CLOACO	Proteus mvxofaciens	PROTMYX
Clostridium amniovalericum	CLOAMN	Proteus penneri	PROTPEN
Clostridium argentinense	CLOARG	Proteus species	PROTSPE
Clostridium aurantibutylicum	CLOAUR	Proteus vulgaris	PROTVUL
Clostridium baratii	CLOBAR	Proteus vulgaris/benneri	PROTVULPEN
Clostridium beijerinckii	CLOBEI	Prototheca	PROH
Clostridium bifermentans	CLOBIF	Prototheca wickerhamii	PROHWIC
Clostridium botulinum	CLOBOT	Prototheca zopfii	PROHZOP
Clostridium butyricum	CLOBUT	Providencia	PROV
Clostridium cadaveris	CLOCAD	Providencia alcalifaciens	PROVALC
Clostridium carnis	CLOCAR	Providencia heimbachae	PROVHEI
Clostridium celatum	CLOCEL	Providencia rettgeri	PROVRET
Clostridium cellobiobarium	CLOCEO	Providencia rustigianii	PROVRUS
Clostridium chauvoei	CLOCHA	Providencia species	PROVSPE
Clostridium clostridioforme	CLOCLO	Providencia stuartii	PROVSTU
Clostridium cochlearium	CLOCOH	Providencia stuartii urea+	PROVSTUUR
Clostridium cocleatum	CLOCOL	Pseudomonas	PSE
Clostridium difficile	CLODIF	Pseudomonas aeruginosa	PSEAER
Clostridium fallax	CLOFAL	Pseudomonas aeruginosa (CF)	PSEAERCF
Clostridium felsineum	CLOFEL	Pseudomonas alcaligenes	PSEALC
Clostridium ghonii	CLOGHO	Pseudomonas fluorescens	PSEFLU
Clostridium glycolicum	CLOGLY	Pseudomonas fluorescens/butida	PSEFLUPUT
Clostridium haemolyticum	CLOHAE	Pseudomonas luteola	CHRM LUT
Clostridium hastiforme	CLOHAS	Pseudomonas mendocina	PSEMEN
Clostridium histolyticum	CLOHIS	Pseudomonas montellii	PSEMON
Clostridium indolis	CLOIND	Pseudomonas oryzae	FLAIORY
Clostridium innocuum	CLOINN	Pseudomonas pertucinogena	PSEPER
Clostridium irregulare	CLOIRR	Pseudomonas pseudoalcaligenes	PSEPSE
Clostridium leptum	CLOLEP	Pseudomonas pseudoalcaligenes ssp pseudoalcaligenes	PSEPSEP
Clostridium limosum	CLOLIM	Pseudomonas butida	PSEPUT
Clostridium malenominatum	CLOMAL	Pseudomonas species	PSESPE
Clostridium mangenotii	CLOMAN	Pseudomonas stutzeri	PSESTU
Clostridium nexile	CLOEX	Pseudonocardia	PSEN
Clostridium novii	CLONOV	Pseudonocardia autotrophica	PSENAUT
Clostridium novii A	CLONOVA	Pseudoramibacter	PSEAR
Clostridium novii B	CLONOVB	Pseudoramibacter alactolyticus	EUBALA
Clostridium oceanicum	CLOOCE	Psychrobacter	PSY
Clostridium orbiscindens	CLOORB	Psychrobacter immobilis	PSYIMM
Clostridium oroticum	CLOORO	Psychrobacter phenylpyruvicus	MORAPHE
Clostridium parapatrificum	CLOPAR	Rahnella	RAH
Clostridium perfringens	CLOPER	Rahnella aquatilis	RAHAOU
Clostridium putrefaciens	CLOPUR	Ralstonia	RAL
Clostridium putrificum	CLOPUT	Ralstonia pauca	CDCIVC2
Clostridium ramosum	CLORAM	Ralstonia pickettii	BURPIC
Clostridium sardinense	CLOSAR	Ralstonia pickettii biovar 1	BURPIC1

Clostridium sartagoforme	CLOSAT	Ralstonia pickettii biovar 2	BURPIC2
Clostridium scatologenes	CLOSCA	Ralstonia pickettii biovar 3	BURPIC3
Clostridium septicum	CLOSEP	Ralstonia solanacearum	BURSOL
Clostridium sordellii	CLOSOR	Rhodococcus	RHOC
Clostridium species	CLOSEP	Rhodococcus coprophilus	RHOCCOP
Clostridium shenoides	CLOSPH	Rhodococcus equi	RHOCEOU
Clostridium spiroforme	CLOSPI	Rhodococcus erythropolis	RHOCERY
Clostridium sporogenes	CLOSP0	Rhodococcus fascians	RHOCPAS
Clostridium sporosphaeroides	CLOSP5	Rhodococcus globerulus	RHOCGLO
Clostridium subterminale	CLOSUB	Rhodococcus rhodochrous	RHOGRHO
Clostridium symbiosum	CLOSYM	Rhodococcus species	RHOCSPE
Clostridium tertium	CLOTET	Rhodotorula	RHOT
Clostridium tetani	CLOTET	Rhodotorula glutinis	RHOTGLU
Clostridium tvrobutvricum	CLOTYR	Rhodotorula mucilaginosa var mucilaginosa	RHOTMUCM
Collinsella	COLL	Rhodotorula rubra	RHOTRUB
Collinsella aerofaciens	EUBAER	Rhodotorula species	RHOTSPS
Comamonas	COM	Rickettsia	RICK
Comamonas terrigena	COMTER	Rickettsia (Group)	RICKG
Comamonas testosteroni	COMTES	Riemerella	RIE
Coprococcus	COP	Riemerella anatipestifer	RIEANA
Coprococcus catus	COPCAT	Rikenella	RIK
Coprococcus comes	COPCOM	Rikenella microfus	RIKMIC
Coprococcus eutactus	COPEUT	Roseomonas	ROS
Cornebacterium	COR	Roseomonas cervicalis	ROSCER
Cornebacterium accolens	CORACC	Roseomonas fauriae	ROSFAR
Cornebacterium afermentans	CORAFE	Roseomonas gilardii	ROSGIL
Cornebacterium afermentans ssp afermentans	CORAFEAF	Roseomonas species	ROSSPE
Cornebacterium afermentans ssp lipophilum	CORAFEAL	Rothia	ROT
Cornebacterium amycolatum	CORAMY	Rothia dentocariosa	ROTDEN
Cornebacterium amycolatum/mini-tissimum	CORAMYMIN	Rothia mucilaginosa	STOMUC
Cornebacterium amycolatum/striatum	CORAMYST	Ruminococcus	RUM
Cornebacterium argenteorotense	CORARG	Ruminococcus albus	RUMALB
Cornebacterium auris	CORAU	Ruminococcus bromii	RUMBRO
Cornebacterium bovis	CORBOV	Ruminococcus hansenii	STRHAN
Cornebacterium coveale	CORCOV	Ruminococcus productus	RUMPRO
Cornebacterium cvstitidis	CORCYS	Saccharomyces	SAC
Cornebacterium diphtheriae	CORDIP	Saccharomyces cerevisiae	SACCE
Cornebacterium diphtheriae ssp belfanti	CORDIPB	Saccharomyces pastorianus	SACPAS
Cornebacterium diphtheriae ssp gravis	CORDIPG	Saccharomyces uvarum	SACUVA
Cornebacterium diphtheriae ssp intermedius	CORDIPI	Salmonella	SAL
Cornebacterium diphtheriae ssp mitis	CORDIPM	Salmonella aberdeen	SALABE
Cornebacterium durum	CORDUR	Salmonella abortus-equi	SALABOE
Cornebacterium flavescens	CORFLA	Salmonella adelaide	SALADL
Cornebacterium genitalium	CORGEN	Salmonella aderike	SALADR
Cornebacterium genitalium biovar I	CORGENI	Salmonella agona	SALAGO
Cornebacterium genitalium biovar II	CORGENII	Salmonella alachua	SALALA
Cornebacterium genitalium biovar III	CORGENIII	Salmonella anatum	SALANA
Cornebacterium genitalium biovar IV	CORGENIV	Salmonella arizonae	SALARI
Cornebacterium genitalium biovar V	CORGENV	Salmonella avana	SALAVA
Cornebacterium genitalium biovar VI	CORGENVI	Salmonella bahrenfeld	SALBAH
Cornebacterium glucuronolyticum	CORGLC	Salmonella blockley	SALBLO
Cornebacterium imitans	CORIMI	Salmonella bongori	SALBON
Cornebacterium jeikeium	CORJEI	Salmonella braenderup	SALBRA
Cornebacterium kutscheri	CORKUT	Salmonella bredenev	SALBRE
Cornebacterium macdonlevi	CORMAC	Salmonella bunn	SALBUN
Cornebacterium matruchotii	CORMAT	Salmonella californica	SALCAL
Cornebacterium minutissimum	CORMIN	Salmonella carrau	SALCAR
Cornebacterium mucifaciens	CORMUC	Salmonella cerro	SALCER
Cornebacterium mycetoides	CORMYC	Salmonella champaign	SALCHA
Cornebacterium pilosum	CORPIL	Salmonella chittagong	SALCHI
Cornebacterium propinquum	CORPRO	Salmonella choleraesuis	SALCHO
Cornebacterium pseudodiphtheriticum	CORPSD	Salmonella choleraesuis ssp arizonae	SALCHOA
Cornebacterium pseudogenitalium	CORPSG	Salmonella choleraesuis ssp choleraesuis	SALCHOC
Cornebacterium pseudogenitalium biovar	CCORPSGC1	Salmonella choleraesuis ssp diarizonae	SALCHOD
Cornebacterium pseudogenitalium biovar	CCORPSGC2	Salmonella choleraesuis ssp houtenae	SALCHOH
Cornebacterium pseudogenitalium biovar	CCORPSGC3	Salmonella choleraesuis ssp indica	SALCHOI
Cornebacterium pseudogenitalium biovar	CCORPSGC4	Salmonella choleraesuis ssp salamae	SALCHOS
Cornebacterium pseudotuberculosis	CORPST	Salmonella cubana	SALCUB
Cornebacterium renale	CORREN	Salmonella dakar	SALDAK
Cornebacterium renale group	CORRENGR	Salmonella daressalaam	SALDAR
Cornebacterium riegliei	CORRIE	Salmonella derby	SALDER
Cornebacterium seminale	CORSEM	Salmonella dessau	SALDES
Cornebacterium singulare	CORSIN	Salmonella dublin	SALDUB
Cornebacterium species	CORSPE	Salmonella duesseldorf	SALDUE
Cornebacterium striatum	CORSTR	Salmonella enteritidis	SALENT
Cornebacterium thomsonii	CORTHO	Salmonella fresno	SALFRE
Cornebacterium ulcerans	CORULC	Salmonella gallinarum	SALGAL
Cornebacterium urealyticum	CORURE	Salmonella gifu	SALGIV
Cornebacterium variable	CORVAR	Salmonella haardt	SALHAA
Cornebacterium vitaeruminis	CORVIT	Salmonella hadar	SALHAD
Cornebacterium xerosis	CORXER	Salmonella hamburg	SALHAM
Coxiella	COX	Salmonella heidelberg	SALHEI
Coxiella burnetii	COXBUR	Salmonella illinois	SALILL
Crvotococcus	CRY	Salmonella infantis	SALINF
Crvotococcus albidus	CRYALB	Salmonella invernness	SALINV
Crvotococcus albidus var aerius	CRYALBAE	Salmonella iava	SALJAA
Crvotococcus albidus var albidus	CRYALBAL	Salmonella iaviana	SALJAI
Crvotococcus albidus var diffluens	CRYALBD	Salmonella kirkee	SALKIR
Crvotococcus gastricus	CRYGAS	Salmonella kunduchi	SALKUN
Crvotococcus laurentii	CRYLAU	Salmonella kvittindefoss	SALKVI

Crvotococcus luteolus	CRYLUT	Salmonella lansing	SALLAN
Crvotococcus neoformans	CRYNEO	Salmonella litchfield	SALLIT
Crvotococcus neoformans var gattii	CRYNEOG	Salmonella liverpool	SALLIV
Crvotococcus neoformans var neoformans	CRYNEON	Salmonella london	SALLON
Crvotococcus species	CRYSPE	Salmonella luciana	SALLUC
Crvotococcus terreus	CRYTER	Salmonella manhattan	SALMAN
Crvotococcus uniuuttulatus	CRYUNI	Salmonella meleagridis	SALMEL
Deinococcus	DEI	Salmonella memphis	SALMEM
Deinococcus radiodurans	DEIRAD	Salmonella michigan	SALMIC
Delftia	DEL	Salmonella minneapolis	SALMIA
Delftia acidovorans	COMACI	Salmonella minnesota	SALMIS
Dermabacter	DERB	Salmonella montevideo	SALMON
Dermabacter hominis	DERBOM	Salmonella muenchen	SALMUE
Dermacoccus	DERC	Salmonella newington	SALNEI
Dermacoccus nishinomivaensis	MICNIS	Salmonella newport	SALNEP
Dermatophilus	DETR	Salmonella nottingham	SALNOT
Dermatophilus congolensis	DETRCON	Salmonella ohio	SALOHIO
Desulfomonas	DESM	Salmonella onderstepoort	SALOND
Desulfomonas pigra	DESMPIG	Salmonella oranienburg	SALORA
Desulfovibrio	DESV	Salmonella paratyphi A	SALPARA
Desulfovibrio species	DESVSPE	Salmonella paratyphi B	SALPARB
Dialister	DIA	Salmonella poona	SALPOO
Dialister pneumosintes	BACTPNE	Salmonella pullorum	SALPUL
Dichelobacter	DIC	Salmonella quinhon	SALQUI
Dichelobacter nodosus	DICNOD	Salmonella rubislaw	SALRUB
Dietzia	DIE	Salmonella saintpaul	SALSAI
Dietzia maris	DIEMAR	Salmonella schwarzengrund	SALSCH
DO NOT USE	STRINS	Salmonella senftenberg	SALSEN
Dolosigranulum	DOL	Salmonella species	SALSPE
Dolosigranulum pigrum	DOLPIG	Salmonella tallahassee	SALTAL
Edwardsiella	EDW	Salmonella thompson	SALTHO
Edwardsiella hoshinae	EDWHOS	Salmonella typhi	SALTYP
Edwardsiella ictaluri	EDWICT	Salmonella typhimurium	SALTYPM
Edwardsiella tarda	EDWTAR	Salmonella virginia	SALVIR
Edwardsiella tarda biogroup 1	EDWTAR1	Salmonella westerstede	SALWES
Eggerthella	EGG	Salmonella worthington	SALWOR
Eggerthella lenta	EUBLEN	Sarcina	SAR
Ehrlichia	EHR	Sarcina species	SARSPE
Ehrlichia chaffeensis	EHRCHA	Sarcina ventriculi	SARVEN
Ehrlichia equi	EHREOU	Sebaldella	SEB
Ehrlichia sennetsu	EHRSEN	Sebaldella termitidis	SEBTER
Eikenella	EIK	Selenomonas	SEL
Eikenella corrodens	EIKCOR	Selenomonas artemidis	SELART
Empedobacter	EMP	Selenomonas diana	SELDIA
Empedobacter brevis	EMPBRE	Selenomonas flueggei	SELFLU
Enterobacter	ENTB	Selenomonas infelix	SELINF
Enterobacter aerogenes	ENTBAER	Selenomonas noxia	SELNOX
Enterobacter aerogenes/cloacae	ENTBAERCLO	Selenomonas putrigena	SELSPU
Enterobacter amnigenus	ENTBAMN	Serratia	SER
Enterobacter amnigenus biogroup 1	ENTBAMN1	Serratia entomophila	SERENT
Enterobacter amnigenus biogroup 2	ENTBAMN2	Serratia ficaria	SERFIC
Enterobacter asburiae	ENTBASB	Serratia fonticola	SERFON
Enterobacter cancerogenus	ENTBCAN	Serratia grimesii	SERGRI
Enterobacter cloacae	ENTBCLO	Serratia liquefaciens	SERLIO
Enterobacter dissolvens	ENTBDIS	Serratia marcescens	SERMAR
Enterobacter gergoviae	ENTBGER	Serratia odorifera	SERODO
Enterobacter hormaechei	ENTBHOR	Serratia odorifera 1	SERODO1
Enterobacter intermedius	ENTBIINT	Serratia odorifera 2	SERODO2
Enterobacter kobei	ENTBKOB	Serratia plvmutica	SERPLY
Enterobacter nimibressuralis	ENTBNIM	Serratia proteamaculans ssp proteamaculans	SERPROP
Enterobacter sakazakii	ENTBSAK	Serratia proteamaculans ssp quinovora	SERPROO
Enterobacter species	ENTBSPE	Serratia rubidaea	SERRUB
Enterococcus	ENTC	Serratia species	SERSPE
Enterococcus avium	ENTCAVI	Shewanella	SHE
Enterococcus avium HRE	ENTCAVIHR	Shewanella alga	SHEALG
Enterococcus casseliflavus	ENTCCAS	Shewanella putrefaciens	SHEPUT
Enterococcus casseliflavus HRE	ENTCCASHR	Shewanella putrefaciens biovar 1	SHEPUT1
Enterococcus casseliflavus Van C	ENTCCASVC	Shewanella putrefaciens biovar 2	SHEPUT2
Enterococcus casseliflavus/gallinarum	ENTCCASGAL	Shewanella putrefaciens biovar 3	SHEPUT3
Enterococcus cecorum	ENTCCEC	Shigella	SHI
Enterococcus columbae	ENTCCOL	Shigella boydii	SHIBOY
Enterococcus dispar	ENTCDIS	Shigella dysenteriae	SHIDYS
Enterococcus durans	ENTCDUR	Shigella flexneri	SHIFLE
Enterococcus durans HRE	ENTCDURHR	Shigella sonnei	SHISON
Enterococcus durans/faecium	ENTCDURFAI	Shigella species	SHISPE
Enterococcus faecalis	ENTCFAA	Simonsiella	SIM
Enterococcus faecalis HRE	ENTCFAAHR	Simonsiella muelleri	SIMMUE
Enterococcus faecalis Van A	ENTCFAAVA	Skermania	SKE
Enterococcus faecalis Van B	ENTCFAAVB	Skermania viniformis	SKEPIN
Enterococcus faecalis VRE	ENTCFAAVR	Slackia	SLA
Enterococcus faecium	ENTCFAI	Slackia exigua	EUBEXI
Enterococcus faecium HRE	ENTCFAIHR	Slackia heliotrinireducens	PEPSHEL
Enterococcus faecium Van A	ENTCFAIVA	Sphingobacterium	SPHB
Enterococcus faecium Van B	ENTCFAIVB	Sphingobacterium multivorum	SPHBMUL
Enterococcus faecium VRE	ENTCFAIVR	Sphingobacterium multivorum/thalboophilum	SPHBMULTHA
Enterococcus flavescens	ENTCFLA	Sphingobacterium species	SPHBSPE
Enterococcus gallinarum	ENTCGAL	Sphingobacterium spiritivorum	SPHBSPI
Enterococcus gallinarum Van C	ENTCGALVC	Sphingobacterium thalboophilum	SPHBTHA
Enterococcus hirae	ENTCHIR	Sphingomonas	SPHM
Enterococcus hirae/faecium	ENTCHIRFAI	Sphingomonas capsulata	SPHMCAP

