

MERIL DIAGNOSTICS PVT LTD

AutoQuant 100/100i/200i/400i

ASTM LIS Communication protocol

R&D

Meril Diagnostics PVT LTD

Product	AutoQuant 100/100i/200i/400i		
Doc	AutoQuant Application - LIS communication protocol	Version	1.2

Revision History

Date	Version	Description / Modifications	Author
09.Nov.2013	1.0	Draft created	Chandrakant
11 No. 2013	1.1	Added TCP/IP, multiple data retrieval and serial port cable configuration	Chandrakant
18 May 2017	1.2	Protocol updated with new changes	Naveen.K

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Overview

Purpose:

This Document details the specifications for communication of Clinical Chemistry analyzer With LIS Software using ASTM protocol. Explain the process for communication through instrument software by user.

Scope:

Detailed information on operation of the system is beyond the scope of this document. The information offered here is strictly to aid programmers in grasping very basic operational features of the Analyzer –LIS communication.

Conventions:

This document consists primarily of a series of examples that show the information needed to successfully interface to the system. The basic concept of data transfer in this interface is the exchange of data and control frames between the host system and the analyzer.

Primary Reference:

E1381 – 02

Low-Level Protocol to Transfer Messages between Clinical Laboratory Instruments and Computer Systems.

E1394 – 97

Standard specifications for Transferring Information between Clinical Instruments and Computer Systems.

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Communication **Specifications**

Communication specifications are based on a layer protocol. The layers are:

Physical Layer

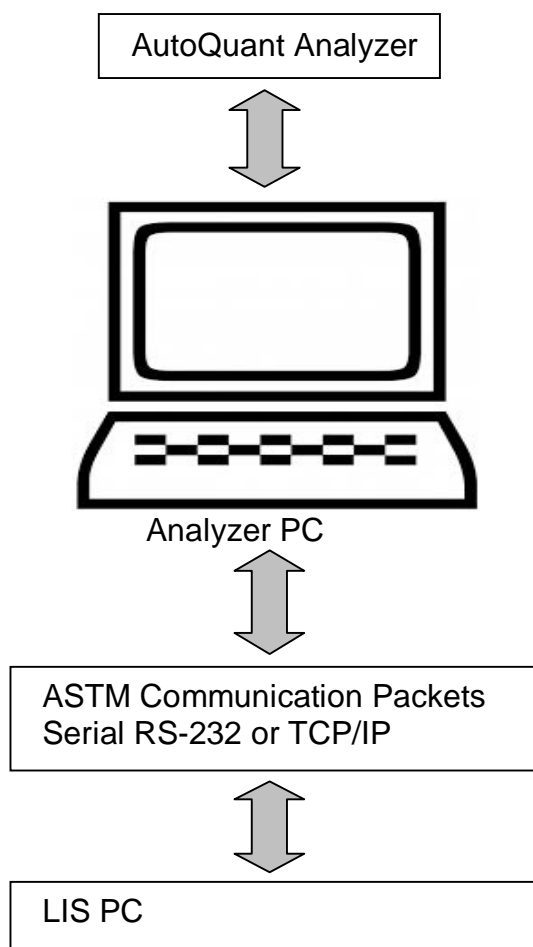
Data Link Layer

Presentation Layer

Physical **layer**

Specifies the sending and receiving of signals between the Analyzer PC and LIS PC through Physical and electrical connections.

