

BC-6800/BC-6600

Communication Protocol



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# Revision History

The changes from communication protocol version 3.0 DMU 1.7 (software version: V01.07.00.14024) to version 6.0 DMU 1.11 (software version: V01.11.00) are summed up as follows:

The changes are mainly about adding new parameters (both blood samples and body fluid samples), as well as the sample type ("ProjectType") field which identifies the sample is blood sample or body fluid sample.

1. For 1-way communication, pay attention to the newly added and modifications of data transmitted from the DMU (parameter fields and sample type field). The command and code for each field differ in different protocol (15ID/HL7/ASTM). See the message code table and example message for details.
2. For bi-directional communication, pay attention to the sample type field added to worklist data transmitted from DMU/LIS searching request data. The LIS end needs to end back corresponding response based on the sample type field. For bi-directional LIS communication, the sample mode, presentation mode, and sample type fields can be excluded in the response. See the sections of bi-directional LIS communication message and example data in different protocols for details.

3. Newly added and modified fields include:

- Newly added body fluid parameters

WBC-BF	White Blood Cell count-body fluid
RBC-BF	Red Blood Cell count-body fluid
MN#	Mononuclear cell number
PMN#	Polymorphonuclear cell number
MN%	Mononuclear cell percentage
PMN%	Polymorphonuclear cell percentage
TC-BF#	Total nucleated cell counts-body fluid
Eos-BF#	Eosinophils number- body fluid
Eos-BF%	Eosinophils percentage- body fluid
HF-BF#	High fluorescent cell number- body fluid
HF-BF%	High fluorescent cell percentage- body fluid
RBC-BF(R)	Red Blood Cell count-body fluid
Neu-BF#	Neutrophils number- body fluid
New-BF%	Neutrophils percentage- body fluid

- Newly added blood parameters:

IPF	Immature Platelet Fraction
Micro#	Microcyte count
Micro%	Microcyte percentage
Macro#	Macrocyte count
Macro%	Macrocyte percentage
MRV	Mean Reticulocyte Volume
RHE	Reticulocyte Hemoglobin Expression(RUO)

RHE                Reticulocyte Hemoglobin Expression

- Modified parameters:

IMG#             Immature Granulocyte

IMG%            Immature Granulocyte percentage

IMG#             Immature Granulocyte(RUO)

IMG%            Immature Granulocyte percentage(RUO)

- Newly added field:

Sample type ("ProjectType"): indicates the sample is blood sample or body fluid sample (with the name of ProjectType in 15ID protocol)

SerialNumber: serial number in LIS, only applicable to the analyzer integrated into a auto sample processing line

Analyzer: analyzer name, only applicable to the analyzer integrated into a auto sample processing line

ScattergramParaVer: the version of the scattergram

ScattergramGraphicFlags: the particle type array which needs to be greyout in the scattergram. See Section 4.6.1.2 and Appendix C

QC sample transmission ID: see corresponding sample ID field in Section 3.6.6 and 4.6.1.2

4. Modified field value:

BloodMode: add the value "4": OV-BF (in 15ID protocol)

Ver.	ECR	Position	Revision Description	Revised by
1.0	/	/	Initial release	Dong Beibei
2.0	EDW011 (Software Version: V01.07.0 0.14024) LIS Communi cation protocol Version: 3.0 DMU 1.7	2.2.2, Table 3	Added 12 body fluid parameters (from WBC-BF to RBC-BF(R))	Dong Beibei
			Added body fluid in the value definition of "BloodMode"	
		2.2.3, Table 4	Added names of all parameters in the table	
		2.2.4, Table 5	Added names of all parameters in the table	
		2.2.5, Table 6	Added the value definition of "ProjectType"	
		2.2.6, Table 7	Added body fluid in the value definition of "BloodMode"	
			Added the value definition of "ProjectType"	
		4.3.4	Corrected the ASTM description: changed ETB into ETX	



Ver.	ECR	Position	Revision Description	Revised by
		4.3.5	Corrected the ASTM description: exclude [<ETB> <ETX>] in check and calculation	
		4.5.5	Added the row of “User Field Number1”	
		4.6.1.2	Added the row of “Sample Type”	
			Added 12 body fluid parameters (from WBC-BF to RBC-BF(R))	
			In “RBC histogram bitmap (BMP)”, revised the description into “Null if it is not configured to be transmitted as graph”	
		4.6.1.3	Updated the example message	
		4.6.2.3	Updated the example message	
		4.6.2.4	Updated the example message	
		4.6.3.2	Added the row of “Sample Type”	
		4.6.3.3	Updated the example message	
		4.6.4.2	Added the row of “ProjectType”	
		4.6.4.3	Updated the example message	
3.0	EDW013	2.2.2, Table 3	The previous RUO parameters IMG# and IMG% renamed as IMG#(R) and IMG%(R)	Dong Beibei
			Added 3 parameters: PDW-SD, InR#, InR‰	
			Added 11 6900 new parameters (from IMG# to Neu-BF%)	
		2.2.4, Table 5	The previous RUO parameters IMG# and IMG% renamed as IMG#(R) and IMG%(R)	
			Added 3 parameters: PDW-SD, InR#, InR‰	

Ver.	ECR	Position	Revision Description	Revised by
			Added 11 6900 new parameters (from IMG# to Neu-BF%)	
		2.3.2	Updated the sample data message	
		3.6.1	Updated the sample message	
		3.6.3	Updated the example message	
		4.6.1.2	The previous RUO parameters IMG# and IMG% renamed as IMG#(R) and IMG%(R)	
			Added 11 6900 new parameters (from IMG# to Neu-BF%)	
		4.6.1.3	Updated the example message	
		4.6.2.2	The previous RUO parameters IMG# and IMG% renamed as IMG#(R) and IMG%(R)	
			Added 11 6900 new parameters (from IMG# to Neu-BF%)	
		4.6.2.3	Updated the example message	
		4.6.2.4	Updated the example message	
		Appendix C, Table 19	Added 12 body fluid parameters (from WBC_BF to RBC-BF-R)	
			Added 11 6900 new parameters (from IMG# to Neu-BF%)	
			Revised encode system of "Macrocytosis" and "Microcytosis" into 99MRC	
4.0	EDW014 (Software Version: V01.10.0)	2.2.2, Table 3	Corrected the typo from "InR%" to "InR‰"	Dong Beibei
			Renamed the previous RUO parameter RHE as RHE(R) (RHE changed into reported parameter)	

Ver.	ECR	Position	Revision Description	Revised by
	0.14999) LIS communi cation protocol version: 5.0 DMU 1.10	2.2.3, Table 4	Added 3 parameters: PDW-SD, InR#, InR%	
			Added 9 6900 new parameters (from IMG# to RHE)	
			Renamed the previous RUO parameter RHE as RHE(R) (RHE changed into reported parameter)	
		2.3.2	Updated the sample data message	
		3.6.1	Updated the example message	
		3.6.3	Updated the example message	
		4.6.1.2	Renamed the previous RUO parameter RHE as RHE(R) (RHE changed into reported parameter)	
		4.6.1.3	Updated the example message	
		4.6.2.2	Renamed the previous RUO parameter RHE as RHE(R) (RHE changed into reported parameter)	
		4.6.2.3	Updated the example message	
5.0	EDW017	2.2.1	Modified all M15ID LIS communication examples, where the changed fields can be found.	Dong Beibei
		2.2.2		
		2.2.4		
		Appendix C, Table 19	Renamed the previous RUO parameter RHE as RHE(R) (RHE changed into reported parameter)	

Ver.	ECR	Position	Revision Description	Revised by
		2.2.5	Modified M15ID 2-way LIS communication.	
		2.2.6	Please add the “ProjectType” field in searching and response messages according to the descriptions in these sections.	
		2.3.2	Updated the M15ID message example	
		3.5.7	Modified the HL7 bi-directional communication contents: added sample type in ORC segment of worklist searching request message; and put sample IDs for both ORM and ORR messages in Field 3 of ORC segment.	
		3.6	Updated the HL7 example message. (Pay attention to the remarks in 3.6.7 )	
		3.6.3	Updated the HL7 QC example message	
		3.6.5	Updated the HL7 bi-directional communication request message example	
		3.6.6	Updated the HL7 bi-directional communication response message example	
		4.5.5	Added sample type field in ASTM bi-directional LIS communication searching request	
		4.6	Updated ASTM LIS communication examples, including: field changes,	

Ver.	ECR	Position	Revision Description	Revised by
		4.6.2	message examples; (Pay attention to the remarks in 4.6.4.2)  Revised the description into “the frame header and terminator are replaced by special strings”	
		4.6.3	Updated ASTM bi-directional	
		4.6.4	communication, added sample type field in searching request and response messages;  Updated the message examples	
		Appendix C, Table 19	Updated and added the codes and names of some fields (the codes are used in HL7	
		Appendix C, Table 21	and ASTM protocols)  Added the row of “ProjectType”	
			Update the rows related to IMG	
		Appendix E Communication Logs	Added the logs of the communication between DMU and LIS.	
6.0	EDW021	2.2.2 2.2.3 4.6.1 4.6.2	Modify the description of the “InstrumentName” field for Uni-directional LIS, delete “applicable to integrated analyzer only.”	Feng Guannan
7.0	EHC004	2.2.2, Table 3; 2.2.3 Table 4; 2.2.4 Table 5; Appendix C, Table 19	Added 20 parameters for abnormal results  Band%  Seg%  ALY%  Pla-Aly%  Mon-Aly%  Imm-Aly%	Mao Rongrong

Ver.	ECR	Position	Revision Description	Revised by
			Other-Aly% Meta% Myelo% Pro-Myelo% Imm-Eos% Imm-Bas% Blast% Mye-Blast% Mon-blast% Lym-blast% IMG/Blast% Pro-Lym% Pro-Mon% Plsm-cell%	
8.0	EJ276	2.2.2 3.6.5 4.6.1	Modified the description of “Sample ID”. For both an integrated or standalone analyzer, the LJ QC sample is trasmitted in the format of the common sample, the value of the field is the QC sample transmission ID.	Mao Rongrong
9.0	EJ292	2.2.2; 2.3.2; 3.6.1;; 4.6.1; Appendix C	Add three fields (Review Rules, Review Rules Group, and Review Rules Group Name) and their descriptions.	Mao Rongrong

# Chapter 1 Connection Control

## 1.1 DMU as TCP Server

The TCP server starts monitoring after the DMU is started up or the communication setup is modified. It can accept one LIS/HIS connection which sustains until message transmission fails, the communication setup is modified or the DMU is closed.

## 1.2 DMU as TCP Client

After the DMU starts up or communication setup is modified, the system will try to reconnect to LIS/HIS once. If the connection is not established in 10s, it is regarded as failed. But the connection failing is not reported as an error on the software screen, and the system will not try to reconnect unless the user initiate a communication call.

If the connection is not built up, the TCP client will try to reconnect when there is a communication call. If the connection is not established in 10s, a communication error will be reported and the communication will be canceled.

If the connection is established successfully, it will sustain until the communication setup is modified or the DMU is closed.

## 1.3 Setup of Communication between Serial Interfaces

Baud rate: 115200

Parity: odd parity (default)

Data bit: 8 (default)

Stop bit: 1 (default)

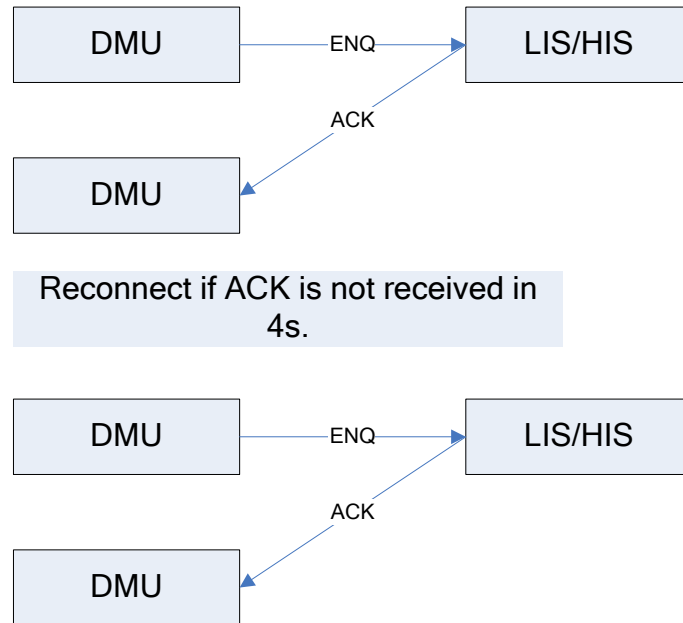
## 1.4 HL7 and 15ID Communication between Serial Interfaces

### 1.4.1 Data Transmission Process

The process of data transmission from the DMU can be divided into the following steps: establishing connection, sending data, and ending communication.

#### 1.4.1.1 Establishing Connection

Before sending a message, the DMU initiates an ENQ, and LIS/HIS will respond with ACK. If the ACK is not received within 4s, the ENQ will be sent again. If there is still no ACK received within 4s, the connection will be regarded as failed, as shown in Figure 1.



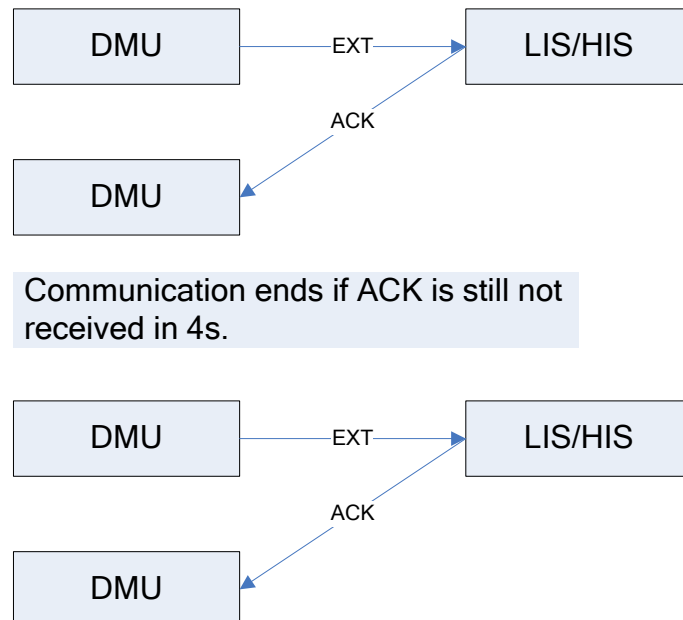
**Figure 1 Establishing connection**

#### 1.4.1.2 Sending Data

Sending the message. See Chapter 2 and Chapter 3 for the message coding definitions.

#### 1.4.1.3 Ending Communication

When the message data transmission is finished, the DMU send EXT, and LIS/HIS respond with ACK. If the ACK is not received within 4s, the EXT will be sent again. If there is still no ACK received, a communication error will be reported, as shown in Figure 2.



**Figure 2 Ending communication**



### 1.4.2 Resending Message

After a message is fully transmitted, the DMU will send EXT to LIS/HIS, and if LIS/HIS respond with NAK, the DMU will resend the message. Every message can only be resent once. If NAK is received again, it will be regarded as a message communication error.

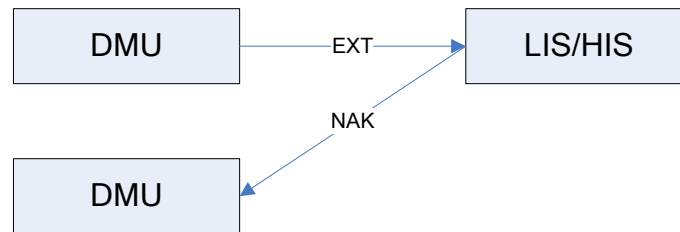


Figure 3 Resending message in communication between serial interfaces

### 1.4.3 Bi-Directional LIS/HIS Communication

The bi-directional LIS/HIS communication is slightly different from common communication process. In bi-direction LIS/HIS communication, when LIS/HIS receive an EXT, it shall send a respond message before sending ACK.

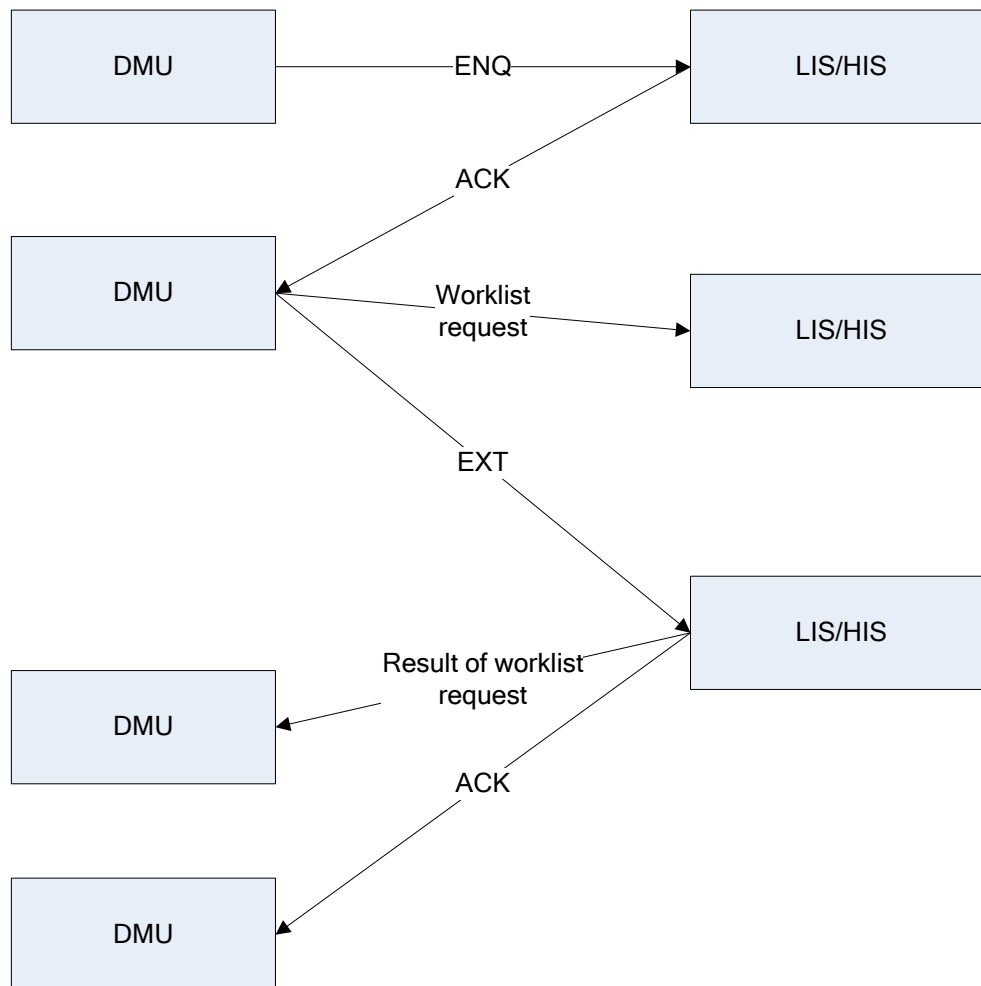
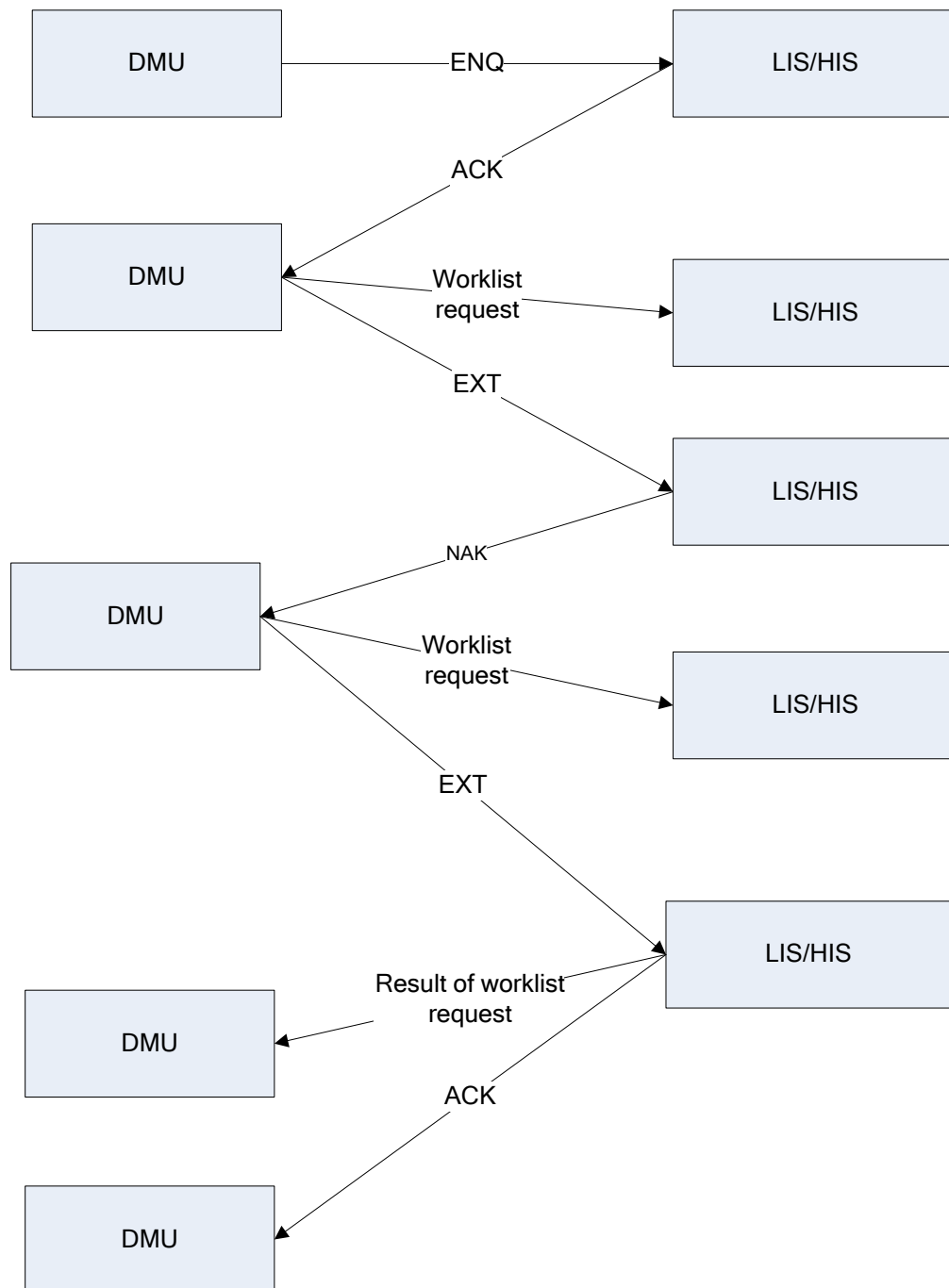


Figure 4 Bi-directional LIS/HIS communication between serial interfaces

### 1.4.4 Resending Request Message in Bi-Directional LIS/HIS

In bi-directional LIS/HIS communication, if NAK is received after sending EXT, the request will be resent (only once).



**Figure 5 Resending request through in bi-directional LIS/HIS communication between serial interfaces**

## 1.4.5 Control Character of Communication between Serial Interfaces

As shown in Table 1.

**Table 1 Control character of communication between serial interfaces**

ENQ	0x10
ACK	0x06
EXT	0x0F
NAK	0x15

## 1.5 HL7 and 15ID Communication between Network Interfaces

When the DMU serves as TCP client or server in HL7 and 15ID communication between network interfaces, the message transmission is different from that between serial interfaces.

As for one-way LIS/HIS communication messages like the analysis results of blood or control samples, you can select synchronous response in HL7 protocol, which means after the DMU sends a message, it will send the next message after receiving the response from LIS/HIS or after response time-out. The 15ID protocol does not support synchronous response.

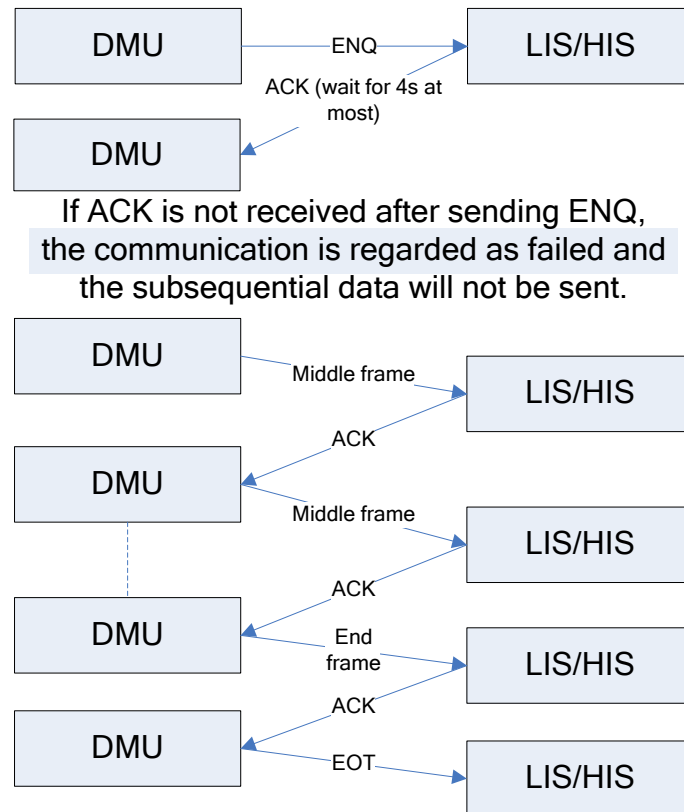
While saving worklist, or run a count without worklist, the DMU initiates a LIS/HIS search request, and LIS/HIS responds to the request in 10s. If the response is received successfully, the DMU will save the information or run the count in the mode acquired from LIS/HIS.

## 1.6 ASTM Communication

ASTM is different from the other two protocols as it defines an independent communication control protocol based on TCP/IP and serial interface communication. In the ASTM protocol, the data transmission process has two layers: message and data frame. See Chapter 4 for details. All the messages need to be transmitted in the form of data frame, so the smallest unit of the communication control defined in this section is frame.

Note: in communication between network interfaces, there are more one-byte control characters (like ENQ, ACK, NAK, EOT, etc.). To reduce the responding time, it is suggest disable the "NoDelay" function.

### 1.6.1 Sending Message



**Figure 6 Sending a message from DMU to LIS/HIS**

Before data transmission, the sender needs to send ENQ to the receiver asking for establishing a connection. The receiver will send back ACK if it is ready to receive data; otherwise it will send NAK. When the sender receives ACK, it will get ready to send data since the connection is successfully established; otherwise, it will end the data transmission. Figure 6 shows the complete process of message transmission from DMU to LIS/HIS.

When DMU receives ACK, it starts sending data frames as the connection is established; if the response is NAK, it means the connection is not established and the communication is failed.

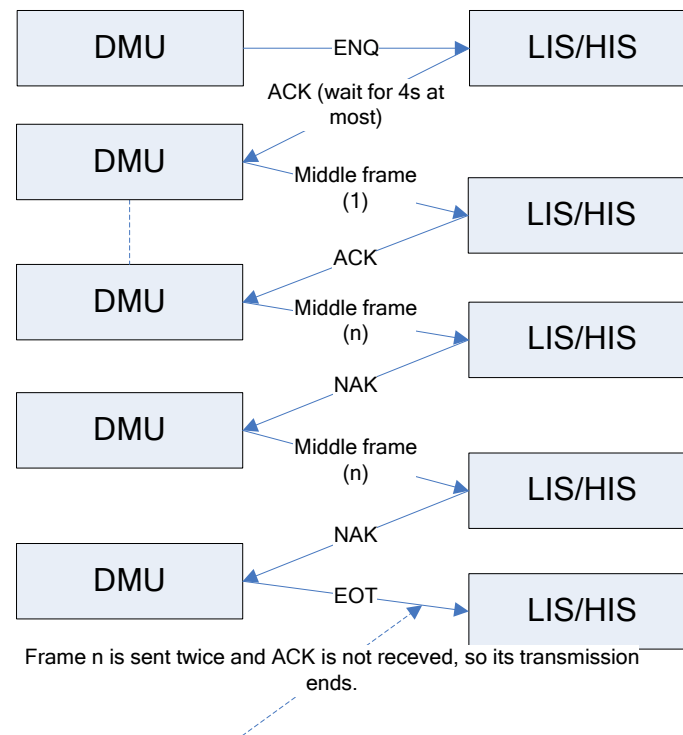
After the connection between DMU and LIS/HIS is established successfully, the DMU starts sending data frames to LIS/HIS, and LIS/HIS responds with ACK if it is ready to receive data, or with NAK if it wants DMU to resend the data. The EOT control character will be sent after the communication is finished.

For transmission from LIS/HIS to DMU, the roles of the sender and receiver reverse. LIS/HIS sends ENQ asking for establishing a connection, sends data frames after receiving ACK response, and then waits for the ACK message for successful transmission.

A transmission refers to the transmission of one message (see Chapter 4 for message definitions). The data frames of a message consist of the middle frame(s) and ending frame. The ending frame refers to the last frame of the message; while the middle frame refers to other data frame(s) except the ending frame.

The response waiting time is 4 seconds. If there is no response within 4s, the connection establishing is regarded as failed, and the communication ends.

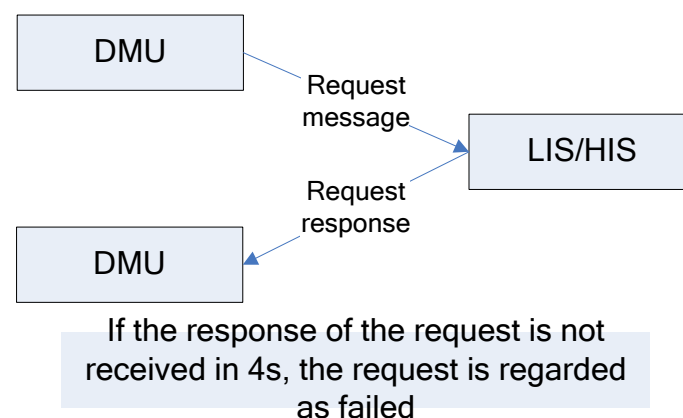
## 1.6.2 Resending Message



**Figure 7 Resending data**

In the process of data transmission, if LIS/HIS requires a data resending since there is error in the received data frames or for other reasons, it will respond with NAK; if the sender still receives NAK after resending the same data frame, the transmission will be regarded as failed and it will end.

## 1.6.3 Bi-Directional LIS/HIS



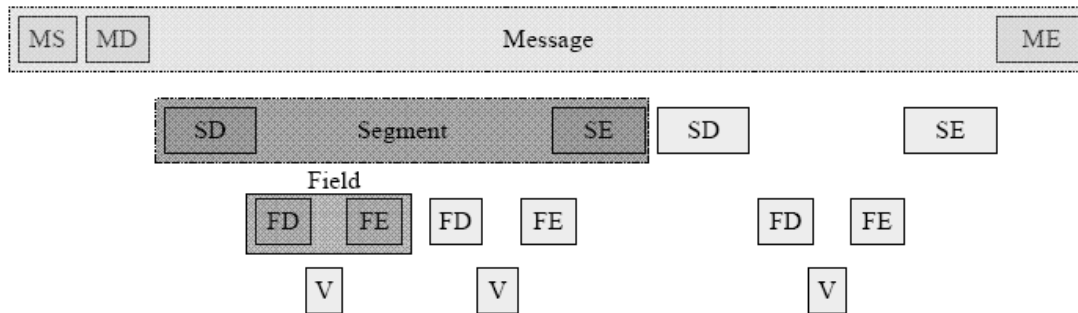
**Figure 8 Bi-directional LIS/HIS communication from DMU to LIS/HIS**

First, the DMU send a request message to LIS/HIS which is the same as that in the "sending message" process; and then it waits the LIS/HIS to respond (See Chapter 4 for message definitions) for 4s. The LIS/HIS responding process is the same as that in the "sending message" process.

# Chapter 2 15ID Communication Protocol

## 2.1 Grammar

### 2.1.1 Data Package Structure



**Figure 9 Data structure of 15ID protocol**

Data package is the smallest unit 15ID communication. In each transmission, no matter the data size is big or not, the data package must be complete in structure.

A complete data package consists of three layers of data information:

1. **Message:** A complete data package is also referred to as a message. It can be identified by three fields:

**MS:** message start field. MS is the first data unit of every message.

**MD:** Message description field. It describes the message type/meaning, etc.

**ME:** message end field. ME is the last data unit of every message.

2. **Segment:** a message consists of one or more segments. A segment can be identified by two fields:

**SD:** segment description field. It describes the segment type/meaning, etc.

**SE:** segment end field. SE is the last data unit of every segment.

3. **Field:** property field. A segment consists of one or more fields. It can be identified by three fields:

**FD:** field description field. It describes the field type/meaning, etc.

**V:** value of the field. It is the final value of the field.

**FE:** field end field. FE is the last data unit of every field.

To achieve the promptest response control flow processing, a protocol is made that: graph data like histograms and scattergrams shall be communicated in raw binary data directly (rather than converted text data), and the receiver need to read the length information from the

message, and then read the binary data based on the length.

## 2.1.2 Data Package Unit Separation

To identify Message from data flow and then identify the fields in the Message, we need to define separations between fields in the protocol. The way of field separation is defined as follows:

1. No visible separation is needed between MS and MD. MS uses binary code "0x05" (one-byte);
2. MD and SD are separated by "0x03";
3. SD and FD are separated by "0x0C";
4. FD and V are separated by "0x16";
5. The value of the field end field FE is "0x08";
6. The value of the segment end field SE is "0x04";
7. The value of the message end field ME is "0x0a".

## 2.1.3 Data Package Coding

To be compatible with the protocol, in the data packages, the MD, SD and FD fields are transmitted in ASC-II strings, V in GBK or UTF-8 strings, but if V is the value of graphic data like histogram or scattergram, it will be transmitted in raw binary data.

You can select GBK or UTF-8 for string coding at the DMU end, but you need to make sure the configuration is the same at the LIS/HIS end.

In bi-directional LIS/HIS communication, only UTF-8 coding is supported.

## 2.2 Message Definition

### 2.2.1 Message Expression

15ID communication data consists of three layers: MD, SD and FD, as shown in Table 2.

**Table 2 Example of 15ID communication protocol format**

MD MD value of the message	SD1 SD value	SD meaning	FD1 FD value. FD1 is part of SD1.	FD1 meaning and value.
			FD2	.....
			FD3	.....



	.....	.....	.....	.....
			.....	.....
			.....	.....

## 2.2.2 Sample Analysis Result Message

See Table 3.

