

Bi-LIS Interface Manual

Protocol :Boditech

Interface : Serial

Ver. : 0.8

Released : 2021-12-10

Introduction

This manual provides the necessary information for interfacing the Boditech's instrument with a host computer. The host computer is often inside a LIS.

The Boditech's instrument can be one of below table and it will be represented as device name in protocol.

	Instrument	Device Name
1	ichroma-50	i50
2	AFIAS-50	A50
3	A5000	A5000
4	ichroma-10	i10
5	A3000	A3000
6	AFIAS-10	A10

The communication between the Boditech's instrument and the host computer can be via:

- a serial connection using RS-232C cable.

1. Communication

2.1. Frame

A frame in Boditech's Bi-LIS contains all information for one transaction. The Boditech's instrument will always include only one record in a frame when sending frames to the host. Frames sent by the host to the instrument must only include one record per frame. Generally a frame looks like this:

<STX> FN <Record1> <ETX> C1 C2 <CR><LF>

Control characters used in frames are:

<STX> - (Hex 02)

<ETB> - (Hex 17)

<CR> - (Hex 0D)

<LF> - (Hex 0A)

<ETX> - (Hex 03)

The frame always begins with "<STX> FN", where FN is the number of the frame. **FN is always 1.**

The frame ends with "<ETX> C1 C2 <CR><LF>". C1 combined with C2 is a two character checksum in hexadecimal format (0-9, A-F).

2.2. Checksum

The checksum is calculated by adding the binary values of the characters, keeping the least significant eight bits of the result. The checksum is initialized to zero with the <STX> character. Each character in the frame is added to the checksum (**modulo 256**). The <STX>, the checksum characters, and the trailing <CR> and <LF> are not included in the checksum (<ETX> and <ETB> are included). The checksum is transmitted as two characters, C1 and C2, in the hexadecimal representation of the checksum, with the

most significant character first.

Example:

A checksum of 122 can be represented as 7A in hexadecimal. The checksum characters are then: C1 = 7 and C2 = A.

2.3 Records

A record consists of fields divided by a delimiter. The record ends with a <CR>. See [chapter 3 Records and Fields](#) for a detailed description of all record types and fields sent and received.

The first field in all records is the “Record Type ID” field, always one character. The record types used in the instrument are:

Q – Message Request Record

O – Message Order Record

R – Message Result Record

| - Field delimiter. Divides the record into fields.

\ - Repeat delimiter. Repeat the field contents

^ - Component delimiters. Divides a field into components.

Using the delimiters above, a record can look like this:

<Record Type ID> | <Field 1> | <Field2>\<Repeat of Field2> | <Component1 of Field3>^<Component2 of Field3> <CR>

2. Records and Fields

3.1 Work Order Query Message

Q Record

Field Number	Field Name	Description	Max Length	Values
Q-1	Record Type ID	Query	1	Q
Q-2	Device Name	Device Name can be one of the Boditech's instrument	10	A10 or A50 or A5000 or i50 or A3000 or i10
Q-3-2	Starting Range ID	Specimen ID	20	Barcode ID

Example:

Q|A10|^123456789 <CR>

Q|A5000|^987654321 <CR>

3.2 Work Order Download (Response) Message

O Record

Field Number	Field Name	Description	Max Length	Values
O-1	Record Type ID	Order	1	O
O-2	Device Name	Device Name can be one of the Boditech's instrument	10	A10 or A50 or A5000 or i50 or A3000 or i10
O-3	Specimen ID	Barcode ID assigned to the specimen	20	Barcode ID

O-5-2	Universal Test ID	Component 1,3,4: Always empty. NOTE: Only component 2 (Project Name) is used. Repeat delimiters are used for Multiple types of analysis within one order.	10	^ Type of analysis^^
O-8	Specimen Collection Date and Time	Specimen Collection Date and Time: Contents the Date/Time when the order was created.	14	YYYYMMDD HHMMSS

Example:

O|A10|123456789||^COVID-19 Ab^^^COVID-19 nAb^^||20211201125654<CR>

O|A5000|987654321||^CRP^^^PCT^^||20141201125654<CR>

See the [chapter 5 Project Name](#) for detail information

3.3 Test Result Upload Message

R Record

Field Number	Field Name	Description	Max Length	Values
R-1	Record Type ID	Result	1	R
R-2	Device Name	Device Name can be one of the Boditech's instrument	10	A10 or A50 or A5000 or i50 or A3000 or i10
R-3	Specimen ID	Barcode ID assigned to the specimen	20	Barcode ID
R-4-2	Project Name		20	Project Name
R-4-3	Sub Project Name	Incase of single item, it is empty	20	Sub item name
R-4-4	Result Type	Quantitative (#) Qualitative (%)	1	# or % or @

