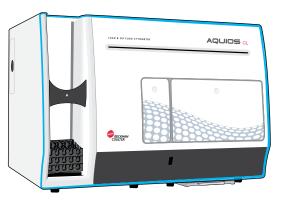
# **AQUIOS LIS Interface Specification**



B26365AB April 2015





#### **AQUIOS LIS Interface Specification**

PN B26365AB April 2015

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# **Revision History**

#### Initial Release, May 2014

Software Version 1.0

#### Issue AB, April 2015

Software version 2.0

Updates were made to the following sections: Supported Transport Methods, Format Column, Unicode Column, Patient Information Record – "P", Comment Record – "C", Manufacturer Record - "M" Image Transmission, APPENDIX A, Test Order IDs and removed original Appendix A, Character Sets.

This document applies to the latest software listed and higher versions. When a subsequent software version affects the information in this document, a new issue will be released to the Beckman Coulter website. For labeling updates, go to www.beckmancoulter.com and download the latest version of the manual or system help for your instrument.

B26365AB iii

iv B26365AB

# Safety Notice

Read all product manuals and consult with Beckman Coulter-trained personnel before attempting to operate instrument. Do not attempt to perform any procedure before carefully reading all instructions. Always follow product labeling and manufacturer's recommendations. If in doubt as to how to proceed in any situation, contact your Beckman Coulter representative.

Beckman Coulter, Inc. urges its customers to comply with all national health and safety standards such as the use of barrier protection. This may include, but is not limited to, protective eyewear, gloves, and suitable laboratory attire when operating or maintaining this or any other automated laboratory analyzer.

# **Alerts for Warning and Caution**



WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. May be used to indicate the possibility of erroneous data that could result in an incorrect diagnosis (does not apply to all products).



CAUTION indicates a potentially hazardous situation, which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices. May be used to indicate the possibility of erroneous data that could result in an incorrect diagnosis (does not apply to all products).

B26365AB V



#### Risk of operator injury if:

- All doors, covers and panels are not closed and secured in place prior to and during instrument operation.
- The integrity of safety interlocks and sensors is compromised.
- Instrument alarms and error messages are not acknowledged and acted upon.
- You contact moving parts.
- You mishandle broken parts.
- Doors, covers and panels are not opened, closed, removed and/or replaced with care.
- Improper tools are used for troubleshooting.

#### To avoid injury:

- Keep doors, covers and panels closed and secured in place while the instrument is in use.
- Take full advantage of the safety features of the instrument.
- Acknowledge and act upon instrument alarms and error messages.
- Keep away from moving parts.
- Report any broken parts to your Beckman Coulter Representative.
- Open/remove and close/replace doors, covers and panels with care.
- Use the proper tools when troubleshooting.



System integrity could be compromised and operational failures could occur if:

- This equipment is used in a manner other than specified. Operate the instrument as instructed in the product manuals.
- You introduce software that is not authorized by Beckman Coulter into your computer. Only operate your system's software with software authorized by Beckman Coulter.
- You install software that is not an original copyrighted version. Only use software that is an original copyrighted version to prevent virus contamination.



If you purchased this product from anyone other than Beckman Coulter or an authorized Beckman Coulter distributor, and, it is not presently under a Beckman Coulter service maintenance agreement, Beckman Coulter cannot guarantee that the product is fitted with the most current mandatory engineering revisions or that you will receive the most current information bulletins concerning the product. If you purchased this product from a third party and would like further information concerning this topic, contact your Beckman Coulter Representative.

Vİ B26365AB

# Contents

```
Revision History, iii
                    Safety Notice, v
                    Introduction, ix
CHAPTER 1:
                    Communication Transport, 1-1
                    Supported Transport Methods, 1-1
                             Serial Configuration Options, 1-1
                             TCP/IP Configuration Options, 1-2
                             Multiple Lines of Transport, 1-2
                    ASTM Protocol, 1-2
                             ASTM Data Record Format, 1-2
                             ASTM Message General Format, 1-3
                                ASTM Message Record Codes, 1-3
                                Unicode support, 1-4
                    LIS Message Formats, 1-4
                             Max Len Column, 1-4
                             Format Column, 1-4
                                Floating Point Format, 1-5
                             Receive Column, 1-6
                             Send Column, 1-6
                             Unicode Column, 1-7
                             Header Record - "H", 1-7
                             Patient Information Record - "P", 1-8
                             Test Order Record - "O", 1-9
                             Result Record - "R", 1-11
                             Comment Record - "C", 1-13
                             Host Query (Request Information Record), 1-14
                             Message Terminator Record - "L", 1-15
                             Manufacturer Record - "M|106" (Test Communication), 1-16
                             Manufacturer Record - "M" Image Transmission, 1-16
                    Rules, 1-18
                    Graphic Results, 1-18
                             Histograms, 1-18
```

**APPENDIX A:** Test Order IDs, A-1

Test Order IDs, A-1

**APPENDIX B:** Messages, B-1

Messages, B-1

**APPENDIX C:** Messages from ASTM Engine, C-1

General ASTM Protocol Errors, C-1 Errors With Individual Fields, C-3

Port-Specific Errors, C-4

**APPENDIX D:** AQUIOS LIS Trace Log, D-1

AQUIOS LIS Trace Log, D-1

Glossary

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Customer End User License Agreement

**Related Documents** 

# **Purpose**

This document establishes the basis for the design and implementation of an LIS interface by both LIS Vendors and the AQUIOS system. This document is also intended to be used by service and support personnel as a guide to diagnosing and troubleshooting LIS communication problems.

### **Overview**

The primary purpose of the LIS interface is to allow the AQUIOS system to receive sample programming from an LIS and transmit results to an LIS.

## **Conventions**

This document uses the following conventions:

- Bold face font indicates buttons or selections that appear on the Workstation screen.
- The term select is used to indicate either one or both of the following actions:
  - To tap or touch with your finger.
  - To click with a mouse.

**NOTE** The verb "press" is reserved for mechanical buttons, such as keys on the keyboard.

- The software path to a specific function or screen appears with the greater then (>) symbol between screen options.
- Links to information in another part of the document for additional information are in blue and are underlined. To access the linked information, select the blue, underlined text.

**IMPORTANT** IMPORTANT is used for comments that add value to the step or procedure being performed. Following the advice in the IMPORTANT adds benefit to the performance of a piece of equipment or to a process.

**NOTE** NOTE is used to call attention to notable information that should be followed during use or maintenance of this equipment.

B26365AB jX

# **Introduction** Conventions

X B26365AB

# **Communication Transport**

# **Supported Transport Methods**

The following transports are supported for CLSI (NCCLS) LIS1-A:

- Serial serial parameters are configurable.
- TCP/IP As server or client.

**NOTE** The AQUIOS system is the server and the LIS system is the client.

# **Serial Configuration Options**

AQUIOS will allow the following configuration options for Serial data transport:

- Port
  - Options: All Available Ports
  - Default: First Available Port
- Baud Rate
  - Options: 4800, 9600, 19200, 38400, 57600
  - Default: 9600
- Data Bits
  - Options: 8
  - Default: 8
- Stop Bits
  - Options: 1
  - Default: 1
- Parity
  - Options: Even, Odd, None
  - Default: None
- Flow Control
  - Options: None, RTS

Default: None

# **TCP/IP Configuration Options**

AQUIOS will allow the following configuration option for TCP/IP data transport:

• Port Number (default is 12001)

## **Multiple Lines of Transport**

AQUIOS will support only single line communications to the LIS.

#### **ASTM Protocol**

The low-level protocol is specified by the "Standard for Low-Level Protocol to Transfer Messages Between Clinical Laboratory Instruments and Computer Systems", LIS1-A (formerly ASTM E1381-02).

The format of the records used is based on "Specification for Transferring Information Between Clinical and Laboratory Instruments and Information Systems; Approved Standard--Second Edition", LIS2-A2 (formerly ASTM 1394)

The data transmission rate for an LIS using TCP/IP will conform to IEEE 802.3 and operate at least 10 MB/second. (LIS01-A2-7.2.3.1).

AQUIOS uses a frame size of 247 bytes (including the 7 bytes of overhead) for serial communication. AQUIOS supports a frame size of 64,000 bytes (including overhead) for TCP communication. However, in order to improve LIS compatibility, AQUIOS will not send frames larger than 8192 bytes (including overhead).

When there is line contention (both systems are bidding at the same time), AQUIOS will behave as an Instrument (LIS01-A2, 6.2.7.1). When line contention occurs, the user will be able to configure the number of line bid retries that will be sent before raising a loss of communication alert. AQUIOS will wait a random amount of time between 1 and 3 seconds after line bid contention to send another ENO.

