Communication Protocol Specifications

for RADIOMETER™ products

RADIOMETER
COPENHAGEN

1. Introduction

Introduction   This chapter introduces the communication protocols for the ABL700 Series of analyzers and RADIANCE STAT Management software products from RADIOMETER. It briefly describes how the manual should be used and how connection to external systems can be facilitated.

Contents   This chapter contains the following topics.

Intended Use

Introduction   The manual is based on two reference standards issued by the American Society for Testing Materials (ASTM). The standards cover low-level (ASTM E1381-95) protocol and high-level (ASTM E1394-91) protocol communication. RADIOMETER has applied these two standards to the ABL700 Series and RADIANCE.

This manual is also based on a reference standard issued by the HL7 Working Group, an ANSI Accredited Standards Developing Organization.

Manual Information   The information given in this manual applies to:

- ABL700 Series software version 3.8

- RADIANCE software version 2.2.1 - Release 8.2

Communication Layers

Introduction   Communication between computer systems is generally described in terms of the
7- layer *Open Systems Interconnect (OSI)* model, see Craig Hunt, *TCP/IP Network Administration*, O'Reilly & Associates Inc.1994. The following table correlates terms used in this manual with the OSI model concepts.

OSI Level	Name	Defines
7 - 6	Application layer Presentation layer	The communicating application, i.e. the ABL700 DMS or the RADIANCE application and the High-level protocol defining the format of data to be communicated ASTM, ASTM6xx and HL7 are protocols of this layer.
5	Session layer	Connection control layer. For the protocols described in this manual, connection control is not handled by a separate layer.
4	Transport layer	Low level protocol layer responsible for transmission control and error detection. Transport layer protocols described in this manual include ASTM 1381-95, Serial (RAW), RADIOMETER Network Protocol and TCP/IP.
3 – 2	Network layer Data Link layer	Protocols for basic traffic control and for the isolation of the upper layer from the physical network. These layers are covered partly by TCP/IP and partly by network standards.
1	Physical Layer	The physical communication medium, e.g. RS232C, IEEE 802.3 Ethernet or Token Ring.

Physical Layer   The ABL700 Series analyzers or RADIANCE can be connected to HIS/LIS
through:

- Serial line connection (RS232)

- Network connection (using TCP/IP as the transport protocol).

Continued on next page

Communication Layers , *Continued*

Low level protocol

The ABL700 and RADIANCE products have implemented three low-level protocols.

Low-level protocols	Is Used......
Serial (ASTM E1381 – 95), "Specification for Transferring Information Between Clinical Laboratory Instruments and Computer Systems".	• when data is to be transferred over a RS232 serial connection. • because it is an international standard familiar with every HIS/LIS vendor, and 3rd party data management systems.
RADIOMETER Network Protocol	• when data is to be transferred via TCP/IP over a network connection.
Serial(Raw) Only a begin transmission character (STX) is sent out of the port. The result is then sent, and then an ending character (ETX) is sent.	• when data is to be transferred over a RS232 serial connection. • to emulate one of the ABL500 series and ABL600 series' communication to a Lab system. • ***NOTE:*** *this is NOT recommended since no checksum or other means of transmission error detection is supported.*

Continued on next page

Communication Layers, *Continued*

High Level Protocol

The goal of a high-level protocol is to create a common language so analyzers and computer systems can communicate with each other. RADIOMETER has based this communication on standardized communication protocols.

The protocols are general-purpose health care (HL7) or clinical laboratory (ASTM) protocols. Only those parts of the standards relevant to RADIOMETER equipment have been implemented and described in this manual.

The ABL700 Series and RADIANCE can communicate using three high-level protocols:

| Protocol	Is Used.....
ASTM6xx – *ASTM E1394 – 91 "Specification for Transferring Information Between Clinical Laboratory Instruments and Computer Systems".* *NOTE: Unlike the previous ABL500 and ABL600 Series products, the ASTM6xx now includes bidirectional communication.*	• to match ABL500 Series and ABL600 Series making it as seamless as possible to use the ABL700 Series and RADIANCE products with existing HIS/LIS interfaces.
ASTM - *ASTM E1394 – 91*	• because it makes more use of the available features of the protocol, like "out of critical range" flags and again, bidirectional communication.
HL7– *Health-Level 7*	• as a computer to computer standard. It is a general purpose health care communication standard. ***NOTE: In RADIANCE, HL7 is only supported by the bidirectional HIS/LIS.***

Message Types and Message Flow

Introduction High-level Communication between the ABL700 Series analyzers and the HIS/LIS or RADIANCE and the HIS/LIS system is specified in this manual as a series of messages, whether they be ASTM, ASTM6xx, or HL7.

The exchanged messages can be divided into 3 groups:

1. Messages sent by ABL700 or RADIANCE to HIS/LIS.

2. Messages received by ABL700 or RADIANCE from HIS/LIS.

3. Query-Response messages where ABL700 or RADIANCE sends a query message and expects a response message from the HIS/LIS.

These messages are exchanged between the ABL700 Series analyzer and the HIS/LIS or between the RADIANCE and the HIS/LIS depending upon the installation setup:
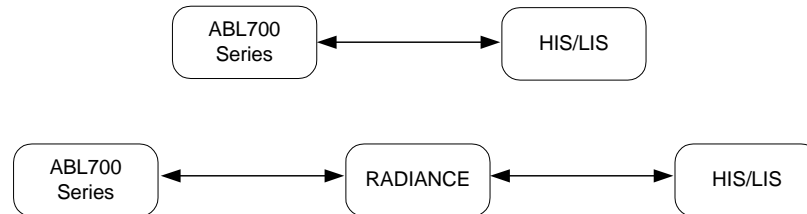
When RADIANCE is used to interface with the HIS/LIS the process of sending messages to the HIS/LIS is a 2 step sequence where the analyzer first sends a message to RADIANCE, which then sends a message to HIS/LIS. Likewise, the process of receiving messages from the HIS/LIS is a 2-step sequence where RADIANCE receives the message and then forwards it to the analyzer.

NOTE: *The messages exchanged between ABL700 Series and* RADIANCE *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 ABL700 or RADIANCE and the HIS/LIS system depending upon the installation setup.

Messages Sent The Messages sent by ABL700 and RADIANCE to the HIS/LIS system are:

- Patient Result

- Calibration Result

- Quality Control Result

- Activity Log Message

Message Types and Message Flow, *Continued*

Messages Received

The Messages received by ABL700 and RADIANCE 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 ABL700 or RADIANCE 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 RADIANCE" whereas the Response message specifications are included in the sections for "Messages Received by the Analyzer or RADIANCE".*

Message Flows for Sent Messages

The following diagram illustrates the flow of messages sent from ABL700 Series analyzer when connected to the HIS/LIS system directly.
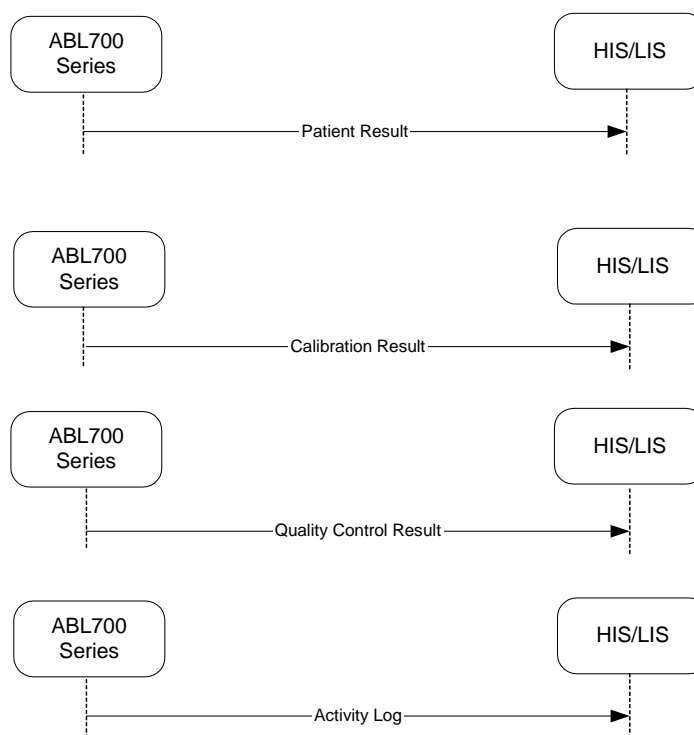
Continued on next page

Message Types and Message Flow, *Continued*

**Message Flows
for Sent
Messages,**
continued

The following illustrates the flow of messages when an ABL700 Series analyzer is connected to RADIANCE and the latter is configured to send all result types to the HIS/LIS system.

Message Types and Message Flow, *Continued*
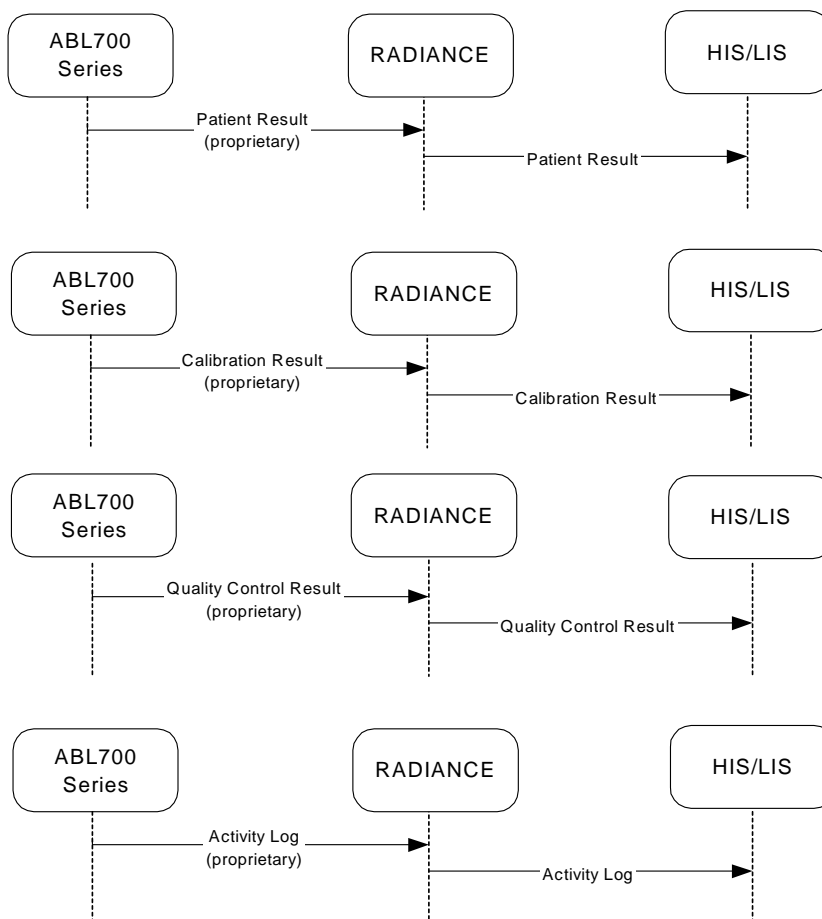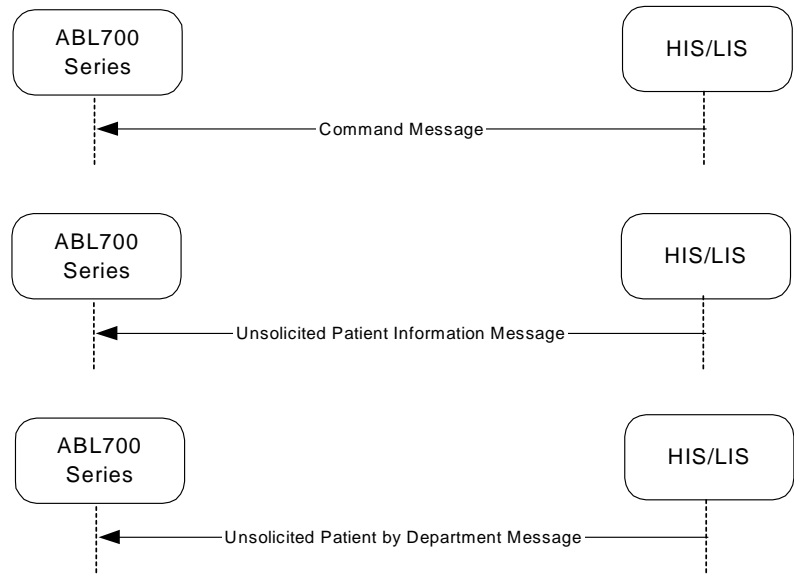
Message Flows for Received Messages

The following diagram illustrates the flow of messages received by the ABL700 Series analyzer when connected to the HIS/LIS system directly.

```
  ┌──────────┐                                    ┌──────────┐
  │  ABL700  │                                    │ HIS/LIS  │
  │  Series  │                                    │          │
  └──────────┘                                    └──────────┘
       ┆  ◄──────────── Command Message ──────────────┆
```

```
  ┌──────────┐                                    ┌──────────┐
  │  ABL700  │                                    │ HIS/LIS  │
  │  Series  │                                    │          │
  └──────────┘                                    └──────────┘
       ┆  ◄────── Unsolicited Patient Information Message ──────┆
```

```
  ┌──────────┐                                    ┌──────────┐
  │  ABL700  │                                    │ HIS/LIS  │
  │  Series  │                                    │          │
  └──────────┘                                    └──────────┘
       ┆  ◄────── Unsolicited Patient by Department Message ──────┆
```

When the ABL700 Series analyzer or RADIANCE 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 RADIANCE receives a *Patient by Department Response* or *Patient Information Response* and there is no outstanding query from the 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 analyzer.

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

```
  ┌──────────┐          ┌──────────┐          ┌──────────┐
  │  ABL700  │          │ RADIANCE │          │ HIS/LIS  │
  │  Series  │          │          │          │          │
  └──────────┘          └──────────┘          └──────────┘
       ┆                     ┆  ◄── Unsolicited Patient ──┆
       ┆                     ┆      by Department Message  ┆
       ┆                     ┆                             ┆
       ┆                     ┆  ◄── Unsolicited Patient ──┆
       ┆                     ┆      Information Message     ┆
```
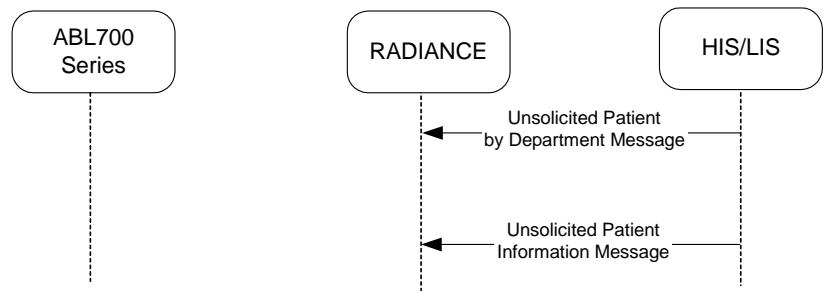
Message Types and Message Flow, *Continued*

**Message Flows for Query-Response Messages**
For Query-Response messages, the Query is initiated by the ABL700 Series analyzer and the Response is sent by the HIS/LIS system.

If the analyzer is connected to RADIANCE, then RADIANCE 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 the ABL700 Series 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 analyzer's database, but the information received is not attached to any patient test result.*
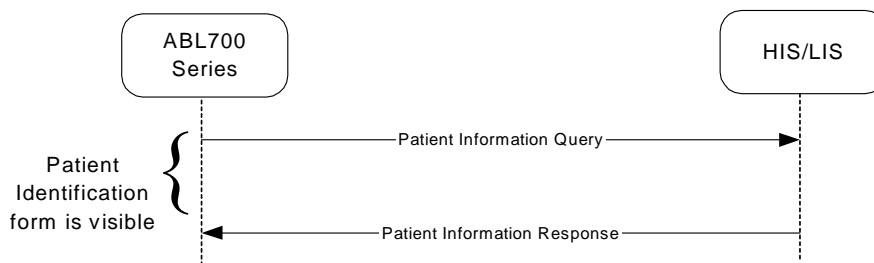
The following diagram illustrates the flow of messages for the Patient Information Query when the analyzer is connected to RADIANCE.
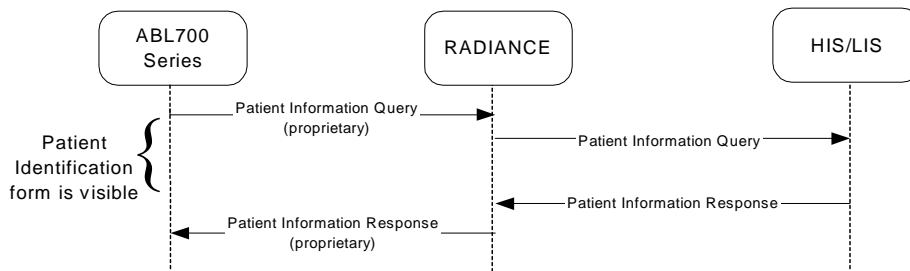
When the *Patient Lookup* function is activated on the ABL700 Series analyzer a series of queries is made. First the Patient by Department Query is made to obtain a list of patients. When the user chooses a patient the analyzer then sends a Patient Information Query to obtain more detailed demographics information on the chosen patient.
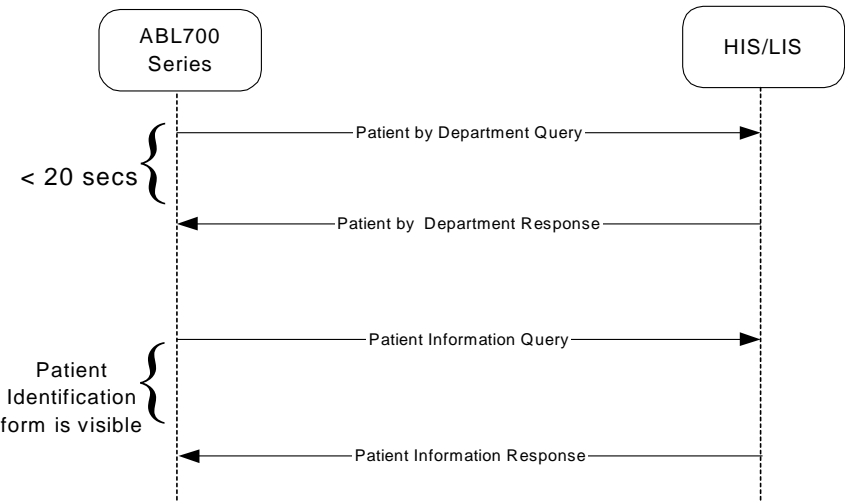
Message Types and Message Flow, *Continued*

NOTE: *If the ABL700 Series does 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 analyzer's database.
               The information received is not attached to any patient test result.

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

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

1-11
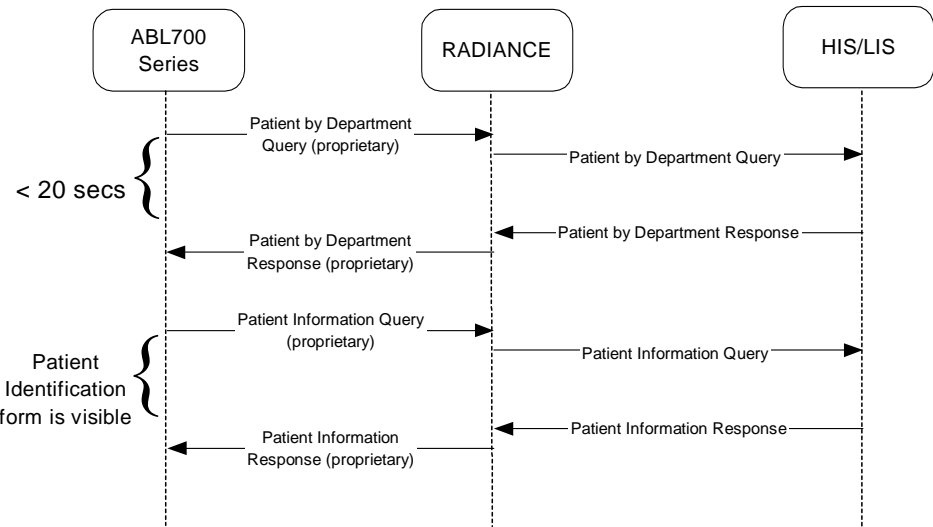
Message Types and Message Flow, *Continued*

NOTE: *The timeout value on the analyzer of 20 seconds may be changed to meet site-specific requirements. Please consult your RADIOMETER Service Representative if this is necessary.*

Audit Trail

Introduction   An audit trail displays a history of edits that have been made to a patient file. RADIANCE generates an audit trail list if a result is edited in RADIANCE or at an analyzer**.** The audit trail list is visible on the screen where patient results are displayed. The audit trail list is also visible on printed reports from RADIANCE.

In addition the audit trail can be sent along with the patient result to the HIS/LIS systems if the option is enabled. In this case, the operator of the HIS/LIS system can view a complete history of changes that have been performed on the patient result. This function is also useful for tracing and documenting changes, which are required by many regulatory boards when audits are performed at a hospital.

NOTE   *ABL700 Series analysers do not support an audit trail on HIS/LIS transmissions.*

For RADIANCE, the audit trail on HIS/LIS transmissions is available only for ASTM and HL7 protocols and not for ASTM6xx.

For more details on Audit Trail see Appendix 6.

Audit Trail Example   The following example illustrates the audit trail included in an ASTM message sent to the HIS/LIS system from RADIANCE.

