



Host Transmission Manual

DxH 500 Series

Published Version: v3



PN B38989AD
February 2020

Manufactured by
Beckman Coulter Ireland Inc.
Lismeehan
O'Callaghan's Mills
Co. Clare, Ireland 353-65-683-1100



DxH 500 Series
Host Transmission Manual

PN B38989AD (February 2020)

Beckman Coulter, the stylized logo, and the Beckman Coulter product and service marks mentioned herein are trademarks or registered trademarks of Beckman Coulter, Inc. in the United States and other countries.

All other trademarks, service marks, products, or services are trademarks or registered trademarks of their respective holders.

May be covered by one or more pat. - see
www.beckmancoulter.com/patents

Find us on the World Wide Web at:
www.beckmancoulter.com

Symbols Glossary is available at
www.beckmancoulter.com/techdocs. See [Related Documents](#) for the part number.

Rx Only in the U.S.A.

Original Instructions

Revision History

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 Web site. For labeling updates, go to www.beckmancoulter.com/techdocs and download the latest version of the manual or system help for your instrument.

Issue AA, 10/2015

Software version 1.0

Issue AB, 3/2018

Software version 2.0

The following sections were modified:

- Trademark statement on the [DxH 500 Series Host Transmission Manual](#) copyright page
- [Alerts for Warning, Caution, Important, and Note](#) in [Safety Notice](#)
- [Safety Precautions](#) in [Safety Notice](#)
- [Purpose](#) in the [Introduction](#)
- [Physical Layer](#) in [CHAPTER 1, Low Level Transfer Protocol](#)
- Added [Physical Layer - TCP/IP Data Exchange](#) in [CHAPTER 1, Low Level Transfer Protocol](#)
- Removed table about Failure Session (Max <NAK>s) in [Transport Layer Sequence](#) in [CHAPTER 1, Low Level Transfer Protocol](#)
- [Message Content](#) in [CHAPTER 2, Message Layer](#)
- [Header Record \(CLSI Section 6.0\)](#) in [CHAPTER 3, Record Field Contents](#)
- [Patient Information Record \(CLSI Section 7.0\)](#) in [CHAPTER 3, Record Field Contents](#)
- [Test Order \(Patient\) Record \(CLSI Section 8.0\)](#) in [CHAPTER 3, Record Field Contents](#)
- [Test Order \(Quality Control\) Record](#) in [CHAPTER 3, Record Field Contents](#)
- [Result Record \(CLSI Section 9.0\)](#) in [CHAPTER 3, Record Field Contents](#)
- [Manufacturer Record \(CLSI Section 14\)](#) in [CHAPTER 3, Record Field Contents](#)
- [Comment Record \(CLSI Section 10\)](#) in [CHAPTER 3, Record Field Contents](#)
- [Message Terminator Record \(CLSI Section 12\)](#) in [CHAPTER 3, Record Field Contents](#)
- [Restricted Characters](#) in [APPENDIX A, Supported and Restricted Characters](#)
- [DxH Error Responses](#) in [APPENDIX B, Sample Messages](#)
- [Panels, Tests, Controls, Dataplots, and Histograms Available](#) in [APPENDIX C, Additional Tables](#)
- [Definitive, Suspect, and System Messages](#) in [APPENDIX C, Additional Tables](#)
- Added note to [APPENDIX D, Graphic Results and Dataplots](#)
- Added [APPENDIX E, Download and Upload Examples](#)

Issue AC, 8/2018

Software version 2.0

The following sections were modified:

- [Establishment Phase](#) in [CHAPTER 1, Low Level Transfer Protocol](#)
- [Test Order \(Patient\) Record \(CLSI Section 8.0\)](#) in [CHAPTER 3, Record Field Contents](#)

- [Manufacturer Record \(CLSI Section 14\)](#) in CHAPTER 3, Record Field Contents
- [Panels, Tests, Controls, Dataplots, and Histograms Available](#) in APPENDIX C, Additional Tables
- [Definitive, Suspect, and System Messages](#) in APPENDIX C, Additional Tables
- [Dataplot Data Header](#) in APPENDIX D, Graphic Results and Dataplots
- [Rendering Information Block Header](#) in APPENDIX D, Graphic Results and Dataplots

Issue AD, 2/2020

Software version 3.0

The following sections were modified:

- Added DxH 560 to this manual
- Added patent and Symbols Glossary links to [DxH 500 Series Host Transmission Manual](#) copyright page
- Added information to Table 3.5 in [Test Order \(Patient\) Record \(CLSI Section 8.0\)](#) in CHAPTER 3, [Record Field Contents](#)
- Added information to Table 3.6 in [Test Order \(Quality Control\) Record](#) in CHAPTER 3, [Record Field Contents](#)
- Added information to Table B.1 in [DxH Error Responses](#) in APPENDIX B, Sample Messages
- Added DxH 560 information to [Related Documents](#)

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, Caution, Important, and Note

Throughout this manual, you will see the appearance of these alerts for Warning and Caution conditions:



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.



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.

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 installation, use, or servicing of this equipment.

Safety Precautions

WARNING

Risk of operator injury and/or biohazardous contamination 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.

CAUTION

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.
- You do not scan removable media (USB flash drive) before connecting it to a computer. Always scan removable media.

CAUTION

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, call your Beckman Coulter Representative.

Safety Symbols

Symbol	Warning Condition	Action
	Biohazard	Use universal precautions when working with pathogenic materials. Means must be available to decontaminate the instrument and to dispose of biohazardous waste.
	Caution/Warning	See Alerts for Warning, Caution, Important, and Note for more information.
	Hot Surface	Hot surfaces in this area. Avoid contact with any surface in this area until you are sure that it has cooled down first.
	Pinch Point	Potential pinch or pierce point in this area. Be aware of the moving probe and carefully present the test sample to avoid injury.

Contents

Revision History, iii

Safety Notice, v

Alerts for Warning, Caution, Important, and Note, v

Safety Precautions, vi

Safety Symbols, vii

Introduction, xv

Purpose, xv

CHAPTER 1: Low Level Transfer Protocol, 1-1

Low Level Transfer Protocol, 1-1

Physical Layer, 1-1

Physical Layer - TCP/IP Data Exchange, 1-2

Data Link Layer, 1-2

Establishment Phase, 1-2

Transfer Phase, 1-3

Frame Number, 1-3

Checksum, 1-4

Acknowledgments, 1-4

Receiver Interrupts, 1-4

Termination Phase, 1-4

Error Recovery, 1-5

Defective Frames, 1-5

Timeouts, 1-5

During Establishment Phase, 1-5

During Transfer Phase, 1-5

Receiver Waiting for Frame, 1-6

Sender Wait on Reply, 1-6

Restricted Characters, 1-6

Transport Layer Sequence, 1-6

CHAPTER 2: Message Layer, 2-1

Message Layer, 2-1

Message Content, 2-1

CHAPTER 3: Record Field Contents, 3-1

- Record Field Contents, 3-1
- Header Record (CLSI Section 6.0), 3-2
- Header Record - Global Errors, 3-5
- Patient Information Record (CLSI Section 7.0), 3-8
- Patient Record - Global Errors, 3-13
- Test Order (Patient) Record (CLSI Section 8.0), 3-14
- Test Order (Patient) Record - Global Errors, 3-19
- Test Order (Quality Control) Record, 3-19
- Test Order (Quality Control) Record - Global Errors, 3-24
- Result Record (CLSI Section 9.0), 3-24
- Result Order Record - Global Errors, 3-28
- Manufacturer Record (CLSI Section 14), 3-28
- Manufacturer Record - Errors, 3-30
- Comment Record (CLSI Section 10), 3-31
- Comment Record - Errors, 3-34
- Message Terminator Record (CLSI Section 12), 3-34

APPENDIX A: Supported and Restricted Characters, A-1

- Supported Characters, A-1
- Restricted Characters, A-1

APPENDIX B: Sample Messages, B-1

- DxH Error Responses, B-1

APPENDIX C: Additional Tables, C-1

- Result Non-Numeric Codes and Results Flags, C-1
- Panels, Tests, Controls, Dataplots, and Histograms Available, C-2
- Definitive, Suspect, and System Messages, C-4

APPENDIX D: Graphic Results and Dataplots, D-1

- Histograms, D-1
- Dataplots, D-1
 - Dataplot Data Header, D-2
 - Dataplot Data Block, D-2
 - Dataplot Data Block Header, D-3
 - Rendering Information Block, D-3
 - Rendering Information Block Header, D-3
 - Color Palette, D-4

[Dithered Display Bitmap Library](#), D-4

[Dataplot Header](#), D-5

[Dataplot Data](#), D-5

APPENDIX E: [Download and Upload Examples](#) , E-1

[Examples](#), E-1

[Acceptable Download Example \(One Test Per Record\)](#), E-1

[Optimal Download Example \(The Repeat Delimiter is Used\)](#), E-1

[Upload Example 1](#), E-1

[Patient Result Upload Example](#), E-1

[Control Result Upload Example](#), E-2

[Error Response Example](#), E-3

[Glossary](#)

[Related Documents](#)

Illustrations

- 1.1 Host Cable Connector - DB-9 Female Connector for Laboratory
Computer Cable Looking at the Connector Face, 1-2
- D.1 Histogram Transmission, D-1
- D.2 Bitmap Format, D-5
- D.3 Dataplot Format, D-6

Tables

1.1	Physical Parameters, 1-1
1.2	DB-9 Pin Assignments for EIA-232-D Connection, 1-1
1.3	Establishment Phase, 1-3
1.4	Normal Session, 1-6
1.5	Delay Request Session (NAK), 1-7
1.6	Failure Session (No Response), 1-7
1.7	Retransmission Request (Multiple <NAK>s), 1-8
1.8	Failure Session (Max <NAK>s), 1-9
1.9	Failure Session (Receiver Timeout During Transfer), 1-9
1.10	Failure Session (Sender Timeout During Transfer Phase), 1-10
2.1	Message Content, 2-1
3.1	Field Definitions, 3-1
3.2	Header Record - Transmitted Fields, 3-3
3.3	Header Record - Escape Character Usage Examples, 3-7
3.4	Patient Information Record - Transmitted Fields, 3-9
3.5	Test Order (Patient) Record - Transmitted Fields, 3-14
3.6	Test Order (Quality Control) Record - Transmitted Fields, 3-20
3.7	Result Record - Transmitted Fields, 3-25
3.8	Manufacturer Record - Transmitted Fields, 3-29
3.9	Comment Record - Transmitted Fields, 3-32
3.10	Message Terminator Record - Transmitted Fields, 3-34
A.1	Restricted Characters, A-1
B.1	Possible Error Responses, B-1
C.1	Non-Numeric Result Codes, C-1
C.2	Result Flags, C-1
C.3	Panel and Test Identifiers, C-2
C.4	Histogram and Dataplot Identifiers, C-3
C.5	Channel and Volume Values for Histograms, C-4
C.6	Definitive Messages, C-4
C.7	Suspect Messages, C-4
C.8	System Messages, C-5
D.1	Dataplot Transmission, D-2
D.2	Dataplot Data Header, D-2
D.3	Dataplot Data Block, D-2

D.4	Dataplot Data Block Header, D-3
D.5	Rendering Information Block, D-3
D.6	Rendering Information Block Header, D-4
D.7	Color Palette, D-4
D.8	Dataplot Header, D-5
D.9	Dataplot Data, D-5

Purpose

The laboratory Information system (LIS) feature of the DxH 500 Series instrument software allows an external laboratory computer to communicate with the instrument through a serial or TCP/IP connection. The interface consists of two major functions:

- Low Level Transfer Protocol (see [CHAPTER 1, Low Level Transfer Protocol](#)) which consists of two parts:
 - [Physical Layer](#)
 - [Data Link Layer](#)
- Message Content (see [Message Content](#) in [CHAPTER 2, Message Layer](#)) which contains the specifications for each of the records that are used to pass information between the instrument and the laboratory computer.

CHAPTER 1

Low Level Transfer Protocol

Low Level Transfer Protocol

To accomplish a successful interface between the instrument and the laboratory computer, a compatible environment, both physical and logical, must be established. At the lowest level, the physical connections must be defined and the behavior of both the sender and receiver of information must be specified.

The recommended Low Level Protocol to use for transferring messages between the instrument and the laboratory computer is the *CLSI LIS01-A2 (formerly ASTM1381-02)* and *CLSI LIS02-A2 (formerly ASTM 1394-97)*.

Physical Layer

All serial communications are expected to use the EIA-232-D communication protocol based upon the *Electronics Industries Association (EIA) standard EIA-232-D*. The instrument is configured as Data Terminal Equipment (DTE).

Protocol: EIA-232-D

Connector: DB-9 Male located on the back of the instrument console PC

COM Port: 1

Table 1.1 Physical Parameters

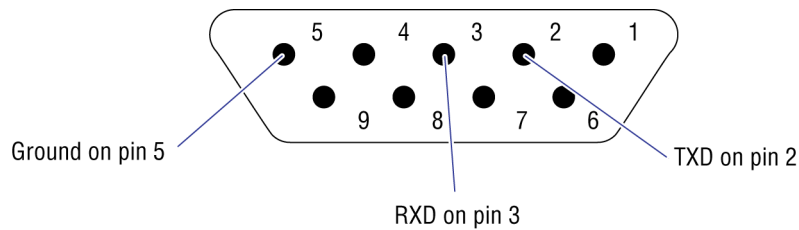
Physical Setting	Default Value	Possible Value
Data Bits	8	8
Parity Bit	None	Odd, Even, None
Stop Bits	1	1, 2
Baud Rate	115200	9600, 19200, 57600, 115200

Table 1.2 DB-9 Pin Assignments for EIA-232-D Connection

Pin	Instrument LIS Port Configuration Provided on DB-9 Male	Laboratory Computer Cable Must Provide on DB-9 Female
2	RXD	TXD
3	TXD	RXD
5	Ground	Ground

NOTE Connection from computer to computer requires a Null Modem Cable as indicated in the table above.