INTERCONNECTION DIAGRAM-HARDWARE

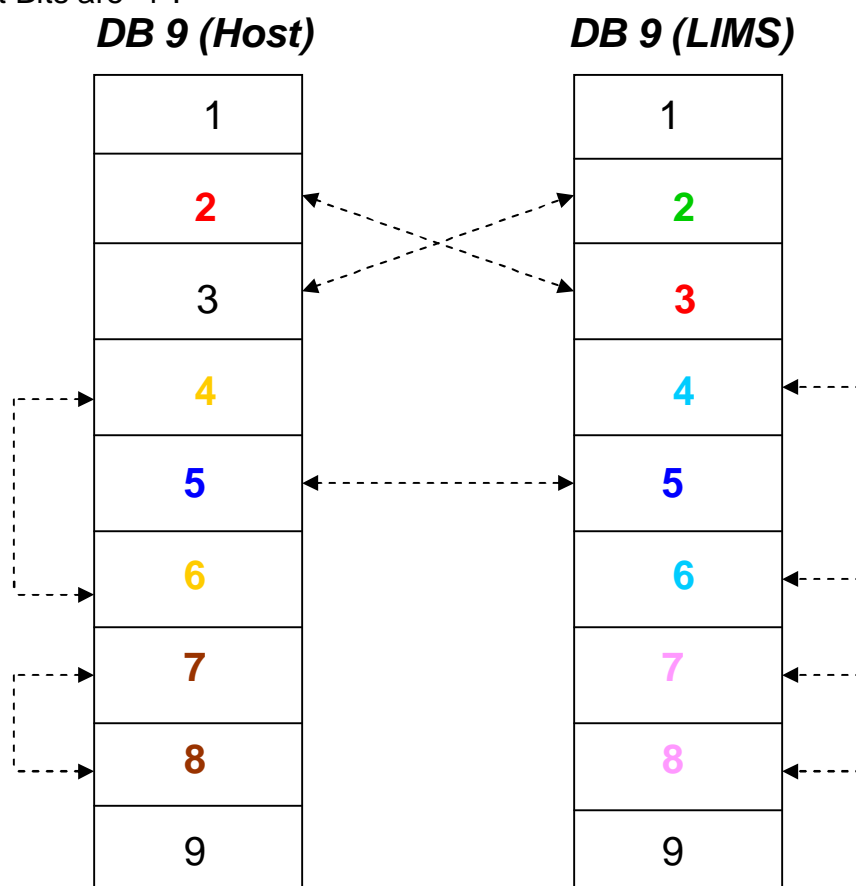


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Serial port configuration:

Standard serial port configuration as shown below can be used for LIS communication.

- ✓ Serial cable used as communication medium ensures uninterrupted communication channel.
- ✓ Being a **Peer-To-Peer** type of communication medium, management of transmittable packets is easier and taken care of by the host application.
- ✓ The serial cable connecting the Host PC and LIMS PC must be a single chunk (without any joints) and should be lesser than 15 meters in length.
- ✓ Odd, Even, No parity can be used during communication against the default “None”
- ✓ Data Length sets those can be used are “8”
- ✓ Start Bits are “1”.



Data link layer

Specifies the sending and receiving of data by link connections and for each frame between Analyzer PC and LIS PC.

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Communication **Status**

Transition is accomplished through the following three phases.

Establishment Phase

Establishes a communication line, and determines the direction of data transfer.

The sender sends an [ENQ] signal to the receiver to respond to the sender, the receiver performs the following action:



Returns an [ACK] signal when communications are enabled.

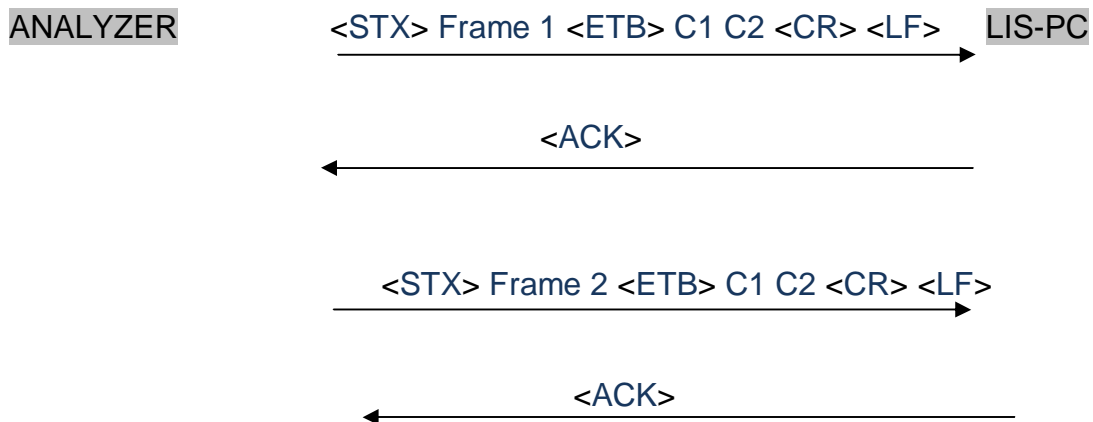


Returns a [NAK] if receiver is not ready (BUSY).