**Table 3 Format of sample analysis result message**

CTR	WBC	White blood cell count	Val	Result value
			Low	Lower limit of parameter result
			High	Higher limit of parameter result
			Flag	Identifier of communication status "0" - normal "1" - suspicious
			Unit	Parameter unit
			EditFlag	Result edited flag  "E" - result edited by the operator "e" - result changed due to the manual editing of another parameter result based on which it is calculated
			HighLowFlag	High or low flag of the analysis result  "H" - out of higher limit "L" - out of lower limit " " - normal
			CorrectedFlag	"C" - corrected result " " - normal
			OverLimitFlag	"V" - result out of linearity range " " - normal

			TemperatureFlag	"T" - temperature out-of-range result " " - normal
	Bas#	Basophil number	FD value same as above	
	Bas%	Basophil percentage	FD value same as above	
	Neu#	Neutrophil number	FD value same as above	
	Neu%	Neutrophil percentage	FD value same as above	
	Eos#	Eosinophil number	FD value same as above	
	Eos%	Eosinophil percentage	FD value same as above	
	Lymph#	Lymphocyte number	FD value same as above	
	Lymph%	Lymphocyte percentage	FD value same as above	
	Mon#	Monocyte number	FD value same as above	
	Mon%	Monocyte percentage	FD value same as above	
	RBC	Red blood cell count	FD value same as above	
	HGB	Hemoglobin Concentration		
	MCV	Mean Corpuscular Volume	FD value same as above	
	MCH	Mean Corpuscular Hemoglobin	FD value same as above	
	MCHC	Mean Corpuscular Hemoglobin Concentration		
	RDW-CV	Red Blood Cell Distribution Width - Coefficient of Variation	FD value same as above	
	RDW-SD	Red Blood Cell Distribution Width - Standard Deviation	FD value same as above	
	HCT	Hematocrit	FD value same as above	
	PLT	Platelet count	FD value same as above	

MPV	Mean Platelet Volume	FD value same as above
PDW	Platelet Distribution Width	FD value same as above
PCT	Plateletcrit	FD value same as above
RET#	Reticulocyte number	FD value same as above
RET%	Reticulocyte percentage	FD value same as above
IRF	Immature Reticulocyte Fraction	FD value same as above
LFR	Low Fluorescent Ratio	FD value same as above
MFR	Middle Fluorescent Ratio	FD value same as above
HFR	High Fluorescent Ratio	FD value same as above
NRBC#	Nucleated Red Blood Cell count	FD value same as above
NRBC%	Nucleated Red Blood Cell percentage	FD value same as above
P-LCR	Platelet-Large Cell Ratio	FD value same as above
P-LCC	Platelet- Large Cell Count	FD value same as above
IMG#(R)	Immature Granulocyte(RUO)	FD value same as above
IMG%(R)	Immature Granulocyte percentage(RUO)	FD value same as above
RBC-O	Optical Red Blood Cell count	FD value same as above
PLT-O	Optical Platelet count	FD value same as above
HFC#	High fluorescent Cell number	FD value same as above
HFC%	High fluorescent Cell percentage	FD value same as above

PLT-I	Platelet count-Impedance	FD value same as above
WBC-R	White Blood Cell count - RET	FD value same as above
WBC-D	White Blood Cell count -DIFF	FD value same as above
WBC-B	White Blood Cell count –BASO	FD value same as above
WBC-N	White Blood Cell count-NRBC	FD value same as above
PDW-SD	Platelet Distribution Width – Standard Deviation	FD value same as above
InR#	Infected Red Blood Cell count	FD value same as above
InR%	Infected Red Blood Cell permillage	FD value same as above
WBC-BF	White Blood Cell count-body fluid	FD value same as above
RBC-BF	Red Blood Cell count-body fluid	FD value same as above
MN#	Mononuclear cell number	FD value same as above
PMN#	Polymorphonuclear cell number	FD value same as above
MN%	Mononuclear cell percentage	FD value same as above
PMN%	Polymorphonuclear cell percentage	FD value same as above
TC-BF#	Total nucleated cell counts-body fluid	FD value same as above
Eos-BF	Eosinophils number- body fluid	FD value same as above
Eos-BF%	Eosinophils percentage- body fluid	FD value same as above
HF-BF#	High fluorescent cell number- body fluid	FD value same as above
HF-BF%	High fluorescent	FD value same as above

	cell percentage- body fluid	
RBC-BF(R)	Red Blood Cell count-body fluid (RUO)	FD value same as above
IMG#	Immature Granulocyte	FD value same as above
IMG%	Immature Granulocyte percentage	FD value same as above
IPF	Immature Platelet Fraction	FD value same as above
Micro#	Microcyte count	FD value same as above
Micro%	Microcyte percentage	FD value same as above
Macro#	Macrocyte count	FD value same as above
Macro%	Macrocyte percentage	FD value same as above
MRV	Mean Reticulocyte Volume	FD value same as above
RHE(R)	Reticulocyte Hemoglobin Expression (RUO)	FD value same as above
RHE	Reticulocyte Hemoglobin Expression	FD value same as above
Neu-BF#	Neutrophils number- body fluid	FD value same as above
Neu-BF%	Neutrophils percentage- body fluid	FD value same as above
Band%	Neutrophils, band	FD value same as above
Seg%	Neutrophils, segmented	FD value same as above
ALY%	Atypical lymphocytes	FD value same as above
Pla-Aly%	Atypical lymphocytes (plasmacytes)	FD value same as above
Mon-Aly%	Atypical	FD value same as above

		lymphocytes (monocytes)		
	Imm-Aly%	Atypical lymphocytes (immature)	FD value same as above	
	Other-Aly%	Atypical lymphocytes (others)	FD value same as above	
	Meta%	Neutrophils, metamyelocyte	FD value same as above	
	Myelo%	Neutrophils, myelocyte	FD value same as above	
	Pro-Myelo%	Neutrophils, promyelocyte	FD value same as above	
	Imm-Eos%	Eosinophils (immature)	FD value same as above	
	Imm-Bas%	Basophils (immature)	FD value same as above	
	Blast%	Blasts	FD value same as above	
	Mye-Blast%	Myeloblasts	FD value same as above	
	Mon-blast%	Monoblasts	FD value same as above	
	Lym-blast%	Lymphoblasts	FD value same as above	
	IMG/Blast%	Blast and immature granulocytes	FD value same as above	
	Pro-Lym%	Immature lymphocytes	FD value same as above	
	Pro-Mon%	Immature monocytes	FD value same as above	
	Plsm-cell%	Plasmacytes	FD value same as above	
	SepLine	Histogram discriminator information	SepWbcLeft	Left discriminator of WBC histogram, reserved field
			SepWbcMid	Middle discriminator of WBC histogram, reserved field
			SepWbcRight	Right discriminator of WBC histogram, reserved field
			SepRBCLeft	Left discriminator of RBC histogram. Null if it is not transmitted

			SepRBCRight	Right discriminator of RBC histogram. Null if it is not transmitted
			SepPLTLeft	Left discriminator of PLT histogram. Null if it is not transmitted
			SepPLTRight	Right discriminator of PLT histogram. Null if it is not transmitted
	Total	Total number of histograms	WbcTotal	Total number of WBC histograms, reserved field
			RbcTotal	Total number of RBC histograms. Null if histograms are not transmitted
			PltTotal	Total number of PLT histograms. Null if histograms are not transmitted
	Mode	Mode information	BloodMode	Presentation mode and sample mode. Value definition: "0": OV-PD; "1": OV-WB; "2": AL-WB; "3": CT-WB; "4": OV-BF;
			AnaMode	Analysis mode: "0": CBC + DIFF "1": CBC "2": CBC+DIFF+RET "3": CBC+DIFF+NRBC "4": CBC+DIFF+RET+NRBC "5": CBC+RET "6": CBC+NRBC "7": RET
	SampGroup	Reference group information	Val	Value of reference group, string
	PatInfo	Patient information	SampleID	Sample ID. For both an

				integrated or standalone analyzer,, when the LJ QC sample is trasmitted in the format of the common sample, the value of the field is the QC sample transmission ID.
			Name	First name, string
			LastName	Last name, string
			Gender	Gender, string
			Birthday	Date of birth, in the format of YYYY–MM–DD HH: MM: SS. Null if no entry
			AgeVal	Age, string
			AgeType	Age unit string. Value definitions: "0": null; "1": year; "2": month; "3": day; "4": hour; "5": week;
			ChargeType	Null; reserved
			PatientType	Null; reserved
			SamSource	Sample type, string
			ChartNo	Patient ID, string
			BedNo	Bed No., string
			InsNo	Insurance No., string, reserved
			Dept	Department, string
			Sender	The person who ordered the analysis, string
			Tester	Analysis operator, string
			Checker	Validated by, string
			Remark	Remark information, string
			Diagnose	Clinical diagnosis



				information
			ReCheck	Mark of reexamination, string
			PatientArea	Impatient zone, string
			ShelfNo	Tube rack No.
			TubeNo	Tube No.
			CusRec1	Custom patient information 1
			CusRec2	Custom patient information 2
			CusRec3	Custom patient information 3
			InstrumentName	Analyzer name
			ProjectType	Sample type. Value definition: "0": blood; "1": body fluid
			ReviewRules	Review rules that have been triggered
			ReviewRulesGroup	The groups of review rules that have been triggered
			ReviewRulesGroupName	Description for review rules that have been triggered
	PatTime	Time information	SampTime	Time of sample collection. Format: YYYY-MM-DD HH: MM: SS, null if no entry
			SendTime	Time of ordering the analysis. Format: YYYY-MM-DD HH: MM: SS, null if no entry
			TestTime	Time of analysis. Format: YYYY-MM-DD HH: MM: SS

			CheckTime	Time of validation Format: YYYY-MM-DD HH: MM: SS, null if not validated
			ReportTime	Time of report. Format: YYYY-MM-DD HH: MM: SS, null if no entry
	AbnormalFlag	Flag message of abnormal result	WBlast	WBC Scattergram Abn. Value definition: "1": have this flag "0": do not have this flag
			WbcHistoAbnormal	WBC histogram Abn. Value same as above
			DiffLeukocytosis	WBC high in DIFF channel. Value same as above
			DiffLeukocypenia	WBC low in DIFF channel. Value same as above
			WNeuHigh	Neutrophilia. Value same as above
			WNeuLow	Neutropenia. Value same as above
			WLymHigh	Lymphocytosis. Value same as above
			WLymLow	Lymphopenia. Value same as above
			WMonHigh	Monocytosis. Value same as above
			WEosHigh	Eosinophilia. Value same as above
			WBasHigh	Basophilia. Value same as above
			WBCAbn	WBC abnormal. Value same as above
			WLeft	Left shift. Value same as above
			WGran	Immature Gran? Value same as above
			WAtl	Atypical Lymph? Value

				same as above
			WNrbc	RBC Lyse resistance. Value same as above
			REryth	Erythrocytosis. Value same as above
			RDistri	RBC Distribution Abnormal. Value same as above
			RAniso	Anisocytosis. Value same as above
			RMacro	Macrocytosis. Value same as above
			RMicro	Microcytosis. Value same as above
			RDimor	Dimorphic Population. Value same as above
			RAnemia	Anemia. Value same as above
			RHypo	Hypochromia. Value same as above
			RUnnormal	HGB Abn./Interfere? Value same as above
			PDistri	PLT Distribution Abnormal. Value same as above
			PSis	Thrombocytosis. Value same as above
			PPenia	Thrombopenia. Value same as above
			PAgg	PLT Clump? Value same as above
			DiffSamplingError	Sampling error in DIFF channel. Value same as above
			DiffChannelError	Analysis error in DIFF channel. Value same as above
			DiffBlasts	DIFF channel error, blast, value same as above

			NrbcPltClump	NRBC/PLT clump. Value same as above
			RbcSamplingError	Sampling error in RBC channel. Value same as above
			RbcChannelError	Analysis error in RBC channel. Value same as above
			RAgg	RBC Agglutination ? Value same as above
			RIron	Iron Deficiency? Value same as above
			HgbDefect	HGB abnormal. Value same as above
			PltSamplingError	Sampling error in PLT channel. Value same as above
			PltChannelError	Analysis error in PLT channel. Value same as above
			BasoSamplingError	Sampling error in BASO channel. Value same as above
			BasoChannelError	Analysis error in BASO channel. Value same as above
			BasoLeukocytosis	WBC high in BASO channel. Value same as above
			BasoLeukocypenia	WBC low in BASO channel. Value same as above
			RetSamplingError	Sampling error in RET channel. Value same as above
			RetChannelError	Analysis error in RET channel. Value same as above
			RetScatterAbnormal	RET Scattergram Abn. Value same as above
			Reticulocytosis	Reticulocytosis. Value

				same as above
			NrbcSamplingError	Sampling error in NRBC channel. Value same as above
			NrbcChannelError	Analysis error in RET channel. Value same as above
			NrbcScatterAbnormal	NNRBC Scattergram Abn. Value same as above
			NrbcPresent	NRBC present. Value same as above
	WBCHisto	WBC histogram binary data	DataLen	WBC histogram binary data length. Null if it is not transmitted
			MetaDataLen	WBC histogram binary data element length. Value definitions: "1": element length is 1; "2": element length is 2; "4": element length is 4; Null if it is not transmitted;
			WHistoData	WBC histogram binary data
	RBCHisto	RBC histogram binary data	DataLen	RBC histogram binary data length. Null if it is not transmitted
			MetaDataLen	RBC histogram binary data element length. Value definitions: "1": element length is 1; "2": element length is 2; "4": element length is 4; Null if it is not transmitted;
			RHistoData	RBC histogram binary data
	PLTHisto	PLT histogram binary data	DataLen	PLT histogram binary data length. Null if it is

				not transmitted
			MetaDataLen	PLT histogram binary data element length. Value definitions: "1": element length is 1; "2": element length is 2; "4": element length is 4; Null if it is not transmitted;
			PHistoData	PLT histogram binary data
	WbcHistoBMP	WBC histogram bitmap data	DataLen	WBC histogram bitmap data length
			MetaDataLen	WBC histogram bitmap data element length. Value: "1". Null if it is not transmitted;
			WHistoBmpData	WBC histogram bitmap data
	RbcHistoBMP	RBC histogram bitmap data	DataLen	RBC histogram bitmap data length
			MetaDataLen	RBC histogram bitmap data element length. Value: "1". Null if it is not transmitted;
			RHistoBmpData	RBC histogram bitmap data
	PLTHistoBMP	PLT histogram bitmap data	DataLen	PLT histogram bitmap data length
			MetaDataLen	PLT histogram bitmap data element length. Value: "1". Null if it is not transmitted;
			PHistoBmpData	PLT histogram bitmap data
	DIFF	DIFF scattergram binary data	FSC	FSC dimension of DIFF scattergram
			SSC	SSC dimension of DIFF scattergram
			FL	FL dimension of DIFF

				scattergram
			FSC-LOG	FSC-LOG dimension of DIFF scattergram, reserved
			DataLen	DIFF scattergram binary data length
			MetaDataLen	DIFF scattergram binary data element length. Value definition: "1": element length is 1; "2": element length is 2; "4": element length is 4; Null if it is not transmitted;
			DIFFData	DIFF scattergram binary data
	BASO	BASO scattergram binary data	FSC	FSC dimension of BASO scattergram
			SSC	SSC dimension of BASO scattergram
			FL	FL dimension of BASO scattergram
			FSC-LOG	FSC-LOG dimension of BASO scattergram
			DataLen	BASO scattergram binary data length
			MetaDataLen	BASO scattergram binary data element length. Value definition: "1": element length is 1; "2": element length is 2; "4": element length is 4; Null if it is not transmitted;
			BASOData	BASO scattergram binary data
	NRBC	NRBC scattergram binary data	FSC	FSC dimension of NRBC scattergram
			SSC	SSC dimension of NRBC scattergram

			FL	FL dimension of NRBC scattergram
			FSC-LOG	FSC-LOG dimension of NRBC scattergram, reserved
			DataLen	NRBC scattergram binary data length
			MetaDataLen	NRBC scattergram binary data element length. Value definition: "1": element length is 1; "2": element length is 2; "4": element length is 4; Null if it is not transmitted;
			NrbcData	NRBC scattergram binary data
	RET	RET scattergram binary data	FSC	FSC dimension of RET scattergram
			SSC	SSC dimension of RET scattergram
			FL	FL dimension of RET scattergram
			FSC-LOG	FSC-LOG dimension of RET scattergram
			DataLen	RET scattergram binary data length
			MetaDataLen	RET scattergram binary data element length. Value definition: "1": element length is 1; "2": element length is 2; "4": element length is 4; Null if it is not transmitted;
			RetData	RET scattergram binary data
	DIFFBMP	DIFF scattergram bitmap data	DataLen	DIFF scattergram bitmap data length
			MetaDataLen	DIFF scattergram



				bitmap data element length. Value: "1". Null if it is not transmitted;
			DIFFBmpData	DIFF scattergram bitmap data
	BASOBMP	BASO scattergram bitmap data	DataLen	BASO scattergram bitmap data length
			MetaDataLen	BASO scattergram bitmap data element length. Value: "1". Null if it is not transmitted;
			BASOBmpData	BASO scattergram bitmap data
	NRBCBMP	NRBC scattergram bitmap data	DataLen	NRBC scattergram bitmap data length
			MetaDataLen	NRBC scattergram bitmap data element length. Value: "1". Null if it is not transmitted;
			NRBCBmpData	NRBC scattergram bitmap data
	RETBMP	RET scattergram bitmap data	DataLen	RET scattergram bitmap data length
			MetaDataLen	RET scattergram bitmap data element length. Value: "1". Null if it is not transmitted;
			RETBmpData	RET scattergram bitmap data
	RET-EXTBMP	RET-EXT scattergram bitmap data	DataLen	RET-EXT scattergram bitmap data length
			MetaDataLen	RET-EXT scattergram bitmap data element length. Value: "1". Null if it is not transmitted;
			RET-EXTBmpData	RET-EXT scattergram bitmap data
	PLT-OBMP	PLT-O scattergram bitmap data	DataLen	PLT-O scattergram bitmap data length
			MetaDataLen	PLT-O scattergram bitmap data element

				length. Value: "1". Null if it is not transmitted;
			PLT-OBmpData	PLT-O scattergram bitmap data

### 2.2.3 QC Setup Message

See Table 4.

**Table 4 Format of QC setup message**

QCR	Info	QC setup information	Type	QC program. Value definition: "0": L-J QC "1": X mean QC "2": X mean R QC "3": X-B QC "4": X-M QC
			FileNo	QC File No.
			LotNo	Lot No. of control
			Level	Level of control . Value definition: "0": low "1": normal "2": high
			ExpDate	Expiration data. Format: YYYY-MM-DD HH: MM: SS
			Instrument Name	Analyzer name
	WBC	White Blood Cell count	Mean	Mean value of the control
			Range	Range of the control
			Unit	Unit of QC parameter
	Bas#	Basophil number	Same as above	
	Bas%	Basophil percentage	Same as above	
	Neu#	Neutrophil number	Same as above	
	Neu%	Neutrophil percentage	Same as above	
	Eos#	Eosinophil number	Same as above	

	Eos%	Eosinophil percentage	Same as above
	Lymph#	Lymphocyte number	Same as above
	Lymph%	Lymphocyte percentage	Same as above
	Mon#	Monocyte number	Same as above
	Mon%	Monocyte percentage	Same as above
	RBC	Red Blood Cell count	Same as above
	HGB	Hemoglobin Concentration	Same as above
	MCV	Mean Corpuscular Volume	Same as above
	MCH	Mean Corpuscular Hemoglobin	Same as above
	MCHC	Mean Corpuscular Hemoglobin Concentration	Same as above
	RDW-CV	Red Blood Cell Distribution Width - Coefficient of Variation	Same as above
	RDW-SD	Red Blood Cell Distribution Width - Standard Deviation	Same as above
	HCT	Hematocrit	Same as above
	PLT	Platelet count	Same as above
	MPV	Mean Platelet Volume	Same as above
	PDW	Platelet Distribution Width	Same as above

PCT	Plateletcrit	Same as above
RET#	Reticulocyte number	Same as above
RET%	Reticulocyte percentage	Same as above
IRF	Immature Reticulocyte Fraction	Same as above
LFR	Low Fluorescent Ratio	Same as above
MFR	Middle Fluorescent Ratio	Same as above
HFR	High Fluorescent Ratio	Same as above
NRBC#	Nucleated Red Blood Cell count	Same as above
NRBC%	Nucleated Red Blood Cell percentage	Same as above
P-LCR	Platelet-Large Cell Ratio	Same as above
P-LCC	Platelet- Large Cell Count	Same as above
IMG#(R)	Immature Granulocyte	Same as above
IMG%(R)	Immature Granulocyte percentage	Same as above
RBC-O	Optical Red Blood Cell count	Same as above
PLT-O	Optical Platelet count	Same as above
HFC#	High fluorescent Cell number	Same as above
HFC%	High fluorescent Cell percentage	Same as above
PLT-I	Platelet count-Impedance	Same as above

WBC-R	Optical White Blood Cell count	Same as above
WBC-D	White Blood Cell count -DIFF	Same as above
WBC-B	White Blood Cell count –BASO	Same as above
WBC-N	White Blood Cell count-NRBC	Same as above
PDW-SD	Platelet Distribution Width – Standard Deviation	Same as above
InR#	Infected Red Blood Cell count	Same as above
InR‰	Infected Red Blood Cell permillage	Same as above
IMG#	Immature Granulocyte	Same as above
IMG%	Immature Granulocyte percentage	Same as above
IPF	Immature Platelet Fraction	Same as above
Micro#	Microcyte count	Same as above
Micro%	Microcyte percentage	Same as above
Macro#	Macrocyte count	Same as above
Macro%	Macrocyte percentage	Same as above
MRV	Mean Reticulocyte Volume	Same as above
RHE	Reticulocyte Hemoglobin Expression (RUO)	Same as above
RHE(R)	Reticulocyte Hemoglobin	Same as above

		Expression	
	Band%	Neutrophils, band	Same as above
	Seg%	Neutrophils, segmented	Same as above
	ALY%	Atypical lymphocytes	Same as above
	Pla-Aly%	Atypical lymphocytes (plasmacytes)	Same as above
	Mon-Aly%	Atypical lymphocytes (monocytes)	Same as above
	Imm-Aly%	Atypical lymphocytes (immature)	Same as above
	Other-Aly%	Atypical lymphocytes (others)	Same as above
	Meta%	Neutrophils, metamyelocyte	Same as above
	Myelo%	Neutrophils, myelocyte	Same as above
	Pro-Myelo%	Neutrophils, promyelocyte	Same as above
	Imm-Eos%	Eosinophils (immature)	Same as above
	Imm-Bas%	Basophils (immature)	Same as above
	Blast%	Blasts	Same as above
	Mye-Blast%	Myeloblasts	Same as above
	Mon-blast%	Monoblasts	Same as above
	Lym-blast%	Lymphoblasts	Same as above
	IMG/Blast%	Blast and immature granulocytes	Same as above
	Pro-Lym%	Immature lymphocytes	Same as above
	Pro-Mon%	Immature monocytes	Same as above

	Plsm-cell%	Plasmacytes	Same as above
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## 2.2.4 QC Result Message

See Table 5.

**Table 5 Format of QC result message**

QCR	Info	QC information	Type	QC program. Value definition: "0": L-J QC "1": X mean QC "2": X mean R QC "3": X-B QC "4": X-M QC
			FileNo	QC File No.
			LotNo	Lot No. of control
			Level	Level of control . Value definition: "0": low "1": normal "2": high
			ExpDate	Expiration data. Format: YYYY-MM-DD HH: MM: SS
			TestTime	Time of QC analysis. Format: YYYY-MM-DD HH: MM: SS
			Tester	QC analysis operator
			TestDateModifyFlag	Flag of QC

				analysis date modification. If the date is modified, the value is "E". Otherwise, null
			TestTimeModifyFlag	Flag of QC analysis time modification. If the time is modified, the value is "E". Otherwise, null
	WBC	White Blood Cell count	Val1	Analysis result 1
			Unit1	Unit of analysis result 1
			EditFlag1	Result edited flag 1  "E": resulted edited "e": result changed due to the manual editing of the parameter based on which it is calculated "": normal
			HighLowFlag1	High/Low flag 1  "H": out of upper limit "L": out of lower limit "": normal



			Val2	Analysis result 2. X mean/X mean R may be transmitted
			Unit2	Unit of analysis result 2. X mean/X mean R may be transmitted
			EditFlag2	Result edited flag 2  "E": resulted edited "e": result changed due to the manual editing of the parameter based on which it is calculated  X mean/X mean R may be transmitted
			HighLowFlag2	High/Low flag 2  "H": out of upper limit "L": out of lower limit "": normal  X mean/X mean R may be transmitted
			AvgVal	Result average. X

				mean/X mean R may be transmitted
			AvgUnit	Unit of result average. X mean/X mean R may be transmitted
			AvgEditFlag	Result average edited flag. X mean/X mean R may be transmitted
	Bas#	Basophil number	Same as above	
	Bas%	Basophil percentage	Same as above	
	Neu#	Neutrophil number	Same as above	
	Neu%	Neutrophil percentage	Same as above	
	Eos#	Eosinophil number	Same as above	
	Eos%	Eosinophil percentage	Same as above	
	Lymph#	Lymphocyte number	Same as above	
	Lymph%	Lymphocyte percentage	Same as above	
	Mon#	Monocyte number	Same as above	
	Mon%	Monocyte percentage	Same as above	
	RBC	Red Blood Cell count	Same as above	
	HGB	Hemoglobin Concentration	Same as above	
	MCV	Mean Corpuscular Volume	Same as above	
	MCH	Mean Corpuscular Hemoglobin	Same as above	
	MCHC	Mean Corpuscular Hemoglobin Concentration	Same as above	
	RDW-CV	Red Blood Cell Distribution Width - Coefficient of Variation	Same as above	
	RDW-SD	Red Blood Cell Distribution Width - Standard Deviation	Same as above	
	HCT	Hematocrit	Same as above	
	PLT	Platelet count	Same as above	
	MPV	Mean Platelet Volume	Same as above	

PDW	Platelet Distribution Width	Same as above
PCT	Plateletcrit	Same as above
RET#	Reticulocyte number	Same as above
RET%	Reticulocyte percentage	Same as above
IRF	Immature Reticulocyte Fraction	Same as above
LFR	Low Fluorescent Ratio	Same as above
MFR	Middle Fluorescent Ratio	Same as above
HFR	High Fluorescent Ratio	Same as above
NRBC#	Nucleated Red Blood Cell count	Same as above
NRBC%	Nucleated Red Blood Cell percentage	Same as above
P-LCR	Platelet-Large Cell Ratio	Same as above
P-LCC	Platelet- Large Cell Count	Same as above
IMG#(R)	Immature Granulocyte(RUO)	Same as above
IMG%(R)	Immature Granulocyte percentage(RUO)	Same as above
RBC-O	Optical Red Blood Cell count	Same as above
PLT-O	Optical Platelet count	Same as above
HFC#	High fluorescent Cell number	Same as above
HFC%	High fluorescent Cell percentage	Same as above
PLT-I	Platelet count- Impedance	Same as above
WBC-R	Optical White Blood Cell count	Same as above
WBC-D	White Blood Cell count -DIFF	Same as above
WBC-B	White Blood Cell count -BASO	Same as above
WBC-N	White Blood Cell count-NRBC	Same as above
PDW-SD	Platelet Distribution Width – Standard Deviation	FD value same as above
InR#	Infected Red Blood Cell count	FD value same as above
InR%	Infected Red Blood Cell permillage	FD value same as above
IMG#	Immature Granulocyte	FD value same as above

IMG%	Immature Granulocyte percentage	FD value same as above
IPF	Immature Platelet Fraction	FD value same as above
Micro#	Microcyte count	FD value same as above
Micro%	Microcyte percentage	FD value same as above
Macro#	Macrocyte count	FD value same as above
Macro%	Macrocyte percentage	FD value same as above
MRV	Mean Reticulocyte Volume	FD value same as above
RHE	Reticulocyte Hemoglobin Expression	FD value same as above
RHE(R)	Reticulocyte Hemoglobin Expression(RUO)	FD value same as above
Band%	Neutrophils, band	Same as above
Seg%	Neutrophils, segmented	Same as above
ALY%	Atypical lymphocytes	Same as above
Pla-Aly%	Atypical lymphocytes (plasmacytes)	Same as above
Mon-Aly%	Atypical lymphocytes (monocytes)	Same as above
Imm-Aly%	Atypical lymphocytes (immature)	Same as above
Other-Aly%	Atypical lymphocytes (others)	Same as above
Meta%	Neutrophils, metamyelocyte	Same as above
Myelo%	Neutrophils, myelocyte	Same as above
Pro-Myelo%	Neutrophils, promyelocyte	Same as above
Imm-Eos%	Eosinophils (immature)	Same as above
Imm-Bas%	Basophils (immature)	Same as above
Blast%	Blasts	Same as above
Mye-Blast%	Myeloblasts	Same as above
Mon-blast%	Monoblasts	Same as above
Lym-blast%	Lymphoblasts	Same as above
IMG/Blast%	Blast and immature granulocytes	Same as above
Pro-Lym%	Immature lymphocytes	Same as above
Pro-Mon%	Immature monocytes	Same as above

	Plsm-cell%	Plasmacytes	Same as above
--	------------	-------------	---------------

## 2.2.5 Worklist Searching Message

See Table 6.

**Table 6 Format of worklist searching message**

CMD	CTMR	Worklist searching message	SampleID	Sample ID, used as the key searching field
			ProjectType	Sample type. Value definition: "0": blood "1": body fluid

## 2.2.6 Worklist Response Message

See Table 7.

**Table 7 Format of worklist response message**

ACK	DAA	Worklist response message	ST	Response. Value definitions: "OK": searching succeeded "Deny": searching failed
			SampleID	Sample ID
			AnaMode	Analysis mode: "0": CBC + DIFF "1": CBC "2": CBC+DIFF+RET "3": CBC+DIFF+NRBC "4": CBC+DIFF+RET+NRBC "5": CBC+RET "6": CBC+NRBC "7": RET
			BloodMode	Presentation mode and sample mode. Value definition: "0": OV-PD; "1": OV-WB; "2": AL-WB; "3": CT-WB;

				"4": OV-BF;
			SampTime	Time of sample collection. Format: YYYY-MM-DD HH: MM: SS. Null if not transmitted
			SendTime	Time of ordering the analysis. Format: YYYY-MM-DD HH: MM: SS. Null if not transmitted
			Name	Patient name
			LastName	Last Name
			Gender	Gender, string
			Birthday	Date of birth. Format: YYYY-MM-DD HH: MM: SS. Null if not transmitted
			AgeVal	Age of the patient
			AgeType	Age unit string. Value definitions: "0": null; "1": year; "2": month; "3": day; "4": hour; "5": week;
			ChargeType	Type of charge, string
			ChartNo	Patient ID
			Dept	Department
			BedNo	Bed No.
			Sender	The person who ordered the analysis
			Remark	Remarks
			Diagnose	Clinical diagnosis
			PatientType	Patient type, string
			SamSource	Sample type
			PatientArea	Inpatient zone
			CusRec1	Custom patient information 1
			CusRec2	Custom patient information 2
			CusRec3	Custom patient information 3
			SerialNumber	Serial number in LIS, applicable to integrated analyzer only.
			ProjectType	Sample type. Value definition: "0": blood

				"1": body fluid
	SampGroup	Reference group	Val	Reference group, string

Note: when the "ProjectType" item in the response message is consistent with the "ProjectType" item in the request message, this item can be excluded in the response message. If not, transmit the "ProjectType" item as requested.

"BloodMode" is not mandatory in the response. If it is not included in the response message, the instrument analyzes the sample in the mode defined in the "Setup" screen of the main unit. If it is included in the response message, the instrument analyzes the sample in the responded mode. If the "ProjectType" corresponding to this "BloodMode" in the response and the request are not the same. It is required to transmit the "ProjectType" item in the response message.

"ST", "Sample ID" and "AnaMode" are mandatory in the transmission.

## 2.3 Examples

### 2.3.1 Coding Data

Note: to make sure the coding data can be displayed in text, some fields and delimiters in the communication protocol are replaced in this document based on the table below (see Table 8).

**Table 8 Codes for special fields and delimiters**

Field/delimiter Name	Code in Protocol	Code in Document
MS	0x05	{
ME	0x0A	}
SE	0x04	\$
FE	0x08	;
Delimiter for MD and SD	0x03	#
Delimiter for SD and FD	0x0C	.
Delimiter for FD and V	0x16	,

For example, the MS field (0x05 in the protocol) is displayed as "{" in the document. So do other fields and delimiters showed in the table.

Based on the feature of the sample data, four examples are shown in the following sections: analysis parameter, sample information, patient information and graphic information.