Figure 1.1 Host Cable Connector - DB-9 Female Connector for Laboratory Computer Cable Looking at the Connector Face



Physical Layer - TCP/IP Data Exchange

Protocol: TCP/IP

Connector: Physical connector conforming to RJ-45F standards

Electrical levels conforming to the IEEE 802.3 Ethernet standard

The laboratory LIS host computer is configured as the TCP/IP server (it provides the IP address and port number that the client can connect to)

The DxH 500 series instrument is configured as the TCP/IP client.

Data Link Layer

The data link layer has procedures for link connection and release, delimiting and synchronism, sequential control, error detection, and error recovery as specified in *CLSI LIS01-A2 (formerly ASTM 1381-02)*. There are three distinct phases in transferring information between the instrument and the laboratory computer. The three phases assure the actions of sender and receiver are coordinated. The three phases are establishment, transfer, and termination.

The data link layer uses a character-oriented protocol to send messages between directly connected systems. The data link mode of operation is a one-way transfer of information with alternate supervision. Information flows in one direction at a time. Replies occur after information is sent, never at the same time. It is a simple stop-and-wait protocol. At times, the two systems are actively operating to transfer information. The remainder of the time the data link is in a neutral state.

Establishment Phase

The establishment phase determines the direction of information flow and prepares the receiver to accept information. A system, which does not have information to send, normally monitors the data link to detect the establishment phase. It acts as a receiver, waiting for the other system.

The system with information available initiates the establishment phase. After the sender determines the data link is in a neutral state, it transmits the <ENQ> transmission control character. The receiver ignores any character other than <ENQ> while in the neutral state. Sender will ignore any responses to the <ENQ> other than <ACK>, <NAK>, or <ENQ>.

Table 1.3 Establishment Phase

Receiver State	Sender		Receiver Reply	Sender Status After Receiving Response
Receiver Ready	<ENQ>	--> <--	<ACK>	Transfer Phase
Receiver Not Ready	<ENQ>	--> <--	<NAK>	Wait 10 seconds, then send <ENQ> again.
Receiver Sending *1	<ENQ>	-->		
		<--	<ENQ>	*2

*1 Line Contention condition - Receiver also has information available and sent the ENQ at the same time as the sender.

*2 If Sender is the instrument, wait 1 second and then begin the establishment phase by sending <ENQ>. If Sender is the laboratory computer, the laboratory computer goes into a neutral state for a minimum of 20 seconds or until the receive message session from the instrument is complete.

After six consecutive NAKs or timeouts during the Establishment Phase, the DxH instrument writes the following message to the error event log: *Unable to establish connection to LIS, will continue to retry*. The DxH will continue to try to establish a connection. However, it will not log any events until after it has successfully established a connection, and then fails to establish a connection the next time the DxH instrument has data to transmit.

Transfer Phase

During the transfer phase, the sender transmits messages to the receiver. The transfer phase continues until all messages are sent. Messages are sent in frames. Each frame contains a maximum of 64,000 characters (including frame overhead). Messages longer than 64,000 characters are divided between two or more frames. Multiple messages are never combined in a single frame. Every message must begin in a new frame. There are two types of frames: intermediate and end. The intermediate frames terminate with the character <ETB>, checksum, <CR><LF>. End frames terminate with <ETX>, checksum, <CR><LF>. A message containing 64,000 characters or less is sent in a single end frame. Longer messages are sent in intermediate frames with the last part of the message sent in the end frame.

Frame Number

The frame number permits the receiver to distinguish between new and re-transmitted frames. It is a single digit sent immediately after the <STX> character. The frame number is an ASCII digit ranging from 0 to 7. The frame number begins at 1 with the first frame of the transfer phase. The frame number is incremented by one for every new frame transmitted. After 7, the number rolls over to 0, and continues in this fashion.

Checksum

The checksum permits the receiver to detect a defective frame. The checksum is encoded as two characters, which are sent after the <ETB> or <ETX> character. The checksum is computed by adding the binary values of the characters, keeping the least significant eight bits of the result. The checksum is initialized to zero with the <STX> character. The first character used in computing the checksum is the frame number. Each character in the message text is added to the checksum (modulo 256). The computation for the checksum does not include <STX>, the checksum characters, or the trailing <CR><LF>. The checksum is an integer represented by eight bits; it can be considered as two groups of four bits. The groups of four bits are converted to the ASCII characters of the hexadecimal representation. The two ASCII characters are transmitted as the checksum, with the most significant character first.

Acknowledgments

After a frame is sent, the sender stops transmitting until a reply is received. The receiver replies to each frame. When it is ready to receive the next frame, it transmits one of three replies to acknowledge the last frame. This reply must be transmitted within the timeout period. A reply of <ACK> signifies the last frame was received successfully and the receiver is prepared to receive another frame. The sender must increment the frame number and either send a new frame or terminate. A reply of <NAK> signifies the last frame was not successfully received and the receiver is prepared to receive the frame again. A reply of <EOT> signifies that the last frame was successfully received; the receiver is prepared to receive another frame, but it is a request to the sender to stop transmitting.

Receiver Interrupts

The receiver interrupt is a means for the receiver to request the sender to stop transmitting messages as soon as possible. During the transfer phase, if the receiver responds to a frame with an <EOT> in place of the usual <ACK>, the sender must interpret this reply as a receiver interrupt request. The <EOT> is a positive acknowledgment of the end frame, signifies the receiver is prepared to receive the next frame, and is a request to the sender to stop transmitting. The sender does not have to stop transmitting after receiving the receiver interrupt request. If the sender chooses to ignore the <EOT>, the receiver must re-request the interrupt for the request to remain valid. If the sender chooses to honor the receiver interrupt request, it must first enter the termination phase to return the data link to the neutral state. This gives the receiver an opportunity to enter the establishment phase and become the sender. The original sender must not enter the establishment phase for at least 15 seconds or until the receiver has sent a message and returned the data link to the neutral state.

Termination Phase

The termination phase returns the data link to the clear or neutral state. The sender notifies the receiver that all messages have been sent. The sender transmits the <EOT> transmission control character and then regards the data link to be in a neutral state. Upon receiving the <EOT>, the receiver also regards the data link to be in a neutral state.

Error Recovery

Methods are described which enable both sender and receiver to recover, in an orderly way, from errors in transmission.

Defective Frames

A receiver checks every frame to guarantee it is valid. A reply of <NAK> is transmitted for invalid frames. Upon receiving the <NAK>, the sender retransmits the last frame with the same frame number. In this way, transmission errors are detected and automatically corrected. The receiver ignores any characters occurring before the <STX> or <EOT> or after the end of the block character <ETB> or <ETX> when checking the frame. A frame should be rejected because:

1. Any character errors are detected (parity error, framing error, etc.)
2. The frame checksum does not match the checksum computed on the received frame
3. The frame number is not the same as the last accepted frame or one number higher (module 8)

Upon receiving a <NAK> or any character except an <ACK> or <EOT> (a <NAK> condition), the sender increments a retransmit counter and retransmits the frame. If this counter shows a single frame was sent and not accepted six times, the sender must abort this message by proceeding to the termination phase. An abort should be extremely rare, but it provides a mechanism to escape from a condition where the transfer phase cannot continue.

Timeouts

The sender and receiver both use timers to detect loss of coordination between them. If a reply of an <ACK>, <NAK>, or <ENQ> is not received within 15 seconds, a timeout occurs. After a timeout, the sender enters the termination phase.

During Establishment Phase

During the establishment phase, the sender sets a timer when transmitting the <ENQ>. If a reply of an <ACK>, <NAK>, or <ENQ> is not received within 15 seconds, a timeout occurs. After a timeout, the sender enters the termination phase. See section 6.5.2.1 in *CLSI LIS01-A2 (formerly ASTM 1381-02)*.

During the establishment phase, if the computer (as receiver) detects contention, it sets a timer. If an <ENQ> is not received within 20 seconds, a timeout occurs. After a timeout, the receiver regards the line to be in the neutral state.

During Transfer Phase

During the transfer phase, the sender sets a timer when transmitting the last character of a frame. If a reply is not received within 15 seconds, a timeout occurs. After a timeout, the sender aborts the message transfer by proceeding to the termination phase. As with excessive re-transmissions of defective frames, the message must be remembered so it can be completely repeated.

Receiver Waiting for Frame

During the transfer phase, the receiver sets a timer when first entering the transfer phase or when replying to a frame. If a frame or <EOT> is not received within 30 seconds, a timeout occurs. After a timeout, the receiver discards the last incomplete message and regards the line to be in the neutral state.

Sender Wait on Reply

A receiver must reply to a frame within 15 seconds or the sender will timeout. A receiver can delay its reply for up to 15 seconds to process the frame. Longer delays cause the sender to abort the message.

Receivers that cannot process messages fast enough to keep up with a sender may cause message buffer overflows in the sender. A sender can normally store at least one complete message. Storage space for more than one outgoing message is desirable but optional.

Restricted Characters

The data link protocol is designed for sending character-based message text. Restrictions are placed on which characters may appear in the message text. The restrictions make it simpler for senders and receivers to recognize replies and frame delimiters. Additional characters are restricted to avoid interfering with software controls for devices such as multiplexers.

A <LF> character is not permitted to appear in the message text; it can appear only as the last character of a frame. None of the ten transmission control characters, the <LF> format effector control character, or four device control characters may appear in message text. The restricted characters are: <SOH>, <STX>, <ETX>, <EOT>, <ENQ>, <ACK>, <DLE>, <NAK>, <SYN>, <ETB>, <LF>, <DC1>, <DC2>, <DC3>, and <DC4>.

Transport Layer Sequence

The following tables illustrate a transport layer sequence:

Table 1.4 Normal Session

Normal Session		Sender		Receiver
Establishment Phase		<ENQ>	-->	
			<--	<ACK>
Transfer Phase	<STX> [frame number] [DATA] <ETX> [C1] [C2] <CR><LF>		-->	
		Frames continue until entire message sent	<--	<ACK>
Termination Phase		<EOT>	-->	No response expected

Table 1.5 Delay Request Session (NAK)

Delay Request Session (NAK)		Sender	Receiver	
Establishment Phase		<ENQ>	-->	
			<--	<NAK>
		(Delay 10 seconds)		
		<ENQ>	-->	
			<--	<ACK>
Transfer Phase	<STX> [frame number] [DATA] <ETX> [C1] [C2] <CR> <LF>		-->	
		Frames continue until entire message sent	<--	<ACK>
Termination Phase		<EOT>	-->	No response expected

Table 1.6 Failure Session (No Response)

Failure Session (No Response)	Sender		Receiver
Establishment Phase	<ENQ>	-->	
	(Time-out after 15 seconds)		No response
Termination Phase	<EOT>	-->	No response expected

Table 1.7 Retransmission Request (Multiple <NAK>s)

Retransmission Request (Multiple <NAK>s)	Sender		Receiver
Establishment Phase	<ENQ>	-->	
		<--	<ACK>
Transfer Phase	<STX> [frame number] [DATA] <ETX> [C1] [C2] <CR> <LF>	-->	
		<--	<NAK>
	<STX> [frame number] [DATA] <ETX> [C1] [C2] <CR> <LF>	-->	
		<--	<NAK>
	<STX> [frame number] [DATA] <ETX> [C1] [C2] <CR> <LF>	-->	
		<--	<NAK>
	<STX> [frame number] [DATA] <ETX> [C1] [C2] <CR> <LF>	-->	
		<--	<NAK>
	<STX> [frame number] [DATA] <ETX> [C1] [C2] <CR> <LF>	-->	
		<--	<NAK>
	<STX> [frame number] [DATA] <ETX> [C1] [C2] <CR> <LF>	-->	
	Frames continue until entire message sent	<--	<ACK>
Termination Phase	<EOT>	-->	No response expected

Table 1.8 Failure Session (Max <NAK>s)

Failure Session (Max <NAK>s)		Sender		Receiver
Establishment Phase		<ENQ>	-->	
			<--	<ACK>
Transfer Phase	<STX> [frame number] [DATA] <ETX> [C1] [C2] <CR> <LF>		-->	
			<--	<NAK>
	<STX> [frame number] [DATA] <ETX> [C1] [C2] <CR> <LF>		-->	
			<--	<NAK>
	<STX> [frame number] [DATA] <ETX> [C1] [C2] <CR> <LF>		-->	
			<--	<NAK>
	<STX> [frame number] [DATA] <ETX> [C1] [C2] <CR> <LF>		-->	
			<--	<NAK>
	<STX> [frame number] [DATA] <ETX> [C1] [C2] <CR> <LF>		-->	
			<--	<NAK>
Termination Phase		<EOT>	-->	No response expected

Table 1.9 Failure Session (Receiver Timeout During Transfer)

Failure Session (Receive Timeout During Transfer)		Sender		Receiver
Establishment Phase		<ENQ>	-->	
			<--	<ACK>
Transfer Phase	<STX> [frame number] [DATA] <ETX> [C1] [C2] <CR> <LF>		-->	
			<--	No response within 15 seconds
Termination Phase		<EOT>	-->	No response expected

Table 1.10 Failure Session (Sender Timeout During Transfer Phase)

Failure Session (Receive Timeout During Transfer)		Sender		Receiver
Establishment Phase		<ENQ>	-->	
			<--	<ACK>
Transfer Phase	<STX> [frame number] [DATA] <ETX> [C1] [C2] <CR> <LF>		-->	
			<--	<ACK>
		No frame sent within 30 seconds	-->	No response
				Discards incomplete message and assumes neutral state

Message Layer

This section was prepared according to *CLSI LIS02-A2 (formerly ASTM 1394-97)*. The intent of this section is to develop a complete understanding of the particular records and fields as supported by the instrument.