#### **ASTM Data Record Format**

The data record format for all transmissions to and from AQUIOS is:

<STX> FN <FRAME> <CR> <<ETB> or <ETX>> <CS> <CR><LF>

where:

<stx></stx>	the start of message character (Hexadecimal ASCII CODE:: 0x02)					
FN	Frame number (Integer Value: 0 to 7)					
<frame/>	data - the message					

1-2 B26365AB

<cr></cr>	data always terminated by a carriage return (Hexadecimal ASCII CODE: 0x0D)
	<b>NOTE</b> <cr> is only present when ETX is present i.e. at the end of a record.</cr>
<etb></etb>	end of frame – required when record is too big for a frame (Hexadecimal ASCII CODE: 0x17)
<etx></etx>	end of frame (Hexadecimal ASCII CODE: 0x03)
<cs></cs>	checksum - follows exactly LIS1-A 6.3.3. in the case of CS.
<cr></cr>	Carriage Return ASCII character (Hexadecimal ASCII CODE: 0x0D)
<lf></lf>	Line Feed ASCII character (Hexadecimal ASCII CODE:0x0A)

# **ASTM Message General Format**

### **Sending Sample Program**

- H Header record
  - P Patient Information (demographics)
    - C Patient comment if any
    - O Order (sample information)
      - C Sample Comment if any
- L Terminator record

All messages will start with a header record and finish with a terminator record.

# **ASTM Message Record Codes**

Record Type	Sent By	Record Explanation			
H - Header Record	LIS and AQUIOS	Record contains information about the LIS			
		and AQUIOS. It also defines the field,			
		repeat, and component delimiters.			
P - Patient Information Record	LIS and AQUIOS	Record contains information about an			
		individual patient.			
		Sent by AQUIOS, immediately preceding an			
		Order Record.			
O - Test Order Record	LIS and AQUIOS	When sent by an LIS, this record represents			
		a test order (i.e., tests to run).			
		Sent by AQUIOS, immediately preceding a			
		Result Record.			
R - Result Record	AQUIOS	Sent by AQUIOS to deliver a test result for a			
		single test performed on a sample.			

Record Type	Sent By	Record Explanation			
C - Comment Record	AQUIOS	Record contains sample comments.			
		AQUIOS discards comment records sent by			
		the LIS.			
Q - Request Information Record	AQUIOS	Request Information Record (Host Query)			
L - Message Terminator Record	LIS and AQUIOS	Terminator Record			

#### **Unicode support**

AQUIOS uses characters in the Unicode character set with a UTF-8 encoding as characters in some of the data fields of messages transmitted and received.

By default, AQUIOS will use the delimiters below. AQUIOS can support any set of delimiters that are defined as per LIS2-A2 delimiter requirements. AQUIOS also supports LIS2-A2 standard escape delimiter processing for embedding delimiters within fields.

Delimiter Type	Delimiter	Description			
Field		Vertical bar ( ) Latin-1 (124)			
Repeat	\	Backslash (\) Latin-1 (96)			
Component	^	Caret (^) Latin-1 (94)			
Escape &		Ampersand (&) Latin-1 (38)			

# **LIS Message Formats**

The following paragraphs define the column specification for the LIS message formats.

#### Max Len Column

The maximum length specified for this field. If this field is blank, then the AQUIOS will not validate the length of this field.

#### **Format Column**

The Format column will be specified as follows:

Format Column	Description
N	Numeric – '0', '1', '2', '3', '4', '5', '6', '7', '8' and '9' only
F	Floating Point – see Floating Point Format
FS	Floating Point plus symbols – A floating point number which may be preceded by a single '<' or '>' to indicate a range of numbers.

1-4 B26365AB

Format Column	Description
С	Characters - Supports either standard ASCII or Unicode UTF-8 encoded characters depending on the field or component. See Unicode Column below.
	<b>NOTE</b> Leading and trailing whitespace will be removed.
C-X	Characters-Exact - Same as C, however, it must match the given choices provided in the specification for the particular field or component. If an exact match is not made, the message will be rejected.
D	Date – YYYYMMDD
DT	Date and Time – YYYYMMDDHHMMSS
Т	Time – HHMMSS
ID	ID format - Same as C.

#### **Floating Point Format**

The receiver should be able to handle as many significant figures as are possible given a field's length. If a field has a length of 15, the receiver should have some method of storing 15 digits of precision. Floating point formatted fields must contain at least one digit (ASCII 0x30-0x39), an optional single decimal point (ASCII 0x2E) in any position, and an optional leading hyphen (ASCII 0x2D) to indicate a negative number. If a required field that has this format does not have valid syntax the message will be rejected.

#### Grammar

This is an Extended Backus-Naur Form grammar describing the floating point format.

- Digit ::= '0' | '1' | '2' | '3' | '4' | '5' | '6' | '7' | '8' | '9';
- Number ::= Digit+;
- Float ::= Number | Number '.' | '.' Number | Number '.' Number ;
- SignedFloat ::= Float | '-' Float ;

# **Examples**

Valid:

-0.0023

1.

9248

0.00005

**-.**5

Invalid:

.

-.

# **Receive Column**

The Format column will be specified as follows:

Receive Column	Description
Req	<ul> <li>This field must be sent by the sender.</li> <li>The AQUIOS will validate the length and format of this field. This field must be well-formed or the message will be rejected. See APPENDIX B, Messages for message.</li> </ul>
Yes	<ul> <li>Sending this field is optional.</li> <li>If the field is sent, the AQUIOS will validate the length and format of this field. This field must be well-formed or the message will be rejected. See APPENDIX B, Messages for message.</li> </ul>
No	<ul><li>This field is ignored by the AQUIOS.</li><li>The AQUIOS will not validate the length and format of this field.</li></ul>

# **Send Column**

The Format column will be specified as follows:

Send Column	Description
Req	<ul> <li>The AQUIOS will always send this field.</li> <li>The AQUIOS guarantees that this field will satisfy the message length and format specified.</li> </ul>
Yes	<ul> <li>Sending this field is optional. If data is available, the AQUIOS will send this field.</li> <li>AQUIOS guarantees that this field will satisfy the message length and format specified.</li> </ul>
No	The AQUIOS will not send this field.

1-6 B26365AB

# **Unicode Column**

The Unicode column will be specified as follows:

Unicode Column	Description
Yes	<ul><li>The AQUIOS supports the Unicode (UTF-8) characters for this field.</li><li>Unicode characters must be specified by Unicode escape characters.</li></ul>
No	The AQUIOS will not accept Unicode characters for this field. If a Unicode escape character is found in this field, the message will be rejected. See APPENDIX B, Messages.

# Header Record - "H"

The Header Record will be the first record of each message sent.

Any set of messages always starts with message header record 'H'. The second field in this record contains the delimiters that are going to be used for the set of records.

The Header record will be formatted as specified in the table below.

Field No.	Description	Delimiter	Max Len	Format	Receive	Send	Unicode	Example/Comments
1	Record Identifier		1	С	Req	Req	No	Н
2	Delimiters: Field	I	1	С	Req	Req	No	vertical bar ( ) Latin-1(124)
	Repeat delimiter	\	1	С	Req	Req	No	backslash (\) Latin-1(96)
	Component delimiter	^	1	С	Req	Req	No	caret (^) Latin-1(94)
	Escape delimiter	&	1	С	Req	Req	No	ampersand (&) Latin-1(38)
5	Sender Name or ID	I	128	С	Yes	Yes	No	AQUIOS
	Device ID	^	128	N	Yes	Yes	No	This is the Workstation ID from the LIS setup screen. This number should be unique per workstation or computer connected to the LIS. The maximum length is 128 for receive and 10 for send.
13	Version Number	I	128	С	Yes	Yes	No	LIS2-A2 This is the ASTM version
14	Date and Time of Message	I	14	DT	Yes	Yes	No	20020417120501
	End of Record	<cr></cr>	1		Req	Req	No	

#### **Example:**

Sending Header and Terminator (Minimum Header)

Sending Header and Terminator (Long Header)

# Patient Information Record - "P"

The patient record is used as defined by the LIS2-A2 protocol and will be sent before test order information, even if there is no patient information.

A patient message without a test order record will be ignored.

The Patient Information Record will be formatted as specified in the table below.