In this example the operator, John Smith (initials JBS), drew a sample from a patient, Peter Hansen, and performed a measurement on an ABL700 Series analyser. He later went in to make the following changes, after which the result was retransmitted to RADIANCE, which in turn retransmitted the result to the HIS/LIS system:

1. Disable pCO_2 via the dynamic parameter button in the patient ID screen.

2. *F*IO2: changed from 21.0 to 80.0

3. Patient temperature (degrees Celsius): change from 37.0 to 39.4

NOTE   *The result has an error message (Calibration drift out of range) on parameter pO_2.*

Audit Trail, *Continued*

RADIANCE
Audit Trail
Example

H|\^&|||ABL735^Central Lab.||||||||1|20011003231512

P|1||112233||Hansen^Peter||19661306|M|||||||^^^|1.82^m|69.0^kg||||||||

O|1||Sample #^3|^^^syringe |||20011002113012||||||||Arterial^Brachial, left|Dr. McCoy|||||||||F|

C|2|L|CHANGE^23:14 2001-10-03 (JBS) pCO2: 111mmHg -> <Not included>|G

R|1|^^^FIO2^I|80.0|%||C|||

C|1|L|CHANGE^23:14 2001-10-03 (JBS) FIO2: 21.0% -> 80.0%|G

R|2|^^^T^I|39.4|Cel||C|||

C|1|L|CHANGE^23:14 2001-10-03 (JBS) T: 37.0 -> 39.4|G

R|3|^^^Cl-^M|99|mmol/L||N||R||John Smith|20011002114000

R|4|^^^pH^M|7.402|||N||R|||

R|5|^^^pO2^M|?111|mmHg||N||R|||

C|1|I|377^Calibration drift out of range|I

R|6|^^^Na+^M|134|mmol/L||N||R|||

R|7|^^^Glu^M|5.0|mmol/L||N||R|||

R|8|^^^Lac^M|1.2|mmol/L||N||R|||

R|9|^^^Ca++^M|0.54|mmol/L||N||R|||

R|10|^^^K+^M|3.7|mmol/L||N||R|||

R|11|^^^tHb^M|10.9|g/dL||N||R|||

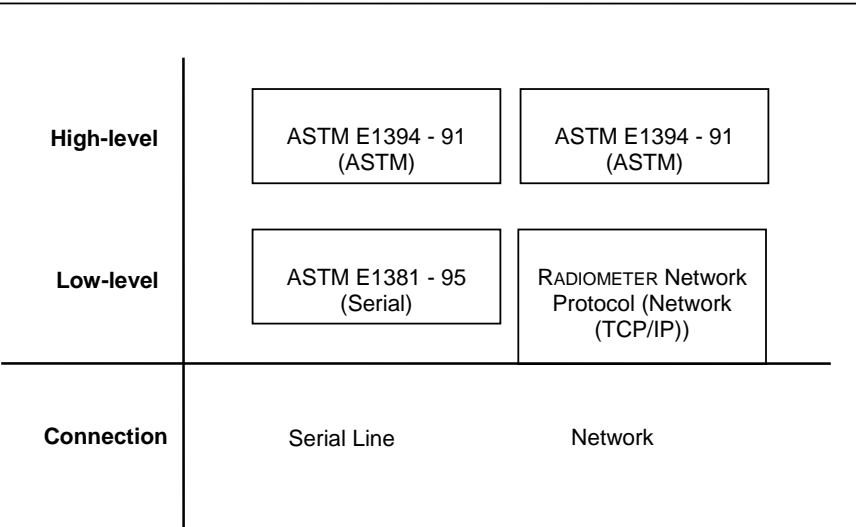R|12|^^^sO2^M|97.5|%||N||R|||

...

L|1|N

Recommended Configuration Option

Introduction   The ASTM communication protocols are standard protocols used for transferring data between clinical instruments and computer systems.

The Low-level protocol ensures error-free communication, and the High-level protocol defines the content and format of the information transmitted between the analyzer and the external system.

Communication Model   The following model illustrates the recommended communication options; product set-up options are in parentheses.

High-level	ASTM E1394 - 91 (ASTM)	ASTM E1394 - 91 (ASTM)
Low-level	ASTM E1381 - 95 (Serial)	RADIOMETER Network Protocol (Network (TCP/IP))
Connection	Serial Line	Network

Data Transmission   Transmission examples from the ABL725 are included in *Chapter 5, ASTM Message Structure and Examples, Complete Transmission Examples using ASTM Low-level Protocol* to illustrate how data is sent in ASTM format.

Communication Configuration   The setup of the analyzer's communication configuration is described in detail in the *ABL700 Series Operator's Manual*.

The setup of RADIANCE communication configuration is described in detail in the *RADIANCE User's Manual.*

Precautions and Warnings

Typographic Conventions

When written in bold and italics, the words *WARNING*, *CAUTION*, and *NOTE* indicate that the information they pertain to should be read carefully before performing the related procedures.

Definition of Terms

Throughout this manual, the various procedures may contain operational precautions and/or warnings. RADIOMETER distinguishes between the three categories. The following table indicates the type of information given in each category:

Notice	Definition
WARNING	Warnings alert the user to potential serious outcomes (death, injury, or serious adverse events) to the patient or user.
PRECAUTION	Precautions alert the user to exercise the special care necessary for safe and effective use of the device. They may include actions to be taken to avoid effects on patients or users that may not be potentially life threatening or result in personal injury, but about which the user should be aware. Precautions may also alert the user to adverse effects caused by use or misuse, and the care necessary to avoid such effects.
NOTE	Notes give practical information.

This manual contains only a series of *NOTES*.

2. ASTM Low-Level Protocol (E1381)

Introduction   This chapter describes the ASTM low-level protocol (E1381).

Contents   This chapter contains the following topics.

ASTM Low Level Layer

Introduction   The following gives details of the Low-level layer.

Low-level Protocol Function	is for........
• link connection and release	determining which system sends out information and which system receives it.
• delimiting and synchronism	dealing with the framing of data and the recognition of frames.
• sequential control	maintaining the sequential order of information across the connection.
• transmission error detection	checking that no characters have been changed/lost during the transmission by adding a check-sum to each frame.
• recovery of detected errors	maintaining re-transmission of corrupted frames.

The low level layer uses a character-oriented simple stop-and-wait protocol to transfer information between the analyzer and the laboratory computer system. Information can only flow in one direction at a given time.

Protocol Phases   There are three phases involved in transferring information between the analyzer and the computer system:

Phase	Name	Is....
1.	Establishment Phase	the link connection
2.	Transfer Phase	the data transmission
3.	Termination Phase	the link release

These phases are discussed in detail overleaf.

ASTM Establishment Phase

Introduction   The establishment phase determines the direction in which the information flows, and prepares the receiver to accept the transmitted information.

Phase Initiation   This phase is initiated when:

The sender delivers an <ENQ>.

The receiver replies by:

- either an <ACK> acknowledging receipt of the message.

- or a <NAK> if unable to receive information.

If a <NAK> response is received, the sender must wait 10 seconds before another <ENQ> is sent.

If the second request is unsuccessful, the sender enters the termination phase.

Contention   Should both the analyzer and the HIS/LIS simultaneously send an <ENQ>, the analyzer has the priority to transmit.

On obtaining a reply of <ENQ> to its transmitted <ENQ>, the computer system must stop trying to send information and prepare to receive.

When the next <ENQ> is received, the computer system replies with an <ACK> or a <NAK> depending on its readiness to accept. If an <ENQ> is not received within 20 seconds, a time-out occurs. i.e. the receiver considers the line to be idle.

On obtaining a reply of <ENQ> to its transmitted <ENQ>, the analyzer must wait at least 1 second before delivering another <ENQ>.

ASTM Transfer Phase

Introduction During the transfer phase a low level message is sent, using one of two types of frames (within "text" data fields are represented in 7-bit ASCII values):

<STX> [FN] "text" <ETB> [C1] [C2] <CR> <LF> (intermediate frame)
<STX> [FN] "text" <ETX> [C1] [C2] <CR> <LF> (end frame)

If a message is longer than 240 characters in length, it will then be split up into:

- 1 or more intermediate frames

- 1 end frame

Interpretation of Low-level Message In all released versions of the ABL700 software, and RADIANCE before 2.21, an ASTM 1381 message (low level message) corresponds to a complete ASTM 1394 or HL7 message (high level message). Hence, each high level record (ASTM 1394) or segment (HL7) is transmitted as an intermediate frame with <ETB> except for the last record or segment of a high level message which is transmitted as an end frame using <ETX>.

In software releases 2.21 and higher of RADIANCE, an ASTM 1381 message (low level message) corresponds to a complete ASTM 1394 record or a HL7 segment. I.e. according to its length, each high level record (ASTM 1394) or segment (HL7) is transmitted as a sequence of zero or more intermediate frames using <ETB> followed by one single end frame with <ETX>.

NOTE: *All transmission examples using ASTM 1381 to be found in this manual follow the latter interpretation i.e. they correspond to a complete ASTM 1394 record or an HL7 segment.*

ASTM Transfer Phase, *Continued*

ABL700 Low-level Example	RADIANCE 2.21 (and higher) Low-level Example
ACK>	ACK>
<STX>0R|13|^^^COHb^M|21.0|%||N||F|||<CR><ETB>D9<CR><LF>	<STX>0R|13|^^^COHb^M|21.0|%||N||F|||<CR><ETX>D9<CR><LF>
<ACK>	<ACK>
<STX>1R|14|^^^MetHb^M|10.1|%||N||F|||<CR><ETB>6E<CR><LF>	<STX>1R|14|^^^MetHb^M|10.1|%||N||F|||<CR><ETX>6E<CR><LF>
<ACK>	<ACK>
<STX>2R|15|^^^tBil^M|438|micromol/L||N||F|||<CR><ETB>C2<CR><LF>	<STX>2R|15|^^^tBil^M|438|micromol/L||N||F|||<CR><ETX>C2<CR><LF>
<ACK>	<ACK>
<STX>3R|16|^^^HbF^M|62|%||N||F|||<CR><ETB>3A<CR><LF>	<STX>3R|16|^^^HbF^M|62|%||N||F|||<CR><ETX>3A<CR><LF>
<ACK>	<ACK>
<STX>4R|17|^^^T^I|37.0|Cel||||F|||<CR><ETB>9D<CR><LF>	<STX>4R|17|^^^T^I|37.0|Cel||||F|||<CR><ETX>9D<CR><LF>
<ACK>	<ACK>
<STX>5R|18|^^^pH(T)^M|7.584|||N||F|||<CR><ETB>24<CR><LF>	<STX>5R|18|^^^pH(T)^M|7.584|||N||F|||<CR><ETX>24<CR><LF>
<ACK>	<ACK>
<STX>6R|19|^^^pCO2(T)^M|22.1|mmHg||N||F|||<CR><ETB>E8<CR><LF>	<STX>6R|19|^^^pCO2(T)^M|22.1|mmHg||N||F|||<CR><ETX>E8<CR><LF>
<ACK>	<ACK>
<STX>7R|20|^^^SBE^C|-0.8|mmol/L||||F|||<CR><ETB>31<CR><LF>	<STX>7R|20|^^^SBE^C|-0.8|mmol/L||||F|||<CR><ETX>31<CR><LF>
<ACK>	<ACK>
<STX>0R|21|^^^SBC^C|25.3|mmol/L||||F|||<CR><ETB>2E<CR><LF>	<STX>0R|21|^^^SBC^C|25.3|mmol/L||||F|||<CR><ETX>2E<CR><LF>
<ACK>	<ACK>
<STX>1R|22|^^^pO2(T)^M|63.9|mmHg||N||F|||<CR><ETB>A7<CR><LF>	<STX>1R|22|^^^pO2(T)^M|63.9|mmHg||N||F|||<CR><ETX>A7<CR><LF>
<ACK>	<ACK>
<STX>2R|23|^^^p50(act)^C|45.07|mmHg||||F|||<CR><ETB>47<CR><LF>	<STX>2R|23|^^^p50(act)^C|45.07|mmHg||||F|||<CR><ETX>47<CR><LF>
<ACK>	<ACK>
<STX>3R|24|^^^tO2^C|12.9|Vol%||||F|||<CR><ETB>79<CR><LF>	<STX>3R|24|^^^tO2^C|12.9|Vol%||||F|||<CR><ETX>79<CR><LF>
<ACK>	<ACK>
<STX>4L|1|N<CR><ETX>07<CR><LF>	<STX>4L|1|N<CR><ETX>07<CR><LF>
<ACK>	<ACK>
<EOT>	<EOT

ASTM Transfer Phase, *Continued*

Frame Structure The frame structure is illustrated in the table below:

Command	Function
<STX>	Start of text transmission control character
[FN]	Frame number "0" - "7" (first in H record is "1")
"text"	Data content message (maximum of 240 characters)
<ETB>	End of transmission block transmission control character
<ETX>	End of text transmission control character
[C1]	Most significant hex character of the check sum 0 - 9 and A - F
[C2]	Least significant hex character of the check sum 0 - 9 and A - F
<CR>	Carriage return character
<LF>	Line feed character

Check Sum The check sum permits the receiver to detect a frame error. The check sum is calculated by adding the binary values of each character to the check sum (modulo 256). The characters in <STX>, the check sum, <CR> and <LF> are not included in the calculation.

ASTM Transfer Phase, *Continued*

Check Sum
(continued)

An example of how the check sum is calculated is :

<STX>*<Frame number>TEXT<ETX>*<Check sum><CR><LF>
Check sum is expressed as 2 digits (hex)

<STX>*7L/1/N<CR><ETX>*0A<CR><LF>

where:

Character	ASCII Value (Decimal)
7	55
L	76
|	124
1	49
|	124
N	78
<CR>	13
<ETX>	3
Sum =	522
522 MOD 256	10 (decimal) or 0A (hex)

After each frame is delivered, the sender ceases transmission until it receives one of three possible replies from the receiver device. These are:

Reply	Interpretation
<ACK>	Last frame received successfully; the sender must increment [FN].
<NAK>	Last frame was not received successfully. Send last frame again; the receiver is prepared to accept the frame again (same [FN] and a maximum of 7 retransmissions).
<EOT>	Last frame received successfully; request to end transmission immediately.

Sender Interruptions

The sender sets a timer when it is transmitting the last character of a frame. If a reply is not obtained from the receiver within 15 seconds, a time-out occurs. In that case, the sender aborts the message transfer process by entering the termination phase.

Receiver Interruptions

The receiver sets a timer when it first enters the transfer phase, or when it is replying to a frame. If a frame or <EOT>is not received within 30 seconds, a time-out occurs. In that case, the receiver discards the last incomplete message and considers the line to be in the neutral state.

ASTM Termination Phase

Introduction   The termination phase returns the data link to the neutral state.

The sender notifies the receiver that all messages have been delivered and sends the <EOT> transmission control character to the receiver. The data link is thus regarded by both devices to be in a neutral state. This means that any character except <ENQ> will be ignored.

Restricted Characters

Restricted Characters

The table below shows the control characters that are not allowed in the message text.

Control Character	Name	Dec. Code	Hex. Code
SOH	Start of header	1	01
STX	Start of text	2	02
ETX	End of text	3	03
EOT	End of transmission	4	04
ENQ	Inquiry	5	05
ACK	Acknowledgment	6	06
DLE	Data link escape	16	10
NAK	Negative acknowledgment	21	15
SYN	Synchronous idle	22	16
ETB	End of transmission block	23	17
LF	Line feed	10	0A
DC1	Device control 1	17	11
DC2	Device control 2	18	12
DC3	Device control 3	19	13
DC4	Device control 4	20	14

Serial Raw Protocol

Introduction   The serial raw connection is a very simple way of transmitting data to other systems. Basically the sender just sends the information on the serial line. Whether the information is received properly at the other end or not, is of no concern to the sender.

Flow-control can be implemented using either hardware control or Xon/Xoff but these are not included in the protocol. The setup of flow-control applies to the physical setup of the communication port on Windows-based systems i.e. from the control panel.

Serial Raw Low level Layer   The Low-level layer covers:

Low-level layers	this....
link connection and link release	determines which system sends out information and which system receives it.
data stream	deals with the framing of data and the recognition of frames.

The Low-level layer uses a character-oriented simple stop-and-wait protocol to transfer information between the analyzer and the laboratory computer system. Information can only flow in one direction at any given time.

Protocol Phases   There are three phases involved in transferring information between the analyzer and the computer system:

Phase Number	Phase Name	Is....
1	Establishment Phase	the link connection
2	Transfer Phase	the data transmission
3	Termination Phase	the link release

The establishment phase determines the direction in which the information flows, and prepares the receiver to accept the transmitted information.

This phase is initiated by delivering an <STX> from the sender.

Contention is not handled in this protocol. The analyzer will just start to transmit.

Continued on next page

Serial Raw Protocol, *Continued*

Transfer Phase   During the transfer phase a message is sent as one long stream of data which consists of text blocks transmitted one after another. There is no checking of the transmission for its correctness.

Termination Phase   The termination phase returns the low level to the neutral state.

The sender notifies the receiver that all messages have been delivered and sends the <ETX> transmission control character to the receiver.

3. Network-Based Communication

Overview

Introduction   The ABL700 Series and RADIANCE are able to transmit ASTM or HL7 high-level packets via TCP/IP network.

Contents   This chapter contains the following topics.

RADIOMETER **Network Protocol**

Introduction   The following deals with network based communication between ABL700 Series/RADIANCE and a HIS/LIS based on the TCP/IP standard.

Implementation   The ABL700 Series analyzer or RADIANCE acts as an TCP/IP client with the responsibility of establishing and terminating connections. The HIS/LIS must monitor a TCP/IP port allocated for the communication. The client side configuration of IP address and port number is described in the ABL700 Series Operator's Manual and RADIANCE User's Manual.

Data Transmission   The data transmitted between the socket client and the socket server is in the form of ASTM or HL7 high-level packets. No low-level control characters are added to the message except the <SOH> and <EOT> characters.

The TCP/IP network protocol controls all low-level error detection, error handling and synchronization.

A result sent from the ABL700/RADIANCE to a HIS/LIS is transmitted as a continuous data stream starting with a <SOH> character and ending with a <EOT> character. In order to receive the data, the server reads the data stream from the port. The data stream is terminated by an <EOT> character. This terminates any message sent from the ABL700 analyzer or RADIANCE system.

If data is sent to the ABL700/RADIANCE, an <EOT> must be included in order to terminate the data stream.

RADIOMETER NETWORK PROTOCOL, *Continued*

Network Transmission Example

The following is an example of network transmission.

```
<SOH>
H|\^&|||ABL 725^R5N1||||||||1|19980922085400|<CR>
P|1||az98||^||19660111|U||||||^||^|^|||||||||||<CR>
O|1||Sample #^286|||||||||||||Not specified^Femoral,Right|Box|
<CR>
R|1|^^^pH^M|7.273|||||F|||199809091518|||<CR>
R|2|^^^pO2^M|.....|mmHg||||F|<CR>
C|1|I|94|I<CR>
R|3|^^^pCO2^M|31.3|mmHg||||F|<CR>
R|4|^^^tHb^M|16.2|g/dL||||F|<CR>
R|5|^^^sO2^M|-0.1|%||||F|<CR>
C|1|I|94|I<CR>
R|6|^^^RHb^M|93.6|%||||F|<CR>
R|7|^^^O2Hb^M|-0.1|%||||F|<CR>
C|1|I|94|I|<CR>
R|8|^^^COHb^M|6.0|%||||F|<CR>
R|9|^^^MetHb^M|0.5|%||||F|<CR>
R|10|^^^B^M|750|mmHg||||F|<CR>
L|1|N||<CR>
<EOT>
```

4. ASTM High-Level Protocol (E1394)

Overview

Introduction   The ABL700 Series analyzers and RADIANCE have two ASTM high level protocols, that are slightly different:

- ASTM is the protocol preferred.

- ASTM6xx is the ASTM E1394 protocol as it was implemented on older ABL500 series and ABL600 series analyzers.

This chapter describes the structure of the ASTM high-level protocol (In the ABL700 Series setup program and the RADIANCE Administrator, ASTM option).

This high-level standard specifies:

- the structure of messages exchanged between the analyzer and the computer system, i.e. the individual records and the fields contained in the records.

- the total list of universal test IDs transmitted via ASTM.

NOTE: RADIANCE has dedicated bidirectional interfaces for the following systems:

- CernerASTM

- HBO

- Hboc

- Labfusion

- Misys (Sunquest)

NOTE: *The Audit Trail function is available for the ASTM (but not the ASTM6xx) and HL7 protocols and is only supported by RADIANCE. Also the format of Comment records documenting general conditions, errors and flags differs slightly between the ABL700 and RADIANCE output. See pages 4-18, 4-19 and 4-20 for details on configuring RADIANCE to transmit results using ABL700 format.*

Contents   This chapter contains the following topics.

Message Structure

Introduction The following table briefly describes concepts used when describing the ASTM 1384-91 High-level protocol. For further details, refer to the original ASTM 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.
Record	A message is composed of records each containing related elements of data (attributes). Examples of records are the patient information record keeping all the patient data that is common to all tests and the order record keeping data that is common for the individual test.
Field	Each record has a number of fields each holding one or more data elements (attributes). For instance, the patient information record has a field containing the patient's name and a field holding the patient's birth data. Fields are delimited by "|"
Component field	A field may be divided into several component fields. The name field of the patient information record has the components *last name*, *first name* and *middle initials*. Components are delimited by '^'

Record Types Messages consist of various record types that are listed in the table below.

Record Type	Name
H	Header record
P	Patient information record
O	Test order record
R	Result record
C	Comment record
M	Manufacturer information record
Q	Query record
L	Message terminator record

Continued on next page

Message Structure, *Continued*

Example of the Message Structure   The example below shows the message structure for reporting a measurement.

Record Type	Name
H	Header record
P	Patient information record
O	Test order record
C	Comment record for entire test
R	Result record 1
C	Comment record for result 1
R	Result record 2
R	Result record 3
R	Result record 4
R	Result record 5
C	Comment record for result record 5
L	Message terminator record

(The comment records C are only transmitted if a system message applies to the previous record).
The first comment record C following the test order record O applies to the entire result, whereas comment records C following the result records R apply to individual parameters.

Continued on next page

Message Structure, *Continued*

Delimiters   Delimiters are used to separate the record into fields and components. Delimiters may vary from implementation to implementation, and are defined as part of the header record.

The following delimiters are used in the ABL700 Series and RADIANCE:

Delimiter	Name	Dec. Code	Hex. Code
"|"	Field delimiter	124	7C
"\\"	Repeat field delimiter	92	5C
"^"	Component field delimiter	94	5E
"&"	Escape delimiter	38	26
<CR>	Record	13	D

NOTE: *The Record delimiter is always <CR> Carriage Return*

Dec code: 13

The Record delimiter <CR> is applied to the end of all record types.

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

Detailed Structure of Each Record Type

Introduction   The information contained in the individual records and fields is dependent on the analyzer configuration, i.e. which

- fields are enabled in the patient identification screen

- parameters are selected if the dynamic parameters function of the analyzer is activated

- input parameters are activated

In this section the content of each record type is examined in detail.

Contents   This section contains the following topics.

Message Header Record

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

Message Header The following is an example of a message header.
Example
H|\^&|||ABL725^ICU^||||||Operators comment||1|19981021135650

Field	Name - E1394 - 91	Example	Comments
1	Record Type ID	H	
2	Delimiter Definition	|\^&	
3	Message Control ID	Not used	
4	Access Password	Not used	
5	Sender Name	ABL725^ICU	Analyzer type and user definable analyzer name.
6	Sender Street Address	Not used	
7	Reserved	Not used	
8	Sender Telephone Number	Not used	
9	Characteristics of Sender	Not used	
10	Receiver ID	Not used	
11	Comments or Special Instructions	Operator's Comment	The field contains comments entered in the "Comments" field on the ID screen.
12	Processing ID	Not used	
13	Version Number	1	Contains the ASTM version number "1", which corresponds to E1394-91
14	Date and Time of Message		Contains the date and time for the transmitted message.

Patient Information Record

Introduction   The patient information record contains general information about the patient.

NOTE: *The patient information record can also be received after a "query for patient information" has been issued.*

Patient Information Record Example   The following is an example of a patient information record.

