BS-220

Chemistry Analyzer

Host Interface Manual

CE

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Preface

Who Should Read This Manual

This manual is written for LIS (Laboratory Information Management System) developers and those who need to learn the HL7 interface used by Mindray. Instructions are provided in this manual for LIS developers to guide them to develop LIS interface that enables their LIS to communicate with the chemistry analyzer of Mindray. The developers are expected to have knowledge of LIS and HL7 standards, and capacity of network programming. The communication protocol is TCP/IP for network layer and HL7 version 2.3.1 for application layer. LIS developers are recommended to develop the LIS interface using Visual C++, Visual Basic, etc. in the Windows operating system.

What Can You Find in This Manual

This operation manual introduces the HL7 interface used by Mindray on the BS-220 Chemistry Analyzer. Chapter 1 describes the HL7 interface generally. The BS-220 supports bidirectional communication with LIS, that is, it can not only send test results to LIS but also download sample information from LIS. Chapter 2 explains the bidirectional communication in detail.

Conventions Used in This Manual

This chart explains the symbols used in this manual.

When you see …	Then …
⚠ **NOTE:**	Read the statement following the symbol. The statement is alerting you to information that requires your attention.

Contents

1   Mindray HL7 Interface

HL7 interface is developed by Mindray for the BS-220 Chemistry Analyzer to adapt to the prevailing Laboratory Information Management System (LIS). It provides a channel for BS-220 and other IP-based networks. With TCP/IP, the LIS host can receive test results from chemistry analyzers, which also send patient information, sample information and test results to LIS in real-time or batch mode. Therefore, users can identify samples by both scanning sample bar code and downloading from LIS host. This chapter describes the two communication modes (sending and downloading). All data are transmitted in format of HL7 v2.3.1. This interface enables bidirectional communication between the BS-220 and the LIS host.

1.1   Messages Compatible with HL7 Interface

HL7, a transmission standard for electronic data and providing nurse for inpatients, was first defined by Americans and now has been applied by many countries. Mindray HL7 interface is defined based upon HL7 v2.3.1. Refer to *HL7 Interface Standards Version 2.3.1* for details.

Only portion of the messages, segments and other data defined are used for Mindray HL7 interface that needs only part of these data.

1.2   HL7 Lower Layer Protocol

TCP/IP is a byte stream protocol, which does not provide message border. HL7 is a higher layer protocol that is based upon messages but provides no message termination mechanism. To determine the message border, the minimal lower layer protocol is used. Refer to *HL7 Interface Standards Version 2.3.1* for details.

Communication Layer

Messages are transmitted in format of:

<SB> *ddddd* **<EB><CR>**

Where,

■ <SB> = Start Block character (1 byte)
ASCII <VT>, namely <0x0B>, must not be confused with the SOH or STX in ASCII.

■ *ddddd* = Data (variable number of bytes)
ddddd is an HL7 message, which only includes ISO 8859-1 characters (hexadecimal 20-FF) and <CR>, exclusive of other control characters and those that can't be printed out.

■ <EB> = End Block character (1 byte)
ASCII <FS>, namely <0x1C >, must not be confused with the ETX or EOT in ASCII.

■ <CR> = Carriage Return (1 byte)
Enter character in ASCII is <0x0D>.

1.3　Minimal Lower Layer Protocol（**MLLP**）

This interface is compatible with the Minimal Lower Layer Protocol (MLLP) of HL7.

MLLP, an encapsulation of HL7 messages, is defined in the HL7 standard. HL7 messages are encapsulated with a single character at the beginning and a dual character at the end. The characters used by the HL7 interface are default in the HL7 standard.

Start character: Hexadecimal <0B>

End character: Hexadecimal <1C><0D>

2 Communication and HL7 Protocol

Communication here concerns result sending and sample information downloading. The former means the analyzer transmits the measurement data to an external system (such as the LIS). There are two types of transmission: real-time and batch. Batch-mode transmission is not allowed in two conditions: 1) Real-time mode is enabled; 2) The system is in testing status. The latter means the analyzer downloads sample information from LIS in real-time or batch mode. Real-time mode can be achieved only if a sample bar code reader is equipped. Batch-mode downloading refers to retrieving samples in certain period of the day.

This chapter introduces the message types (Ver. 2.3.1) used by Mindray HL7 interface.

⚠ **NOTE:**

HL7 supports many types of messages, but only 5 of them are employed on the Mindray HL7 interface.

2.1 Message Grammar

This section introduces the general grammar of Mindray HL7 interface.

⚠ **NOTE:**

For complete and detailed descriptions of HL7 message grammar, refer to the HL7 standard written by the HL7 standard committee.