Field No.	Description	Delimiter	Max Len	Format	Receive	Send	Unicode	Example/Comments
1	Record Identifier		1	С	Req	Req	No	P
2	Sequence Number		5	N	Req	Req	No	
4	Laboratory-Assigned Patient ID	I	50	ID	Yes	Yes	Yes	
5	Government ID (Social Security Number)	I	50	С	Yes	Yes	Yes	
6	Patient Name Last Name		50	С	Yes	Yes	Yes	Doe
	First Name	^	50	С	Yes	Yes	Yes	John
	Middle Name	^	1	С	Yes	Yes	Yes	М
8	Birth date		8	D	Yes	Yes	No	19501120, YYYYMMDD
9	Sex		1	С	Yes	Yes	No	M = Male
								F = Female
								U = Unknown or Undefined
								(If blank or non-listed value, will
								assume 'U')
14	Attending Physician ID (Doctor)	-	50	С	Yes	Yes	Yes	NOTE AQUIOS will use the physician stated here and not the one from the order record.  11532
	Last Name	^	50	С	Yes	Yes	Yes	Jones
	First Name	^	50	С	Yes	Yes	Yes	Mark
	Middle Name	^	1	С	Yes	Yes	Yes	М

1-8 B26365AB

Field No.	Description	Delimiter	Max Len	Format	Receive	Send	Unicode	Example/Comments
25	Admission Status		50	С	Yes	Yes	Yes	
26	Patient Location		50	С	Yes	No	Yes	Room 421
	End of Record	<cr></cr>	1		Req	Req	No	<cr></cr>

#### **Example:**

Sending Patient Information Record

# Test Order Record - "O"

The Test Order Record contains all specimen information, including test requests.

When receiving results from AQUIOS, the LIS must not use the Specimen Type to determine if the AQUIOS specimen is the same as the LIS specimen. If the LIS had previously sent a blank Specimen Type and a user had set the Specimen Type at AQUIOS, then it's possible for AQUIOS to report results to the LIS with a different Specimen Type from the LIS's Specimen Type.

Field No.	Description	Delimiter	Max Len	Format	Receive	Send	Unicode	Example/Comments
1	Record Identifier		1	С	Req	Req	No	0
2	Sequence Number		5	N	Req	Req	No	
3	Specimen ID/Control ID (Sample ID)	I	25	ID	Req	Req	Yes	SAMPLE001
5	Universal Test ID: Identifier	I			No	No	No	
	Name	^			No	No	No	
	Туре	^			No	No	No	
	Test ID <sup>1</sup>	^	50	С	Req	Req	Yes	(see APPENDIX A, Test Order IDs)
6	Priority	ı	1	C-X	Yes	Yes	No	Receive - always discarded Send - always sends "R" for Routine.
8	Specimen Collection Date and Time	I	14	DT	Yes	Yes	No	20091005120000

Field No.	Description	Delimiter	Max Len	Format	Receive	Send	Unicode	Example/Comments
12	Action Code	I	1	C-X	Yes	Yes	No	Receive:  C = Cancel tests. <sup>2</sup> A = Add to existing tests or create a new sample order if none exists.  (If blank or non-listed value, will generate an error and reject the order request.)  Send:  Always sends "A"
16	Specimen Type (Sample Type)	I	50	C-X	Yes	Yes	No	NOTE The values above may be mapped to other codes in the software.  (May be blank if Report Type = "Y" or "X")
17	Ordering Physician ID	I	128	С	Yes	No	Yes	NOTE AQUIOS will use the physician stated in the patient record and not the one from the order record.  102
	Last Name	^	128	С	Yes	Yes	Yes	Jones
	First Name	^	128	С	Yes	Yes	Yes	Mark
	Middle Name	^	1	С	Yes	Yes	Yes	М
26	Report Type		1	C	Yes	Yes	No	For Receive: Y, Z = No Information in response to a Host Query O = LIS provided order. (If blank or non-listed value (other than 'X'), will assume 'O') For Send: X = When Order or Sample is rejected by AQUIOS. O = otherwise
	End of Record	<cr></cr>	1		Req	Req	No	<cr></cr>

 $<sup>^{1}</sup>$  It is recommended for LIS to use repeat delimiter and not use separate order records for each test to download the sample programs.

1-10 B26365AB

 $<sup>^2</sup>$  If no test codes are sent with the cancel request, the entire sample will be cancelled. If test codes are sent, only those tests will be cancelled.

#### **Example:**

```
Sending Test Order Record (Normal Order)
```

```
 H \mid \ ^ \& \ ^ CR> \\ P \mid 1 \mid \ PID \mid \ Smith \land \ John \land S \mid \ 19501120 \mid M \mid \ \mid \ \mid \ Dr. \ Mark \ Jones \mid \ \mid \ \mid \ \mid \ \mid \ Room \ 421 < CR> \\ O \mid 1 \mid \ SAMPLE001 \mid \ ^ \land ^ \land \ 01A \setminus ^ \land ^ \land 02A \mid S \mid \ 20091005120000 \mid \ \mid \ A \mid \ \mid \ Serum \mid Dr. \ John \ Jones \ Jr. \mid \ \mid \ \mid \ \mid \ \mid \ \mid \ O < CR> \\ L \mid 1 \mid N < CR>
```

Sending Test Order Record (No Test Order, in response to Host Query)

Sending Test Order Record (Cancel some tests on a sample)

```
H | \ ^ & <CR>
P | 1 | | PID <CR>
O | 1 | SAMPLE001 | | ^ ^ ^ 01A \ ^ ^ 02A | | | | | | | C <CR>
L | 1 | N <CR>
```

Sending Test Order Record (Cancel all tests on sample)

```
H | \ ^ & <CR>
P | 1 | | PID <CR>
O | 1 | SAMPLE001 | | | | | | | | C <CR>
L | 1 | N <CR>
```

AQUIOS Rejecting Test Order Record

#### Result Record - "R"

The Result Record contains the result of a single analytical determination.

This message is sent from AQUIOS to the LIS.

AQUIOS will send one Result Record for each test result obtained.

The Result Record will be formatted as specified in the table below.

Field No.	Description	Delimiter	Max Len	Format	Receive	Send	Unicode	Example/Comments
1	Record Identifier		1	С	Req	Req	No	R
2	Sequence Number	1	5	N	Req	Req	No	
	Universal Test ID: Identifier	I			No	No	No	See APPENDIX A, Test Order IDs for Test IDs
3	Name	^			No	No	No	
	Туре	^			No	No	No	^^^TETRA1+CD3PCT^^^-
	Test ID	^	128	С	No	Req	Yes	This is the result for
	Replicate Number	^			No	No	No	CD3 Percent for the
	Reagent Lot Number	^			No	No	No	test TETRA1. It is
		^			No	No	No	comprised of the test
	Reagent Serial							order id followed by a
	Number							+ sign then the result
								code
	Data Measurement/Value		128	FS	No	Yes	No	This field may contain a
	(Primary Result							qualitative or a quantitative
4								result, depending on which is
								selected as the primary at
								AQUIOS.
	Value	^	128	С	No	Yes	No	10
	Interpretation	^	128	С	No	Yes	No	
5	Units	l	128	С	No	Yes	Yes	Blank
	Reference Range		128	С	No	Yes	Yes	
6	Action Range Low,							
	Action Range High,							123,157,135,145
	Normal Range Low,							
	Normal Range High							
7	Result Abnormal Flag		128	С	No	Yes	Yes	Blank if within range.
								L = Result is lower than the Normal Range
								H = Result is higher than the Normal Range
								LL = Result is lower than the Action Range
								HH = Result is higher than the Action Range
9	Result Status		1	С	No	Yes	No	F=Final
13	Date/Time Test Completed	I	14	DT	No	Yes	No	Represents Date/Time that transmission is sent to the LIS.

1-12 B26365AB

Field No.	Description	Delimiter	Max Len	Format	Receive	Send	Unicode	Example/Comments
14	Instrument Identification (Sender Name)	I	128	С	No	Yes	No	Serial number of instrument used for the sample run
	Device ID	^	50	N	No	Yes	No	Blank
	End of Record	<cr></cr>	1		Req	Req	No	<cr></cr>

#### **Example:**

Sending Sample results

### Comment Record - "C"

Comment records sent by the LIS will be received by AQUIOS, however they will be discarded. AQUIOS does not send Patient Comment records nor Result Comment records.

AQUIOS does send Sample Comment records following an Order record as follows:

- Sample Comment
  - Sent after an order record.
  - This record is optional.
  - Comments greater than the maximum length will be sent as multiple records.
  - Will have a comment type of "G" to indicate that the comment field is a generic comment.
  - Information reported by the Sample Comment records:
    - Reports the reason for an order rejection. Up to a maximum of 3 errors will be identified per order. The system interprets more than 3 errors as a serious failure.
    - Reports the flags which pertain to the entire test. Each flag is reported as a separate comment.
    - Report any notifications which pertain to the entire test. Each notification is reported as a separate comment.
    - Reports a listing of the result codes which are For Analytical QC purposes only. See APPENDIX A, Test Order IDs with below text:
      - The following result codes are For Analytical QC purposes only.
    - Reports a listing of the result codes which are for population statistics. See APPENDIX A, Test Order IDs with below:

The following result codes are Population Statistics.

The Comment Record will be formatted as specified in the table below.