Transfer Phase

The sender transmits messages to the receiver until all messages are transferred.



Termination Phase

The sender notifies the receiver that all messages have been transferred.

After the termination phase, the status returns to neutral.

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The sender sends the <EOT> to inform the receiver that the message transmission has been completed.



When the sender sends <EOT>, sender goes in to neutral status.

When the receiver receives <EOT>, receiver processes data packet and then gets into neutral status.

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Transmission Characters

Sr. #	CHAR	HEX VALUE	Description
1	STX	02	Receiver will slice data from this character onwards for actual data evaluation.
2	ETX	03	Receiver will slice data up to this character from STX for actual data evaluation.
3	ACK	06	Positive acknowledgment. Character used to confirm correct and complete string sent by the counterpart
4	NACK	15	Negative acknowledgment Character used to confirm that string received is incorrect or incomplete
5	ENQ (BOT)	5	Character used to initiate communication.
6	EOT	17	Character used to confirm that transmission from the transmitting end is over.
7	^	5E(decimal 94)	Component Delimiter
8	`	60	Repeat Delimiter
9	&	38	Escape Delimiter
10	P,O,R,Q,C	--	Record identification bytes P -Patient Information Record O -Test Order Record R -Result Record C -Comment Record Q -Request Information Record

CHECKSUM CALCULATION

The checksum is the modulus 8 of the sum of ASCII values of the frame characters starting with and including 'FN' till character before <ETX> (in case of single frame) or <ETB> (in case of multiple frames).

Record transmission protocol

Specifies the messages that are sent and received by the Analyzer PC and LIS PC.

ASTM data is sent or received in terms of packets.

Packet starts with the Header (H) and ends with the Terminator (L).

Packet without header and terminator is treated as invalid and will be ignored.

ASTM Record Types :

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Sr No.	Record Type	Convention
1	Message Header Record	H
2	Patient Information Record	P
3	Test Order Record	O
4	Result Record	R
5	Comment Record	C
6	Request Information Record	Q
9	Message Terminator Record	L

Fields marked as * are mandatory.

Message Header Record

Field	Message Header Record		Size
	Fields	String format	
1*	Record Type ID	H	1
2*	Delimiter Definition	`^&	4
12	Processing ID	P: (Production) Treat message as an active message to be completed according to standard processing.	1
13	Version No.	ASTM version No. 1394-97	10
14	Date and Time of message	current date time YYYYMMDDHHMMSS	14
15*	Carriage Return	<CR> End of the string	1

Table 7: Message Header Record

Example String:

H|\^&|||||||P|E 1394-97|20100705071134<CR>

About Delimiters

1		Field Delimiter (Alt + 124)
2	`	Repeat Delimiter (Alt + 96)
3	^	Component Delimiter (Alt + 94)
4	&	Escape Delimiter (Alt + 38)

Patient Information Record

Field	Patient Information Record		Size
	Fields	String format	
1*	Patient Record	P	1
2*	Sequence Number	Frame Number (only 1 digit)	1
3	Practice Assigned Patient	Patient ID	40

