



XS Series ASTM Communication Specifications

Revision 2.5

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Sysmex Corporation

Revision History

Revision	Date	Major Contents of Changes
2.2	January 18, 2006	Initial Release Version
2.4	March 22, 2007	<ul style="list-style-type: none">• Correction of mistake in statement of settable baud rate types• Correction of mistake in communication example• Correction of range of QC file number set for requested record from the mistaken "1 - 40" to the correct "1 - 20"• Correction of mistake in description of QC test body number for requested record• Compatibility with ASTM E1381-02• IP message reverted from "Abn_Lympho?" to "Abn_Lympho/Blasts?" only for North American specification products• Correction of mistake in comment record send/receive example
2.5	April 25, 2012	<ul style="list-style-type: none">• Output of "PRBC?" added to IP messages (Suspect)

Table of Contents

1.	Scope	4
2.	Terminology	4
3.	Communication Specifications	5
3.1	Physical Layer (Hardware)	6
3.1.1	Connectors	6
3.1.2	Signal identification level	6
3.1.3	Connection cable	6
3.1.4	Interface parameters	7
3.1.5	Standard specifications (ASTM E1381-02)	7
3.2	Data Link Layer (Transmission Protocol)	7
3.2.1.	Communication Status	7
3.2.2.	Establishment Phase	8
3.2.3.	Transfer Phase	8
3.2.4.	Termination Phase	10
3.2.5.	Timeout	10
3.3	Presentation Layer	11
3.3.1	Messages, Records and Fields	11
3.3.2	Communication Protocol	13
3.3.3	Details of Record	15
4.	Examples of Communication	34
4.1.	Inquiry of Analysis Order (IPU → Host Computer)	34
4.1.1.	When making a Batch Inquiry from the work list:	34
4.1.2.	When making a Real-Time Inquiry in the manual mode analysis:	34
4.1.3.	When making a Real-Time Inquiry in the sampler mode analysis:	34
4.2.	Analysis Information (Host Computer → IPU)	35
4.2.1.	When an Analysis Order exists:	35
4.2.2.	When no Analysis Order exists:	35
4.3.	Analysis Results and QC Results (IPU → Host Computer)	36
4.3.1.	Transmitting Analysis Results:	36
4.3.2.	Transmitting QC Result in real-time mode:	37
4.3.3.	Transmitting QC Result in a manual batch mode:	38
Appendix A.	TCP/IP Communication	39
A.1	Network Interface Layer	39
A.2	TCP/IP	39
A.3	Transmission Timing	39
A.4	Transmission Messages	39
	(Example) Real-Time Inquiry:	39

1. Scope

This document describes the Data Communication Specifications for XS-1000i and XS-800i (hereinafter, describes XS-Series) using ASTM E1394-97, E1381-02.

[Note]

ASTM (America Society for Testing and Materials), one of the world largest volunteer non-profit organizations, founded in 1898 for the purpose of creating standard regulations for materials, products and system services. This specification conforms to the following two standards:

ASTM E1381-02:

Specifications for low-level protocols to transfer data between clinical laboratory instruments and computer systems.

ASTM E1394-97:

Standard specifications for transferring data between clinical instruments and computer systems.

2. Terminology

The definition of the terminology used in this document is described in the following.

1) Numerics:

Indicates ASCII codes “0” (30H) through “9” (39H).

2) Alphabet:

Indicates ASCII codes “A” (41H) through “Z” (5AH) and “a” (61H) through “z” (7AH).

3) Alpha-numeric:

Indicates numerical or alphabetical character.

3. Communication Specifications

Communication specifications are based on a layer protocol.

1. Physical layer
Specifies the sending and receiving of signals between the IPU and the host computer through physical and electrical connections. See the subsequent section, “3.1 Physical Layer (Hardware)”.
2. Data link layer
Specifies the sending and receiving of data by link connections and for each frame between the IPU and the host computer. See the subsequent section, “3.2 Data Link Layer (Transmission Protocol)”.
3. Presentation layer
Specifies the messages that are sent and received by the IPU and the host computer. See the subsequent section, “3.3 Presentation Layer”.

Presentation layer	← Specifies message specifications.
Data link layer	← Specifies link connection and frame specifications.
Physical layer	← Specifies mechanical and electrical specifications.

Caution:

The IPU of the XS series supports serial connection and TCP/IP.

For serial connection, it conforms to ASTM E1381-02/ASTM E1394-97.

For TCP/IP connection, the following two modes are supported as output modes for data formatted according to ASTM 1394-97.

1. ASTM E1381-02 mode

Presentation layer conforms to ASTM E1394-97.

Data link layer conforms to ASTM E1381-02.

Physical layer conforms to IEEE802.3.

2. ASTM E1381-95 mode

Presentation layer conforms to ASTM E1394-97.

Data link layer conforms to IEEE802.3.

	Serial connection	TCP/IP connection	
		ASTM E1381-95 mode *1	ASTM E1381-02 mode *1
Presentation layer	ASTM E1394-97	ASTM E1394-97	ASTM E1394-97
Data link layer *2	ASTM E1381-02	IEEE802.3	ASTM E1381-02
Physical layer *2	ASTM E1381-02	IEEE802.3	IEEE802.3

*1: For TCP/IP connections, if the “Format” setting parameter on the IPU host computer is set to

“ASTM 1381-02/1394-97”, operation should be performed in ASTM E1381-02 mode. ; if the parameter is set to “ASTM 1381-95/1394-97”, operation should be performed in ASTM E1381-95 mode.

*2: IEEE802.3 specifications for the data link layer and physical layer are not stated in this document.

3.1 Physical Layer (Hardware)

3.1.1 Connectors

Although the ASTM standard specifies a DB-25-pin connector for the computer as standard, a DB-9-pin male connector, which is located on the rear of the instrument, is used to communicate.

Table 1: Connector pin assignment

Pin No.	Signal name	Signal direction	Remarks
1	NC		Not used
2	Receive data	RxD	To XS from host
3	Transmit data	TxD	From XS to host
4	Data terminal ready	DTR	From XS to host
5	Signal ground	SG	-
6	Data set ready	DSR	To XS from host
7	Request to send	RTS	From XS to host
8	Clear to send	CTS	To XS from host
9	NC		Not Used

[Note] The control signals are not used with ASTM specifications.
Do not connect unused pins since a permanent damage to the hardware will result.

3.1.2 Signal identification level

Table 2: Signal identification level

Level	Data signal	Control signal
+3V or more	Logic "0", start bit	ON
-3V or less	Logic "1", stop bit	OFF

[Note 1] The ASTM communication will not use these control signals.

3.1.3 Connection cable

The IPU uses a cable with a DB-9-pin female connector, in accordance with the following connection chart.

IPU DB-9		Host computer DB-9 DB-25		
TxD	3	3	2	TxD
RxD	2	2	3	RxD
SG	5	5	7	SG
RTS	7	7	4	RTS
CTS	8	8	5	CTS
DTR	4	4	20	DTR
DSR	6	6	6	DSR
NC	1			
NC	9			

3.1.4 Interface parameters

Table 3: Interface Parameters

Parameter	Selection of Settings
Baud rate	600, 1200, 2400, 4800, <u>9600</u> , 14400, 19200, 38400 bps
Data length	7 bits, <u>8 bits</u>
Stop bit	<u>1 bit</u> , 2 bits
Parity	<u>None</u> , Even, Odd

Establishing the settings underlined allows conformance with the ASTM standard.

[Note] However, 7-bit data lengths, even or odd parity, and two stop bits are recognized by the ASTM standard for use with special applications.

The ASTM standard does not specify connection with the baud rate of 600 or 14400 bps.

3.1.5 Standard specifications (ASTM E1381-02)

The physical layer of the IPU conforms to ASTM E1381-02 “5. Physical Layers,” except for the connector type. The IPU uses a D-SUB-9-pin male connector. (Although the ASTM standard specifies a 25-pin connector.)

3.2 Data Link Layer (Transmission Protocol)

The data link layer transfers data between systems using a character-based protocol in accordance with ASTM E1381-02 “6. Data Link Layers”. This section describes communications control procedures. For details, refer to ASTM E1381-02.

In addition, when using ASTM E1381-02 mode, it establishes the TCP connection prior to communication. For establishing connection, the host computer operates as a server and the IPU operates as a client. The IPU establishes a connection by requesting the connection using the IP address and port provided by the host computer.

3.2.1. Communication Status

The data link layer is consisted of the following two state:

- (1) Neutral Status
- (2) Linked Status

There are three distinct phases in transferring information between IPU and computer system. In each phase, one system directs the operation and is responsible for continuity of the communication. Three phases assure actions of sender and receiver are coordinated.

