LIS Interface Manual

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1. HL7 interface outline

HL7 interface is a new function developed to suit Laboratory Information Management System (LIS) which develops rapidly nowadays. It provides a channel for Heto chemistry analyzer and network which are based on IP protocol .LIS server can receive test data from chemistry analyzer with TCP/IP connected. Analyzer can also update patient information ,sample information , test result to LIS server by real time or batch transmit .It also supports customer to get sample application information by scan sample barcode or batch transmit which will be introduced detailedly below .The data transmit format of this interface is created according to HL7 version 2.3.1

This interface supports two-way transmission between chemistry analyzer and LIS system.

1.1 HL7 Supportive interface message

HL7 refers to a set of international standards for transfer of clinical and administrative data between software applications used by various healthcare providers. Originally defined by America and adopted by many countries. This interface is defined based on HL7 V2.5 For more information, please refer to HL7

Interface Standards Version 2.5.

Only part of message type, segment type and some other data which are stipulated in HL7 are used in this interface because Heto HL7 interface only use part of data.

1.2 HL7 Underlying Protocol

TCP/IP is a byte stream protocol, it doesn't provide message boundaries. HL7 is based on message as upper layer protocol. It doesn't provide message termination mechanism either. To confirm message boundaries, we use the smallest underlying protocol (HL7 Interface Standards Version 2.3.1. also has corresponding description on it)

Communication Layer

Message will be transmitted in below format:

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

Definition:

<SB> = Start Block character (1 byte)

ASCII <VT>, namely, <0x0B>. Do not be mixed with character SOH or STX of ASCII.

ddddd = Data (variable number of bytes)

ddddd is HL7 message . Only involve ISO 8859-1character (hexadecimal value 20 - FF) and <CR>,

It doesn't include other control character and character that can't be printed.

<EB> = End Block character (1 byte)

ASCII <FS>, namely, <0x1C>. Do not be mixed with character ETX or EOT of ASCII.

<CR> = Carriage Return (1 byte)

ASCII carriage return，namely，<0x0D>.

1.3 Minimal Lower Layer Protocol（MLLP）

The interface supports Minimal Lower Layer Protocol (MLLP) of HL7. It's one kind encapsulation way of HL7 message. MLLP protocol is defined by HL7 standard specification .The encapsulation way of HL7 message is that the message takes a monocase at the beginning and ends with two-character. The character that HL7 uses is the default character of HL7 standard.

Beginning character: hexadecimal <0B>

Final character : <1C><0D>

2. Duplex communication

Includes two respects：The transmission of test result and acquisition of sample information .The transmission of test result mainly realizes the testing data transmission of chemistry analyzer to outside system (eg: LIS). There are two ways of data transmission: Real time transmission during test and Bulk transfer of historical results. We stipulate that it's allowed to process bulk transmission except when you already set real-time transmission in system setting and the analyzer is running tests.The acquisition of sample application information means the analyzer gets sample application information from LIS and process it in analyzer software to test.There are two acquisition ways : Real time transmission(can only be used on the analyzer which is equipped with sample scanner system , matched with sample barcode ,and aquire after scan)Bulk acquisition (All the sample information which is applied the same day before sending request needs to aquire)

1.4 Introduction

HL7 message (version2.3.1)that will be used in HL7 interface will be be described in this chapter.

Attention：HL7 supports many kinds of message. But we just use 5 kind here . Common grammer rules is described as below .

1.5 Message grammer

It will introduce the common grammer of Heto HL7 interface in this section .

Attention：Please refer to HL7 standard provided by HL7 standard committee if you need the absolute, detailed description of HL7 message grammer.

Every HL7 message consists of some sections, section ends up with <CR> . Every section consists of section name of three characters and domain of variable number . Domain consists of components and child components. It defines the separator of every component unit in MSH section of every message.

Eg：

MSH|^~\&|HETO|AU400|||20060427194802||ORU^R01|1|P|2.5||||0|| UNICODE |||

Definition：The 5 characters definition after MSH is to distinguish the separator of every domain component and child component .Although these characters can be any non-textual characters, HL7 recommands the characters below :

Character	Meaning
|	Separator of domain
^	Separator of component
&	Separator of child component
~	Repeat separator
\	Escape character

The first section of MSH includes every separator. Some sections followed are empty because they are optional and Heto HL7 interface don't use it. Detailed definition of section and select

will be described later.
Field 9： Includes message type and affair（ORU、R01）
Field 10：Including one message ID which is identified only.
Field 11：Inculding processing ID (P means product)
Field 12：Define HL7(version 2.5) of the message used .
The order of section after MSH section is ruled for any kind of message .The order will be described detailtedly below. It means the section is optional or repetitive by using these grammer structure.\
[ ] means the section inside is optional.
{ } means every section inside can repeat for 0 , 1 or several times.

1.6 Supportive HL7 Message

All HL7 used in this interface includes: ORU、ACK、QRY、QCK、DSR。
The uploaded sketch map of test result shows below:
The acquired sketch map of sample application information obtained from LIS server shows below：
The following are detailed instructions
ORU/ACK：Non-requested observation reports/response
ORU^R01 The main function of message is to transfer the laboratory results in HL7. We use it to transfer the patient's sample test result, calibration result and control result to LIS system.
□ It includes the following information for patient's sample test result:
－Patient's information that network Data needs (patient's name , sample ID etc.)
－The doctor's advice information(sample type,submitting physician,examining physician,clinical diagnosis)
－Inspection result
It's a set of message. Every message corresponding to one sample test(It may contains the test result of several items)
LIS system can choose whatever it needs .
Specific structure shows below:

ORU Observational Results (Unsolicited)	Describtion
MSH	Message Header
PID	Patient Identification
OBR	Observation Request
{OBX}	Observation

□ Corresponding calibration test result, includes the information belows:
－Item information（Item ID、Item name）
－Calibration rule，Calibration time
－Relevant information of Clibration liquid（Number、Serial number、Name、Lot、period of validity、Concentration ,etc.）
－Calibration result（Response、Number of Clibration parameters、Calibration parameter values）
One message will send all calibration test results of one item. IIS system can choose what it needs.
□ It includes the information below for Control test result：

－Item information（Item ID、Item name）

－Relevant information of control liquid（Number、Serial number、Name、Lot、period of validity、Mean value）