Field No.	Description	Delimiter	Max Len	Format	Receive	Send	Unicode	Example/Comments
1	Record Identifier		1	С	Req	Req	No	С
2	Sequence Number	I	5	N	Req	Req	No	
3	Comment Source		1	С	No	Yes	No	I = Clinical Instrument
4	Comment (Applies only to Order records)	I	256	С	Yes	Yes	Yes	Order Comment example: "Sample is hemolyzed"
5	Comment Type	ı	1	С	Yes	Yes	Yes	I = Instrument Flag(s) Comment G = Generic Comment (If blank or non-listed value, will assume 'G').
	End of Record	<cr></cr>	1		Req	Req	No	<cr></cr>

#### **Example:**

Sending Sample Comment Record

```
H | \ ^ & <CR>
```

P | 1 || PID || Smith^John^S || 19501120 | M | W || || Dr. Mark Jones || || || || Hospital^Room 421 <CR>

C | 1 | I | Sample is hemolyzed. | G < CR >

R | 1 | ^ ^ ^ 01A ^ 2 ^ LOT1 ^ 123 | 12.04 | mg / ml | | | | F | | | | 20090501130000 | DxC1 ^ 01 <CR>

R | 1 | ^ ^ 02A ^ 1 ^ LOT2 ^ 321 | 1.04 ^ Positive | mg / ml | | | | F | | | | 20090501130000 | DxC2 ^ 02 <CR>

L | 1 | N < CR>

# **Host Query (Request Information Record)**

The LIS must download test orders as soon as they become available or changes have been made which require an update to AQUIOS. This means that the primary mode of operation for order download is broadcast download mode; however, the LIS must expect a host query to arrive at any time and must respond to any host query from AQUIOS. If the LIS can only operate in exclusively broadcast download or host query modes, AQUIOS provides the option to disable the sending of host query messages.

Upon receipt of a host query request, if the LIS has corresponding sample information, the LIS must reply with a sample order. If no sample information is available, the LIS must reply to the host query

1-14 B26365AB

request with a sample order where the Report Type is set to "Y". A Report Type of "Y" indicates that no sample programming is available for the sample.

The Host Query Record will be formatted as specified in the table below.

Field No.	Description	Delimiter	Max Len	Format	Receive	Send	Unicode	Example/Comments
1	Record Identifier		1	С	No	Req	No	Q
2	Sequence Number		5	N	Req	Req	No	
3	Starting Range ID Number Patient ID				No	No	No	
	Specimen ID	^	25	ID	No	Req	Yes	Repeat delimiter may be used for multiple Specimen IDs
13	Request Information Status Codes <sup>4</sup>	ı	1	C-X	No	Req	No	O = Request Sample Programming information
	End of Record	<cr></cr>	1		Req	Req	No	<cr></cr>

<sup>&</sup>lt;sup>4</sup> LIS2-A2 defines other possible codes for this field, however, only the "O" code is sent.

#### **Sending Host Query**

```
H | \ ^ & | | | AQUIOS ^ 100 | | | | | | | 1.0 | 20121004190802 <CR>
Q | 1 | ^ 1000 | | | | | | | | | | 0 <CR>
L | 1 | N <CR>
```

# Message Terminator Record - "L"

This record is sent by AQUIOS and the LIS. This record signifies the last record in a message. There must be one terminator record for every header record sent by either system.

The Terminator Record will be formatted as specified in the table below.

Field No.	Description	Delimiter	Max Len	Format	Receive	Send	Unicode	Example/Comments
1	Record Identifier		1	С	Req	Req	No	L
2	Sequence Number	I	5	N	Req	Req	No	
3	Terminator Code	I	1	C-X	Yes	Yes	No	N = Normal termination
	End of Record	<cr></cr>	1		Req	Req	No	<cr></cr>

#### **Example:**

Sending Header and Terminator

# Manufacturer Record - "M|106" (Test Communication)

The M|106 Record will be sent by either the AQUIOS as a test message to test communications between the LIS and AQUIOS. No response to this message is required.

The M|106 Record will be formatted as specified in the table below.

Field No.	Description	Delimiter	Max Len	Format	Receive	Send	Unicode	Example/Comments
1	Record Identifier		1	С	Req	Req	No	М
2	Sequence Number	_	5	N	Req	Req	No	
3	Record Identifier	_	3	N	Req	Req	No	106
4	Date and Time	_	14	DT	No	Yes	No	20020215121532
5	AQUIOS Driver Version Number	-	128	С	No	Yes	No	LIS2-A2
	End of Record	<cr></cr>	1		Req	Req	No	<cr></cr>

#### **Example:**

AQUIOS Sending M 106 Test Communication Record

 $H \mid \ ^ \& < CR >$ 

M | 1 | 106 | 20080523162244 | 1.00.00.00 <CR>

L | 1 | N < CR >

# Manufacturer Record - "M" Image Transmission

The Image record contains a single histogram.

Image Dimensions are fixed 256x256.

Transmitted Images match the Panel Report.

This message is sent from AQUIOS to the LIS.

1-16 B26365AB

If histogram transmission is enabled on the AQUIOS, histogram information is included along with regular results. Histogram records follow Order records just as Result records do, and can be interspersed with other Result records.

The Histogram Record will be formatted as specified in the table below.

Refer to Graphic Results for additional details on Image transmission format.

Histogram records will be transmitted in the order that is displayed on screen (left to right, top to bottom).

Field No.	Description	Delimiter	Max Len	Format	Receive	Send	Unicode	Example/Comm ents
1	Record Identifier		1	С	Req	Req	No	М
2	Sequence Number		5	N	Req	Req	No	
3	Universal Test ID: Identifier				No	No	No	Imagex, where x is Numeric ID of
	Name	^			No	No	No	the dataplot, ordered left to
	Туре	^			No	No	No	right, within the
	Test ID	^	128	N	No	Req	Yes	panel report.
								Example Image1
4	Data Measurement/Value (Primary Result/Histogram)	I		FS	No	Yes	No	This field contains the histogram encoded as a base64 string. See Graphic Results for more details.
9	Result Status		1	С	No	Yes	No	F = Final
13	Date/Time Test Completed	I	14	DT	No	Yes	No	Represents Date/Time that transmission is sent to the LIS.
14	Instrument Identification (Sender Name)	ı	128	С	No	Yes	No	Serial number of instrument used for the sample run
	Device ID	^	50	N	No	Yes	No	Blank
	End of Record	<cr></cr>	1		Req	Req	No	<cr></cr>

### **Rules**

- Two test requests have the same Sample ID but different Patient Information:
  - The new LIS test request is rejected and the existing test request is placed in the Incomplete tab.
  - AQUIOS sends back the order with a comment record noting the rejection of the request, with the error message in the comments field. See APPENDIX B, Messages.
- When AQUIOS rejects a sample program (request), it will send a Test Order Record with the relevant Specimen ID and a Report Type of "X". A comment record of type G after the Order record will provide a textual explanation for the rejection. See APPENDIX B, Messages.
- If the Specimen ID is blank, then AQUIOS will reject the order and send the appropriate message.

# **Graphic Results**

## **Histograms**

Graphics will be transmitted in the Value field of the Manufacturer Information Record as a jpg file binary format encoded into a Base 64 string. A .NET application can easily convert such a string using the provided FromBase64 conversion functions. For those programming languages that do not include such a function, the basic logic follows.

Each group of three bytes is stored as four Base 64 characters. The Base 64 character set includes capital letters A-Z, followed by lower-case letters a-z, followed by numbers 0-9, followed by + and / as follows:

Value	Char	Value	Char	Value	Char	Value	Char
0	Α	16	Q	32	g	48	w
1	В	17	R	33	h	49	Х
2	С	18	S	34	i	50	у
3	D	19	Т	35	j	51	Z
4	Е	20	U	36	k	52	0
5	F	21	V	37	I	53	1
6	G	22	W	38	m	54	2
7	Н	23	Х	39	n	55	3
8	I	24	Y	40	0	56	4
9	J	25	Z	41	р	57	5

1-18 B26365AB

Value	Char	Value	Char	Value	Char	Value	Char
10	K	26	a	42	q	58	6
11	L	27	b	43	r	59	7
12	М	28	С	44	S	60	8
13	N	29	d	45	t	61	9
14	0	30	е	46	u	62	+
15	Р	31	f	47	V	63	1

For example, the three bytes 0, 1, and 2 would be encoded as follows:

Byte Value	0				1						2													
Bit Pattern	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2
Index			(	)			0						4								2	2		
Base64- Encoded			,	4			Α						E								(	3		

Expanding that example, the array of bytes with values from 0 to 255 would be Base 64 encoded as follows:

 $AAECAwQFBgcICQoLDA0ODxAREhMUFRYXGBkaGxwdHh8gISIjJCUmJygpKissLS4vMDEyMzQ1Njc4\\Oto7PD0+P0BBQkNERUZHSElKS0xNTk9QUVJTVFVWV1hZWltcXV5fYGFiY2RlZmdoaWprbG1ub3BxcnN0dXZ3eHl6e3x9fn+AgYKDhIWGh4iJiouMjY6PkJGSk5SvlpeYmZqbnJ2en6ChoqOkpaanqKmqq6ytrq+wsbKztLW2t7i5uru8vb6/wMHCw8TfxsfIycrLzM3Oz9DR0tPU1dbX2Nna29zd3t/g4eLj5Oxm5+jp6uvs7e7v8Phy8/T19vf4+fr7/P3+/wA=$ 

To convert back from Base 64 to Binary, reverse the process by looking at each group of four Base 64 Characters, converting the index to six-bit patterns, and combing the four sets of six bits to make three bytes. The only catch is that if the block is not an even multiple of 3 Bytes, the Base 64 representation will be padded with equal signs as a null-value character. If one equal sign is found at the end, the last byte should not be included in the conversion. If two equal signs are found at the end, the last two bytes should not be included.