### 2.3.2 Sample Data

#### 2.3.2.1 Blood Sample

```
{
CTR#WBC:Val,15.22;Low,4.00;High,12.00;Flag,1;Unit,10^9/L;EditFlag,;HighLowFlag,H;Corre
ctedFlag,;OverLimitFlag,;TemperatureFlag,;$
Bas#:Val,0.06;Low,0.00;High,0.10;Flag,1;Unit,10^9/L;EditFlag,;HighLowFlag,;CorrectedFlag,;
OverLimitFlag,;TemperatureFlag,;$
Bas%:Val,0.4;Low,0.0;High,1.0;Flag,1;Unit,%;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLim
itFlag,;TemperatureFlag,;$
Neu#:Val,11.66;Low,2.00;High,8.00;Flag,1;Unit,10^9/L;EditFlag,;HighLowFlag,H;CorrectedFla
g,;OverLimitFlag,;TemperatureFlag,;$
Neu%:Val,76.6;Low,50.0;High,70.0;Flag,1;Unit,%;EditFlag,;HighLowFlag,H;CorrectedFlag,;Ov
erLimitFlag,;TemperatureFlag,;$
Eos#:Val,0.02;Low,0.02;High,0.80;Flag,1;Unit,10^9/L;EditFlag,;HighLowFlag,;CorrectedFlag,;
OverLimitFlag,;TemperatureFlag,;$
Eos%:Val,0.1;Low,0.5;High,5.0;Flag,1;Unit,%;EditFlag,;HighLowFlag,L;CorrectedFlag,;OverLi
mitFlag,;TemperatureFlag,;$
```



Lymph#:Val,2.05;Low,0.80;High,7.00;Flag,1;Unit,10<sup>9</sup>/L;EditFlag,,HighLowFlag,,CorrectedFlag,,OverLimitFlag,,TemperatureFlag,,\$  
 Lymph%:Val,13.5;Low,20.0;High,60.0;Flag,1;Unit,%;EditFlag,,HighLowFlag,L;CorrectedFlag,,OverLimitFlag,,TemperatureFlag,,\$  
 Mon#:Val,1.43;Low,0.12;High,1.20;Flag,1;Unit,10<sup>9</sup>/L;EditFlag,,HighLowFlag,H;CorrectedFlag,,OverLimitFlag,,TemperatureFlag,,\$  
 Mon%:Val,9.4;Low,3.0;High,12.0;Flag,1;Unit,%;EditFlag,,HighLowFlag,,CorrectedFlag,,OverLimitFlag,,TemperatureFlag,,\$  
 RBC:Val,2.72;Low,3.50;High,5.20;Flag,0;Unit,10<sup>12</sup>/L;EditFlag,,HighLowFlag,L;CorrectedFlag,,OverLimitFlag,,TemperatureFlag,,\$  
 HGB:Val,8.8;Low,12.0;High,16.0;Flag,1;Unit,g/dL;EditFlag,,HighLowFlag,L;CorrectedFlag,,OverLimitFlag,,TemperatureFlag,,\$  
 MCV:Val,129.8;Low,80.0;High,100.0;Flag,0;Unit,fL;EditFlag,,HighLowFlag,H;CorrectedFlag,,OverLimitFlag,,TemperatureFlag,,\$  
 MCH:Val,32.2;Low,27.0;High,34.0;Flag,1;Unit,pg;EditFlag,,HighLowFlag,,CorrectedFlag,,OverLimitFlag,,TemperatureFlag,,\$  
 MCHC:Val,24.8;Low,31.0;High,37.0;Flag,1;Unit,g/dL;EditFlag,,HighLowFlag,L;CorrectedFlag,,OverLimitFlag,,TemperatureFlag,,\$  
 RDW-CV:Val,24.8;Low,11.0;High,16.0;Flag,0;Unit,%;EditFlag,,HighLowFlag,H;CorrectedFlag,,OverLimitFlag,,TemperatureFlag,,\$  
 RDW-SD:Val,116.4;Low,35.0;High,56.0;Flag,0;Unit,fL;EditFlag,,HighLowFlag,H;CorrectedFlag,,OverLimitFlag,,TemperatureFlag,,\$  
 HCT:Val,0.354;Low,0.350;High,0.490;Flag,0;Unit,,;EditFlag,,HighLowFlag,,CorrectedFlag,,OverLimitFlag,,TemperatureFlag,,\$  
 PLT:Val,55;Low,100;High,300;Flag,0;Unit,10<sup>9</sup>/L;EditFlag,,HighLowFlag,L;CorrectedFlag,,OverLimitFlag,,TemperatureFlag,,\$  
 MPV:Val,11.7;Low,6.5;High,12.0;Flag,0;Unit,fL;EditFlag,,HighLowFlag,,CorrectedFlag,,OverLimitFlag,,TemperatureFlag,,\$  
 PDW:Val,17.2;Low,15.0;High,17.0;Flag,0;Unit,,;EditFlag,,HighLowFlag,H;CorrectedFlag,,OverLimitFlag,,TemperatureFlag,,\$  
 PCT:Val,0.064;Low,0.108;High,0.282;Flag,0;Unit,%;EditFlag,,HighLowFlag,L;CorrectedFlag,,OverLimitFlag,,TemperatureFlag,,\$  
 P-LCR:Val,38.7;Low,11.0;High,45.0;Flag,0;Unit,%;EditFlag,,HighLowFlag,,CorrectedFlag,,OverLimitFlag,,TemperatureFlag,,\$  
 P-LCC:Val,21;Low,30;High,90;Flag,0;Unit,10<sup>9</sup>/L;EditFlag,,HighLowFlag,L;CorrectedFlag,,OverLimitFlag,,TemperatureFlag,,\$  
 IMG#(R):Val,0.49;Low,,;High,,;Flag,1;Unit,10<sup>9</sup>/L;EditFlag,,HighLowFlag,,CorrectedFlag,,OverLimitFlag,,TemperatureFlag,,\$  
 IMG%(R):Val,3.2;Low,,;High,,;Flag,1;Unit,%;EditFlag,,HighLowFlag,,CorrectedFlag,,OverLimitFlag,,TemperatureFlag,,\$  
 HFC#:Val,0.40;Low,,;High,,;Flag,1;Unit,10<sup>9</sup>/L;EditFlag,,HighLowFlag,,CorrectedFlag,,OverLimitFlag,,TemperatureFlag,,\$

itFlag,;TemperatureFlag,;\$  
 HFC%:Val,2.6;Low,;High,;Flag,1;Unit,%;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFlag,;TemperatureFlag,;\$  
 PLT-I:Val,55;Low,;High,;Flag,0;Unit,10^9/L;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFlag,;TemperatureFlag,;\$  
 WBC-D:Val,14.73;Low,;High,;Flag,1;Unit,10^9/L;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFlag,;TemperatureFlag,;\$  
 WBC-B:Val,15.22;Low,;High,;Flag,1;Unit,10^9/L;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFlag,;TemperatureFlag,;\$  
 PDW-SD:Val,17.0;Low,;High,;Flag,0;Unit,fL;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFlag,;TemperatureFlag,;\$  
 InR#:Val,0.01;Low,;High,;Flag,0;Unit,10^9/L;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFlag,;TemperatureFlag,;\$  
 InR%:Val,0.00;Low,;High,;Flag,0;Unit,%;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFlag,;TemperatureFlag,;\$  
 WBC-C:Val,15.22;Low,4.00;High,12.00;Flag,1;Unit,10^9/L;EditFlag,;HighLowFlag,H;CorrectedFlag,;OverLimitFlag,;TemperatureFlag,;\$  
 SepLine:SepWbcLeft,;SepWbcMid,;SepWbcRight,;SepRBCLeft,29;SepRBCRight,250;SepPLTLeft,3;SepPLTRight,47;\$  
 Total:WbcTotal,;RbcTotal,51277;PltTotal,1004;\$  
 Mode:BloodMode,2;AnaMode,0;\$  
 SampGroup:Val,Child;\$  
 PatInfo:SampleID,40139349110;Name,Michael;LastName,Jordan;Gender,Male;Birthday,2008-12-29 16:00:09;AgeVal,5;AgeType,1;ChargeType,;PatientType,;SamSource,Venous blood;ProjectType,0;ChartNo,patientID2001;BedNo,1002;InsNo,;Dept,Internal medicine;Sender,Jack;Tester,admin;Checker,;Remark,Emergency patient;Diagnose,Virus infections;ReCheck,1;PatientArea,A  
 501;ShlefNo,54;TubeNo,8;CusRec1,;CusRec2,;CusRec3,;InstrumentName,2#;  
 ReviewRules,([WBC]<5),([PLT]>0);ReviewRulesGroup,31,32;ReviewRulesGroupName,RBC Agglutination or Cold Agglutination, NRBC Present;\$  
 PatTime:SampTime,2014-07-05 16:00:09;SendTime,2014-07-16 16:00:09;TestTime,2014-08-05 08:56:35;CheckTime,;ReportTime,2014-09-07 16:00:09;\$  
 AbnormalFlag:WBlast,0;DiffLeukocytosis,0;DiffLeukocypenia,0;WNeuHigh,1;WNeuLow,0;WLy mHigh,0;WLy mLow,0;WMonHigh,0;WEosHigh,0;WBasHigh,0;WLeft,1;WGran,1;WAtl,1;WNrb c,0;REryth,0;RAniso,1;RMacro,1;RMicro,0;RDimor,0;RAnemia,1;RHypo,1;RUnnormal,1;PSis,0;PPenia,1;PAgg,0;DiffChannelError,0;DiffBlasts,0;RbcChannelError,0;RAgg,0;RIron,0;PltChannelError,0;BasoChannelError,0;RetChannelError,0;RetScatterAbnormal,0;Reticulocytosis,0;NrbcChannelError,0;NrbcScatterAbnormal,0;NrbcPresent,0;LymphoBlasts,1;AbnNrbc,1;Lipid Particles,0;InfectedRbc,0;RbcError,0;Clog,0;HgbError,0;RbcCHError,0;RetError,0;HgbCHError,0;Fragments,0;RbcHistAnb,0;PltError,0;PltoError,0;PltoCHError,0;PltHist,0;PltScatter,0;PltMicro,0;PltLarge,0;PltGiant,0;SysError,0;StatusAbn,0;Pancytopenia,0;AspirationError,0;\$

```

WBCHisto:DataLen,0;MetaDataLen,0;WHistoData,;$
RBCHisto:DataLen,0;MetaDataLen,0;RHistoData,;$
PLTHisto:DataLen,0;MetaDataLen,0;PHistoData,;$
WbcHistoBMP:DataLen,0;MetaDataLen,;WHistoBmpData,;$
RbcHistoBMP:DataLen,0;MetaDataLen,;RHistoBmpData,;$
PLTHistoBMP:DataLen,0;MetaDataLen,;PHistoBmpData,;$
DIFF:FSC,;SSC,;FL,;FSC-LOG,;DataLen,;MetaDataLen,;DIFFData,;$
BASO:FSC,;SSC,;FL,;FSC-LOG,;DataLen,;MetaDataLen,;BASOData,;$
NRBC:FSC,;SSC,;FL,;FSC-LOG,;DataLen,;MetaDataLen,;NrbcData,;$
RET:FSC,;SSC,;FL,;FSC-LOG,;DataLen,;MetaDataLen,;RetData,;$
DIFFBMP:DataLen,;MetaDataLen,;DIFFBmpData,;$
BASOBMP:DataLen,;MetaDataLen,;BASOBmpData,;$
NRBCBMP:DataLen,;MetaDataLen,;NRBCBmpData,;$
RETBMP:DataLen,;MetaDataLen,;RETBmpData,;$
RET-EXTBMP:DataLen,;MetaDataLen,;RET-EXTBmpData,;$
PLT-OBMP:DataLen,;MetaDataLen,;PLT-OBmpData,;$
}

```

The graphic information includes histogram raw data, histogram bitmap data, scattergram raw data, and scattergram bitmap data. Each type of data is expressed in one segment, which includes the following fields: MetaDataLen, DataLen and XXXData. XXXData can be regarded as a digit group, DataLen is the number of bytes of the digit group, and MetaDataLen is the value of the data element which can be 1, 2 or 4. If MetaDataLen is 1, XXXData will be digital group in byte; if it is 2, XXXData will be in short (expressed in network byte order and needs to be converted to host byte order); if it is 4, XXXData will be in int (expressed in network byte order and needs to be converted to host byte order).

### 2.3.2.2 Body Fluid Sample

```

{
CTR#WBC-BF:Val,0.000;Low,;High,;Flag,0;Unit,10^9/L;EditFlag,;HighLowFlag,;CorrectedFlag
,;OverLimitFlag,;TemperatureFlag,;$
RBC-BF:Val,0.000;Low,;High,;Flag,0;Unit,10^12/L;EditFlag,;HighLowFlag,;CorrectedFlag,;Ov
erLimitFlag,;TemperatureFlag,;$
MN#:Val,****;Low,;High,;Flag,0;Unit,10^9/L;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimit
Flag,;TemperatureFlag,;$
MN%:Val,****;Low,;High,;Flag,0;Unit,%;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFlag,
;TemperatureFlag,;$
PMN#:Val,****;Low,;High,;Flag,0;Unit,10^9/L;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimi
tFlag,;TemperatureFlag,;$
PMN%:Val,****;Low,;High,;Flag,0;Unit,%;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFla

```

g,;TemperatureFlag,;\$

TC-BF#:Val,0.000;Low,;High,;Flag,0;Unit,10^9/L;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFlag,;TemperatureFlag,;\$

Eos-BF:Val,\*\*\*;Low,;High,;Flag,0;Unit,10^9/L;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFlag,;TemperatureFlag,;\$

Eos-BF%:Val,\*\*\*;Low,;High,;Flag,0;Unit,%;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFlag,;TemperatureFlag,;\$

HF-BF#:Val,\*\*\*;Low,;High,;Flag,0;Unit,10^9/L;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFlag,;TemperatureFlag,;\$

HF-BF%:Val,\*\*\*;Low,;High,;Flag,0;Unit,%;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFlag,;TemperatureFlag,;\$

RBC-BF(R):Val,0.0000;Low,;High,;Flag,0;Unit,10^12/L;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFlag,;TemperatureFlag,;\$

Neu-BF#:Val,\*\*\*;Low,;High,;Flag,0;Unit,10^9/L;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFlag,;TemperatureFlag,;\$

Neu-BF%:Val,\*\*\*;Low,;High,;Flag,0;Unit,%;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFlag,;TemperatureFlag,;\$

SepLine:SepWbcLeft,;SepWbcMid,;SepWbcRight,;SepRBCLeft,10;SepRBCRight,250;SepPLTLeft,3;SepPLTRight,39;\$

Total:WbcTotal,;RbcTotal,0;PltTotal,15;\$

Mode:BloodMode,4;AnaMode,0;\$

SampGroup:Val,General;\$

PatInfo:SampleID,test-33;Name,;LastName,;Gender,;Birthday,;AgeVal,;AgeType,0;ChargeType,;PatientType,;SamSource,;ProjectType,1;ChartNo,;BedNo,;InsNo,;Dept,;Sender,;Tester,admin;Checker,;Remark,;Diagnose,;ReCheck,0;PatientArea,;ShlefNo,;TubeNo,;CusRec1,;CusRec2,;CusRec3,;InstrumentName,6800;\$

PatTime:SampTime,;SendTime,;TestTime,2014-08-15 15:38:52;CheckTime,;ReportTime,;\$

AbnormalFlag:WBlast,0;DiffLeukocytosis,0;DiffLeukocypenia,0;WNeuHigh,0;WNeuLow,0;WLy mHigh,0;WLy mLow,0;WMonHigh,0;WEosHigh,0;WBasHigh,0;WLeft,0;WGran,0;WAtl,0;WNrbc,0;REryth,0;RAniso,0;RMacro,0;RMicro,0;RDimor,0;RAnemia,0;RHypo,0;RUnnormal,0;PSis,0;PPenia,0;PAgg,0;DiffChannelError,0;DiffBlasts,0;RbcChannelError,0;RAgg,0;RIron,0;PltChannelError,0;BasoChannelError,0;RetChannelError,0;RetScatterAbnormal,0;Reticulocytosis,0;NrbcChannelError,0;NrbcScatterAbnormal,0;NrbcPresent,0;LymphoBlasts,0;AbnNrbc,0;LipidParticles,0;InfectedRbc,0;RbcError,0;Clog,0;HgbError,0;RbcCHError,0;RetError,0;HgbCHError,0;Fragments,0;RbcHistAnb,0;PltError,0;PltoError,0;PltoCHError,0;PltHist,0;PltScatter,0;PltMicro,0;PltLarge,0;PltGiant,0;SysError,0;StatusAbn,0;Pancytopenia,0;AspirationError,0;\$

WBCHisto:DataLen,0;MetaDataLen,0;WHistoData,;\$

RBCHisto:DataLen,0;MetaDataLen,0;RHistoData,;\$

PLTHisto:DataLen,0;MetaDataLen,0;PHistoData,;\$

WbcHistoBMP:DataLen,0;MetaDataLen,;WHistoBmpData,;\$

RbcHistoBMP:DataLen,0;MetaDataLen,;RHistoBmpData,;\$

```

PLTHistoBMP:DataLen,0;MetaDataLen,;PHistoBmpData,;$
DIFF:FSC,;SSC,;FL,;FSC-LOG,;DataLen,;MetaDataLen,;DIFFData,;$
BASO:FSC,;SSC,;FL,;FSC-LOG,;DataLen,;MetaDataLen,;BASOData,;$
NRBC:FSC,;SSC,;FL,;FSC-LOG,;DataLen,;MetaDataLen,;NrbcData,;$
RET:FSC,;SSC,;FL,;FSC-LOG,;DataLen,;MetaDataLen,;RetData,;$
DIFFBMP:DataLen,;MetaDataLen,;DIFFBmpData,;$
BASOBMP:DataLen,;MetaDataLen,;BASOBmpData,;$
NRBCBMP:DataLen,;MetaDataLen,;NRBCBmpData,;$
RETBMP:DataLen,;MetaDataLen,;RETBmpData,;$
RET-EXTBMP:DataLen,;MetaDataLen,;RET-EXTBmpData,;$
PLT-OBMP:DataLen,;MetaDataLen,;PLT-OBmpData,;$
}

```

The graphic information includes histogram raw data, histogram bitmap data, scattergram raw data, and scattergram bitmap data. Each type of data is expressed in one segment, which includes the following fields: MetaDataLen, DataLen and XXXData. XXXData can be regarded as a digit group, DataLen is the number of bytes of the digit group, and MetaDataLen is the value of the data element which can be 1, 2 or 4. If MetaDataLen is 1, XXXData will be digital group in byte; if it is 2, XXXData will be in short (expressed in network byte order and needs to be converted to host byte order); if it is 4, XXXData will be in int (expressed in network byte order and needs to be converted to host byte order).

## 2.3.3 QC Message

### 2.3.3.1 In QC Sample Format

```

{
QCC#Info:Type,0;FileNo,1;LotNo,MB034H;Level,2;ExpDate,2014-11-11
00:00:00;InstrumentName,1#;$
WBC:Mean,18.94;Range,2.50;Unit,10^9/L;$
Bas#:Mean,0.51;Range,0.29;Unit,10^9/L;$
Bas%:Mean,2.7;Range,1.5;Unit,%;$
Neu#:Mean,12.71;Range,2.00;Unit,10^9/L;$
Neu%:Mean,67.1;Range,10.0;Unit,%;$
Eos#:Mean,1.70;Range,1.20;Unit,10^9/L;$
Eos%:Mean,9.0;Range,6.0;Unit,%;$
Lymph#:Mean,3.60;Range,1.60;Unit,10^9/L;$
Lymph%:Mean,19.0;Range,8.0;Unit,%;$
Mon#:Mean,0.42;Range,0.80;Unit,10^9/L;$
Mon%:Mean,2.2;Range,3.5;Unit,%;$
RBC:Mean,5.87;Range,0.30;Unit,10^12/L;$
}

```

HGB:Mean,18.0;Range,0.8;Unit,g/dL;\$  
 MCV:Mean,98.2;Range,5.0;Unit,fL;\$  
 MCH:Mean,30.7;Range,2.5;Unit,pg;\$  
 MCHC:Mean,31.2;Range,3.0;Unit,g/dL;\$  
 RDW-CV:Mean,14.7;Range,6.0;Unit,%;\$  
 RDW-SD:Mean,51.2;Range,12.0;Unit,fL;\$  
 HCT:Mean,0.576;Range,0.030;Unit,;\$  
 PLT:Mean,480;Range,65;Unit,10<sup>9</sup>/L;\$  
 MPV:Mean,11.3;Range,3.0;Unit,fL;\$  
 PDW:Mean,16.5;Range,5.0;Unit,;\$  
 PCT:Mean,0.542;Range,0.200;Unit,%;\$  
 RET#:Mean,;Range,;Unit,10<sup>12</sup>/L;\$  
 RET%:Mean,;Range,;Unit,%;\$  
 IRF:Mean,;Range,;Unit,%;\$  
 LFR:Mean,;Range,;Unit,%;\$  
 MFR:Mean,;Range,;Unit,%;\$  
 HFR:Mean,;Range,;Unit,%;\$  
 NRBC#:Mean,;Range,;Unit,10<sup>9</sup>/L;\$  
 NRBC%:Mean,;Range,;Unit,/100WBC;\$  
 P-LCR:Mean,36.3;Range,10.0;Unit,%;\$  
 P-LCC:Mean,174;Range,50;Unit,10<sup>9</sup>/L;\$  
 IMG#(R):Mean,;Range,;Unit,10<sup>9</sup>/L;\$  
 IMG%(R):Mean,;Range,;Unit,%;\$  
 RBC-O:Mean,;Range,;Unit,10<sup>12</sup>/L;\$  
 PLT-O:Mean,427;Range,60;Unit,10<sup>9</sup>/L;\$  
 HFC#:Mean,;Range,;Unit,10<sup>9</sup>/L;\$  
 HFC%:Mean,;Range,;Unit,%;\$  
 PLT-I:Mean,;Range,;Unit,10<sup>9</sup>/L;\$  
 WBC-R:Mean,;Range,;Unit,10<sup>9</sup>/L;\$  
 WBC-D:Mean,;Range,;Unit,10<sup>9</sup>/L;\$  
 WBC-B:Mean,;Range,;Unit,10<sup>9</sup>/L;\$  
 WBC-N:Mean,;Range,;Unit,10<sup>9</sup>/L;\$  
 PDW-SD:Mean,;Range,;Unit,fL;\$  
 InR#:Mean,;Range,;Unit,10<sup>9</sup>/L;\$  
 InR%:Mean,;Range,;Unit,%;\$  
 WBC-C:Mean,18.94;Range,2.50;Unit,10<sup>9</sup>/L;\$  
 WBC-BF:Mean,;Range,;Unit,;\$

RBC-BF:Mean,,Range,,Unit,;\$  
MN#:Mean,,Range,,Unit,;\$  
MN%:Mean,,Range,,Unit,;\$  
PMN#:Mean,,Range,,Unit,;\$  
PMN%:Mean,,Range,,Unit,;\$  
TC-BF#:Mean,,Range,,Unit,;\$  
Eos-BF:Mean,,Range,,Unit,;\$  
Eos-BF%:Mean,,Range,,Unit,;\$  
HF-BF#:Mean,,Range,,Unit,;\$  
HF-BF%:Mean,,Range,,Unit,;\$  
RBC-BF(R):Mean,,Range,,Unit,;\$  
IMG#:Mean,,Range,,Unit,10^9/L;\$  
IMG%:Mean,,Range,,Unit,%;\$  
IPF:Mean,,Range,,Unit,%;\$  
Micro#:Mean,,Range,,Unit,10^12/L;\$  
Micro%:Mean,,Range,,Unit,%;\$  
Macro#:Mean,,Range,,Unit,10^12/L;\$  
Macro%:Mean,,Range,,Unit,%;\$  
MRV:Mean,,Range,,Unit,fL;\$  
Neu-BF#:Mean,,Range,,Unit,;\$  
Neu-BF%:Mean,,Range,,Unit,;\$  
RHE(R):Mean,,Range,,Unit,pg;\$  
RHE:Mean,,Range,,Unit,pg;\$  
}  
{  
QCR#Info:Type,0;FileNo,1;LotNo,MB034H;Level,2;ExpDate,2014-11-11  
00:00:00;TestTime,2014-08-20  
16:09:16;Tester,admin;TestDateModifyFlag,,;TestTimeModifyFlag,;\$  
WBC:Val1,19.40;Unit1,10^9/L;EditFlag1,,;HighLowFlag1,,;Val2,,;Unit2,,;EditFlag2,,;HighLowFlag2,,;AvgVal,,;AvgUnit,,;AvgEditFlag,,;\$  
Bas#:Val1,0.48;Unit1,10^9/L;EditFlag1,,;HighLowFlag1,,;Val2,,;Unit2,,;EditFlag2,,;HighLowFlag2,,;AvgVal,,;AvgUnit,,;AvgEditFlag,,;\$  
Bas%:Val1,2.5;Unit1,%;EditFlag1,,;HighLowFlag1,,;Val2,,;Unit2,,;EditFlag2,,;HighLowFlag2,,;AvgVal,,;AvgUnit,,;AvgEditFlag,,;\$  
Neu#:Val1,13.16;Unit1,10^9/L;EditFlag1,,;HighLowFlag1,,;Val2,,;Unit2,,;EditFlag2,,;HighLowFlag2,,;AvgVal,,;AvgUnit,,;AvgEditFlag,,;\$  
Neu%:Val1,67.7;Unit1,%;EditFlag1,,;HighLowFlag1,,;Val2,,;Unit2,,;EditFlag2,,;HighLowFlag2,,;AvgVal,,;AvgUnit,,;AvgEditFlag,,;\$

Eos#:Val1,1.79;Unit1,10^9/L;EditFlag1,;HighLowFlag1,;Val2,;Unit2,;EditFlag2,;HighLowFlag2,;AvgVal,;AvgUnit,;AvgEditFlag,;\$

Eos%:Val1,9.3;Unit1,%;EditFlag1,;HighLowFlag1,;Val2,;Unit2,;EditFlag2,;HighLowFlag2,;AvgVal,;AvgUnit,;AvgEditFlag,;\$

Lymph#:Val1,3.50;Unit1,10^9/L;EditFlag1,;HighLowFlag1,;Val2,;Unit2,;EditFlag2,;HighLowFlag2,;AvgVal,;AvgUnit,;AvgEditFlag,;\$

Lymph%:Val1,18.1;Unit1,%;EditFlag1,;HighLowFlag1,;Val2,;Unit2,;EditFlag2,;HighLowFlag2,;AvgVal,;AvgUnit,;AvgEditFlag,;\$

Mon#:Val1,0.47;Unit1,10^9/L;EditFlag1,;HighLowFlag1,;Val2,;Unit2,;EditFlag2,;HighLowFlag2,;AvgVal,;AvgUnit,;AvgEditFlag,;\$

Mon%:Val1,2.4;Unit1,%;EditFlag1,;HighLowFlag1,;Val2,;Unit2,;EditFlag2,;HighLowFlag2,;AvgVal,;AvgUnit,;AvgEditFlag,;\$

RBC:Val1,5.61;Unit1,10^12/L;EditFlag1,;HighLowFlag1,;Val2,;Unit2,;EditFlag2,;HighLowFlag2,;AvgVal,;AvgUnit,;AvgEditFlag,;\$

HGB:Val1,17.7;Unit1,g/dL;EditFlag1,;HighLowFlag1,;Val2,;Unit2,;EditFlag2,;HighLowFlag2,;AvgVal,;AvgUnit,;AvgEditFlag,;\$

MCV:Val1,106.9;Unit1,fL;EditFlag1,;HighLowFlag1,H;Val2,;Unit2,;EditFlag2,;HighLowFlag2,;AvgVal,;AvgUnit,;AvgEditFlag,;\$

MCH:Val1,31.6;Unit1,pg;EditFlag1,;HighLowFlag1,;Val2,;Unit2,;EditFlag2,;HighLowFlag2,;AvgVal,;AvgUnit,;AvgEditFlag,;\$

MCHC:Val1,29.6;Unit1,g/dL;EditFlag1,;HighLowFlag1,;Val2,;Unit2,;EditFlag2,;HighLowFlag2,;AvgVal,;AvgUnit,;AvgEditFlag,;\$

RDW-CV:Val1,15.9;Unit1,%;EditFlag1,;HighLowFlag1,;Val2,;Unit2,;EditFlag2,;HighLowFlag2,;AvgVal,;AvgUnit,;AvgEditFlag,;\$

RDW-SD:Val1,62.3;Unit1,fL;EditFlag1,;HighLowFlag1,;Val2,;Unit2,;EditFlag2,;HighLowFlag2,;AvgVal,;AvgUnit,;AvgEditFlag,;\$

HCT:Val1,0.600;Unit1,;EditFlag1,;HighLowFlag1,;Val2,;Unit2,;EditFlag2,;HighLowFlag2,;AvgVal,;AvgUnit,;AvgEditFlag,;\$

PLT:Val1,422;Unit1,10^9/L;EditFlag1,;HighLowFlag1,;Val2,;Unit2,;EditFlag2,;HighLowFlag2,;AvgVal,;AvgUnit,;AvgEditFlag,;\$

MPV:Val1,10.7;Unit1,fL;EditFlag1,;HighLowFlag1,;Val2,;Unit2,;EditFlag2,;HighLowFlag2,;AvgVal,;AvgUnit,;AvgEditFlag,;\$

PDW:Val1,16.5;Unit1,;EditFlag1,;HighLowFlag1,;Val2,;Unit2,;EditFlag2,;HighLowFlag2,;AvgVal,;AvgUnit,;AvgEditFlag,;\$

PCT:Val1,0.454;Unit1,%;EditFlag1,;HighLowFlag1,;Val2,;Unit2,;EditFlag2,;HighLowFlag2,;AvgVal,;AvgUnit,;AvgEditFlag,;\$

P-LCR:Val1,32.5;Unit1,%;EditFlag1,;HighLowFlag1,;Val2,;Unit2,;EditFlag2,;HighLowFlag2,;AvgVal,;AvgUnit,;AvgEditFlag,;\$

P-LCC:Val1,137;Unit1,10^9/L;EditFlag1,;HighLowFlag1,;Val2,;Unit2,;EditFlag2,;HighLowFlag2,;AvgVal,;AvgUnit,;AvgEditFlag,;\$

IMG#(R):Val1,0.52;Unit1,10^9/L;EditFlag1,;HighLowFlag1,;Val2,;Unit2,;EditFlag2,;HighLowFlag2,;AvgVal,;AvgUnit,;AvgEditFlag,;\$



```

ag2,;AvgVal,;AvgUnit,;AvgEditFlag,;$
IMG%(R):Val1,2.7;Unit1,%;EditFlag1,;HighLowFlag1,;Val2,;Unit2,;EditFlag2,;HighLowFlag2,;
AvgVal,;AvgUnit,;AvgEditFlag,;$
HFC#:Val1,0.00;Unit1,10^9/L;EditFlag1,;HighLowFlag1,;Val2,;Unit2,;EditFlag2,;HighLowFlag2
,;AvgVal,;AvgUnit,;AvgEditFlag,;$
HFC%:Val1,0.0;Unit1,%;EditFlag1,;HighLowFlag1,;Val2,;Unit2,;EditFlag2,;HighLowFlag2,;Avg
Val,;AvgUnit,;AvgEditFlag,;$
PLT-I:Val1,422;Unit1,10^9/L;EditFlag1,;HighLowFlag1,;Val2,;Unit2,;EditFlag2,;HighLowFlag2,;
AvgVal,;AvgUnit,;AvgEditFlag,;$
WBC-D:Val1,19.90;Unit1,10^9/L;EditFlag1,;HighLowFlag1,;Val2,;Unit2,;EditFlag2,;HighLowFl
ag2,;AvgVal,;AvgUnit,;AvgEditFlag,;$
WBC-B:Val1,19.40;Unit1,10^9/L;EditFlag1,;HighLowFlag1,;Val2,;Unit2,;EditFlag2,;HighLowFl
ag2,;AvgVal,;AvgUnit,;AvgEditFlag,;$
PDW-SD:Val1,14.0;Unit1,fL;EditFlag1,;HighLowFlag1,;Val2,;Unit2,;EditFlag2,;HighLowFlag2,;
AvgVal,;AvgUnit,;AvgEditFlag,;$
InR#:Val1,0.00;Unit1,10^9/L;EditFlag1,;HighLowFlag1,;Val2,;Unit2,;EditFlag2,;HighLowFlag2,;
AvgVal,;AvgUnit,;AvgEditFlag,;$
InR%:Val1,0.00;Unit1,‰;EditFlag1,;HighLowFlag1,;Val2,;Unit2,;EditFlag2,;HighLowFlag2,;Av
gVal,;AvgUnit,;AvgEditFlag,;$
WBC-C:Val1,19.40;Unit1,10^9/L;EditFlag1,;HighLowFlag1,;Val2,;Unit2,;EditFlag2,;HighLowFl
ag2,;AvgVal,;AvgUnit,;AvgEditFlag,;$
}

```

### 2.3.3.2 In Common Sample Format

```

{
CTR#WBC:Val,19.40;Low,16.44;High,21.44;Flag,0;Unit,10^9/L;EditFlag,;HighLowFlag,;Corre
ctedFlag,;OverLimitFlag,;TemperatureFlag,;$
Bas#:Val,0.48;Low,0.22;High,0.80;Flag,0;Unit,10^9/L;EditFlag,;HighLowFlag,;CorrectedFlag,;
OverLimitFlag,;TemperatureFlag,;$
Bas%:Val,2.5;Low,1.2;High,4.2;Flag,0;Unit,%;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLim
itFlag,;TemperatureFlag,;$
Neu#:Val,13.16;Low,10.71;High,14.71;Flag,0;Unit,10^9/L;EditFlag,;HighLowFlag,;CorrectedFl
ag,;OverLimitFlag,;TemperatureFlag,;$
Neu%:Val,67.7;Low,57.1;High,77.1;Flag,0;Unit,%;EditFlag,;HighLowFlag,;CorrectedFlag,;Ove
rLimitFlag,;TemperatureFlag,;$
Eos#:Val,1.79;Low,0.50;High,2.90;Flag,0;Unit,10^9/L;EditFlag,;HighLowFlag,;CorrectedFlag,;
OverLimitFlag,;TemperatureFlag,;$
Eos%:Val,9.3;Low,3.0;High,15.0;Flag,0;Unit,%;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLi
mitFlag,;TemperatureFlag,;$
Lymph#:Val,3.50;Low,2.00;High,5.20;Flag,0;Unit,10^9/L;EditFlag,;HighLowFlag,;CorrectedFla

```

g,;OverLimitFlag,;TemperatureFlag,;\$

Lymph%:Val,18.1;Low,11.0;High,27.0;Flag,0;Unit,%;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFlag,;TemperatureFlag,;\$

Mon#:Val,0.47;Low,0.00;High,1.22;Flag,0;Unit,10^9/L;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFlag,;TemperatureFlag,;\$

Mon%:Val,2.4;Low,0.0;High,5.7;Flag,0;Unit,%;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFlag,;TemperatureFlag,;\$

RBC:Val,5.61;Low,5.57;High,6.17;Flag,0;Unit,10^12/L;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFlag,;TemperatureFlag,;\$

HGB:Val,17.7;Low,17.2;High,18.8;Flag,0;Unit,g/dL;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFlag,;TemperatureFlag,;\$

MCV:Val,106.9;Low,93.2;High,103.2;Flag,0;Unit,fL;EditFlag,;HighLowFlag,H;CorrectedFlag,;OverLimitFlag,;TemperatureFlag,;\$

MCH:Val,31.6;Low,28.2;High,33.2;Flag,0;Unit,pg;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFlag,;TemperatureFlag,;\$

MCHC:Val,29.6;Low,28.2;High,34.2;Flag,0;Unit,g/dL;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFlag,;TemperatureFlag,;\$

RDW-CV:Val,15.9;Low,8.7;High,20.7;Flag,0;Unit,%;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFlag,;TemperatureFlag,;\$

RDW-SD:Val,62.3;Low,39.2;High,63.2;Flag,0;Unit,fL;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFlag,;TemperatureFlag,;\$

HCT:Val,0.600;Low,0.546;High,0.606;Flag,0;Unit,;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFlag,;TemperatureFlag,;\$

PLT:Val,422;Low,415;High,545;Flag,0;Unit,10^9/L;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFlag,;TemperatureFlag,;\$

MPV:Val,10.7;Low,8.3;High,14.3;Flag,0;Unit,fL;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFlag,;TemperatureFlag,;\$

PDW:Val,16.5;Low,11.5;High,21.5;Flag,0;Unit,;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFlag,;TemperatureFlag,;\$

PCT:Val,0.454;Low,0.342;High,0.742;Flag,0;Unit,%;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFlag,;TemperatureFlag,;\$

P-LCR:Val,32.5;Low,26.3;High,46.3;Flag,0;Unit,%;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFlag,;TemperatureFlag,;\$

P-LCC:Val,137;Low,124;High,224;Flag,0;Unit,10^9/L;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFlag,;TemperatureFlag,;\$

IMG#(R):Val,0.52;Low,;High,;Flag,0;Unit,10^9/L;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFlag,;TemperatureFlag,;\$

IMG%(R):Val,2.7;Low,;High,;Flag,0;Unit,%;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFlag,;TemperatureFlag,;\$

HFC#:Val,0.00;Low,;High,;Flag,0;Unit,10^9/L;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFlag,;TemperatureFlag,;\$

HFC%:Val,0.0;Low,;High,;Flag,0;Unit,%;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFlag  
 ,;TemperatureFlag,;\$  
 PLT-I:Val,422;Low,;High,;Flag,0;Unit,10^9/L;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimit  
 Flag,;TemperatureFlag,;\$  
 WBC-D:Val,19.90;Low,;High,;Flag,0;Unit,10^9/L;EditFlag,;HighLowFlag,;CorrectedFlag,;Over  
 LimitFlag,;TemperatureFlag,;\$  
 WBC-B:Val,19.40;Low,;High,;Flag,0;Unit,10^9/L;EditFlag,;HighLowFlag,;CorrectedFlag,;Over  
 LimitFlag,;TemperatureFlag,;\$  
 PDW-SD:Val,14.0;Low,;High,;Flag,0;Unit,fL;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimit  
 Flag,;TemperatureFlag,;\$  
 InR#:Val,0.00;Low,;High,;Flag,0;Unit,10^9/L;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimit  
 Flag,;TemperatureFlag,;\$  
 InR%:Val,0.00;Low,;High,;Flag,0;Unit,%;EditFlag,;HighLowFlag,;CorrectedFlag,;OverLimitFla  
 g,;TemperatureFlag,;\$  
 WBC-C:Val,19.40;Low,16.44;High,21.44;Flag,0;Unit,10^9/L;EditFlag,;HighLowFlag,;Corrected  
 Flag,;OverLimitFlag,;TemperatureFlag,;\$  
 SepLine:SepWbcLeft,;SepWbcMid,;SepWbcRight,;SepRBCLeft,0;SepRBCRight,0;SepPLTLef  
 t,0;SepPLTRight,0;\$  
 Total:WbcTotal,;RbcTotal,0;PltTotal,0;\$  
 Mode:BloodMode,2;AnaMode,0;\$  
 SampGroup:Val,General;\$  
 PatInfo:SampleID,1MB999;Name,;LastName,;Gender,;Birthday,;AgeVal,;AgeType,0;ChargeTy  
 pe,;PatientType,;SamSource,;ProjectType,0;ChartNo,;BedNo,;InsNo,;Dept,;Sender,;Tester,ad  
 min;Checker,;Remark,;Diagnose,;ReCheck,0;PatientArea,;ShlefNo,??;TubeNo,0;CusRec1,;C  
 usRec2,;CusRec3,;InstrumentName,1#;\$  
 PatTime:SampTime,;SendTime,;TestTime,2014-08-20 16:09:16;CheckTime,;ReportTime,;\$  
 AbnormalFlag:WBlast,0;DiffLeukocytosis,0;DiffLeukocypenia,0;WNeuHigh,0;WNeuLow,0;WLy  
 mHigh,0;WLymlow,0;WMonHigh,0;WEosHigh,0;WBasHigh,0;WLeft,0;WGran,0;WAtl,0;WNrb  
 c,0;REryth,0;RAniso,0;RMacro,0;RMicro,0;RDimor,0;RAnemia,0;RHypo,0;RUnnormal,0;PSis,  
 0;PPenia,0;PAgg,0;DiffChannelError,0;DiffBlasts,0;RbcChannelError,0;RAgg,0;RIron,0;PltCha  
 nnelError,0;BasoChannelError,0;RetChannelError,0;RetScatterAbnormal,0;Reticulocytosis,0;  
 NrbcChannelError,0;NrbcScatterAbnormal,0;NrbcPresent,0;LymphoBlasts,0;AbnNrbc,0;Lipid  
 Particles,0;InfectedRbc,0;RbcError,0;Clog,0;HgbError,0;RbcCHError,0;RetError,0;HgbCHError  
 ,0;Fragments,0;RbcHistAnb,0;PltError,0;PltoError,0;PltoCHError,0;PltHist,0;PltScatter,0;PltMic  
 ro,0;PltLarge,0;PltGiant,0;SysError,0;StatusAbn,0;Pancytopenia,0;AspirationError,0;\$  
 WBCHisto:DataLen,0;MetaDataLen,0;WHistoData,;\$  
 RBCHisto:DataLen,0;MetaDataLen,0;RHistoData,;\$  
 PLTHisto:DataLen,0;MetaDataLen,0;PHistoData,;\$  
 WbcHistoBMP:DataLen,0;MetaDataLen,;WHistoBmpData,;\$  
 RbcHistoBMP:DataLen,0;MetaDataLen,;RHistoBmpData,;\$  
 PLTHistoBMP:DataLen,0;MetaDataLen,;PHistoBmpData,;\$

```

DIFF:FSC,;SSC,;FL,;FSC-LOG,;DataLen,;MetaDataLen,;DIFFData,;$
BASO:FSC,;SSC,;FL,;FSC-LOG,;DataLen,;MetaDataLen,;BASOData,;$
NRBC:FSC,;SSC,;FL,;FSC-LOG,;DataLen,;MetaDataLen,;NrbcData,;$
RET:FSC,;SSC,;FL,;FSC-LOG,;DataLen,;MetaDataLen,;RetData,;$
DIFFBMP:DataLen,;MetaDataLen,;DIFFBmpData,;$
BASOBMP:DataLen,;MetaDataLen,;BASOBmpData,;$
NRBCBMP:DataLen,;MetaDataLen,;NRBCBmpData,;$
RETBMP:DataLen,;MetaDataLen,;RETBmpData,;$
RET-EXTBMP:DataLen,;MetaDataLen,;RET-EXTBmpData,;$
PLT-OBMP:DataLen,;MetaDataLen,;PLT-OBmpData,;$
}

```

### 2.3.4 Bidirectional LIS/HIS Request Message

```

{
CMD#CTMR:SampleID,SampleID4001;ProjectType,0;$
}

```

### 2.3.5 Bidirectional LIS/HIS Request Response Message

```

{
ACK#DAA:ST,OK;SampleID,SampleID4001;AnaMode,0;SampTime,2009-03-07
10:30:00;SendTime,2009-03-07
10:31:00;Name,Michael;LastName,Jordan;Gender,Male;Birthday,2009-02-10
00:00:00;AgeVal,6;AgeType,1;ChargeType,Public;ChartNo,patientID2001;Dept,Internal
medicine;BedNo,1002;Sender,Jack;Remark,Emergency patient;Diagnose,Virus
infections;PatientType,Outpatient;SamSource,Venous blood;PatientArea,A -
501;CusRec1,Nothing;CusRec2,Nothing;CusRec3,Nothing;SerialNumber,3;$
SampGroup:Val,Child;$
}

```

# Chapter 3 HL7 Communication Protocol

## 3.1 Overview

The LIS/HIS communication function of the DMU enabled the communication between the analyzer and the PC in laboratory through Ethernet, including sending analysis results to and receiving worklist from lab PC.