Transition to each of three phases is accomplished through the following three phases.

1) Establishment Phase

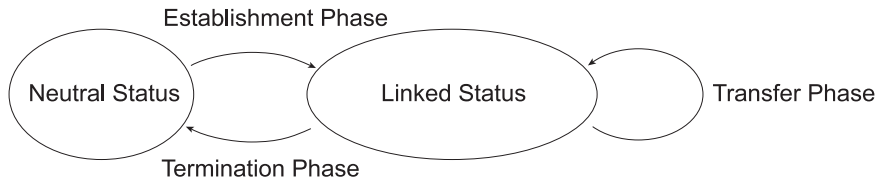
Establishes a communication line, and determines the direction of data transfer. In this way, the sender and receiver are identified, and the change is made from neutral status to linked status.

2) Transfer Phase

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

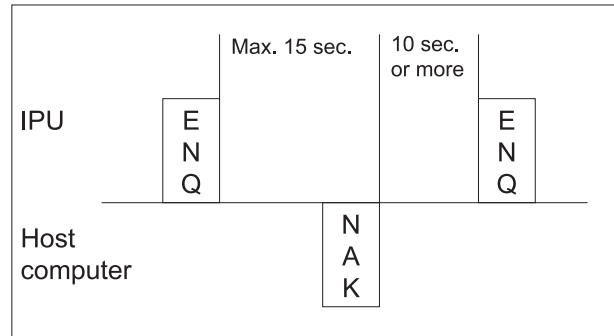
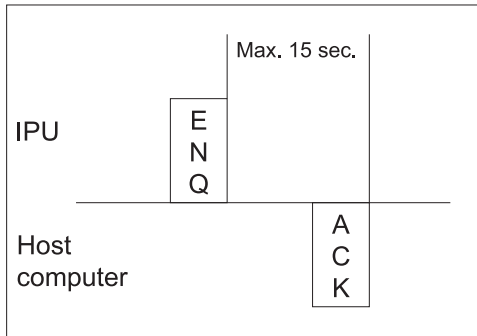
3) Termination Phase

Releases the communication line. Changes both the sender and receiver from linked status to neutral status. The sender notifies the receiver that all messages have been transferred.

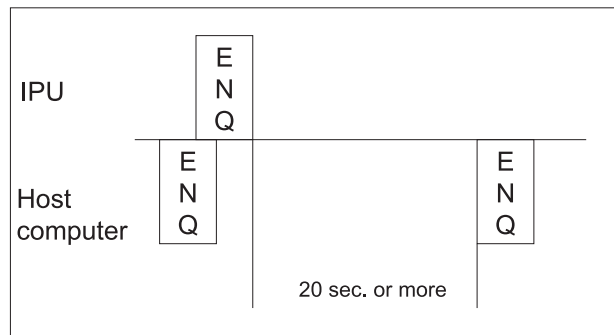
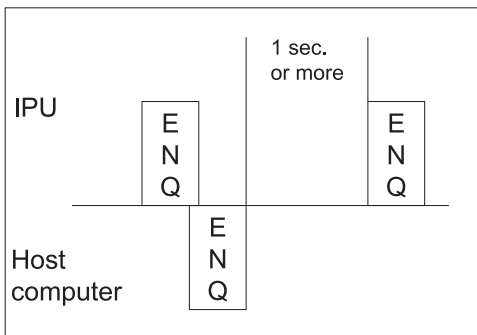


3.2.2. Establishment Phase

- 1) The sender (IPU) sends an [ENQ] signal to the receiver (host computer). To respond to the sender, the receiver performs the following action:
 - Returns an [ACK] signal when communications are enabled.
 - Returns a [NAK] when communications are disabled.
 The sender waits for at least 10 seconds before attempting to send an [ENQ] signal again.



- 2) When both sender and receiver send [ENQ] signals, the host computer must yield control authority to the IPU.
 - The IPU sends [ENQ] again after 1 second.
 - The host computer must wait for 20 seconds before sending [ENQ] again.



3.2.3. Transfer Phase

During the transfer phase, the sender sends messages to the receiver. The transfer phase continues until all messages have been sent.

- 1) Messages are sent in multiple frames. Each frame contains a maximum of 64,000 characters* (including frame overhead). If the message is longer than 63,993 characters, it is divided into two or more frames.
 - * When using a serial connection, in order to maintain compatibility with E1381-95, the maximum number of characters in a record is set to 240 characters. For complete compatibility with E1381-02, it is necessary to set the maximum number of characters in a record to 63,993 characters. For information on the setting method, contact your nearest branch office, sales office, or representative. When using TCP/IP connection, the maximum number of characters is set to 63,993 characters.

- 2) Multiple messages cannot be included in a single frame.
- 3) When the record is within the maximum number of characters, a text frame with the following format is sent.
[STX] [F#] [Text] [ETX] [CHK1] [CHK2] [CR] [LF]

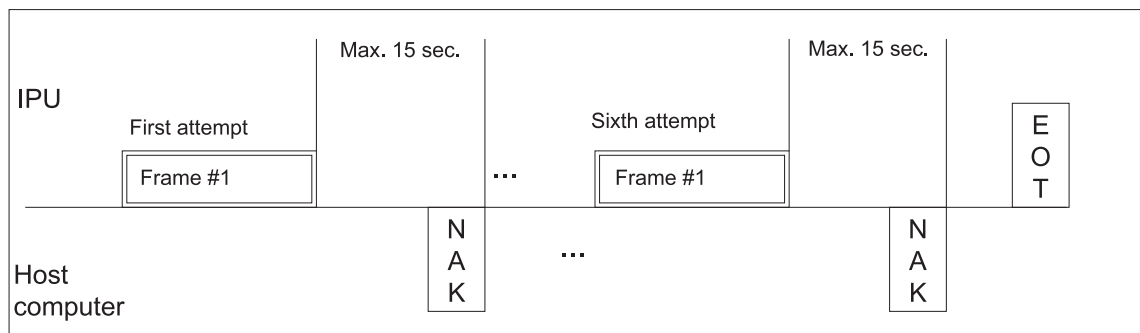
If the text is longer than the maximum number of characters, it is divided into 2 or more frames. The intermediate frame text termination code is [ETB], and the final frame text termination code is [ETX], as shown below.

```
[STX] [F#] [Text] [ETB] [CHK1] [CHK2] [CR] [LF]
[STX] [F#] [Text] [ETB] [CHK1] [CHK2] [CR] [LF]
...
[STX] [F#] [Text] [ETX] [CHK1] [CHK2] [CR] [LF]
```

where:

Code	Explanation
[STX]	Start of a frame
[F#]	Frame number. One of the numbers 0 to 7 is used, starting with 1 and repeating 2, 3, 4, 5, 6, 7, 0. In case of retransmission, the same frame number is sent.
[Text]	ASTM E1394-97 records are used. (See the subsequent section, Presentation layer.) For this reason the codes below will not be used. 0x00 - 0x06, 0x08, 0x0A, 0x0E - 0x1F, 0x7F, 0xFF
[ETB]	Control code indicating end of text (for intermediate frame)
[ETX]	Control code indicating end of text (for final frame)
[CHK1], [CHK2]	Expressed by characters "0" - "9" and "A" - "F". Characters beginning from the character after [STX] and until [ETB] or [ETX] (including [ETB] or [ETX]) are added in binary. The 2-digit numbers, which represent the least significant 8 bits in hexadecimal code, are converted to ASCII characters "0" - "9" and "A" - "F". The most significant digit is stored in CHK1 and the least significant digit in CHK2.
[CR] [LF]	Control codes indicating end of frame

- 4) If the receiver has successfully received the frame, and is prepared to receive the next frame, receiver responds with [ACK]. After the sender receives [ACK], sender advances the frame number and sends either a new frame or transitions to the termination phase.
- 5) If the receiver fails to receive the frame and is prepared to receive the same frame again, receiver responds with [NAK]. After sender receives [NAK], sender sends the most recent frame again, using the same frame number. If a total of 6 attempts to send the frame failed, sender transitions to the termination phase and must end sending of the message.



- 6) The IPU processes the response of [EOT] from the host computer as [ACK]. (Response of [EOT] from the receiver is usually a request of transmission to the sender. However, IPU does not support this.)

3.2.4. Termination Phase

During the termination phase, the status returns to neutral.

The sender sends the [EOT] to inform the receiver that the message transmission has been completed. When the sender sends [EOT], sender transitions to neutral status. When the receiver receives [EOT], receiver transitions to neutral status.