－Control time，Test result （Concentration value）

One message will send all Control test results of one item. IIS system can choose what it needs. The send construction of Calibration and Control result shows below：

ORU	Observational Results (Unsolicited) Describtion
MSH	Message Header
OBR	Observation Request of Calibration and Control

ACKˆR01 Used for the response to ORU message from LIS sever.The structure shows below:

ACK Acknowledgment	Description
MSH	Message Header
MSA	Message Acknowledgment Segment

QRY/QCK：Query observation result/response

QRYˆQ02 Message query the current data, it's used to query the sample application message required from LIS system, this message activate event Q02. The structure shows below：

QRY Query	Description
MSH	Message Header
QRD	Query definition
QRF	Query Filter

QCKˆQ02 Used for the response to QRY message from LIS sever. The structure shows below：

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

DSR/ACK：Obeservation result display/response

DSRˆQ03 The main purpose of DSR message is to query the sending display of result.. That means to send the sample application message required by LIS to auto chemistry analyzer.The structure is showed below according to HL7 standard:

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

ACKˆQ03 Used for the response to DSR message from LIS sever. The structure shows below：

ACK	Acknowledgment Description
MSH	Message Header

MSA	Message Acknowledgment Segment
ERR	Error information

1.7 Message segment

The following details pertain primarily to each message segment：

－ The length of Domain

－ Use instruction

All used domain in message segment are listed.And the serial number which has # behind is mandatory field.

Attention:

In Heto interface, we won't omit any filed in message segment for future possible expanded needs. It will be emptied if there is no value in that field.

1.7.1 MSH Message Header

HL7 The first segment. All message are started with MSH which is usually at the front of message.

The messahe segment is used to define the attempt of message、source、purposeand somedetails of message grammer.

The domain used in MSH segment of Heto HL7 shows below:

Serial No.	Field name	Length	Description
1	Field Separator	1	Including Segment ID, separator in the first real field and it's define remain filed separator
2	Encoding Characters	4	Including component separator, repeat separator, Escape separator and sub component separator （^~\&）
3	Sending Application	180	Sending application, to be named Heto
4	Sending Facility	180	Sending facility, to be named facility model number.
5	Receiving Application	180	Empty, retain, Receiving Application
6	Receiving Facility	180	Empty, retain, Receiving Facility
7	Date/Time Of Message	26	Current time of message, invoking system time
8	Security	40	Empty, retain, security
9	Message Type	7	Message type, such as ORU^R01
10	Message Control ID	20	Message Control ID, universal unique identifier message, increase from 1 as message amount increases
11	Processing ID	3	Processing ID，always P(means product)
12	Version ID	60	Version ID，HL7 version：2.3.1

13	Sequence Number	15	empty, retain, sequence number
14	Continuation Pointer	180	empty, retain, Continuation Pointer
15	Accept Acknowledgment Type	2	Empty , retain . Receiving response type
16	Application Acknowledgment Type	2	Application Acknowledgment Type，means send result type. 0-patient sample test result; 1-Calibration result; 2- QC result
17	Country Code	2	empty, retain, country code
18	Character Set	10	Character set, ASCII
19	Principal Language Of Message	60	empty, retain, principal language of message
20	Alternate Character Set Handling Scheme	20	Empty, retain, alternate character set handling scheme.

Remark: The field will appear in all messages. LIS system send to HL7 message of chemistry analyzer, No. 3 and No.4 field are formulated by LIS developer, No. 5 and No. 6 field are named "_____Heto" and "AU serials" separately. No. 10 and No. 16 field use integer type, other field all use character string type.

1.7.2 MSA - message acknowledgment segment

The domain used in MSA field of Heto HL7 shows below:

Serial no.	Field name	Length	description
1	Acknowledgment Code	2	Acknowledgment code，AA means accept, AE means Error, AR means refuse.
2	Message Control ID	20	Message control ID, it's same with MSH-10 from sender.
3	Text Message	80	Text Message, message discripted while error or refuse, It' s corresponding with the 6th segment . Can be used to write error log.
4	Expected Sequence Number	15	Empty ， retain . Expected Sequence Number
5	Delayed Acknowledgment Type	1	Empty ， retain . Delayed Acknowledgment Type
6	Error Condition	100	Error condition（condition code）

Description：MSA-6 field valus is below:

Acknowledgment code	Condition code （MSA-6）	Condition message（MSA-3）	Description /Remark
AA	0	Message accepted	Success
AE	100	Segment sequence error	Segment sequence error or required field missing.
	101	Required field missing	Required field missing
	102	Data type error	Data type error, eg: character converted from numeric
	103	Table value not found	Table value not found, not need currently
AR	200	Unsupported message type	Unsupported message type
	201	Unsupported event code	Unsupported event code
	202	Unsupported processing id	Unsupported processing ID
	203	Unsupported version id	Unsupport version ID
	204	Unknown key identifier	Unknow keyword identity, such as transmit unexist patient information
	205	Duplicate key identifier	a record with these keys already exists
	206	Application record locked	Application storage level not implement, such as database locked
	207	Application internal error	Unknow applications internal error

Remark: The message field will appear in the message of ACK^R01、QCK^Q02、ACK^Q03, the NO. 4 and No.6 field uses integer, other field uses character string type.

1.7.3 PID Patient Identification

PID section is for constructing patient personal information. Following domain is used in Heto HL7 interface

