 ABX Diagnostics Montpellier

# ABX Diagnostics Pentra DX 120 Output format RAA026BA





## ASTM Format description

ABX Diagnostics 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.

The ASTM LIS feature of the Pentra DX 120 Data Management software allows an external LIS to communicate with one or more Pentra DX 120 Data Management through one LIS serial line or one network interface using TCP/IP protocol. This document is intended as a guide to LIS vendors developing interfaces that communicate with the Pentra DX 120 Data Management System.

### 1. Physical layer

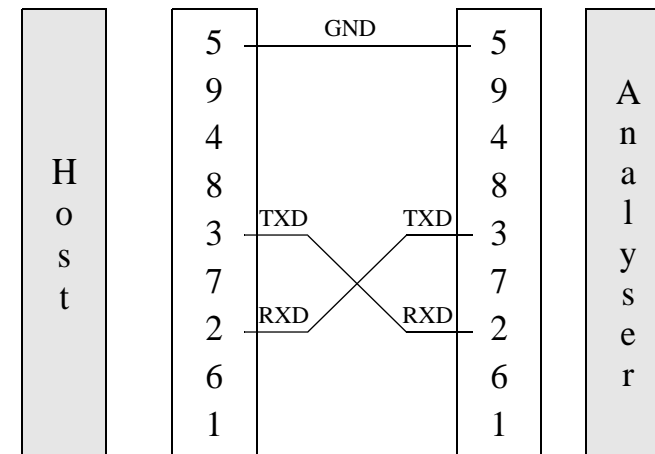
#### 1.1. Serial interface

All communications are expected to use the RS232 communication protocol, based upon the Electronics Industries Association (EIA) standard RS232-C. As part of the conformance to this standard, the Pentra DX 120 Data Management System is configured as Data Terminal Equipment (DTE).

The Pentra DX 120 Data Management System is cabled to the LIS via a DB-9 connector on the octopus cable plugged into the computer workstation on the Pentra DX 120.

Table 1: DB9 Connection

Pin (DB9) Pentra DX Data Management	LIS Port Configuration (Pentra DX/Pentra DX 120)	LIS Cable Must Provide
3	RXD	TXD
2	TXD	RXD
7	Ground	Ground



#### 1.2. Network interface

In the Pentra DX 120 Data Management system, the implementation of network based communication is based on the Windows socket standard.

The socket client establishes a permanent session to the socket server. If, for any reason, the connection aborts, the Pentra DX 120 Data Management system attempts to



re establish the connection.

The data transmitted between the socket clients to the socket server is in the form of ASTM high level packets. Same low level control characters are used than for the Serial Interface.

## 2. Connection specifications (ASTM E-1381)

### 2.1. Output data characteristics

Allowed characters: Allowed are ASCII 10 (LF), 13 (CR), 32-126, 128-254. However, the message data sent to the Pentra DX Data Management System must be restricted to ASCII 32-126 for proper operation of the Pentra DX Data Management System Software. Specific fields may further restrict allowed characters.  
Maximum message length: 240 characters.

### 2.2. Communication protocol

Table 2: Standard control characters

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

### 2.2.1. Instrument\Host connexion

Table 3: Typical discussion between Instrument and Host

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

Table 4: Typical discussion between Host and Instrument

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

### 2.2.2. Discussion with conflict between Instrument and Host

If negative answer (NACK): The instrument sends again the same frame up to 6 times. If no response is to an ENQ, another ENQ is sent 18s after.  
In case of ENQ\ENQ conflict analyzer waits for 5s and sends <ACK>.

Analyzer is master in case of conflict.



## 2.2.3. Defect packet during discussion between Instrument and Host

Table 5: Defect packet during discussion between Instrument 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>	>	

## 2.3. ASTM Data frame format

A sequential number located after the <STX> character is inserted into each Data frame. Frame number is set to 1 when transfer phase is initialized and is incremented by 1 for each frame up to 7 and then returns to 0. Frame number is to permit receiver to distinguish between new and retransmitted frame, in case of retransmitted frame (after a <NAK> response from Host), 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 and 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
3	End of data message ETX if end frame		1	
4	Checksum		2	
5	CRLF	\$0D \$0A	2	

### 2.3.1. Frame checksum

According to ASTM E-1381 frame checksum (<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>

## 3. Records general format specifications (ASTM 1394)

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

Example of record inside Data frame: <STX>1...Data...<CR><ETX>xx<CR><LF>

<STX>1H|^&||HostSimulator||||ABX|P|E1394-97|20020705144108<CR><ETX>D3<CR><LF>



Table 7: ASTM Records

Record ID	ASTM Definition
H	Header
P	Patient
O	Order
R	Result
C	Comment
Q	Query (Request information order)
L	Terminator record

## 3.1. Structure of Records

### 3.1.1. 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>

### 3.1.2. Instrument Patient file modification by Host

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

### 3.1.3. 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)

## 3.2. Description of Records

- Only the fields described with their specified length, in further tables, are used by ABX instruments.
- Length of field can be less than maximum value but must not be more.
- Only «Sample ID» and «Test» fields from Order record must be informed, all other fields are optional.
- Delimiter must be used even if field is free.
- Delimiters inside records are separate by «|» (ASCII \$7C).
- Delimiters inside fields are separate by «^» (ASCII \$5E).