This communication protocol is defined based on the HL7 Standards. HL7 is a series of electronic data exchange standards for healthcare industry, which is originally defined by the US and is now adopted worldwide. This protocol is defined based on HL7 v2.3.1. For details of HL7 standards, see *HL7 Interface Standards Version 2.3.1*.

## 3.2 Low-Level Transmission Protocol

The DMU communicates through TCP or serial port. See Chapter 1 for details.

## 3.3 HL7 Message Level Protocol

### 3.3.1 HL7 Protocol Overview

See Appendix A .

### 3.3.2 HL7 Low-Level Message Protocol

HL7 of high-level protocol is based on messages. The function of terminating the message is not provided. In order to determine the message boundary, the MLLP low-level protocol is used (see HL7 Interface Standards Version 2.3.1).

#### Communication Level

Messages are transmitted in the following format:

<SB> ddddd <EB><CR>

among which:

**<SB> = Start Block character (1 byte)**

ASCII <VT>, i.e. <0x0B>. Do not confuse with the SOH or STX character in ASCII.

**dddd = Data (variable number of bytes)**

dddd is the effective data of HL7 message and expressed in the form of string. For the strings used in the HL7 interface messages of the DMU, the UTF-8 code is used.

**<EB> = End Block character (1 byte)**

ASCII <FS>, i.e. <0x1C>. Do not confuse with the ETX or EOT character in ASCII.

**<CR> = Carriage Return (1 byte)**

ASCII carriage return character, i.e. <0x0D>.

## 3.4 Duplex Communication

1. The DMU directly sends the analysis results (or QC data) to LIS/HIS, as shown in Figure 10.

R01 event: the DMU sends the analysis results to LIS.  
Both sample analysis results and QC results can be sent in this way.

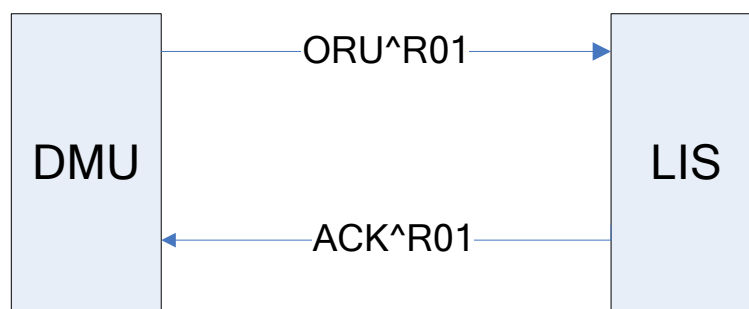


Figure 10 Analysis results (QC data) communication process

2. Worklist information searching

Worklist belongs to the Order message. Thus, the corresponding HL7 messages: ORM (General Order Message), ORR (General Order Response Message) can be used. The communication process is shown in Figure 11.

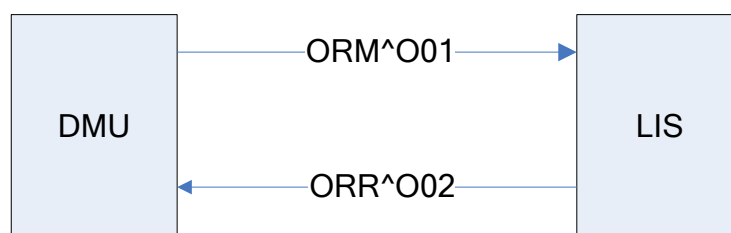


Figure 11 Worklist searching communication process

### 3.4.1 Mostly used messages:

**ORU^R01 message:** it is mostly used for the transmission of the analysis results and QC data.

ORU	Observational Results (Unsolicited)	Description
-----	-------------------------------------	-------------

MSH Message Header, mandatory, including the communication information like message No., sending time, message delimiter and coding method, etc.

{

PID Patient demographic information, including patient name, gender, patient ID, date of birth, etc.

[PV1] Patient visit information, including patient type, department, bed No. and payer, etc.

```
{
    OBR    sample information, including sample No., operator and time of
analysis, etc.
    {[OBX]} analysis data, including analysis results and mode of
analysis, etc.
}
```

**ACK^R01 message:** it confirms the receipt of ORU^R01 message.

ACK	Acknowledgment
Description	

MSH Message header

MSA message acknowledgment, describing whether it has received the transmitted message

**ORM^O01 message:** Common order message, all the actions related to order basically use the message of this type. For example, create a new order or cancel an order. Here, the DMU requests LIS/HIS to re-fill the order message.

ORM	General Order Message	Description
-----	-----------------------	-------------

MSH Message header

{ORC} Common message of Order, including the ID information of the sample searched

**ORR^O02 Message:** acknowledgement of the ORM^O01 message. Here, returning the completed information of order (i.e. worklist).

ORR^O02	General	Order	Response	Message
Description				

MSH Message header

MSA Message acknowledgment

[PID patient information

[PV1]] patient visit information

{

ORC Common message of Order, including the sample ID

[

OBR Sample information

{[OBX]} Data of other sample information, including analysis mode, etc.

]

}

## 3.5 HL7 Segment Definitions

The tables in this section provide detailed definitions of the fields in all the message segments. Each row provides the information of one field, and the content of each column is described as follows:

1. No.: the HL7 message begins with the segment name of 3 characters followed by the fields which are separated by delimiters. "No." refers to the order of the field in the HL7 message segment.

E.g.

```
PID      | 1      |      | 7393670^^^MR||^Liu||19950804000000|F
  ↑        ↑        ↑
Segment name Field 1 Field 3
```

**Message example 3-1 Example of HL7 segment No.**

Note: for MSH segment, the field delimiter subsequential to the segment name is considered to be the first field, used to define the field delimiter values of the whole message.

2. Field name: the logic sense of the field.
3. Data type: the data type based on HL7 standards. See Appendix A for details;
4. Recommended max length: the recommended max length based on HL7 standards. But during the communication process, the data length may be longer than recommended, in which case the fields shall be identified by delimiters while analyzing the message segment.
5. Description: description to the value of the field.
6. Example: example of the fields.

### 3.5.1 MSH

MSH (Message Header) segment contains basic information of HL7 messages, including delimiter value, message type and coding method etc. It is the first field of every HL7 message.

Message example:

```
MSH|^~\&|BC-6800|Mindray|||20101012092538||ORU^R01|1|P|2.3.1|||||UNICODE
```

See Table 9 for definition of each field in MSH segment.

**Table 9 MSH Field Definitions**

No.	Field/delimiter Name	Data Type	Recommended Max Length	Description	Example
1	Field Delimiter	ST	1	Includes the delimiter of the first field after the segment name; used to determine the delimiter values of the	



				rest part of the message.	
2	Encoding Characters	ST	4	Includes component delimiters, repetition delimiters, escape delimiters and subcomponent delimiters.	^~\&
3	Sending application	EI	180	Application of sending terminal.	BC-6800
4	Sending Facility	EI	180	Device of sending terminal. Value: Mindray (in Chinese and English version)	Mindray
7	Date/Time Of Message	TS	26	Time of creating the message (in the format of YYYY[MM[DD[HH[MM[SS]]]]]), using the system time	20101012092538
9	Message Type	CM	7	Message type, in the format of "message type^event type".	ORU^R01
10	Message Control ID	ST	20	Message control ID, used as the unique identifier of a message.	1
11	Processing ID	PT	3	Message processing ID. Value: "P": sample and worklist searching message; "Q": QC analysis result message; In Ack messages, it is consistent with the previously received message.	P
12	Version ID	VID	60	HL7 version number. Value: "2.3.1".	2.3.1
18	Character Set	ID	10	Character set. Value: "UNICODE", which means the message in communication is expressed in UTF-8 strings.	UNICODE

### 3.5.2 MSA

The MSA (Message Acknowledgement) segment contains message acknowledge information.

Message example:

MSA|AA|1

See Table 10 for field definitions in use.

**Table 10 MSA Field Definitions**

No.	Field/delimiter Name	Data Type	Recommended Max Length	Description	Example
1	Acknowledgment Code	ID	2	Acknowledgement code: "A"- received; "AE" – error; "AR"- rejected.	AA

2	Message Control ID	ST	20	Message control ID, consistent with the MSH-10 of the received message	1
6	Error Condition	CE	100	Error condition (status code), can be selected to transmit, and contains error condition descriptions; see Table 11 for the values.	

**Table 11 Error Codes of MSA-6 Field**

Status Code (MSA-6)	Status Text (MSA-3)	Description/Remark
Succeeded:		AA
0	Message accepted	Succeeded
Error status code:		AE
100	Segment sequence error	Segment sequence in the message is wrong, required segment missing
101	Required field missing	Required field in a segment missing
102	Data type error	Segment data type error, e.g. data type is character instead of numeric
103	Table value not found	Table value not found; not used temporarily
Rejected status code:		AR
200	Unsupported message type	Message type not supported
201	Unsupported event code	Event code not supported
202	Unsupported processing id	Processing ID not supported
203	Unsupported version id	Version ID not supported
204	Unknown key identifier	Unknown key identifier, e.g. transmitting a nonexistent patient information
205	Duplicate key identifier	Repeated key words existed
206	Application record locked	Issues can not be executed in the application saving level, e.g. database is locked
207	Application internal error	Other unknown error of the application

### 3.5.3 PID

The PID (Patient Identification) segment contains the patient demographic information.

Message example:

PID|1||C1^^^MR||^Liu||20101005084346|Male

See Table 12 for field definitions in use.

**Table 12 PID Field Definitions**

No.	Field/delimiter Name	Data Type	Recommended Max Length	Description	Example
1	Set ID - PID	SI	4	Serial No., used to identify different PID segments in a message	1
3	Patient Identifier List	CX	20	Used as patient ID in the sample analysis result messages, in the form of "patient ID^^^^MR". Used as batch No. of control in QC messages.	C1^^^^MR
5	Patient Name	XPN	48	Patient name (consists of FirstName and LastName), in the form of "LastName^FirstName"	^Liu
7	Date/Time of Birth	TS	26	Used as time of birth in sample information messages. In the form of YYYY[MM[DD[HH[MM[SS]]]]]. Used as expiration date of the control in QC messages.	20101005084346
8	Sex	IS	1	Gender, string. Same with the strings displayed on the screen.	Male.

### 3.5.4 PV1

The PV1 (Patient Visit) segment contains the patient visit information.

Message example:

PV1|1|Outpatient|Medicine^BN1||||||||||||||MedicalInsurance

See Table 13 for field definitions in use.

**Table 13 PV1 Field Definitions**

No.	Field/delimiter Name	Data Type	Recommended Max Length	Description	Example
1	Set ID - PV1	SI	4	Serial No., used to identify different PV1 segments in a message.	1
2	Patient Class	IS	1	Patient type, string, content not defined. Same with the strings displayed on the screen.	Outpatient

3	Assigned Patient Location	PL	80	Patient location information, in the form of "Department^ ^ Bed No."	Medicine^^B N1
20	Financial Class	FC	50	Payer, string, content not defined.	MedicalInsurance

### 3.5.5 OBR

The OBR (Observation Request) segment contains the test report information.

Message example:

OBR|1||TestSampleID1|00001^Automated

Count^99MRC||20101006084439|20101009091515|||Li||Cold|20101007084458|||HMM  
|||admin

See Table 14 for field definitions in use.

**Table 14 OBR Field Definitions**

No.	Field/delimit er Name	Data Type	Recomme nded Max Length	Description	Example
1	Set ID - OBR	SI	4	Serial No., used to identify different OBR segments in a message	1
2	Placer Order Number	EI	22	Used as sample ID in the worklist searching response messages (i.e. ORR^O02 messages).	
3	Filler Order Number +	EI	22	Used as sample ID in sample analysis result messages. Used as QC file No. in QC messages.	TestSampleID1
4	Universal Service ID	CE	200	Universal service ID, used to identify different types of analysis results. See Appendix C for its value definitions.	00001^Automated Count^99MRC
6	Requested Date/time	TS	26	Draw time. Used as the time when the blood sample is drawn.	20101006084439
7	Observation Date/Time #	TS	26	Time of analysis.	20101009091515
10	Collector Identifier *	XCN	60	Analysis orderer Here indicates the person who orders the analysis.	Li

13	Relevant Clinical Info.	ST	300	Relevant clinical information. Can be used as the clinical diagnostic information of patient information.	Cold
14	Specimen Received Date/Time *	TS	26	Time when the sample is received. Used as the time when the analysis is ordered.	20101007084458
15	Specimen Source *	CM	300	Source of the sample. Reserved field in DMU.	
22	Results Rpt/Status Chng - Date/Time +	TS	26	Result report/Status change - Tie. Used as the time of validation.	
24	Diagnostic Serv Sect ID	ID	10	Diagnosis maker ID; value: "HM" (means Hematology)	HM
28	Result Copies To	XCN	150	Copy the result to. Used as the person who validate the sample results.	
32	Principal Result Interpreter +	CM	200	Principal result interpreter. Used as the operator of the sample analysis in sample messages. Used as the operator of the QC count in QC messages.	admin

### 3.5.6 OBX

The OBX (Observation/Result) segment contains the parameter information of each test result. In a complete sample/QC/bidirectional request message, there may be more than one OBX segment. These OBX segments are different according to the content for transmission. See Table 19 in Appendix C for detailed definitions.

Message example:

OBX|8|NM|6690-2^WBC^LN||2.20|10\*9/L|4.00-10.00|L~A|||F

See Table 15 for field definitions in use.

**Table 15 OBX Field Definitions**

No.	Field/delimiter Name	Data Type	Recommended Max Length	Description	Example
1	Set ID - OBX	SI	10	Serial No., used to identify different OBX segments in a message.	8
2	Value Type	ID	3	Data type of the analysis result. Value: "ST", "NM", "ED", "IS"	NM

				", etc. See Appendix B for details.	
3	Observation Identifier	CE	590	<p>Sample type identifier.</p> <p>In the form of "ID^Name^EncodeSys", where ID is the identifier of the sample type; Name is the description of the item; EncodeSys is the coding system of the item.</p> <p>See the configuration files and Appendix C for the values of the codes for different items.</p> <p>Note: ID and EncodeSys are used to identify different analysis parameters, while Name is for description purpose rather than identification.</p>	6690-2^WBC^LN
5	Observation Value	*	65535	<p>Analysis result data, which can be numeric, string, enumeration value, binary data, etc. See Appendix C for detailed value definitions (Binary data like histogram or scattergram are converted to codes using the Base64 coding method. See Appendix D for the coding method).</p>	2.20
6	Units	CE	60	<p>Unit of sample types. Use the standard units defined in HL7. See Appendix C for units used in communication.</p>	10*9/L
7	References Range	ST	60	<p>Reference range of analysis results, in the form of "lower limit-higher limit", "&lt;upper limit" or "&gt;lower limit".</p>	4.00-10.00
8	Abnormal Flags	ID	5	<p>Analysis result flags. Value definitions:</p> <p>"N": normal</p> <p>"A": abnormal</p> <p>"H": higher than upper limit</p> <p>"L": lower than lower limit</p> <p>Note: The flag for normal or abnormal and that for high or low result may appear in this file</p>	L~A

				Id at the same time. In this case, the two types of flags are connected by a "~", e.g. "H~A"	
11	Observ Result Status	ID	1	Status of the analysis result. "F": final result.	F
13	User Defined Access Checks	ST	20	User-defined. For flags of reagent expiration or modification, etc. In the form of "Flag1~Flag2". There are 6 types of flags in all: O – reagent expiration E – result edited e – result calculated from result edited C – result corrected V – result out of linearity range T – temperature error	

### 3.5.7 ORC

The ORC (Common Order) segment contains the common information of order.

Message example:

ORC|RF||SampleID||BL

See Table 16 for field definitions.

**Table 16 ORC Field Definitions**

No.	Field/delimiter Name	Data Type	Recommended Max Length	Description	Example
1	Order Control	ID	2	Order control. In ORM message, the value is "RF", which means "re-fill order request" In ORR message, the value is "AF", which means "acknowledge order re-filling"	RF
2	Placer Order Number	EI	22	Code for order placer.	
3	Filler OrderNum	EI	22	Code for order receiver. In ORM or ORR message, the value is the sample ID.	SampleID
4	Placer group number	ST	22	Code fore order placer group Used for sample type here	BL BF

Note: for consistency and convenience, the sample IDs for both ORM message and for ORR message are put in Field 3. See the bi-directional LIS message examples (3.6.5 and 3.6.6 for details)

## 3.6 Complete Message Examples

The two message examples below shows the communication process of sample data

### 3.6.1 Sample Message

Remarks: The “Analyzer” OBX item is transmitted in integrated analyzer communication only.

#### 3.6.1.1 Blood sample

```
MSH|^~\&|BC-6800|Mindray|||20140909160725||ORU^R01|4|P|2.3.1|||||UNICODE<CR>
PID|1||patientID2001^^^MR||Jordan^Michael||20081229160009|Male<CR>
PV1|1||Internal medicine^^1002<CR>
OBR|1||40139349110|00001^Automated
Count^99MRC||20140705160009|20140805085635||Jack|||Virus
infections|20140716160009|||||HM|||||admin<CR>
OBX|1|IS|08001^Take Mode^99MRC||A|||||F<CR>
OBX|2|IS|08002^Blood Mode^99MRC||W|||||F<CR>
OBX|3|IS|08003^Test Mode^99MRC||CBC+DIFF|||||F<CR>
OBX|4|IS|01002^Ref Group^99MRC||Child|||||F<CR>
OBX|5|NM|30525-0^Age^LN||5|yr|||||F<CR>
OBX|6|ST|01001^Remark^99MRC||Emergency patient|||||F<CR>
OBX|7|IS|01006^Recheck flag^99MRC||T|||||F<CR>
OBX|8|ST|13000^ReviewRulesGroup^99MRC||31,32|||||F
OBX|9|ST|13001^ReviewRules^99MRC||([WBC]<5),([PLT]>0)|||||F
OBX|10|ST|13004^ReviewRulesGroupName^99MRC||RBC Agglutination or Cold Agglutination,
NRBC Present|||||F
OBX|8|IS|05007^Project Type^99MRC||BL|||||F<CR>
OBX|9|IS|01007^Sample Type^99MRC||Venous blood|||||F<CR>
OBX|10|IS|01008^Patient Area^99MRC||A - 501|||||F<CR>
OBX|11|ST|01012^Shelf No^99MRC||54|||||F<CR>
OBX|12|ST|01013^Tube No^99MRC||8|||||F<CR>
OBX|13|ST|01014^Report Time^99MRC||20140907160009|||||F<CR>
OBX|14|ST|09001^Analyzer^99MRC||2#|||||F<CR>
OBX|15|NM|6690-2^WBC^LN||15.22|10*9/L|4.00-12.00|H~A|||F<CR>
OBX|16|NM|704-7^BAS#^LN||0.06|10*9/L|0.00-0.10|A|||F<CR>
OBX|17|NM|706-2^BAS%^LN||0.4|%|0.0-1.0|A|||F<CR>
OBX|18|NM|751-8^NEU#^LN||11.66|10*9/L|2.00-8.00|H~A|||F<CR>
```



OBX|19|NM|770-8^NEU%^LN||76.6|50.0-70.0|H~A|||F<CR>  
 OBX|20|NM|711-2^EOS%^LN||0.02|10\*9/L|0.02-0.80|A|||F<CR>  
 OBX|21|NM|713-8^EOS%^LN||0.1|0.5-5.0|L~A|||F<CR>  
 OBX|22|NM|731-0^LYM%^LN||2.05|10\*9/L|0.80-7.00|A|||F<CR>  
 OBX|23|NM|736-9^LYM%^LN||13.5|20.0-60.0|L~A|||F<CR>  
 OBX|24|NM|742-7^MON%^LN||1.43|10\*9/L|0.12-1.20|H~A|||F<CR>  
 OBX|25|NM|5905-5^MON%^LN||9.4|3.0-12.0|A|||F<CR>  
 OBX|26|NM|789-8^RBC^LN||2.72|10\*12/L|3.50-5.20|L~N|||F<CR>  
 OBX|27|NM|718-7^HGB^LN||8.8|g/dL|12.0-16.0|L~A|||F<CR>  
 OBX|28|NM|787-2^MCV^LN||129.8|fL|80.0-100.0|H~N|||F<CR>  
 OBX|29|NM|785-6^MCH^LN||32.2|pg|27.0-34.0|A|||F<CR>  
 OBX|30|NM|786-4^MCHC^LN||24.8|g/dL|31.0-37.0|L~A|||F<CR>  
 OBX|31|NM|788-0^RDW-CV^LN||24.8|11.0-16.0|H~N|||F<CR>  
 OBX|32|NM|21000-5^RDW-SD^LN||116.4|fL|35.0-56.0|H~N|||F<CR>  
 OBX|33|NM|4544-3^HCT^LN||0.354|0.350-0.490|N|||F<CR>  
 OBX|34|NM|777-3^PLT^LN||55|10\*9/L|100-300|L~N|||F<CR>  
 OBX|35|NM|32623-1^MPV^LN||11.7|fL|6.5-12.0|N|||F<CR>  
 OBX|36|NM|32207-3^PDW^LN||17.2|15.0-17.0|H~N|||F<CR>  
 OBX|37|NM|10002^PCT^99MRC||0.064|0.108-0.282|L~N|||F<CR>  
 OBX|38|NM|10014^PLCR^99MRC||38.7|11.0-45.0|N|||F<CR>  
 OBX|39|NM|10013^PLCC^99MRC||21|10\*9/L|30-90|L~N|||F<CR>  
 OBX|40|NM|51584-1^IMG%^LN||0.49|10\*9/L|A|||F<CR>  
 OBX|41|NM|38518-7^IMG%^LN||3.2|A|||F<CR>  
 OBX|42|NM|10020^HFC#^99MRC||0.40|10\*9/L|A|||F<CR>  
 OBX|43|NM|10021^HFC%^99MRC||2.6|A|||F<CR>  
 OBX|44|NM|10022^PLT-I^99MRC||55|10\*9/L|N|||F<CR>  
 OBX|45|NM|10024^WBC-D^99MRC||14.73|10\*9/L|A|||F<CR>  
 OBX|46|NM|10025^WBC-B^99MRC||15.22|10\*9/L|A|||F<CR>  
 OBX|47|NM|10031^PDW-SD^99MRC||17.0|fL|N|||F<CR>  
 OBX|48|NM|10032^InR#^99MRC||0.01|10\*9/L|N|||F<CR>  
 OBX|49|NM|10033^InR%^99MRC||0.00|N|||F<CR>  
 OBX|50|NM|12227-5^WBC^LN||15.22|10\*9/L|4.00-12.00|H~A|||F<CR>  
 OBX|51|IS|12004^Neutrophilia^99MRC||T|||||F<CR>  
 OBX|52|IS|17790-7^WBC Left Shift?^LN||T|||||F<CR>  
 OBX|53|IS|34165-1^Imm Granulocytes?^LN||T|||||F<CR>  
 OBX|54|IS|15192-8^Atypical Lymphs?^LN||T|||||F<CR>  
 OBX|55|IS|15150-6^Anisocytosis^LN||T|||||F<CR>

OBX|56|IS|12075^Macrocytes^99MRC||T||||F<CR>  
 OBX|57|IS|12014^Anemia^99MRC||T||||F<CR>  
 OBX|58|IS|15180-3^Hypochromia^LN||T||||F<CR>  
 OBX|59|IS|12015^HGB Interfere^99MRC||T||||F<CR>  
 OBX|60|IS|12018^Thrombopenia^99MRC||T||||F<CR>  
 OBX|61|IS|12053^Abn Lympho/ Blasts^99MRC||T||||F<CR>  
 OBX|62|IS|12054^NRBC?^99MRC||T||||F<CR>  
 OBX|63|NM|15051^RBC Histogram. Left Line^99MRC||29||||F<CR>  
 OBX|64|NM|15052^RBC Histogram. Right Line^99MRC||250||||F<CR>  
 OBX|65|NM|15053^RBC Histogram. Binary Meta Length^99MRC||1||||F<CR>  
 OBX|66|NM|15057^RBC Histogram. Total^99MRC||51277||||F<CR>  
 OBX|67|NM|15111^PLT Histogram. Left Line^99MRC||3||||F<CR>  
 OBX|68|NM|15112^PLT Histogram. Right Line^99MRC||47||||F<CR>  
 OBX|69|NM|15113^PLT Histogram. Binary Meta Length^99MRC||1||||F<CR>  
 OBX|70|NM|15117^PLT Histogram. Total^99MRC||1004||||F<CR>  
 OBX|71|NM|15203^WBC DIFF Scattergram. Meta len^99MRC||1||||F<CR>  
 OBX|72|NM|15205^WBC DIFF Scattergram. Fsc dimension^99MRC||128||||F<CR>  
 OBX|73|NM|15206^WBC DIFF Scattergram. Ssc dimension^99MRC||128||||F<CR>  
 OBX|74|NM|15207^WBC DIFF Scattergram. FL dimension^99MRC||128||||F<CR>  
 OBX|75|NM|15208^WBC DIFF Scattergram. FSC-LOG dimension^99MRC||128||||F<CR>  
 OBX|76|NM|15253^Baso Scattergram. Meta Len^99MRC||1||||F<CR>  
 OBX|77|NM|15255^Baso Scattergram. Fsc dimension^99MRC||128||||F<CR>  
 OBX|78|NM|15256^Baso Scattergram. Ssc dimension^99MRC||128||||F<CR>  
 OBX|79|NM|15257^Baso Scattergram. FL dimension^99MRC||128||||F<CR>  
 OBX|80|NM|15258^Baso Scattergram. FSC-LOG dimension^99MRC||128||||F<CR>  
 OBX|81|NM|15307^RET Scattergram. Meta Len^99MRC||1||||F<CR>  
 OBX|82|NM|15303^RET Scattergram. Fsc dimension^99MRC||128||||F<CR>  
 OBX|83|NM|15304^RET Scattergram. Ssc dimension^99MRC||128||||F<CR>  
 OBX|84|NM|15305^RET Scattergram. FL dimension^99MRC||128||||F<CR>  
 OBX|85|NM|15308^RET Scattergram FSC-LOG dimension^99MRC||128||||F<CR>  
 OBX|86|NM|15355^NRBC Scattergram. Meta Len^99MRC||1||||F<CR>  
 OBX|87|NM|15351^NRBC Scattergram. Fsc dimension^99MRC||128||||F<CR>  
 OBX|88|NM|15352^NRBC Scattergram. Ssc dimension^99MRC||128||||F<CR>  
 OBX|89|NM|15353^NRBC Scattergram. FL dimension^99MRC||128||||F<CR>  
 OBX|90|NM|15356^NRBC Scattergram FSC-LOG dimension^99MRC||128||||F<CR>

### 3.6.1.2 Blood Sample Message with Graphics Data

MSH|^~\&|BC-6800|Mindray|||20140909195447||ORU^R01|2|P|2.3.1|||||UNICODE<CR>

PID|1||P00000003^^^MR<CR>  
 PV1|1<CR>  
 OBR|1||40162170410|00001^Automated  
 Count^99MRC|||20140905091449|||||||||HM|||||admin<CR>  
 OBX|1|IS|08003^Test Mode^99MRC||CBC+DIFF|||||F<CR>  
 OBX|2|IS|01002^Ref Group^99MRC||General|||||F<CR>  
 OBX|3|IS|01006^Recheck flag^99MRC||T|||||F<CR>  
 OBX|4|ST|13000^ReviewRulesGroup^99MRC||31,32|||||F  
 OBX|5|ST|13001^ReviewRules^99MRC||([WBC]<5),([PLT]>0)|||||F  
 OBX|6|ST|13004^ReviewRulesGroupName^99MRC||RBC Agglutination or Cold Agglutination,  
 NRBC Present|||||F  
 OBX|4|ST|01012^Shelf No^99MRC||78|||||F<CR>  
 OBX|5|ST|01013^Tube No^99MRC||3|||||F<CR>  
 OBX|6|ST|09001^Analyzer^99MRC||1#|||||F<CR>  
 OBX|7|NM|6690-2^WBC^LN||5.82|10\*9/L|4.00-10.00|A|||F<CR>  
 OBX|8|NM|704-7^BAS#^LN||0.04|10\*9/L|0.00-0.10|A|||F<CR>  
 OBX|9|NM|706-2^BAS%^LN||0.7|0.0-1.0|A|||F<CR>  
 OBX|10|NM|751-8^NEU#^LN||2.91|10\*9/L|2.00-7.00|A|||F<CR>  
 OBX|11|NM|770-8^NEU%^LN||50.0|50.0-70.0|A|||F<CR>  
 OBX|12|NM|711-2^EOS#^LN||0.14|10\*9/L|0.02-0.50|A|||F<CR>  
 OBX|13|NM|713-8^EOS%^LN||2.4|0.5-5.0|A|||F<CR>  
 OBX|14|NM|731-0^LYM#^LN||\*\*\*|10\*9/L|0.80-4.00|N|||F<CR>  
 OBX|15|NM|736-9^LYM%^LN||\*\*\*|20.0-40.0|N|||F<CR>  
 OBX|16|NM|742-7^MON#^LN||\*\*\*|10\*9/L|0.12-1.20|N|||F<CR>  
 OBX|17|NM|5905-5^MON%^LN||\*\*\*|3.0-12.0|N|||F<CR>  
 OBX|18|NM|789-8^RBC^LN||3.97|10\*12/L|3.50-5.50|N|||F<CR>  
 OBX|19|NM|718-7^HGB^LN||12.8|g/dL|11.0-16.0|N|||F<CR>  
 OBX|20|NM|787-2^MCV^LN||99.7|fL|80.0-100.0|N|||F<CR>  
 OBX|21|NM|785-6^MCH^LN||32.1|pg|27.0-34.0|N|||F<CR>  
 OBX|22|NM|786-4^MCHC^LN||32.2|g/dL|32.0-36.0|N|||F<CR>  
 OBX|23|NM|788-0^RDW-CV^LN||16.5|11.0-16.0|H~N|||F<CR>  
 OBX|24|NM|21000-5^RDW-SD^LN||61.3|fL|35.0-56.0|H~N|||F<CR>  
 OBX|25|NM|4544-3^HCT^LN||0.396|0.370-0.540|N|||F<CR>  
 OBX|26|NM|777-3^PLT^LN||120|10\*9/L|100-300|N|||F<CR>  
 OBX|27|NM|32623-1^MPV^LN||10.2|fL|6.5-12.0|N|||F<CR>  
 OBX|28|NM|32207-3^PDW^LN||16.5|15.0-17.0|N|||F<CR>  
 OBX|29|NM|10002^PCT^99MRC||0.123|0.108-0.282|N|||F<CR>  
 OBX|30|NM|10014^PLCR^99MRC||28.2|11.0-45.0|N|||F<CR>

[illegible]

AA=

=|||||F<CR>

OBX|58|IS|15014^ScattergramParaVer^99MRC||V1|||||F<CR>

OBX|59|ED|15015^ScattergramGraphicFlags^99MRC||^Application^Octer-stream^Base64^B  
AUI|||||F<CR>

OBX|60|NM|15203^WBC DIFF Scattergram. Meta len^99MRC||1|||||F<CR>

OBX|61|NM|15205^WBC DIFF Scattergram. Fsc dimension^99MRC||128|||||F<CR>

OBX|62|NM|15206^WBC DIFF Scattergram. Ssc dimension^99MRC||128|||||F<CR>

OBX|63|NM|15207^WBC DIFF Scattergram. FL dimension^99MRC||128|||||F<CR>

OBX|64|NM|15208^WBC DIFF Scattergram. FSC-LOG dimension^99MRC||128|||||F<CR>

OBX|65|ED|15201^WBC DIFF Scattergram.  
BIN^99MRC||^Application^Octer-stream^Base64^Uk8rAAc7QzcABT9JMAAFOT4pAARHUB0  
ABzMwQwAESV0jAAdBQBYABzE1OwAELjAvAAQ1UxgABzQ4MAAEP0M9AAVQTiMABzA1  
QgAEKDsXAAQiMxMAAx5DDgADPFooAAc1Qw0AB0IQKgAHNFYRAAc3ODoABDpYIAAHM  
TUxAARXaxoABIE0DQADJkcKAANLXCyABzMzNAAEIC0KAANAVR0AB0JXOAAJRkkgAAd  
FWygABzM1PQAEMzRIAARMXycABx8yDgADMTY6AARAPxQAByl2DAADMjg8AARCXScA  
B0dSlgAHPUYtAAVEWSoABxwxCwADOD0zAAQyNTkABEpaKQAHRVYiAAcINAwAAx00CQ  
ADPUY6AAUdLQYAAzY/OwAFNkwZAAcyMzoABCwwQAAEMTU1AAQ3REABTg6MAAEUI  
UmAAC3QEoABS4yNAAELDsBAQ6RDcABSd5BQADMjc0AAQcLAsAAzFODwAHHCwJAA  
MeOgcAA0JQNgaJlZ0JAAMjPxUAAz9MlwAHTVwIAAdGVh0AB1dyHAAGLjhAAAQ7UywABz  
1aHwAHQk0tAAceMAwAA010cAAJOjwpAAREWiwABztQJgAHPeM1AAUvSg8AA05ZSQAJJ  
kQPAAMfRg4AAzdFQwAFIjMPAAMuMDwABDxCpAAFTIYoAAdFWiMABzQ6MQAEHC0MAA  
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AAy00FwAERVUIAAceNw0AA0NZIAAHMzMxAAQuNDcABDA5NwAERVwbAAccMQoAAytK  
BwADNjsvAAQfTxcAAyRFBAAODOUQ6AAUzOGwACCAuDgADMDs6AAREWh8ABzU+LgAE  
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AAcvO0QABEFBOAAFRF4IAAccMQsAAzI5NwAEMDk4AAQ0NS4ABCw8HgAEPkQwAAVPV  
E0ACTpQlWAhSV8kAAcxMikABCMxDQADN1kiAAciLg0AAyJcFAADXXQgAAY7Q0YABUBN  
HwAHKjEUAAQyNTUABD1ZHAHOkM6AAVHXSGABz45LwAEMzUuAAQdMQwAA152HAA  
GHigJAAMeJQYAAyApDAADQUVBAAU/RksABT9FNwAFMz1PAAUwOEKABBwtCQADP1ZF  
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QUgABTE2OAAEHTkOAAAMoMBIAAzEzMQAELz45AAQcKgkAAyFACQADOjsyAAQrMBMA  
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ABVJQIQAHMzg1AAQ0MykABDk8MAAEMjc8AARGUyAABzU4NAAEMDg8AAQ5VR0ABz5  
TJAAHQE8gAAcrQRUABztLMQAFODYxAAQzVBoABYEvDwADMD02AARWbh4ABjtMJQAH  
S2AkAAcIMg0AA191GwAGli0OAAAM8WxYABzI3MAAEHzcOAAmzOi8ABERPIgAHL0cRAAdL  
V1kACURblgAHQ10aAAdivIQABzI0NQAENDYqAAQdLAoAA0FShAAHM1sXAAc1NTQABC  
81MQAEPIcYAAcJMqoAAzxLHwAHJSgMAAMcNqsAAyAoDAADHzIOAAmkQQgAA0ddIQAH