No.	Column	Length	Notes

1	Set ID – PID	10	Determing different patient's message segment
2	Patient ID	20	Patient Admission number
3#	Patient Identifier List	20	Medical record No.
4	Alternate Patient ID – PID	20	Bed No.
5#	Patient Name	48	Patient name
6	Mother's Maiden Name	48	Empty, keep, inpatient ward
7	Date/Time of Birth	26	Patient birth date
8	Sex	1	Sex Male，send M Female, send F Others，send O
9	Patient Alias	48	Blood Type
10	Race	80	Empty, retain. Race
11	Patient Address	106	Patient Address
12	County Code	4	County Code（Zip Code）
13	Phone Number – Home	40	Home Phone no
14	Phone Number – Business	40	Empty, retain. Company Telephone
15	Primary Language	60	Empty, retain. Major laguage
16	Marital Status	80	Empty, retain. Marital Status
17	Religion	80	Empty, retain. Religion
18	Patient Account Number	20	Patient type
19	SSN Number - Patient	16	Medical insurance account
20	Driver's License Number–Patient	25	Charge type
21	Mother's Identifier	20	Empty, retain. Mother's Identifier
22	Ethnic Group	80	Nationality
23	Birth Place	60	birthplace
24	Multiple Birth Indicator	1	Empty, retain. Multiple Birth Indicator, Yes notes 'Y'，No notes 'N'
25	Birth Order	2	Empty, retain. Birth order，integer above '0'.
26	Citizenship	80	Remark
27	Veterans Military Status	60	Empty, retain. Veteran status
28	Nationality	80	Nationality
29	Patient Death Date and Time	26	Empty, retain. Patient Death Date and Time
30	Patient Death Indicator	1	Empty, retain. Patient Death Indicator，Yes notes 'Y'，No notes 'N'

Notes: This message segment only used in ORU^R01. 1st, 25th column use "Integer Data Type"；24th, 30th column use "Boolean data type"；Another colume use "String data type".

1.7.4 OBR Observation Request

OBR Section is for transmission of ordering information of relevant test report. The following domain are used in Heto HL7 interface while transferring the patient's sample test result(When MSH-16 take 0)

No.	Column	Length	Notes
1	Set ID – OBR	10	Confirm different OBR column
2	Placer Order Number	22	Patient Order Number, used as sample barcode no.
3	Filler Order Number	22	Doctor Order Number, used as sample no.
4#	Universal Service ID	200	Universal service identifier，using Heto^type
5	Priority	2	Whether STAT，Yes notes 'Y', No notes 'N' .Defaulted as "N" if empty
6	Requested Date/time	26	Empty, retain. Requested date/time
7	Observation Date/Time	26	Test date/time, Observation Date/Time
8	Observation End Date/Time	26	Empty, retain., Observation End Date/Time
9	Collection Volume	20	Empty, retain. Collection Volume
10	Collector Identifier	60	Empty, retain. Collector Identifier
11	Specimen Action Code	1	Empty, retain. Sample handling code.
12	Danger Code	60	Empty, retain. Danger Code
13	Relevant Clinical Info	300	Relevant Clinical Info ,Used as patient's clinical diagnostic information
14	Specimen Received Date/Time	26	Sample Received Date/Time
15	Specimen Source	300	Sample type: choosing from "serum", "plasma"，"urine", etc.
16	Ordering Provider	120	Used as submitting physician(submitting physician：FamilyName #1，submitting dept：AssigningAgencyOrDepartment #22)
17	Order Callback Phone Number	40	Empty, retain
18	Placer Field 1	60	Sample characteristics("icterus"，"hemolysis"，"lipemia"，etc.
19	Placer Field 2	60	Blood bag no.
20	Filler Field 1	60	Empty, retain ,Major doctor

21	Filler Field 2	60	Empty, retain ,Treament Departments
22	Result Rpt/Status Change – Date/Time	26	Empty, retain. Result Rpt/Status Change – Date/Time
23	Charge to Practice	40	Empty, retain. Charge to Practice
24	Diagnostic Serv Sect ID	10	Empty, retain. Diagnostic Serv Sect ID
25	Result Status	1	Empty, retain. Result Status
26	Parent Result	200	Empty, retain. Parent Result
27	Quantity/Timing	200	Empty, retain. Quantity/Timing
28	Result Copies To	150	Empty, retain. Result Copies To
29	Parent	150	Empty, retain. Parent
30	Transportation Mode	20	Empty, retain. Transportation Mode
31	Reason for Study	300	Empty, retain. Reason for Study
32	Principal Result Interpreter	200	Empty, retain. Principal Result Interpreter
33	Assistant Result Interpreter	200	Empty, retain. Assistant Result Interpreter
34	Technician	200	Empty, retain. Technician
35	Transcriptionist	200	Empty, retain. Transcription
36	Scheduled Date/Time	26	Empty, retain. Scheduled Date/Time
37	Number of Sample Containers	4	Empty, retain. Number of Sample Containers
38	Transport Logistics of Collected Sample	60	Empty, retain. Transport Logistics of Collected Sample
39	Collector’s Comment	200	Empty, retain. Collector’s Comment
40	Transport	60	Empty, retain. Transport Arrangement Responsibility
41	Transport Arranged	30	Empty, retain. whether transportation need to be arranged or not
42	Escort Required	1	Empty, retain. Escort Required
43	Planned Patient Transport Comment	200	Empty, retain. Planned Patient Transport Comment
44	Ordering Facility Name	60	Empty, retain. Ordering Facility Name
45	Ordering Facility Address	106	Empty, retain. Ordering Facility Address
46	Ordering Facility Phone	48	Empty, retain. Ordering Facility Phone Number

	Number		
47	Ordering Provider Address	106	Empty, retain. Ordering Provider Address

Notes: This message segment only used in ORU^R01. 1st, 3rd, 37th column use “Integer Data Type”; 9th column use “Real Float Decimal Numeric”; another colume use “String data type”.

When trasfering item Calibration test result, (MSH-16 take 1), the column defined as following:

No	Column	Length	Notes
1	Set ID – OBR	10	Confirm different OBR column
2	Placer Order Number	22	Patient Order Number, used as item no.
3	Filler Order Number	22	Doctor Order Number, used as item name
4#	Universal Service ID	200	Universal service identifier，using Heto^type
5	Priority	2	Empty, retain. Priority
6	Requested Date/time	26	Empty, retain. Requested Date/time
7	Observation Date/Time	26	Observation Date/Time ,Used as Calibration time
8	Observation End Date/Time	26	Empty, retain. Observation End Date/Time
9	Collection Volume	20	Used as calibration rule. 0- One-point linear 1- Two-point linear 2- Mutiple-point linear 3- Logistic-Log4P 4- Logistic-Log5P 5- Exponential5P 6- Polynomial5P 7- Parabola 8- Spline
10	Collector Identifier	60	Empty, retain. Collector Identifier
11	Specimen Action	1	Quantity of Calibration liquid
12	Danger Code	60	Calibration liquid no.
13	Relevant Clinical Info	300	Calibration liquid name
14	Specimen Received Date/Time	26	Calibration liquid batch code