## 3.2.1. Header record

Table 8: Header record fields

ASTM field	Definition	Transmitted data	Field max. length	PDX Receive	PDX Send
7.1.1	Record Type	H	1	Required	Required
7.1.2	Delimiters definition	idem standard:   Field delimiter \ Repeat delimiter ^ Component delimiter & Escape delimiter	4	Required	Required
7.1.3	Message Control ID			Ignored	No
7.1.4	Access Password			Ignored	No
7.1.5	Sender Name	PDX	3	Ignored	Yes
7.1.6	Sender Address			Ignored	No
7.1.7	Reserved field			Ignored	No
7.1.8	Sender Telephone Nb			Ignored	No
7.1.9	Characteristics of Sender			Ignored	No
7.1.10	Receiver ID			Ignored	No
7.1.11	Comments or Special Instructions			Ignored	No
7.1.12	Processing ID	P	1	Ignored	Yes Always 'P'
7.1.13	ASTM Version Nb	1394-97	12	Ignored	Yes
7.1.14	Date and Time of message	YYYYMMDDHHMMSS	14	Ignored	Yes current

## 3.2.2. Patient record

Table 9: Patient record fields

ASTM field	Definition	Transmitted data	Field max. length	PDX Receive	PDX Send
8.1.1	Record Type	P	1	Required	Required
8.1.2	Sequence Nb	1, 2, ...	3	Required	Required
8.1.3	Practice Assigned Patient ID			Ignored	No
8.1.4	Laboratory Assigned Patient ID	Patient Id	25	Required	Yes
8.1.5	Patient ID No 3			Ignored	No
8.1.6	Patient Name	Lastname^Firstname	20^20	Yes	Yes
8.1.7	Mother's Maiden Name			Ignored	No
8.1.8	Birthdate	YYYYMMDD^NNN^A (See Note 1)	8^3^1	Yes	Yes
8.1.9	Patient Sex	M: Male F: Female All other values are treated as Unspecified	1	Yes	Yes
8.1.10	Patient Race-Ethnic Origin			Ignored	No
8.1.11	Patient Address			Ignored	No
8.1.12	Reserved field			Ignored	No
8.1.13	Patient Telephone Nb			Ignored	No
8.1.14	Attending Physician ID	Text	20	Yes	Yes
8.1.15	Special Field 1			Ignored	No
8.1.16	Special Field 2			Ignored	No
8.1.17	Patient Height			Ignored	No
8.1.18	Patient Weight			Ignored	No
8.1.19	Patient's Known or Suspected Diagnosis			Ignored	No

Table 9: Patient record fields

ASTM field	Definition	Transmitted data	Field max. length	PDX Receive	PDX Send
8.1.20	Patient Active Medication			Ignored	No
8.1.21	Patient's Diet			Ignored	No
8.1.22	Practice Field 1			Ignored	No
8.1.23	Practice Field 2			Ignored	No
8.1.24	Admission and Discharge Dates			Ignored	No
8.1.25	Admission Status			Ignored	No
8.1.26	Location	Text	20	Yes	Yes
8.1.27	Nature of Alternative Diagnostic Code and Classifiers			Ignored	No
8.1.28	Alternative Diagnostic Code and Classifiers			Ignored	no
8.1.29	Patient Religion			Ignored	No
8.1.30	Martial status			Ignored	No
8.1.31	Isolation Status			Ignored	No
8.1.32	Language			Ignored	No
8.1.33	Hospital Service			Ignored	No
8.1.34	Hopital Institution			Ignored	No
8.1.35	Dosage Category			Ignored	No

• NOTE 1: 8.1.8 «Birthdate»: If the birthdate is sent by the LIS, the age and age unit fields are ignored and recalculated at the Pentra DX Data Management.

If no birthdate is sent, then the age and age unit fields are used:

Format sent is ^NNN^A

NNN: Age

A: Age unit 'Y': Year, 'M': Month, 'D': Day

### 3.2.3. Order record

Table 10: Order record fields

ASTM field	Definition	Transmitted data	Field max. length	PDX Receive	PDX Send
9.4.1	Record Type	O	1	Required	Required
9.4.2	Sequence Nb	1, 2, ...	3	Required	Required
9.4.3	Sample ID	SampleID^Rack^Position See Note 2	16^3^2	SampleID Required	Required
9.4.4	Instrument Specimen ID			Ignored	No
9.4.5	Universal Test ID	^^^Test name (See Note 3)	x	Required	Yes
9.4.6	Priority	S: Stat mode (Priority) All other priority code are treated as «Routine» mode	1	Yes	Yes
9.4.7	Requested/Ordered Date and Time			Ignored	No
9.4.8	Specimen Collection Date and Time	YYYYMMDDHHMMSS	14	No (See Note 4)	Yes
9.4.9	Collection End Time			Ignored	No
9.4.10	Collection Volume			Ignored	No
9.4.11	Collector ID			Ignored	No
9.4.12	Action Code	A or N: Create order Q: Control	1	Ignored (Except A or N)	Yes, 'Q' if Control
9.4.13	Danger Code			Ignored	No
9.4.14	Relevant Clinical Informations			Ignored	No
9.4.15	Date/Time Specimen Received			Ignored	No