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MUh8ABYAxDgADikgLAAM9VRkAB0FaNwAJp0E9AAVcdh4ABkJVHwAHS1kiAAdCWSIABz  
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gADQVs1AAkzNj4ABDc6VwAFPVQbAAAccPggAAzA0OwAET1UfAAc8QUEABURWFwAHOE  
UyAAU4QUAABURGIQAHr1ofAAdLVzwACSEtEAADRlgiAAc7RzkABTE0OgAERFYeAAc9O  
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5NQAeHjQKAAMdLwMAAyEyDQADHDQJAAMxNjoABFpxHwAGKUEmAAQxNTkABCPdHw  
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y4ABCQsDQADJTITAAMxP0QABUtpKAAHQ14fAAdDWSMABzVXFgAHPURDAAVARD4AB  
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IDMNAAMzaAYAAzNBBAADHS0LAANIXC4AB0BFOQAFJkEWAAdBRD4ABTMuJAAETFOe  
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NUIABDhCRAAFITMPAAM2OR4ABBwoCwADPEdAAAu4SxkABYqYdGADNTotAARDWCgA  
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ImAAQzND0ABEJXGwAHNzgeAAQyNBsABERPIgAHRFolAAc0MykABE1VKwAHNDMoAAQ  
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QVEcAAdMXDAABYfJCQADOMENAAMzNi8ABB4sCwADNDUIAAQmOxMAAx8sCQADPEg  
2AAUhLwwAAzI5KAAEPU81AAk0QjwABTI1LQAEMjYrAARQUy4ABzA4PwAERIMjAAdBWx  
wABzU4LgAEQ1cfAAczNyMABEtmIgAHLzk1AAQ6WRsABzBTMgAJJDsUAAM9XR4AB0dUI  
wAHHS4LAANBWYQABzM3PAAEVFVIAAk3RjsABSyzEgADKjQUAARVWswAB0pZJwAHH  
C4LAAMvMjoABDc4LgAEIC8LAAM3NxsABDxFPAAFNTU2AARDVYQABYwxGAAEHDAHAA  
NDVEYACT9OXwAJHToMAAMcKAoAAzdcGgAHMzE5AAQUMzQABDQ7NwAEHC8LAAM1  
OD8ABD1COwAFNUAbAAQeMw4AAx0uCQADMzA0AARGWicABz1OGAAHNDs9AAQRouY  
ABDMxMwAEUloqAAcrPRoABDM4NgAEIjAPAAMqNkQABB0uDQADPlcfAAc5W h0ABzIfNg  
AF00dDAAVGWioAB0NGKQAHQE6AAUwNUUABCC0FAADLzc3AARGWylABzI1PAAEQE  
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U3WTEACTI5NgAENT8gAAQ0Mz4ABC84NQAEEVWwdAAYwTw8AB0ZaJAAHQEKzAAU4W  
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LgoAA0IZJwAHIDQQAAM3Oi4ABC47NwAEHTcHAAMwNzAABDI2MwAEO0Y2AAVHTIMABY  
9RDwADQ1AZAAc5RCEABYRXFQADIE8XAANCWh0AB0FLJwAHNDc2AARYdh8ABjtFOQA  
FKD0VAAQdLQkAAzMwNQAEMjdCAAQ8Ty4ABYyZEqADNT0oAARMSyIABY5zBQADITwK  
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yYrEAADID8JAAMyMkEABDIDRAAFNjUqAAQyMy4ABDEyNQAElzALAAM5ShUABzU6KwA  
EMVgmAAcfLwwAA0ZW0AAJICKNAAMdLwoAA0ZfGgAHHS0KAAMuWRYABzo2JgAEWnla  
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00ZAAcjMw4AAxwxCQADMC43AAQhMQ0AAzpMNgAFRIshAAc9SzYABSAzDgADMTI2AAQ  
gPiIABEthTwAJNjQuAAQyNjYABDPFQgAFOEY7AAUILhMAAzM0LQAEHjwLAANJXi0AB0ha  
JwAHWXYAAy4OSMABDE0OQAENIUyAAAdAUSYAB1tvHgAGLFoGAANXcBoABjM4LwAE  
Mi8uAAQ8Q0MABSxWFW

.....

304^RET Scattergram. Ssc dimension^99MRC||128|||||F<CR>  
OBX|75|NM|15305^RET Scattergram. FL dimension^99MRC||128|||||F<CR>  
OBX|76|NM|15308^RET Scattergram FSC-LOG dimension^99MRC||128|||||F<CR>  
OBX|77|NM|15355^NRBC Scattergram. Meta Len^99MRC||1|||||F<CR>  
OBX|78|NM|15351^NRBC Scattergram. Fsc dimension^99MRC||128|||||F<CR>  
OBX|79|NM|15352^NRBC Scattergram. Ssc dimension^99MRC||128|||||F<CR>  
OBX|80|NM|15353^NRBC Scattergram. FL dimension^99MRC||128|||||F<CR>  
OBX|81|NM|15356^NRBC Scattergram FSC-LOG dimension^99MRC||128|||||F<CR>

### 3.6.1.3 Body Fluid Sample

MSH|^~\&|BC-6800|Mindray|||20140910100530||ORU^R01|1|P|2.3.1|||||UNICODE<CR>  
PID|1||^MR<CR>  
PV1|1<CR>  
OBR|1||0815-13|00001^Automated  
Count^99MRC|||20140815141621|||||||||HM|||||service<CR>  
OBX|1|IS|08003^Test Mode^99MRC||CBC+DIFF|||||F<CR>  
OBX|2|IS|01002^Ref Group^99MRC||General|||||F<CR>  
OBX|3|ST|09001^Analyzer^99MRC||x1|||||F<CR>  
OBX|4|NM|57845-0^WBC-BF^LN||0.000|10\*9/L||N||F<CR>  
OBX|5|NM|23860-0^RBC-BF^LN||0.000|10\*12/L||N||F<CR>  
OBX|6|NM|26490-3^MN#^LN||\*\*\*|10\*9/L||N||F<CR>  
OBX|7|NM|26493-7^MN%^LN||\*\*\*|N||F<CR>  
OBX|8|NM|10034^PMN#^99MRC||\*\*\*|10\*9/L||N||F<CR>  
OBX|9|NM|10035^PMN%^99MRC||\*\*\*|N||F<CR>

OBX|10|NM|10036^TC-BF#^99MRC||0.000|10\*9/L||N||F<CR>  
 OBX|11|NM|35063-7^Eos-BF#^LN||\*\*\*\*|10\*9/L||N||F<CR>  
 OBX|12|NM|26452-3^Eos-BF%^LN||\*\*\*\*|%||N||F<CR>  
 OBX|13|NM|10037^HF-BF#^99MRC||\*\*\*\*|10\*9/L||N||F<CR>  
 OBX|14|NM|10038^HF-BF%^99MRC||\*\*\*\*|%||N||F<CR>  
 OBX|15|NM|10039^RBC-BF-R^99MRC||0.0000|10\*12/L||N||F<CR>  
 OBX|16|NM|10044^Neu-BF#^99MRC||\*\*\*\*|10\*9/L||N||F<CR>  
 OBX|17|NM|10045^Neu-BF%^99MRC||\*\*\*\*|%||N||F<CR>  
 OBX|18|NM|15051^RBC Histogram. Left Line^99MRC||10|||||F<CR>  
 OBX|19|NM|15052^RBC Histogram. Right Line^99MRC||250|||||F<CR>  
 OBX|20|NM|15053^RBC Histogram. Binary Meta Length^99MRC||1|||||F<CR>  
 OBX|21|NM|15057^RBC Histogram. Total^99MRC||0|||||F<CR>  
 OBX|22|NM|15111^PLT Histogram. Left Line^99MRC||3|||||F<CR>  
 OBX|23|NM|15112^PLT Histogram. Right Line^99MRC||39|||||F<CR>  
 OBX|24|NM|15113^PLT Histogram. Binary Meta Length^99MRC||1|||||F<CR>  
 OBX|25|NM|15117^PLT Histogram. Total^99MRC||21|||||F<CR>  
 OBX|26|NM|15203^WBC DIFF Scattergram. Meta len^99MRC||1|||||F<CR>  
 OBX|27|NM|15205^WBC DIFF Scattergram. Fsc dimension^99MRC||128|||||F<CR>  
 OBX|28|NM|15206^WBC DIFF Scattergram. Ssc dimension^99MRC||128|||||F<CR>  
 OBX|29|NM|15207^WBC DIFF Scattergram. FL dimension^99MRC||128|||||F<CR>  
 OBX|30|NM|15208^WBC DIFF Scattergram. FSC-LOG dimension^99MRC||128|||||F<CR>  
 OBX|31|NM|15253^Baso Scattergram. Meta Len^99MRC||1|||||F<CR>  
 OBX|32|NM|15255^Baso Scattergram. Fsc dimension^99MRC||128|||||F<CR>  
 OBX|33|NM|15256^Baso Scattergram. Ssc dimension^99MRC||128|||||F<CR>  
 OBX|34|NM|15257^Baso Scattergram. FL dimension^99MRC||128|||||F<CR>  
 OBX|35|NM|15258^Baso Scattergram. FSC-LOG dimension^99MRC||128|||||F<CR>  
 OBX|36|NM|15307^RET Scattergram. Meta Len^99MRC||1|||||F<CR>  
 OBX|37|NM|15303^RET Scattergram. Fsc dimension^99MRC||128|||||F<CR>  
 OBX|38|NM|15304^RET Scattergram. Ssc dimension^99MRC||128|||||F<CR>  
 OBX|39|NM|15305^RET Scattergram. FL dimension^99MRC||128|||||F<CR>  
 OBX|40|NM|15308^RET Scattergram FSC-LOG dimension^99MRC||128|||||F<CR>  
 OBX|41|NM|15355^NRBC Scattergram. Meta Len^99MRC||1|||||F<CR>  
 OBX|42|NM|15351^NRBC Scattergram. Fsc dimension^99MRC||128|||||F<CR>  
 OBX|43|NM|15352^NRBC Scattergram. Ssc dimension^99MRC||128|||||F<CR>  
 OBX|44|NM|15353^NRBC Scattergram. FL dimension^99MRC||128|||||F<CR>  
 OBX|45|NM|15356^NRBC Scattergram FSC-LOG dimension^99MRC||128|||||F<CR>



### 3.6.2 Sample Response Message

In synchronous communication of DMU, each analysis result message need a response message which contains two segments: MSH and MSA. To send a correct response message, take into consideration that: the MSH-9 field should be ACK^R01 which indicates that it is a sample response message; If the value in the MSA-2 field is the same with the MSH-10 value of the received analysis result, it indicates that this response message is corresponding to the sent analysis result. The MSA-2 value in the following example is 1

```
MSH|^~\&|BC-6800|Mindray|||20140909160728||ACK^R01|5|P|2.3.1|||||UNICODE<CR>
MSA|AA|4<CR>
```

### 3.6.3 QC Message

The content of the QC message differs from the sample analysis result message: the MSH-11 value of the QC message is Q which indicates that it is a QC message; each QC message is corresponding to one QC point in the DMU software which may contain several analysis results. For example, there is one analysis result in an L-J QC message, while there are two analysis results and one mean calculation result in an X mean R QC message.

A QC message consists of an MSH message header and several analysis results, each of which begins with the PID and OBR segments which contain sample information, and followed by several OBX segments to carry parameter results and other information. The OBR-4 field of each analysis result indicates the type of the result See Appendix C for details.

An example of the L-J QC message is shown as follows:

```
MSH|^~\&|BC-6800|Mindray|||20140909162050||ORU^R01|3|Q|2.3.1|||||UNICODE<CR>
PID|1||MB034H|||20141111000000<CR>
OBR|1||1|00003^LJ QCR^99MRC|||20140827193211|||||HM|||||admin<CR>
OBX|1|IS|05001^Qc Level^99MRC||H|||||F<CR>
OBX|2|IS|08001^Take Mode^99MRC||A|||||F<CR>
OBX|3|IS|08002^Blood Mode^99MRC||W|||||F<CR>
OBX|4|IS|08003^Test Mode^99MRC||CBC+DIFF|||||F<CR>
OBX|5|ST|09001^Analyzer^99MRC||1#|||||F<CR>
OBX|6|NM|6690-2^WBC^LN||20.01|10*9/L|16.44-21.44|N|||F<CR>
OBX|7|NM|704-7^BAS#^LN||0.51|10*9/L|0.22-0.80|N|||F<CR>
OBX|8|NM|706-2^BAS%^LN||2.6|1.2-4.2|N|||F<CR>
OBX|9|NM|751-8^NEU#^LN||13.52|10*9/L|10.71-14.71|N|||F<CR>
OBX|10|NM|770-8^NEU%^LN||67.6|57.1-77.1|N|||F<CR>
OBX|11|NM|711-2^EOS#^LN||1.89|10*9/L|0.50-2.90|N|||F<CR>
OBX|12|NM|713-8^EOS%^LN||9.4|3.0-15.0|N|||F<CR>
OBX|13|NM|731-0^LYM#^LN||3.70|10*9/L|2.00-5.20|N|||F<CR>
OBX|14|NM|736-9^LYM%^LN||18.5|11.0-27.0|N|||F<CR>
```

OBX|15|NM|742-7^MON#^LN||0.39|10\*9/L|0.00-1.22|N|||F<CR>  
 OBX|16|NM|5905-5^MON%^LN||1.9|%|0.0-5.7|N|||F<CR>  
 OBX|17|NM|789-8^RBC^LN||5.67|10\*12/L|5.57-6.17|N|||F<CR>  
 OBX|18|NM|718-7^HGB^LN||17.5|g/dL|17.2-18.8|N|||F<CR>  
 OBX|19|NM|787-2^MCV^LN||107.6|fL|93.2-103.2|H~N|||F<CR>  
 OBX|20|NM|785-6^MCH^LN||30.8|pg|28.2-33.2|N|||F<CR>  
 OBX|21|NM|786-4^MCHC^LN||28.6|g/dL|28.2-34.2|N|||F<CR>  
 OBX|22|NM|788-0^RDW-CV^LN||15.9|%|8.7-20.7|N|||F<CR>  
 OBX|23|NM|21000-5^RDW-SD^LN||62.8|fL|39.2-63.2|N|||F<CR>  
 OBX|24|NM|4544-3^HCT^LN||0.611||0.546-0.606|H~N|||F<CR>  
 OBX|25|NM|777-3^PLT^LN||434|10\*9/L|415-545|N|||F<CR>  
 OBX|26|NM|32623-1^MPV^LN||10.8|fL|8.3-14.3|N|||F<CR>  
 OBX|27|NM|32207-3^PDW^LN||16.5||11.5-21.5|N|||F<CR>  
 OBX|28|NM|10002^PCT^99MRC||0.471|%|0.342-0.742|N|||F<CR>  
 OBX|29|NM|10014^PLCR^99MRC||32.9|%|26.3-46.3|N|||F<CR>  
 OBX|30|NM|10013^PLCC^99MRC||143|10\*9/L|124-224|N|||F<CR>  
 OBX|31|NM|51584-1^IMG#^LN||0.56|10\*9/L|N|||F<CR>  
 OBX|32|NM|38518-7^IMG%^LN||2.8|%|N|||F<CR>  
 OBX|33|NM|10020^HFC#^99MRC||0.00|10\*9/L|N|||F<CR>  
 OBX|34|NM|10021^HFC%^99MRC||0.0|%|N|||F<CR>  
 OBX|35|NM|10022^PLT-I^99MRC||434|10\*9/L|N|||F<CR>  
 OBX|36|NM|10024^WBC-D^99MRC||20.02|10\*9/L|N|||F<CR>  
 OBX|37|NM|10025^WBC-B^99MRC||20.01|10\*9/L|N|||F<CR>  
 OBX|38|NM|10031^PDW-SD^99MRC||14.3|fL|N|||F<CR>  
 OBX|39|NM|10032^InR#^99MRC||0.00|10\*9/L|N|||F<CR>  
 OBX|40|NM|10033^InR%^99MRC||0.00|%|N|||F<CR>  
 OBX|41|NM|12227-5^WBC^LN||20.01|10\*9/L|16.44-21.44|N|||F<CR>  
 <EB><CR>Remarks:

### 3.6.4 QC Response Message

The only difference between the QC response message and the sample analysis result response message is that the MSH-11 value of the QC response message is Q.

An example of the ACK X-R QC message is shown as follows:

MSH|^~\&|BC-6800|Mindray|||20140909162050||ACK^R01|9|Q|2.3.1|||||UNICODE<CR>  
 MSA|AA|1<CR>

### 3.6.5 LJ QC Message in the Format of Common Samples

LJ QC sample messages can be communicated in the format of common samples (set up in Setup>Communication>L-J QC result is communicated in the format of blood sample result of DMU). See 3.6.1 for the format. An example is shown as follows:

```
MSH|^~\&|BC-6800|Mindray|||20140909162225||ORU^R01|1|P|2.3.1|||||UNICODE<CR>
PID|1||^MR<CR>
PV1|1<CR>
OBR|1||1MB999|00001^Automated
Count^99MRC|||20140820160916|||||||||HM|||||admin<CR>
OBX|1|IS|08001^Take Mode^99MRC||A|||||F<CR>
OBX|2|IS|08002^Blood Mode^99MRC||W|||||F<CR>
OBX|3|IS|08003^Test Mode^99MRC||CBC+DIFF|||||F<CR>
OBX|4|IS|01002^Ref Group^99MRC||General|||||F<CR>
OBX|5|IS|05007^Project Type^99MRC||BL|||||F<CR>
OBX|6|ST|01012^Shelf No^99MRC||??|||||F<CR>
OBX|7|ST|01013^Tube No^99MRC||0|||||F<CR>
OBX|8|ST|09001^Analyzer^99MRC||1#|||||F<CR>
OBX|9|NM|6690-2^WBC^LN||19.40|10*9/L|16.44-21.44|N|||F<CR>
OBX|10|NM|704-7^BAS#^LN||0.48|10*9/L|0.22-0.80|N|||F<CR>
OBX|11|NM|706-2^BAS%^LN||2.5|1.2-4.2|N|||F<CR>
OBX|12|NM|751-8^NEU#^LN||13.16|10*9/L|10.71-14.71|N|||F<CR>
OBX|13|NM|770-8^NEU%^LN||67.7|57.1-77.1|N|||F<CR>
OBX|14|NM|711-2^EOS#^LN||1.79|10*9/L|0.50-2.90|N|||F<CR>
OBX|15|NM|713-8^EOS%^LN||9.3|3.0-15.0|N|||F<CR>
OBX|16|NM|731-0^LYM#^LN||3.50|10*9/L|2.00-5.20|N|||F<CR>
OBX|17|NM|736-9^LYM%^LN||18.1|11.0-27.0|N|||F<CR>
OBX|18|NM|742-7^MON#^LN||0.47|10*9/L|0.00-1.22|N|||F<CR>
OBX|19|NM|5905-5^MON%^LN||2.4|0.0-5.7|N|||F<CR>
OBX|20|NM|789-8^RBC^LN||5.61|10*12/L|5.57-6.17|N|||F<CR>
OBX|21|NM|718-7^HGB^LN||17.7|g/dL|17.2-18.8|N|||F<CR>
OBX|22|NM|787-2^MCV^LN||106.9|fL|93.2-103.2|H~N|||F<CR>
OBX|23|NM|785-6^MCH^LN||31.6|pg|28.2-33.2|N|||F<CR>
OBX|24|NM|786-4^MCHC^LN||29.6|g/dL|28.2-34.2|N|||F<CR>
OBX|25|NM|788-0^RDW-CV^LN||15.9|15.7-20.7|N|||F<CR>
OBX|26|NM|21000-5^RDW-SD^LN||62.3|fL|39.2-63.2|N|||F<CR>
OBX|27|NM|4544-3^HCT^LN||0.600|0.546-0.606|N|||F<CR>
OBX|28|NM|777-3^PLT^LN||422|10*9/L|415-545|N|||F<CR>
```

OBX|29|NM|32623-1^MPV^LN||10.7|fL|8.3-14.3|N|||F<CR>  
 OBX|30|NM|32207-3^PDW^LN||16.5||11.5-21.5|N|||F<CR>  
 OBX|31|NM|10002^PCT^99MRC||0.454|%|0.342-0.742|N|||F<CR>  
 OBX|32|NM|10014^PLCR^99MRC||32.5|%|26.3-46.3|N|||F<CR>  
 OBX|33|NM|10013^PLCC^99MRC||137|10\*9/L|124-224|N|||F<CR>  
 OBX|34|NM|51584-1^IMG#^LN||0.52|10\*9/L|N|||F<CR>  
 OBX|35|NM|38518-7^IMG%^LN||2.7|%|N|||F<CR>  
 OBX|36|NM|10020^HFC#^99MRC||0.00|10\*9/L|N|||F<CR>  
 OBX|37|NM|10021^HFC%^99MRC||0.0|%|N|||F<CR>  
 OBX|38|NM|10022^PLT-I^99MRC||422|10\*9/L|N|||F<CR>  
 OBX|39|NM|10024^WBC-D^99MRC||19.90|10\*9/L|N|||F<CR>  
 OBX|40|NM|10025^WBC-B^99MRC||19.40|10\*9/L|N|||F<CR>  
 OBX|41|NM|10031^PDW-SD^99MRC||14.0|fL|N|||F<CR>  
 OBX|42|NM|10032^InR#^99MRC||0.00|10\*9/L|N|||F<CR>  
 OBX|43|NM|10033^InR%^99MRC||0.00|‰|N|||F<CR>  
 OBX|44|NM|12227-5^WBC^LN||19.40|10\*9/L|16.44-21.44|N|||F<CR>  
 OBX|45|NM|15051^RBC Histogram. Left Line^99MRC||0|||||F<CR>  
 OBX|46|NM|15052^RBC Histogram. Right Line^99MRC||0|||||F<CR>  
 OBX|47|NM|15053^RBC Histogram. Binary Meta Length^99MRC||1|||||F<CR>  
 OBX|48|NM|15057^RBC Histogram. Total^99MRC||0|||||F<CR>  
 OBX|49|NM|15111^PLT Histogram. Left Line^99MRC||0|||||F<CR>  
 OBX|50|NM|15112^PLT Histogram. Right Line^99MRC||0|||||F<CR>  
 OBX|51|NM|15113^PLT Histogram. Binary Meta Length^99MRC||1|||||F<CR>  
 OBX|52|NM|15117^PLT Histogram. Total^99MRC||0|||||F<CR>  
 OBX|53|NM|15203^WBC DIFF Scattergram. Meta len^99MRC||1|||||F<CR>  
 OBX|54|NM|15205^WBC DIFF Scattergram. Fsc dimension^99MRC||0|||||F<CR>  
 OBX|55|NM|15206^WBC DIFF Scattergram. Ssc dimension^99MRC||0|||||F<CR>  
 OBX|56|NM|15207^WBC DIFF Scattergram. FL dimension^99MRC||0|||||F<CR>  
 OBX|57|NM|15208^WBC DIFF Scattergram. FSC-LOG dimension^99MRC||0|||||F<CR>  
 OBX|58|NM|15253^Baso Scattergram. Meta Len^99MRC||1|||||F<CR>  
 OBX|59|NM|15255^Baso Scattergram. Fsc dimension^99MRC||0|||||F<CR>  
 OBX|60|NM|15256^Baso Scattergram. Ssc dimension^99MRC||0|||||F<CR>  
 OBX|61|NM|15257^Baso Scattergram. FL dimension^99MRC||0|||||F<CR>  
 OBX|62|NM|15258^Baso Scattergram. FSC-LOG dimension^99MRC||0|||||F<CR>  
 OBX|63|NM|15307^RET Scattergram. Meta Len^99MRC||1|||||F<CR>  
 OBX|64|NM|15303^RET Scattergram. Fsc dimension^99MRC||0|||||F<CR>  
 OBX|65|NM|15304^RET Scattergram. Ssc dimension^99MRC||0|||||F<CR>

OBX|66|NM|15305^RET Scattergram. FL dimension^99MRC||0|||||F<CR>  
 OBX|67|NM|15308^RET Scattergram FSC-LOG dimension^99MRC||0|||||F<CR>  
 OBX|68|NM|15355^NRBC Scattergram. Meta Len^99MRC||1|||||F<CR>  
 OBX|69|NM|15351^NRBC Scattergram. Fsc dimension^99MRC||0|||||F<CR>  
 OBX|70|NM|15352^NRBC Scattergram. Ssc dimension^99MRC||0|||||F<CR>  
 OBX|71|NM|15353^NRBC Scattergram. FL dimension^99MRC||0|||||F<CR>  
 OBX|72|NM|15356^NRBC Scattergram FSC-LOG dimension^99MRC||0|||||F<CR>

Remarks: As the sample ID field, For both an integrated or standalone analyzer, the OBR-3 field has a value which is the QC sample transmission ID.

The “Analyzer” OBX item is only applicable to integrated analyzers.

### 3.6.6 Bidirectional LIS/HIS Request Message

A bidirectional LIS/HIS request message contains a sample ID. After the LIS/HIS received the request message, it will search for the corresponding patient and sample information to provide a response.

A request response message contains two segments: MSH and ORC. The MSH segment is almost the same with that of the analysis result message, except that the MSH-9 value is ORM^O01. The ORC-3 field should be filled with the receiver code (in this case, the sample ID; where in the following sample, it is SampleID1). Note that in the autoloading analysis, if there is a barcode scanning error while sending a request message, the sample ID will be “Invalid”.

An example of the request message is shown as follows:

For V1.0 and V2.0 searching request messages, sample ID is used as the filter for searching  
 MSH|^~\&|BC-6800|Mindray|||20081120174836||ORM^O01|4|P|2.3.1|||||UNICODE  
 ORC|RF||SampleID1

For V3.0 searching request messages or above, the combination of sample ID+sample type is used as the filter for searching

MSH|^~\&|BC-6800|Mindray|||20140328102554||ORM^O01|2|P|2.3.1|||||UNICODE  
 ORC|RF||sampleid99|BL

See sections above for the fields of MSH and ORC segments.

### 3.6.7 Bidirectional LIS/HIS Request Response Message

When the LIS/HIS received a request message, it needs to send back a request response message. The first two message segments of the request response message are MSH and MSA. The MSH-9 message type field (indicating the type of the segment) is filled with ORR^O02, while the MSA segment should be filled up as shown in the following example of the request response message. If the LIS/HIS gets searching results for the request, there will be PID, PV1, ORC, OBR and OBX message segments after the two heading segments to

provide the patient and sample information, in the same way as the sample data message does. The ORC segment is indispensable for a request response message with searching results, in which the ORC-1 value is AF, and ORC-2 is the key searching field(the sample ID). Note that the OBR-2 field indicates the sample ID, which should be the same as in the ORC-2 field; otherwise, the message will be regarded as incorrect.

An example of the request response message with searching results is shown as follows:

```
MSH|^~\&|BC-6800|Mindray|||20140909170111||ORR^O02||P|2.3.1|||||UNICODE<CR>
MSA|AA|1<CR>
PID|1||patientID2001^MR||Jordan^Michael||20090210000000|Male<CR>
PV1|1|Outpatient|Internal medicine^^1002||||||||||Public<CR>
ORC|AF||SampleID4001<CR>
OBR|1|SampleID4001||00001^Automated Count^99MRC||20090307103000||||Jack||Virus
infections|20090307103100|||||||HM|||||||Bill<CR>
OBX|1|IS|08003^Test Mode^99MRC||CBC+DIFF|||||F<CR>
OBX|2|IS|01002^Ref Group^99MRC||Child|||||F<CR>
OBX|3|NM|30525-0^Age^LN||6|yr|||||F<CR>
OBX|4|ST|01001^Remark^99MRC||Emergency patient|||||F<CR>
OBX|5|ST|08005^SerialNumber^99MRC||3|||||F<CR>
OBX|6|IS|01007^Sample Type^99MRC||Venous blood|||||F<CR>
OBX|7|IS|01008^Patient Area^99MRC||A - 501|||||F<CR>
OBX|8|ST|01009^Custom patient info 1^99MRC||Nothing|||||F<CR>
OBX|9|ST|01010^Custom patient info 2^99MRC||Nothing|||||F<CR>
OBX|10|ST|01011^Custom patient info 3^99MRC||Nothing|||||F<CR>
```

<EB><CR>Note: when the “ProjectType” item in the response message is consistent with the “ProjectType” item in the request message, this item (including “BL/BF” of ORC and “ProjectType” of OBX) can be excluded in the response message. If not, transmit the “ProjectType” item as requested.

The OBX items “BloodMode” and “Take Mode” are not mandatory in the response. If they are not included in the response message, the instrument analyzes the sample in the mode defined in the “Setup” screen of the main unit. If it is included in the response message, the instrument analyzes the sample in the responded mode. If the “ProjectType” corresponding to this “BloodMode” in the response and the request are not the same. It is required to transmit the “ProjectType” item in the response message. The OBX item “Test Mode” is mandatory in the response.

The OBX item “SerialNumber” is the serial number in LIS, which is only applicable to integrated analyzers.

An example of the request response message with no search result is shown as follows, in which the MSA-2 field indicates the result of the response. In this example, the MSA-2 value is “AR”, indicating the request was rejected; if it is “AE”, then there is an error in the request

process.

MSH|^~\&|BC-6800|Mindray|||20140328102737||ORR^O02||P|2.3.1|||||UNICODE  
MSA|AR|3

# Chapter 4 ASTM Communication Protocol

## 4.1 ASTM Protocol Overview

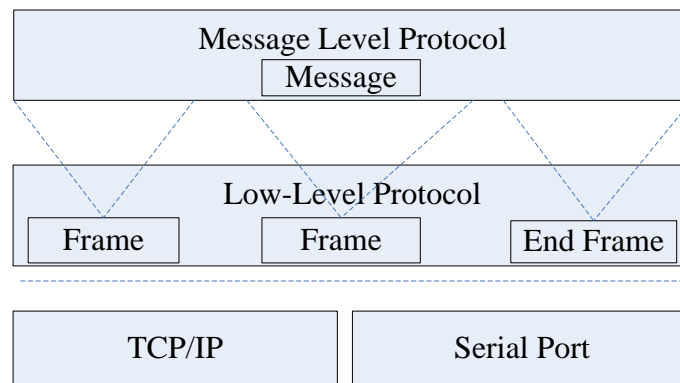
See the ASTM protocol documents for details of the protocol:

NCCLS LIS1-A (formerly ASTM 1381-02): Data Link Protocol

NCCLS LIS2-A (formerly ASTM 1394-97): Message Structure Protocol

Note: the characters used in ASTM protocol are standard ASCII characters (ISO 8859-1: 1987) unless there is a note for exception.

## 4.2 Protocol Layers



**Figure 12 Layers of the ASTM protocol**

Message: A complete data package is called message. It is a set of information, which can be a sample analysis result, QC result or request information. Message is the unit of a call for communication.

Frame: the component of a message which is the unit of communication control and communication error identification.

The ASTM communication protocol is a protocol based on TCP/IP protocol and serial port communication control. ASTM protocol has two layers: the low-level protocol for message transmission, and message level protocol between DMU and LIS/HIS.

## 4.3 Frame Structure

All the frame control characters are ASCII characters which shall not be contained in the text part of the frame. As required by the protocol, the maximal data length of a frame is 64,000 bytes (including the control character).

### 4.3.1 Frame Description

Frame structure:

<STX> FN Text [<ETB>|<ETX>] C1 C2 <CR><LF>



**STX:** text transmission start control character;

**FN:** serial number of the frame, use numbers from 0 to 7 in turn (starting from 1) to identify different frames;

**Text:** content of the message;

**ETB:** end character for text in the middle frame;

**ETX:** end character for text in the end frame;

**C1:** first-4-bit value of the check sum, expressed by 0-9 and A-F;

**C2:** last-4-bit value of the check sum, expressed by 0-9 and A-F;

**CR:** frame end "carriage return" control character

**LF:** frame end "line feed" control character;

### 4.3.2 Control Character

Key	Dec (decimal)	Hex (hexadecimal)	Printable	Description
^B	2	02	<STX>	Frame start character
^C	3	03	<ETX>	End frame, text end character
^J	10	0A	<LF>	Frame end line feed character
^M	13	0D	<CR>	Frame end carriage return character
^W	23	17	<ETB>	Middle frame, text end character
^E	5	05	<ENQ>	Connection establishing request (transmission preparation) character
^D	4	04	<EOT>	Transmission completion character
^F	6	06	<ACK>	Successful reception response character
^U	21	15	<NAK>	Re-sent response

### 4.3.3 Middle Frame

Structure of a middle frame:

<STX> FN Text <ETB> C1 C2 <CR><LF>

### 4.3.4 End Frame

Structure of an end frame:

<STX> FN Text <ETX> C1 C2 <CR><LF>

### 4.3.5 Check and Calculation

In the frame "<STX> FN text [<ETB>|<ETX>] C1 C2 <CR> <LF>", add every

character value from FN to [<ETB>|<ETX>] (note: do not add <STX> [<ETB>|<ETX>] C1 C2 <CR> <LF>), divide the sum by 256, get the remainder, and convert it to 8bit where the 4 most significant bits (first 4 bits) are C1, and the 4 least significant bits (last 4 bits) are C2. E.g. 01111010, convert it to hexadecimal, that is 7A, then C1 = "7", C2 = "A".

## 4.4 Message Structure

### 4.4.1 Message Description

Message								
Record 00				Record 01				Record ##
Field 00			Field ##	Field 00			Field ##	...
Component 00	...	Component ##	...	Component 00	.....	Component ##	...	...

- Message: a set of records from message header record (H) to message terminator record (T).
- Record: a set of fields. It has information about a certain subject, e.g. patient information. The first field of each record is the record type field.
- Field: a set of components. The description of special property of the record, e.g. date of birth in patient information.
- Component: basic unit of message data. E.g. for patient name, it consists of two basic units, Last Name and First Name which are separated by component delimiter.

Maximal field length: no limit to the length of a field.

Maximal record length: no limit to the length of a record; only depends on the length limit for character processing.

### 4.4.2 Message Coding

#### 4.4.2.1 Character Limit and Coding

The message transmission is text transmission, so it is not allowed to use invisible characters. For the universal ASCII characters:

Supported characters: 7, 9, 11, 12, 13, 32-126, 128-254

Unsupported characters: 0-6, 8, 10, 14-31, 127, 255

In the communication process, it is not allowed to use the following characters since they are used as control characters:

<STX>, <EOT>, <ENQ>, <ACK>, <NAK>, <ETB>, <ETX>, <CR>, <LF>.

Considering communication between different platforms, the characters which are not in ASCII standard character set are coded using UTF-8.

#### 4.4.2.2 Binary Data Coding

For raw binary data, they need to be converted to strings using BASE64 (See Appendix D ) for transmission.