3.2.5. Timeout

The timer is used to detect a failure to coordinate between the sender and receiver. The timer is used as a mean of recovery for communication line and communication destination device failures.

- 1) During the establishment phase, the timer is set when the sender sends [ENQ]. Time out results if a response of [ACK], [NAK], or [ENQ] is not received within 15seconds. After time out, the sender transitions to the termination phase.
- 2) During the transfer phase, the timer is sets when the sender sends the final character of a frame. Time out results if no response is received within 15 seconds. After time out, the sender transitions to the termination phase.
The receiver sets a 30-second timer when first entering the transfer phase or when responding (either [ACK] or [NAK]) to a frame. Time out results if the receiver does not receive a frame or [EOT] from the sender within 30 seconds. After time out, the receiver discards the latest incomplete message and transitions to the termination phase.

3.3 Presentation Layer

3.3.1 Messages, Records and Fields

3.3.1.1. Messages

In the presentation layer, all data is transmitted using messages. Messages are composed of record arrays that start with the message header record (H) and end with message termination record (L).

3.3.1.2. Records

A record is a series of text, beginning with an ASCII alphabet character referred to as the identifier, and ending with [CR] complete message. Records are end by record delimiter.

Table 4: Records

Record Type	Record Identifier	Level	Contents
Header Record	H	0	Contains the sender and receiver information
Patient Information Record	P	1	Contains the patient information
Inquiry Record	Q	1	Contains test order inquiry information requesting to the host computer
Test Order Record	O	2	Contains the test order information
Test Result Record	R	3	Contains analysis result information
Comment Record	C	1-4	Contains the specimen comment and patient comment information
Manufacturer Information Record	M	1-4	Not used
Scientific Information Record	S	N/A	Not used
Message Terminator Record	L	0	Indicates the end of the message

- A smaller level number indicates a higher level.
- A higher-level record contains information that is common to all lower-level records.
- All levels other than 0 must be located after higher levels. However, the manufacturer information record (not used) and the comment record can be inserted at any level. They are considered to be one level lower than the preceding record.

Example of transmission

H->P->O->R->L Correct

H->R->L Incorrect, because P and O must be transmitted in prior to R.

3.3.1.3. Fields

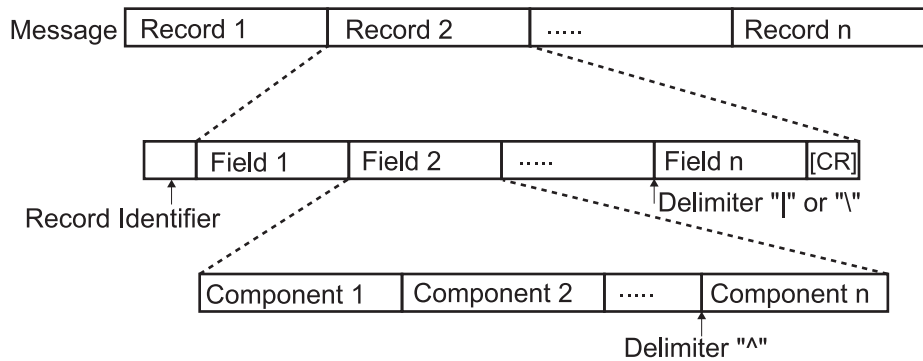
A record is further divided into multiple fields by field delimiters.

A field is identified by its position within a record, and has a variable length.

The followings are used as delimiters.

Table 5: Field Delimiters

Type	Code	Description
Field Delimiter	Vertical bar () [7CH]	Separates adjacent fields in a record.
Repeat Delimiter	Backslash (\) [5CH]	Separates multiple number of descriptors in a field.
Component delimiter	Caret (^) [5EH]	Separates data elements within a field that has a hierarchical or qualifier nature.
Escape Delimiter	Ampersand (&) [26H]	Is used within a text field to identify special case operations.



3.3.2 Communication Protocol

3.3.2.1 Analysis Order Inquiry (IPU → Host computer)

This protocol is used for XS-Series to inquire to the host computer an analysis order information to obtain the sample information. Inquiry can be made with keyword of either the sample ID No. or the combination of Rack No. and Tube Position No.

Table 6: Analysis Order Inquiry

IPU	Direction	Host Computer
ENQ	→	
	←	ACK
H (Header Record)	→	
	←	ACK
Q (Request Record)	→	
	←	ACK
L (Message Terminator Record)	→	
	←	ACK
EOT	→	

Note: When using the ASTM E1381-95 mode of TCP/IP, handling of ENQ, ACK, and EOT is not performed. See Appendix A.

3.3.2.2 Analysis Information (Host computer → IPU)

This protocol is used for the host computer to respond an analysis information against the inquiry made by the IPU. Comment record may be omitted.

Table 7: Analysis Information

IPU	Direction	Host Computer
	←	ENQ
ACK	→	
	←	H (Header Record)
ACK	→	
	←	P (Patient Record)
ACK	→	
	←	C (Patient Comment Record)
ACK	→	
	←	O (Test Order Record)
ACK	→	
	←	C (Specimen Comment Record)
ACK	→	
	←	L (Message Terminator Record)
ACK	→	
	←	EOT

Note: When using the ASTM E1381-95 mode of TCP/IP, handling of ENQ, ACK, and EOT is not performed. See Appendix A.


3.3.2.3. Analysis Results & QC Data (IPU → Host computer)

This protocol is used for the IPU to transmit the analysis results, the QC data in a real-time mode (QC sample No. is QC-xxxxxx and transmitted as similar to the regular sample data), and the QC data in a manual batch mode (selected QC data is output in the QC Chart screen). When the QC data is to be output, the patient record contains nothing, thus an empty patient record is transmitted. Comment record may be omitted.

Table 8: Analysis Results and QC Data

IPU	Direction	Host Computer
ENQ	→	
	←	ACK
H (Header Record)	→	
	←	ACK
P (Patient Record)	→	
	←	ACK
C (Patient Comment Record)	→	
	←	ACK
O (Test Order Record)	→	
	←	ACK
C (Specimen Comment Record)	→	
	←	ACK
R (Result Record)	→	
	←	ACK
L (Message Terminator Record)	→	
	←	ACK
EOT	→	

Repeating the No. of parameters



Note: When using the ASTM E1381-95 mode of TCP/IP, handling of ENQ, ACK, and EOT is not performed. See Appendix A.

3.3.3 Details of Record

3.3.3.1. Header Record

[Example of transmission]

■ IPU → Host computer

H|\^&||XS^00-05^11001^^^^12345678||||||E1394-97[CR]

■ Host computer → IPU

H|\^&|||||||E1394-97[CR]

Table 9: Details of Header Record

ASTM Field	Field Name	IPU → Host	Host → IPU	Max. Size (Bytes)	Remarks
7.1.1	Record type	H	H	1	Fixed
7.1.2	Delimiter definition	\^&	\^&	4	Fixed
7.1.3	Message control ID	Not used	Not used	-	
7.1.4	Access password	Not used	Not used	-	
7.1.5	Sender name or ID	Analyzer name^ Software version^ Analyzer serial No.^^^^ PS code	Not used	8^ 13^ 5^^^^ 8	
7.1.6	Sender street address	Not used	Not used	-	
7.1.7	Reserved field	Not used	Not used	-	
7.1.8	Sender Telephone No.	Not used	Not used	-	
7.1.9	Sender characteristics	Not used	Not used	-	
7.1.10	Receiver ID	Not used	Not used	-	
7.1.11	Comment	Not used	Not used	-	
7.1.12	Processing ID	Not used	Not used	-	
7.1.13	ASTM Version No.	E1394-97	E1394-97	8	Fixed
7.1.14	Date and Time of message	Not used	Not used	-	

Detailed Explanation of the fields:

1) 7.1.2 Delimiter definition

“|\^&” is used as a fixed character string. No field delimiter is required between 7.1.1 and 7.1.2.

2) 7.1.5 Sender name or ID

Analyzer name is fixed as “XS”, and software version is referred to the software version the XS-Series is working with.

