HORIBA Medical

ABX Micros ESV 60
scil Vet abc Plus+

Hematology Analyzer

Output Formats

Ref: RAA058AEN

ABX Micros ESV 60
scil Vet abc Plus+

Foreword

Table of Contents

Revisions

Part number	Software version	Chapters	Date
RAA058AEN	V3.X	All	November 2015

Modifications

- The result record field for reference range is updated for V3.X (Result record fields, page 11).
- Data frame example is updated for result sent by the instrument (Example of result sent by instrument (LMG test), page 15)

Introduction

The ASTM Format is recommended by HORIBA Medical for every new connection development. The ABX Format is currently supported to be compliant with existing connections.

Different protocols can be used on HORIBA Medical instrument. A connection between a computer (host) and a HORIBA Medical instrument can be performed when the protocol, the format description and the connection mode have been properly setup.

Table 1: Definitions

Term	Definition
<ACK>	Acknowledgment (ASCII Decimal 6)
[C1]	The most significant character of Checksum
[C2]	The least significant character of Checksum
[DATA]	The data contents of the record
<ENQ>	Inquire (ASCII Decimal 5)
<ETB>	End of Transmission Block (ASCII Decimal 23). For use only when a single record is too large to fit into one frame.
<ETX>	End of Text (ASCII Decimal 3). Required at the end of each record.
[frame number]	Single digit frame number “0” to “7”, starts with “1”.
<LF>	Line Feed (ASCII Decimal 10).
<NAK>	Negative Acknowledgment (ASCII Decimal 21).
<STX>	Start of Frame (ASCII Decimal 2).
Communications packet	All framing required for transmission of data. This framing includes: <STX>[frame number][DATA] [<ETB> or <ETX>][C1][C2] <LF>
Component Field	One of several related pieces of information within a field.
Field	A specific location within a record for a piece of information, indicated by a field delimiter and position.
Frame	A complete communications packet.
LIS	Laboratory Information System
Message	A collection of related information; a group of records that begins with a "Header" record and ends with a "Terminator" record. A single record could theoretically constitute a message, but within this context, a message always contains multiple records.
<EOT>	End of Transmission (ASCII decimal 4)

Table 1: Definitions

Term	Definition
<CR>	Carriage Return (ASCII decimal 13)
Record	In reference to the low level protocol, a record is the message data (shown as [DATA]) as described within the communications packet. If the data is longer than 240 characters, then it must be split in two (or more) parts and sent in two (or more) communications packets. The intermediate packet uses the <ETB> character, and the ending packet uses the <ETX> character. No single communications packet contains more than one record. In reference to the message layer, a record can be one of the following codes: H (header), P (patient), O (order), R (result), L (terminator), C (comment).
Session	A total unit of communication activity used in this standard to indicate the events starting with the Establishment phase and ending with the Termination phase.
Test	A determination of a single analyte or a combination of values from other determinations or observations from which a variable or gradable result is derived.

Connections

Physical connection

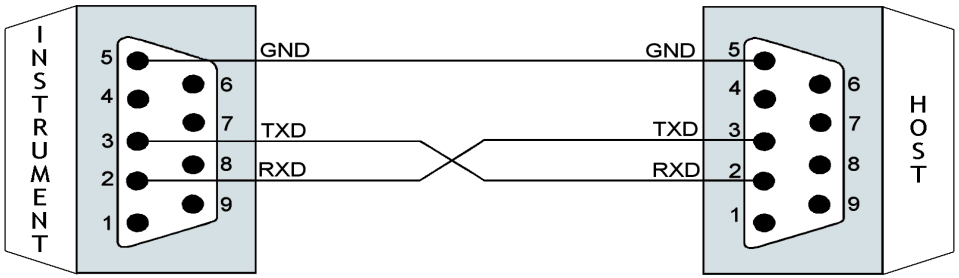
1. RS232

All communications are expected to use the RS232 communication protocol, based on the Electronics Industries Association (EIA) standard RS232-C. As part of the conformance to this standard, the ABX Micros ESV60/SCIL Vet abc+ Data Management System is configured as Data Terminal Equipment (DTE).

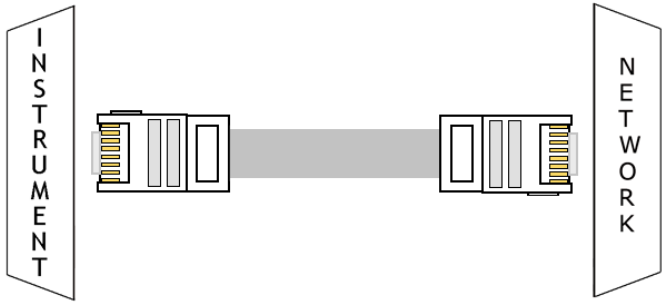
The ABX Micros ESV60/SCIL Vet abc+ Data Management System is connected to the LIS via a DB-9 connector on the octopus cable plugged into the computer workstation on the the ABX Micros ESV60/SCIL Vet abc+.

Table 2: DB9 connection

Pin (DB9) ABX Micros ESV60/ SCIL Vet abc+ Data Management	LIS Port Configuration (ABX Micros ESV60/ SCIL Vet abc+)	LIS Cable Must Provide
3	RXD	TXD
2	TXD	RXD
5	Ground	Ground

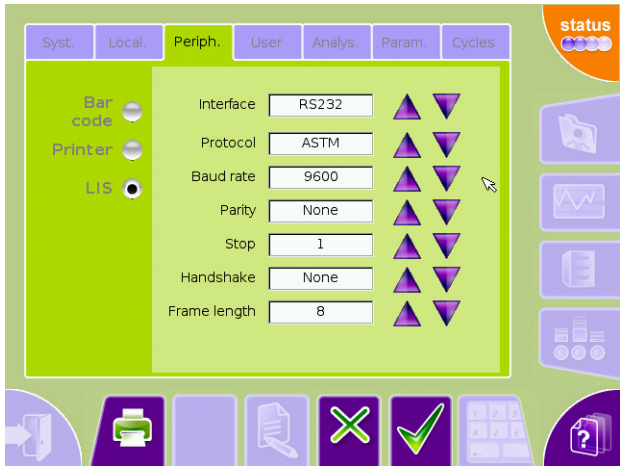


2. Ethernet (RJ45)



RS232 connection

You can access and set up the RS232 parameters by entering the ABX Micros ESV60/ SCIL Vet abc+ menu:
Maintenance > Serv. > Settings > Periph. > LIS.



The host and instrument communication port must be set up with:
- The baud speed value
- The parity value
- The bit stop value
- The handshake value
- The frame size value

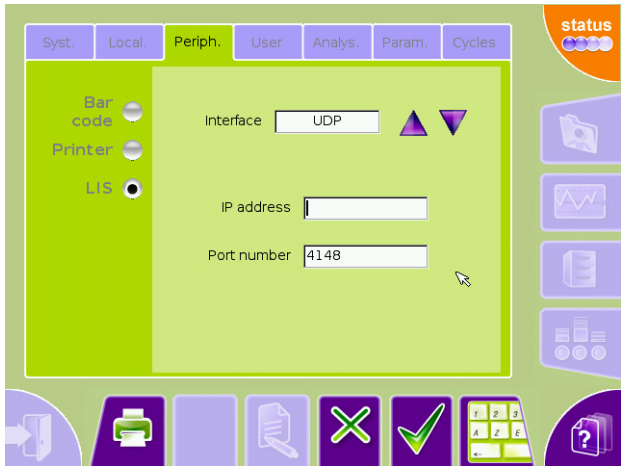
Ethernet connection (in ASTM mode only)

You can access and set up the ethernet parameters by entering the ABX Micros ESV60/ SCIL Vet abc+ menu:
Maintenance > Serv. > Settings > Periph. > LIS.