Since there may be big-endian and little-endian difference at the sending end and the receiving end, in the transmission process of raw data, if the smallest unit data of the raw data needs to be expressed by 2 bytes or more, the raw data need to be converted to network byte order before being coded using Base64. Take the transmission of 32-bit integer digit group as an example. The smallest unit of the raw data (integer digit group) is integer that is expressed by 4 bytes, so before Base64 coding, the integer digit group needs to be converted to one-byte digit group based in network byte order, and then converted to text using Base64.

Note: the characters are case sensitive.

#### 4.4.3 Delimiters

In a complete message, all the records shall be ended with <CR> (carriage return).

To identify different components, fields, or repeated texts in a record, different delimiters are used between fields, components, and repeated texts.

ASTM uses the following ASCII characters:

Record end character	<CR>	Carriage return character (invisible)
Field delimiter		
Repetition delimiter	\	
Component delimiter	^	
Escape delimiter	&	

##### Transmission of delimiter:

The delimiter definition is in the second field of the message header record, normally in the format "H | \ ^ & |", where H is the record type identifier, followed by 4 delimiter definitions, and the last '|' is a field delimiter, indicating what follows is another field. The delimiters are in the following order: field delimiter, repetition delimiter, component delimiter and escape delimiter.

##### Null delimiter:

For null field or component, if it is the last one, delimiter is not needed; if not, a delimiter for this field/component is needed to separate it from the following field/component. That is to say, in a record, the position of a field or a component matters. So even if a field/component is null, the position shall be reserved by using a delimiter.

Note: according to the ASTM standard, the position of a null field/component shall be reserved rather than being omitted.

#### 4.4.4 Escape Character

While transmitting data, there may be protocol control characters or other characters that are

not allowed to transmit. In this case, these characters need to be converted to escape character.

According to the escape character conversion rules in the ASTM standard, the escape characters needed in message transmission are shown as follows:

Escape sequence	Delimiter	Remarks
&F&		Field delimiter
&R&	\	Repetition delimiter
&S&	^	Component delimiter
&E&	&	Escape delimiter

Escape characters of low-level protocol control characters:

Escape sequence	Delimiter	Remarks
&X5&	<ENQ>	
&X4&	<EOT>	
&X2&	<STX>	
&X17&	<ETB>	
&X3&	<ETX>	
&XD&	<CR>	
&XA&	<LF>	
&X6&	<ACK>	
&X15&	<NAK>	

Note: in a message, the record terminator character (<CR>) is the protocol control character which does not need to be converted.

## 4.4.5 Record Type

As defined in ASTM, the following record types are involved:

Record type	Type identifier	Remarks
Message Header Record	H	Message header record
Patient Information Record	P	Patient information record
Test Order Record	O	Test order record
Result Record	R	Result record
Comment Record	C	(Not in use)
Scientific Record	S	(Not in use)
Manufacturer Information Record	M	(Not in use)
Request Information Record	Q	Request information record (bi-directional LIS/HIS)
Message Terminator Record	L	Message terminator record

## 4.4.6 Special Notice

### 1. Time:

Format of time:

Date: YYYYMMDD

Date+Time: YYYYMMDDHHMMSS

### 2. Record sequence number:

In the message level protocol, all records except message header records begin with two fields: "Record Type ID" and "Sequence Number".

Record Type ID: record type identifier. E.g. the record type ID for patient information is "P".

Sequence Number: record sequence number, numeric string, indicating the sequence number of the record among all records of the same type. E.g.: if there are 2 "O" records, 3 "R" records in a message, then the sequence number of the first "O" record is "1", and the second one "2"; the sequence number of the first, second and third "R" records are "1", "2" and "3" respectively. If there are more records of the same type, the sequence number increases accordingly.

## 4.5 Message Records

In ASTM protocol, the unique identifiers for sample property, parameter result are coded using Lonic, which is the same with that of HL7. See Appendix C for code values. What is different from HL7 is that in ASTM, the "EncodeSys" is not transmitted), and only "ID" and "Name" are transmitted only.

Note: in the record definition tables, the right-aligned and italic parts are components, others are fields. The components below a field are the components of this field; if there is no component below a field, it means it is a single-component field.

### 4.5.1 Message Header and terminator Records

#### 4.5.1.1 Message Header Record

The first record of every message is called message header record, which consists of record delimiter definition, instrument name, instrument ID, protocol version number, message creation time, etc.

Field Name	Field Sequence Number	Value Example	Remarks
Record Type ID	1	H	Record type field; value fixed
Delimiter Definition	2	\^&	ASTM delimiter set; value fixed
Message Control ID	3	1	Message control ID field
Sender Name or ID	5		
<i>Manufacturer</i>		Mindray	Fixed
<i>Instrument Model</i>		BC-6800	Fixed
<i>Protocol Version</i>			Reserved
Special Instructions	11		Message text type field. See Table 18 of Appendix C for values.

<i>Name</i>		Automated Count	"Name" item
<i>ID</i>		00001	"ID" item
Processing ID	12	P	Current message type; fixed to be "P" indicating sample messages.
Version Number	13	LIS2-A2	Version number of ASTM; fixed
Date and Time of Message	14	20100208145026	Time of message transmission; use current system time; in the format of YYYYMMDDHHMMSS

Message Control ID: the unique identifier of a message Commonly starts from 1.

Taking the communication of sample analysis result as an example, the complete message header is shown below:

```
<STX>1H|\&|1||Mindray^BC-6800^||||Automated
Count^00001|P|LIS2-A2|20130912164204<CR><ETB>DC<CR><LF>
```

Note: "<CR>" stands for carriage return.

#### 4.5.1.2 Message Terminator Record

The last record of every message is called message terminator record, which is defined as follows:

Field Name	Field Sequence Number	Value Example	Remarks
Record Type ID	1	L	Record type field; value fixed
Sequence Number	2	1	Sequence number of record; fixed
Termination Code	3	N	Termination code; value: "N"; fixed

A complete message terminator record is shown as follows:

```
L|1|N<CR>
```

#### 4.5.2 Patient Information Record

Mainly includes patient ID, patient name, date of birth, age, physician, department, etc.

Used in sample analysis result message and worklist request response message.

Field Name	Field Sequence Number	Value Example	Remarks
Record Type	1	P	Fixed
Sequence Number	2	1	Record sequence number; see 4.4.6 for details
Patient ID Number 3	5	333	Patient ID
Patient Name	6		Patient name
<i>First name</i>		FirstName	
<i>Last name</i>		LastName	
Birthdate	8		
<i>Date of birth</i>		20091220000000	YYYYMMDDHHMMSS
<i>Age</i>		2	

<i>Age unit</i>		Y	Values of age unit: Null Y: year M: month W: week D: day H: hour
Patient Sex	9	Female	Entry by the operator (string)
Admission Status	25	Emergency	Department, string displayed on screen
Location	26		
<i>Inpatient zone</i>		EA	String displayed on screen
<i>Bed No.</i>		32-1	String displayed on screen

Complete record example:

P|1|||333|FirstName^LastName||20091220000000^2^Y|Female|||||||Emergency|EA^32-1<CR>.

### 4.5.3 Test Order Record

The record of analysis sequence number, usually followed by result record. Commonly , a Test Order Record contains sample sequence number and related information of analysis result messages (including both sample analysis results and QC results)

Field Name	Field Sequence Number	Value Example	Remarks
Record Type ID	1	O	Fixed
Sequence Number	2	1	Record sequence number; see 4.4.6 for details
Specimen ID	3	K11321	Sample ID
Requested Date and Time	7	20100613010203	Blood sample: time of analysis; QC: time of QC run
Collection Date and Time	8	20100612153501	Time of sample collection
Collector ID	11	Jones	The person who ordered the analysis
Relevant Clinical Information	14	Diagnosis	Clinical diagnosis
Date/Time Specimen Received	15	20100612153501	Date/Time when the specimen is received
Specimen Descriptor	16		
<i>Specimen Type</i>		Sample Type	Sample type
<i>Specimen Source</i>			Reserved
Ordering Physician	17	XQRD	Blood sample: operator; QC:

			operator
User Field Number 1	19	Alice	User-defined; used for validator here
User Field Number 2	20		User-defined; used for time of validation here
Date/Time Results Reported or Last Modified	23	20111220153501	Report time
Report Type	26	F	Report types: F – final results; not request response; fixed to be F Q – has result for request Y – no result for request

Complete record example:

O|1|K11321|||20100613010203|20100612153501|||Jones|||Diagnosis|20100612153501|  
Sample Type^|XQRD||Alice|||20111220153501|||F<CR>

#### 4.5.4 Analysis Result record

Contains sample analysis result/QC result/extend information.

Since the default fields of Patient Information Record and Test Order Record can not meet our requirements of sample information/patient information/sample result/QC information transmission, Result Record is used to bring extra fields for transmission. See Appendix C Message Coding Definition for extended codes. For extended information items, only message ID and result are needed.

Result Record is used in messages other than worklist searching messages.

Field Name	Field Sequence Number	Value Example	Remarks
Record Type ID	1	R	Fixed
Sequence Number	2	14	Record sequence number; see 4.4.6 for details
Universal Test ID	3		
<i>Universal Test ID</i>			Universal test ID; reserved
<i>Universal Test ID Name</i>		WBC	Name; see Appendix C for data type and coding system
<i>Universal Test ID Type</i>			ID type; reserved
<i>Manufacturer's or Local Code</i>		6690-2	ID; see Appendix C for data type and coding system
Data or Measurement Value	4	2.30	Result data



Units	5	10 <sup>9</sup> /L	Unit of result; use the units displayed on screen
Reference Ranges	6		Reference ranges
<i>Lower limit</i>		4.00	
<i>Upper limit</i>		12.00	
Result Abnormal Flags	7		Result flags
<i>High/Low flags</i>		L	H – higher than upper limit L – lower than lower limit
<i>Result edited flag</i>		e	E – result edited flag e – result changed due to the manual editing of another parameter result based on which it is calculated Null if the result is not edited
<i>Suspicious flag</i>		N	N - normal A - abnormal
<i>Reagent expiration flag</i>		O	O – reagent expired Null if the reagent is not expired
<i>Temperature flag</i>		T	T - instrument overtemperature Null if no overtemperature
<i>Result corrected flag</i>		C	C - Result corrected flag Null if not corrected
<i>Out of linearity range flag</i>		V	V - out of linearity range Null if within range

Complete record example:

<STX>5R|18|^NEU#^751-8|2.39|10&S&9/L|2.00^7.00|^A^^^<CR><ETB>E4<CR><LF>

### 4.5.5 Request Searching Record

Used in bi-directional LIS/HIS request (worklist request).

Field Name	Field Sequence Number	Value Example	Remarks
Record Type ID	1	Q	Fixed
Sequence Number	2	1	Record sequence number; see 4.4.6 for details
Starting Range ID Number	3	K11321	Sample ID in the worklist to be requested
Beginning Request Results data and Time	7	20111220153501	Time when the request begins; use the current system time; format: YYYYMMDDHHMMSS
User Field Number1	11	BL	User defined field used for sample

		BF	type here. Value definition: "BL": blood; "BF": body fluid;
--	--	----	---

Complete record example:

<STX>2Q|1|sampleid99|||20140328103119|||BL<CR><ETB>AB<CR><LF>

## 4.6 Message for Communication

Note: the message examples contains complete frame header and terminator. Since special characters may have problems in display, the frame header and terminator are replaced by special strings. E.g. use <STX> for frame header. The frames in the example after conversion should be continuous, but the frames are separated by line feed characters for better readability.

### 4.6.1 Sample Analysis Result Message

#### 4.6.1.1 Record Structure

Record Structure:

- 1 Header
- 2 Patient
- 3 Order
- 4 Result1
- 5 Result2
- 6 Result3
- .....
- n Message Terminator

#### 4.6.1.2 Content of Sample Data

Content of sample analysis result message for communication:

Record Type	Record Value	Field Position: Content	Component Value	Value Description
H	Record header	12: message type	Sample Analysis Result	See Table 18 of OBR-4 codes
P	Patient information	5: Patient ID	The patient ID displayed on screen	
		6: Patient name	First name	First name of patient
			Last Name	Last name of patient
		8: date of birth	Date of birth	YYYYMMDDHHMMSS
			Age	
			Age unit	Available age units: null, Y, M, W, D, and H, indicating null, year, month, week, day, and

				hour respectively
		9: gender	Gender	What displayed on screen
		25: department	Department	What displayed on screen
		26: location	Inpatient zone	What displayed on screen
			Bed No.	What displayed on screen
O	Sample Information	3: Sample ID	Sample ID	What displayed on screen. For both an integrated or standalone analyzer, when the LJ QC sample is transmitted in the format of the common sample, the value of the field is the QC sample transmission ID.
		7: time of analysis	Time of analysis	YYYYMMDDHHMMSS; what displayed on screen
		8: Time of sample collection	Time of sample collection	YYYYMMDDHHMMSS; what displayed on screen
		11: The person who ordered the analysis	The person who ordered the analysis	String
		14: clinical diagnosis	Clinical diagnosis	What displayed on screen
		15: Date/Time when the specimen is received	Date/Time when the specimen is received	YYYYMMDDHHMMSS; what displayed on screen
		16: sample type	Sample type	What displayed on screen
			Sample source	Reserved; null
		17: operator	Operator	What displayed on screen
		19: validator	Validator	What displayed on

				screen
		20: time of validation	Time of validation	YYYYMMDDHHMMSS; what displayed on screen
		23: Report time	Report time	YYYYMMDDHHMMSS; what displayed on screen
		26: report type	Result	F, fixed
R	Presentation mode	2: ID	ID	See Appendix C for data type and coding system
			ID	See Appendix C for data type and coding system
		4: result	Presentation mode	See Appendix C for HL7 and ASTM enumeration definition
		5: unit	Null	
		6: reference range	Null	
		7: flag	Null	
R	Blood Mode	Value same as above		
R	Analysis mode	Value same as above		
R	Sample Type	Value same as above		
R	Analyzer Name	4: result, value displayed on screen; other values same as above.		
R	Reference group	4: result, value displayed on screen; other values same as above		
R	Remarks	4: result, value displayed on screen; value same as above		
R	Reexam flag	4: result; T - reexamination needed; F –reexamination not needed; other values same as above		
R	ReviewRules	4: result; review rules that have been triggered; other values same as above		
R	ReviewRulesGroup	4: result; the groups of review rules that have been triggered; other values same as above		
R	ReviewRulesGroupName	4: result; description for the groups of review rules that have been triggered; other values same as above		
R	Tube rack No.	4: result, value displayed on screen; value same as above		
R	Tube No.	4: result, value displayed on screen; value same as above		

R	Payer	4: result, value displayed on screen; value same as above		
R	Patient type	4: result, value displayed on screen; value same as above		
R	Custom1	4: result, value displayed on screen; value same as above		
R	Custom2	4: result, value displayed on screen; value same as above		
R	Custom3	4: result, value displayed on screen; value same as above		
R	WBC: white blood cell count	2: ID; format same as above; see data type and coding system in Appendix C for the value		
		4: result	Sample Analysis Result	What displayed on screen
		5: unit	Unit of sample analysis result	What displayed on screen
		6: reference range	Upper limit	What displayed on screen
			Lower limit	What displayed on screen
		7: flag	High/Low flags	H – high flag; L – low flag
			Result edited flag	E – result edited; e – result changed due to the manual editing of another parameter result based on which it is calculated
			Suspicious flag	N – normal result; A – suspicious result
			Reagent expiration flag (reserved component)	O – reagent expired; reserved; fixed to be null
			Temperature flag	T – overtemperature; null - temperature normal
			Result corrected flag	C – result corrected; null - result not corrected
			Out of	V – result out of

			linearity range flag	linearity range; null - within range
R	Bas#	Basophil number: value same as above		
R	Bas%	Basophil percentage: value same as above		
R	Neu#	Neutrophil number: value same as above		
R	Neu%	Neutrophil percentage: value same as above		
R	Eos#	Eosinophil number: value same as above		
R	Eos%	Eosinophil percentage: value same as above		
R	Lymph#	Lymphocyte number: value same as above		
R	Lymph%	Lymphocyte percentage: value same as above		
R	Mon#	Monocyte number: value same as above		
R	Mon%	Monocyte percentage: value same as above		
R	RBC	Red Blood Cell count: value same as above		
R	HGB	Hemoglobin Concentration: value same as above		
R	MCV	Mean Corpuscular Volume: value same as above		
R	MCH	Mean Corpuscular Hemoglobin: value same as above		
R	MCHC	Mean Corpuscular Hemoglobin Concentration: value same as above		
R	RDW-CV	Red Blood Cell Distribution Width - Coefficient of Variation: value same as above		
R	RDW-SD	Red Blood Cell Distribution Width - Standard Deviation: value same as above		
R	HCT	Hematocrit: value same as above		
R	PLT	Platelet count: value same as above		
R	MPV	Mean Platelet Volume: value same as above		
R	PDW	Platelet Distribution Width: value same as above		
R	PCT	Plateletcrit: value same as above		
R	RET#	Reticulocyte number: value same as above		
R	RET%	Reticulocyte percentage: value same as above		
R	IRF	Immature Reticulocyte Fraction: value same as above		
R	LFR	Low Fluorescent Ratio: value same as above		
R	MFR	Middle Fluorescent Ratio: value same as above		
R	HFR	High Fluorescent Ratio: value same as above		
R	NRBC#	Nucleated Red Blood Cell count: value same as above		
R	NRBC%	Nucleated Red Blood Cell percentage: value same as above		
R	P-LCR	Platelet-Large Cell Ratio: value same as above		

R	P-LCC	Platelet- Large Cell Count: value same as above
R	IMG#	Immature Granulocyte (RUO): value same as above
R	IMG%	Immature Granulocyte percentage (RUO): value same as above
R	RBC-O	Optical Red Blood Cell count: value same as above
R	PLT-O	Optical Platelet count: value same as above
R	HFC#	High fluorescent Cell number: value same as above
R	HFC%	High fluorescent Cell percentage: value same as above
R	PLT-I	Platelet count- Impedance: value same as above
R	WBC-R	White Blood Cell count -RET: value same as above
R	WBC-D	White Blood Cell count -DIFF: value same as above
R	WBC-B	White Blood Cell count -BASO: value same as above
R	WBC-N	White Blood Cell count -NRBC: value same as above
R	PDW-SD	Platelet Distribution Width – Standard Deviation: value same as above
R	InR#	Infected Red Blood Cell count: value same as above
R	InR‰	Infected Red Blood Cell permillage: value same as above
R	WBC-C	Corrected WBC value: value same as above
R	WBC-BF	White blood cell count-body fluid: value same as above
R	RBC-BF	Red blood cell count-body fluid: value same as above
R	MN#	Parameter for body fluid: value same as above
R	PMN#	Parameter for body fluid: value same as above
R	MN%	Parameter for body fluid: value same as above
R	PMN%	Parameter for body fluid: value same as above
R	TC-BF#	Parameter for body fluid: value same as above
R	Eos-BF	RUO parameter for body fluid: value same as above
R	Eos-BF%	RUO parameter for body fluid: value same as above
R	HF-BF#	RUO parameter for body fluid: value same as above
R	HF-BF%	RUO parameter for body fluid: value same as above
R	RBC-BF(R)	RUO parameter for body fluid: value same as above
R	IMG#	Immature Granulocyte: value same as above
R	IMG%	Immature Granulocyte percentage: value same as above
R	IPF	Immature Platelet Fraction: value same as above
R	Micro#	Microcyte count: value same as above
R	Micro%	Microcyte percentage: value same as above

R	Macro#	Macrocyte count: value same as above
R	Macro%	Macrocyte percentage: value same as above
R	MRV	Mean Reticulocyte Volume: value same as above
R	RHE	Reticulocyte Hemoglobin Expression (RUO): value same as above
R	RHE	Reticulocyte Hemoglobin Expression: value same as above
R	Neu-BF#	Neutrophils number- body fluid: value same as above
R	Neu-BF%	Neutrophils percentage- body fluid: value same as above
R	Band%	Neutrophils, band: value same as above
R	Seg%	Neutrophils, segmented: value same as above
R	ALY%	Atypical lymphocytes: value same as above
R	Pla-Aly%	Atypical lymphocytes (plasmacytes) : value same as above
R	Mon-Aly%	Atypical lymphocytes (monocytes) : value same as above
R	Imm-Aly%	Atypical lymphocytes (immature) : value same as above
R	Other-Aly%	Atypical lymphocytes (others) : value same as above
R	Meta%	Neutrophils, metamyelocyte: value same as above
R	Myelo%	Neutrophils, myelocyte: value same as above
R	Pro-Myelo%	Neutrophils, promyelocyte: value same as above
R	Imm-Eos%	Eosinophils (immature) : value same as above
R	Imm-Bas%	Basophils (immature) : value same as above
R	Blast%	Blasts: value same as above
R	Mye-Blast%	Myeloblasts: value same as above
R	Mon-blast%	Monoblasts: value same as above
R	Lym-blast%	Lymphoblasts: value same as above
R	IMG/Blast%	Blast and immature granulocytes: value same as above
R	Pro-Lym%	Immature lymphocytes: value same as above
R	Pro-Mon%	Immature monocytes: value same as above
R	Plsm-cell%	Plasmacytes: value same as above
R	Flags of abnormal blood cell differential or morphology: WBC Scattergram Abn. Note: only transmitted when this flag exists in	2: ID; format same as above; see data type and coding system in Appendix C for the value
		4: result      T      T – flag exists in the result; fixed
		5: unit      Null
		6: reference range      Null



	the result	7: flag	Null	
R	...	Flag; value same as above. Only transmitted when this flag exists in the result. For details of flags, see the "Flags of Abnormal Blood Cell Differential or Morphology" part of Table 19 in Appendix C		
R	RBC histogram binary data.	2: ID; format same as above; see data type and coding system in Appendix C for the value		
		4: result	Binary coding data	4.4.2 Message coding: rule coding value
		Field 5, 6, 7: idle; null Null if it is not configured to be transmitted as "data"		
R	Left discriminator of the RBC histogram	2: ID; format same as above; see data type and coding system in Appendix C for the value		
		4: result	Numeric	Discriminator value
		Field 5, 6, 7: idle; null		
R	Right discriminator of the RBC histogram	2: ID; format same as above; see data type and coding system in Appendix C for the value		
		4: result	Numeric	Discriminator value
		Field 5, 6, 7: idle; null		
R	RBC histogram metadata length	2: ID; format same as above; see data type and coding system in Appendix C for the value		
		4: result	Numeric	Unit data type length
		Field 5, 6, 7: idle; null		
R	Total number of RBC histograms	2: ID; format same as above; see data type and coding system in Appendix C for the value		
		4: result	Numeric	Total number of graphic metadata (digit group length)
		Field 5, 6, 7: idle; null		
R	RBC histogram bitmap (BMP)	2: ID; format same as above; see data type and coding system in Appendix C for the value		
		4: result	Binary coding data (can be null)	4.4.2 Message coding: rule coding value
		Field 5, 6, 7: idle; null Null if it is not configured to be transmitted as graph		
R	PLT histogram	PLT histogram transmission is the same as that of RBC histogram		
R	Version of scattergram	2: ID; format same as above; see data type and coding system in Appendix C for the value		
		4: result	String	V1: BC-6800, national V2: BC-6900, Version 1.9

				V3: BC-6800, international, Version 1.10
		Field 5, 6, 7: idle; null		
R	the particle type array which needs to be greyout in the scattergram	2: ID; format same as above; see data type and coding system in Appendix C for the value		
		4: result	Binary data (can be null)	4.4.2 Message coding: rule coding value Appendix C scattergram data, greyout particle type array
		Field 5, 6, 7: idle; null Null if it is configured not to transmit scattergram data		
R	DIFF scattergram bitmap data	In the same structure as RBC histogram bitmap (BMP)		
R	Diff scattergram metadata length	Structure same as above; unit data type length		
R	Fsc dimension of DIFF scattergram	Structure same as above; Fsc dimension		
R	Ssc dimension of DIFF scattergram	Same as above		
R	FL dimension of DIFF scattergram	Same as above		
R	FSC—LOG dimension of DIFF scattergram	Same as above		
R	DIFF scattergram binary data	Structure same as that of RBC histogram binary data; same data coding		
R	BASO scattergram	BASO scattergram data transmission is the same as that of DIFF scatter gram, and it contains the same number of result records		
R	RET scattergram	RET scattergram data transmission is the same as that of DIFF scatter gram, and it contains the same number of result records		
R	PLT-O scattergram bitmap	The transmission of the RET bitmap data is the same as that of DIFF scattergram		
R	RET-EXT scattergram bitmap	The transmission of the RET bitmap data is the same as that of DIFF scattergram		
R	NRBC scattergram	BASO scattergram data transmission is the same as that of DIFF scatter gram, and it contains the same number of result records		

### 4.6.1.3 Example of Sample Analysis Result Message

Blood Sample:

```
<STX>1H|^&|1||Mindray^BC-6800^||||Automated
Count^00001|P|LIS2-A2|20140909170247<CR><ETB>E7<CR><LF>
<STX>2P|1|||patientID2001|Michael^Jordan||20081229160009^5^Y|Male|||||||Internal medicine|A -
501^1002<CR><ETB>21<CR><LF>
<STX>3O|1|40139349110|||20140805085635|20140705160009|||Jack|||Virus
infections|20140716160009|Venous blood^|admin|||||20140907160009|||F<CR><ETB>6E<CR><LF>
<STX>4R|1|^Take Mode^08001|A|^|^^^<CR><ETB>BC<CR><LF>
<STX>5R|2|^Blood Mode^08002|W|^|^^^<CR><ETB>40<CR><LF>
<STX>6R|3|^Test Mode^08003|CBC+DIFF|^|^^^<CR><ETB>A8<CR><LF>
<STX>7R|4|^Ref Group^01002|Child|^|^^^<CR><ETB>7F<CR><LF>
<STX>0R|5|^Remark^01001|Emergency patient|^|^^^<CR><ETB>60<CR><LF>
<STX>1R|6|^Recheck flag^01006|T|^|^^^<CR><ETB>14<CR><LF>
<STX>2R|7|^ReviewRulesGroupName^13004|RBC Agglutination or Cold Agglutination, NRBC
Present|^|^^^<CR><ETB>7B<CR><LF>
<STX>3R|8|^ReviewRulesGroup^13000|31,32|^|^^^<CR><ETB>D1<CR><LF>
<STX>4R|9|^ReviewRules^13001|([WBC]<5),([PLT]>0)|^|^^^<CR><ETB>BB<CR><LF>
<STX>2R|7|^Shelf No^01012|54|^|^^^<CR><ETB>88<CR><LF>
<STX>3R|8|^Tube No^01013|8|^|^^^<CR><ETB>F8<CR><LF>
<STX>4R|9|^Charge type^01015|||^|^^^<CR><ETB>83<CR><LF>
<STX>5R|10|^Patient type^01016|||^|^^^<CR><ETB>38<CR><LF>
<STX>6R|11|^Analyzer^09001|2#|^|^^^<CR><ETB>20<CR><LF>
<STX>7R|12|^Project Type^05007|BL|^|^^^<CR><ETB>B0<CR><LF>
<STX>0R|13|^Custom patient info 1^01009|||^|^^^<CR><ETB>2E<CR><LF>
<STX>1R|14|^Custom patient info 2^01010|||^|^^^<CR><ETB>29<CR><LF>
<STX>2R|15|^Custom patient info 3^01011|||^|^^^<CR><ETB>2D<CR><LF>
<STX>3R|16|^WBC^6690-2|15.22|10&S&9/L|4.00^12.00|H^A^^^<CR><ETB>85<CR><LF>
<STX>4R|17|^BAS#^704-7|0.06|10&S&9/L|0.00^0.10|^A^^^<CR><ETB>BD<CR><LF>
<STX>5R|18|^BAS%^706-2|0.4|0.0^1.0|^A^^^<CR><ETB>9D<CR><LF>
<STX>6R|19|^NEU#^751-8|11.66|10&S&9/L|2.00^8.00|H^A^^^<CR><ETB>5F<CR><LF>
<STX>7R|20|^NEU%^770-8|76.6|50.0^70.0|H^A^^^<CR><ETB>A3<CR><LF>
<STX>0R|21|^EOS#^711-2|0.02|10&S&9/L|0.02^0.80|^A^^^<CR><ETB>C3<CR><LF>
<STX>1R|22|^EOS%^713-8|0.1|0.5^5.0|^A^^^<CR><ETB>FB<CR><LF>
<STX>2R|23|^LYM#^731-0|2.05|10&S&9/L|0.80^7.00|^A^^^<CR><ETB>DC<CR><LF>
<STX>3R|24|^LYM%^736-9|13.5|20.0^60.0|^A^^^<CR><ETB>A6<CR><LF>
<STX>4R|25|^MON#^742-7|1.43|10&S&9/L|0.12^1.20|H^A^^^<CR><ETB>21<CR><LF>
<STX>5R|26|^MON%^5905-5|9.4|3.0^12.0|^A^^^<CR><ETB>27<CR><LF>
<STX>6R|27|^RBC^789-8|2.72|10&S&12/L|3.50^5.20|^N^^^<CR><ETB>42<CR><LF>
<STX>7R|28|^HGB^718-7|8.8|g/dL|12.0^16.0|^A^^^<CR><ETB>60<CR><LF>
<STX>0R|29|^MCV^787-2|129.8|fL|80.0^100.0|^N^^^<CR><ETB>78<CR><LF>
<STX>1R|30|^MCH^785-6|32.2|pg|27.0^34.0|^A^^^<CR><ETB>CF<CR><LF>
<STX>2R|31|^MCHC^786-4|24.8|g/dL|31.0^37.0|^A^^^<CR><ETB>D3<CR><LF>
```

<STX>3R|32|^RDW-CV^788-0|24.8%|11.0^16.0|H^^N^^^^<CR><ETB>4E<CR><LF>  
 <STX>4R|33|^RDW-SD^21000-5|116.4|fL|35.0^56.0|H^^N^^^^<CR><ETB>64<CR><LF>  
 <STX>5R|34|^HCT^4544-3|0.354||0.350^0.490|M^^N^^^^<CR><ETB>D8<CR><LF>  
 <STX>6R|35|^PLT^777-3|55|10&S&9/L|100^300|L^^N^^^^<CR><ETB>62<CR><LF>  
 <STX>7R|36|^MPV^32623-1|11.7|fL|6.5^12.0|M^^N^^^^<CR><ETB>05<CR><LF>  
 <STX>0R|37|^PDW^32207-3|17.2||15.0^17.0|H^^N^^^^<CR><ETB>BE<CR><LF>  
 <STX>1R|38|^PCT^10002|0.064|%|0.108^0.282|L^^N^^^^<CR><ETB>11<CR><LF>  
 <STX>2R|39|^PLCR^10014|38.7|%|11.0^45.0|M^^N^^^^<CR><ETB>82<CR><LF>  
 <STX>3R|40|^PLCC^10013|21|10&S&9/L|30^90|L^^N^^^^<CR><ETB>1E<CR><LF>  
 <STX>4R|41|^IMG#^51584-1|0.49|10&S&9/L|^A^^A^^^^<CR><ETB>B1<CR><LF>  
 <STX>5R|42|^IMG%^38518-7|3.2|%|^A^^A^^^^<CR><ETB>F6<CR><LF>  
 <STX>6R|43|^HFC#^10020|0.40|10&S&9/L|^A^^A^^^^<CR><ETB>2E<CR><LF>  
 <STX>7R|44|^HFC%^10021|2.6|%|^A^^A^^^^<CR><ETB>78<CR><LF>  
 <STX>0R|45|^PLT-I^10022|55|10&S&9/L|^M^^N^^^^<CR><ETB>53<CR><LF>  
 <STX>1R|46|^WBC-D^10024|14.73|10&S&9/L|^A^^A^^^^<CR><ETB>C4<CR><LF>  
 <STX>2R|47|^WBC-B^10025|15.22|10&S&9/L|^A^^A^^^^<CR><ETB>C0<CR><LF>  
 <STX>3R|48|^PDW-SD^10031|17.0|fL|^M^^N^^^^<CR><ETB>FC<CR><LF>  
 <STX>4R|49|^lnR#^10032|0.01|10&S&9/L|^M^^N^^^^<CR><ETB>77<CR><LF>  
 <STX>5R|50|^lnR%^10033|0.00|%^|^M^^N^^^^<CR><ETB>BD<CR><LF>  
 <STX>6R|51|^WBC^12227-5|15.22|10&S&9/L|4.00^12.00|H^^A^^^^<CR><ETB>B3<CR><LF>  
 <STX>7R|52|^Neutrophilia^12004|T||^M^^^^<CR><ETB>D0<CR><LF>  
 <STX>0R|53|^WBC Left Shift?^17790-7|T||^M^^^^<CR><ETB>2F<CR><LF>  
 <STX>1R|54|^Imm Granulocytes?^34165-1|T||^M^^^^<CR><ETB>C4<CR><LF>  
 <STX>2R|55|^Atypical Lymphs?^15192-8|T||^M^^^^<CR><ETB>5D<CR><LF>  
 <STX>3R|56|^Anisocytosis^15150-6|T||^M^^^^<CR><ETB>4C<CR><LF>  
 <STX>4R|57|^Macrocytes^12075|T||^M^^^^<CR><ETB>00<CR><LF>  
 <STX>5R|58|^Anemia^12014|T||^M^^^^<CR><ETB>2C<CR><LF>  
 <STX>6R|59|^Hypochromia^15180-3|T||^M^^^^<CR><ETB>CD<CR><LF>  
 <STX>7R|60|^HGB Interferen^12015|T||^M^^^^<CR><ETB>72<CR><LF>  
 <STX>0R|61|^Thrombopenia^12018|T||^M^^^^<CR><ETB>C2<CR><LF>  
 <STX>1R|62|^Abn Lympho/ Blasts^12053|T||^M^^^^<CR><ETB>3D<CR><LF>  
 <STX>2R|63|^NRBC?^12054|T||^M^^^^<CR><ETB>42<CR><LF>  
 <STX>3R|64|^RBC Histogram. Left Line^15051|29||^M^^^^<CR><ETB>1D<CR><LF>  
 <STX>4R|65|^RBC Histogram. Right Line^15052|250||^M^^^^<CR><ETB>BF<CR><LF>  
 <STX>5R|66|^RBC Histogram. Binary Meta Length^15053|1||^M^^^^<CR><ETB>44<CR><LF>  
 <STX>6R|67|^RBC Histogram. Total^15057|51277||^M^^^^<CR><ETB>95<CR><LF>  
 <STX>7R|68|^PLT Histogram. Left Line^15111|3||^M^^^^<CR><ETB>03<CR><LF>  
 <STX>0R|69|^PLT Histogram. Right Line^15112|47||^M^^^^<CR><ETB>A9<CR><LF>  
 <STX>1R|70|^PLT Histogram. Binary Meta Length^15113|1||^M^^^^<CR><ETB>51<CR><LF>  
 <STX>2R|71|^PLT Histogram. Total^15117|1004||^M^^^^<CR><ETB>61<CR><LF>  
 <STX>3R|72|^WBC DIFF Scattergram. Meta len^15203|1||^M^^^^<CR><ETB>A1<CR><LF>  
 <STX>4R|73|^WBC DIFF Scattergram. Fsc dimension^15205|128||^M^^^^<CR><ETB>2B<CR><LF>  
 <STX>5R|74|^WBC DIFF Scattergram. Ssc dimension^15206|128||^M^^^^<CR><ETB>3B<CR><LF>  
 <STX>6R|75|^WBC DIFF Scatterqram. FL dimension^15207|128||^M^^^^<CR><ETB>A7<CR><LF>

