

labXpert Software

Communication Protocol



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## Revision History

Protocol Ver.	Manual Version	ECR	Position	Revision Description	Revised by
1.0	1.0	/	/	<p>Initial release</p> <p>The communication protocol for the labXpert software is compatible with the BC-6800/6600 communication protocol and is therefore prepared on the basis of the BC-6800 communication protocol (H-046-004436-00-9.0 BC-6800_BC-6600 通信协议 (英文), 9.0 version).</p> <p>The new information added to the BC-6800/6600 protocol include:</p> <ul style="list-style-type: none"> <li>● Communication protocols for the CRP parameters and CRP parameter-related flags</li> <li>● Support for the CRP analysis mode in the Bidirectional LIS/HIS Request Response</li> <li>● New mark for reviewed samples.</li> </ul>	Mao Rongrong
2.0	/	EIV006	Appendix C, Table 19, Table 21	<p>Added the following information:</p> <p>Communication protocols for new parameters, flags, and the WNB scattergram in BC-6800Plus series analyzers</p> <p>In the Request Response Message, added the support for SMST mode.</p>	Mao Rongrong
3.0	/	EIV008	Appendix C, table 19	<p>Added the following items in the Appendix C, Data type and coding system:</p> <p>“Review results” (code 09999), “aspiration abnormal” (code 12105)</p>	Mao Rongrong

4.0	2.0	EJ319	Appendix C table 29, table 31 Chapter 1, section 1.5 Chapter 2,3, 4 Appendix A Appendix F Appendix G	Added the following based on the previous version: 1. Modify the code 12227-5(WBC_CORRECT), change its name to 12227-5(WBC_CORRECT) 2. Add new modes: CR/PLT-8X, CDR/PLT-8X 3. Added the information of the new parameters and scattergrams for BC-6800Plus 4. Add the code for genders 5. Add a new section 1.5 6. Add Appendix F Enabling Guest Account 7. Add new Chapter 4: simplified communication protocol for labXpert 8. Add Appendix G JSON standard 9. Update figure, table, and TOC lists.	Mao Rongrong
5.0	3.0	EJ340	Appendix C, table 27, table 28	1. Added "Validation Rule details" in table 27; 2. In table 28, change the parameter unit "um3" to "um\S\3"	Li Jinqiang Xu Baozhong Mao Rongrong
6.0	4.0	EJ362	Appendix C, table 27 Chapter 2 Chapter 3 Chapter 4	Add the new flag information, delete the useless flag information, modify the wrong flag information, to make them be consistent with the software interface.  New version protocol 6.0: 1. "Table 27 Data Type and Coding System": analyzer corrects FR-CRP by default, LIS, LIS tests ID 2. Support LIS requests sample skipped for analysis. 3. Differentiate the transmission mode for Chinese patient names from that for the non-Chinese names	Xu Baozhong Zhou Xinbiao Chao Xuebin Mao Rongrong
7.0	/	EKE004	/	1. New version protocol 7.0: add "TNC-B" in 2. Update MREz protocol to version 2.0: add LisTestID in <b>Table 15</b> , add DefaultCrp, TNC-B in <b>Table 17</b> , update example in 4.2.5.2.	Xu Baozhong

8.0	5.0	EIE014	Appendix C, table 28 Chapter 2 Chapter 3 Chapter 4 Table 15, 17, 19, 22, 23, 30	<ol style="list-style-type: none"> <li>1. Added new ORC messages in section 2.5.7</li> <li>2. Added sample messages for the new “LIS receiving samples by SN” function in section 2.6.6</li> <li>3. Add chapter 2.6.1.4, 2.6.1.5</li> <li>4. Add chapter 3.6.1.5</li> <li>5. Added information about the communication of A1C results in 4.2.5.2</li> <li>6. Appendix C, added glycohemoglobin test parameters, flags, chromatographs, chromatograph peaks and the related coding rule</li> <li>7. Add new table 22</li> <li>8. Table 15, added chromatograph messages, chromatograph peak messages</li> <li>9. Table 17, added information about the A1C parameters</li> <li>10. Table 19, added glycohemoglobin test flags</li> <li>11. Section 3.6.2.2, added CRL-1, CRL-2</li> <li>12. Table 23, added CRL-1, CRL-2</li> <li>13. Table 30, added new test mode A1C, “STANDARD”, “EXTEND”, added new control levels CRL-1, CRL-2</li> <li>14. Table 12, added HbA1c Mode Group</li> </ol>	Liuping Chao Xuebin
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# Chapter 1 Connection Control

## 1.1 labXpert as TCP Server

The TCP server starts monitoring after the labXpert 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 labXpert is closed.

## 1.2 labXpert as TCP Client

After the labXpert 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 try to reconnect until the communication is established.

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 labXpert is closed.

## 1.3 HL7 Communication between Network 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 labXpert 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.

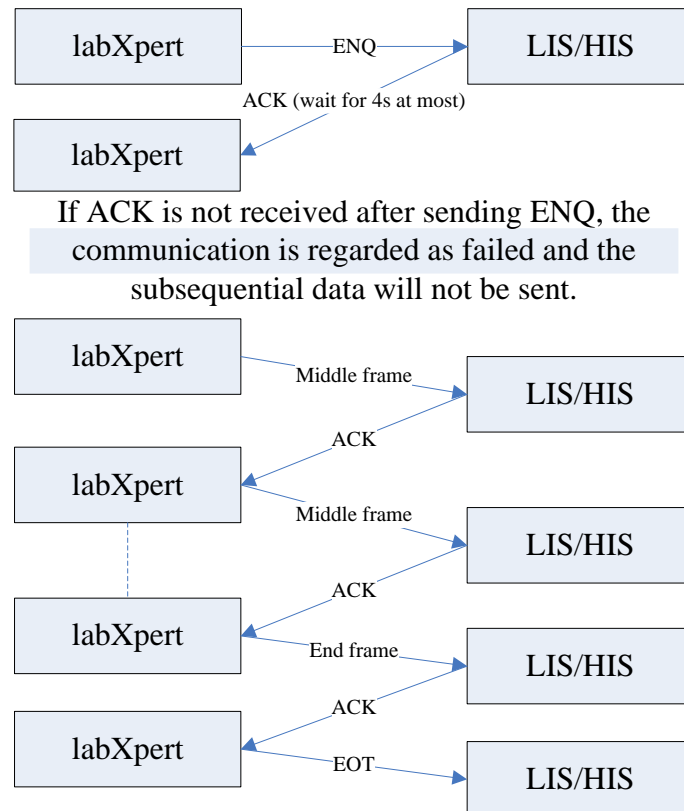
While saving worklist, or run a count without worklist, the labXpert initiates a LIS/HIS search request, and LIS/HIS responds to the request in 10s. If the response is received successfully, the labXpert will save the information or run the count in the mode acquired from LIS/HIS.

## 1.4 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 3 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.

### 1.4.1 Sending Message



**Figure 1 Sending a message from labXpert 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 labXpert to LIS/HIS.

When labXpert 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 labXpert and LIS/HIS is established successfully, the labXpert 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 labXpert to resend the data. The EOT control character will be sent after the communication is finished.

For transmission from LIS/HIS to labXpert, 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 3 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.

### 1.4.2 Resending Message

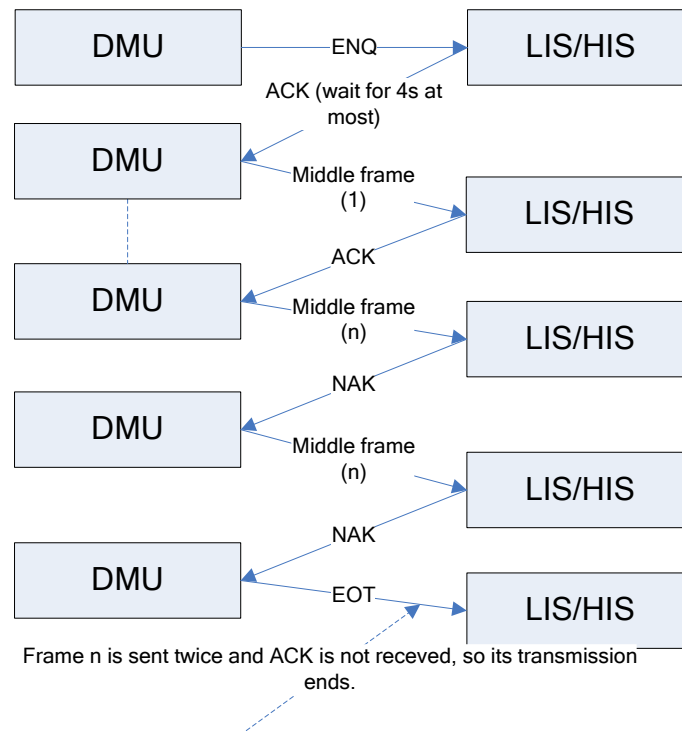


Figure 2 Resending data

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.

### 1.4.3 Bi-Directional LIS/HIS

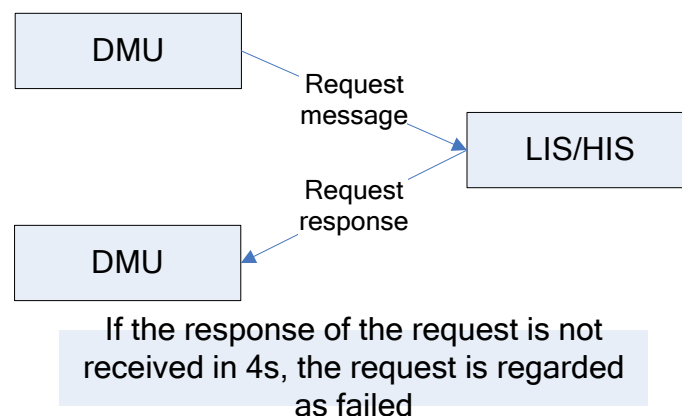
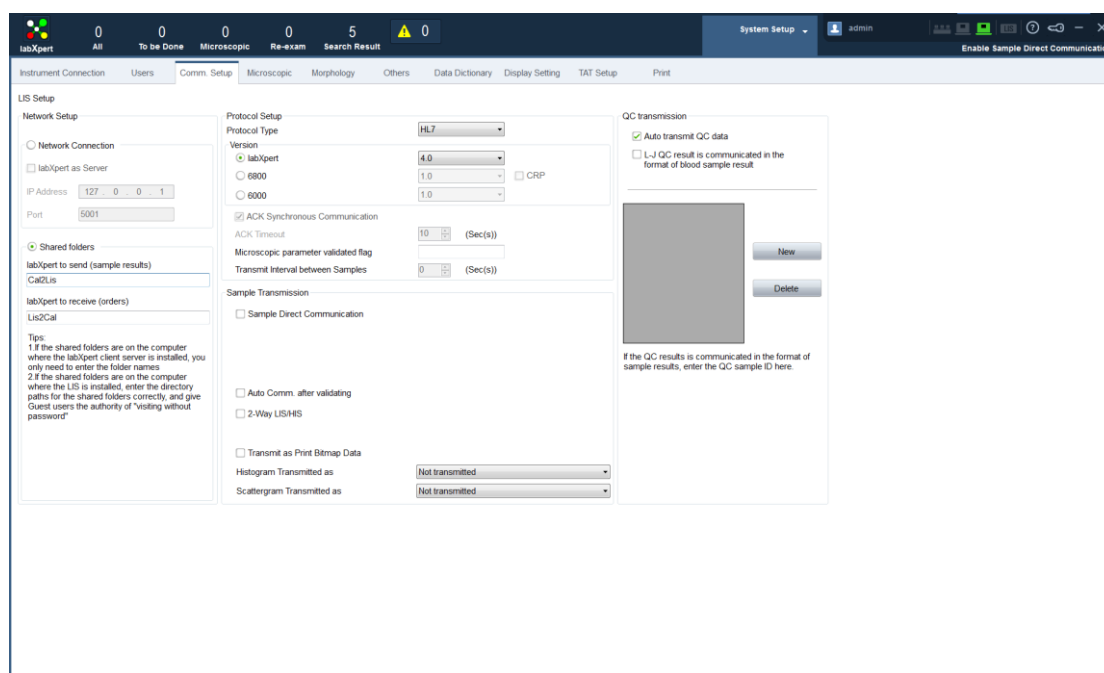


Figure 3 Bi-directional LIS/HIS communication from labXpert to LIS/HIS

First, the labXpert 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 3 for message definitions) for 4s. The LIS/HIS responding process is the same as that in the “sending message” process.

## 1.5 Communication with Windows Shared Folders

1. The Mindray labXpert exchanges files with the LIS through Windows shared folders. The shared folders are located on a PC that serves as the labXpert server or on a PC that does not serve as the labXpert server. Two folders are used respectively to send results and receive work orders. The communication setting interface is as follows:



**Figure 4 Communication Settings**

If the folders are located on a PC that serves as the labXpert server, the folders are set as follows:

Folder Name	Remarks
Cal2Lis	<ol style="list-style-type: none"> <li>1. Used to store the result files sent from the CAL8000 to the LIS.</li> <li>2. The path for the LIS to read results is \\IP address of the PC installed with labXpert server\Cal2Lis</li> </ol>
Lis2Cal	<ol style="list-style-type: none"> <li>1. Used to store the sample reception work orders related to the labXpert only.</li> <li>2. The path for the LIS to write the work orders is \\IP address of the PC installed with labXpert server end\Cal2Lis</li> </ol>

Here, the folder names Cal2Lis and LisCal serve as examples only. You can name folders as desired.

If the folders are located on a PC that does not serve as the labXpert server, the folders

are set as follows:

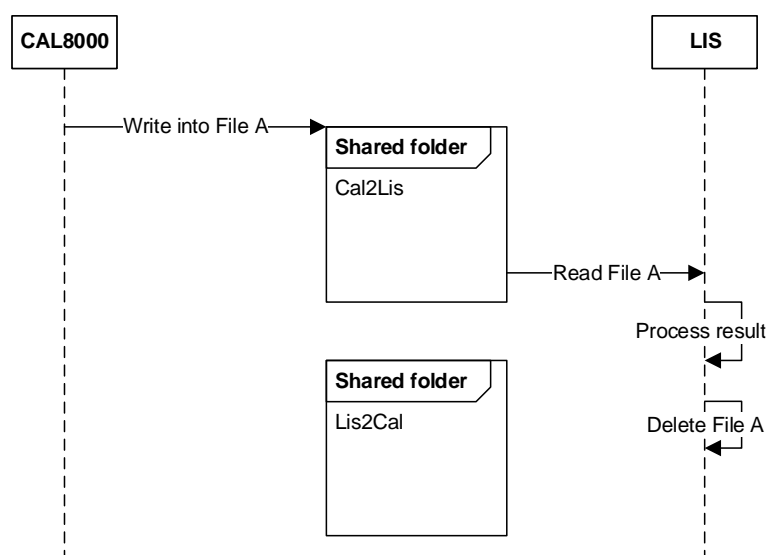
Folder Name	Remarks
\\IPaddress\Cal2Lis	Used to store the result files sent from the CAL8000 to the LIS.
\\IPaddress\Lis2Cal	Used to store the sample reception work orders related to the labXpert only.

The IP address here refers to the IP address of the PC where the shared folders are located, and can also be set to the host name.

## 2. File format and interaction process

### 1) The labXpert sends the sample/QC results to the LIS.

- File writing: The labXpert writes files into the result folder, and ensures that all file names are unique.  
File naming convention: YYYYMMDDHHMMSSff\_Barcode (or sample number).dat
- File reading: After a new file is written, the LIS reads the file within 3s, and deletes the file after successfully reading the file.
- Specific interaction process:



**Figure 5 Transmit results through shared folder**

- Demo file example of a sample result:
- MSH|^~&|LabXpert|Mindray|||20160729112109||ORU^R01|1|P|2.3.1|||||UNICODE  
PID|1||^MR  
PV1|1  
OBR|1||14030406305|00001^Automated  
Count^99MRC|||20140304181721|||||||20160729112109||HM|Validated|||admin|||admin  
OBX|1|IS|08001^Take Mode^99MRC||A|||||F  
OBX|2|IS|08002^Blood Mode^99MRC||W|||||F  
OBX|3|IS|08003^Test Mode^99MRC||CBC+DIFF|||||F  
OBX|4|IS|01002^Ref Group^99MRC||通用|||||F

OBX|5|IS|05007^Project Type^99MRC||BL|||||F  
 OBX|6|ST|01012^Shelf No^99MRC||46|||||F  
 OBX|7|ST|01013^Tube No^99MRC||10|||||F  
 OBX|8|NM|6690-2^WBC^LN||4.21|10\*9/L|4.00-10.00|N|||F  
 OBX|9|NM|704-7^BAS#^LN||0.02|10\*9/L|0.00-0.10|N|||F  
 OBX|10|NM|706-2^BAS%^LN||0.4|10\*9/L|0.0-1.0|N|||F  
 OBX|11|NM|751-8^NEU#^LN||2.54|10\*9/L|2.00-7.00|N|||F  
 OBX|12|NM|770-8^NEU%^LN||60.3|10\*9/L|50.0-70.0|N|||F  
 OBX|13|NM|711-2^EOS#^LN||0.19|10\*9/L|0.02-0.50|N|||F  
 OBX|14|NM|713-8^EOS%^LN||4.6|10\*9/L|0.5-5.0|N|||F  
 OBX|15|NM|731-0^LYM#^LN||1.19|10\*9/L|0.80-4.00|N|||F  
 OBX|16|NM|736-9^LYM%^LN||28.3|10\*9/L|20.0-40.0|N|||F  
 OBX|17|NM|742-7^MON#^LN||0.27|10\*9/L|0.12-1.20|N|||F  
 OBX|18|NM|5905-5^MON%^LN||6.4|10\*9/L|3.0-12.0|N|||F  
 OBX|19|NM|789-8^RBC^LN||5.55|10\*12/L|3.50-5.50|H~N|||F  
 OBX|20|NM|718-7^HGB^LN||160|g/L|110-160|N|||F  
 OBX|21|NM|787-2^MCV^LN||87.4|fL|80.0-100.0|N|||F  
 OBX|22|NM|785-6^MCH^LN||28.7|pg|27.0-34.0|N|||F  
 OBX|23|NM|786-4^MCHC^LN||329|g/L|320-360|N|||F  
 OBX|24|NM|788-0^RDW-CV^LN||13.6|10\*9/L|11.0-16.0|N|||F  
 OBX|25|NM|21000-5^RDW-SD^LN||41.9|fL|35.0-56.0|N|||F  
 OBX|26|NM|4544-3^HCT^LN||48.6|10\*9/L|37.0-54.0|N|||F  
 OBX|27|NM|777-3^PLT^LN||161|10\*9/L|100-300|N|||F  
 OBX|28|NM|32623-1^MPV^LN||10.4|fL|6.5-12.0|N|||F  
 OBX|29|NM|32207-3^PDW^LN||16.7|10\*9/L|15.0-17.0|N|||F  
 OBX|30|NM|10002^PCT^99MRC||0.168|10\*9/L|0.108-0.282|N|||F  
 OBX|31|NM|10014^PLCR^99MRC||31.3|10\*9/L|11.0-45.0|N|||F  
 OBX|32|NM|10013^PLCC^99MRC||50|10\*9/L|30-90|N|||F  
 OBX|33|NM|51584-1^IMG#^LN||0.00|10\*9/L|N|||F  
 OBX|34|NM|38518-7^IMG%^LN||0.1|10\*9/L|N|||F  
 OBX|35|NM|10020^HFC#^99MRC||0.01|10\*9/L|N|||F  
 OBX|36|NM|10021^HFC%^99MRC||0.2|10\*9/L|N|||F  
 OBX|37|NM|10022^PLT-I^99MRC||161|10\*9/L|N|||F  
 OBX|38|NM|10024^WBC-D^99MRC||4.23|10\*9/L|N|||F  
 OBX|39|NM|10025^WBC-B^99MRC||4.21|10\*9/L|N|||F  
 OBX|40|NM|12227-5^WBC^LN||4.21|10\*9/L|4.00-10.00|N|||F  
 OBX|41|NM|15203^WBC DIFF Scattergram. Meta len^99MRC||1|||||F  
 OBX|42|NM|15205^WBC DIFF Scattergram. Fsc dimension^99MRC||128|||||F  
 OBX|43|NM|15206^WBC DIFF Scattergram. Ssc dimension^99MRC||128|||||F  
 OBX|44|NM|15207^WBC DIFF Scattergram. FL dimension^99MRC||128|||||F  
 OBX|45|NM|15208^WBC DIFF Scattergram. FSC-LOG dimension^99MRC||128|||||F  
 OBX|46|NM|15253^Baso Scattergram. Meta Len^99MRC||1|||||F  
 OBX|47|NM|15255^Baso Scattergram. Fsc dimension^99MRC||128|||||F  
 OBX|48|NM|15256^Baso Scattergram. Ssc dimension^99MRC||128|||||F

OBX|49|NM|15257^Baso Scattergram. FL dimension^99MRC||128|||||F  
 OBX|50|NM|15258^Baso Scattergram. FSC-LOG dimension^99MRC||128|||||F  
 OBX|51|NM|15307^RET Scattergram. Meta Len^99MRC||1|||||F  
 OBX|52|NM|15303^RET Scattergram. Fsc dimension^99MRC||128|||||F  
 OBX|53|NM|15304^RET Scattergram. Ssc dimension^99MRC||128|||||F  
 OBX|54|NM|15305^RET Scattergram. FL dimension^99MRC||128|||||F  
 OBX|55|NM|15308^RET Scattergram FSC-LOG dimension^99MRC||128|||||F  
 OBX|56|NM|15355^NRBC Scattergram. Meta Len^99MRC||1|||||F  
 OBX|57|NM|15351^NRBC Scattergram. Fsc dimension^99MRC||128|||||F  
 OBX|58|NM|15352^NRBC Scattergram. Ssc dimension^99MRC||128|||||F  
 OBX|59|NM|15353^NRBC Scattergram. FL dimension^99MRC||128|||||F  
 OBX|60|NM|15356^NRBC Scattergram FSC-LOG dimension^99MRC||128|||||F

- Demo file example of a QC result:
- MSH|^~&|LabXpert|Mindray|||20160729112955||ORU^R01|3|Q|2.3.1|||||UNICODE

PID|1||MB014L|||20140310000000  
 OBR|1||1|00003^LJ QCR^99MRC|||20140301161246|||||||||||||HM|||||admin  
 OBX|1||IS|05001^Qc Level^99MRC||L|||||F  
 OBX|2||IS|08001^Take Mode^99MRC||A|||||F  
 OBX|3||IS|08002^Blood Mode^99MRC||W|||||F  
 OBX|4||IS|08003^Test Mode^99MRC||CBC+DIFF|||||F  
 OBX|5|NM|6690-2^WBC^LN||3.66|10\*9/L|2.79-4.39|N|||F  
 OBX|6|NM|704-7^BAS#^LN||0.05|10\*9/L|0.00-0.14|N|||F  
 OBX|7|NM|706-2^BAS%^LN||1.4|%|0.2-2.2|N|||F  
 OBX|8|NM|751-8^NEU#^LN||2.04|10\*9/L|1.52-2.52|N|||F  
 OBX|9|NM|770-8^NEU%^LN||55.8|%|44.0-68.0|N|||F  
 OBX|10|NM|711-2^EOS#^LN||0.91|10\*9/L|0.59-1.19|N|||F  
 OBX|11|NM|713-8^EOS%^LN||24.9|%|17.9-31.9|N|||F  
 OBX|12|NM|731-0^LYM#^LN||0.55|10\*9/L|0.14-0.94|N|||F  
 OBX|13|NM|736-9^LYM%^LN||15.0|%|5.5-24.5|N|||F  
 OBX|14|NM|742-7^MON#^LN||0.11|10\*9/L|0.00-0.22|N|||F  
 OBX|15|NM|5905-5^MON%^LN||2.9|%|0.0-5.9|N|||F  
 OBX|16|NM|789-8^RBC^LN||2.49|10\*12/L|2.28-2.64|N|||F  
 OBX|17|NM|718-7^HGB^LN||60|g/L|56-64|N|||F  
 OBX|18|NM|787-2^MCV^LN||80.7|fL|73.8-83.8|N|||F  
 OBX|19|NM|785-6^MCH^LN||23.9|pg|21.9-26.9|N|||F  
 OBX|20|NM|786-4^MCHC^LN||297|g/L|280-340|N|||F  
 OBX|21|NM|788-0^RDW-CV^LN||15.8|%|11.0-21.0|N|||F  
 OBX|22|NM|21000-5^RDW-SD^LN||44.1|fL|34.4-54.4|N|||F  
 OBX|23|NM|4544-3^HCT^LN||20.1|%|17.4-21.4|N|||F  
 OBX|24|NM|777-3^PLT^LN||64|10\*9/L|40-80|N|||F  
 OBX|25|NM|32623-1^MPV^LN||9.8|fL|6.5-12.5|N|||F  
 OBX|26|NM|32207-3^PDW^LN||16.3||10.9-20.9|N|||F  
 OBX|27|NM|10002^PCT^99MRC||0.062|%|0.007-0.107|N|||F

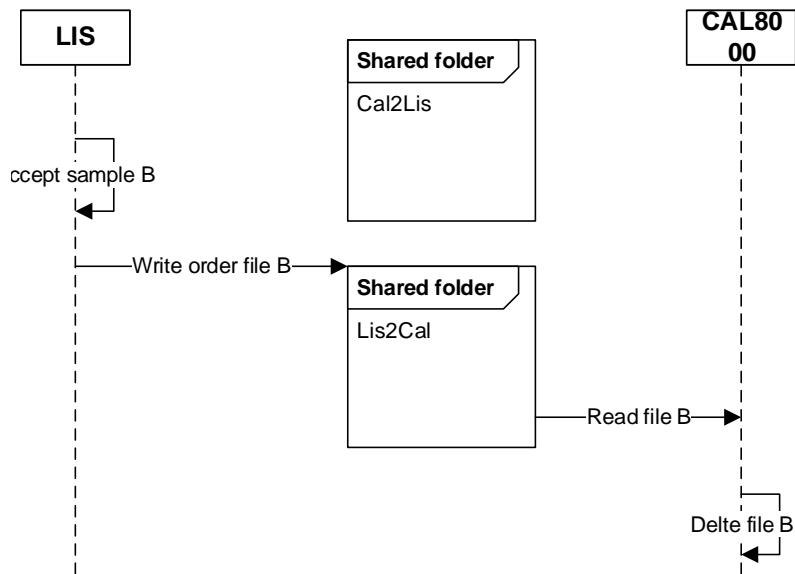
```

OBX|28|NM|10014^PLCR^99MRC||27.2|15.6-35.6|N||F
OBX|29|NM|10013^PLCC^99MRC||17|10*9/L|7-23|N||F
OBX|30|NM|51584-1^IMG#^LN||0.12|10*9/L|N||F
OBX|31|NM|38518-7^IMG%^LN||3.2|N||F
OBX|32|NM|10020^HFC#^99MRC||0.00|10*9/L|N||F
OBX|33|NM|10021^HFC%^99MRC||0.0|N||F
OBX|34|NM|10022^PLT-I^99MRC||64|10*9/L|N||F
OBX|35|NM|10024^WBC-D^99MRC||3.74|10*9/L|N||F
OBX|36|NM|10025^WBC-B^99MRC||3.66|10*9/L|N||F
OBX|37|NM|12227-5^WBC^LN||3.66|10*9/L|2.79-4.39|N||F

```

2) The LIS pushes the work orders.