		<i>Semi-qualitative</i> (@)		
R-5	Data Value	Quantitative Result Value	20	Number
R-6	Unit	The unit of the Data Value (mg/L, mol/L...)	10	Ex) mg/L.
R-7	Reference Ranges	Always like “1-88”, separate by ‘-’. It could be empty	20	1-20
R-8	Qualitative Result	If Result Type(R-3-4) would be Quantitative(#), this value would be empty. Qualitative is one of Positive/Negative/Indeterminate	1	Empty or Positive or Negative or Indeterminate
R-9-1	Which Cartridge Slot	Which bay and slot information, ex) L_1 means LeftBay’s first slot, R_5 means RightBay’s fifth slot.	5	L_1, L_2, L_3, L_4, L_5, R_1, R_2, R_3, R_4 or R_5.
R-9-2	Which Tube Position	Which tube position information ex) _01 : First Tube ~ _10 : Last Tube	10	_01, _02, _03, _04, _05, _06, _07, _08, _09, or _10
R-10	Result Status	Always be F(final)	1	F
R-12	Date/Time Test Started	It could be empty	14	YYYYMMDD hhmmss
R-14	Date/Time Test Completed	Time when the test was completed on the instrument	14	YYYYMMDD hhmmss
R-15	PID (User Input)	PID assigned to the specimen	20	User input PID

Example:

In case of single quantitative item “CRP” from LeftBay’s fourth cartridge and second tube hole.

R|A10|123456789|^CRP^^#|76|mg/L|0.5-200||L_4^_02|F|||20141201144906|<CR>

In case of single qualitative item “COVID-19 Ag” from RightBay’s first cartridge and first tube

R|A10|^COVID-19 Ag^^%||||Positive|R_1^_01|F||||20210428153944|<CR>

In case of combo quantitative item “PCT/CRP”, two results will upload separately from LeftBay’s first cartridge and third tube

R|A10|123456789|^PCT/CRP^CRP^#|46|mg/L|0.5-200||L_1^_03|F||||20141201144906|<CR>

R|A10|123456789|^PCT/CRP^PCT^#|15|ng/mL|0.1-100||L_1^_03|F||||20141201144906|<CR>

In case of combo semi-qualitative item “COVID-19 Ab”, two results(IgG, IgM) will upload separately from LeftBay’s first cartridge and without tube

R|A10|123456789|^COVID-19 Ab^IgG^@||||Positive|L_1^|F||||20141201144906|<CR>

R|A10|123456789|^COVID-19 Ab^IgM^@||||Negative|L_1^|F||||20141201144906|<CR>

See the [chapter 5 Project Name](#) for detail information

3.4 Check Result Message

C Record

Check the result of the specimen is already uploaded or not.

Field Number	Field Name	Description	Max Length	Values
C-1	Record Type ID	Result	1	R
C-2	Device Name	Device Name can be one of the Boditech's instrument	10	A10 or A50 or A5000 or i50 or A3000 or i10
C-3	Specimen ID	Barcode ID assigned to the specimen	20	Barcode ID
C-4	Project Name		20	Project Name
C-5	Reserved			

Example:

Check if the specimen (123456789)'s the CRP result is uploaded or not.