3.3.3.2. Patient Information Record

[Example of transmission]

- IPU → Host computer

P|1||123456|^Johnson^Thomas||20010820|M|||||^Dr. M|||||^West[CR]

- Host computer → IPU

P|1||100|^Carol^Thomas||20010820|F|||||^Dr. N|||||^East[CR]

Table 10: Details of Patient Information Record

ASTM Field	Field Name	IPU→Host	Host→IPU	Max. size (Bytes)	Remarks
8.1.1	Record type	P	P	1	Fixed
8.1.2	Sequence No.	Sequence No.	Sequence No.	4	Sequence No. of records
8.1.3	Practice assigned patient ID	Not used	Not used	-	
8.1.4	Laboratory assigned patient ID	Not used	Not used	-	
8.1.5	Patient ID No.	Patient ID	Patient ID	16	
8.1.6	Patient name	^First name ^Last name	^First name ^Last name	^20 ^20	
8.1.7	Mother's maiden name	Not used	Not used	-	
8.1.8	Birth date	YYYYMMDD	YYYYMMDD	8	Ex) 20010802 for 2 nd of August 2001
8.1.9	Patient sex	M, F or U	M, F or U	1	Male, Female, or Unknown
8.1.10	Patient race	Not used	Not used	-	
8.1.11	Patient address	Not used	Not used	-	
8.1.12	Reserved	Not used	Not used	-	
8.1.13	Patient telephone No.	Not used	Not used	-	
8.1.14	Attending physician ID	^Physician name	^Physician name	^20	
8.1.15	Special field 1	Not used	Not used	-	
8.1.16	Special field 2	Not used	Not used	-	
8.1.17	Patient height	Not used	Not used	-	
8.1.18	Patient weight	Not used	Not used	-	
8.1.19	Patient's known or suspected diagnosis	Not used	Not used	-	
8.1.20	Patient active medications	Not used	Not used	-	
8.1.21	Patient diet	Not used	Not used	-	
8.1.22	Practice field 1	Not used	Not used	-	
8.1.23	Practice field 2	Not used	Not used	-	
8.1.24	Admission and discharge dates	Not used	Not used	-	
8.1.25	Admission status	Not used	Not used	-	
8.1.26	Location	^^^Ward	^^^Ward	^^^20	
8.1.27	DRG or AVG	Not used	Not used	-	
8.1.28	DRG or AVG 2	Not used	Not used	-	
8.1.29	Patient religion	Not used	Not used	-	
8.1.30	Marital status	Not used	Not used	-	
8.1.31	Isolation status	Not used	Not used	-	
8.1.32	Language	Not used	Not used	-	
8.1.33	Hospital service	Not used	Not used	-	
8.1.34	Hospital institution	Not used	Not used	-	
8.1.35	Dosage category	Not used	Not used	-	

Detailed Explanation of the fields:

- 1) 8.1.2 Sequence No.
The sequence number starts with 1 and indicates the sequence position in which the record appeared in the message. This number is reset to 1 when a higher-level record appears in the message.
- 2) 8.1.5 Patient ID No.
The patient ID is a unique patient identification and may contain a maximum of 16 digits of alpha-numeric and a hyphen "-" (2D h).
- 3) 8.1.6 Patient Name
The first name and the last name may be 20 characters each with consisting of alpha-numeric.
- 4) 8.1.8 Birth date
The birthdate is the date of birth of the patient, and the date format is fixed with "YYYYMMDD". Here, YYYY indicates the year, MM the month, and DD the day.
- 5) 8.1.9 Patient Sex
The patient sex is indicated with M, F or U. Here, M indicates male, F female, and U unknown.
- 6) 8.1.14 Attending Physician ID
The attending physician ID may be entered with a maximum of 20 characters of alpha-numeric.
- 7) 8.1.26 Location
The patient ward name may be entered a maximum of 20 characters of alpha-numeric.

3.3.3.3. Request Information Record

[Example of transmission]

■ IPU → Host computer

Q|1| 1^1^^M|||20010905150959[CR]

■ Host computer → IPU

Not used

Table 11: Details of Request Information Record

ASTM Field	Field Name	IPU→Host	Host→IPU	Max. Size (Bytes)	Remarks
12.1.1	Record Type	Q	Not used	1	Fixed
12.1.2	Sequence No.	Sequence No.	Not used	4	Sequence No. of records
12.1.3	Starting Range ID No.	Rack No.^ Tube position^ Sample No.^ Sample No. attribute	Not used	6^ 2^ 15^ 1	Sample No. attribute is one of followings: M: Manual entry A: Automatic assignment by analyzer B: Barcode reader input
12.1.4	Ending Range ID No.	Not used	Not used	-	
12.1.5	Universal test ID	Not used	Not used	-	
12.1.6	Nature of request time limit	Not used	Not used	-	
12.1.7	Beginning request results date and time	YYYYMMDD HHMMSS	Not used	14	
12.1.8	Ending request results date and time	Not used	Not used	-	
12.1.9	Requesting physician name	Not used	Not used	-	
12.1.10	Requesting physician telephone No.	Not used	Not used	-	
12.1.11	User field No. 1	Not used	Not used	-	
12.1.12	User field No. 2	Not used	Not used	-	
12.1.13	Requested information status code	Not used	Not used	-	

Detailed Explanation of the fields:

1) 12.1.2 Sequence No.

The sequence number starts with 1 and indicates the sequence position in which the record appeared in the message. This number is reset to 1 when a higher-level record appears in the message.

2) 12.1.3 Starting Range ID No.

Rack No. Up to 6-digit number assigned to the rack.

Tube Position No. The sample position number within a rack, and is one of the numbers 01 through 10.

Sample ID number Consisted of 15-digit of alpha-numeric and hyphen "-" (2D h). When the sample ID number is less than 15 digits, spaces are padded to the most significant digits.

Note 1: In the manual mode analysis and in the real-time inquiry, sample ID number is the keyword to inquire, and both the rack number and the tube position number will not be sent.

Note 2: In the batch inquiry using the work list, both the rack number and the tube position number is the keyword to inquire, and the sample ID number will not be sent.

Sample No. attribute M Sample ID No. is manually entered.
A Analyzer automatically assigned number and is started with "ERR".
This is used when the ID Read Error occurred.
B Barcode reader read number

3) 12.1.7 Beginning request result date and time

The date format is fixed with "YYYYMMDDHHMMSS".

Here, YYYY indicates the year, MM the month, DD the day, HH the hour in the 24-hour system (00-23), MM the minute (00-59), and SS the second (00-59).

3.3.3.4. Test Order Record

[Example of transmission]

■ IPU → Host computer

O|1|^123-4567-890123^B|^|^WBC|^|^RBC\.... ^|^NEUT#|||||N|||||F[CR]

■ Host computer → IPU

O|1|^123-4567-890123^C|^|^WBC|^|^RBC\.... ^|^NEUT#||20010807101000||||
N|||||Q[CR]

Table 12: Details of Test Order Record

ASTM Field	Field Name	IPU→Host	Host→IPU	Max. Size (Bytes)	Remarks
9.4.1	Record type	O	O	1	Fixed
9.4.2	Sequence No.	Sequence No.	Sequence No.	4	Sequence No. of records
9.4.3	Specimen ID	Not used	Rack No.^ Tube Position^ Sample No.^ Sample No. attribute	6^ 2^ 15^ 1	Sample No. attribute is one of the followings: M: Manual entry A: Automatic assignment by the analyzer B: Barcode reader C: Set by the host computer
9.4.4	Instrument specimen ID	Rack No.^ Tube Position^ Sample No.^ Sample No. attribute	Not used	6^ 2^ 15^ 1	
9.4.5	Universal Test ID	^^^Parameter	^^^Parameter	^^^6	Test Order of each analysis parameter
9.4.6	Priority	Not used	Not used	-	
9.4.7	Requested/order date and time	Not used	YYYYMMDD HHMMSS	14	
9.4.8	Specimen collection date and time	Not used	Not used	-	
9.4.9	Collection end time	Not used	Not used	-	
9.4.10	Collection volume	Not used	Not used	-	
9.4.11	Collector ID	Not used	Not used	-	
9.4.12	Action code	N, Q	N, Q	1	N: Normal sample Q: QC material
9.4.13	Danger code	Not used	Not used	-	
9.4.14	Relevant clinical information	Not used	Not used	-	
9.4.15	Date/time specimen received	Not used	Not used	-	
9.4.16	Specimen descriptor	Not used	Not used	-	
9.4.17	Ordering physician	Not used	Not used	-	
9.4.18	Physician's telephone No.	Not used	Not used	-	
9.4.19	User field No. 1	Not used	Not used	-	
9.4.20	User field No. 2	Not used	Not used	-	
9.4.21	Laboratory field No. 1	Not used	Not used	-	
9.4.22	Laboratory field No. 2	Not used	Not used	-	
9.4.23	Date/time results reported or last modified	Not used	Not used	-	
9.4.24	Instrument charge to computer system	Not used	Not used	-	

ASTM Field	Field Name	IPU→Host	Host→IPU	Max. Size (Bytes)	Remarks
9.4.25	Instrument section ID	Not used	Not used	-	
9.4.26	Report type	F	Y, Q	1	F: Final results (Fixed) Y: No test order Q: Response to inquiry
9.4.27	Reserved field	Not used	Not used	-	
9.4.28	Location or ward of specimen collected	Not used	Not used	-	
9.4.29	Nosocomial infection flag	Not used	Not used	-	
9.4.30	Material service	Not used	Not used	-	
9.4.31	Material institution	Not used	Not used	-	

Detailed Explanation of the fields:

1) 9.4.2 Sequence No.