- File writing: Upon receipt of samples, the LIS immediately writes the file into the Lis2Cal folder. The file is named "*Date&Time\_Sample\_barcode.dat*", where Date&Time is in the format of "YYYYMMDDhhmmss".  
Example: "20160729150913\_30521678.dat"
- If sample information changes after receipt, the work order file must be re-written.
- File reading: The CAL8000 must read the file within 3s, and delete the file after reading the file.
- Specific interaction process:



**Figure 6 Receive orders through shared folder**

- Demo file example of a work order result:
- MSH|^~&||||20160729134313||ORR^O02|14|P|2.3.1|||||UNICODE  
MSA|AA|14  
PID|1||ChartNo^^^MR||LastName^FirstName||Gender  
PV1|1|PatientType|Department^BedNo|||||||ChargeType  
ORC|AF||order1  
OBR|1|order1||00001^Automated Count^99MRC|||||Sender||Diagnose|||||||HM  
OBX|1|IS|08001^Take Mode^99MRC||A|||||F  
OBX|2|IS|08002^Blood Mode^99MRC||W|||||F  
OBX|3|IS|08003^Test Mode^99MRC||CBC+DIFF|||||F



```

OBX|4|IS|01002^Ref Group^99MRC|||||F
OBX|5|NM|30525-0^Age^LN||2|yr||||F
OBX|6|ST|01001^Remark^99MRC||Remark||||F
OBX|7|IS|01007^Sample Type^99MRC||SampleType||||F
OBX|8|IS|05007^Project Type^99MRC||BL||||F
OBX|9|IS|01008^Patient Area^99MRC||PatientArea||||F
OBX|10|ST|01009^Custom patient info 1^99MRC|||||F
OBX|11|ST|01010^Custom patient info 2^99MRC|||||F
OBX|12|ST|01011^Custom patient info 3^99MRC|||||F
OBX|13|ST|01014^Report Time^99MRC|||||F

```

### 3. Technical requirements on file reading/writing

- File writing

- ✓ Write mode: Write a file in exclusive mode to prevent that the peer end reads the file before the file is completely written.
- ✓ File permission: All users can have full control over files.
- ✓ On the PC where the shared folders are located, the **Guest** account must be activated, and the password of the **Guest** account must be set to null. For details about the configuration method, see the Appendix "Method for Activating the Guest Account".

- File reading

If a file cannot be read, the peer end is still writing the file. In this case, read the file later.

### 4. About the labXpert-LIS connection status indicator

In this file transfer mode, if shared folders exist, the indicator is on; otherwise, the indicator is off.

If an LIS communication error occurs, support from the LIS side is needed.

# Chapter 2 HL7 Communication Protocol

## 2.1 Overview

The LIS/HIS communication function of the labXpert 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*.

## 2.2 Low-Level Transmission Protocol

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

## 2.3 HL7 Message Level Protocol

### 2.3.1 HL7 Protocol Overview

See Appendix A .

### 2.3.2 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 labXpert, 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>`.

## 2.4 Duplex Communication

1. The labXpert directly sends the analysis results (or QC data) to LIS/HIS, as shown in Figure 7.

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

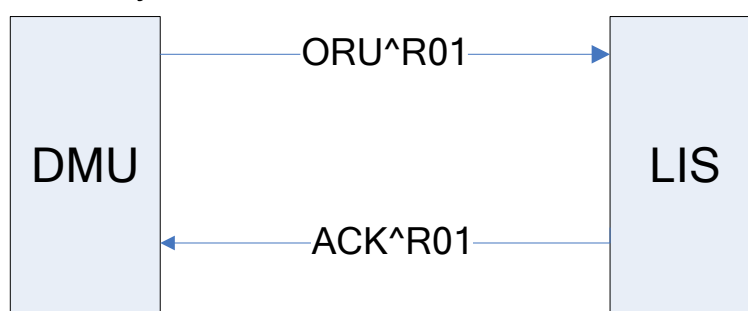


Figure 7 Analysis results (QC data) communication process

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 8.

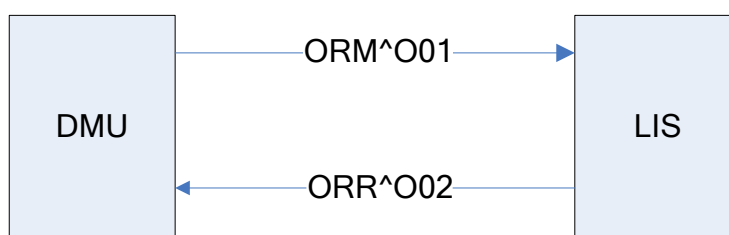


Figure 8 Worklist searching communication process

### 2.4.1 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 labXpert 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.

]

}

## 2.5 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 2-1 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.

### 2.5.1 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|^~\&| LabXpert |Mindray|||20101012092538||ORU^R01|1|P|2.3.1|||||UNICODE
```

See Table 1 for definition of each field in MSH segment.

**Table 1 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	ST	4	Includes component delimiters,	^~\&

	Characters			repetition delimiters, escape delimiters and subcomponent delimiters.	
3	Sending application	EI	180	Application of sending terminal.	LabXpert
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

## 2.5.2 MSA

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

Message example:

MSA|AA|1

See Table 2 for field definitions in use.

**Table 2 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, "AS"-skipped	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 3 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
Skipped		AS

### 2.5.3 PID

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

Message example:

An example message for a Chinese patient

PID|1||C1^^^MR||^张三||20101005084346|Male

PID|1||C1^^^MR|| Jordan^Michael ||20101005084346|Male

An example message for a non-Chinese patient

PID|1||C1^^^MR|| Jordan^Michael ||20101005084346|Male

See Table 4 for field definitions in use.

**Table 4 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" When the patient is a Chinese patient, only the "FirstName" field is used. The "LastName" field is left empty	Chinese name: ^张三 Non-Chinese name: Jordan^Michael
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.

## 2.5.4 PV1

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

Message example:

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

See Table 5 for field definitions in use.



**Table 5 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

## 2.5.5 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|||||||HM  
|||||||admin

See Table 6 for field definitions in use.

**Table 6 OBR Field Definitions**

No.	Field/delimiter Name	Data Type	Recommended 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	CE	200	Universal service ID, used to	00001^Auto

	Service ID			identify different types of analysis results. See Appendix C for its value definitions.	mated Count^99MR C
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 labXpert.	
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
25	Result Status +	XCN	150	Result stauts Indicating sample validation status Validated: sample validated Not Validated: sample not validated	Validated
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

## 2.5.6 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 1 OBR-4 and ASTM Message Type Codes 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 for field definitions in use.

**Table 7 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", etc. See Appendix B for details.	NM
3	Observation Identifier	CE	590	Sample type identifier. 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. See the configuration files and Appendix C for the values of the codes for different items. Note: ID and EncodeSys are used to identify different analysis parameters, while Name is for description purpose rather than identification.	6690-2^WBC^LN
5	Observation Value	*	65535	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 App	2.20

No.	Field/delimiter Name	Data Type	Recommended Max Length	Description	Example
				endix D for the coding method).	
6	Units	CE	60	Unit of sample types. Use the standard units defined in HL7. See Appendix C for units used in communication.	10*9/L
7	References Range	ST	60	Reference range of analysis results, in the form of "lower limit-higher limit", "<upper limit" or ">lower limit".	4.00-10.00
8	Abnormal Flags	ID	5	Analysis result flags. Value definitions: "N": normal "A": abnormal "H": higher than upper limit "L": lower than lower limit Note: The flag for normal or abnormal and that for high or low result may appear in this field at the same time. In this case, the two types of flags are connected by a "~", e.g. "H~A"	L~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	

## 2.5.7 ORC

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

Message example (searching by sample ID and sample type)

ORC|RF||SampleID||BL

Message example ( searching by sample ID and sample type, in the meanwhile, for the “LIS Settings for Sample Receiving”, “Fill in tube position and SN” is enabled )

ORC|RF||SampleID|BL||2^3|13||||||NW

See Table 8 for field definitions.

**Table 8 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
6	Tube Position	CE	10	Tube position This field is used in the inquiry messages when the “LIS receiving samples by SN” function is enabled (“More” - “System Setup” — “Comm. Setup”-“LIS Settings for Sample Receiving”) . When the function is disabled, the field is not used. The filed will be filled in the format of “rack No.^ tube position”. When the inquired sample is analyzed in another sample presentation mode than the autoloading mode, the field is filled as “^” .	. In the above example, the field is filled as “2^3”, in which, “2” represents the rack number, “3” is the tube position where the sample is placed. When the inquired sample is analyzed in another sample presentation mode than the autoloading mode, the field

					is filled as “^” .
7	Lis Sign Serial No	ST	10	<p>The serial number communicated to LIS when the “LIS receiving samples by SN” function is enabled (<i>“More” - “System Setup” — “Comm. Setup”-“LIS Settings for Sample Receiving”</i>) .</p> <p>When the function is disabled, the field is not used..</p> <p>The SN is calculated in accordance with below formula:  <math display="block">SN = [Rack\ No. - First\ Rack\ No.] * 10 + Tube\ No.</math> </p> <p>When the inquired sample is analyzed in another sample presentation mode than the autoloading mode, the field is left empty.</p>	<p>In the above example, the field is filled as “2^3”, in which, “2” represents the rack number, “3” is the tube position the sample is placed. The first rack No. is set to “1”, therefore the SN is 13.</p>
16	Order Control Code Reason	CE	50	<p>The field represents the cause for LIS inquiry.</p> <p>This field is used in the inquiry messages when the “LIS receiving samples by SN” function is enabled (<i>“More” - “System Setup” — “Comm. Setup” - “LIS Settings for Sample Receiving”</i>). When the function is disabled, the field is not used.</p> <p>The value is fixed as “NW” (New Order).</p>	NW

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 (see 2.6.6 and 2.6.7 for details)

## 2.6 Complete Message Examples

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

### 2.6.1 Sample Message

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

#### 2.6.1.1 Blood sample

An example message for a non-Chinese patient:

MSH|^~\&| LabXpert |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|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>  
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 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>  
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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>  
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 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>  
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 OBX|88|NM|15352^NRBC Scattergram. Ssc dimension^99MRC||128||||F<CR>  
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**An example message for a Chinese patient:**

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 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|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>  
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 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>  
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 OBX|82|NM|15303^RET Scattergram. Fsc dimension^99MRC||128|||||F<CR>  
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### 2.6.1.2 Blood sample message with graphics data

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 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|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|0.11-16.0|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>  
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35

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36

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.....

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>  
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### 2.6.1.3 Body Fluid Sample

MSH|^~\&| LabXpert |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>  
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 OBX|43|NM|15352^NRBC Scattergram. Ssc dimension^99MRC||128|||||F<CR>  
 OBX|44|NM|15353^NRBC Scattergram. FL dimension^99MRC||128|||||F<CR>  
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#### 2.6.1.4 Glycohemoglobin test samples

MSH|^~\&|LabXpert|Mindray||20200511161940||ORU^R01|8|P|2.3.1|||||UNICODE

PID|1||mindray0001^^^MR||^Jack||19950518000000|male adult  
 PV1|1|outpatient|surgery^^NO.100|||||||||social security  
 OBR|1||20150709111338|00001^Automated  
 Count^99MRC||20200511155804|20200511161940|||nurse|||bacterial  
 infection|20200511160804|||||||HM|NotValidated  
 OBX|1|IS|08001^Take Mode^99MRC||O|||||F  
 OBX|2|IS|08002^Blood Mode^99MRC||W|||||F  
 OBX|3|IS|08003^Test Mode^99MRC||STANDARD|||||F  
 OBX|4|IS|01002^Ref Group^99MRC||male adult|||||F  
 OBX|5|NM|30525-0^Age^LN||25|yr|||||F  
 OBX|6|ST|01001^Remark^99MRC||bacterial infection|||||F  
 OBX|7|IS|05007^Project Type^99MRC||BL|||||F  
 OBX|8|IS|01007^Sample Type^99MRC||blood|||||F  
 OBX|9|IS|01008^Patient Area^99MRC||inpatient area|||||F  
 OBX|10|ST|09001^Analyzer^99MRC||H50|||||F  
 OBX|11|NM|17856-6^HbA1c%^LN||0.6|%(NGSP)|4.0-6.0|L~N|||F  
 OBX|12|NM|10093^HbA1c-MonoS^99MRC||0.6|%(Mono-S)|2.9-5.0|L~N|||F  
 OBX|13|NM|59261-8^HbA1c-IFCC^LN||2|mmol/mol|20-42|L~N|||F  
 OBX|14|NM|10090^HbF^99MRC||2.1|%|0.0-99.9|N|||F  
 OBX|15|NM|10091^HbA1^99MRC||1.4|%|0.0-99.9|N|||F  
 OBX|16|NM|10092^eAG^99MRC||4.2|mmol/L|0.0-55.5|N|||F

### 2.6.1.5 Glycohemoglobin analysis samples with figures

MSH|^~\&|LabXpert|Mindray|||20200511162145||ORU^R01|9|P|2.3.1|||||UNICODE  
 PID|1||mindray0001^^^MR||^jack||19950518000000|male  
 PV1|1|outpatient|surgery^^NO.100|||||||||social security  
 OBR|1||20150709111338|00001^Automated  
 Count^99MRC||20200511155804|20200511161940|||nurse|||bacterial  
 infection|20200511160804|||||||HM|NotValidated  
 OBX|1|IS|08001^Take Mode^99MRC||O|||||F  
 OBX|2|IS|08002^Blood Mode^99MRC||W|||||F  
 OBX|3|IS|08003^Test Mode^99MRC||STANDARD|||||F  
 OBX|4|IS|01002^Ref Group^99MRC||male adult|||||F  
 OBX|5|NM|30525-0^Age^LN||25|yr|||||F  
 OBX|6|ST|01001^Remark^99MRC||bacterial infection|||||F  
 OBX|7|IS|05007^Project Type^99MRC||BL|||||F  
 OBX|8|IS|01007^Sample Type^99MRC||blood|||||F  
 OBX|9|IS|01008^Patient Area^99MRC||inpatient|||||F  
 OBX|10|ST|09001^Analyzer^99MRC||H50|||||F

OBX|11|NM|17856-6^HbA1c%^LN||0.6|%(NGSP)|4.0-6.0|L~N|||F

OBX|12|NM|10093^HbA1c-MonoS^99MRC||0.6|%(Mono-S)|2.9-5.0|L~N|||F

OBX|13|NM|59261-8^HbA1c-IFCC^LN||2|mmol/mol|20-42|L~N|||F

OBX|14|NM|10090^HbF^99MRC||2.1|%|0.0-99.9|N|||F

OBX|15|NM|10091^HbA1^99MRC||1.4|%|0.0-99.9|N|||F

OBX|16|NM|10092^eAG^99MRC||4.2|mmol/L|0.0-55.5|N|||F

OBX|17|NM|15425^Total Area^99MRC||0.00|||||F

OBX|18|NM|15407^A1a RTime^99MRC||1.0|||||F

OBX|19|NM|15408^A1a Area^99MRC||2.00|||||F

OBX|20|NM|15409^A1a Area Percent^99MRC||3.0|||||F

OBX|21|NM|15410^A1b RTime^99MRC||4.0|||||F

OBX|22|NM|15411^A1b Area^99MRC||5.00|||||F

OBX|23|NM|15412^A1b Area Percent^99MRC||6.0|||||F

OBX|24|NM|15413^F RTime^99MRC||7.0|||||F

OBX|25|NM|15414^F Area^99MRC||8.00|||||F

OBX|26|NM|15415^F Area Percent^99MRC||9.0|||||F

OBX|27|NM|15416^LA1c RTime^99MRC||10.0|||||F

OBX|28|NM|15417^LA1c Area^99MRC||11.00|||||F

OBX|29|NM|15418^LA1c Area Percent^99MRC||12.0|||||F

OBX|30|NM|15419^SA1c RTime^99MRC||13.0|||||F

OBX|31|NM|15420^SA1c Area^99MRC||14.00|||||F

OBX|32|NM|15421^SA1c Area Percent^99MRC||15.0|||||F

OBX|33|NM|15422^A0 RTime^99MRC||16.0|||||F

OBX|34|NM|15423^A0 Area^99MRC||17.00|||||F

OBX|35|NM|15424^A0 Area Percent^99MRC||18.0|||||F

OBX|36|NM|15426^P00 RTime^99MRC||19.0|||||F

OBX|37|NM|15427^P00 Area^99MRC||20.00|||||F

OBX|38|NM|15428^P00 Area Percent^99MRC||21.0|||||F

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HzbLPMdmOMkaEMwWWHIM1EGLzWIVImaP6cJ4yUAUtCyz7pMUFmKzOF6OmOVVcCu8  
ZADwg5ZXccntic1iqYjZYxltMxllpri8xibJtDubZZ5kG9QnYcVYy7TMNca4Pa8o6ygXIK7w+qAj  
Ei35CdgsdtAy6y3ow3yznFVE1x5iZo8Y0bKTAcANWqZZQeD4ZvGVxOXwmFneWTbBHRIYu  
EHLVCYIHKIZ5QWNStca1Pg/aolBsZhAtCy+YEjNbs2eneQJB107dCKV8eSnyYsge4ODyTh  
muWng93N8k5jGepmaGolQfyZR+KjxTt4+YBrrK+5Q1rPA0fJNF6Nm2V3n9hOu6EWZRBj/2V  
h/TMmdiwO3NmH0OzU1uNmufMUR9fua34KEfVflxxr/FbODR2h2akCcbPMadiyfuAlt1IkPg0P  
wfntc4Jmw+xJhGYnAXGzvMe/LsQdeCpClqWW/WQBjix2amM2wgcdBe0gUoHUkbDivVamm  
UtabWcm3fwMod3RsbJ5y8UEGaXV+6rq7W7Sf4xQROtysby84kx14Ss7zfbSkzO4caZdZvW  
uOYp13WJZaKh1RKUOUCS0lts3NAmpR225lZmdBpNm5nlO29+MxfhtdliXocoFI9XBxiL/dk5

YIMusplc1Ose1V2BtVUuFD3iJ7xTsEObSTzBwt6bGlyKyXQGmzt8YGyCI427qxRhNfCyLapX  
T2tWalJ3LulHxG0iemVxG9m06YvRmNa4ctzGRhNkuKNVE7PoE1nbb3mumj/3us3Gx33y8v8  
c3iaxT/8imzoLG6d9hXnBUYiO57AdC7oZ8twMMNuuUNpFbQB0nM+u00aTa8K3mNkbapqjG  
hjJgA0XdeC+CJB2KNNY66g2x+3q2m7nqR5V1h4qDQrtQ1PEAB0PaDWRABdvJq6leqGVYm  
UykqTFfDY4od6d1q6q4Xz9UVJg4K7UpdY01Vm5XGPb0aqnYAJX5bltYL6XrTedTV0LV3ido7  
Zersi/3uB+Kg0K7UNdbIVrm52FpAxhn6HqNFWi+fvoVT1U3VNIum4J0ycfblkM8VJg4K7Upc44  
6MZoHBxFvd9szPHSBEGXawwCDHHG2wW4CZx2NJILwZYpnkXWHioNCuxDXuyGvW0oOj  
VdY1Ap1CJ21S2Ni3B3geAB6AQOziFuBvNuQwYinF/bR8d0FoF1E8SGaz1o5v0A/CUaEtwuzf  
5n+ODPibkC/gRJGzrOZ/7jhCVWgXUTzIPmYhExoGyISNacXQakfWBrkKI8DgELeA1aZ5dAP  
MnsZ3fFYtxh1HqArtlooHEZodDTqBBs+grxBPvzf+JDawCSOSwExl5cT9uHrbJ7SLKB4kYtYK  
HEMQFY4GR4VW4JgHcymMwOjBOpgELeyuJ9auMKEqtlsoHgQylNeKDbNAvyvZ1op3I9aD4  
aujh1Ha9F2A9QqUK0yoCu2KFbfxNZoa+xlrcPdEmJvBu7/wpqM3/1kcTOH91dURVzimCgjtqq  
wea2rRjO2mfTtvlSyM/0uX/M0jmBWekggz44+Uw5uF7axiFjcL2ykxm4tiNhdas6WwT6iw996Fa  
xnlwoW99y5cyygXLuy9Z8ebhY2gTOGjKQgoZnNRzObCmf34Vf37D24X2LzZ3PoU0ufMvv55  
e33C7YKI999fQvrQ7Mf3I9v7HyVoNTz/GdSHZs3bZndBzBukgZC+YnYrELLFbA5Mli1mc/D2D  
f4izJq3ze6CFDskCOIDs6ZAGXVpeP5h/g7oc2bLTEHHxy9rlpgpFPbldvsPtlMKNDNas4AAAA  
ASUVORK5CYII=|||||F

## 2.6.2 Sample Response Message

In synchronous communication of labXpert 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>
```

## 2.6.3 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 labXpert 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|^~\&| LabXpert |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:
```

## 2.6.4 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|^~\&|LabXpert|Mindray|||20140909162050||ACK^R01|9|Q|2.3.1|||||UNICODE<CR>
MSA|AA|1<CR>
```

## 2.6.5 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 labXpert). See 2.6.1 for the format. An example is shown as follows:

```
MSH|^~\&|LabXpert|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|8.7-20.7|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. When the L-J QC sample is transmitted in the format of the common sample, for an analyzer on a sample processing line, the value of the OBR-3 field is the QC sample transmission ID; but for a standalone analyzer, the the value of the OBR-3 field is the control lot No. or its file No. The “Analyzer” OBX item is only applicable to integrated analyzers.

## 2.6.6 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|^~\&|LabXpert|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|^~\&|LabXpert|Mindray|||20140328102554||ORM^O01|2|P|2.3.1|||||UNICODE  
ORC|RF||sampleid99|BL
```

When the “LIS receiving samples by SN” function is enabled, except for the “sample ID + sample type”, the sample tube position and a serial number (used for receiving samples) will also be written into the message.

```
MSH|^~\&|LabXpert|Mindray|||20140328102554||ORM^O01|2|P|2.3.1|||||UNICODE  
ORC|RF||sampleid99|BL||2^3|13|||||||NW
```

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

## 2.6.7 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|^~\&|LabXpert|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|^~\&|LabXpert|Mindray|||20140328102737||ORR^O02||P|2.3.1|||||UNICODE  
MSA|AR|3

An example of “skip sample” is shown as follows, in which the MSA-2 field indicates the result of the response. In this example, the MSA-2 value is “AS”, indicating the sample is skipped for analysis.