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	ID		
6	Patient Name	Name of the Patient (Last Name^First Name^Middle Name^Title). If Patient Name contains single quote i.e. " " then it will get replaced by "" while saving data.	30
8	BirthDate	YYYYMMDDHHMMSS	14
9	Patient Sex	M/F/U (Male/Female/Other)	1
11	Patient Address	Street Address^City^State^Zip^Country Code If Patient Address contains single quote i.e. " " then it will get replaced by "" while saving data.	50
13	Patient Telephone No.	Phone1`Phone2`Phone3 (It may contain area code ,countrycode, beeper number, hours to call) e.g. +912212345678`+912212345679	20
14	Attending Physician ID	(Ordering Physician `Attending Physician `Referring Physician) If Physician ID contains single quote i.e. " " then it will get replaced by "" while saving data.	40
17	Height	Height/Weight and Unit are separated by component delimiter. 1.2^M (Default unit is cms for ht and Kg for wt).	8
18	Weight		7
36*	Carriage Return	<CR>	1

Table 8: Patient Information Record

Example String:

P|1|patient1|||VICHARE^PAT1^V||19710704|M||ANDHERI^MAHARASHTRA|RES1|8756873`694749387948|NENE^RAM|||1.2^M|23<CR>

Important: -

Test Order Record

Field	Test Order Record		Size
	Fields	String format	
1*	Test Order Identifier	O	1
2*	Sequence Number	Frame No.	1
3*	Specimen ID	Sample ID^Container No. (Samp1^01) Values of Container No: 1 = TUBE (10 ml) – Default Value 3 = TUBE (5-7 ml)	25

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5*	Universal Test ID	Test Name (^^ALB^^ALP^^LIVER)	250
6*	Priority	S /A : Stat OR As soon as possible [i.e. Emergency] R : Routine	1
8	Specimen collection Date and Time	Actual date and time , the sample was collected (YYYYMMDDHHMMSS)	14
11	Collector ID	The person and facility which collected the specimen. If Collector ID contains single quote i.e.” ’” then it will get replaced by “”” while saving data.	20
12*	Action Code	A : Add the requested tests or batteries to the existing sample N : New requests accompanying a new sample P : Pending sample (Add but don't schedule) C : Cancel request for the battery or tests named (Delete Test)	1
15	Date/ Time Specimen Received	Date and Time recorded by laboratory	14
16*	Specimen Descriptor	Sample Type : Blood, Urine, Serum, Plasma, CSF (Not Case-Sensitive)	6
32*	Carriage Return	<CR>	1

Example String:

O|1|020100030286||^^^GLU^^^UREA|R|||||A|||SERUM<CR>

Important

Specimen collection Date and Time:

If YYYYMMDD part is not Numeric then Analyzer Software will save the data received with Sample Collection Date same as System Date.

Result Record

Field	Result Record		Size
	Fields	String format	
1*	Result Record Identifier	R	1
2*	Sequence Number	Frame No.	1
3*	Universal Test ID	Test Name (^^ALB)	8
4*	Data or Measurement Value	Result value	10
5	Units	ISO 2955	20
6	Reference Ranges	Lower limit to Upper limit	30

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7*	Result Abnormal Flags		50
8	Nature of Abnormality Testing	N : Generic Normal Range was applied to all patients	1
9	Result Status	C : Correction of previously transmitted results (Patient Report)	
		F : Final Results	
13*	Date / Time Test Completed	Result Date in YYYYMMDDHHMMSS format	14
15*	Carriage Return	<CR>	1

Example String:

R|1|^^^ALP|200|IU/L|DEFAULT|A|N|F|||20100513113450<CR>
R|2|^^^AMY|93|U/L|DEFAULT|N|N|F|||20100513113535<CR>

Comment Record

Field	Comment Record		Size
	Fields	String format	
1*	Comment Record Identifier	C	1
2*	Sequence Number	Frame No.	1
3*	Comment Source	L : Computer System (LIS) I : Instrument (ASTM)	1
4*	Comment Text	Code ^Comment Text	1000
5*	Comment Type	G : Generic/Free text comment T: Test Name comment	1
6*	Carriage Return	<CR>	1

Table 11: Comment Record

Example String:

C|1|| Test ALB Does Not Exist For SampleID 01010125.|G<CR>

Request Information Record

Field	Request Information Record		Size
	Fields	String format	
1*	Request Record Identifier	Q	1
2*	Sequence Number	Frame No.	1
3*	Starting Range ID Number	SampleID1`SampleID2	115
6	Nature of Request Time Limits	S : Sample Collection Date	14
		R : Result Test Date	14
13*	Request Information Status Codes	O : Requesting test orders and demographics only	1
15*	Carriage Return	<CR>	1

Example String:

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Q|1|^020100030279`020100030321`020100030304`020100030297|||S|||||O<CR>

Message Terminator Record

Field	Message Terminator Record		Size
	Fields	String format	
1*	Message Terminator Record Identifier	L	1
2*	Sequence Number	1	1
3*	Termination Code	N : Normal Termination	1

Table 12: Message Terminator Record

Example String:

L|1|N<CR>

Data packets format example-

Patient Request (Host to LIS)

<ENQ><ACK>
<STX>1H \^& Meril^3.6^11052213 E-1394-97 20131205091027<CR>Q 1 ^pat1 0<CR>L 1 N<CR><ETX>
<ACK>
<EOT><ACK>

Patient Details (LIS to Host)

<ENQ> (LIS to Host)

<ACK> (Host-> LIS)

<STX>1H|\^&||****|TBM-LIMS|Seepz|||||E-1394-

97|20131205090513<CR>P|1|PAT1|LPAT1|LPAT13 |Joshi^Pramila^V||19710704|M|W|ANDHE
RI^MAHARASHTRA|RES1|8756873`69749387948|`NENE^RAM|SP1|SP2|1.2^M|23|PDIG1|PACT
MED|DIET|PR1|PR2|20080929`20080929|OP|ANDHERI|NAItDig|AltDig|H|M|ARP|marathi|HpSer|
HpInst|A<CR>C|1|L|Patient

Information|G<CR>O|1|Pat1|IPat1|^^^ABCD1`^^^ALB`^^^TBIL|R|20080929|20080929|2008092
9|200^ml|preeta|N|DngC|RCIInfo|20080929|SERUM|`NENE^RAM|233245354||LB1|LB2|2008092
9|566|B1|O|RES1|WARD1|NIF|SPSER|SPINST<CR>L|1|N<CR><ETX>6B<CR><LF> (LIS to
Host)

<ACK> (Host-> LIS)

<EOT> (LIS to Host)

Result Packet (Host to LIS)

