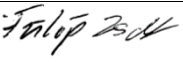
Document title	# EC90 LIS Interface **V1.01**
Document purpose	This document describes the communication specifications of EC90
Intended use	Development

	Name	**Date**	**Signature**
Written by	Zsolt Fülöp	26.02.2021	
Approved by			

1. Revisions

Revision History:

Revision	Date	Status	By	Signature	Description
V1.0	02.02.2021	Initial version	Zsolt Fülöp		EC 90 LIS communication initial version
V1.01	26.02.2021				Device identification and serial number added to header record User specified sample ID added to order record

Table of Contents

2. EC90 LIS interface

The communication is based on physical connection method RS232 or Ethernet connection per HOST connection. The communication protocol is based on the ASTM standards 1381 and E 1394.

- ASTM 1381 for “physical” communication – this communication protocol describes the mechanism of sending of data
- ASTM E 1394 for “logical” communication – this communication protocol describes the mechanism of coding of data.

Physical level and data link level

Specification for Low-level protocol to transfer message between clinical laboratory instruments and computer systems

Data link level consists of the following 3 types of communication status:

- Setting status
- Forwarding status
- End status

Setting status

Establish a logical communication and determine the sending direction of information. This defines the Sending and Receiving sides.

1. The Sending side transmits [ENQ] to the Receiving side.
2. In its response, the Receiving side:
    a. Returns [ACK] if the transmission is available.
    b. Returns [NAK] if the transmission is unavailable. The Sending side must wait 10 seconds before re-sending [ENQ].

Forwarding status

The Sending side transmits messages to the Receiving side. The following is an example of the text frame structure:

<STX><Frame #><Data><ETX><Checksum><CR><LF>

Symbol	**Code**	**Sescription**
STX	Indicates the beginning of the text Send.	Code to be sent at the beginning of a frame.
Frame #	Frame Number	Frame Number is “0” to “7” of ASCII numbers. Its purpose is to distinguish between sent frame and re-send frames. This 1-digit number is sent immediately after STX characters. The Frame Number begins with “1” when the Forwarding Status starts, and increases sequentially, every time a new frame is sent and a positive reply is received.

		The Frame Number returns to "0" after "7", and the above steps are repeated.
Data	Message Text (Refer to explanation of ASTM E1394)	Employ ASTM E1394 Record. Refer to the Message Format in the later section for details.
ETX	Indicates the end of the text Send.	The code to indicate the end of the final frame.
Checksum		Sum charcter values between [STX] and [ETX] in Binary. Then take the last 8 bits and express it in Hexadecimal (2 digits). Then, change the 2-digit number into "0" to "F" ASCII character format, and save each digit as checksum
CR	The ASCII Code for Recovery.	Code required before completing an E1394-91 Record (E1381-91 Message) or code that is sent between the 2nd and last within a frame.
LF	ASCII Code for line changes.	LF Code is used for the last character of a frame. LF cannot be used for Text messages.

End status

The Sending side sends [EOT] to indicate that all information has been transmitted to the Receiving side, and turns to the Idling Status.

Timeout

In Setting Status, the Sending side sets a 15-second timer when sending [ENQ]. If there is no response within the 15 seconds, Timeout is applied. The Sending side turns to an End Status when Timeout occurs.

Restricted Message Codes

- STX (02) Beginning of Text Sending
- ETX (03) End of Text Sending
- EOT (04) End of Sending
- ENQ (05) Inquiry
- ACK (06) Positive Response
- NAK (15) Negative Response

3. Communication mode

EC90->LIS

In this mode as soon as an analysis is performed completely, EC90 analyser may send its results to host computer.

EC90	Com. Direction	Host
ENQ	->	
	<-	ACK
H: Header record	->	
	<-	ACK
P: Patient record	->	
	<-	ACK
OBR: Order record	->	
	<-	ACK
OBX: Test result	->	
	<-	ACK
L: End Mark Record	->	
	<-	ACK
EOT	->	

4. Data record

The data record is a type of Text beginning with ASCII (alphabet code) called record descriptor, and ending with [CR]

- H Record (header)
- P Record (patient)
- OBR Record – one or more (order)
- For each line or one more OBX lines (result)
- L Record (end of message)

Example:

H|\\^&||A.2|20150106142536|
P|1|00010032|A0125|CLAUDE^DOMINIQUE|19680514|
OBR|1|00010032||NORBERT^HAURY||||||
OBX|1|00010032 |TYPE|Na|124.5|mmol/L|0||||20150106112502|
OBX|2|00010032 |TYPE|K|21.1|mmol/L|0||||20150106112502|
OBX|3|00010032 |TYPE|iCa|43.1|mmol/L|0||||20150106112502|
OBX|4|00010032 |TYPE|Cl|15.6|mmol/L|0||||20150106112502|
L|1

Fields

The record can be separated into several fields by separators. The fields are distinguished by their position in the record. Field lengths are not fixed. The following are types of separators:

Field	|	Distinguish between fields within records. - When there is no contents in a field, send the separator only.
Repeat	~	Use to distinguish a repeated/multiple same type of information within a field.
Component	^	Divide a field into several sub-fields.
Sub-component	&	Defined only in Header. Not used as separator.
Escape	\	Defined only in Header. Not used as separator.

Header record

Header records include definitions of separators, Version Information, and the Message Created Date etc.

H|\\^&|EC90|00500|A.2|20150106142536|

Field n°	Field	Value or remarks
1	Header ID	H
2	Delimiter definition	Field delimiter: generally "|"
		Repeat character: generally "~"
		Component delimiter: generally "^"
		Escape and sub component character: generally "\" and "&" unused
3	Device identification number	EC90
4	Device SN	00500
5	Version N°	A.2
6	Date & time of message	YYYYMMDDHHMMSS

Patient record

Patient record includes patient attribute information.

P|1|00010032|A0125|CLAUDE^DOMINIQUE|19680514|

Field n°	Field	Value or remarks
1	Patient ID	P
2	Trans-mission sequence number	Sequence Number. Sequential from “1” and increase by one per patient.
3	Sample ID	Sample ID
4	Patient ID	Patient ID, if defined
5	Patient Name	FN^LN
6	DOB	Date of Birth Format: YYYYMMDD

Order record

Order record includes test order information. Multiple order items are included in a record by using component separators.

OBR|1|00010032|Test123|NORBERT^HAURY||||||

Field n°	Field	Value or remarks
1	Order ID	OBR
2	Sequence number	Sequence Number Sequential per OBR record
3	Sample ID	Sample ID
4	SPECID	User specified Sample ID
5	Operator ID	Operator ID
6-10	Not in use	

Test result record

Test result record includes information on the received results.

OBX|1|00010032 |TYPE|Na|124.5|mmol/L|0||||20150106112502|

Field n°	Field	Value or remarks
1	Result ID	OBX
2	Sequence number	Sequence Number. Sequential per OBX Record
2	Sample ID	Sample ID
3	TYPE	TYPE message
4	Result type	Na, K, ICA, Cl
5	Result	123.4
6	Unit	mmol/L
7	Error no.	Measurement error flags
8-10	Not in use	
11	Date & time of message	YYYYMMDDHHMMSS

End mark record

L|1

Field n°	Field	Value or remarks
1	End Mark ID	L
2	Sequence number	1