MSH|^~\&|LIS|LIS|||20191023164325||ORR^O02|2|P|2.3.1|||||UNICODE  
MSA|AS|6|||

# Chapter 3 ASTM Communication Protocol

## 3.1 ASTM Protocol Overview

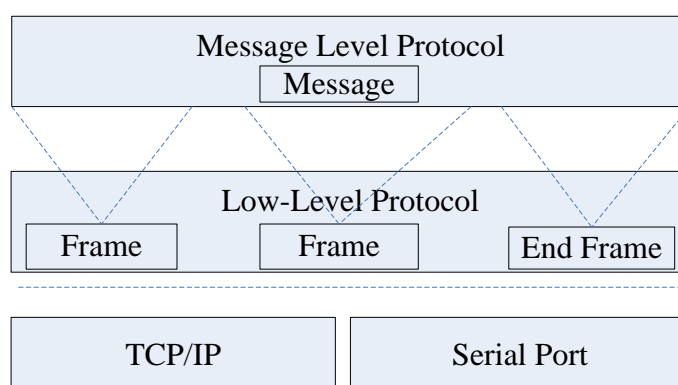
See the ASTM protocol documents for details of the protocol:

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.

## 3.2 Protocol Layers



**Figure 9 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 labXpert and LIS/HIS.

## 3.3 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).

### 3.3.1 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;

### 3.3.2 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

### 3.3.3 Middle Frame

Structure of a middle frame:

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

### 3.3.4 End Frame

Structure of an end frame:

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

### 3.3.5 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".

## 3.4 Message Structure

### 3.4.1 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.

### 3.4.2 Message Coding

#### 3.4.2.1 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.

#### 3.4.2.2 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.

### 3.4.3 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.

### 3.4.4 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.

### 3.4.5 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

### 3.4.6 Special Notice

- 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.

## 3.5 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.

### 3.5.1 Message Header and terminator Records

#### 3.5.1.1 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>		LabXpert	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

Field Name	Field Sequence Number	Value Example	Remarks
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^LabXpert^||||Automated

Count^00001|P|LIS2-A2|20130912164204<CR><ETB>DC<CR><LF>

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

### 3.5.1.2 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>

### 3.5.2 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 3.4.6 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	If it is a Chinese name, this field is left empty.
Birthdate	8		
<i>Date of birth</i>		20091220000000	YYYYMMDDHHMMSS
<i>Age</i>		2	
<i>Age unit</i>		Y	Values of age unit:

Field Name	Field Sequence Number	Value Example	Remarks
			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:

An example message for a Non-Chinese patient:

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

An example message for a Chinese patient:

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

### 3.5.3 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 3.4.6 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

Field Name	Field Sequence Number	Value Example	Remarks
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
Laboratory Field Number 1	21	Validated	User-defined; indicating validation status Validated: sample validated Not Validated: sample not validated
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>

### 3.5.4 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 3.4.6 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>

### 3.5.5 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 3.4.6 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 BF	User defined field used for sample type here. Value definition: "BL": blood; "BF": body fluid;

Complete record example:

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

## 3.6 Message for Communication

Note: the message examples contain 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.

### 3.6.1 Sample Analysis Result Message

#### 3.6.1.1 Record Structure

Record Structure:

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

#### 3.6.1.2 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 1 OBR-4 and ASTM Message Type 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; when the L-J QC sample is transmitted in the format of the common sample, for an analyzer on a sample processing line, the value of the field is the QC sample transmission ID; but for a standalone analyzer, the the value of the field is the control lot No. or its file No.
		7: time of analysis	Time of analysis	YYYYMMDDHHMMSS; what displayed on screen
		8: Time of	Time of	YYYYMMDDHHMMSS;

Record Type	Record Value	Field Position: Content	Component Value	Value Description
		sample collection	sample collection	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	



Record Type	Record Value	Field Position: Content	Component Value	Value Description
		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	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

Record Type	Record Value	Field Position: Content	Component Value	Value Description
			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 linearity range flag	V – result out of 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		

Record Type	Record Value	Field Position: Content	Component Value	Value Description
		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		

Record Type	Record Value	Field Position: Content	Component Value	Value Description
		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		

Record Type	Record Value	Field Position: Content	Component Value	Value Description
		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	CRP	CRP: value same as above		
R	HbA1c%	Glycohemoglobin parameters: hemoglobin A1c (NGSP), value same as above		
R	HbA1c-MonoS	Glycohemoglobin parameters: hemoglobin A1c(MONO-S), value same as above		
R	HbA1c-IFCC	Glycohemoglobin parameters: hemoglobin A1c (IFCC), value same as above		
R	HbF	Glycohemoglobin parameters: fetal hemoglobin, value same as above		
R	HbA1	Glycohemoglobin parameters: total Glycohemoglobin, value same as above		
R	eAG	Glycohemoglobin RUO parameters: estimated average blood glucose, value same as above		
R	Flags of abnormal blood cell differential or morphology: WBC Scattergram Abn. Note: only transmitted when this flag exists in the result	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	
		7: flag	Null	
R	...	Flag; value same as above. Only transmitted when this		

Record Type	Record Value	Field Position: Content	Component Value	Value Description
		flag exists in the result. For details of flags, see the “Flags of Abnormal Blood Cell Differential or Morphology” part of Table 27 Data Type and Coding System 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

Record Type	Record Value	Field Position: Content	Component Value	Value Description
				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)	3.4.2 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	The transmission of the RET bitmap data is the same as		

Record Type	Record Value	Field Position: Content	Component Value	Value Description
	bitmap	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		

### 3.6.1.3 Example of Sample Analysis Result Message

An example message for a non-Chinese patient

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<STX>1H|^&|1||Mindray^LabXpert^||||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|^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>

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<STX>7R|28|^HGB^718-7|8.8|g/dL|12.0^16.0|L^A^M^M^M^M<CR><ETB>60<CR><LF>  
 <STX>0R|29|^MCV^787-2|129.8|fL|80.0^100.0|H^M^N^M^M^M^M<CR><ETB>78<CR><LF>  
 <STX>1R|30|^MCH^785-6|32.2|pg|27.0^34.0|^A^M^M^M^M^M^M<CR><ETB>CF<CR><LF>  
 <STX>2R|31|^MCHC^786-4|24.8|g/dL|31.0^37.0|L^A^M^M^M^M^M^M<CR><ETB>D3<CR><LF>  
 <STX>3R|32|^RDW-CV^788-0|24.8|%|11.0^16.0|H^M^N^M^M^M^M^M<CR><ETB>4E<CR><LF>  
 <STX>4R|33|^RDW-SD^21000-5|116.4|fL|35.0^56.0|H^M^N^M^M^M^M^M<CR><ETB>64<CR><LF>  
 <STX>5R|34|^HCT^4544-3|0.354||0.350^0.490|^M^N^M^M^M^M^M<CR><ETB>D8<CR><LF>  
 <STX>6R|35|^PLT^777-3|55|10&S&9/L|100^300|L^M^N^M^M^M^M^M<CR><ETB>62<CR><LF>  
 <STX>7R|36|^MPV^32623-1|11.7|fL|6.5^12.0|^M^N^M^M^M^M^M<CR><ETB>05<CR><LF>  
 <STX>0R|37|^PDW^32207-3|17.2||15.0^17.0|H^M^N^M^M^M^M^M<CR><ETB>BE<CR><LF>  
 <STX>1R|38|^PCT^10002|0.064|%|0.108^0.282|L^M^N^M^M^M^M^M<CR><ETB>11<CR><LF>  
 <STX>2R|39|^PLCR^10014|38.7|%|11.0^45.0|^M^N^M^M^M^M^M<CR><ETB>82<CR><LF>  
 <STX>3R|40|^PLCC^10013|21|10&S&9/L|30^90|L^M^N^M^M^M^M^M<CR><ETB>1E<CR><LF>  
 <STX>4R|41|^IMG#^51584-1|0.49|10&S&9/L|^|^A^M^M^M^M^M^M<CR><ETB>B1<CR><LF>  
 <STX>5R|42|^IMG%^38518-7|3.2|%^|^|^A^M^M^M^M^M^M<CR><ETB>F6<CR><LF>  
 <STX>6R|43|^HFC#^10020|0.40|10&S&9/L|^|^A^M^M^M^M^M^M<CR><ETB>2E<CR><LF>  
 <STX>7R|44|^HFC%^10021|2.6|%^|^|^A^M^M^M^M^M^M<CR><ETB>78<CR><LF>  
 <STX>0R|45|^PLT-I^10022|55|10&S&9/L|^|^M^N^M^M^M^M^M<CR><ETB>53<CR><LF>  
 <STX>1R|46|^WBC-D^10024|14.73|10&S&9/L|^|^A^M^M^M^M^M^M<CR><ETB>C4<CR><LF>  
 <STX>2R|47|^WBC-B^10025|15.22|10&S&9/L|^|^A^M^M^M^M^M^M<CR><ETB>C0<CR><LF>  
 <STX>3R|48|^PDW-SD^10031|17.0|fL|^|^M^N^M^M^M^M^M<CR><ETB>FC<CR><LF>  
 <STX>4R|49|^InR#^10032|0.01|10&S&9/L|^|^M^N^M^M^M^M^M<CR><ETB>77<CR><LF>  
 <STX>5R|50|^InR%^10033|0.00|%^|^|^M^N^M^M^M^M^M<CR><ETB>BD<CR><LF>  
 <STX>6R|51|^WBC^12227-5|15.22|10&S&9/L|4.00^12.00|H^M^A^M^M^M^M^M<CR><ETB>B3<CR><LF>  
 <STX>7R|52|^Neutrophilia^12004|T|||^|^M^M^M^M^M^M^M<CR><ETB>D0<CR><LF>  
 <STX>0R|53|^WBC Left Shift?^17790-7|T|||^|^M^M^M^M^M^M^M<CR><ETB>2F<CR><LF>  
 <STX>1R|54|^Imm Granulocytes?^34165-1|T|||^|^M^M^M^M^M^M^M<CR><ETB>C4<CR><LF>  
 <STX>2R|55|^Atypical Lymphs?^15192-8|T|||^|^M^M^M^M^M^M^M<CR><ETB>5D<CR><LF>  
 <STX>3R|56|^Anisocytosis^15150-6|T|||^|^M^M^M^M^M^M^M<CR><ETB>4C<CR><LF>  
 <STX>4R|57|^Macrocytes^12075|T|||^|^M^M^M^M^M^M^M<CR><ETB>00<CR><LF>  
 <STX>5R|58|^Anemia^12014|T|||^|^M^M^M^M^M^M^M<CR><ETB>2C<CR><LF>  
 <STX>6R|59|^Hypochromia^15180-3|T|||^|^M^M^M^M^M^M^M<CR><ETB>CD<CR><LF>  
 <STX>7R|60|^HGB Interfere^12015|T|||^|^M^M^M^M^M^M^M<CR><ETB>72<CR><LF>  
 <STX>0R|61|^Thrombopenia^12018|T|||^|^M^M^M^M^M^M^M<CR><ETB>C2<CR><LF>  
 <STX>1R|62|^Abn Lympho/ Blasts^12053|T|||^|^M^M^M^M^M^M^M<CR><ETB>3D<CR><LF>  
 <STX>2R|63|^NRBC?^12054|T|||^|^M^M^M^M^M^M^M<CR><ETB>42<CR><LF> <STX>3R|64|^RBC  
 Histogram. Left Line^15051|29|||^|^M^M^M^M^M^M^M<CR><ETB>1D<CR><LF> <STX>4R|65|^RBC  
 Histogram. Right Line^15052|250|||^|^M^M^M^M^M^M^M<CR><ETB>BF<CR><LF> <STX>5R|66|^RBC  
 Histogram. Binary Meta Length^15053|1|||^|^M^M^M^M^M^M^M<CR><ETB>44<CR><LF>  
 <STX>6R|67|^RBC Histogram. Total^15057|51277|||^|^M^M^M^M^M^M^M<CR><ETB>95<CR><LF>  
 <STX>7R|68|^PLT Histogram. Left Line^15111|3|||^|^M^M^M^M^M^M^M<CR><ETB>03<CR><LF>  
 <STX>0R|69|^PLT Histogram. Right Line^15112|47|||^|^M^M^M^M^M^M^M<CR><ETB>A9<CR><LF>  
 <STX>1R|70|^PLT Histogram. Binary Meta  
 Length^15113|1|||^|^M^M^M^M^M^M^M<CR><ETB>51<CR><LF> <STX>2R|71|^PLT Histogram.  
 Total^15117|1004|||^|^M^M^M^M^M^M^M<CR><ETB>61<CR><LF> <STX>3R|72|^WBC DIFF Scattergram.

Meta len^15203|1||^/^^^<CR><ETB>A1<CR><LF> <STX>4R|73|^WBC DIFF Scattergram.  
 Fsc dimension^15205|128||^/^^^<CR><ETB>2B<CR><LF> <STX>5R|74|^WBC DIFF  
 Scattergram. Ssc dimension^15206|128||^/^^^<CR><ETB>3B<CR><LF>  
 <STX>6R|75|^WBC DIFF Scattergram. FL  
 dimension^15207|128||^/^^^<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>

An example message for a Chinese patient

<STX>1H|^&|1||Mindray^LabXpert^||||Automated  
 Count^00001|P|LIS2-A2|20140909170247<CR><ETB>E7<CR><LF>  
 <STX>2P|1||patientID2001|张三^|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|^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

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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|^L^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|^L^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|H^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|^L^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|^N^<CR><ETB>D8<CR><LF>
<STX>6R|35|^PLT^777-3|55|10&S&9/L|100^300|^N^<CR><ETB>62<CR><LF>
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<STX>0R|53|^WBC Left Shift?^17790-7|T||^<CR><ETB>2F<CR><LF>
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<STX>2R|55|^Atypical Lymphs?^15192-8|T||^|^^^<CR><ETB>5D<CR><LF>  
 <STX>3R|56|^Anisocytosis^15150-6|T||^|^^^<CR><ETB>4C<CR><LF>  
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Mode^08002|W||^|^^^<CR><ETB>40<CR><LF> <STX>6R|3|^Test  
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AA  
AA  
AA

### 3.6.1.5 Glycohemoglobin test samples

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77

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D7vcL0+yKy2Psy6rT4cEaM+gv2ePsdcoD5+J5w+6QaSPmc2kT7qyJl+SHmsPjVZSj868pdAA  
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AAACgQAAAOEAAAKBAAACgQAAAOEAAAKBAK+6lQIAKbUCkNUBA5ewTQEWUAkAabuM  
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A||^|^^^^<CR><ETB>B7<CR><LF> <STX>6R|59|^Chromatogram Baseline  
Binary^15402|AA  
AA  
AA  
AA  
AA  
AA  
AAAAAAIk0hOtbnJTsxpJE7eGHQO1+PBzwD7iY8pkxGPemrZTz2hll8SDSSPJnjoTzrkrE8PU  
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HVPT3t2D0R2dw95sTgPbqw5D2OnOg9Y4jsPTd08D0MYPQ94Ev4PbU3/D3EEQA+rwCpP  
n9Az6D8wU+bekHPIffCT5C1Qs+LMsNPhbBDz4AtxE+66wTPtWiFT6/mBc+qY4ZPpOEGz5+  
eh0+aHafPIJmIT48XCM+JlIPhFIJz77PSk+5TMrPs8pLT65Hy8+pBUxPo4LMz54ATU+Yvc2P  
kztOD434zo+ldk8PgvPPj71xEA+37pCPsqwRD60pkY+npXlPoiSSj5yiEw+XX5OPkd0UD4xall  
+G2BUPgVWVj7wS1g+2kFaPsQ3XD6uLV4+mSNGPoMZYj5tD2Q+VwVmPkH7Zz4s8Wk+Fu  
drPgDdbT7q0m8+1MhxPr++cz6ptHU+k6p3Pn2geT5nlns+Uox9PjyCfz4TvIA+CLBPv2xgj7yrl  
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kT5PYZI+RFyTPjIXID4uUpU+I02WPhhlz4NQ5g+Az6ZPvg4mj7tM5s+4i6cPtcPnT7MJJ4+wR  
+fPrYaoD6rFaE+oBCiPpYLoz6LBqQ+gAGIPnX8pT5q96Y+||^|^^^^<CR><ETB>67<CR><LF>  
> <STX>7L|1|N<CR><ETX>07<CR><LF>

### 3.6.1.4 Body fluid sample

## 3.6.2 QC Message

### 3.6.2.1 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.

### 3.6.2.2 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 1 OBR-4 and ASTM Message Type 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; N-Normal, P- Pathologic, CRL-1, CRL-2, 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		

Record Type	Record Value	Field Position: Content	Component Value	Value Description
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		

Record Type	Record Value	Field Position: Content	Component Value	Value Description
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		

Record Type	Record Value	Field Position: Content	Component Value	Value Description
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		

Record Type	Record Value	Field Position: Content	Component Value	Value Description
R	Pro-Mon%	Immature monocytes: value same as above		
R	Plsm-cell%	Plasmacytes: value same as above		
R	HbA1c%	Glycohemoglobin parameters: hemoglobin A1c (NGSP), value same as above		
R	HbA1c-IFCC	Glycohemoglobin parameters: hemoglobin A1c(IFCC), value same as above		

### 3.6.2.3 Example of L-J QC Message

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

```

<STX>1H|V&|2||Mindray^LabXpert^||||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|^N^^^^<CR><ETB>8F<CR><LF>
<STX>6R|12|^BAS#^704-7|0.54|10&S&9/L|0.22^0.80|^N^^^^<CR><ETB>D5<CR><LF>
<STX>7R|13|^BAS%^706-2|2.8|1.2^4.2|^N^^^^<CR><ETB>B5<CR><LF>
<STX>0R|14|^NEU#^751-8|13.08|10&S&9/L|10.71^14.71|^N^^^^<CR><ETB>83<CR><LF>
<STX>1R|15|^NEU%^770-8|67.0|57.1^77.1|^N^^^^<CR><ETB>70<CR><LF>
<STX>2R|16|^EOS#^711-2|1.85|10&S&9/L|0.50^2.90|^N^^^^<CR><ETB>E8<CR><LF>
<STX>3R|17|^EOS%^713-8|9.5|3.0^15.0|^N^^^^<CR><ETB>FE<CR><LF>
<STX>4R|18|^LYM#^731-0|3.53|10&S&9/L|2.00^5.20|^N^^^^<CR><ETB>ED<CR><LF>
<STX>5R|19|^LYM%^736-9|18.1|11.0^27.0|^N^^^^<CR><ETB>71<CR><LF>
<STX>6R|20|^MON#^742-7|0.50|10&S&9/L|0.00^1.22|^N^^^^<CR><ETB>DF<CR><LF>
<STX>7R|21|^MON%^5905-5|2.6|0.0^5.7|^N^^^^<CR><ETB>02<CR><LF>
<STX>0R|22|^RBC^789-8|5.59|10&S&12/L|5.57^6.17|^N^^^^<CR><ETB>03<CR><LF>
<STX>1R|23|^HGB^718-7|17.8|g/dL|17.2^18.8|^N^^^^<CR><ETB>57<CR><LF>
<STX>2R|24|^MCV^787-2|106.6|fL|93.2^103.2|^N^^^^<CR><ETB>79<CR><LF>
<STX>3R|25|^MCH^785-6|31.7|pg|28.2^33.2|^N^^^^<CR><ETB>EA<CR><LF>
<STX>4R|26|^MCHC^786-4|29.8|g/dL|28.2^34.2|^N^^^^<CR><ETB>A6<CR><LF>
<STX>5R|27|^RDW-CV^788-0|15.9|18.7^20.7|^N^^^^<CR><ETB>EC<CR><LF>
<STX>6R|28|^RDW-SD^21000-5|61.8|fL|39.2^63.2|^N^^^^<CR><ETB>FB<CR><LF>
<STX>7R|29|^HCT^4544-3|0.596|0.546^0.606|^N^^^^<CR><ETB>EC<CR><LF>
<STX>0R|30|^PLT^777-3|418|10&S&9/L|415^545|^N^^^^<CR><ETB>52<CR><LF>

```

<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>  
 <STX>3R|33|^PCT^10002|0.450|0.342^0.742|^N^<CR><ETB>C2<CR><LF>  
 <STX>4R|34|^PLCR^10014|32.9|26.3^46.3|^N^<CR><ETB>88<CR><LF>  
 <STX>5R|35|^PLCC^10013|137|10&S&9/L|124^224|^N^<CR><ETB>73<CR><LF>  
 <STX>6R|36|^IMG#^51584-1|0.52|10&S&9/L|^N^<CR><ETB>BE<CR><LF>  
 <STX>7R|37|^IMG%^38518-7|2.7|^N^<CR><ETB>0D<CR><LF>  
 <STX>0R|38|^HFC#^10020|0.00|10&S&9/L|^N^<CR><ETB>35<CR><LF>  
 <STX>1R|39|^HFC%^10021|0.0|^N^<CR><ETB>7B<CR><LF>  
 <STX>2R|40|^PLT-^10022|418|10&S&9/L|^N^<CR><ETB>83<CR><LF>  
 <STX>3R|41|^WBC-D^10024|19.84|10&S&9/L|^N^<CR><ETB>D5<CR><LF>  
 <STX>4R|42|^WBC-B^10025|19.50|10&S&9/L|^N^<CR><ETB>CF<CR><LF>  
 <STX>5R|43|^PDW-SD^10031|14.1|fL|^N^<CR><ETB>F7<CR><LF>  
 <STX>6R|44|^InR#^10032|0.00|10&S&9/L|^N^<CR><ETB>73<CR><LF>  
 <STX>7R|45|^InR%^10033|0.00|^N^<CR><ETB>C3<CR><LF>  
 <STX>0R|46|^WBC^12227-5|19.50|10&S&9/L|16.44^21.44|^N^<CR><ETB>BE<CR><LF>  
 <STX>1L|1|^N<CR><ETX>01<CR><LF>