15	Specimen Source	300	Calibration liquid valid date
16	Ordering Provider	120	The standard concentration of Cal. liquid
17	Order Callback Phone Number	40	Cal. liquid level High-H；Middle-M；Lower-L
18	Placer Field 1	60	Response
19	Placer Field 2	60	Quantity of Cal parameter
20	Filler Field 1	60	Cal parameter value
21	Filler Field 2	60	Empty, retain.
22	Result Rpt/Status Change – Date/Time	26	Empty, retain. Result Rpt/Status Change – Date/Time
23	Charge to Practice	40	Empty, retain. Charge to Practice
24	Diagnostic Serv Sect ID	10	Empty, retain. Diagnostic Serv Sect ID
25	Result Status	1	Empty, retain. Result Status
26	Parent Result	200	Empty, retain. Parent Result
27	Quantity/Timing	200	Empty, retain. Quantity/Timing
28	Result Copies To	150	Empty, retain. Result Copies To
29	Parent	150	Empty, retain. Parent
30	Transportation Mode	20	Empty, retain. Transportation Mode
31	Reason for Study	300	Empty, retain. Reason for Study
32	Principal Result Interpreter	200	Empty, retain. Principal Result Interpreter
33	Assistant Result Interpreter	200	Empty, retain. Assistant Result Interpreter
34	Technician	200	Empty, retain. Technician
35	Transcriptionist	200	Empty, retain. Transcription
36	Scheduled Date/Time	26	Empty, retain. Scheduled Date/Time
37	Number of Sample Containers	4	Empty, retain. Number of Sample Containers
38	Transport Logistics of Collected Sample	60	Empty, retain. Transport Logistics of Collected Sample
39	Collector’s Comment	200	Empty, retain. Collector’s Comment

40	Transport Arrangement Responsibility	60	Empty, retain. Transport Arrangement Responsibility
41	Transport Arranged	30	Empty, retain. Transport Arranged
42	Escort Required	1	Empty, retain. Need to escort
43	Planned Patient Transport Comment	200	Empty, retain. Planned Patient Transport Comment
44	Ordering Facility Name	60	Empty, retain. Applicant name
45	Ordering Facility Address	106	Empty, retain. Applicant address
46	Ordering Facility Phone Number	48	Empty, retain. Applicant telephone no.
47	Ordering Provider Address	106	Empty, retain. Ordering Provider Address

Notes: This message segment only used in ORU^R01.e1st,9th,11th,19th,37th column use “Integer Data Type”; 10th column use “Real Float Decimal Numeric”; other colume use “String data type”.The content of 12th~18th colume is based on the quantity of Cal liquid. The format is V1^V2^…Vi . The 20th colume is based on the quantity of Cal parameters. Use ^ separator to separate different values too .

Different Cal rules have different Cal parameters.

 For one-point linear Cal, two-point Cal and multiple-point linear Cal , there are two Cal parameters :K、R0；

 For Logistic-Log4P，there are 4 Cal parameters :K、R0、a、b。

 For Logistic-Log5P and Exponential 5P，there are 5 Cal parameters :K、R0、a、b、c。

 For Polynomial 5P，there are 5 Cal parameters :R0、a、b、c、d。

 For Parabola，there are 3 Cal parameters :R0、a、b。

 For Spline，there are 4*(n-1) Cal parameters :R0i、ai、bi，ci. N is the quantity of Cal liquid

When trasfering QC test result, (MSH-16 takes 2), the column defined as following:

No	Column	Length	Notes
1	Set ID – OBR	10	Confirm different OBR column
2	Placer Order Number	22	Patient Order Number, used as item no.
3	Filler Order Number	22	Doctor Order Number, used as item name
4	Universal Service ID	200	Universal service identifier，using manufactory’s name^type

5	Priority	2	Empty, retain. Priority
6	Requested Date/time	26	Empty, retain. Requested Date/time
7	Observation Date/Time	26	Used as quality control time
8	Observation End Date/Time	26	Empty, retain. Observation End Date/Time
9	Collection Volume	20	Empty, retain.
10	Collector Identifier	60	Empty, retain.
11	Specimen Action Code	1	Quantity of quality control
12	Danger Code	60	Quality control no.
13	Relevant Clinical Info.	300	Quality control name
14	Specimen Received Date/Time	26	Quality control batch lot
15	Specimen Source	300	Quality control valid date
16	Ordering Provider	120	Empty, retain.
17	Order Callback Phone Number	40	Quality control liquid level High-H；Middle-M；Lower-L
18	Placer Field 1	60	Quality control liquid value (mean concentration)
19	Placer Field 2	60	Quality control liquid standard deviation
20	Filler Field 1	60	Test result value (concentration)
21	Filler Field 2	60	Empty, retain.
22	Result Rpt/Status Change – Date/Time	26	Empty, retain. Result Rpt/Status Change – Date/Time
23	Charge to	40	Empty, retain. Charge to Practice

	Practice		
24	Diagnostic Serv Sect ID	10	Empty, retain. Diagnostic Serv Sect ID
25	Result Status	1	Empty, retain. Result Status
26	Parent Result	200	Empty, retain. Parent Result
27	Quantity/Timing	200	Empty, retain. Quantity/Timing
28	Result Copies To	150	Empty, retain. Result Copies To
29	Parent	150	Empty, retain. Parent
30	Transportation Mode	20	Empty, retain. Transportation Mode
31	Reason for Study	300	Empty, retain. Reason for Study
32	Principal Result Interpreter	200	Empty, retain. Principal Result Interpreter
33	Assistant Result Interpreter	200	Empty, retain. Assistant Result Interpreter
34	Technician	200	Empty, retain. Technician
35	Transcriptionist	200	Empty, retain. Transcription
36	Scheduled Date/Time	26	Empty, retain. Scheduled Date/Time
37	Number of Sample Containers	4	Empty, retain. Number of Sample Containers
38	Transport Logistics of Collected Sample	60	Empty, retain. Transport Logistics of Collected Sample
39	Collector’s Comment	200	Empty, retain. Collector’s Comment
40	Transport Arrangement Responsibility	60	Empty, retain. Transport Arrangement Responsibility
41	Transport	30	Empty, retain. Transport Arranged

	Arranged		
42	Escort Required	1	Empty, retain. Need to escort Escort Required
43	Planned Patient Transport Comment	200	Empty, retain. Planned Patient Transport Comment
44	Ordering Facility Name	60	Empty, retain. Applicant name
45	Ordering Facility Address	106	Empty, retain. Applicant address
46	Ordering Facility Phone Number	48	Empty, retain. Applicant telephone no.
47	Ordering Provider Address	106	Empty, retain. Ordering Provider Address

Notes: This message segment only used in ORU^R01. 1st, 11th, 37th column use “Integer Data Type” Others use “String data type”.