The low level protocol communications are separate from the message level.

Message Content

The following is a list of the limitations and general considerations regarding message content.

Table 2.1 Message Content

Content	Limitations and General Considerations
Allowed Characters	UTF-8 encoding shall be used. UTF-8 (8-bit Unicode Transformation Format) is a variable-length character encoding for Unicode. It is able to represent any character in the Unicode standard and is backwards compatible with ASCII. The 8-bit values, within the range of 0 to 127, will still correspond to the ASCII standard character set in UTF-8 encoding.
Maximum Field Length	While no maximum field length is imposed within the low level protocol mechanism, the parser restricts the fields' length because of a 64,000 byte frame limit. Refer to the record tables in this document for specific field restrictions.
Language	The Test Identifier and the Definitive, Suspect, and System Messages as defined in Table C.3, Panel and Test Identifiers , Table C.6, Definitive Messages , Table C.7, Suspect Messages , and Table C.8, System Messages in APPENDIX C, Additional Tables will be transmitted in English. The Last Name, First Name, Physician, Location, and Comment fields may contain characters native to the selected language, and as such, will be transmitted with the non-English characters. CHAPTER 3, Record Field Contents lists the acceptable values for each field.
Maximum Record Length	The message parsing performed by the DxH instrument software restricts records to 64,000 bytes in length.

Table 2.1 Message Content (*Continued*)

Content	Limitations and General Considerations
Record Codes	The following codes are required in relation to the CLSI standard: Message Header Record - H Patient Record - P Test Order Record - O Result Record - R Comment Record - C Scientific Record - S (Not used by DxH) Manufacturer Record - M (Used for sending dataplots and histograms results) Request Information Record - Q (Not used by DxH) Message Terminator Record - L
Delimiters	The ASCII characters that follow the H (Header Record Identifier) define the unique field, repeat, component, and escape delimiters that are used in the message. Alphanumeric characters should not be used as delimiters because they are likely to appear within the field content. The following are recommended delimiters for all messages. These delimiters will always be used in upload messages, but download messages can use any valid characters for delimiters. Field Delimiter - - vertical bar - Latin 1 (124) Repeat Delimiter - \ - backslash - Latin 1 (92) Component Delimiter - ! - exclamation - Latin 1 (33) Escape Delimiter - ~ - tilde - Latin 1 (126)
Fields	Fields shall be identified by their position, obtained by counting field delimiters from the front of the record. This position-sensitive identification procedure requires that when the contents of the field are null, its corresponding field delimiter must be included in the record to ensure that the correct field can be found by counting delimiters. Delimiters are not included for trailing null fields or for trailing fields with data. That is, if the tenth field was the last field containing data, the record could terminate after the tenth field, and therefore would contain only nine delimiters. NOTE NULL in this context is not a character, but is the lack of any characters for the field. The laboratory computer may transmit a null value for a field because 1) it does not know the value, 2) it knows the value is irrelevant to the instrument, or 3) the instrument defaults are to be used for the value.
Manufacturer Record	The Manufacturer Record is ignored when received by the instrument and is used by the instrument to transmit dataplot and histogram results.
Scientific Record	The Scientific Record is ignored when received by the instrument and not created or sent by the instrument.
Units	Transmitted in user-selected format

Record Field Contents

This section lists the following records and the fields they contain:

- [Header Record \(CLSI Section 6.0\)](#)
- [Patient Information Record \(CLSI Section 7.0\)](#)
- [Test Order \(Patient\) Record \(CLSI Section 8.0\)](#)
- [Test Order \(Quality Control\) Record](#)
- [Result Record \(CLSI Section 9.0\)](#)
- [Manufacturer Record \(CLSI Section 14\)](#)
- [Comment Record \(CLSI Section 10\)](#)
- [Message Terminator Record \(CLSI Section 12\)](#)

Following each record is a list of the requirements and general considerations regarding the contents of one or more fields on the record.

The following field definitions apply to all records and fields. The action taken may be different if the record is being received by the DxH instrument (download) or sent by the DxH instrument (upload) as indicated in the columns DxH Download and DxH Upload.

Table 3.1 Field Definitions

Field Definition	Description
Required	The order will be rejected if this field is missing.
Ignored*	The system will accept the field, if present, but will not use it for processing. If the field is not present, it is ignored.
Yes	The system will accept the field, if present, and process it. If the field is not present, it is ignored.

Table 3.1 Field Definitions (*Continued*)

Field Definition	Description
No	The system will not send the field to the LIS host.
N/A*	Does not apply to the specific field.
Valid Field	Any field that fits all the requirements listed below is considered a valid field: • Contains the correct type of characters • Does not exceed maximum length • Does not contain any restricted characters • Contains the correct case

* If the DxH instrument receives a field that is indicated to be ignored or N/A, the Host will not receive any messages from DxH.

NOTE

- If the header record has an invalid field, the entire download will be rejected.
- The test order will be rejected if a field in the order record is invalid. An appropriate error message will be sent back to the Host.
- If a field in the patient record is invalid, patient demographics will be rejected, but the test order will be accepted if the test order has no invalid fields. An appropriate error message will be sent back to the Host.
- If a comment record has invalid data, only the comment will be rejected.

Header Record (CLSI Section 6.0)

Fields that are transmitted in the header record by the DxH instruments are described below.

Header Record Example:

Typical Upload

H|\!~|||DxH 500!90|||||P|LIS2-A2|20160510121416

Minimal Download

H|\!~

Table 3.2 Header Record - Transmitted Fields

Field Name	CLSI Section	Field Delimiter	Example Data	Case-sensitive?	Max. Length	DxH Download	DxH Upload	Error #	Comment/Info
Record Type	6.1	H		Yes	1	Required	Required	35, 78	Header record (H) is the first record of every message. It contains the overhead information for the remainder of the message.
Delimiter Definition	6.2								The actual delimiters to be employed in a given transmission shall be specified in this field. It is the responsibility of the sender to avoid the inclusion of any delimiter characters within the field contents. The receiver will determine what characters to use by reading the delimiter specification it receives in each header record. If no delimiters are sent, the entire message will be rejected. An appropriate error will be sent to the host. - Vertical bar used to delimit fields. \ - Backslash used to indicate the entire field is to be repeated. Only some fields are defined to allow repeat delimiters. ! - Exclamation used to delimit components. ~ - Tilde (recommended escape delimiter) used to include the delimiters and other special characters in field content (see below for usage example).
Field				N/A	1	Required	Required	70	
Repeat		\	\	N/A	1	Required	Required	70	
Component		!	!	N/A	1	Required	Required	70	
Escape		~	~	N/A	1	Required	Required	70	
Message Control ID	6.3		Not Xmit	N/A		Ignored	No	None	
Access Password	6.4		Not Xmit	N/A		Ignored	No	None	

Table 3.2 Header Record - Transmitted Fields (*Continued*)

Field Name	CLSI Section	Field Delimiter	Example Data	Case-sensitive?	Max. Length	DxH Download	DxH Upload	Error #	Comment/Info
Sender Name or ID	6.5		DxH500	No	9	Ignored	Yes	None	Send instrument mode name followed by the instrument ID (defined in the LIS Setup UI) in the component field. Example: DxH500! 01 Instrument model: DxH 500 DxH 520 DxH 560
Instrument ID		!	01	No	2	Ignored	Yes	None	2-digit (numerical) Instrument ID as defined in the LIS Setup UI.
Sender Street Address	6.6		Not Xmit	N/A		Ignored	No	None	
Reserved Field	6.7		Not Xmit	N/A		Ignored	No	None	
Sender Telephone Number	6.8		Not Xmit	N/A		Ignored	No	None	
Characteristics of Sender	6.9		Not Xmit	N/A		Ignored	No	None	
Receiver ID	6.10		Not Xmit	N/A		Ignored	No	None	
Comment or Special Instructions	6.11		Not Xmit	N/A		Ignored	No	None	

Table 3.2 Header Record - Transmitted Fields *(Continued)*

Field Name	CLSI Section	Field Delimiter	Example Data	Case-sensitive?	Max. Length	DxH Download	DxH Upload	Error #	Comment/Info
Processing ID	6.12		P	Yes	1	Yes	Yes	75	Indicates how this message is processed: • P-Production: Treat message as an active message to be completed according to standard processing • Q-Quality Control: Message is initiated for the purpose of transmitting Quality Control/Quality Assurance or Regulatory data. For downloaded messages, P (Production) code is used.
Version Number	6.13		LIS2-A2	No	7	Yes	Yes	77	Version number of the CLSI specification used to define this specification. Version number is <i>LIS02-A2</i> . This is a free text field. Only maximum length is checked.
Date and Time of Message	6.14		20130822155959	N/A	14	Yes	Yes	76	Although not required, including this field is good practice to support debug and message log analysis. Date format: YYYYMMDDHHMMSS
End of Record		<CR>		N/A	1	Required	Required	36	All records end in carriage return.

Header Record - Global Errors

In addition to the specific error indicated in the header table, the following general errors also apply: Errors 35, 37, 38, 39, 70, and 78.

Record Field Contents

Header Record - Global Errors

Table 3.3 Header Record - Escape Character Usage Examples

Field Name	Usage Example
Escape	~ Tilde (recommended escape delimiter) used to include the delimiters and other special characters in field content (for example, to include vertical bar [field delimiter] in the field content, use ~F~; to include a backslash [repeat delimiter], use ~R~; to include exclamation [component delimiter] in the field content, use ~S~; and to include a tilde [escape delimiter], use ~E~). See examples below. Using the Escape Delimiter (~) in the Field Content: H \!~ LISHOST P LIS2-A 20000424220052 P 1 PAT1 Baker!Lisa!M!Ms. 19601225 F Jones O 1 SPEC1 !!CD R 20001025 N WB C 1 L Sending tilde ~E~ in comment G L 1 N Comment text will be interpreted as: Sending tilde ~ in comment Using Component Delimiter (!) in Field Content: H \!^ LISHOST P LIS2-A 20000424220052 P 1 PAT1 Baker!Lisa!M!Ms. 19601225 F Jones O 1 SPEC1 !!CD R 20001025 N WB C 1 L Sending bang ~S~ in comment G L 1 N Comment text will be interpreted as: Sending bang ! in comment

Table 3.3 Header Record - Escape Character Usage Examples (*Continued*)

Field Name	Usage Example
	Using Repeat Delimiter (^) in Field Content: H ^!~ LISHOST P LIS2-A 20000424220052 P 1 PAT1 Baker!Lisa!M!Ms. 19601225 F Jones O 1 SPEC1 !!CD R 20001025 N WB C 1 L Sending repeat delimiter ~R~ in comment G L 1 N Comment text will be interpreted as: Sending repeat delimiter ^ in comment Using Field Delimiter () in Field Content: H \!^ LISHOST P LIS2-A 20000424220052 P 1 PAT1 Baker!Lisa!M!Ms. 19601225 F Jones O 1 SPEC1 !!CD R 20001025 N WB C 1 L Sending field delimiter ^F^ in comment G L 1 N Comment text will be interpreted as: Sending field delimiter in comment

Patient Information Record (CLSI Section 7.0)

The fields that are transmitted in the Patient record by the DxH instruments are described.

Patient record contains information that applies specifically to a patient. It also contains demographic information. A patient record must be sent. If no patient information is available, an empty Patient record is sent prior to the Test Order record.

Where the DxH software field differs from those defined In the CLSI document, the equivalent DxH field name is shown in *italics*.

Patient Information Record Example:

Typical Upload

P|1||12345677||SMITH!JOHN||20120112!4!Y|M||||

Minimal Download

P|1|

Table 3.4 Patient Information Record - Transmitted Fields

Field Name	CLSI Section	Delimiter	Example Data	Case-sensitive?	Max. Length	DxH Download	DxH Upload	Error #	Comment/Info
Record Identifier	7.1	P	P	Yes	1	Required	Required	2	Each line of the patient record begins with a record type and ends with a carriage return. P = Patient
Record Sequence Number	7.2		1	No	5	Required	Required	32	This sequence number begins with 1 and is incremented within the message for each subsequent patient record. All order records that follow are associated with this sequence patient until a subsequent patient record is encountered
Practice Assigned Patient ID	7.3		Not Xmit	N/A		Ignored	No	None	
Laboratory Assigned Patient ID (<i>Patient ID</i>)	7.4		123456789012	N/A	16	Yes	Yes	18, 24	Patient ID assigned by the laboratory to uniquely identify the patient.
Patient ID Flag		!	E	Yes	1	Ignored	Yes	None	Indicator of whether the Patient ID was modified/edited or manually matched E = Edited M = Manual match
Patient ID #3	7.5		Not Xmit	N/A		Ignored	No	None	

Table 3.4 Patient Information Record - Transmitted Fields (*Continued*)

Field Name	CLSI Section	Delimiter	Example Data	Case-sensitive?	Max. Length	DxH Download	DxH Upload	Error #	Comment/Info
Patient Name:	7.6								Patient name can contain the “First name,” “Last name,” “Middle name/Initial, Suffix” and “Title” components. DxH instrument only uses “First name” and “Last name.” The other components are not used.
Last Name			Doe	No	15	Yes	Yes	24, 18	
First Name		!	Joe	No	15	Yes	Yes	24, 18	
Middle Name/Initial		!	Not Xmit	N/A	N/A	Ignored	No	None	
Suffix		!	Not Xmit	N/A	N/A	Ignored	No	None	
Title		!	Not Xmit	N/A	N/A	Ignored	No	None	
Mother’s Maiden Name:	7.7		Not Xmit	N/A	N/A	Ignored	No	None	
Birthdate:	7.8								Birth date can contain the “Date of birth,” “Age,” and “Age units” components. If the “Date of Birth” data is available and is valid, the “Age” will be calculated based on the date of birth, whether or not the age is transmitted.
Date of Birth			19901209	N/A	8	Yes	Yes	4	Must use the format YYYYMMDD, where all characters are numerals. Birth dates indicating a date in the future are considered invalid. Patient Records with invalid birth dates will result in no birth date being stored.