Table 10: Order record fields

ASTM field	Definition	Transmitted data	Field max. length	PDX Receive	PDX Send
9.4.16	Specimen Descriptor	Text	8	Required	No
9.4.17	Ordering Physician			Ignored	No
9.4.18	Physician Phone Nb			Ignored	No
9.4.19	User Field 1			Ignored	No
9.4.20	User Field 2			Ignored	No
9.4.21	Laboratory Field 1			Ignored	No
9.4.22	Laboratory Field 2			Ignored	No
9.4.23	Date and Time Results reported or last modified			Ignored	No
9.4.24	Instrument Charge to Computer System			Ignored	No
9.4.25	Instrument Section ID			Ignored	No
9.4.26	Report Types			Ignored	No
9.4.27	Reserved field			Ignored	No
9.4.28	Location or Ward of Specimen Collection			Ignored	No
9.4.29	Nosocomial Infection Flag			Ignored	No
9.4.30	Specimen Service			Ignored	No
9.4.31	Specimen institution			Ignored	No

• NOTE 2: Field 9.4.3 «Sample ID»: Alphanumeric characters are accepted (0-9, A-Z). Spaces and punctuation are not allowed. Refer to Host specification document for each instrument connected for other limitations. The information of «^Rack^Position» is only sent by the instrument.

• NOTE 3: Field 9.4.5 «Universal test ID»: No length limitation, example: «^^^TEST1\^^^TEST2\...»

List of compatible test: CBC, DIF, RET, CBR, DIR, NRBC (ERB), CBE, SPSE

(Slide), SPSEC (Slide + Stain)

• NOTE 4: Do not send collection Date and Time to the workstation to avoid patient anteriority calculation problem.

### 3.2.4. Result record

Table 11: Result record fields

ASTM field	Definition	Transmitted data	Field max. length	PDX Receive	PDX Send
10.1.1	Record Type	R	1	Required	Required
10.1.2	Sequence Nb	1, 2, ...	3	Required	Required
10.1.3	Universal Test ID	^^^Parametername (See Note 5)	x	Required	Required
10.1.4	Data or Measurement Value	Test result (See "Special characteristics for ABX datas", page 10)		yes (See Note 7)	yes
10.1.5	Unit	See Note 6	15	No	Yes
10.1.6	Reference Range			No	No
10.1.7	Result Abnormal Flag	Analytical flag (See Note 8) L,H,LL,HH,>	2	No	Yes
10.1.8	Nature of Abnormality Testing			No	No
10.1.9	Result Status	W: suspicion N: rejected result	1	No	Yes
10.1.10	Date of Change in Normative Values or Units			No	No
10.1.11	Operator Identification		40	No	Yes



Table 11: Result record fields

ASTM field	Definition	Transmitted data	Field max. length	PDX Receive	PDX Send
10.1.12	Date/Time Test Starting			No	No
10.1.13	Date/Time Test Completed	YYYYMMDDHHMMSS	14	Required	No
10.1.14	Instrument Identification		1	No	Yes

- NOTE 5: Field 10.1.3 «Universal test ID» had no length limitation.
- NOTE 6 Field 10.1.5 «Units» pentra DX sends the unit in DOS characters, example «µ» is sent «æ».
- NOTE 7: Patient anteriority (Delta check) calculation. See Table 25, “Example of last anteriority result sent by host”, page 16 (Not validated for V1.0.0 software).
- NOTE 8: Field 10.1.7 «Result Abnormal Flag»  
L,H,LL,HH: Result above normal or panic ranges.  
>: Result over instrument capacity (Dilution must be done).

### 3.2.5. Comment record

Table 12: Comments record fields

ASTM field	Definition	Transmitted data	Field max. length	PDX Receive	PDX Send
11.1.1	Record Type	C	1	Yes	Required
11.1.2	Sequence Nb	1, 2, ...	3	Yes	Required

Table 12: Comments record fields

ASTM field	Definition	Transmitted data	Field max. length	PDX Receive	PDX Send
11.1.3	Comment Source			No	Yes
11.1.4	Comment Text	Text See Note 9	200	Yes	yes
11.1.5	Comment Type	'I': comment is an alarm or a pathologic message. 'G' comment is a rule comment message.		No	Yes

- NOTE 9: Field 11.1.4 «Comment text» If the comment record is received after the patient record, then the comment is associated to the demographic. If the comment record is received after the order record, then the comment is associated to the report.

### 3.2.6. Request information record (Query mode)

Instrument request informations for only one tube at the time: 1 Request information record for each tube.

For example:

Table 13: Example of Query for one tube

```

Instrument
Host
<ENQ>
<ACK>
<STX>1H|^&||PDX|||||P|1394-97|20031202104812<CR><ETX>19<CR><LF>
<ACK>
<STX>2Q|1|^SID007|||||O<CR><ETX>B8<CR><LF>
<ACK>
  
```



Table 13: Example of Query for one tube

```
<STX>3L|1<CR><ETX>3C<CR><LF>
<ACK>
<EOT>
```

Table 14: Request information record fields

ASTM field	Definition	Transmitted data	Field max. length	PDX Receive	PDX Send
12.1.1	Record Type	Q	1	No	Required
12.1.2	Sequence Nb	1	3	No	Required
12.1.3	Identifier	^Sample Id	16	No	Yes
12.1.4	End of identifier list			No	No
12.1.5	Universal Test ID			No	No
12.1.6	Time limits			No	No
12.1.7	Time max. limit			No	No
12.1.8	Time min. limit			No	No
12.1.9	Physician name			No	No
12.1.10	Telephone number			No	No
12.1.11	Reserve for user			No	No
12.1.12	Reserve for user			No	No
12.1.13	Status code	O: Query for test informations	1	No	Yes Always 'O'