Once the Base 64 string is converted back to binary, it can be written out as a binary file with a .jpg extension, and treated as a jpg file, or manipulated as jpg data programmatically.

The following is an example of an actual manufacturing record transmission:

CAxEEBSExBhJBUQdhcRMiMoEIFEKRobHBCSMzUvAVYnLRChYkNOEl8RcYGRomJygpKjU2Nzg50k NERUZHSElKU1RVVldYWVpjZGVmZ2hpanN0dXZ3eHl6goOEhYaHiImKkpOUlZaXmJmaoqOkpaanq KmgsrO0tba3uLm6wsPExcbHyMnK0tPU1dbX2Nna4uPk5ebn6Ong8vP09fb3+Pn6/9oADAMBAAIRAx EAPwD3+iis7VdbstGFt9qaTdczpBGkaFiSzKoJx0UFlyxwBkDqQCAaNFYj+JrWPVJLR7W6W3jk8h74hB AJdu7Z97dnHfbtzxnPFUPDfjjTNdgvbltQ06OFLny7fbcqS0exGBbn73zHI7dOoNC12B6HVUVlR6vbXOs Qw2t9bzQ/Z5XkEUitghowpJHT7zVpedF/z0T/AL6FS5xW7AfRTPOi/wCeif8AfQo86L/non/fQpe0h3QpeWH0Uzzov+eif99Cjzov8Anon/AH0KPaQ7oLD6KZ50X/PRP++hR50X/PRP++hR7SHdBYfRTPOi/wCeif8 AfQo86L/non/fQo9pDugsPqlFf+brN1p/lY8iGKXzN33t5cYx2xs/WrXnRf8APRP++hWHd2Gpf25LqOm 6tp8CzQxxSRXNm0x+QuQQyypj089QelVGdN7yQN0xcbxBpaW32hrrbEI5ZSSjZVIjiQkYyNp4571Da+ KtHvL2OzhuJvPkcxqr2sqDcF34JZQASo3DJ+YcjIrJi0H7aniXz2ezGpLJbW6yuj+UjLhnAU4wzktgnPAzjo L39hRDVPtv29ONQF7s2DtbeRtzn/gWfwx3rTmoJO8tbd+v9fkO36/8D7xG8aaVLpN7fWUkk/2a0N2Fl hkgEsYGcqzqAw7EjOMjNWU8U6S9pc3IlnCWzIkiNaSiTLnCbUK7nDE8FQQe2awNL8L3s3h+C31bUbdJ l0k2EMUUAH2feq79xDkSHKKBjaMA9c5rX1TRF1Br9luNPcXcEMLRX1r9oixGztkrvXdndxyMEZ5qpy wydlL8fP8Ay/pis7m3a3Ud5ax3EPmeXIMgSRtGw9irAEH2IBqaszRLT+ydIgspr83ckecyu5OcknA3MzY GcDLE4AyT1rQ86L/non/fQrGVSmpPlloCvbUfRTPOi/56J/30KPOi/wCeif8AfQqfaQ7oLD6KZ50X/PRP ++hR50X/AD0T/voUe0h3QWH0Uzzov+eif99Cjzov+eif99Cj2kO6Cw+imedF/wA9E/76FHnRf89E/wC+h R7SHdBYfRTPOi/56J/30KVZEY4V1J9jTU4vRMB1Zuu6fLqenR28LIrrdW8xLkgbY5kdug64U4960qKpa O4I5h9D1NtXaLNn/ZL366gZPMbz9ygER7Nu3G9Qd27pxt710UNtDBLPJEm153EkhyTubaFz7cKBx6V LRQtFb+v60QdbmfN/yMNn/wBek/8A6HDV2b/USf7p/lVKb/kYbP8A69J//Q4auzf6iT/dP8qip8D9AQ +iiirAKZD/AKiP/dH8qfTIf9RH/uj+VQ/jXo/0AfTD/r1/3T/MU+mH/Xr/ALp/mKKm3zX5gh9FFFWA UUUUAFFFRwmZkJnREfewARyw25005IHJGCR2JIycZIAsX3D/ALzfzNPpkX3D/vN/M0+op/AvQGFFF FWAUUUUAMl+4P8AeX+Yp9Ml+4P95f5in1C+N+i/UAoooqwCiiigAph/16/7p/mKfTD/AK9f90/zFRU2 +a/MEPoooqwCiiigDPm/5GGz/wCvSf8A9Dhq7N/qJP8AdP8AKqU3/Iw2f/XpP/6HDV2b/USf7p/lUV PgfoCH0VBa31pe+d9kuoLjyJWhl8qQP5ci9UbHRhkZB5qvfatb2Gk3OoypOYbfduXyyrfKxU/ewAuR98 kJj5iwX5q15Xe1gL9ZN/cranTJZmeK3WVA0o3FSz4hSMhWByzyqRlWUbTnadrDL1vW9Pa8m0vWIL Q6bHPDHci6tZZkcSgeTnMYjUGQNlyzKvlqD8z/ACcraeL21K/tP7b8NOtvZXLzwSzzpNcgBHdcwxqA m35AQ5JUhScsiOlwoyupvaz7eW39aAtdi0W6fVv7PhktILI3o2mW3lmcRtxyqyhcjBIIYocgYwM5Vl/q LwJN9ks57q7jWRIoNjIssgjEgXzCNqqeBvPygnGc8V5LqvjK10+/M1lGLSW/hgFpd3NxJM+xJdruiIgd32 xoJPOkUOY1XLogLdHa+O7DTbm/uVuEurRbp1kt45LSAWyhkQzKocswmnfdukIGG3EqAC9Soc0Vy2d 7NeauvP8Ar7iIzi9md1YX2n6lK13p919qikiTE0UjPAyhnA2MPkLZDBtvPC7v4asRy3HmrHNbbd3mHzI 5AyKAwCA5w25lOcAEDDDPQtzdlqkt/qG2zu2js9TLzJdNMJDGwhVFhhDDYJA0czso8wL5TFh+8G3p4 ZlnQugcAOyfOjIcqSp4IBxkcHoRgjIINROPKywjEweUyOjIXzEFQgquBwTk7jnccjHBAxxkyVHMZlQGB Ed96gh3KjbkbjkA8gZIHcgDIzkSVABRUBe7+ySsIIDcjf5UZmOxsE7NzbcrkYzhTjJxuxkxi+W4F/HY7Jrq zfynjkLIolMauqltp4IdDkA4z3IxRysCRJGEqxiFyjb2MoK7VIYYU85yckjAI+U5I4zPVVLpIrKa5uv9FiiaV pGndQFRWb5yQSApA3cngHnByBRs9YsdYvbrTBKxurOQSSi3aUIFErBP3u1Q2TGQygkAq6H0DU04vk TtsD3NSSeGJ4kklRHmfZErMAXbBbA9ThWOB2BPagyMLhIxC5RkZjKCu1SCMKec5OSRgEfKckcZgnlt WEk80DyGwcuD9mZmVvL5MY25Y7XK5TOcsvXIqP7BbyXd+k1tPLFdxIJhPMZIJBhlKLGzELx97CgNu H3jnF2XUC/UYnha4e3WVDMiK7xhhuVWJCkjqASrYPfafSsJdXjh+3SJds8dqZNjSs32d98YnDSTeViN VG5QVLKFIzliqjaS9t5YrWWGTzorrHkywqZEYFSwbcuQFIHDHg5AzkjLcGlqBJL9wf7y/wAxT6ZL9wf7 y/zFPrFfG/RfqAUUUVYBRRRQAUw/69f90/zFPph/16/7p/mKipt81+YIfRRRVgFFFFAGfN/yMNn/AN ek/wD6HDV2b/USf7p/lVKb/kYbP/r0n/8AQ4auzf6iT/dP8qip8D9ARg+IZdO064Ooyf2cNRFnKYUkm W2uLnyiJgizFgRGCpLggrhsnABDcV8Q0a6iS3utHf7FDfpLHcTuDvmHnsvMhPmRZJBRlUKOF3IwZO8 1tbK40zU/3qSzBEg8sz5CT8NCAvmIEkLSIQQyMSU+YYUjwbxLqTjxm08ey2v1fz4Bp9sYN4dlLkkgGV 1dnRyVRgbUZCtu2+hRjKUG40zS/rqiW1Y2dM8PJ4jis7+4vLuJFZxMbi5mlmmkJCNJuY4X92qLuB6J06 itJPB8cc9x9kWx8qURtsktxIGkywaQEnPf0GLZYDgEAhNDfSrWzntJnhtoyZl3K7B9oid2U5cHEgzu+dc YwegznauLmzN7PBbymS8tE/dl2aTLruDBuTl9qkDq2Cx2nBz+bY3MsdKtNObtr6br/gd/I0wdHC1aP7 2SUn59fv8AwXa5zV74SihNwJY5JSXJMlvGFEUJI2mIsSWb+EJkgnGeArHmdMtbvUNba2/0q+js5JplsJ mST7U8UewIElBjZtqsMlN6gfKmI8DtfEWqT3FxH5d/BBHZ+X9rSS2eVEzuzIJsbkCk4JwO2CGIFc7pVgl jeefq1xby2tugL2dxHHJZvuhkMcufO2SHfLB1ZVUTx5YFgR9Lw19bcXUqbejvq/T56adL6s4/YqFVxpr

