HL7 Protocol, Communication protocol specifications

RADIOMETER

Table of Contents

System performance

The procedures described in this manual must be observed in order to ensure proper system performance, and to avoid hazards.

Radiometer cannot provide or verify system performance characteristics if the system is not installed, used and maintained in accordance with Radiometer procedures or if accessories not meeting the specifications provided by Radiometer are used.

Radiometer warrants that the data media on which the software included in the system is furnished is free from defects in material and workmanship under normal use for three (3) months from the date of delivery as evidenced by a copy of invoice or receipt.

Warranties and disclaimer

Radiometer makes no warranties, express or implied, other than expressly stated.

Any warranties expressly stated in this document are conditional upon the system being installed, used and maintained in accordance with Radiometer procedures, including that only accessories meeting the specifications provided by Radiometer are used.

Radiometer disclaims any liability for system performance if the system is not installed, used and maintained in accordance with Radiometer procedures or if accessories not meeting the specifications provided by Radiometer are used.

Further, Radiometer disclaims any liability for loss of data and direct, consequential or other damages, including loss of profit or loss of business, whether such claim for damages is based upon contract, negligence or tort (including strict liability), and even if Radiometer has knowledge of the possibility of the potential damage or loss.

Confidentiality

The contents of this document shall not be reproduced or communicated to any third party without the prior written consent of Radiometer.

Changes

This document is subject to change without notice.

While every effort is made to ensure the correctness of the information provided in this document as changed from time to time, Radiometer disclaims any liability for errors and omissions.

Radiometer, the Radiometer logo, ABL, AQT, TCM, RADIANCE, AQURE, PICO, CLINITUBES and QUALICHECK are trademarks of or used under license by Radiometer Medical ApS.

© 2016 Radiometer Medical ApS. All rights reserved.

Table of Contents

Overview

Introduction This manual describes the structure of the HL7 high-level protocol. In the product setup program, this is the HL7 option. This manual also describes how Radiometer analyzers and the RADIANCE system implement the HL7 protocol. This manual is not for the ABL5xx/6xx analyzer series.

Contents This book contains the following topics.

HL7 Protocol

Overview

Introduction This section describes how Radiometer analyzers and the RADIANCE system implement the HL7 protocol. This manual is not for the ABL5xx/6xx analyzer series.

Introduction

Introduction

This manual covers the specification of the following high-level communication protocol.

- HL7 2.2

Radiometer analyzers and the RADIANCE system use this protocol to connect to HIS/LIS systems.

Terminology

Terminology	Unless otherwise stated, when the following is written it refers to:
Radiometer analyzers	**All** analyzers and devices produced by Radiometer from, and including, the ABL700 analyzer series. For more information about Radiometer analyzers using this protocol, see the CPS reference manual 994-188.

Message structure

Introduction The following table briefly describes concepts used when describing the HL7 high level protocol. For further details refer to the original HL7 v 2.2 standard specification.

Concept	Definition
Message	A complete, self-contained entity of data. An example of a message is a complete patient test result including patient identification, order information, parameter values and error messages
Segment	A message is composed of segments each containing related elements of data (attributes). Examples of segments are the patient information segment keeping all the patient data that is common to all tests and the order segment keeping data that is common for the individual test.
Field	Each segment has a number of fields each holding one or more data elements (attributes). For instance, the patient information segment has a field containing the patient's name and a field holding the patient's birth data.
Component field	A field may be divided into several component fields. The name field of the patient information segment has the components last name, first name and middle initials.

Message Messages consist of various segment types that are listed in the table below.

Segment Type	Name
MSH	Message header segment
PID	Patient information segment
PV1	Patient Visit Segment
OBR	Test order segment
OBX	Result segment
NTE	Notes and comments segment
QRD*	Query definition segment

*Not transmitted by the ABL9 analyzer

Message Structure Example

To report measurements, calibration results, quality control results and system messages, and to request information such as patient demographics, the analyzer sends messages to the HIS/LIS as a sequence of segments.

The example below shows the message structure for reporting a measurement.

Segment Type	Name
MSH	Message header segment
PID	Patient information segment
OBR	Observation request segment
NTE	Notes and comments segment
OBX	Observation/result segment 1
NTE	Notes and comments segment
OBX	Observation/result segment 2
NTE	Notes and comments segment
OBX	Observation/result segment 3
OBX	Observation result segment 4
OBX	Observation result segment 5
OBX	Observation result segment 6
OBX	Observation/result segment 7

The Notes and Comments segment are only transmitted if a system message, or an Audit Trail, applies to the previous segment.

The first Notes and Comments segment following the Observation request segment applies to the entire result, whereas Notes and comments segment following the Observation/result segment apply to individual parameters.

Delimiters

Delimiters are used to separate the segment into fields and components. Delimiters may vary from implementation to implementation, and are defined as part of the header segment. The following delimiters are used in Radiometer analyzers:

Delimiter	Name	Dec. Code	Hex. Code
"|"	Field delimiter	124	7C
"~"	Repeat field delimiter	126	7E
"^"	Component field delimiter	94	5E

Delimiter	Name	Dec. Code	Hex. Code
"&"	Sub compound delimiter	38	26
"\"	Escape character	92	5C
<CR>	Segment	13	D

Note: The Segment delimiter is always <CR> Carriage Return

Dec code: 13

The Segment delimiter <CR> is applied to the end of all segment types.

Escaping Component Delimiters in Fields

Introduction If text in a component contains a component delimiter, the text must be translated so that the receiver can parse the message correctly. How this is done depends on the installed RADIANCE system version and analyzer software version.

RADIANCE system v2.71 and lower

When a field contains a delimiter then each delimiter is translated to a '?' character in the transmitted message.

E.g. Field lastname=fieldvalue1^fieldvalue2 will be transmitted as fieldvalue1?fieldvalue2

RADIANCE system v2.72 or higher

When a field contains a delimiter then it is escaped according to the standard. Each delimiter is prefixed by the escape delimiter.

E.g. Field lastname=fieldvalue1^fieldvalue2 will be transmitted as fieldvalue1\^fieldvalue2

Analyzer software

Fields are translated such that ^ is replaced with ? or escaped with the escape delimiter depending on the analyzer software version. Please contact your Radiometer Service Representative to find out which method is used for your analyzer.

*The ABL9 analyzer escapes all delimiter characters shown in the chart above except the ampersand (&).

Retaining old component behavior

For installations which have been upgraded to the new standard, where it is desired to maintain the old behavior for component delimiter handling please contact your Radiometer Service Representative for an update.

Dates and Times	Dates are always represented as: YYYYMMDD Times are always represented as: HHMMSS Dates and times together are represented as: YYYYMMDDHHMMSS
Decimal Values	Decimal values are transmitted with a period as the decimal separator, e.g. 7.243

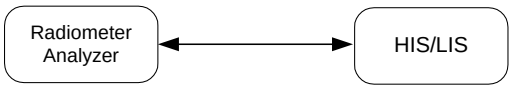
Message types and structure

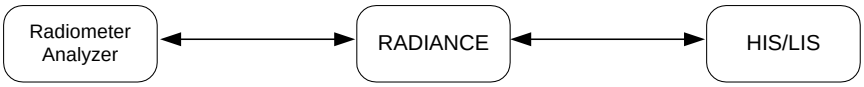
Introduction High-level Communication between Radiometer analyzers and the HIS/LIS or the RADIANCE system and the HIS/LIS system is specified in this manual as a series of messages, whether they are ASTM, ASTM6xx, or HL7.

The exchanged messages can be divided into 3 groups:

1. Messages sent by Radiometer analyzers or the RADIANCE system to HIS/LIS.
2. Messages received by Radiometer analyzers or the RADIANCE system from HIS/LIS.
3. Query-Response messages where Radiometer analyzers or the RADIANCE system sends a query message and expects a response message from the HIS/LIS.

These messages are exchanged between the Radiometer analyzers and the HIS/LIS or between the RADIANCE system and the HIS/LIS depending upon the installation setup:





When the RADIANCE system is used to interface with the HIS/LIS the process of sending messages to the HIS/LIS is a 2-step sequence where the analyzer first sends a message to the RADIANCE system, which then sends a message to HIS/LIS. Likewise, the process of receiving messages from the HIS/LIS is a 2-step sequence where the RADIANCE system receives the message and then forwards it to the analyzer.

Note: The messages exchanged between Radiometer analyzers and the RADIANCE system is proprietary and is not discussed in this manual.

The following sections categorize the messages according to the above 3 groups, and illustrate the message flow between Radiometer analyzers or the RADIANCE system and the HIS/LIS system depending upon the installation setup.

Messages Sent The Messages sent by Radiometer analyzers and the RADIANCE system to the HIS/LIS system are:

- Patient Result
- Calibration Result

- Quality Control Result
- Activity Log Message
- Calibration Verification Result (AQT specific)
- Built-in QC Result (AQT specific)
- Calibration Adjustment Result (AQT specific)

Messages Received

The Messages received by Radiometer analyzers and the RADIANCE system from the HIS/LIS system are:

- Command Message
- Unsolicited Patient Information Message
- Unsolicited Patient by Department Message

Note: For a description of the unsolicited messages, refer to the message specifications for the Patient Information Response and the Patient by Department Response.

Query-Response Messages

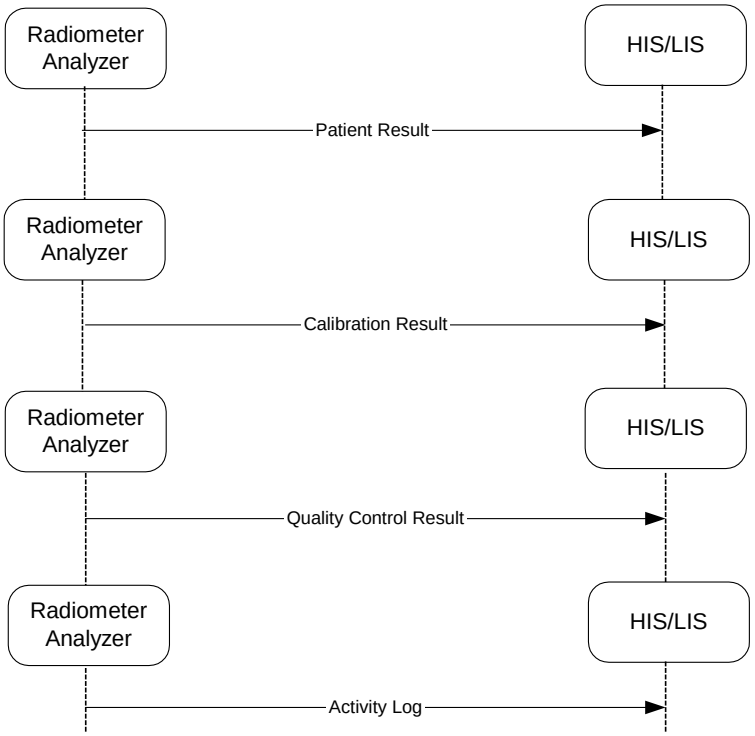
The Query-Response Messages where Radiometer analyzers or the RADIANCE system sends a query message and expects a response message from the HIS/LIS include:

- Patient Information Query/Patient Information Response
- Patient by Department Query/Patient by Department Response

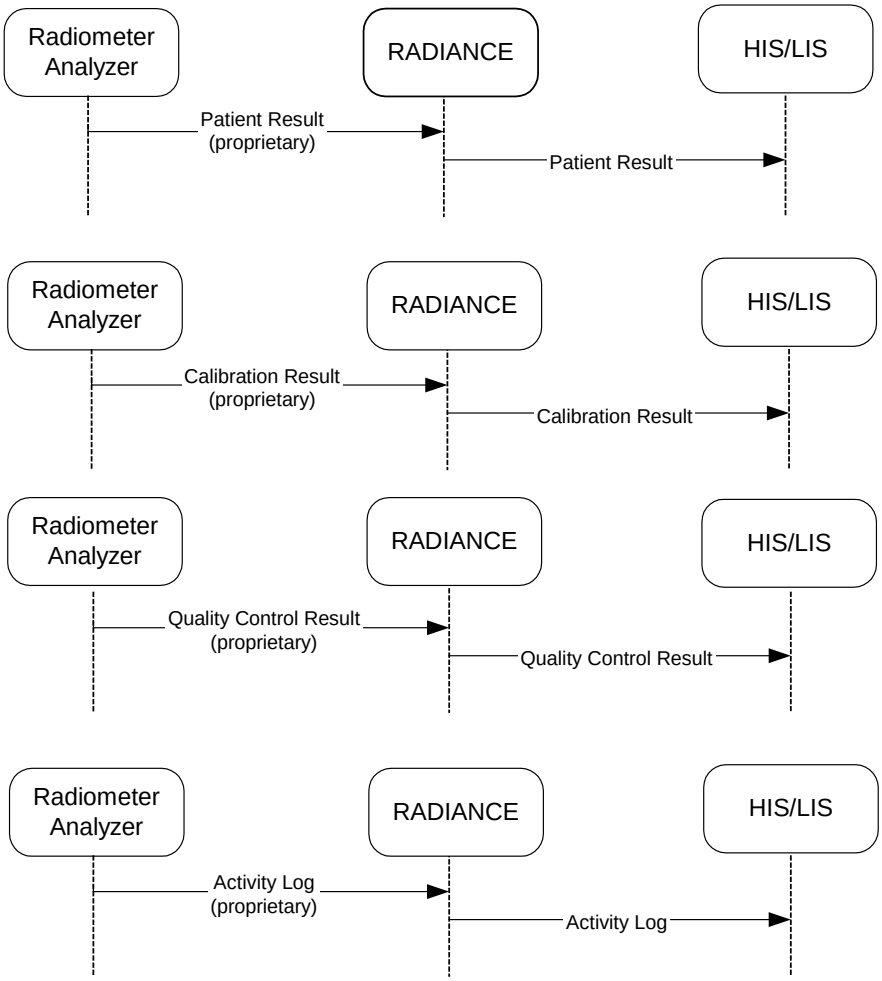
Note: In this manual the Query message specifications are included in the section for "Messages Sent from the Analyzer or the RADIANCE system" whereas the Response message specifications are included in the sections for "Messages Received by the Analyzer or the RADIANCE system".

Message Flows for Sent Messages

The following diagram illustrates the flow of messages sent from Radiometer analyzers when connected to the HIS/LIS system directly.

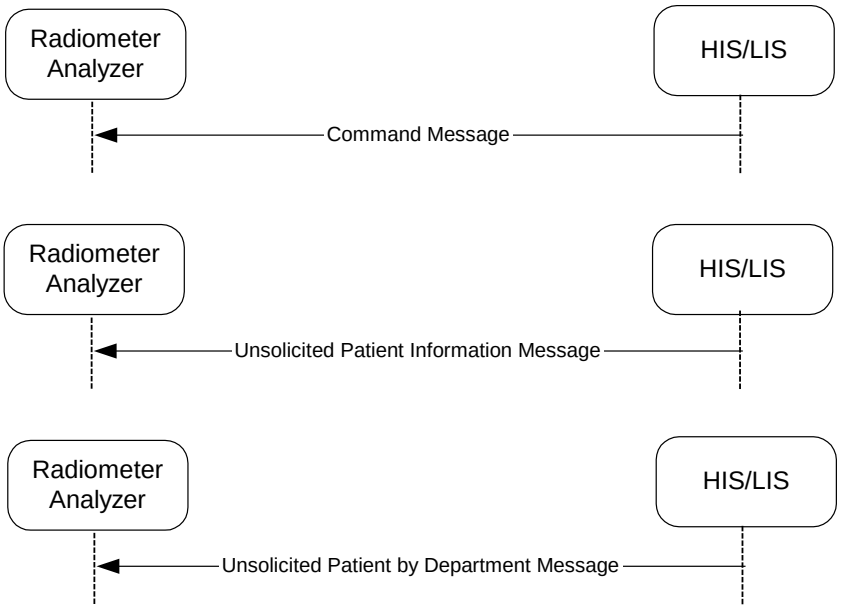


The following illustrates the flow of messages when a Radiometer analyzer is connected to the RADIANCE system and the latter is configured to send all result types to the HIS/LIS system.



Message Flows for Received Messages

The following diagram illustrates the flow of messages received by Radiometer analyzers when connected to the HIS/LIS system directly.



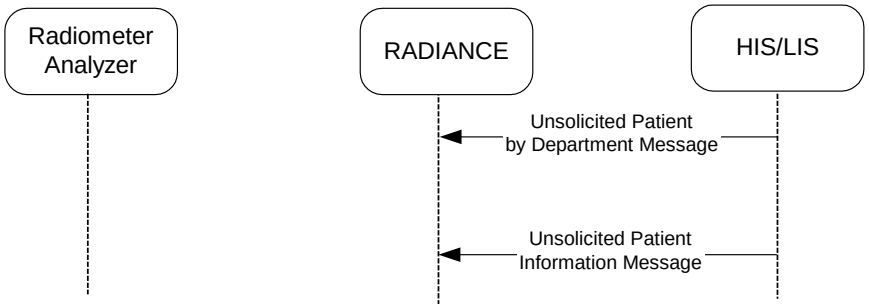
When Radiometer analyzers or the RADIANCE system receives a Patient Information Response or a Patient by Department Response and there is no outstanding query then it is considered unsolicited.

In these cases the information is stored in the patient profile database and is not attached to any patient test result.

When the RADIANCE system receives a **Patient by Department Response** or **Patient Information Response** and there is no outstanding query from the Radiometer analyzer then it is considered unsolicited.

This message is used to update the RADIANCE database with the latest patient information for a given patient department. It is not forwarded to the Radiometer analyzer.

The following diagram illustrates the **Unsolicited Patient by Department Message** and **Unsolicited Patient Information Message** when the RADIANCE system is connected to the HIS/LIS system.



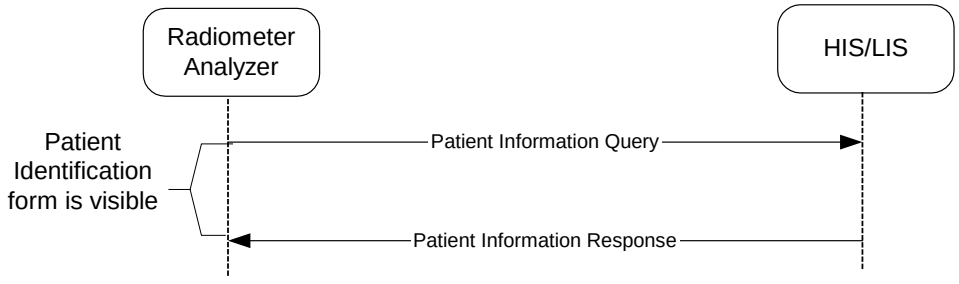
Message Flows for Query-Response Messages

For Query-Response messages, Radiometer analyzers initiate the Query and the Response is sent by the HIS/LIS system.

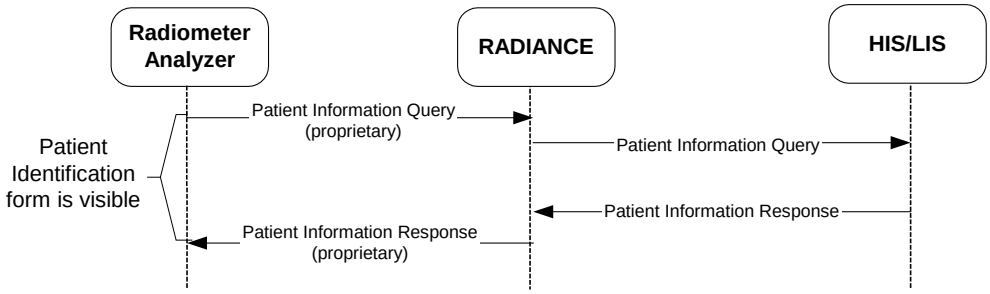
If the analyzer is connected to the RADIANCE system, then the RADIANCE system relays the queries from the analyzer to the HIS/LIS system, and, likewise, relays responses from the HIS/LIS system to the analyzer.

The following diagram illustrates the flow of messages for the Patient Information Query when the analyzer is connected to the HIS/LIS system directly.

Note: If in Radiometer analyzers the Patient Identification Form is closed before the response to a patient information request has been received, the response is treated as an unsolicited patient information message. Hence, a response received after the Patient Identification form has been closed is stored as a patient profile in the Radiometer analyzer's database, but the information received is not attached to any patient test result.



The following diagram illustrates the flow of messages for the Patient Information Query when the Radiometer analyzer is connected to the RADIANCE system.



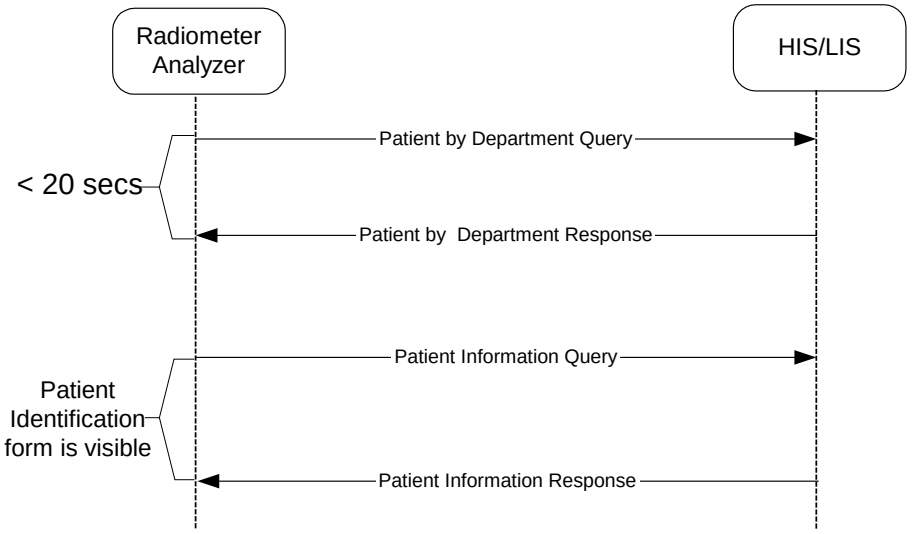
When the **Patient Lookup** function is activated on Radiometer analyzers, a series of queries is made. First the Patient by Department Query is made to obtain a list of patients. When the user chooses a patient the Radiometer analyzer then sends a Patient Information Query to obtain more detailed demographics information on the chosen patient.