### 3.2.7. Terminator record

Table 15: Terminator record

ASTM field	Definition	Transmitted data	Field max. length	PDX Receive	PDX Send
13.1.1	Record type	L	1	Required	Required
13.1.2	Sequence number	1	3	Required	Required
13.1.3	Termination code			Ignored	No

## 4. Special characteristics for ABX datas

### 4.1. CBC Data presentation

Table 16: CBC Data presentation

Parameter	English code	Standard Units	S.I. Units	mmol Units	Japanese Units
White Blood Cell	WBC	10 <sup>3</sup> /mm <sup>3</sup>	10 <sup>9</sup> /L	10 <sup>9</sup> /L	10 <sup>2</sup> /mm <sup>3</sup>
Red Blood Cell	RBC	10 <sup>6</sup> /mm <sup>3</sup>	10 <sup>12</sup> /L	10 <sup>12</sup> /L	10 <sup>4</sup> /mm <sup>3</sup>
Hemoglobin	HGB	g/dL	g/L	mmol/L	g/dL
Hematocrit	HCT	%	L/L	L/L	%
Mean Corpuscular Volume	MCV	µm <sup>3</sup>	fL	fL	µm <sup>3</sup>
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 <sup>3</sup> /mm <sup>3</sup>	10 <sup>9</sup> /L	10 <sup>9</sup> /L	10 <sup>4</sup> /mm <sup>3</sup>



Table 16: CBC Data presentation

Parameter	English code	Standard Units	S.I. Units	mmol Units	Japanese Units
Mean Platelet Volume	MPV	$\mu\text{m}^3$	fL	fL	$\mu\text{m}^3$
Plateletcrit	PCT	%	$10^{-2}/\text{L}$	$10^{-2}/\text{L}$	%
Platelet Distribution Width	PDW	%	%	%	%

## 4.2. DIF Data presentation

Table 17: DIF Data presentation

Parameter	English code	Standard Units	S.I. Units	mmol Units	Japanese Units
White Blood Cell	WBC	$10^3/\text{mm}^3$	$10^9/\text{L}$	$10^9/\text{L}$	$10^2/\text{mm}^3$
Red Blood Cell	RBC	$10^6/\text{mm}^3$	$10^{12}/\text{L}$	$10^{12}/\text{L}$	$10^4/\text{mm}^3$
Hemoglobin	HGB	g/dL	g/L	mmol/L	g/dL
Hematocrit	HCT	%	L/L	L/L	%
Mean Corpuscular Volume	MCV	$\mu\text{m}^3$	fL	fL	$\mu\text{m}^3$
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	$10^3/\text{mm}^3$	$10^9/\text{L}$	$10^9/\text{L}$	$10^4/\text{mm}^3$
Mean Platelet Volume	MPV	$\mu\text{m}^3$	fL	fL	$\mu\text{m}^3$
Plateletcrit	PCT	%	$10^{-2}/\text{L}$	$10^{-2}/\text{L}$	%
Platelet Distribution Width	PDW	%	%	%	%
Lymphocytes #	LYM#	$10^3/\text{mm}^3$	$10^9/\text{L}$	$10^9/\text{L}$	$10^2/\text{mm}^3$

Table 17: DIF Data presentation

Parameter	English code	Standard Units	S.I. Units	mmol Units	Japanese Units
Lymphocytes %	LYM%	%	%	%	%
Monocytes #	MON#	$10^3/\text{mm}^3$	$10^9/\text{L}$	$10^9/\text{L}$	$10^2/\text{mm}^3$
Monocytes %	MON%	%	%	%	%
Neutrophils #	NEU#	$10^3/\text{mm}^3$	$10^9/\text{L}$	$10^9/\text{L}$	$10^2/\text{mm}^3$
Neutrophils %	NEU%	%	%	%	%
Eosinophils #	EOS#	$10^3/\text{mm}^3$	$10^9/\text{L}$	$10^9/\text{L}$	$10^2/\text{mm}^3$
Eosinophils %	EOS%	%	%	%	%
Basophils #	BAS#	$10^3/\text{mm}^3$	$10^9/\text{L}$	$10^9/\text{L}$	$10^2/\text{mm}^3$
Basophils %	BAS%	%	%	%	%
Atypical Lymphocytes #	ALY#	$10^3/\text{mm}^3$	$10^9/\text{L}$	$10^9/\text{L}$	$10^2/\text{mm}^3$
Atypical Lymphocytes %	ALY%	%	%	%	%
Large Immature Cell #	LIC#	$10^3/\text{mm}^3$	$10^9/\text{L}$	$10^9/\text{L}$	$10^2/\text{mm}^3$
Large Immature Cell %	LIC%	%	%	%	%
Lymphocyte Immature cell %	IML%	%	%	%	%
Lymphocyte Immature cell #	IML#	$10^3/\text{mm}^3$	$10^9/\text{L}$	$10^9/\text{L}$	$10^2/\text{mm}^3$
Monocyte Immature cell %	IMM%	%	%	%	%
Monocyte Immature cell #	IMM#	$10^3/\text{mm}^3$	$10^9/\text{L}$	$10^9/\text{L}$	$10^2/\text{mm}^3$
Granulocyte Immature cell %	IMG%	%	%	%	%
Granulocyte Immature cell #	IMG#	$10^3/\text{mm}^3$	$10^9/\text{L}$	$10^9/\text{L}$	$10^2/\text{mm}^3$