The sequence number starts with 1 and indicates the sequence position in which the record appeared in the message. This number is reset to 1 when a higher-level record appears in the message.

2) 9.4.3 Specimen ID

- | | |
|----------------------|--|
| Rack No. | Up to 6-digit number assigned to the rack. Return the same number that was inquired. |
| Tube Position No. | The sample position number within a rack, and is one of the numbers 01 through 10. Return the same number that was inquired. |
| Sample ID number | Consisted of 15-digit of alpha-numeric and hyphen “-” (2D h). The sample ID number starting with “QC” is reserved for the quality control samples. When the sample ID number is less than 15 digits, spaces should be padded to the most significant digits. |
| Sample No. attribute | <p>M Sample ID No. is manually entered.</p> <p>A Automatically assigned number by the analyzer. This number is assigned by the automatic-increment function, and is used to set the sample number that is started with “ERR”. This is used when the ID Read Error occurred.</p> <p>B Barcode reader read number. This is used when the sample ID number was read by the ID bar code reader.</p> <p>C Host computer assigned number. When an inquiry with the keyword of the rack number and the tube position number is received, the host computer assigns the sample No.</p> |

Note: In the real-time inquiry with the keyword of the sample number, please return the same sample number and the sample number attribute that were inquired.
In the real-time inquiry with the keywords of the rack number and the tube position number, or in the batch inquiry from the work list, please return the appointed sample number specified by the rack number and the tube position number, and the sample number attribute “C”.

3) 9.4.4 Instrument Specimen ID

- | | |
|-------------------|--|
| Rack No. | Rack number that was used to analyze, and is consisted with a 6-digit number. Rack number will not be sent if analyzed in the manual mode. |
| Tube Position No. | The sample position number within a rack, and is one of the numbers 01 through 10. Return the same number that was inquired. Tube position number will not be sent if analyzed in the manual mode. |
| Sample ID number | There are cases that the bar code read error number, QC sample number, or QC file number may be set in addition to the usual 15-digit sample ID No. |
| Usual sample No. | Consisted of 15-digit alpha-numeric and hyphen “-” (2D h). When the sample ID number is less than 15 digits, spaces are padded to the most significant digits. |

Bar code read error No. The most significant 3-digit is fixed with “ERR” and following 12 digits in maximum with alpha-numeric and hyphen “-” (2D h).

QC sample number Up to 11 digits of alpha-numeric and hyphen “-” (2D h) starting with “QC-”. Spaces are padded to the most significant digits. This QC sample number is used when QC data is output in a real time transmission.

QC File No. Outputs the file No. “1” through “20” or “XbarM”, and is used to output the QC data manually.

Sample No. attribute M Sample ID No. was manually entered.

A Automatically assigned number by the analyzer. This number is assigned by the automatic-increment function, and is used to set the sample number that is started with “ERR”. This is used when the ID Read Error occurred.

B Barcode reader read number. This is used when the sample ID number was read by the ID bar code reader.

C Host computer assigned number. This is used when the sample ID number was assigned by the host computer.

[Note] The manual output of the QC data (QC Chart output) will not send the rack number, tube position number and Sample number attribute.

4) 9.4.5 Universal Test ID

When an order is sent from the host computer to the IPU, set the parameter that is to be ordered. When a multiple parameters are to be set, use a repeat delimiter (\).

For example, ^^^parameter1\^^^parameter2\^^^parameter3

Table 13: Abbreviation of Universal Test ID

Abbreviated parameter name	Parameter name
WBC	Number of all leucocytes
RBC	Number of all erythrocytes
HGB	Hemoglobin concentration
HCT	Hematocrit value: Erythrocytes ratio of total blood volume
MCV	Mean erythrocyte volume in total sample
MCH	Mean hemoglobin volume per RBC
MCHC	Mean hemoglobin concentration of erythrocytes
PLT	Number of all platelets
NEUT%	Neutrophil Percent
LYMPH%	Lymphocyte Percent
MONO%	Monocyte Percent
EO%	Eosinophil Percent
BASO%	Basophil Percent
NEUT#	Neutrophil Count
LYMPH#	Lymphocyte Count
MONO#	Monocyte Count
EO#	Eosinophil Count
BASO#	Basophil Count
RDW-SD	Calculated distribution width of erythrocytes, standard deviation
RDW-CV	Calculated distribution width of erythrocytes, coefficient of variation
PDW *1	Calculated distribution width of platelets
MPV	Mean platelet volume
P-LCR *1	Platelet- Large Cell Ratio
PCT *1	Plateleterit

When the IPU sends analysis results to the host computer, analyzed parameters are set.

[Analysis parameters are output (analysis results output, QC data real time output)]

WBC, RBC, HGB, HCT, MCV, MCH, MCHC, PLT, RDW-SD, RDW-CV, PDW*¹, MPV, P-LCR*¹, PCT*¹, NEUT#, LYMPH#, MONO#, EO#, BASO#, NEUT%, LYMPH%, MONO%, EO%, BASO%

[When QC chat parameters are output (QC data manual output)]

WBC, WBC-C, WBC-D, RBC, HGB, HCT, MCV, MCH, MCHC, PLT, RDW-SD, RDW-CV, PDW, MPV, P-LCR, PCT, NEUT#, LYMPH#, MONO#, EO#, BASO#, NEUT%, LYMPH%, MONO%, EO%, BASO%, FSC-X, DIFF-X, DIFF-Y

*1: These parameters are not output if the software is the North American specifications.

5) 9.4.7 Requested/Order data and time

Indicates the date and time of the analysis for the inquired sample. The format is pre-fixed as “YYYYMMDDHHMMSS”.

Here, YYYY indicates the year, MM the month, DD the day, HH the hour in the 24-hour system (00-23), MM the minute (00-59), and SS the second (00-59).

6) 9.4.12 Action Code

Indicates the contents of the result record sent.

N Normal sample

Q QC sample

7) 9.4.26 Report Type

Indicates the report type.

F Final result (Fixed. The IPU will always output the final results.)

Y No test order exists. (Use this when no order exists for the inquiry.)

Q Response to the inquiry. (Use this when an order exists for the inquiry.)

Note: When there is no analysis order exists, the analyzer will analyze the sample with a default order.

If “Q” is not set, the analyzer will determine that there is no analysis order.

3.3.3.5. Result Record
[Sending and receiving examples]

■ IPU → Host

R|1|^^^WBC^1|7.80|10*3/uL||N|||||20011116101000[CR]

R|2|^^^RBC^1|4.51|10*6/uL||A|||||20011116101000[CR]

...
R|18|^^^PCT_C(S)?|200||A|||||20011116101000[CR]

■ Host → IPU

Not used

Table 14: Details of Result Record

ASTM Field	Field Name	IPU→Host	Host→IPU	Max. Size (Bytes)	Remarks
10.1.1	Record type	R	Not used	1	
10.1.2	Sequence No.	Sequence No.	Not used	4	Sequence No. of records
10.1.3	Universal Test ID	^^^Parameter ^Dilution ratio ^^^Extended order result	Not used	^^^27 ^1 ^^^1	Dilution ratio is one of followings: 1: Non-capillary mode 7: Capillary mode
10.1.4	Data or measurement value	Value	Not used	-	
10.1.5	Units	Unit	Not used	7	
10.1.6	Reference ranges	Not used	Not used	-	
10.1.7	Result abnormal flags	L, H, >, N, A, W	Not used	1	L: Lower than patient limit H: Higher than patient limit >: Out of linearity range N: Normal A: Analysis error or hardware problem W: Low reliability
10.1.8	Nature of abnormality testing	Not used	Not used	-	
10.1.9	Result status	Not used	Not used	-	
10.1.10	Date of change in instrument normative values	Not used	Not used	-	
10.1.11	Operator identification	Not used	Not used	-	
10.1.12	Date/time test started	Not used	Not used	-	
10.1.13	Date/time test completed	YYYYMMDD HHMMSS	Not used	14	
10.1.14	Instrument identification	Not used	Not used	-	

Detailed Explanation of the fields:

1) 10.1.2 Sequence No.

The sequence number starts with 1 and indicates the sequence position in which the record appeared in the message. This number is reset to 1 when a higher-level record appears in the message.