*Not implemented by the ABL9 Analyzer.

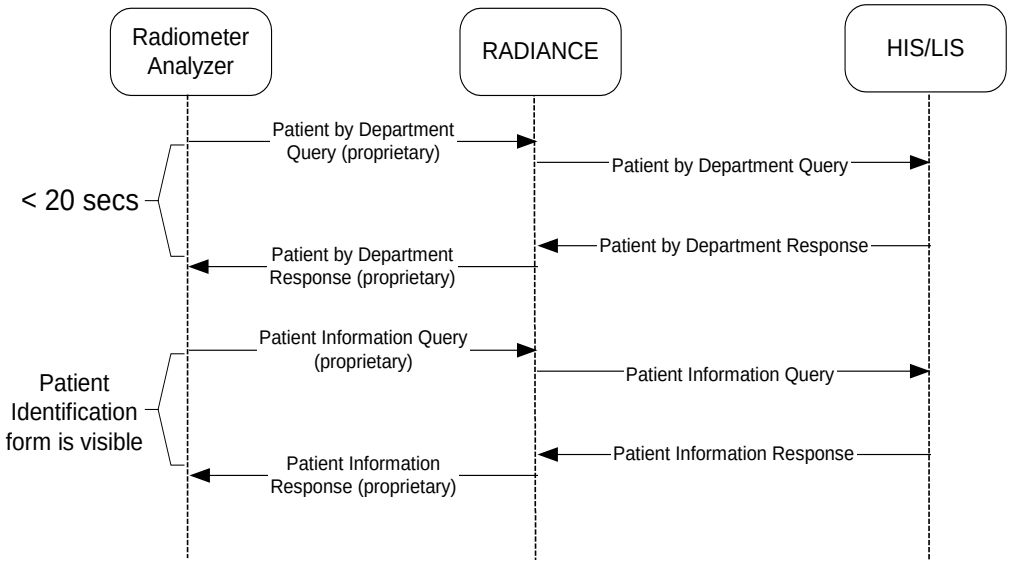
Note: If Radiometer analyzers do not receive a response to a Patient by Department Query within 20 seconds of sending the query, the query times out. A response received after the timeout is treated as an unsolicited Patient by Department message and is stored in the patient by department list in the Radiometer analyzer's database. The information received is not attached to any patient test result.

Flow of Analyzer Messages to the HIS/LIS

The following diagram illustrates the flow of messages when the Radiometer analyzer is connected directly to the HIS/LIS system.



The following diagram illustrates the flow of messages for **Patient by Department** Query when the Radiometer analyzer is connected to the RADIANCE system, and the RADIANCE system is configured for these queries.



Note:

- The timeout value on the Radiometer analyzer of 20 seconds may be changed to meet site-specific requirements. Please consult your Radiometer Service Representative if necessary.
- Patient by Department Query is not supported in ASTM6xx.

HL7 Message Structure and Examples

Overview

Introduction The following gives examples of the message structure.

Contents This section contains the following topics:

- **Messages sent from the Radiometer analyzer**
- **Messages received by the Radiometer analyzer**

Messages sent from the Radiometer analyzer

Introduction This section gives examples of messages that are sent from Radiometer analyzers to the HIS/LIS.

Patient result

Message Structure

The message structure of a patient result is shown below. The segment type <NTE> is only sent if a comment is present. The number of OBX segments depends on the analyzer.

Segment Type	Name
MSH	Header segment
PID	Patient Information segment
OBR	Test order segment
[{NTE}]	0 or more Comment segments associated with entire patient result **Note:** Radiometer analyzers can only have 0 or 1 comment records
[{OBX	0 or more Result segments each containing a parameter value in the patient result
[{NTE}]	Optional Comment segment associated with previous result segment (parameter value) **Note:** Radiometer analyzers can only have 0 or 1 comment records.
}]	

Example

Two examples are given below to illustrate a patient result transmission.

Radiometer Analyzers

```
MSH|^~\&|ABL735^ABL735 Operating Theatres|ABL735^ABL735
Operating
Theatres|||20010516135518||ORU^R01|20010516135518|P^not
present|2.2
PID|1|||F87248654|Doe^John|||U
OBR|1||6^Sample #|||||||O||||Arterial^
NTE|1|L|443
OBX|1|ST|^pH^M||7.600|||N|||F|||20010503151400||
OBX|2|ST|^pO2^M||127|mmHg||N|||F|||||
OBX|3|ST|^pCO2^M||20.4|mmHg||N|||F|||||
OBX|4|ST|^Cl-^M||73|mmol/L||N|||F|||||
OBX|5|ST|^K+^M||5.5|mmol/L||N|||F|||||
OBX|6|ST|^Na+^M||125|mmol/L||N|||F|||||
OBX|7|ST|^Glu^M||11.3|mmol/L||N|||F|||||
OBX|8|ST|^Lac^M||10.0|mmol/L||N|||F|||||
```

```
OBX|9|ST|^Ca++^M||0.36|mmol/L||N|||F|||||
OBX|10|ST|^tHb^M||17.3|g/dL||N|||F|||||
NTE|1|L|314
OBX|11|ST|^sO2^M||.....|%||N|||F|||||
NTE|1|L|314
OBX|12|ST|^O2Hb^M||-58.4|%||<|||F|||||
NTE|1|L|314^94
OBX|13|ST|^COHb^M||110.4|%||>|||F|||||
NTE|1|L|314^93
OBX|14|ST|^MetHb^M||-6.5|%||<|||F|||||
NTE|1|L|314^94
OBX|15|ST|^tBil^M||.....|micromol/L||<|||F|||||
NTE|1|L|314^94
OBX|16|ST|^T^I||37.0|Cel|||||F|||||
OBX|17|ST|^FIO2^D||21.0|%|||||F|||||
OBX|18|ST|^pH(T)^M||7.600|||N|||F|||||
OBX|19|ST|^pCO2(T)^M||20.4|mmHg||N|||F|||||
OBX|20|ST|^SBE^C||-1.5|mmol/L|||||F|||||
OBX|21|ST|^pO2(T)^M||127|mmHg||N|||F|||||
```

RADIANCE system Trans-mission (Audit Trail enabled)

In the following example a retransmission is illustrated where temperature has been changed from 37 to 39.4 and FIO2 has been changed from 21% to 80%. At the same time there is a calibration error on pH.

Note:

There are the following differences from Radiometer Analyzers transmission

1. Audit Trail NTE segments
2. A transmission status in the OBR segment of "C" for Correction
3. A transmission status in the OBX segments of "C" for Correction.
4. Only 1 error per NTE segment. The error text is included as the 2nd component in field 3.

```
MSH|^~\&|ABL735^Central Lab.|ABL735^Central
Lab.|||20020723101533||ORU^R01|20020723101533|P^not
present|2.2
PID|1|||0004|Sørensen^Susanne||19460123|F
OBR|1||271^Sample #|||||||O||||Arterial^Femoral,
right|||||||||C
OBX|1|ST|^pH^M||7.412|||N|||R|||20020723093536||JBS
```

```
NTE|1|L|377^Calibration Drift 2 out of range
OBX|2|ST|^pH(T)^C||7.377|||N|||C|||||
NTE|1|O|CHANGE^2002-07-23 09:35:57 (JBS) pH(T): 7.412 ->
7.377
OBX|3|ST|^p50(act),T^E||4.12|kPa||N|||C|||||
NTE|1|O|CHANGE^2002-07-23 09:35:57 (JBS) p50(act),T: 3.47 ->
4.12
OBX|4|ST|^p50(act)^E||3.47|kPa||N|||F|||||
OBX|5|ST|^pCO2^M||5.53|kPa||N|||F|||||
OBX|6|ST|^pCO2(T)^C||6.21|kPa||N|||C|||||
NTE|1|O|CHANGE^2002-07-23 09:35:57 (JBS) pCO2(T): 5.53 ->
6.21
OBX|7|ST|^pO2^M||11.5|kPa||N|||F|||||
OBX|8|ST|^pO2(T)^C||13.3|kPa||N|||C|||||
NTE|1|O|CHANGE^2002-07-23 09:35:57 (JBS) pO2(T): 11.5 -> 13.3
OBX|9|ST|^SBE^C||1.7|mmol/L||N|||F|||||
OBX|10|ST|^ABE^C||1.6|mmol/L||N|||F|||||
OBX|11|ST|^Ca++^M||1.21|mmol/L||N|||F|||||
OBX|12|ST|^Ca(7.4)^C||1.22|mmol/L||N|||F|||||
OBX|13|ST|^Cl-^M||110|mmol/L||N|||F|||||
OBX|14|ST|^Glu^M||8.0|mmol/L||N|||F|||||
OBX|15|ST|^cH+^C||?38.7|nmol/L||N|||F|||||
OBX|16|ST|^HCO3-^C||?25.9|mmol/L||N|||F|||||
OBX|17|ST|^SBC^C||?25.8|mmol/L||N|||F|||||
OBX|18|ST|^K+^M||3.6|mmol/L||N|||F|||||
OBX|19|ST|^cH+(T)^C||42.0|nmol/L||N|||C|||||
NTE|1|O|CHANGE^2002-07-23 09:35:57 (JBS) cH+(T): 38.7 -> 42.0
OBX|20|ST|^Lac^M||0.6|mmol/L||N|||F|||||
OBX|21|ST|^Na+^M||142|mmol/L||N|||F|||||
OBX|22|ST|^tCO2(B)^C||?50.2|Vol%||N|||F|||||
OBX|23|ST|^tHb^M||9.4|mmol/L||N|||F|||||
OBX|24|ST|^sO2^M||0.973|||N|||F|||||
NTE|1|L|377^Calibration Drift 2 out of range
OBX|25|ST|^COHb^M||0.013|||N|||F|||||
OBX|26|ST|^RHb^M||0.027|||N|||F|||||
OBX|27|ST|^MetHb^M||0.005|||N|||F|||||
OBX|28|ST|^T^I||39.4.0|Cel||N|||C|||||
NTE|1|O|CHANGE^2002-07-23 09:35:57 () T: 37.0 -> 39.4
OBX|29|ST|^FIO2^I||0.800|||N|||C|||||
NTE|1|O|CHANGE^2002-07-23 09:35:57 () FIO2: 0.210 -> 0.800
```