Each HL7 message is composed of segments that end with <CR>.

Each segment consists of a name (three characters) and variable fields that are composed of components and subcomponents. The separators of each element are defined in the MSH segment in every message.

For instance,

MSH|^~\&|Mindray|BS-200|||20060427194802||ORU^R01|1|P|2.3.1||||0||ASCII|||

Where, the five characters following MSH are defined as delimiters to separate the fields, components and subcomponents. Although the characters can be any non-text ones, the HL7 standard recommends you to use the following:

Character	Description
|	Field separator
^	Component separator
&	Subcomponent separator
~	Repetition separator
\	Escape character

The first field of MSH includes all separators and most of other fields are empty. These fields are optional and not used by Mindray HL7 interface.

Field 9   Includes message types (ORU)

Field 10   Includes an unique text string to indicate message ID

Field 11   Includes processing ID (P refers to product)

Field 12   Defines the version of HL7 (2.3.1) for the message

The order of the segments following MSH in every message is specially specified.

⚠ **NOTE:**

A segment is defined as optional or to be repeated by using the following grammar:

[ ] indicates the segment in it is optional.

{ } indicates the segment in it can be repeated for 0 or 1 time or more.

2.2 Compatible HL7 Messages

All messages used for HL7 interface include ORU, ACK, QRY, QCK and DSR.

Test results are transferred as follows:
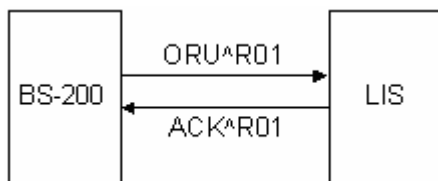
Sample information is downloaded from LIS as follows:
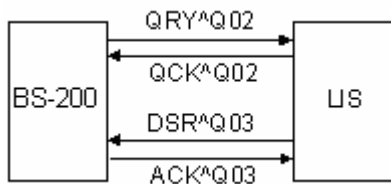
ORU/ACK: Observe result (unsolicited)/Acknowledgment

ORU^R01 is used to transmit sample result, QC result and calibration results to the LIS host. (Transmission of calibration results is not allowed on the BS-220)

An **ORU^R01** message includes:

- Patient information (patient name, sample ID, etc)

- Doctor's order (sample type, sender, tester, clinical diagnosis, etc)

- Test results (test No., concentration, unit, reference, etc)

When the test information reaches the LIS server, you can select desired items as needed.

On the BS-220, each ORU^R01 message transmits one test, which could be routine test, ISE Analyte, off-system test or calculation test. A sample with multiple tests will be transmitted via multiple ORU messages.

The structure of an **ORU** message is as follows:

ORU	Description
MSH	Message header
PID	Patient identification
OBR	Observation report ID
OBX	Observation/Result

■ Calibration result includes the following information:

-Test information (test No. and test name)

-Calibration rule and date/time

-Calibrator information (quantity, sequence number, name, lot No., expiration date, concentration, etc)

-Calibration result (response, number of calibration parameters, parameter value)

All calibration results of a test can be transmitted via one message. The above-mentioned information can be applied as needed. Refer to following contents for details.

■ QC result includes the following information:

-Test information (test No. and test name)

-Control information (name, lot No., expiration date, concentration level, mean value)

-Date/time and QC result (concentration and unit)

The above-mentioned information can be applied as needed. Refer to following contents for details.

On the BS-220, each ORU^R01 message carries the result of one QC run.

The message structure for calibration and QC results are show below:

ORU Observational Results (Unsolicited)	Description
MSH	Message Header
OBR	Observation report(calibration and QC)

ACK^R01 message responds to ORU message and is as follows:

ACK	Acknowledgment	Description
MSH		Message Header
MSA		Message Acknowledgment

QRY/QCK: Query/Query acknowledgment

QRY^Q02 message is used for sample information query on LIS and has an event Q02. The structure of **QRY** message is as follows:

QRY	Description
MSH	Message Header
QRD	Query Definition
QRF	Query Filter

QCK^Q02 message responds to QRY^Q02 message and is as follows:

QCK	Description
MSH	Message Header
MSA	Message Acknowledgment
ERR	Error
QAK	Query Acknowledgment

DSR/ACK: Display response/ Acknowledgment

DSR^Q03 message sends and displays searched results, i.e. send sample information from LIS to the analyzer. The structure of **DSR** message is as follows:

DSR	Description
MSH	Message Header
MSA	Message Acknowledgment
ERR	Error
QAK	Query Acknowledgment
QRD	Query Definition
QRF	Query Filter
{DSP}	Display Data
DSC	Continuation Pointer

ACK^Q03 responds to DSR^Q03 message and is as follows:

ACK	Description
MSH	Message Header
MSA	Message Acknowledgement
ERR	Error

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Message Segment

This section describes the components of each segment: field name, field length and description.