## 4.3. DIR Data presentation

Table 18: DIR Data presentation

Parameter	English code	Standard Units	S.I. Units	mmol Units	Japanese Units
White Blood Cell	WBC	10 <sup>3</sup> /mm <sup>3</sup>	10 <sup>9</sup> /L	10 <sup>9</sup> /L	10 <sup>2</sup> /mm <sup>3</sup>
Red Blood Cell	RBC	10 <sup>6</sup> /mm <sup>3</sup>	10 <sup>12</sup> /L	10 <sup>12</sup> /L	10 <sup>4</sup> /mm <sup>3</sup>
Hemoglobin	HGB	g/dL	g/L	mmol/L	g/dL
Hematocrit	HCT	%	L/L	L/L	%
Mean Corpuscular Volume	MCV	μm <sup>3</sup>	fL	fL	μm <sup>3</sup>
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 <sup>3</sup> /mm <sup>3</sup>	10 <sup>9</sup> /L	10 <sup>9</sup> /L	10 <sup>4</sup> /mm <sup>3</sup>
Mean Platelet Volume	MPV	μm <sup>3</sup>	fL	fL	μm <sup>3</sup>
Plateletcrit	PCT	%	10 <sup>-2</sup> /L	10 <sup>-2</sup> /L	%
Platelet Distribution Width	PDW	%	%	%	%
Lymphocytes #	LYM#	10 <sup>3</sup> /mm <sup>3</sup>	10 <sup>9</sup> /L	10 <sup>9</sup> /L	10 <sup>2</sup> /mm <sup>3</sup>
Lymphocytes %	LYM%	%	%	%	%
Monocytes #	MON#	10 <sup>3</sup> /mm <sup>3</sup>	10 <sup>9</sup> /L	10 <sup>9</sup> /L	10 <sup>2</sup> /mm <sup>3</sup>
Monocytes %	MON%	%	%	%	%
Neutrophils #	NEU#	10 <sup>3</sup> /mm <sup>3</sup>	10 <sup>9</sup> /L	10 <sup>9</sup> /L	10 <sup>2</sup> /mm <sup>3</sup>
Neutrophils %	NEU%	%	%	%	%
Eosinophils #	EOS#	10 <sup>3</sup> /mm <sup>3</sup>	10 <sup>9</sup> /L	10 <sup>9</sup> /L	10 <sup>2</sup> /mm <sup>3</sup>
Eosinophils %	EOS%	%	%	%	%
Basophils #	BAS#	10 <sup>3</sup> /mm <sup>3</sup>	10 <sup>9</sup> /L	10 <sup>9</sup> /L	10 <sup>2</sup> /mm <sup>3</sup>

Table 18: DIR Data presentation

Parameter	English code	Standard Units	S.I. Units	mmol Units	Japanese Units
Basophils %	BAS%	%	%	%	%
Atypical Lymphocytes #	ALY#	10 <sup>3</sup> /mm <sup>3</sup>	10 <sup>9</sup> /L	10 <sup>9</sup> /L	10 <sup>2</sup> /mm <sup>3</sup>
Atypical Lymphocytes %	ALY%	%	%	%	%
Large Immature Cell #	LIC#	10 <sup>3</sup> /mm <sup>3</sup>	10 <sup>9</sup> /L	10 <sup>9</sup> /L	10 <sup>2</sup> /mm <sup>3</sup>
Large Immature Cell %	LIC%	%	%	%	%
Lymphocyte Immature cell %	IML%	%	%	%	%
Lymphocyte Immature cell #	IML#	10 <sup>3</sup> /mm <sup>3</sup>	10 <sup>9</sup> /L	10 <sup>9</sup> /L	10 <sup>2</sup> /mm <sup>3</sup>
Monocyte Immature cell %	IMM%	%	%	%	%
Monocyte Immature cell #	IMM#	10 <sup>3</sup> /mm <sup>3</sup>	10 <sup>9</sup> /L	10 <sup>9</sup> /L	10 <sup>2</sup> /mm <sup>3</sup>
Granulocyte Immature cell %	IMG%	%	%	%	%
Granulocyte Immature cell #	IMG#	10 <sup>3</sup> /mm <sup>3</sup>	10 <sup>9</sup> /L	10 <sup>9</sup> /L	10 <sup>2</sup> /mm <sup>3</sup>
Reticulocytes #	RET#	10 <sup>6</sup> /mm <sup>3</sup>	10 <sup>12</sup> /L	10 <sup>12</sup> /L	10 <sup>4</sup> /mm <sup>3</sup>
Reticulocytes %	RET%	%	%	%	%
Corrected Reticulocyte Concentration	CRC	%	%	%	%
Reticulocytes (Low)	RETL%	%	%	%	%
Reticulocytes (Medium)	RETM%	%	%	%	%
Reticulocytes (High)	RETH%	%	%	%	%
Immature Reticulocytes	RETIMM	%	%	%	%
Mean Reticulocyte Volume	MRV	μm <sup>3</sup>	fL	fL	μm <sup>3</sup>
Mean Fluorescence Index	MFI	%	%	%	%
Immature Reticulocyte Fraction	IRF				
PIC	PIC				