The following example is a transmission sent by the RADIANCE system, which has been received from an AQT90 analyzer. It illustrates how < and > can appear in the reported values:

```
MSH|^~\&|AQT90^AA1|AQT90^AA1|||20081003164625||ORU^R31|1|P|2.
5|||AL|NE|US|8859/1

PID|1||111111110||Mogensen^John||19280505|M

PV1|1|U|StatLink Test Patient Department

ORC|NW|||||||||||||||||||||||||||

OBR|1|||^|||||||||||BLDA^^^LLFA^^^P|^||||||20081002171850|||F
|||||||||mfc0

NTE|1|L|999^Result error message: service Text

OBX|1|ST|^^^Age^I||50|years||N|||F|||20081002171850||^mfc0|||
20081002171850

OBX|2|ST|^^^CPAP^I||12|cmH2O||N|||F

OBX|3|ST|^^^TnI^M||15.0|ug/L|16.0-17.0|N|||F

OBX|4|ST|^^^CKMB^M||<20.0|ug/L|21.0-22.0|N|||F

OBX|5|ST|^^^Myo^M||30.0|ug/L|31.0-32.0|N|||F

OBX|6|ST|^^^NT-proBNP^M||<20000|ng/L|20001-20002|N|||F

OBX|7|ST|^^^D-dimer^M||5.0|ug/L|6.0-7.0|N|||F

OBX|8|ST|^^^CRP^M||>50.0|mg/L|51.0-52.0|N|||F

OBX|9|ST|^^^beta-hCG^M||150.000|IU/L|151.000-152.000|N|||F
```

Calibration result

Message Structure

The message structure of a calibration result is shown below. The record type <NTE> is only sent if a comment is present. The number of OBX records depends on the analyzer.

Segment Type	Name
MSH	Header segment
PID	Patient Information segment. Contains fixed string P|1
OBR	Test order segment. Identifies calibration result.
[{NTE}]	0 or more Comment segments associated with entire calibration result **Note:** Radiometer analyzers can only have 0 or 1 comment records
[{OBX	0 or more Result segments each containing a parameter value in the calibration result
[{NTE}]	Optional Comment segment associated with previous result segment (parameter value) **Note:** Radiometer analyzers can only have 0 or 1 comment records.
}]	

Example

A transmission example for a calibration result is given below.

```
MSH|^~\&|ABL735^ABL735 Operating Theatres|ABL735^ABL735
Operating
Theatres|||20010516135620||ORU^R01|20010516135620|P^not
present|2.2
PID|1
OBR|1||202^Cal #|||||||O||||2 Point Calibration
OBX|1|ST|^Glu^1^M||10.0|mmol/L|||||F|||20010516123000||
OBX|2|ST|^Glu^Sens^M||866.4|pA/mM|||||F|||||
OBX|3|ST|^Glu^Drift^M||-0.0|mmol/L|||||F|||||
OBX|4|ST|^Lac^1^M||4.0|mmol/L|||||F|||||
OBX|5|ST|^Lac^Sens^M||1181.0|pA/mM|||||F|||||
OBX|6|ST|^Lac^Drift^M||-0.0|mmol/L|||||F|||||
OBX|7|ST|^tHb^Zero^M||580.26|pA|||||F|||||
OBX|8|ST|^tHb^ZeroDrift^M||0.75|pA|||||F|||||
OBX|9|ST|^tHb^ZeroStatus^M||0||||||F|||||
OBX|10|ST|^pH^1^M||7.404||||||F|||||
```

```
OBX|11|ST|^pH^Status^M||7.453||||||F|||||
OBX|12|ST|^pH^Drift1^M||0.000||||||F|||||
OBX|13|ST|^pH^2^M||6.876||||||F|||||
OBX|14|ST|^pH^Sens^M||97.8|%|||||F|||||
OBX|15|ST|^pH^Drift2^M||0.000||||||F|||||
OBX|16|ST|^K+^1^M||3.9|mmol/L|||||F|||||
OBX|17|ST|^K+^Status^M||3.1|mmol/L|||||F|||||
OBX|18|ST|^K+^Drift1^M||0.0|mmol/L|||||F|||||
OBX|19|ST|^K+^2^M||40.1|mmol/L|||||F|||||
OBX|20|ST|^K+^Sens^M||98.1|%|||||F|||||
OBX|21|ST|^K+^Drift2^M||0.1|mmol/L|||||F|||||
OBX|22|ST|^Na+^1^M||145|mmol/L|||||F|||||
OBX|23|ST|^Na+^Status^M||41|mmol/L|||||F|||||
OBX|24|ST|^Na+^Drift1^M||-0|mmol/L|||||F|||||
OBX|25|ST|^Na+^2^M||20|mmol/L|||||F|||||
OBX|26|ST|^Na+^Sens^M||96.7|%|||||F|||||
OBX|27|ST|^Na+^Drift2^M||0|mmol/L|||||F|||||
OBX|28|ST|^Cl-^1^M||102|mmol/L|||||F|||||
OBX|29|ST|^Cl-^Status^M||195|mmol/L|||||F|||||
OBX|30|ST|^Cl-^Drift1^M||-0|mmol/L|||||F|||||
OBX|31|ST|^Cl-^2^M||53|mmol/L|||||F|||||
OBX|32|ST|^Cl-^Sens^M||95.1|%|||||F|||||
OBX|33|ST|^Cl-^Drift2^M||-0|mmol/L|||||F|||||
OBX|34|ST|^Ca++^1^M||1.24|mmol/L|||||F|||||
OBX|35|ST|^Ca++^Status^M||1.05|mmol/L|||||F|||||
OBX|36|ST|^Ca++^Drift1^M||-0.00|mmol/L|||||F|||||
OBX|37|ST|^Ca++^2^M||5.00|mmol/L|||||F|||||
OBX|38|ST|^Ca++^Sens^M||96.7|%|||||F|||||
OBX|39|ST|^Ca++^Drift2^M||0.01|mmol/L|||||F|||||
OBX|40|ST|^pO2^1^M||138.7|mmHg|||||F|||||
OBX|41|ST|^pO2^Sens^M||22.9|pA/mmHg|||||F|||||
OBX|42|ST|^pO2^Drift1^M||-0.3|mmHg|||||F|||||
OBX|43|ST|^pO2^2^M||0.2|mmHg|||||F|||||
OBX|44|ST|^pO2^Zero^M||1.2|mmHg|||||F|||||
OBX|45|ST|^pO2^Drift2^M||-0.2|mmHg|||||F|||||
OBX|46|ST|^pCO2^1^M||39.3|mmHg|||||F|||||
OBX|47|ST|^pCO2^Status^M||61.2|mmHg|||||F|||||
OBX|48|ST|^pCO2^Drift1^M||-0.1|mmHg|||||F|||||
OBX|49|ST|^pCO2^2^M||78.8|mmHg|||||F|||||
OBX|50|ST|^pCO2^Sens^M||94.4|%|||||F|||||
```

```
OBX|51|ST|^pCO2^Drift2^M||0.0|mmHg|||||F|||||
OBX|52|ST|^B^M||749|mmHg|||||F|||||
```

Quality control result

Message Structure

The message structure of a quality control result is shown below. The segment type <NTE> is only sent if a comment is present. The number of OBX segments depends on the analyzer.

Segment Type	Name
MSH	Header segment
PID	Patient Information segment. Contains fixed string P|1
OBR	Test order segment. Identifies Quality Control result.
[{NTE}]	0 or more Comment segments associated with entire QC result **Note:** Radiometer analyzers can only have 0 or 1 comment records
[{OBX	**0 or more Result segments each containing a parameter value in the QC result**
[{NTE}]	**Optional Comment segment associated with previous result segment (parameter value)** **Note:** Radiometer analyzers can only have 0 or 1 comment records.
}]	

Examples

Transmission examples for a quality control result are given below.

```
MSH|^~\&|ABL735^ABL735 Operating Theatres|ABL735^ABL735
Operating
Theatres|||20010516135534||ORU^R01|20010516135534|P^not
present|2.2
PID|1
OBR|1||12^QC #||||||||O||||S7755^16
OBX|1|ST|^T^I||32.6|Cel|||||F|||20010516082400||
OBX|2|ST|^pH^M||7.596||||||F|||||
OBX|3|ST|^pO2^M||59.0|mmHg|||||F|||||
OBX|4|ST|^pCO2^M||21.3|mmHg|||||F|||||
OBX|5|ST|^Cl-^M||74|mmol/L|||||F|||||
OBX|6|ST|^Ca++^M||0.36|mmol/L|||||F|||||
OBX|7|ST|^K+^M||5.5|mmol/L|||||F|||||
OBX|8|ST|^Na+^M||125|mmol/L|||||F|||||
```

```
OBX|9|ST|^Glu^M||11.3|mmol/L|||||F|||||
OBX|10|ST|^Lac^M||9.9|mmol/L|||||F|||||
OBX|11|ST|^tHb^M||19.2|g/dL|||||F|||||
OBX|12|ST|^sO2^M||70.0|%|||||F|||||
OBX|13|ST|^O2Hb^M||49.1|%|||||F|||||
OBX|14|ST|^COHb^M||19.9|%|||||F|||||
OBX|15|ST|^MetHb^M||10.0|%|||||F|||||
OBX|16|ST|^tBil^M||443|micromol/L|||||F|||||
OBX|17|ST|^HbF^M||51|%|||||F|||||
OBX|18|ST|^B^M||749|mmHg|||||F|||||
OBX|19|ST|^pH(T)^C||7.591||||||F|||||
OBX|20|ST|^pCO2(T)^C||21.7|mmHg|||||F|||||
OBX|21|ST|^pO2(T)^C||61.0|mmHg|||||F|||||
```

AQT90 Example

Second example is an AQT90 QC result with QC ranges and some errors:

```
MSH|^~\&|AQT90 FLEX^I393-838R9999N0004|AQT90 FLEX^I393-
838R9999N0004|||20090622140645||ORU^R01||P^not
present|2.2||||||
PID|1
OBR|1||14^QC #|||||||O||||hCG2^1
NTE|1|L|1066
OBX|1|ST|^beta-
hCG^M||0.420000|mIU/mL|10.09^65.01^31.8^50.9|L|||F|||20090622
140655||Radiometer
NTE|1|L|1196
```

Calibration Verification result

Message Structure

The message structure of a quality control result is shown below. The segment type <NTE> is only sent if a comment is present. The number of OBX segments depends on the analyzer.

Segment Type	Name
MSH	Header segment
PID	Patient Information segment. Contains fixed string P|1
OBR	Test order segment. Identifies calibration verification result.
[{NTE}]	0 or more Comment segments associated with entire calibration verification result **Note:** Radiometer analyzers can only have 0 or 1 comment records
[{OBX	**0 or more Result segments each containing a parameter value in the calibration verification result**
[{NTE}]	**Optional Comment segment associated with previous result segment (parameter value)** **Note:** Radiometer analyzers can only have 0 or 1 comment records.
}]	

Examples Transmission examples for calibration verification results are given below.