P|1||117118112||Doe^John||19601218|M||||||37^years|38^weeks^1050^grams|188^cm|82^kg||||||||ICU2

Field	Name - E1394 - 91	Example	Comments
1	Record Type ID	P	
2	Sequence Number	1	Always 1 in transmissions. Is incremented when used in Patient Department Response from LIS
3	Practice Assigned Patient ID	Not used	
4	Laboratory Assigned Patient ID	117118112	Patient ID.
5	Patient ID No. 3	Not used	
6	Patient Name	Doe^John	Last Name^First Name
7	Mother's Maiden Name	Not used	
8	Date of Birth	19601218	Date of birth. Date of birth is transmitted in the format: YYYMMDD
9	Patient Sex	M	The following codes are used: M - Male F - Female U - Unknown
10	Patient Race	Not used	
11	Patient Address	Not used	
12	Reserved	Not used	
13	Patient Telephone Number	Not used	
14	Attending Physician ID	Not used	

Continued on next page

Patient Information Record, *Continued*

Patient Information Record Example, continued

Field	Name - E1394 - 91	Example	Comments
15	Special Field 1	37^years	Patient age ^ unit
16	Special Field 2	38^weeks^10 50^grams	Gestational age ^ gestation age unit ^ gestational birth weight ^ gestation weight unit.
17	Patient Height	188^cm	Patient height ^ unit.
18	Patient Weight	82^kg	Patient weight ^ unit.
19	Diagnosis	Not used	
20	Medication	Not used	
21	Diet	Not used	
22	Practice Field No. 1	Not used	
23	Practice Field No. 2	Not used	
24	Admission Date	Not used	
25	Admission Status	Not used	
26	Location	ICU2	Patient department.
27	Nature of Diagnostic Code	Not used	
28	Diagnostic Code	Not used	
29	Patient Religion	Not used	
30	Marital Status	Not used	
31	Isolation Status	Not used	
32	Language	Not used	
33	Hospital Service	Not used	
34	Hospital Institution	Not used	
35	Dosage Category	Not used	

Test Order Record (Patient Result)

Introduction   The test order record contains information about the particular test on a single specimen.

Test Order   The following is an example of a test order record.

Record Example O|1|ABC1234|Sample#^63|^^^syringe|||1998102305715|||||||||Blood^Arterial|Dr. McCoy|||||||||F||||||

Field	Name - E1394 - 91	Example	Comments
1	Record Type ID	O	
2	Sequence Number	1	Always 1 in transmissions from the ABL700 Series (only one O record is transmitted).
3	Specimen ID - Accession Number	ABC1234	Accession number entered during analysis.
4	Instrument Specimen ID - sample number	Sample #^63	The analyzer automatically generates the number. The text in front of the sequence number identifies the result type. Each result type has its own series of sequence numbers.
		Sample #^63	Sample - patient sample.
		Cal #^12	Cal - calibration.
		QC #^54	QC - quality control.
		Error	Activity log message.
5	Universal Test ID	^^^syringe	Measuring mode
6	Priority Code	Not used	
7	Ordered Data/Time	Not used	
8	Sample Draw Time	19981023105715	Sample draw time entered during analysis.
9	Collection End Time	Not used	
10	Collection Volume	Not used	
11	Collector ID	Not used	

Test Order Record (Patient Result), *Continued*

**Test Order
Record Example**
(continued)

Field	Name - E1394 - 91	Example	Comments
12	Action Code	Not used	
13	Danger Code	Not used	
14	Relevant Clinical Information	Not used	
15	Date/Time Specimen Received	Not used	
16	Specimen Descriptor	Blood^femoral right 2-Point Calibration S7730^4	Sample type^Sample site Both fields are entered during measurement. Calibration type. QC Solution ID^QC lot – quality control.
17	Ordering Physician	Dr. McCoy	Physician name or code entered during the analysis.
18	Physician's Telephone Number	Not used	
19	User field No. 1	Not used	
20	User Field No. 2	Not used	
21	Laboratory Field No. 1	Not used	
22	Laboratory Field No. 2	Not used	
23	Date/Time Result reported or Last Modified	Not used	
24	Instrument Charge to Computer System	Not used	
25	Instrument Section ID	Not used	
26	Report Types	F C	F – Final Results (used for initial transmission) C – correction of previously transmitted results (used for corrected results when Audit Trail is enabled)

Test Order Record (Patient Result), *Continued*

27	Reserved Field	Not used	
28	Location of Ward of Specimen Collection	Not used	
29	Nosocomical Infection Flag	Not used	
30	Specimen Service	Not used	
31	Specimen Institution	Not used	

Test Order Record – RADIANCE - (Patient Information Response)

Introduction   Zero or more test order records may be included in a patient information response when a patient is queried via patient id or via accession number. When queried by accession number the response contains 1 O record which includes the accession number queried on.

When queried by patient ID the O records identify a list of test orders outstanding for the patient with 1 accession number per O record.

Test Order   The following is an example of a test order record.

Record Example   O|1|ABC1234||^^^O1234^BGOXIELECT|||||||||||Dr. McCoy|||||||||||||||

Field	Name - E1394 - 91	Example	Comments
1	Record Type ID	O	
2	Sequence Number	1	Always 1 in transmissions from the ABL700 Series (only one O record is transmitted).
3	Specimen ID - Accession Number	ABC1234	Accession number queried on/returned by HIS/LIS system.
4	Instrument Specimen ID - sample number	Not used	
5	Universal Test ID	^^^O1234^BGOXI ELECT	^^^Order item code^Order item
6	Priority Code	Not used	
7	Ordered Data/Time	Not used	
8	Sample Draw Time	Not used	
9	Collection End Time	Not used	
10	Collection Volume	Not used	
11	Collector ID	Not used	

Continued on next page

Test Order Record – Radiance - (Patient Information Response), *Continued*

Test Order Record Example *(continued)*

Field	Name - E1394 - 91	Example	Comments
12	Action Code	Not used	
13	Danger Code	Not used	
14	Relevant Clinical Information	Not used	
15	Date/Time Specimen Received	Not used	
16	Specimen Descriptor	Not used	
17	Ordering Physician	Dr. McCoy	Physician name responsible for ordering test.
18	Physician's Telephone Number	Not used	
19	User field No. 1	Not used	
20	User Field No. 2	Not used	
21	Laboratory Field No. 1	Not used	
22	Laboratory Field No. 2	Not used	
23	Date/Time Result reported or Last Modified	Not used	
24	Instrument Charge to Computer System	Not used	
25	Instrument Section ID	Not used	
26	Report Types	Not used	
27	Reserved Field	Not used	
28	Location of Ward of Specimen Collection	Not used	
29	Nosocomical Infection Flag	Not used	
30	Specimen Service	Not used	
31	Specimen Institution	Not used	

Test Order Record – ABL700 – (Patient Information Response)

Introduction   Zero or I test order records may be included in a patient information response when a patient is queried via patient ID or via accession number. When queried by accession number the response contains 1 O record which includes the accession number queried on.

When queried by patient ID the **optional** O record identifies an outstanding order for the patient in question.

Test Order Record Example   The following is an example of a test order record.

O|1|ABC1234|||||||||||||||||||||||||||||||

Field	Name - E1394 - 91	Example	Comments
1	Record Type ID	O	
2	Sequence Number	1	Always 1 in transmissions from the ABL700 Series (only one O record is transmitted).
3	Specimen ID - Accession Number	ABC1234	Accession number queried on/returned by HIS/LIS system.
4	Instrument Specimen ID - sample number	Not used	
5	Universal Test ID	Not used	
6	Priority Code	Not used	
7	Ordered Data/Time	Not used	
8	Sample Draw Time	Not used	
9	Collection End Time	Not used	
10	Collection Volume	Not used	
11	Collector ID	Not used	

Test Order Record – ABL700 – (Patient Information Response)), *Continued*

Test Order Record Example *(continued)*

Field	Name - E1394 - 91	Example	Comments
12	Action Code	Not used	
13	Danger Code	Not used	
14	Relevant Clinical Information	Not used	
15	Date/Time Specimen Received	Not used	
16	Specimen Descriptor	Not used	
17	Ordering Physician	Not used	
18	Physician's Telephone Number	Not used	
19	User field No. 1	Not used	
20	User Field No. 2	Not used	
21	Laboratory Field No. 1	Not used	
22	Laboratory Field No. 2	Not used	
23	Date/Time Result reported or Last Modified	Not used	
24	Instrument Charge to Computer System	Not used	
25	Instrument Section ID	Not used	
26	Report Types	Not used	
27	Reserved Field	Not used	
28	Location of Ward of Specimen Collection	Not used	
29	Nosocomical Infection Flag	Not used	
30	Specimen Service	Not used	
31	Specimen Institution	Not used	

Result Record

Introduction   The result record 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.

Result Record Example   The following is an example of a result record.

R|1|^^^pO2^M|62.7|mmHg||N||F||Bill|19980909151803|||

Field	Name - E1394 - 91	Example	Comments
1	Record Type ID	R	
2	Sequence Number	1	This is the first R record.
3	Universal Test ID	^^^pO2^M	This field consists of four components; the first three are not used: Not used ^ Not used ^ Not used ^pO$_2$ 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
4	Measurement Value	62.7	The value can be prefixed with a "?" indicating that an error exists on the parameter. e.g. ?62.7

Continued on next page

Result Record, *Continued*

**Result Record
Example**
(continued)

Field	Name - E1394 - 91	Example	Comments
5	Units	mmHg	Parameter names and the possible units are available in *Appendix 1*.
6	Reference Ranges	Not used	
7	Result Abnormal Flag	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
8	Nature of Abnormality Testing	Not used	
9	Result Status	F C R	"F" indicating final result. "C" indicating corrected parameter result if Audit Trail is enabled. "R" indicating a retransmitted parameter which has not been corrected. Only sent if Audit Trail is enabled.
10	Date of Change in Instrument Normative Values or Units	Not used	
11	Operator Identification	Bill	The operator ID. Only sent with the first "R" record.

Continued on next page

Result Record, *Continued*

Result Record Example
(continued)

Field	Name - E1394 - 91	Example	Comments
12	Date/Time Test Started	19980909151803	Time stamp generated when analysis is completed. Only send with the first "R" record.
13	Date/Time Test Completed	Not used	
14	Instrument Identification	Not used	

Comment Record – ABL700

Introduction   Comment records contain information concerning the general conditions of the analyzer or errors/flags on individual parameters.

NOTE: *A comment always applies to the preceding record of the message. In a result message, a comment record sent before the first R record is a general message whereas a comment sent after an R record is related to the preceding R record.*

Comment Record Example

The following is an example of a comment record.

C|1|I|94|I

Field	Name - E1394 - 91	Example	Comments
1	Record Type ID	C	
2	Sequence Number	1	This is the first C record.
3	Comment Source	I	Always I, denoting Clinical Instrument System.
4	Comment Text	94	One or more error codes separated by component delimiters (e.g. 94^123). A list of error codes is available in *Appendix 3*.
5	Comment Type	I	Always I, indicating that this is an Instrument Flag.

Comment Record - RADIANCE

Introduction Comment records contain information concerning the general conditions of the analyzer or errors/flags on individual parameters or information on corrections made to results, if Audit Trail is enabled.

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

RADIANCE differs from ABL700 format in that a Comment record is written for each error, rather than giving a list of errors in one Comment record.

NOTE: *A comment always applies to the preceding record of the message. In a result message, a comment record sent before the first R record is a general message whereas a comment sent after an R record is related to the preceding R record.*

Comment Record Example The following is an example of a list of comment records succeeding an erroneous pO2 result

R|1|^^^pO2^M|62.7|mmHg||N||F||Bill||19980909151803|||

C|1|I|377^Calibration drift out of range|I

C|2|I|480^pO2 drifting|I

Field	Name - E1394 - 91	Example	Comments
1	Record Type ID	C	
2	Sequence Number	1	This is the first C record.
3	Comment Source	I	Always I, denoting Clinical Instrument System.
4	Comment Text	377^Calibration drift out of range	<error code>^<error text> A list of error codes is available in *Appendix 3*.
5	Comment Type	I	Always I, indicating that this is an Instrument Flag.

Comment Record – Audit Trail

Introduction   Comment records contain information concerning the general conditions of the analyzer or errors/flags on individual parameters or information on corrections made to results, if Audit Trail is enabled.

This section describes the format of Comment records used to document changes to results which are retransmitted by RADIANCE, when Audit trail is enabled.

NOTE: *Comment records dealing with changes to a result can document changes to patient demographic data (in the P or O record) or changes to parameters in the result. Changes to patient demographics or deletion of parameters from a result are documented via Comment records immediately succeeding the O record and preceding the first R record. Changes to existing parameter results or additions of new parameters are documented via Comment records that immediately succeed the R record in question.*

Comment   The following is an example of a comment record documenting a change to the
Record Example   patient temperature.

C|1|L|CHANGE^23:14 2001-10-03 (JBS) T: 37.0 -> 39.4|G

Field	Name - E1394 - 91	Example	Comments
1	Record Type ID	C	
2	Sequence Number	1	This is the first C record.
3	Comment Source	L	Always L, denoting computer system.
4	Comment Text	CHANGE^23:14 2001-10-03 (JBS) T: 37.0 -> 39.4	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>"
5	Comment Type	G	Always G, indicating that this is a generic/free text comment.

Comment Record – (Notification)

Introduction   Comment records can also contain notification information that is entered in
RADIANCE Data Management application.

These fields include who is notified, who has made the notification and the
notification time.

NOTE: *These records can only be sent by RADIANCE, and only if the notification fields in
RADIANCE Data Management have been edited*

These are included immediately before the first R record.

Comment   The following is an example of a comment record with a notification.
Record Example C|1|L|Notified^2002/07/23 12:34:00^Nurse Smith^Dr. McCoy|G

Field	Name - E1394 - 91	Example	Comments
1	Record Type ID	C	
2	Sequence Number	1	This is the first C record.
3	Comment Source	L	Always L, denoting computer system (RADIANCE).
4	Comment Text	Notified^2002/07/23 12:34:00^Nurse Smith^Dr. McCoy	Notified^<Sample Notified Time> ^<Sample Notified whom>^<Sample Notified By>
5	Comment Type	G	Always G, indicating that this is a generic/free text comment.

Query Record

Introduction   A query message, which contains a query record, can be sent by the analyser or by RADIANCE if these systems are 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 either the patient ID or the accession number. On the analyzer, it is configurable whether the patient ID or accession number is used as the query criteria. This is not an issue for radiance as it passes the query sent by the analyser to the connected HIS/LIS system without modifying it.

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

Query Record Example   The following gives 3 differing examples of a query record:

a) Q|1|11475^

b) Q|1|^11475

c) Q|1|||||||||LOCATION^ICU-1

Field	Name - E1394 - 91	Example	Comments
1	Record Type ID	Q	
2	Sequence Number	1	Always 1 in transmissions from the ABL700 Series (only one Q record is transmitted).
3	Query Text	11475^ (see *example a* above)	Patient ID^Accession Number. In example a) patient ID number 11475 is sent. If the number entered was an accession number ^11475 would be sent (see *example b)* above)
11	Query text for Patient by Department query	LOCATION^ICU - 1 (see *example c* above)	LOCATION ^Patient Dept. In this example Patient Dept. is ICU -1.
13	Request Information Status Code		Optional. See *Appendix 4.*

Manufacturer Information Record

Introduction   A manufacturer information record cannot be sent from the ABL700 Series of analyzers, but one can be received in order to lock or unlock the analyzer. More commands can be sent from the RADIANCE Analyzer Control to the analyzer using a proprietary protocol.

NOTE: *RADIANCE does not support this record.*

Manufacturer   The following is an example of a manufacturer information record.
Information
Record Example   M|1|LOCK|

Field	Name - E1394 - 91	Example	Comments
1	Record Type ID	M	
2	Sequence Number	1	1
3	Command	LOCK	LOCK - Places the analyzer in the LOCK mode. *NOTE: UNLOCK Releases analyzer from the LOCK mode.*

Message Terminator Record

Introduction   The message terminator record is always the last record in a message.

Message Terminator Record Example   The following is an example of a message terminator record.

L|1|N

Field	Name - E1394 - 91	Example	Comments
1	Record Type ID	L	
2	Sequence Number	1	1
3	Termination Code	N	"N" - Normal termination.

5. ASTM Message Structure and Examples

Overview

Introduction   This chapter describes how data is sent in the ASTM format, and gives examples.

Contents   This chapter contains the following topics.

Messages Sent From the Analyzer or RADIANCE

Overview

Introduction   The term "message" covers a sequence of records. These can either be sent from the analyzer or RADIANCE to an external computer system, or from the external computer system to RADIANCE or the analyzer.

This section gives examples of messages that are sent from the ABL700 Series analyzer or RADIANCE to the HIS/LIS.

Contents   This section contains the following topics.

Symbols and Meanings

Introduction   The following gives the symbols and their meanings in this topic:

Symbol	Meaning
[{ }]	Zero or more occurrences
[ ]	Optional
{ }	One or more occurrences

**Example
Showing Levels**   The message structure of a patient result is shown below. The C record is only sent if a comment is present, and the number of R records depends on the analyzer configuration.

```
1   H
2        P
3            O
4            [C]
4            [{R
5                    [C]
4            }]
1   L
```

Patient Result

Message Structure

The message structure of a patient result is shown below. The C record is only sent if a comment is present and the number of R records depends on either the analyzer or RADIANCE configuration. Errors found during measurement are not transmitted using this protocol.

Record Type	Name
H	**Header record**
P	**Patient Information record.**
O	**Test order record.**
[{C}]	**0 or more Comment records associated with entire patient result.**
	*NOTE***:** *ABL700 can only have 0 or 1 comment records.*
[{R	**0 or more Result records each containing a parameter value in the patient result**
[{C}]	**Optional Comment records associated with previous result record (parameter value).**
	*NOTE***:** *ABL700 can only have 0 or 1 comment records.*
}]	
L	**Message Terminator record**

Transmission Example

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

- from a ABL700 Series analyser (or RADIANCE configured to use "ABL700" transmission format).

- from RADIANCE where Audit Trail is enabled.

Continued on next page

Patient Result, *Continued*

ABL700 Transmission

The Patient Result has no general errors but does have an error on the pO_2.

H|\^&|||ABL735^Central Lab.|||||||1|19990923114712

P|1||112233||Hansen^Peter|||M||||||25^years||1.82^m|75.0^kg||||||||

O|1||Sample #^3|^^^syringe |||19990922122500||||||||Arterial^Brachial, left|

R|1|^^^Cl-^M|99|mmol/L||N||F||123|19990923105100

R|2|^^^pH^M|7.402|||N||F|||

R|3|^^^pO2^M|?111|mmHg||N||F|||

C|1|I|210|I

R|4|^^^pCO2^M|40.7|mmHg||N||F|||

R|5|^^^Na+^M|134|mmol/L||N||F|||

R|6|^^^Glu^M|5.0|mmol/L||N||F|||

R|7|^^^Lac^M|1.2|mmol/L||N||F|||

R|8|^^^Ca++^M|0.54|mmol/L||N||F|||

R|9|^^^K+^M|3.7|mmol/L||N||F|||

R|10|^^^tHb^M|12.8|g/dL||N||F|||

R|11|^^^sO2^M|97.5|%||N||F|||

R|12|^^^O2Hb^M|91.8|%||N||F|||

R|13|^^^COHb^M|3.9|%||N||F|||
R|14|^^^MetHb^M|1.9|%||N||F|||

R|15|^^^tBil^M|297|micromol/L||N||F|||

R|16|^^^HbF^M|84|%||N||F|||

R|17|^^^T^I|37.0|Cel||||F|||

R|18|^^^pH(T)^M|7.402|||N||F|||

R|19|^^^pCO2(T)^M|40.7|mmHg||N||F|||

R|20|^^^SBE^C|0.6|mmol/L||||F|||

R|21|^^^SBC^C|24.9|mmol/L||||F|||

R|22|^^^pO2(T)^M|?111|mmHg||N||F|||

R|23|^^^p50(act)^E|?19.82|mmHg||||F|||

R|24|^^^tO2^C|?16.6|Vol%||||F|||

L|1|N

Continued on next page

Patient Result, *Continued*

RADIANCE Transmission (Audit Tail 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:

The following differences from ABL700 transmission:

1. *Audit Trail C records.*
2. *A transmission status in the O record of "C" for Correction.*
3. *Transmission status in the R records of "C" for Correction or "R" for Retransmission.*
4. *Only 1 error per comment record. The error text is included as the 2nd component in field 3.*

Continued on next page

Patient Result, *Continued*

RADIANCE Transmission (Audit Trial enabled), continued

H|\^&|||ABL735^Central Lab.||||||||1|20020719164827

P|1||0004||Sørensen^Susanne||19460123|F||||||^|^^^|1.37^m|55.00^kg||||||||

O|1||Sample #^267|^^^||||||||||||Not specified^||||||||||C

R|1|^^^pH^M|?7.412|||N||R|||20020719151122

C|1|I|377^Calibration Drift 2 out of range|I

R|2|^^^pH(T)^C|?7.377|||N||C|||

C|1|L|CHANGE^2002-07-19 16:44:02 () pH(T): 7.412 -> 7.377|G

R|3|^^^p50(act),T^E|?4.12|kPa||N||C|||

C|1|L|CHANGE^2002-07-19 16:44:02 () p50(act),T: 3.47 -> 4.12|G

R|4|^^^p50(act)^E|?3.47|kPa||N||R|||

R|5|^^^pCO2^M|5.53|kPa||N||R|||

R|6|^^^pCO2(T)^C|6.21|kPa||N||C|||

C|1|L|CHANGE^2002-07-19 16:44:02 () pCO2(T): 5.53 -> 6.21|G

R|7|^^^pO2^M|11.5|kPa||N||R|||

R|8|^^^pO2(T)^C|?13.3|kPa||N||C|||

C|1|L|CHANGE^2002-07-19 16:44:02 () pO2(T): 11.5 -> 13.3|G

R|9|^^^SBE^C|?1.7|mmol/L||N||R|||

R|10|^^^ABE^C|?1.6|mmol/L||N||R|||

R|11|^^^Ca++^M|1.21|mmol/L||N||R|||

R|12|^^^Ca(7.4)^C|?1.22|mmol/L||N||R|||

R|13|^^^Cl-^M|110|mmol/L||N||R|||

R|14|^^^Glu^M|8.0|mmol/L||N||R|||

R|15|^^^cH+^C|?38.7|nmol/L||N||R|||

R|16|^^^HCO3-^C|?25.9|mmol/L||N||R|||

R|17|^^^SBC^C|?25.8|mmol/L||N||R|||

R|18|^^^K+^M|3.6|mmol/L||N||R|||

R|19|^^^cH+(T)^C|?42.0|nmol/L||N||C|||

C|1|L|CHANGE^2002-07-19 16:44:02 () cH+(T): 38.7 -> 42.0|G

R|20|^^^Lac^M|0.6|mmol/L||N||R|||

R|21|^^^Na+^M|142|mmol/L||N||R|||

R|22|^^^tCO2(B)^C|?50.2|Vol%||N||R|||

R|23|^^^tHb^M|9.4|mmol/L||N||R|||

R|24|^^^sO2^M|?0.973|||N||R|||

C|1|I|377^Calibration Drift 2 out of range|I

R|25|^^^COHb^M|0.013|||N||R|||

R|26|^^^RHb^M|0.027|||N||R|||

R|27|^^^MetHb^M|0.005|||N||R|||

R|28|^^^T^I|39.4|Cel||N||C|||

C|1|L|CHANGE^2002-07-19 16:44:02 () T: 37.0 -> 39.4|G

R|29|^^^FIO2^I|0.800|||N||C|||

C|2|L|CHANGE^2002-07-19 16:43:36 () FIO2: 0.210 -> 0.800|G

L|1|N

Calibration Result

Message Structure

The message structure of a calibration result is shown below. The C record is only sent if a comment is present, and the number of R records depends either on the analyzer or RADIANCE configuration.