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

<STX>1H|^&|2||Mindray^LabXpert^||||Automated  
 Count^00001|P|LIS2-A2|20140909171936<CR><ETB>EE<CR><LF>  
 <STX>2P|1|||||^<CR><ETB>54<CR><LF>  
 <STX>3O|1|1MB999|||||20140820201334|||||^admin|||||F<CR><ETB>B2<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|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|^Shelf No^01012|??|^<CR><ETB>9D<CR><LF>  
 <STX>3R|8|^Tube No^01013|0|^<CR><ETB>F0<CR><LF>  
 <STX>4R|9|^Charge type^01015|^<CR><ETB>83<CR><LF>  
 <STX>5R|10|^Patient type^01016|^<CR><ETB>38<CR><LF>  
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 <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|19.50|10&S&9/L|16.44^21.44|^N^<CR><ETB>92<CR><LF>  
 <STX>4R|17|^BAS#^704-7|0.54|10&S&9/L|0.22^0.80|^N^<CR><ETB>D8<CR><LF>  
 <STX>5R|18|^BAS%^706-2|2.8|1.2^4.2|^N^<CR><ETB>B8<CR><LF>  
 <STX>6R|19|^NEU#^751-8|13.08|10&S&9/L|10.71^14.71|^N^<CR><ETB>8E<CR><LF>  
 <STX>7R|20|^NEU%^770-8|67.0|57.1^77.1|^N^<CR><ETB>72<CR><LF>  
 <STX>0R|21|^EOS#^711-2|1.85|10&S&9/L|0.50^2.90|^N^<CR><ETB>E2<CR><LF>  
 <STX>1R|22|^EOS%^713-8|9.5|3.0^15.0|^N^<CR><ETB>F8<CR><LF>

```
<STX>2R|23|ALYM#^731-0|3.53|10&S&9/L|2.00^5.20|MN^MM^CR><ETB>E7<CR><LF>
<STX>3R|24|ALYM%^736-9|18.1|11.0^27.0|MN^MM^CR><ETB>6B<CR><LF>
<STX>4R|25|MON#^742-7|0.50|10&S&9/L|0.00^1.22|MN^MM^CR><ETB>E2<CR><LF>
<STX>5R|26|MON#%^5905-5|2.6|0.0^5.7|MN^MM^CR><ETB>05<CR><LF>
<STX>6R|27|RBC^789-8|5.59|10&S&12/L|5.57^6.17|MN^MM^CR><ETB>0E<CR><LF>
<STX>7R|28|HGB^718-7|17.8|g/dL|17.2^18.8|MN^MM^CR><ETB>62<CR><LF>
<STX>0R|29|MCV^787-2|106.6|fL|93.2^103.2|H^MN^MM^CR><ETB>7C<CR><LF>
<STX>1R|30|MCH^785-6|31.7|pg|28.2^33.2|MN^MM^CR><ETB>E4<CR><LF>
<STX>2R|31|MCHC^786-4|29.8|g/dL|28.2^34.2|MN^MM^CR><ETB>A0<CR><LF>
<STX>3R|32|RDW-CV^788-0|15.9|18.7^20.7|MN^MM^CR><ETB>E6<CR><LF>
<STX>4R|33|RDW-SD^21000-5|61.8|fL|39.2^63.2|MN^MM^CR><ETB>F5<CR><LF>
<STX>5R|34|HCT^4544-3|0.596|0.546^0.606|MN^MM^CR><ETB>E6<CR><LF>
<STX>6R|35|PLT^777-3|418|10&S&9/L|415^545|MN^MM^CR><ETB>5D<CR><LF>
<STX>7R|36|MPV^32623-1|10.8|fL|8.3^14.3|MN^MM^CR><ETB>0A<CR><LF>
<STX>0R|37|PDW^32207-3|16.4|11.5^21.5|MN^MM^CR><ETB>78<CR><LF>
<STX>1R|38|PCT^10002|0.450|0.342^0.742|MN^MM^CR><ETB>C5<CR><LF>
<STX>2R|39|PLCR^10014|32.9|26.3^46.3|MN^MM^CR><ETB>8B<CR><LF>
<STX>3R|40|PLCC^10013|137|10&S&9/L|124^224|MN^MM^CR><ETB>6D<CR><LF>
<STX>4R|41|IMG#^51584-1|0.52|10&S&9/L|^MN^MM^CR><ETB>B8<CR><LF>
<STX>5R|42|IMG%^38518-7|2.7|^MN^MM^CR><ETB>07<CR><LF>
<STX>6R|43|HFC#^10020|0.00|10&S&9/L|^MN^MM^CR><ETB>37<CR><LF>
<STX>7R|44|HFC%^10021|0.0|^MN^MM^CR><ETB>7D<CR><LF>
<STX>0R|45|PLT-IM^10022|418|10&S&9/L|^MN^MM^CR><ETB>86<CR><LF>
<STX>1R|46|WBC-D^10024|19.84|10&S&9/L|^MN^MM^CR><ETB>D8<CR><LF>
<STX>2R|47|WBC-B^10025|19.50|10&S&9/L|^MN^MM^CR><ETB>D2<CR><LF>
<STX>3R|48|PDW-SD^10031|14.1|fL|^MN^MM^CR><ETB>FA<CR><LF>
<STX>4R|49|lnR#^10032|0.00|10&S&9/L|^MN^MM^CR><ETB>76<CR><LF>
<STX>5R|50|lnR%^10033|0.00|^MN^MM^CR><ETB>BD<CR><LF>
<STX>6R|51|WBC^12227-5|19.50|10&S&9/L|16.44^21.44|MN^MM^CR><ETB>C0<CR><LF>
<STX>7R|52|RBC Histogram. Left Line^15051|0|^MM^MM^CR><ETB>E3<CR><LF>
<STX>0R|53|RBC Histogram. Right Line^15052|0|^MM^MM^CR><ETB>51<CR><LF>
<STX>1R|54|RBC Histogram. Binary Meta Length^15053|1|^MM^MM^CR><ETB>3D<CR><LF>
<STX>2R|55|RBC Histogram. Total^15057|0|^MM^MM^CR><ETB>B8<CR><LF>
<STX>3R|56|PLT Histogram. Left Line^15111|0|^MM^MM^CR><ETB>F9<CR><LF>
<STX>4R|57|PLT Histogram. Right Line^15112|0|^MM^MM^CR><ETB>6F<CR><LF>
<STX>5R|58|PLT Histogram. Binary Meta Length^15113|1|^MM^MM^CR><ETB>5B<CR><LF>
<STX>6R|59|PLT Histogram. Total^15117|0|^MM^MM^CR><ETB>D6<CR><LF>
<STX>7R|60|WBC DIFF Scattergram. Meta len^15203|1|^MM^MM^CR><ETB>A2<CR><LF>
<STX>0R|61|WBC DIFF Scattergram. Fsc dimension^15205|0|^MM^MM^CR><ETB>B9<CR><LF>
<STX>1R|62|WBC DIFF Scattergram. Ssc dimension^15206|0|^MM^MM^CR><ETB>C9<CR><LF>
<STX>2R|63|WBC DIFF Scattergram. FL dimension^15207|0|^MM^MM^CR><ETB>35<CR><LF>
<STX>3R|64|WBC DIFF Scattergram. FSC-LOG dimension^15208|0|^MM^MM^CR><ETB>91<CR><LF>
<STX>4R|65|Baso Scattergram. Meta Len^15253|1|^MM^MM^CR><ETB>F9<CR><LF>
<STX>5R|66|Baso Scattergram. Fsc dimension^15255|0|^MM^MM^CR><ETB>38<CR><LF>
```



```

<STX>6R|67|^Baso Scattergram. Ssc dimension^^15256|0||^|^^^<CR><ETB>48<CR><LF>
<STX>7R|68|^Baso Scattergram. FL dimension^^15257|0||^|^^^<CR><ETB>B4<CR><LF>
<STX>0R|69|^Baso Scattergram. FSC-LOG dimension^^15258|0||^|^^^<CR><ETB>08<CR><LF>
<STX>1R|70|^RET Scattergram. Meta Len^^15307|1||^|^^^<CR><ETB>58<CR><LF>
<STX>2R|71|^RET Scattergram. Fsc dimension^^15303|0||^|^^^<CR><ETB>91<CR><LF>
<STX>3R|72|^RET Scattergram. Ssc dimension^^15304|0||^|^^^<CR><ETB>A1<CR><LF>
<STX>4R|73|^RET Scattergram. FL dimension^^15305|0||^|^^^<CR><ETB>0D<CR><LF>
<STX>5R|74|^RET Scattergram FSC-LOG dimension^^15308|0||^|^^^<CR><ETB>3D<CR><LF>
<STX>6R|75|^NRBC Scattergram. Meta Len^^15355|1||^|^^^<CR><ETB>9F<CR><LF>
<STX>7R|76|^NRBC Scattergram. Fsc dimension^^15351|0||^|^^^<CR><ETB>D8<CR><LF>
<STX>0R|77|^NRBC Scattergram. Ssc dimension^^15352|0||^|^^^<CR><ETB>E0<CR><LF>
<STX>1R|78|^NRBC Scattergram. FL dimension^^15353|0||^|^^^<CR><ETB>4C<CR><LF>
<STX>2R|79|^NRBC Scattergram FSC-LOG dimension^^15356|0||^|^^^<CR><ETB>7C<CR><LF>
<STX>3L|1|N<CR><ETX>03<CR><LF>

```

### 3.6.2.4 Example of X Mean R QC Message

```

<STX>1H|V&|1||Mindray^LabXpert^||||XR
QCR^00006|P|LIS2-A2|20140910101433<CR><ETB>BE<CR><LF>
<STX>2O|1||||20140909195007|||||^|admin||||||F<CR><ETB>57<CR><LF>
<STX>3R|1|^Take Mode^^08001|O||^|^^^<CR><ETB>C9<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|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>
<STX>2R|8|^Qc file No^^05005|1||^|^^^<CR><ETB>D9<CR><LF>
<STX>3R|9|^Qc lot No^^05006|12||^|^^^<CR><ETB>BD<CR><LF>
<STX>4R|10|^Analyzer^^09001|11#||^|^^^<CR><ETB>4D<CR><LF>
<STX>5R|11|^WBC^^6690-2|0.00|10&S&9/L|^|^N^^^<CR><ETB>5A<CR><LF>
<STX>6R|12|^BAS#^704-7|****|10&S&9/L|^|^N^^^<CR><ETB>2E<CR><LF>
<STX>7R|13|^BAS%^706-2|****|^|^N^^^<CR><ETB>7B<CR><LF>
<STX>0R|14|^NEU#^751-8|****|10&S&9/L|^|^N^^^<CR><ETB>3F<CR><LF>
<STX>1R|15|^NEU%^770-8|****|^|^N^^^<CR><ETB>90<CR><LF>
<STX>2R|16|^EOS#^711-2|****|10&S&9/L|^|^N^^^<CR><ETB>38<CR><LF>
<STX>3R|17|^EOS%^713-8|****|^|^N^^^<CR><ETB>90<CR><LF>
<STX>4R|18|^LYM#^731-0|****|10&S&9/L|^|^N^^^<CR><ETB>47<CR><LF>
<STX>5R|19|^LYM%^736-9|****|^|^N^^^<CR><ETB>A5<CR><LF>
<STX>6R|20|^MON#^742-7|****|10&S&9/L|^|^N^^^<CR><ETB>43<CR><LF>
<STX>7R|21|^MON%^5905-5|****|^|^N^^^<CR><ETB>C7<CR><LF>
<STX>0R|22|^RBC^^789-8|0.00|10&S&12/L|^|^N^^^<CR><ETB>55<CR><LF>
<STX>1R|23|^HGB^^718-7|0.1|mmol/L|^|^N^^^<CR><ETB>6B<CR><LF>
<STX>2R|24|^MCV^^787-2|****|fL|^|^N^^^<CR><ETB>1E<CR><LF>
<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>

```

<STX>5R|27|^RDW-CV^788-0|\*\*\*\*||^N^<CR><ETB>3E<CR><LF>  
 <STX>6R|28|^RDW-SD^21000-5|\*\*\*\*|fL|^N^<CR><ETB>41<CR><LF>  
 <STX>7R|29|^HCT^4544-3|0.000|L/L|^N^<CR><ETB>A8<CR><LF>  
 <STX>0R|30|^PLT^777-3|0|10&S&9/L|^N^<CR><ETB>AD<CR><LF>  
 <STX>1R|31|^MPV^32623-1|\*\*\*\*|fL|^N^<CR><ETB>81<CR><LF>  
 <STX>2R|32|^PDW^32207-3|\*\*\*\*||^N^<CR><ETB>C9<CR><LF>  
 <STX>3R|33|^PCT^10002|\*\*\*\*|mL/L|^N^<CR><ETB>90<CR><LF>  
 <STX>4R|34|^PLCR^10014|\*\*\*\*|%^N^<CR><ETB>D0<CR><LF>  
 <STX>5R|35|^PLCC^10013|\*\*\*\*|10&S&9/L|^N^<CR><ETB>51<CR><LF>  
 <STX>6R|36|^HFC%^10020|\*\*\*\*|10&S&9/L|^N^<CR><ETB>23<CR><LF>  
 <STX>7R|37|^HFC%^10021|\*\*\*\*|%^N^<CR><ETB>99<CR><LF>  
 <STX>0R|38|^PLT-^10022|0|10&S&9/L|^N^<CR><ETB>1B<CR><LF>  
 <STX>1R|39|^WBC-D^10024|0.00|10&S&9/L|^N^<CR><ETB>94<CR><LF>  
 <STX>2R|40|^WBC-B^10025|0.00|10&S&9/L|^N^<CR><ETB>8C<CR><LF>  
 <STX>3R|41|^PDW-SD^10031|\*\*\*\*|fL|^N^<CR><ETB>D7<CR><LF>  
 <STX>4R|42|^lnR^10032|\*\*\*\*|10&S&9/L|^N^<CR><ETB>59<CR><LF>  
 <STX>5R|43|^lnR%^10033|\*\*\*\*|%^N^<CR><ETB>A9<CR><LF>  
 <STX>6R|44|^WBC^12227-5|0.00|10&S&9/L|^N^<CR><ETB>8D<CR><LF>  
 <STX>7R|45|^IMG^51584-1|\*\*\*\*|10&S&9/L|^N^<CR><ETB>A2<CR><LF>  
 <STX>0R|46|^IMG%^38518-7|\*\*\*\*||^N^<CR><ETB>F2<CR><LF>  
 <STX>1R|47|^Micro^15199-3|\*\*\*\*|10&S&12/L|^N^<CR><ETB>E9<CR><LF>  
 <STX>2R|48|^Micro%^10042|\*\*\*\*|%^N^<CR><ETB>C2<CR><LF>  
 <STX>3R|49|^Macro^15198-5|\*\*\*\*|10&S&12/L|^N^<CR><ETB>E6<CR><LF>  
 <STX>4R|50|^Macro%^10040|\*\*\*\*|%^N^<CR><ETB>B3<CR><LF>  
 <STX>5R|51|^WBC^6690-2|0.00|10&S&9/L|^N^<CR><ETB>5E<CR><LF>  
 <STX>6R|52|^BAS^704-7|\*\*\*\*|10&S&9/L|^N^<CR><ETB>32<CR><LF>  
 <STX>7R|53|^BAS%^706-2|\*\*\*\*||^N^<CR><ETB>7F<CR><LF>  
 <STX>0R|54|^NEU^751-8|\*\*\*\*|10&S&9/L|^N^<CR><ETB>43<CR><LF>  
 <STX>1R|55|^NEU%^770-8|\*\*\*\*||^N^<CR><ETB>94<CR><LF>  
 <STX>2R|56|^EOS^711-2|\*\*\*\*|10&S&9/L|^N^<CR><ETB>3C<CR><LF>  
 <STX>3R|57|^EOS%^713-8|\*\*\*\*||^N^<CR><ETB>94<CR><LF>  
 <STX>4R|58|^LYM^731-0|\*\*\*\*|10&S&9/L|^N^<CR><ETB>4B<CR><LF>  
 <STX>5R|59|^LYM%^736-9|\*\*\*\*||^N^<CR><ETB>A9<CR><LF>  
 <STX>6R|60|^MON^742-7|\*\*\*\*|10&S&9/L|^N^<CR><ETB>47<CR><LF>  
 <STX>7R|61|^MON%^5905-5|\*\*\*\*||^N^<CR><ETB>CB<CR><LF>  
 <STX>0R|62|^RBC^789-8|0.00|10&S&12/L|^N^<CR><ETB>59<CR><LF>  
 <STX>1R|63|^HGB^718-7|0.1|mmol/L|^N^<CR><ETB>6F<CR><LF>  
 <STX>2R|64|^MCV^787-2|\*\*\*\*|fL|^N^<CR><ETB>22<CR><LF>  
 <STX>3R|65|^MCH^785-6|\*\*\*\*|amol|^N^<CR><ETB>0F<CR><LF>  
 <STX>4R|66|^MCHC^786-4|\*\*\*\*|mmol/L|^N^<CR><ETB>DA<CR><LF>  
 <STX>5R|67|^RDW-CV^788-0|\*\*\*\*||^N^<CR><ETB>42<CR><LF>  
 <STX>6R|68|^RDW-SD^21000-5|\*\*\*\*|fL|^N^<CR><ETB>45<CR><LF>  
 <STX>7R|69|^HCT^4544-3|0.000|L/L|^N^<CR><ETB>AC<CR><LF>  
 <STX>0R|70|^PLT^777-3|0|10&S&9/L|^N^<CR><ETB>B1<CR><LF>  
 <STX>1R|71|^MPV^32623-1|\*\*\*\*|fL|^N^<CR><ETB>85<CR><LF>

<STX>2R|72|^PDW^32207-3|\*\*\*\*||^N^<CR><ETB>CD<CR><LF>  
 <STX>3R|73|^PCT^10002|\*\*\*\*|mL/L|^N^<CR><ETB>94<CR><LF>  
 <STX>4R|74|^PLCR^10014|\*\*\*\*|%^N^<CR><ETB>D4<CR><LF>  
 <STX>5R|75|^PLCC^10013|\*\*\*\*|10&S&9/L|^N^<CR><ETB>55<CR><LF>  
 <STX>6R|76|^HFC#^10020|\*\*\*\*|10&S&9/L|^N^<CR><ETB>27<CR><LF>  
 <STX>7R|77|^HFC%^10021|\*\*\*\*|%^N^<CR><ETB>9D<CR><LF>  
 <STX>0R|78|^PLT-|^10022|0|10&S&9/L|^N^<CR><ETB>1F<CR><LF>  
 <STX>1R|79|^WBC-D^10024|0.00|10&S&9/L|^N^<CR><ETB>98<CR><LF>  
 <STX>2R|80|^WBC-B^10025|0.00|10&S&9/L|^N^<CR><ETB>90<CR><LF>  
 <STX>3R|81|^PDW-SD^10031|\*\*\*\*|fL|^N^<CR><ETB>DB<CR><LF>  
 <STX>4R|82|^InR#^10032|\*\*\*\*|10&S&9/L|^N^<CR><ETB>5D<CR><LF>  
 <STX>5R|83|^InR%^10033|\*\*\*\*|%^N^<CR><ETB>AD<CR><LF>  
 <STX>6R|84|^WBC^12227-5|0.00|10&S&9/L|^N^<CR><ETB>91<CR><LF>  
 <STX>7R|85|^IMG#^51584-1|\*\*\*\*|10&S&9/L|^N^<CR><ETB>A6<CR><LF>  
 <STX>0R|86|^IMG%^38518-7|\*\*\*\*||^N^<CR><ETB>F6<CR><LF>  
 <STX>1R|87|^Micro#^15199-3|\*\*\*\*|10&S&12/L|^N^<CR><ETB>ED<CR><LF>  
 <STX>2R|88|^Micro%^10042|\*\*\*\*|%^N^<CR><ETB>C6<CR><LF>  
 <STX>3R|89|^Macro#^15198-5|\*\*\*\*|10&S&12/L|^N^<CR><ETB>EA<CR><LF>  
 <STX>4R|90|^Macro%^10040|\*\*\*\*|%^N^<CR><ETB>B7<CR><LF>  
 <STX>5R|91|^WBC^6690-2|0.00|10&S&9/L|^N^<CR><ETB>62<CR><LF>  
 <STX>6R|92|^BAS#^704-7|\*\*\*\*|10&S&9/L|^N^<CR><ETB>36<CR><LF>  
 <STX>7R|93|^BAS%^706-2|\*\*\*\*||^N^<CR><ETB>83<CR><LF>  
 <STX>0R|94|^NEU#^751-8|\*\*\*\*|10&S&9/L|^N^<CR><ETB>47<CR><LF>  
 <STX>1R|95|^NEU%^770-8|\*\*\*\*||^N^<CR><ETB>98<CR><LF>  
 <STX>2R|96|^EOS#^711-2|\*\*\*\*|10&S&9/L|^N^<CR><ETB>40<CR><LF>  
 <STX>3R|97|^EOS%^713-8|\*\*\*\*||^N^<CR><ETB>98<CR><LF>  
 <STX>4R|98|^LYM#^731-0|\*\*\*\*|10&S&9/L|^N^<CR><ETB>4F<CR><LF>  
 <STX>5R|99|^LYM%^736-9|\*\*\*\*||^N^<CR><ETB>AD<CR><LF>  
 <STX>6R|100|^MON#^742-7|\*\*\*\*|10&S&9/L|^N^<CR><ETB>72<CR><LF>  
 <STX>7R|101|^MON%^5905-5|\*\*\*\*||^N^<CR><ETB>F6<CR><LF>  
 <STX>0R|102|^RBC^789-8|0.00|10&S&12/L|^N^<CR><ETB>84<CR><LF>  
 <STX>1R|103|^HGB^718-7|0.1|mmol/L|^N^<CR><ETB>9A<CR><LF>  
 <STX>2R|104|^MCV^787-2|\*\*\*\*|fL|^N^<CR><ETB>4D<CR><LF>  
 <STX>3R|105|^MCH^785-6|\*\*\*\*|amol|^N^<CR><ETB>3A<CR><LF>  
 <STX>4R|106|^MCHC^786-4|\*\*\*\*|mmol/L|^N^<CR><ETB>05<CR><LF>  
 <STX>5R|107|^RDW-CV^788-0|\*\*\*\*||^N^<CR><ETB>6D<CR><LF>  
 <STX>6R|108|^RDW-SD^21000-5|\*\*\*\*|fL|^N^<CR><ETB>70<CR><LF>  
 <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>1H|\&|2||Mindray^LabXpert^|||||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^LabXpert^|||||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>

```

## 3.6.4 Bi-Directional LIS/HIS Response Message

### 3.6.4.1 Record Structure

Record Structure:

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

### 3.6.4.2 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 1 OBR-4 and ASTM Message Type 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

Record Type	Record Value	Field Position: Content	Component Value	Value Description
				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 X – skip sample for analysis
R	Presentation mode	2: ID	ID name	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	
		Value same as above		
R	Blood Mode	Value same as above		
R	Analysis mode	Value same as above		

Record Type	Record Value	Field Position: Content	Component Value	Value Description
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 3.6.3), 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.

### 3.6.4.3 Example of Request Response Message

An example of request having been successfully answered is shown below. The sample is successfully found and analyzed, the response code is “Q”.

An example message for a Chinese patient:

```

<STX>1H|\&|1||Mindray^LabXpert^||||Worksheet
response^00011|P|LIS2-A2|20140909165555<CR><ETB>6C<CR><LF>
<STX>2P|1|||patientID2001|张三^|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>
```

An example message for a non-Chinese patient:

```
<STX>1H|^&|1||Mindray^LabXpert^||||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>
```

An example of sample being skipped for analysis is shown below. The sample is successfully found, but the response code is "X":

An example message for a Chinese patient:

```
<STX>1H|^&|0||Mindray^LabXpert^||||Worksheet
response^00011|P|LIS2-A2|20191025110845<CR><ETB>6C<CR><LF>
<STX>2P|1||| patientID |张三||20100405060708^10^Y|Male ||||| Internal medicine |
"Inpatient zone" ^"Bed Number".<CR><ETB>08<CR><LF>
<STX>3O|1|s1||||20190102030405|||"Submitter"|||"Diagnosis" |20190203040506| Venous blood
^||||||X<CR><ETB>46<CR><LF>
<STX>3L|1|N<CR><ETX>05<CR><LF>
```

An example message for a non-Chinese patient:

```
<STX>1H|^&|0||Mindray^LabXpert^||||Worksheet
response^00011|P|LIS2-A2|20191025110845<CR><ETB>6C<CR><LF>
<STX>2P|1||| patientID2001| Michael^Jordan ||20100405060708^10^Y| Male ||||| Internal
medicine|A - 501^1002<CR><ETB>08<CR><LF>
```



<STX>3O|1|s1||||20190102030405|||Jack|||Virus      infections|20190203040506|Venous      blood  
^|||||||X<CR><ETB>46<CR><LF>  
<STX>3L|1|N<CR><ETX>05<CR><LF>

# **Chapter 4 labXpert Simplified Communication Protocol**

## **4.1 Connection Control**

### **4.1.1 labXpert as the TCP Server**

The TCP server can start interception after the labXpert is started or after communication settings are modified. One connection can be established with the LIS/HIS. The established connection is retained until message sending fails, communication settings are modified, or the labXpert is shut down.

### **4.1.2 labXpert as the TCP Client**

After the labXpert software is started or communication settings are modified, an attempt is automatically made to establish a connection. If the connection is not established within 10s, the connection attempt fails. Then, another connection attempt is made.

If the communication connection is still not established, the TCP client tries to establish a connection during automatic or manual communication. If the connection is not established within 10s, the system reports a communication error and cancels the current communication.

After a connection is successfully established, the connection is retained until the connection is interrupted, communication settings are modified, or the labXpert is shut down.

### **4.1.3 Network Port Communication**

Unidirectional communication messages of count/QC results are directly sent to the LIS, and no response is required.

When counting of samples starts, labXpert sends a bidirectional query request to the LIS/HIS. The LIS/HIS returns a query response within 10s. After successfully receiving the response, the system performs counting according to the mode queried from the LIS/HIS.

## **4.2 Communication Protocol**

### **4.2.1 Overview**

The new protocol is a standard extension based on the JSON object. It is a text communication protocol, and uses UTF-8 for encoding.

## 4.2.2 Transport Layer Protocol

Like the HL7, the system uses MLLP.

The message body uses special characters for separation, for example, <SB> dddd  
<EB><CR>.

## 4.2.3 Message Body



Figure 10 Structure of the message body

## 4.2.4 Interaction

### 4.2.4.1 Bidirectional LIS Query

#### 4.2.4.1.1 Overview

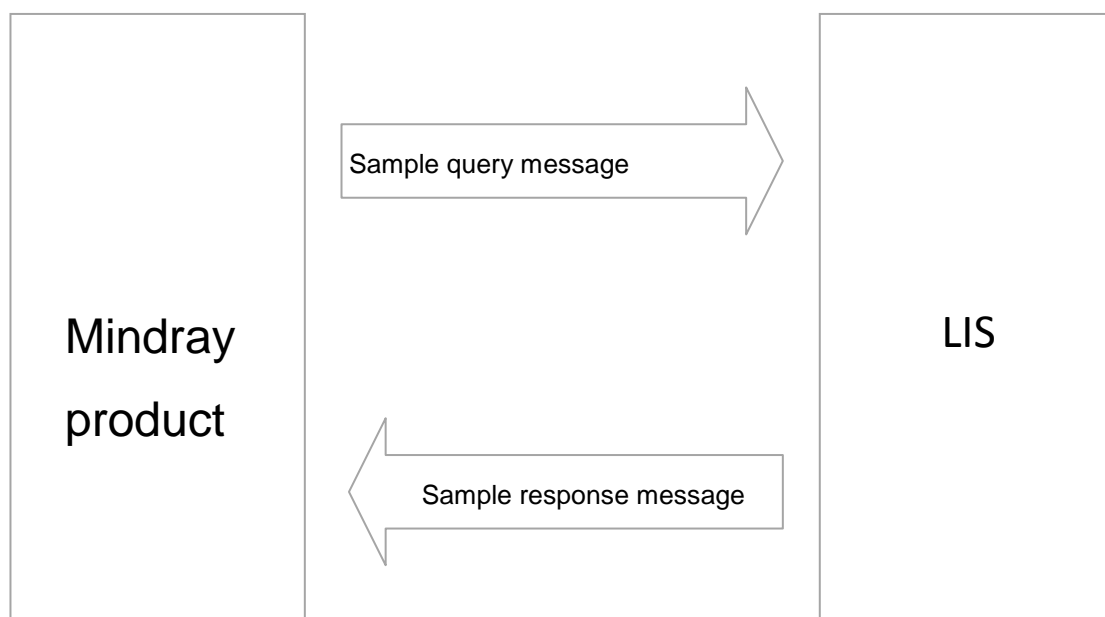


Figure 11 Bidirectional interaction with the LIS

#### 4.2.4.1.2 Sample Query Message

```
<0B>
{"Type":"Query","SampleID":"Sample ID","TestItemType":"BL"}
<1C><0D>
```

The following table describes fields in the message. Optional fields may not appear in the message body.

**Table 9 Description of fields in the query message**

Field	Mandatory or not?	Type	Value
Type	Yes	String	It is set to "Query" in a query message.
SampleID	Yes	String	Sample ID
TestItemType	Yes	String	For details, see Table 10 Values of TestItemType.

**Table 10 Values of TestItemType**

Content	Meaning
BL	Blood sample
BF	Blood fluid sample

#### 4.2.4.1.3 Sample Response Message

An example of response message of successful inquiry is shown below. The AckCode is "AA".  
An example message for a Chinese patient:

```
{"Type":"Response","SampleID":"Sample ID","TestItemType":"BL","AckCode":"AA",
AnalyzeMode":"CBC+DIFF","LisSerialNumber":"Sample LIS serial number","SpecimenT
ype":"Venous blood","SamplingTime":"20180314145241","SubmittingTime":"2018031415
0241","Submitter":"Submitter","Diagnosis":"Diagnosis","ReferenceGroup":"Reference gro
up","Remark":"Remark","MedicalRecordID":"Medical record ID","PatientName":"张三","P
atientLastName":"","Birth":"2000010203","Age":"18","AgeUnit":"yr","Gender":"Female","P
atientType":"Outpatient","Department":"Department","BedNumber":"Bed number","Patien
tArea":"Patient area","Charge":"Charging type"}
<1C><0D>
```

An example message for a non-Chinese patient:

```
<0B>
{"Type":"Response","SampleID":"Sample ID","TestItemType":"BL","AckCode":"AA",
AnalyzeMode":"CBC+DIFF","LisSerialNumber":"Sample LIS serial number","SpecimenT
ype":"Venous blood","SamplingTime":"20180314145241","SubmittingTime":"2018031415
0241","Submitter":"Submitter","Diagnosis":"Diagnosis","ReferenceGroup":"Reference gro
up","Remark":"Remark","MedicalRecordID":"Medical record ID","PatientName":"Patient
name","PatientLastName":"Last name","Birth":"2000010203","Age":"18","AgeUnit":"yr",
```

Gender":"Female","PatientType":"Outpatient","Department":"Department","BedNumber":"  
Bed number","PatientArea":"Patient area","Charge":"Charging type"}

<1C><0D>

An example of "skip sample" message is shown below. The AckCode is "AS".

<0B>

{"Type":"Response","SampleID":"s1","TestItemType":"BL","AckCode":"AS"}

<1C><0D>

**Table 11 Description of fields in the response message**

Field	Mandatory or not?	Type	Value
Type	Yes	String	Field type. It is always set to "Response" in a response message.
SampleID	Yes	String	Sample ID, which must be the same as that in the received query message.
TestItemType	Yes	String	For details, see Table 10 Values of TestItemType.
AckCode	No	String	Response code AA: Query is completed. "AS": skip for analysis If the AckCode field is absent, or the content cannot be recognized, the default response code is "AA".
AnalyzeMode	Yes	String	Sample count mode It consists of multiple count mode groups, which are separated by "+". For details about the count mode groups, see Table 12 Count mode. Example: If routine blood tests, including CBC, DIFF, CRP, and SMST, must be performed on samples, the mode is set to "CBC+DIFF+CRP+SMST".
LisSerialNumber	No	String	Serial number of a sample in the LISumd
SpecimenType	No	String	Sample type, for example, "venous blood".
SamplingTime	No	String	Sampling time in the format of "YYYYMMDDhhmmss"
SubmittingTime	No	String	Submitting time in the format of "YYYYMMDDhhmmss"
Submitter	No	String	Submitter

Field	Mandatory or not?	Type	Value
Diagnosis	No	String	Clinic diagnosis
ReferenceGroup	No	String	Reference group
Remark	No	String	Remarks
MedicalRecordID	No	String	Medical record ID, used to identify a patient.
PatientName	No	String	Patient name
PatientLastName	No	String	Last name of the patient. Reserved for western patient names. When it is a Chinese name, the field is left empty.
Birth	No	String	Date of birth in the format of "YYYYMMDD[hh[mm[ss]]]"
Age	No	String	Age
AgeUnit	No	String	Age unit For details, see Table 13 Age <b>unit</b> .
Gender	No	String	Gender For details, see Table 14 Gender.
PatientType	No	String	Patient type, for example, "Outpatient".
Department	No	String	Department
BedNumber	No	String	Bed number
PatientArea	No	String	Zone
ChargeType	No	String	Charging type

**Table 12 Count mode**

Routine Blood Test Mode Group
CBC
CBC+DIFF
CBC+DIFF+NRBC
CBC+DIFF+RET
CBC+DIFF+RET+NRBC
CBC+NRBC
CBC+RET
RET
CR/PLT-8X (that is, CBC+RET(PLT-8X))
CDR/PLT-8X (CBC+DIFF+RET(PLT-8X))
CRP Mode Group
CRP
Blood Slide Mode Group

SMST
HbA1c Mode Group
A1C (HbA1c mode responded from Bidirectional LIS)
STANDARD (standard mode, sending the sample results to LIS)
EXTEND (extended mode, sending the sample results to LIS)

**Table 13 Age unit**

Content	Meaning
yr	Year
mo	Month
wk	Week
d	Date
hr	Hour

**Table 14 Gender**

Content	Meaning
M (or m)	Male
F (or f)	Female
U (or u)	Unknown
Other content	Directly processed as the displayed string.

## 4.2.5 Sample Result Communication

### 4.2.5.1 Overview

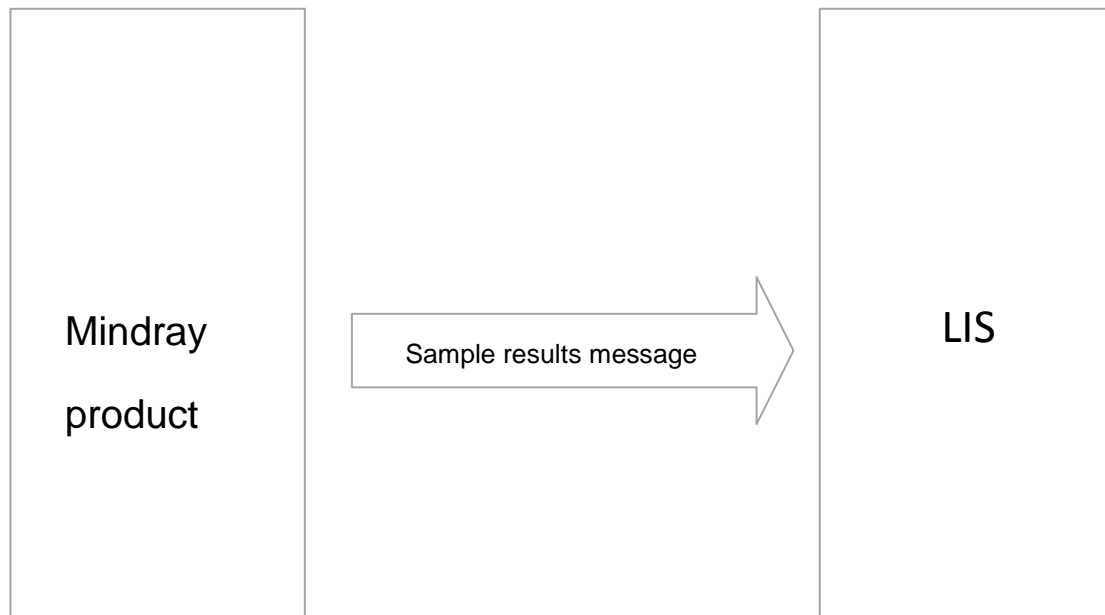


Figure 12 Result communication

### 4.2.5.2 Sample Result Message

Routine blood count results report:

<0B>

```
{"Type":"SampleResultInfo","SampleID":"Sample ID","TestItemType":"BL","Remark":  
"Remark","SuggestRecheck":"T","AnalyzeTime":"20180314164301","InstrumentName":"B  
C-6800#1","CountChannel":"CRP1","AnalyzeMode":"CBC+DIFF","RackNo":"1","TubeNo":  
"2","IsValidated":"Validated","Tester":"Tester","Auditor":"Auditer","AuditTime":"201803141  
64331","AutoAuditResult":"Auto Validation OK","AutoAuditMessages":["Rule msg1","Rul  
e msg2"]}<0D>
```

```
{"Type":"ReportParameters","WBC":"WBC result","WBC_Flags":"RHE","RBC":"RBC  
result"}<0D>
```

```
{"Type":"ResearchParameters","HFC#":"HFC#result","HFC_Flags":""}<0D>
```

```
{"Type":"OtherParameters","DefaultCrp":"DefaultCrp result ","DefaultCrp_Flags":""}<  
0D>
```

```
{"Type":"Alerts","AlertValues":["ScatterAbnormal","Anemia"]}<0D>
```

```
{"Type":"Histo","SubType":"RBC","Data":"RBC graphical data, bitmap encoded usi  
ng Base64"}<0D>
```

```
{"Type":"Scatter","SubType":"DIFF","Data":"DIFF graphical data, bitmap encoded  
using Base64"}
```

<1C><0D>

Glycohemoglobin test result report:

```
{"Type":"SampleResultInfo","SampleID":"20150709111338","TestItemType":"BL","Re
```



mark": "bacterial infection", "AnalyzeTime": "20200511161940", "InstrumentName": "H50", "AnalyzeMode": "STANDARD", "RackNo": "1", "TubeNo": "2", "IsValidated": "NotValidated"

{ "Type": "ReportParameters", "HbA1c\_NGSP": "0.6", "HbA1c\_NGSP\_Flags": "L", "HbA1c\_MonoS": "0.6", "HbA1c\_MonoS\_Flags": "L", "HbA1c\_IFCC": "2", "HbA1c\_IFCC\_Flags": "L", "HbF": "2.1", "HbA1": "1.4" }

{ "Type": "ResearchParameters", "eAG": "4.2" }

{ "Type": "ChromatoGraph", "Data": "Chromatogram data, bitmap encoded using Base64" }

{ "Type": "ChromatoPeak", "Total Area": "0.00", "A1a RTime": "1.0", "A1a Area": "2.00", "A1a Area Percent": "3.0", "A1b RTime": "4.0", "A1b Area": "5.00", "A1b Area Percent": "6.0", "F RTime": "7.0", "F Area": "8.00", "F Area Percent": "9.0", "LA1c RTime": "10.0", "LA1c Area": "11.00", "LA1c Area Percent": "12.0", "SA1c RTime": "13.0", "SA1c Area": "14.00", "SA1c Area Percent": "15.0", "A0 RTime": "16.0", "A0 Area": "17.00", "A0 Area Percent": "18.0", "P00 RTime": "19.0", "P00 Area": "20.00", "P00 Area PER": "21.0" }

**Table 15 Description of fields in the sample result message**

Sample information fields			
Field	Mandatory or not?	Type	Value
Type	Yes	String	Type is always set to "SampleResultInfo" for a sample information field in a result message.
SampleID	Yes	String	Sample ID
TestItemType	Yes	String	For details, see Table 10 Values of TestItemType.
Remark	No	String	Remarks
SuggestRecheck	No	String	Suggest recheck "T" indicates that a recheck is suggested.
AnalyzeTime	Yes	String	Sample analysis time in the format of "YYYYMMDDhhmmss"
InstrumentName	No	String	Analyzer name
CountChannel	No	String	Count channel For details, see Table 16 Count channels.
AnalyzeMode	No	String	Sample count mode It consists of multiple count mode groups, which are separated by "+". For details about the count mode groups, see Table 12 Count mode. Example:

Sample information fields			
			If routine blood tests, including CBC, DIFF, CRP, and SMST, must be performed on samples, the mode is set to "CBC+DIFF+CRP+SMST".
RackNo	No	String	Rack number It may be a numeric string of the rack number, or "??".
TubeNo	No	String	Tube number
IsValidated	No	String	Whether the result is validated. Values: Validated NotValidated
Tester	Yes	String	Tester
Auditer	No	String	Auditor
AuditTime	No	String	Audit time in the format of "YYYYMMDDhhmmss"
AutoAuditResult	No	String	Automatically audit the results. Values: Auto Validation OK: Successful auto validation Review: To be manually reviewed Microscopic: Microscopic examination Re-exam: Re-examination Microscopic + Re-exam: Microscopic examination plus re-examination
AutoAuditMessages	No	String array	Messages are automatically audited. Each element corresponds to a message.
LisTestID	No	String	LIS internal testing ID
Report parameter field (may contain multiple parameter fields. The number of parameters is variable. In addition, when the QC result is used as a normal sample for communication, parameters will be filled in the report parameter fields.)			
Field	Mandatory or not?	Type	Value
Type	Yes	String	It is always set to "ReportParameters" for a report parameter field.
Parameter result (parameter name. For details, see Table 17 Parameter names.)	Yes	String	String of the parameter result
Parameter flag (The value is "Parameter	No	String	Parameter flag. It may contain multiple flag characters. For details about the flag

Sample information fields				
name_Flag".)			characters, see	
			HbA1c_NGSP	HbA1c_NGSP_Flags
			HbA1c_MonoS	HbA1c_MonoS_Flags
			HbA1c_IFCC	HbA1c_IFCC_Flags
			HbF	HbF_Flags
			HbA1	HbA1_Flags
			eAG	eAG_Flags
			Table 18 Parameter flags.	
Other parameter field (may contain multiple parameter fields. The number of parameter fields is variable. In addition, in case that QC result is transmitted in the format of sample results, there will be no “other parameter” field in the message.)				
Field	Mandatory or not?	Type	Value	
Type	Yes	String	It is always set to " OtherParameters" for the other parameter field.	
Parameter result (parameter name. For details, see Table 17 Parameter names.)	Yes	String	String of the parameter result	
Parameter flag (The value is "Parameter name_Flag".)	No	String	Parameter flag. It may contain multiple flag characters. For details about the flag characters, see	
			HbA1c_NGSP	HbA1c_NGSP_Flags
			HbA1c_MonoS	HbA1c_MonoS_Flags
			HbA1c_IFCC	HbA1c_IFCC_Flags
			HbF	HbF_Flags
			HbA1	HbA1_Flags
			eAG	eAG_Flags
			Table 18 Parameter flags.	
Research parameter field (may contain multiple parameter fields. The number of parameters is variable. In addition, when the QC result is used as a normal sample for communication, there is no research parameter and this field does not exist.)				
Field	Mandatory or not?	Type	Value	
Type	Yes	String	It is always set to "ResearchParameters" for a research parameter field.	
Parameter result (parameter name.	Yes	String	String of the parameter result	

Sample information fields				
For details, see Table 17 Parameter names.)				
Parameter flag (The value is "Parameter name_Flag".)	No	String	Parameter flag. It may contain multiple flag characters. For details about the flag characters, see	
			HbA1c_NGSP	HbA1c_NGSP_Flags
			HbA1c_MonoS	HbA1c_MonoS_Flags
			HbA1c_IFCC	HbA1c_IFCC_Flags
			HbF	HbF_Flags
			HbA1	HbA1_Flags
			eAG	eAG_Flags
			Table 18 Parameter flags.	
Alert fields (Optional. If there is no alert, this field is not contained.)				
Field	Mandatory or not?	Type	Value	
Type	Yes	String	It is always set to "Alerts" for an alert field.	
AlertValues	Yes	String array	The element is an alert. For values of this field, see Table 19 Alerts.	
Histogram field (Each histogram corresponds to one field, and one field may have zero or multiple histograms.)				
Field	Mandatory or not?	Type	Value	
Type	Yes	String	It is always set to "Histo" for a histogram field.	
SubType	Yes	String	Histogram subtype  For values of this field, see Table 20.	
Data	Yes	String	Graphical data encoded using Base64. For details about the format, see the communication configuration.	
Scatter diagram field (Each scatter diagram corresponds to one field, and one field may have zero or multiple scatter diagrams.)				
Field	Mandatory or not?	Type	Value	
Type	Yes	String	It is always set to "Scatter" for a scatter diagram field.	
SubType	Yes	String	Scatter diagram subtype For values of this field, see Table 21 Scattergram subtypes.	

Sample information fields			
Data	Yes	String	Graphical data encoded using Base64. For details about the format, see the communication configuration.
Chromatogram fields			
Field	Mandatory or not?	Type	Value
Type	Yes	String	It is always set to " ChromatoGraph " for a chromatogram field.
Data	Yes	String	Graphical data encoded using Base64. For details about the format, see the communication configuration.
Chromatogram peak fields			
Field	Mandatory or not?	Type	Value
Type	Yes	String	It is always set to " ChromatoPeak " for a chromatogram peak field.
Parameter result (parameter name. For details, see <b>Table 22 Chromatogram peak type.</b> )	Yes	String	String of the parameter result

**Table 16 Count channels**

Content	Meaning
CRP1	CRP count channel 1
CRP2	CRP count channel 2
CRP3	CRP count channel 3
CPR4	CRP count channel 4

**Table 17 Parameter names**

Parameter Name	Parameter Flag
WBC	WBC_Flags
Bas#	Bas#_Flags

Parameter Name	Parameter Flag
Bas%	Bas%_Flags
Neu#	Neu#_Flags
Neu%	Neu%_Flags
Eos#	Eos#_Flags
Eos%	Eos%_Flags
Lym#	Lym#_Flags
Lym%	Lym%_Flags
Mon#	Mon#_Flags
Mon%	Mon%_Flags
RET%	RET%_Flags
RET#	RET#_Flags
IRF	IRF_Flags
LFR	LFR_Flags
MFR	MFR_Flags
HFR	HFR_Flags
RBC	RBC_Flags
HGB	HGB_Flags
MCV	MCV_Flags
MCH	MCH_Flags
MCHC	MCHC_Flags
RDW-CV	RDW-CV_Flags
RDW-SD	RDW-SD_Flags
HCT	HCT_Flags
NRBC#	NRBC#_Flags
NRBC%	NRBC%_Flags
PLT	PLT_Flags
MPV	MPV_Flags
PDW	PDW_Flags
PCT	PCT_Flags
P-LCR	P-LCR_Flags
P-LCC	P-LCC_Flags
PLT-I	PLT-I_Flags
WBC-D	WBC-D_Flags
IMG#	IMG#_Flags
IMG%	IMG%_Flags

Parameter Name	Parameter Flag
HFC#	HFC#_Flags
HFC%	HFC%_Flags
WBC-B	WBC-B_Flags
WBC-R	WBC-R_Flags
RBC-O	RBC-O_Flags
PLT-O	PLT-O_Flags
WBC-N	WBC-N_Flags
PDW-SD	PDW-SD_Flags
InR#	InR#_Flags
InRPerMilli (that is, InR‰)	InRPerMilli_Flags
WBC-BF	WBC-BF_Flags
RBC-BF	RBC-BF_Flags
MN#	MN#_Flags
PMN#	PMN#_Flags
MN%	MN%_Flags
PMN%	PMN%_Flags
TC-BF#	TC-BF#_Flags
Eos-BF#	Eos-BF#_Flags
Eos-BF%	Eos-BF%_Flags
HF-BF#	HF-BF#_Flags
HF-BF%	HF-BF%_Flags
RBC-BF(R)	RBC-BF(R)_Flags
IPF	IPF_Flags
Micro#	Micro#_Flags
Micro%	Micro%_Flags
Macro#	Macro#_Flags
Macro%	Macro%_Flags
MRV	MRV_Flags
Neu-BF#	Neu-BF#_Flags
Neu-BF%	Neu-BF%_Flags
RHE	RHE_Flags
Seg%	Seg%_Flags
Band%	Band%_Flags
ALY%	ALY%_Flags

Parameter Name	Parameter Flag
Pla-Aly%	Pla-Aly%_Flags
Mon-Aly%	Mon-Aly%_Flags
Imm-Aly%	Imm-Aly%_Flags
Other-Aly%	Other-Aly%_Flags
Meta%	Meta%_Flags
Myelo%	Myelo%_Flags
Pro-Mye%	Pro-Mye%_Flags
Imm-Eos%	Imm-Eos%_Flags
Imm-Bas%	Imm-Bas%_Flags
Pro-Lym%	Pro-Lym%_Flags
Pro-Mon%	Pro-Mon%_Flags
Blast%	Blast%_Flags
Mye-Blast%	Mye-Blast%_Flags
Mon-blast%	Mon-blast%_Flags
Lym-blast%	Lym-blast%_Flags
IMG/Blast%	IMG/Blast%_Flags
Plsm-cell%	Plsm-cell%_Flags
FR-CRP	FR-CRP_Flags
hs-CRP	hs-CRP_Flags
CRP	CRP_Flags
DefaultCrp	DefaultCrp_Flags
WBC-O	WBC-O_Flags
TNC-D	TNC-D_Flags
TNC-B	TNC-B_Flags
IME#	IME#_Flags
IME%	IME%_Flags
H-NR%	H-NR%_Flags
L-NR%	L-NR%_Flags
NLR	NLR_Flags
PLR	PLR_Flags
TNC-N	TNC-N_Flags
RPI	RPI_Flags
H-IPF	H-IPF_Flags
IPF#	IPF#_Flags
LY-BF#	LY-BF#_Flags



Parameter Name	Parameter Flag
LY-BF%	LY-BF%_Flags
MO-BF#	MO-BF#_Flags
MO-BF%	MO-BF%_Flags
FRC#	FRC#_Flags
FRC%	FRC%_Flags
Neu-X	Neu-X_Flags
Neu-Y	Neu-Y_Flags
Neu-Z	Neu-Z_Flags
Lym-X	Lym-X_Flags
Lym-Y	Lym-Y_Flags
Lym-Z	Lym-Z_Flags
Mon-X	Mon-X_Flags
Mon-Y	Mon-Y_Flags
Mon-Z	Mon-Z_Flags
SRBC	SRBC_Flags
LRBC	LRBC_Flags
SMCV	SMCV_Flags
LMCV	LMCV_Flags
MCHr	MCHr_Flags
HDW	HDW_Flags
MPC	MPC_Flags
MPM	MPM_Flags
HYPER%	HYPER%_Flags
HYPO%	HYPO%_Flags
HbA1c_NGSP	HbA1c_NGSP_Flags
HbA1c_MonoS	HbA1c_MonoS_Flags
HbA1c_IFCC	HbA1c_IFCC_Flags
HbF	HbF_Flags
HbA1	HbA1_Flags
eAG	eAG_Flags

**Table 18 Parameter flags**

Content	Meaning
H	High
L	Low
R	Questionable
O	Out of the linear range

Content	Meaning
C	Parameter corrected according to the instrument result
T	Temperature alert
E	Modified by users' editing
e	Calculated and modified based on the user edited values

**Table 19 Alerts**

Alert	Meaning
WBC Scattergram Abn.	The WBC scatter diagram is abnormal.
Leucocytosis	Leucocytosis
Leucopenia	Leucopenia
Neutrophilia	Neutrophilia
Neutropenia	Neutropenia
Lymphocytosis	Lymphocytosis
Lymphopenia	Lymphopenia
Monocytosis	Monocytosis
Eosinophilia	Eosinophilia
Basophilia	Basophilia
Left Shift?	Left Shift?
Immature Gran?	Immature gran?
Atypical Lymph?	Atypical lymph?
RBC Lyse Resistance?	RBC lyse resistance?
Erythrocytosis	Erythrocytosis
Anisocytosis	Anisocytosis
Macrocytosis	Macrocytosis
Microcytosis	Microcytosis
Dimorphic Population	Dimorphic population
Anemia	Anemia
Hypochromia	Hypochromia
Turbidity/HGB Interference?	Turbidity/HGB interference?
Thrombocytosis	Thrombocytosis
Thrombopenia	Thrombopenia
PLT Clump?	PLT Clump?
DIFF Analysis Abn.	DIFF analysis is abnormal.
Blasts?	Blasts?

Alert	Meaning
RBC Agglutination?	RBC agglutination?
Iron Deficiency?	Iron deficiency?
PLT Analysis Abn.	PLT analysis is abnormal.
BASO Analysis Abn.	BASO analysis is abnormal.
RET Analysis Abn.	RET analysis is abnormal.
RET Scattergram Abn.	Teh RET scatter diagram is abnormal.
Reticulocytosis	Reticulocytosis
NRBC Analysis Abn.	NRBC analysis is abnormal.
NRBC Scattergram Abn.	NRBC scatter diagram is abnormal.
NRBC Present	NRBC present
Abn. Lymph/blast?	Abn. Lymph/blast?
NRBC?	NRBC?
Lipid Particles?	Lipid particles?
Infected RBC?	Infected RBC?
Clog	Clog
RBC Analysis Abn.	RBC analysis is abnormal.
HGB Analysis Abn.	HGB analysis is abnormal.
Fragments?	Fragments?
RBC Histogram Abn.	The RBC histogram is abnormal.
PLT-O Analysis Abn.	PLT-O analysis is abnormal.
PLT Histogram Abn.	PLT Histogram is abnormal.
PLT Scattergram Abn.	PLT Scattergram is abnormal.
Small Platelet	Small platelet
Large Platelet	Large platelet
Giant Platelet	Giant platelet
System Error	System error
Status Abn.	The status is abnormal.
Pancytopenia	Pancytopenia
Insufficient aspiration	Insufficient aspiration
Insufficient aspiration/Sample abnormal	Insufficient aspiration/Sample abnormal
CRP sample aspiration abnormal	CRP sample aspiration is abnormal.
CRP sample analysis abnormal	CRP sample analysis is abnormal.
BCV abnormal	BCV isnormal.
New latex, no calibrate	New latex, no calibration
WNB Analysis Abn	WNB aalysis is abnormal.

Alert	Meaning
WNB Abn Scattergram	WNB scatter diagram is abnormal.
WBC Fragments?	WBC fragments?
Sample aspiration is abnormal	Sample aspiration is abnormal.
High Area	Chromatogram area too large.
Low Area	Chromatogram area too small.
SA1c Peak not properly separated	SA1c Peak not properly separated.
HbA0 Peak Abn.	HbA0 peak abnormal.
Peak Num Abn.	Abnormal peak number
Chro. Abn.	Chromatogram abnormal
Early SA1c RTime.	Shorter SA1c retention time
Late SA1c RTime.	Longer SA1c retention time
Early HbA0 RTime.	Shorter HbA0 retention time
Late HbA0 RTime.	Longer HbA0 retention time
Analysis not completed	Analysis not completed
Signal Abn.	Abnormal signal
Suspected HbE	Suspected HbE
Suspected HbD	Suspected HbD
HbS detected	HbS detected
HbC detected	HbC detected.
Suspected Hb Variant	Suspected Hb Variant

**Table 20 Histogram subtypes**

Content	Meaning
WBC	WBC histogram
RBC	RBC histogram
PLT	PLT histogram

**Table 21 Scattergram subtypes**

Content	Meaning
DIFF	DIFF scattergram
BASO	BASO scattergram
RET	RET scattergram
RET-EXT	RET-EXT scattergram
PLT-O	PLT-O scattergram
RBC-VHF	RBC-VHF scattergram
RBC-SCT	RBC-SCT scattergram
NRBC	NRBC scattergram

Content	Meaning
WNB	WNB scattergram

**Table 22 Chromatogram peak type**

Content	Meaning
Total Area	Total Area
A1a RTime	A1a Retention Time
A1a Area	A1a Peak Area
A1a Area Percent	A1a Peak Area Percentage
A1b RTime	A1b Retention Time
A1b Area	A1b Peak Area
A1b Area Percent	A1b Peak Area Percentage
F RTime	F Retention Time
F Area	F Peak Area
F Area Percent	F Peak Area Percentage
LA1c RTime	LA1c Retention Time
LA1c Area	LA1c Peak Area
LA1c Area Percent	LA1c Peak Area Percentage
SA1c RTime	SA1c Retention Time
SA1c Area	SA1c Peak Area
SA1c Area Percent	SA1c Peak Area Percentage
A0 RTime	A0 Retention Time
A0 Area	A0 Peak Area
A0 Area Percent	A0 Peak Area Percentage
P00 RTime	P00 Retention Time
P00 Area	P00 Peak Area
P00 Area PER	P00 Peak Area Percentage
P01 RTime	P01 Retention Time
P01 Area	P01 Peak Area
P01 Area PER	P01 Peak Area Percentage
P02 RTime	P02 Retention Time
P02 Area	P02 Peak Area
P02 Area PER	P02 Peak Area Percentage
P03 RTime	P03 Retention Time
P03 Area	P03 Peak Area
P03 Area PER	P03 Peak Area Percentage
P04 RTime	P04 Retention Time

Content	Meaning
P04 Area	P04 Peak Area
P04 Area PER	P04 Peak Area Percentage
P05 RTime	P05 Retention Time
P05 Area	P05 Peak Area
P05 Area PER	P05 Peak Area Percentage
P06 RTime	P06 Retention Time
P06 Area	P06 Peak Area
P06 Area PER	P06 Peak Area Percentage
P07 RTime	P07 Retention Time
P07 Area	P07 Peak Area
P07 Area PER	P07 Peak Area Percentage
P08 RTime	P08 Retention Time
P08 Area	P08 Peak Area
P08 Area PER	P08 Peak Area Percentage
P09 RTime	P09 Retention Time
P09 Area	P09 Peak Area
P09 Area PER	P09 Peak Area Percentage
P10 RTime	P10 Retention Time
P10 Area	P10 Peak Area
P10 Area PER	P10 Peak Area Percentage
P11 RTime	P11 Retention Time
P11 Area	P11 Peak Area
P11 Area PER	P11 Peak Area Percentage
P12 RTime	P12 Retention Time
P12 Area	P12 Peak Area
P12 Area PER	P12 Peak Area Percentage
P13 RTime	P13 Retention Time
P13 Area	P13 Peak Area
P13 Area PER	P13 Peak Area Percentage
P14 RTime	P14 Retention Time
P14 Area	P14 Peak Area
P14 Area PER	P14 Peak Area Percentage
P15 RTime	P15 Retention Time
P15 Area	P15 Peak Area
P15 Area PER	P15 Peak Area Percentage

Content	Meaning
D RTime	D Retention Time
D Area	D Peak Area
D Area PER	D Peak Area Percentage
S RTime	S Retention Time
S Area	S Area
S Area PER	S Area Percentage
C RTime	C Retention Time
C Area	C Area
C Area PER	C Area Percentage
Variant RTime	Variant Retention Time
Variant Area	Variant Area
Variant Area PER	Variant Area Percentage

## 4.2.6 QC Result Communication

### 4.2.6.1 Overview

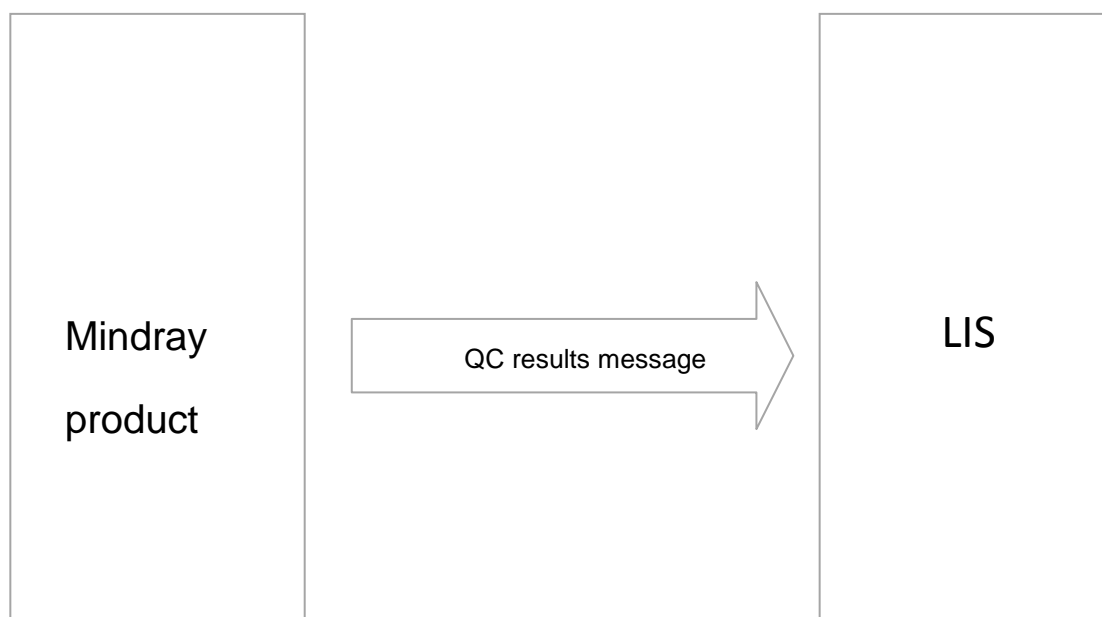


Figure 13 QC result interaction

### 4.2.6.2 Control Result Message

<0B>

{ "Type": "QCResultInfo", "QCType": "LJ", "FileNo": "File number", "LotNo": "Lot number of the QC material", "Level": "H", "ValidDate": "20180514", "AnalyzeTime": "20180314171548", "Tester": "

Tester","InstrumentName":"BC-6800#1","SamplingMode":"A","BloodMode":"W","Analyze Mode":"CBC+DIFF","CountChannel":"CRP1"}<0D>  
{"Type":"QCParameters","WBC":"WBC result","RBC":"RBC result"}  
<1C><0D>

**Table 23 Description of fields in the QC result message**

QC information fields			
Field	Mandatory or not?	Type	Value
Type	Yes	String	It is always set to "QCResultInfo" for a QC information field.
QCType	Yes	String	QC type. Values: ● LJ: LJ QC result
FileNo	Yes	String	File number
LotNo	Yes	String	Lot number of the QC material
Level	Yes	String	Level of the QC material Values: ● H: High ● M: Medium ● L: Low ● N: Normal ● P: Pathological ● CRL-1"-CRL-1 ● CRL-2"-CRL-2
ValidDate	Yes	String	Validity period in the format of "YYYYMMDD[hh[mm[ss]]]"
AnalyzeTime	Yes	String	Analysis time in the format of "YYYYMMDDhhmmss"
Tester	Yes	String	Tester
InstrumentName	Yes	String	Instrument name
SamplingMode	Yes	String	Sampling mode For values of this field, see Table 24 Sampling modes.
BloodMode	Yes	String	Blood sample mode For values of this field, see Table 25 Blood sample modes.
AnalyzeMode	No	String	Sample count mode For values of this field, see Table 12 Count mode.
CountChannel	No	String	Count channel For values of this field, see Table 16 Count channels.
QC parameter fields			
Field	Mandatory	Type	Value



	or not?		
Type	Yes	String	It is always set to "QCParameters" for a QC parameter field.
Parameter result (parameter name. For details, see Table 17 Parameter names.)	Yes	String	String of the parameter result

**Table 24 Sampling modes**

Content	Meaning
O	Open manual sampling
C	Closed sampling
A	Auto sampling

**Table 25 Blood sample modes**

Content	Meaning
W	Whole blood
P	Pre-dilution
B	Body fluid
M	Micro-blood

# 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|LabXpert|||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 26 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 1 lists all the codes of this field.

**Table 1 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 27** lists the HL7 type and code identifier of each communication data item. **Table 28** lists all the units for parameters in the communication.

**Table 27 Data Type and Coding System**

Data name	HL7 Type (OBX-2)	Code (ID)	EncodeSys	Example of OBX-3 field
Non-parameter Data Items				
Take Mode	IS	08001	99MRC	08001^Take Mode^99MRC
Blood Mode	IS	08002	99MRC	08002^Blood Mode^99MRC
Test Mode	IS	08003	99MRC	08003^Test Mode^99MRC
Age	NM	30525-0	LN	30525-0^Age^LN
Remark	ST	01001	99MRC	01001^Remark^99MRC
Ref Group	IS	01002	99MRC	01002^Ref Group^99MRC
Recheck flag	IS	01006	99MRC	01006^Recheck flag^99MRC
Sample Type	IS	01007	99MRC	01007^Sample Type^99MRC
Patient Area	IS	01008	99MRC	01008^Patient Area^99MRC
Custom patient info 1	ST	01009	99MRC	01009^Custom patient info 1^99MRC
Custom patient info 2	ST	01010	99MRC	01010^Custom patient info 2^99MRC
Custom patient info 3	ST	01011	99MRC	01011^Custom patient info 3^99MRC
Shelf No	ST	01012	99MRC	01012^Shelf No^99MRC
Tube No	ST	01013	99MRC	01013^Tube No^99MRC
Report Time	ST	01014	99MRC	01014^Report Time^99MRC
Charger type	ST	01015	99MRC	01015^Charger type^99MRC
Patient type	ST	01016	99MRC	01016^Patient type^99MRC
Qc Level	IS	05001	99MRC	05001^Qc Level^99MRC
QC test date modify flag	IS	05002	99MRC	05002^QC test date modify flag^99MRC
QC test time modify flag	IS	05003	99MRC	05003^QC test time modify flag^99MRC
Qc valid date	ST	05004	99MRC	05004^Qc valid date ^99MRC
Qc file No	ST	05005	99MRC	05005^Qc file No ^99MRC
Qc lot No	ST	05006	99MRC	05006^Qc lot No ^99MRC
Project type	ST	05007	99MRC	05007^Project Type^99MRC
Analyzer	ST	09001	99MRC	09001^Analyzer^99MRC
CRP Channel	ST	09002	99MRC	1
SerialNumber	ST	08005	99MRC	08005^SerialNumber^99MRC
AuditResult	ST	09999	99MRC	09999^ AuditResult ^99MRC
AuditMessag es	ST	09997	99MRC	09997^ AuditMessages ^99MRC
LisTestID	ST	09998	99MRC	09998^ LisTestID ^99MRC

SN	ST	09003	99MRC	09003^ SN ^99MRC
Parameter Result Items				
WBC	NM	6690-2	LN	6690-2^WBC^LN
CORRECTED WBC	NM	12227-5	LN	12227-5^CORRECTED WBC^LN
BAS#	NM	704-7	LN	704-7^BAS#^LN
BAS%	NM	706-2	LN	706-2^BAS%^LN
NEU#	NM	751-8	LN	751-8^NEU#^LN
NEU%	NM	770-8	LN	770-8^NEU%^LN
EOS#	NM	711-2	LN	711-2^EOS#^LN
EOS%	NM	713-8	LN	713-8^EOS%^LN
LYM#	NM	731-0	LN	731-0^LYM#^LN
LYM%	NM	736-9	LN	736-9^LYM%^LN
MON#	NM	742-7	LN	742-7^MON#^LN
MON%	NM	5905-5	LN	5905-5^MON%^LN
RBC	NM	789-8	LN	789-8^RBC^LN
HGB	NM	718-7	LN	718-7^HGB^LN
MCV	NM	787-2	LN	787-2^MCV^LN
MCH	NM	785-6	LN	785-6^MCH^LN
MCHC	NM	786-4	LN	786-4^MCHC^LN
RDW-CV	NM	788-0	LN	788-0^RDW-CV^LN
RDW-SD	NM	21000-5	LN	21000-5^RDW-SD^LN
HCT	NM	4544-3	LN	4544-3^HCT^LN
PLT	NM	777-3	LN	777-3^PLT^LN
MPV	NM	32623-1	LN	32623-1^MPV^LN
PDW	NM	32207-3	LN	32207-3^PDW^LN
PCT	NM	10002	99MRC	10002^PCT^99MRC
RET#	NM	14196-0	LN	14196-0^RET#^LN
RET%	NM	4679-7	LN	4679-7^RET%^LN
IRF	NM	33516-6	LN	33516-6^IRF^LN
LFR	NM	10015	99MRC	10015^LFR^99MRC
MFR	NM	10016	99MRC	10016^MFR^99MRC
HFR	NM	10017	99MRC	10017^HFR^99MRC
NRBC#	NM	30392-5	LN	30392-5^NRBC#^LN
NRBC%	NM	26461-4	LN	26461-4^NRBC%^LN
PLCR	NM	10014	99MRC	10014^PLCR^99MRC
PLCC	NM	10013	99MRC	10013^PLCC^99MRC
RBC-O	NM	10018	99MRC	10018^RBC-O^99MRC
PLT-O	NM	10019	99MRC	10019^PLT-O^99MRC
HFC#	NM	10020	99MRC	10020^HFC#^99MRC



HFC%	NM	10021	99MRC	10021^HFC%^99MRC
PLT-I	NM	10022	99MRC	10022^PLT-I^99MRC
WBC-R	NM	10023	99MRC	10023^WBC-R^99MRC
WBC-D	NM	10024	99MRC	10024^WBC-D^99MRC
WBC-B	NM	10025	99MRC	10025^WBC-B^99MRC
WBC-N	NM	10026	99MRC	10026^WBC-N^99MRC
PDW_SD	NM	10031	99MRC	10031^PDW-SD^99MRC
lnR#	NM	10032	99MRC	10032^lnR#^99MRC
lnR‰	NM	10033	99MRC	10033^lnR‰^99MRC
WBC-BF	NM	57845-0	LN	57845-0^WBC-BF^LN
RBC-BF	NM	23860-0	LN	23860-0^RBC-BF^LN
MN#	NM	26490-3	LN	26490-3^MN#^LN
MN%	NM	26493-7	LN	26493-7^MN%^LN
Eos-BF#	NM	35063-7	LN	35063-7^Eos-BF#^LN