1. UDP mode

The host UDP socket must be set up with:
- The instrument IP address or DNS address (entered in menu: **Maintenance > Serv. > Settings > Syst. > Network**);
- The port number where the instrument is awaiting connection.

The instrument UDP socket must be set up with:
- The host IP address or DNS address;
- The port number where the host is awaiting connection.

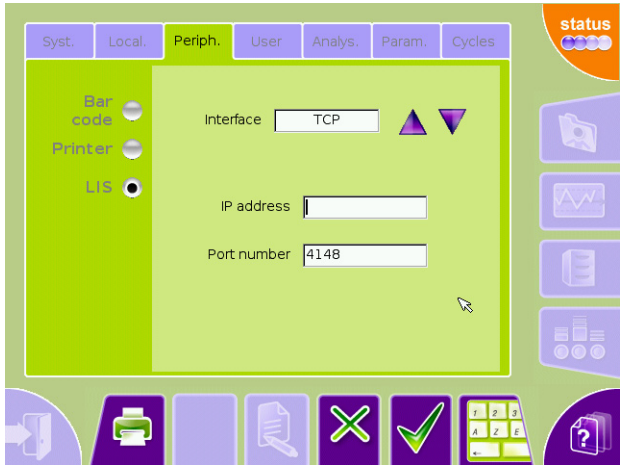


The protocol is based on the ASTM standard.

2. TCP mode

The host TCP socket must be set up with the port number where the instrument is awaiting connection.

The instrument TCP socket must be set up with:
- The host IP address or DNS address;
- The port number where the host is awaiting connection.



The protocol is based on ASTM standard.

3. FTP mode

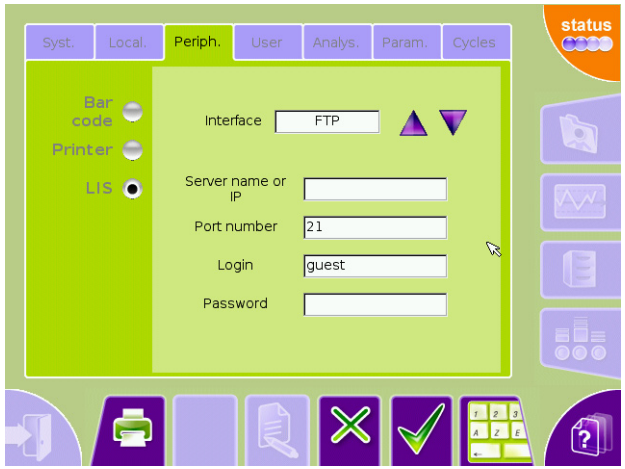
The instrument starts the connection with the FTP server right before it sends one file result, then it is disconnected.
Each file sent has a specific name "*ModuleSerialNumber_YYYYMMDDhhmmss.astm*", where *ModuleSerialNumber* is the ABX Micros ESV60/SCIL Vet abc+ menu serial number, and *YYYYMMDDhhmmss* is the date and time of the analysis result.

Each line of the transmitted file is a "Record" according to the ASTM format.

A "Record" has no checksum.

The host FTP options must be set up with:
- The user login and password;
- The port number where the instrument is awaiting connection;
- The location where data will be stored.

The instrument FTP options must be set up with:
- The host IP address or DNS address;
- The port number where the host is awaiting connection;
- The user login and password.



ASTM format

The HORIBA Medical analyzers format responds to the ASTM specifications E-1381 & E-1394:

- E-1381: Standard specification for low level protocol to transfer messages between clinical and laboratory instruments and computer systems.
- E-1394: Standard specification for transferring information between clinical and laboratory instruments and computer systems.

1. Connection specifications (ASTM E-1381)

1.1. Hardware and software characteristics

The default format for emitted character is 1 bit start, 8 data bits, No parity, 1 bit stop.
The default communication speed is 9600 bauds.

Hardware settings of the interface:

- RS232 connection via a DB9 connector
- Ethernet connection via an RJ45 cable

1.2. Output data characteristics

Characters: ASCII
Maximum message length: 247 characters.
The analyzer manages Xon/Xoff protocol.

1.3. Communication protocol

Table 3: Standard control characters

Control String	Hexadecimal value
<ENQ>	$05
<ACK>	$06
<NAK>	$15
<STX>	$02
<ETX>	$03

Table 3: Standard control characters

Control String	Hexadecimal value
<CR>	$0D
<LF>	$0A
<EOT>	$04

1.3.1. Instrument/Host connection

Table 4: Typical discussion between the instrument and the host (except FTP mode in ASTM format)

Instrument	<>	Host
<ENQ>	>	
	<	<ACK>
<STX>1...Data...<CR><ETX>xx<CR><LF>	>	
	<	<ACK>
<STX>2...Data...<CR><ETX>xx<CR><LF>	>	
	<	<ACK>
<EOT>	>	

1.3.2. Discussion with conflict between the instrument and the host

Number of transmission if negative answer (NACK): 6
Timeout if no response: 15 s (Automatic disconnection max. time)
Retry timeout: None
Special timing: None
Description of other specific treatments: None

1.3.3. Defect packet during discussion between Instrument and Host

Table 5: Defect packet during discussion between Instrment and Host

Instrument	<>	Host
<ENQ>	>	
	<	<ACK>
<STX>1...Data...<CR><ETX>xx<CR><LF>	>	
	<	<NAK>
<STX>1...Data...<CR><ETX>xx<CR><LF>	>	
	<	<ACK>
<STX>2...Data...<CR><ETX>xx<CR><LF>	>	
	<	<ACK>
<EOT>	>	
Instrument	<>	Host

1.4. ASTM Data frame format

A sequential number located after the <STX> character is inserted into each Data frame. The frame number is set to 1 when the transfer phase is initialized and is incremented by 1 for each frame up to 7 and then returns to 0.
The frame number allows the receiver to distinguish new and retransmitted frames, in case of retransmitted frame (after a <NAK> response from the host), the frame number is not incremented: <STX>1...Data...<CR><ETX>xx<CR><LF>

Table 6: Frame format

ASTM field	Definition	Transmitted data	# of bytes	Comments
0	STX	$02	1	
1	Frame number	1 to 7, 0, ...	1	Frame number is set to 1, incremented by 1 for each frame up to 7, and then returns to 0
2	Data message		240 max.	Header, Patient, Order, Result & Comment messages

Table 6: Frame format

ASTM field	Definition	Transmitted data	# of bytes	Comments
3	End of data message ETX if end frame		1	
4	Checksum		2	
5	CRLF	$0D $0A	2	

1.4.1. Frame cheksum

According to ASTM E-1381, the frame cheksum (<STX>1...Data...<CR><ETX>xx<CR><LF>) is defined as modulo 256 of ASCII values sum between <STX> not included and <ETX> included characters: 1...Data...<CR><ETX>

2. Records general format specifications (ASTM E-1394)

Data frames encapsulate records defined by the ASTM E-1394 norm, records themselves encapsulate ASTM fields.