All fields used in message segment are listed in following tables. The fields displayed in red are required.

■ **MSH Message Header**

All HL7 messages begin with MSH, which is the first segment of an HL7 message and always located at the beginning of the message. The MSH segment defines the intention, source, purpose and grammar of the message.

The MSH segment of Mindray HL7 interface message uses the following fields:

No.	Field	Length	Description
1	Field Separator	1	Includes the separator between segment ID and the first real field, and defines the field separators (|) of the remaining part of the message.
2	Encoding Characters	4	Includes component, repetition, escape and subcomponent separators (^~\&).
3	Sending Application	180	Sending application, set to Mindray.
4	Sending Facility	180	Sending facility, set to BS-200.
5	Receiving Application	180	Void and reserved. Receiving application.
6	Receiving Facility	180	Void and reserved. Receiving facility.
7	Date/Time Of Message	26	Time of the current message. Calling the system time.
8	Security	40	Void and reserved. Security.
9	Message Type	7	Type of the message, such as ORU^R01.
10	Message Control ID	20	Message control ID. Indicates one message each and increases from 1 with message increasing.
11	Processing ID	3	Processing ID. Always set to P (product).
12	Version ID	60	Version ID. Version of HL7 protocol: 2.3.1.
13	Sequence Number	15	Void and reserved. Serial number
14	Continuation Pointer	180	Void and reserved. Continuation pointer
15	Accept Acknowledgment Type	2	Void and reserved. Type of accepted acknowledgment

No.	Field	Length	Description
16	Application Acknowledgment Type	2	Void and reserved. Type of application response, used as result type.
			0- Sample result;
			1- Calibration result;
			2- QC result.
			It is void in non-ORU messages.
17	Country Code	2	Void and reserved. Country code
18	Character Set	10	Character set. ASCII is used.
19	Principal Language Of Message	60	Void and reserved. Principle language of the message
20	Alternate Character Set Handling Scheme	20	Void and reserved. Handling scheme of alternate character

Comments: MSH segment applies to all messages. Fields 3 and 4 are determined by LIS manufacturer; fields 5 and 6 are set to "Mindray" and "BS-200"; fields 10 and 16 are integers; others are strings.

■ **MSA - message acknowledgment segment**

The MSA segment of Mindray HL7 interface message uses the following fields:

No.	Field	Length	Description
1	Acknowledgment Code	2	Acknowledgment code. AA stands for accepted, AE for error and AR for rejected.
2	Message Control ID	20	Message control ID, corresponding to MSH-10.
3	Text Message	80	Text message, a description of error or reject event, corresponding to field 6.
			It can be written into error logs.
4	Expected Sequence Number	15	Void and reserved. Expected sequence number.
5	Delayed Acknowledgment Type	1	Void and reserved. Delayed acknowledgment type.
6	Error Condition	100	Error condition (status code).

Note: Fields of MSA-6 are introduced as follows.

The status code list is shown as the figure below.

Status Code (MSA-6)	Status Text(MSA-3)	Description/Comment
Succeed:		AA

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Status Code (MSA-6)	Status Text(MSA-3)	Description/Comment
0	Message accepted	Succeed
Error code:		AE
100	Segment sequence error	Segment sequence is incorrect or required segment is missed.
101	Required field missing	Required field in a segment is missed.
102	Data type error	Data type of a field is incorrect.
103	Table value not found	Table value is not found, therefore not used temporarily.
Reject code:		AR
200	Unsupported message type	Message type is not supported.
201	Unsupported event code	Event code is not supported.
202	Unsupported processing id	Processing ID is not supported.
203	Unsupported version id	Version ID is not supported.
204	Unknown key identifier	Key identifier is unknown, such as inexistent patient information.
205	Duplicate key identifier	The key identifier already exists.
206	Application record locked	The transaction could not be performed at the application storage level, such as locked database.
207	Application internal error	Unknown application internal error.

Comments: MSA segment applies to ACK^R01, QCK^Q02 and ACK^Q03 messages. Fields 4 and 6 are integers, while others are strings.