C|A10|123456789|CRP|<CR>

4. Dynamic Description

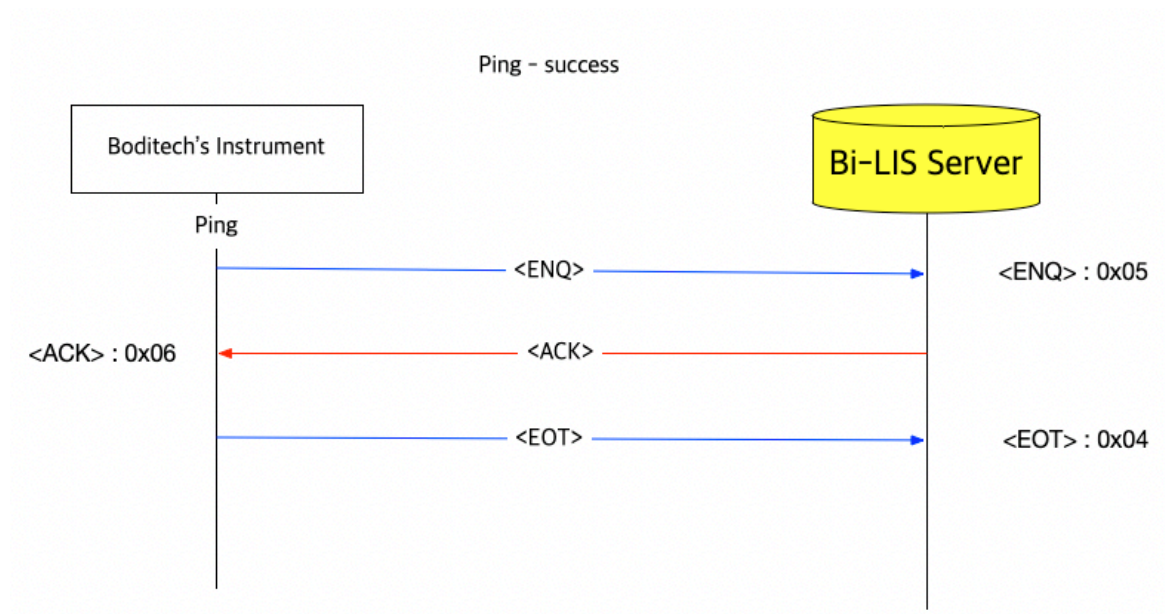
In this chapter a dynamic description of the transactions between the Boditech's instrument and a LIS system is described.

4.1 Pings to the LIS

In order for the Boditech's instrument to test the connection to the LIS a so-called ping is used.

A ping consists of the Boditech's instrument sending an <ENQ> to the LIS. It then waits for the LIS to send back either an <ACK> or a <NAK>. When <ACK> or <NAK> is received the Boditech's instrument immediately sends an <EOT> to indicate a closure of the transfer. If the Boditech's instrument does not receive <ACK> or <NAK> within 2 seconds the ping fails and the Boditech's instrument sends <EOT>.

Instrument	LIS
<ENQ>	
	<ACK> or <NAK>
<EOT>	



4.2 Order Request and Download

Boditech's instrument	Host computer (LIS)	Phase
<Frame (Record Q)>		Order Request
	<Frames (Record O)>	Order download
<ACK>		
	<EOT>	

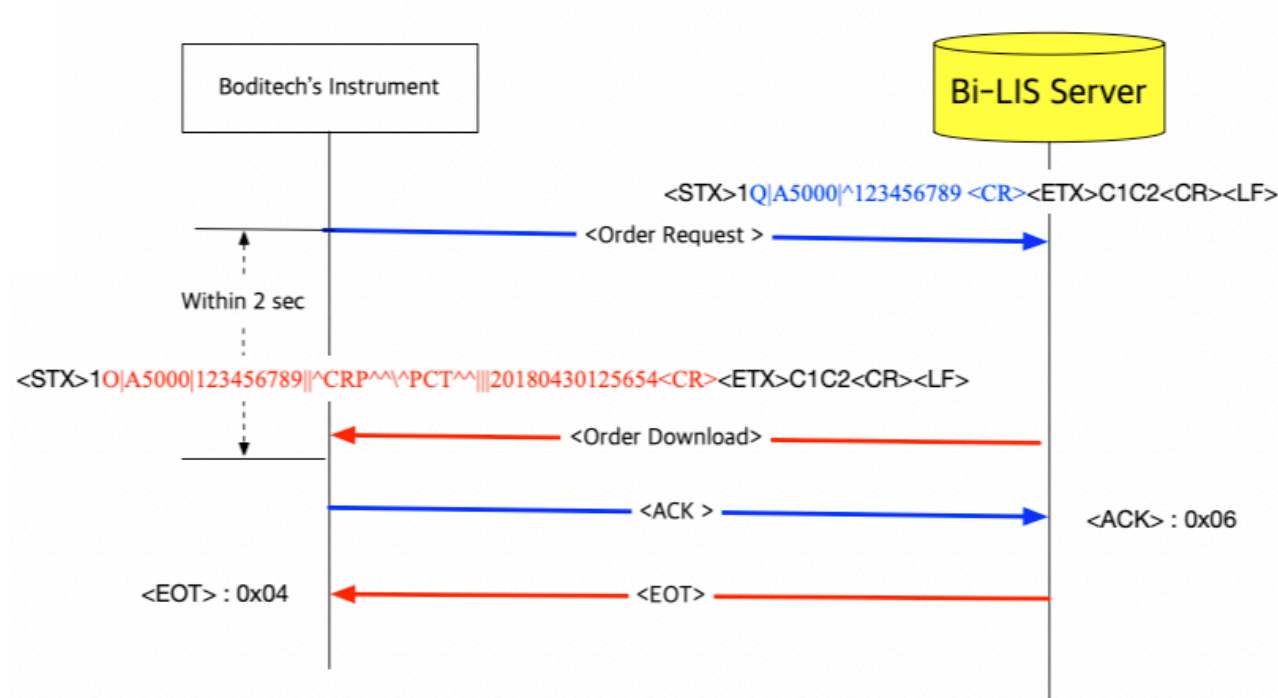
Order request phase: The Boditech's instrument sends the frames. Between each frame the host shall send <ACK>.