## 4.4. RET Data presentation

Table 19: RET Data presentation

Parameter	English code	Standard Units	S.I. Units	mmol Units	Japanese Units
Red Blood Cell	RBC	10 <sup>6</sup> /mm <sup>3</sup>	10 <sup>12</sup> /L	10 <sup>12</sup> /L	10 <sup>4</sup> /mm <sup>3</sup>
Reticulocytes #	RET#	10 <sup>6</sup> /mm <sup>3</sup>	10 <sup>12</sup> /L	10 <sup>12</sup> /L	10 <sup>4</sup> /mm <sup>3</sup>
Reticulocytes %	RET%	%	%	%	%
Reticulocytes (Low)	RETL%	%	%	%	%
Reticulocytes (Medium)	RETM%	%	%	%	%
Reticulocytes (High)	RETH%	%	%	%	%
Mean Reticulocyte Volume	MRV	μm <sup>3</sup>	fL	fL	μm <sup>3</sup>
Mean Fluorescence Index	MFI	%	%	%	%
Corrected Reticulocyte Concentration	CRC	%	%	%	%
Immature Reticulocytes	RETIMM	%	%	%	%
Immature Reticulocyte Fraction	IRF				
PIC	PIC				

## 4.5. CBR Data presentation

Table 20: CBR Data presentation

Parameter	English code	Standard Units	S.I. Units	mmol Units	Japanese Units
White Blood Cell	WBC	10 <sup>3</sup> /mm <sup>3</sup>	10 <sup>9</sup> /L	10 <sup>9</sup> /L	10 <sup>2</sup> /mm <sup>3</sup>
Red Blood Cell	RBC	10 <sup>6</sup> /mm <sup>3</sup>	10 <sup>12</sup> /L	10 <sup>12</sup> /L	10 <sup>4</sup> /mm <sup>3</sup>
Hemoglobin	HGB	g/dL	g/L	mmol/L	g/dL

Table 20: CBR Data presentation

Parameter	English code	Standard Units	S.I. Units	mmol Units	Japanese Units
Hematocrit	HCT	%	L/L	L/L	%
Mean Corpuscular Volume	MCV	μm <sup>3</sup>	fL	fL	μm <sup>3</sup>
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	%	%	%	%
Reticulocytes #	RET#	10 <sup>6</sup> /mm <sup>3</sup>	10 <sup>12</sup> /L	10 <sup>12</sup> /L	10 <sup>4</sup> /mm <sup>3</sup>
Reticulocytes %	RET%	%	%	%	%
Reticulocytes (Low)	RETL%	%	%	%	%
Reticulocytes (Medium)	RETM%	%	%	%	%
Reticulocytes (High)	RETH%	%	%	%	%
Mean Fluorescence Index	MFI	%	%	%	%
Mean Reticulocyte Volume	MRV	μm <sup>3</sup>	fL	fL	μm <sup>3</sup>
Corrected Reticulocyte Concentration	CRC	%	%	%	%
Immature Reticulocytes	RETIMM	%	%	%	%
Immature Reticulocyte Fraction	IRF				
Platelets	PLT	10 <sup>3</sup> /mm <sup>3</sup>	10 <sup>9</sup> /L	10 <sup>9</sup> /L	10 <sup>4</sup> /mm <sup>3</sup>
Mean Platelet Volume	MPV	μm <sup>3</sup>	fL	fL	μm <sup>3</sup>
Plateletcrit	PCT	%	10 <sup>-2</sup> /L	10 <sup>-2</sup> /L	%
Platelet Distribution Width	PDW	%	%	%	%
PIC	PIC				



## 4.6. ERB Data presentation

Table 21: ERB Data presentation

Parameter	English code	Standard Units	S.I. Units	mmol Units	Japanese Units
White Blood Cell	WBC	10 <sup>3</sup> /mm <sup>3</sup>	10 <sup>9</sup> /L	10 <sup>9</sup> /L	10 <sup>2</sup> /mm <sup>3</sup>
Erythroblast %	ERB%	%	%	%	%
Erythroblast #	ERB#	10 <sup>3</sup> /mm <sup>3</sup>	10 <sup>9</sup> /L	10 <sup>9</sup> /L	10 <sup>2</sup> /mm <sup>3</sup>
Corrected white blood cell	CWBC	10 <sup>3</sup> /mm <sup>3</sup>	10 <sup>9</sup> /L	10 <sup>9</sup> /L	10 <sup>2</sup> /mm <sup>3</sup>

## 4.7. CBE Data presentation

Table 22: CBE Data presentation

Parameter	English code	Standard Units	S.I. Units	mmol Units	Japanese Units
White Blood Cell	WBC	10 <sup>3</sup> /mm <sup>3</sup>	10 <sup>9</sup> /L	10 <sup>9</sup> /L	10 <sup>2</sup> /mm <sup>3</sup>
Red Blood Cell	RBC	10 <sup>6</sup> /mm <sup>3</sup>	10 <sup>12</sup> /L	10 <sup>12</sup> /L	10 <sup>4</sup> /mm <sup>3</sup>
Hemoglobin	HGB	g/dL	g/L	mmol/L	g/dL
Hematocrit	HCT	%	L/L	L/L	%
Mean Corpuscular Volume	MCV	μm <sup>3</sup>	fL	fL	μm <sup>3</sup>
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 <sup>3</sup> /mm <sup>3</sup>	10 <sup>9</sup> /L	10 <sup>9</sup> /L	10 <sup>4</sup> /mm <sup>3</sup>
Mean Platelet Volume	MPV	μm <sup>3</sup>	fL	fL	μm <sup>3</sup>