The 12th、13th、14th、15th、17th、18th、19th、20th 11th, 37th column format are V1^V2^…Vi based on quantity of quality control.

Notice: Regarding the daytime QC, every QC test will be combined to one message sending. And regarding time to time QC and intraday QC, couples of QC test of every test combing to be one message sending, but for QC test from different batch will sending separately.

1.7.5 OBX Observation

OBX is mainly used for transmission of observed information of relevant test report. If it’s the patient sample test information (MSH - 16 to 0) to be trnsfered, a patient may have multiple OBX, this interface does not provide repeatability test for test data, datas will be dealt automatically by customer system.

The OBX field of Heto HL7 port uses the following domain：

Serial No.	Field	Length	Remark
1	Set ID – OBX	10	To determine the different OBX fields
2	Value Type	3	Value types, used to identify the type of test results NM (numeric) means a numeric value, used for quantitative items ST (string) means a string value, used for

			qualitative items
3	Observation Identifier	590	Inspection items channel number,used for item ID number
4	Observation Sub-ID	20	Empty, retain , Observation Sub-ID ,Test item name
5	Observation Value	65536	Observation value, used as a quantitative inspection result value (result concentration, feminine gender or masculine gender)
6	Units	90	Empty, retain ,Unit, the unit of test results value
7	References Range	90	Empty, retain ,Reference range,the test normal range results value
8	Abnormal Flags	5	Empty, retain .Abnormal signs, to check if test results are normal (description) L- on the low side H- on the low side N- Normal
9	Probability	5	Empty, retain. Possibility
10	Nature of Abnormal Test	2	Empty, retain. Abnormal test cause
11#	Observe Result Status	1	Observe result status，take F-final results
12	Date Last Observe Normal Values	26	Empty, retain. The last date for observe normal value
13	User Defined Access Checks	20	User-defined access checking, used for the original results
14	Date/Time of the Observation	28	observation date/ time，used for check time
15	Producer's ID	60	Empty, retain. Used for result producer ID
16	Responsible Observer	80	Responsible for the observer, used as inspection doctor
17	Observation Method	60	Empty, retain. Observation method.

Notes: This message only appears in the ORU ^ R01 message. No.1, 3, 9 fields use the integer data type; No.5, 13 fields use floating point data types; The string data type should be used in

other fields. Need to be aware that after do the SI item testing, No. 5, 13 field format will be results 1 ^ Result 2 ^ Reuslt 3, including result 1 for turbidity (L), result 2 as hemolysis (H), and result 3 as jaundice (I), these are the SI item three results respectively.

1.7.6 QRD - query definition segment

The QRD field of Heto HL7 port uses the following domain：

No.	Field	Length	Remark
1	Query Date/Time	26	Time of this query, take system time
2	Query Format Code	1	Query format code, select R（record-oriented format）
3	Query Priority	1	Query priority, select D（deferred）
4	Query ID	10	Query ID，marking different query, and query itmes are increasing from 1.
5	Deferred Response Type	1	Empty，retain.Defer response type
6	Deferred Response Date/Time	26	Empty，retain。Defer response date/time.
7	Quantity Limited Request	10	Quantity limited request, select RD（Records）
8	Who Subject Filter	60	Query person filter, used as patient sample barcode.
9	What Subject Filter	60	Query content filter, set as OTH during query.
10	What Department Data Code	60	Empty，retain.Department data code.
11	What Data Code Value Qual.	20	Empty，retain.Data code value limits.
12	Query Results Level	1	Empty，retain. Query results level, select T（Full results）

Notes：This information field can appeare in QRY^Q02 and DSR^Q03. The 8th field is sample

barcode number during real-time acquisition, and it is empty during batch acquisition or acquire as per serial number. The 4th field is integral data type, and the other fields are using character string data type.

1.7.7 QRF - query filter segment

Use cooperatively QRF and QRD to further refine original query content. The QRF field of Heto HL7 interface is using the following domains：

No.	Field	Length	Remark
1	Where Subject Filter	20	Query person place filter, select device model. HETO^AU400
2	When Data Start Date/Time	26	Record start date/time,Used for the beginning of sample receive time during query.
3	When Data End Date/Time	26	Record and date/time,Used for the end of sample receive time during query.
4	What User Qualifier	60	Empty, retain.User qualified symbol
5	Other QRY Subject Filter	60	Empty, retain. Other QRF reception filter
6	Which Date/Time Qualifier	12	Target type, select RCT（Specimen receipt date/time, receipt of specimen in filling ancillary (Lab)）
7	Which Date/Time Status Qualifier	12	Target status, select COR（Corrected only (no final with corrections)）
8	Date/Time Selection Qualifier	12	Date/time selection qualifier, select ALL（All values within the range）
9	When Quantity/Timing Qualifier	60	Empty, retain. Time intervals

Notes： This information field can appear in QRY^Q02 and DSR^Q03. The 3rd and 4th segment are the time for acquisition at 0:00 and acquisition when it happens. Used for query the condition of time interval. All segments use the stiring type.

1.7.8 ERR - error segment

ERR Segment is used to add error notes during confirm message. The ERR segment of Heto HL7 interface use the following domain：

No.	Field	Length	Remark
1	Error Code and Location	80	Error code and position

Nots： This message segment may appear in QCK^Q02、DSR^Q03 or ACK^Q03 message(refers to message error status code table for details). This information segment has only one segment, using integral data type.

1.7.9 QAK - query acknowledgment segment

QAK segment contains some message following query response. QAK segment of Heto HL7 interface use the following domain：

No.	Field	Length	**Remark**
1	Query Tag	32	Query Tag, select SR（means sample application 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

Notes： This message segment may appear in QCK^Q02 and DSR^Q03 information. All fields use character string data type.