Record Type	Name
H	**Header record**
P	**Patient Information record. Contains fixed string P|1**
O	**Test order record. Identifies calibration result.**
[{C}]	**0 or more Comment records associated with entire calibration result** *NOTE: ABL700 can only have 0 or 1 comment records.*
[{R	**0 or more Result records each containing a parameter value in the calibration result**
[{C}]	**Optional Comment records associated with previous result record (parameter value)** *NOTE: ABL700 can only have 0 or 1 comment records.*
}]	
L	**Message Terminator record**

Transmission Example

A transmission example for a calibration result is given below.

These results have no general errors but do have errors for the following parameters:

- Glucose drift
- Ca^{++} Drift 1
- K^+ Drift 1
- pO2 Drift 1
- pCO$_2$ Drift 1

Calibration Result, *Continued*

Transmission Example *continued*

H|\^&|||ABL735^||||||||1|19990923102738

P|1

O|1||Cal #^133|||||||||||||1 Point Calibration

R|1|^^^tHb^Zero^M|486.34|pA||||F|||19990923083000

R|2|^^^tHb^ZeroDrift^M|1.91|pA||||F|||

R|3|^^^tHb^ZeroStatus^M|0|||||F|||

R|4|^^^Glu^1^M|9.9|mmol/L||||F|||

R|5|^^^Glu^Sens^M|231.0|pA/mM||||F|||

R|6|^^^Glu^Drift^M|?0.9|mmol/L||||F|||

C|1|I|376|I

R|7|^^^Lac^1^M|4.0|mmol/L||||F|||

R|8|^^^Lac^Sens^M|452.6|pA/mM||||F|||

R|9|^^^Lac^Drift^M|0.1|mmol/L||||F|||

R|10|^^^Cl-^1^M|104|mmol/L||||F|||

R|11|^^^Cl-^Status^M|105|mmol/L||||F|||

R|12|^^^Cl-^Drift1^M|-1|mmol/L||||F|||

R|13|^^^pH^1^M|7.398|||||F|||

R|14|^^^pH^Status^M|7.261|||||F|||

R|15|^^^pH^Drift1^M|-0.005|||||F|||

R|16|^^^Ca++^1^M|1.25|mmol/L||||F|||

R|17|^^^Ca++^Status^M|2.66|mmol/L||||F|||

R|18|^^^Ca++^Drift1^M|?0.17|mmol/L||||F|||

C|1|I|376|I

R|19|^^^K+^1^M|4.0|mmol/L||||F|||

R|20|^^^K+^Status^M|3.2|mmol/L||||F|||

R|21|^^^K+^Drift1^M|?0.2|mmol/L||||F|||

C|1|I|376|I

R|22|^^^Na+^1^M|145|mmol/L||||F|||

R|23|^^^Na+^Status^M|122|mmol/L||||F|||

R|24|^^^Na+^Drift1^M|1|mmol/L||||F|||

R|25|^^^pO2^1^M|140.1|mmHg||||F|||

R|26|^^^pO2^Sens^M|11.7|pA/mmHg||||F|||

Calibration Result, *Continued*

Transmission Example continued

R|27|^^^pO2^Drift1^M|?6.3|mmHg||||F|||

C|1|I|376|I

R|28|^^^pCO2^1^M|39.7|mmHg||||F|||

R|29|^^^pCO2^Status^M|44.6|mmHg||||F|||

R|30|^^^pCO2^Drift1^M|?2.8|mmHg||||F|||

C|1|I|376|I

R|31|^^^B^M|756|mmHg||||F|||

L|1|N

Quality Control Result

Message Structure

The message structure of a quality control result is shown below. The C record is only sent if a comment is present, and the number of R records depends on either the analyzer or RADIANCE configuration.

Record Type	Name
H	**Header record**
P	**Patient Information record. Contains fixed string P|1**
O	**Test order record. Identifies Quality Control result.**
[{C}]	**0 or more Comment records associated with entire QC result** *NOTE**: ABL700 can only have 0 or 1 comment records.*
[{R	**0 or more Result records each containing a parameter value in the QC result**
[{C}]	**Optional Comment records associated with previous result record (parameter value)** *NOTE**: ABL700 can only have 0 or 1 comment records.*
}]	
L	**Message Terminator record**

Continued on next page

Quality Control Result, *Continued*

Transmission Example

A transmission example for a quality control result is given below.

There are no general errors but there is an error on the following parameter:

- Ca^{++}

H|\^&|||ABL735^ICU-1||||||||1|20010516124441

P|1|||||||||||||||||||||||

O|1||QC #^3|||||||||||||S7745^21

R|1|^^^T^I|27.2|Cel||||F|||20010502185500

R|2|^^^pCO2^M|39.4|mmHg||||F|||

R|3|^^^Cl-^M|96|mmol/L||||F|||

R|4|^^^pH^M|7.406|||||F|||

R|5|^^^pO2^M|99.4|mmHg||||F|||

R|6|^^^Glu^M|5.2|mmol/L||||F|||

R|7|^^^Ca++^M|0.72|mmol/L||||F|||

C|1|I|589|I

R|8|^^^K+^M|3.7|mmol/L||||F|||

R|9|^^^tHb^M|13.1|g/dL||||F|||

R|10|^^^sO2^M|96.7|%||||F|||

R|11|^^^O2Hb^M|92.3|%||||F|||

R|12|^^^COHb^M|2.5|%||||F|||

R|13|^^^MetHb^M|2.0|%||||F|||

R|14|^^^tBil^M|300|micromol/L||||F|||

R|15|^^^HbF^M|71|%||||F|||

R|16|^^^B^M|757|mmHg||||F|||

R|17|^^^pH(T)^C|7.404|||||F|||

R|18|^^^pCO2(T)^C|39.8|mmHg||||F|||

R|19|^^^pO2(T)^C|101|mmHg||||F|||

L|1|N

Activity Log

Message Structure

The message structure of an activity log is shown below.

Record Type	Name
H	**Header record**
P	**Patient Information record. Contains fixed string P|1**
O	**Test order record. Contains fixed string O|1||Error**
R	**Result record containing system message code, optional text and timestamp**
[C]	**Optional Comment record used to include Extra Info field of activity log. ABL700 Series only. See appendix 4.**
L	**Message Terminator record**

Transmission Example

A transmission example for an activity log is given below.

H\|\^&\|\|\|ABL735^Central Lab.\|\|\|\|\|\|\|\|1\|19990923124707

P\|1

O\|1\|\|Error

R\|1\|\|663\|\|\|\|\|\|\|\|19990917144501

L\|1\|N

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 or Accession Number.

NOTE: *The ABL700 Series analyzers may also send a query message to cancel an outstanding query. This is handled by a field in the Q record. See appendix 4.*

Record Type	Name
H	Header record
Q	Query record. Contains patient ID or Accession Number of patient to query on.
L	Message Terminator record

Transmission Examples   Transmission examples for patient information are given below.

In the following example:

- an **accession number of 789** is used for the query:

H|\^&|||ABL735^Harbour Hospital ABL#3||||||||1|20010507144634
Q|1|^789
L|1|N

In the following example:

- a **patient ID of 12345** is used for the query.

H|\^&|||ABL735^Central Lab.||||||||1|19990923125103
Q|1|12345^
L|1|N

Patient By Department Query

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

NOTE: *The ABL700 series analyzers may also send a query message to cancel an outstanding query. This is handled by a field in the Q record. Refer to appendix 4.*

Record Type	Name
H	**Header record**
Q	**Query record. Identifies Patient department to query on. Field 11 identifies the patient department as the second component (e.g LOCATION^ICU-3)**
L	**Message Terminator record**

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

Patient department is ICU-3.

H|\^&|||ABL725^ICU ABL#3|||||||1|20000101141500
Q|1|||||||||LOCATION^ICU-3
L|1|N

Messages Received By the Analyzer or RADIANCE

Introduction   This section gives examples of messages that are received by the ABL700 Series analyzer or RADIANCE from the HIS/LIS.

Contents   This section contains the following topics.

Patient Information Response

Message Structure	The message structure of a patient information response is slightly different for RADIANCE and for the ABL700. The message structure for each is shown below.
	This message is sent by the HIS/LIS in response to a Patient Information Query or can be sent as unsolicited patient information. See *Chapter 1, Message Types and Message Flow*. On ABL700 unsolicited patient information is stored in the analyzer database whereas the unsolicited message can be stored in the RADIANCE database when it is received by RADIANCE. (For more information on how to do this see *Rime.ini setting SavePatDemographicsResponse (values:never, unsolicitedOnly, always)* under the section *[HIS]* in RADIANCE INI file document. This document is downloadable from the Radiance.dk site.)
NOTE	The inclusion of the O record is **mandatory** in a response from HIS/LIS to an accession-based query number.

RADIANCE Message Structure	

Record Type	Name
H	**Header record**
P	**Patient Information record. Contains patient demographics.**
[{O}]	**RADIANCE. Order records, identify Accession numbers associated with the patient result.**
L	**Message terminator record**

ABL 700 NOTE: *The ABL700 can at most receive 1 O record. See message structure below.*

ABL700 Message Structure	

Record Type	Name
H	**Header record**
P	**Patient Information record. Contains patient demographics.**
[O]	**ABL700 Series. Order record, identifying an Accession number associated with the patient result.**
L	**Message terminator record**

Transmission Examples	Transmission examples for a patient information response are given below. Patient details are:

Patient ID:1234
Last Name:Doe
First Name:John
Sex: Male
Height:159
Weight:67kg
Birth date: 1956-06-07

Patient Information Response, *Continued*

Response from HIS/LIS to an Accession-based Query

In the following a response from the HIS/LIS to a Query based on Accession Number can be seen. Accession number is: 789

H|\^&|||Harbour Hospital LIS^|||||||1|20010507144648

P|1||1234||Doe^John||19560607|M|||||||159^cm|67^kg||||||||

O|1|789

L|1|N

Response from HIS/LIS to a PatientID- based Query

In the following a response from the HIS/LIS to a Query based on Patient ID can be seen. Patient ID is: 1234

H|\^&|||Harbour Hospital LIS^|||||||1|20010507144634

P|1||1234||Doe^John||19560607|M|||||||159^cm|67^kg||||||||

L|1|N

Patient by Department Response

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

Record Type	Name
H	Header record
[{P}]	0 or more Patient Information records.
L	Message Terminator record

Transmission Example

A transmission example for a Patient By Department list sent by the HIS/LIS in response to a Patient By Department Query is given below.

Patient department ICU-1. The department has 5 patients.

H|\^&|||mainframe||||||Patient List||1|20000101141700

P|1||12324||Palmer^Laura||19641217|F|||||||||||||||||ICU-1

P|2||17667||Lynch^David||19460120|M|||||||||||||||||ICU-1

P|3||34567||Smith^John||19520120|M|||||||||||||||||ICU-1

P|4||88388||Jones^Angela||19530120|F|||||||||||||||||ICU-1

P|5||56111||Abraham^Charles||19170605|M|||||||||||||||||ICU-1

L|1|N

Command Message (ABL700 Series Only)

Message Structure

This message may be sent by the HIS/LIS to place an ABL700 Series analyzer in a Locked or Unlocked state.

The message is not supported by RADIANCE.

The structure of a command message is shown below.

Record Type	Name
H	**Header record**
M	**Manufacturer Information record**
L	**Message Terminator record**

Transmission Example

A transmission example for a command message is given below.

H|\^&|||||||||||19990922085400

M|1|LOCK

L|1|N

Complete Transmission Examples using ASTM Low-Level Protocol

Introduction   The following depicts a complete example using ASTM low-level Protocol.

NOTE: *In the following example ABL and Radiance transmissions are unbolded. Transmission from the HIS/LIS system are bolded.*

Transmission Example

<ENQ>

<ACK>

<STX>1H|\^&|||ABL735^Central Lab.||||||||1|19990923131544<CR><ETX>C8<CR><LF>

<ACK>

<STX>2P|1||12345||Doe^John|||U|||||||^||^|^||||||||<CR><ETX>66<CR><LF>

<ACK>

<STX>3O|1||Sample #^4|||||||||||||Arterial^|<CR><ETX>60<CR><LF>

<ACK>

<STX>4R|1|^^^pH^M|7.584|||N||F|||19990923112600<CR><ETX>1A<CR><LF>

<ACK>

<STX>5R|2|^^^pO2^M|63.9|mmHg||N||F|||<CR><ETX>D4<CR><LF>

<ACK>

<STX>6R|3|^^^pCO2^M|22.1|mmHg||N||F|||<CR><ETX>0C<CR><LF>

<ACK>

<STX>7R|4|^^^Cl-^M|75|mmol/L||N||F|||<CR><ETX>06<CR><LF>

<ACK>

<STX>0R|5|^^^Lac^M|8.7|mmol/L||N||F|||<CR><ETX>65<CR><LF>

<ACK>

<STX>1R|6|^^^Ca++^M|0.32|mmol/L||N||F|||<CR><ETX>77<CR><LF>

<ACK>

<STX>2R|7|^^^K+^M|5.3|mmol/L||N||F|||<CR><ETX>C8<CR><LF>

<ACK>

<STX>3R|8|^^^Na+^M|120|mmol/L||N||F|||<CR><ETX>2B<CR><LF>

<ACK>

<STX>4R|9|^^^Glu^M|11.9|mmol/L||N||F|||<CR><ETX>B1<CR><LF>

<ACK>

<STX>5R|10|^^^tHb^M|18.9|g/dL||N||F|||<CR><ETX>ED<CR><LF>

<ACK>

<STX>6R|11|^^^sO2^M|70.4|%||N||F|||<CR><ETX>9D<CR><LF>

<ACK>

<STX>7R|12|^^^O2Hb^M|48.5|%||N||F|||<CR><ETX>DC<CR><LF>

Complete Transmission Examples using ASTM Low-Level Protocol, *Continued*

Transmission Example *(continued)*

<ACK>

<STX>0R|13|^^^COHb^M|21.0|%||N||F|||<CR><ETX>D9<CR><LF>

<ACK>

<STX>1R|14|^^^MetHb^M|10.1|%||N||F|||<CR><ETX>6E<CR><LF>

<ACK>

<STX>2R|15|^^^tBil^M|438|micromol/L||N||F|||<CR><ETX>C2<CR><LF>

<ACK>

<STX>3R|16|^^^HbF^M|62|%||N||F|||<CR><ETX>3A<CR><LF>

<ACK>

<STX>4R|17|^^^T^I|37.0|Cel||||F|||<CR><ETX>9D<CR><LF>

<ACK>

<STX>5R|18|^^^pH(T)^M|7.584|||N||F|||<CR><ETX>24<CR><LF>

<ACK>

<STX>6R|19|^^^pCO2(T)^M|22.1|mmHg||N||F|||<CR><ETX>E8<CR><LF>

<ACK>

<STX>7R|20|^^^SBE^C|-0.8|mmol/L||||F|||<CR><ETX>31<CR><LF>

<ACK>

<STX>0R|21|^^^SBC^C|25.3|mmol/L||||F|||<CR><ETX>2E<CR><LF>

<ACK>

<STX>1R|22|^^^pO2(T)^M|63.9|mmHg||N||F|||<CR><ETX>A7<CR><LF>

<ACK>

<STX>2R|23|^^^p50(act)^C|45.07|mmHg||||F|||<CR><ETX>47<CR><LF>

<ACK>

<STX>3R|24|^^^tO2^C|12.9|Vol%||||F|||<CR><ETX>79<CR><LF>

<ACK>

<STX>4L|1|N<CR><ETX>07<CR><LF>

<ACK>

<EOT>

Complete Transmission Examples using Serial Raw Protocol

Transmission Example

The following is an example of a transmission example:

<STX>

H|\^&|||ABL735^Central Lab.||||||||1|19990923133423<CR>

P|1||12345||Doe^John|||U||||||^||^|^|||||||||<CR>

O|1||Sample #^4|||||||||||||Arterial^|<CR>

R|1|^^^pH^M|7.584|||N||F|||19990923112600<CR>

R|2|^^^pO2^M|63.9|mmHg||N||F|||<CR>

R|3|^^^pCO2^M|22.1|mmHg||N||F|||<CR>

R|4|^^^Cl-^M|75|mmol/L||N||F|||<CR>

R|5|^^^Lac^M|8.7|mmol/L||N||F|||<CR>

R|6|^^^Ca++^M|0.32|mmol/L||N||F|||<CR>

R|7|^^^K+^M|5.3|mmol/L||N||F|||<CR>

R|8|^^^Na+^M|120|mmol/L||N||F|||<CR>

R|9|^^^Glu^M|11.9|mmol/L||N||F|||<CR>

R|10|^^^tHb^M|18.9|g/dL||N||F|||<CR>

R|11|^^^sO2^M|70.4|%||N||F|||<CR>

R|12|^^^O2Hb^M|48.5|%||N||F|||<CR>

R|13|^^^COHb^M|21.0|%||N||F|||<CR>

R|14|^^^MetHb^M|10.1|%||N||F|||<CR>

R|15|^^^tBil^M|438|micromol/L||N||F|||<CR>

R|16|^^^HbF^M|62|%||N||F|||<CR>

R|17|^^^T^I|37.0|Cel||||F|||<CR>

R|18|^^^pH(T)^M|7.584|||N||F|||<CR>

R|19|^^^pCO2(T)^M|22.1|mmHg||N||F|||<CR>

R|20|^^^SBE^C|0.8|mmol/L||||F|||<CR>

R|21|^^^SBC^C|25.3|mmol/L||||F|||<CR>

R|22|^^^pO2(T)^M|63.9|mmHg||N||F|||<CR>

R|23|^^^p50(act)^C|45.07|mmHg||||F|||<CR>

R|24|^^^tO2^C|12.9|Vol%||||F|||<CR>

L|1|N<CR>

<ETX>

Complete Transmission Examples using RADIOMETER Network Protocol

Transmission Example
The following is an example of a transmission example using the RADIOMETER network protocol.

<SOH>

H|\^&|||ABL735^Intensive Care Unit ||||||||1|19991013131021<CR>

P|1||29546587||^|||U|||||||^|^^^|^|^|||||||<CR>

O|1||Sample #^8037|||||||||||||Arterial^|<CR>

R|1|^^^pCO2^M|32.4|mmHg||L||F||User|19990419151100<CR>

C|1|I|84|I<CR>

R|2|^^^pH^M|7.326|||L||F|||<CR>

C|1|I|84|I<CR>

R|3|^^^pO2^M|99.9|mmHg||N||F|||<CR>

R|4|^^^Lac^M|8.9|mmol/L||N||F|||<CR>

R|5|^^^tHb^M|13.6|g/dL||N||F|||<CR>

R|6|^^^RHb^M|2.2|%||N||F|||<CR>

R|7|^^^O2Hb^M|96.7|%||N||F|||<CR>

R|8|^^^COHb^M|0.6|%||N||F|||<CR>

R|9|^^^MetHb^M|0.4|%||N||F|||<CR>

R|10|^^^T^I|37.0|Cel||||F|||<CR>

R|11|^^^FIO2^I|21.0|%||||F|||<CR>

R|12|^^^pH(T)^M|7.326|||N||F|||<CR>

R|13|^^^pCO2(T)^M|32.4|mmHg||N||F|||<CR>

R|14|^^^SBE^C|-8.4|mmol/L||||F|||<CR>

R|15|^^^SBC^C|18.0|mmol/L||||F|||<CR>

R|16|^^^Hct^C|41.8|%||||F|||<CR>

R|17|^^^pO2(T)^M|99.9|mmHg||N||F|||<CR>

R|18|^^^p50(act)^E|28.20|mmHg||||F|||<CR>

R|19|^^^AaDpO2^E|7.6|mmHg||||F|||<CR>

R|20|^^^AaDpO2,T^E|7.6|mmHg||||F|||<CR>

R|21|^^^tO2^C|18.6|Vol%||||F|||<CR>

R|22|^^^RI^E|8|%||||F|||<CR>

L|1|N<CR>

<EOT>

6. ASTM6xx High-Level Protocol (E1394)

Overview

Introduction   This chapter describes the structure of the ASTM6xx high-level protocol. In the product setup program, this is the ASTM6xx option.

This chapter describes how the ABL700 Series analyzers and RADIANCE implement the ASTM6xx protocol. See Section Two of this manual, *ASTM Communication Protocol* on how the protocol was implemented on the ABL500 Series, ABL600 Series analyzers.

Error messages associated with results stored in the ABL700 Series analyzers or in RADIANCE are not transmitted with results if this protocol is used.

RADIANCE has dedicated bidirectional interfaces for the following systems:

- CernerASTM
- HBO
- Hboc
- Labfusion
- Misys (Sunquest)

Contents   This chapter contains the following topics.

Message Structure

Introduction   The following table briefly describes concepts used when describing the ASTM 1384-91 high level protocol. For further details refer to the original ASTM 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
Record	A message is composed of records each containing related elements of data (attributes). Examples of records are the patient information record keeping all the patient data that is common to all tests and the order record keeping data that is common for the individual test.
Field	Each record has a number of fields each holding one or more data elements (attributes). For instance, the patient information record has a field containing the patient's name and a field holding the patient's birth data. Fields are delimited by "|"
Component field	A field may be divided into several component fields. The name field of the patient information record has the components *last name, first name* and *middle initials*. Components are delimited by '^'

Record Types   Hex code: D Messages consist of various record types that are listed in the table below.

Record Type	Name
H	Header record
P	Patient information record
O	Test order record
R	Result record
M	Manufacturer information record
Q	Query record
L	Message terminator record

Continued on next page

Message Structure, *Continued*

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 external computer system in the form of a sequence of records.

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

Record Type	Name
H	Header record
P	Patient information record
O	Test order record
R	Result record 1
R	Result record 2
R	Result record 3
R	Result record 4
R	Result record 5
R	Result record 6
R	Result record 7
L	Message terminator record

Error messages are not transmitted.