■ **PID Patient Identification**

The PID segment constitutes patient information and uses the following fields:

No.	Field	Length	Description
1	Set ID – PID	10	Identifies different patient information segments
2	Patient ID	20	Patient admission No.
3	Patient Identifier List	20	Medical record number
4	Alternate Patient ID – PID	20	Bed No.
5	Patient Name	48	Name of patient
6	Mother's Maiden Name	48	Patient zone

No.	Field	Length	Description
7	Date/Time of Birth	26	Birth date of patient. (Format: YYYYMMDDHHMMSS). It could be void.
8	Sex	1	Patient gender. M for male F for female O for others
9	Patient Alias	48	Blood type (O, A, B and AB)
10	Race	80	Void and reserved. Race of patient.
11	Patient Address	106	Void and reserved. Address of patient.
12	County Code	4	Void and reserved. County code of patient.
13	Phone Number - Home	40	Void and reserved. Phone number (home) of patient.
14	Phone Number - Business	40	Void and reserved. Phone number (business) of patient.
15	Primary Language	60	Void and reserved. Primary language of patient.
16	Marital Status	80	Void and reserved. Marital status of patient.
17	Religion	80	Void and reserved. Religion of patient.
18	Patient Account Number	20	Void and reserved.
19	SSN Number -Patient	16	Void and reserved.
20	Driver's License Number – Patient	25	Void and reserved.
21	Mother's Identifier	20	Void and reserved. Mother's identifier.
22	Ethnic Group	80	Void and reserved.
23	Birth Place	60	Void and reserved. Birth place of patient.
24	Multiple Birth Indicator	1	Void and reserved. Multiple birth indicator, Y(yes) or N(no).
25	Birth Order	2	Void and reserved. Birth order, an integer greater than 0.
26	Citizenship	80	Void and reserved.
27	Veterans Military Status	60	Void and reserved. Veteran military status of patient.
28	Nationality	80	Void and reserved.
29	Patient Death Date and Time	26	Void and reserved. Patient death date and time.

No.	Field	Length	Description
30	Patient Death Indicator	1	Void and reserved. Patient death indicator, Y (yes) or N (no).

Comments: PID segment only applies to ORU^R01 message. Fields 1 and 25 are integers; fields 24 and 30 are Booleans; others are strings.

■ OBR Observation Request

The OBR segment transmits the doctor's orders associated with the patient report. If MSH-16 is 0, Mindray HL7 interface uses the following fields:

No.	Field	Length	Description
1	Set ID – OBR	10	Identifies different OBR segments.
2	Placer Order Number	22	Order number of placer, used as sample bar code.
3	Filler Order Number	22	Order number of filler, used as sample ID.
4	Universal Service ID	200	Universal service ID, set to Mindray^BS-200.
5	Priority	2	STAT or not. Y for yes and N for no.
6	Requested Date/time	26	Void and reserved. Requesting date/time.
7	Observation Date/Time	26	Observation date/time, used as testing date/time.
8	Observation End Date/Time	26	Void and reserved. Observation end date/time.
9	Collection Volume	20	Void and reserved. Collection volume.
10	Collector Identifier	60	Void and reserved. Collector identifier.
11	Specimen Action Code	1	Void and reserved. Specimen action code.
12	Danger Code	60	Void and reserved. Danger code.
13	Relevant Clinical Info.	300	Clinical diagnosis.
14	Specimen Received Date/Time	26	Void and reserved. Specimen receiving date/time.
15	Specimen Source	300	Sample source, used as sample type, such as blood, urine, etc
16	Ordering Provider	120	Order provider, used as sender.
17	Order Callback Phone Number	40	Void and reserved. Sending department
18	Placer Field 1	60	Characteristic of sample (icterus, hemolysis and lipemia)
19	Placer Field 2	60	Void and reserved.
20	Filler Field 1	60	Attending doctor

No.	Field	Length	Description
21	Filler Field 2	60	Treatment department
22	Result Rpt/Status Change – Date/Time	26	Void and reserved. Result report/status change-date/time.
23	Charge to Practice	40	Void and reserved. Charge to practice.
24	Diagnostic Serv Sect ID	10	Void and reserved. Diagnosis ID.
25	Result Status	1	Void and reserved. Status of result.
26	Parent Result	200	Void and reserved. Parent result.
27	Quantity/Timing	200	Void and reserved. Quantity/time.
28	Result Copies To	150	Void and reserved. Result copies to.
29	Parent	150	Void and reserved. Parent order.
30	Transportation Mode	20	Void and reserved. Transportation mode.
31	Reason for Study	300	Void and reserved. Reason for study.
32	Principal Result Interpreter	200	Void and reserved. Principal result interpreter.
33	Assistant Result Interpreter	200	Void and reserved. Assistant result interpreter.
34	Technician	200	Void and reserved. Technician.
35	Transcriptionist	200	Void and reserved. Transcriptionist.
36	Scheduled Date/Time	26	Void and reserved. Scheduled date/time.
37	Number of Sample Containers	4	Void and reserved. Number of sample containers.
38	Transport Logistics of Collected Sample	60	Void and reserved. Transport logistics of collected sample.
39	Collector's Comment	200	Void and reserved. Collector's comment.
40	Transport Arrangement Responsibility	60	Void and reserved. Transport arrangement responsibility.
41	Transport Arranged	30	Void and reserved. Transport arranged.
42	Escort Required	1	Void and reserved. Escort required.
43	Planned Patient Transport Comment	200	Void and reserved. Planned patient transport comment.
44	Ordering Facility Name	60	Void and reserved. Name of placer.
45	Ordering Facility Address	106	Void and reserved. Address of placer.