Table 7: ASTM Records

Record ID	ASTM Definition	Micros ES
H	Header	X
P	Patient	X
O	Order	X
R	Result	X
C	Comment	X
Q	Query (Request information order)	
S	Scientific Record	
M	Manufacturer information	
L	Terminator record	X

2.1. Structure of Records

2.1.1. Structure of records for Order transmission

- H (Header)
- P (Patient)
- C (Patient Comments) Optional
- .. O (Order)
- .. C (Order Comments) Optional
- L (Terminator)

The transmission of an order without patient record is not allowed, but patient record can be empty. Example: <STX>2P|1<CR><ETX>BB<CR><LF>

2.1.2. Instrument Patient file modification by Host

- H (Header)
- P (Patient)
- C (Patient Comments) Optional
- L (Terminator)

2.1.3. Structure of records for Result transmission

- H (Header)
- P (Patient)
- C (Patient Comments) Optional
- .. O (Order)
- .. C (Order Comments) Optional
- .. C (Run Alarms) Optional
- ... . R (Result)
- ... . C (Flag Result) Optional
- ... . R (Result)
- ... . C (Flag Result) Optional
- .....
- .....
- ... . R (Result)
- ... . C (Flag Result) Optional
- L (Terminator)

2.2. Description of Records

- Only fields described with their specified length are used by HORIBA Medical instruments.
- The length of a field can be less than the maximum value but must not be more.
- Only “Sample ID” and “Test” fields from the order record are mandatory, all other fields are optionals.
- Delimiters must be used even if a field is empty.
- Delimiters inside records are separated by “|” (ASCII $7C).
- Delimiters inside fields are separated by “^” (ASCII $5E).

2.2.1. Header record

Table 8: Header record fields

ASTM field	Definition	Transmitted data	Field max. length	Micros ES
7.1.1	Record Type	H	1	X
7.1.2	Delimiters definition	idem standard: | Field delimiter \ Repeat delimiter ^ Component delimiter & Escape delimiter	4	X
7.1.3	Message Control ID			
7.1.4	Access Password			
7.1.5	Sender Name	SAT	3	X
7.1.6	Sender Address			
7.1.7	Reserved			
7.1.8	Sender Telephone Nb			
7.1.9	Characteristics of Sender			
7.1.10	Receiver ID			
7.1.11	Comments or Special Instructions			
7.1.12	Processing ID	P: Production message Q: Quality control message	1	X
7.1.13	ASTM Version Nb	E 1394-97	9	X
7.1.14	Date and Time of message	YYYYMMDDHHMMSS	14	X

2.2.2. Patient record

Table 9: Patient record fields

ASTM field	Definition	Transmitted data	Field max. length	Micros ES
8.1.1	Record Type	P	1	X
8.1.2	Sequence Nb	1, 2, ...	2	X
8.1.3	Practice Assigned Patient ID			
8.1.4	Laboratory Assigned Patient ID	Patient Id	16	X
8.1.5	Patient ID No 3			
8.1.6	Patient Name	Name^First name	40	X
8.1.7	Mother's Maiden Name			
8.1.8	Birthdate	YYYYMMDD	8	X
8.1.9	Patient Sex	M = Male F = Female	1	X
8.1.10	Patient Race-Ethnic Origin			
8.1.11	Patient Address			
8.1.12	Reserved			
8.1.13	Patient Telephone Nb			
8.1.14	Attending Physician ID	Text	20	X
8.1.15	Special Field 1			
8.1.16	Special Field 2			
8.1.17	Patient Height			
8.1.18	Patient Weight			
8.1.19	Patient's Known or Suspected Diagnosis			
8.1.20	Patient Active Medication			
8.1.21	Patient's Diet			
8.1.22	Practice Field 1			
8.1.23	Practice Field 2			
8.1.24	Admission and Discharge Dates			
8.1.25	Admission Status			
8.1.26	Location			
8.1.27	Nature of Alternative Diagnostic Code and Classifiers			
8.1.28	Nature of Alternative Diagnostic Code and Classifiers			
8.1.29	Patient Religion			
8.1.30	Martial status			
8.1.31	Isolation Status			
8.1.32	Language			
8.1.33	Hospital Service			
8.1.34	Hopital Institution	Text	32	X
8.1.35	Dosage Category			

2.2.3. Order record

Table 10: Order record fields

ASTM field	Definition	Transmitted data	Field max. length	Micros ES
9.4.1	Record Type	O	1	X
9.4.2	Sequence Nb	1, 2, ...	2	X
9.4.3	Sample ID	Sample ID	16	X
9.4.4	Instrument Specimen ID			
9.4.5	Universal Test ID	^^^LMG	13	X
9.4.6	Priority		40	X
9.4.7	Requested/Ordered Date and Time			
9.4.8	Specimen Collection Date and Time	YYYYMMDDHHMMSS	14	X
9.4.9	Collection End Time	YYYYMMDDHHMMSS	14	X
9.4.10	Collection Volume			
9.4.11	Collector ID			

Table 10: Order record fields

ASTM field	Definition	Transmitted data	Field max. length	Micros ES
9.4.12	Action Code			
9.4.13	Danger Code			
9.4.14	Relevant Clinical Information			
9.4.15	Date/Time Specimen Received			
9.4.16	Specimen Descriptor			
9.4.17	Ordering Physician			
9.4.18	Physician Tel Nb			
9.4.19	User Field 1			
9.4.20	User Field 2			
9.4.21	Laboratory Field 1			
9.4.22	Laboratory Field 2			
9.4.23	Date and Time Results reported or last modified			
9.4.24	Instrument Charge to Computer System			
9.4.25	Instrument Section ID			
9.4.26	Report Types	F: final result	1	X
9.4.27	Reserved			
9.4.28	Location or Ward of Specimen Collection			
9.4.29	Nosocomial Infection Flag			
9.4.30	Specimen Service			
9.4.31	Specimen institution			

2.2.4. Result record

Table 11: Result record fields

ASTM field	Definition	Transmitted data	Field max. length	Micros ES
10.1.1	Record Type	R	1	X
10.1.2	Sequence Nb	1, 2, ...	2	X
10.1.3	Universel Test ID	^^^parameter name in english^LOINC code	15	
10.1.4	Data or Measurement Value	Test result (See Special characteristics for HORIBA Medical data, page 12) or "--.--")	5	X
10.1.5	Unit or Set of units (P80 V1.1 and above/PXL80)	1 = Standard 2 = International 3 = mmol 4 = japanese	1	X
10.1.6	Reference Range	Configurated units and results format are kept during transmission. Tramission format: «[Low normal range] to [High normal range]»	14	X
10.1.7	Result Abnormal Flag	Analytical flag L,H	1	X
10.1.8	Nature of Abnormality Testing			
10.1.9	Result Status	W: suspicion N: rejected result F: final result (without flag) X: Parameter exceeding the capicity	1	X
10.1.10	Date of Change in Normative Values or Units			
10.1.11	Operator Identification			
10.1.12	Date/Time Test Starting			
10.1.13	Date/Time Test Completed	YYYYMMDDHHMMSS	14	X
10.1.14	Instrument Identification			

2.2.5. Comment record

Table 12: Coments record fields

ASTM field	Definition	Transmitted data	Field max. length	Micros ES
11.1.1	Record Type	C	1	X
11.1.2	Sequence Nb	1, 2, ...	2	X
11.1.3	Comment Source	I clinical instrument system	1	X
11.1.4	Comment Text	Text	100	X
11.1.5	Comment Type	G:Free text I: Instrument flag comment	1	X

The comment record is used to transmit:
- the analysis alarms. Refer to Analysis alarms, page 13.
- the WBC, RBC, PLT histograms with thresholds. Refer to Histograms and thresholds, page 13.