Enterococcus malodoratus	ENTCMAL	Sphingomonas daucimobilis	SPHMPAU
Enterococcus mundtii	ENTCMUN	Spirochete	SPRC
Enterococcus pseudoavium	ENTCPSE	Spirochete (Group)	SPRCG
Enterococcus raffinosus	ENTCRAF	Sporobolomvces	SPOB
Enterococcus raffinosus Van A	ENTCRAFVA	Sporobolomvces salmonicolor	SPOBSAL
Enterococcus saccharolyticus	ENTCSAC	Staphylococcus	STA
Enterococcus solitarius	ENTCSOL	Staphylococcus arlettae	STAARL
Enterococcus species	ENTCSPE	Staphylococcus aureus	STAAUE
Enterococcus sulfureus	ENTCSUL	Staphylococcus aureus MR	STAAUEMR
Erwinia	ERW	Staphylococcus aureus ssp anaerobius	STAAUEAN
Erwinia persicina	ERWPFR	Staphylococcus aureus ssp aureus	STAAUEAU
Erysipelothrix	ERY	Staphylococcus aureus Van I	STAAUEVI
Erysipelothrix rhusiopathiae	ERYRHU	Staphylococcus aureus Van R	STAAUEVR
Erysipelothrix tonsillarum	ERYTON	Staphylococcus auricularis	STAAUI
Escherichia	ESC	Staphylococcus capitis	STACAI
Escherichia blattae	ESCBLA	Staphylococcus capitis ssp capitis	STACAIIC
Escherichia coli	ESCCOL	Staphylococcus capitis ssp ureolyticus	STACAIU
Escherichia coli AD	ESCCOLAD	Staphylococcus cabrae	STACAP
Escherichia coli atypical	ESCCOLATY	Staphylococcus carnosus	STACAR
Escherichia coli H2S+	ESCCOLHS	Staphylococcus carnosus ssp carnosus	STACARC
Escherichia coli inactive	ESCCOLINA	Staphylococcus carnosus ssp utilis	STACARU
Escherichia coli serotype O111	ESCCOLO111	Staphylococcus chromogenes	STACHR
Escherichia coli serotype O157	ESCCOLO157	Staphylococcus chromogenes/hvicus	STACHRHYI
Escherichia fergusonii	ESCFER	Staphylococcus coag negative	STACNEG
Escherichia hermannii	ESCHER	Staphylococcus cohnii	STACOH
Escherichia vulneris	ESCVUL	Staphylococcus cohnii ssp cohnii	STACOHIC
Eubacterium	EUB	Staphylococcus cohnii ssp ureolyticum	STACOHU
Eubacterium barkeri	EUBBAR	Staphylococcus delphini	STADEL
Eubacterium bifforme	EUBBIF	Staphylococcus epidermidis	STAEPI
Eubacterium brachy	EUBBRA	Staphylococcus epidermidis MR	STAEPIMR
Eubacterium combesii	EUBCOM	Staphylococcus equorum	STABOU
Eubacterium contortum	EUBCON	Staphylococcus felis	STAFEL
Eubacterium cylindroides	EUBCYL	Staphylococcus gallinarum	STAGAL
Eubacterium dolichum	EUBDOL	Staphylococcus haemolyticus	STAHAE
Eubacterium eligens	EUBELI	Staphylococcus haemolyticus MR	STAHAEHR
Eubacterium formicigenerans	EUBFOR	Staphylococcus hominis	STAHOM
Eubacterium hadrum	EUBHAD	Staphylococcus hominis MR	STAHOMMR
Eubacterium hallii	EUBHAL	Staphylococcus hominis ssp hominis	STAHOMH
Eubacterium limosum	EUBLIM	Staphylococcus hominis ssp novobiosepticus	STAHOMN
Eubacterium minutum	EUBMIN	Staphylococcus hvicus	STAHYI
Eubacterium moniliforme	EUBMON	Staphylococcus intermedius	STAIINT
Eubacterium multiforme	EUBMUL	Staphylococcus kloosii	STAKLO
Eubacterium nitritogenes	EUBNIT	Staphylococcus lentus	STALEN
Eubacterium nodatum	EUBNOD	Staphylococcus lugdunensis	STALUG
Eubacterium ramulus	EUBRAM	Staphylococcus lutrae	STALUT
Eubacterium rectale	EUBREC	Staphylococcus muscae	STAMUS
Eubacterium saburreum	EUBSAB	Staphylococcus pasteurii	STAPAS
Eubacterium sabhenum	EUBSAP	Staphylococcus piscifermentans	STAPIS
Eubacterium siraeum	EUBSIR	Staphylococcus pulvereri	STAPUL
Eubacterium species	EUBSPE	Staphylococcus saccharolyticus	STASAC
Eubacterium sulci	FUSSUL	Staphylococcus saprophyticus	STASAP
Eubacterium tenue	EUBTEN	Staphylococcus saprophyticus MR	STASAPMR
Eubacterium tortuosum	EUBTOR	Staphylococcus saprophyticus ssp bovis	STASAPB
Eubacterium ventriosum	EUBVEN	Staphylococcus saprophyticus ssp saprophyticus	STASAPS
Eubacterium vulii ssp margaretae	EUBYURM	Staphylococcus schleiferi	STASCH
Eubacterium vulii ssp schittka	EUBYURS	Staphylococcus schleiferi ssp coagulans	STASCHC
Eubacterium vulii ssp vulii	EUBYURY	Staphylococcus schleiferi ssp schleiferi	STASCHS
Ewingella	EWI	Staphylococcus sciuri	STASCI
Ewingella americana	EWIAME	Staphylococcus sciuri ssp carnaticus	STASCIC
Exiguobacterium	EXI	Staphylococcus sciuri ssp rodentium	STASCIR
Exiguobacterium acetivlicum	EXIACE	Staphylococcus sciuri ssp sciuri	STASCIS
Facklamia	FAC	Staphylococcus simulans	STASIM
Facklamia hominis	FACHOM	Staphylococcus simulans MR	STASIMMR
Fibrobacter	FIB	Staphylococcus species	STASPE
Fibrobacter succinogenes	FIBSUC	Staphylococcus species MR	STASPEMR
Filifactor	FILF	Staphylococcus vitulinus	STAVIT
Filifactor alocis	FUSALO	Staphylococcus warneri	STAWAR
Filobasidiella	FIL	Staphylococcus warneri MR	STAWARMR
Filobasidiella neoformans	FILNEO	Staphylococcus xylosus	STAXYL
Finegoldia	FIN	Stenotrophomonas	STE
Finegoldia magna	PEPSMAG	Stenotrophomonas africana	STEAFR
Flavimonas	FLAI	Stenotrophomonas maltophilia	STEMAL
Flavobacterium	FLAO	Stenotrophomonas maltophilia (CF)	STEMALCF
Flavobacterium mizutaii	FLAOMIZ	Stomatococcus	STO
Flavobacterium species	FLAOSPE	Stomatococcus species	STOSPE
Francisella	FRA	Streptobacillus	STRB
Francisella novicida	FRANOV	Streptobacillus moniliformis	STRBMON
Francisella philomiragia	FRAPHI	Streptococcus	STR
Francisella tularensis	FRATUL	Streptococcus acidominimus	STRACI
Francisella tularensis ssp holarctica	FRATULH	Streptococcus adalactiae	STRAGA
Francisella tularensis ssp tularensis	FRATULT	Streptococcus alactolyticus	STRALA
Fungi	FUNGI	Streptococcus anginosus	STRANG
Fungi (Group)	FUNGIG	Streptococcus bovis	STRBOV
Fusobacterium	FUS	Streptococcus bovis I	STRBOVI
Fusobacterium gonidiaformans	FUSGON	Streptococcus bovis II	STRBOVII
Fusobacterium mortiferum	FUSMOR	Streptococcus canis	STRCAN
Fusobacterium naviforme	FUSNAV	Streptococcus constellatus	STRCON
Fusobacterium necrogenes	FUSNEG	Streptococcus criceti	STRCRC
Fusobacterium necrophorum	FUSNEC	Streptococcus cristatus	STRCRS
Fusobacterium necrophorum ssp funduliforme	FUSNECF	Streptococcus downei	STRDOW

Fusobacterium necrophorum ssp necrophorum	FUSNECN	Streptococcus dysgalactiae	STRDYS
Fusobacterium nucleatum	FUSNUC	Streptococcus dysgalactiae ssp dysgalactiae	STRDYSY
Fusobacterium nucleatum ssp animalis	FUSNUCA	Streptococcus dysgalactiae ssp equisimilis	STRDYSEM
Fusobacterium nucleatum ssp fusiforme	FUSNUCF	Streptococcus equi	STRBOU
Fusobacterium nucleatum ssp nucleatum	FUSNUCN	Streptococcus equi ssp equi	STRBOUE
Fusobacterium nucleatum ssp polymorphum	FUSNUCP	Streptococcus equi ssp zooepidemicus	STRBOUZ
Fusobacterium nucleatum ssp vincentii	FUSNUCV	Streptococcus equinus	STRBON
Fusobacterium perfoetens	FUSPEF	Streptococcus ferus	STRFER
Fusobacterium periodonticum	FUSPER	Streptococcus gordonii	STRGOR
Fusobacterium prausnitzii	FUSPRA	Streptococcus group C	STRGRC
Fusobacterium russii	FUSRUS	Streptococcus group C/G	STRGRCG
Fusobacterium ulcerans	FUSULC	Streptococcus group CFG	STRGRCFG
Fusobacterium varium	FUSVAR	Streptococcus group E	STRGRE
Gardnerella	GAR	Streptococcus group F	STRGRF
Gardnerella vaginalis	GARVAG	Streptococcus group G	STRGRG
Gemella	GEM	Streptococcus group L	STRGRL
Gemella bergeri	GEMBER	Streptococcus hvointestinalis	STRHYO
Gemella haemolysans	GEMHAE	Streptococcus iniae	STRINI
Gemella morbillorum	GEMMOR	Streptococcus intermedius	STRINR
Gemella sanguinis	GEMSAN	Streptococcus macedonicus	STRMAC
Gemella species	GEMSPE	Streptococcus milleri group	STRMILGR
Geotrichum	GEO	Streptococcus mitis	STRMIT
Geotrichum candidum	GEOCAN	Streptococcus mitis group	STRMITGR
Geotrichum species	GEOSPE	Streptococcus mitis/pneumoniae	STRMITPNE
Globicatella	GLO	Streptococcus mutans	STRMUT
Globicatella sanguinis	GLOSAN	Streptococcus mutans group	STRMUTGR
Gordonia	GOR	Streptococcus oralis	STRORA
Gordonia aichiensis	GORAIC	Streptococcus parasanguinis	STRPAR
Gordonia amarae	GORAMA	Streptococcus pleomorphus	STRPLE
Gordonia bronchialis	GORBRO	Streptococcus pneumoniae	STRPNE
Gordonia rubropertincta	GORRUB	Streptococcus pneumoniae Pen I	STRPNEPI
Gordonia sputi	GORSPU	Streptococcus pneumoniae Pen R	STRPNEPR
Gordonia terrae	GORTER	Streptococcus porcinus	STRPOR
Gram + Bacilli	G+B	Streptococcus pyogenes	STRPYO
Gram + Bacteria	+	Streptococcus rattii	STRRAT
Gram + Cocci	G+C	Streptococcus salivarius	STRSAL
Gram + Coccobacilli	G+CB	Streptococcus salivarius group	STRSALGR
Gram - Bacilli	G-B	Streptococcus sanguinis	STRSAN
Gram - Bacteria	-	Streptococcus sanguinis group	STRSANGR
Gram - Cocci	G-C	Streptococcus sobrinus	STRSOB
Gram - Coccobacilli	G-CB	Streptococcus species	STRSPE
Gram - Diplococci	G-DC	Streptococcus suis	STRSUI
Granulicatella	GRAN	Streptococcus thermophilus	STRTHE
Granulicatella adiacens	STRADJ	Streptococcus uberis	STRUBE
Haemophilus	HAE	Streptococcus vestibularis	STRVES
Haemophilus aphrophilus	HAEAPH	Streptococcus viridans group	STRVIRGR
Haemophilus aphrophilus/paraphrophilus	HAEAPHPAR	Succinivibrio	SUC
Haemophilus ducreyi	HAEDUC	Succinivibrio dextrinosolvens	SUCDEX
Haemophilus haemoglobinophilus	HAEHAG	Sutterella	SUTE
Haemophilus haemolyticus	HAEHAL	Sutterella wadsworthensis	SUTEWAD
Haemophilus influenzae	HAEIF	Suttonella	SUT
Haemophilus influenzae biogroup aegyptius	HAEIFA	Suttonella indologenes	SUTIND
Haemophilus influenzae biotype I	HAEIFI	Tatumella	TAT
Haemophilus influenzae biotype II	HAEIFII	Tatumella ptyseos	TATPTY
Haemophilus influenzae biotype III	HAEIFIII	Tetragenococcus	TET
Haemophilus influenzae biotype IV	HAEIFIV	Tetragenococcus halophilus	TETHAL
Haemophilus influenzae biotype V	HAEIFV	Tissierella	TIS
Haemophilus influenzae biotype VI	HAEIFVI	Tissierella praecuta	TISPRE
Haemophilus influenzae biotype VIII	HAEIFVIII	Torulopsis	TOR
Haemophilus parahaemolyticus	HAEPAH	Torulopsis candida	TORCAN
Haemophilus parainfluenzae	HAEPAI	Torulopsis pintolopesii	TORPIN
Haemophilus parainfluenzae biotype I	HAEPAI I	Trabulsiella	TRA
Haemophilus parainfluenzae biotype II	HAEPAI II	Trabulsiella guamensis	TRAGUA
Haemophilus parainfluenzae biotype III	HAEPAI III	Trichosporon	TRI
Haemophilus parainfluenzae biotype IV	HAEPAI IV	Trichosporon aquatile	TRIAOU
Haemophilus paraphrophilus	HAEPAP	Trichosporon beigellii	TRIBEI
Haemophilus parasuis	HAEPAS	Trichosporon pullulans	TRIPUL
Haemophilus segnis	HAESG	Tsukamurella	TSU
Haemophilus somnus	HAESOM	Tsukamurella inchenensis	TSUINC
Haemophilus species	HAESPE	Tsukamurella paurometabola	TSUPAU
Hafnia	HAF	Tsukamurella pulmonis	TSUPUL
Hafnia alvei	HAFALV	Tsukamurella tvorinosolvens	TSUTYR
Hafnia alvei group 1	HAFALV1	Tsukamurella wratislaviensis	TSUWRA
Hallella	HAL	Turicella	TUR
Hallella seredgens	HALSER	Turicella otitidis	TUOTI
Halomonas	HALO	Unidentified organism	UNIORG
Halomonas aquamarina	ALCFAEH	Unspecified	UNS
Hansenula	HAN	Ureaplasma	URE
Hansenula polymorpha	HANPOL	Ureaplasma urealyticum	UREURE
Hansenula saturnas	HANSAT	Vagococcus	VAG
Helcococcus	HELCO	Vagococcus species	VAGSPE
Helcococcus kunzii	HELCKUN	Veillonella	VEI
Helicobacter	HELI	Veillonella atypica	VEIATY
Helicobacter acinonvchis	HELIACI	Veillonella dispar	VEIDIS
Helicobacter cinaedi	HELICIN	Veillonella parvula	VEIPAR
Helicobacter felis	HELIFEL	Veillonella species	VEISPE
Helicobacter fennelliae	HELIFEN	Vibrio	VIB
Helicobacter muridarum	HELIMUR	Vibrio alginolyticus	VIBALG
Helicobacter mustelae	HELIMUS	Vibrio cholerae	VIBCHO
Helicobacter nemestrinae	HELINEM	Vibrio cincinnatiensis	VIBCIN

Helicobacter bullorum	HELIPUL	Vibrio fluvialis	VIBFLU
Helicobacter pylori	HELIPYL	Vibrio furnissii	VIBFUR
Histoplasma	HIS	Vibrio harveii	VIBHAR
Histoplasma capsulatum	HISCAP	Vibrio hollisae	VIBHOL
Issatchenkia	ISS	Vibrio metschnikovii	VIBMET
Issatchenkia orientalis	ISSORI	Vibrio mimicus	VIBMIM
Johnsonella	JOH	Vibrio parahaemolyticus	VIBPAR
Johnsonella ignava	JOHIGN	Vibrio species	VIBSPE
Jonesia	JON	Vibrio vulnificus	VIBVUL
Jonesia denitrificans	JONDEN	Weeksella	WEE
Kingella	KIN	Weeksella virosa	WEEVIR
Kingella denitrificans	KINDEN	Weeksella virosa/Bergevella zoohelcum	WEEVIRBERZOO
Kingella kingae	KINKIN	Weeksella/Bergevella	WEE/BER
Kingella oralis	KINORA	Weissella	WEI
Kingella species	KINSPE	Weissella confusa	WEICON
Klebsiella	KLE	Weissella paramesenteroides	WEIPAR
Klebsiella granulomatis	CALYGRA	Wolinella	WOLI
Klebsiella ornithinolytica	KLEORN	Wolinella succinogenes	WOLISUC
Klebsiella oxytoca	KLEOXY	Xenorhabdus	ZEN
Klebsiella oxytoca/pneumoniae	KLEOXYPNE	Xenorhabdus beddingii	XENBED
Klebsiella planticola	KLEPLA	Xenorhabdus bovienii	XENBOV
Klebsiella pneumoniae ssp ozaenae	KLEPNEO	Xenorhabdus nematophilus	XENNEM
Klebsiella pneumoniae ssp pneumoniae	KLEPNEP	Xenorhabdus poinarii	XENPOI
Klebsiella pneumoniae ssp rhinoscleromatik	KLEPNER	Yamadazvma	YAM
Klebsiella species	KLESPE	Yamadazvma guilliermondii	YAMGUI
Klebsiella terrigena	KLETER	Yarrowia	YAR
Kloeckera	KLO	Yarrowia lipolytica	YARLIP
Kloeckera apiculata	KLOAPI	Yeast	YST
Kluyvera	KLU	Yeast (Group)	YSTG
Kluyvera ascorbata	KLUASC	Yeast-like	YSTL
Kluyvera crocrescens	KLUCRY	Yeast-like (Group)	YSTLG
Kluyvera georgiana	KLUGEO	Yersinia	YER
Kluyvera species	KLUSPE	Yersinia aldovae	YERALD
Kluyveromyces	KLUM	Yersinia bercovieri	YERBER
Kluyveromyces lactis	KLUMLAC	Yersinia enterocolitica	YERENT
Kluyveromyces marxianus	KLUMMAR	Yersinia enterocolitica group	YERENTGR
Kocuria	KOC	Yersinia frederiksenii	YERFRE
Kocuria kristinae	MICKRI	Yersinia intermedia	YERINT
Kocuria rosea	MICROS	Yersinia kristensenii	YERKRI
Kocuria varians	MICVAR	Yersinia mollaretii	YERMOL
Kurthia	KUR	Yersinia pestis	YERPES
Kurthia gibsonii	KURGIB	Yersinia pseudotuberculosis	YERPSE
Kurthia zopfii	KURZOP	Yersinia rohdei	YERROH
Kytococcus	KYT	Yersinia ruckeri	YERRUC
Kytococcus sedentarius	MICSED	Yersinia species	YERSPE
Lactobacillus	LACB	Yokenella	YOK
Lactobacillus acidophilus	LACBACI	Yokenella regensburgi	YOKREG
Lactobacillus brevis	LACBBRE	Zygosaccharomyces	ZYG
Lactobacillus buchneri	LACBBUC	Zygosaccharomyces bailli	ZYGBAI
Lactobacillus casei	LACBCAS	Zygosaccharomyces species	ZYGSPE

14. Appendix E – BD Instrument Specifics

14.1. BD BACTEC MGIT 960

BD BACTEC MGIT 960 supports ASTM E_1394 Logical Protocol and ASTM E_1381 Physical Protocol.

14.1.1. Configurable Options

LIS Enable – acceptable values are ENABLE or DISABLE. Used to enable the LIS interface within the instruments. The instrument defaults to DISABLE.

Baud Rate – acceptable values are 1200, 2400, 4800, 9600, 19200. The instrument defaults to 9600.

Data Bits – acceptable values are 7 and 8. The instrument defaults to 8.

Stop Bits – acceptable values are 1 and 2. The instrument defaults to 1.

Parity - acceptable values are ODD, EVEN, and NONE. The instrument defaults to NONE.

Upload Results – acceptable values are SOLICITED and UNSOLICITED. The instrument defaults to UNSOLICITED. In unsolicited mode the instrument automatically uploads results as tests are completed. The instrument in solicited mode waits for LIS to request the results.

Consumable Tracking – acceptable values include ENABLE or DISABLE. The instrument defaults to DISABLE. Enabling this option causes the instrument to automatically send a specimen's test status to the LIS when a specimen has been scanned-in the instrument for the first time (ONGOING) or scanned-out of the instrument (REMOVED) (automatic transfer when UPLOAD_RESULT option set to UNSOLICITED).

Orphan Result – acceptable values include ENABLE and DISABLE. The instrument defaults to DISABLE. Enabling this option causes the instrument to report results for tests that do NOT have an accession number associated with them.

Packed Frames – acceptable values include ENABLE and DISABLE. The instrument defaults to ENABLE. Enabling this option allows message frames sent to the LIS to support multiple records per frame ("packed"). When Disabled, only one record is transmitted per frame.

14.1.2. Message Content

Field List

The BD BACTEC MGIT 960 shall exchange fields with the LIS per the following table:

Header Record Field Name	ASTM Pos.	Direction
Sender Name	H, 5, 1, 1	U
Version Number	H, 13, 1, 1	U
Message Date/Time	H 14, 1, 1	U

Order Record Field Name	ASTM Pos.	Direction
Accession Number	O, 3, 1, 1	U
Isolate Number	O, 3, 1, 2	U
Test ID	O, 5, 1, 4	U

Result Record Field Name	ASTM Pos.	Direction
Result Type Code	R, 3, 1, 4	U
Test/Consumable Sequence Number	R, 3, 1, 5	U
Antibiotic	R, 3, 1, 6	U
Antibiotic Concentration	R, 3, 1, 7	U
Antibiotic Concentration Units	R, 3, 1, 8	U
Test Status	R, 4, 1, 1	U
Result Data 1		
BACTEC MGIT 960 Growth Units	R, 4, 1, 2	U
Result Data 3		
AST susceptibility (Interpreted)	R, 4, 1, 4	U
Preliminary/Final Status	R, 9, 1, 1	U
Test Start Date/Time	R, 12, 1, 1	U
Result/Status Date/Time	R, 13, 1, 1	U
Instrument Type	R, 14, 1, 1	U
Protocol Length	R, 14, 1, 3	U
Instrument Number	R, 14, 1, 4	U
Instrument Location	R, 14, 1, 5	U

Request Record Field Name	ASTM Pos.	Direction
Request Starting Patient Id	Q, 3, 1, 1	
Request Starting Accession Number	Q, 3, 1, 2	D
Request Starting Sequence Number	Q, 3, 1, 3	D
Request Ending Patient Id	Q, 4, 1, 1	
Request Ending Accession Number	Q, 4, 1, 2	
Request Ending Sequence Number	Q, 4, 1, 3	
Request Test Id	Q, 5, 1, 1	D
Request Test Status	Q, 5, 1, 2	D
Request Instrument Type	Q, 5, 1, 3	
Request Instrument Number	Q, 5, 1, 4	
Request Result Qualifier	Q, 5, 1, 5	D
Request Time Qualifier	Q, 6, 1, 1	
Starting Date/Time	Q, 7, 1, 1	D
Ending Date/Time	Q, 8, 1, 1	D
Request Information Status Code	Q, 13, 1, 1	

Terminator Record Field Name	ASTM Pos.	Direction
Termination Code	L, 3, 1, 1	U/D

Field Descriptions

Header Fields

General

Patient Fields

BD BACTEC MGIT 960 does not support patient information and therefore always transmits an empty Patient record.

Order Fields

Accession Number (O, 3, 1, 1) – The unique alphanumeric string that identifies a specimen. This field can be up to 20 characters long, e.g. Acc123.

Isolate Number (O, 3, 1, 2) – Specimen's assigned isolate number.

Test Id (O, 5, 1, 4) – BD BACTEC MGIT 960 transmits **MGIT_960_GND** for Growth and Detection specimens or **MGIT_960_AST** for AST sets.

Result Fields

Result Id Code (R, 3, 1, 4) – transmits **GND_MGIT** for growth and Detection specimens or **AST_MGIT** for AST sets.

Test Sequence Number (R, 3, 1, 5) – specimen's assigned sequence number (barcode) that is always be 12 digits.

Drug Abbreviation (R, 3, 1, 6) – Antibiotic abbreviation used for a drug within an AST set.

Drug Concentration (R, 3, 1, 7) – Drug concentration used for a drug within an AST set.

Drug Units of Measurement (R, 3, 1, 8) – Drug units of measurement used for a drug within an AST set.

Test Status LIS Code (R, 4, 1, 1) – BD BACTEC MGIT 960 transmits the following specimen status:

INST_ONGOING
INST_POSITIVE
INST_NEGATIVE
INST_COMPLETE
INST_REMOVED (for Ongoing Removed only)
INST_ERROR

It should be noted that Result records are not transmitted for G&D specimens that are in error. However, Result records are transmitted for AST set specimens that are in error because an AST set in error is considered a completed status. An AST set in error cannot return to an Ongoing state. A G&D specimen in error requires the users to resolve the before it returns to an Ongoing or Completed state.

Result Data (R, 4, 1, 2) – The BD BACTEC MGIT 960 instrument measures Mycobacterial growth. The instrument assigns a numerical value to quantify the amount of growth in a tube. This growth value is placed in the second component for any results generated by this instrument, one of either **GND_MGIT** or **AST_MGIT** tests. This field is never more than 5 characters long.

AST SIR Status (R, 4, 1, 4) – The BD BACTEC MGIT 960 instrument transmits an 'S' for susceptible, 'I' for Indeterminate (not currently used), or an 'R' for resistant.

Result Status Code (R, 9, 1, 1) – Always a ‘P’ for Preliminary result.