Continued on next page

Message Structure, *Continued*

Delimiters Delimiters are used to separate the record into fields and components. Delimiters may vary from implementation to implementation, and are defined as part of the header record.
The following delimiters are used in the ABL700 Series and RADIANCE:

Delimiter	Name	Dec. Code	Hex. Code
"|"	Field delimiter	124	7C
"\\"	Repeat field delimiter	92	5C
"^"	Component field delimiter	94	5E
"&"	Escape delimiter	38	26
<CR>	Record	13	D

NOTE: *The Record delimiter is always <CR> Carriage Return*

    Dec code: 13

    The Record delimiter is applied to the end of all record types.

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

Detailed Structure of Each Record Type

Introduction The information contained in the individual records and fields is dependent on the analyzer configuration, i.e. which fields are enabled in the patient identification screen, which parameters are selected if the dynamic parameters function of the analyzer is activated, and which results layout parameters are activated.

In this section the content of each record type is examined in detail.

Contents This section contains the following topics.

Message Header Record

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

Message Header Example   The following is an example of a message header.

H|\^&|||ABL725^ICU||||||Operators comment||1|19981021135650

Field	Name	Example	Comments
1	Record Type ID	H	
2	Delimiter Definition	|\^&	
3	Message Control ID	Not used	
4	Access Password	Not used	
5	Sender Name	ABL725^ICU	Analyzer type and user definable analyzer name.
6	Sender Street Address	Not used	
7	Reserved	Not used	
8	Sender Telephone Number	Not used	
9	Characteristics of Sender	Not used	
10	Receiver ID	Not used	
11	Comments or Special Instructions	Operator's Comment	The field contains comments entered in the "Comments" field on the ID screen.
12	Processing ID	Not used	
13	Version Number	1	Contains the ASTM version number "1", which corresponds to E1394-91.
14	Date and Time of Message	date:1998.10.21 time:13.56	Contains the date and time for the transmitted message.

Patient Information Record

Introduction The patient information record contains general information about the patient.

NOTE: *The patient information record can also be received after a "query for patient information" has been issued.*

Patient Information Record Example

The following is an example of a patient information record.

P|1||117118112||Doe^John||19601218|M||||||37^years||188^cm|82^kg||||||||ICU2

Field	Name - E1394 - 91	Example	Comments
1	Record Type ID	P	
2	Sequence Number	1	Always 1 in transmissions. Is incremented when used in Patient Department Response from LIS
3	Practice Assigned Patient ID	Not used	
4	Laboratory Assigned Patient ID	117118112	Patient ID.
5	Patient ID No. 3	Not used	
6	Patient Name	Doe^John	Last Name^First Name
7	Mother's Maiden Name	Not used	
8	Date of Birth	19601218	Date of birth. Date of birth is transmitted in the format: YYYMMDD
9	Patient Sex	M	The following codes are used: M - Male F - Female U - Unknown
10	Patient Race	Not used	
11	Patient Address	Not used	
12	Reserved	Not used	
13	Patient Telephone Number	Not used	

Continued on next page

Patient Information Record, *Continued*

Patient Information Record Example, *continued*

14	Attending Physician ID	Not used	
15	Special Field 1	37^years	Patient age ^ unit
16	Special Field 2	Not used	
17	Patient Height	188^cm	Patient height ^ unit.
18	Patient Weight	82^kg	Patient weight ^ unit.
19	Diagnosis	Not used	
20	Medication	Not used	
21	Diet	Not used	
22	Practice Field No. 1	Not used	
23	Practice Field No. 2	Not used	
24	Admission Date	Not used	
25	Admission Status	Not used	
26	Location	ICU2	Patient department.
27	Nature of Diagnostic Code	Not used	
28	Diagnostic Code	Not used	
29	Patient Religion	Not used	
30	Marital Status	Not used	
31	Isolation Status	Not used	
32	Language	Not used	
33	Hospital Service	Not used	
34	Hospital Institution	Not used	
35	Dosage Category	Not used	

Test Order Record

Introduction   The test order record contains information about the particular test on a single specimen.

Test Order Record Example   The following is an example of a test order record.

O|1|ABC1234|Sample#^63|^^^syringe|||199810231057|||||||||Blood^Arterial|Dr.Strangelove|||||||||||||||

Field	Name	Example	Comments
1	Record Type ID	O	
2	Sequence Number	1	Always 1 in transmissions from the ABL700 Series (only one O record is transmitted).
3	Specimen ID - Accession Number	ABC1234	Accession number entered during analysis.
4	Instrument Specimen ID - sample number	Sample #^63	The analyzer automatically generates the number. The text in front of the sequence number identifies the result type. Each result type has its own series of sequence numbers.
		Sample #^63	Sample - patient sample.
		Cal #^12	Cal - calibration.
		QC #^54	QC - quality control.
		Error	Activity log message.
5	Universal Test ID	^^^ syringe	Measuring mode
6	Priority Code	Not used	
7	Ordered Data/Time	Not used	
8	Sample Draw Time	19981023105715	Sample draw time entered during analysis.
9	Collection End Time	Not used	
10	Collection Volume	Not used	
11	Collector ID	Not used	

Continued on next page

Test Order Record, *Continued*

**Test Order
Record Example**
(continued)

Field	Name	Example	Comments
12	Action Code	Not used	
13	Danger Code	Not used	
14	Relevant Clinical Information	Not used	
15	Date/Time Specimen Received	Not used	
16	Specimen Descriptor	Blood^Arterial	"Blood"^Sample type is entered during measurement.
		2 Point Calibration	Calibration type.
		QC level 5^S7730	"QC level" + slot number^QC Solution ID (and no lot number)
17	Ordering Physician	Dr. Strangelove	Physician name or code entered during the analysis.
18	Physician's Telephone Number	Not used	
19	User field No. 1	Not used	
20	User Field No. 2	Not used	
21	Laboratory Field No. 1	Not used	
22	Laboratory Field No. 2	Not used	
23	Date/Time Result reported or Last Modified	Not used	
24	Instrument Charge to Computer System	Not used	
25	Instrument Section ID	Not used	
26	Report Types	Not used	
27	Reserved Field	Not used	
28	Location of Ward of Specimen Collection	Not used	
29	Nosocomical Infection Flag	Not used	
30	Specimen Service	Not used	
31	Specimen Institution	Not used	

Test Order Record - RADIANCE - (Patient Information Response)

Introduction   Zero or more test order records may be included in a patient information response when a patient is queried via patient id or via accession number. When queried by accession number the response contains 1 O record which includes the accession number queried on.

When queried by patient id the O records identify a list of test orders outstanding for the patient with 1 accession number per O record.

Test Order   The following is an example of a test order record.

Record Example   O|1|ABC1234||^^^O1234^BGOXIELECT||||||||||||Dr. McCoy|||||||||||||||

Field	Name - E1394 - 91	Example	Comments
1	Record Type ID	O	
2	Sequence Number	1	Always 1 in transmissions from the ABL700 Series (only one O record is transmitted).
3	Specimen ID - Accession Number	ABC1234	Accession number queried on/returned by HIS/LIS system.
4	Instrument Specimen ID - sample number	Not used	
5	Universal Test ID	^^^O1234^BGOXIELECT	^^^Order item code^Order item
6	Priority Code	Not Used	
7	Ordered Data/Time	Not used	
8	Sample Draw Time	Not used	
9	Collection End Time	Not used	
10	Collection Volume	Not used	
11	Collector ID	Not used	

Continued on next page

Test Order Record - Radiance - (Patient Information Response), *Continued*

Test Order Record Example *(continued)*

Field	Name - E1394 - 91	Example	Comments
12	Action Code	Not used	
13	Danger Code	Not used	
14	Relevant Clinical Information	Not used	
15	Date/Time Specimen Received	Not used	
16	Specimen Descriptor	Not used	
17	Ordering Physician	Dr. McCoy	Physician name responsible for ordering test.
18	Physician's Telephone Number	Not used	
19	User field No. 1	Not used	
20	User Field No. 2	Not used	
21	Laboratory Field No. 1	Not used	
22	Laboratory Field No. 2	Not used	
23	Date/Time Result reported or Last Modified	Not used	
24	Instrument Charge to Computer System	Not used	
25	Instrument Section ID	Not used	
26	Report Types	Not used	
27	Reserved Field	Not used	
28	Location of Ward of Specimen Collection	Not used	
29	Nosocomical Infection Flag	Not used	
30	Specimen Service	Not used	
31	Specimen Institution	Not used	

Test Order Record – ABL700 – (Patient Information Response)

Introduction   Zero or 1 test order records may be included in a patient information response when a patient is queried via patient id or via accession number. When queried by accession number the response contains 1 O record which includes the accession number queried on.

When queried by patient id the **optional** O record identifies an outstanding order for the patient in question.

Test Order   The following is an example of a test order record.
Record Example   O|1|ABC1234||||||||||||||||||||||||||||||||

Field	Name - E1394 - 91	Example	Comments
1	Record Type ID	O	
2	Sequence Number	1	Always 1 in transmissions from the ABL700 Series (only one O record is transmitted).
3	Specimen ID - Accession Number	ABC1234	Accession number queried on/returned by HIS/LIS system.
4	Instrument Specimen ID - sample number	Not used	
5	Universal Test ID	Not used	
6	Priority Code	Not Used	
7	Ordered Data/Time	Not used	
8	Sample Draw Time	Not used	
9	Collection End Time	Not used	
10	Collection Volume	Not used	
11	Collector ID	Not used	

Test Order Record – ABL700 – (Patient Information Response), *Continued*

Test Order Record Example *(continued)*

Field	Name - E1394 - 91	Example	Comments
12	Action Code	Not used	
13	Danger Code	Not used	
14	Relevant Clinical Information	Not used	
15	Date/Time Specimen Received	Not used	
16	Specimen Descriptor	Not used	
17	Ordering Physician	Not used	
18	Physician's Telephone Number	Not used	
19	User field No. 1	Not used	
20	User Field No. 2	Not used	
21	Laboratory Field No. 1	Not used	
22	Laboratory Field No. 2	Not used	
23	Date/Time Result reported or Last Modified	Not used	
24	Instrument Charge to Computer System	Not used	
25	Instrument Section ID	Not used	
26	Report Types	Not used	
27	Reserved Field	Not used	
28	Location of Ward of Specimen Collection	Not used	
29	Nosocomical Infection Flag	Not used	
30	Specimen Service	Not used	
31	Specimen Institution	Not used	

Result Record

Introduction The result record 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.

Result Record Example

The following is an example of a result record.

R|1|^^^pH^M|7.273|||||F||Bill|19980909151803|||

Field	Name - E1394 - 91	Example	Comments
1	Record Type ID	R	
2	Sequence Number	1	This is the first R record.
3	Universal Test ID	^^^pH^M	This field consists of ^^^parametername^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
4	Measurement Value	7.273	The value can be prefixed with a "?" indicating that an error exists on the parameter. e.g. ?62.7 or error code for activity log message

Continued on next page

Result Record, *Continued*

Result Record Example
(continued)

Field	Name - E1394 - 91	Example	Comments
5	Units		Parameter names and the possible units are available in *Appendix 1*.
6	Reference Ranges	Not used	
7	Result Abnormal Flag	Not used	
8	Nature of Abnormality Testing	Not used	
9	Result Status	F	Always "F" indicating final result.
10	Date of Change in Instrument Normative Values or Units	Not used	
11	Operator Identification	Bill	The operator ID. Only sent with the first "R" record.
12	Date/Time Test Started	year: 1998 month:09 day: 09 time sent: 15:1803	Time stamp generated when analysis is completed. Only send with the first "R" record.
13	Date/Time Test Completed	Not used	
14	Instrument Identification	Not Used	

Query Record

Introduction A query message, which contains a query record, can be sent by the analyzer or by RADIANCE if these systems are configured for the following:

- Patient Information Query

For the Patient Information Query, patient information can be requested using either the patient ID or the accession number. On the analyzer, it is configurable whether the patient ID or accession number is used as the query criteria. This is not an issue for RADIANCE as it passes the query sent by the analyzer to the connected HIS/LIS system without modifying it.

Query Record Example The following gives 3 differing examples of a query record:

a) Q|1|11475^

b) Q|1|^11475

Field	Name - E1394 - 91	Example	Comments
1	Record Type ID	Q	
2	Sequence Number	1	Always 1 in transmissions from the ABL700 Series (only one Q record is transmitted).
3	Query Text	11475^ (see *example a* above)	Patient ID^Accession Number. In example a) patient ID number 11475 is sent. If the number entered was an accession number ^11475 would be sent (see *example b)* above)
11	Query text for Patient by Department query	Not used	
13	Request Information Status Code		Optional. See *Appendix 4.*

Manufacturer Information Record

Introduction   A manufacturer information record cannot be sent from the ABL700 Series of analyzers, but one can be received in order to lock or unlock the analyzer. More commands can be sent from the RADIANCE Analyzer Control to the analyzer using a proprietary protocol.

NOTE: *Radiance does not support this record.*

**Manufacturer   The following is an example of a manufacturer information record.
Information
Record Example**   M|1|LOCK|

Field	Name	Example	Comments
1	Record Type ID	M	
2	Sequence Number	1	1
3	Command	LOCK	LOCK - Places the analyzer in the LOCK mode. UNLOCK - Exits the analyzer from the LOCK mode.

Message Terminator Record

Information   The message terminator record is always the last record in a message.

Message   The following is an example of a message terminator record.
Terminator
Record Example   L|1|N

Field	Name	Example	Comments
1	Record Type ID	L	
2	Sequence Number	1	1
3	Termination Code	N	"N" - Normal termination.

7. ASTM6xx Message Structure and Examples

Overview

Introduction   This chapter describes how data is sent in the ASTM6xx High-level format, and gives examples.

Contents   This chapter contains the following topics.

Messages Sent from the Analyzer or RADIANCE

Introduction   The term "message" covers a sequence of records. These can either be sent from the analyzer to an external computer system, or from the HIS/LIS to the analyzer.

This section gives examples of messages that are sent from the ABL700 Series analyzer to the connected HIS/LIS.

Contents   This section contains the following topics.

Symbols and Meanings

Introduction   The following gives the symbols and their meanings in this topic:

Symbol	Meaning
[{}]	Zero or more occurrences
[ ]	Optional
{ }	One or more occurrences

Example Showing Levels   The message structure of a patient result is shown below. The C record is only sent if a comment is present, and the number of R records depends on the analyzer configuration.

```
1   H
2        P
3           O
4           [C]
4           [{R
5                  [C]
4           }]
1   L
```

Patient Result

Message Structure   The message structure of a patient result is shown below. The C record is only sent if a comment is present, and the number of R records depends on the analyzer configuration. Errors found during measurement are not transmitted using this protocol.

Record Type	Name
H	**Header record**
P	**Patient Information record**
O	**Test order record**
[{R	**0 or more Result records each containing a parameter value in the patient result**
}]	
L	**Message Terminator record**

Patient Result, *Continued*

Transmission Example

A transmission example for a patient result is given below. Even though the Patient result has an error on the pO_2, this error is not visible in the following example as errors are not transmitted in the ASTM 6xx.

H|\^&|||ABL735^Central Lab.|||||||||1|19990924091012
P|1||112233||Peter^Hansen|||M||||||25^years||1.82^m|75.0^kg|||||||||
O|1||Sample #^3|^^^Syringe|||19990922122500|||||||||Blood^Arterial|
R|1|^^^Cl-^M|99|mmol/L||||F||123|19990923105100
R|2|^^^pH^M|7.402|||||F|||
R|3|^^^pO2^M|?111|mmHg||||F|||
R|4|^^^pCO2^M|40.7|mmHg||||F|||
R|5|^^^Na+^M|134|mmol/L||||F|||
R|6|^^^Glu^M|5.0|mmol/L||||F|||
R|7|^^^Lac^M|1.2|mmol/L||||F|||
R|8|^^^Ca++^M|0.54|mmol/L||||F|||
R|9|^^^K+^M|3.7|mmol/L||||F|||
R|10|^^^tHb^M|12.8|g/dL||||F|||
R|11|^^^sO2^M|97.5|%||||F|||
R|12|^^^O2Hb^M|91.8|%||||F|||
R|13|^^^COHb^M|3.9|%||||F|||
R|14|^^^MetHb^M|1.9|%||||F|||
R|15|^^^tBil^M|297|micromol/L||||F|||
R|16|^^^HbF^M|84|%||||F|||
R|17|^^^T^I|37.0|Cel||||F|||
R|18|^^^pH(T)^M|7.402|||||F|||
R|19|^^^pCO2(T)^M|40.7|mmHg||||F|||
R|20|^^^SBE^C|0.6|mmol/L||||F|||
R|21|^^^SBC^C|24.9|mmol/L||||F|||
R|22|^^^pO2(T)^M|?111|mmHg||||F|||
R|23|^^^p50(act)^E|?19.82|mmHg||||F|||
R|24|^^^tO2^C|?16.6|Vol%||||F|||
L|1|N

Calibration Result

Message Structure

The message structure of a calibration result is shown below. The number of R records depends on the analyzer configuration.

Errors found during measurement are not transmitted using this protocol.see als

Record Type	Name
H	**Header record**
P	**Patient Information record. Contains fixed string P|1**
O	**Test order record. Identifies calibration result.**
[{R	**0 or more Result records each containing a parameter value in the calibration result**
}]	
L	**Message Terminator record**

Continued on next page

Calibration Result, *Continued*

Transmission Example

A transmission example for a calibration result is given below.

H|\^&|||ABL735^Central Lab.||||||||1|19990924091345

P|1

O|1||Cal #^165|||||||||||||Cal 2

R|1|^^^Glu|9.9|mmol/L||||F|||19990924080000

R|2|^^^Glu^Sens|250.5|pA/mM||||F|||

R|3|^^^Glu^Drift|0.2|mmol/L||||F|||

R|4|^^^Lac|4.0|mmol/L||||F|||

R|5|^^^Lac^Sens|433.1|pA/mM||||F|||

R|6|^^^Lac^Drift|0.0|mmol/L||||F|||

R|7|^^^tHb^Zero|492.02|pA||||F|||

R|8|^^^tHb^ZeroDrift|0.49|pA||||F|||

R|9|^^^tHb^ZeroStatus|0|||||F|||

R|10|^^^pH^High|7.398|||||F|||

R|11|^^^pH^Status|7.257|||||F|||

R|12|^^^pH^DriftH|-0.001|||||F|||

R|13|^^^pH^Low|6.869|||||F|||

R|14|^^^pH^Sens|97.0|%||||F|||

R|15|^^^pH^DriftL|-0.000|||||F|||

R|16|^^^Ca++^Low|1.25|mmol/L||||F|||

R|17|^^^Ca++^Status|3.08|mmol/L||||F|||

R|18|^^^Ca++^DriftL|-0.00|mmol/L||||F|||

Calibration Result, *Continued*

Transmission Example *(continued)*

R|19|^^^Ca++^High|4.98|mmol/L||||F|||

R|20|^^^Ca++^Sens|95.3|%||||F|||

R|21|^^^Ca++^DriftH|-0.01|mmol/L||||F|||

R|22|^^^K+^Low|4.0|mmol/L||||F|||

R|23|^^^K+^Status|3.4|mmol/L||||F|||

R|24|^^^K+^DriftL|0.0|mmol/L||||F|||

R|25|^^^K+^High|40.0|mmol/L||||F|||

R|26|^^^K+^Sens|96.6|%||||F|||

R|27|^^^K+^DriftH|0.0|mmol/L||||F|||

R|28|^^^Na+^High|145|mmol/L||||F|||

R|29|^^^Na+^Status|122|mmol/L||||F|||

R|30|^^^Na+^DriftH|0|mmol/L||||F|||

R|31|^^^Na+^Low|20|mmol/L||||F|||

R|32|^^^Na+^Sens|98.6|%||||F|||

R|33|^^^Na+^DriftL|0|mmol/L||||F|||

R|34|^^^Cl-^High|104|mmol/L||||F|||

R|35|^^^Cl-^Status|104|mmol/L||||F|||

R|36|^^^Cl-^DriftH|-0|mmol/L||||F|||

R|37|^^^Cl-^Low|53|mmol/L||||F|||

R|38|^^^Cl-^Sens|91.0|%||||F|||

R|39|^^^Cl-^DriftL|-0|mmol/L||||F|||

R|40|^^^pO2^High|140.3|mmHg||||F|||

R|41|^^^pO2^Sens|14.8|pA/mmHg||||F|||

R|42|^^^pO2^DriftH|?8.6|mmHg||||F|||

R|43|^^^pO2^Low|0.0|mmHg||||F|||

R|44|^^^pO2^Zero|4.9|mmHg||||F|||

R|45|^^^pO2^DriftL|0.4|mmHg||||F|||

R|46|^^^pCO2^Low|39.8|mmHg||||F|||

R|47|^^^pCO2^Status|45.2|mmHg||||F|||

R|48|^^^pCO2^DriftL|0.0|mmHg||||F|||

R|49|^^^pCO2^High|79.7|mmHg||||F|||

R|50|^^^pCO2^Sens|96.0|%||||F|||

R|51|^^^pCO2^DriftH|-0.0|mmHg||||F|||

R|52|^^^B|757|mmHg||||F|||

L|1|N

Quality Control Result

Message Structure   The message structure of a quality control result is shown below. The number of R records depends on the analyzer configuration.
Errors found during measurement are not transmitted using this protocol.

Record Type	Name
H	**Header record**
P	**Patient Information record. Contains fixed string P|1**
O	**Test order record. Identifies Quality Control result.**
[{R	**0 or more Result records each containing a parameter value in the QC result**
}]	
L	**Message Terminator record**

Quality Control Result, *Continued*

Transmission Example

H|\^&|||ABL735^Central Lab.|||||||1|19990924091644

P|1||||||||||||||||||||||||ICU2|

O|1||QC #^7|||||||||||||QC level 3^S7755

R|1|^^^T|26.0|Cel||||F|||19990917112500

R|2|^^^pH|7.607|||||F|||

R|3|^^^pO2|67.7|mmHg||||F|||

R|4|^^^pCO2|20.6|mmHg||||F|||

R|5|^^^Cl-|75|mmol/L||||F|||

R|6|^^^Glu|12.4|mmol/L||||F|||

R|7|^^^Lac|9.4|mmol/L||||F|||

R|8|^^^Ca++|0.39|mmol/L||||F|||

R|9|^^^K+|5.3|mmol/L||||F|||

R|10|^^^Na+|120|mmol/L||||F|||

R|11|^^^tHb|19.0|g/dL||||F|||

R|12|^^^sO2|70.2|%||||F|||

R|13|^^^O2Hb|48.7|%||||F|||

R|14|^^^COHb|20.6|%||||F|||

R|15|^^^MetHb|10.0|%||||F|||

R|16|^^^tBil|440|micromol/L||||F|||

R|17|^^^HbF|57|%||||F|||

R|18|^^^B|755|mmHg||||F|||

R|19|^^^pH(T)|7.607|||||F|||

R|20|^^^pCO2(T)|20.7|mmHg||||F|||

R|21|^^^pO2(T)|203|mmHg||||F|||

L|1|N

Activity Log

Message Structure

The message structure of an activity log is shown below.