2.2.6. Terminator record

Table 13: Terminal record

ASTM field	Definition	Transmitted data	Field max. length	Micros ES
13.1.1	Record type	L	1	X
13.1.2	Sequence number	1	1	X
13.1.3	Termination code	N: Normal	1	X

3. Special characteristics for HORIBA Medical data

3.1. LMG Data presentation

Table 14: LMG Data presentation

Parameter	ASTM field 10.1.5	Standard Set1	International Set2	mmol Set3	Japanese Set4
White Blood Cell	WBC	$10^3/mm^3$	$10^9/L$	$10^9/L$	$10^2/mm^3$
Lymphocytes #	LYM#	$10^3/mm^3$	$10^9/L$	$10^9/L$	$10^2/mm^3$
Lymphocytes %	LYM%	%	%	%	%
Monocytes #	MON#	$10^3/mm^3$	$10^9/L$	$10^9/L$	$10^2/mm^3$
Monocytes %	MON%	%	%	%	%
Granulocytes #	GRA#	$10^3/mm^3$	$10^9/L$	$10^9/L$	$10^2/mm^3$
Granulocytes %	GRA%	%	%	%	%
Red Blood Cell	RBC	$10^6/mm^3$	$10^{12}/L$	$10^{12}/L$	$10^4/mm^3$
Hemoglobin	HGB	g/dL	g/L	mmol/L	g/dL
Hematocrit	HCT	%	L/L	L/L	%
Mean Corpuscular Volume	MCV	μm^3	fL	fL	μm^3
Mean Corpuscular Hemoglobin	MCH	pg	pg	fmol	pg
Mean Corpuscular Hemoglobin Concentration	MCHC	g/dL	g/L	mmol/L	g/dL
Red Distribution Width	RDW	%	%	%	%
Platelets	PLT	$10^3/mm^3$	$10^9/L$	$10^9/L$	$10^4/mm^3$
Mean Platelet Volume	MPV	μm^3	fL	fL	μm^3
Eosinophil #	EOS#	$10^3/mm^3$	$10^9/L$	$10^9/L$	$10^2/mm^3$
Eosinophil %	EOS%	%	%	%	%

3.2. Alarms and Pathologies

3.2.1. Suspicion and Reject

When a result is suspected of being abnormal or false, it is not reliable and the instrument returns a flag in field 10.1.9 (Refer to Table 11 - Result record fields, page 11.).

3.2.2. Normal and Panic ranges

Flags when result exceeds Normal or Panic ranges are transmitted through field 10.1.7, they should be compared, to get a full result information, to the ranges set by the user (Refer to Table 11 - Result record fields, page 11.).

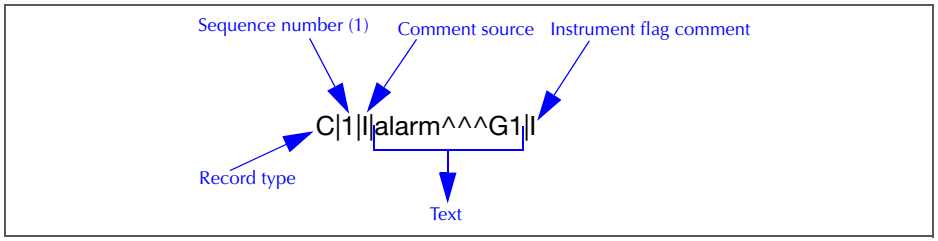
3.2.3. Analysis alarms

The analysis alarms (Refer to Table 15 - Analysis alarms list, page 13.) are transmitted to a comment record.
It follows the order record.

Table 15: Analysis alarms list

Parameter	Transmitted data
WBC or LMG	AG1 AG2 EOS
PLT	SCL SCH MIC

An analysis alarms comment record is structured as follows:



4. Histograms and thresholds

The WBC, RBC and PLT histograms and thresholds are transmitted on three comment records.

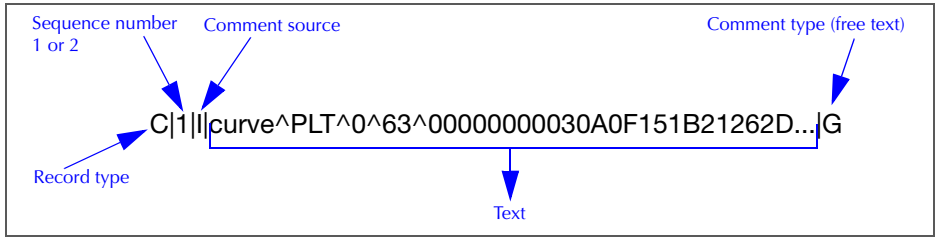
4.1. Histograms

The first two comment records contain half the histogram:
- the first comment record contains the histogram from point 0 to 63.
- the second comment record contains the histogram from point 64 to 127.

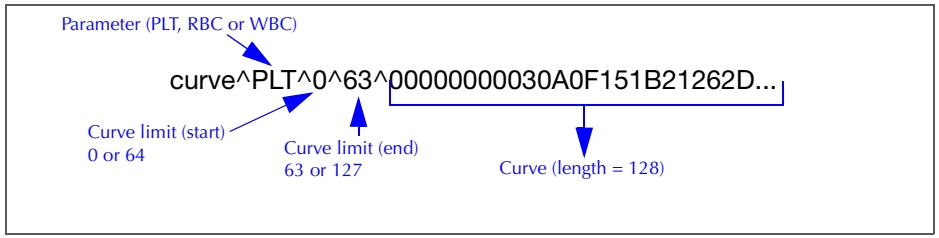
These comment records follow the result record for WBC, RBC and PLT.

A histogram comment record is structured as follows:

Histogram comment record structure



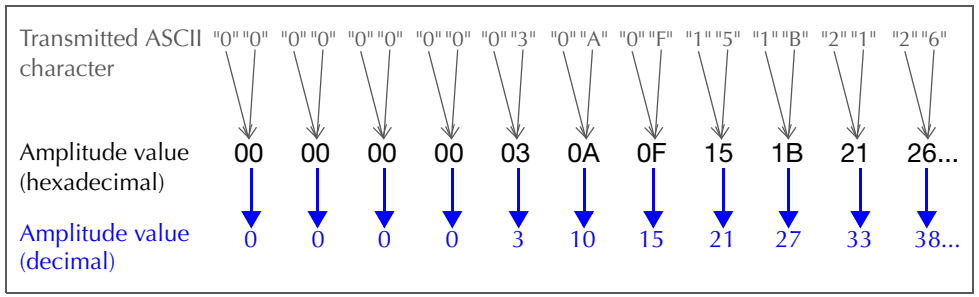
Text structure



The curve is a sequence of hexadecimal values representing each point of the curve (amplitude value).

Each hexadecimal value is transmitted in ASCII (2 characters per point).
Example: for the hexadecimal amplitude value "15", the ASCII characters "1" and "5" are transmitted.

The example below shows the amplitude value (hexadecimal) corresponding to the transmitted values (ASCII).



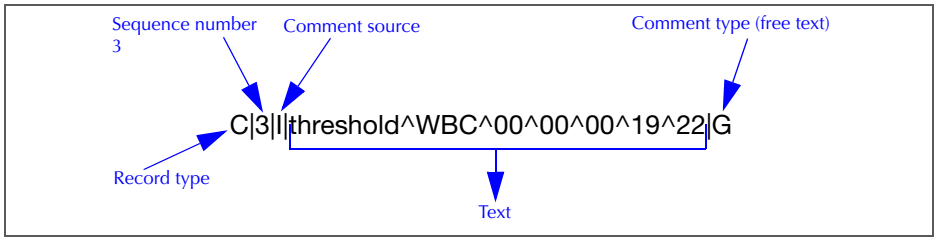
4.2. Thresholds

The third comment record contains the threshold (for WBC and PLT only).