First example is a calibration verification done as an LQC.

```
MSH|^~\&|AQT90 FLEX^R0071N0005|AQT90

FLEX^R0071N0005|||20110516151219||ORU^R01||P^not
present|2.2||||||

PID|1

OBR|1||1^CV #^LQC||||20110317092056||||O||||Non-R-
^1234|||||||||||||||||||{Operator}

OBX|1|ST|^TnI^M||20|ug/L||N|||F|||||

SID|100
```

Second example is a calibration verification done as a patient sample (LCR). Here, the measurement encountered a problem and result was above reportable range.

```
MSH|^~\&|AQT90 FLEX^R0071N0005|AQT90
FLEX^R0071N0005|||20110516151206||ORU^R01||P^not
present|2.2||||||

PID|1

OBR|1||7^CV #^LCR|||||||O||||^|||||||||||||||||{Operator}

NTE|1|L|1071^1071: MaxSampleAge Exceeded

OBX|1|ST|^TnI^M||>25|ug/L||>|||F|||||

SID|100

NTE|1|L|93^0093: Value above the reportable range
```

Calibration adjustment result

Message Structure

The message structure of a quality control result is shown below. The segment type <NTE> is only sent if a comment is present. The number of OBX segments depends on the analyzer.

Segment Type	Name
MSH	Header segment
PID	Patient Information segment. Contains fixed string P|1
OBR	Test order segment. Identifies calibration adjustment result.
[{NTE}]	0 or more Comment segments associated with entire calibration adjustment result **Note:** Radiometer analyzers can only have 0 or 1 comment records
[{OBX	**0 or more Result segments each containing a parameter value in the calibration adjustment result**
[{NTE}]	**Optional Comment segment associated with previous result segment (parameter value)** **Note:** Radiometer analyzers can only have 0 or 1 comment records.
}]	

Example

A transmission example for a calibration adjustment result is given below.

```
MSH|^~\&|AQT90 FLEX^R0071N0005|AQT90
FLEX^R0071N0005|||20110516151137||ORU^R01||P^not
present|2.2||||||

PID|1

OBR|1||11^CalAdjust
#||||20110311114135||||O||20130301||CRP^100||||||||||||||||||
|{Operator}

OBX|1|ST|^^^Blank outliers|OK|2||0^2||||F|||||||

OBX|2|ST|^^^Calibration outliers|OK|0||0^2||||F|||||||
```

AQT Built-in QC result

Message Structure

The message structure of an AQT Built-in QC result is shown below. The segment type <NTE> is only sent if a comment is present. The number of OBX segments depends on the analyzer.

Segment Type	Name
MSH	Header segment
PID	Patient Information segment. Contains fixed string P|1
OBR	Test order segment. Identifies built-in QC result.
[{NTE}]	0 or more Comment segments associated with entire built-in QC result **Note:** Radiometer analyzers can only have 0 or 1 comment records
[{OBX	**0 or more Result segments each containing a parameter value in the built-in QC result**
[{NTE}]	**Optional Comment segment associated with previous result segment (parameter value)** **Note:** Radiometer analyzers can only have 0 or 1 comment records.
}]	

Example

A transmission example for a built-in QC result is given below.

```
MSH|^~\&|AQT90 FLEX^R0071N0005|AQT90
FLEX^R0071N0005|||20110830032933||ORU^R01||P^not
present|2.2||||||

PID|1

OBR|1||1^BuiltinQC
#||||20110317103128||||O|||||||||||||||||||||{Operator}

OBX|1|ST|^^^Power^AU Voltage
12V||12.0||10.8^13.2||||F||OK|||||

OBX|2|ST|^^^Power^AU Voltage
24AV||24.0||21.6^26.4||||F||OK|||||

OBX|3|ST|^^^Power^AU Voltage
24BV||24.0||21.6^26.4||||F||OK|||||

OBX|4|ST|^^^Power^AU Voltage
24CV||24.0||21.6^26.4||||F||OK|||||

OBX|5|ST|^^^Software^Software versions||||^||||F||OK|||||
```

```
OBX|6|ST|^^^Instrument^Instrument
Temperature||26.5||15^38||||F||OK|||||

OBX|7|ST|^^^Wet Section^Needle Pierce
Count||5000||0^10000||||F||OK|||||

OBX|8|ST|^^^Shaker Incubator^Incubation
Temperature||37.0||36.5^37.5||||F||OK|||||

OBX|9|ST|^^^Dryer^Dry Temperature
Before||70.0||68^72||||F||OK|||||

OBX|10|ST|^^^Dryer^Flow Temperature||||^||||F||OK|||||

OBX|11|ST|^^^Optical Unit^Maximum dark||||0^115||||F||OK|||||

OBX|12|ST|^^^Optical Unit^Maximum dark
difference||69||0^70||||F||OK|||||

OBX|13|ST|^^^Optical Unit^Reference Sample||5.0||-
20^30||||F||OK|||||

OBX|14|ST|^^^Optical Unit^Integrator||0.0||-
10^10||||F||OK|||||

OBX|15|ST|^^^Optical Unit^||||-10^10||||F||OK|||||
```

Activity log

Message Structure

The message structure of an activity log is shown below.

Segment Type	Name
MSH	Header segment
PID	Patient Information segment. Contains fixed string P|1
OBR	Test order segment. Contains fixed string O|1||Error
OBX	Result segment containing system message code, optional text and timestamp
[NTE]	Optional Comment segment used to include Extra Info field of activity log. Radiometer analyzers only. See *appendix*.

Example

A transmission example for an activity log is given below.

```
MSH|^~\&|ABL735^ABL735 Operating Theatres|ABL735^ABL735
Operating
Theatres|||20010516135718||ORU^R01|20010516135718|P^not
present|2.2
PID|1
OBR|1||^Error
OBX|1|ST|^Errors||663|||||||||20010515075955
```

Patient information query

Message Structure

This message is sent to the HIS/LIS to request patient demographics for a patient identified via the patient ID.

Segment Type	Name
MSH	Header segment
QRD	Query segment. Contains patient ID used as query key.

* Not implemented by the ABL9 Analyzer.

Example

A transmission example for a query packet is given below.

```
MSH|^~\&|ABL735^ABL735 Operating Theatres|ABL735^ABL735
Operating
Theatres|||20010516153301||ADR^A19|20010516153301|P^not
present|2.2
QRD||R|I|1|||1^RD|123|DEM
```

Patient by department query

Introduction This message is sent to the HIS/LIS to request for a list of patients checked into a specified patient department.

Segment Type	Name
MSH	**Header segment**
QRD	**Query segment. Contains patient ID used as query key.**

* Not implemented by the ABL9 Analyzer.

Example A transmission example for a patient by department query is given below.

Patient department is ICU-2.

```
MSH|^~\&|ABL735^ABL735 Operating Theatres|ABL735^ABL735
Operating
Theatres|||20010521112634||ADR^A19|20010521112634|P^not
present|2.2
QRD||R|I|1|||||ANU|ICU-2
```

Messages Received by the Radiometer analyzer

Introduction This section gives examples of messages that are received by Radiometer analyzers from the HIS/LIS.

Patient information response

Message Structure

This message is sent by the HIS/LIS in response to a Patient Information Query or can be sent as unsolicited patient information.

Segment Type	Name
MSH	Header segment
[MSA]	Optional Message Acknowledgement segment. If this segment is included in the message, the acknowledgement code must be 'AA' (MSA| AA). Radiometer analyzers ignore (do not use) the remaining elements of the MSA segment.
[QRD]	Optional Query Definition segment.
[EVN]	Optional Event segment. Radiometer analyzers ignore all elements of this segment.
PID	Patient Identification segment.
PV1	Patient Visit segment.

Example

A transmission example for a patient information record is given below.

```
MSH|^~\&|||||20010521123420||ADR^A19
PID||||12345|Doe^John||19560521|M
PV1|||ICU-1
```

Patient by department list

Introduction This message is sent by the HIS/LIS in response to a Patient by Department Query.

Segment Type	Name
MSH	Header segment
[MSA]	Optional Message Acknowledgement segment. If this segment is included in the message, the acknowledgement code must be 'AA' (MSA|AA). Radiometer analyzers ignore (do not use) the remaining elements of the MSA segment.
QRD	Optional Query Definition segment. **Note:** this is a mandatory segment.
[EVN]	Optional Query Definition segment. **Note:** This is a mandatory segment.
[{	
PID	0 or more Patient Identification segment-Patient Visit segment pairs.
PV1	
}]	

Transmission Example See below for a transmission example for a Patient By Department list sent by the HIS/LIS in response to a Patient By Department Query.

Patient department -ICU.

The department has four patients.

The segments of the example message include elements not used (e.g. MSA – Timestamp; EVN segment) by Radiometer analyzers.

```
MSH|^~\&|LDS-
LAB|LABOR|RADIANS|ABL700|20000311165904||ADR^A19|R_0000000450
|P|2.2
MSA|AA|20001214145000||
QRD||R|I|1||||ANU|ICU
EVN|A19|20000301165904||
PID|1||1234|56|Doe^John||19610102|M
PV1||I|ICU
PID|2||9966|9966|TheKid^Billy||19650708|M
PV1||I|ICU
PID|3||007|007|Bond^Jimmy||19320511|M
PV1||I|ICU
```

```
PID|4||066|066|Droid^Laura||19750713|F
PV1||I|ICU
```

Command record

Introduction This message may be sent by the HIS/LIS to place a Radiometer analyzer, which is in a Locked or Unlocked state.

Segment Type	Name
MSH	Header segment
QRD	Query segment that emulates the Manufacturer Information segment used to send command. Command LOCK or UNLOCK is in field 8.

Example A transmission example for a command record is given below.

```
MSH|^~\&|||||20010521123420
QRD|||I|1||||LOCK|OTH
```

Detailed Structure of Each Segment Type

Overview

Introduction This section deals with the structure of each segment type.

Message header structure

Introduction The Message header segment contains general information and identifies the sender. The Message header segment is always the first record in a transmission.

Field definitions

Field	Name	Example	Comments
0	Identifier	MSH	Fixed entry
1	Field Separator	|	This field contains the separator between the segment ID and the first real field. As such it serves as the separator and defines the character to be used as a separator for the rest of the message.
2	Encoding Characters	^~\&	
3	Sending Application	ABL725^ICU	This field uniquely identifies the sending application among all other applications within the network enterprise. Analyzer type and user definable analyzer name.
4	Sending Facility	ABL725^ICU	This field contains the address of one of several occurrences of the same application within the sending system. Analyzer type and user definable analyzer name.
5	Receiving Application	Not used	
6	Receiving Facility	Not used	
7	Date/Time Of Message	19991207131842	year: 1999 month/day:12.07 time: 13:18,42
8	Security	Not used	
9	Message Type	ORU^R01	Value ADR^A19 used for queries.