2) 10.1.3 Universal Test ID through 10.1.13 Date/time test completed

Each field will vary depending on the contents to be sent.

2.1) When analysis data is to be sent, the parameters that have been ordered will be sent.

Table 15: Analysis Parameter List

10.1.3 Parameter name	Universal Dilution ratio	test ID Extended order	10.1.4 Data or measurement value *1	10.1.5 Units	10.1.7 Result abnormal flag	10.1.13 Date/time test completed
WBC	1 or 7	Not used	000.00	10*3/μL	L, H, >, N, A or W	YYYYMMDDHHMMSS
RBC	1 or 7	Not used	00.00	10*6/μL	L, H, >, N, A or W	YYYYMMDDHHMMSS
HGB *3	1 or 7	Not used	000.0	g/dL	L, H, >, N, A or W	YYYYMMDDHHMMSS
HCT	1 or 7	Not used	000.0	%	L, H, >, N, A or W	YYYYMMDDHHMMSS
MCV	1 or 7	Not used	000.0	fL	L, H, >, N, A or W	YYYYMMDDHHMMSS
MCH *3	1 or 7	Not used	000.0	pg	L, H, >, N, A or W	YYYYMMDDHHMMSS
MCHC *3	1 or 7	Not used	000.0	g/dL	L, H, >, N, A or W	YYYYMMDDHHMMSS
PLT	1 or 7	Not used	0000	10*3/μL	L, H, >, N, A or W	YYYYMMDDHHMMSS
NEUT%	1 or 7	Not used	000.0	%	L, H, >, N, A or W	YYYYMMDDHHMMSS
LYMPH%	1 or 7	Not used	000.0	%	L, H, >, N, A or W	YYYYMMDDHHMMSS
MONO%	1 or 7	Not used	000.0	%	L, H, >, N, A or W	YYYYMMDDHHMMSS
EO%	1 or 7	Not used	000.0	%	L, H, >, N, A or W	YYYYMMDDHHMMSS
BASO%	1 or 7	Not used	000.0	%	L, H, >, N, A or W	YYYYMMDDHHMMSS
NEUT#	1 or 7	Not used	000.00	10*3/μL	L, H, >, N, A or W	YYYYMMDDHHMMSS
LYMPH#	1 or 7	Not used	000.00	10*3/μL	L, H, >, N, A or W	YYYYMMDDHHMMSS
MONO#	1 or 7	Not used	000.00	10*3/μL	L, H, >, N, A or W	YYYYMMDDHHMMSS
EO#	1 or 7	Not used	000.00	10*3/μL	L, H, >, N, A or W	YYYYMMDDHHMMSS
BASO#	1 or 7	Not used	000.00	10*3/μL	L, H, >, N, A or W	YYYYMMDDHHMMSS
RDW-SD	1 or 7	Not used	000.0	fL	L, H, >, N, A or W	YYYYMMDDHHMMSS
RDW-CV	1 or 7	Not used	000.0	%	L, H, >, N, A or W	YYYYMMDDHHMMSS
PDW *2	1 or 7	Not used	000.0	fL	L, H, >, N, A or W	YYYYMMDDHHMMSS
MPV	1 or 7	Not used	000.0	fL	L, H, >, N, A or W	YYYYMMDDHHMMSS
P-LCR *2	1 or 7	Not used	000.0	%	L, H, >, N, A or W	YYYYMMDDHHMMSS
PCT *2	1 or 7	Not used	00.00	%	L, H, >, N, A or W	YYYYMMDDHHMMSS

- *1: Data or measurement value indicates the maximum number of digits and placement of the decimal point.
- *2: These parameters are not output if the software is the North American specifications.
- *3: When using the Dutch SI unit system, data value and units are output as follows.

Parameter name	Data or measurement value	Units
HGB	000.0	mmol/L
MCH	0000	amol
MCHC	000.0	mmol/L

- a) 10.1.3 Universal Test ID
Parameter name, dilution ratio, and extended order result are output.
Parameter name: Parameter name is output.
Dilution ratio: "1" indicates either Manual mode, or Sampler mode.
"7" indicates Capillary mode.
Extended order result: This is not used.
- b) 10.1.4 Data or measurement value
Analysis data of calculation parameter is output. When analysis data is subject to the masking due to the hardware problems, analysis data is masked in the same way that is applied to the IPU display.
"----" Analysis error or hardware error
"++++" Overflow from the display range or internal computer range.
- c) 10.1.5 Units
Unit for the analysis parameter is output.
- d) 10.1.7 Result abnormal flags
Abnormal flags of the analysis result are output.
L indicates that the result is lower than the normal range.
H indicates that the result is higher than the normal range.
> indicates that the result is out of the linearity range.
N indicates that the result is normal.
A indicates that the result is abnormal, such as analysis error or hardware error.
W indicates that the result is flagged with a low reliability mark.

e) 10.1.13 Date/time test completed

Indicates the date and time the test was completed. The format is pre-fixed as “YYYYMMDDHHMMSS”. Here, YYYY indicates the year, MM the month, DD the day, HH the hour in the 24-hour system (00-23), MM the minute (00-59), and SS the second (00-59).

2.2) QC Chart data output

When QC Chart parameters are output, those parameters that were ordered are output. Each field is set differently due to the contents of transmission.

Table 16: QC Parameter List

10.1.3 Parameter name	Universal Dilution ratio	test ID Extended order	10.1.4 Data or measurement value *1	10.1.5 Units	10.1.7 Result abnormal flag	10.1.13 Date/time test completed
WBC	1	Not used	000.00	10*3/μL	N or A	YYYYMMDDHHMMSS
WBC-C	1	Not used	000.00	10*3/μL	N or A	YYYYMMDDHHMMSS
WBC-D	1	Not used	000.00	10*3/μL	N or A	YYYYMMDDHHMMSS
RBC	1	Not used	00.00	10*6/μL	N or A	YYYYMMDDHHMMSS
HGB *2	1	Not used	000.0	g/dL	N or A	YYYYMMDDHHMMSS
HCT	1	Not used	000.0	%	N or A	YYYYMMDDHHMMSS
MCV	1	Not used	000.0	fL	N or A	YYYYMMDDHHMMSS
MCH *2	1	Not used	000.0	pg	N or A	YYYYMMDDHHMMSS
MCHC *2	1	Not used	000.0	g/dL	N or A	YYYYMMDDHHMMSS
PLT	1	Not used	0000	10*3/μL	N or A	YYYYMMDDHHMMSS
NEUT%	1	Not used	000.0	%	N or A	YYYYMMDDHHMMSS
LYMPH%	1	Not used	000.0	%	N or A	YYYYMMDDHHMMSS
MONO%	1	Not used	000.0	%	N or A	YYYYMMDDHHMMSS
EO%	1	Not used	000.0	%	N or A	YYYYMMDDHHMMSS
BASO%	1	Not used	000.0	%	N or A	YYYYMMDDHHMMSS
NEUT#	1	Not used	000.00	10*3/μL	N or A	YYYYMMDDHHMMSS
LYMPH#	1	Not used	000.00	10*3/μL	N or A	YYYYMMDDHHMMSS
MONO#	1	Not used	000.00	10*3/μL	N or A	YYYYMMDDHHMMSS
EO#	1	Not used	000.00	10*3/μL	N or A	YYYYMMDDHHMMSS
BASO#	1	Not used	000.00	10*3/μL	N or A	YYYYMMDDHHMMSS
RDW-SD	1	Not used	000.0	fL	N or A	YYYYMMDDHHMMSS
RDW-CV	1	Not used	000.0	%	N or A	YYYYMMDDHHMMSS
PDW	1	Not used	000.0	fL	N or A	YYYYMMDDHHMMSS
MPV	1	Not used	000.0	fL	N or A	YYYYMMDDHHMMSS
P-LCR	1	Not used	000.0	%	N or A	YYYYMMDDHHMMSS
PCT	1	Not used	00.00	%	N or A	YYYYMMDDHHMMSS
DIFF-X	1	Not used	000.0	ch	N or A	YYYYMMDDHHMMSS
DIFF-Y	1	Not used	000.0	ch	N or A	YYYYMMDDHHMMSS
FSC-X	1	Not used	000.0	ch	N or A	YYYYMMDDHHMMSS

*1: Data or measurement value indicates the maximum number of digits and placement of the decimal point.

*2: When using the Dutch SI unit system, data value and units are output as follows.

Parameter name	Data or measurement value	Units
HGB	000.0 or 000.00	mmol/L
MCH	0000	amol
MCHC	000.0	mmol/L

Note: The number of digits for HGB in the Dutch SI unit system is set at the time of the software installation.

a) 10.1.3 Universal Test ID

Parameter name: QC parameter name is output.