<ENQ><ACK>

<STX>1H|\^&||Meril^3.6^11052213|||||E-1394-97|20131203141051<CR><ETX>28<CR><LF><ACK>

<STX>2P|1|||Chan Du||M|||||25^Y<CR><ETX>49<CR><LF><ACK>

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```

<STX>3R|1|^^^TP|10.00|g/dL|0^0|||N|F|||20131203141051<CR><ETX>0F<CR><LF><ACK>
<STX>4R|2|^^^ALB|5.00|g/dL|0^0|||N|F|||20131203141051<CR><ETX>10<CR><LF><ACK>
<STX>5L|1|N<CR><ETX>06<CR><LF><ACK>
<EOT> <ACK>

```

Actual data Send and Receive through AutoQuant.

RECEIVE:

For TCP/IP settings, go to Maintenance > parameter settings > Enter password > enter TCP/IP details with port number > Select.

Software parameters setting

Communication port selection
☐ COM1 ☐ COM2 ☐ COM3 ☐ COM4 ☐ COM5

QC Rules
☐ 1:2S ☐ 1:3S ☐ 2:2S ☐ R4S ☐ 10X

Run preference
☒ Sample position wise ☐ Reagent wise
☐ Power on wash ☒ Power on stop

QC Value
☒ SD type ☐ Range type
☐ Power off wash ☒ Power off stop

Auto Re-run setup
☐ Result is too low
☐ Unstable reagent blank
☐ Linearity limit
☐ Substrate depleted

Server IP: 10 . 10 . 14 . 150 Port: 8080
☐ LIS Serial Port: 9600 ☐ Send online results

☐ COM1 ☐ COM2 ☐ COM3 ☐ COM4 ☐ COM5

☐ Skip remaining test if any sample or reagent short

Language: English
Cal Validation %: 10.00
Detergent Position: NONE
Lamp Off Time(mins): 30
☒ Reflex Testing
☐ Skip Dirty Cuvette

Select Return

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For serial port or TCP/IP communication, Go to Schedule screen, click the button shown below

The screenshot shows the 'Schedule' screen of the AutoQuant software. At the top, there are fields for 'Run date' (05/16/2016), 'Patient ID', 'Lab ID', 'Position', 'Cup or Tube', 'Sample Type', and 'Cuvette'. The 'LIS' button is highlighted in the top left. Below these fields is a table with columns for 'Lab ID', 'Position', 'Cup or Tube', 'Sample Type', 'Patient ID', 'QC Lot', and 9 sample positions (1-9). The right side of the screen contains a vertical stack of buttons: 'Dilute', 'New workList', 'ID++', 'Save/Modify', 'Copy', 'Delete', 'Reagent Check', and 'SAMPLE BARCODE'.

'LIS information' window will open.

For Serial port:

Select the port number and Baud rate.

- **Select appropriate com-port, on which serial port of LIS is connected.**
- **Baud Rate will be selectable during LIS communication. Same baud rate should be set at LIS Software.**

For TCP/IP:

Select TCP/IP and confirm the IP address and IP port. Start receiving directly.

- Click on Receive button as highlighted in above screen.
- On click patient Input Dialog will open. As displayed below

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- Enter patient ID for patient information to be receive and click on save. Multiple patient ID can be saved similarly.

The screenshot shows a software window titled "Patient ID Details". At the top left, there is a label "Patient ID" above a text input field, which is circled in black. Below this is a table with two columns: "No" and "Patient ID". The table has multiple empty rows. To the right of the table is a vertical stack of five buttons: "SAMPLE BARCODE", "Receive", "Save", "Delete", and "Return". The "Save" button is circled in black. The window has a standard Mac OS-style title bar and scroll bars for the table.

- After save Receive button will be enabled as shown in below screen.

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LIS information dialog

Com port: COM3 Baud rate: 9600 RS232 IP address: 10.10.14.150 IP port: 8080 TCP/IP

Run date: 09/10/2016 Lab ID: 1 Position: 1 Cup or Tube: Cup Ok

	Patient ID	Lab ID	Position	Cup or Tube	1	2	3	4	5	6	7	8	9
1	PAT1	1	1	Cup	ALP								

Name: LPAT13 M Collect date: 09/29/2008 Sample Type: SERUM

Date of birth: Invalid DateTime. Gender: M Patient ID: PAT1

Doctor name: NENE*RAM Age: 46

Receive Save Return

- All details are shown in respective fields, Instrument sample ID and position will be automatically taken up by the software based on already scheduled or run samples for that day. User has to confirm all the details. If required to change Position and container type, user can select that patient, change position and type, click OK, modified information will be reflected for that sample.
- Data will be reflected in list. Click Save to schedule the details.
- Patient information receive process is completed. Work list can be seen as below.

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- User can run the schedule as per normal procedure.

DATA UPLOAD (send)

- After Run completion, results are displayed on report screen as displayed below.

Select Patient ID to send the results to LIS. Add information (details) if required, click saves and click on Data upload button as displayed in above screen. If required, multiple patient data can be selected by dragging mouse over required ID's.

It will ask for LIS communication details select the fields as per below screen.

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Data sending to LIS system

Com port COM3	Baud rate 9600	<input checked="" type="radio"/> RS232
IP address 10 . 10 . 14 . 150	IP port 8080	<input checked="" type="radio"/> TCP/IP
Select	Return	

LIS Port has to be selected.
Click on Select. Data will be uploaded to LIS.
Completion message will be displayed in screen.

Data sending to LIS system

Com port COM3	Baud rate 9600	<input checked="" type="radio"/> RS232
IP address 10 . 10 . 14 . 150	IP port 8080	<input checked="" type="radio"/> TCP/IP
Select	Return	

Selected data has been sent to the LIS system.