No.	Field	Length	Description
46	Ordering Facility Phone Number	48	Void and reserved. Phone number of placer.
47	Ordering Provider Address	106	Void and reserved. Address of provider.

Comments: OBR segment only applies to ORU^R01 message. Fields 1, 3 and 37 are integers; field 9 is a floating number; others are strings.

To transmit calibration result (MSH-16 is 1), Mindray HL7 interface uses the following fields: (Calibration result transmission is not allowed on BS-220)

No.	Field	Length	Description
1	Set ID – OBR	10	Identifies different OBR segments.
2	Placer Order Number	22	Order number of placer, used as test No.
3	Filler Order Number	22	Order number of filler, used as test name.
4	Universal Service ID	200	Universal service ID, set to Mindray^BS-200.
5	Priority	2	STAT or not. Y for yes and N for no.
6	Requested Date/time	26	Void and reserved. Requesting date/time.
7	Observation Date/Time	26	Observation date/time, used as calibration date/time.
8	Observation End Date/Time	26	Void and reserved. Observation end date/time.
9	Collection Volume	20	Calibration rule. It includes 1-One-point linear; 1-Two-point linear; 3-Multi-point linear; 4-Logit-Log5P; 5-Exponential 5P; 6-Polynomial 5P; 7-Parabola; 8-Spline.
10	Collector Identifier	60	K factor
11	Specimen Action Code	1	Number of calibrators
12	Danger Code	60	Calibrator No.
13	Relevant Clinical Info.	300	Calibrator name
14	Specimen Received Date/Time	26	Lot No.
15	Specimen Source	300	Expiration date
16	Ordering Provider	120	Standard concentration
17	Order Callback Phone Number	40	Concentration level. High-H, Medium-M, Low-L
18	Placer Field 1	60	Response
19	Placer Field 2	60	Number of calibration parameters
20	Filler Field 1	60	Calibration value
21	Filler Field 2	60	Void and reserved.
22	Result Rpt/Status Change – Date/Time	26	Void and reserved. Result report/status change-date/time.

No.	Field	Length	Description
23	Charge to Practice	40	Void and reserved. Charge to practice.
24	Diagnostic Serv Sect ID	10	Void and reserved. Diagnosis ID.
25	Result Status	1	Void and reserved. Status of result.
26	Parent Result	200	Void and reserved. Parent result.
27	Quantity/Timing	200	Void and reserved. Quantity/time.
28	Result Copies To	150	Void and reserved. Result copies to.
29	Parent	150	Void and reserved. Parent order.
30	Transportation Mode	20	Void and reserved. Transportation mode.
31	Reason for Study	300	Void and reserved. Reason for study.
32	Principal Result Interpreter	200	Void and reserved. Principal result interpreter.
33	Assistant Result Interpreter	200	Void and reserved. Assistant result interpreter.
34	Technician	200	Void and reserved. Technician.
35	Transcriptionist	200	Void and reserved. Transcriptionist.
36	Scheduled Date/Time	26	Void and reserved. Scheduled date/time.
37	Number of Sample Containers	4	Void and reserved. Number of sample containers.
38	Transport Logistics of Collected Sample	60	Void and reserved. Transport logistics of collected sample.
39	Collector's Comment	200	Void and reserved. Collector's comment.
40	Transport Arrangement Responsibility	60	Void and reserved. Transport arrangement responsibility.
41	Transport Arranged	30	Void and reserved. Transport arranged.
42	Escort Required	1	Void and reserved. Escort required.
43	Planned Patient Transport Comment	200	Void and reserved. Planned patient transport comment.
44	Ordering Facility Name	60	Void and reserved. Name of placer.
45	Ordering Facility Address	106	Void and reserved. Address of placer.
46	Ordering Facility Phone Number	48	Void and reserved. Phone number of placer.
47	Ordering Provider Address	106	Void and reserved. Address of provider.