1.7.10DSP - display data segment

DSP segment is used to display the sample application information and patient information by querying. It can be repeated. DSP segment of Heto HL7 interface uses the following domains：

No.	**Field**	**Length**	**Remark**
1	Set ID - DSP	4	Confirm different DSP segment
2	Display Level	4	Display level
3#	Data Line	300	Data line, query contents
4	Logical Break Point	2	Logical Break Point
5	Result ID	20	Result ID

Notes： This message segment may appear in DSR^Q03 information. The first field use integral data type and other fields use character string data type.

The 3rd field “Data Line” is used to display the sample application information downloaded from LIS server. Each detailed item and order of sample application information shows as below table. Thereinto, barcode No. and item No. are indispensable, but other information can be blank. If the sample itmes are more than 1, it will add field from the 29th field, and the format is the same as the 29th field.

No.	Content	Length	Type and value
1	Admission No.	**20**	Admission No.
2	Bed No.	**20**	Bed No.
3	Patient Name	**48**	Patient Name
4	Date of Birth	**26**	Date of Patient Birth
5	Sex	**1**	Male = M； Female = F； Other = O
6	Patient Alias	**48**	O、A、B、AB. Patient Alias
7	Race	**80**	Empty, retain, Race
8	Patient Address	**106**	Patient Address
9	County Code	**20**	County Code
10	Home Phone Number	**40**	Home Phone Number
11	Business Phone Number	**40**	Empty, retain Business Phone Number
12	Primary Language	**40**	Empty, retain, Primary Language
13	Marital Status	**80**	Empty, retain, Marital Status
14	Religion	**80**	Empty, retain, Religion
15	Patient Account Number	**20**	Empty, retain, Patient Account outpatient； inpatient； Other
16	Social Security Number	**16**	Social Security Number
17	Driver License Number	**40**	Driver License Number own； insurance

18	Ethnic Group	**80**	Ethnic Group
19	Birth Place	**60**	Birth Place
20	Nationality	**80**	Nationality
21	Bar Code	**40**	Bar Code
22	Sample ID	**10**	Sample ID
23	Sample Time	**26**	Sample Time
24	Priority	**2**	Y； N； If it is blank, the default is N
25	Collection Volume	**20**	Empty, retain, Collection Volume
26	Sample type	**20**	serum; plasma; urine; Cerebrospinal fluid; Other
27	Fetch Doctor	**60**	Fetch Doctor
28	Fetch Department	**60**	Fetch Department
29	Test ID^Test Name^Unit^Normal Range	**65535**	Item No.^item name^unit^reference range

1.7.11DSC - Continuation pointer segment

DSC segment is used to indicate if it is the last data message in the response data

No.	**Field**	**Length**	**Remark**
1	Continuation pointer	180	Continuation pointer

Notes: the information segment is only used in DSR^Q03. When responding batch query in DSR^Q03 data, the only field in DSR segment can not be blank except the last sample application information field can be blank (the mark of data transmission complete). This information segment has only one field, and the data type is integral type.

3.Communication procees and message example

3.1 Message Format

Generally speacking, the formate of HL7 message is:
<SB> ddddd <EB><CR>
Thereinto, <SB> represents the begining of message , corresponding with <VT> of ASCII , namely 0x0B ；
<EB> represents the end of message ,corresponding with <FS> of ASCII, namely 0x1C；
<CR> represents the end confirmation of message, and it's also separator of different messages , namely 0x0D；
ddddd is the real content need to be transferred , involves several segments and each segment is end up with <CR>， namely 0x0D.

Attention : Among all following message example , In the field which represent time , if it's 14 digital , the time format is yyyymmddhhMMss , if it's 8 digital , time format is yyyymmdd
Following is content of a series of messages based on HL7 format.

3.2 Sample result delivery

Analyzer sent the sample test result to LIS server and use sample as unit to transfer. Namely involved tests of a sample are transferred as a message.

When receiving the message, the LIS host first judges the legality and type of the message and then replies accordingly
1.
Thereinto , there are MSH、PID、OBR、OBX (if a sample involves several items , it has several OBX segments)segments which are involved in ORU message .And MSH is the message header involved in any message. The format shows below(The word in bracket of every segments is interpretive language, not the content of the segment itself)

MSH|^~\&|Heto(Manufacturer name)|AU400(Instrument model)|||20070423101830(Current system time，format yyyymmddhhMMss)||ORU^R01(message type)|1(message control ID，Identified message, it will be added from 1 as the message amout increase.)|P(Fixed value，represents product)|2.5(the version of HL7 protocol used)||||0(sample test result takes 0、calibration test result takes 1、control test result takes 2、others empty)||UNICODE(character set)|||

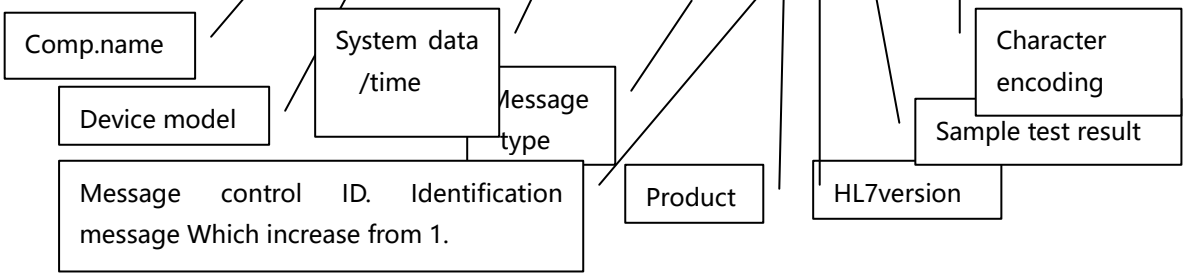
.
If there is a patient, the information shows below：

Field	Value
Patient name	Mike
Gender	Male
Birth Date	01.10.85
Sample barcode	12345678