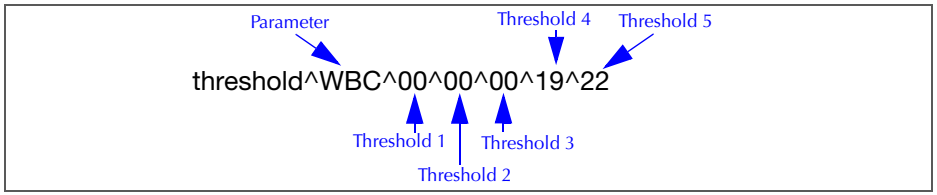
This comment record follows the comment records for the WBC and PLT histograms.

A threshold comment record is structured as follows:

Threshold comment record structure



Text structure



The thresholds are the same as those displayed on the instrument:
- one for PLT;
- three for WBC.

5. Example of data frame

Table 16: Example of result sent by instrument (LMG test)

Instrument
Host
<ENQ>
<ACK>
<STX>1H|\^&|||SAT||||||P|E 1394-97|20150408102350<CR><ETX>7F<CR><LF>
<ACK>
<STX>2P|1|||||||U||||||||||||||||||||<CR><ETX>90<CR><LF>
<ACK>
<STX>3O|1|th||\^\^\^LMG|||150408100401|150408100401||||||||||||||F|||||<CR><ETX>17<CR><LF>
<ACK>
<STX>4C|1|I|alarm\^\^AG2|I<CR><ETX>BD<CR><LF>
<ACK>
<STX>5R|1|\^\^\^MPV\^776-5|8.0|1|6.5 to 15.0|||F||tech||20150408100401|<CR><ETX>70<CR><LF>
<ACK>
<STX>6R|2|\^\^\^PLT\^777-3|744|1|300 to 800|||F||tech||20150408100401|<CR><ETX>45<CR><LF>
<ACK>
<STX>7C|1|I|curve\^PLT\^0\^63\^0000040D1628314254667C8A9CA9B6BBC4CDCDD1D6DADFD AD6D6D1CDC8C4BBB2A9A09C938A857C78736F6B625D59544B47423E393535312C2C2C2C 2828231F1A|G<CR><ETX>3D<CR><LF>
<ACK>
<STX>0C|2|I|curve\^PLT\^64\^127\^1A161111110D0D0D0D0D0D0D0D0D0D0D0D0D0D0D0D0D0808 0808080808080804040404040404040404040404040404040404040404040000000000000000000000 00000|G<CR><ETX>C5<CR><LF>
<ACK>
<STX>1C|3|I|threshold\^PLT\^54|G<CR><ETX>19<CR><LF>
<ACK>
<STX>2R|3|\^\^\^HCT\^4544-3|54.5|1|24.0 to 45.0|H||F||tech||20150408100401|<CR><ETX>32<CR><LF>
<ACK>
<STX>3R|4|\^\^\^HGB\^717-9|18.6|1|8.0 to 15.0|H||F||tech||20150408100401|<CR><ETX>CA<CR><LF>

Table 16: Example of result sent by instrument (LMG test)

<ACK>
<STX>4R|5|\^\^\^MCH\^785-6|30.2|1|12.5 to 17.5|H||F||tech||20150408100401|<CR><ETX>02<CR><LF>
<ACK>
<STX>5R|6|\^\^\^MCHC\^786-4|34.2|1|30.0 to 36.0|||F||tech||20150408100401|<CR><ETX>F9<CR><LF>
<ACK>
<STX>6R|7|\^\^\^MCV\^787-2|88|1|39 to 55|H||F||tech||20150408100401|<CR><ETX>04<CR><LF>
<ACK>
<STX>7R|8|\^\^\^RBC\^789-9|6.17|1|5.00 to 10.00|||F||tech||20150408100401|<CR><ETX>F0<CR><LF>
<ACK>
<STX>0C|1|I|curve\^RBC\^0\^63\^0000000000000000000000020304020101010301010201040 60A0E162733486E759CB7CBDBDEDFD7D4C6B7987A7261583F372A201B19130E0A0B0907070 60603|G<CR><ETX>05<CR><LF>
<ACK>
<STX>1C|2|I|curve\^RBC\^64\^127\^040304060404050203030204030503030202020401030102 0 1010100000000010000000000000000000000000000000000000000000000000000000000000000000000 00|G<CR><ETX>FD<CR><LF>
<ACK>
<STX>2R|9|\^\^\^RDW\^788-0|12.2|1|17.0 to 22.0|L||F||tech||20150408100401|<CR><ETX>11<CR><LF>
<ACK>
<STX>3R|10|\^\^\^EOS#\^711-2|15.30|1|0.00 to 150.00|||F||tech||20150408100401|<CR><ETX>8D<CR><LF>
<ACK>
<STX>4R|11|\^\^\^EOS%\^713-8|72.4|1|2.0 to 120.0|||F||tech||20150408100401|<CR><ETX>0C<CR><LF>
<ACK>
<STX>5R|12|\^\^\^GRA#\^20482-6|17.50|1|2.50 to 14.00|H||F||tech||20150408100401|<CR><ETX>11<CR><LF>
<ACK>
<STX>6R|13|\^\^\^GRA%\^14773-6|82.4|1|37.0 to 87.0|||F||tech||20150408100401|<CR><ETX>81<CR><LF>
<ACK>

Table 16: Example of result sent by instrument (LMG test)

<STX>7R|14|^^^LYM#^731-0|3.50|1|1.50 to
7.00|||F||tech||20150408100401|<CR><ETX>16<CR><LF>

<ACK>

<STX>0R|15|^^^LYM%^736-9|17.0|1|20.0 to
55.0|L||F||tech||20150408100401|<CR><ETX>6B<CR><LF>

<ACK>

<STX>1R|16|^^^MON#^742-7|0.10|1|0.00 to
0.85|||F||tech||20150408100401|<CR><ETX>0C<CR><LF>

<ACK>

<STX>2R|17|^^^MON%^744-3|0.6|1|1.0 to
4.0|L||F||tech||20150408100401|<CR><ETX>C7<CR><LF>

<ACK>

<STX>3R|18|^^^WBC^804-5|21.1|1|5.5 to
19.5|H||F||tech||20150408100401|<CR><ETX>03<CR><LF>

<ACK>

<STX>4C|1|I|curve^WBC^0^63^0000000000083F8AD2DFC48F614030261E1A191B1D252C343
9373631322C29221D181515111110121011101110111112110F0D0D0D0D0C0B0B0909080706
0404|G<CR><ETX>E6<CR><LF>

<ACK>

<STX>5C|2|I|curve^WBC^64^127^040404030303050404030304060706050708 0A0B0C0E0F12
141516191C1D1E212124272C302D3032393B3B3E4042454A4E53515153545351565C5957535
55700|G<CR><ETX>31<CR><LF>

<ACK>

<STX>6C|3|I|threshold^WBC^00^00^62^2C^2E|G<CR><ETX>2D<CR><LF>

<ACK>

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

<ACK>

<EOT>

ABX Format

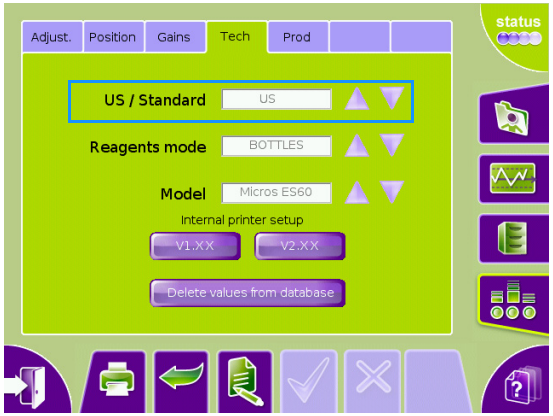
1. Overview

- The ABX format supports unidirectionnal or bidirectionnal connections. The ABX Micros ESV60/SCIL Vet abc+ instruments use only unidirectionnal mode.
- The ABX format can have a different number of fields according to the transmitted items set up by the user (results, curves, flags, etc.) or to the type of cycle.
- Fields sequence is not fixed.
- The result identifier is different according to the type of result: patient result ("RESULT"), QC result (QC-RES-M), etc.