Start Date/Time (R, 12, 1, 1) – This is the date and time that the test was first started or entered into an instrument. This field is formatted as described in the ASTM E_1394 specification in section 6.6.2.

The BD BACTEC MGIT 960 AST tests are run in reusable plastic carriers. The plastic carrier contains a sequence number that uniquely identifies the tube carrier. This is the sequence number transmitted with results up to the LIS. However, it is possible that a single plastic carrier could be used more than once for a particular access number. If the LIS intends to allow these carriers to be used more than once for the same access number, then the LIS should take note of the test start date/time. The test start date/time, with the sequence number, uniquely identifies a test and its result.

MGIT AST test information downloaded from the LIS is checked for this start date/time. If this field is filled, meaning that existing results are being copied back to the BD EpiCenter, the BD EpiCenter tries to use it to match an existing test in its database. New test orders should not fill this field. If the test sequence number and entry date/time don't match an existing test, or are blank, then the BD EpiCenter considers it a new test order.

Test Result Date/Time (R, 13, 1, 1) – The instrument's date and time that the specimen completed its test.

- For an INST_ONGOING specimen this field is empty.
- For an INST_POSITIVE specimen this is the time the specimen went positive.
- For an INST_NEGATIVE specimen this is the time the specimen went negative (calculated by adding the protocol length with the start time).
- For an INST_REMOVED specimen, this is the time the specimen was removed from the instrument.
- For an INST_COMPLETE specimen this is the time the AST set completed.
- For an INST_ERROR specimen this is the time the AST set went into error (this is considered a completed status).

Instrument Type (R, 14, 1, 1) – transmits a ‘MGIT960’.

Protocol Length (R, 14, 1, 3) – the specimen's assigned protocol length.

Instrument Number (R, 14, 1, 4) –the user configured instrument number that ranges from 1 to 99.

Instrument Location (R, 14, 1, 5) – the specimen's location within the instrument. For example, Drawer A, Row D, Column 12 would be represented as “A/D12”.

Request Fields

The ASTM 1394 protocol defines this as a Request Information Record message. A download Request record is also known as a “Query”. The only type of download “Query” request that the Firefly instrument accepts is a request for test results. A Terminator record with a termination code of “F” or “Q” is used to signal the last packet of a query response. If a query request was invalid, the instrument interface responds with only the Terminator record with a termination code of “Q”. If the instrument interface can not locate any specimens in the active or history databases that meet the query criteria, it responds with only the

Terminator record with a termination code of "F". **Note, that the BD BACTEC MGIT 960 instrument does NOT request data from an LIS.**

A query contains a set of request parameters that are used to determine which specimen(s) to access. The following defines the ASTM 1394 Request record fields that are transmitted from the LIS in an Download message and the MGIT 960 statuses that correspond to the StatusId field.

Accession Number (Q, 3, 1, 2) – The unique alphanumeric string that identifies a specimen. This field can be up to 20 characters long, e.g. Acc123. The use of "ALL" or no definition indicates that the Accession # is not used as a search parameter in the query.

Sequence Number (Q, 3, 1, 3) – specimen's assigned sequence number (barcode) that is always be 12 digits. The use of "ALL" or no definition indicates that the Sequence # is not used as a search parameter in the query.

Test ID (Q, 5, 1, 1) – The BD BACTEC MGIT 960 instrument accepts the test ids **MGIT_960_GND**, **MGIT_960_AST**, or **ALL** and returns the test results for those test types currently in the instrument. The keyword **ALL** returns both GND and AST test results that are currently in the instrument.

Test Status Id (Q, 5, 1, 2) – The status of the specimens being requested. This field is only evaluated if the Test ID field contains valid data. No definition indicates that the specimen status is not used as a search parameter.

The following Test Statuses are used when requesting test results for specimens:

INST_ONGOING (G&D and AST)
INST_POSITIVE
INST_NEGATIVE
INST_COMPLETE (G&D and AST)

Qualifier (Q, 5, 1, 5) – optional qualifier 'MOD' that indicates that the request is for specimen results that have been modified/changed since last request.

Beginning Time (Q, 7, 1, 1) – the beginning time and date used when requesting data that occurred within a specified time range.

End Time (Q, 8, 1, 1) – the ending time and date used when requesting data that occurred within a specified time range.

When a "Time Range" has been specified in a Query (Begin Time and/or End Time fields), the time field from the instrument's database that is used for comparison is dependent upon the Query's "TestId" field as follows,

INST_ONGOING - Time the specimen was scanned into instrument.
INST_POSITIVE - Time the specimen went positive.
INST_NEGATIVE - Time the specimen went negative.
INST_REMOVED - Time the specimen was removed.
INST_COMPLETE - Time the AST set specimen completed.
INST_ERROR - Time the AST set specimen went into error.

Terminator Fields

General

14.1.3. Example ASTM 1394 Protocol

The following are examples of various instrument message transmissions that conform to the BD Common LIS Interface using the ASTM 1394 protocol.

MGIT960 G&D specimen that has been entered into an instrument, but has NOT been tested:

```
H|\^&|||Becton Dickinson|7 Loveton Circle^Sparks^MD^21152||410 316-
4000|||P|V1.00|19981019184200
P|1
O|1|0970038018||^GND
R|1|^GND_MGIT^430109967349|INST_ONGOING^0|||P|||MGIT960^42^1^B/A01
L|1|N
```

MGIT960 G&D specimen that has been tested and is still active in the instrument:

```
H|\^&|||Becton Dickinson|7 Loveton Circle^Sparks^MD^21152||
410 316-4000|||P|V1.00|19981019184200
P|1
O|1|0970038018||^GND
R|1|^GND_MGIT^430109967349|INST_ONGOING^123|||P||19960502115414|
19960507115414|MGIT960^42^1^B/A01
L|1|N
```

MGIT960 G&D specimen that has been tested POSITIVE:

```
H|\^&|||Becton Dickinson|7 Loveton Circle^Sparks^MD^21152||
410 316-4000|||P|V1.00|19981019184200
P|1
O|1|0970038018||^GND
R|1|^GND_MGIT^430109967349|INST_POSITIVE^1234|||P||19960502115414|
19960509123456|MGIT960^42^1^B/A01
L|1|N
```

MGIT960 G&D specimen that has been tested NEGATIVE:

```
H|\^&|||Becton Dickinson|7 Loveton Circle^Sparks^MD^21152||
410 316-4000|||P|V1.00|19981019184200
P|1
O|1|0970038018||^GND
R|1|^GND_MGIT^430109967349|INST_NEGATIVE^12|||P||19960502115414|
19960509123456|MGIT960^42^1^B/A01
L|1|N
```

MGIT960 AST specimens that have been entered into an instrument, but have NOT been tested:

```
H|\^&|||Becton Dickinson|7 Loveton Circle^Sparks^MD^21152||
410 316-4000|||P|V1.00|19981019184200
P|1
O|1|0970038018^1||^AST
R|1|^AST_MGIT^439309967349^EMB^5.0^ug/ml|INST_ONGOING^0|||P|||
MGIT960^13^B/A02
R|2|^AST_MGIT^439309967349^RIF^1.0^ug/ml|INST_ONGOING^0|||P|||
MGIT960^13^B/A03
L|1|N
```

MGIT960 AST specimens from an AST set that have been tested and are still active in the instrument:

```
H|\^&|||Becton Dickinson|7 Loveton Circle^Sparks^MD^21152||
410 316-4000|||P|V1.00|19981019184200
P|1
O|1|0970038018^1||^MGIT_960_AST
R|1|^AST_MGIT^439309967349^EMB^5.0^ug/ml|INST_ONGOING^123|||P||
19960502115414|19960502115414|MGIT960^^^13^B/A02
R|2|^AST_MGIT^439309967349^RIF^1.0^ug/ml|INST_ONGOING^12|||P||
19960502115414|19960502115414|MGIT960^^^13^B/A03
L|1|N
```

MGIT960 AST specimens that have completed testing:

```
H|\^&|||Becton Dickinson|7 Loveton Circle^Sparks^MD^21152||
410 316-4000|||P|V1.00|19981019184200
P|1
O|1|0970038018^1||^MGIT_960_AST
R|1|^AST_MGIT^439309967349^EMB^5.0^ug/ml|INST_COMPLETE^1234^R|||P||
19960502115414|19960502115414|MGIT960^^^13^B/A02
R|2|^AST_MGIT^439309967349^RIF^1.0^ug/ml|INST_COMPLETE^12^S|||P||
19960502115414|19960502115414|MGIT960^^^13^B/A03
L|1|N
```

A Request Record (Query) sent from an LIS to a MGIT960 instrument requesting all specimen results for a period of time.

```
H|\^&|||||||19990208000001
Q|1|^ALL^ALL||ALL||19980502123000|19980613123000
L|1|N
```

A Request Record (Query) sent from an LIS to a MGIT960 instrument requesting only ONGOING specimen results for a period of time.

```
H|\^&|||||||19990208000001
Q|1|^ALL^ALL||INST_ONGING||19980502123000|19980613123000
L|1|N
```

A Request Record (Query) sent from an LIS to a MGIT960 instrument requesting all specimen results which have been assigned the specified Accession #.

```
H|\^&|||||||19990208000001
Q|1|^Access1234||ALL
L|1|N
```

A Request Record (Query) sent from an LIS to a MGIT960 instrument requesting a specimen result which has been assigned the specified Sequence #.

```
H|\^&|||||||19990208000001
Q|1|^430109967349||ALL
L|1|N
```

A Request Record (Query) sent from an LIS to a MGIT960 instrument **requesting all specimen results which have been modified/changed since the last request.**

```
H|\^&|||||||19990208000001
Q|1|||ALL^^^MOD
L|1|N
```

A Request Record (Query) sent from an LIS to a MGIT960 instrument **requesting all G&D specimen results that went Positive between January 2, 1999 at 15:34:00 and January 3, 1999 at 15:34:00.**

```
H|\^&|||||||19990208000001
Q|1|||MGIT_GND^INST_POSITIVE||19990102123400|19990103123400
L|1|N
```

14.2. BD ProbeTec ET, BD Viper XTR, & BD Viper LT

BD ProbeTec ET supports ASTM E_1394 Logical Protocol and ASTM E_1381 Physical Protocol.

BD ProbeTec ET does not send results for specimens without accession or specimen numbers. As such the instrument does not allow LIS communication to be enabled unless the instrument Specimen Tracking/Accession Barcoding feature is enabled. The feature is enabled from a configuration screen.

14.2.1. Configurable Options

Comm Port Number – is a dedicated communication port on the instrument and therefore is not configurable.

Baud Rate – acceptable values are 2400, 4800, 9600, 14400, 19200, 38400. The instrument defaults to 9600. Viper LT will support Baud Rates of 300, 600, 1200, 1800, 2000, 2400, 3600, 4800, 7200, 9600, 14400, 19200, 28800, 38400, 57600, 115200.

Data Bits – acceptable values are 7 and 8. The instrument defaults to 8.

Stop Bits – acceptable values are 1 and 2. The instrument defaults to 1.

Parity - acceptable values are ODD, EVEN, and NONE. The instrument defaults to NONE.

Upload Mode – acceptable values are SOLICITED and UNSOLICITED. The instrument defaults to UNSOLICITED. The instrument in unsolicited mode uploads results as tests are completed. The instrument in solicited mode waits for the LIS to request the results.

Low Positive Status Upload – select 1 to enable the option or 0 to disable the option on BD ProbeTec ET. Check to enable the option on Viper XTR. If the option is enabled, a MOTA value greater than or equal to 2,000 and less than 10,000 will produce an **INST_LOW_POS Test Status LIS Code (R,4,1,1)**. Disabled is the default.

This feature is not supported for Viper LT.

Upload Algorithm Results – (BD Viper XTR & BD Viper LT) – Select check box to upload calculated algorithm value to the LIS.

Packed/Unpacked Frames – (BD Viper XTR & BD Viper LT) – Select checkbox to upload frames in Packed format.

14.2.2. Message Content**Field List**

Header Record Field Name	ASTM Pos.	Direction
Sender Name	H, 5, 1, 1	U
Version Number	H, 13, 1, 1	U
Message Date/Time	H 14, 1, 1	U

Order Record Field Name	ASTM Pos.	Direction
Accession Number	O, 3, 1, 1	U
Test ID	O, 5, 1, 4	U
Specimen Action Code	O, 12, 1, 1	U

Result Record Field Name	ASTM Pos.	Direction
Result Type Code	R, 3, 1, 4	U
Test/Consumable Sequence Number	R, 3, 1, 5	U
Test Status	R, 4, 1, 1	U
Result Data 1		
ProbeTecET/Viper XTR/Viper LT Alg. Results	R, 4, 1, 2	U
Test Start Date/Time	R, 12, 1, 1	U
Result/Status Date/Time	R, 13, 1, 1	U
Instrument Type	R, 14, 1, 1	U
Media/Assay Type	R, 14, 1, 2	U
Instrument Number	R, 14, 1, 4	U
Instrument Location	R, 14, 1, 5	U
QC Type	R, 14, 1, 6	U
QC Kit Lot Number	R, 14, 1, 7	U

Request Record Field Name	ASTM Pos.	Direction
Request Starting Patient Id	Q, 3, 1, 1	
Request Starting Accession Number	Q, 3, 1, 2	
Request Starting Sequence Number	Q, 3, 1, 3	
Request Ending Patient Id	Q, 4, 1, 1	
Request Ending Accession Number	Q, 4, 1, 2	
Request Ending Sequence Number	Q, 4, 1, 3	
Request Test Id	Q, 5, 1, 1	D
Request Test Status	Q, 5, 1, 2	
Request Instrument Type	Q, 5, 1, 3	
Request Instrument Number	Q, 5, 1, 4	
Request Result Qualifier	Q, 5, 1, 5	D
Request Time Qualifier	Q, 6, 1, 1	
Starting Date/Time	Q, 7, 1, 1	
Ending Date/Time	Q, 8, 1, 1	
Request Information Status Code	Q, 13, 1, 1	

Terminator Record Field Name	ASTM Pos.	Direction
Termination Code	L, 3, 1, 1	U/D

Field Descriptions

Header Fields

General

Patient Fields

BD ProbeTec ET does not support patient information and therefore always transmits an empty Patient record.

P|1

Order Fields

Accession Number (O, 3, 1, 1) – The unique alphanumeric string that identifies a specimen. This field can be up to 20 characters long, e.g. Acc123. This is a required field for processing specimen and test information. The instrument excludes the following special characters from being entered in the accession / specimen number field and therefore never transmits them: * ? [] #. Viper LT excludes the following additional characters: !|.

Test Id (O, 5, 1, 4) – BD ProbeTec ET transmits **BD_PROBETEC_GND** for the test id code field.

Specimen Action Code (O, 12, 1, 1) - In the special case when no accession / specimen number is transmitted then the Specimen Action Code is designated 'Q' as an indicator to treat the result as a QC result.

P|1

O|1|Accession_789 || ^ ^ ^BD_PROBETEC_GND

P|1

O|1||| ^ ^ ^BD_PROBETEC_GND|||||Q

Result Fields

Result Id Code (R, 3, 1, 4) – BD ProbeTec ET always transmits '**GND_PROBETEC**' for the result id code.

Test Sequence Number (R, 3, 1, 5) – Designates the assay kit lot number and is always 7 digits.

Test Status LIS Code (R, 4, 1, 1) – BD ProbeTec ET transmits the following specimen status:

INST_POSITIVE

INST_LOW_POS (If enabled, see Configurable Options. Not sent by BD Viper LT)

INST_NEGATIVE

INST_INDETERMINATE

INST_EQUIVOCAL (Not sent for BD Viper LT)

The instrument transmits the following QC status:

INST_QC_PASS

INST_QC_FAIL

Algorithmic Results (R, 4, 1, 2) – If enabled, see Configurable Options.

Test Start Date/Time (R, 12, 1, 1) – BD ProbeTec ET transmits the instrument's date and time that the specimen started its test. Time zone is not included.

Test Result Date/Time (R, 13, 1, 1) – BD ProbeTec ET transmits the instrument's date and time that the specimen ended its test. Time zone is not included. Typically, the test result date and time are 1 hour after the test start date and time.

Instrument Type (R, 14, 1, 1) – BD ProbeTec ET transmits a '**PROBETEC**' for its instrument type.

Media (Assay) Type (R, 14, 1, 2) – BD ProbeTec ET transmits the following assay types:

1 – CT assay	(Viper XTR)
2 – GC assay	(Viper XTR)
3 – Intentionally skipped	
4 – DTB assay	
5 – ctb assay	
6 – mac assay	
7 – kan assay	
8 – Intentionally skipped	
9 – CF assay	
10 – LP assay	
11 – MP assay	
12 – tCF assay	
13 – tMP assay	
14 – dCT assay	(Viper XTR, Viper LT)
15 – dGC assay	(Viper XTR, Viper LT)
16 – SCV assay	
17 – HSV1 assay	(Viper XTR)
18 – HSV2 assay	(Viper XTR)
19 – HPV assay	(Viper XTR – HR for Viper LT)
20 – TV assay	(Viper XTR)
200 – HPV 16	(Viper LT)
201 – HPV 18	(Viper LT)
202 – HPV 45	(Viper LT)
203 – HPV 31	(Viper LT)
204 – HPV 51	(Viper LT)
205 – HPV 52	(Viper LT)
206 – HPV 33/58	(Viper LT)
207 – HPV 56/59/66	(Viper LT)
208 – HPV 35/39/68	(Viper LT)
209 – GT	(Viper LT)

The list of assay types will expand as further assays are supported on the BD ProbeTec ET instrument.

Protocol Length (R, 14, 1, 3) – BD ProbeTec ET currently has a 1 hour test time and therefore does not transmit a protocol length.

Instrument Number (R, 14, 1, 4) – BD ProbeTec ET transmits the user configured instrument number that ranges from 1 to 99.

Instrument Location (R, 14, 1, 5) – BD ProbeTec ET transmits a plate number from 1 to 30, followed by a 96 microwell location of row (A–H), then column (1–12).

Viper XTR transmits a plate number from 1 to 60, followed by a 96 microwell location of row (A–H), then column (1–12).

Viper LT transmits a rack number from 1 to 30, followed by a 96 microwell location of row (A–H), then column (1–12).

QC Type (R, 14, 1, 6) – BD ProbeTec ET transmits a '+' or '-' if the parent Order record designates a QC result to indicate what type of QC, positive or negative QC.

QC Kit Lot Number (R, 14, 1, 7) – BD ProbeTec ET transmits a value only if parent order record is designated as a QC test.

```
P|1
O|1|Accession_789 || ^ ^ ^BD_PROBETEC_GND
R|1| ^ ^ ^ GND_PROBETEC ^000120299|INST_NEGATIVE| || || ||
|19981019153400|19981019163400| PROBETEC ^1^^3^14A10

P|1
O|1| || ^ ^ ^BD_PROBETEC_GND| || || || |Q
R|1| ^ ^ ^ GND_PROBETEC ^000120299|INST_QC_PASS| || || ||
|19981019153400|19981019163400| PROBETEC ^1^^3^14H12^+^000031500
```

Request Fields

The ASTM 1394 protocol defines this as a Request Information Record message. A download Request record is also known as a "Query". The only type of download "Query" request that the BD ProbeTec ET instrument accepts is a request for test results. The BD Probetec ET instrument will accept "query" requests in either the SOLICITED or UNSOLICITED settings for the Upload Mode as described above under Configurable Options. **Note, that the BD PROBETEC ET instrument does NOT request data from an LIS.**

For an ALL request, BD Viper LT will send up to 30 of the most recently completed racks.

Test ID (Q, 5, 1, 1) – BD ProbeTec ET accepts the following test name: **BD_PROBETEC_GND**. The keyword **ALL** can also be used to return all of the test results currently in the instrument.

```
Q|1| |BD_PROBETEC_GND
Q|1| |ALL
```

Result Qualifier (Q, 5, 1, 5) – BD ProbeTec ET accepts the following result qualifiers:

MOD – All available results that have not been previously transmitted to the LIS.

```
Q|1| |BD_PROBETEC_GND^^^^MOD
```

Terminator Field

General

14.2.3. Example ASTM 1394 Protocol

The following are examples of valid requests for test results from the LIS to the BD ProbeTec ET instrument that conform to the BD Common LIS Interface using the ASTM 1394 protocol:

A Request Record (Query) sent from an LIS to a BD ProbeTec ET instrument **requesting all test results currently in the instrument.**

For an ALL request, Viper LT will send up to 30 of the most recently completed racks.

H\^&

Q|1||ALL

L|1|N

A Request Record (Query) sent from an LIS to a BD ProbeTec ET instrument **requesting all available test results that have not been previously transmitted to the LIS.**

H\^&

Q|1|| BD_PROBETEC_GND^^^^MOD

L|1|N

14.2.4. Unsolicited Demographics Download (Viper LT)

Viper LT shall accept patient demographic fields from the LIS per the following tables:

Header Record Field Name	ASTM Pos.	Direction
Sender Name	H, 5, 1, 1	U/D
Version Number	H, 13, 1, 1	U/D
Message Date/Time	H 14, 1, 1	U/D

Patient Record Field Name	ASTM Pos.	Direction
Patient ID	P, 4, 1, 1	D
Date of Birth	P, 8, 1, 1	D
Patient Sex	P, 9, 1, 1	D
Hospital Service	P, 33, 1, 1	D
Hospital Client	P, 34, 1, 1	D

Order Record Field Name	ASTM Pos.	Direction
Accession Number	O, 3, 1, 1	D
Collection Date Time	O, 8, 1, 1	D

Terminator Record Field Name	ASTM Pos.	Direction
Termination Code	L, 3, 1, 1	U/D

14.2.4.1. Patient Fields

Patient ID (P, 4, 1, 1) - Identifier that uniquely identifies a patient. **This is a required field for patient demographic downloads.** This field can be up to 16 characters long (e.g. PatId123). If the field is blank, the record is ignored.

Date of Birth (P, 8, 1, 1) – Patient date of birth formatted as described in ASTM E_1394 section 6.6.2. This field is optional.

Patient Sex (P, 9, 1, 1) – There are 3 predefined values accepted for this (**M**)ale, (**F**)emale, and (**U**)nspecified. If the value does not match the code for either Male or Female then the sex is set to Unspecified. This field is optional.

Hospital Service (P, 33, 1, 1) – An acronym or abbreviation for the ward or hospital department involved in caring for this patient, e.g. ER may represent the Emergency Room. This field can be up to 20 characters long.

Hospital Client (P, 34, 1, 1) – This is the facility that the specimen came from, for instance Smith Radiology or Central Labs. This field is optional. This field can be up to 20 characters long.

14.2.4.2. Order Fields

Accession Number (O, 3, 1, 1) - Maximum field length: 20 characters. A unique alphanumeric string that identifies a specimen. If the field is blank, the record is ignored.