Field	Name	Example	Comments
10	Message Control ID	19991207131842	Queries use transmission time (as per example) Other transmissions can use <MessageControlID> (any unique ID assigned to the message)
11	Processing ID	P^not present	
12	Version ID	2.2	

Examples

```
MSH|^~\&|ABL725^ICU|ABL725^ICU|||19991207131842||ORU^R01|1999
1207131842|P^not present|2.2
```

Patient identification segment

Introduction The patient identification segment contains general information about the patient. Information transmitted in the patient identification segment is entered during the analysis.

Note: The patient identification segment can also be received after a “query for patient information” has been issued.

Field definitions

Field	Name	Example	Comments
0	Identifier	PID	Fixed entry
1	Set ID - patient ID	1	Always 1 in transmissions (only one PID segment is transmitted).
2 *	Patient ID (External ID)	Not used	
3 *	Patient ID (Internal ID)	117118112	Patient ID entered during the analysis. Patient ID can be entered using the bar code reader.
4 *	Alternate Patient ID - PID	Not used	
5	Patient Name	Doe^John	<family name>^<given name> - entered during analysis.
6	Mother’s Maiden Name	Not used	
7	Date/Time of Birth	19601218	Date of birth, if entered during analysis. Date of birth is transmitted in the format: YYYYMMDD
8	Patient Sex	M	M - Male F - Female U - Unknown Sex is entered during analysis.

ABL77 and ABL9 analyzers

The ABL77 and ABL9 analyzers only send this Segment for Patient Results.

Fields are marked * if they differ from other Radiometer analyzers. An explanation follows in the chart below.

Field	Name	Example	Comments
2	Patient ID (External ID)	Not used	
3	Patient ID (Internal ID)	Not used	
4	Alternate Patient ID - PID	Patient ID	Patient ID entered during the analysis.

Example

The following is an example of a patient identification segment.

```
PID|1|||117118112|Doe^John||19601218|M
```

Patient visit segment

Background

This segment communicates the patient department.

* Not transmitted by the ABL9 Analyzer.

Field definitions

Field	Name	Example	Comments
0	Identifier	PV1	Fixed entry
1	Set ID - PV1	1	Always 1
2 *	Patient Class	Not used	
3 *	Assigned Patient Location	Patient Department	Patient Department

ABL77 analyzer

The ABL77 analyzer only sends this Segment for Patient Results.

Fields are marked * if they differ from other Radiometer analyzers. An explanation follows the chart below.

Field	Name	Example	Comments
2	Patient		This field is used for Patient Location when the ABL77 analyzer sends Patient results.
3	Assigned Patient Location		The ABL77 analyzer expects the patient Location to be in Field 3 (Assigned Patient Location) for query responses

Observation request segment

Introduction The observation request segment contains information about the particular test on a single specimen.

Field definitions

Field	Name	Example	Comments
0	Identifier	OBR	Fixed entry
1	Set ID - OBR	1	Always 1 in transmissions from Radiometer analyzers. (Only one OBR segment is transmitted).
2	Placer Order Number	Not used	
3 **	Filler Order Number		<entity identifier>^ <namespace ID> The analyzer automatically generates the entity identifier (number). The text after this number identifies the result type. Each result type has its own series of sequence numbers. 63^Sample # — Sample - patient sample 12^Cal # — Cal – calibration 54^QC # — QC - quality control 417^BuiltinQC # — BuiltinQC – AQT90 built-in QC 4^CalAdjust # — CalAdjust – AQT90 Calibration adjustment 17^CV #^LQC 43^CV #^LCR — Calibration verification (LQC or LCR, resp.) ^Error — Activity log message
4	Universal Service ID	3647537734	<identifier> Accession number entered

Field	Name	Example	Comments
5	Priority	Not used	
6 * **	Requested Date/time	Not used	
7	Observation Date/Time	19990916125604	Draw time entered during analysis. 1999: Year 09: Month 16:Day 12:56,04:
8	Observation End Date/Time	Not used	
9	Collection Volume	Not used	
10 * ***	Collector Identifier	Dr. Johnson	Physician entered
11 *	Specimen Action Code	O	Always set to O. Specimen obtained by service other than Lab
12	Danger Code	Not used	
13	Relevant Clinical Info.	Not used 20111017	Expiration date for Calibration adjustment results, only
14	Specimen Received Date/Time	Not used	

Field	Name	Example	Comments
15 *	Specimen Source	Arterial^femoral right 2 Point Calibration S7730^4 TnI^4074	<specimen source name or code>^<free text additives> **Patient samples:** Radiometer has mapped Sample Type and Sample Site to these two component fields as Sample type^Sample site. Both fields are entered during measurement. **Calibration:** Calibration type **Quality control:** QC Solution ID^QC lot - quality control **Calibration adjust:** **P**arameterName^ Lot
16 *	Ordering Provider	Not used	
17	Order Callback Phone Number	Not used	
18	Placer field 1	Not used	
19	Placer field 2	Not used	
20	Filler Field 1	Not used	
21	Filler Field 2	Not used	
22	Results Rpt/Status Chng - Date/Time	Not used	
23	Charge to Practice	Not used	
24	Diagnostic Serv Sect ID	Not used	

Field	Name	Example	Comments
25 *	Result Status	F or C	F: initially transmitted result. Status “Final. C: retransmitted result. Only set when Audit Trail is enabled. Status “Corrected.
26	Parent Result	Not used	
27	Quantity/Timing	Not used	
28	Result Copies To	Not used	
29	Parent	Not used	
30	Transportation Mode	Not used	
31	Reason for Study	Not used	
32	Principal Result Interpreter	Not used	
33	Assistant Result Interpreter	Not used	
34 *	Technician	Nurse Betty	Operator entered
35	Transcriptionist	Not used	
36 * ***	Scheduled Date/Time	20090916125801	Scheduled time

ABL77 analyzer* fields

Fields are marked * if they differ from other Radiometer analyzers. An explanation follows the chart below.

Field	Name	Example	Comments
6	Requested Date/time		This field is used for “Order Date” in YYYYMMDDHHMM format (Patient Results only).
10	Collector Identifier		This field is used for “Drawn by”. (Patient Results only).
11	Specimen Action Code		This field is not used.
15	Specimen Source		For QC results QCLevel^QC Lot Number is sent rather than QC SolutionID^QC Lot number.

16	Ordering Provider		This field is for “Ordered By” for Patient Results only.
25	Result Status		The ABL77 analyzer and supporting documentation use the term “Edit Log” to denote changes to results rather than the term “Audit Trail”.
34	Technician	Not used	
36	Scheduled Date/Time	Not used	

ABL80 analyzer**

Fields are marked ** if they differ from other Radiometer analyzers. An explanation follows the chart below.

Field	Name	Example	Comments
3	Filler Order Number		The ABL80 analyzer does not send “^Error” for the Activity log. The activity log (edit log) is sent separately.
6	Requested date/time		Not used by Radiometer analyzers but can be configured via configuration file as <%TimestampOrdered%> to be sent by the ABL80 analyzer. In the ABL80 analyzer it is represented as “Order Date”. Only the date part is sent.

ABL9 analyzer*

Fields are marked *** if they differ from other Radiometer analyzers. An explanation follows the chart below.

Field	Name	Example	Comments
10	Collector Identifier	Dr. Johnson	Physician if entered, otherwise logged in user
36	Scheduled Date/Time		Not used

Example

The following is an example of an observation request segment.

```
OBR|1||63^Sample
#|3647537734|||19990916125604|||Dr.Johnson|O||||Arterial^Femo
ral right||||||||||F
```

Observation result segment

Introduction The observation/result segment contains information about a single parameter in a particular test. The parameter can be an input (a keyed-in value), default, measured, calculated, or estimated parameter.

Field definitions

Field	Name	Example	Comments
0	Identifier	OBX	Fixed entry
1	Set ID - OBX	1	Sequence number starts with 1 and increments for each new OBX segment sent.
2	Value Type	ST	Data type. ST = String Data Fixed entry *(This is really a RMED misunderstanding of the HL7 standard, but maintained for backwards compatibility)*

Field	Name	Example	Comments
3 *	Observation Identifier	^pH^M	<identifier>^<text>^<name of coding system> This field consists of three components; the first is not used: Not used ^pH Parameter name ^M Parameter type Parameter names are listed in *Appendix 1* Possible parameter types are: “C” Calculated parameter “D” Default parameter “E” Estimated parameter “I” Input parameter “M” Measured parameter “ ” Parameter type not specified
		^^^Calibration outliers	or **(AQT90 CalAdjust)** ^^^<check type> There are the two check types listed
		^^^Blank outliers	
		^^^Power^AU Voltage 12V	or **(AQT90 builtinQC)** ^^^<check type>^<check point> Check type identifies the hardware, and the check point is the specific check that failed for that hardware
4	Observation Sub-ID	OK Fail	**(AQT90 Built-in QC, only)** Whether the check passed (OK) or failed (Fail)

Field	Name	Example	Comments
5 *	Observation Value	7.273	For AQT results this value can also be prefixed by a < or a > in which case the value represents the lower and higher range respectively, e.g. <10 (meaning value is less than 10) >20000 (meaning value is greater than 20000)
6	Units		Possible units are available in *Appendix*
7 *	References Range	Not used (except:) 10.09^65.01^31.8^50.9 10.8^13.2	Only used for: **Quality control:** <QCMinStatLimit>^<QCMaxStatLimit>^<QCControlRangeLow>^<QCControlRangeHigh> These values represent the QC Statistical Limits and the QC Control Range applied by the analyzer **AQT Builtin QC and AQT CalAdjust:** <LowerLimit>^<UpperLimit> These values represent the ranges used to evaluate the check
8 *	Abnormal Flags	N	Possible result flags are: “N” Normal value “L” Below low normal range “H” Above high normal range “LL” Below low critical range “HH” Above high critical range “<” Below analyzer measuring range “>” Above analyzer measuring range This field can also be empty.
9	Probability	Not used	
10	Nature of Abnormal Test	Not used	

Field	Name	Example	Comments
11 *	Observation Result Status	F C	“F” indicating final result. “C” indicating corrected result (only used if Audit trail is enabled)
12	Date Last Obs Normal Values	Not used	
13	User Defined Access Checks	OK Fail	**(AQT90 CalAdjust, only:)** Whether the check passed (OK) or failed (Fail)
14	Date/Time of the Observation	19990920123412	Time stamp generated when analysis is completed. Only sent with the first “OBX” message. 19990920: date 12:34,12: time
15	Producer's ID	Not used	
16 *	Responsible Observer	McCoy	The operator ID. Only sent with the first “OBX” segment.
17	Observation Method	Not used	

ABL77 analyzer

Fields are marked * if they differ from other Radiometer analyzers. An explanation follows the chart below.