Table 22: CBE Data presentation

Parameter	English code	Standard Units	S.I. Units	mmol Units	Japanese Units
Plateletcrit	PCT	%	10 <sup>-2</sup> /L	10 <sup>-2</sup> /L	%
Platelet Distribution Width	PDW	%	%	%	%
Erythroblast %	ERB%	%	%	%	%
Erythroblast #	ERB#	10 <sup>3</sup> /mm <sup>3</sup>	10 <sup>9</sup> /L	10 <sup>9</sup> /L	10 <sup>2</sup> /mm <sup>3</sup>
Corrected white blood cell	CWBC	10 <sup>3</sup> /mm <sup>3</sup>	10 <sup>9</sup> /L	10 <sup>9</sup> /L	10 <sup>2</sup> /mm <sup>3</sup>

## 4.8. Manual Input of parameters

Table 23: Manual input of parameters Data presentation

Parameter	English code	Standard Units	S.I. Units	mmol Units	Japanese Units
Bands #	BND#	10 <sup>3</sup> /mm <sup>3</sup>	10 <sup>9</sup> /L	10 <sup>9</sup> /L	10 <sup>2</sup> /mm <sup>3</sup>
Bands %	BND%	%	%	%	%
Metamyelocytes #	MET#	10 <sup>3</sup> /mm <sup>3</sup>	10 <sup>9</sup> /L	10 <sup>9</sup> /L	10 <sup>2</sup> /mm <sup>3</sup>
Metamyelocytes %	MET%	%	%	%	%
Myelocytes #	MYE#	10 <sup>3</sup> /mm <sup>3</sup>	10 <sup>9</sup> /L	10 <sup>9</sup> /L	10 <sup>2</sup> /mm <sup>3</sup>
Myelocytes %	MYE%	%	%	%	%
Promyelocytes #	PRO#	10 <sup>3</sup> /mm <sup>3</sup>	10 <sup>9</sup> /L	10 <sup>9</sup> /L	10 <sup>2</sup> /mm <sup>3</sup>
Promyelocytes %	PRO%	%	%	%	%
Blasts #	BLA#	10 <sup>3</sup> /mm <sup>3</sup>	10 <sup>9</sup> /L	10 <sup>9</sup> /L	10 <sup>2</sup> /mm <sup>3</sup>



Table 23: Manual input of parameters Data presentation

Parameter	English code	Standard Units	S.I. Units	mmol Units	Japanese Units
Blasts %	BLA%	%	%	%	%
Others #	OTH#	10 <sup>3</sup> /mm <sup>3</sup>	10 <sup>9</sup> /L	10 <sup>9</sup> /L	10 <sup>2</sup> /mm <sup>3</sup>
Others %	OTH%	%	%	%	%

#### 4.9. Alarms and Pathologies

##### 4.9.1. Analyzer & Analytical alarms

Analyzer and analytical alarms are transmitted through the Comment record located after the Order record. If several alarms are detected they will be separate by the component delimiter.

##### 4.9.2. Suspected pathologies

Suspected pathologies are transmitted through one Comment record located after the corresponding Result record. If several pathologies are suspected they will be separate by the component delimiter.

##### 4.9.3. Suspicion and Reject

When one result is suspected abnormal or false, that means result is not reliable, the instrument returns a flag in field 10.1.9 (See Table 11, “Result record fields”, page 8).

##### 4.9.4. Normal and Panic ranges

Flags when result exceeds Normal or Panic ranges are transmitted through field 10.1.7 (See Table 11, “Result record fields”, page 8).

#### 5. Management of errors

##### 5.1. During Instrument transmission

During result transmission by the instrument, if the host lost the transmission (Time-Out or EOT) the full message will be transmitted again.

##### 5.2. During Host transmission

According to E-1381 protocol, error management of Time-out, Checksum and frame number, in case of none respect of these norms, will return NACK (or communication will be halted).

According to E-1394 protocol, all Orders without «Sample ID» will not be interpreted by the instrument.

All too long fields will be cut to fit to ASTM field specified length.

#### 6. Example of data frame

##### 6.1. Example of Order sent by Host

- Patient ID: PID12345
- Patient Name: LASTNAME, FIRSTNAME
- Birthdate: 23/12/1964
- Prescripator: Prescripator
- Department: Location
- Sample ID (mandatory field): SID007
- Test (mandatory field): CBC



Table 24: Example of Order sent by Host

Host
Instrument
<ENQ>
<ACK>
<STX>1H \^&   PDX     P 1394-97 20031202102713<CR><ETX>06<CR><LF>
<ACK>
<STX>2P 1  PID12345  LASTNAME^FIRSTNAME  19641223 M    Prescrip t   Loca- tion<CR><ETX>D6<CR><LF>
<ACK>
<STX>3C 1  Patient Comment<CR><ETX>3C<CR><LF>
<ACK>
<STX>4O 1 SID007  ^C B C R    A<CR><ETX>04<CR><LF>
<ACK>
<STX>5C 1  Order Comment<CR><ETX>65<CR><LF>
<ACK>
<STX>6L 1 N<CR><ETX>09<CR><LF>
<ACK>
<EOT>