Collection Date Time (O, 8, 1, 1) Date and time that the specimen was collected from the patient, formatted as described in ASTM E_1394 section 6.6.2.

```
H|\^&|||||20130215184200
P|1||PatId123||^|19651029|M|^|
|||||ER|St. Josephs Hospital
O|1|Acc123||^|20130214023300|||||^|^|
L|1|N
```

14.3. BD Phoenix 100 and BD Phoenix M50

BD Phoenix 100 and BD Phoenix M50 support ASTM E_1394 Logical Protocol and ASTM E_1381 Physical Protocol.

14.3.1. Configurable Options

The BD Phoenix 100 and BD Phoenix M50 provide 3 groups of Configurable Options for customizing the LIS Interface.

General Options

Results Upload Options

Communications Setup

The instruments also provide an Organism Configuration Screen and an Antimicrobial Configuration Screen for editing LIS Codes.

14.3.1.1. General Options

Send Interpretation Results

Acceptable values are CHECKED and UNCHECKED. When CHECKED, final SIR values are included in the AST result record. The instrument defaults to CHECKED.

Unsolicited Queries

Acceptable values are CHECKED and UNCHECKED. When CHECKED, the instrument shall issue a query to the LIS at the time the panel is physically placed in the instrument if the panel is missing an organism id. The instrument defaults to UNCHECKED.

Send When Placed In Instrument

Acceptable values are CHECKED and UNCHECKED. When CHECKED, the instrument shall send a result upload to the LIS at the time the panel is physically placed in the instrument. The instrument defaults to CHECKED.

14.3.1.2. Results Upload Options

There are five results upload options, only one of which can be CHECKED at a time. The BD Phoenix M50 makes use of radio buttons which are SELECTED instead of CHECKED.

Solicited

Acceptable values are CHECKED and UNCHECKED. When CHECKED the instrument waits for the LIS to request the results. The instrument defaults to UNCHECKED.

Send On Finalization

Acceptable values are CHECKED and UNCHECKED. When CHECKED the instrument shall send results to the LIS when the panel is finalized or a modification has been made to a finalized panel. The instrument defaults to UNCHECKED.

Send On Completion

Acceptable values are CHECKED and UNCHECKED. When CHECKED the instrument shall send results to the LIS when the panel's status transitions to COMPLETE or a modification has been made to a COMPLETE panel. The instrument defaults to CHECKED.

Send as Available

Acceptable values are CHECKED and UNCHECKED. When CHECKED the instrument shall send results to the LIS when the panel's status transitions to COMPLETE or the panel has partial results. Partial results are when at least one MIC value is determined for an AST or ID/AST panel or the organism ID is determined for an ID/AST panel. The instrument defaults to UNCHECKED.

Send at Fixed Time

Acceptable values are CHECKED and UNCHECKED. When CHECKED the instrument shall send results to the LIS when the panel's status transitions to COMPLETE and send panels with partial results to the LIS at the Fixed Time. When the Fixed Time is reached, any panel that is ONGOING and has partial results shall be uploaded to the LIS with a Test Status of INST_PARTIAL_COMPLETE. The instrument defaults to UNCHECKED.

14.3.1.3. Communications Setup

NOTE: Modifying any of the following options will result in the BD Phoenix 100 or BD Phoenix M50 rebooting.

Baud Rate

Acceptable values are 2400, 4800, 9600, 14400, 19200, 38400. The BD Phoenix 100 and BD Phoenix M50 default to 9600. The BD Phoenix M50 also supports 57600 and 115200 baud rates.

Data Bits

Acceptable values are 7 and 8. The instrument defaults to 8.

Parity

Acceptable values are ODD, EVEN, and NONE. The instrument defaults to NONE.

Stop Bits

Acceptable values are 1 and 2. The instrument defaults to 1.

Packed Frames

Acceptable values for BD Phoenix 100 are YES and NO. Acceptable values for BD Phoenix M50 are CHECKED for YES and UNCHECKED for NO. Selecting YES allows message frames sent to the LIS to support multiple records per frame ("packed"). When NO is selected, only one record is transmitted per frame. The instrument defaults to YES.

14.3.1.4. Organism and Antimicrobial Configuration Screens

Except for antimicrobials listed in special messages and BDxpert Rules within comment fields, all referrals to organism IDs and antimicrobials in LIS communications use the LIS Codes stored in the instrument which are set to default values per Appendix C and Appendix D. These codes can be edited to a different value. The values in Appendix C and Appendix D represent most organisms and antimicrobials. The currently supported lists that can be edited are found on the BD EpiCenter, BD Phoenix 100, and BD Phoenix M50 configuration screens.

14.3.2. Modes of Communications

Download refers to communications from the LIS to the instrument and upload refers to communications from the instrument to the LIS. NOTE: The total size of a message downloaded to the instrument should not exceed 100k characters.

Note: New in version V5.02, results for orphan panels and QC panels are not uploaded to the LIS unless the panels satisfy the criteria of an LIS query.

The BD Phoenix 100 and BD Phoenix M50 shall support the following modes of communications with an LIS:

Result Uploads

The BD Phoenix 100 and BD Phoenix M50 shall upload results according to the CHECKED Results Upload Option. For AST sets, several result records shall be sent in a single message. Each result record shall report the results for a single drug in the AST set. For ID/AST combo tests, an ID result record is sent as the first result record, and the AST result records follow.

Query Uploads

The BD Phoenix 100 and BD Phoenix M50 shall upload queries if the Unsolicited Queries Option is CHECKED.

Order Downloads

The BD Phoenix 100 and BD Phoenix M50 shall accept order downloads. All orders must include either a Test ID or a Sequence Number, a valid Accession number and a valid Isolate Number. An order consisting of a valid Consumable Sequence Number and valid Accession\Isolate Number shall be saved to the instrument database as a PENDING panel. Orders without the Consumable Sequence Number shall be saved in the instrument, BUT must be associated to a Consumable Sequence Number via the LIS Login Screen prior to being saved to the instrument database on the BD Phoenix 100. Orders without the Consumable Sequence Number on the BD Phoenix M50 shall be ignored. Orders with invalid data shall be rejected by the instrument. See the Phoenix User Manual (RE: LIS Order Cancelled Messages) for more information regarding cancelled LIS orders.

If an order is received with an organism ID that is either unknown to the instrument or is an unclaimed organism, the order will still be saved to the database or saved for future association with a Consumable Sequence Number, BUT the organism ID will be replaced with Invalid Organism Received.

If an order is downloaded with a sequence number that already exists in the instrument and all populated order fields are valid, the panel record is populated/overwritten with the order fields. Modifications shall not be accepted for Finalized panels.

An order field with all spaces will be treated as "missing". Leading or trailing spaces are trimmed.

Query Downloads

The BD Phoenix 100 and BD Phoenix M50 shall accept download queries. The instrument shall accept queries on the following fields: Result Qualifier, Start Time, End Time, Request Time Qualifier, Sequence Number, Test ID, Status and Accession. Queries with invalid data shall be rejected by the instrument. See the Phoenix User Manual (RE: LIS Query Assembly Messages) for more information regarding invalid queries.

14.3.3. Message Content

The BD Phoenix 100 and BD Phoenix M50 shall exchange fields with the LIS per the following table:

Field List

The BD Phoenix 100 and BD Phoenix M50 shall exchange fields with the LIS per the following table:

Header Record Field Name	ASTM Pos.	Direction
Sender Name	H, 5, 1, 1	U
Version Number	H, 13, 1, 1	U
Message Date/Time	H 14, 1, 1	U

Order Record Field Name	ASTM Pos.	Direction
Accession Number	O, 3, 1, 1	U/D
Isolate Number	O, 3, 1, 2	U/D
Organism	O, 3, 1, 3	U/D
Test ID	O, 5, 1, 4	U/D
Test/Consumable Sequence Number	O, 5, 1, 5	U/D
Priority	O, 6, 1, 1	U/D
Report Type	O, 26, 1, 1	U

Result Record Field Name	ASTM Pos.	Direction
Result Type Code	R, 3, 1, 4	U
Test/Consumable Sequence Number	R, 3, 1, 5	U
Antibiotic	R, 3, 1, 6	U
Test Status	R, 4, 1, 1	U
Result Data 1		
AST MIC for AST MIC Result	R, 4, 1, 2	U
Organism ID for ID Result	R, 4, 1, 2	U
Result Data 2		
AST susceptibility (Final)	R, 4, 1, 3	U
Profile Number for ID Test	R, 4, 1, 3	U
Result Data 3		
Resistance Marker 1	R, 4, 1, 4	U

Result Record Field Name	ASTM Pos.	Direction
Result Data 4		
Resistance Marker 2	R, 4, 1, 5	U
Result Data 5		
Resistance Marker 3	R, 4, 1, 6	U
Result Data 6		
Resistance Marker 4	R, 4, 1, 7	U
Result Data 7		
Resistance Marker 5	R, 4, 1, 8	U
Resistance Marker 6	R, 4, 1, 9	U
Resistance Marker 7	R, 4, 1, 10	U
Resistance Marker 8	R, 4, 1, 11	U
Resistance Marker 9	R, 4, 1, 12	U
Resistance Marker 10	R, 4, 1, 13	U
Preliminary/Final Status	R, 9, 1, 1	U
Test Start Date/Time	R, 12, 1, 1	U
Result/Status Date/Time	R, 13, 1, 1	U
Test Complete Date/Time	R, 13, 2, 1	U
Instrument Type	R, 14, 1, 1	U
Instrument Number	R, 14, 1, 4	U
Instrument Location	R, 14, 1, 5	U

Comment Record Field Name	ASTM Pos.	Direction
Comment Text	C, 4, 1, 1	U
Comment Type	C, 5, 1, 1	U

Request Record Field Name	ASTM Pos.	Direction
Request Starting Accession Number	Q, 3, 1, 2	U/D
Request Starting Sequence Number	Q, 3, 1, 3	U/D
Request Test Id	Q, 5, 1, 1	D
Request Test Status	Q, 5, 1, 2	D
Request Result Qualifier	Q, 5, 1, 5	D
Request Time Qualifier	Q, 6, 1, 1	D
Starting Date/Time	Q, 7, 1, 1	D
Ending Date/Time	Q, 8, 1, 1	D

Terminator Record Field Name	ASTM Pos.	Direction
Termination Code	L, 3, 1, 1	U/D

Field Descriptions

Patient Fields

BD Phoenix 100 and BD Phoenix M50 do not support patient demographics and therefore shall send an empty Patient record.

Order Fields

Accession Number (O, 3, 1, 1) - Maximum field length: 20 characters. A unique alphanumeric string that identifies a specimen.

Isolate Number (O, 3, 1, 2) - Maximum field length: 2 characters. Allowable range: 1-20. The number associated with an isolate.

Organism (O, 3, 1, 3) - Maximum field length: 20 characters. LIS code of the organism ID. The organism ID for an ID panel or an ID/AST panel is the User ID if it exists, or if a User ID does not exist and the panel has a single Instrument ID, it is the Instrument Organism ID. The organism ID for an AST panel is the User ID if it exists, or if a User ID does not exist and the panel has been auto associated, it is the Instrument Organism ID. Organism IDs and their corresponding LIS codes can be viewed/edited in the instrument's Organism Configuration Screen

For QC Panels the organism ID shall be the Test Strain.

Test ID (O, 5, 1, 4) - Maximum field length: 20 characters. Populated with the panel format abbreviation as shown on the panel's barcode label. Appendix B contains a sample list.

Test/Consumable Sequence Number (O, 5, 1, 5) - 12 digit numeric string identifying the instrument consumable.

Priority (O, 6, 1, 1) - Maximum field length: 1 character. This field is defined in the ASTM E_1394 specification. Currently only the values 'A' for Critical, 'R' for Normal and blank for default normal or no change are supported.

Report Type (O, 26, 1, 1) – This field is defined in the ASTM E_1394 specification. When a cancelled order is sent back to the LIS the report type is 'X'.

Result Fields

The BD Phoenix 100 and BD Phoenix M50 uploads shall consist of AST results and ID results. The information contained in the generic "Data Fields" depends on the type of result being reported. AST Result records contain antimicrobial and susceptibility information. ID Result records contain organism and Resistance Marker information.

Result ID Code (R, 3, 1, 4) A BD defined code that indicates the type of information in the result record. The keyword **AST_MIC** indicates results for a MIC based Antimicrobial Susceptibility Test and the keyword **ID** indicates identification results.

Test/Consumable Sequence Number (R, 3, 1, 5) – 12 digit numeric string identifying the instrument consumable.

Antimicrobial (R, 3, 1, 6) (AST Results) Populated with the LIS code corresponding to the antimicrobial. Antimicrobials and their corresponding LIS codes can be viewed/edited in the instrument's Antimicrobial Configuration Screen. This field can be up to 20 characters long.

Test Status LIS Code (R, 4, 1, 1) For non QC panels this field is populated with one of the statuses listed in Appendix B. For QC panels that are ONGOING or PENDING, the status is reported as for non QC panels, however, for COMPLETED panels the status is INST_QC_PASS or INST_QC_FAIL.

Result Data Field 1

The contents of the Result Data fields vary depending on the type of result being reported, as described below.

Minimum Inhibitory Concentration (R, 4, 1, 2) (MIC based AST Result) For AST tests that produce MIC values; this field contains the minimum antibiotic concentration that inhibits growth of the tested organism. This field can be up to 20 characters long and is assumed to contain a number in ug/mL.

This field may contain signed MIC values such as “<=4” or “>8”, MIC values for compound antimicrobials such as “0.5/4” or “<=0.5/16” as well as the following:

“?” - Ongoing

“C” - Antimicrobial is Rapid Completed (*For nonQC tests in V4.01 and later*)

“X” - Error

Note: For QC panels, MIC values of X will be uploaded to the LIS for V4.01. The uploaded MIC values for QC panels are 'blank' in previous software versions.

Organism (R, 4, 1, 2) (*ID Results Only*) LIS code of the organism ID. The organism ID for an ID panel or an ID/AST panel is the User ID if it exists or if a User ID does not exist and the panel has a single Instrument ID it is the Instrument Organism ID. The organism ID for an AST panel containing a resistance marker, otherwise the organism ID is only included in the order record. Organism IDs and their corresponding LIS codes can be viewed/edited in the instrument's Organism Configuration Screen. This field can be up to 20 characters long.

Result Data Field 2

AST Susceptibility, Final (R, 4, 1, 3) (*AST results only*) This is a code that indicates the organism's susceptibility to the antibiotic specified in this record. The acceptable values for this field are, blank, S, I, R, N, X representing MIC is pending, susceptible, intermediate, resistant, not susceptible and error respectively.

Result Data Field 3

Resistance Marker 1 (R, 4, 1, 4) (*ID results*) This represents a Resistance Marker associated with the organism identified in the ID result record. This field can be up to 8 characters long. Examples of Resistance Markers and their corresponding LIS codes are listed below.

Extended Spectrum B-Lactamase	RM_ESBL
Methicillin Resistant Staphylococcus	RM_MRSA
Streptomycin HLAR	RM_HLSR
B-Lactamase in Gram Positive Cocci	RM_GP_BL
Vancomycin Resistant Enterococci	RM_VRE
Gentamicin HLAR	RM_HLGR
High Level Kanamycin Resistant	RM_HLKR
Streptococcus MLSb Phenotype	RM_MLSB
Streptococcus Macrolide Efflux Phenotype	RM_MEFF
High Level Penicillin Resistant S. Pneumoniae	RM_HLPRSP
Low Level Penicillin Resistant S. Pneumoniae	RM_LLPRSP
High Level Mupiricin Resistant Staphylococcus	RM_HLMUP

Result Data Field 4

Resistance Marker 2 (R, 4, 1, 5) (*ID results*) This represents a Resistance Marker associated with the organism identified in the ID result record. This field can be up to 8 characters long. Examples of Resistance Markers and their corresponding LIS codes are listed under **Result Data Field 3**.

Result Data Field 5

Resistance Marker 3 (R, 4, 1, 6) (ID results) This represents a Resistance Marker associated with the organism identified in the ID result record. This field can be up to 8 characters long. . Examples of Resistance Markers and their corresponding LIS codes are listed under **Result Data Field 3**.

Resistance Marker 4-10 (R, 4, 1, 7-13) (ID results) This represents a Resistance Marker associated with the organism identified in the ID result record. This field can be up to 8 characters long. . Examples of Resistance Markers and their corresponding LIS codes are listed under **Result Data Field 3**.

Preliminary/Final Status (R, 9, 1, 1) This field contains either a “P” for preliminary status or an “F” for final status, which occurs when the panel is finalized at the instrument.

Start Date/Time (R, 12, 1, 1) This is the date and time that the panel was physically placed in the instrument. This field is represented in the YYYYMMDDHHMMSS format.

Result/Status Date/Time (R, 13, 1, 1) This is the date and time that the panel’s status transitioned to COMPLETE. This field is represented in the YYYYMMDDHHMMSS format.

Test Complete Date/Time (R, 13, 2, 1) (ID results) This is the date and time that the ID panel obtained an ID. (**AST results**) This is the date & time that a drug obtained a valid MIC. This field is represented in the YYYYMMDDHHMMSS format.

Instrument Type (R, 14, 1, 1) Identifies the instrument with the keyword PHOENIX.

Instrument Number (R, 14, 1, 4) Instrument number between 1 and 99.

Instrument Location (R, 14, 1, 5) Indicates the panel position inside the instrument as a 3 character string represented in TierStation format. Tier values are A-D and station values are 1-25. This field is empty for PENDING panels.

Request Fields

Starting Accession Number (Q, 3, 1, 2) - Maximum field length: 20 characters. This field should be populated if the request is for either a single specimen or for a range of specimens. If accession number is not to be used as a search criterion for requested data, then this field can be left blank. Populating this field with the keyword ALL queries for all panels in the instrument database that meet the remaining criteria.

Starting Sequence Number (Q, 3, 1, 3) - Required field length: 12 digit consumable ID value. This field should be populated if the request is for a single panel. If sequence number is not to be used as a search criterion for requested data, then this field can be left blank. Populating this field with the keyword ALL queries for all panels in the instrument database that meet the remaining criteria.

Test ID (Q, 5, 1, 1) - Maximum field length: 20 characters. This field should be populated with the test type (ID, AST_MIC). The BD Phoenix 100 and BD Phoenix M50 accept the keywords **ID** and **AST_MIC** as valid test types as well as the pre-defined test names. See appendix B for examples. Populating this field with the keyword **ALL** queries for all panels in the instrument database that meet the remaining criteria.

Test Status (Q, 5, 1, 2) The BD Phoenix 100 and BD Phoenix M50 accept queries for panels with a status as follows:

- **INST_ONGOING**, panels with an ongoing status that may or may not yet contain results.
- **INST_COMPLETE**, panels with a complete, rapid complete, in attention ignored, in attention complete, QC pass, or QC fail status
- **INST_RAPID_COMPLETE**, panels with a rapid complete status
- **INST_PARTIAL_COMPLETE**, panels with an ongoing status that have obtained results.
- **INST_QC_PASS**, QC panels with a passed QC status
- **INST_QC_FAIL**, QC panels with a failed QC status

Result Qualifier (Q, 5, 1, 5) The only acceptable value for this field is the keyword **MOD** to request only results that have been modified since the last request.

Time Qualifier (Q, 6, 1, 1) - Maximum field length: 1 character. The acceptable values for this field are 'S' which indicate the following date time fields refer to test start times or 'R' which indicate the following date time fields can refer to result/status times.

Starting Date/Time (Q, 7, 1, 1) The starting date/time (inclusive) of the data requested represented in the YYYYMMDDHHMMSS format.

Ending Date/Time (Q, 8, 1, 1) The ending date/time (inclusive) of the data requested represented in the YYYYMMDDHHMMSS format.

Comment Fields

The BD Phoenix 100 and BD Phoenix M50 send comment strings for BDXpert rule text and special messages.

The following is an example of a comment record containing a rule where <310> is the rule number and (AMX, ATM, CAZ) is a list of the affected antimicrobials.

C|1| |<310> BDXpert Rule 310 text.(AMX, ATM, CAZ)|E

Special Messages are messages that indicate a special condition for a BD Phoenix 100 panel.

The following is an example of a comment record containing a special message with a list of the affected antimicrobials.

C|1| | Special message text.(AM, CAZ)|T

Comment Text (C, 4, 1, 1) – The text to be used for the patient, specimen or isolate comment. This field can be up to 1600 characters long.

Comment Type (C, 5, 1, 1) – The type of comment record. This field should be an **E**, or **T** for BDXpert rule, or special message comments respectively.