2. Protocol configuration

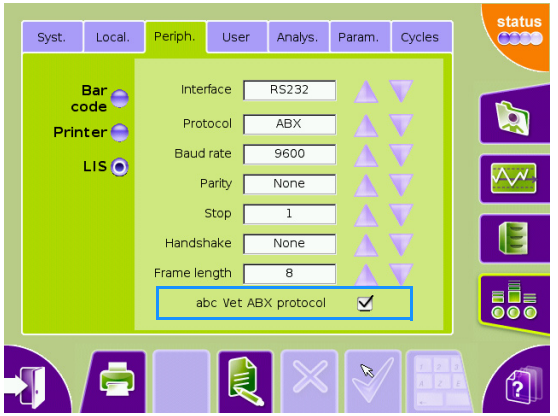
From software version V2.1.0, the configuration of the LIS connection with the ABX format could be the same as for an ABC Vet by activating the compatibility mode. Therefore, an ABC Vet could be replaced by an ABX Micros ESV60/SCIL Vet abc+ without any modification of the LIS.

1- Go to **Maintenance\Adjustment\Tech** and select **US** mode.



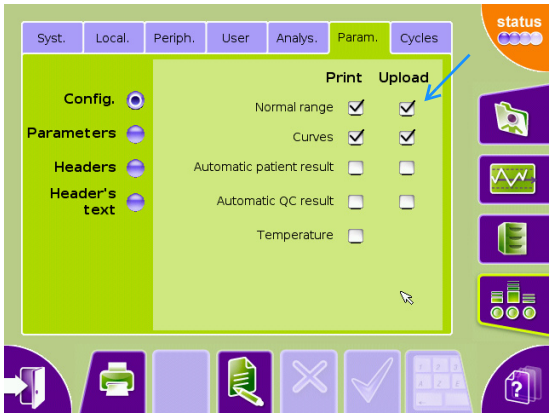
If the compatibility mode is activated the content of the "0xFF", "u", "s" and "v" field is the same as for an ABX Micros 60 or an ABC Vet. Refer to Identifier list (Instrument to Host) on page 19..
The analysis date is send to the LIS with the format selected in the ***Local*** tab.
For example, if the format "YYYY/MM/DD" is selected, the date will be sent to the LIS with the format "YY/MM/DD" (length limitation in the specfications of the ABX format).
Addition of the empty field "Q" on all data frames (QC, VET, HUM).
In the veterinary version, the species name is sent in the "$7F" field.

2- Go to **Maintenance > Serv. > Settings > Periph. > LIS** and select **abc Vet ABX protocol**.



If the compatibility mode is activated:

- the content of the "0xFF", "u", "s" and "v" field is the same as for an ABX Micros 60 or an ABC Vet. Refer to Identifier list (Instrument to Host) on page 19.
- The analysis date is sent to the LIS with the format selected in the ***Local*** tab. For example, if the format "YYYY/MM/DD" is selected, the date will be sent to the LIS with the format "YY/MM/DD" (length limitation in the specfications of the ABX format).
- Addition of the empty field "Q" on all data frames (QC, VET, HUM).
- In the veterinary version, the species name is send in the "$7F" field.
- In the **Param./Config.** screen, an option appears allowing to activate the transmission of the normal ranges to the LIS.



3. Protocol description

3.1. Unidirectionnal mode

Table 17: Typical unidirectionnal transmission from Instrument to Host

Instrument	<>	Host	Comment
<STX> + RESULT + <ETX>	>		

4. Message structure

4.1. Lines structure

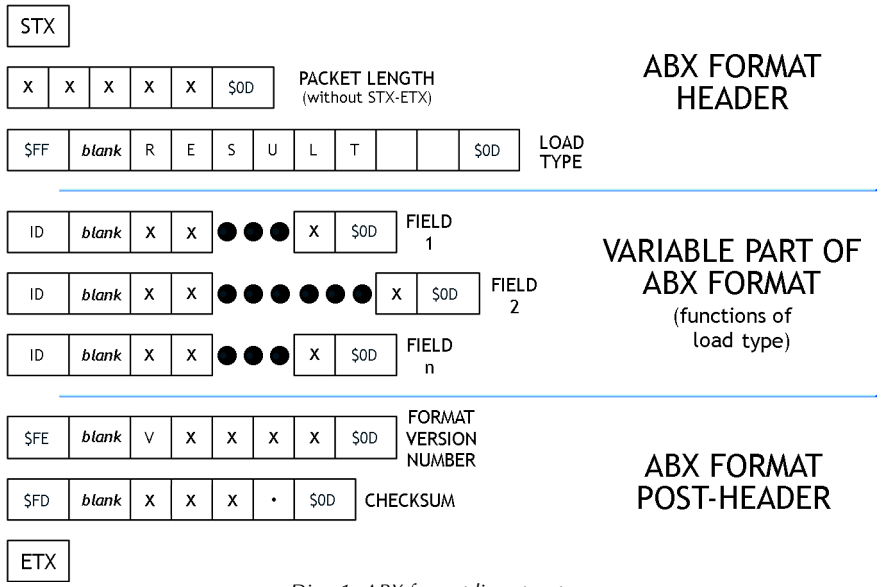
HEADER:
- STX
- Size + carriage return (Size: 5 bytes representing the total amount of the data except STX and ETX).
- Identifier followed by a Load Type + carriage return (Load: 8 character string preceeded by a blank indicating the type of data).

.....

VARIABLE PART:
- Identifier followed by the Information associated to the Load Type + carriage return (Identifier: 1 byte moving about $21 to $FF, it describes the information type which follows this indicator, always followed by a blank character $20).
- Remainder of the other Identifiers and Information associated to the Load Type + carriage returns.
- Other Load Type blocs + Associated Information

.....

POST-HEADER:
- Identifier followed by CheckSum + carriage return (CheckSum: Sum modulo 65536 of all characters except ETX, STX and all information about checksum (identifier - space - checksum - carriage return) in the hexadecimal format on 4 bytes, preceeded by a blank character $20).
- ETX



Diag.1: ABX format line structure

4.2. Control characters

Table 18: Standard control characters

Control String	Hexadecimal value
<ENQ>	$05
<ACK>	$06
<NAK>	$15
<STX>	$02
<ETX>	$03
<CR>	$0D
<LF>	$0A
<EOT>	$04
<SOH>	$01

5. Data transmitted by the analyzer to the host

5.1. Packet type

The information described in the packet type allows the specification of the global message content: hematological routine results or statistic results.