## 6.2. Example of last anteriority result sent by host

Table 25: Example of last anteriority result sent by host

Host
Instrument
<ENQ>
<ACK>

Table 25: Example of last anteriority result sent by host

<STX>1H \^&   PDX     P 1394-97 20040322101102<CR><ETX>11<CR><LF>
<ACK>
<STX>2P 1  PID001  NAME^FIRSTNAME  19641223 M    PRESCRIPTOR     LOCATION<CR><E TX>14<CR><LF>
<ACK>
<STX>3C 1  PATIENT COMMENT G<CR><ETX>36<CR><LF>
<ACK>
<STX>4O 1 2312001  ^WBC^RBC^HGB^HCT^MCV^MCH^MCHC^R DW^PLT^MPV^PCT^PDW R     BLOOD     <CR><ETX>05<CR><LF>
<ACK>
<STX>5R 1 ^WBC 11.7 10^3/mm3  H    ABX  20040322100222 0<CR><ETX>06<CR><LF>
<ACK>
<STX>6R 2 ^RBC 4.59 10^6/mm3    PentraDX  20040322100222 0<CR><ETX>F2<CR><LF>
<ACK>
<STX>7R 3 ^HGB 13.8 g/dL    PentraDX  20040322100222 0<CR><ETX>FD<CR><LF>
<ACK>
<STX>0R 4 ^HCT 41.8 %    PentraDX  20040322100222 0<CR><ETX>E5<CR><LF>
<ACK>
<STX>1R 5 ^MCV 91 æm3    PentraDX  20040322100222 0<CR><ETX>EE<CR><LF>
<ACK>
<STX>2R 6 ^MCH 30.0 pg    PentraDX  20040322100222 0<CR><ETX>8A<CR><LF>
<ACK>
<STX>3R 7 ^MCHC 33.0 g/dL    PentraDX  20040322100222 0<CR><ETX>41<CR><LF>
<ACK>
<STX>4R 8 ^RDW 12.1 %    PentraDX  20040322100222 0<CR><ETX>F2<CR><LF>
<ACK>
<STX>5R 9 ^PLT 187 10^3/mm3    PentraDX  20040322100222 0<CR><ETX>DE<CR><LF>
<ACK>



Table 25: Example of last anteriority result sent by host

```

<STX>6R|10|^^^MPV|10.4|æm3|||||PentraDX||20040322100222|0<CR><ETX>85<CR><LF>
<ACK>
<STX>7R|11|^^^PCT|0.194|%|||||PentraDX||20040322100222|0<CR><ETX>53<CR><LF>
<ACK>
<STX>0R|12|^^^PDW|18.8|%||H||||ABX||20040322100222|0<CR><ETX>41<CR><LF>
<ACK>
<STX>1L|1<CR><ETX>3A<CR><LF>
<ACK>
<EOT>
  
```

### 6.3. Example of Result sent by instrument

Table 26: Example of Result sent by instrument

```

Instrument
Host
<ENQ>
<ACK>
<STX>1H|^&||||PDX|||||P|1394-97|20031202123751<CR><ETX>1C<CR><LF>
<ACK>
<STX>2P|1||PID12345||LASTNAME^FIRSTNAME||19641223|M||||Prescriptor|||||||Location<CR><ETX>D6<CR><LF>
<ACK>
<STX>3O|1|SID007^11^3||R|||||||<CR><ETX>42<CR><LF>
<ACK>
<STX>4C|1|P|Order Comment|G<CR><ETX>2E<CR><LF>
<ACK>
  
```

Table 26: Example of Result sent by instrument

```

<STX>5C|2|P|Slide PLT abnormal morphology|G<CR><ETX>1E<CR><LF>
<ACK>
<STX>6R|11|^^^WBC|5.5|10^3/mm3|||||20031204124839|ABX|||0<CR><ETX>A3<CR><LF>
<ACK>
<STX>7R|2|^^^RBC|4.53|10^6/mm3|||||20031204124839|ABX|||0<CR><ETX>D5<CR><LF>
<ACK>
<STX>0R|3|^^^HGB|13.0|g/dL|||||20031204124839|ABX|||0<CR><ETX>D6<CR><LF>
<ACK>
<STX>1R|4|^^^HCT|38.9|%||L|||||20031204124839|ABX|||0<CR><ETX>21<CR><LF>
<ACK>
<STX>2R|5|^^^MCV|86|æm3|||||20031204124839|ABX|||0<CR><ETX>DB<CR><LF>
<ACK>
<STX>3R|6|^^^MCH|28.8|pg|||||20031204124839|ABX|||0<CR><ETX>82<CR><LF>
<ACK>
<STX>4R|7|^^^MCHC|33.5|g/dL|||||20031204124839|ABX|||0<CR><ETX>2F<CR><LF>
<ACK>
<STX>5R|8|^^^RDW|13.9|%|||||20031204124839|ABX|||0<CR><ETX>E4<CR><LF>
<ACK>
<STX>6R|9|^^^PLT|150|10^3/mm3|||||20031204124839|ABX|||0<CR><ETX>BD<CR><LF>
<ACK>
<STX>7C|1||Macro Platelets|<CR><ETX>FD<CR><LF>
<ACK>
<STX>0R|10|^^^MPV|11.5|æm3||H|||||20031204124839|ABX|||0<CR><ETX>B1<CR><LF>
<ACK>
<STX>1R|11|^^^PCT|0.173|%|||||20031204124839|ABX|||0<CR><ETX>32<CR><LF>
<ACK>
<STX>2R|12|^^^PDW|22.0|%||H|||||20031204124839|ABX|||0<CR><ETX>91<CR><LF>
<ACK>
  
```



Table 26: Example of Result sent by instrument

```
<STX>3L|1<CR><ETX>3C<CR><LF>  
<ACK>  
<EOT>
```