Terminator Field

General

14.3.4. Example ASTM 1394 Protocol

Result Upload Examples

Example of a rejected order

H\^&|||Becton Dickinson|||||V1.0|20031110093857
P|1
O|1|~!@#\$^1||^CT04N|||||||X
C|1||LIS Order Cancelled: Invalid Accession Number Field|T
L|1|N

Example of a “Send When Placed in Instrument” result upload

H\^&|||Becton Dickinson|||||V1.0|20031110101102
P|1
O|1|IDAST 1^1||^GNIDAST 951^429510000001|R
R|1|^ID^429510000001|INST_ONGOING||||P||20031110101102||PHOENIX^^^1^C7
R|2|^AST_MIC^429510000001^AM|INST_ONGOING^?^ ||||P||
20031110101102||PHOENIX^^^1^C7
R|3|^AST_MIC^429510000001^AN|INST_ONGOING^?^ ||||P||
20031110101102||PHOENIX^^^1^C7
R|4|^AST_MIC^429510000001^AMC|INST_ONGOING^?^ ||||P||
20031110101102||PHOENIX^^^1^C7
L|1|N

Example of a result upload for an ID panel

H\^&|||Becton Dickinson|||||V1.0|20031110102747
P|1
O|1|ID 1^1^ALCPIE||^GNID 952^429520000001|R
R|1|^ID^429520000001|INST_COMPLETE^ALCPIE||||P||20031110101102|
20031110102747\20031110102747|PHOENIX^^^1^D7
L|1|N

Example of result uploaded to an LIS with the Send Interpretation Results option UNCHECKED

H\^&|||Becton Dickinson|||||V1.0|20031110114736
P|1
O|1|IDAST 1^1^SHISPE||^G^NIDAST 951^429510000001|R
R|1|^ID^429510000001|INST_COMPLETE^SHISPE||||P||20031110112648|
20031110114736\20031110114735|PHOENIX^^^1^A7
R|2|^AST_MIC^429510000001^AM|INST_COMPLETE^<=4^S||||P||
20031110112648|20031110114736\20031110114735|PHOENIX^^^1^A7
R|3|^AST_MIC^429510000001^AN|INST_COMPLETE^<=4^S||||P||
20031110112648|20031110114736\20031110114735|PHOENIX^^^1^A7
R|4|^AST_MIC^429510000001^AMC|INST_COMPLETE^<=4/2^S||||P||
20031110112648|20031110114736\20031110114735|PHOENIX^^^1^A7
L|1|N

Example of a result upload for an ID/AST panel with special messages, resistance markers and the Send Interpretation Results option UNCHECKED

H\^&|||Becton Dickinson|||||V1.0|20031110150803
P|1
O|1|ABC^1^ENTCFAA||^CT01P^424940000029|R
C|1||The MICs for this antibiotic and species combination are not reported by the Phoenix system. An alternate method should be utilized.(RA)|T
C|2||Fill failures were detected with this antibiotic and no MIC can be determined. The isolate should be retested.(CF)|T
R|1|^ID^424940000029|INST_IN_ATTN_COMPLETE^ENTCFAA^^RM_VRE^RM_HLSR^RM_HLGR||||P||20031110145645|20031110150803|PHOENIX^^^1^C5
R|2|^AST_MIC^424940000029^AM|INST_IN_ATTN_COMPLETE^>32||||P||20031110145645|20031110150803\20031110150802|PHOENIX^^^1^C5
R|3|^AST_MIC^424940000029^AZM|INST_IN_ATTN_COMPLETE^>8||||P||20031110145645|20031110150803\20031110150802|PHOENIX^^^1^C5
R|4|^AST_MIC^424940000029^CAZ|INST_IN_ATTN_COMPLETE^>64||||P||20031110145645|20031110150803\20031110150802|PHOENIX^^^1^C5
R|5|^AST_MIC^424940000029^CC|INST_IN_ATTN_COMPLETE^>8||||P||20031110145645|20031110150803\20031110150802|PHOENIX^^^1^C5
L|1|N

Query Upload Examples

Example of an Unsolicited Query uploaded due to a missing organism id

H\^&|||Becton Dickinson|||||V1.0|20031110151943

Q|1|^InvOrg^429530000072

L|1|N

Order Download Examples

Example of a download order for a critical panel

H\^&|||

P|1

O|1|Critical^1||^GNID 952|A

L|1|N

Query Download Examples

For test start times between Nov 10,2003 at 09:00:00 and Nov 10,2003 at 16:00:00

H\^&

Q|1|||S|20031110090000|20031110160000

L|1|N

For test result times after Nov 10,2003 at 09:00:00

H\^&

Q|1|||S|20031110090000||

L|1|N

For panels that have partial results and have been modded since the last request

H\^&

Q|1|||^INST_PARTIAL_COMPLETE^^MOD

L|1|N

For the panel with 429530000072 sequence number

H\^&

Q|1|^429530000072||

L|1|N

For ALL accession numbers

H\^&

Q|1|||ALL|||

L|1|N

14.4. BD BACTEC FX

14.4.1. BD BACTEC FX LIS Configuration Screen

The BD BACTEC FX LIS Configuration Screen allows the user to specify the configurable behavior of the LIS interface. To navigate to the BD BACTEC FX LIS Configuration Screen select the Configuration Tab then the LIS Tab. The configurable options on the BD BACTEC FX LIS Configuration Screen are somewhat different than the parameters specified within the BD BACTEC 9000 Configuration File but are intended to give the user most of the same LIS interface functionality.

The BD BACTEC FX LIS interface is configured by enabling and defining fields within the LIS tab on the BD BACTEC FX Configuration screen. If parameters are changed on the LIS configuration screen, the new configuration will take effect immediately after the SAVE button is pressed. The BD BACTEC FX doesn't need to and will not restart after the LIS configuration parameters are changed (BD BACTEC 9000 requires reboot after configuration changes). However BD recommends that the host LIS be inactive during the reconfiguration period. An LIS download transaction could be lost during the reconfiguration of the BD BACTEC FX LIS interface. In addition the BD BACTEC FX's response to an active LIS query will not be transmitted or cancelled.

14.4.2. BD BACTEC FX Configurable Options

14.4.2.1. LIS ENABLE Group

The options for this group are mutually exclusive.

Possible parameters:

ENABLED

DISABLED

Default: DISABLED

14.4.2.2. Port Parameters Group

Parameters defined in this group control the communication parameters assigned to the serial communications port on the BD BACTEC FX that is connected to the LIS

14.4.2.2.1. BAUD

The BAUD parameter allows the adjustment of the speed of the communications link between the LIS system and the BD BACTEC FX.

Possible parameters:

1200

2400

4800

9600

19.2K

Default: 9600

14.4.2.2.2. PARITY

The PARITY parameter allows for the adjustment of the error check that can be performed on every character that is received and transmitted.

Possible parameters:

NONE

ODD

EVEN

Default: NONE

14.4.2.2.3. DataBits

The Databits parameter allows for the adjustment of the size of the character that is transmitted and received by the Physical Protocol Layer.

Possible parameters:

7 DataBits

8 DataBits

Default: 8 DataBits

14.4.2.2.4. STOPBits

The STOPBits parameter allows for the adjustment of the number of stop bits that are appended to the characters that are transmitted by the Physical Protocol Layer.

Possible parameters:

1 StopBit

2 StopBits

Default: 1 StopBit

14.4.2.3. Physical Layer Group

This group allows the user to select between the physical communications protocols that the LIS interface will use.

The options for this group are mutually exclusive.

Possible parameters:

ASTM 1381

BDMODEM

Default: BDMODEM

NOTE: If the ASTM physical layer is to be used for LIS communication, refer to the BD LIS interface specification for ASTM interfaces, document number L-005933.

14.4.2.4. LIS Options Group

This group allows the user to define the LIS/LAB specific workflow (dictating when data is sent to the LIS) and the types of data that will be sent to the LIS.

14.4.2.4.1. Upload Pos Result

When this checkbox is enabled (checked), Positive results will be uploaded to the LIS, whenever a Results Upload to the LIS occurs (see LIS Solicited Results section 14.4.2.4.2).

Default: Disabled

14.4.2.4.2. LIS Solicited Results

If LIS Solicited Results is enabled (checked), Negative Results will be sent only when the LIS requests results. If Upload Positive Results is enabled, Positive results will also be sent to the LIS when solicited.

If LIS Solicited Results is disabled (unchecked), Negative results will be sent automatically when the vial goes out of protocol. If Upload Positive Results is enabled, Positive results will also be sent to the LIS when the vial turns Positive. If Vial Tracking is enabled, then Vial Tracking information will also be sent automatically to the LIS when the vial's location changes.

Default: Solicit

14.4.2.4.3. Vial Tracking

When this function is enabled (checked) Vial Tracking information will be sent to the LIS when the vial location changes (INST_NEW, INST_REMOVED, INST_REENTERED). This function is disabled when the LIS Solicited Results checkbox is enabled (checked) so therefore, Vial Tracking information will only be sent unsolicited. The BD BACTEC FX will report INST_REENTERED for all vials that have been removed and reentered. The workflow for BD BACTEC FX allows the operator to remove an ongoing vial and reenter it.

Default: Disabled

14.4.2.4.4. Host Query Mode

The BD BACTEC FX will perform a Host Query to request patient demographics information from the LIS for any vial without a patient name/id that has an associated accession number. This option only works if Accession Barcoding is enabled on the Configuration screen and the LIS Solicited Results (is not selected) is operating in the Unsolicited mode.

Possible parameters:

MANUAL

User initiated Batch Host Query. When this option is selected the user can initiate a Batch Host Query via the Maintenance\Test tab by pressing the LIS button. A Batch Host Query consists of multiple individual SINGLE Host Queries for all vials in the BD BACTEC FX database without Patient Demographics. When this option is selected the parameter Query Timeout can also be adjusted within the LIS Options Group. The Query Timeout dictates how long the BD BACTEC FX will wait for the LIS to respond to a Host Query before sending the next Host Query requesting Patient data for the next vial.

SINGLE

A Single Host Query is initiated when a new vial with an accession number is entered. When this option is selected the parameter Query Timeout can also be adjusted within the LIS Options Group. The Query

Timeout dictates how long the BD BACTEC FX will wait for the LIS to respond to a Host Query before sending the next Single Host Query requesting Patient data for the next newly entered vial.

AUTO

In Auto Mode the BD BACTEC FX will perform a Single Host Query when a new vial with an accession number is entered. It will also initiate a Batch Host Query based on the frequency defined in the Auto HQ Interval field. So if the LIS doesn't respond to the Single Host Query when a vial is loaded, the BD BACTEC FX will automatically gather the missing patient information via a Batch Host Query sent at the next Auto HQ Interval. In AUTO mode the parameter Query Timeout can also be adjusted within the LIS Options Group. The Query Timeout dictates how long the BD BACTEC FX will wait for the LIS to respond to a Single Host Query before sending the next Single Host Query requesting the demographic for the next vial.

DISABLED

Do not initiate a Host Query of any kind due to instrument workflow.

Default: AUTO

Query Timeout

Query Timeout is enabled for AUTO, SINGLE and MANUAL Host Query modes. It can be set from 1–99 seconds. The Query Timeout dictates how long the BD BACTEC FX will wait for the LIS to respond to a Single Host Query before sending the next Single Host Query requesting the demographic associated with the next vial.

14.4.2.4.5. Auto HQ Interval

Auto HQ Interval can be set for AUTO mode. It can be set from 1–999 minutes. This parameter dictates the frequency the BD BACTEC FX will perform an AUTO Batch Host Query.

14.4.2.4.6. Log Comms Checkbox

The Log Comms checkbox is used as a tool for BD personnel in order to assist in troubleshooting LIS communication issues. When enabled and a USB key is present, additional low-level messages are logged to a file on the USB key. These messages, when used in tandem with the LIS messages from the event log, will assist in deciphering any communications issues.

14.4.2.4.7. Force Upload Checkbox

The Force Upload checkbox is to be used as a troubleshooting mechanism for LIS communication issues. When checked (and saved via the <Save> button on the LIS configuration tab) the Save button on the Culture Screen Vial Tab shall be disabled and the 'Send' button shall be displayed and enabled in its place when non-modified vial data is recalled into the Vial Tab. Pressing the 'Send' button will transmit a Result record of the recalled vial on the Culture screen to the LIS

14.4.2.5. ASTM 1381 Group

Not applicable for the BDModem Protocol. This group allows the user to specify Packed Frames or Unpacked Frames.

Packed Frames ON/OFF

Default: ON

14.4.2.6. BD Modem Group

The parameters defined within this group are used to determine where specific data is located in the LIS records and to define the expected characters in a message to determine specific information.

14.4.2.5.1. New Sequence Position

To ensure backwards-compatibility with LIS interfaces written prior to this specification, this option indicates where barcodes would be found in an Order record, regardless if they are downloaded or not. The NEW parameter should only be used if an LIS interface is being written or updated to this specification.

Possible parameters:

OLD

NEW

Default: NEW

14.4.2.5.2. Hospital Service Field (33)

This parameter allows the selection of the field for placement of the Hospital Service Code in the Patient Record, for both download and upload. This parameter allows vendors who have implemented the old BD DMC LIS interface to use code that they already have. The DMC LIS (OLD interface) interface calls for the Hospital Service Code to be placed in field 26 of the record. The BD BACTEC 9000 LIS (NEW interface) interface calls for the Hospital Service Code to be placed in field 33 of the record. This option should be set to match the location that the LIS vendor will be using to provide the Hospital Service Code. If the dialog box is checked the Hospital Service Code is in field 33. If it is not checked the Hospital Service Code will be in field 26

Possible parameters: 26 or 33

Default: 33

14.4.2.5.3. SOH

The SOH parameter allows the selection of the character that will be used to indicate the Start Of Header for a message. The values are specified in hex.

Possible parameters: 00hex..FFhex

Default: 01hex

14.4.2.5.4. EOT

The EOT parameter allows the selection of the character that will be used to indicate the End Of Text for a message. The values are specified in hex. The value that is used by the LIS vendors could be one of two possible values. The protocol has been implemented with EOT set to 2 or 4. When the LIS system is configured the LIS vendor should indicate

the value that they are using for EOT. The EOT value in the configuration file should be set accordingly.

Possible parameters: 00hex..FFhex

Default: 04hex

14.4.2.5.5. ACK

The ACK parameter allows the selection of the character that will be used to indicate the Acknowledgement for a message. The values are specified in hex.

Possible parameters: 00hex..FFhex

Default: 06hex

14.4.2.5.6. NAK

The NAK parameter allows the selection of the character that will be used to indicate the Negative Acknowledgement for a message. The values are specified in hex.

Possible parameters: 00hex..FFhex

Default: 15hex

14.4.2.5.7. CAN

The CAN parameter allows the selection of the character that will be used to indicate the Cancellation for a message. The values are specified in hex.

Possible parameters: 00hex..FFhex

Default: 18hex

14.4.2.5.8. SYN

The SYN parameter allows the selection of the character that will be used to indicate the Synchronization request for the start of a message. This control character has been implemented using two different values. The LIS vendor should be queried as to the value they used in the implementation and the option set accordingly. The two values that have been used are 26 and 16 hex. The values are specified in hex.

Possible parameters: 00hex..FFhex

Default: 16hex

14.4.2.7. Send Button

When vial information for a non-pending, non-orphan sequenced vial is recalled onto the Culture screen, the <Send> button shall become enabled – when the Force Upload Checkbox is enabled (see section 14.4.2.4.7).

Touching the <Send> button shall cause the displayed vial data to be transmitted as an LIS message immediately. Since this is used as a troubleshooting mechanism, the information will be formulated into the appropriate LIS message format and the LIS message to be transferred to the attached LIS.

Once any data on the Culture Screen Vial Tab has been modified, the 'Send' button shall be removed from the display and the 'Save' button shall be displayed and disabled.

14.4.2.8. Print Button

The Print button on the Maintenance/Configuration/Lis tab shall be displayed and enabled when the LIS interface is enabled.

When enabled, the Print button shall be accessible by all users; no password or enabling of the Log Comm checkbox is required in order for this button to be operational.

Touching the Print button shall cause all of the LIS messages that are contained in the event log to be printed to the selected printer in the selected language. This will include the messages time stamp in order for the timing of these messages as well as the low-level messages being saved on the USB key to be coordinated.

14.4.3. Message Content**14.4.3.1. Field List**

The BD BACTEC FX shall exchange fields with the LIS per the following table:

Header Record Field Name	ASTM Pos.	Direction
Sender Name	H, 5, 1, 1	U
Version Number	H, 13, 1, 1	U
Message Date/Time	H 14, 1, 1	U

Patient Record Field Name	ASTM Pos.	Direction
Patient ID	P, 4, 1, 1	U/D
Patient Last Name	P, 6, 1, 1	U/D
Patient First Name	P, 6, 1, 2	D
Patient Middle Name	P, 6, 1, 3	D
Patient Name Suffix	P, 6, 1, 4	D
Patient Name Title	P, 6, 1, 5	D
Old Hospital Service	P, 26, 1, 1	U/D
Hospital Service	P, 33, 1, 1	U/D

Order Record Field Name	ASTM Pos.	Direction
Accession Number	O, 3, 1, 1	U/D
Old Sequence 1	O, 3, 1, 3	D
Old Sequence 2	O, 3, 2, 3	D
Old Sequence 3	O, 3, 3, 3	D
Old Sequence 4	O, 3, 4, 3	D
Old Sequence 5	O, 3, 5, 3	D
Old Sequence 6	O, 3, 6, 3	D
Old Sequence 7	O, 3, 7, 3	D
Old Sequence 8	O, 3, 8, 3	D
Old Sequence 9	O, 3, 9, 3	D
Old Sequence 10	O, 3, 10, 3	D
Test ID	O, 5, 1, 4	U
Sequence 1	O, 5, 1, 5	D
Sequence 2	O, 5, 2, 5	D
Sequence 3	O, 5, 3, 5	D
Sequence 4	O, 5, 4, 5	D
Sequence 5	O, 5, 5, 5	D
Sequence 6	O, 5, 6, 5	D
Sequence 7	O, 5, 7, 5	D
Sequence 8	O, 5, 8, 5	D
Sequence 9	O, 5, 9, 5	D
Sequence 10	O, 5, 10, 5	D
Collection Date Time	O, 8, 1, 1	U/D

Result Record Field Name	ASTM Pos.	Direction
Result ID Code	R, 3, 1, 4	U
Result Sequence Number	R, 3, 1, 5	U
Test Status	R, 4, 1, 1	U
Prelim Status	R, 9, 1, 1	U
Start Date Time	R, 12, 1, 1	U
End Date Time	R, 13, 1, 1	U
Instrument Type	R, 14, 1, 1	U
Media Type	R, 14, 1, 2	U
Protocol Length	R, 14, 1, 3	U
Instrument Number	R, 14, 1, 4	U
Instrument Location	R, 14, 1, 5	U

Request Record Field Name	ASTM Pos.	Direction
Request Starting Accession Number	Q, 3, 1, 2	U
Request Test Status	Q, 5, 1, 2	D
Starting Date/Time	Q, 7, 1, 1	D
Ending Date/Time	Q, 8, 1, 1	D
Request Information Status Code	Q, 13, 1, 1	U/D

Terminator Record Field Name	ASTM Pos.	Direction
Termination Code	L, 3, 1, 1	U/D

14.4.3.2. Field Descriptions

14.4.3.2.1. Header Fields

General – Same as BD EpiCenter (see section 8.2.1)

14.4.3.2.2. Patient Fields

Patient ID (P, 4, 1, 1) - Identifier that uniquely identifies a patient. **This is a required field for patient demographic downloads.** This field can be up to 16 characters long, e.g. PatId123.

Patient Name (P, 6, 1, 1-5) – Patient name is divided into 5 components in the ASTM E_1394 specification. The BD BACTEC FX stores these fields as a single string in its database. Therefore the BD LIS Interface concatenates these fields from a download message. The patient name can be up to 40 characters long. If these fields are selected for upload on the BD BACTEC FX the whole name is placed in the first component of this field (P, 6, 1, 1). Patient name shown in the sample record is Dr. John R Doe Jr.

Patient Last Name (P, 6, 1, 1)

Patient First Name (P, 6, 1, 2)

Patient Middle Name (P, 6, 1, 3)

Patient Name Suffix (P, 6, 1, 4)

Patient Name Title (P, 6, 1, 5)

Old Hospital Service (P, 26, 1, 1) – (Do Not Use unless the LIS vendor has previously implemented the old BD DMC LIS interface and that code is reused). An acronym or abbreviation for the ward or hospital department involved in caring for this patient, e.g. ER may represent the Emergency Room. (Old Hospital Service field only for compatibility with older BD BACTEC 9000 LIS interfaces).

Hospital Service (P, 33, 1, 1) – An acronym or abbreviation for the ward or hospital department involved in caring for this patient, e.g. ER may represent the Emergency Room.

Accession Number (O, 3, 1, 1) - Maximum field length: 20 characters. A unique alphanumeric string that identifies a specimen.

Old Sequence1 (O, 3, 1, 3) – (Do Not Use unless the LIS vendor has previously implemented the old BD DMC LIS interface and that code is reused). 12 digit numeric string identifying the instrument consumable.

Old Sequence2 (O, 3, 2, 3) – (Do Not Use unless the LIS vendor has previously implemented the old BD DMC LIS interface and that code is reused). 12 digit numeric string identifying the instrument consumable.

Old Sequence3 (O, 3, 3, 3) – (Do Not Use unless the LIS vendor has previously implemented the old BD DMC LIS interface and that code is reused). 12 digit numeric string identifying the instrument consumable.

Old Sequence4 (O, 3, 4, 3) – (Do Not Use unless the LIS vendor has previously implemented the old BD DMC LIS interface and that code is reused). 12 digit numeric string identifying the instrument consumable.

Old Sequence5 (O, 3, 5, 3) – (Do Not Use unless the LIS vendor has previously implemented the old BD DMC LIS interface and that code is reused). 12 digit numeric string identifying the instrument consumable.

Old Sequence6 (O, 3, 6, 3) – (Do Not Use unless the LIS vendor has previously implemented the old BD DMC LIS interface and that code is reused). 12 digit numeric string identifying the instrument consumable.

Old Sequence7 (O, 3, 7, 3) – (Do Not Use unless the LIS vendor has previously implemented the old BD DMC LIS interface and that code is reused). 12 digit numeric string identifying the instrument consumable.

Old Sequence8 (O, 3, 8, 3) – (Do Not Use unless the LIS vendor has previously implemented the old BD DMC LIS interface and that code is reused). 12 digit numeric string identifying the instrument consumable.

Old Sequence9 (O, 3, 9, 3) – (Do Not Use unless the LIS vendor has previously implemented the old BD DMC LIS interface and that code is reused). 12 digit numeric string identifying the instrument consumable.

Old Sequence10 (O, 3, 10, 3) – (Do Not Use unless the LIS vendor has previously implemented the old BD DMC LIS interface and that code is reused). 12 digit numeric string identifying the instrument consumable.

Test Id (O, 5, 1, 4) – BD BACTEC FX transmits “**BACTECFX_GND**” for the Test ID.

Sequence1 (O, 5, 1, 5) -- 12 digit numeric string identifying the instrument (BD BACTEC FX) consumable.

Sequence2 (O, 5, 2, 5) -- 12 digit numeric string identifying the instrument (BD BACTEC FX) consumable.

Sequence3 (O, 5, 3, 5) -- 12 digit numeric string identifying the instrument (BD BACTEC FX) consumable.

Sequence4 (O, 5, 4, 5) -- 12 digit numeric string identifying the instrument (BD BACTEC FX) consumable.

Sequence5 (O, 5, 5, 5) -- 12 digit numeric string identifying the instrument (BD BACTEC FX) consumable.

Sequence6 (O, 5, 6, 5) -- 12 digit numeric string identifying the instrument (BD BACTEC FX) consumable.

Sequence7 (O, 5, 7, 5) -- 12 digit numeric string identifying the instrument (BD BACTEC FX) consumable.

Sequence8 (O, 5, 8, 5) -- 12 digit numeric string identifying the instrument (BD BACTEC FX) consumable.

Sequence9 (O, 5, 9, 5) -- 12 digit numeric string identifying the instrument (BD BACTEC FX) consumable.

Sequence10 (O, 5, 10, 5) -- 12 digit numeric string identifying the instrument (BD BACTEC FX) consumable.

Collection Date Time (O, 8, 1, 1) Date and time that the specimen was collected from the patient, formatted as described in ASTM E_1394 section 6.6.2.

14.4.3.2.3. Result Fields

Result ID Code (R, 3, 1, 4) – The BD BACTEC FX transmits a “**GND**” as the Result ID Code.

Result Sequence Number (R, 3, 1, 5) – 12 digit numeric string identifying the instrument (BD BACTEC FX) consumable.