Record Type	Name
H	**Header record**
P	**Patient Information record. Contains fixed string P|1**
O	**Test order record. Contains fixed string O|1||Error**
R	**Result record containing system message code, optional text and timestamp**
L	**Message Terminator record**

Transmission Example

A transmission example for an activity log is given below.

H\|\^&\|\|\|ABL735^Central Lab.\|\|\|\|\|\|\|\|1\|19990924092045

P\|1

O\|1\|\|Error

R\|1\|\|501\|\|\|\|\|\|\|\|19990923160503

L\|1\|N

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 or Accession Number.

NOTE: *The ABL700 Series analyzers may also send a query message to cancel an outstanding query. This is handled by a field in the Q record. See appendix 4 for more details.*

Record Type	Name
H	**Header record**
Q	**Query record. Contains patient ID or Accession Number of patient to query on**
L	**Message Terminator record**

Transmission Example   A transmission example for a query message is given below.

H|\^&|||ABL735^Dep. 714||||||||1|19991207125625

Q|1|100200^

L|1|N

Messages Received by the Analyzer or RADIANCE

Introduction   This section gives examples of messages that are received by the ABL700 Series analyzer from the HIS/LIS.

Contents   This section contains the following topics.

Patient Information Response

Message Structure

The message structure of a patient information response is slightly different for RADIANCE and for the ABL700. The message structure for each is shown below.

This message is sent by the HIS/LIS in response to a Patient Information Query or can be sent as unsolicited patient information. See *Chapter 1, Message Types and Message Flow*. On ABL700 unsolicited patient information is stored in the analyzer database whereas the unsolicited message is not supported by RADIANCE.

NOTE

The inclusion of the O record is mandatory in a response from HIS/LIS to an accession-based query number.

RADIANCE Message Structure

Record Type	Name
H	Header record
P	Patient Information record. Contains patient demographics.
[{O}]	RADIANCE. Order records, identify Accession numbers associated with the patient result.
L	Message terminator record

ABL 700 NOTE: *The ABL700 can at most receive 1 O record. See message structure below.*

ABL700 Message Structure

Record Type	Name
H	Header record
P	Patient Information record. Contains patient demographics.
[O]	ABL700 Series. Order record, identifying an Accession number associated with the patient result.
L	Message terminator record

Transmission Examples

Transmission examples for a patient information response are given below. Patient details are:

Patient ID:1234
Last Name:Doe
First Name:John
Sex: Male
Height:159
Weight:67kg
Birth date: 1956-06-07

Continued on next page

Patient Information Response, *Continued*

Response from HIS/LIS to an Accession-based query number
In the following a response from the HIS/LIS to a Query based on Accession Number can be seen. Accession number is: 789

H|\^&|||Harbour Hospital LIS^||||||||1|20010507144648

P|1||1234||Doe^John||19560607|M||||||||159^cm|67^kg||||||||

O|1|789

L|1|N

Response from HIS/LIS to a PatientID- based Query
In the following a response from the HIS/LIS to a Query based on Patient ID can be seen. Patient ID is: 1234

H|\^&|||Harbour Hospital LIS^||||||||1|20010507144634

P|1||1234||Doe^John||19560607|M||||||||159^cm|67^kg||||||||

L|1|N

Command Message (ABL700 Series Only)

Message Structure

This message may be sent by the HIS/LIS to place an ABL700 Series analyzer in a Locked or Unlocked state.

The message is not supported by RADIANCE.

The structure of a command message is shown below.

Record Type	Name
H	**Header record**
M	**Manufacturer Information record**
L	**Message Terminator record**

Transmission Example

A transmission example for a command message is given below.

H|\^&|||||||||||19990922085400

M|1|LOCK

L|1|N

Complete Transmission Examples Using ASTM Low-Level Protocol

Transmission Example The following is an example of a transmission example.

NOTE: *In the following example, ABL and RADIANCE transmissions are **not** in **bold.** Transmission from HIS/LIS systems **are** in **bold**.*

<ENQ>

<ACK>

<STX>1H|\^&|||ABL735^Central Lab.|||||||||1|19990924092803<CR><ETB>CD<CR><LF>

<ACK>

<STX>2P|1||12345||Johnson^John||19690315|M||||||^||1,82^m|62,0^kg||||||||<CR><ETB>91<CR><LF>

<ACK>

<STX>3O|1||Sample #^4|||||||||||||Blood^Arterial|<CR><ETB>50<CR><LF>

<ACK>

<STX>4R|1|^^^pH^M|7.584|||||F|||19990923112600<CR><ETB>CC<CR><LF>

<ACK>

<STX>5R|2|^^^pO2^M|63.9|mmHg||||F|||<CR><ETB>86<CR><LF>

<ACK>

<STX>6R|3|^^^pCO2^M|22.1|mmHg||||F|||<CR><ETB>BE<CR><LF>

<ACK>

<STX>7R|4|^^^Cl-^M|75|mmol/L||||F|||<CR><ETB>B8<CR><LF>

<ACK>

<STX>0R|5|^^^Lac^M|8.7|mmol/L||||F|||<CR><ETB>17<CR><LF>

<ACK>

<STX>1R|6|^^^Ca++^M|0.32|mmol/L||||F|||<CR><ETB>29<CR><LF>

<ACK>

<STX>2R|7|^^^K+^M|5.3|mmol/L||||F|||<CR><ETB>7A<CR><LF>

<ACK>

<STX>3R|8|^^^Na+^M|120|mmol/L||||F|||<CR><ETB>DD<CR><LF>

<ACK>

<STX>4R|9|^^^Glu^M|11.9|mmol/L||||F|||<CR><ETB>63<CR><LF>

<ACK>

<STX>5R|10|^^^tHb^M|18.9|g/dL||||F|||<CR><ETB>9F<CR><LF>

<ACK>

<STX>6R|11|^^^sO2^M|70.4|%||||F|||<CR><ETB>4F<CR><LF>

Continued on next page

Complete Transmission Examples Using ASTM Low-Level Protocol, *Continued*

Transmission Example, *continued*

<ACK>

<STX>7R|12|^^^O2Hb^M|48.5|%||||F|||<CR><ETB>8E<CR><LF>

<ACK>

<STX>0R|13|^^^COHb^M|21.0|%||||F|||<CR><ETB>8B<CR><LF>

<ACK>

<STX>1R|14|^^^MetHb^M|10.1|%||||F|||<CR><ETB>20<CR><LF>

<ACK>

<STX>2R|15|^^^tBil^M|438|micromol/L||||F|||<CR><ETB>74<CR><LF>

<ACK>

<STX>3R|16|^^^HbF^M|62|%||||F|||<CR><ETB>EC<CR><LF>

<ACK>

<STX>4R|17|^^^T^I|37.0|Cel||||F|||<CR><ETB>9D<CR><LF>

<ACK>

<STX>5R|18|^^^pH(T)^M|7.584|||||F|||<CR><ETB>D6<CR><LF>

<ACK>

<STX>6R|19|^^^pCO2(T)^M|22.1|mmHg||||F|||<CR><ETB>9A<CR><LF>

<ACK>

<STX>7R|20|^^^SBE^C|-0.8|mmol/L||||F|||<CR><ETB>31<CR><LF>

<ACK>

<STX>0R|21|^^^SBC^C|25.3|mmol/L||||F|||<CR><ETB>2E<CR><LF>

<ACK>

<STX>1R|22|^^^pO2(T)^M|63.9|mmHg||||F|||<CR><ETB>59<CR><LF>

<ACK>

<STX>2R|23|^^^p50(act)^C|45.07|mmHg||||F|||<CR><ETB>47<CR><LF>

<ACK>

<STX>3R|24|^^^tO2^C|12.9|Vol%||||F|||<CR><ETB>79<CR><LF>

<ACK>

<STX>4L|1|N<CR><ETX>07<CR><LF>

<ACK>

<EOT>

Complete Transmission Examples Using Serial Raw Protocol

Transmission Example

The following is an example of a transmission example:

\<STX\>

H|\^&|||ABL735^Central Lab.||||||||1|19990924092843\<CR\>

P|1||12345||Johnson^John||19690315|M||||||^||1,82^m|62,0^kg||||||||\<CR\>

O|1||Sample #^4|||||||||||||Blood^Arterial|\<CR\>

R|1|^^^pH^M|7.584|||||F|||19990923112600\<CR\>

R|2|^^^pO2^M|63.9|mmHg||||F|||\<CR\>

R|3|^^^pCO2^M|22.1|mmHg||||F|||\<CR\>

R|4|^^^Cl-^M|75|mmol/L||||F|||\<CR\>

R|5|^^^Lac^M|8.7|mmol/L||||F|||\<CR\>

R|6|^^^Ca++^M|0.32|mmol/L||||F|||\<CR\>

R|7|^^^K+^M|5.3|mmol/L||||F|||\<CR\>

R|8|^^^Na+^M|120|mmol/L||||F|||\<CR\>

R|9|^^^Glu^M|11.9|mmol/L||||F|||\<CR\>

R|10|^^^tHb^M|18.9|g/dL||||F|||\<CR\>

R|11|^^^sO2^M|70.4|%||||F|||\<CR\>

R|12|^^^O2Hb^M|48.5|%||||F|||\<CR\>

R|13|^^^COHb^M|21.0|%||||F|||\<CR\>

R|14|^^^MetHb^M|10.1|%||||F|||\<CR\>

R|15|^^^tBil^M|438|micromol/L||||F|||\<CR\>

R|16|^^^HbF^M|62|%||||F|||\<CR\>

R|17|^^^T^I|37.0|Cel||||F|||\<CR\>

R|18|^^^pH(T)^M|7.584|||||F|||\<CR\>

R|19|^^^pCO2(T)^M|22.1|mmHg||||F|||\<CR\>

R|20|^^^SBE^C|-0.8|mmol/L||||F|||\<CR\>

R|21|^^^SBC^C|25.3|mmol/L||||F|||\<CR\>

R|22|^^^pO2(T)^M|63.9|mmHg||||F|||\<CR\>

R|23|^^^p50(act)^C|45.07|mmHg||||F|||\<CR\>

R|24|^^^tO2^C|12.9|Vol%||||F|||\<CR\>

L|1|N\<CR\>

\<ETX\>

Complete Transmission Examples Using Radiometer Network Protocol

Transmission Example

The following is a complete transmission example using Radiometer network protocol:

<SOH>

H|\^&|||ABL735^Intensive Care Unit |||||||||1|19991013130740<CR>

P|1||29546587||^|||U|||||||^||^|^|||||||||<CR>

O|1||Sample #^8037|||||||||||||Blood^Arterial|<CR>

R|1|^^^pCO2^M|32.4|mmHg||||F||User|19990419151100<CR>

R|2|^^^pH^M|7.326|||||F|||<CR>

R|3|^^^pO2^M|99.9|mmHg||||F|||<CR>

R|4|^^^Lac^M|8.9|mmol/L||||F|||<CR>

R|5|^^^tHb^M|13.6|g/dL||||F|||<CR>

R|6|^^^RHb^M|2.2|%||||F|||<CR>

R|7|^^^O2Hb^M|96.7|%||||F|||<CR>

R|8|^^^COHb^M|0.6|%||||F|||<CR>

R|9|^^^MetHb^M|0.4|%||||F|||<CR>

R|10|^^^T^I|37.0|Cel||||F|||<CR>

R|11|^^^FIO2^I|21.0|%||||F|||<CR>

R|12|^^^pH(T)^M|7.326|||||F|||<CR>

R|13|^^^pCO2(T)^M|32.4|mmHg||||F|||<CR>

R|14|^^^SBE^C|-8.4|mmol/L||||F|||<CR>

R|15|^^^SBC^C|18.0|mmol/L||||F|||<CR>

R|16|^^^Hct^C|41.8|%||||F|||<CR>

R|17|^^^pO2(T)^M|99.9|mmHg||||F|||<CR>

R|18|^^^p50(act)^E|28.20|mmHg||||F|||<CR>

R|19|^^^AaDpO2^E|7.6|mmHg||||F|||<CR>

R|20|^^^AaDpO2,T^E|7.6|mmHg||||F|||<CR>

R|21|^^^tO2^C|18.6|Vol%||||F|||<CR>

R|22|^^^RI^E|8|%||||F|||<CR>

L|1|N<CR>

<EOT>

8. HL7 High-Level Protocol

Introduction   This chapter describes how the ABL700 Series analyzers implement the HL7 High-level protocol..

NOTE: *In RADIANCE HL7 is only supported through the bidirectional interface. The bi-directional interface only supports patient results.*

NOTE: *RADIANCE has dedicated bidirectional interfaces for the following systems:*

- *CernerHL7*

- *Generic HL7*

- *SMS HL7*

- *HL7*

- *Misys (Sunquest) HL7*

NOTE: *The Audit Trail function is only available for the ASTM and HL7 protocols and is only supported by RADIANCE.*

In addition, the format of Comment records documenting general conditions, errors and flags differs slightly between the ABL700 and RADIANCE output. See 8-20 for details on configuring RADIANCE to transmit results using ABL700 format.

Contents

Message Structure

Introduction   The following table briefly describes concepts used when describing the HL7 high-level protocol. For further details, refer to the original HL7version 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*.

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

Message

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

Message Structure, *Continued*

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. See 8-21 for details on how the Audit trail is transmitted via Notes and Comments segments.

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.

Message Structure, *Continued*

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 the ABL700 Series:

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

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

Detailed Structure of Each Segment Type

Introduction   The information contained in the individual segments and fields is dependent on the analyzer configuration, i.e. which fields are enabled in the patient identification screen, which parameters are selected if the dynamic parameters function of the analyzer is activated, and which input parameters are activated.
In this section the content of each record type is examined in detail.

Contents   This section contains the following topics.

Message Header Segment

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

Message Header Examples   The following is an example of a message header.

MSH|^~\&|ABL725^ICU|ABL725^ICU|||19991207131842||ORU^R01|199912071 31842|P^not present|2.2

Field	Name	Example	Comments
0	Identifier	MSH	
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	
10	Message Control ID	19991207131842	Using trans.time
11	Processing ID	P^ not present	
12	Version ID	2.2	

Message Header Segment, *Continued*

**Message Header
Examples**
(continued)

Field	Name	Example	Comments
13	Sequence Number	Not used	
14	Continuation Pointer	Not used	
15	Accept Acknowledgment Type	Not used	
16	Application Acknowledgment Type	Not used	
17	Country Code	Not used	
18	Character Set	Not used	
19	Principal Language Of Message	Not used	

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.*

Patient Identification Segment Example   The following is an example of a patient identification segment.

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

Field	Name	Example	Comments
0	Identifier	PID	
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)	Not used	
4	Alternate Patient ID - PID	117118112	Patient ID entered during the analysis. Patient ID can be entered using the bar code reader.
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.

Patient Identification Segment, *Continued*

Patient Identification Segment Example *(continued)*

Field	Name	Example	Comments
9	Patient Alias	Not used	
10	Race	Not used	
11	Patient Address	Not used	
12	County Code	Not used	
13	Phone Number - Home	Not used	
14	Phone Number - Business	Not used	
15	Primary Language	Not used	
16	Marital Status	Not used	
17	Religion	Not used	
18	Patient Account Number	Not used	
19	SSN Number - Patient	Not used	
20	Driver's License Number - Patient	Not used	
21	Mother's Identifier	Not used	
22	Ethnic Group	Not used	
23	Birth Place	Not used	
24	Multiple Birth Indicator	Not used	
25	Birth Order	Not used	
26	Citizenship	Not used	
27	Veterans Military Status	Not used	
28	Nationality	Not used	
29	Patient Death Date and Time	Not used	
30	Patient Death Indicator	Not used	

Patient Visit Segment

Background   RADIOMETER uses this segment to communicate the patient department.

Field	Name	Example	Comments
0	Identifier	PV1	
1	Set ID - PV1	1	Always 1
2	Patient Class	Not used	
3	Assigned Patient Location	Patient Department	Patient Department
4	Admission Type	Not used	
5	Preadmit Number	Not used	
6	Prior Patient Location	Not used	
7	Attending Doctor	Not used	
8	Referring Doctor	Not used	
9	Consulting Doctor	Not used	
10	Hospital Service	Not used	
11	Temporary Location	Not used	
12	Preadmit Test Indicator	Not used	
13	Readmission Indicator	Not used	
14	Admit Source	Not used	
15	Ambulatory Status	Not used	
16	VIP Indicator	Not used	
17	Admitting Doctor	Not used	
18	Patient Type	Not used	
19	Visit Number	Not used	
20	Financial Class	Not used	
21	Charge Price Indicator	Not used	
22	Courtesy Code	Not used	
23	Credit Rating	Not used	
24	Contract Code	Not used	
25	Contract Effective Date	Not used	

Patient Visit Segment, *continued*

Patient Visit Segment, *continued*

Field	Name	Example	Comments
26	Contract Amount	Not used	
27	Contract Period	Not used	
28	Interest Code	Not used	
29	Transfer to Bad Debt Code	Not used	
30	Transfer to Bad Debt Date	Not used	
31	Bad Debt Agency Code	Not used	
32	Bad Debt Transfer Amount	Not used	
33	Bad Debt Recovery Amount	Not used	
34	Delete Account Indicator	Not used	
35	Delete Account Date	Not used	
36	Discharge Disposition	Not used	
37	Discharged to Location	Not used	
38	Diet Type	Not used	
39	Servicing Facility	Not used	
40	Bed Status	Not used	
41	Account Status	Not used	
42	Pending Location	Not used	
43	Prior Temporary Location	Not used	
44	Admit Date/Time	Not used	
45	Discharge Date/Time	Not used	
46	Current Patient Balance	Not used	
47	Total Charges	Not used	
48	Total Adjustments	Not used	
49	Total Payments	Not used	
50	Alternate Visit ID	Not used	
51	Visit Indicator	Not used	
52	Other Healthcare Provider	Not used	

Observation Request Segment

Introduction

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

Observation Request Segment Example

The following is an example of an observation request segment.

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

Field	Name	Example	Comments
0	Identifier	OBR	
1	Set ID - OBR	1	Always 1 in transmissions from the ABL700 Series (only one OBR segment is transmitted).
2	Placer Order Number	Not used	
3	Filler Order Number	63^Sample # 12^Cal # 54^QC # ^Error	<entity identifier > ^ <namespace ID > The analyzer automatically generates the number. The text after the number identifies the result type. Each result type has its own series of sequence numbers. Sample - patient sample Cal - calibration QC - quality control. Activity log message.

Observation Request Segment, *Continued*

Observation Request Segment Example *(continued)*

Field	Name	Example	Comments
4	Universal Service ID	3647537734	<identifier> Accession number entered
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	
14	Specimen Received Date/Time	Not used	

Observation Request Segment, *Continued*

**Observation
Request
Segment
Example**
(continued)

Field	Name	Example	Comments
15	Specimen Source	Arterial^femoral right	\<specimen source name or code \> ^ \<free text additives \>
			Radiometer has mapped Sample Type and Sample Site to these two component fields like
		2 Point Calibration S7730^4	Sample type^Sample site Both fields are entered during measurement.
			Calibration type.
			QC Solution ID^QC lot - quality control.
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	

Observation Request Segment, *Continued*

**Observation
Request
Segment
Example**
(continued)

Field	Name	Example	Comments
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	
25	Result Status	F or C	F: initially transmitted result. Status "F"inal. C: retransmitted result. Only set when Audit Trail is enabled. Status "C"orrected.
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	Not used	
35	Transcriptionist	Not used	
36	Scheduled Date/Time	Not used	
37	Number of Sample Containers	Not used	
38	Transport Logistics of Collected Sample	Not used	
39	Collector's Comment	Not used	
40	Transport Arrangement Responsibility	Not used	
41	Transport Arranged	Not used	
42	Escort Required	Not used	
43	Planned Patient Transport Comment	Not used	

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.

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

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

Field	Name	Example	Comments
0	Identifier	OBX	Sequence number starts with 1 and increments for each new OBX segment sent.
1	Set ID - OBX	1	
2	Value Type	ST	Data type. ST = String Data
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
4	Observation Sub-ID	Not used	
5	Observation Value	7.273	

Observation Result Segment, *Continued*

**Observation
Result segment
Example**
(continued)

Field	Name	Example	Comments
6	Units		Possible units are available in *Appendix 1*
7	References Range	Not used	
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
9	Probability	Not used	
10	Nature of Abnormal Test	Not used	
11	Observation Result Status	F	Always "F" indicating final result.
12	Date Last Obs Normal Values	Not used	
13	User Defined Access Checks	Not used	
14	Date/Time of the Observation	19990920 123412	Time stamp generated when analysis is completed. Only send 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 send with the first "OBX" segment.
17	Observation Method	Not used	

Notes and Comments Segment (ABL700)

Introduction   Notes and comments segments sent by the ABL700 contain information
concerning the general conditions of the analyzer or errors/flags on individual
parameters.

NOTE: *Notes and comments segments sent by the ABL700 before the first OBX segment
are general messages. Comment segments sent after an OBX segment, are related
to the preceding OBX segment.*

**Notes and
Comments
Segment
Example**

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

NTE|1|L|94

Field	Name	Example	Comments
0	Identifier	NTE	
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 in *Appendices, System Error Codes*

Notes and Comments Segment (RADIANCE)

Introduction

Notes and comments segments sent by RADIANCE 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 RADIANCE.

RADIANCE differs from ABL700 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.

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

Field	Name	Example	Comments
0	Identifier	NTE	
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 *Appendices, System Error Codes*

Notes and Comments Segment (Audit Trail)

Introduction Notes and comments segments sent by RADIANCE 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 RADIANCE, 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.*

Notes and Comments Segment 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 (JBS9 pH(T): 7.412 ->7.377

Field	Name	Example	Comments
0	Identifier	NTE	
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 (JBS9 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>"

Query Definition Segment

Introduction   A query message, which contains a query segment, can be sent by the analyser 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.

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

Continued on next page

Query Definition Segment, *Continued*

Query Definition Segment Example

The following is an example of a query definition segment.

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

Field	Name	Example	Comments
0	Identifier	QRD	
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	1RD	Always 1RD. This is the maximum length of the response that can be accepted by the requesting system in this case one segment.
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.
11	What Data Code Value Qualifier	Not used	
12	Query Results Level	Not used	

Manufacturer Information Segment

Introduction   A manufacturer information segment cannot be sent from the ABL700 Series of 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.

Manufacturer Information Segment Example

The following is an example of a manufacturer information segment.

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

Field	Name	Example	Comments
0	Identifier	QRD	
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.

Continued on next page

Manufacturer Information Segment, *Continued*

Manufacturer Information Segment Example *(continued)*

Field	Name	Example	Comments
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
10	What Department Data Code	Not used	
11	What Data Code Value Qualifier	Not used	
12	Query Results Level	Not used	

9. HL7 High-Level Transmission Examples

Overview

Introduction   This chapter provides examples of how data is sent in the HL7 High-Level format.

Contents   This chapter contains the following topics.