Table 3.4 Patient Information Record - Transmitted Fields (*Continued*)

Field Name	CLSI Section	Delimiter	Example Data	Case-sensitive?	Max. Length	DxH Download	DxH Upload	Error #	Comment/Info
Age		!	13	N/A	3	Yes	Yes	24, 56	“Age” is calculated from date of birth when available. “Age” can be up to 3 numeric digits. The “Age” component without the following “Age Units” component is considered invalid. The combination of “Age” and “Age Units” field should be valid. On upload and download, if “Date of Birth” is available, the “Age” shall be calculated based on the “Date of Birth,” whether or not the “Age” is available. “Age” cannot exceed 150 years. Number of digits: YYY = Years (3) MM = Months (2) WW = Weeks (2) DD = Days (2) HH = Hours (2)
Age Units		!	Y	No	1	Yes	Yes	56	Units for the patient’s age. Y = Years M = Months W = Weeks D = Days H = Hours
Date Of Birth Flag		!	E	N/A	1	Ignored	Yes	None	Indicator of whether the Date of Birth field was modified. E = Edited
Age Flag		!	E	N/A	1	Ignored	Yes	None	Indicator of whether the Age field was modified. E = Edited

Table 3.4 Patient Information Record - Transmitted Fields (*Continued*)

Field Name	CLSI Section	Delimiter	Example Data	Case-sensitive?	Max. Length	DxH Download	DxH Upload	Error #	Comment/Info
Patient Sex (<i>Gender</i>)	7.9		M	No	1	Yes	Yes	24, 56	Only the single characters are allowed. All other values will result in the rejection of the demographics. An appropriate error will be sent back to the host. M = Male F = Female U = Unknown
Patient Sex Flag (<i>Gender flag</i>)		!	E	Yes	1	Ignored	Yes	None	Indicator of whether the Patient Sex field was modified. E = Edited
Patient Ethnic Origin	7.10		Not Xmit	N/A	N/A	Ignored	No	None	
Patient Address	7.11		Not Xmit	N/A	N/A	Ignored	No	None	
Reserved Field	7.12		Not Xmit	N/A	N/A	Ignored	No	None	
Patient Telephone Number	7.13		Not Xmit	N/A	N/A	Ignored	No	None	
Attending Physician ID:	7.14		Not Xmit	N/A	N/A	Ignored	No	None	The "Ordering Physician," as part of the Test Order Record is used to define "Physician."
Special Field 1	7.15		Not Xmit	N/A	N/A	Ignored	No	None	
Special Field 2	7.16		Not Xmit	N/A	N/A	Ignored	No	None	
Patient Height	7.17		Not Xmit	N/A	N/A	Ignored	No	None	
Patient Weight	7.18		Not Xmit	N/A	N/A	Ignored	No	None	
Patient Diagnosis	7.19		Not Xmit	N/A	N/A	Ignored	No	None	
Patient Medications	7.20		Not Xmit	N/A	N/A	Ignored	No	None	
Patient Diet	7.21		Not Xmit	N/A	N/A	Ignored	No	None	
Practice Field #1	7.22		Not Xmit	N/A	N/A	Ignored	No	None	
Practice Field #2	7.23		Not Xmit	N/A	N/A	Ignored	No	None	

Table 3.4 Patient Information Record - Transmitted Fields (*Continued*)

Field Name	CLSI Section	Delimiter	Example Data	Case-sensitive?	Max. Length	DxH Download	DxH Upload	Error #	Comment/Info
Admission and Discharge Dates	7.24		Not Xmit	N/A	N/A	Ignored	No	None	
Admission Status	7.25		Not Xmit	N/A	N/A	Ignored	No	None	
Location	7.26		Oncology	No	16	Yes	Yes	24, 18	Patient location
Nature of Alt. Diag. Code & Class	7.27		Not Xmit	N/A	N/A	Ignored	No	None	
Alt. Diag. Code & Class.	7.28		Not Xmit	N/A	N/A	Ignored	No	None	
Patient Religion	7.29		Not Xmit	N/A	N/A	Ignored	No	None	
Marital Status	7.30		Not Xmit	N/A	N/A	Ignored	No	None	
Isolation Status	7.31		Not Xmit	N/A	N/A	Ignored	No	None	
Language	7.32		Not Xmit	N/A	N/A	Ignored	No	None	
Hospital Service	7.33		Not Xmit	N/A	N/A	Ignored	No	None	
Hospital Institution	7.34		Not Xmit	N/A	N/A	Ignored	No	None	
Dosage Category	7.35		Not Xmit	N/A	N/A	Ignored	No	None	
End of Record		<CR>		N/A	1	Required	Required	42	All records end in carriage return.

NOTE Demographic information will be uploaded in result messages to the LIS Host.

Patient Record - Global Errors

In addition to the specific error indicated in the Patient Record table, the following general errors also apply: Errors 41, 43, 44, and 45.

Test Order (Patient) Record (CLSI Section 8.0)

The fields that are transmitted in the Test Order (Patient) record by the DxH instruments are described.

Test Order (Patient) record contains information that uniquely identifies a patient specimen, the list of tests to be completed, and the type of action requested.

Test Order Record Example:

Typical Upload

O|1|SID_133|!!!CD|||20160510111238|||N|||WB

Table 3.5 Test Order (Patient) Record - Transmitted Fields

Field Name	CLSI Section	Delimiter	Example Data	Case-sensitive?	Max. Length	DxH Download	DxH Upload	Error #	Comment/Info
Record Identifier	8.4.1	O	O	Yes	1	Required	Required	58, 66	
Sequence Number	8.4.2		1	N/A	5	Required	Required	67, 23	This sequence number begins with 1 and is incremented within the message for each subsequent order record. All order records are associated with the preceding patient record. A new patient record will reset the order record sequence number to 1. Result records that follow are associated with this sequence order record until a subsequent order record is encountered.
Specimen ID	8.4.3								

Table 3.5 Test Order (Patient) Record - Transmitted Fields (*Continued*)

Field Name	CLSI Section	Delimiter	Example Data	Case-sensitive?	Max. Length	DxH Download	DxH Upload	Error #	Comment/Info
Specimen ID			1234567890123456	No	16	Required	Required	5, 15, 23, 26, 34	Specimen ID is required. Test Orders received without a Specimen ID will be rejected. Received Specimen ID cannot match IDs Reserved for Control IDs. Specimen ID must be unique and must not match existing Worklist Specimen ID. Test Orders received with duplicate Specimen ID will be rejected.
Specimen ID Edit Flag		!	E	No	1	No	Yes	None	Indicator of whether the Specimen ID is modified after the sample is analyzed. E = Edited
Instrument Specimen ID: (<i>Sequence Number</i>)	8.4.4		234678	N/A	6	No	Yes	None	Sequential number generated by instrument. Specimen Sequence number range 000001 to 999999
Sampling Method/Cassette & Position		!	OV	N/A	5	No	Yes	None	Available Modes: OV = Open Vial CP = Closed Vial Cassette and position number applicable only to AL systems: AA 00-99 (Cassette Type) BB 00-99 (Cassette Number) C 1-5 (Tube Position)
Universal Test ID:	8.4.5								
Universal Test ID (Part 1)			Not Xmit	N/A	N/A	Ignored	No	None	

Table 3.5 Test Order (Patient) Record - Transmitted Fields (*Continued*)

Field Name	CLSI Section	Delimiter	Example Data	Case-sensitive?	Max. Length	DxH Download	DxH Upload	Error #	Comment/Info
Universal Test ID (Part 2)		!	Not Xmit	N/A	N/A	Ignored	No	None	
Universal Test ID (Part 3)		!	Not Xmit	N/A	N/A	Ignored	No	None	
Manufacturer/Local Code: (Test)		!	C	No	3	Yes	Yes	6, 9, 23	If a Test is not received with download, the “Default” test will be assigned. On upload, the Test used to process the specimen is sent. Available tests: C = CBC CD = CBC/DIFF
Priority	8.4.6		Not Xmit	N/A	N/A	Ignored	No	None	
Request/Ordered Date & Time	8.4.7		Not Xmit	N/A	N/A	Ignored	No	None	
Specimen Collection Date and Time	8.4.8		20130321093000	N/A	14	Yes	Yes	23, 57, 29,30, 80, 84	If received, must be in YYYYMMDDHHMMSS format. The following restrictions apply: • If collection date/time is > 2 hours from current time, collection date/time is invalid. • If collection date/time is ≤ 2 hours from current time, collection date/time is valid. • Collection date/time can be earlier than current time. • Collection time cannot be before date of birth.
Collection End Time	8.4.9		Not Xmit	N/A	N/A	Ignored	No	None	
Collection Volume	8.4.10		Not Xmit	N/A	N/A	Ignored	No	None	

Table 3.5 Test Order (Patient) Record - Transmitted Fields (*Continued*)

Field Name	CLSI Section	Delimiter	Example Data	Case-sensitive?	Max. Length	DxH Download	DxH Upload	Error #	Comment/Info
Collector ID	8.4.11		Not Xmit	N/A	N/A	Ignored	No	None	
Action Code	8.4.12		N	No	1	Yes	Yes	23, 25, 26	This field indicates the action to take in associating test requests with specimens. The following codes are used: • C - Cancel pending test requests associated with the specimen. • N - New test requests are added to the worklist. • Q - Treat specimen as a Q/C test specimen. This code is used only for upload of result of quality specimens. See Test Order QC for details. On download, a NULL field is interpreted as "New."
Danger Code	8.4.13		Not Xmit	N/A	N/A	Ignored	No	None	
Relevant Clinical Information	8.4.14		Not Xmit	N/A	N/A	Ignored	No	None	
Date Time Specimen Received	8.4.15		Not Xmit	N/A	N/A	Ignored	No	None	
Specimen Descriptor:	8.4.16								
Specimen Type			WB	Yes	2	Required	Yes	8, 6, 23	WB = Whole Blood PD = Predilute

Table 3.5 Test Order (Patient) Record - Transmitted Fields (*Continued*)

Field Name	CLSI Section	Delimiter	Example Data	Case-sensitive?	Max. Length	DxH Download	DxH Upload	Error #	Comment/Info
Ordering Physician	8.4.17								DxH instrument provides only a single "Physician field." Information on physician must be sent in the Physician ID component of this field. The "Physician First name," "Last name," "Middle name/Initial, Suffix" and "Title" components are not used.
Physician ID (Physician)			J Williams	No	16	Yes	Yes	23, 26	
Physician Last Name		!	Not Xmit	N/A	N/A	Ignored	No	None	
Physician First Name		!	Not Xmit	N/A	N/A	Ignored	No	None	
Physician Middle Name/Initial		!	Not Xmit	N/A	N/A	Ignored	No	None	
Suffix		!	Not Xmit	N/A	N/A	Ignored	No	None	
Physician Phone Number	8.4.18		Not Xmit	N/A	N/A	Ignored	No	None	
User Field # 1	8.4.19		Not Xmit	N/A	N/A	Ignored	No	None	
User Field # 2	8.4.20		Not Xmit	N/A	N/A	Ignored	No	None	
Laboratory Field # 1	8.4.21		Not Xmit	N/A	N/A	Ignored	No	None	
Laboratory Field # 2	8.4.22		Not Xmit	N/A	N/A	Ignored	No	None	
Date/Results Reported or Last Modified	8.4.23		Not Xmit	N/A	N/A	Ignored	No	None	
Instrument Charge to Information System	8.4.24		Not Xmit	N/A	N/A	Ignored	No	None	
Instrument Section ID	8.4.25		Not Xmit	N/A	N/A	Ignored	No	None	
Report Types	8.4.26		Not Xmit	N/A	N/A	Ignored	No	None	
Reserved Field	8.4.27		Not Xmit	N/A	N/A	Ignored	No	None	
Location of Specimen Collection	8.4.28		Not Xmit	N/A	N/A	Ignored	No	None	
Nosocomial Infection Flag	8.4.29		Not Xmit	N/A	N/A	Ignored	No	None	
Specimen Service	8.4.30		Not Xmit	N/A	N/A	Ignored	No	None	

Table 3.5 Test Order (Patient) Record - Transmitted Fields *(Continued)*

Field Name	CLSI Section	Delimiter	Example Data	Case-sensitive?	Max. Length	DxH Download	DxH Upload	Error #	Comment/Info
Specimen Institution	8.4.31		Not Xmit	N/A	N/A	Ignored	No	None	
End of Record	<CR>	<CR>		N/A		Required	Required	48	All records end in carriage return.

Test Order (Patient) Record - Global Errors

In addition to the specific error indicated in the Test Order Record table, the following general errors also apply: Errors 15, 17, 47, 49, 50, and 51.

Test Order (Quality Control) Record

The fields that are transmitted in the Test Order (Quality Control) record by the DxH instruments are described.

The Test Order (Quality Control) record is identified by “Q” as an action code. The record is used to send information to the LIS; it is not used to receive information. It contains information that is specific to a control specimen.