1-20 B26365AB

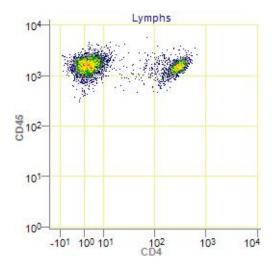
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Decoding the above Image5 Base64 string would result in the below jpg file:



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# Test Order IDs

# **Test Order IDs**

Test ID	Description					
"TETRA1"	TETRA1 test order					
"TETRA2"	TETRA2 test order					
"TETRA"	TETRA COMBO, TETRA1 test followed by TETRA2 test					

**NOTE** All test IDs are uppercase. Test requests with lower case characters will not be accepted. A request sent without a Test ID will turn off the connection to the LIS and will necessitate exiting the software and restarting.

**NOTE** Values in the Result column preceded by a single asterisk "\*" are for QC analytical purposes only, and results preceded by a double asterisk "\*\*" are for Population Statistics.

Test	Result	Result Code	Hide
TETRA1	CD3+ (T Cells) Percent	CD3PCT	FALSE
	CD3+ (T Cells) Count/uL	CD3CNT	FALSE
	CD3+/CD4+ (Helper T Cells) Percent	CD4PCT	FALSE
	CD3+/CD4+ (Helper T Cells) Count/uL	CD4CNT	FALSE
	CD3+/CD8+ (Suppressor T Cells) Percent	CD8PCT	FALSE
	CD3+/CD8+ (Suppressor T Cells) Count/uL	CD8CNT	FALSE
	CD4:CD8 Ratio Ratio	48RATIO	FALSE
	**CD3 Separation	**CD3SEP	TRUE
	**CD4 Separation	**CD4SEP	TRUE
	**CD8 Separation	**CD8SEP	TRUE

A-2 B26365AB

Test	Result	Result Code	Hide
TETRA2	**CD45 Lymph/High SS Cells Separation	**CD45SEP	TRUE
	**SS Lymph/High SS Cells Separation	**SS_SEP	TRUE
	**FS Lymph/High SS Cells Separation	**FS_SEP	TRUE
	**CD3+ Channel Number	**CD3CHNO	TRUE
	**CD56/16+ Channel Number	**CD56CHNO	TRUE
	**CD19+ Channel Number	**CD19CHNO	TRUE
	**CD45 Lymphs Channel Number	**CD45CHNO	TRUE
	**SS Lymphs Channel Number	**SSCHNO	TRUE
	**FS Lymphs Channel Number	**FSCHNO	TRUE
	CD45+ Low SS Count/uL	**LYCNT	FALSE
	CD45+ Low SS Percent	**LYPCT	FALSE
	CD45+ Count/uL	**WBCCNT	FALSE
	**CD45+ Low SS Events	**LYEVENTS	TRUE
	**Total Count	**TOTCNT	TRUE
	**CD3-/CD56+CD16+/CD19+ Percent	**56P19PPCT	TRUE
	**CD3-/CD56+CD16+/CD19+ Count/uL	**56P19PCNT	TRUE
	**CD3-/CD56-CD16-/CD19- Percent	**56N19NPCT	TRUE
	**CD3-/CD56-CD16-/CD19- Count/uL	**56N19NCNT	TRUE
	**CD3+/CD56+CD16+ Percent	**CD3PCD56PPCT	TRUE
	**CD3+/CD56+CD16+ Count/uL	**CD3PCD56PCNT	TRUE
	**CD3- Channel Number	**CD3NCHNO	TRUE
	**CD56/16- Channel Number	**CD56NCHNO	TRUE
	**CD19- Channel Number	**CD19NCHNO	TRUE
TETRACOMBO	Average CD3+ (T Cells) Percent	CD3PCT	FALSE
	Average CD3+ (T Cells) Count/uL	CD3CNT	FALSE
	CD3+/CD4+ (Helper T Cells) Percent	CD4PCT	FALSE
	CD3+/CD4+ (Helper T Cells) Count/uL	CD4CNT	FALSE
	CD3+/CD8+ (Suppressor T Cells) Percent	CD8PCT	FALSE
	CD3+/CD8+ (Suppressor T Cells) Count/uL	CD8CNT	FALSE
	CD3-/CD19+ (B Cells) Percent	CD19PCT	FALSE
	CD3-/CD19+ (B Cells) Count/uL	CD19CNT	FALSE
	CD3-/CD56+CD16+ (NK Cells) Percent	CD56PCT	FALSE
	CD3-/CD56+CD16+ (NK Cells) Count/uL	CD56CNT	FALSE
	CD4:CD8 Ratio Ratio	48RATIO	FALSE
	*Total Lymphocytes (T+B+NK) Percent	*TBNKPCT	FALSE
	*CD3+ Reliability Check	*CD3REL	FALSE

B26365AB A-3

Test	Result	Result Code	Hide
TETRACOMBO	*CD3+ Intrapanel Check	*CD3INTRA	FALSE
	CD45+ Low SS Count/uL	**LYCNT	FALSE
	CD45+ Low SS Percent	**LYPCTWBC	FALSE
	CD45+ Count/uL	**WBCCNT	FALSE
	**CD3+/CD4-/CD8- Percent	**4N8NPCT	TRUE
	**CD3+/CD4-/CD8- Count/uL	**4N8NCNT	TRUE
	**CD3+/CD4+/CD8+ Percent	**4P8PPCT	TRUE
	**CD3+/CD4+/CD8+ Count/uL	**4P8PCNT	TRUE
	**CD3+/CD4+/CD8- Percent	**4P8NPCT	TRUE
	**CD3+/CD4+/CD8- Count/uL	**4P8NCNT	TRUE
	**CD3+/CD4-/CD8+ Percent	**4N8PPCT	TRUE
	**CD3+/CD4-/CD8+ Count/uL	**4N8PCNT	TRUE
	**CD45+ Low SS Events Tetra1	**LYEVENTS1	TRUE
	**CD45+ Low SS Events Tetra2	**LYEVENTS2	TRUE
	CD3+ (T Cells) Percent Tetra1	**T1CD3PCT	FALSE
	CD3+ (T Cells) Count/uL Tetra1	**T1CD3CNT	FALSE
	CD3+ (T Cells) Percent Tetra 2	**T2CD3PCT	FALSE
	CD3+ (T Cells) Count/uL Tetra 2	**T2CD3CNT	FALSE
	**CD3-/CD56+CD16+/CD19+ Percent	**56P19PPCT	TRUE
	**CD3-/CD56+CD16+/CD19+ Count/uL	**56P19PCNT	TRUE
	**CD3-/CD56-CD16-/CD19- Percent	**56N19NPCT	TRUE
	**CD3-/CD56-CD16-/CD19- Count/uL	**56N19NCNT	TRUE
	CD45+ Low SS Count/uL Tetra 2	**T2LYCNT	TRUE
	**Total Count Tetra 1	**T1TOTCNT	TRUE
	**Total Count Tetra 2	**T2TOTCNT	TRUE
	**CD3+/CD56+CD16+ Percent	**CD3PCD56PPCT	TRUE
	**CD3+/CD56+CD16+ Count/uL	**CD3PCD56PCNT	TRUE
	**CD3 Separation Tetra1	CD3SEPT1	TRUE
	**CD3 Separation Tetra 2	CD3SEPT2	TRUE
	**CD4 Separation	CD4SEP	TRUE
	**CD8 Separation	CD8SEP	TRUE
	**CD19 Separation	CD19SEP	TRUE
	**CD56/16 Separation	CD56SEP	TRUE
	**CD45 Lymph/High SS Cells Separation Tetra1	CD45SEPT1	TRUE
	**CD45 Lymph/High SS Cells Separation Tetra 2	CD45SEPT2	TRUE
	**SS Lymph/High SS Cells Separation Tetra1	SSSEPT1	TRUE