Field	Name	Example	Comments
3	Observation Identifier		For Patient and QC Results the ABL77 analyzer sends: ^Parameter^ParameterType For Calibration Results the ABL77 analyzer sends: ^Parameter^Sens^Parameter Type (Sens = sensitivity) The ABL77 analyzer uses the same Parameter Types with the exception that there are no unspecified (“ ”) or estimated (“E”) parameters on the ABL77 analyzer.
5	Observation Value		Aside from the numeric values the following symbols may be sent: “* * *”. This represents that the value was outside of the display range (for Patient and QC Results only) “# # #”. This represents that the value was outside of the response range (Patient, QC and Calibration results). There can also be a “?” in front of a numeric value to indicate possible air in sample or calibration fluid. In the case of Patient Results a “?” can also mean that the parameter failed QC. The Observation Result Segment will not be sent for a parameter if an abbreviation is used to express the result for that parameter on the Radiometer analyzer (i.e. if a parameter is reported as having no endpoints).

Field	Name	Example	Comments
7	Reference Ranges	**Patient:** OBX|3|ST|^pCO2^M||11|mmHg|(35 - 45)^Ref\(30 - 50)^Crit|LL|||F|||||<CR> **QC:** OBX|2|ST|^pCO2^M||40|mmHg|(36 - 43)|N|||F|||||<CR> **Calibration:** OBX|2|ST|^pCO2^Sens^M||52.0||(30.0 - 61.5)|N|||F|||||<CR>	For Patient Results, reference ranges and critical limits are sent in the following form: (Low-High) ^Ref\(Low-High)^Crit For QC and Calibration Results, the acceptance ranges are in the following form: (Low-High)

Field	Name	Example	Comments
8	Abnormal Flags		For each type of result, the Abnormal Flags have slightly different meanings: For Patient Results: L – Below low reference range. H – Above high reference range. LL – Below low-critical range. HH – Above high critical limit. < -- Below low reportable range. > -- Above high reportable range. N –Normal The field can also be empty. For QC Results: L – Below low acceptable range. H – Above high acceptable range. < -- Below low reportable range. > -- Above high reportable range. N – Normal The field can also be empty.
11	Observation Result Status		The ABL77 analyzer and supporting documentation use the term “Edit Log” to denote changes to results rather than the term “Audit Trail”.
16	Responsible Observer		The ABL77 analyzer and supporting documentation use the term “User Name” rather than “Operator ID”.

Example The following is an example of an observation/result segment.

```
OBX|1|ST|^pH^M||7.273|||N|||F|||19990920123412||McCoy||
```

Message acknowledgement segment (ABL77 analyzer only)

Introduction Only the ABL77 analyzer receives the following Segment.

After a record has been sent, the system will wait for a message from the target host to acknowledge that the record has been accepted. A message header must precede the message acknowledgment segment.

The ABL77 analyzer parses out the first 2 fields (i.e. fields 0-1). The ABL77 analyzer expects this segment to be sent from the host (preceded by a MSH segment) for each Patient, QC and Calibration result that the ABL77 analyzer sends.

Field definitions

Field	HL7 Element Name	ABL77 analyzer Field Name / Data
0	Segment Type ID	MSA
1	Acknowledgement Code	AA (Accepted)

Example

```
MSA|AA
```

Note and comments (Radiometer analyzers)

Introduction Notes and comments segments sent by Radiometer analyzers contain information concerning the general conditions of the Radiometer analyzer or errors/flags on individual parameters.

Note: Notes and comments segments sent by Radiometer analyzers before the first OBX segment are general messages. Comment segments sent after an OBX segment, are related to the preceding OBX segment.

Field definitions

Field	Name	Example	Comments
0	Identifier	NTE	Fixed entry
1	Set ID - NTE	1	
2	Source of Comment	L	Always L, denoting that Ancillary (filler) department is source of comment
3	Comment	94	One or more error codes separated by component delimiters (e.g. 94^123). A list of error codes is available. See *Reference manual.*

ABL77 and ABL80 analyzers The ABL77 and ABL80 analyzers do not send any Notes and comments except in connection with Audit Trail. See **Note and Comments (Audit Trail)** segment.

Example The following is an example of a notes and comments segment.

```
NTE|1|L|94
```

Notes and comments segment (the RADIANCE system)

Introduction

Notes and comments segments sent by the RADIANCE system contain information concerning the general conditions of the analyzer or errors /flags on individual parameters as well as Audit Trail changes made to the result, if this function is enabled.

This section describes the format of Comment records used to document general conditions or errors/flags, which are sent by the RADIANCE system.

The RADIANCE system differs from Radiometer analyzers format in that a Comment record is written for each error, rather than giving a list of errors in one Comment record.

Note:

Notes and comments segments before the first OBX segment are general messages. Comment segments sent after an OBX segment, are related to the preceding OBX segment.

Field definitions

Field	Name	Example	Comments
0	Identifier	NTE	Fixed entry
1	Set ID - NTE	1	
2	Source of Comment	L	Always L, denoting that Ancillary (filler) department is source of comment
3	Comment	377^Calibration drift 2 out of range	<error code>^<error text> A list of error codes is available in *Reference manual.*

Notes and Comments Segment Example

The following is an example of a notes and comments segment.

```
NTE|1|L|377^Calibration Drift 2 out of range
```

Notes and comments segment (Audit trail)

Introduction Notes and comments segments sent by the RADIANCE system contain information concerning the general conditions of the analyzer or errors/flags on individual parameters as well as Audit Trail of changes made to the result, if this function is enabled.

This section describes the format of Notes and comments segments used to document changes to results that are retransmitted by the RADIANCE system, when Audit Trail is enabled.

Note: **Notes and comments** segments before the first OBX segment are used to document changes to patient demographics sent in the PID segment as well as OBX segments (parameter result), which have been deleted, in the changed result. Comment segments sent after an OBX segment document a new OBX segment (parameter result) or a changed OBX segment.

Field definitions

Field	Name	Example	Comments
0	Identifier	NTE	Fixed entry
1	Set ID - NTE	1	
2	Source of Comment	O	Always O, denoting that other system is source of comment.
3 * ** ***	Comment	CHANGE^2002-07-23 09:35:57 (JBS) pH(T): 7.412 ->7.377	CHANGE^<time of change> (<operator>) <parameter>:<old value> -> <new value> For parameters that are inserted <old value> ="<not included>" For parameters that are deleted from the retransmitted result <new value> ="<not included>"

ABL77 analyzer

The only **Note and Comment** segment the ABL77 analyzer sends is the **Note and Comments (Audit Trail)** segment. Fields are marked * if they differ from other Radiometer analyzers. An explanation follows the chart below.

The following is different for the ABL77 analyzer.

Field	Name	Example	Comments
3	Comment	NTE|1|O|CHANGE^2005-01-05 10:35:54 (rjohnson) firstName: Ray -> Jay<CR>	The ABL77 analyzer uses “edit by” to denote (<operator>)

ABL80 analyzer

The only **Note and Comment** segment the ABL80 analyzer sends is the **Note and Comments (Audit Trail)** segment. Fields are marked ** if they differ from other Radiometer analyzers. An explanation follows the chart below.

The following is different for the ABL80 analyzer.

Field	Name	Example	Comments
3	Comment		CHANGE^<time of change> (<operator>) <parameter>:<old value> -> <new value> For parameters that are inserted <old value> ="<no entry>” For parameters that are deleted from the retransmitted result <new value> ="<no entry>”

ABL9 analyzer

Fields are marked *** if they differ from other Radiometer analyzers. An explanation follows the chart below.

The following is different for the ABL9 analyzer.

Field	Name	Example	Comments
3	Comment		CHANGE^<time of change> (<operator>) <parameter>:<old value> -> <new value> For parameters that are inserted <old value> ="[no entry]”

			For parameters that are deleted from the retransmitted result <new value> ="[no entry]"

Example The following is an example of a notes and comments segment with Audit Trail.

```
NTE|1|O|CHANGE^2002-07-23 09:35:57 (JBS) pH(T): 7.412 ->7.377
```

Query definition segment

Introduction A query message, which contains a query segment, can be sent by the analyzer if it is configured for one or both of the following:

- Patient Information Query
- Patient by Department Query

For the Patient Information Query, patient information can be requested using the patient ID.

For Patient by Department Query, a list of patients is requested using the patient department as the query criteria.

* Not transmitted by the ABL9 Analyzer.

Note: Query by Accession number is not supported using HL7 protocol.

Field definitions

Field	Name	Example	Comments
0	Identifier	QRD	Fixed entry
1	Query Date/Time	Not used	
2	Query Format Code	R	Always R signifying that the response is in record-oriented format
3	Query Priority	I	Always I signifying that the priority is immediate
4	Query ID	1	This field contains a unique identifier for the query. Assigned by the querying application. Returned intact by the responding application
5	Deferred Response Type	Not used	
6	Deferred Response Date/Time	Not used	
7	Quantity Limited Request	1^RD	Always 1^RD. This is the maximum length of the response that can be accepted by the requesting system in this case one segment.

Field	Name	Example	Comments
8	Who Subject Filter	11475	In patient information query this field is used for the patient ID.
9	What Subject Filter	DEM	This field signifies what type of information is required to satisfy the request. DEM is used for patient information query. ANU is used for patient by dept. query.
10	What Department Data Code		In patient-by-dept. queries this field is used to identify the patient dept.

Example The following is an example of a query definition segment.

```
QRD||R|I|1|||1^RD|11475|DEM
```

Manufacturer information segment

Introduction

A manufacturer information segment cannot be sent from Radiometer analyzers, but one can be received in order to lock or unlock the analyzer.

More commands can be sent from the RADIANCE analyzer control module.

Field definitions

Field	Name	Example	Comments
0	Identifier	QRD	Fixed entry
1	Query Date/Time	Not used	
2	Query Format Code	Not used	
3	Query Priority	I	Always I signifying that the priority is immediate
4	Query ID	1	This field contains a unique identifier for the query. Always 1.
5	Deferred Response Type	Not used	
6	Deferred Response Date/Time	Not used	
7	Quantity Limited Request	Not used	
8	Who Subject Filter	LOCK	Command to the analyzer LOCK - Places the analyzer in the LOCK mode. UNLOCK - Exits the analyzer from the LOCK mode.
9	What Subject Filter	OTH	Always OTH, as this field signifies what type of information is required to satisfy the request, in this case: Other

ABL9, ABL80 and ABL77 analyzers

The ABL9, ABL80 and ABL77 analyzers do not support this segment.

Example

The following is an example of a manufacturer information segment.

```
QRD|||I|1||||LOCK|OTH
```

Complete Transmission Examples

Overview

Introduction This chapter includes a series of transmission examples using HL7 as a high-level protocol.