Eos-BF%	NM	26452-3	LN	26452-3^Eos-BF%^LN
PMN#	NM	10034	99MRC	10034^PMN#^99MRC
PMN%	NM	10035	99MRC	10035^PMN%^99MRC
TC-BF#	NM	10036	99MRC	10036^TC-BF#^99MRC
HF-BF#	NM	10037	99MRC	10037^ HF-BF#^99MRC
HF-BF%	NM	10038	99MRC	10038^ HF-BF%^99MRC
RBC-BF-R	NM	10039	99MRC	10039^ RBC-BF-R ^99MRC
IMG#	NM	51584-1	LN	51584-1^ IMG# ^LN
IMG%	NM	38518-7	LN	38518-7^ IMG% ^LN
IPF	NM	10041	99MRC	10041 ^ IPF ^99MRC
Micro#	NM	15199-3	LN	15199-3 ^ Micro# ^ LN
Micro%	NM	10042	99MRC	10042 ^ Micro% ^99MRC
Macro#	NM	15198-5	LN	15198-5 ^ Macro# ^ LN
Macro%	NM	10040	99MRC	10040 ^ Macro% ^99MRC
MRV	NM	48706-6	LN	48706-6 ^ MRV ^ LN
RHE	NM	10043	99MRC	10043 ^ RHE ^99MRC
Neu-BF#	NM	10044	99MRC	10044 ^ Neu-BF# ^99MRC
Neu-BF%	NM	10045	99MRC	10045 ^ Neu-BF% ^99MRC
Neuts Band%. Manual	NM	764-1	LN	764-1 ^ Neuts Band%. Manual ^LN
Neuts Seg%. Manual	NM	769-0	LN	769-0 ^ Neuts Seg%. Manual ^ LN
Abnormal Lymphs%. Manual	NM	29261-5	LN	29261-5 ^ Abnormal Lymphs%. Manual ^LN
Pla-Aly%	NM	33835-0	99MRC	33835-0 ^ Pla-Aly% ^99MRC
Mon-Aly%	NM	4662-3	99MRC	4662-3 ^ Mon-Aly% ^99MRC
Imm-Aly%	NM	10046	99MRC	10046 ^ Imm-Aly% ^99MRC
Other-Aly%	NM	10047	99MRC	10047 ^ Other-Aly% ^99MRC

Metamyelocyte %. Manual	NM	740-1	LN	740-1 ^ Metamyelocyte%. Manual ^LN
Myelocytes%. Manual	NM	749-2	LN	749-2 ^ Myelocytes%. Manual ^LN
Promyelocytes %. Manual	NM	783-1	LN	783-1 ^ Promyelocytes%. Manual ^ LN
Imm-Eos%	NM	33803-8	99MRC	33803-8 ^ Imm-Eos% ^99MRC
Imm-Bas%	NM	33786-8	99MRC	33786-8 ^ Imm-Bas% ^99MRC
Blast%	NM	10049	99MRC	10049 ^ Blast% ^99MRC
Myeloblasts%. Manual	NM	747-6	LN	747-6 ^ Myeloblasts%. Manual ^LN
Monoblasts%. Manual	NM	33840-0	LN	33840-0 ^ Monoblasts%. Manual ^ LN
Lymphoblasts %. Manual	NM	33831-9	LN	33831-9 ^Lymphoblasts%. Manual ^LN
IMG/Blast%	NM	10048	99MRC	10048 ^ IMG/Blast% ^99MRC
Prolymphocyte s%. Manual	NM	6746-2	LN	6746-2 ^ Prolymphocytes%. Manual ^LN
Promonocytes %. Manual	NM	13599-6	LN	13599-6 ^ Promonocytes%. Manual ^ LN
Plsm-cell%	NM	40492-1	99MRC	40492-1 ^ Plsm-cell% ^99MRC
FR-CRP	NM	71426-1	LN	71426-1 ^ FR-CRP ^LN
hs-CRP	NM	71426-1-1	99MRC	71426-1-1 ^ hs-CRP ^ 99MRC
CRP	NM	71426-1	LN	71426-1 ^CRP^LN
CRP Default Corrected	NM	910082	99MRC	910082 ^ CRP Default Corrected ^ 99MRC
WBC-O	NM	10051	99MRC	10051 ^ WBC-O ^99MRC
TNC-D	NM	10052	99MRC	10052 ^ TNC-D ^99MRC
TNC-B	NM	10089	99MRC	10089^TNC-B^99MRC
IME#	NM	10053	99MRC	10053 ^ IME# ^99MRC
IME%	NM	10054	99MRC	10054 ^ IME% ^99MRC
H-NR%	NM	10055	99MRC	10055 ^ H-NR% ^99MRC
L-NR%	NM	10056	99MRC	10056 ^ L-NR% ^99MRC
NLR	NM	10057	99MRC	10057 ^ NLR ^99MRC
PLR	NM	10058	99MRC	10058 ^ PLR ^99MRC
TNC-N	NM	10059	99MRC	10059 ^ TNC-N ^99MRC
RPI	NM	10060	99MRC	10060 ^ RPI ^99MRC
H-IPF	NM	10061	99MRC	10061 ^ H-IPF ^99MRC
IPF#	NM	10062	99MRC	10062 ^ IPF# ^99MRC
LY-BF#	NM	10063	99MRC	10063^ LY-BF# ^99MRC
LY-BF%	NM	10064	99MRC	10064 ^ LY-BF% ^99MRC
MO-BF#	NM	10065	99MRC	10065 ^ MO-BF# ^99MRC
MO-BF%	NM	10066	99MRC	10066 ^ MO-BF% ^99MRC
FRC#	NM	10067	99MRC	10067 ^ FRC# ^99MRC

FRC%	NM	10068	99MRC	10068 ^ FRC%^99MRC
Neu-X	NM	10069	99MRC	10069 ^ Neu-X ^99MRC
Neu-Y	NM	10070	99MRC	10070 ^ Neu-Y ^99MRC
Neu-Z	NM	10071	99MRC	10071 ^ Neu-Z ^99MRC
Lym-X	NM	10072	99MRC	10072 ^ Lym-X ^99MRC
Lym-Y	NM	10073	99MRC	10073 ^ Lym-Y ^99MRC
Lym-Z	NM	10074	99MRC	10074 ^ Lym-Z ^99MRC
Mon-X	NM	10075	99MRC	10075 ^ Mon-X ^99MRC
Mon-Y	NM	10076	99MRC	10076 ^ Mon-Y ^99MRC
Mon-Z	NM	10077	99MRC	10077 ^ Mon-Z ^99MRC
SRBC	NM	10078	99MRC	10078 ^ SRBC ^99MRC
LRBC	NM	10079	99MRC	10079 ^ LRBC ^99MRC
SMCV	NM	10080	99MRC	10080 ^ SMCV ^99MRC
LMCV	NM	10081	99MRC	10081 ^ LMCV ^99MRC
MCHR	NM	10082	99MRC	10082 ^ MCHR ^99MRC
HDW	NM	10083	99MRC	10083 ^ HDW ^99MRC
MPC	NM	10084	99MRC	10084 ^ MPC ^99MRC
MPM	NM	10085	99MRC	10085 ^ MPM ^99MRC
HYPERPER	NM	10086	99MRC	10086 ^ HYPERPER ^99MRC
HYPO	NM	10087	99MRC	10087 ^ HYPO ^99MRC
HbA1c%	NM	17856-6	LN	17856-6 ^ HbA1c% ^ LN
HbA1c-MonoS	NM	10093	99MRC	10093 ^ HbA1c-MonoS ^99MRC
HbA1c-IFCC	NM	59261-8	LN	59261-8 ^ HbA1c-IFCC ^ LN
HbF	NM	10090	99MRC	10090 ^ HbF ^99MRC
HbA1	NM	10091	99MRC	10091 ^ HbA1 ^99MRC
eAG	NM	10092	99MRC	10092 ^ eAG ^99MRC
Intermediate Data of Analysis Results (histogram and scattergram data of WBC, RBC, and PLT, etc.)				
RBC Histogram. Binary	ED	15050	99MRC	15050 ^ RBC Histogram. Binary ^99MRC
RBC Histogram. Left Line	NM	15051	99MRC	15051 ^ RBC Histogram. Left Line ^99MRC
RBC Histogram. Right Line	NM	15052	99MRC	15052 ^ RBC Histogram. Right Line ^99MRC
RBC Histogram. Binary Meta Length	NM	15053	99MRC	15053 ^ RBC Histogram. Binary Meta Length ^99MRC
RBC Histogram. Left	IS	15054	99MRC	15054 ^ RBC Histogram. Left Line Adjusted ^99MRC

Line Adjusted				
RBC Histogram. Right Line Adjusted	IS	15055	99MRC	15055^RBC Histogram. Right Line Adjusted^99MRC
RBC Histogram. BMP	ED	15056	99MRC	15056^RBC Histogram. BMP^99MRC
RBC Histogram. Total	NM	15057	99MRC	15057^RBC Histogram. Total^99MRC
PLT Histogram. Binary	ED	15100	99MRC	15100^PLT Histogram. Binary^99MRC
PLT Histogram. Left Line	NM	15111	99MRC	15111^PLT Histogram. Left Line^99MRC
PLT Histogram. Right Line	NM	15112	99MRC	15112^PLT Histogram. Right Line^99MRC
PLT Histogram. Binary Meta Length	NM	15113	99MRC	15113^PLT Histogram. Binary Meta Length^99MRC
PLT Histogram. Left Line Adjusted	IS	15114	99MRC	15114^PLT Histogram. Left Line Adjusted^99MRC
PLT Histogram. Right Line Adjusted	IS	15115	99MRC	15115^PLT Histogram. Right Line Adjusted^99MRC
PLT Histogram. BMP	ED	15116	99MRC	15116^PLT Histogram. BMP^99MRC
PLT Histogram. Total	NM	15117	99MRC	15117^PLT Histogram. Total^99MRC
ScattergramParaVer	NM	15014	99MRC	15014^ScattergramParaVer^99MRC
ScattergramGraphicFlags	ED	15015	99MRC	15015^ScattergramGraphicFlags^99MRC
WBC DIFF Scattergram. BMP	ED	15200	99MRC	15200^WBC DIFF Scattergram. BMP^99MRC
WBC DIFF Scattergram. Meta len	NM	15203	99MRC	15203^WBC DIFF Scattergram. Meta len^99MRC
WBC DIFF Scattergram. Fsc dimension	NM	15205	99MRC	15205^WBC DIFF Scattergram. Fsc dimension^99MRC
WBC DIFF	NM	15206	99MRC	15206^WBC DIFF

Scattergram. Ssc dimension				Scattergram. Ssc dimension^99MRC
WBC DIFF Scattergram. FL dimension	NM	15207	99MRC	15207^WBC DIFF Scattergram. FL dimension^99MRC
WBC DIFF Scattergram. FSC-LOG dimension	NM	15208	99MRC	15208^WBC DIFF Scattergram. FSC-LOG dimension^99MRC
WBC DIFF MultipleType	NM	15209	99MRC	15209^WBC DIFF MultipleType^99MRC
WBC DIFF Scattergram. BIN	ED	15201	99MRC	15201^WBC DIFF Scattergram. BIN^99MRC
Baso Scattergram. BMP	ED	15250	99MRC	15250^Baso Scattergram. BMP^99MRC
Baso Scattergram. BIN	ED	15251	99MRC	15251^Baso Scattergram. BIN^99MRC
Baso Scattergram. Meta Len	NM	15253	99MRC	15253^Baso Scattergram. Meta Len^99MRC
Baso Scattergram. Fsc dimension	NM	15255	99MRC	15255^Baso Scattergram. Fsc dimension^99MRC
Baso Scattergram. Ssc dimension	NM	15256	99MRC	15256^Baso Scattergram. Ssc dimension^99MRC
Baso Scattergram. FL dimension	NM	15257	99MRC	15257^Baso Scattergram. FL dimension^99MRC
Baso Scattergram. FSC-LOG dimension	NM	15258	99MRC	15258^Baso Scattergram. FSC-LOG dimension^99MRC
RET Scattergram. BMP	ED	15300	99MRC	15300^RET Scattergram. BMP^99MRC
PLT-O Scattergram. BMP	ED	15301	99MRC	15301^PLT-O Scattergram. BMP^99MRC
RET-EXT Scattergram.	ED	15302	99MRC	15302^RET-EXT Scattergram. BMP^99MRC

BMP				
RET Scattergram. Fsc dimension	NM	15303	99MRC	15303^RET Scattergram. Fsc dimension^99MRC
RET Scattergram. Ssc dimension	NM	15304	99MRC	15304^RET Scattergram. Ssc dimension^99MRC
RET Scattergram. FL dimension	NM	15305	99MRC	15305^RET Scattergram. FL dimension^99MRC
RET Scattergram. BIN	ED	15306	99MRC	15306^RET Scattergram. BIN^99MRC
RET Scattergram. Meta Len	NM	15307	99MRC	15307^RET Scattergram. Meta Len^99MRC
RET Scattergram FSC-LOG dimension	NM	15308	99MRC	15308^RET Scattergram FSC-LOG dimension^99MRC
PLTO Scattergram. BIN	ED	15309	99MRC	15309^PLTO Scattergram. BIN^99MRC
PLTO MultipleType	NM	15310	99MRC	15310^PLTO MultipleType^99MRC
PLTO Scattergram. Meta Len	NM	15311	99MRC	15311^PLTO Scattergram. Meta Len^99MRC
NRBC Scattergram. BMP	ED	15350	99MRC	15350^NRBC Scattergram. BMP^99MRC
NRBC Scattergram. Fsc dimension	NM	15351		15351^NRBC Scattergram. Fsc dimension^99MRC
NRBC Scattergram. Ssc dimension	NM	15352	99MRC	15352^NRBC Scattergram. Ssc dimension^99MRC
NRBC Scattergram. FL dimension	NM	15353	99MRC	15353^NRBC Scattergram. FL dimension^99MRC
NRBC Scattergram. BIN	ED	15354	99MRC	15354^NRBC Scattergram. BIN^99MRC
NRBC	NM	15355	99MRC	15355^NRBC Scattergram.

Scattergram. Meta Len				Meta Len^99MRC
NRBC Scattergram FSC-LOG dimension	NM	15356	99MRC	15356^NRBC Scattergram FSC-LOG dimension^99MRC
WNB Scattergram. BMP	ED	15600	99MRC	15600^WNB Scattergram. BMP^99MRC
WNB Scattergram. Fsc dimension	NM	15601		15601^WNB Scattergram. Fsc dimension^99MRC
WNB Scattergram. Ssc dimension	NM	15602	99MRC	15602^WNB Scattergram. Ssc dimension^99MRC
WNB Scattergram. FL dimension	NM	15603	99MRC	15603^WNB Scattergram. FL dimension^99MRC
WNB Scattergram. BIN	ED	15604	99MRC	15604^WNB Scattergram. BIN^99MRC
WNB Scattergram. Meta Len	NM	15605	99MRC	15605^WNB Scattergram. Meta Len^99MRC
WNB Scattergram FSC-LOG dimension	NM	15606	99MRC	15606^WNB Scattergram FSC-LOG dimension^99MRC
RBCVHF Scattergram. BMP	ED	15700	99MRC	15700^RBCVHF Scattergram. BMP^99MRC
RBCVHF Scattergram HC dimension	NM	15703	99MRC	15703^RBCVHF Scattergram HC dimension^99MRC
RBCVHF Scattergram. VOL dimension	NM	15704	99MRC	15704^RBCVHF Scattergram. VOL dimension^99MRC
RBCSCT Scattergram. BMP	ED	15800	99MRC	15800^RBCSCT Scattergram. BMP^99MRC
RBCSCT Scattergram	NM	15803	99MRC	15803^RBCSCT Scattergram FS

FS dimension				dimension^99MRC
RBCSCT				15804^RBCSCT
Scattergram.	NM	15804	99MRC	Scattergram. SS
SS dimension				dimension^99MRC
Intermediate Data of Analysis Results (Chromatogram, Chromatogram Peak, etc.)				
Chromatogram Wave Binary	ED	15400	Chromatogr am Wave Binary	99MRC
Chromatogram Wave Meta Length	NM	15401	Chromatogr am Wave Meta Length	99MRC
Chromatogram Baseline Binary	ED	15402	Chromatogr am Baseline Binary	99MRC
Chromatogram Baseline Meta Length	NM	15403	Chromatogr am Baseline Meta Length	99MRC
Chromatogram HOR. Max Axis	NM	15404	Chromatogr am HOR. Max Axis	99MRC
Chromatogram VER. Max Axis	NM	15405	Chromatogr am VER. Max Axis	99MRC
Chromatogram BMP	ED	15406	Chromatogr am BMP	99MRC
A1a RTime	NM	15407	Ala RTime	99MRC
A1a Area	NM	15408	Ala Area	99MRC
A1a Area Percent	NM	15409	Ala Area Percent	99MRC
A1b RTime	NM	15410	Alb RTime	99MRC
A1b Area	NM	15411	Alb Area	99MRC
A1b Area Percent	NM	15412	Alb Area Percent	99MRC
F RTime	NM	15413	F RTime	99MRC
F Area	NM	15414	F Area	99MRC
F Area Percent	NM	15415	F Area Percent	99MRC
LA1c RTime	NM	15416	LA1c RTime	99MRC
LA1c Area	NM	15417	LA1c Area	99MRC



LA1c Area Percent	NM	15418	LA1c Area Percent	99MRC
SA1c RTime	NM	15419	SA1c RTime	99MRC
SA1c Area	NM	15420	SA1c Area	99MRC
SA1c Area Percent	NM	15421	SA1c Area Percent	99MRC
A0 RTime	NM	15422	A0 RTime	99MRC
A0 Area	NM	15423	A0 Area	99MRC
A0 Area Percent	NM	15424	A0 Area Percent	99MRC
Total area of chromatographic peaks	NM	15425	Total Area	99MRC
P00 RTime	NM	15426	P00 RTime	99MRC
P00 Area	NM	15427	P00 Area	99MRC
P00 Area Percent	NM	15428	P00 Area Percent	99MRC
P01 RTime	NM	15429	P01 RTime	99MRC
P01 Area	NM	15430	P01 Area	99MRC
P01 Area Percent	NM	15431	P01 Area Percent	99MRC
P02 RTime	NM	15432	P02 RTime	99MRC
P02 Area	NM	15433	P02 Area	99MRC
P02 Area Percent	NM	15434	P02 Area Percent	99MRC
P03 RTime	NM	15435	P03 RTime	99MRC
P03 Area	NM	15436	P03 Area	99MRC
P03 Area Percent	NM	15437	P03 Area Percent	99MRC
P04 RTime	NM	15438	P04 RTime	99MRC
P04 Area	NM	15439	P04 Area	99MRC
P04 Area Percent	NM	15440	P04 Area Percent	99MRC
P05 RTime	NM	15441	P05 RTime	99MRC
P05 Area	NM	15442	P05 Area	99MRC
P05 Area Percent	NM	15443	P05 Area Percent	99MRC
P06 RTime	NM	15444	P06 RTime	99MRC
P06 Area	NM	15445	P06 Area	99MRC
P06 Area Percent	NM	15446	P06 Area Percent	99MRC
P07 RTime	NM	15447	P07 RTime	99MRC
P07 Area	NM	15448	P07 Area	99MRC

P07 Area Percent	NM	15449	P07 Area Percent	99MRC
P08 RTime	NM	15450	P08 RTime	99MRC
P08 Area	NM	15451	P08 Area	99MRC
P08 Area Percent	NM	15452	P08 Area Percent	99MRC
P09 RTime	NM	15453	P09 RTime	99MRC
P09 Area	NM	15454	P09 Area	99MRC
P09 Area Percent	NM	15455	P09 Area Percent	99MRC
P10 RTime	NM	15456	P10 RTime	99MRC
P10 Area	NM	15457	P10 Area	99MRC
P10 Area Percent	NM	15458	P10 Area Percent	99MRC
P11 RTime	NM	15459	P11 RTime	99MRC
P11 Area	NM	15460	P11 Area	99MRC
P11 Area Percent	NM	15461	P11 Area Percent	99MRC
P12 RTime	NM	15462	P12 RTime	99MRC
P12 Area	NM	15463	P12 Area	99MRC
P12 Area Percent	NM	15464	P12 Area Percent	99MRC
P13 RTime	NM	15465	P13 RTime	99MRC
P13 Area	NM	15466	P13 Area	99MRC
P13 Area Percent	NM	15467	P13 Area Percent	99MRC
P14 RTime	NM	15468	P14 RTime	99MRC
P14 Area	NM	15469	P14 Area	99MRC
P14 Area Percent	NM	15470	P14 Area Percent	99MRC
P15 RTime	NM	15471	P15 RTime	99MRC
P15 Area	NM	15472	P15 Area	99MRC
P15 Area Percent	NM	15473	P15 Area Percent	99MRC
A1a Peak Start Time	NM	15476	A1a Peak Start Time	99MRC
A1a Peak End Time	NM	15477	A1a Peak End Time	99MRC
A1b Peak Start Time	NM	15478	A1b Peak Start Time	99MRC
A1b Peak End Time	NM	15479	A1b Peak End Time	99MRC
F Peak Start Time	NM	15480	F Peak Start Time	99MRC

F Peak End Time	NM	15481	F Peak End Time	99MRC
LA1c Peak Start Time	NM	15482	LA1c Peak Start Time	99MRC
LA1c Peak End Time	NM	15483	LA1c Peak End Time	99MRC
SA1c Peak Start Time	NM	15484	SA1c Peak Start Time	99MRC
SA1c Peak End Time	NM	15485	SA1c Peak End Time	99MRC
A0 Peak Start Time	NM	15486	A0 Peak Start Time	99MRC
A0 Peak End Time	NM	15487	A0 Peak End Time	99MRC
P00 Peak Start Time	NM	15488	P00 Peak Start Time	99MRC
P00 Peak End Time	NM	15489	P00 Peak End Time	99MRC
P01 Peak Start Time	NM	15490	P01 Peak Start Time	99MRC
P01 Peak End Time	NM	15491	P01 Peak End Time	99MRC
P02 Peak Start Time	NM	15492	P02 Peak Start Time	99MRC
P02 Peak End Time	NM	15493	P02 Peak End Time	99MRC
P03 Peak Start Time	NM	15494	P03 Peak Start Time	99MRC
P03 Peak End Time	NM	15495	P03 Peak End Time	99MRC
P04 Peak Start Time	NM	15496	P04 Peak Start Time	99MRC
P04 Peak End Time	NM	15497	P04 Peak End Time	99MRC
P05 Peak Start Time	NM	15498	P05 Peak Start Time	99MRC
P05 Peak End Time	NM	15499	P05 Peak End Time	99MRC
P06 Peak Start Time	NM	15500	P06 Peak Start Time	99MRC
P06 Peak End Time	NM	15501	P06 Peak End Time	99MRC
P07 Peak Start Time	NM	15502	P07 Peak Start Time	99MRC

P07 Peak End Time	NM	15503	P07 Peak End Time	99MRC
P08 Peak Start Time	NM	15504	P08 Peak Start Time	99MRC
P08 Peak End Time	NM	15505	P08 Peak End Time	99MRC
P09 Peak Start Time	NM	15506	P09 Peak Start Time	99MRC
P09 Peak End Time	NM	15507	P09 Peak End Time	99MRC
P10 Peak Start Time	NM	15508	P10 Peak Start Time	99MRC
P10 Peak End Time	NM	15509	P10 Peak End Time	99MRC
P11 Peak Start Time	NM	15510	P11 Peak Start Time	99MRC
P11 Peak End Time	NM	15511	P11 Peak End Time	99MRC
P12 Peak Start Time	NM	15512	P12 Peak Start Time	99MRC
P12 Peak End Time	NM	15513	P12 Peak End Time	99MRC
P13 Peak Start Time	NM	15514	P13 Peak Start Time	99MRC
P13 Peak End Time	NM	15515	P13 Peak End Time	99MRC
P14 Peak Start Time	NM	15516	P14 Peak Start Time	99MRC
P14 Peak End Time	NM	15517	P14 Peak End Time	99MRC
P15 Peak Start Time	NM	15518	P15 Peak Start Time	99MRC
P15 Peak End Time	NM	15519	P15 Peak End Time	99MRC
D RTime	NM	15520	D RTime	99MRC
D Area	NM	15521	D Area	99MRC
D Area Percent	NM	15522	D Area Percent	99MRC
D Peak Start Time	NM	15523	D Peak Start Time	99MRC
D Peak End Time	NM	15524	D Peak End Time	99MRC
S RTime	NM	15525	S RTime	99MRC
S Area	NM	15526	S Area	99MRC

S Area Percent	NM	15527	S Area Percent	99MRC
S Peak Start Time	NM	15528	S Peak Start Time	99MRC
S Peak End Time	NM	15529	S Peak End Time	99MRC
C RTime	NM	15530	C RTime	99MRC
C Area	NM	15531	C Area	99MRC
C Area Percent	NM	15532	C Area Percent	99MRC
C Peak Start Time	NM	15533	C Peak Start Time	99MRC
C Peak End Time	NM	15534	C Peak End Time	99MRC
Variant RTime	NM	15535	Variant RTime	99MRC
Variant Area	NM	15536	Variant Area	99MRC
Variant Area Percent	NM	15537	Variant Area Percent	99MRC
Variant Peak Start Time	NM	15538	Variant Peak Start Time	99MRC
Variant Peak End Time	NM	15539	Variant Peak End Time	99MRC
Flags of Abnormal Blood Cell Differential or Morphology				
WBC Abnormal scattergram	IS	12000	99MRC	12000^WBC Abnormal scattergram^99MRC
Leucocytosis	IS	12002	99MRC	12002^Leucocytosis^99MRC
Leucopenia	IS	12003	99MRC	12003^Leucopenia^99MRC
Neutrophilia	IS	12004	99MRC	12004^Neutrophilia^99MRC
Neutropenia	IS	12005	99MRC	12005^Neutropenia^99MRC
Lymphocytosis	IS	12006	99MRC	12006^Lymphocytosis^99MRC
Lymphopenia	IS	12007	99MRC	12007^Lymphopenia^99MRC
Monocytosis	IS	12008	99MRC	12008^Monocytosis^99MRC
Eosinophilia	IS	12009	99MRC	12009^Eosinophilia^99MRC
Basophilia	IS	12010	99MRC	12010^Basophilia^99MRC
WBC Left Shift?	IS	17790-7	LN	17790-7^WBC Left Shift?^LN
Imm Granulocytes?	IS	34165-1	LN	34165-1^Imm Granulocytes?^LN
Atypical Lymphs?	IS	15192-8	LN	15192-8^Atypical Lymphs?^LN
rstRBC	IS	34525-6	LN	34525-6^rstRBC^LN

Erythrocytosis	IS	12012	99MRC	12012^Erythrocytosis^99MRC
Anisocytosis	IS	15150-6	LN	15150-6^Anisocytosis^LN
Macrocytes	IS	12075	99MRC	12075^Macrocytes^99MRC
Microcytes	IS	12076	99MRC	12076^Microcytes^99MRC
RBC Dual Pop	IS	10379-6	LN	10379-6^RBC Dual Pop^LN
Anemia	IS	12014	99MRC	12014^Anemia^99MRC
Hypochromia	IS	15180-3	LN	15180-3^Hypochromia^LN
HGB Interfere	IS	12015	99MRC	12015^HGB Interfere^99MRC
Thrombocytosis	IS	12017	99MRC	12017^Thrombocytosis^99MRC
Thrombopenia	IS	12018	99MRC	12018^Thrombopenia^99MRC
Platelet Clump?	IS	7796-6	LN	7796-6^Platelet Clump?^LN
Sample Abnormal	IS	12021	99MRC	12021^Sample Abnormal^99MRC
Platelets.small	IS	32208-1	LN	32208-1^Platelets.small^LN
Iron Deficiency	IS	12024	99MRC	12024^Iron Deficiency^99MRC
DIFF-CH Error	IS	12027	99MRC	12027^DIFF-CH Error^99MRC
Blasts	IS	44017-2	LN	44017-2^Blasts^LN
RBC-CH Error	IS	12030	99MRC	12030^RBC-CH Error^99MRC
RBC Agglutination?	IS	50670-9	LN	50670-9^ RBC Agglutination?^LN
PLT-CH Error	IS	12033	99MRC	12033^PLT-CH Error^99MRC
BASO-CH Error	IS	12035	99MRC	12035^BASO-CH Error^99MRC
RET-CH Error	IS	12039	99MRC	12039^RET-CH Error^99MRC
RET Abn Scattergram	IS	12040	99MRC	12040^RET Abn Scattergram^99MRC
Reticulocytosis	IS	12041	99MRC	12041^Reticulocytosis^99MRC
NRBC-CH Error	IS	12043	99MRC	12043^NRBC-CH Error^99MRC
NRBC Abn Scattergram	IS	12044	99MRC	12044^NRBC Abn Scattergram^99MRC
Abn Lympho/ Blasts	IS	12053	99MRC	12053^Abn Lympho/ Blasts^99MRC
NRBC?	IS	12054	99MRC	12054^NRBC?^99MRC
Lipid Particles?	IS	12055	99MRC	12055^Lipid Particles? ^99MRC
Infected RBC?	IS	12056	99MRC	12056^Infected RBC? ^99MRC
Clog	IS	12058	99MRC	12058^Clog^99MRC
RBC-CH Error	IS	12060	99MRC	12060^RBC-CH Error^99MRC
HGB-CH Error	IS	12062	99MRC	12062^HGB-CH Error^99MRC
Fragments	IS	12063	99MRC	12063^Fragments^99MRC
RBC Abnormal	IS	12064	99MRC	12064^RBC Abnormal

histogram				histogram^99MRC
PLT-O-CH Erro	IS	12067	99MRC	12067^PLT-O-CH Erro^99MRC
PLT Abnormal histogram	IS	12068	99MRC	12068^PLT Abnormal histogram^99MRC
PLT Abn Scattergram	IS	12069	99MRC	12069^PLT Abn Scattergram^99MRC
Platelets.Large	IS	12070	99MRC	12070^Platelets.Large^99MRC
Platelets.Giant	IS	12071	99MRC	12071^Platelets.Giant^99MRC
System Error	IS	12072	99MRC	12072^System Error^99MRC
Status Abn	IS	12073	99MRC	12073^Status Abn^99MRC
Pancytopenia	IS	12074	99MRC	12074^Pancytopenia ^99MRC
NRBC present	IS	34188-3	LN	34188-3^NRBC present^LN
CRP Sample Abnormal	IS	12021-1	99MRC	12021-1^CRP Sample Abnormal^99MRC
CRP System Error	IS	12080	99MRC	12080^CRP System Error^99MRC
CRP Abnormal HCT Calibrate	IS	12081	99MRC	12081^CRP Abnormal HCT Calibrate^99MRC
CRP New Latex not Calibrated	IS	12082	99MRC	12082^CRP New Latex not Calibrated^99MRC
Aspiration Abn	IS	12101	99MRC	12101^Aspiration Abn^99MRC
WNB Analysis Abn	IS	12102	99MRC	12102^WNB Analysis Abnr^99MRC
WNB Abn Scattergram	IS	12103	99MRC	12103^WNB Abn Scattergram^99MRC
WBC Fragments?	IS	12104	99MRC	12104^WBC Fragments?^99MRC
Aspiration Abnormal	IS	12105	99MRC	12105^Aspiration Abnormal^99MRC
High Area	IS	12083	99MRC	12083^ High Area ^99MRC
Low Area	IS	12084	99MRC	12084^ Low Area ^99MRC
SA1c Peak not properly separated	IS	12085	99MRC	12085^ SA1c Peak not properly separated^99MRC
HbA0 Peak Abn.	IS	12086	99MRC	12086^ HbA0 Peak Abn.^99MRC
Peak Num Abn.	IS	12087	99MRC	12087^ Peak Num Abn.^99MRC
Chro. Abn.	IS	12088	99MRC	12088^ Chro. Abn.^99MRC
Early SA1c RTime.	IS	12089	99MRC	12089^ Early SA1c RTime.^99MRC
Late SA1c RTime.	IS	12090	99MRC	12090^ Late SA1c RTime.^99MRC

Early HbA0 RTime.	IS	12091	99MRC	12091^ Early HbA0 RTime.^99MRC
Late HbA0 RTime.	IS	12092	99MRC	12092^ Late HbA0 RTime.^99MRC
Analysis not completed	IS	12093	99MRC	12093^ Analysis not completed ^99MRC
Signal Abn.	IS	12094	99MRC	12094^ Signal Abn.^99MRC
Suspected HbE	IS	12095	99MRC	12095^ Suspected HbE ^99MRC
Suspected HbD	IS	12096	99MRC	12096^ Suspected HbD ^99MRC
HbS detected	IS	12097	99MRC	12097^ HbS detected ^99MRC
HbC detected	IS	12098	99MRC	12098^ HbC detected ^99MRC
Suspected Hb Variant	IS	12099	99MRC	12099^ Suspected Hb Variant ^99MRC

**Table 28 Parameter Units in Communication**

Parameter Units in Software	Parameter Units in Communication (OBX-6)
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	um\S\3
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
%(NGSP)	%(NGSP)
mmol/mol	mmol/mol
%(Mono-S)	%(Mono-S)
mg/dL	mg/dL

2. Some OBX messages uses custom enumeration values. See 错误!未找到引用源。 for the meaning of the values.

Table 29 HL7 and ASTM Enumeration Definitions

Data	Value Enumeration
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: Can be one of the following modes, or any combination of the modes: "CBC" "DIFF" "RET" "NRBC" "CBC+DIFF+RET+NRBC" "CRP" "CBC+DIFF+RET+NRBC+CRP" "SMST" "CBC+DIFF+RET+NRBC+CRP+SMST" "CR/PLT-8X" "CDR/PLT-8X" "A1C" "STANDARD" "EXTEND"
Qc Level	Value enumeration: "L" - low "M" - normal "H" – high "N" – Normal "P" – Pathology "CRL-1" - CRL-1

	<b>"CRL-2"- CRL-2</b>
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>
<b>Gender</b>	<b>"M"/"m": Male</b> <b>"F"/"f": Female</b> <b>"U"/"u": unknow</b> <b>Others: displayed as strings</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 labXpert 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 错误!未找到引用源。 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 30 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 labXpert, which includes: data sent and received by the labXpert, the information of communication processes, communication errors and abnormalities.

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