Test Order (Quality Control) Record Example:

Typical Upload
O|1|371607413!H!RxH 5Diff Control!20160405|36862!OV|!!!CD|||||Q||||WB|||||72528-1-K3!|||||||

Table 3.6 Test Order (Quality Control) Record - Transmitted Fields

Field Name	CLSI Section	Delimiter	Example Data	Case-sensitive?	Max. Length	DxH Download	DxH Upload	Error #	Comment/Info
Record Identifier	8.4.1	O	O	Yes	1	Required	Required	None	
Sequence Number	8.4.2		1	N/A	5	Required	Required	None	This sequence number begins with 1 and is incremented within the message for each subsequent order record. All order records are associated with the preceding patient record. A new patient record will reset the order record sequence number to 1. Result records that follow are associated with this sequence order record until a subsequent order record is encountered
Specimen ID	8.4.3								
Lot Number			1234567890	No	10	N/A	Yes	None	Lot number of the control sample
Control Level		!	N	No	1	N/A	Yes	None	The name of a control level: L = Low N = Normal H = High
Control Type		!	DxH 500 Control	No	17	N/A	Yes	None	The name of a control type. Control identified as BEC. Send Control Name. Otherwise, "other" is sent. Available types: • DxH 500 Control • Other
Expiration Date		!	20141211	N/A	8	N/A	Yes	None	Lot expiration date: date format "YYYYMMDD"

Table 3.6 Test Order (Quality Control) Record - Transmitted Fields (*Continued*)

Field Name	CLSI Section	Delimiter	Example Data	Case-sensitive?	Max. Length	DxH Download	DxH Upload	Error #	Comment/Info
Instrument Specimen ID: (<i>Sequence Number</i>)	8.4.4		234567	N/A	6	N/A	Yes	None	Sequential number generated by the Instrument. Specimen Sequence number range 000001 to 999999
Sampling Method/ Cassette & Position		!	OV	N/A	5	N/A	Yes	None	Available Modes: OV = Open Vial CP = Closed Vial Cassette and position number applicable only to AL systems: AA 00-99 (Cassette Type) BB 00-99 (Cassette Number) C 1-5 (Tube Position)
Universal Test ID:	8.4.5								
Universal Test ID (Part 1)			Not Xmit	N/A	N/A	N/A	No	None	
Universal Test ID (Part 2)		!	Not Xmit	N/A	N/A	N/A	No	None	
Universal Test ID (Part 3)		!	Not Xmit	N/A	N/A	N/A	No	None	
Manufacturer/Local Code: Test		!	C	No	3	N/A	Yes	None	C = CBC CD = CBC/DIFF
Priority	8.4.6		Not Xmit	N/A	N/A	N/A	No	None	
Request/Ordered Date & Time	8.4.7		Not Xmit	N/A	N/A	N/A	No	None	
Specimen Collection Date and Time	8.4.8		Not Xmit	N/A	N/A	N/A	No	None	
Collection End Time	8.4.9		Not Xmit	N/A	N/A	N/A	No	None	
Collection Volume	8.4.10		Not Xmit	N/A	N/A	N/A	No	None	

Table 3.6 Test Order (Quality Control) Record - Transmitted Fields (*Continued*)

Field Name	CLSI Section	Delimiter	Example Data	Case-sensitive?	Max. Length	DxH Download	DxH Upload	Error #	Comment/Info
Collector ID	8.4.11		Not Xmit	N/A	N/A	N/A	No	None	
Action Code	8.4.12		Q	No	1	N/A	Yes	None	Q - Treat specimen as a Q/C specimen. This code is used only for the upload of results for quality control specimens.
Danger Code	8.4.13		Not Xmit	N/A	N/A	N/A	No	None	
Relevant Clinical Information	8.4.14		Not Xmit	N/A	N/A	N/A	No	None	
Date Time Specimen Received	8.4.15		Not Xmit	N/A	N/A	N/A	No	None	
Specimen Descriptor:	8.4.16								
Specimen Type (Specimen)			WB	Yes	2	N/A	Yes	8, 6, 23	Whole Blood only valid specimen for control WB = Whole Blood
Ordering Physician	8.4.17								
Physician ID			Not Xmit	N/A	N/A	N/A	No	None	
Physician Last Name		!	Not Xmit	No	No	N/A	No	None	
Physician First Name		!	Not Xmit	No	No	N/A	No	None	
Physician Middle Name/Initial		!	Not Xmit	N/A	N/A	N/A	No	None	
Suffix		!	Not Xmit	N/A	N/A	N/A	No	None	
Physician Phone Number	8.4.18		Not Xmit	N/A	N/A	N/A	No	None	
User Field # 1	8.4.19		Not Xmit	N/A	N/A	N/A	No	None	
User Field # 2	8.4.20		Not Xmit	N/A	N/A	N/A	No	None	
Laboratory Field # 1	8.4.21								

Table 3.6 Test Order (Quality Control) Record - Transmitted Fields (*Continued*)

Field Name	CLSI Section	Delimiter	Example Data	Case-sensitive?	Max. Length	DxH Download	DxH Upload	Error #	Comment/Info
IQAP Participant Number			12345-1-1	Yes	10	N/A	Yes	None	Unique IQAP ID assigned by Beckman Coulter for IQAP participants. This component will be up to 10 characters in the format PPPPP-L-IN where: PPPPP is the IQAP participant number (e.g. 63045). L is the Laboratory number (e.g. 1). I is the instrument type (e.g. K for DxH 500). N is the sequential number of the instrument type in that laboratory ("1"- "9" and "A"- "Z"). If IQAP not set up, sent as Null.
Excluded Flag		!	E	No	1	N/A	Yes	None	Indicator of whether the control run was excluded from the statistical calculations for a data set. If the control run is excluded from the calculation, an "E" will be transmitted in this component.
Laboratory Field # 2	8.4.22		Not Xmit	N/A	N/A	N/A	No	None	
Date/Results Reported or Last Modified	8.4.23		Not Xmit	N/A	N/A	N/A	No	None	
Instrument Charge to Information System	8.4.24		Not Xmit	N/A	N/A	N/A	No	None	

Table 3.6 Test Order (Quality Control) Record - Transmitted Fields (*Continued*)

Field Name	CLSI Section	Delimiter	Example Data	Case-sensitive?	Max. Length	DxH Download	DxH Upload	Error #	Comment/Info
Instrument Section ID	8.4.25		Not Xmit	N/A	N/A	N/A	No	None	
Report Types	8.4.26		Not Xmit	N/A	N/A	N/A	No	None	
Reserved Field	8.4.27		Not Xmit	N/A	N/A	N/A	No	None	
Location of Specimen Collection	8.4.28		Not Xmit	N/A	N/A	N/A	No	None	
Nosocomial Infection Flag	8.4.29		Not Xmit	N/A	N/A	N/A	No	None	
Specimen Service	8.4.30		Not Xmit	N/A	N/A	N/A	No	None	
Specimen Institution	8.4.31		Not Xmit	N/A	N/A	N/A	No	None	
End of Record	<CR>	<CR>		N/A	1	Required	Required	None	All records end in carriage return.

Test Order (Quality Control) Record - Global Errors

In addition to the specific error indicated in the Test Order Record table, the following general errors also apply: Errors None.

Result Record (CLSI Section 9.0)

The fields that are transmitted in the Results record by the DxH instruments are described. Result record contains information that identifies, for a particular test, the result value, the units, the demographic range information, the condition of the result (for example, normal or abnormal), and the date/time of the test.

Results Order Record Example:

Typical Upload

R|3|!!!HGB|15.14! |g/dL||0.1 to 25||||RAVEN||20150502121423|90

Table 3.7 Result Record - Transmitted Fields

Field Name	CLSI Section	Delimiter	Example Data	Case-sensitive?	Max. Length	DxH Download	DxH Upload	Error #	Comment/Info
Record Identifier	9.1	R	R	Yes	1	N/A	Required	None	
Sequence Number	9.2		1	No	5	N/A	Required	None	The result record sequence number begins with 1 and is incremented within the message for each subsequent result record. All result records are associated with the immediately preceding order record. A new order record will reset the result record sequence number to 1. Comment records that follow are associated with this sequence result record until a subsequent result record is encountered.
Universal Test ID:	9.3								The first three components of this field are not used by the Instrument, and should be transmitted as null fields by the laboratory computer as they are ignored.
Universal Test ID (Part 1)			Not Xmit	N/A	N/A	N/A	No	None	
Universal Test ID (Part 2)		!	Not Xmit	N/A	N/A	N/A	No	None	
Universal Test ID (Part 3)		!	Not Xmit	N/A	N/A	N/A	No	None	

Table 3.7 Result Record - Transmitted Fields (*Continued*)

Field Name	CLSI Section	Delimiter	Example Data	Case-sensitive?	Max. Length	DxH Download	DxH Upload	Error #	Comment/Info
Manufacturer/ Local Code (Part 4) (<i>Parameter</i>)		!	RBC	No	6	N/A	Required	None	See Panels, Tests, Controls, Dataplots, and Histograms Available in APPENDIX C, Additional Tables for the possible tests for patients and for controls. The parameter names listed in the tables correspond to the <i>Test Identifier</i> that will be transmitted in this field. the Test Identifiers are transmitted as defined are are not translated. If a test parameter that is for Research Use Only (RUO) is transmitted, a comment record with comment text <i>Test names beginning with @ are for research use only. Not for use in diagnostics procedures</i> is transmitted after the order record and before any result records are transmitted.
Data Measurement/Value	9.4								
Value			4.20	No	6	N/A	Yes	None	If the Result Value is numeric, it will only contain digits 0 – 9 and/or a decimal point (for example 4.39) For a non-numeric result, one of the codes, as described in Result Non-Numeric Codes and Results Flags in APPENDIX C, Additional Tables will be used.

Table 3.7 Result Record - Transmitted Fields (*Continued*)

Field Name	CLSI Section	Delimiter	Example Data	Case-sensitive?	Max. Length	DxH Download	DxH Upload	Error #	Comment/Info
Flags		!	MRL	Yes	4	N/A	Yes	None	Flags are specified in Result Non-Numeric Codes and Results Flags in APPENDIX C, Additional Tables . The Flags component consists of 3 characters. The three-character string will send a <SPACE> character if no flag is present for that position.
Units	9.5		10 ⁶ /μL	No	15	N/A	Yes	None	User-selected unit identifier for the parameter result. Conversion Factors for U.S. and Japan Display Formats are contained in the instrument's Instructions for Use.
Dilution Factor	9.6		Not Xmit	N/A	N/A	N/A	No	None	
Reference Ranges	9.7		4.00 to 5.50	No	24	N/A	Yes	None	Alphanumeric representation of reference range used for the result as defined in System.
Result Abnormal Flags	9.8		A	No	1	N/A	Yes	None	The following codes are used: A (Abnormal): If the result contains one or more flag (Flags component of field number 9.4) or if the result value is non-numeric. Blank: If no flags associated with the result. (Flags component of field number 9.4 is empty.)
Nature of Abnormality Testing	9.9		Not Xmit	N/A	N/A	N/A	No	None	
Results Status	9.10		Not Xmit	N/A	N/A	N/A	No	None	

Table 3.7 Result Record - Transmitted Fields (Continued)

Field Name	CLSI Section	Delimiter	Example Data	Case-sensitive?	Max. Length	DxH Download	DxH Upload	Error #	Comment/Info
Date Change in Instrument Normative Values or Units	9.11		Not Xmit	N/A	N/A	N/A	No	None	
Operator Identification	9.12		JSmith	Yes	8	N/A	Yes	None	This field identifies the operator that was logged on when the specimen was processed
Date/Time Test Started	9.13		Not Xmit	N/A	N/A	N/A	No	None	
Date/Time Test Completed	9.14		20131023125959	N/A	14	N/A	Yes	None	Date and time of analysis. Analysis date and time YYYYMMDD HHMMSS
Instrument Identification	9.15		01	No	2	N/A	Yes	None	The Instrument ID as defined in the LIS Setup UI
End of Record	<CR>	<CR>			1	N/A	Required	None	All records end in carriage return.

Result Order Record - Global Errors

In addition to the specific error indicated in the Result Order Record table, the following general errors also apply: Errors None.

Manufacturer Record (CLSI Section 14)

NOTE The Manufacturer Record is only available in Software Version 2.0 or later.

The Manufacturer Record is ignored when received by the instrument and is used by the instrument to transmit dataplot and histogram results.

Typical Upload

[illegible]

Table 3.8 Manufacturer Record - Transmitted Fields

Field Name	CLSI Section	Delimiter	Example Data	Case-sensitive?	Max. Length	DxH Download	DxH Upload	Error #	Comment/Info
Record Identifier		M	M	Yes	1	N/A	Required	None	
Sequence Number			1	No	5	N/A	Required	None	The Manufacturer Record sequence number begins with 1 and is incremented within the message for each subsequent Manufacturer Record. All Manufacturer Records are associated with the immediately preceding order record. A new order record will reset the Manufacturer Record sequence number to 1. Comment records that follow are associated with this sequence Manufacturer Record until a subsequent Manufacturer Record is encountered.
Universal Test ID:									
Universal Test ID (Part 1)			Not Xmit	N/A	N/A	N/A	No	None	
Universal Test ID (Part 2)		!	Not Xmit	N/A	N/A	N/A	No	None	

Table 3.8 Manufacturer Record - Transmitted Fields (*Continued*)

Field Name	CLSI Section	Delimiter	Example Data	Case-sensitive?	Max. Length	DxH Download	DxH Upload	Error #	Comment/Info
Universal Test ID (Part 3)		!	Not Xmit	N/A	N/A	N/A	No	None	
Manufacturer/Local Code (Part 4) (Dataplot/ Histogram)		!	RBC.Histogram.Array	No	N/A	N/A	Required	None	In an upload message, this contains the Identifier that represents the graphic result. See Panels, Tests, Controls, Dataplots, and Histograms Available in APPENDIX C, Additional Tables for available histograms and dataplots. This is not translated.
Data Measurement/Value:						N/A		None	
Value			See Tables in APPENDIX D, Graphic Results and Dataplots	No	N/A	N/A	Yes	None	
Date/Time Test Completed			20131023125959	N/A	14	N/A	Yes	None	Date and time of analysis. Data format is YYYYMMDDHHMSS
Instrument Identification			01	No	2	N/A	Yes	None	The Instrument ID as defined in the LIS Setup UI
End of Record		<CR>			1		Required	None	

Manufacturer Record - Errors

In addition to the specific error indicated in the Manufacturer Record table, the following general errors also apply: Errors None.