Dilution ratio: Fixed to “1”.

Extended order result: Not used.

b) 10.1.4 Data or measurement value

QC result of each QC parameter is output. When QC result is subject to the masking due to the hardware problems, QC result is masked in the same way that is applied to the IPU display.

“----” Analysis error or hardware error

“++++” Overflow from the display range or internal computer range.

c) 10.1.5 Units

Unit for the QC parameter is output.

- d) 10.1.7 Result abnormal flags
Abnormal flag of the QC result is output.
N indicates that the result is normal.
A indicates that the result is abnormal, such as analysis error or hardware error.
- e) 10.1.13 Date/time test completed
Indicates the date and time the QC analysis was completed. The format is pre-fixed as “YYYYMMDDHHMMSS”. Here, YYYY indicates the year, MM the month, DD the day, HH the hour in the 24-hour system (00-23), MM the minute (00-59), and SS the second (00-59).

2.3) Abnormal IP Message output
Only those parameter with IP Message is output.

Table 17: Abnormal IP Message List

10.1.3 Universal test ID			10.1.4 Data or measurement value	10.1.5 Units	10.1.7 Result abnormal flag	10.1.13 Date/time test completed
Parameter name	Dilution ratio	Extended order				
WBC_Abn_Scattergram	Not used	Not used	Not used	Not used	A	YYYYMMDDHHMMSS
Neutropenia	Not used	Not used	Not used	Not used	A	YYYYMMDDHHMMSS
Neutrophilia	Not used	Not used	Not used	Not used	A	YYYYMMDDHHMMSS
Lymphopenia	Not used	Not used	Not used	Not used	A	YYYYMMDDHHMMSS
Lymphocytosis	Not used	Not used	Not used	Not used	A	YYYYMMDDHHMMSS
Leukocytopenia	Not used	Not used	Not used	Not used	A	YYYYMMDDHHMMSS
Leukocytosis	Not used	Not used	Not used	Not used	A	YYYYMMDDHHMMSS
Monocytosis	Not used	Not used	Not used	Not used	A	YYYYMMDDHHMMSS
Eosinophilia	Not used	Not used	Not used	Not used	A	YYYYMMDDHHMMSS
Basophilia	Not used	Not used	Not used	Not used	A	YYYYMMDDHHMMSS
RBC_Abn_Distribution	Not used	Not used	Not used	Not used	A	YYYYMMDDHHMMSS
Dimorphic_Population	Not used	Not used	Not used	Not used	A	YYYYMMDDHHMMSS
Anisocytosis	Not used	Not used	Not used	Not used	A	YYYYMMDDHHMMSS
Microcytosis	Not used	Not used	Not used	Not used	A	YYYYMMDDHHMMSS
Macrocytosis	Not used	Not used	Not used	Not used	A	YYYYMMDDHHMMSS
Hypochromia	Not used	Not used	Not used	Not used	A	YYYYMMDDHHMMSS
Anemia	Not used	Not used	Not used	Not used	A	YYYYMMDDHHMMSS
Erythrocytosis	Not used	Not used	Not used	Not used	A	YYYYMMDDHHMMSS
PLT_Abn_Distribution	Not used	Not used	Not used	Not used	A	YYYYMMDDHHMMSS
Thrombocytopenia	Not used	Not used	Not used	Not used	A	YYYYMMDDHHMMSS
Thrombocytosis	Not used	Not used	Not used	Not used	A	YYYYMMDDHHMMSS

- a) 10.1.3 Universal Test ID
Parameter name: IP message is output.
Dilution ratio: Not used.
Extended order result: Not used.
- b) 10.1.4 Data or measurement value
Not used.
- c) 10.1.5 Units
Not used.
- d) 10.1.7 Result abnormal flags
A indicates that the IP message is flagged.
- e) 10.1.13 Date/time test completed
Indicates the date and time the analysis was completed. The format is pre-fixed as “YYYYMMDDHHMMSS”. Here, YYYY indicates the year, MM the month, DD the day, HH the hour in the 24-hour system (00-23), MM the minute (00-59), and SS the second (00-59).

2.4) Suspect IP Message output

Only those parameter with Suspect IP message is output when the Q-Flag grade value is within the range.

Table 18: Suspect IP Message List

10.1.3 Universal test ID			10.1.4 Data or measurement value ^{*1}	10.1.5 Units	10.1.7 Result abnormal flag	10.1.13 Date/time test completed
Parameter name	Dilution ratio	Extended order				
Blasts?	Not used	Not used	000	Not used	A or none	YYYYMMDDHHMMSS
Immature Gran?	Not used	Not used	000	Not used	A or none	YYYYMMDDHHMMSS
Left Shift?	Not used	Not used	000	Not used	A or none	YYYYMMDDHHMMSS
NRBC?	Not used	Not used	000	Not used	A or none	YYYYMMDDHHMMSS
Atypical Lympho? ^{*2}	Not used	Not used	000	Not used	A or none	YYYYMMDDHHMMSS
Abn Lympho?	Not used	Not used	000	Not used	A or none	YYYYMMDDHHMMSS
RBC Agglutination?	Not used	Not used	000	Not used	A or none	YYYYMMDDHHMMSS
Turbidity/HGB Interference?	Not used	Not used	000	Not used	A or none	YYYYMMDDHHMMSS
Iron Deficiency?	Not used	Not used	000	Not used	A or none	YYYYMMDDHHMMSS
HGB Defect?	Not used	Not used	000	Not used	A or none	YYYYMMDDHHMMSS
Fragments?	Not used	Not used	000	Not used	A or none	YYYYMMDDHHMMSS
PRBC? ^{*3}	Not used	Not used	000	Not used	A or none	YYYYMMDDHHMMSS
PLT Clumps?	Not used	Not used	000	Not used	A or none	YYYYMMDDHHMMSS
PLT Clumps (S)?	Not used	Not used	000	Not used	A or none	YYYYMMDDHHMMSS

*1: Data or measurement value indicates the maximum number of digits.

*2: On North American specification products, Atypical_Lympho/Blasts? is output.

*3: Only output when the version is Ver. 00-20 or later and the license key is valid.

a) 10.1.3 Universal Test ID

Parameter name: IP message is output.

Dilution ratio: Not used.

Extended order result: Not used.

b) 10.1.4 Data or measurement value

The Suspect IP message is output when the Q-Flag grade value is 0 to 300.

c) 10.1.5 Units

Not used.

d) 10.1.7 Result abnormal flags

A indicates that the IP message is flagged.

e) 10.1.13 Date/time test completed

Indicates the date and time the analysis was completed. The format is pre-fixed as “YYYYMMDDHHMMSS”. Here, YYYY indicates the year, MM the month, DD the day, HH the hour in the 24-hour system (00-23), MM the minute (00-59), and SS the second (00-59).

2.5) Action Message output
 Action message is output.

Table 19: Action Message List

10.1.3 Universal test ID			10.1.4 Data or measurement value	10.1.5 Units	10.1.7 Result abnormal flag	10.1.13 Date/time test completed
Parameter name	Dilution ratio	Extended order				
ACTION_MESSAGE_DIFF	Not used	Not used	Not used	Not used	A	YYYYMMDDHHMMSS
ACTION_MESSAGE_Delta	Not used	Not used	Not used	Not used	A	YYYYMMDDHHMMSS

- a) 10.1.3 Universal Test ID
 - Parameter name: Action message is output.
 “ACTION_MESSAGE_DIFF” Re-analyze DIFF.
 “ACTION_MESSAGE_Delta” Delta Check Error
 - Dilution ratio: Not used.
 - Extended order result: Not used.
- b) 10.1.4 Data or measurement value
 Not used.
- c) 10.1.5 Units
 Not used.
- d) 10.1.7 Result abnormal flags
 A indicates that the action message is flagged.
- e) 10.1.13 Date/time test completed
 Indicates the date and time the analysis was completed. The format is pre-fixed as
 “YYYYMMDDHHMMSS”.
 Here, YYYY indicates the year, MM the month, DD the day, HH the hour in the 24-hour system (00-23),
 MM the minute (00-59), and SS the second (00-59).

- 2.6) Positive/Error output
Positive/Error information is output.