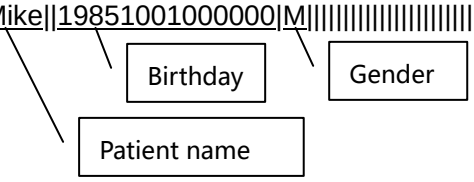
Sample Type	Serum
Sample ID	10
STAT	Yes
Item ID	2、5、6
Item name	TBil、ALT、AST
Test result	100、98.2、26.4
Result unite	umol/L、umol/L、umol/L

Then the message ORU^R01 sent to LIS server is:

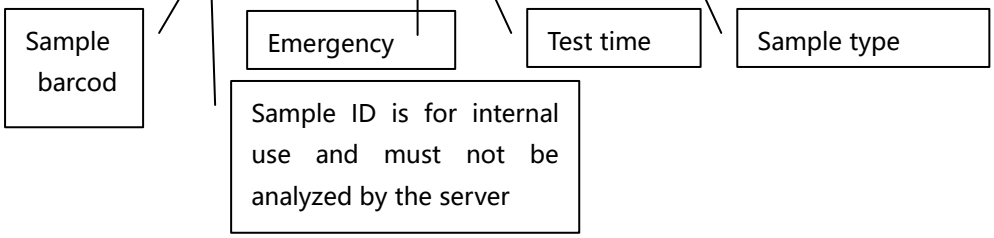
<SB>MSH|^~\&|HETO|AU400|||20070423101830||ORU^R01|1|P|2.5||||0||UNICODE|||<CR>



PID|1||||Mike||19851001000000|M|||||||||||||||||||||<CR>



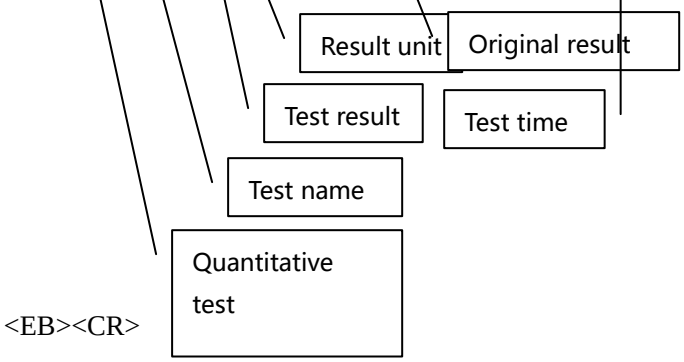
OBR|1|12345678|10|HETO^AU400|Y||20070413093253|||||||scrum|||||||||||||||||||||||||||||<CR>



OBX|1|NM||Tbil|100|umol/L||||||100|20070413093253||||<CR>

OBX|2|NM||ALT|98.2|umol/L||||||98.2|20070413093253||||<CR>

OBX|3|NM||AST|26.4|umol/L||||||26.4|20070413093253||||<CR>



<EB><CR>

When receiving the message, the LIS host first judges the legality and type of the message and then replies accordingly. The following is a standard reply by LIS

<SB>MSH|^~\&|HETO|AU400|||20070423101830||ACK^R01|1|P|2.5||||0||UNICODE|||<CR>

Message type : response of ORU

MSA|AA|1|Message accepted|||0|<CR>

Text information

Error code

Message is received

<EB><CR>

If error is included in the ORU message, it can be returned in the MSA segment, and the analyzer will handle it properly and trigger alarms. Eg: When an reject error of 206 occurs on the LIS host, the ACK message for reply is as follows:

<SB>MSH|^~\&|HETO|AU400|||20070423101830||ACK^R01|1|P|2.5||||0||UNICODE|||<CR>

Message tpe ； response of ORU

MSA|AR|1|Application record locked|||206|<CR>

Text information

Error Code

Mesaage is rejected

<EB><CR>

3.3Sample information aquisition

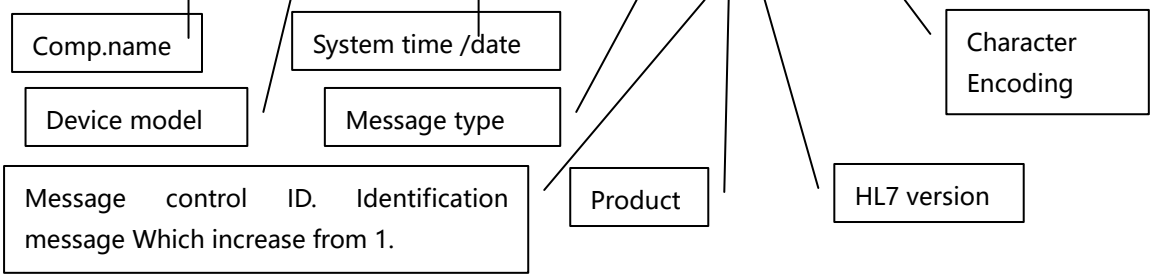
Analyzer obtains sample information from LIS server. In **AU400**, the acquisition condition is basically on sample barcode , sample ID or start and end time of sample application , and sent as acquisition request. When receiving the message, the LIS host first judges the legality and type of the message and then replies accordingly

Thereinto , there areMSH、MSA、ERR、QAK、QRD、DSP、DSC (DSP has many segment , every segment represents a property)segments which are involved in DSR message .And MSH is the message header involved in any message. The format shows below(The word in bracket of every segments is interpretive language, not the content of the segment itself)

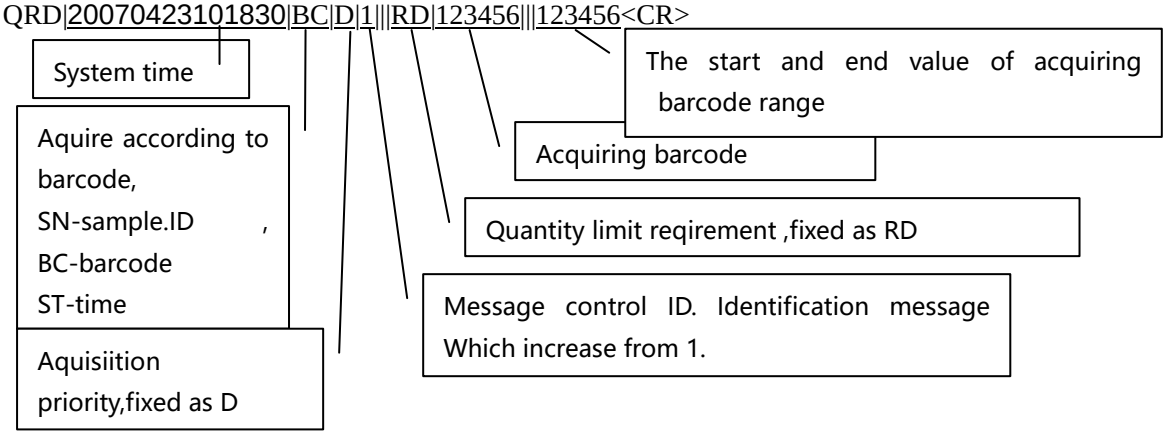
MSH|^~\&|Heto(Manufacturer name)|AU400(Instrument model)|||20070423101830(Current system time，format yyyymmddhhMMss)||DSR^Q03(message type)|1(message control ID，Identified message, it will be added from 1 as the message amout increase.)|P(Fixed value，represents product)|2.5(the version of HL7 protocol used) |||||| UNICODE (character set)|||