Comments: This segment only applies to ORU^R01 message. Fields 1, 9, 11, 19 and 37 are integers; field 10 is a floating number; others are strings. Fields 12-18 vary with the number of calibrators in the format of V1^V2^…Vi. Field 20 varies with the number of calibration parameters and is also separated by ^.

Different calibration rules have various parameters:

Linear (one-point, two-point and multi-point): K and R0;

Logit-Log4P: K, R0, a and b;

Logit-Log5P: K, R0, a, b and c;

Polynomial 5P: K, R0, a, b, c and d;

Parabola: R0, a and b;

Spline: 4*(n-1) parameters, which are R0i, ai, bi, ci. n is number of calibrators.

To transmit QC result (MSH-16 is 2), Mindray HL7 interface uses the following fields:

No.	Field	Length	Description
1	Set ID – OBR	10	Identifies different OBR segments.
2	Placer Order Number	22	Order number of placer, used as test No..
3	Filler Order Number	22	Order number of filler, used as test name.
4	Universal Service ID	200	Universal service ID, set to Mindray^BS-200.
5	Priority	2	STAT or not. Y for yes and N for no.
6	Requested Date/time	26	Requesting date/time, used as QC date/time
7	Observation Date/Time	26	Void and reserved. Observation date/time
8	Observation End Date/Time	26	Void and reserved. Observation end date/time
9	Collection Volume	20	Void and reserved
10	Collector Identifier	60	Void and reserved
11	Specimen Action Code	1	Void and reserved
12	Danger Code	60	Void and reserved
13	Relevant Clinical Info.	300	Control name
14	Specimen Received Date/Time	26	Lot No.
15	Specimen Source	300	Expiration date
16	Ordering Provider	120	Void and reserved
17	Order Callback Phone Number	40	Concentration level. High-H, Medium-M, Low-L
18	Placer Field 1	60	Mean value (mean concentration)
19	Placer Field 2	60	Standard deviation
20	Filler Field 1	60	Test result (concentration)
21	Filler Field 2	60	Unit
22	Result Rpt/Status Change – Date/Time	26	Void and reserved. Result report/status change-date/time.

No.	Field	Length	Description
23	Charge to Practice	40	Void and reserved. Charge to practice.
24	Diagnostic Serv Sect ID	10	Void and reserved. Diagnosis ID.
25	Result Status	1	Void and reserved. Status of result.
26	Parent Result	200	Void and reserved. Parent result.
27	Quantity/Timing	200	Void and reserved. Quantity/time.
28	Result Copies To	150	Void and reserved. Result copies to.
29	Parent	150	Void and reserved. Parent order.
30	Transportation Mode	20	Void and reserved. Transportation mode.
31	Reason for Study	300	Void and reserved. Reason for study.
32	Principal Result Interpreter	200	Void and reserved. Principal result interpreter.
33	Assistant Result Interpreter	200	Void and reserved. Assistant result interpreter.
34	Technician	200	Void and reserved. Technician.
35	Transcriptionist	200	Void and reserved. Transcriptionist.
36	Scheduled Date/Time	26	Void and reserved. Scheduled date/time.
37	Number of Sample Containers	4	Void and reserved. Number of sample containers.
38	Transport Logistics of Collected Sample	60	Void and reserved. Transport logistics of collected sample.
39	Collector's Comment	200	Void and reserved. Collector's comment.
40	Transport Arrangement Responsibility	60	Void and reserved. Transport arrangement responsibility.
41	Transport Arranged	30	Void and reserved. Transport arranged.
42	Escort Required	1	Void and reserved. Escort required.
43	Planned Patient Transport Comment	200	Void and reserved. Planned patient transport comment.
44	Ordering Facility Name	60	Void and reserved. Name of placer.
45	Ordering Facility Address	106	Void and reserved. Address of placer.
46	Ordering Facility Phone Number	48	Void and reserved. Phone number of placer.
47	Ordering Provider Address	106	Void and reserved. Address of provider.

Comments: This segment only applies to ORU^R01 message. Fields 1, 11 and 37 are integers; others are strings. Each QC run is transmitted in one message.

■ OBX Observation

The OBX segment transmits the observations. If sample results are to be transmitted (MSH-16 is 0)—Each patient may have multiple test results, then more than one OBX segment will be used to transmit the results. On the BS-220, all test results of a patient are transmitted separately. The HL7 interface does not check the repeatability of the test results, which should be performed by the user system.