Complete transmission examples using ASTM low-level protocol

Example

<ENQ>

<ACK>

<STX>1MSH|^~\&|ABL735^ABL735 Operating Theatres|ABL735^ABL735 Operating
Theatres|||20010528143535||ORU^R01|20010528143535|P^not present|2.2<CR><ETB>FC<CR><LF>

<ACK>

<STX>2PID|1|||F87248654|Doe^John|||U<CR><ETB>90<CR><LF>

<ACK>

<STX>3OBR|1||6^Sample #||||||||O||||Arterial^<CR><ETB>C9<CR><LF>

<ACK>

<STX>4NTE|1|L|443<CR><ETB>CB<CR><LF>

<ACK>

<STX>5OBX|1|ST|^pH^M||7.600|||N|||F|||20010503151400||<CR><ETB>E0<CR><LF>

<ACK>

<STX>6OBX|2|ST|^pO2^M||127|mmHg||N|||F|||||<CR><ETB>8D<CR><LF>

<ACK>

<STX>7OBX|3|ST|^pCO2^M||20.4|mmHg||N|||F|||||<CR><ETB>FC<CR><LF>

<ACK>

<STX>0OBX|4|ST|^Cl-^M||73|mmol/L||N|||F|||||<CR><ETB>EB<CR><LF>

<ACK>

<STX>1OBX|5|ST|^K+^M||5.5|mmol/L||N|||F|||||<CR><ETB>B5<CR><LF>

<ACK>

<STX>2OBX|6|ST|^Na+^M||125|mmol/L||N|||F|||||<CR><ETB>1B<CR><LF>

<ACK>

<STX>3OBX|7|ST|^Glu^M||11.3|mmol/L||N|||F|||||<CR><ETB>96<CR><LF>

<ACK>

<STX>4OBX|8|ST|^Lac^M||10.0|mmol/L||N|||F|||||<CR><ETB>7C<CR><LF>

<ACK>

<STX>5OBX|9|ST|^Ca++^M||0.36|mmol/L||N|||F|||||<CR><ETB>70<CR><LF>

<ACK>

<STX>6OBX|10|ST|^tHb^M||17.3|g/dL||N|||F|||||<CR><ETB>D5<CR><LF>

<ACK>

<STX>7NTE|1|L|314<CR><ETB>CB<CR><LF>

<ACK>

<STX>0OBX|11|ST|^sO2^M||.....|%||N|||F|||||<CR><ETB>A2<CR><LF>

<ACK>

<STX>1NTE|1|L|314<CR><ETB>C5<CR><LF>

<ACK>

<STX>2OBX|12|ST|^O2Hb^M||-58.4|%||<|||F|||||<CR><ETB>E0<CR><LF>

<ACK>

<STX>3NTE|1|L|314^94<CR><ETB>92<CR><LF>

<ACK>

<STX>4OBX|13|ST|^COHb^M||110.4|%||>|||F|||||<CR><ETB>EE<CR><LF>

<ACK>

<STX>5NTE|1|L|314^93<CR><ETB>93<CR><LF>

<ACK>

<STX>6OBX|14|ST|^MetHb^M||-6.5|%||<|||F|||||<CR><ETB>55<CR><LF>

<ACK>

<STX>7NTE|1|L|314^94<CR><ETB>96<CR><LF>

<ACK>

<STX>0OBX|15|ST|^tBil^M||.....|micromol/L||<|||F|||||<CR><ETB>E3<CR><LF>

<ACK>

<STX>1NTE|1|L|314^94<CR><ETB>90<CR><LF>

<ACK>

<STX>2OBX|16|ST|^T^I||37.0|Cel|||||F|||||<CR><ETB>88<CR><LF>

<ACK>

<STX>3OBX|17|ST|^FIO2^I||21.0|%|||||F|||||<CR><ETB>50<CR><LF>

<ACK>

<STX>4OBX|18|ST|^pH(T)^M||7.600|||N|||F|||||<CR><ETB>06<CR><LF>

<ACK>

<STX>5OBX|19|ST|^pCO2(T)^M||20.4|mmHg||N|||F|||||<CR><ETB>D6<CR><LF>

<ACK>

<STX>6OBX|20|ST|^SBE^C||-1.5|mmol/L|||||F|||||<CR><ETB>1C<CR><LF>

<ACK>

<STX>7OBX|21|ST|^pO2(T)^M||127|mmHg||N|||F|||||<CR><ETX>50<CR><LF>

<ACK>

<EOT>

Complete transmission examples using Serial Raw protocol

Examples

```
<STX>
MSH|^~\&|ABL735^ABL735 Operating Theatres|ABL735^ABL735 Operating
Theatres|||20
010528143724||ORU^R01|20010528143724|P^not present|2.2 <CR>
PID|1|||F87248654|Doe^John|||U<CR>
OBR|1||6^Sample #|||||||O||||Arterial^<CR>
NTE|1|L|443<CR>
OBX|1|ST|^pH^M||7.600|||N|||F|||20010503151400||<CR>
OBX|2|ST|^pO2^M||127|mmHg||N|||F|||||<CR>
OBX|3|ST|^pCO2^M||20.4|mmHg||N|||F|||||<CR>
OBX|4|ST|^Cl-^M||73|mmol/L||N|||F|||||<CR>
OBX|5|ST|^K+^M||5.5|mmol/L||N|||F|||||<CR>
OBX|6|ST|^Na+^M||125|mmol/L||N|||F|||||<CR>
OBX|7|ST|^Glu^M||11.3|mmol/L||N|||F|||||<CR>
OBX|8|ST|^Lac^M||10.0|mmol/L||N|||F|||||<CR>
OBX|9|ST|^Ca++^M||0.36|mmol/L||N|||F|||||<CR>
OBX|10|ST|^tHb^M||17.3|g/dL||N|||F|||||<CR>
NTE|1|L|314<CR>
OBX|11|ST|^sO2^M||.....|%||N|||F|||||<CR>
NTE|1|L|314<CR>
OBX|12|ST|^O2Hb^M||-58.4|%||<|||F|||||<CR>
NTE|1|L|314^94<CR>
OBX|13|ST|^COHb^M||110.4|%||>|||F|||||<CR>
NTE|1|L|314^93<CR>
OBX|14|ST|^MetHb^M||-6.5|%||<|||F|||||<CR>
NTE|1|L|314^94<CR>
OBX|15|ST|^tBil^M||.....|micromol/L||<|||F|||||<CR>
NTE|1|L|314^94<CR>
OBX|16|ST|^T^I||37.0|Cel|||||F|||||<CR>
OBX|17|ST|^FIO2^I||21.0|%|||||F|||||<CR>
OBX|18|ST|^pH(T)^M||7.600|||N|||F|||||<CR>
OBX|19|ST|^pCO2(T)^M||20.4|mmHg||N|||F|||||<CR>
OBX|20|ST|^SBE^C||-1.5|mmol/L|||||F|||||<CR>
OBX|21|ST|^pO2(T)^M||127|mmHg||N|||F|||||<CR>
<ETX>
```

Complete transmission examples using Network protocol

Example

```
<SOH>
MSH|^~\&|ABL735^ABL735 Operating Theatres|ABL735^ABL735 Operating
Theatres|||20010521113752||ORU^R01|20010521113752|P^not present|2.2<CR>
PID|1|||123|Weirsoe^Jens|||U<CR>
OBR|1||4^Sample #|||||||O||||Arterial^<CR>
OBX|1|ST|^pO2^M||184|mmHg||N|||F|||20010502182800||<CR>
OBX|2|ST|^pCO2^M||8.7|mmHg||N|||F|||||<CR>
NTE|1|L|210<CR>
OBX|3|ST|^Cl-^M||.....|mmol/L||<|||F|||||<CR>
NTE|1|L|210^94<CR>
OBX|4|ST|^pH^M||7.618|||N|||F|||||<CR>
NTE|1|L|476<CR>
OBX|5|ST|^Glu^M||0.4|mmol/L||N|||F|||||<CR>
OBX|6|ST|^Ca++^M||0.93|mmol/L||N|||F|||||<CR>
NTE|1|L|210<CR>
OBX|7|ST|^K+^M||0.2|mmol/L||<|||F|||||<CR>
NTE|1|L|94<CR>OBX|8|ST|^tHb^M||-0.01|g/dL||<|||F|||||<CR>
NTE|1|L|94<CR>
OBX|9|ST|^sO2^M||.....|%||N|||F|||||<CR>
OBX|10|ST|^RHb^M||.....|%||N|||F|||||<CR>
OBX|11|ST|^O2Hb^M||.....|%||N|||F|||||<CR>
OBX|12|ST|^COHb^M||.....|%||N|||F|||||<CR>
OBX|13|ST|^MetHb^M||.....|%||N|||F|||||<CR>
OBX|14|ST|^tBil^M||0|micromol/L||N|||F|||||<CR>
OBX|15|ST|^B^M||757|mmHg||N|||F|||||<CR>
OBX|16|ST|^T^I||38.0|Cel|||||F|||||<CR>
OBX|17|ST|^FIO2^D||21.0|%|||||F|||||<CR>
OBX|18|ST|^RQ^D||0.86||||||F|||||<CR>
OBX|19|ST|^pO2(v)^D||0.0|mmHg|||||F|||||<CR>
OBX|20|ST|^sO2(v)^D||0.0|%|||||F|||||<CR>
OBX|21|ST|^Qt^D||0.0|L/min|||||F|||||<CR>
OBX|22|ST|^VO2^D||0|mL/min|||||F|||||<CR>
OBX|23|ST|^V(CO)^D||0.0|mL|||||F|||||<CR>
OBX|24|ST|^p50(st)^D||26.84|mmHg|||||F|||||<CR>
OBX|25|ST|^COHb(1)^D||0.0|%|||||F|||||<CR>
```

```
OBX|26|ST|^COHb(2)^D||0.0|%|||||F|||||<CR>
OBX|27|ST|^Birth Weight^D||0|g|||||F|||||<CR>
OBX|28|ST|^Gestational Age^D||0|Weeks|||||F|||||<CR>
OBX|29|ST|^pH(T)^C||7.602|||||F|||||<CR>
OBX|30|ST|^pCO2(T)^C||9.1|mmHg|||||F|||||<CR>
OBX|31|ST|^HCO3-^C||9.0|mmol/L|||||F|||||<CR>
OBX|32|ST|^SBE^C||-13.0|mmol/L|||||F|||||<CR>
OBX|33|ST|^tCO2(P)^C||20.7|Vol%|||||F|||||<CR>
OBX|34|ST|^pO2(A)^C||139.4|mmHg|||||F|||||<CR>
OBX|35|ST|^pO2(A),T^C||138.4|mmHg|||||F|||||<CR>
OBX|36|ST|^AaDpO2^C||.....|mmHg|||||F|||||<CR>
OBX|37|ST|^a/ApO2^C||132.0|%|||||F|||||<CR>
OBX|38|ST|^Ca(7.4)^C||1.03|mmol/L|||||F|||||<CR>
<EOT>
```

Date of issue

Radiometer representative:

Manufacturer:

RADIOMETER

If you have any questions
or need assistance,
please contact your local
Radiometer representative.

Radiometer Medical ApS
Åkandevej 21
2700 Brønshøj
Denmark
www.radiometer.com

HL7 Protocol, Communication protocol specifications

Publication: 201611
Edition: I
Code number: 990-493

IVD