Messages Sent From the Analyzer

Introduction   This section gives examples of messages that are sent from the ABL700 Series analyzer to the HIS/LIS.

Contents   This section contains the following topics.

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, and the number of OBX segments
depends on the analyzer configuration.

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: ABL700 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: ABL700 can only have 0 or 1 comment records.
}]	

Continued on next page

9-3

Patient Result, *Continued*

Transmission Example

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

- From a ABL700 Series analyser (or RADIANCE configured to use "ABL700" transmission format).

- From RADIANCE where Audit Trail is enabled.

ABL700 Transmission

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|||||

Patient Result, *Continued*

RADIANCE Transmission (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 ABL700 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.*

Patient Result, *Continued*

RADIANCE Transmission (Audit Trail enabled) *continued*

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

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, and the number of OBX records
depends on the analyzer configuration.

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 one Comment segments associated with entire calibration result** *NOTE: ABL700 can only have 0 or 1comment 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: ABL700 can only have 0 or 1comment records.*
}]	

Continued on next page

Calibration Result, *Continued*

Transmission 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|||||

Calibration Result, *Continued*

Transmission Example, *continued*

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, and the number of OBX segments depends on the analyzer configuration.

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 one Comment segments associated with entire QC result** *NOTE: ABL700 can only have 0 or 1comment 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: ABL700 can only have 0 or 1comment records.*
}]	

Continued on next page

Quality Control Result, *Continued*

Transmission Example

A transmission example for a quality control result is 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|||||

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. ABL700 Series only. See appendix 4.**

Transmission 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.**

**Transmission
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|||1RD|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 department used as query key.**

Transmission 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 Analyzer

Introduction   This section gives examples of messages that are received by the ABL700 Series analyzer from the HIS/LIS.

Contents   This section contains the following topics.

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 an 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). The remaining elements of the MSA segment are ignored (not used) by ABL700.**
[QRD]	**Optional Query Definition segment.**
[EVN]	**Optional Event segment. All elements of this segment are ignored (not used) by ABL700.**
PID	**Patient Identification segment.**
PV1	**Patient Visit segment.**

**Transmission
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). The remaining elements of the MSA segment are ignored (not used) by ABL700.
QRD	Optional Query Definition segment. Note: this is a mandatory segment.
[EVN]	Optional Event segment. All elements of this segment are ignored (not used) by ABL700.
[{	
PID	0 or more Patient Identification segment-Patient Visit segment pairs.
PV1	
}]	

Transmission Example   A transmission example for a Patient By Department list sent by the HIS/LIS in response to a Patient By Department Query is given below. Patient department - ICU. The department has 4 patients. The segments of the example message includes elements ignored (not used) by ABL700.

MSH|^~\&|LDS-LAB|LABOR|RADIANS|ABL700|20000311165904||ADR^A19|R_0000000450|P|2.2

MSA|AA|20001214145000||

QRD||R|I|1||||ICU|ANU

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^James||19320511|M

PV1||I|ICU

PID|4||066|066|Palmer^Laura||19750713|F

PV1||I|ICU

Command Record

Introduction   This message may be sent by the HIS/LIS to place an ABL700 Series analyzer 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.**

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

MSH|^~\&|||||20010521123420

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

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>

Continued on next page

Complete Transmission Examples Using ASTM Low-Level Protocol, *Continued*

Example,
continued

<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

Transmission 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>

Complete Transmission Examples Using Network Protocol, *Continued*

Transmission Example, *continued*

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>

10.   Tips for Programmers

The following contains a list of tips accumulated in order to help programmers program software to connect to the analyzers.

- QC and Patient results will have a different number of fields for the same "P" record or PID segment, for example, so process each frame of data due to the length of each line, and not based on the number of expected fields.

- Field 4 in the O record or Field 3 in the OBR segment identifies the type of result e.g. Sample=Patient, QC=QC, Cal=Calibration.

- Always implement the check sum calculation when using the ASTM low-level protocol. Otherwise incorrect results may be received.

- The number of R records/OBX segments and their order in the ASTM, ASTM6xx or HL7 communication protocol changes depending on parameter selection, i.e., it cannot be expected that a particular parameter will always remain in the same position. To identify a particular parameter read the "Universal Test ID" field "Parameter name" in the R Record/OBX segment.

- Using the ASTM or ASTM6xx protocol, a result is not finished until a message terminator record has been received.

Appendix 1 - List of Parameters and Units

Patient Results   The following gives a list of Parameters and Unit names for Patient Results

Parameter	ASTM/HL7	ASTM6xx	Unit 1	Unit 2	Unit 3
Baro.	B	B	mmHg	kPa	torr
pH	pH	pH			
pH(‰)	pH(T)	pH(T)			
, CO†	pCO2	pCO2	mmHg	kPa	torr
, CO†(‰)	pCO2(T)	pCO2(T)	mmHg	kPa	torr
ƒHCO›'(P)	HCO3-	HCO3-	mmol/L		
ƒBase(B)	ABE	ABE	mmol/L		
ƒBase(Ecf)	SBE	SBE	mmol/L		
ƒHCO›'(P,st)	SBC	SBC	mmol/L		
ƒtCO†(P)	tCO2(P)	tCO2(P)	mL/dL	mmol/L	Vol%
ƒtCO†(B)	tCO2(B)	tCO2(B)	mL/dL	mmol/L	Vol%
pH(st)	pH(st)	pH(st)			
™O$_2$/ ™ (Dry Air)	O2	O2	%		
™CO$_2$/ ™ (Dry Air)	CO2	CO2	%		
ƒtHb	tHb	tHb	g/dL	g/L	mmol/L
ˆHHb	RHb	RHb	%		
ˆO†Hb	O2Hb	O2Hb	%		
‡O†	sO2	sO2	%		
ˆCOHb	COHb	COHb	%		
ˆMetHb	MetHb	MetHb	%		
ˆHbF	HbF	HbF	%		
Hct	Hct	Hct	%		
, O†	pO2	pO2	mmHg	kPa	torr
, O†(‰)	pO2(T)	pO2(T)	mmHg	kPa	torr
, O†(A)	pO2(A)	pO2(A)	mmHg	kPa	torr
, O†(A,‰)	pO2(A),T	pO2(A),T	mmHg	kPa	torr
, 50	p50(act)	p50(act)	mmHg	kPa	torr
, 50(‰)	p50(act),T	p50(act),T	mmHg	kPa	torr
, 50(st)	p50(st)	p50(st)	mmHg	kPa	torr
, O†(A-a)	AaDpO2	AaDpO2	mmHg	kPa	torr

Continued on next page

Appendix 1 - List of Parameters and Units, *Continued*

Patient Results
(continued)

Parameter	ASTM/HL7	ASTM6xx	Unit 1	Unit 2	Unit 3
, O†(A-a,‰)	AaDpO2,T	AaDpO2,T	mmHg	kPa	torr
, O†(a/A)	a/ApO2	a/ApO2	%		
, O†(a/A,‰)	a/ApO2,T	a/ApO2,T	%		
, O†(x)	px	px	mmHg	kPa	torr
, O†(S′)	pO2(S)	pO2(SO)	mmHg	kPa	torr
ƒtO†(B)	tO2	tO2	mL/dL	mmol/L	Vol%
ƒtO†(a-″)	avDO2	ctO2(a-v)	mL/dL	mmol/L	Vol%
?O†	O2CAP	O2CAP	mL/dL	mmol/L	Vol%
ƒtO†(x)	cx	cx	mL/dL	mmol/L	Vol%
¬O†	DO2	DO2	mL/min	mmol/min	
•-	Qt	Qt	L/min		
•O†	VO2	VO2	mL/min	mmol/min	
ˆO†(I)	FIO2	FIO2	%		
ˆShunt	Shunt	Shunt	%		
ˆShunt(‰)	Shunt,T	Shunt,T	%		
RI	RI	RI	%		
RI(‰)	RI,T	RI,T	%		
RQ	RQ	RQ			
Qx	Qx	Qx			
‡O†(P′)	sO2(P)	sO2(P0)	%		
™CO	V(CO)	VCO	mL		
™(B)	V(B)	V(B)	L		
ƒK„	K+	K+	mmol/L	meq/L	
ƒNa„	Na+	Na+	mmol/L	meq/L	
ƒCa‹	Ca++	Ca++	mmol/L	meq/L	mg/dL
ƒCa‹ (7.4)	Ca(7.4)	Ca(7.4)	mmol/L	meq/L	mg/dL
ƒCl′	Cl-	Cl-	mmol/L	meq/L	
AnionGap,K„	Anion gap (K+)	Anion gap (K+)	mmol/L	meq/L	

Appendix 1 - List of Parameters and Units, *Continued*

Patient Results
(continued)

Parameter	ASTM/HL7	ASTM6xx	Unit 1	Unit 2	Unit 3
Anion Gap	Anion gap	Anion gap	mmol/L	meq/L	
Temp	T	T	Cel	F	
P′	P	P0	mmHg	kPa	torr
S′	S	S0	%		
, O†(″)	pO2(v)	pO2(v)	mmHg	kPa	torr
‡O†(″)	sO2(v)	sO2(v)	%		
ƒGlu	Glu	Glu	mmol/L	mg/dL	
ƒLac	Lac	Lac	mmol/L	meq/L	mg/dL
ƒK„(U)	K+(urine)	cK+(U)	mmol/L	meq/L	
ƒNa„(U)	Na+(urine)	cNa+(U)	mmol/L	meq/L	
ƒCl′(U)	Cl-(urine)	cCl-(U)	mmol/L	meq/L	
, O†(x,‰)	px,T	px,T	mmHg	kPa	torr
ˆCOHb(1)	COHb(1)	FCOHb(1)	%		
ˆCOHb(2)	COHb(2)	FCOHb(2)	%		
ƒtBil	tBil	tBil	micromol/L	mg/dL	mg/L
*m*Osm	mOsm	mOsm	mmol/kg		
ƒH„	cH+	cH+	nmol/L		
ABE	ABE	ABE	mmol/L		
SBE	SBE	SBE	mmol/L		
Birth Weight	Birth Weight	Birth Weight	g	oz	kg
ƒH„(‰)	cH+(T)	cH+(T)	nmol/L		
, O†(a)/ˆO†(l)	pO2(a)/FIO2	pO2(a)/FIO2	mmHg	kPa	torr
, O†(a,‰)/ˆO†(l)	pO2(a,T)/FIO2	pO2(a,T)/FIO2	mmHg	kPa	torr
ƒBase(B,ox)	cBase(B,ox)	cBase(B,ox)	mmol/L		
ƒBase(Ecf,ox)	cBase(Ecf,ox)	cBase(Ecf,ox)	mmol/L		

Appendix 1 - List of Parameters and Units, *Continued*

QC Results   The following gives a list of Parameter and Unit names for QC results

Parameter	ASTM/HL7	ASTM6xx	Unit 1	Unit 2	Unit 3
Baro.	B	B	mmHg	kPa	torr
pH	pH	pH			
, CO†	pCO2	pCO2	mmHg	kPa	torr
ƒtHb	tHb	tHb	g/dL	g/L	mmol/L
ˆO†Hb	O2Hb	O2Hb	%		torr
‡O†	sO2	sO2	%		
ˆCOHb	COHb	COHb	%		
ˆMetHb	MetHb	MetHb	%		
ˆHbF	HbF	HbF	%		
, O†	pO2	pO2	mmHg	kPa	torr
ƒK„	K+	K+	mmol/L	meq/L	Vol%
ƒNa„	Na+	Na+	mmol/L	meq/L	
ƒCa‹	Ca++	Ca++	mmol/L	meq/L	mg/dL
ƒCl′	Cl-	Cl-	mmol/L	meq/L	mmol/L
Temp	T	T	'C	'F	
ƒGlu	Glu	Glu	mmol/L	mg/dL	
ƒLac	Lac	Lac	mmol/L	meq/L	mg/dL
pH	pH(T)	pH(T)			
, CO†	pCO2(T)	pCO2(T)	mmHg	kPa	torr
, O†	pO2(T)	pO2(T)	mmHg	kPa	torr
ƒtBil	tBil	tBil	micromol/L	mg/dL	mg/L

Continued on next page

Appendix 1 - List of Parameters and Units, *Continued*

Calibration Results	The following gives the Parameter and Unit names for Calibration results.			

ASTM/HL7	ASTM6xx	Unit 1	Unit 2	Unit 3
pH^1	pH^High		kPa	torr
pH^2	pH^Low			
pH^Drift1	pH^DriftH		kPa	torr
pH^Drift2	pH^DriftL		g/L	mmol/L
pH^Status	pH^Status			torr
pH^Sens	pH^Sens	%		
pCO2^1	pCO2^Low	mmHg	kPa	torr
pCO2^2	pCO2^High	mmHg	kPa	torr
pCO2^Drift1	pCO2^DriftL	mmHg	kPa	torr
pCO2^Drift2	pCO2^DriftH	mmHg	kPa	torr
pCO2^Status	pCO2^Status	mmHg	kPa	torr
pCO2^Sens	pCO2^Sens	%		
pO2^1	pO2^High	mmHg	kPa	torr
pO2^2	pO2^Low	mmHg	kPa	torr
pO2^Drift1	pO2^DriftH	mmHg	kPa	torr
pO2^Drift2	pO2^DriftL	mmHg	kPa	torr
pO2^Sens	pO2^Sens	pA/mmHg	pA/kPa	mg/dL
pO2^Zero	pO2^Zero	mmHg	kPa	torr
tHb^Zero	tHb^Zero	p A	kPa	torr
tHb^ZeroDrift	tHb^ZeroDrift	p A	kPa	torr
tHb^ZeroStatus	tHb^ZeroStatus		mg/dL	mg/L
K+^1	K+^Low	mmol/L	meq/L	mg/L
K+^2	K+^High	mmol/L	meq/L	torr
K+^Drift1	K+^DriftL	mmol/L	meq/L	torr
K+^Drift2	K+^DriftH	mmol/L	meq/L	torr
K+^Status	K+^Status	mmol/L	meq/L	torr
K+^Sens	K+^Sens	%		torr
Na+^1	Na+^High	mmol/L	meq/L	torr
Na+^2	Na+^Low	mmol/L	meq/L	torr
Na+^Drift1	Na+^DriftH	mmol/L	meq/L	torr
Na+^Drift2	Na+^DriftL	mmol/L	meq/L	
Na+^Status	Na+^Status	mmol/L	meq/L	

Appendix 1 - List of Parameters and Units, *Continued*

ASTM/HL7	ASTM/6xx	Unit 1	Unit 2	Unit 3
Na+^Sens	Na+^Sens	%		torr
Ca++^1	Ca++^Low	mmol/L	meq/L	mg/dL
Ca++^2	Ca++^High	mmol/L	meq/L	mg/dL
Ca++^Drift1	Ca++^DriftL	mmol/L	meq/L	mg/dL
Ca++^Drift2	Ca++^DriftH	mmol/L	meq/L	mg/dL
Ca++^Status	Ca++^Status	mmol/L	meq/L	mg/dL
Ca++^Sens	Ca++^Sens	%		
Cl-^1	Cl-^High	mmol/L	meq/L	
Cl-^2	Cl-^Low	mmol/L	meq/L	
Cl-^Drift1	Cl-^DriftH	mmol/L	meq/L	
Cl-^Drift2	Cl-^DriftL	mmol/L	meq/L	
Cl-^Status	Cl-^Status	mmol/L	meq/L	
Cl-^Sens	Cl-^Sens	%		
Glu^Sens	Glu^Sens	pA/mM		
Glu^Drift	Glu^Drift	mmol/L	mg/dL	
Lac^Sens	Lac^Sens	pA/mM		
Lac^Drift	Lac^Drift	mmol/L	meq/L	mg/dL
Glu^1	Glu	mmol/L	mg/dL	
Lac^1	Lac	mmol/L	meq/L	mg/dL

Appendix 1 - List of Parameters and Units, *Continued*

Patient Information for RADIANCE

The following table lists the allowable unit strings for patient information parameters contained in the P record or PID segment for RADIANCE.

Parameter	Field/ Component	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Patient Age	15/2	years	months	days	weeks	hours
Patient Height	17/2	feet	cm	m	in	
Patient Weight	18/2	kg	lbs	oz	g	
Patient Gestational Age	16/2	years	months	days	weeks	hours
Patient Birth Weight	16/4	kg	lbs	oz	g	

Patient Information for ABL700

The following table lists the allowable unit strings for patient information parameters contained in the P record or PID segment for ABL700

Parameter	Field/ Component	Unit 1	Unit 2	Unit 3
Patient Age	15/2	years	months	days
Patient Height	17/2	feet	cm	m
Patient Weight	18/2	kg	lbs	
Patient Gestational Age	16/2	Weeks		
Patient Birth Weight	16/4	kg	oz	g

Appendix 2 - Extended Handshake Options

NOTE - ABL700 3.8 Software: *From ABL700 Software version 3.8, Extended Handshake Options DO NOT APPLY.*

Appendix 3 - Activity Log Messages

Introduction   The following contains a list of system error messages.

NOTE: *The list may be updated during upgrades of the ABL700 and RADIANCE software.*
    To get an updated list contact your RADIOMETER representative.

NOTE: *In the following list numbers 94-167 are not in RADIANCE version 2.*

ErrorCode	ErrorName	
0		
1	Inconsistent software versions. Please contact service.	
83	Measured value above reference range but within the critical limits	
84	Measured value below reference range but within the critical limits	
85	Measured value is below the critical limits but within the measuring range	
86	Measured value is above the critical limits but within the measuring range	
89	Measured QC value above the defined control range	
90	Measured QC value below the defined control range	
93	Measured value above the measuring range	
94	Measured value below the measuring range	
99	LIS/HIS: Low level protocol send failed	
100	LIS/HIS: Low level protocol receive failed7	
101	LIS/HIS: Low level protocol unable to send because connection is busy	
102	LIS/HIS: Low level protocol receive failed because of timeout	
109	LIS/HIS: Low level protocol send failed. ACK or NAK not received	
115	LIS/HIS: Low level protocol ACK after ENQ not received	
117	LIS/HIS: Connection manager configuration not correct	
118	LIS/HIS: Connection manager could not open high level protocol	
128	LIS/HIS: Failed to open connection	
129	LIS/HIS: Failed to close connection	
131	LIS/HIS: Failed to send packet	
132	LIS/HIS: Failed to receive packet	
133	LIS/HIS: High level protocol could not open low level protocol	
134	LIS/HIS: High level protocol configuration not correct	
135	LIS/HIS: High level protocol could not open connection	
136	LIS/HIS: High level protocol could not close connection	
141	LIS/HIS: Low level protocol configuration not correct	
142	LIS/HIS: Low level protocol failed to open connection	
143	LIS/HIS: Low level protocol failed to close connection	
165	LIS/HIS: High level protocol could not generate high level packet	
166	LIS/HIS: Low level protocol received packet in wrong format	
167	LIS/HIS: High level protocol received packet in wrong format	
200	User msg:	*Note: See appendix 4*
201	Westgard Rule (1.2s) violation	
202	Westgard Rule (1.3s) violation	

203	Westgard Rule (2.2s) violation	
204	Westgard Rule (R.4s) violation	
205	Westgard Rule (4.1s) violation	
206	Westgard Rule (10.x) violation	
207	Calibration schedule reminder(s) present	
208	Quality control schedule reminder(s) present	
209	Replacement schedule reminder(s) present	
210	Calibration error(s) present	
211	Quality control error(s) present	
212	System message(s) present	
213	Automatic backup failed	
214	Automatic backup succeeded	
215	Automatic backup failed. Error code:	
216	Printer error	
217	Replacement:	*Note: See appendix 4*
218	Inlet positioning error	
219	Conditioning error in El/Met electrode module	
220	Conditioning error in Future electrode module	
225	Inlet not in target position before timeout. withdrawing from sample aspiration	
226	Inlet not in Syringe position before timeout. preparing for sample aspiration	
227	Inlet not in Side position before timeout. preparing for sample aspiration	
228	Inlet not in Cone position before timeout. preparing for Gas sample aspiration	
232	Oxi Water Spectrum Intensity Bad	
234	Oxi Sample Spectrum Intensity too low	
235	Spectrometer EEPROM reading failed	
236	Spectrometer EEPROM writing failed	
237	Spectrometer voltage bias too high	
238	Spectrometer voltage bias too low	
245	Spectrometer temperature too high	
246	Spectrometer temperature too low	
247	Spectrometer A/D converter failed	
248	Spectrometer missing trigger	
249	Halogen Lamp voltage too high	
250	Halogen lamp voltage too low	
251	Halogen Lamp intensity too high	
252	Halogen Lamp intensity too low	
254	Photodiode current setting too high	
255	Photodiode current setting too low	
256	Neon Lamp voltage too high	
257	Neon Lamp voltage too low	
258	Neon Lamp intensity too low	
259	Temp. error: Oxi photodiode	
269	Hemolyzer phase regulation failed	
270	Temp. error: Hemolyzer	
290	Warning: SHb detected	
291	SHb too high	
292	Turbidity too high	
293	Warning: HbF detected and compensated for	
307	S7770 SULFORHODAMINE DILUTION DETECTED. CAL NOT PERFORMED. -	
310	SAT100 CAL TURBIDITY OUTSIDE LIMITS - CAL NOT PERFORMED.-	
311	SAT100 CAL COHB OUTSIDE LIMITS - CAL NOT PERFORMED. - DEVELOP	

312	SAT100 CAL METHB OUTSIDE LIMITS - CAL NOT PERFORMED. - DEVELOP
314	Oxi wavelength deviation large
315	Neon number too high
316	Neon number too low
318	GASUNIT PRESSURE TRANSDUCER VOLTAGE TOO HIGH
319	GASUNIT PRESSURE TRANSDUCER VOLTAGE TOO LOW
320	GASUNIT VALVE1 DUTYCYCLE TOO HIGH
321	GASUNIT VALVE1 DUTYCYCLE TOO LOW
322	GASUNIT VALVE2 DUTYCYCLE TOO HIGH
323	GASUNIT VALVE2 DUTYCYCLE TOO LOW
324	GASUNIT REGULATION PRESSURE TOO HIGH
325	GASUNIT REGULATION PRESSURE TOO LOW
326	Gas 1 cylinder empty
327	Gas 2 cylinder empty
328	No leading air segment in inlet's liquid sensor within time frame
329	QC expiration date exceeded
330	BGs Liquid sensor full while reversing liquid
331	No sample detected during sample aspiration
332	No sample in pH/BG upper liquid sensor within time limit
333	pH/BG upper liquid sensor is not full within time limit
334	pHBG's Liquid Sensor very full in pH only mode
339	Inlet Liquid Sensor empty too soon, while calibrating reagent pump
340	Inlet Liquid Sensor not empty within timeout, while calibrating reagent pump
342	Inlet Liquid Sensor empty too soon, while calibrating pH/BG pump
343	Inlet Liquid Sensor not empty within timeout, while calibrating pH/BG pump
345	Inlet Liquid Sensor empty too soon, while calibrating El/Met pump
346	Inlet Liquid Sensor not empty within timeout, while calibrating El/Met pump
347	Inlet not in Lock position before timeout, preparing for sample aspiration
348	Inlet not in SIDE position before timeout, preparing for sample aspiration
349	Inlet not in LOCK position before timeout, preparing for sample aspiration (cap)
350	Inlet not in SERVICE position before timeout
351	Inlet not in SIDE position before timeout, FlapOpenedTooLong
354	Temp. error: Inlet preheater
355	Temp. error: pH/BG module
356	Temp. error: El/Met module
357	Temp. error: Barometer
365	Cleaning Solution missing - check level in bottle
366	Oxi not empty within time limit in Cal1
367	pH/BG not filled within time limit
369	El/Met not filled within time limit
370	El/Met not filled within time limit in Cal1
374	Inhomogeneous sample at pH/BG module
375	Calibration status out of limits
376	Calibration Drift 1 out of range
377	Calibration Drift 2 out of range
378	Calibration sensitivity out of range
379	Calibration unstable. (Response fault)
386	Barometer out of range
408	Zero current error
418	Interferences
443	Ca(7.4) not usable