Test Status LIS Code (R, 4, 1, 1) – This describes the Status of a BD BACTEC FX vial. The possible values are:

- INST_NEW
- INST_POSITIVE
- INST_NEGATIVE
- INST_REMOVED
- INST_REENTERED
- INST_ONGOING

Preliminary Status (R, 9, 1, 1) – We always put a P in this field, because all results from BD BACTEC FX are preliminary.

Start Date/Time (R, 12, 1, 1) This is the date and time that the vial was physically placed in the instrument. This field is represented in the YYYYMMDDHHMMSS format.

End Date/Time (R, 13, 1, 1) This is the date and time that the panel's status transitioned to POSITIVE or OUT OF PROTOCOL. This field is represented in the YYYYMMDDHHMMSS format.

Instrument Type (R, 14, 1, 1) The BD BACTEC FX transmits **BACTECFX** for the instrument Type.

Media Type(R, 14, 1, 2) 2 digit code representing the type of media contained within a BACTEC vial.

Protocol Length(R, 14, 1, 3) This field indicates the length of time required to complete the BACTEC GND test. For BD BACTEC FX (a growth and detection test), this number represents the number of days before a vial can be considered negative.

Instrument Number (R, 14, 1, 4) Instrument number between 1 and 99.

Instrument Location (R, 14, 1, 5) Indicates the vial position inside the instrument as an 8 character string = ii-d-ccc

where:

ii = instrument number(1–99)

d = drawer letter(A–D)

r = row letter(A–K with no I)

cc= column number (1–10)

14.4.3.2.4. Request Fields

The ASTM 1394 protocol defines this as a Request Information Record message. A download Request record is also known as a “Query”. The only type of download “Query” request that the BD BACTEC FX instrument accepts is a request for test results. A Terminator record with a termination code of “F”(processed) or “Q”(error) is used to signal the last packet of a query response. If a query request was invalid, the instrument interface responds with only the Terminator record with a termination code of “Q”. If the instrument interface cannot locate any specimens in the active or history databases that meet the query criteria, it responds with only the Terminator record with a termination code of “F”.

A query contains a set of request parameters that are used to determine which specimen(s) to access. The following defines the ASTM 1394 Request record fields that can be transmitted from the LIS in a Download message and are accepted and acted upon by the BD BACTEC FX.

Test Status (Q, 5, 1, 2) The BD BACTEC FX instrument accepts queries for vials with a status as follows:

INST_POSITIVE = POSITIVE & Manual Positive vials
 INST_NEGATIVE = NEGATIVE & Manual Negative vials
 ALL = POSITIVE & NEGATIVE & ONGOING & Manuals Positive & Manual Negative vials
 AWL = (Do Not Use unless the LIS vendor has previously implemented the BD DMC LIS interface and that code is reused). POSITIVE & NEGATIVE & ONGOING & Manuals Positive & Manual Negative vials

Starting Date\Time (Q, 7, 1, 1) – Requested starting time for query -- the beginning of the Date/Time range to gather data for. If it is null, the BD BACTEC FX will use the Date 1/1/1970.

End Date\Time (Q, 8, 1, 1) – Requested Ending time for the query -- the ending of the Date\Time range to gather data for. It must be greater than the Starting Date\Time or the query will be rejected. If it is null, the BD BACTEC FX will use the current date time.

When a "Time Range" has been specified in a Query (Begin Time and/or End Time fields), the time field from the instrument's database that is used for comparison is dependent upon the Query's "Test Status" field as follows:

INST_POSITIVE – Time the specimen went positive.
 INST_NEGATIVE – Time the specimen went out of protocol.
 INST_ONGOING – The time the specimen was entered into the BD BACTEC FX.
 MANUAL vials – Time the user set the Status.

14.4.3.2.5. Terminator Fields

General – Same as BD EpiCenter (see section 8.2.7)

14.4.4. Example ASTM 1394 Protocol

The following are examples of various BD BACTEC FX message transmissions that conform to the BD Common LIS Interface using the ASTM 1394 protocol.

BACTEC FX G&D specimen that has been entered into an instrument as a new vial: (note: whether the vial has received a first test or not is not relevant in the BD BACTEC FX instrument.) – sent from the BD BACTEC FX instrument to the LIS.

```
H|\^&|||Becton Dickinson|||||V1.0|20081017105509
P|1
O|1|ACC-001||^BACTECFX_GND||19700101000000
R|1|^GND^446500000000|INST_NEW||||P||20081017105508||BACTECFX^65^5^01^A-
G01
L|1|N
```

BACTEC FX G&D specimen that has been tested **POSITIVE** – sent from the BD BACTEC FX instrument to the LIS:

```
H|\^&|||Becton Dickinson|||||V1.0|20081024064721
P|1||PATID||LastName FirstName
O|1|ACC-001||^BACTECFX_GND||19700101000000
R|1|^GND^4465000000|INST_POSITIVE||||P||20081017105508|20081017110031|B
ACTECFX^65^5^01^A-G01
L|1|N
```

BACTEC FX G&D specimen that has been tested **NEGATIVE** – sent from the BD BACTEC FX instrument to the LIS:

```
H|\^&|||Becton Dickinson|||||V1.0|20081017110336
P|1||PATID2||LastName2 FirstName2
O|1|DAG||^BACTECFX_GND||19700101000000
R|1|^GND^446504178134|INST_NEGATIVE||||P||20080918155201|20080923160143|B
ACTECFX^65^28^01^A-A02
L|1|N
```

A Request Record (Query) sent from an LIS to a BD BACTEC FX instrument **requesting all specimen results** (all positive, negative, and ongoing vials records will be sent).

```
H|\^&
C|1|This is a request for POSITIVE, NEGATIVE AND ONGOING vials from the LIS
Q|1|ALL^ALL|^ALL|||||P
L|1
```

A Request Record (Query) sent from an LIS to a BD BACTEC FX instrument **requesting only POSITIVE specimen results for a period of time** (vials that had a positive result called between 9/23/2008 4:01:43 p.m. and 10/17/2008 10:55:08 a.m.)

```
H|\^&
C|1|This is a request for POSITIVE vials from the LIS
Q|1|ALL^ALL|^INST_POSITIVE||20080923160143|20081017105508||||P
L|1
```

A Patient Record sent from an LIS to a BD BACTEC FX instrument

```
H|\^&
C|1|L|Patient information from LIS to BACTEC FX
P|1||PATID3||LastName^FirstName^Middle^Suffix^Title|||||
|HosSer|
O|1|Acc-003| |^^^\^^^\^^^\^^^\^^^\^^^\^^^\^^^\^^^\||20081025120000
L|1
```

14.5. BD Innova

14.5.1. LIS Connection

The instrument attempts to connect to an LIS server when processing of a batch begins. If a connection to the LIS server has not yet been established or has been disconnected, the instrument will attempt to establish a connection when processing of subsequent batches begin.

The instrument connects to the LIS via Ethernet TCP/IP using a configurable IP address and port. Configuring the IP address and port is done via a CSV file.

The instrument exchanges data with the LIS per the protocol specified in the Data Link Section of ASTM E_1381.

The instrument formats the content of the data exchanged as messages containing a collection of records per ASTM E_1394.

The instrument will send and receive frames that contain only a single logical record (i.e. Header, Patient, Order, Result and Terminator records all are sent in separate frames).

The instrument will not respond to queries generated by the LIS.

The instrument will not accept unsolicited data sent from the LIS.

The implemented LIS Interface specification is selectable to be either the legacy interface or the preferred BD ASTM interface. The interface is configurable via a CSV file.

Selecting the BD ASTM Interface will result in the following changes:

- Queries to the LIS will not contain a confirmation record.
- Specimen plating status will be sent separately formatted as an H/P/O/R/L message.

The instrument will expect a query response from the LIS within a configurable amount of time. The timeout value is configurable via a CSV file. The default time is 15 seconds.

14.5.2. BD ASTM Interface

14.5.2.1. Overview

The instrument will default to the BD ASTM Interface.

When the instrument reads a new container ID barcode from a container, a query for patient demographics and test orders is sent to the LIS.

When processing has successfully completed for a container, the instrument will send a result message to the LIS containing H/P/O/R/L records.

Sending of the result message can be enabled or disabled via a CSV file. The default setting is enabled.

14.5.2.2. Valid Characters

The following characters are valid at the Innova instrument.

A-Z, a-z, 0-9, ; , . / @ \$ % () _ + - ` =

14.5.2.3. Invalid Characters

The following characters are invalid at the Innova instrument.

" * ? [] ! # | ' & < > { } ~ ^ \

These characters cannot be entered at the BD Innova instrument but could be supplied by an LIS/ BD EpiCenter Server download.

If these characters are encountered in the Patient Information record that has been received from the LIS/ BD EpiCenter server, the following will occur :

- If an illegal character is contained in the container barcode field (O, 3, 1, 1), the illegal character will be replaced with a "\$". The barcode will be passed on for further validation. When the "Mismatched barcode" check is performed, the check will fail and the container will be rejected.

If an illegal character is contained in any other field of the record, the field will be "nulled out." This will result in several potential scenarios:

- If the BD Innova is operating in LIS/BD EpiCenter Protocol Defined Source mode and if the Specimen Type/Body Site field has been nulled out, the specimen will be rejected with a protocol not found.
- If the field that has been nulled out is contained in the label configuration, this field will be null on the plate label.
- If the field is not printed on the plate label and it is not the barcode field or the Specimen Type/Body Site field in LIS/BD EpiCenter Protocol Defined Source mode, then the user will never see this nulled - out field.
- The result record that is echoed back to the LIS will contain the nulled-out field. This should cause no issues in either the LIS or the BD EpiCenter Server sites.

14.5.2.4. Message Content

The following sections describe which fields are exchanged with the BD Innova instrument.

14.5.2.5. Field List

Each field is displayed with its default mapping in the ASTM E_1394 records. This position consists of a record type (Patient, Order, Result, Query, or Comment), a field delimiter counter, repeat delimiter counter, and component delimiter counter. The fields are grouped according to the ASTM E_1394 record type they are mapped to.

The field list also indicates if that field is defaulted as an upload (U) field, download (D) field, or both (U/D).

The first two fields of every record include the Record Type indicator and a record index value. These fields are considered part of every record but are not listed in these tables.

Header Record Field Name	ASTM Pos.	Direction
Delimiter Field	H, 2, 1, 1	U/D
Sender Name	H, 5, 1, 1	U/D
Processing ID	H, 12, 1, 1	U/D
Version Number	H, 13, 1, 1	U/D
Message Date/Time	H 14, 1, 1	U/D

Patient Record Field Name	ASTM Pos.	Direction
Patient ID	P, 4, 1, 1	U/D
Patient Name (Last)	P, 6, 1, 1	U/D
Patient Name (First)	P, 6, 1, 2	U/D
Patient Name (Middle)	P, 6, 1, 3	U/D
Date of Birth	P, 8, 1, 1	U/D
Patient Sex	P, 9, 1, 1	U/D
Hospital Service	P, 33, 1, 1	U/D
Hospital Client	P, 34, 1, 1	U/D

Order Record Field Name	ASTM Pos.	Direction
Accession Number / Container ID*	O, 3, 1, 1	U/D
Culture ID	O, 3, 1, 2	U/D
Barcode Number / Accession Number*	O, 5, 1, 5	U/D
Collection Date/Time	O, 8, 1, 1	U/D
Specimen Type	O, 16, 1, 1	U/D
Body Site	O, 16, 1, 2	U/D
Ordering Physician	O, 17, 1, 1	U/D
Server Free Text	O, 19, 5, 1	U/D
Report Type	O, 26, 1, 1	U/D

*See Field Descriptions - Order Fields Subsection

Result Record Field Name	ASTM Pos.	Direction
Result ID Code	R, 3, 1, 4	U
Test Status	R, 4, 1, 1	U
Mode	R, 4, 1, 9	U
Preliminary/Final Status	R, 9, 1, 1	U
Media Setup Date/Time	R, 13, 1, 2	U
Instrument Type	R, 14, 1, 1	U
Machine Instrument Number	R, 14, 1, 4	U
Instrument Location	R, 14, 1, 5	U
Protocol Name	R, 14, 1, 8	U

Request Record Field Name	ASTM Pos.	Direction
Accession Number	Q, 3, 1, 2	U
Container Barcode Number	Q, 3, 1, 3	U
Request Instrument Number	Q, 5, 1, 4	U
Request Information Status Code	Q, 13, 1, 1	U

Comment Record Field Name	ASTM Pos.	Direction
Comment Text	C, 4, 1, 1	U
Comment Type	C, 5, 1, 1	U

Terminator Record Field Name	ASTM Pos.	Direction
Termination Code	L, 3, 1, 1	U/D

14.5.2.6. Field Descriptions

This section provides detailed information for each field listed in the previous section.

14.5.2.6.1. Header Fields

The header record that starts each logical message is the same from all BD instruments. An example record is provided below.

H|^&|||Becton Dickinson| || |||P|X1.00|20100901184200

Delimiter Fields (H, 2, 1, 1) – These single characters can be used to process the remainder of the message. These characters denote the field, repeat, component and escape delimiters as described in the ASTM E_1394 specification.

These fields are defaulted to “|”, “^”, “&”, and “|” respectively, as shown above.

Sender Name (H, 5, 1, 1) – Messages coming from a BD instrument have the BD identifier in this field as shown above.

Processing ID (H, 12, 1, 1) – Indicates how this message is to be processed. The following codes will be used:

P – Treat message as an active message to be completed according to standard processing.

Version Number (H, 13, 1, 1) – This version number represents the version of the LIS interface used for communications. For the BD Innova instrument, the version number will begin with X1.00.

Message Date/Time (H, 14, 1, 1) – BD includes the current time and date when constructing his message, formatted as described in the ASTM E_1394 specification in section 6.6.2.

14.5.2.6.2. Patient Fields

P | 1 | | PatId123 | | Last Name ^ First Name ^ MI | 19651029
| M | | | | | | | | | | | | | | | | | | | | Hospital Service | Hospital Client

Patient ID (P, 4, 1, 1) - Identifier that uniquely identifies a patient. This field can be up to 16 characters long (e.g. PatId123). This field is optional.

Patient Name (P, 6, 1, 1-3) – Patient name is divided into 5 components in the ASTM E_1394 specification. The Innova instrument will accept the first 3 components of this field. The instrument stores these fields as a single string in its database. The patient name can be up to 40 characters long. When uploaded, the whole name is placed in the first component of this field (P, 6, 1, 1). This field is optional.

Date of Birth (P, 8, 1, 1) – Patient date of birth formatted as described in ASTM E_1394 section 6.6.2. The date shown in the sample record is Oct. 29, 1965. This field is optional.

Patient Sex (P, 9, 1, 1) – There are 3 predefined values accepted for this (M)ale, (F)emale, and (U)nspecified. If the value does not match the code for either Male or Female, then the sex is set to Unspecified. This field is optional.

Hospital Service (P, 33, 1, 1) – This is the location within the hospital that the specimen came from, for instance ER (emergency room), OR1 (operating room 1). This field is optional.

Hospital Client (P, 34, 1, 1) – This is the facility that the specimen came from, for instance Smith Radiology or Central Labs. This field is optional.

14.5.2.6.3. Order Fields

O | 1 | | Access1 ^ 331316 ^ ACC123 | | ^ ^ ^ | | | 20090108080510 | | | | | | | |
URINE ^ CleanCatch | Dr. Ameigh | | | | | | | | | | | | | | | | | | | | Server Free Text | | | | | | | | O

Accession Number (O, 3, 1, 1) – A unique alphanumeric string that identifies a specimen. This field can be up to 16 characters long. This field is required.

NOTE: If “CONTAINER_BC_INSTEAD_OF_ACC” flag is set to 1 (one – CID Mode 1), this field will contain the container barcode that was queried for to obtain the accession number.

Culture ID (O, 3, 1, 2) – An alphanumeric string that identifies a culture. This field is optional.

Barcode Number (O, 5, 1, 5) – An alphanumeric string to be included on the printed plate label. This field is optional.

NOTE: if “CONTAINER_BC_INSTEAD_OF_ACC” flag is set to 1 (one – CID Mode 1), this field will contain the accession that is to be associated to the CID that was queried for in Q, 3, 1, 3 field.

For additional information on “CONTAINER_BC_INSTEAD_OF_ACC” functionality, see the CONTAINER_BC_INSTEAD_OF_ACC section.

Collection Date/Time (O, 8, 1, 1) – Date and time that the specimen was collected from the patient, formatted as described in ASTM E_1394 section 6.6.2. This field is optional.

Specimen Type (O, 16, 1, 1) – The type of specimen collected from the patient. This field is optional.

For LIS/BD EpiCenter Defined Protocol Source, this field must exactly match the field at the Innova associated to a protocol. This field is a maximum of 14 characters at the Innova.

Body Site (O, 16, 1, 2) – The body site for the source of the specimen collected from the patient. This field is optional.

For LIS/BD EpiCenter Defined Protocol Source, this field must exactly match the field at the Innova associated to a protocol. This field is a maximum of 14 characters at the Innova.

Ordering Physician (O, 17, 1, 1) – The physician that has ordered the test. This field is optional. This field has a maximum of 16 characters when it is printed on the label at the Innova.

Server Free Text (O, 19, 5, 1) – This field contains free text that can hold any alphanumeric information (such as special instructions to look for fungi on the plate, etc.). This field will have a maximum of 16 characters when printed on the label. This field is optional.

Report Types (O, 26, 1, 1) – If the Report Types field contains an “X”, “Y”, or “Z”, the specimen is rejected. Any other value will be ignored. This field is optional. (From ASTM 1384 specifications)

X – request cancelled

Y – no order on record for this test (in response to query)

Z – no record of this patient (in response to query)

14.5.2.6.4. Result Fields

```
R | 1 | ^^STREAK|INST_COMPLETE^^^^^^MANAGED |||| | P |||  
|^20110817130534 | INNOVA^^^1^1-1-1^^^Urine
```

Result ID Code (R, 3, 1, 4) – This is a BD defined code that indicates the type of information being exchanged in the result record. This field contains the value, “STREAK”, to indicate the results are from an automated plate streaking instrument.

Test Status (R, 4, 1, 1) – The status value for a particular specimen. This field is the pre-defined value INST_COMPLETE for specimens that have completed successfully. For specimens that have not completed successfully, the value is INST_ERROR.

Mode (R, 4, 1, 9) – The mode indicates whether the specimen was run with the “User Defined Protocol” mode of operation (UD) or the LIS Defined Protocol mode of operation (LD).

This field will contain the following values:

“MANAGED” – specimen processed in LD mode.

“BATCH” – specimen processed in UD mode

Preliminary/Final Status (R, 9, 1, 1) – This field contains a “P” to indicate the results should be considered Preliminary Results.

Media Setup Date/Time (R, 13, 1, 2) – This field indicates the time the specimen was successfully streaked. If the specimen was not successfully streaked, this field will be blank.

Instrument Type (R, 14, 1, 1) – This field indicates which BD instrument produced the result. This field contains the value, “INNOVA”.

Machine Instrument Number (R, 14, 1, 4) – This is the number assigned to the instrument.

Instrument Location (R, 14, 1, 5) – Indicates the location of the container in the instrument. Represented as drawer number - canoe number - position in canoe.

Protocol Name (R, 14, 1, 8) – This is the protocol used to plate the specimen. It is derived from the Specimen Type/Body Site supplied by the LIS or selected by the user for a User Defined specimen.

14.5.2.6.5. Request Fields

Standard Query

Q | 1 | ^0123456 | ^1 | | | | | | O |

CID Mode 1 Query

Q | 1 | ^0123456 | ^1 | | | | | | O |

Accession Number (Q, 3, 1, 2) – The unique alphanumeric string that identifies a specimen. This field can be up to 16 characters long. In the example above, the Accession number is “0123456”.

Container Barcode Number (Q, 3, 1, 3) – The unique alphanumeric string that identifies a container. This field can be up to 16 characters long.

This field will ONLY be populated when the Innova has its “CONTAINER_BC_INSTEAD_OF_ACC” flag set to 1 (one – CID Mode 1).

NOTE: when this field is used, its value MUST be returned in O, 3, 1, 1 so that the Innova can verify the accession number that is returned is intended for the container barcode that was queried.

Request Information Status Code (Q, 13, 1, 1) – The following codes will be used:

- O – Requesting test orders and demographics only (no results)
- A – abort/cancel last request criteria (allows a new request to follow, sent from Innova if query result not received before timeout)

14.5.2.6.6. Comment Fields

The comment record in the Innova will immediately follow the result record if the result is INST_ERROR. It will contain the enum value associated to the specimen’s result and the associated string that is displayed to the user on the DB Log screen and on the Batch Results screen. If there is more than one result enum value associated to the Specimen, then more than one comment record will be sent to the LIS/EpiCenter, one for each result enum value and string.

C | 1 | | <4> No Barcode | R

C | 2 | | <28> Low Liquid Level | R

Comment Text (C, 4, 1, 1) – The text to be used for the patient, specimen or isolate comment. This field can be up to 1600 characters long.

The number between the < > will be the enum value that is associated to the Innova ContainerProcessingStatusMask. The text that follows in this field will be the string that is displayed to the user at the Innova and that is associated to the ContainerProcessingStatusMask enum value.

Comment Type (C, 5, 1, 1) – The type of comment record. This field should be a **P, S, I, E, T, or R** for patient, specimen, isolate, chartables rule, special message comments, or result comment respectively. For the BD Innova, this field will contain an "R".