Comment Record (CLSI Section 10)

For patient results, user-defined comments are sent immediately following a patient, order, or result record. The comment record also follows an order or result record when the result contains one or more flags/messages.

On recent download:

- Comment records following a patient and order record are processed by the DxH as comments associated with patient and specimen, respectively.
- Comment record sent by the DxH instrument in response to a downloaded message will indicate a rejected message.

On record upload:

- If the comment follows the Patient Record, it will be a general comment against the patient record (Comment Type = G).
- If the comment follows the Order Record, it can be a general comment against the specimen (Comment Type = G), a Test Name comment against the panel (Comment Type = T), a Lab Action against the results (Comment Type = L), or an Instrument Flag comment, which will contain the suspect and system messages for the results (Comment Type = I, subtype U for suspect, and Y for system messages).
- If the comment follows the Result Record, it can be a general comment against the test (Comment Type = G), or an Instrument Flag comment, which will contain the definitive messages for the results (Comment Type = I).

Only fields that are transmitted by the DxH instrument are included in this record. All other fields described in the standard (*CLSI LIS02-A2*) for this record are not included in this document.

Comment Record Example:

Typical Upload

C|2|I|Cellular Interference|I!U

Table 3.9 Comment Record - Transmitted Fields

Field Name	CLSI Section	Delimiter	Example Data	Case-sensitive?	Max. Length	DxH Download	DxH Upload	Error #	Comment/Info
Record Identifier	10.1	C	C	Yes	1	Required	Required	58	Comment record applies to any other record except the message trailer record. It contains free- standing text sent to or from the instrument.
Sequence Number	10.2		1	No	1	Required	Required	68	This sequence number begins with 1 and is incremented within the message for each subsequent comment record. Comment records are associated with the preceding patient, order, or result record. A new patient, order, or result record will reset the comment record sequence number to 1.
Comment Source	10.3		I	Yes	1	Yes	Yes	75	Used to indicate source of comment. I - Clinical Instrument System L - Computer system On message upload, Comment Source code is I regardless of the original source of the comment and on message download, the Comment Source code is L.

Table 3.9 Comment Record - Transmitted Fields (*Continued*)

Field Name	CLSI Section	Delimiter	Example Data	Case-sensitive?	Max. Length	DxH Download	DxH Upload	Error #	Comment/Info
Comment Text	10.4		Hypochromia	No	120	Yes	Yes	77	When the instrument finds an error and does not accept a Patient or Test Order Record, which will prevent tests from being ordered, it transmits a Comment Record containing the Informational Comment back to the LIS Host. (Note: The comment will be transmitted only when such a record is rejected, not just for any error.) If multiple Test Result Records are uploaded in a message, the Comment Record applies to the Result Order Record immediately preceding the Comment Record. Comment Text can be up to 120 characters. Note: Each message is uploaded in a separate Comment Record. See DxH Error Responses in APPENDIX B, Sample Messages .
Comment Type	10.5		I	Yes	1	Yes	Yes	75	Used to indicate type of comment: G - Generic/Free Text Comment (for error messages or user-defined comments). The following codes are used: I - Instrument Flag Comment (for test result flags/messages) On message upload, Comment Type code can be I or G. On message download, Comment Type code is I.

Table 3.9 Comment Record - Transmitted Fields *(Continued)*

Field Name	CLSI Section	Delimiter	Example Data	Case-sensitive?	Max. Length	DxH Download	DxH Upload	Error #	Comment/Info
Flag Type		!	U	Yes	1	No	Yes	None	Used to indicate if the flag is a system message or suspect message. If the order record has no system or suspect message flags, Flag Type field would not be sent. Y – System Message U – Suspect Message
End of Record		<CR>			1	Required	Required	69	All records end in carriage return.

NOTE For Order/Result records, if user-defined comments are present, such comment records will follow comment records for flags/messages.

Comment Record - Errors

In addition to the specific error indicated in the Comment Record table, the following general errors also apply: Error 71, 72, 73, and 74.

Message Terminator Record (CLSI Section 12)

This is the last record in a message. A header record may be transmitted after this indicating the start of a second message.

Message Terminator Record Example:

Typical Upload
L|1|N

Table 3.10 Message Terminator Record - Transmitted Fields

Field Name	CLSI Section	Delimiter	Example Data	Case-sensitive?	Max. Length	DxH Download	DxH Upload	Error #	Comment/Info
Record Identifier	12.1	L	L	Yes	1	Required	Required	33, 58	
Sequence Number	12.2		1	N/A	1	Required	Required	54	For this record type, the value will always be 1.

Table 3.10 Message Terminator Record - Transmitted Fields (Continued)

Field Name	CLSI Section	Delimiter	Example Data	Case-sensitive?	Max. Length	DxH Download	DxH Upload	Error #	Comment/Info
Termination Code	12.3		N	Yes	1	Required	Yes	75	N - Normal termination T - Sender aborted. R - Receiver requested termination E - Unknown system error
End of Record	12.4	<CR>			1	Required	Required	53	All records end in carriage return.

Supported and Restricted Characters

Supported Characters

The following groups contain the types of characters supported and are used to describe field contents:

- Alpha (Alphabetic): Any alphabetic-based system of characters (such as English, French, Spanish, and Latin)
- Logo (Logographic): any grapheme-based system of characters (such as Chinese, Japanese, and Korean)
- Numeric: Arabic number characters (0-9)
- Symbol: Symbol characters (such as %)

Restricted Characters



Risk of misidentification. Do not use the characters % # @ [\] ` { | } ~ ? " * in demographics, including Specimen or Patient ID. Do not use spaces in the leading or trailing position of a Specimen or Patient ID.

The Specimen ID and the Patient ID are not case-sensitive. For example, Specimen ID *abcd* will match a test order with Specimen ID *ABCD*.

Table A.1 Restricted Characters

Character	ASCII Value
<space>	32 ¹
#	35
@	64
[	91
\	92
]	93
`	96
{	123
	124
}	125
~	126

Table A.1 Restricted Characters (*Continued*)

Character	ASCII Value
*	42
?	63
"	34
%	37

¹Leading and trailing spaces are not allowed except where specified above (for example, *Flags* field). A maximum of one <space> is allowed between characters. Two or more consecutive <space> characters between characters are not allowed.

APPENDIX B

Sample Messages

DxH Error Responses

The following table lists the possible error responses that will be sent by the DxH 500 Series instrument.

NOTE This table contains all possible error codes. All of them may not be generated. Only error codes mentioned in the Record Field Content tables will be generated. Some of the fields in the Event Log Message column may be blank.

Table B.1 Possible Error Responses

Error #	Error Description	Event Log Message		Information
2	Patient Record missing in LIS message	Host data error	Patient record missing in LIS message	Host message does not have the "P" record
4	Invalid Birthdate	Host data error	Patient record: Invalid Birthdate	If birthdate is not in YYYYMMDD format
5	Specimen ID is reserved for Control ID	Host data error	Specimen ID is reserved for control ID	Host message contains a Sample ID that is reserved as patient control in DxH.
6	Missing required fields: Specimen ID	Host data error	Test Order record: missing Specimen ID	Host message missing Specimen ID
8	Specimen type not supported	Host data error	Specimen type not supported	Host message contains invalid specimen type.
9	Test not supported	Host data error	Test not supported	Host message contains invalid test
11	Specimen ID to cancel not found.	Host data error	Tests not cancelled. Specimen not found.	Host sends a message, with action code "C" for specimen that does not exist in DxH Worklist.
15	Cannot create new entry as order for Specimen ID already exists.	Host error	Cannot create new test order. Existing test order for Specimen ID	Send a message from host with test and action code "N."
17	Cannot cancel tests that are not requested or in progress.	Host data error	Test not canceled. Does not exist or in progress	Download a test with action code "C." Existing test is not pending or in progress.
18	Contains Invalid characters in Patient record	Host data error	Patient record. Demographics contain invalid characters in Patient record. Demographics not processed.	Host sends a message with restricted characters in any field in patient record.

Table B.1 Possible Error Responses (*Continued*)

Error #	Error Description	Event Log Message		Information
21	Illegal characters in Specimen Type field.	Host data error	Test Order record: Invalid data in required field. Test order rejected.	Host downloads message with restricted characters in Specimen Type field.
23	Exceeds maximum length in Order record	Host data error	Test Order record: Exceeds maximum length in order record. Test order rejected.	Host downloads a test order with any field exceeding maximum length.
24	Exceeds maximum length in Patient record	Host data error	Patient Record: Exceeds maximum length in Patient record. Demographics not processed.	Host downloads patient record with any field exceeding maximum length.
25	Invalid Code in Order record	Host data error	Test Order record: Invalid code in Order record. Test order rejected.	Host downloads a test order with invalid code in action code field
26	Contains Invalid Characters.	Host data error	Test Order record: Contains invalid characters. Test order rejected.	Host downloads a test order with invalid characters in restricted fields.
30	Future collection date/time is not allowed.	Host data error	Test Order record: Collection date/time > 2 hours from current time. Test order rejected.	Host downloads a sample with future collection date/time and collection date/time is > 2 hours from current time,
31	Future specimen receipt date/time is not allowed.	Host data error	Test order record: Future specimen receipt date/time is not allowed. Test order rejected.	Host downloads a sample with future specimen receipt date/time when order date/time is either empty or in the past.
32	Invalid sequence number received in Patient record	Host data error	Patient record: Invalid sequence number received in Patient record. Demographics not processed.	Host downloads message with invalid sequence number for patient record.
33	Terminator record missing in LIS message	Host parsing error	Terminator record missing in LIS message.	Host downloads message with no terminator record.
34	Test order missing Specimen ID	Host data error	Missing Specimen ID: Specimen ID must be assigned to process the specimen.	Host downloads message with no specimen ID
35	Header record is missing in message.	Host data error	Header record missing in LIS message	Host downloads message with no header record. (H record is missing)

Table B.1 Possible Error Responses (Continued)

Error #	Error Description	Event Log Message		Information
36	Header record missing record terminator.	Host parsing error	Terminator character missing	Host downloads a message with no record terminator in the header record.
37	Header record has trailing <CR> and <LF> characters missing	Host parsing error	Header record: Trailing carriage return <CR> and line feed <LF> characters missing	Host downloads a message with missing <CR><LF> pair for the header record.
38	Header record has <ETB> or <ETX> character missing.	Host parsing error	Header record: End of transmission block <ETB> or end of test <ETC> character missing	Host downloads a message with missing <ETB> or <ETX> for the header record.
39	Header record has <STX> character missing.	Host parsing error	Header record: start of text <STX> character missing	Host downloads a message with missing <STX> for the header record.
41	Patient record contains incorrect CRC	Host parsing error	Patient record: record contains incorrect CRC	Host downloads message with incorrect CRC in patient record.
42	Patient record has terminator character missing.	Host parsing error	Patient record: record terminator character missing	Host downloads message with no terminator character in patient record.
43	Patient record: trailing <CR> and <LF> characters missing	Host parsing error	Patient record: trailing carriage return <CR> and line feed <LF> characters missing	Host downloads a message with missing <CR><LF> pair for the patient record.
44	Patient record has <ETB> or <ETX> character missing	Host parsing error	Patient record: end of transmission block <ETB> or end of test <ETX> character missing	Host downloads a message with missing <ETB> or <ETX> for the patient record.
45	Patient record <STX> character missing	Host parsing error	Patient record: start of text <STX> character missing	Host downloads a message with missing <STX> for the patient record.
47	Order record contains incorrect CRC	Host parsing error	Order record: record contains incorrect CRC	Host downloads message with incorrect CRC in order record.
48	Order record has terminator character missing.	Host parsing error	Test order record: record terminator character missing	Host downloads message with no terminator character in order record.
49	Order record: trailing <CR> and <LF> characters missing	Host parsing error	Order record: Trailing carriage return <CR> and line feed <LF> characters missing	Host downloads a message with missing <CR><LF> pair for the order record.

Table B.1 Possible Error Responses (*Continued*)

Error #	Error Description	Event Log Message		Information
50	Order record has <ETB> or <ETX> character missing.	Host parsing error	Order record: end of transmission block <ETB> or end of test <ETX> character missing	Host downloads a message with missing <ETB> or <ETX> for the order record.
51	Order record <STX> character missing	Host parsing error	Order record: start of text <STX> character missing	Host downloads a message with missing <STX> for the order record.
53	Terminator record has terminator character missing.	Host parsing error	Record terminator character missing	Host downloads message with no terminator character in terminator record.
54	Terminator record has invalid sequence number.	Host parsing error	Terminator record: invalid sequence number	Host downloads message with invalid sequence number in terminator record.
56	Invalid code in Patient record	Host data error	Patient record: Invalid code in Patient record. Demographics not processed	Host downloads a message with invalid age or age units or invalid gender.
57	Invalid Date/Time format	Host data error	Test Order record: Invalid Date/Time format. Test order rejected.	Host downloads a test order with invalid date/time format. For example, 23 for month.
58	Record type not supported	Host parsing error	LIS Record: record type not supported	Host downloads a message with invalid record identifier, anything other than H, P, C, O, and L.
66	Order record is missing in message	Host parsing error	Order record missing in LIS message	Host downloads a sample with no order record.
67	Order record has invalid sequence number	Host data error	Test Order record: Order record has invalid sequence number. Test order rejected.	Host downloads an order with invalid sequence number in order record.
68	Invalid sequence number received in comment record	Host data error	Comment record: Invalid sequence number received	Host downloads an order with invalid sequence number in comment record.
69	Comment record has terminator character missing	Host parsing error	Comment record: record terminator character missing	Host downloads message with no terminator character in comment record.
70	Invalid delimiters	Host parsing error	Invalid delimiters in header record	Host downloads order with duplicate delimiters in the header record.
71	Comment record contains incorrect CRC	Host parsing error	Comment record: record contains incorrect CRC	Host downloads message with incorrect CRC in comment record.