Table 19: Packet type list

Data packet string (8 characters)	Use
RESULT	Hematological result transmission on a routine mode
QC-RES-M	Result transmission of a median level control blood
REASSESS	Result transmission of a control blood in ABX Micros 60 compatibility
RESNOR-H	High limits for QC or patient result
RESNOR-L	Low limits for QC or patient result

5.2. Identifier list (Instrument to Host)

Table 20: ABX Micros 60/ABC Vet compatibility mode disable

Identifier	Correspondance	Example	Length	Format
$70 p	Analyzer number	01	2+2+1	Integers
$71 q	Analysis date and time	31/12/99 13h15mn31s	2+19+1	String(19)
$73 s	Analyzer sequence number	Always empty		
$74 t	Sampling mode	M: manual (open tube) R: rack (close tube)	2+1+1	String(1)
$75 u	Id # or sample id.	1450302154275-42	2+16+1	String(16)
$76 v	animal name/owner name patient name	SMITH Ronald FELIX / Dupond	2+30+1	String(30)
$80 ç	Analysis type	A: CBC D: LMG	2+1+1	String(1)

Table 21: ABX Micros 60/ABC Vet compatibility mode enable

Identifier	Correspondance	Example	Length	Format
$70 p	Analyzer number	01	2+2+1	Integers
$71 q	Analysis date and time	User configuration	2+19+1	String(19)
$73 s	Analyzer sequence number	QC = 8888 Patient result = SID		
$74 t	Sampling mode	M: manual (open tube) R: rack (close tube)	2+1+1	String(1)
$75 u	Id # or sample id.	QC = 8888 Patient result = SID	2+16+1	String(16)
$76 v	Sample ID	sample ID	2+30+1	String(30)
$80 ç	Analysis type	A: CBC D: LMG	2+1+1	String(1)
$51 Q	Empty	Empty string	2+28+1	String(28)
$7F	Species	Dog	2+16+1	String(16)

Note 1: *$7F is a non-printable character.

5.2.1. Numerical results fields

- From software version 2.1.0, the instrument sends the patients results to the LIS only in Standard units, whatever the units system that is configured in the instrument is (Standard, mmol/L, International, Japanese).
- If one parameter cannot be calculated by the analyzer, the field is replaced with --.--

Parameter status:
Following the numerical field, a first digit gives the counting rejection status or the suspicion, a second one gives the parameter value status according to high and low normalities, to high and low extreme values and to the overloading capacities.

Table 22: Identifier First digit

First digit (letter)	Correspondance
$52 R	Parameter rejected for a counting default
$42 B	Incorrect balance between the counting methods
$53 S	Suspicious parameter value
$20 blank	No anomaly observed

Table 23: Identifier Second digit

Second digit (letter)	Correspondance
$42 B (french) or $4C L (other languages)	Parameter < to the lower extreme value
|$62 b (french) or $6C l (other languages)	Parameter < to the low normal value
$20 blank	Parameter normal value
$68 h	Parameter > to the high normal value
$48 H	Parameter > to the high extreme value
$43 C	Platelet concentrate
$4F O	Parameter exceeding the capacity

Example: 5.5 millions RBC with a counting error in the standard units:
$32 $20 $30 $35 $2E $35 $30 $52 $68 $0D or
«2 05.50Rh» + carriage return

Table 24: CBC numerical result fields list

Identifier	Correspondance	Example	Format (Length)
$21 !	WBC	07.40	2+String(7)+1
$32 2	RBC	04.64	2+String(7)+1
$33 3	Hgb	14.17	2+String(7)+1
$34 4	Hct	43.95	2+String(7)+1
$35 5	MCV	94.68	2+String(7)+1
$36 6	MCH	30.53	2+String(7)+1
$37 7	MCHC	32.24	2+String(7)+1
$38 8	RDW	12.98	2+String(7)+1
$40 @	PLT	00401	2+String(7)+1
$41 A	MPV	07.94	2+String(7)+1
$42 B	THT	0.318	2+String(7)+1
$43 C	PDW	13.50	2+String(7)+1

Table 25: LMG numerical result fields list

Identifier	Correspondance	Example	Format (Length)
$21 !	WBC	07.40	2+String(7)+1
$22 "	Lymphocytes (#)	02.03	2+String(7)+1
$23 #	Lymphocytes (%)	27.40	2+String(7)+1
$24 $	Monocytes (#)	00.70	2+String(7)+1
$25 %	Monocytes (%)	09.40	2+String(7)+1
$26 &	Granulocytes (#)	04.67	2+String(7)+1
$27 '	Granulocytes (%)	63.20	2+String(7)+1
$32 2	RBC	04.64	2+String(7)+1
$33 3	HGB	14.17	2+String(7)+1
$34 4	HCT	43.95	2+String(7)+1
$35 5	MCV	94.68	2+String(7)+1
$36 6	MCH	30.53	2+String(7)+1

Table 25: LMG numerical result fields list

Identifier	Correspondance	Example	Format (Length)
$37 7	MCHC	32.24	2+String(7)+1
$38 8	RDW	12.98	2+String(7)+1
$40 @	PLT	00401	2+String(7)+1
$41 A	MPV	07.94	2+String(7)+1
$42 B	THT	0.318	2+String(7)+1
$43 C	PDW	13.50	2+String(7)+1
$2A *	EOS (#)	018.7	2+String(7)+1
$2B +	EOS (%)	000.7	2+String(7)+1

5.2.2. Flag fields

Flags are transmitted in a comprehensive mode (same presentation than on the screen, that is to say dependant from the language).

They are replaced with blanks when the flag is not detected.

Note 2: In the following tables, identifiers formats are separated by blanks only for a better comprehension.

Table 26: Identifier list

Identifier	Parameter	Format	Length
$50 P	WBC or LMG	AG1 AG2 EOS	2+12+1
$53 S	PLT	Pc Sc Mc	2+6+1

5.2.3. Other identifiers

Note 3: For $FB and $FF, the strings having less than 8 characters are completed on the right side by blanks.

Table 27: Other identifiers

Identifier	Correspondance	Format	Length
$FB û	Analyzer name MICROS60	Character string	2+8+1
$FD ý	16 bits checksum value	4 hexadecimal bytes	2+4+1
$FE Þ	Version N° of Identifier list	String of characters: Vx.xx	2+5+1

6. Histograms and threshold

6.1. Histograms

Histograms are transmitted on 128 channels, preceeded by a blank. They are automatically rescaled to a 223 maximum amplitude value. The zero amplitude value is $20, the maximum amplitude value is $FF.

The curve is transmitted by a sequence of points corresponding to the amplitude, each point of the curve is transmitted in ASCII format (one byte).

The example below shows the amplitude value corresponding to the transmitted values.

	"	" "	" "	" "	"	"#"	"*"	"/"	"5"	";"	"A"	"F"...
Amplitude value (decimal)	0	0	0	0	3	10	15	21	27	33	38...	

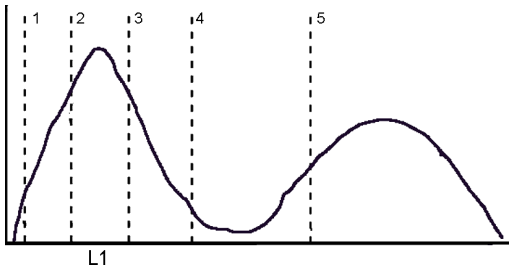
6.2. Separation thresholds

It is the channel number (decimal value) enclosing areas on the histograms. Each threshold is transmitted on 3 bytes preceeded by a blank.