<STX>7R 76 ^WBC	DIFF	Scattergram.	FSC-LOG
dimension^^15208 128  ^ ^^^<CR><ETB>03<CR><LF>			
<STX>0R 77 ^Baso Scattergram. Meta Len^^15253 1  ^ ^^^<CR><ETB>F8<CR><LF>			
<STX>1R 78 ^Baso Scattergram. Fsc dimension^^15255 128  ^ ^^^<CR><ETB>A2<CR><LF>			
<STX>2R 79 ^Baso Scattergram. Ssc dimension^^15256 128  ^ ^^^<CR><ETB>B2<CR><LF>			
<STX>3R 80 ^Baso Scattergram. FL dimension^^15257 128  ^ ^^^<CR><ETB>15<CR><LF>			
<STX>4R 81 ^Baso Scattergram. FSC-LOG dimension^^15258 128  ^ ^^^<CR><ETB>71<CR><LF>			
<STX>5R 82 ^RET Scattergram. Meta Len^^15307 1  ^ ^^^<CR><ETB>5F<CR><LF>			
<STX>6R 83 ^RET Scattergram. Fsc dimension^^15303 128  ^ ^^^<CR><ETB>03<CR><LF>			
<STX>7R 84 ^RET Scattergram. Ssc dimension^^15304 128  ^ ^^^<CR><ETB>13<CR><LF>			
<STX>0R 85 ^RET Scattergram. FL dimension^^15305 128  ^ ^^^<CR><ETB>77<CR><LF>			
<STX>1R 86 ^RET Scattergram FSC-LOG dimension^^15308 128  ^ ^^^<CR><ETB>A7<CR><LF>			
<STX>2R 87 ^NRBC Scattergram. Meta Len^^15355 1  ^ ^^^<CR><ETB>9E<CR><LF>			
<STX>3R 88 ^NRBC Scattergram. Fsc dimension^^15351 128  ^ ^^^<CR><ETB>42<CR><LF>			
<STX>4R 89 ^NRBC Scattergram. Ssc dimension^^15352 128  ^ ^^^<CR><ETB>52<CR><LF>			
<STX>5R 90 ^NRBC Scattergram. FL dimension^^15353 128  ^ ^^^<CR><ETB>B5<CR><LF>			
<STX>6R 91 ^NRBC Scattergram FSC-LOG dimension^^15356 128  ^ ^^^<CR><ETB>E5<CR><LF>			
<STX>7L 1 N<CR><ETX>07<CR><LF>			

Body fluid sample:

<STX>1H ^& 1  Mindray^BC-6800^    Automated			
Count^00001 P LIS2-A2 20140910100915<CR><ETB>DA<CR><LF>			
<STX>2P 1     ^ ^^^^^^^^^^^^^^^^^^<CR><ETB>54<CR><LF>			
<STX>3O 1 0815-13     20140815141621     ^ service     ^F<CR><ETB>94<CR><LF>			
<STX>4R 1 ^Take Mode^^08001 O  ^ ^^^<CR><ETB>CA<CR><LF>			
<STX>5R 2 ^Blood Mode^^08002 B  ^ ^^^<CR><ETB>2B<CR><LF>			
<STX>6R 3 ^Test Mode^^08003 CBC+DIFF  ^ ^^^<CR><ETB>A8<CR><LF>			
<STX>7R 4 ^Ref Group^^01002 General  ^ ^^^<CR><ETB>59<CR><LF>			
<STX>0R 5 ^Remark^^01001    ^ ^^^<CR><ETB>AC<CR><LF>			
<STX>1R 6 ^Recheck flag^^01006 F  ^ ^^^<CR><ETB>06<CR><LF>			
<STX>2R 7 ^ReviewRulesGroupName^^13004 RBC Agglutination or Cold Aggutation,NRBC Present  ^ ^^^<CR><ETB>7B<CR><LF>			
<STX>3R 8 ^ReviewRulesGroup^^13000 31,32  ^ ^^^<CR><ETB>D1<CR><LF>			
<STX>4R 9 ^ReviewRules^^13001 ([WBC]<5),([PLT]>0)  ^ ^^^<CR><ETB>BB<CR><LF>			
<STX>2R 7 ^Shelf No^^01012    ^ ^^^<CR><ETB>1F<CR><LF>			
<STX>3R 8 ^Tube No^^01013    ^ ^^^<CR><ETB>C0<CR><LF>			
<STX>4R 9 ^Charge type^^01015    ^ ^^^<CR><ETB>83<CR><LF>			
<STX>5R 10 ^Patient type^^01016    ^ ^^^<CR><ETB>38<CR><LF>			
<STX>6R 11 ^Analyzer^^09001 x1  ^ ^^^<CR><ETB>74<CR><LF>			
<STX>7R 12 ^Project Type^^05007 BF  ^ ^^^<CR><ETB>AA<CR><LF>			
<STX>0R 13 ^Custom patient info 1^^01009    ^ ^^^<CR><ETB>2E<CR><LF>			
<STX>1R 14 ^Custom patient info 2^^01010    ^ ^^^<CR><ETB>29<CR><LF>			
<STX>2R 15 ^Custom patient info 3^^01011    ^ ^^^<CR><ETB>2D<CR><LF>			
<STX>3R 16 ^WBC-BF^^57845-0 0.000 10&S&9/L ^ ^N^^^<CR><ETB>78<CR><LF>			

<STX>4R|17|^RBC-BF^23860-0|0.000|10&S&12/L|^|^N^<CR><ETB>95<CR><LF>  
 <STX>5R|18|^MN#^26490-3|\*\*\*\*|10&S&9/L|^|^N^<CR><ETB>5E<CR><LF>  
 <STX>6R|19|^MN%^26493-7|\*\*\*\*|%^|^N^<CR><ETB>DA<CR><LF>  
 <STX>7R|20|^PMN#^10034|\*\*\*\*|10&S&9/L|^|^N^<CR><ETB>3C<CR><LF>  
 <STX>0R|21|^PMN%^10035|\*\*\*\*|%^|^N^<CR><ETB>AA<CR><LF>  
 <STX>1R|22|^TC-BF#^10036|0.000|10&S&9/L|^|^N^<CR><ETB>E1<CR><LF>  
 <STX>2R|23|^Eos-BF#^35063-7|\*\*\*\*|10&S&9/L|^|^N^<CR><ETB>98<CR><LF>  
 <STX>3R|24|^Eos-BF%^26452-3|\*\*\*\*|%^|^N^<CR><ETB>0B<CR><LF>  
 <STX>4R|25|^HF-BF#^10037|\*\*\*\*|10&S&9/L|^|^N^<CR><ETB>99<CR><LF>  
 <STX>5R|26|^HF-BF%^10038|\*\*\*\*|%^|^N^<CR><ETB>0F<CR><LF>  
 <STX>6R|27|^RBC-BF-R^10039|0.0000|10&S&12/L|^|^N^<CR><ETB>E4<CR><LF>  
 <STX>7R|28|^Neu-BF#^10044|\*\*\*\*|10&S&9/L|^|^N^<CR><ETB>37<CR><LF>  
 <STX>0R|29|^Neu-BF%^10045|\*\*\*\*|%^|^N^<CR><ETB>A5<CR><LF>  
 <STX>1R|30|^RBC Histogram. Left Line^15051|10|^|^<CR><ETB>0A<CR><LF>  
 <STX>2R|31|^RBC Histogram. Right Line^15052|250|^|^<CR><ETB>B6<CR><LF>  
 <STX>3R|32|^RBC Histogram. Binary Meta Length^15053|1|^|^<CR><ETB>3B<CR><LF>  
 <STX>4R|33|^RBC Histogram. Total^15057|0|^|^<CR><ETB>B6<CR><LF>  
 <STX>5R|34|^PLT Histogram. Left Line^15111|3|^|^<CR><ETB>FA<CR><LF>  
 <STX>6R|35|^PLT Histogram. Right Line^15112|39|^|^<CR><ETB>A9<CR><LF>  
 <STX>7R|36|^PLT Histogram. Binary Meta Length^15113|1|^|^<CR><ETB>59<CR><LF>  
 <STX>0R|37|^PLT Histogram. Total^15117|21|^|^<CR><ETB>FF<CR><LF>  
 <STX>1R|38|^WBC DIFF Scattergram. Meta len^15203|1|^|^<CR><ETB>A1<CR><LF>  
 <STX>2R|39|^WBC DIFF Scattergram. Fsc dimension^15205|128|^|^<CR><ETB>2B<CR><LF>  
 <STX>3R|40|^WBC DIFF Scattergram. Ssc dimension^15206|128|^|^<CR><ETB>32<CR><LF>  
 <STX>4R|41|^WBC DIFF Scattergram. FL dimension^15207|128|^|^<CR><ETB>9E<CR><LF>  
 <STX>5R|42|^WBC DIFF Scattergram. FSC-LOG dimension^15208|128|^|^<CR><ETB>FA<CR><LF>  
 <STX>6R|43|^Baso Scattergram. Meta Len^15253|1|^|^<CR><ETB>F7<CR><LF>  
 <STX>7R|44|^Baso Scattergram. Fsc dimension^15255|128|^|^<CR><ETB>A1<CR><LF>  
 <STX>0R|45|^Baso Scattergram. Ssc dimension^15256|128|^|^<CR><ETB>A9<CR><LF>  
 <STX>1R|46|^Baso Scattergram. FL dimension^15257|128|^|^<CR><ETB>15<CR><LF>  
 <STX>2R|47|^Baso Scattergram. FSC-LOG dimension^15258|128|^|^<CR><ETB>71<CR><LF>  
 <STX>3R|48|^RET Scattergram. Meta Len^15307|1|^|^<CR><ETB>5F<CR><LF>  
 <STX>4R|49|^RET Scattergram. Fsc dimension^15303|128|^|^<CR><ETB>03<CR><LF>  
 <STX>5R|50|^RET Scattergram. Ssc dimension^15304|128|^|^<CR><ETB>0A<CR><LF>  
 <STX>6R|51|^RET Scattergram. FL dimension^15305|128|^|^<CR><ETB>76<CR><LF>  
 <STX>7R|52|^RET Scattergram FSC-LOG dimension^15308|128|^|^<CR><ETB>A6<CR><LF>  
 <STX>0R|53|^NRBC Scattergram. Meta Len^15355|1|^|^<CR><ETB>95<CR><LF>  
 <STX>1R|54|^NRBC Scattergram. Fsc dimension^15351|128|^|^<CR><ETB>39<CR><LF>  
 <STX>2R|55|^NRBC Scattergram. Ssc dimension^15352|128|^|^<CR><ETB>49<CR><LF>  
 <STX>3R|56|^NRBC Scattergram. FL dimension^15353|128|^|^<CR><ETB>B5<CR><LF>  
 <STX>4R|57|^NRBC Scattergram FSC-LOG dimension^15356|128|^|^<CR><ETB>E5<CR><LF>  
 <STX>5L|1|N<CR><ETX>05<CR><LF>

## 4.6.2 QC Message

### 4.6.2.1 Record Structure

Record Structure:

- 1 Header
- 2 Order
- 3 Result1
- 4 Result2
- 5 Result3
- .....
- n Message Terminator

For QC programs with multiple results, the parameters are transmitted in the following order:

- 1 WBC1
- .....
- 44 InR‰
- 45 WBC-C
- 46 WBC
- .....
- 90 WBC-C

For X mean R QC and XM QC, 2 results and the mean value shall be transmitted.

### 4.6.2.2 Content of QC Data

Content of QC message for communication:

Record Type	Record Value	Field Position: Content	Component Value	Value Description
H	Message Header Record	12: message type	QC result	See Table 18 of OBR-4 codes
O	QC information	3: Sample ID	Sample ID	Reserved; null
		7: time of analysis	Time of analysis	YYYYMMDDHHMMSS; what displayed on screen
		17: operator	Operator	What displayed on screen
		26: report type	Result	F, fixed
R	Presentation mode	2: ID	ID	See Appendix C for data type and coding system
			ID	See Appendix C for data type and coding system
		4: result	Presentation mode	See Appendix C for HL7

				and ASTM enumeration definition
		5: unit	Null	
		6: reference range	Null	
		7: flag	Null	
R	Blood Mode	Value same as above		
R	Analysis mode	Value same as above		
R	Level of control	4: result; H – high; M – normal; L – low; values of other fields same as above		
R	Date edited flag	4: result; E – date edited; null – date not edited Values of other fields same as above		
R	Time edited flag	4: result; E – date edited; null – date not edited Values of other fields same as above		
R	Expiration date	4: result; expiration date of the control (YYMMDDHHMMSS) Values of other fields same as above		
R	QC File No.	4: result, value displayed on screen; value same as above		
R	Lot No.	4: result, value displayed on screen; value same as above		
R	Analyzer Name	4: result, value displayed on screen; other values same as above.		
R	WBC: white blood cell count	2: ID; format same as above; see data type and coding system in Appendix C for the value		
		4: result	Sample Analysis Result	What displayed on screen
		5: unit	Unit of sample analysis result	What displayed on screen
		6: limit	Upper limit	What displayed on screen
			Lower limit	What displayed on screen
		7: flag	High/Low flags	H – high flag; L – low flag
			Result edited flag	E – result edited
			Suspicious flag	Reserved; null
			Reagent expiration flag (reserved component)	Reserved; null
			Temperature flag	Reserved; null
			Result corrected flag	Reserved; null
			Out of linearity range flag	Reserved; null
R	Bas#	Basophil number: value same as above		



R	Bas%	Basophil percentage: value same as above
R	Neu#	Neutrophil number: value same as above
R	Neu%	Neutrophil percentage: value same as above
R	Eos#	Eosinophil number: value same as above
R	Eos%	Eosinophil percentage: value same as above
R	Lymph#	Lymphocyte number: value same as above
R	Lymph%	Lymphocyte percentage: value same as above
R	Mon#	Monocyte number: value same as above
R	Mon%	Monocyte percentage: value same as above
R	RBC	Red Blood Cell count: value same as above
R	HGB	Hemoglobin Concentration: value same as above
R	MCV	Mean Corpuscular Volume: value same as above
R	MCH	Mean Corpuscular Hemoglobin: value same as above
R	MCHC	Mean Corpuscular Hemoglobin Concentration: value same as above
R	RDW-CV	Red Blood Cell Distribution Width - Coefficient of Variation: value same as above
R	RDW-SD	Red Blood Cell Distribution Width - Standard Deviation: value same as above
R	HCT	Hematocrit: value same as above
R	PLT	Platelet count: value same as above
R	MPV	Mean Platelet Volume: value same as above
R	PDW	Platelet Distribution Width: value same as above
R	PCT	Plateletcrit: value same as above
R	RET#	Reticulocyte number: value same as above
R	RET%	Reticulocyte percentage: value same as above
R	IRF	Immature Reticulocyte Fraction: value same as above
R	LFR	Low Fluorescent Ratio: value same as above
R	MFR	Middle Fluorescent Ratio: value same as above
R	HFR	High Fluorescent Ratio: value same as above
R	NRBC#	Nucleated Red Blood Cell count: value same as above
R	NRBC%	Nucleated Red Blood Cell percentage: value same as above
R	P-LCR	Platelet-Large Cell Ratio: value same as above
R	P-LCC	Platelet- Large Cell Count: value same as above
R	IMG#	Immature Granulocyte: value same as above
R	IMG%	Immature Granulocyte percentage: value same as above
R	RBC-O	Optical Red Blood Cell count: value same as above

R	PLT-O	Optical Platelet count: value same as above
R	HFC#	High fluorescent Cell number: value same as above
R	HFC%	High fluorescent Cell percentage: value same as above
R	PLT-I	Platelet count- Impedance: value same as above
R	WBC-R	White Blood Cell count -RET: value same as above
R	WBC-D	White Blood Cell count -DIFF: value same as above
R	WBC-B	White Blood Cell count -BASO: value same as above
R	WBC-N	White Blood Cell count -NRBC: value same as above
R	PDW-SD	Platelet Distribution Width – Standard Deviation: value same as above
R	InR#	Infected Red Blood Cell count: value same as above
R	InR‰	Infected Red Blood Cell permillage: value same as above
R	WBC-C	Corrected WBC value: value same as above
R	IMG#	Immature Granulocyte: value same as above
R	IMG%	Immature Granulocyte percentage: value same as above
R	IPF	Immature Platelet Fraction: value same as above
R	Micro#	Microcyte count: value same as above
R	Micro%	Microcyte percentage: value same as above
R	Macro#	Macrocyte count: value same as above
R	Macro%	Macrocyte percentage: value same as above
R	MRV	Mean Reticulocyte Volume: value same as above
R	RHE	Reticulocyte Hemoglobin Expression (RUO): value same as above
R	RHE	Reticulocyte Hemoglobin Expression: value same as above
R	Neu-BF#	Neutrophils number- body fluid: value same as above
R	Neu-BF%	Neutrophils percentage- body fluid: value same as above
R	Band%	Neutrophils, band: value same as above
R	Seg%	Neutrophils, segmented: value same as above
R	ALY%	Atypical lymphocytes: value same as above
R	Pla-Aly%	Atypical lymphocytes (plasmacytes) : value same as above
R	Mon-Aly%	Atypical lymphocytes (monocytes) : value same as above
R	Imm-Aly%	Atypical lymphocytes (immature) : value same as above
R	Other-Aly%	Atypical lymphocytes (others) : value same as above
R	Meta%	Neutrophils, metamyelocyte: value same as above
R	Myelo%	Neutrophils, myelocyte: value same as above
R	Pro-Myelo%	Neutrophils, promyelocyte: value same as above
R	Imm-Eos%	Eosinophils (immature) : value same as above

R	Imm-Bas%	Basophils (immature) : value same as above
R	Blast%	Blasts: value same as above
R	Mye-Blast%	Myeloblasts: value same as above
R	Mon-blast%	Monoblasts: value same as above
R	Lym-blast%	Lymphoblasts: value same as above
R	IMG/Blast%	Blast and immature granulocytes: value same as above
R	Pro-Lym%	Immature lymphocytes: value same as above
R	Pro-Mon%	Immature monocytes: value same as above
R	Plsm-cell%	Plasmacytes: value same as above

#### 4.6.2.3 Example of L-J QC Message

##### LJ QC sample message transmitted in the format of QC sample messages

```

<STX>1H|^&|2||Mindray^BC-6800^||||LJ
QCR^00003|P|LIS2-A2|20140909171830<CR><ETB>B8<CR><LF>
<STX>2O|1||||20140820201334||||||^|admin||||||F<CR><ETB>46<CR><LF>
<STX>3R|1|^Take Mode^08001|A|^|^|^^^<CR><ETB>BB<CR><LF>
<STX>4R|2|^Blood Mode^08002|W|^|^|^^^<CR><ETB>3F<CR><LF>
<STX>5R|3|^Test Mode^08003|CBC+DIFF|^|^|^^^<CR><ETB>A7<CR><LF>
<STX>6R|4|^Qc Level^05001|H|^|^|^^^<CR><ETB>67<CR><LF>
<STX>7R|5|^QC test date modify flag^05002|^|^|^^^<CR><ETB>EA<CR><LF>
<STX>0R|6|^QC test time modify flag^05003|^|^|^^^<CR><ETB>F6<CR><LF>
<STX>1R|7|^Qc valid date^05004|20141111000000|^|^|^^^<CR><ETB>A1<CR><LF>
<STX>2R|8|^Qc file No^05005|1|^|^|^^^<CR><ETB>D9<CR><LF>
<STX>3R|9|^Qc lot No^05006|MB034H|^|^|^^^<CR><ETB>C8<CR><LF>
<STX>4R|10|^Analyzer^09001|1#|^|^|^^^<CR><ETB>1C<CR><LF>
<STX>5R|11|^WBC^6690-2|19.50|10&S&9/L|16.44^21.44|^|^|^^^<CR><ETB>8F<CR><LF>
<STX>6R|12|^BAS#^704-7|0.54|10&S&9/L|0.22^0.80|^|^|^^^<CR><ETB>D5<CR><LF>
<STX>7R|13|^BAS%^706-2|2.8|1.2^4.2|^|^|^^^<CR><ETB>B5<CR><LF>
<STX>0R|14|^NEU#^751-8|13.08|10&S&9/L|10.71^14.71|^|^|^^^<CR><ETB>83<CR><LF>
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<STX>2R|16|^EOS#^711-2|1.85|10&S&9/L|0.50^2.90|^|^|^^^<CR><ETB>E8<CR><LF>
<STX>3R|17|^EOS%^713-8|9.5|3.0^15.0|^|^|^^^<CR><ETB>FE<CR><LF>
<STX>4R|18|^LYM#^731-0|3.53|10&S&9/L|2.00^5.20|^|^|^^^<CR><ETB>ED<CR><LF>
<STX>5R|19|^LYM%^736-9|18.1|11.0^27.0|^|^|^^^<CR><ETB>71<CR><LF>
<STX>6R|20|^MON#^742-7|0.50|10&S&9/L|0.00^1.22|^|^|^^^<CR><ETB>DF<CR><LF>
<STX>7R|21|^MON%^5905-5|2.6|0.0^5.7|^|^|^^^<CR><ETB>02<CR><LF>
<STX>0R|22|^RBC^789-8|5.59|10&S&12/L|5.57^6.17|^|^|^^^<CR><ETB>03<CR><LF>
<STX>1R|23|^HGB^718-7|17.8|g/dL|17.2^18.8|^|^|^^^<CR><ETB>57<CR><LF>
<STX>2R|24|^MCV^787-2|106.6|fL|93.2^103.2|^|^|^^^<CR><ETB>79<CR><LF>
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<STX>5R|27|^RDW-CV^788-0|15.9|15.9^20.7|^|^|^^^<CR><ETB>EC<CR><LF>

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 <STX>1R|31|^MPV^32623-1|10.8|fL|8.3^14.3|^N^<CR><ETB>FF<CR><LF>  
 <STX>2R|32|^PDW^32207-3|16.4||11.5^21.5|^N^<CR><ETB>75<CR><LF>  
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 <STX>4R|34|^PLCR^10014|32.9|%|26.3^46.3|^N^<CR><ETB>88<CR><LF>  
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 <STX>1R|39|^HFC%^10021|0.0|%|^|^N^<CR><ETB>7B<CR><LF>  
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# **LJ QC sample message transmitted in the format of common sample messages**

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 Count^00001|P|LIS2-A2|20140909171936<CR><ETB>EE<CR><LF>  
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 <STX>5R|2|^Blood Mode^08002|W|^|^<CR><ETB>40<CR><LF>  
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 <STX>5R|10|^Patient type^01016|||||^<CR><ETB>38<CR><LF>  
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 <STX>5R|34|^HCT^^4544-3|0.596||0.546^0.606|^N^><CR><ETB>E6<CR><LF>  
 <STX>6R|35|^PLT^^777-3|418|10&S&9/L|415^545|^N^><CR><ETB>5D<CR><LF>  
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 <STX>4R|57|^PLT Histogram. Right Line^^15112|0|^N^><CR><ETB>6F<CR><LF>  
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<STX>2R|63|^WBC DIFF Scattergram. FL dimension^^15207|0||^|^^^<CR><ETB>35<CR><LF>
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#### 4.6.2.4 Example of X Mean R QC Message

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QCR^00006|P|LIS2-A2|20140910101433<CR><ETB>BE<CR><LF>
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<STX>6R|4|^Qc Level^^05001|M||^|^^^<CR><ETB>6C<CR><LF>
<STX>7R|5|^QC test date modify flag^^05002||^|^^^<CR><ETB>EA<CR><LF>
<STX>0R|6|^QC test time modify flag^^05003||^|^^^<CR><ETB>F6<CR><LF>
<STX>1R|7|^Qc valid date^^05004|20140909000000||^|^^^<CR><ETB>AF<CR><LF>
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 <STX>3R|25|^MCH^785-6|\*\*\*\*|amol|^|^N^<CR><ETB>0B<CR><LF>  
 <STX>4R|26|^MCHC^786-4|\*\*\*\*|mmol/L|^|^N^<CR><ETB>D6<CR><LF>  
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<STX>7R|109|^HCT^4544-3|0.000|L/L|^N^<CR><ETB>D7<CR><LF>
<STX>0R|110|^PLT^777-3|0|10&S&9/L|^N^<CR><ETB>DC<CR><LF>
<STX>1R|111|^MPV^32623-1|****|fL|^N^<CR><ETB>B0<CR><LF>
<STX>2R|112|^PDW^32207-3|****|^N^<CR><ETB>F8<CR><LF>
<STX>3R|113|^PCT^10002|****|mL/L|^N^<CR><ETB>BF<CR><LF>
<STX>4R|114|^PLCR^10014|****|%^N^<CR><ETB>FF<CR><LF>
<STX>5R|115|^PLCC^10013|****|10&S&9/L|^N^<CR><ETB>80<CR><LF>
<STX>6R|116|^HFC#^10020|****|10&S&9/L|^N^<CR><ETB>52<CR><LF>
<STX>7R|117|^HFC%^10021|****|%^N^<CR><ETB>C8<CR><LF>
<STX>0R|118|^PLT-I^10022|0|10&S&9/L|^N^<CR><ETB>4A<CR><LF>
<STX>1R|119|^WBC-D^10024|0.00|10&S&9/L|^N^<CR><ETB>C3<CR><LF>
<STX>2R|120|^WBC-B^10025|0.00|10&S&9/L|^N^<CR><ETB>BB<CR><LF>
<STX>3R|121|^PDW-SD^10031|****|fL|^N^<CR><ETB>06<CR><LF>
<STX>4R|122|^InR#^10032|****|10&S&9/L|^N^<CR><ETB>88<CR><LF>
<STX>5R|123|^InR%^10033|****|%^N^<CR><ETB>D8<CR><LF>
<STX>6R|124|^WBC^12227-5|0.00|10&S&9/L|^N^<CR><ETB>BC<CR><LF>
<STX>7R|125|^IMG#^51584-1|****|10&S&9/L|^N^<CR><ETB>D1<CR><LF>
<STX>0R|126|^IMG%^38518-7|****|^N^<CR><ETB>21<CR><LF>
<STX>1R|127|^Micro#^15199-3|****|10&S&12/L|^N^<CR><ETB>18<CR><LF>
<STX>2R|128|^Micro%^10042|****|%^N^<CR><ETB>F1<CR><LF>
<STX>3R|129|^Macro#^15198-5|****|10&S&12/L|^N^<CR><ETB>15<CR><LF>
<STX>4R|130|^Macro%^10040|****|%^N^<CR><ETB>E2<CR><LF>
<STX>5L|1|N<CR><ETX>05<CR><LF>

```

## 4.6.3 Bi-Directional LIS/HIS Request Message

### 4.6.3.1 Record Structure

Record Structure:

- 1 Header
- 2 Request
- 3 Message Terminator

### 4.6.3.2 Content of Request Message

Content of bidirectional LIS/HIS request:

Record Type	Record Value	Field Position: Content	Component Value	Value Description
H	Message Header Record	3: message ID	Message ID	Message ID, which is also used in analysis result messages
		12: message type	Worklist request	See Table 18 of OBR-4 codes
Q	Request information	3: Sample ID	Sample ID	What displayed on screen
		7: time of request	Time of request	YYYYMMDDHHMMSS;

				time when the message is generated
		11: Sample type	Sample type	"BL": blood "BF": body fluid

#### 4.6.3.3 Example of Request Message

##### Blood sample:

```
<STX>1H|\^&|2||Mindray^BC-6800^||||Worksheet
request^00010|P|LIS2-A2|20140909163557<CR><ETB>06<CR><LF>
<STX>2Q|1|SampleID4001||||20140909163557||||BL<CR><ETB>AF<CR><LF>
<STX>3L|1|N<CR><ETX>03<CR><LF>
```

##### Body fluid sample:

```
<STX>1H|\^&|1||Mindray^BC-6800^||||Worksheet
request^00010|P|LIS2-A2|20140909163815<CR><ETB>02<CR><LF>
<STX>2Q|1|SampleID4001||||20140909163815||||BF<CR><ETB>A6<CR><LF>
<STX>3L|1|N<CR><ETX>03<CR><LF>
```

#### 4.6.4 Bi-Directional LIS/HIS Response Message

##### 4.6.4.1 Record Structure

Record Structure:

- 1 Header
- 2 Patient
- 3 Order
- 4 Result1
- 5 Result2
- 6 Result3
- .....
- n Message Terminator

##### 4.6.4.2 Content of Request Response

Result of request response

Record Type	Record Value	Field Position: Content	Component Value	Value Description
H	Record header	3: message ID	Message ID	Use the ID of the request message
		12: message type	Result of worklist request	See Table 18 of OBR-4 codes
P	Patient information	5: Patient ID	The patient ID displayed on screen	
		6: Patient name	First name	First name of patient
			Last Name	Last name of patient
		8: date of birth	Date of birth	YYYYMMDDHHMMSS

			Age	
			Age unit	Available age units: null, Y, M, W, D, and H, indicating null, year, month, week, day, and hour respectively
		9: gender	Gender	What displayed on screen
		25: department	Department	What displayed on screen
		26: location	Inpatient zone	What displayed on screen
			Bed No.	What displayed on screen
O	Sample Information	3: Sample ID	Sample ID	ID of the requested sample
		8: Time of sample collection	Time of sample collection	YYYYMMDDHHMMSS
		11: The person who ordered the analysis	The person who ordered the analysis	String in UI
		14: clinical diagnosis	Clinical diagnosis	What displayed on screen
		15: Date/Time when the specimen is received	Date/Time when the specimen is received	YYYYMMDDHHMMSS; what displayed on screen
		16: sample type	Sample type	What displayed on screen
			Sample source	Reserved; null
		26: report type	Result of request	Q – result of request is found Y – result of request is not found
R	Presentation mode	2: ID	ID	See Appendix C for data type and coding system
			ID	See Appendix C for data type and coding system
		4: result	Presentation mode	See Appendix C for HL7 and ASTM enumeration definition
		5: unit	Null	
		6: reference range	Null	
		7: flag	Null	

R	Blood Mode	Value same as above
R	Analysis mode	Value same as above
R	Sample type	Value same as above
R	SerialNumber	Value same as above, applicable to integrated analyzer only.
R	Reference group	4: result, value displayed on screen; other values same as above
R	Remarks	4: result, value displayed on screen; value same as above
R	Payer	4: result, value displayed on screen; value same as above
R	Patient type	4: result, value displayed on screen; value same as above
R	Custom1	4: result, value displayed on screen; value same as above
R	Custom2	4: result, value displayed on screen; value same as above
R	Custom3	4: result, value displayed on screen; value same as above

Note: when the “ProjectType” item in the response message is consistent with the “ProjectType” item in the request message (see “BL/BF” in 4.6.3), this item can be excluded in the response message. If not, transmit the “ProjectType” item as requested.

The OBX items “BloodMode” and “Take Mode” are not mandatory in the response. If they are not included in the response message, the instrument analyzes the sample in the mode defined in the “Setup” screen of the main unit. If it is included in the response message, the instrument analyzes the sample in the responded mode. If the “ProjectType” corresponding to this “BloodMode” in the response and the request are not the same. It is required to transmit the “ProjectType” item in the response message. The OBX item “Test Mode” is mandatory in the response.

#### 4.6.4.3 Example of Request Response Message

```
<STX>1H|\^&|1||Mindray^BC-6800^||||Worksheet
response^00011|P|LIS2-A2|20140909165555<CR><ETB>6C<CR><LF>

<STX>2P|1||||patientID2001|Michael^Jordan||20090210000000^6^Y|Male||||||||Internal medicine|A -
501^1002<CR><ETB>08<CR><LF>

<STX>3O|1|SampleID4001||||20090307103000||Jack||Virus      infections|20090307103100|Venous
blood^||||||Q<CR><ETB>46<CR><LF>

<STX>4R|1|^Test Mode^08003|CBC+DIFF||^|^^^^<CR><ETB>A4<CR><LF>

<STX>5R|2|^Ref Group^01002|Child||^|^^^^<CR><ETB>7B<CR><LF>

<STX>6R|3|^Remark^01001|Emergency patient||^|^^^^<CR><ETB>64<CR><LF>

<STX>7R|4|^Charge type^01015|Public||^|^^^^<CR><ETB>E0<CR><LF>

<STX>0R|5|^Patient type^01016|Outpatient||^|^^^^<CR><ETB>34<CR><LF>

<STX>1R|6|^SerialNumber^08005|3||^|^^^^<CR><ETB>53<CR><LF>

<STX>2R|7|^Custom patient info 1^01009|Nothing||^|^^^^<CR><ETB>DA<CR><LF>

<STX>3R|8|^Custom patient info 2^01010|Nothing||^|^^^^<CR><ETB>D5<CR><LF>

<STX>4R|9|^Custom patient info 3^01011|Nothing||^|^^^^<CR><ETB>D9<CR><LF>

<STX>5L|1|N<CR><ETX>05<CR><LF>
```



# Appendix A HL7 Protocol Overview

## A.1 Grammar

### A.1.1 Message Constructing Principles

Every HL7 message consists of several segments and ends up with the <CR> (0x0D).

Each segment consists of the segment name of three characters and a number of fields, and each field consists of some components and subcomponents. For each message, the delimiters of the fields, components and subcomponents are defined in the MSH segment.

E.g.

MSH|^~\&|Mindray|BC-6800|||20060427194802||ORU^R01|1|P|2.3.1|||||UNICODE

among which:

The five characters following MSH define the delimiters used between fields, components and subcomponents. Although they can be any non-text characters, HL7 standard recommends you use the characters in the table below:

**Table 17 HL7 Delimiters**

Character	Function
	Field delimiter
^	Component delimiter
&	Subcomponent delimiter
~	Repetition delimiter
\	ESC

The first two fields of MSH contains all the delimiters. Some fields behind are null because they are optional and not used by Mindray HL7 interface. Details about field definition and selection will be stated in the following sections.

For message of any type, the segments behind MSH appear in a fixed order. The order will be described in the following sections and the following grammar is used to organize the segments in proper order.

[] encloses optional segments.

{ } encloses segments which can repeat once or more.

### A.1.2 Principles of Escape Character Conversion

For the field data of ST, TX, FT, and CF, etc. delimiters may be used in strings like remarks, clinical diagnosis and customized gender etc. When coding, the delimiters in the original strings shall be converted to escape sequence; which is restored in decoding. The principles for escape character conversion for BC-6800/BC-6600 HL7 interface are as follows:

ESC Sequence	Original Character
\F\	Field delimiter
\S\	Component delimiter
\T\	Subcomponent delimiter
\R\	Repetition delimiter
\E\	Escape delimiter
\.br\	<CR>, segment end character.

Note: the "\" in the escape sequence represents the ESC delimiter, whose value is defined in the MSH segment.

## Appendix B HL7 Data Type Definition

### CE - Code Element

<identifier (ST)> ^ <text (ST)> ^ <name of coding system (ST)> ^ <alternate identifier (ST)> ^ <alternate text (ST)> ^ <name of alternate coding system (ST)>

### CM - Composite

Format defined by the field.

### CX - Extended composite ID with check digit

<ID (ST)> ^ <check digit (ST)> ^ <code identifying the check digit scheme employed (ID)> ^ < assigning authority (HD)> ^ <identifier type code (IS)> ^ < assigning facility (HD)>

### ED – Encapsulate Data

<source application (HD) > ^ <type of data (ID) > ^ <data sub type (ID) > ^ <encoding (ID) > ^ <data (ST) >

### EI - Entity Identifier

<entity identifier (ST)> ^ <namespace ID (IS)> ^ <universal ID (ST)> ^ <universal ID type (ID)>

### FC – Financial Class

<financial class (IS) > ^ <effective date (TS) >

### HD - Hierarchic designator

<namespace ID (IS)> ^ <universal ID (ST)> ^ <universal ID type (ID)>

Used only as part of EI and other data types.

### FT - Formatted text

This data type is derived from the string data type by allowing the addition of embedded formatting instructions. These instructions are limited to those that are intrinsic and independent of the circumstances under which the field is being used.

### IS - Coded value for user-defined tables

The value of such a field follows the formatting rules for an ST field except that it is drawn from a site-defined (or user-defined) table of legal values. There shall be an HL7 table number associated with IS data types.

### ID - Coded values for HL7 tables

The value of such a field follows the formatting rules for an ST field except that it is drawn from a table of legal values. There shall be an HL7 table number associated with ID data types.

### NM - Numeric



A number represented as a series of ASCII numeric characters consisting of an optional leading sign (+ or -), the digits and an optional decimal point.

#### **PL - Person location**

<point of care (IS)> ^ <room (IS)> ^ <bed (IS)> ^ <facility (HD)> ^ <location status (IS)> ^ <person location type (IS)> ^ <building (IS)> ^ <floor (IS)> ^ <location description (ST)>

#### **PT - Processing type**

<processing ID (ID)> ^ <processing mode (ID)>

#### **SI - Sequence ID**

A non-negative integer in the form of an NM field. The uses of this data type are defined in the chapters defining the segments and messages in which it appears.