14.5.2.7. Examples

14.5.2.7.1. Query - Standard

```
H\^&|||Becton Dickinson|||||P|X1.00|20100816171740
Q|1|^10467||^ ^ ^ALL|||||O
L|1|N
```

14.5.2.7.2. LIS Query Response - Standard

```
H\^&|||LIS|||||P|1|20100806093245
P|1||PatID1||Clark^John| |19800806 |M|||||||||||||ER|Universal Labs
O|1|10467|||||20100805093245| | | | | |URINE^Clean Catch|
L|1|F
```

14.5.2.7.3. Query - CID Mode 1

```
H\^&|||Becton Dickinson|||||P|X1.00|20100816171740
Q|1|^10467||^ ^ ^ALL|||||O
L|1|N
```

14.5.2.7.4. LIS Query Response – CID Mode 1

```
H\^&|||LIS|||||P|1|20100806093245
P|1||PatID1||Clark^John| |19800806 |M|||||||||||||ER|Universal Labs
O|1|10467 ||^ ^ ^PatAccession|||20100805093245| | | | | |URINE^Clean Catch|
L|1|F
```

14.5.2.7.5. LIS Query Response with no information

H\^&|||LIS|||||P|1|20100806093245
L|1I

14.5.2.7.6. Confirmation Message Upload

H\^&||Becton Dickinson|||||P|X1.00|20100816172135
P|1|PatID1|John Clark|19800806|M|||||||||||||ER|Universal Labs
O|1|10467|^|^|20100805093245|||||URINE ^ Clean Catch
R|1|^^^STREAK|INST_COMPLETE| || |P| || |INNOVA^^^1^3-2-
6^^^Plate Protocol
L|1|N

14.5.2.7.7. Confirmation Message Upload Error Status

H|\^&|||Becton Dickinson|||||P|X1.00|20100816172135
P|1|PatID1||John Clark| |19800806 | M |||||ER|Universal Labs
O|1|10467|\^|||20100805093245|||||URINE ^ Clean Catch
R|1|^^^STREAK|INST_ERROR| | | |P| | | |INNOVA^^^1^3-2-6^^^Plate
Protocol
C | 1 | <4> No Barcode | R
C | 2 | <28> Low Liquid Level | R
L|1|N

14.5.2.7.8. Host Reject Messages

14.5.2.7.8.1. Report Type X

Test was deleted do not plate.

```
H \ ^ & || HOST    ||||| P | 1 | 20090109100400
P | 1 || 13099844202 | ^ ||
O | 1 | 13099844202 ^ ^ | ^ ^ ^ |||||||||||||||| X
L | 1 N
```

14.5.2.7.8.2. Report Type Y

No specimen information found – if this is LIS Driven mode, do not plate no protocol information available.

```
H \ ^ & || HOST    ||||| P | 1 | 20090109100400
P | 1 || 13099844202 ||^||
O | 1 | 13099844202 ^ ^ || ^ ^ ^ |||||||||||||||| Y
L | 1 N
```

14.5.2.7.8.3. Report Type Z

No patient information found – if this is LIS Driven mode and there is no associated Specimen information, do not plate no protocol information available.

```
H | \ ^ & || HOST    ||||| P | 1 | 20090109100400
P | 1 || 13099844202 ||^||
O | 1 | 13099844202 ^ ^ | ^ ^ ^ |||||||||||||||| Z
L | 1 N
```

14.5.2.8. CONTAINER BC INSTEAD OF ACC Barcode

This section describes the `CONTAINER_BC_INSTEAD_OF_ACC` barcode functionality that will be available in a Post-V3.10 release. This functionality gives the user the ability to read a barcode on the specimen container and query the LIS for the associated Accession barcode.

A new parameter will be added to the MachineGeneralAttributes.csv file. This parameter will be named CONTAINER_BC_INSTEAD_OF_ACC. Its default value will be "0" for standard container barcode query. If the barcode on the container is not the accession and the user desires to have the accession returned, this parameter should be configured to have a value of 1 (one).

14.5.2.8.1. Standard Container Barcode is Accession Functionality

If the barcode that is on the container IS the Accession barcode, the LIS/BD EpiCenter will be queried for Patient Information by sending the container barcode that was read in Q, 3,1, 2. When the LIS/BD EpiCenter returns the Patient Information, it must return the same barcode that was queried for in O, 3, 1, 1. If the same barcode is not returned in this O, 3, 1, 1; the Patient Information will be rejected with a “Mismatched Barcode” error.

14.5.2.8.2. CONTAINER_BC_INSTEAD_OF_ACC Functionality – CID Mode 1

If the barcode that is on the container IS the Container barcode and NOT the Accession barcode, the LIS (and in a future BD EpiCenter release), will be queried for Patient Information by sending the container barcode that was read in Q, 3, 1, 3. When the Patient Information is returned, the barcode that was queried for must be returned in O, 3, 1, 1 and the associated accession must be returned in O, 5, 1, 5. If the same barcode is not returned in this O, 3, 1, 1; the Patient Information will be rejected with a "Mismatched Barcode" error.

14.6. BD MAX

This section describes the configuration of the interface between an LIS and the BD MAX instrument, and is a complement to the information included in the BD MAX User's Manual (REF: 8089570 International Windows Version / 8089571 US Open System Windows Version / 8089572 US IVD Windows Version).

14.6.1. Additional Definitions Applicable to the BD MAX System

This list of definitions is a complement to the list provided in Section 3 of this document.

Confirmed Positive – This is a positive result that has been confirmed as a positive by the user on the Results > Run Details > PCR Analysis screen. This status is only used in the LIS Result record.

Instrument Positive (Preliminary Positive) – This is the positive result that is determined by the instrument software. It is reported to the LIS, should this option be configured via the MAX User Interface, as an instrument positive until it is confirmed as a positive by the user on the Results > Run Details > PCR Analysis screen. This status is only used in the LIS Result record.

Cycle Threshold (CT) – The number of PCR cycles it took during the test run for the fluorescent signal to reach the threshold value.

14.6.2. Valid and Invalid characters for BD MAX

Invalid characters – The following list of characters will not be accepted by the BD MAX:

“ * ? [] ! # | ‘ & < > { } ~ ^ \

Valid Characters – The following characters are acceptable for entry on the BD MAX instrument:

A – Z, a – z, 0 – 9, ; , . / @ \$ % () _ + - ` =

14.6.3. Unresolved (UNR)/Indeterminate (IND)/Incomplete (INC) Results Handling

When this option is configured via the BD MAX User Interface, Unresolved and Indeterminate results are reported to the LIS. Incomplete results are not reported across the LIS.

14.6.4. Overview of the BD MAX LIS Interface

The BD MAX communicates with the LIS via a serial interface. The physical interface is provided through the D89 serial connection on the BD MAX All-In-One computer. The logical interface follows the ASTM 1934 protocol. If the LIS is enabled on the BD MAX, the application will create an LIS interface thread at start up. The BD MAX will communicate results to the LIS based on the user selected configuration options. The protocols and specifications for exchanging data are described in subsequent sections.

14.6.5. General Information About Default Settings

The BD MAX default will be LIS Interface disabled. The LIS Vendor/BD Field Service Engineer must enter various laboratory specific configuration parameters to enable the LIS interface when required for laboratory operations.

The configuration settings have to be selected based on the LIS vendors parameters. There is no standard configuration for an LIS connection.

Comprehensive information about available settings on the BD MAX can be found in Section 14.6.11.

14.6.6. Uploading Results to the LIS - “Unsolicited” vs “Solicited Mode”

When the BD MAX completes a run, if the LIS is enabled and “**unsolicited**” mode is configured, the configuration settings for the result upload will be checked. If the user has configured BD MAX to upload instrument negative results, the negative final calls will be uploaded to the LIS. If the user has configured the BD MAX to upload instrument positive results, the instrument positive final calls will be uploaded to the LIS. If the user has configured the BD MAX to upload instrument resistance results then instrument positive, instrument negative, and instrument unresolved calls will be uploaded to the LIS for resistance detected, resistance not detected, and resistance unreportable results, respectively. If the user has configured the BD MAX to upload instrument indeterminate and unresolved results then instrument indeterminate and instrument unresolved calls will be uploaded to the LIS.

If “**solicited**” mode is selected, results will be uploaded upon request from the LIS.

Sending results for solicited or unsolicited mode can be enabled or disabled via the Configuration/LIS screen. The default setting for all upload types is disabled. The default setting for solicited uploads is enabled. This screen will only be accessible to users that have *ADMIN* permission level.

Detailed information can be found in Section 14.6.12.

14.6.6.1. LIS Retransmit Feature

The current BD MAX System Software sends results to the LIS when certain conditions are met. On occasion, results must be re-transmitted from the instrument to the LIS. This feature will allow a user to re-transmit results that have been previously sent from the instrument to the LIS system (the instrument is required to be in unsolicited mode). A user shall be able to re-transmit a result to the LIS system if this result was previously sent. Comprehensive information about the LIS Retransmit Feature can be found in the BD MAX User’s Manual (REF: 8089570 International Windows Version / 8089571 US Open System Windows Version).

14.6.7. General Information About the “Confirming Positive Results” Feature

If the user does not desire to have the instrument positive results sent to the LIS without being confirmed first, a feature is provided that gives the user the ability to confirm the positive result and then send the confirmed positive final call to the LIS.

When one run is opened with results, the user can select Positives from the Group By combo box. Only the positions with positive results will be displayed, and each graph will gain a check-box, allowing the user to confirm the positive results displayed.

If the user has configured the LIS to upload confirmed positive results in unsolicited mode, the confirmed positive results will be sent to the LIS as soon as possible.



NOTE: To have the uploading of negative and positive final calls and confirmed positives available with Open System Testing, the Result Logic needs to be enabled and programmed.

Detailed information can be found in Section 14.6.12.

14.6.8. Results Queries From the LIS

The BD MAX will accept result request queries from the LIS when the LIS is enabled in solicited mode. The result information that will be sent to the LIS will be based on the date range specified in the query and the types of results that have been configured to be sent to the LIS (instrument positive, instrument negative, and/or confirmed positives).

When configured to send a result record to the LIS, the instrument will send a result message to the LIS containing H/P/O/R/L records. For a result to be sent to the LIS, the test must have an Accession.

Detailed information about message content can be found in Section 14.6.13.

14.6.9. Communication Protocols

14.6.9.1. Logical Protocols (ASTM E 1394)

Basic information about the logical protocol used by BD (ASTM E 1394) can be found in Section 4.2.

The logical protocol describes where to place individual pieces of information into a record string and how to combine the record strings into a properly formatted message. The combination of logically grouped records is called a **data packet**. Data packets are composed of **records**, which contains the data that is transferred between an LIS and the BD MAX instrument. The data within the record is separated into **fields** by **delimiters** (|). Within a field, a **caret (^)** can be present to split the field into a subfield (component) for additional information.

Records contain logical subdivisions of information identifying the sender of the message, patient, test order, test results, requests for information, comments and end of the data packet. A **letter in the first field of the record** always identifies the **record type**.

General information related to Record types and fields can be found in Section 8.2.

14.6.9.1.1. Logical Protocol - ASTM transmission Control Characters

In addition to the information described in Section 8.2, the following information can help understand the nomenclature used in the logical protocol and help understand the LIS connection on the BD MAX.

In order to “wrap” the logical data, certain identifying characters are required by the logical protocol to control the low level functions. These characters are called **control characters**. To avoid misinterpretation, control characters are never values that are part of the logical message; instead they are represented by ASCII values that are not printable characters. Many of the ASCII control codes are to mark data packets, or to control a data transmission protocol: **ACK**nowledge, **N**egative **AcK**nowledge, **S**tart **O**f Header, **S**tart of **TeX**t, **E**nd of **TeX**t, etc.

ASTM Control Characters			
Decimal	Hex	Abbreviation	Name/Meaning
2	02	STX	Start of text
3	03	ETX	End of text
4	04	EOT	End of Transmission
5	05	ENQ	Enquiry
6	06	ACK	Acknowledgement
10	0A	LF	Line feed
13	0D	CR	Carriage return
21	15	NAK	Negative Acknowledgement
23	17	ETB	End of Transmit Block

An example of ASTM Control Characters codes application during communication between the BD MAX and the LIS:

- a) BD MAX informs the LIS it wants to send a message, using (**ENQ**)
- b) LIS responds (**ACK**) if it is ready or (**NAK**) if it not.
- c) If it is ready, then the BD MAX starts the transmission, using (**STX**/....data..../**ETX**)
- d) After receiving the transmission, the LIS responds (**ACK**) if it has received the data or (**NAK**) if it did not.
- e) After transmission is complete, the BD MAX will end the transmission, using (**EOT**).

14.6.9.2. Physical Protocols (ASTM E 1381)

Basic information about the physical protocol used by BD (ASTM E 1381) can be found in Section 4.2.

The physical protocol describes how logical level message strings can be partitioned and transmitted to the LIS. The ASTM E 1381, low-level protocol defines how the logical data record is separated into **data packets**, or “**frames**”. The protocol also controls the sequencing of message transmission and error checking on the frames that ensures the integrity and correctness of the transmission, ensuring that no data is lost during transmission.

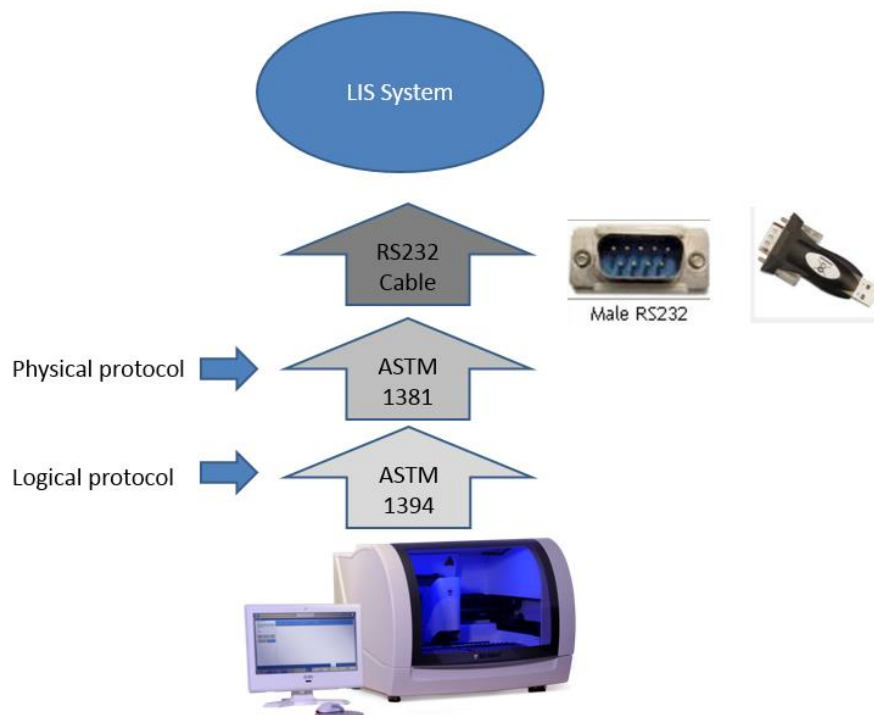
14.6.9.2.1. Unpacked/Packed Frames

The BD LIS interface is configurable to send either packed frames or unpacked frames. This setting needs to be adapted to the strategy used by the LIS Vendor.

See Section 6.1.2. on additional details regarding the BD interpretation of Packed/Unpacked frame.

14.6.10. Physical Cable Interface

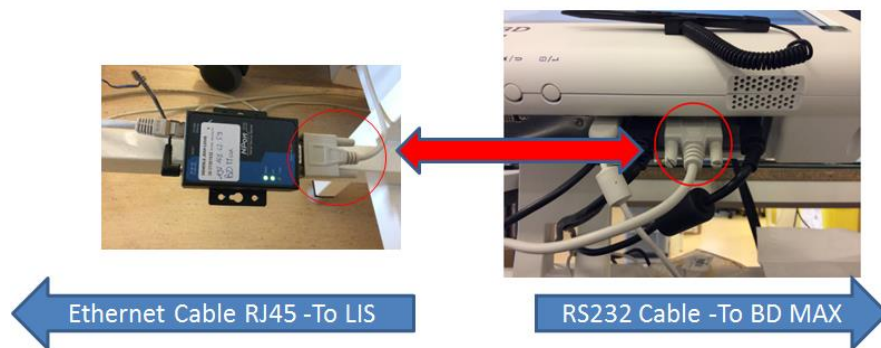
On the BD MAX, the connection to the LIS must be made using a **RS232 COM-Port**. No other type of connection can be used. In some cases, specific adapters could be required.



NOTE: The serial port interface used by the instruments uses only 3 signals in the interface cable, Transmit Data (Pin 2), Receive Data (Pin 3), and Signal Ground (Pin 5). BD does not believe that the inclusion of additional signals will cause any problems for the interface, however BD has not tested this case.

On the BD MAX, **COM 1 must be used**. The typical physical cable used is a **NULL modem serial cable (female-to-female)**. NULL modem serial cables are normally used to connect DTE-to-DTE devices (PC-to-PC).

Example of a BD MAX to LIS physical connection:



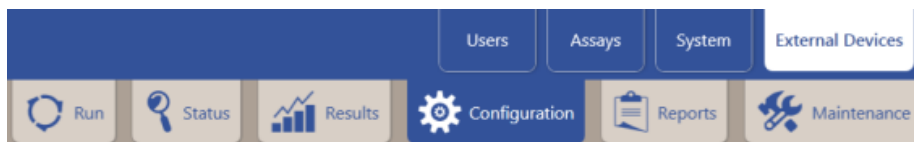
NOTE: In some cases, specific adapters will have to be used. A USB to COM-port adapter may have to be installed.



14.6.11. BD MAX LIS Configuration Screen

This section is a complement to the information included in the BD MAX User manual (REF: 8089570 International Windows Version / 8089571 US Open System Windows Version / 8089572 US IVD Windows Version).

The BD MAX LIS Configuration Screen lets the user specify the configurable behavior of the LIS interface. To navigate to the BD MAX LIS Configuration Screen, select the Configuration Tab then the External Devices Tab (when logged in as ADMIN).



The LIS Configuration Group will be displayed. The BD MAX LIS interface is configured by enabling and defining fields within the LIS Tab at the BD MAX instrument. If parameters are changed for the LIS configuration, the new configuration takes effect immediately.

14.6.12. BD MAX LIS Configurable Options

There are several aspects of the BD MAX LIS interface that are configurable by the user. The configurable parts of the interface are described below.

NOTE: The configuration settings have to be selected based on the LIS vendor's parameters and end-user selections. There is no standard configuration for an LIS connection. Settings may vary between LIS vendors. When working in the LIS configuration screen, it is recommend to note the existing parameters (for example, by performing a print screen of the existing parameters). This information could be used to restore the parameters if they are lost for any reason.

LIS Configuration

☐ Enable LIS

Physical

BAUD: 9600 PARITY: ODD

Data Bits: 8 Stop Bits: 1

Logical

☒ LIS Solicited Results

☐ Upload Instrument Negatives

☐ Upload Instrument Positives

☐ Upload Confirmed Positives

☐ Upload Instrument Resistances

☐ Upload Instrument IND and UNRs

☒ Packed Frames

14.6.12.1. Enable LIS

LIS Configuration

☐ Enable LIS

The options for this choice are mutually exclusive.

Possible Parameters:

ENABLED

DISABLE

Default: Disabled

14.6.12.2. Parameters Group: Physical

Parameters defined in this group control the communication parameters assigned to the serial communications port that is connected to the LIS.

Physical

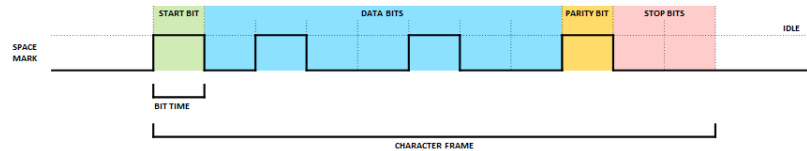
BAUD: 9600 PARITY: ODD

Data Bits: 8 Stop Bits: 1

Serial communication using RS-232 requires that four parameters are specified: the **baud rate** of the transmission, the number of **data bits** encoding a character, the sense of the optional **parity** bit, and the number of **stop bits**.

Each transmitted character is packaged in a character frame that consists of a single start bit followed by the data bits, the optional parity bit, and the stop bit or bits.

Example: A typical character frame encoding the letter "m" (hexadecimal 0x6d) with 7 data bits, 1 parity bit, and 2 stop bits):



14.6.12.2.1. BAUD

The BAUD parameter allows the adjustment of the speed of the communications link between the LIS system and the BD MAX.

Possible Choices:

1200
2400
4800
9600
19200

Default: 9600

14.6.12.2.2. PARITY

The PARITY parameter allows for the adjustment of the error check that can be performed on every character that is received and transmitted.

Possible Parameters:

NONE
ODD
EVEN

Default: ODD

NOTE: Many LIS vendors will require that the "NONE" setting is selected.

14.6.12.2.3. DataBits

The DataBits parameter allows for the adjustment of the size of the character that is transmitted and received by the Physical Protocol Layer.

Possible Values:

7 DataBits
8 DataBits

Default: 8 DataBits

14.6.12.2.4. STOPBits

The STOPBits parameter allows for the adjustment of the number of stop bits that are appended to the characters that are transmitted by the Physical Protocol Layer.

Possible Parameters

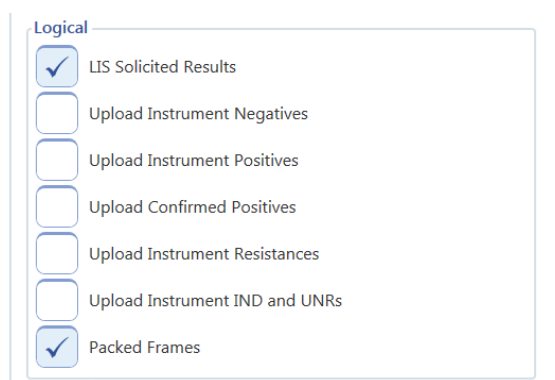
1 StopBit

2 StopBits

Default: 1 StopBit

14.6.12.3. LIS Options Group: Logical

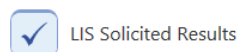
This group allows the user to define the LIS/LAB specific workflow (dictating when data is sent to the LIS) and the types of data that will be sent to the LIS.



Logical

- ☒ LIS Solicited Results
- ☐ Upload Instrument Negatives
- ☐ Upload Instrument Positives
- ☐ Upload Confirmed Positives
- ☐ Upload Instrument Resistances
- ☐ Upload Instrument IND and UNRs
- ☒ Packed Frames

14.6.12.3.1. LIS Solicited Results

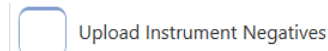


☒ LIS Solicited Results

If LIS Solicited Results is enabled (checked), results will be sent only when the LIS requests results. If this Option is selected **the LIS must actively** ask for new results. This option needs to be determined with the LIS vendor.

Default: Solicited

14.6.12.3.2. Upload Instrument Negatives

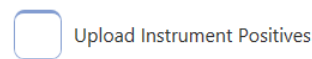


☐ Upload Instrument Negatives

When this checkbox is enabled (checked), Negative results will be uploaded to the LIS, whenever a Results Upload to the LIS occurs. This could occur when the result is called for the test, if so configured, or when a request from the LIS is received for INST_NEGATIVES results.

Default: Disabled

14.6.12.3.3. Upload Instrument Positives



☐ Upload Instrument Positives

When this checkbox is enabled (checked), PRELIMINARY Positive (meaning Positive results determined by the instruments – not confirmed by the user) results will be uploaded to the LIS, whenever a Results

Upload to the LIS occurs. This could occur when the result is called for the test, if so configured, or when a request from the LIS is received for INST_POSITIVE results.

Default: Disabled

14.6.12.3.4. Upload Confirmed Positives

☐ Upload Confirmed Positives

When this checkbox is enabled (checked), CONFIRMED Positive results will be uploaded to the LIS, whenever a Results Upload to the LIS occurs. This could occur when the user selects the Save Confirmed Positives button on the Results > Run Details > PCR Analysis screen, if so configured, or when a request from the LIS is received for CONFIRMED_POSITIVE results.