Table B.1 Possible Error Responses (Continued)

Error #	Error Description	Event Log Message		Information
72	Comment record: trailing <CR> and <LF> characters missing	Host parsing error	Comment record: trailing carriage return <CR> and line feed <LF> characters missing	Host downloads a message with missing <CR><LF> pair for the comment record.
73	Comment record has <ETB> or <ETX> character missing	Host parsing error	Comment record: end of transmission block <ETB> or end of test <ETX> character missing	Host downloads a message with missing <ETB> or <ETX> for the comment record.
74	Comment record <STX> character missing	Host parsing error	Comment record: start of text <STX> character missing	Host downloads a message with missing <STX> for the comment record.
75	Invalid code	Host data error	Invalid code	Host downloads a terminator record with a code other than N. Host downloads a header record with processing ID other than P. Host downloads comment record with invalid comment source or type.
76	Invalid Date/Time format in Header record	Host data error	Header record: Invalid Date/Time format in	Host downloads a header record with invalid date/time format. For example, 23 for month.
77	Exceeds maximum length	Host data error	Exceeds maximum length	Host downloads a header, comment, or terminator record with any of the fields exceeding maximum length.
78	Header record out of sequence	Host parsing error	Header record: header record is not the first record in an LIS message	Host downloads the file with multiple batches in a single test order download and a Header record is found out of sequence.
80	Collection date/time must be later than Patient D.O.B.	Host data error	Test Order record: Collection date/time must be later than Patient D.O.B. Test order rejected	Host downloads an order with collection date/time greater than Patient's D.O.B.
84	Specimen collection date/time cannot be after specimen received date/time	Host data error	Test order record: Specimen collection date/time cannot be after specimen received date/time	Host downloads an order with collection date/time later than specimen receipt date/time.
85	Contains Invalid Characters	Host data error	header record: Contains invalid characters	Host downloads an order with invalid characters in header record
86	Worklist full	Host data error	Worklist contains maximum number of test orders	Host downloads an order and the Worklist is full.

Result Non-Numeric Codes and Results Flags

For a non-numeric result, one of the codes, as described below, will be used.

Table C.1 Non-Numeric Result Codes

Code	Description
----	Total vote-out (average result)
.....	Incomplete computation.
+++++	Result is outside the instrument's operating range
?????	Result is outside of the range of values that can be formatted for display

The Flags component consists of three characters. The flags are shown below in order of priority, with highest priority at the top and lowest at the bottom. The three-character string will send a <SPACE> character if no flag is present for that position:

+		H
---	--	---

If there are no flags present, nothing is sent.

Table C.2 Result Flags

Flag and Position			Description
1	2	3	
E			Manual edit of a primary parameter
e			Automatic edit of a calculated parameter
M			Results are manually matched to demographics
+			Result is above the measuring range
-			Result is below the measuring range
	R		Review results
	*		Hemoglobin and Hematocrit (H&H) check failure
		H	• Patient results above the action limit • Control results above the expected range
		L	• Patient results below the action limit • Control results below the expected range

Table C.2 Result Flags (*Continued*)

Flag and Position			Description
1	2	3	
		h	Patient results above the reference interval, but less than the action limit (H)
		l	Patient results below the reference interval, but less than the action limit (L)

Panels, Tests, Controls, Dataplots, and Histograms Available

The following table lists the panel identifiers for all panels that can be ordered from LIS, and for all panels that can be uploaded to LIS. This table also identifies the possible tests for each panel identifier listed. The Test Identifiers are not translated.

An **X** in one of the Histogram columns identifies the possible histograms and/or dataplots for the panel.

Table C.3 Panel and Test Identifiers

Panel	Specimen	Test	Histogram and Diff Plot			
			WBC Histogram	RBC Histogram	PLT Histogram	WBC Scatterplot
CBC (C)	Whole Blood	WBC	N/A	X	X	N/A
		RBC				
		HGB				
		HCT				
		MCV				
		MCH				
		MCHC				
		RDW				
		RDW-SD				
		PLT				
		MPV				

Table C.3 Panel and Test Identifiers (Continued)

Panel	Specimen	Test	Histogram and Diff Plot			
			WBC Histogram	RBC Histogram	PLT Histogram	WBC Scatterplot
CBC/DIFF (CD)	Whole Blood	WBC	N/A	X	X	X
		RBC				
		HGB				
		HCT				
		MCV				
		MCH				
		MCHC				
		RDW				
		RDW-SD				
		PLT				
		MPV				
		LY				
		MO				
		NE				
		EO				
		BA				
		LY#				
		MO#				
		NE#				
		EO#				
		BA#				

The following table defines the identifiers that will be used for each histogram and dataplot.

Table C.4 Histogram and Dataplot Identifiers

Description	Identifier	X-axis	Y-axis
RBC Histogram	RBC.Histogram.Array	fL	Frequency
PLT Histogram	Plt.Histogram.Array	fL	Frequency
5PD Dataplot	5DIFF	Axial Light Loss	Volume

The following table defines the channel and volume values that will be used for each histogram.

Table C.5 Channel and Volume Values for Histograms

RBC		PLT	
Channel	Volume	Channel	Volume
0	0	0	0
14	30	7	2
47	100	36	10
70	150	72	20
94	200	110	30

Definitive, Suspect, and System Messages

The Definitive, Suspect, and System messages are not translated.

NOTE Ignore trailing spaces.

Table C.6 Definitive Messages

Definitive Message Value			
Leukopenia	Leukocytosis	Neutropenia	Neutrophilia
Lymphopenia	Lymphocytosis	Monocytosis	Eosinophilia
Basophilia	Anemia	Erythrocytosis	Microcytosis
Macrocytosis	Hypochromia	Anisocytosis	Thrombocytopenia
Thrombocytosis	Small Platelets	Large Platelets	

Table C.7 Suspect Messages

Suspect Message Value	
Debris	LY/MO Overlap
MO/NE Overlap	NE/EO Overlap
NE/LY Overlap	Dimorphic RBC
Large Cells	RBC aggregates
Low Diff Events	
PLT1: Debris	BA interference
PLT2: Debris	Suspect Diff
PLT3: PLT/RBC Overlap	Abnormal Diff
Cellular Interference	

Table C.8 System Messages

System Message Value		
H&H Check Failed	HGB Blank Error	Cleaner Expired
PLT Carryover	Lyse Expired	WBC/Diff Carryover
Background Failed	Diluent Expired	Daily Checks Failed
Optical LED value error	Service Access	Optical Adjust Failed
Optical LED mean error	Instrument Temperature Out of Range	

Additional Tables

Result Non-Numeric Codes and Results Flags

Graphic Results and Dataplots

NOTE Graphic results and dataplots in this appendix only apply to Software Version 2.0 or later.

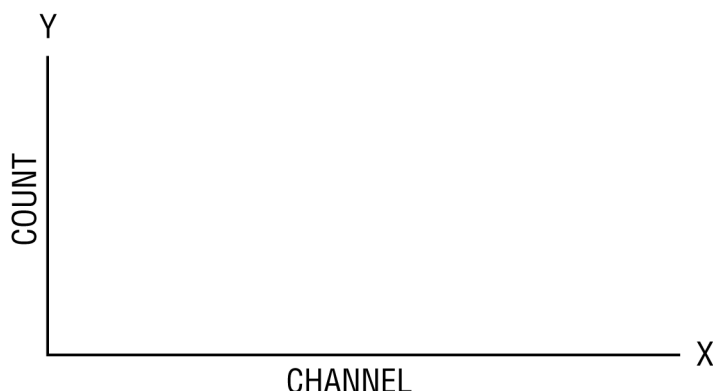
Histograms

The histograms display a simple line graph which is representative of the count of events occurring in each channel.

The histograms are transmitted as 256 ASCII bytes, representing a 128-byte Hex array. It takes two ASCII bytes to represent one Hex byte. Each Hex byte represents a scaled count for each channel 0-255. To convert the transmitted 128 ASCII bytes back to hexadecimal array, just reverse the process by converting each ASCII byte to a hexadecimal byte (for example, a value of 10 that is transmitted as two ASCII characters 1 [31H] and 0 [30H] represents one hex value of 10H that equals 16 in decimal).

The histograms can be constructed by plotting the count for each channel, then drawing a line between plots. For plotting, the X-axis represents the channel and the Y-axis represents the count, as illustrated in Figure D.1, Histogram Transmission.

Figure D.1 Histogram Transmission



Dataplots

The two-dimensional dataplots communicate a greater amount of information to the viewer about the events.

The following sections describe the format of the dataplot data and provide a how-to example for displaying the dataplot data on a raster device such as a video display or printer.

The dataplots consist of two major components: dataplot data and rendering information. Taken together, these two components allow a receiving application to display the dataplots. The hexadecimal data is converted to two ASCII bytes before being transmitted to the host. To convert the transmitted ASCII bytes back to hexadecimal array, just reverse the process by converting each ASCII byte to a hexadecimal byte (for example, a value of 10 that is transmitted as two ASCII characters 1 [31H] and 0 [30H] represents one hex value of 10H that equals 16 in decimal).

The dataplot portion of the host transmission consists of a dataplot data header and one dataplot data block. A completed dataplot transmission, including the dataplot data header, is shown in the following table.

Table D.1 Dataplot Transmission

Dataplot data header
Dataplot data block

Dataplot Data Header

The dataplot data header tells the receiving application how large the dataplot transmission is and how many dataplot data blocks are contained in the transmission.

The dataplot data header contains two elements: the total length of the dataplot transmission and the number of dataplot data blocks in the transmission. The data are represented as one 16-bit integer which indicates the total size in bytes of the dataplot transmission after the dataplot has been converted to ASCII and one 8-bit integer which indicates the total number of dataplot data blocks in the transmission (between 1 and 4). Only one block is currently supported. See the following table for details.

Table D.2 Dataplot Data Header

Transmission Length LSB
Transmission Length MSB
Total Number of Dataplot Data Blocks

Dataplot Data Block

The dataplot data block contains both the rendering information and the actual two-dimensional dataplot data. Each dataplot data block is composed of four subsections: dataplot data block header, rendering information block, dataplot header, and the dataplot data. The following table illustrates the dataplot data block format.

Table D.3 Dataplot Data Block

Dataplot Data Block Header
Rendering Information Block
Dataplot Header
Dataplot Data

Dataplot Data Block Header

The dataplot data block header tells the receiving application about the type of dataplot being transmitted as well as details about any included rendering information. The dataplot data block header has the following format:

Table D.4 Dataplot Data Block Header

Header	Description
Dataplot Type Code	Dataplot Type Code is an 8-bit integer which represents the run type of the sample which produced this dataplot. It will be one of the following values: DT_TYPE_5DIFF (0x01) is 5 Part Differential Dataplot.
Dataplot Option Code	Dataplot Option Code is an 8-bit integer which contains option flags that pertain to the current dataplot. The following flags are currently defined and can be combined into Dataplot Option Code with a logical or when applicable: DO_HAS_NO_RENDER_INFO (0x00) indicates that no rendering information block follows DO_COMPRESSED (0x01) indicates that the dataplot has been compressed. This option is not supported currently, but may be available in future software. DO_HAS_RENDER_INFO (0x02) indicates that a valid rendering information block follows.
Dataplot Width (LSB)	Dataplot width is a 16-bit integer which specifies the width of the dataplot.
Dataplot Width (MSB)	
Dataplot Height (LSB)	Dataplot height is a 16-bit integer which specifies the height of the dataplot.
Dataplot Height (MSB)	

Rendering Information Block

The rendering information block contains information the receiver can use to reconstruct the dataplot. The dataplots are color-coded to identify the population and dithered to code the density. The rendering information block contains color palettes and dither pattern bitmaps that should be used when displaying or printing the dataplots. It is highly recommended that host software employ this scheme when displaying the dataplots. The structure of the rendering information block is as follows:

Table D.5 Rendering Information Block

Rendering Information Block Header
Color Palette
Dithered Display Bitmap Library

Rendering Information Block Header

The rendering information block header contains fields which indicate the size and format of the bitmaps and the color palette. The following table is an illustration of the rendering information block header.

Table D.6 Rendering Information Block Header

Header	Description
Rendering Information Block Options	Rendering Information Block Options may be one or more of the following flags: RH_OPTIONS_NONE (0x00) indicates that no options are set. It is an 8-bit integer.
Number of Color Palette Table Entries	Number of Color Palette Table Entries is the number of entries in the color palette. It is an 8-bit integer.
Number of Bitmap Library Entries	Number of Bitmap Library Entries is the number of bitmap patterns contained in the Dithered display bitmap library. It is an 8-bit integer.
Bitmap Width in Pixels	Bitmap Width in Pixels is the width of each bitmap in pixels. It is an 8-bit integer.
Bitmap Height in Pixels	Bitmap Height in Pixels is the height of each bitmap in pixels. It is an 8-bit integer.

Color Palette

Each color palette entry contains three 8-bit integers which represent the red, green, and blue values for that index as shown in the following table.