If acquiring a sample barcode :123456 , the QRY Q02 message that should be sent to LIS server is：

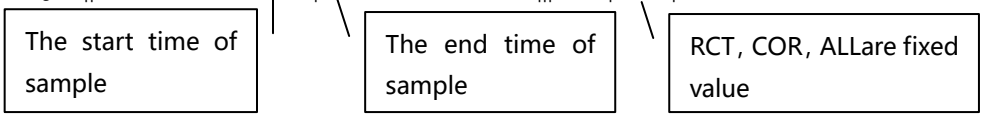
<SB>MSH|^~\&|HETO|AU400|||20070423101830||QRY^Q02|1|P|2.5|||||UNICODE<CR>



QRD|20070423101830|BC|D|1|||RD|123456|||123456<CR>



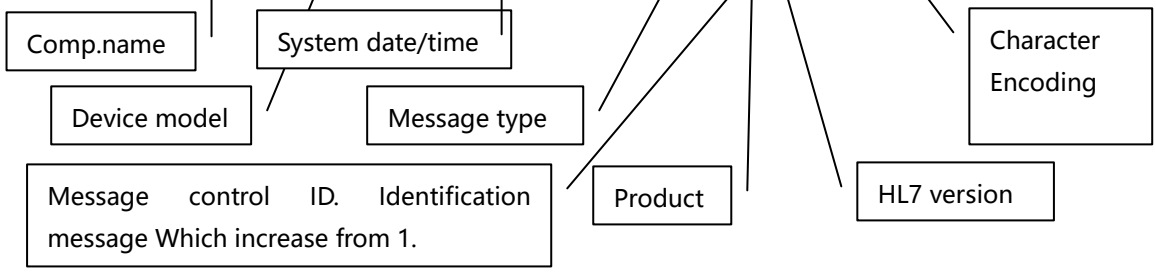
QRF||20070423000000|20070423101830|||RCT|COR|ALL<CR>



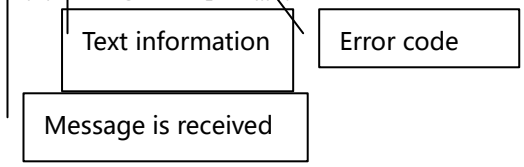
<EB><CR>

When receiving the message, the LIS host first judges the legality and type of the message and then replies accordingly：

<SB>MSH|^~\&|HETO|AU400| ||20070423101830||DSR^Q03|1|P|2.5|||||UNICODE<CR>



MSA|AA|1|Message accepted|||0|<CR>



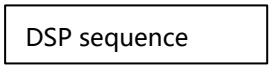
ERR|0|<CR>

QAK|SR|OK|<CR>

QRD|20070423101830|BC|D|6|||RD||||123456<CR>

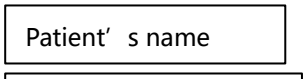
DSP|1|||||<CR>

DSP|2|||||<CR>

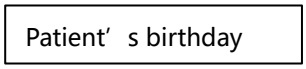


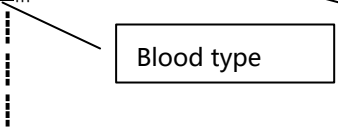
DSP|3||YOLDASSIS NI|||<CR>

DSP|4||20050101010101|||<CR>



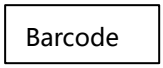
DSP|5||O|||<CR>



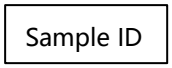


DSP|21||123456|||<CR>

DSP|22||1|||<CR>

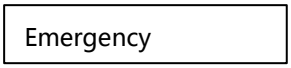


DSP|23|||||<CR>



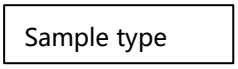
DSP|24||N|||<CR>

DSP|25|||||<CR>

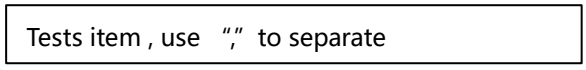


DSP|26||Serum|||<CR>

DSP|27|||||<CR>

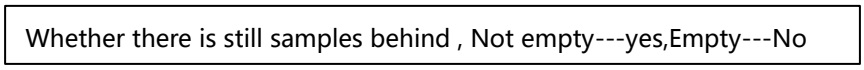


DSP|28|||||<CR>



DSP|29||ALT,TP|||<CR>

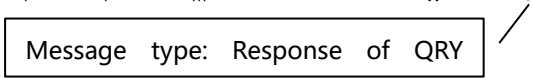
DSC||<CR>



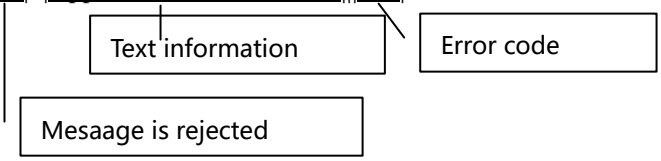
<EB><CR>

If there is mistake in QRY message that LIS server receive. Error code can be set in MSA segment and returned . Chemistry software will deal with it as error and give a alarm. Eg:When LIS server send a reject error code such as 206 , the responsive DSR message is：

<SB>MSH|^~\&|HETO|AU400|||20070423101830||DSR^Q03|1|P|2.5||||0||UNICODE|||<CR>



MSA|AR|1|Application record locked|||206|<CR>



<EB><CR>