A-4 B26365AB

Test	Result	Result Code	Hide
TETRACOMBO	**SS Lymph/High SS Cells Separation Tetra 2	SSSEPT2	TRUE
	**FS Lymph/High SS Cells Separation Tetra1	FSSEPT1	TRUE
	**FS Lymph/High SS Cells Separation Tetra 2	FSSEPT2	TRUE

B26365AB A-5

### **Test Order IDs** Test Order IDs

A-6 B26365AB

# Messages

## Messages

Message	Comments	Err	Msg to LIS
Invalid action code [Action Code] for specimen ID 1000001, rejecting message.	Logged when an invalid action code is transmitted by the LIS. The following message is also sent as a comment back to the LIS when a rejected message is sent:  Invalid action code [Action Code] for specimen ID 1000001, rejecting message.	Y	Y
The request could not be added for specimen ID 1000001 because Report Type = 'X'.	Logged when an order record sent by the LIS has the Report Type field = 'X'. Report Type = 'X' only when AQUIOS is rejecting a message.	Y	Y
Field [field name] is required but was not supplied, rejecting message.	A request was received with a blank required field. The request is rejected.	Y	Y
The request could not be added because the Sample ID 1000001 already has a request with different patient information.	Two test requests have the same Sample ID but different Patient Information. AQUIOS System sends back the order with a comment record noting the rejection of the request along with the error message in the comments field.	Y	Y
Invalid test code [Test Code] for specimen ID 1000001, rejecting message.	Logged when an invalid test code is transmitted by the LIS. The following message is also sent as a comment back to the LIS when a rejected message is sent:  Invalid test code [Test Code] for specimen ID 1000001, rejecting message.	Y	Y
Field [PatientLocation] exceed 50 characters and was truncated, rejecting message.	Exception is thrown when an incoming field exceeds the defined length. Rejected message is sent back to LIS. The following message is also sent as a comment back to the LIS when a rejected message is sent:  Field [PatientLocation] exceed 50 characters and was truncated, rejecting message.	Y	Y

B26365AB B-1

Message	Comments	Err	Msg to LIS
The request could not be added because the Sample ID is invalid. [xxx] is invalid.	Sample ID sent from LIS is invalid. Rejected message is sent back to LIS. The following messafe is sent:  The request could not be added because the Sample ID is invalid. [xxx] is invalid.	Y	Y
Error formatting data for analyzer for Specimen ID: Specimen ID, Exception.Message	Unknown type of exception is thrown when unable to create dataset when parsing ASTM message from LIS.	Y	N
An error occurred processing ASTM messages: Exception.Message	Unknown type of exception thrown when an error occurs parsing LIS transaction to send to LIS	Y	N
Error formatting result value for test code for specimen ID: Specimen ID, Exception.Message	Unknown type of exception when populating BCI. Results object for sending results to LIS.	Y	N
No ACK received sending message to LIS.	BCI.LISDeviceClient.SendResults() returns this error when sending results to LIS	Y, from Engine	N
Parsing failure sending message to LIS.	BCI.LISDeviceClient.SendResults() returns this error when sending results to LIS	Y, from Engine	N
Success sending message to LIS.	BCI.LISDeviceClient.SendResults() returns this error when sending results to LIS	N, from Engine	N
No ACK received sending rejected order message to LIS.	BCI.LISDeviceClient.SendRejectedOrders() returns this error when sending rejected order message to LIS	Y, from Engine	N
Parsing failure sending rejected order message to LIS.	BCI.LISDeviceClient.SendRejectedOrders() returns this error when sending rejected order message to LIS	Y, from Engine	N
Success sending rejected order message to LIS.	BCI.LISDeviceClient.SendRejectedOrders() returns this result when sending rejected order message to LIS to signal success.	N, from Engine	N
Error formatting rejected order message for LIS for specimen ID Specimen ID, Exception.Message	Unknown type of exception occurs when creating BCI.DriverLib.RejectedOrder object and/or calling BCI.LISDeviceClient.SendRejctedOrders().	Y	N
No specimen ID supplied for host query.	Logged when no specimen ID is sent by analyzer when requesting a host query.	Y	N
No ACK received sending host query.	BCI.LISDeviceClient.SendHostQuery() returns this error when sending host query to LIS	Y, from Engine	N
Parsing failure while sending host query.	BCI.LISDeviceClient.SendHostQuery() returns this error when sending host query to LIS	Y, from Engine	N
Success sending host query.	BCI.LISDeviceClient.SendHostQuery() returns this result when sending rhost query to LIS to signal success.	N, from Engine	N
Error formatting host query message for LIS for specimen ID Specimen ID, Exception.Message	Unhandled exception while executing BCI.LISDeviceClient.SendHostQuery()	Y	N
Disconnected or Connected	Informational message when the connection state with the LIS toggles.	N, from Engine	N

B-2 B26365AB

Message	Comments	Err	Msg to LIS
Order was received.	Informational message when an order was received from LIS.	N	N
Order cancellation was received.	Informational message when an order cancellation message was received from LIS.	N	N
SEND or RECV Data sent or received from LIS	Informational message that logs all incoming or outgoing data included in the ASTM message. Example:  SEND 1 H   \ ^ &       AQUIOS ^ 100               1.0   20120912072526  Or  RECV 1 H   \ ^ &                       1.0   20120912072526	N	N
==== An unhandled exception occurred. Driver restarted. ====	This message is logged when BCI.LISDeviceClient raises an unhandled exception.	Y, from Engine	N
ASTM processing is initialized.	Informational message when BCI.LISDeviceClient is initialized for processing message.	N	N
ASTM processing is stopped.	Informational message when BCI.LISDeviceClient processing has been terminated	N	N

B26365AB B-3

B-4 B26365AB

# Messages from ASTM Engine

### **General ASTM Protocol Errors**

These errors are should be somewhat rare outside of debugging and indicate some of the more rare (and possibly severe) connection problems or protocol violations.

Message	Comments
The byte cache has been reset. It is possible that a malformed packet was received or the connection was reset incorrectly.	Indicates that bytes making up a partial message have been thrown away in an attempt to be able to properly parse future messages. This is due to the device violating the protocol or a lossy connection.  {0}: The buffer at the time of the overflow.  TokenizerCacheReset
Received more than the maximum number of allowed bytes ({0}) in an incoming frame. Message cannot be received.	Indicates that the tokenizer received more than the specified number of allowed bytes in a data packet.  {0}: The maximum number of allowed bytes.  {1}: The buffer at the time of the overflow.  TokenizerBufferOverflow
Received a byte which failed the parity check in an incoming frame. Message cannot be received.	Indicates that the tokenizer recieved a byte which failed the parity check. FailedParityBit
Could not send frame. Did not contain correct framing bytes (STX, ETX, or ETB). {0}	Indicates that a packet could not be created due to missing frame bytes. {0}: The failed bytes. ASTMPacketFactoryFailedToPacketize
Could not send frame. Contained one or more invalid bytes. See LIS1-A 6.6.2 for further details. {0}	Indicates that a packet could not be created due to the record containing invalid bytes. {0}: The failed bytes. ASTMPacketFactoryContainedInvalidBytes
Bad packet received. Sent NAK.	Indicates that a bad packet was received, causing a NAK to be sent. FlowControlBadPacketReceived
Received unexpected bytes: {0}	Indicates that a bad byte or set of bytes was received in the given state. {0}: The byte or bytes. FlowControlReceivedUnexpectedBytesInState
Timed out while waiting to receive the next packet.	Indicates that we timed out while waiting for a response to a line bid. TimedOutWaitingForPacket
Timed out while waiting for a response to a transmitted line bid.	Indicates that we timed out while waiting for a response to a line bid. TimedOutWaitingForLBACK

B26365AB C-1

Message	Comments
Timed out while waiting for a response to a transmitted message.	Indicates that we timed out while waiting for a response to a transmitted message.  TimedOutWaitingForACK
Too many consecutive errors while trying to send.	Indicates that there were too many consecutive errors while attempting to send data. FlowControlSendingErrors
Packet failed frame number test. {0}	Indicates that the given packet failed the frame number test. {0}: The human readable string representing the packet. FlowControlFailedFrameNumberTest
Packet failed checksum test. {0}	Indicates that the given packet failed the check sum test. {0}: The human readable string representing the packet. FlowControlFailedChecksumTest
Attempted to send a record longer than the maximum allowable record length.	Indicates that the flow controller could not send a given record because it was longer than the allowed maximum record length. FlowControlRecordLength
Received a record of type {0} from the device. This record is not valid as the next record in the sequence: \r\n{1}	Indicates that the Record Collator received a record of a type it was not expecting, given the records already received.  {0}: The type of the unexpected record {1}: A newline separated list of the records already received. No more than 5 lines.  UnexpectedRecord
No Pending ASTM Records. (This is usually due to a previous error).	Used to indicate that there were no records when an unexpected record type was received. Should be passed in as the {1} argument to UnexpectedRecord. NoRecords
Received an unknown record type: {0}.	Indicates that the Record Collator received a record of a type it doesn't know how to handle. {0}: The type of the unexpected record UnknownRecord
Received an unknown manufacturer's record id: {0}.	Indicates that the Flater received a manufacturer's record of a type it doesn't know how to handle. UnknownManufacturersRecord
The device sent an incomplete transmission and it could not be parsed.	The analyzer sent a chain of bytes which did not contain enough information to identify the record type. UnableToldentifyRecord

C-2 B26365AB

### **Errors With Individual Fields**

These errors will be reported by individual fields.