6.2.1. WBC thresholds

Separation thresholds 1-2-3 allow the L1 flag determination. For the analyzers in LMG mode, the 4-5 thresholds allow the separation of the 3 populations Lymphocytes, Monocytes, Granulocytes.

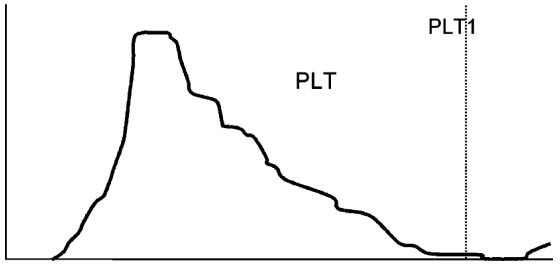
Example 1: output format of the WBC curve thresholds for an LMG sampling. In this example, the analyzer does not send the calculation thresholds of the L1 flag.
«] 000 000 000 040 060» + carriage return.



Diag.2: WBC histogram

6.2.2. PLT thresholds

Threshold 1 is the number of the last channel used to calculate the PLT number.



Diag.3: PLT Histogram

Table 28: Histogram identifiers

Identifier	Parameter	Format	Length
$57 W	WBC	Amplitude of each channel	2+128+1
$58 X	RBC	Amplitude of each channel	2+128+1
$59 Y	Plt	Amplitude of each channel	2+128+1
$5D]	WBC thresholds	5 thresholds	1+20+1
$5F _	PLT thresholds	1 threshold	1+4+1

7. Example of data frame

7.1. Example of low and high limits sent by the instrument

```
<STX> 00267 <CR>
[FF] RESNOR-L <CR>
p 72<CR>
[7F] Dog                                <CR>
! 006.0  <CR>
2 05.50  <CR>
3 012.0  <CR>
4 037.0  <CR>
5 00060  <CR>
6 019.5  <CR>
7 032.0  <CR>
8 014.0  <CR>
@ 00200  <CR>
A 006.7  <CR>
B --.--  <CR>
C --.--  <CR>
# 012.0  <CR>
% 003.0  <CR>
' 062.0  <CR>
" 001.0  <CR>
$ 000.1  <CR>
& 003.1  <CR>
+ 002.0  <CR>
* 000.1  <CR>
[FB] MICROS60<CR>
[FE] v2.8 <CR>
[FD] 2DBE<CR>
<ETX>
```

```
<STX> 00267 <CR>
[FF] RESNOR-L <CR>
p 72<CR>
[7F] Dog                                <CR>
! 017.0  <CR>
2 08.50  <CR>
3 018.0  <CR>
4 055.0  <CR>
5 00077  <CR>
6 024.5  <CR>
7 036.0  <CR>
8 017.0  <CR>
@ 00500  <CR>
A 0011.1  <CR>
B --.--  <CR>
C --.--  <CR>
# 030.0  <CR>
% 010.0  <CR>
' 087.0  <CR>
" 004.8  <CR>
$ 001.4  <CR>
& 012.8  <CR>
+ 010.0  <CR>
* 001.2  <CR>
[FB] MICROS60<CR>
[FE] v2.8 <CR>
[FD] 2DBE<CR>
<ETX>
```

7.2. Example of result sent by the instrument

Compatibility mode disable

```
<STX> 00762 <CR>
[FF] RESULT   <CR>
p 72<CR>
q 10/11/24 11h26mn53s <CR>
u 123                          <CR>
s   <CR>
v Name First name              <CR>
t M<CR>
Ç D<CR>
! 009.2  <CR>
2 04.40  <CR>
3 014.4  <CR>
4 043.6  <CR>
5 00099  <CR>
6 032.8h <CR>
7 033.0  <CR>
8 013.5  <CR>
@ 00230  <CR>
A 007.6  <CR>
B 0.175  <CR>
C 012.9  <CR>
# 005.31 <CR>
% 002.8  <CR>
' 091.9h <CR>
" 000.41 <CR>
$ 000.2  <CR>
& 008.6  <CR>
W [...]  <CR>
X [...]  <CR>
Y [...]  <CR>
S        <CR>
_  105   <CR>
P        <CR>
] 000 000 000 026 036  <CR>
[FB] MICROS60<CR>
[FE] v2.8 <CR>
[FD] 7819<CR>
<ETX>
```

Compatibility mode enable

```
<STX> 00793 <CR>
[FF] RESULT   <CR>
p 72<CR>
q 24/11/10 11h26mn53s <CR>
u 0000000000000123    <CR>
s 0123  <CR>
v 123                          <CR>
t M<CR>
Ç D<CR>
! 009.2  <CR>
2 04.40  <CR>
3 014.4  <CR>
4 043.6  <CR>
5 00099  <CR>
6 032.8h <CR>
7 033.0  <CR>
8 013.5  <CR>
@ 00230  <CR>
A 007.6  <CR>
B 0.175  <CR>
C 012.9  <CR>
# 005.31 <CR>
% 002.8  <CR>
' 091.9h <CR>
" 000.41 <CR>
$ 000.2  <CR>
& 008.6  <CR>
W [...]  <CR>
X [...]  <CR>
Y [...]  <CR>
S        <CR>
_  105   <CR>
P        <CR>
] 000 000 000 026 036  <CR>
Q                       <CR>
[FB] MICROS60<CR>
[FE] v2.8 <CR>
[FD] 7819<CR>
<ETX>
```

7.3. Example of QC result sent by the instrument

Compatibility mode disable

```
<STX> 00762 <CR>
[FF] QC-RES-M   <CR>
p 72<CR>
q 10/11/24 11h26mn53s <CR>
u 123                       <CR>
s   <CR>
v QC1                       <CR>
t R<CR>
Ç D<CR>
! 008.8  <CR>
2 04.37  <CR>
3 014.5  <CR>
4 042.5  <CR>
5 00097  <CR>
6 033.2  <CR>
7 034.2  <CR>
8 014.2  <CR>
@ 00234  <CR>
A 007.6  <CR>
B --.--  <CR>
C --.--  <CR>
# 009.0  <CR>
% 025.6  <CR>
' 065.4  <CR>
" 000.7  <CR>
$ 002.2  <CR>
& 005.9  <CR>
W [...]  <CR>
X [...]  <CR>
Y [...]  <CR>
S        <CR>
_  105   <CR>
P        <CR>
] 000 000 000 035 053  <CR>
[FB] MICROS60<CR>
[FE] v2.8 <CR>
[FD] AA62<CR>
<ETX>
```

Compatibility mode enable

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[FF] REASSESS   <CR>
p 72<CR>
q 24/11/10 11h26mn53s <CR>
u 0000000000000123    <CR>
s   0123<CR>
v QC1                       <CR>
t R<CR>
Ç D<CR>
! 008.8  <CR>
2 04.37  <CR>
3 014.5  <CR>
4 042.5  <CR>
5 00097  <CR>
6 033.2  <CR>
7 034.2  <CR>
8 014.2  <CR>
@ 00234  <CR>
A 007.6  <CR>
B --.--  <CR>
C --.--  <CR>
# 009.0  <CR>
% 025.6  <CR>
' 065.4  <CR>
" 000.7  <CR>
$ 002.2  <CR>
& 005.9  <CR>
W [...]  <CR>
X [...]  <CR>
Y [...]  <CR>
S        <CR>
_  105   <CR>
P        <CR>
] 000 000 000 035 053  <CR>
Q                       <CR>
[FB] MICROS60<CR>
[FE] v2.8 <CR>
[FD] AA62<CR>
<ETX>
```