- When a frame is sent and there is no answer at all within 2 seconds, the order request fails and The Boditech's instrument sends <EOT>.

Order download phase: The Boditech's instrument waits for frames.

- If no frame is received in 2 seconds, the order request fails and AFIAS-10 sends <EOT>.
- If invalid frame is received, the Boditech's instrument sends <NAK>. If received frame is OK, the Boditech's instrument sends <ACK>.

Order Request and Order Download

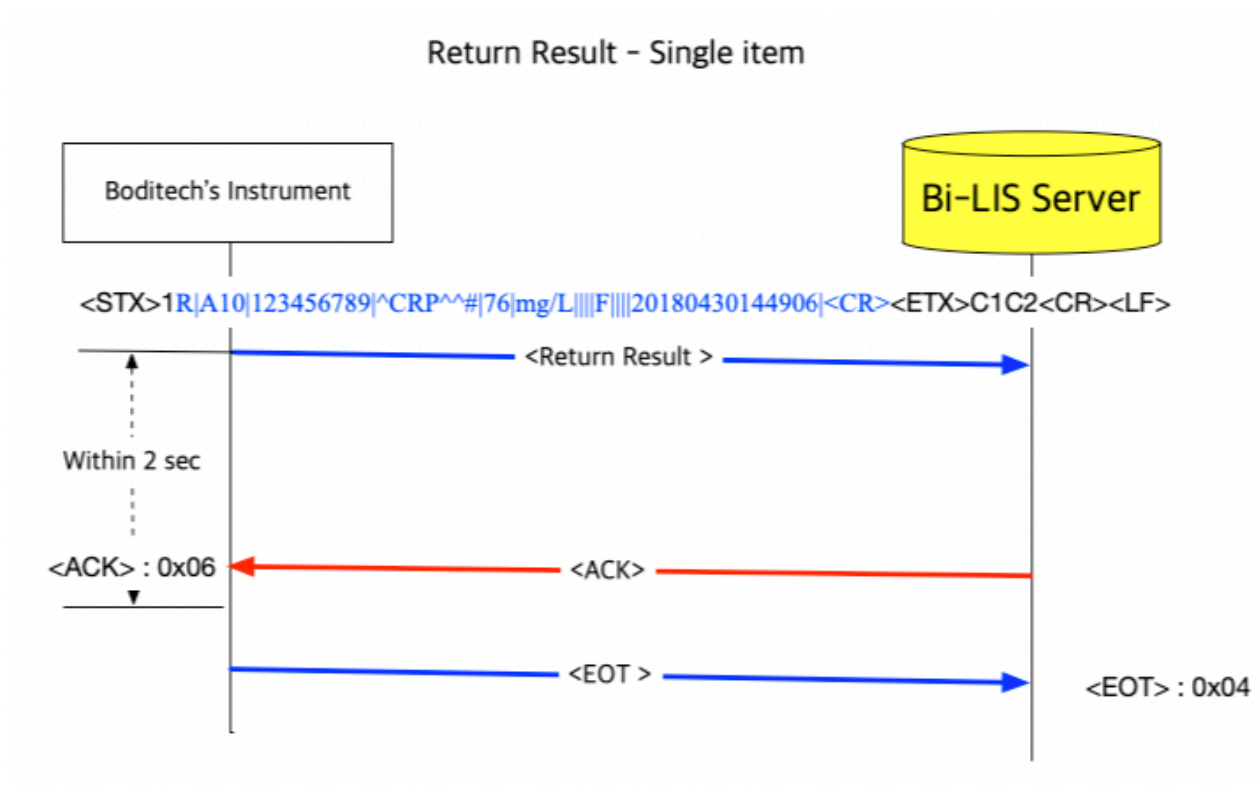


4.3 Return Result

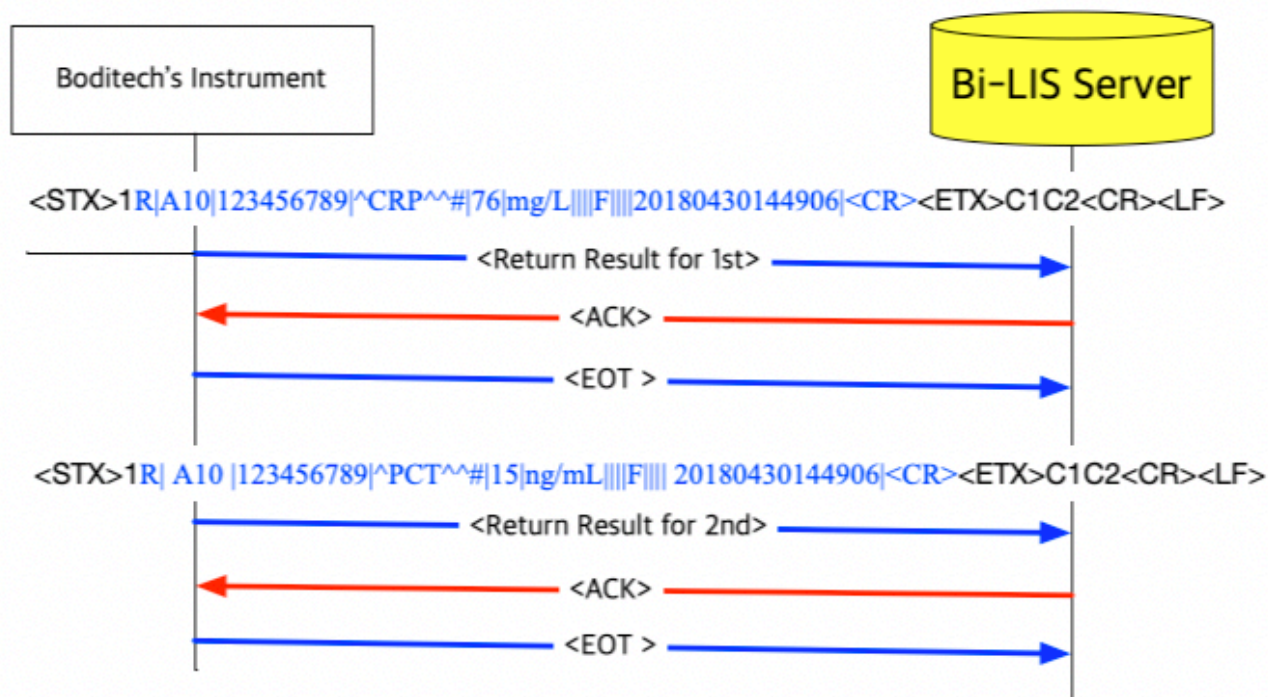
Boditech's instrument	Host computer (LIS)	Phase
<Frames (Record R)>		Return Result
	<ACK>	
<EOT>		

Return result phase: The Boditech's instrument sends the frame. the host shall send <ACK>.

- If <ACK> is received, the return result is succeed and the Boditech's instrument sends <EOT>
- If no <ACK> is received, the return result is failed and the Boditech's instrument sends <EOT>
- When a frame is sent and there is no answer at all within 2 seconds, the return result fails and the Boditech's instrument sends <EOT>.



Return Result - Combo item (CRP/PCT)