The OBX segment of Mindray HL7 interface uses the following fields:

No.	Field	Length	Description
1	Set ID – OBX	10	Identifies different OBX segments.
2	Value Type	3	Value type, identifies the test result.
			NM (numeric), numeric value, for quantitative tests
			ST (string), for qualitative tests
3	Observation Identifier	590	Observation identifier, used as test ID.
4	Observation Sub-ID	20	Observation Sub-ID, used as test name.
5	Observation Value	65536	Observation value, used as test result (concentration, negative(-), positive(+), weak positive(+-), etc.).
6	Units	90	Unit of test result.
7	References Range	90	Reference range for test result. It is qualitative reference for qualitative tests.
8	Abnormal Flags	5	Abnormal flag to indicate whether the test result is normal or not.
			User can define the flags via the data dictionary on the operation software of BS-220.
9	Probability	5	Void and reserved. Probability.
10	Nature of Abnormal Test	2	Void and reserved. Reason of abnormal test.
11	Observe Result Status	1	Status of observation result, set to F-final results.
12	Date Last Observe Normal Values	26	Void and reserved. Date of last normal observation value.
13	User Defined Access Checks	20	User-defined access check, used as original result.
14	Date/Time of the Observation	28	Observation date/time, used as testing date/time.
15	Producer's ID	60	Void and reserved. Used as test department.
16	Responsible Observer	80	Responsible observer, used as tester.
17	Observation Method	60	Void and reserved. Observation method.

Comments: OBX segment only applies to ORU^R01 message. Fields 1, 3 and 9 are integers; fields 5 and 13 are floating numbers; others are strings.

■ QRD - query definition segment

The QRD segment of Mindray HL7 interface uses the following fields:

No.	Field	Length	Description
1	Query Date/Time	26	Query date/time, i.e. system date/time.
2	Query Format Code	1	Query format code, set to R (record-oriented format).
3	Query Priority	1	Query priority, set to D (deferred).
4	Query ID	10	Query ID, indicates different queries and increases from 1.
5	Deferred Response Type	1	Void and reserved. Deferred response type.
6	Deferred Response Date/Time	26	Void and reserved. Deferred response date/time.
7	Quantity Limited Request	10	Quantity limited request, set to RD (records).
8	Who Subject Filter	60	Subject filter, used as sample bar code.
9	What Subject Filter	60	Subject filter. OTH for query and CAN for canceling
10	What Department Data Code	60	Void and reserved. Department data code.
11	What Data Code Value Qual.	20	Void and reserved. Data code value qualifier.
12	Query Results Level	1	Void and reserved. Query results level. T for Full results

Comments: QRD segment may appear in QRY^Q02 and DSR^Q03 messages. Field 8 is bar code for real-time downloading and null for group downloading; field 4 is an integer, while others are strings.

■ QRF - query filter segment

The QRF segment is used together with the QRD segment and uses the following fields:

No.	Field	Length	Description
1	Where Subject Filter	20	Subject address filter, set to BS-200.
2	When Data Start Date/Time	26	Data start date/time, used as start receipt date/time.
3	When Data End Date/Time	26	Data end date/time, used as end receipt date/time.
4	What User Qualifier	60	Void and reserved. User qualifier.

No.	Field	Length	Description
5	Other QRY Subject Filter	60	Void and reserved. Other QRY subject filter.
6	Which Date/Time Qualifier	12	Void and reserved. Object type. RCT(Specimen receipt date/time, receipt of specimen in filling ancillary (Lab))
7	Which Date/Time Status Qualifier	12	Void and reserved. Object status. COR(Corrected only (no final with corrections))
8	Date/Time Selection Qualifier	12	Void and reserved. Date/time selection qualifier. ALL(All values within the range)
9	When Quantity/Timing Qualifier	60	Void and reserved. Time interval.

Comments: QRF segment only applies to QRY^Q02 message. Fields 3 and 4 are 0 o'clock and query time of the day, and used as search conditions. All fields are strings.

■ ERR - error segment

The ERR segment adds error description to acknowledgment message and uses the following fields:

No.	Field	Length	Description
1	Error Code and Location	80	Error code and location.

Comments: ERR segment may appear in QCK^Q02, DSR^Q03 or ACK^Q03 message. The only field of this segment is an integer.

■ QAK - query acknowledgment segment

The QAK segment includes query response information and uses the following fields:

No.	Field	Length	Description
1	Query Tag	32	Query tag, set to SR (sample request information).
2	Query Response Status	2	Query response status: OK: Data found, no errors NF: No data found, no errors AE: Application error AR: Application reject

Comments: QAK segment applies to QCK^Q02 and DSR^Q03 messages. All fields of this segment are strings.

■ DSP - display data segment

The DSP segment displays searched sample information and patient information and uses the following fields:

No.	Field	Length	Description
1	Set ID - DSP	4	Identifies different DSP segments.
2	Display Level	4	Display level.
3	Data Line	300	Data line, i.e. searched contents.
4	Logical Break Point	2	Logical break point.
5	Result ID	20	Result ID.