#### **ST – String**

#### **TS - Time stamp**

YYYY[MM[DD[HHMM[SS[S[S[S[S]]]]]]][+/-ZZZZ] ^ <degree of precision>

#### **XCN - Extended composite ID number and name**

In Version 2.3, use instead of the CN data type. <ID number (ST)> ^ <family name (ST)> & <last\_name\_prefix (ST)> ^ <given name (ST)> ^ <middle initial or name (ST)> ^ <suffix (e.g., JR or III) (ST)> ^ <prefix (e.g., DR) (ST)> ^ <degree (e.g., MD) (ST)> ^ <source table (IS)> ^ <assigning authority (HD)> ^ <name type code (ID)> ^ <identifier check digit (ST)> ^ <code identifying the check digit scheme employed (ID)> ^ <identifier type code (IS)> ^ <assigning facility (HD)> ^ <name representation code (ID)>

#### **XPN - Extended person name**

In Version 2.3, replaces the PN data type. <family name (ST)> ^ <given name (ST)> & <last\_name\_prefix (ST)> ^ <middle initial or name (ST)> ^ <suffix (e.g., JR or III) (ST)> ^ <prefix (e.g., DR) (ST)> ^ <degree (e.g., MD) (IS)> ^ <name type code (ID)> ^ <name representation code (ID)>

#### **VID - Version identifier**

<version ID (ID)> ^ <internationalization code (CE)> ^ <international version ID (CE)>

## Appendix C Message Coding Definition

1. In HL communication messages, the OBR-4 (Universal Serview ID) field, in the form of "ID^Name^EncodeSys", is used to identify the type of the analysis result (e.g. sample analysis result, microscopic examination result, QC result, etc.). Table 18 lists all the codes of this field.

**Table 18 OBR-4 and ASTM Message Type Codes**

Data	Code (ID)	Name	EncodeSys	Remarks
Sample Analysis Result	00001	Automated Count	99MRC	
Microscopic result	00002	Manual Count	99MRC	
LQ QC count result	00003	LJ QCR	99MRC	
X mean QC count result	00004	X QCR	99MRC	
X-B QC count result	00005	XB QCR	99MRC	
X mean R QC count result	00006	XR QCR	99MRC	
Mean value f X mean QC results	00007	X QCR Mean	99MRC	
Mean value f X mean R QC results	00008	XR QCR Mean	99MRC	
X-M QC count result	00009	XM QCR	99MRC	
Worklist request	00010	Worksheet Request	99MRC	
Response to worklist request	00011	Worksheet Response	99MRC	

2. Each OBX segment contains information of one analysis parameter or non-parameter data item. It consists of the following fields: OBX-2, indicating the type of the HL7 data contained; OBX-3 (Observation Identifier), the identifier of the data in the form of "ID^Name^EncodeSys"; OBX-5, containing the value of the data; OBX-6, containing the unit for the parameter, (in the standard unit recommended by HL7).

Table 19 lists the HL7 type and code identifier of each communication data item. Table 20 lists all the units for parameters in the communication.

**Table 19 Data Type and Coding System**

Data	HL7 Type (OBX-2)	Code (ID)	Name	EncodeSys	Example of OBX-3 field
Non-parameter Data Items					
Presentation mode	IS	08001	Take Mode	99MRC	08001^Take Mode^99MRC
Blood Mode	IS	08002	Blood Mode	99MRC	08002^Blood Mode^99MR

					C
Measurement Mode	IS	08003	Test Mode	99MRC	08003^Test Mode^99MRC
Age	NM	30525-0	Age	LN	30525-0^Age^LN
Remarks	ST	01001	Remark	99MRC	01001^Remark^99MRC
Reference group	IS	01002	Ref Group	99MRC	01002^Ref Group^99MRC
Reexam flag	IS	01006	Recheck flag	99MRC	01006^Recheck flag^99MRC
Sample type	IS	01007	Sample Type	99MRC	01007^Sample Type^99MRC
Inpatient zone	IS	01008	Patient Area	99MRC	01008^Patient Area^99MRC
Custom patient information 1	ST	01009	Custom patient info 1	99MRC	01009^Custom patient info 1^99MRC
Custom patient information 2	ST	01010	Custom patient info 2	99MRC	01010^Custom patient info 2^99MRC
Custom patient information 3	ST	01011	Custom patient info 3	99MRC	01011^Custom patient info 3^99MRC
Tube rack No.	ST	01012	Shelf No	99MRC	01012^Shelf No^99MRC
Tube No.	ST	01013	Tube No	99MRC	01013^Tube No^99MRC
Report time	ST	01014	Report Time	99MRC	01014^Report Time^99MRC
Payer	ST	01015	Charger type	99MRC	01015^Charger type^99MRC
Patient type	ST	01016	Patient type	99MRC	01016^Patient type^99MRC
Level of control	IS	05001	Qc Level	99MRC	05001^Qc Level^99MRC
QC date edited flag	IS	05002	QC test date modify flag	99MRC	05002^QC test date modify flag^99MRC
QC time edited flag	IS	05003	QC test time modify flag	99MRC	05003^QC test time modify flag^99MRC
Expiration date of control	ST	05004	Qc valid date	99MRC	05004^Qc valid date^99MRC
QC file No.	ST	05005	Qc file No	99MRC	05005^Qc file No ^99MRC
Lot No. of control	ST	05006	Qc lot No	99MRC	05006^Qc lot No ^99MRC
Sample type	ST	05007	Project type	99MRC	05007^Project Type^99MRC
Analyzer name	ST	09001	Analyzer	99MRC	09001^Analyzer^99MRC
Serial number in LIS	ST	08005	SerialNumber	99MRC	08005^SerialNumber^99MRC
Review Rules	ST	13000	ReviewRulesG	99MRC	13000^ReviewRulesGroup

Group			roup		^99MRC
Review Rules	ST	13001	ReviewRules	99MRC	13001^ReviewRules^99MRC
Review Rules Group Description	ST	13004	ReviewRulesGroup Name	99MRC	13004^ReviewRulesGroup Name^99MRC
Parameter Result Items					
WBC	NM	6690-2	WBC	LN	6690-2^WBC^LN
WBC_CORRECT	NM	12227-5	WBC	LN	12227-5^WBC^LN
BAS	NM	704-7	BAS#	LN	704-7^BAS#^LN
BAS_PER	NM	706-2	BAS%	LN	706-2^BAS%^LN
NEU	NM	751-8	NEU#	LN	751-8^NEU#^LN
NEU_PER	NM	770-8	NEU%	LN	770-8^NEU%^LN
EOS	NM	711-2	EOS#	LN	711-2^EOS#^LN
EOS_PER	NM	713-8	EOS%	LN	713-8^EOS%^LN
LYM	NM	731-0	LYM#	LN	731-0^LYM#^LN
LYM_PER	NM	736-9	LYM%	LN	736-9^LYM%^LN
MON	NM	742-7	MON#	LN	742-7^MON#^LN
MON_PER	NM	5905-5	MON%	LN	5905-5^MON%^LN
RBC	NM	789-8	RBC	LN	789-8^RBC^LN
HGB	NM	718-7	HGB	LN	718-7^HGB^LN
MCV	NM	787-2	MCV	LN	787-2^MCV^LN
MCH	NM	785-6	MCH	LN	785-6^MCH^LN
MCHC	NM	786-4	MCHC	LN	786-4^MCHC^LN
RDW_CV	NM	788-0	RDW-CV	LN	788-0^RDW-CV^LN
RDW_SD	NM	21000-5	RDW-SD	LN	21000-5^RDW-SD^LN
HCT	NM	4544-3	HCT	LN	4544-3^HCT^LN
PLT	NM	777-3	PLT	LN	777-3^PLT^LN
MPV	NM	32623-1	MPV	LN	32623-1^MPV^LN
PDW	NM	32207-3	PDW	LN	32207-3^PDW^LN
PCT (Plateletcrit)	NM	10002	PCT	99MRC	10002^PCT^99MRC
RET	NM	14196-0	RET#	LN	14196-0^RET#^LN
RET_PER	NM	4679-7	RET%	LN	4679-7^RET%^LN
IRF	NM	33516-6	IRF	LN	33516-6^IRF^LN
LFR	NM	10015	LFR	99MRC	10015^LFR^99MRC
MFR	NM	10016	MFR	99MRC	10016^MFR^99MRC
HFR	NM	10017	HFR	99MRC	10017^HFR^99MRC
NRBC	NM	30392-5	NRBC#	LN	30392-5^NRBC#^LN
NRBC_PER	NM	26461-4	NRBC%	LN	26461-4^NRBC%^LN
P_LCR	NM	10014	PLCR	99MRC	10014^PLCR^99MRC
P_LCC	NM	10013	PLCC	99MRC	10013^PLCC^99MRC

RBC-O	NM	10018	RBC-O	99MRC	10018^RBC-O^99MRC
PLT-O	NM	10019	PLT-O	99MRC	10019^PLT-O^99MRC
HFC	NM	10020	HFC#	99MRC	10020^HFC#^99MRC
HFC_PER	NM	10021	HFC%	99MRC	10021^HFC%^99MRC
PLT-I	NM	10022	PLT-I	99MRC	10022^PLT-I^99MRC
WBC-R	NM	10023	WBC-R	99MRC	10023^WBC-R^99MRC
WBC-D	NM	10024	WBC-D	99MRC	10024^WBC-D^99MRC
WBC-B	NM	10025	WBC-B	99MRC	10025^WBC-B^99MRC
WBC-N	NM	10026	WBC-N	99MRC	10026^WBC-N^99MRC
PDW_SD	NM	10031	PDW_SD	99MRC	10031^PDW-SD^99MRC
InR	NM	10032	InR#	99MRC	10032^InR#^99MRC
InR_PER	NM	10033	InR‰	99MRC	10033^InR‰^99MRC
WBC_BF	NM	57845-0	WBC-BF	LN	57845-0^WBC-BF^LN
RBC_BF	NM	23860-0	RBC-BF	LN	23860-0^RBC-BF^LN
MN_BF	NM	26490-3	MN#	LN	26490-3^MN#^LN
MN_BF_PER	NM	26493-7	MN%	LN	26493-7^MN%^LN
EOS_BF	NM	35063-7	Eos-BF#	LN	35063-7^Eos-BF#^LN
EOS_BF_PER	NM	26452-3	Eos-BF%	LN	26452-3^Eos-BF%^LN
PMN_BF	NM	10034	PMN#	99MRC	10034^PMN#^99MRC
PMN_BF_PER	NM	10035	PMN%	99MRC	10035^PMN%^99MRC
TNC_BF_BF	NM	10036	TC-BF#	99MRC	10036^TC-BF#^99MRC
HF-BF#	NM	10037	HF-BF#	99MRC	10037^ HF-BF#^99MRC
HF-BF%	NM	10038	HF-BF%	99MRC	10038^ HF-BF%^99MRC
RBC-BF-R	NM	10039	RBC-BF-R	99MRC	10039^ RBC-BF-R ^99MRC
IMG#	NM	51584-1	IMG#	LN	51584-1^ IMG# ^LN
IMG%	NM	38518-7	IMG%	LN	38518-7^ IMG% ^LN
IPF	NM	10041	IPF	99MRC	10041 ^ IPF ^99MRC
Micro#	NM	15199-3	Micro#	LN	15199-3 ^ Micro# ^ LN
Micro%	NM	10042	Micro%	99MRC	10042 ^ Micro% ^99MRC
Macro#	NM	15198-5	Macro#	LN	15198-5 ^ Macro# ^ LN
Macro%	NM	10040	Macro%	99MRC	10040 ^ Macro% ^99MRC
MRV	NM	48706-6	MRV	LN	48706-6 ^ MRV ^ LN
RHE	NM	10043	RHE	99MRC	10043 ^ RHE ^99MRC
Neu-BF#	NM	10044	Neu-BF#	99MRC	10044 ^ Neu-BF# ^99MRC
Neu-BF%	NM	10045	Neu-BF%	99MRC	10045 ^ Neu-BF% ^99MRC
Neuts Band%. Manual	NM	764-1	Neuts Band%. Manual	LN	764-1 ^ Neuts Band%. Manual ^LN
Neuts Seg%. Manual	NM	769-0	Neuts Seg%. Manual	LN	769-0 ^ Neuts Seg%. Manual ^ LN
Abnormal Lymphs%.	NM	29261-5	Abnormal Lymphs%.	LN	29261-5 ^ Abnormal Lymphs%. Manual ^LN

Manual			Manual		
Pla-Aly%	NM	33835-0	Pla-Aly%	99MRC	33835-0 ^ Pla-Aly% ^99MRC
Mon-Aly%	NM	4662-3	Mon-Aly%	99MRC	4662-3 ^ Mon-Aly% ^99MRC
Imm-Aly%	NM	10046	Imm-Aly%	99MRC	10046 ^ Imm-Aly% ^99MRC
Other-Aly%	NM	10047	Other-Aly%	99MRC	10047 ^ Other-Aly% ^99MRC
Metamyelocyte %. Manual	NM	740-1	Metamyelocyte e%. Manual	LN	740-1 ^ Metamyelocyte%. Manual ^LN
Myelocytes%. Manual	NM	749-2	Myelocytes%. Manual	LN	749-2 ^ Myelocytes%. Manual ^LN
Promyelocytes %. Manual	NM	783-1	Promyelocytes %. Manual	LN	783-1 ^ Promyelocytes%. Manual ^ LN
Imm-Eos%	NM	33803-8	Imm-Eos%	99MRC	33803-8 ^ Imm-Eos% ^99MRC
Imm-Bas%	NM	33786-8	Imm-Bas%	99MRC	33786-8 ^ Imm-Bas% ^99MRC
Blast%	NM	10049	Blast%	99MRC	10049 ^ Blast% ^99MRC
Myeloblasts%. Manual	NM	747-6	Myeloblasts%. Manual	LN	747-6 ^ Myeloblasts%. Manual ^LN
Monoblasts%. Manual	NM	33840-0	Monoblasts%. Manual	LN	33840-0 ^ Monoblasts%. Manual ^ LN
Lymphoblasts %. Manual	NM	33831-9	Lymphoblasts %. Manual	LN	33831-9 ^Lymphoblasts%. Manual ^LN
IMG/Blast%	NM	10048	IMG/Blast%	99MRC	10048 ^ IMG/Blast% ^99MRC
Prolymphocyte s%. Manual	NM	6746-2	Prolymphocyte s%. Manual	LN	6746-2 ^ Prolymphocytes%. Manual ^LN
Promonocytes %. Manual	NM	13599-6	Promonocytes %. Manual	LN	13599-6 ^ Promonocytes%. Manual ^ LN
Plsm-cell%	NM	40492-1	Plsm-cell%	99MRC	40492-1 ^ Plsm-cell% ^99MRC
Intermediate Data of Analysis Results (histogram and scattergram data of WBC, RBC, and PLT, etc.)					
RBC histogram binary data	ED	15050	RBC Histogram. Binary	99MRC	15050^RBC Histogram. Binary^99MRC
Left discriminator of the RBC	NM	15051	RBC Histogram. Left Line	99MRC	15051^RBC Histogram. Left Line^99MRC

histogram					
Right discriminator of the RBC histogram	NM	15052	RBC Histogram. Right Line	99MRC	15052^RBC Histogram. Right Line^99MRC
RBC histogram metadata length	NM	15053	RBC Histogram. Binary Meta Length	99MRC	15053^RBC Histogram. Binary Meta Length^99MRC
RBC histogram left discriminator adjusted flag	IS	15054	RBC Histogram. Left Line Adjusted	99MRC	15054^RBC Histogram. Left Line Adjusted^99MRC
RBC histogram right discriminator adjusted flag	IS	15055	RBC Histogram. Right Line Adjusted	99MRC	15055^RBC Histogram. Right Line Adjusted^99MRC
RBC histogram bitmap data	ED	15056	RBC Histogram. BMP	99MRC	15056^RBC Histogram. BMP^99MRC
Total number of RBC histograms	NM	15057	RBC Histogram. Total	99MRC	15057^RBC Histogram. Total^99MRC
PLT histogram binary data	ED	15100	PLT Histogram. Binary	99MRC	15100^PLT Histogram. Binary^99MRC
Left discriminator of the PLT histogram	NM	15111	PLT Histogram. Left Line	99MRC	15111^PLT Histogram. Left Line^99MRC
Right discriminator of the PLT histogram	NM	15112	PLT Histogram. Right Line	99MRC	15112^PLT Histogram. Right Line^99MRC
PLT histogram metadata length	NM	15113	PLT Histogram. Binary Meta Length	99MRC	15113^PLT Histogram. Binary Meta Length^99MRC
PLT histogram left discriminator adjusted flag	IS	15114	PLT Histogram. Left Line Adjusted	99MRC	15114^PLT Histogram. Left Line Adjusted^99MRC
PLT histogram right	IS	15115	PLT Histogram.	99MRC	15115^PLT Histogram. Right Line

discriminator adjusted flag			Right Line Adjusted		Adjusted^99MRC
PLT histogram bitmap data	ED	15116	PLT Histogram. BMP	99MRC	15116^PLT Histogram. BMP^99MRC
Total number of PLT histograms	NM	15117	PLT Histogram. Total	99MRC	15117^PLT Histogram. Total^99MRC
Version of scattergram	NM	15014	ScattergramP araVer	99MRC	15014^ScattergramParaVe r^99MRC
Particle type array which needs to be greyout in the scattergram	ED	15015	ScattergramGr aphicFlags	99MRC	15015^ScattergramGraphi cFlags^99MRC
DIFF 2D scattergram bitmap data	ED	15200	WBC DIFF Scattergram. BMP	99MRC	15200^WBC DIFF Scattergram. BMP^99MRC
Diff scattergram metadata length	NM	15203	WBC DIFF Scattergram. Meta len	99MRC	15203^WBC DIFF Scattergram. Meta len^99MRC
Fsc dimension of DIFF scattergram	NM	15205	WBC DIFF Scattergram. Fsc dimension	99MRC	15205^WBC DIFF Scattergram. Fsc dimension^99MRC
Ssc dimension of DIFF scattergram	NM	15206	WBC DIFF Scattergram. Ssc dimension	99MRC	15206^WBC DIFF Scattergram. Ssc dimension^99MRC
FL dimension of DIFF scattergram	NM	15207	WBC DIFF Scattergram. FL dimension	99MRC	15207^WBC DIFF Scattergram. FL dimension^99MRC
FSC—LOG dimension of DIFF scattergram	NM	15208	WBC DIFF Scattergram. FSC-LOG dimension	99MRC	15208^WBC DIFF Scattergram. FSC-LOG dimension^99MRC
DIFF scattergram binary data	ED	15201	WBC DIFF Scattergram. BIN	99MRC	15201^WBC DIFF Scattergram. BIN^99MRC
BASO 2D scattergram bitmap data	ED	15250	Baso Scattergram. BMP	99MRC	15250^Baso Scattergram. BMP^99MRC
BASO scattergram binary data	ED	15251	Baso Scattergram. BIN	99MRC	15251^Baso Scattergram. BIN^99MRC



BASO scattergram metadata length	NM	15253	Baso Scattergram. Meta Len	99MRC	15253^Baso Scattergram. Meta Len^99MRC
Fsc dimension of BASO scattergram	NM	15255	Baso Scattergram. Fsc dimension	99MRC	15255^Baso Scattergram. Fsc dimension^99MRC
Ssc dimension of BASO scattergram	NM	15256	Baso Scattergram. Ssc dimension	99MRC	15256^Baso Scattergram. Ssc dimension^99MRC
FL dimension of BASO scattergram	NM	15257	Baso Scattergram. FL dimension	99MRC	15257^Baso Scattergram. FL dimension^99MRC
FSC-LOG dimension of BASO scattergram	NM	15258	Baso Scattergram. FSC-LOG dimension	99MRC	15258^Baso Scattergram. FSC-LOG dimension^99MRC
RET 2D scattergram bitmap data	ED	15300	RET Scattergram. BMP	99MRC	15300^RET Scattergram. BMP^99MRC
PLT-O 2D scattergram bitmap data	ED	15301	PLT-O Scattergram. BMP	99MRC	15301^PLT-O Scattergram. BMP^99MRC
RET-EXT 2D scattergram bitmap data	ED	15302	RET-EXT Scattergram. BMP	99MRC	15302^RET-EXT Scattergram. BMP^99MRC
RET dimension of RET scattergram	NM	15303	RET Scattergram. Fsc dimension	99MRC	15303^RET Scattergram. Fsc dimension^99MRC
SSC dimension of RET scattergram	NM	15304	RET Scattergram. Ssc dimension	99MRC	15304^RET Scattergram. Ssc dimension^99MRC
FL dimension of RET scattergram	NM	15305	RET Scattergram. FL dimension	99MRC	15305^RET Scattergram. FL dimension^99MRC
RET scattergram binary data	ED	15306	RET Scattergram. BIN	99MRC	15306^RET Scattergram. BIN^99MRC
RET scattergram metadata	NM	15307	RET Scattergram. Meta Len	99MRC	15307^RET Scattergram. Meta Len^99MRC

length					
FSC-LOG dimension of RET scattergram	NM	15308	RET Scattergram FSC-LOG dimension	99MRC	15308^RET Scattergram FSC-LOG dimension^99MRC
NRBC 2D scattergram bitmap data	ED	15350	NRBC Scattergram. BMP	99MRC	15350^NRBC Scattergram. BMP^99MRC
FSC dimension of NRBC scattergram	NM	15351	NRBC Scattergram. Fsc dimension		15351^NRBC Scattergram. Fsc dimension^99MRC
SSC dimension of NRBC scattergram	NM	15352	NRBC Scattergram. Ssc dimension	99MRC	15352^NRBC Scattergram. Ssc dimension^99MRC
FL dimension of NRBC scattergram	NM	15353	NRBC Scattergram. FL dimension	99MRC	15353^NRBC Scattergram. FL dimension^99MRC
NRBC scattergram binary data	ED	15354	NRBC Scattergram. BIN	99MRC	15354^NRBC Scattergram. BIN^99MRC
NRBC scattergram metadata length	NM	15355	NRBC Scattergram. Meta Len	99MRC	15355^NRBC Scattergram. Meta Len^99MRC
FSC-LOG dimension of NRBC scattergram	NM	15356	NRBC Scattergram FSC-LOG dimension	99MRC	15356^NRBC Scattergram FSC-LOG dimension^99MRC
Flags of Abnormal Blood Cell Differential or Morphology					
WBC Scattergram Abn.	IS	12000	WBC Abnormal scattergram	99MRC	12000^WBC Abnormal scattergram^99MRC
WBC Histogram Abn.	IS	12001	WBC Abnormal histogram	99MRC	12001^WBC Abnormal histogram^99MRC
Leucocytosis	IS	12002	Leucocytosis	99MRC	12002^Leucocytosis^99MRC
Leucopenia	IS	12003	Leucopenia	99MRC	12003^Leucopenia^99MRC
Neutrophilia	IS	12004	Neutrophilia	99MRC	12004^Neutrophilia^99MRC
Neutropenia	IS	12005	Neutropenia	99MRC	12005^Neutropenia^99MRC
Lymphocytosis	IS	12006	Lymphocytosis	99MRC	12006^Lymphocytosis^99MRC

					MRC
Lymphopenia	IS	12007	Lymphopenia	99MRC	12007^Lymphopenia^99MRC
Monocytosis	IS	12008	Monocytosis	99MRC	12008^Monocytosis^99MRC
Eosinophilia	IS	12009	Eosinophilia	99MRC	12009^Eosinophilia^99MRC
Basophilia	IS	12010	Basophilia	99MRC	12010^Basophilia^99MRC
WBC Abn.	IS	12011	WBC Abnormal	99MRC	12011^WBC Abnormal^99MRC
Left Shift?	IS	17790-7	WBC Left Shift?	LN	17790-7^WBC Left Shift?^LN
Immature Granulocyte?	IS	34165-1	Imm Granulocytes?	LN	34165-1^Imm Granulocytes?^LN
Abn./Atypical Lymph?	IS	15192-8	Atypical Lymphs?	LN	15192-8^Atypical Lymphs?^LN
RBC Lyse Resist?	IS	34525-6	rstRBC	LN	34525-6^rstRBC^LN
Erythrocytosis	IS	12012	Erythrocytosis	99MRC	12012^Erythrocytosis^99MRC
RBC Distribution Abn.	IS	12013	RBC Abnormal distribution	99MRC	12013^RBC Abnormal distribution^99MRC
Anisocytosis	IS	15150-6	Anisocytosis	LN	15150-6^Anisocytosis^LN
Macrocytosis	IS	12075	Macrocytes	99MRC	12075^Macrocytes^99MRC
Microcytosis	IS	12076	Microcytes	99MRC	12076^Microcytes^99MRC
Dimorphologic	IS	10379-6	RBC Dual Pop	LN	10379-6^RBC Dual Pop^LN
Anemia	IS	12014	Anemia	99MRC	12014^Anemia^99MRC
Hypochromia	IS	15180-3	Hypochromia	LN	15180-3^Hypochromia^LN
HGB Abn./Interfere?	IS	12015	HGB Interfere	99MRC	12015^HGB Interfere^99MRC
Platelet Distribution Abn.	IS	12016	PLT Abnormal Distribution	99MRC	12016^PLT Abnormal Distribution^99MRC
Thrombocytosis	IS	12017	Thrombocytosis	99MRC	12017^Thrombocytosis^99MRC
Thrombopenia	IS	12018	Thrombopenia	99MRC	12018^Thrombopenia^99MRC
Platelet Clump?	IS	7796-6	Platelet Clump?	LN	7796-6^Platelet Clump?^LN
Right Shift	IS	12020	Right Shift	99MRC	12020^Right Shift^99MRC

Asp. Abn./Sample Abn.	IS	12021	Sample Abnormal	99MRC	12021^Sample Abnormal^99MRC
RBC Agglutination?	IS	12022	RBC Clump	99MRC	12022^RBC Clump^99MRC
Small Platelet	IS	32208-1	Platelets.small	LN	32208-1^Platelets.small^LN
RBC or HGB Abn.	IS	12023	RBC HGB Abnormal	99MRC	12023^ RBC HGB Abnormal^ 99MRC
Iron Deficiency	IS	12024	Iron Deficiency	99MRC	12024^Iron Deficiency^99MRC
RBC or HGB suspicious	IS	12025	RBC HGB doubt	99MRC	12025^ RBC HGB doubt^99MRC
DIFF Data Collection Error	IS	12026	DIFF Sampling Error	99MRC	12026^DIFF Sampling Error^99MRC
DIFF Data Analysis Error	IS	12027	DIFF-CH Error	99MRC	12027^DIFF-CH Error^99MRC
Blast cell	IS	44017-2	Blasts	LN	44017-2^Blasts^LN
NRBC /PLT Clump?	IS	12028	NRBC /PLTClumps	99MRC	12028^NRBC /PLTClumps^99MRC
RBC Data Collection Error	IS	12029	RBC Sampling Error	99MRC	12029^RBC Sampling Error^99MRC
RBC Data Analysis Error	IS	12030	RBC-CH Error	99MRC	12030^RBC-CH Error^99MRC
RBC Agglutination?	IS	50670-9	RBC Agglutination?	LN	50670-9^ RBC Agglutination?^LN
HGB Abn.	IS	12031	HGB Defect	99MRC	12031^HGB Defect^99MRC
PLT Data Collection Error	IS	12032	HGB Sampling Error	99MRC	12032^HGB Sampling Error^99MRC
PLT Data Analysis Error	IS	12033	PLT-CH Error	99MRC	12033^PLT-CH Error^99MRC
BASO Data Collection Error	IS	12034	BASO Sampling Error	99MRC	12034^BASO Sampling Error^99MRC
BASO Data Analysis Error	IS	12035	BASO-CH Error	99MRC	12035^BASO-CH Error^99MRC
Leucocytosis (BASO)	IS	12036	Leukocytosis( BASO)	99MRC	12036^Leukocytosis(BAS O)^99MRC
Leucopenia (BASO)	IS	12037	Leukopenia(B ASO)	99MRC	12037^Leukopenia(BASO) ^99MRC
RET Data Collection Error	IS	12038	RET Sampling Error	99MRC	12038^RET Sampling Error^99MRC

RET Data Analysis Error	IS	12039	RET-CH Error	99MRC	12039^RET-CH Error^99MRC
RET Scattergram Abn.	IS	12040	RET Abn Scattergram	99MRC	12040^RET Abn Scattergram^99MRC
Reticulocytosis	IS	12041	Reticulocytosis	99MRC	12041^Reticulocytosis^99MRC
NRBC Data Collection Error	IS	12042	NRBC Sampling Error	99MRC	12042^NRBC Sampling Error^99MRC
NRBC Data Analysis Error	IS	12043	NRBC-CH Error	99MRC	12043^NRBC-CH Error^99MRC
NRBC Scattergram Abn.	IS	12044	NRBC Abn Scattergram	99MRC	12044^NRBC Abn Scattergram^99MRC
Nucleated Red Blood Cell	IS	34188-3	NRBC present	LN	34188-3^NRBC present^LN

**Table 20 Parameter Units in Communication**

<b>Parameter Units in Software</b>	<b>Parameter Units in Communication (OBX-6)</b>
10^12/L	10*12/L
10^9/L	10*9/L
10^4/L	10*4/L
10^3/L	10*3/L
10^6/uL	10*6/uL
10^4/uL	10*4/uL
10^3/uL	10*3/uL
10^2/uL	10*2/uL
mL/L	mL/L
/nL	/nL
/pL	/pL
g/L	g/L
g/dL	g/dL
L/L	L/L
mmol/L	mmol/L
%	%
fL	fL
um^3	um3
pg	pg
fmol	fmol
amol	amol

year (age unit)	yr
month (age unit)	mo
day (age unit)	d
hour (age unit)	hr
week (age unit)	wk

3. Some OBX messages uses custom enumeration values. See Table 21 for the meaning of the values.

**Table 21 HL7 and ASTM Enumeration Definitions**

<b>Data</b>	<b>Value Enumeration</b>
Take Mode	Value enumeration: "O" - open-vial "A" - autoloading "C" – closed-tube
Blood Mode	Value enumeration: "W" - whole blood "P" - predilute "B" – body fluid "Q" – control
Test Mode	Value enumeration: "CBC" "CBC+DIFF" "CBC+RET" "CBC+NRBC" "CBC+DIFF+RET" "CBC+DIFF+NRBC" "CBC+DIFF+RET+NRBC" "RET"
Qc Level	Value enumeration: "L" - low "M" - normal "H" - high
Histogram discriminator adjusted flag and other flags	The data type of OBX-2 is "IS". Value enumeration: "T" - true "F" - false
QC analysis date/time edited flag	"E" - edited. Not transmitted if the date/time is not edited.
<b>Sample Type (Project Type)</b>	<b>"BL": blood</b> <b>"BF": body fluid</b>

4. Histogram data: the histograms can be transmitted in the following ways based on the software configuration:

- 1) Do not transmit histogram data.
- 2) Transmitted as bitmap. The data type field of OBX segment is "ED", and the data field is in the form of "^Image^BMP^Base64^.....bitmap histogram data.....", where "Image" indicates that the data in transmission is data of graphs, "BMP" is the custom subdata type, and

"Base64" is the way of coding the bitmap data.

3) Transmitted as binary histogram data. The data type field of OBX segment is "ED", and the data field is in the form of "^Application^Octet-stream^Base64^.....histogram data.....", where "Application^Octet-stream" is the HL7 standard subdata type, indicating the binary data defined by the application, and "Base64" is the way of coding the bitmap data.

Note: the ID field in the OBX segment defines whether the histogram is transmitted in bitmap or binary data.

5. Scattergram data: the data type field of OBX segment is "ED", and the data field is in the form of "^Image^BMP^Base64^.....scattergram bitmap data.....", where "Image^BMP^Base64" indicates that the data in transmission is BMP data coded by Base 64.

In the transmission of the greyout particle type array of scattergram, the data type of OBX segment is "ED"; the data field is similar to "^Application^Octet-stream^Base64^.....greyout particle type array data.....", where the length is variable; the particle types are enumeration values. See the table below for the matching between the enumeration values and the cell types.

MinType	0x0	MIN Type
BasoGhost	0x0	Ghost
Baso	0x01	Basophil
BasoWbc	0x02	White blood cell
DiffGhost	0x03	Ghost
DiffLym	0x04	Lymphocyte
DiffMon	0x05	Monocyte
DiffEos	0x06	Eosinophil
DiffNeu	0x07	Neutrophil
DiffAly	0x08	Abnormal lymphocyte
DiffImm	0x09	Immature cell
RetRbc	0x0a	Red blood cell
RetLfr	0x0b	Low fluorescent RET
RetMfr	0x0c	Middle fluorescent RET
RetHfr	0x0d	High fluorescent RET
RetWbc	0x0e	White blood cell
RetPlt	0x0f	Platelet
Nrbc	0x10	Nucleated red blood cell
NrbcGhost	0x11	Ghost
NrbcWbc	0x12	White blood cell
Notype	0x13	Not differentiated
DiffHf	0x14	High fluorescent cell -

		body fluid
Retlpf	0x15	Immature platelet
MaxType	0x16	Maximal number of types

6. Communication of patient age: the age of the patient is transmitted in an OBX segment which contains an integer and a unit. The age could be "<1" day (same as the DMU UI).



## Appendix D Base64 Encoding Process

1. Select the 3 adjacent bytes (i.e. 24 bit) from the data stream to be encoded; from left to right, divide them into 4 6-bit groups; and then, the ASCII string is obtained by mapping based on Table 22 below.

Raw data:	15H	A3H	4BH
Binary data	00010101	10100011	01001011
6-bit groups obtained after dividing	000101	011010	001101 001011
Corresponding codes	5H	1AH	0DH 0BH
Corresponding characters	F	a	N L

**Table 22 Base64 Mapping**

Value/Code	Value/Code	Value/Code	Value/Code
0 A	17 R	34 I	51 z
1 B	18 S	35 j	52 0
2 C	19 T	36 k	53 1
3 D	20 U	37 l	54 2
4 E	21 V	38 m	55 3
5 F	22 W	39 n	56 4
6 G	23 X	40 o	57 5
7 H	24 Y	41 p	58 6
8 I	25 Z	42 q	59 7
9 J	26 a	43 r	60 8
10 K	27 b	44 s	61 9
11 L	28 c	45 t	62 +
12 M	29 d	46 u	63 /
13 N	30 e	47 v	
14 O	31 f	48 w	(pad) =
15 P	32 g	49 x	
16 Q	33 h	50 y	

2. Repeat step 1 continuously till the whole data stream is encoded.

When the data left is less than 3 bytes, 0 is added to the right to complement. If the 6-bit groups obtained is composed of the complement bit (0) only, then it is mapped to the “=” character. When there is the last one byte left, there will be two “=” characters in the obtained coding string; when two bytes are left, then the obtained coding string consists of one “=” character. See the two examples below:

① Raw data                      0AH  
    00001010

Data obtained after complementing	00001010	00000000	00000000
6-bit groups obtained after dividing	000010	100000	000000 000000
Corresponding codes	02H	20H	00H 00H
Corresponding characters	C	g	= =

② Raw data                      0AH                      0BH  
    00001010                      00001011

Data obtained after complementing	00001010	00001011	00000000	
6-bit groups obtained after dividing	000010	100000	101100	000000
Corresponding codes	02H	20H	2CH	00H
Corresponding characters	C	g	s	=

## Appendix E Communication Log

To track the problems related to LIS and to apply 1-way/2-way LIS, the communication log function is added to the DMU, which includes: data sent and received by the analyzer, the information of communication processes, communication errors and abnormalities.

The format of the log is shown in the figure below:

```
2014-08-20 11:01:17:571 IPU.vshost Send    >> : <STX>4R|1|^Take Mode^^08001|A||^|^^^^^^<CR><ETB>BC<CR><LF>
2014-08-20 11:01:17:575 IPU.vshost Receive<< : <ACK>
```

The log is saved in the data folder under the installation directory of the DMU. For example, if the data folder path is : D:\HematologyData, the path of the communication log will be: D:\HematologyData\Mindray\BC-6800 Hematology Analyzer\ExceptionPath{609a5d93-7906-40f1-b393-957a77c6210d}. The file name is similar to "MRCommunication\_2014-08-27.log". Only the logs in the past 30 days or the 30 latest log files can be saved.

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