Message	Comments
DeflationError	The driver cannot send the message due to an error at field '{0}':
InflationError	The driver cannot parse the message due to an error at field '{0}':
StringTooBig	The value '{0}' is too long.
BlankAttemptFailed	The driver attempted to blank the string and failed.
ArraySizeInvalid	The array size '{0}' is invalid
AnyNotDefined	The value '{0}' is not defined.
NumericOutOfRange	The value '{0}' is out of range for this field.
StringCoderFallback	Exception thrown by the string encoder/decoder The string cannot be processed due to the following: \r\n{0}
StringInvalidUnicodePoints	The string cannot be processed as it contains invalid characters:\r\n{0}
RecordTooShort	The record is '{0}' bytes long. More bytes were expected
TruncatedFieldMessage	The human-readable string which will be displayed on the Communication Log page when a field is truncated. {0}: The name of the field. Should be localized. {1}: The original, non-truncated text from the field. {2}: The truncated version of the original text. Modified {0} from '{1}' to '{2}'.
FieldParseFailed	Indicates that a field could not be successfully parsed. {0}: The human readable name of the field. {1}: The string representation of the unparsable bytes The device sent invalid characters in the {0} field.\r\nThe device sent: \"{1}\"
MaxParseLengthExceeded	Indicates that a field could not be sent because it exceeded the maximum width {0}: The human readable name of the field {1}: The expected maximum width {2}: The string representation of the unparsable bytes.  The device sent too many characters in the {0} field, exceeding the maximum allowed width of {1} characters for this type of device.\r\nThe device sent: \"{2}\"
RequiredParseDataMissing	Indicates that a transmission was received with required data missing. {0}: The human readable name of the field or component. The device sent a record which is missing required data. The missing required data is in the {0} field.
RequiredPrintDataMissing	Indicates that a transmission was received with required data missing. {0}: The human readable name of the field or component. The driver cannot send a record which is missing required data. The missing required data is in the {0} field.

B26365AB C-3

### **Port-Specific Errors**

Usually reported in the 'description' string of the DeviceClient's 'ConnectionStatus' event. If the connection is up (if the event reports 'isError' is false) the 'description' string will be blank.

Message	Comments
SerialErrorPrefix	This text directly precedes the human-readable text for any serial port error. Serial Port encountered the following error:
SerialErrorSuffix	This text directly follows the human-readable text for any serial port error. Please check serial settings for this device and try again.
TCPClientConnecting	This text directly follows the human-readable text for when a device using TCP Client is attempting to connect to a server.  Client is trying to establish connection to server.
TCPClientError	This text directly follows the human-readable text for when a device using TCP Client is disconnected.Client was closed.
TCPServerNoClientError	This text directly follows the human-readable text for when a device using TCP Server is listening but does not have a client yet.  TCP Server for driver is listening, but still does not have a connected client.
TCPServerAddressAlreadyInUse	Displayed when the TCP server has not yet started because another program is running a server on the same port.  Cannot start the TCP server because the configured port is already in use.
NamedPipeConnectionError	This text explains that a named socket connection was terminated by the other end of the connection.  Named socket server connection was terminated abnormally.

C-4 B26365AB

## **AQUIOS LIS Trace Log**

### **AQUIOS LIS Trace Log**

The table below shows the mapping of the AQUIOS LIS Trace Log.

AQUIOS Test Request Fields	AQUIOS LIS Trace Log Display
GOV ID	PATIENT ID3
PHYSICIAN CODE	DOCTOR.ID
PHYSICIAN LAST	DOCTOR.LAST
PHYSICIAN FIRST	DOCTOR.FIRST
PHYSICIAN MIDDLE	DOCTOR.MIDDLE
SAMPLE ID	SPECIMEN ID
STATUS	PATIENTADMISSIONSTATUS
LOCATION	PATIENT LOCATION
SPECIMEN TYPE	SAMPLETYPE

This message is added to the Aquios LIS Trace Log when an order request cannot be inserted into the database:

An error occurred processing LIS order request, unable to insert job to database. Speciman ID: xx, Test Name: yy.

B26365AB D-1

### **AQUIOS LIS Trace Log** AQUIOS LIS Trace Log

D-2 B26365AB

## Glossary

This glossary is a collection of specialized terms and their meanings that are either used in this manual or related to the information in it. If a term has more than one meaning, all meanings relevant to this manual are included.

**LIS** — Laboratory Information System

**AQUIOS** — The computer system that controls the instrument(s) or the AQUIOS system. AQUIOS communicates with the LIS.

**ASTM** — American Society for Testing and Material (communication protocol)

**NCCLS** — An International, interdisciplinary, nonprofit, standard-developing, and educational organization that promotes the development and use of voluntary consensus standards and guidelines within healthcare community. (NCCLS (Now known as CLSI) inherited the ASTM protocol and currently supports it.)

**CLSI** — Clinical and Laboratory Standards Institute. Formerly named NCCLS. Currently CLSI inherits and updates NCCLS or ASTM documents.

Message — A collection of information passed from one software component or device to another

**Record** — Part of a message. A message is composed of several records.

**Frame** — Part of a record. If the record size is large, it will be divided into multiple frames.

**Accept (Sample Program)** — Update the database with the sample information. No need to send a message for acceptance per ASTM protocol.

**Reject (Sample Program)** — Send a rejection message (order message with report type "X") to the LIS. Database is not updated with the sample information.

B26365AB Glossary-1

Glossary-2 B26365AB

# Index

G
general ASTM protocol errors, C-1 messages from ASTM engine, C-1 graphic results, 1-18 histograms, 1-18
<ul> <li>H</li> <li>header record - "H"         LIS message formats, 1-7         host query (request information record)         LIS message formats, 1-14     </li> </ul>
I individual field errors, C-3
L  LIS message formats, 1-4 comment record – "C", 1-13 format column, 1-4 header record - "H", 1-7 host query (request information record), 1-14 manufacturer record - "M" image transmission, 1-16 manufacturer record – "M 106" (test communication), 1-16 max len column, 1-4 message terminator record – "L", 1-15 patient information record - "P", 1-8 receive column, 1-6 result record – "R", 1-11 send column, 1-6

test order record – "O", 1-9 unicode column, 1-7	multiple lines of transport, 1-2 serial configuration options, 1-1
LIS trace log AQUIOS, D-1	TCP/IP configuration options, 1-2
М	TCP/IP configuration options
manufacturer record - "M" image transmission  LIS message formats, 1-16  manufacturer record - "M 106" (test communication)  LIS message formats, 1-16  max len column  LIS message formats, 1-4  message terminator record - "L"  LIS message formats, 1-15  messages, B-1  messages from ASTM engine errors with individual fields, C-3 general ASTM protocol errors, C-1 port-specific errors, C-4  multiple lines of transport supported transport methods, 1-2	supported transport methods, 1-2 test order IDs, A-1 test order record - "O" LIS message formats, 1-9 transport methods supported, 1-1  U unicode column LIS message formats, 1-7
0	
overview, -ix	
patient information record - "P" LIS message formats, 1-8 port-specific errors, C-4 messages from ASTM engine, C-4 protocol errors general ASTM, C-1	
purpose, -ix	
R	
receive column LIS message formats, 1-6 result record – "R" LIS message formats, 1-11 rules, 1-18	
S	
serial configuration options supported transport methods, 1-1 supported transport methods, 1-1	

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## Related Documents

### **AQUIOS Host Transmission**

PN B26365

- Introduction
- Communication Transport
- Appendices
- Glossary

### AQUIOS CL Flow Cytometer Instructions for Use

PN B21896

- Introduction
- System Overview
- Operation Principles
- Daily Startup
- Quality Control
- Sample Analysis
- Data Review
- Shutdown
- Setup
- Troubleshooting
- Cleaning Procedures
- Replacement Procedures
- Appendices
- References

### **AQUIOS Tetra System Guide**

PN B26364

- Use and Function
- Operation Principles
- Sample Analysis
- Data Review
- Performance Characteristics
- Application Specifications
- Appendix
- References

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