Comments: DSP segment only applies to DSR^Q03 message. Field 1 is an integer, while others are strings.

The third field "Data Line" displays the sample information downloaded from the LIS server. The sequence of the sample information is shown as follows. The bar code and test No. are required, while other items are optional.

Sequence	Data	Data Type and Value
1	Admission Number	String
2	Bed Number	String
3	Patient Name	String
4	Date of Birth	String. The format is YYYYMMDDHHmmSS, such as 20061122130540.
5	Sex	String. Male/M, Female/F, Other/O
6	Patient Alias	String. It includes O, A, B and AB.
7	Race	String, blank
8	Patient Address	String
9	County Code	String
10	Home Phone Number	String
11	Business Phone Number	String, blank
12	Primary Language	String, blank
13	Marital Status	String, blank
14	Religion	String, blank
15	Patient Account Number	String. It includes Outpatient, inpatient, other.
16	Social Security Number	String, It includes Own and Insurance.
17	Driver License Number	String
18	Ethnic Group	String
19	Birth Place	String
20	Nationality	String
21	Bar Code	String
22	Sample ID	Int
23	Sample Time	String. See item 4
24	STAT	String. It includes Y (yes),

Sequence	Data	Data Type and Value
		N(No) and void. N is default.
25	Collection Volume	Float, blank
26	Sample Type	String. It includes serum, plasma and urine.
27	Fetch Doctor	String
28	Fetch Department	String
29	Test Number^Test Name^Unit^Normal Range	String^string^string^string

The analyzer recognizes a test with its Test Number. For the same test, if the test number in the analyzer and that in the LIS server are not the same, you can open the ItemID.ini file in the folder where the executive file of operating software locates and configure the test number. Only if test correspondence is set, the test results can be transmitted and sample information be downloaded.

■ **DSC - Continuation pointer segment**

The DSC segment indicates whether the data message is the last one.

No.	Field	Length	Description
1	Continuation pointer	180	Continuation pointer

Comments: DSC segment only applies to DSR^Q03 message. The only field of this segment is void when DSR^Q03 message responds to group query and not void in other conditions. This field is an integer.

2.3 Message Example

A message in format of HL7 is listed below.

MSH|^~\&|Mindray|BS-200|||20060505165930||ORU^R01|2|P|2.3.1||||0||ASCII|||
PID|2|||||||M||||||||||||||||||||
OBR|1|1000|10|Mindray^BS-200||103422|20060505|||||||||serum||||||||||||||||||||||||||||||||
OBX|1|NM|1|TBil|0|umol/L|||||||0|20060505||||

MSH|^~\&|LIS-Server|NanShan Hospital|Mindray|BS-200|20060505165930||ACK^R01|2|P|2.3.1|
MSA|AE|2|||100|

MSH|^~\&|Mindray|BS-200|||20060505175741||QRY^Q02|3|P|2.3.1|
QRD|20060505175741|D|D|3|||RD||OTH||||
QRF|BS-200|20060505000000|20060505175741|||||||

MSH|^~\&|LIS-Server|NanShan
Hospital|Mindray|BS-200|20060505175741||QCK^Q02|3|P|2.3.1|
MSA|AA|3|Message accepted|||0|
ERR|0|
QAK|SR|OK|

MSH|^~\&|LIS-Server|NanShan
Hospital|Mindray|BS-200|20060505175741||DSR^Q03|1|P|2.3.1|
MSA|AA|1|Message accepted|||0|
ERR|0|
QAK|SR|OK|
QRD|20060505175741|D|D|3|||RD|00000001|OTH||||
DSP|1||123|||
DSP|2||456|||
DSP|3||Tom|||
DSP|4|||||
DSP|5||M|||
DSP|6|||||
DSP|7|||||
DSP|8|||||
DSP|9|||||
DSP|10|||||
DSP|11|||||
DSP|12|||||
DSP|13|||||
DSP|14|||||
DSP|15|||||
DSP|16|||||
DSP|17|||||
DSP|18|||||
DSP|19|||||
DSP|20|||||
DSP|21||00000001|||
DSP|22||3|||
DSP|23||093452|||
DSP|24||20060425|||
DSP|25|||||
DSP|26||serum|||
DSP|27||Dingding|||
DSP|28||ABC|||

DSP|29||1^TBil^g/mol^10-80|||
DSP|30||3^AB^^|||
DSC|1|

MSH|^~\&|Mindray|BS-200|||20060505175742||ACK^Q03|1|P|2.3.1|
MSA|AA|1|Message accepted|||0|
ERR|0|