Table D.7 Color Palette

Red Component
Green Component
Blue Component

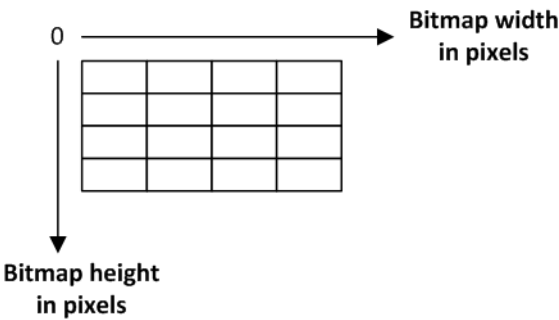
Dithered Display Bitmap Library

The dithered display bitmap library contains the dithering bitmaps. They indicate the density of a specific cell population. Receiving applications should use these bitmaps when generating displays. The bitmap format is a standard raster scanned array of pixels.

Each value is an 8-bit integer which corresponds to an entry in the color palette described above. The following figure describes the bitmap format.

Each bitmap is stored as a row-major array of pixels represented as 8-bit integers. The array contains bitmap width in pixels x bitmap height in pixels 8-bit integers.

Figure D.2 Bitmap Format



Dataplot Header

The dataplot header contains instructions on how the dataplot data is to be interpreted. The structure of the dataplot is shown in the following table.

Table D.8 Dataplot Header

Header	Description
Dataplot Data Options	Dataplot data options may be one of the following flags: DO_OPTIONS_NONE (0x00) no option has been selected. It is an 8-bit integer.
Dataplot Datum Size	Dataplot datum size is the size in bits of each point in the dataplot. It is usually 8 which represents a byte. It is an 8-bit integer.
Reserved	Reserved for future use and should be ignored. It is an 8-bit integer.
Reserved	Reserved for future use and should be ignored. It is an 8-bit integer.

Dataplot Data

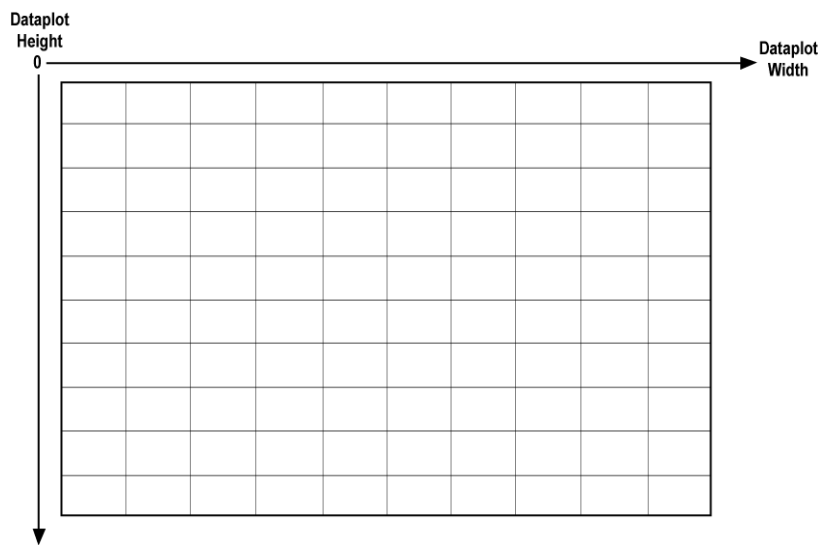
The dataplot data contains the number of datapoint blocks and the data. Number of datapoint blicks is one 8-bit integer which indicates the number of datapoints array. Only one datapoint block is currently supported. Currently, this value is sent as 0 and it should be ignored. The dataplot data contains the actual datapoint array. The datapoints are transmitted as 2,048 bytes of hexadecimal data. Each of the 2,048 bytes of hexadecimal data is converted to 4,096 bytes of ASCII data before being transmitted to the host.

Table D.9 Dataplot Data

Number of Datapoint Blocks
Data

The format of the dataplot is shown in the following figure.

Figure D.3 Dataplot Format



Download and Upload Examples

Examples

Acceptable Download Example (One Test Per Record)

```
H|\!~|||LISHOST|||||P|LIS2-A2|20040318235959
P|1|12345677|SMITH!JOHN|20120112!4!Y|M||||
O|1|SID_133|!!!CD||20160510111238||||N|||WB
P|2|Pat124|Smith!Joe!K|19870902|M|||||||||ChildrenMiami
O|1|Sp1001|!!!CD||20160510111238||||N|||WB
L|1|N
```

Optimal Download Example (The Repeat Delimiter is Used)

```
H|^!~|||LISHOST|||||P|LIS2-A2|20000424220052
P|1|Pat123|Doe!John!L|19901209|M||||P102!Brown!Lisa
O|1|SPEC1|!!!CD|R|20001025||||N|||WB
L|1|N
```

Upload Example 1

```
H|\!~|||DxH 500!90|||||P|LIS2-A2|20160510115759
P|1|Pat123|
O|1|SID_133|!!!CD||20160510111238||||N|||WB
L|1|N
```

Patient Result Upload Example

```
H|\!~|||DxH 500!90|||||P|LIS2-A2|20160510115759
P|1|PID_12!|ID_12!FIRST_NAME_12!!!|19000101!!!E!E!F!E|||||||LOCATION_12|||||
C|1|I|COMM_12|G
O|1|SID_12!|12!OV|!!!CD||19000101000001|||||WB|PRESC_12!!!!|||
C|1|I|R&D Access|I!Y
C|2|I|Cellular Interference|I!U
C|3|I|NE/LY Overlap|I!U
R|1|!!!WBC|5.02 ! R |x10e3/uL||0.2 to 100|A|||RAVEN||20150502121423|90
R|2|!!!RBC|4.92 ! |x10e6/uL||0.03 to 8||||RAVEN||20150502121423|90
R|3|!!!HGB|15.14! |g/dL||0.1 to 25||||RAVEN||20150502121423|90
R|4|!!!HCT|47.3! |h%||0 to 85|A|||RAVEN||20150502121423|90
R|5|!!!MCV|96.2 ! |fL||50 to 150||||RAVEN||20150502121423|90
R|6|!!!MCH|30.8! |pg||0 to 99999.9||||RAVEN||20150502121423|90
```

R|7|!!!MCHC|32.0! |g/dL||0 to 99999.9|A|||RAVEN||20150502121423|90
R|8|!!!RDW|13.4! |%||10 to 40|||RAVEN||20150502121423|90
R|9|!!!RDW-SD|43.8! |fL||15 to 150|||RAVEN||20150502121423|90
R|10|!!!PLT|258.8! R |x10e3/uL||7 to 2000|A|||RAVEN||20150502121423|90
R|11|!!!MPV|10.45! |fL||5 to 25|||RAVEN||20150502121423|90
R|12|!!!LY|31.32! R |%||0 to 100|A|||RAVEN||20150502121423|90
R|13|!!!MO|9.81! R |%||0 to 100|A|||RAVEN||20150502121423|90
R|14|!!!NE|56.65! R |%||0 to 100|A|||RAVEN||20150502121423|90
R|15|!!!EO|1.91! R |%||0 to 100|A|||RAVEN||20150502121423|90
R|16|!!!BA|0.31! R |%||0 to 100|A|||RAVEN||20150502121423|90
R|17|!!!LY#|1.57! R |x10e3/uL||0 to 100|A|||RAVEN||20150502121423|90
R|18|!!!MO#|0.49! R |x10e3/uL||0 to 100|A|||RAVEN||20150502121423|90
R|19|!!!NE#|2.84! R |x10e3/uL||0 to 100|A|||RAVEN||20150502121423|90
R|20|!!!EO#|0.10! R |x10e3/uL||0 to 100|A|||RAVEN||20150502121423|90
L|1|N

Control Result Upload Example

H|\!~||DxH 500!90|||Q|LIS2-A2|20160510121416
P|1|
O|1|371607413!H!RxH 5Diff Control!20160405|36862|OV|!!!CD|||Q||WB|||72528-1-K3!|||
R|1|!!!WBC|17.85! |x10e3/uL||0.2 to 100|||ADMIN||20160317092252|90
R|2|!!!RBC|4.99! |x10e6/uL||0.03 to 8|||ADMIN||20160317092252|90
R|3|!!!HGB|16.39! |g/dL||0.1 to 25|||ADMIN||20160317092252|90
R|4|!!!HCT|46.7! |%||0 to 85|||ADMIN||20160317092252|90
R|5|!!!MCV|93.6! |fL||50 to 150|||ADMIN||20160317092252|90
R|6|!!!MCH|32.8! |pg||0 to 99999.9|||ADMIN||20160317092252|90
R|7|!!!MCHC|35.1! |g/dL||0 to 99999.9|||ADMIN||20160317092252|90
R|8|!!!RDW|12.8! |%||10 to 40|||ADMIN||20160317092252|90
R|9|!!!RDW-SD|43.4! |fL||15 to 150|||ADMIN||20160317092252|90
R|10|!!!PLT|500.4! |x10e3/uL||7 to 2000|||ADMIN||20160317092252|90
R|11|!!!MPV|8.58! |fL||5 to 25|||ADMIN||20160317092252|90
R|12|!!!LY|12.83! |%||0 to 100|||ADMIN||20160317092252|90
R|13|!!!MO|1.82! |%||0 to 100|||ADMIN||20160317092252|90
R|14|!!!NE|78.65! |%||0 to 100|||ADMIN||20160317092252|90
R|15|!!!EO|6.70! |%||0 to 100|||ADMIN||20160317092252|90
R|16|!!!BA|0.00! |%||0 to 100|||ADMIN||20160317092252|90
R|17|!!!LY#|2.29! |x10e3/uL||0 to 100|||ADMIN||20160317092252|90
R|18|!!!MO#|0.32! |x10e3/uL||0 to 100|||ADMIN||20160317092252|90
R|19|!!!NE#|14.04! |x10e3/uL||0 to 100|||ADMIN||20160317092252|90
R|20|!!!EO#|1.20! |x10e3/uL||0 to 100|||ADMIN||20160317092252|90
R|21|!!!BA#|0.00! |x10e3/uL||0 to 100|||ADMIN||20160317092252|90
L|1|N

Error Response Example

```
H|\!~|||DxH|||||LIS||P|LIS2-2A|20090623143204
P|1||12345677||SMITH!JOHN||20120112!4!Y|M|||||
O|1|SID_133|!!!CDR|||20160510111238|||N|||WB
C|1|I|Test Panel(s) not supported or enabled.|G
L|1|N
```


Glossary

<ACK> — Acknowledgment (ASCII Decimal 6).

[C1] — The most significant character of checksum.

[C2] — The least significant character of checksum.

<CR> — Carriage Return (ASCII decimal 13).

[DATA] — The data contents of the record.

<ENQ> — Inquire (ASCII Decimal 5).

<EOT> — End of Transmission (ASCII decimal 4).

<ETB> — End of Transmission Block (ASCII Decimal 23). For use only when a single record is too large to fit into one frame.

<ETX> — End of Text (ASCII Decimal 3). Required at the end of each record.

[frame number] — Single-digit frame number "0" to "7." Starts with "1."

<LF> — Line Feed (ASCII Decimal 10).

<NAK> — Negative Acknowledgment (ASCII Decimal 21).

<STX> — Start of Frame (ASCII Decimal 2).

communications packet — All framing required for transmission of data. This framing includes: <STX>[frame number][DATA] [<ETB> or <ETX>][C1][C2] <LF>.

component field — A single data element or data elements that express a finer aggregate or extension of data elements which precede it. Components cannot contain repeat fields.

download — The transmission of data from the laboratory computer to the Instrument.

field — A specific location within a record for a piece of information, indicated by a field delimiter and position.

frame — A subdivision of a message, used to allow periodic communication housekeeping such as error checks and acknowledgment.

LIS — Laboratory Information System. (Laboratory computer)

message — A collection of related information; a group of records that begins with a "Header" record and ends with a "Terminator" record. A single record could theoretically constitute a message, but within this context, a message always contains multiple records. Refer to the Message Layer section and the descriptions of each type of record included in this document.

receiver — The device that responds to the sender and accepts the message. The receiver in this document is either the instrument or the laboratory computer.

record — In reference to the low level protocol, a record is the communications packet. If the frame length is longer than 64,000 characters, then it must be split into two parts and sent in two or more communications packets. The intermediate packet uses the <ETB> character, and the ending packet uses the <ETX> character. No single communications packet contains more than one record.

In reference to the message layer, it is an aggregate of fields describing one aspect of the complete message. A record will contain one of the following codes: H (header), P (patient), O (order), R (result), L (terminator), C (comment) and M (manufacturer information).

repeat field — An additional field of the preceding type when indicated by a repeat delimiter.

The instrument parses repeat fields received from the LIS host in the Universal Test ID field of a Test Order Record. The instrument ignores other occurrences of repeat fields

sender — The device that has a message to send and initiates the transmission process, in this case between the laboratory computer and the instrument. The sender in this document is either the instrument or the laboratory computer.

session — A total unit of communication activity used to indicate the events starting with the Establishment phase and ending with the Termination phase. Refer to Frame Layer Protocol in this document.

test — Panels (predefined) to be performed on a specimen associated with a given test order, or tests that are the result of panels performed on a specimen.

test request — The order of a test for a specific sample, either a single test or a list of tests

upload — The transmission of data from the instrument to the laboratory computer.

Related Documents

Your documentation can be found on our website at www.beckmancoulter.com/techdocs.

Instructions for Use

DxH 500 (PN B95837); DxH 520 (PN B85528);
DxH 560 (PN C31608)

- System Overview
- Operation Principles
- Daily Checks
- Quality Control
- Sample Analysis
- Data Review
- Worklist
- Shutdown
- Setup
- Troubleshooting
- Quality Assurance
- Cleaning Procedures
- Replacement/Adjustment Procedures
- Appendices
- Abbreviations and Acronyms
- Glossary
- References
- Index
- Warranty

Host Transmission

PN B38989

Symbols Glossary

PN C29230

Hematology Tube List (DxH 520 and DxH 560 Only)

PN C12794

www.beckmancoulter.com