```
Begin Record :
2020-05-19 17:50:40.824 Begin Send Data
<0x0B>MSH|^~^&|LabXpert|Mindray||20200519175040||ORU^R01|1|P|2.3.1|||||UNICODE<0x0D>
PID|1||^MR<0x0D>
PV1|1<0x0D>
OBR|1||ctrl|00001^Automated Count^99MRC|||20200519175039|||||||||HM|NotValidated<0x0D>
OBX|1|IS|08001^Take Mode^99MRC||O|||||F<0x0D>
OBX|2|IS|08002^Blood Mode^99MRC||W|||||F<0x0D>
OBX|3|IS|08003^Test Mode^99MRC||CBC+DIFF|||||F<0x0D>
OBX|4|IS|01002^Ref Group^99MRC||通用|||||F<0x0D>
OBX|5|IS|05007^Project Type^99MRC||BL|||||F<0x0D>
OBX|6|ST|09001^Analyzer^99MRC||BC-7500[B]|||||F<0x0D>
OBX|7|NM|789-8^RBC^LN||6.00|10*12/L|3.50-5.50|H^N|||F<0x0D>
OBX|8|NM|718-7^HGB^LN||1|g/L|110-160|L^N|||F<0x0D>
```

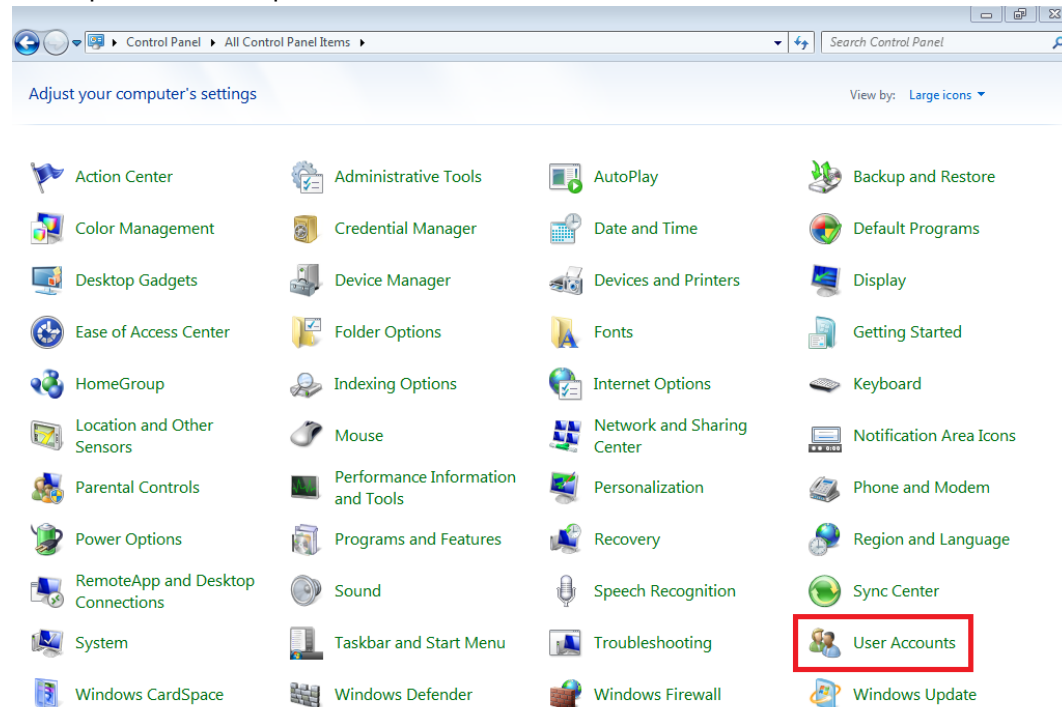
The log is saved in the data folder under the installation directory of the labXpert. For example, if the data folder path is: D:\LabXpertServerData. The communication folder path is: D:\LabXpertServerData\Log\LisLog, and the file name is formatted as 20200519175621\_Blood\_202005190339.txt. Each day has a folder, each sample has a txt file. The log files of the latest 10 days are saved.

Note: LabXpertServerData is a hidden folder, it can be found after choosing “Show hidden files, folders, and drives” in your computer.

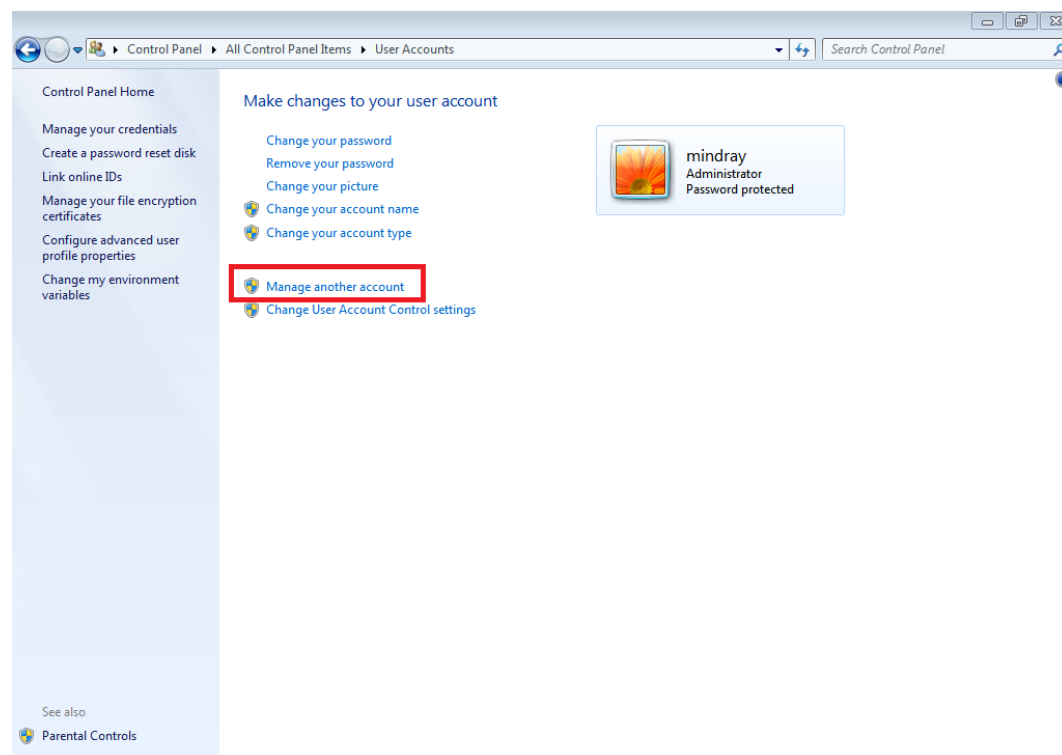
# Appendix F Enable the Guest Account

## Windows 7 or Windows 8

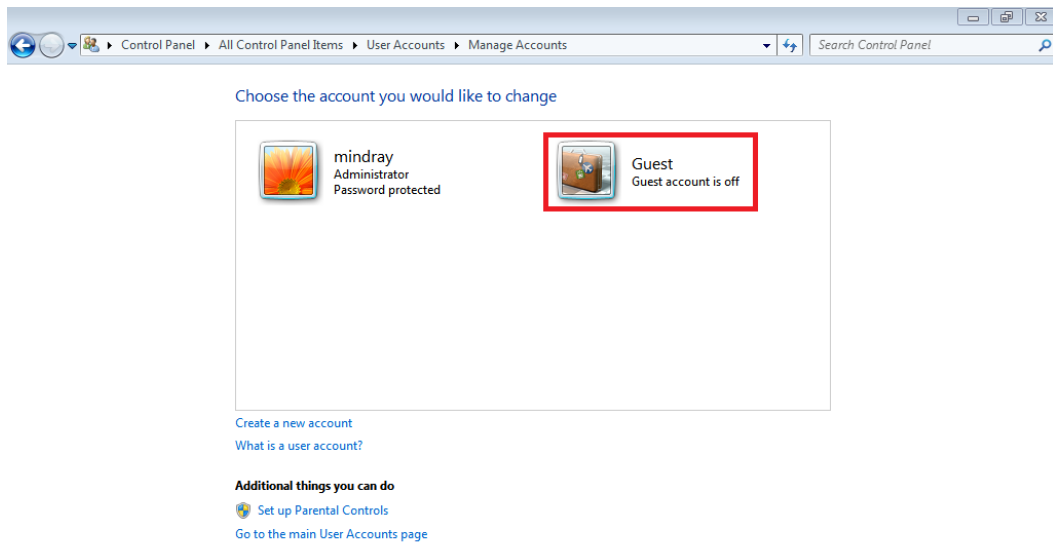
1. Open the control panel, and choose **User Accounts**.



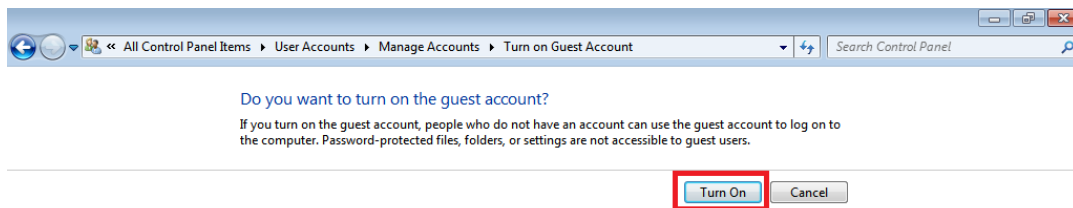
2. Click **Manage another account**.



3. Click **Guest**.



4. Click **Turn On**.

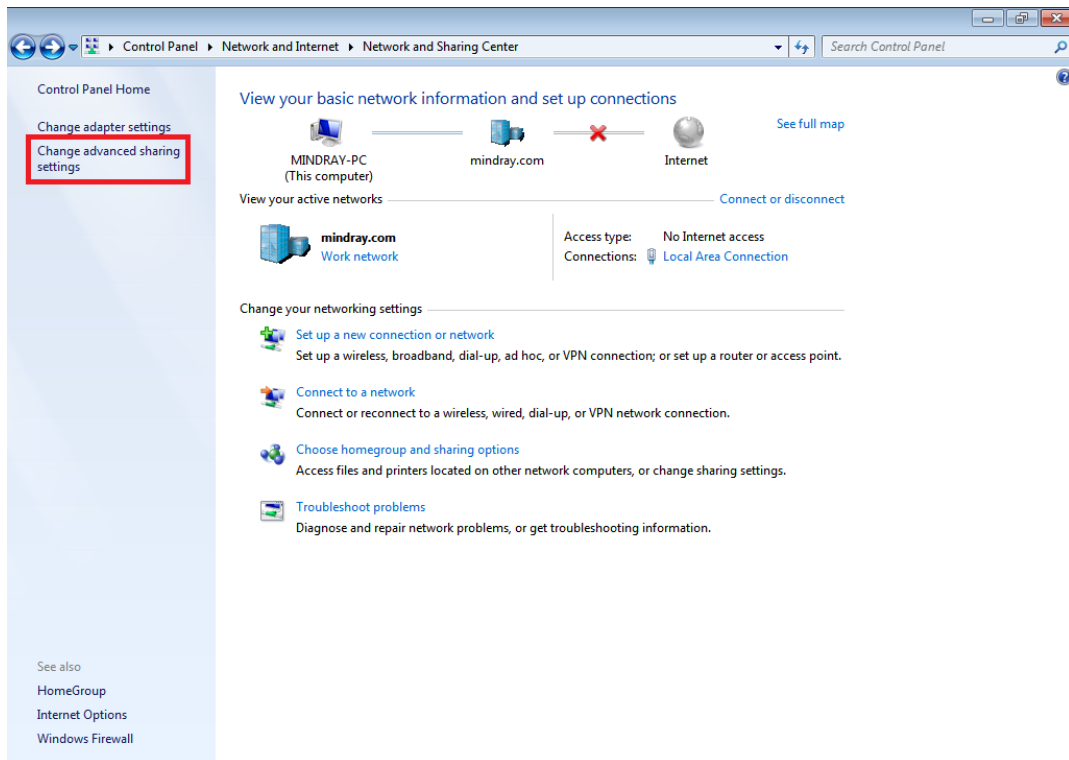


By now, the **Guest** account is activated.

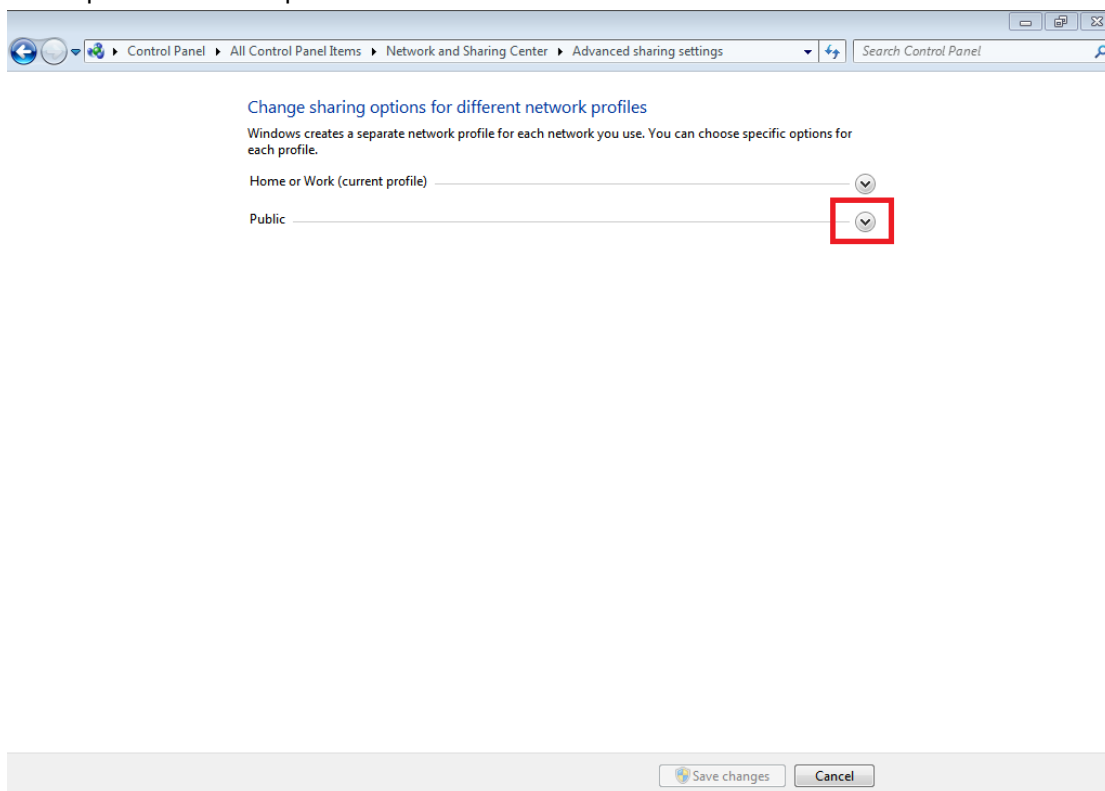
#### Turn off the password sharing:

1. On the control panel, click Network and Sharing Center, and then click Change advanced sharing settings.

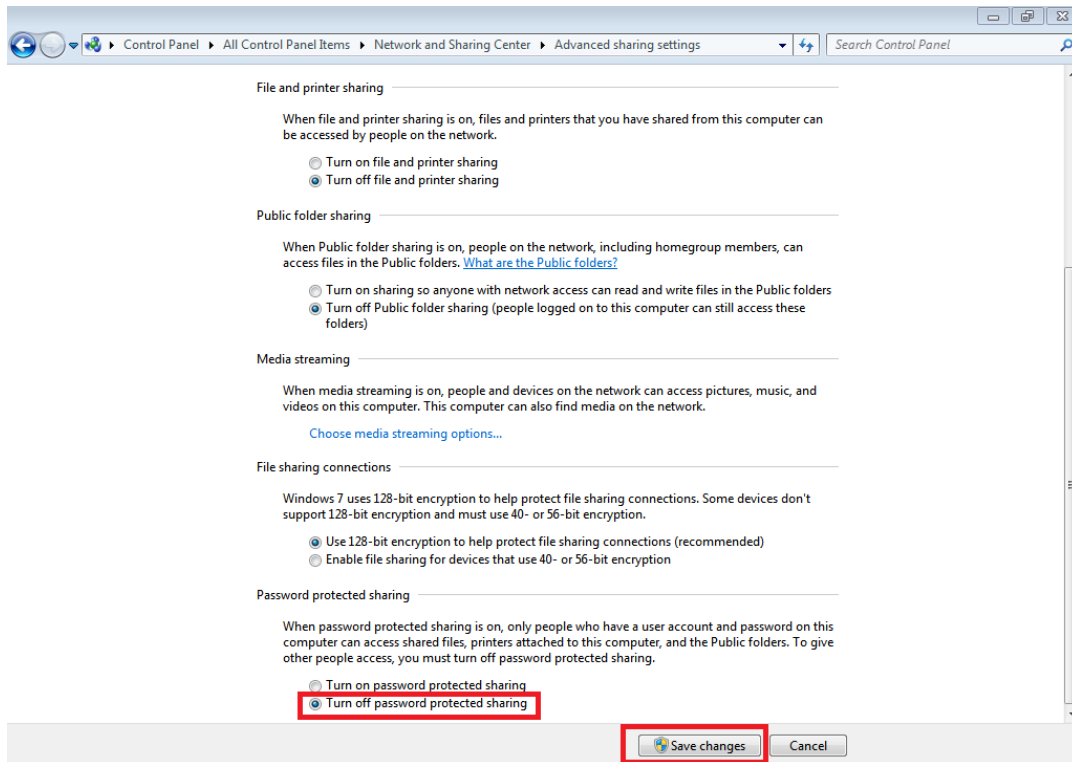




2. Expand the **Public** profile.

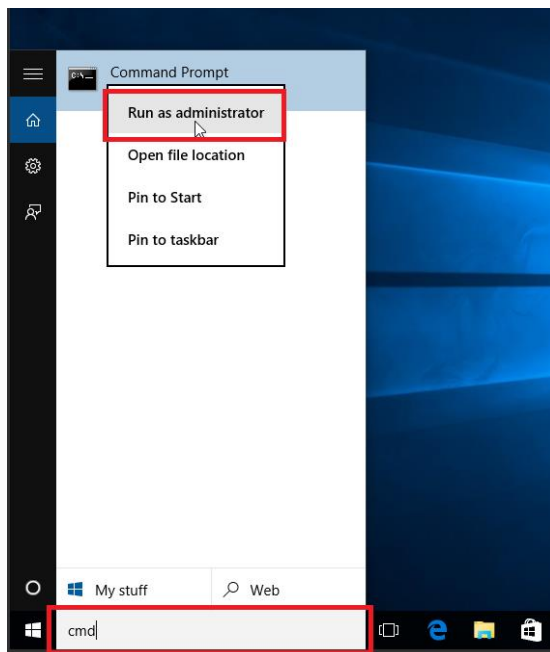


3. Select **Turn off password protected sharing**, and click **Save Changes**.



## Windows 10

1. Click the Start button in the lower left corner of the task bar, and enter "cmd" in the search box. Right-click the searched command, and select "Run as administrator".



2. At the command prompt, enter "net user guest /active:yes" to activate the **Guest** account.
3. At the command prompt, enter "net user guest "" to clear the password of the **Guest** account.
4. Turn off the network password. For details about the method, see the previous description about "Turn off the password sharing" in the Windows 7 or Windows 8 system.

## Appendix G JSON Standard

Refer to RFC4627.

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