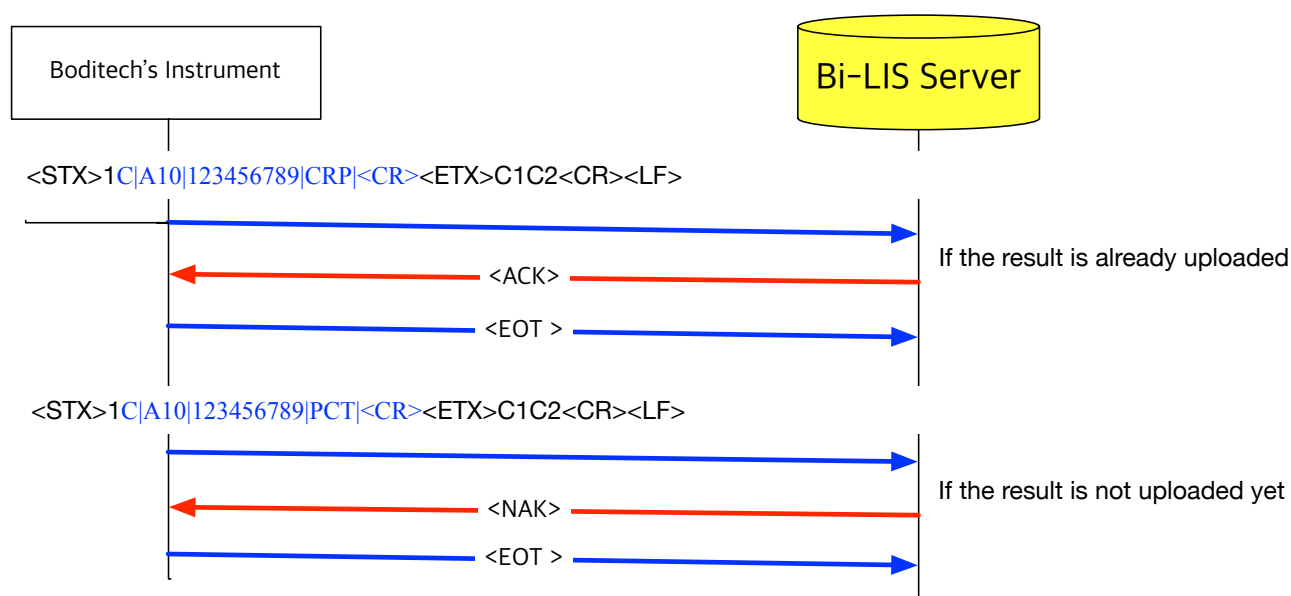
4.4 Check Result

Boditech's instrument	Host computer (LIS)	Phase
<Frames (Record C)>		Check Result
	<ACK> or <NAK>	
<EOT>		

Check result phase: The Boditech's instrument sends the frame. the host shall send <ACK> or <NAK>.

- If the result is uploaded already, the host shall send <ACK>.
- If the result is not uploaded yet, the host shall send <NAK>.
- If <ACK> or <NAK> is received, the check result is succussed and the Boditech's instrument sends <EOT>
- If no <ACK> or <NAK> is received, the check result is failed and the Boditech's instrument sends <EOT>
- When a frame is sent and there is no answer at all within 2 seconds, the return result fails and the Boditech's instrument sends <EOT>.

Check Result



5. Project Name

To interchange the project item between the Boditech's instrument and LIS.

Below table's project name should be used.

No	Project Name	No	Project Name	No	Project Name
1	PSA	26	ST2	51	PRL Plus
2	AFP	27	Infliximab	52	PSA Plus
3	hsCRP	28	Adalimumab	53	AFP Plus
4	CEA	29	Golimumab	54	CEA Plus
5	MAU	30	Anti-HBs	55	Ferritin Plus
6	HbA1c	31	Anti-HCV	56	Strep A
7	CRP	32	HBsAg	57	Astro
8	PCT	33	NORO	58	CK-MB/Tn-I/Myo
9	D-Dimer	34	ROTA	59	PCT/CRP
10	T4	35	Rota/Adeno	60	Influ/RSV
11	TSH	36	Tn-I Plus	61	RSV
12	HBsAg	37	NT-proBNP	62	Adeno
13	LH	38	Zika IgG/IgM	63	Mycoplasma
14	Testosterone	39	HIV Ag/Ab	64	AMH
15	Progesterone	40	Dengue IgG/IgM	65	CHIKV IgG/IgM
16	Cortisol	41	Dengue NS1 Ag	66	Anti-CCP Plus
17	FSH	42	Gonorrhea	67	COVID-19 Ab
18	PRL	43	Syphilis	68	COVID-19 Ag
19	ASO	44	Zika NS1	69	IL6
20	Ferritin	45	Flu A+B	70	Total Anti-Infliximab
21	CK-MB	46	b-HCG Plus	71	COVID-19/Flu Ag Combo
22	Myoglobin	47	PCT Plus	72	COVID-19 nAb
23	T3	48	TSH Plus	73	Free Anti-Infliximab
24	Total bhCG	49	FSH Plus	74	BNP
25	Vitamin D	50	LH Plus	75	Troponin T

This information will be used at the project name field of O Record and R Record.

O Record :

O|A10|123456789|^CRP^^\^PCT^^|||20181201125654<CR>

R Record :

R|A10|123456789|^CRP^^#|76|mg/L|||F|||20181201144906|<CR>