447	Zero current error during measurement
452	Interference during measurement
457	Future not filled within time limit in Cal1
458	Inlet not in CONE3 position before timeout, preparing Cal2
459	Oxi not empty within time limit in Cal2
460	Inlet not in SIDE position before timeout, preparing Cal3
467	Inhomogeneous sample at El/Met module
468	Inhomogeneous sample at Future module
469	Inhomogeneous Cal1 solution
470	Inhomogeneous Cal2 solution
471	Inlet not in SERVICE position before timeout, preparing Vacate
474	No sample in El/Met upper liquid sensor within time limit
475	No sample in Oxi's liquid sensor within time limit
476	Measurement unstable
478	pCO2 drifting
480	pO2 drifting
481	No Rinse plug detected in Flush
482	Rinse plug too large in Flush
484	Today is last day in current statistical month - remember to print QC statistics
487	A new statistical month has begun - remember to export WDC data
490	No sample in inlet's liquid sensor when Oxi is filled
493	Warning: Bilirubin detected and compensated for
494	Bilirubin too high
498	Inlet not in CONE3 position before timeout, preparing Cal1
499	Sample too early in OXI's liquid sensor.
500	Rinse detected by pH/BG upper Liquid Sensor during filling from bottom
501	Rinse not aspirated into the pH/BG module within time limit
502	Air detected during filling of Inlet during PumpCal - retrying...
503	Unable to fill Inlet with continuous rinse segment during Pump Calibration
504	No sample in El/Met lower Liquid Sensor within time limit
505	Future upper liquid sensor did not detect Cleaning Solution
506	El/Met upper liquid sensor did not detect Cleaning Solution
507	pH/BG upper liquid sensor did not detect Cleaning solution
508	Rinse Error
509	pH/BG upper liquid sensor did not receive Rinse from above
510	El/Met upper liquid sensor did not receive Rinse from above
511	Upper Future liquid sensor did not receive Rinse from above
512	Temperature error
513	No gas
514	Communication error
516	Bottle empty or transport error
520	Inlet error
521	Inhomogeneous sample
522	Calibration error
523	Calibration drift out of range
524	Measuring error
525	Conditioning error
527	Communication script error
528	Communication socket error
529	Inlet liquid sensor error
530	Serial communication error

531	pH/BG upper Liquid Sensor error
532	El/Met lower Liquid Sensor error
534	El/Met upper Liquid Sensor error
535	Future lower Liquid Sensor error
536	Future upper Liquid Sensor error
537	Oxi Liquid Sensor error
538	pH/BG pump error
539	El/Met pump error
540	Future pump error
541	Reagent pump error
542	Waste pump error
543	Communication protocol error
544	Communication encoder error
545	General communication error
547	Temperature error
556	Inlet Liquid Sensor full after adjustment during Startup
557	pH/BG upper Liquid Sensor full after adjustment during Startup
558	El/Met lower Liquid Sensor full after adjustment during Startup
559	El/Met upper Liquid Sensor full after adjustment during Startup
560	FUTin Liquid Sensor full after adjustment during Startup
561	Future Liquid Sensor full after adjustment during Startup
562	Oxi Liquid Sensor full after adjustment during Startup
563	tHb Liquid Sensor full after adjustment during Startup
564	No Cleaning solution detected by Oxi liquid sensor during initializing.
565	No Cleaning solution detected by tHb liquid sensor during initializing
567	No Cal 2 solution detected by Oxi liquid sensor during initializing
568	No Cal 2 solution detected by tHb liquid sensor during initializing
569	No Cal 1 solution detected by Oxi liquid sensor during initializing
570	No Cal 1 solution detected by tHb liquid sensor during initializing
571	No Rinse solution detected by Oxi liquid sensor during initializing
572	No Rinse solution detected by tHb liquid sensor during initializing
573	Oxi Sample spectrum intensity too high
574	Missing Cal data
576	Pump calibration error
577	Timing button missing
578	Option management error
579	Oximetry hardware problem. Not possible to measure.
580	Oximetry hardware problem. Possible to measure.
581	Oxi spectrum mismatch
582	tHB calibration outside limits
583	Measurement value is outside measuring range of the parameter
584	Oximetry calibration error
585	Oximetry measuring error
586	Oximetry hardware error
587	Option key error
588	Measured QC value lower than statistical range
589	Measured QC value higher than statistical range
593	Insufficient sample
594	No sample in El/Met lower liquid sensor when Oxi is filled
595	Liquid sensor calibration error
597	Liquid detected in pH/BG module during Gas Calibration

600	Demo option will expire soon
602	Inlet not filled properly during Rinse
603	Options being installed
604	Parameter not installed
605	Cal expired
606	Cal expired (pH)
608	Cal expired (pCO2)
609	Cal expired (pO2)
610	Cal expired (K)
611	Cal expired (Na)
612	Cal expired (Ca)
613	Cal expired (Cl)
614	Cal expired (Glu)
615	Cal expired (Lac)
616	Cal expired (Oxi)
618	Waste detector error
619	Waste container missing
620	Waste container full
621	Waste container critically full
622	Expected Liquid level below 0
623	Solution empty
624	Solution missing
625	Timed out waiting for Gas1 segment at Inlet liquid sensor
627	Inlet not in CONE3 position before timeout, preparing Refill
628	No Cleaning solution detected by Oxi liquid sensor during Refill
629	No Cleaning solution detected by tHb liquid sensor during Refill
630	No Cal 2 solution detected by Oxi liquid sensor during Refill
631	No Cal 2 solution detected by tHb liquid sensor during Refill
632	No Cal 1 solution detected by Oxi liquid sensor during Refill
633	No Cal 1 solution detected by tHb liquid sensor during Refill
634	No Rinse solution detected by Oxi liquid sensor during Refill
635	No Rinse solution detected by tHb liquid sensor during Refill
636	Gas 1 cylinder low pressure.
637	Gas 2 cylinder low pressure.
639	Unexpected liquid detected during Leak Test
641	ABL/DMS PC restarted
642	ABL/DMS PC Connected to AU
643	ABL/DMS PC Disconnected from AU
644	Missing sample at El/Met measuring module in Capillary 95 uL mode
645	Inlet probe positioning error just after flap was opened
646	Refill error
647	Inlet not in CONE3 position before timeout, preparing FillRinse
648	Calibration failed or not accepted
649	Inlet not in CONE3 position before timeout, preparing OxiCal1
650	Oxi liquid sensor not empty within timeframe in 1 point Calibration.
651	Inlet not in CONE3 position before timeout, preparing Cleaning
652	Oxi liquid sensor did not receive Rinse from the Fluidic Module
653	Sample in pH/BG upper liquid sensor prematurely during aspiration
654	Sample in El/Met upper Liquid Sensor, prematurely during aspiration
655	Sample in pH/BG upper liquid sensor prematurely during aspiration
656	Sample in Oxi liquid sensor prematurely during aspiration

657	TopPlug never reached pH/BG upper Liquid Sensor
658	Inlet flaps removed
659	Cover removed or window opened
660	Inlet calibration error
661	Leak detected
662	Barometer out of range
663	Leakage
664	Sample transport error
665	Measured value out of selected range
668	Calibration drift value exceeded user selected limit
669	QC value out of selected range
671	Analyzing Unit service setup non default
672	Inlet error: Pickup offset adjust error
673	Inlet error: Optic ref point error
674	Inlet error: No gasket detected
675	Inlet error: Position calc. error
676	Inlet error: Sensitivity out of range
677	Unreliable
678	Heater error
679	Barometer error
680	pH/BG module not active
681	El/Met module not active
682	Oxi module not active
683	Inlet module not active
686	Cal 2 Solution missing - check level in bottle
687	Cal 1 Solution missing - check level in bottle
688	ctHb/ceHb too low for Oxi calculation
689	Gas pressure offset voltage out of range.
690	Automatic AU SW Repair
691	AU in bootstrap mode
692	ABL not connected to Radiance
693	ABL not connected to Radiance - incorrect password
694	ABL connected to Radiance
695	ABL disconnected from Radiance
696	ABL<>Radiance communication error
697	Requested AutoCheck QC ampoule not present in carousel
698	Performing AutoCheck on last ampoule in schedule instead of non-present
699	AutoCheck QC measurement started due to calibration error
700	Scheduled AutoCheck not run due to errors in last calibration
703	QC expired
704	AutoCheck QC measurement is repeated
705	AutoCheck QC measurement is repeated twice
707	Replacement(s) overdue by 10%. Analyzer locked.
708	Corrective action not possible due to empty AutoCheck carousel
709	El/Met module not expected
710	Oxi module not expected
711	Warning: DysHb High
712	FHbF measurement not possible
713	ctBil measurement not possible
714	AutoCheck mechanical error
715	AutoCheck communication error

716	AutoCheck cover missing	
717	Carousel packing non-optimal	
718	AutoCheck carousel will need refilling soon	
719	Insufficient sample at pH/BG module	
720	Insufficient sample at El/Met module	
721	Insufficient sample at Future module	
722	Sample error	
723	No Cleaning solution detected by inlet during Startup	
724	No Cal 2 solution detected by inlet during Startup	
725	No Cal 1 solution detected by inlet during Startup	
726	No Rinse solution detected by inlet during Startup	
727	No Cleaning solution detected by inlet during Refill	
728	No Cal 2 solution detected by inlet during Refill	
729	No Cal 1 solution detected by inlet during Refill	
730	No Rinse solution detected by inlet during Refill	
731	Upper Future liquid sensor did not receive Rinse from above	
733	New part installed	
734	DMS not connected to AU	
735	Ampoule temperature error	
736	Unstable AutoCheck temperature	
737	Calibration solution missing. Check level in bottle	
738	Ampoule(s) in AutoCheck carousel not installed	
739	Solution's composition not identifiable	
740	AutoCheck cover failure	
741	AutoCheck Ampoule House failure	
742	AutoCheck Carousel failure	
743	AutoCheck Breaker failure	
744	AutoCheck Laser Setup Error	
745	Low hard disk space	
746	Rinse - Solution low warning	
747	Cal1 - Solution low warning	
748	Cal2 - Solution low warning	
749	Cleaning - Solution low warning	
750	Solution projection adjusted	
751	Wet section activity:	*Note: See appendix 4*
752	Cal3 - Solution low warning	
753	Service Electrode Updatings setup non default	
754	Cal expired (Urea)	
755	tHb hardware problem	
756	tHb offset compensation out of range	
757	tHb dark signal unstable	
758	tHb dark signal too low	
759	tHb dark signal too high	
760	tHb light level too low	
761	tHb light level too high	
762	tHb Liquid Sensor error	
763	AutoCheck temperature out of validated range	
764	Liquid detected in pH/BG module during Expired Air Sample	
765	Inlet is choked	
766	ABL not connected to Radiance - no Radiance connection license	
767	ABL not connected to Radiance - ABL StatLink version too high	

768	ABL not connected to Radiance - ABL StatLink version too low
769	ABL<>Radiance communication error - XML packet could not be parsed

Appendix 4 - Extended System Messages

Optional Comment   An optional ASTM C record or HL7 NTE segment may be added to a system message transfer in order to include the content of a user message, the item of a replacement and the type of an analyzer activity. To enable this additional data transfer, please contact your local RADIOMETER technician.

*NOTE***:**   *The added C record is only transmitted when extra information (information in addition to the error code) is available. Error code 751 is used for analyzer activities, code 200 is used for user messages and code 217 is used for a replacement.*

Example   The following example shows the transmission of a message concerning replacement of a Na membrane:

```
H|\^&|||ABL735^|||||||||1|20001026133628
P|1
O|1||Error
R|1||217|||||||||20001026133212
C|1|I|Na Membrane|G
L|1|N
```

Appendix 5 - Additional Input Parameters

Introduction   The following gives details about additional parameters which can be used.

Parameter	ASTM6xx	ASTM/HL7
Spontaneous RR	Spontaneous_RR	Spontaneous_RR
Set RR	Set_RR	Set_RR
Vt	Vt	Vt
Ve	Ve	Ve
Peak Flow	Peak_Flow	Peak_Flow
Liter Flow	Liter_Flow	Liter_Flow
Ti	Ti	Ti
PEEP	PEEP	PEEP
Pressure Support	Pressure_Support	Pressure_Support
CPAP	CPAP	CPAP
CMV	CMV	CMV
SIMV	SIMV	SIMV
Flow-by	Flow-by	Flow-by
HFV	HFV	HFV
I:E Ratio	I:E_Ratio	I:E_Ratio
Wave	Wave	Wave
ICD9 Code	ICD9_Code	ICD9_Code
Oxygen Device	Oxygen_Device_1	Oxygen_Device_1
Oxygen Device	Oxygen_Device_2	Oxygen_Device_2
Diagnostic Code	Diagnostic_Code	Diagnostic_Code

Appendix 6 – Audit Trail – General Considerations

Types of Transmissions

The Audit trail of changes to Patient Results are reflected in the HIS/LIS output sent by RADIANCE, whether it be HL7 or ASTM.

Transmitted Patient Results can be in one of 4 states.

State - Patient Result is considered….	
initial	when it is received for the first time from the analyzer and does not contain any entries in the change log.
initial with change log	if it has been received and edited or retransmitted to RADIANCE before the service has been sent to the HIS/LIS for the first time. This will typically be the case if the HIS/LIS connection has been down for a period of time. In this case when the connection is recovered the service should be sent as if it had the state "initial" but the entire change log should be included.
retransmitted	when it has been retransmitted from the analyzer, and it contains changes with respect to the original transmission. These changes will be reflected in the change log in RIME.
edited	when it has been changed by one of the RADIANCE applications.

How To Send

The "initial" Patient Result should be sent to the HIS/LIS system with the Report type (ASTM) or Result status (HL7) of transmission set to Final status. All subsequent transmissions are considered to be of type "edited" or "retransmitted" and should be sent with status set to Corrected. In addition parameters included in the service will be marked with a status indicating whether they have been changed or not. Refer to the sections ASTM and HL7 below for the specific settings.

When a record, or segment in the transmission, refers to a parameter that has been changed then the change is documented via a series of comment records, or note segments, immediately following the parameter record or segment.

Change Log - Total and Not Incremental

Each transmission to the HIS/LIS will contain a *COMPLETE* log of changes to the Patient Result since it's "initial" state. This means that the Patient Result will

- grow in size each time

- that the last transmission will contain all historical information required by the HIS/LIS system to satisfy regulatory requirements. This also implies that not all transmissions are required by the HIS/LIS system to assemble a complete change log for the Patient Result.

The last Patient Result can always be manually retransmitted to get a complete log thereby eliminating concern over lost data during retransmission.

Continued on next page

1

Appendix 6 – Audit Trail – General Considerations, *Continued*

Parameter Error Handling in Comment Records/Note Segments

Currently errors associated with a patient, QC or calibration result are included as a ^ separated list of error codes in 1 C record, following the O record or R record, for ASTM transmissions.

When the Audit trail is enabled, each error will have it's own C record/Note segment.

In order to be backward compatible, however, it must still be possible to generate the old format. To do this, the Audit Trail function must be disabled.

In order for RADIANCE to be backward compatible, a version of the astm ini file, astm7xx.ini, is installed which can be used to format messages according to the old format.

To use this file the current astm.ini file must be renamed (or deleted) and the file astm7xx.ini must be renamed to astm.ini. The HISLISPlugin must be restarted, via the NTSA, after this change.

Ordering of Comment Records/Note Segments

The comment record/note segment in HIS/LIS transmissions is used to both transmit a log of changes to a service and to document eventual errors/flags associated with parameter values.

When a parameter record/segment has both 1 or more errors and 1 or more changes associated with it then *Error* records/segments *come first* followed by *Change* records/segments.

e.g.
```
R|24|^^^tO2^C|?16.6|Vol%||||C|||
C|1|I|210^error text 1|I
C|2|I|334^error text 2|I
C|3|I|112^error text 3|I
C|4|I|CHANGE^23:05 2001-10-03 (Bill) tO2: 13.2 -> 16.6|G
```

Log of Changes to Patient/Sample Demographic Data

If a change has been made to a Patient Result which is not reflected in one of the R records or OBX segments included in the service transmission, (e.g. Patient or Sample Demographics which are located in the P/O record or PID/OBR segments) then the change is documented as a general comment (C record or NTE segment preceding the first R record or OBX segment).

e.g.
```
P|1||112233||Peter^Hansen|||M|||||||25^years||1.82^m|69.0^kg||
|||||||
O|1||Sample #^3|^^^syringe
|||20011002113012|||||||||Arterial^Brachial, left|Dr.
McCoy|||||||||C|
C|1|L|CHANGE^23:14 2001-10-03 (Bill) weight: 75.0 -> 69.0|G
```

Continued on next page

2

Appendix 6 – Audit Trail – General Considerations, *Continued*

Patient Demographic Labels

The Patient demographic item being changed may contain one of the following labels:

Label	Is for….
lastName	Last (family name of patient
middleName	Middle name of patient
firstName	First name of patient
sex	Showing the sex of the patient
weight	Weight of patient
height	Height of patient
birthweight	Weight at birth
GestationalAge	Age in weeks at birth

Handling of Missing Transmissions during HIS/LIS Connection Failures

This section specifies what to do if a Patient Result has been received by RADIANCE and "edited" or "retransmitted" before there has been a chance to send the Patient Result onwards to the HIS/LIS system for the first time.

This can happen when the HIS/LIS connection has been down for a period of time and one then chooses to send both the "initial" Patient Result and all subsequent "edited" and/or "retransmitted" Patient Results when the connection is re-established. However, because each transmitted Patient Result contains a complete log of changes, only the latest version of the Patient result is sent and this is marked as "initial" (status Final) in the O record or OBR segment. This enables the HIS/LIS system to handle the service as a first time delivery. e.g.

```
H|\^&|||ABL735^Central Lab.|||||||||1|20011003231512
P|1||112233||Peter^Hansen|||M||||||25^years||1.82^m|69.0^kg||
||||||
O|1||Sample #^3|^^^syringe
|||20011002113012||||||||||Arterial^Brachial, left|Dr.
McCoy|||||||||F|
C|1|L|CHANGE^23:14 2001-10-03 (Bill) weight: 75.0 -> 69.0|G
C|2|L|CHANGE^23:14 2001-10-03 (Bill) pCO2: 111 -> <Not
included>|G
R|1|^^^Cl-^M|99|mmol/L||N||F||Bill|20011002114000
R|2|^^^pH^M|7.402|||N||F|||
R|3|^^^pO2^M|?111|mmHg||N||F|||
C|1|I|210|I
R|5|^^^Na+^M|134|mmol/L||N||F|||
R|6|^^^Glu^M|5.0|mmol/L||N||F|||
R|7|^^^Lac^M|1.2|mmol/L||N||F|||
R|8|^^^Ca++^M|0.54|mmol/L||N||F|||
R|9|^^^K+^M|3.7|mmol/L||N||F|||
R|10|^^^tHb^M|10.9|g/dL||N||F|||
C|1|L|CHANGE^23:04 2001-10-03 (Bill) tHb: 12.8 -> 10.9|G
R|11|^^^sO2^M|97.5|%||N||R|||
...
L|1|N
```

Appendix 6 – Audit Trail – General Considerations, *Continued*

ASTM

Marking a Patient Result as a Retransmission

The "Report Type" field (26) in the O record is used to flag a retransmission of a patient result. It may have one of the following values:

- F : final result (used for initial transmissions)

- C : correction of previously transmitted result (used for all subsequent retransmissions of the same result .

Types of Changes Marked in Retransmission

A change can be an

- update

- addition

- deletion

of a parameter value.

A change in the value, or addition of a new value in a result, is reflected in the reporting of the value. The affected value is marked as changed via the R record for the affected parameter. This is done via the "Result Status" field (9) in the R record. It may have one of the following values:

- F: final result (used for initial transmission)

- C: Corrected (used for a parameter which has been changed in a retransmission)

- R: Retransmission (used for a parameter in a retransmission which has not been changed)

In addition, a series of 1 or more C (comment) records follow the R record for each parameter that has changed. These document the change(s), including the time of change and the operator who has made the change(s). A comment record appears for each change, thereby tracking all changes made, and allowing both the initial result and any intermediate results to be reproduced. The change is specified as free text, and is included as the 2nd component of the "Comment Text" field (4).

For a value which has been deleted, the change is documented by a general comment to the result. These are included as C records and immediately follow the O record but precede the first R record.

For an example transmission refer to *Chapter 5*.

Appendix 6 – Audit Trail – General Considerations, *Continued*

HL7

Marking a result as a retransmission

The "Result status" field (25) in the OBR segment is used to flag a retransmission of a patient result. It may have one of the following values:

- F : final result (used for initial transmissions)

- C : correction of previously transmitted result (used for all subsequent retransmissions of the same result .

Types of Changes Marked in Retransmission

A change can be an

- update

- addition

- deletion

of a parameter value.

A change in the value or addition of a new value in a result is reflected in the reporting of the value. The affected value is marked as changed via the OBX segment for the affected parameter. This is done via the "Observation Result Status" field (11) in the OBX segment. It may have one of the following values:

- F: final result (used for initial transmission)

- C: Corrected (used for a parameter which has been changed in a retransmission)

In addition a series of 1 or more NTE (comment) segments follow the OBX segment for each parameter that has changed. These document the change(s), including the time of change and the operator who has made the change(s). A comment segment appears for each change, thereby tracking all changes made, and reproducing both the initial result and any intermediate results. The change is specified as free text, and is included as the 2nd component of the "Comment" field (3).

For a value which has been deleted, the change is documented by a general comment to the result. These are included as NTE segments and immediately follow the OBR segment but precede the first OBX segment.

For an example HL7 transmission refer to *Chapter 9*.

Manufacturer: **RADIOMETER COPENHAGEN**

RADIOMETER MEDICAL A/S, DK-2700 BRØNSHØ

Communication Protocol Specifications

Publication: September 2003

Edition: E

Code Number: 989-329