Default: Disabled

14.6.12.3.5. Upload Instrument Resistances

☐ Upload Instrument Resistances

When this checkbox is enabled (checked), Resistance results will be uploaded to the LIS, whenever a Results Upload to the LIS occurs. This could occur when the result is called for the test, if so configured, or when a request from the LIS is received for INST_POSITIVES, CONFIRMED_POSITIVE or ALL results. Note: Resistance calls are sent in conjunction with positive results and will only be sent if the system is also configured to send positives.

Default: Disabled

14.6.12.3.6. Upload Instrument IND and UNRs

☐ Upload Instrument IND and UNRs

When this checkbox is enabled (checked), Indeterminate and Unresolved results will be uploaded to the LIS, whenever a Results Upload to the LIS occurs. This could occur when the result is called for the test, if so configured, or when a request from the LIS is received for ALL results.

Default: Disabled

14.6.12.3.7. Packed Frames

☒ Packed Frames

If selected BD MAX will send frames packed with multiple records.

If unselected (unchecked), BD MAX will send frames that contain only a single record.

This setting needs to be discussed with the LIS vendor.

Default: Enabled

14.6.13. Message Content

The following sections describe which fields are exchanged between the BD MAX and the LIS.

14.6.13.1. Field Content

This section lists all of the fields by name BD MAX can exchange with the LIS.

Each field is displayed with its default mapping in the ASTM E_1394 records. This position consists of a record type (Header, Result, Query, Terminator, etc.), a field delimiter counter, repeat delimiter counter, and component delimiter counter. The fields are grouped according to the ASTM E_1394 record type to which they are mapped.

The field list also indicates if that field is defaulted as an upload (U) or download (D) field, or both (U/D). A blank column indicates that the field is not to be exchanged with an LIS. Fields not configured to be exchanged with the LIS are ignored in a download message.

The first two fields of every record include the Record Type indicator and a record index value. These fields are considered part of every record but are not listed in these tables. The following section describes these fields in more detail, including the expected values for each field.

Header Record Field Name	ASTM Pos.	Direction
Sender Name	H, 5, 1, 1	U/D
Version Number	H, 13, 1, 1	U/D
Message Date/Time	H 14, 1, 1	U/D

Patient Record Field Name	ASTM Pos.	Direction
Patient ID	P, 4, 1, 1	U/D

Order Record Field Name	ASTM Pos.	Direction
Accession Number	O, 3, 1, 1	U/D
Test ID	O, 5, 1, 4	U/D
Test/Assay Name	O, 16.1.1	U/D

Result Record Field Name	ASTM Pos.	Direction
Result ID Code	R, 3, 1, 4	U
Test Status	R, 4, 1, 1	U
User Result Identifier	R, 4, 1, 2	U
Preliminary/Final Status	R, 9, 1, 1	U
Test Start Date Time	R, 12, 1, 1	U
Instrument Type	R, 14, 1, 1	U
Instrument Number	R, 14, 1, 4	U
Instrument Position (specimen location)	R, 14, 1, 5	U
Test Name (Analyte)	R, 14, 1, 8	U
Confirmed Positive indicator	R, 15, 1, 2	U

Request Record Field Name	ASTM Pos.	Direction
Patient ID request field	Q, 3, 1, 1	D
Accession request field	Q, 3, 1, 2	D
Request Test Status	Q, 5, 1, 2	D
Starting Date/Time	Q, 7, 1, 1	D
Ending Date/Time	Q, 8, 1, 1	D
Request Information Status Code	Q, 13, 1, 1	D

Terminator Record Field Name	ASTM Pos.	Direction
Termination Code	L, 3, 1, 1	U/D

14.6.13.2. Field Descriptions

This section provides detailed information for each field listed in the previous section, and is a complement to the information in Section 8.2.

14.6.13.2.1. Interpreting the ASTM position

This section is intended to give background information to help understand the Field Description Section.

14.6.13.2.1.1. Understanding Field Delimiter Counter

This position refers to the second term in the ASTM position description in the table above. For instance, in (H, 5, 1, 1), the field position would be "5".

The position of a field in the record is determined the following way. Position 1 is the start of the line. Then, each subsequent position will be introduced by a "|". For instance, the first thirteen positions would be placed the following way:

1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13

In the following example, field "H" is at position 1, field "\^&" is at position 2, field "Becton Dickinson" is at position 5, field "V1.0" is at position 13, field "20151120171114" is at position 14.

H\^& | Becton Dickinson | | | | V1.0 20151120171114

This field position refers to the second term in the ASTM position description in the table above. For instance, in (H, 5, 1, 1), the field position would be "5".

14.6.13.2.1.2. Understanding Component Delimiter Counter

This component position refers to the fourth term in the ASTM position description in the table above. For instance, in (R, 14, 1, 5), the component position would be "5".

Field Position (separated by "|"):

1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15^^^|

Component Position (separated by “^”):

| 1^2^3^4^5|

In the following example, “62-A4-A-BOT-10” is at field position 14, component position #5.

R|1|^^^AND|INST_NEGATIVE||||P||20140823132809||BDMAX_AND^^^1^
62-A4-A-BOT-10^^^SA|^FALSE

14.6.13.2.2. Header Fields

See also Section 8.2.

Delimiter Fields (H, 2, 1, 1) – These single characters can be used to process the remainder of the message. These characters denote the field, repeat, component and escape delimiters as described in the ASTM E_1394 specification. These fields are defaulted to “|”, “\”, “^”, and “&” respectively, as shown in shaded grey below.

H|\^&||Becton Dickinson|||||V1.0|20111110091907

Sender Name (H, 5, 1, 1) – Messages coming from a BD instrument have the BD identifier in this field as shown in shaded grey below.

H|\^&||Becton Dickinson|||||V1.0|20111110091907

Version Number (H, 13, 1, 1) – This version number represents the version of the LIS interface used for communications. For the BD MAX instrument, the version number will begin with Vs1.00, as shown in shaded grey below.

H|\^&||Becton Dickinson|||||**V1.0**|20111110091907

Message Date/Time (H, 14, 1, 1) – BD includes the current time and date when constructing this message, formatted as described in the ASTM E_1394 specification in section 6.6.2 (YYYYMMDDHHMMSS), as shown in shaded grey below.

H|\^&||Becton Dickinson|||||V1.0|**20111110091907**

14.6.13.2.3. Patient Fields

See also Section 8.2.2.

Patient ID (P, 4, 1, 1) – Identifier that uniquely identifies a patient. This field can be up to 20 characters long. This field is optional.

P|1|**PatId123**

14.6.13.2.4. Order Fields

See also Section 8.2.3.

Accession Number (O, 3, 1, 1) – The unique alphanumeric string that identifies a specimen. This field can be up to 20 characters long. This is a required field for a result upload to the LIS.

O|1|**23878**||^^^BDMAX_AND|||||BD MAX MRSA

Test ID (O, 5, 1, 4) – The unique string that identifies the BD instrument type and test type. In the case of the BD MAX instrument, this will always be BDMAX_AND.

O|1|23878||**BDMAX_AND**|||||BD MAX MRSA

Test/Assay Name (O, 16,1,1) – The name of the assay or test to be run. This field is ignored empty on upload and mandatory on download. Limit of 40 characters.

O|1|23878||**BDMAX_AND**|||||**BD MAX MRSA**

14.6.13.2.5. Result Fields

See also Section 8.2.4.

Once a result has been successfully sent to the LIS in the unsolicited mode of operation, it will not be resent to the LIS. If the BD MAX is configured for Solicited mode operation, any time the result is requested by the LIS, it will be sent to the LIS if it is within the specified date/time range of the request.

Result ID Code (R, 3, 1, 4) – This is a BD defined code that indicates the type of information being exchanged in the result record.

The BD MAX transmits an “AND” (Amplification and Detection) as the Result ID Code.

R|1|**AND**|INST_NEGATIVE|||||P||20140823132809||BDMAX_AND^^^1^6
2-A4-A-BOT-10^^^SA|^FALSE

User-defined protocols (UDPs) can also specify that, in addition to the “AND” results for the test, Cycle Threshold (CT) results be sent for selected channels. The BD MAX transmits a “CT” as the Result ID Code for these results.

R|3|**CT**|28.90|||||20150624183540||BDMAX_AND^^^1^43-B11-B-TOP-
9^^^CY5

Test Status (R, 4, 1, 1) – The status value for a particular test. This field is filled for all test results.

For “AND” results, the status code is one of the pre-defined values. The possible values are:

- INST_POSITIVE
- INST_NEGATIVE
- INST_UNRESOLVED
- INST_INDETERMINATE

R|1|**AND**|**INST_POSITIVE**|||||P||20111105075215||BDMAX_AND^^^1^98
2-B12-B-TOP-12^^^SA|^CONFIRMED POSITIVE

R|1|**AND**|**INST_NEGATIVE**|||||P||20140823132809||BDMAX_AND^^^1^6
2-A4-A-BOT-10^^^SA|^FALSE

R|1|^^^AND|INST_UNRESOLVED||||P||20111105075215||BDMAX_AND^^
^1^982-B12-B-TOP-12^^^SA|^CONFIRMED POSITIVE

R|1|^^^AND|INST_INDETERMINATE||||P||20140823132809||BDMAX_AN
D^^^1^62-A4-A-BOT-10^^^SA|^FALSE

For “CT” results, the status code is a numeric value, rounded to 2 decimal places.

R|3|^^^CT|28.90||||||20150624183540||BDMAX_AND^^^1^43-B11-B-TOP-
9^^^CY5

Preliminary/Final Status (R, 9, 1, 1) – This field contains a “P”, which normally indicates the results should be considered Preliminary Results. ASTM E_1394 specifies that this field should contain an “F” for final results. However, to remain consistent with previous versions of the system, the BD MAX always transmits a “P” in this field. Final positive results are indicated in the Confirmed Positive (R, 15, 1, 2) field (see below).

R|1|^^^AND|INST_NEGATIVE||||P||20140823132809||BDMAX_AND^^^1^6
2-A4-A-BOT-10^^^SA|^FALSE

Start Date/Time (R, 12, 1, 1) – This is the date and time that the test was first started or entered into an instrument. This field is formatted as described in the ASTM E_1394 specification in section 6.6.2 (YYYYMMDDHHMMSS format).

R|1|^^^AND|INST_NEGATIVE||||P||20140823132809||BDMAX_AND^^^1^6
2-A4-A-BOT-10^^^SA|^FALSE

Instrument Type (R, 14, 1, 1) – This field indicates which BD instrument produced the result. This field contains the value, “BDMAX_AND”.

R|1|^^^AND|INST_NEGATIVE||||P||20140823132809||BDMAX_AND^^^1^6
2-A4-A-BOT-10^^^SA|^FALSE

Machine Instrument Number (R, 14, 1, 4) – This is the user number assigned to the instrument that ran the test. This value can be between 1 and 99.

R|1|^^^AND|INST_NEGATIVE||||P||20140823132809||BDMAX_AND^^^1^6
2-A4-A-BOT-10^^^SA|^FALSE

Location Information (R, 14, 1, 5) – – This value indicates the position inside of the instrument where the test was performed.

R|1|^^^AND|INST_NEGATIVE||||P||20140823132809||BDMAX_AND^^^1^6
2-A4-A-BOT-10^^^SA|^FALSE

Test Name (analyte) (R, 14, 1, 8) – For “AND” results, this is the Assay name from the BD MAX instrument that ran the test. The maximum length of the test name is 40 characters. It should be noted that for multi-analyte assays such as Staph SR, the assay name is replaced by the analyte name. A table of LIS codes is below. For UDP, analytes are based on the Results Logic settings.

R|1|^^^AND|INST_NEGATIVE||||P||20140823132809||BDMAX_AND^^^1^62-A4-A-BOT-10^^^SA|^FALSE

For “CT” results, this field is either the name of the color channel or the user-defined alias for the color channel. The possible color names are listed below.

Color Channel Name	Frequency (nm)
FAM	475/520
VIC	530/565
ROX	585/630
CY5	630/665
CY55	680/715

R|3|^^^CT|28.90||||||20150624183540||BDMAX_AND^^^1^43-B11-B-TOP-9^^^CY5

R|3|^^^CT|28.90||||||20150624183540||BDMAX_AND^^^1^43-B11-B-TOP-9^^^EXAMPLE-ALIAS

Confirmed Positive (R, 15, 1, 2) – This is the user set indication that the positive test has been “confirmed” as a positive.

R|1|^^^AND|INST_POSITIVE||||P||20111105075215||BDMAX_AND^^^1^982-B12-B-TOP-12^^^BD MAX MRSA IUOv3|^CONFIRMED POSITIVE

NOTE : When the “confirmed positives” setting is not enabled, strings for inst_negative and ins_positive will always include a FALSE in this field. (“FALSE” meaning “not confirmed by the user”)

R|1|^^^AND|INST_NEGATIVE||||P||20140823132809||BDMAX_AND^^^1^62-A4-A-BOT-10^^^SA|^FALSE

14.6.13.2.5.1. Summary of the Syntax (Result Fields)

General syntax	Example with BD MAX™ StaphSR
H ^& Becton Dickinson V1.0 Date-Time	H ^& Becton Dickinson V1.0 20140823151055
P 1 Patient- ID	P 1 12345678
O 1 Accession-Number ^TestID	O 1 AB99990008 ^BDMAX_AND *TestID will always be "BDMAX_AND"
R 1 ^ResultIDCode TestStatus Preliminary/Final Date - Time InstrumentType^^N°instrume nt^Position of Sample^^Test Results ^ConfirmationTRUE/FALSE	Example 1: R 1 ^AND INST_NEGATIVE P 201408231328 09 BDMAX_AND^^^1^62-A4-A-BOT- 10^^SA ^FALSE Example 2: R 2 ^AND INST_NEGATIVE P 201408231328 09 BDMAX_AND^^^1^62-A4-A-BOT- 10^^MRSA ^FALSE *ResultIDCode will always be "AND" *InstrumentType will always be "BDMAX_AND" * When the "confirmed positives" setting is not enabled, strings for inst_negative and ins_positive will always include a FALSE after the test results.
L 1 N	L 1 N

14.6.13.2.6. Request Fields

See also Section 8.2.6.

The ASTM 1394 protocol defines this as a Request Information Record message. A download Request record is also known as a "Query". A request will typically be originating from the LIS System. The only type of download "Query" request that the BD MAX instrument accepts is a request for test results. A Terminator record with a termination code of "F"(processed) or "Q"(error) is used to signal the last packet of a query response. If a query request was invalid, the instrument interface responds with only the Terminator record with a termination code of "Q". If the instrument interface cannot locate any specimens in the active or history databases that meet the query criteria, it responds with only the Terminator record with a termination code of "F".

A query contains a set of request parameters that are used to determine which specimen(s) to access. For instance, if the LIS requests

information about “All Confirmed Positive Results from November 5th, 2011 00:00:00 to November 6th, 2011 22:30:00”, this would result in the following query (detailed information about each field can be found below):

Q|1|ALL^ALL||^CONFIRMED_POSITIVE||20111105000000|20111106223000
||||P

The following defines the ASTM 1394 Request record fields that can be transmitted from the LIS in a Download message and are accepted and acted upon by the BD MAX. The Starting Date/Time to Ending Date/Time range is important for this query because all tests within the Starting Date/Time to Ending Date/Time will be sent to the LIS when requested, whether or not they have been previously sent.

Patient ID Request Field (Q, 3, 1, 1) – The only accepted value in this field is ALL.

Q|1|ALL^ALL||^CONFIRMED_POSITIVE||20111105000000|20111106223000
||||P

Accession Request Field (Q, 3, 1, 2) – The only accepted value in this field is ALL.

Q|1|ALL^ALL||^CONFIRMED_POSITIVE||20111105000000|20111106223000
||||P

Test Status (Q, 5, 1, 2) The BD MAX instrument accepts queries for vials with a status as follows:

INST_POSITIVE = POSITIVE

INST_NEGATIVE = NEGATIVE

CONFIRMED_POSITIVE = CONFIRMED POSITIVES

INST_UNREPORTABLE = INDETERMINATE & UNRESOLVED

ALL = POSITIVE & NEGATIVE & CONFIRMED POSITIVES &
INDETERMINATE & UNRESOLVED

Q|1|ALL^ALL||^CONFIRMED_POSITIVE||20111105000000|201111062230
00||||P

Starting Date\Time (Q, 7, 1, 1) – Requested starting time for query - the beginning of the Date/Time range for which data should be collected. If it is null, the BD MAX will use today's date minus 30 days. NOTE: The time that is used for any starting date/time is 12:00:00 a.m.

Q|1|ALL^ALL||^CONFIRMED_POSITIVE||20111105000000|20111106223000
||||P

End Date\Time (Q, 8, 1, 1) – Requested ending time for the query - the ending of the Date/Time range for which data should be collected. It must be greater than the Starting Date/Time or the query will be rejected. If it is null, the BD MAX will use the current date time. NOTE: The time that is used for any ending date/time is 12:00:00 a.m.

Q|1|ALL^ALL||^CONFIRMED_POSITIVE||20111105000000|20111106223000
||||P

Request Information Status Code (Q, 13, 1, 1) – The following codes are the only codes that will be used in the BD MAX:

A – abort/cancel last request.

P – preliminary results.

Q|1|ALL^ALL||^CONFIRMED_POSITIVE||20111105000000|20111106223000
||||**P**

14.6.13.3. Details for Bi-directional connection (worklist upload to BD MAX)

The following information can be downloaded to the BD MAX from LIS and will be imported to the worklist:

Test/assay name (O, 16, 1, 1) (can only be downloaded)

O|1|23878||^BDMAX_AND|||||BD MAX MRSA

Accession number (O, 3, 1, 1)

O|1|23878||^BDMAX_AND|||||BD MAX MRSA

Test ID (O, 5, 1, 4) (constant, stay the same regardless of the test/assay name or patient info)

O|1|23878||^BDMAX_AND|||||BD MAX MRSA

Once the worklist imported, the user will need to scan/enter the accession number to highlight the right tube. The SBT barcode can then be assigned to the sample.

14.6.13.3.1. LIS Codes for Current BD MAX Assays

The table below outlines the strings that will be sent to the LIS in the Test/assay name field in the result fields of an LIS message. LIS Code is the value that will appear in the Test Name field.

NOTE: Assays LIS Order Code Remap Feature is also available. Refer to BD MAX User's Manual (8089570/8089571) for additional details.

Assay Name (kit box name)	Test names (ADF names) *Names in <i>italic</i> refer to ADF name in previous 3-snap in configuration	LIS Targets (Analyte name)	Common organism name
BD MAX™ Cdiff	<i>BD MAX Cdiff</i> BD MAX Cdiff 56	CDIFF	<i>Clostridium difficile</i>
BD MAX™ Enteric Bacterial Panel	<i>BD MAX Ent Bac</i> BD MAX ENT BAC 52	Shig STX Campy Salm	<i>Shigella</i> species Shiga toxin (E coli O157 + others) <i>Campylobacter</i> <i>Salmonella</i> species
BD MAX™ Extended Enteric Bacterial Panel *The 4 first targets are detected by the BD MAX™ Enteric Bacterial Panel Master Mix, used in conjunction with the BD MAX™ Extended Enteric Bacterial Panel.	BD MAX EX ENT BAC 26	Shig STX Campy Salm Vibrio Plesio ETEC Yersi	<i>Shigella</i> species Shiga toxin (E coli O157 + others) <i>Campylobacter</i> <i>Salmonella</i> species <i>Plesiomonas shigelloides</i> <i>Vibrio</i> (<i>V.vulnificus</i> , <i>V.parahaemolyticus</i> , <i>V.cholerae</i>) Enterotoxigenic <i>E.coli</i> <i>Yersinia enterocolitica</i>
BD MAX™ Enteric Parasite Panel	<i>BD MAX Ent Parasite</i> BD MAX ENT PARA 53	Glamb Ehist Crypto	<i>Giardia lamblia</i> <i>Cryptosporidium</i> (<i>C.hominis</i> and <i>C.parvum</i>) <i>Entamoeba histolytica</i>
BD MAX™ GBS	<i>BD MAX GBS</i> BD MAX GBS 61	GBS	Group B Strep
BD MAX™ GC rt PCR	<i>BD MAX GC rt PCR</i> BD MAX GC rt PCR 60	GC	<i>N. gonorrhoeae</i>
BD MAX™ CT GC	<i>BD MAX CT GC</i> BD MAX CT GC 59	CT GC	<i>C.trachomatis</i> <i>N. gonorrhoeae</i>
BD MAX™ CT GC TV	<i>BD MAX CT GC TV</i> BD MAX CT GC TV 58	CT GC TV	<i>C.trachomatis</i> <i>N. gonorrhoeae</i> <i>Trichomonas vaginalis</i>
BD MAX™ MRSA	BD MAX MRSA	MRSA	MRSA
BD MAX™ MRSA XT	<i>BD MAX MRSA XT</i> BD MAX MRSA XT 54	MRSA	MRSA
BD MAX™ StaphSR	<i>BD MAX StaphSR</i> BD MAX StaphSR 55	SA MRSA	<i>S. aureus</i> (MSSA, sensitive Staph) MRSA
BD MAX™ Vaginal Panel	BD MAX Vaginal 46	BV Cgroup Ckru Cgla TV	Bacterial vaginosis markers <i>Candida</i> spp. <i>Candida glabrata</i> <i>Candida krusei</i> <i>Trichomonas vaginalis</i>
BD MAX™ CRE RUO	BD MAX CRE RUO	KPC OXA-48 NDM	Carbapenem-resistant Enterobacteriaceae

14.6.14. Guidelines for Setting up a Connection

14.6.14.1. Tools and Information Required

When setting up a new LIS connection, the customer must provide the list of assays and UDP (User Defined Protocols) that will have to be connected to the LIS.

A computer will be required during installation.

14.6.14.2. Required Cables and Adapters

Cables and, in some cases, adapters will be required for installation. Required cables and adapters may change depending on the LIS system used by the customer. These cables and adapters must be provided by the customer (there is no part number for these).

14.6.14.2.1. COM-Port to Network (RJ45) Adapter

The LIS provider and/or local IT determines the settings.

14.6.14.2.2. COM-Port

If a COM port (DB9) is not available on the computer connecting to the BD MAX, a COM port adapter will need to be installed.

14.6.14.2.3. Null-Modem Cable

For all direct connections with a COM-Port, a Null Modem Cable must be used.

14.6.14.3. Setting the Connection to LIS

- a) Physically connect the LIS cabling system.
- b) Set the LIS configuration according to the LIS provider parameters and customer options.
- c) Provide an example of the string for each assay that will be uploaded/downloaded to and from the LIS to the LIS vendor.
- d) Test the connection for upload and download.