Table 20: Positive and Error Information List

10.1.3 Universal test ID			10.1.4 Data or measurement value	10.1.5 Units	10.1.7 Result abnormal flag	10.1.13 Date/time test completed
Parameter name	Dilution ratio	Extended order				
Positive_Diff	Not used	Not used	Not used	Not used	A	YYYYMMDDHHMMSS
Positive_Morph	Not used	Not used	Not used	Not used	A	YYYYMMDDHHMMSS
Positive_Count	Not used	Not used	Not used	Not used	A	YYYYMMDDHHMMSS
Error_Func	Not used	Not used	Not used	Not used	A	YYYYMMDDHHMMSS
Error_Result	Not used	Not used	Not used	Not used	A	YYYYMMDDHHMMSS

a) 10.1.3 Universal Test ID

Parameter name: Positive/Error information is output.
 “Positive_Diff” indicates that any of the Diff values is abnormal.
 “Positive_Morph” indicates that the cell morphology is abnormal.
 “Positive_Count” indicates that any of the cell count is abnormal.
 “Error_Func” indicates an analysis error other than ID read error occurred.
 “Error_Result” indicates one of analysis errors “Blood not asp.”, “Short sample”, or “Low count” occurred.

Dilution ratio: Not used.
 Extended order result: Not used.

b) 10.1.4 Data or measurement value
Not used.

c) 10.1.5 Units
Not used.

d) 10.1.7 Result abnormal flags
A indicates that a Positive or Error is flagged.

e) 10.1.13 Date/time test completed
Indicates the date and time the analysis was completed. The format is pre-fixed as “YYYYMMDDHHMMSS”.
Here, YYYY indicates the year, MM the month, DD the day, HH the hour in the 24-hour system (00-23), MM the minute (00-59), and SS the second (00-59).

2.7) Output of File path to image data

When image data exists, the file path to the image data is output.

Table 21: Scattergram Information List

10.1.3 Universal test ID			10.1.4 Data or measurement value	10.1.5 Units	10.1.7 Result abnormal flag	10.1.13 Date/time test completed
Parameter name	Dilution ratio	Extended order				
SCAT_DIFF	Not used	Not used	File path	Not used	N	YYYYMMDDHHMMSS
DIST_RBC	Not used	Not used	File path	Not used	N	YYYYMMDDHHMMSS
DIST_PLT	Not used	Not used	File path	Not used	N	YYYYMMDDHHMMSS
DIST_WBC	Not used	Not used	File path	Not used	N	YYYYMMDDHHMMSS

a) 10.1.3 Universal Test ID

Parameter name: Type of image data set in the “data or measurement value” is output.

“SCAT_DIFF” DIFF scattergram image data

“DIST_RBC” RBC histogram image data

“DIST_PLT” PLT histogram image data

“DIST_WBC” WBC histogram image data

Dilution ratio: Not used.

Extended order result: Not used.

b) 10.1.4 Data or measurement value

The file path to the image data is output. The symbol “\” used in the file path is converted to the escape sequence “&R&” and sent. The actual image data is written in the folder “C:\shared\PNG\<date folder>”. Data value is output with the “PNG” and following file path. Date folder is pre-fixed in the “YYYYMMDD” format. The file name is determined by the date (“YYYYMMDD” fixed), the sample ID number, and the image parameter name, as shown in the following example.

[Example] “PNG&R&20030930&R&2003_09_30_12_00_1234567890_DIFF.PNG”

In this case, the image file is stored in the folder name “C:\shared\PNG\20030930”, with the file name “2003_09_30_12_00_1234567890_DIFF.PNG”.

c) 10.1.5 Units

Not used.

d) 10.1.7 Result abnormal flag

“N” is always output.

e) 10.1.13 Date/time test completed

Indicates the date and time the analysis was completed. The format is pre-fixed as “YYYYMMDDHHMMSS”.

Here, YYYY indicates the year, MM the month, DD the day, HH the hour in the 24-hour system (00-23), MM the minute (00-59), and SS the second (00-59).

3.3.3.6. Comment Record

[Example of transmission]

- IPU → Host computer

C|1||patient comments^specimen comments[CR]

- Host computer → IPU

C|1||patient comments^specimen comments[CR]

Table 22: Details of Comment Record

ASTM Field	Field Name	IPU→Host	Host→IPU	Max. Size (Bytes)	Remarks
11.1.1	Record type	C	C	1	
11.1.2	Sequence No.	Sequence No.	Sequence No.	4	Sequence No. of records
11.1.3	Comment source	Not used	Not used	-	
11.1.4	Comment text	Comments	Comments	100: Patient comments, or 40: Specimen comments	Patient comments, or Specimen comments
11.1.5	Comment type	Not used	Not used	-	

Detailed Explanation of the fields:

- 1) 11.1.2 Sequence No.

The sequence number starts with 1 and indicates the sequence position in which the record appeared in the message. This number is reset to 1 when a higher-level record appears in the message.

- 2) 11.1.4 Comment text

Patient comments: 100 characters or less of alpha-numeric for patient comments.

Specimen comments: 40 characters or less of alpha-numeric for specimen comments.

3.3.3.7. Message Terminator Record

[Sending and receiving examples]

- IPU → Host computer

L|1|N[CR]

- Host computer → IPU

L|1|N[CR]

Table 23: Message Terminator Record

ASTM Field	Field Name	IPU→Host	Host→IPU	Max. Size (Bytes)	Remarks
13.1.1	Record type	L	L	1	Fixed
13.1.2	Sequence No.	1	1	4	Always 1.
13.1.3	Terminator code	N	N	1	N: Normal termination

4.2. Analysis Information (Host Computer → IPU)

4.2.1. When an Analysis Order exists:

HC	<ENQ>
IPU	<ACK>
HC	<STX>1H\^& E1394-97<CR><ETX><CHK1><CHK2><CR><LF>
IPU	<ACK>
HC	<STX>2P 1 100 ^Heisei^Taro 20010820 M ^Dr.1 ^^^WEST <CR><ETX><CHK1><CHK2><CR><LF>
IPU	<ACK>
HC	<STX>3C 1 patient_comments<CR><ETX><CHK1><CHK2><CR><LF>
IPU	<ACK>
HC	<STX>4O 1 2^1^ 1234567890^B\^^^^WBC\^^^^RBC\^^^^HGB\^^^^HCT\ ^^^^MCV\^^^^MCH\^^^^MCHC\^^^^PLT\^^^^NEUT%\^^^^LYMPH%\ ^^^^MONO%\^^^^EO%\^^^^BASO%\^^^^NEUT#\^^^^LYMPH#\^^^^MONO#\ ^^^^EO#\^^^^BASO#\^^^^RDW-SD\^^^^RDW-CV\^^^^PDW\^^^^MPV\ ^^^^P-LCR\^^<ETB><CHK1><CHK2><CR><LF>
IPU	<ACK>
HC	<STX>5^^PCT 20010807101000 N Q<CR> <ETX><CHK1><CHK2><CR><LF>
IPU	<ACK>
HC	<STX>6C 1 specimen_comments<CR><ETX><CHK1><CHK2><CR><LF>
IPU	<ACK>
HC	<STX>7L 1 N<CR><ETX><CHK1><CHK2><CR><LF>
IPU	<ACK>
HC	<EOT>

4.2.2. When no Analysis Order exists:

HC	<ENQ>
IPU	<ACK>
HC	<STX>1H\^& E1394-97<CR><ETX><CHK1><CHK2><CR><LF>
IPU	<ACK>
HC	<STX>2P 1<CR><ETX><CHK1><CHK2><CR><LF>
IPU	<ACK>
HC	<STX>3O 1 2^1^ 1234567890^B 20010910101000 Y<CR> <ETX><CHK1><CHK2><CR><LF>
IPU	<ACK>
HC	<STX>4L 1 N<CR><ETX><CHK1><CHK2><CR><LF>
IPU	<ACK>
HC	<EOT>

4.3. Analysis Results and QC Results (IPU → Host Computer)

4.3.1. Transmitting Analysis Results:

IPU	<ENQ>
HC	<ACK>
IPU	<STX>1H ^& XS^00-01^11001^^^^12345678 E1394-97<CR><ETX><CHK1><CHK2><CR><LF>
HC	<ACK>
IPU	<STX>2P 1 100 ^Heisei^Taro 20010820 M ^Dr.1 ^^^WEST <CR><ETX><CHK1><CHK2><CR><LF>
HC	<ACK>
IPU	<STX>3C 1 patient_comments<CR><ETX><CHK1><CHK2><CR><LF>
HC	<ACK>
IPU	<STX>4O 1 2^1^ 1234567890^B ^WBC ^RBC ^HGB ^HCT\ ^MCV ^MCH ^MCHC ^PLT ^NEUT%^LYMPH%\ ^MONO%^EO%^BASO%^NEUT# ^LYMPH# ^MONO#\ ^EO# ^BASO# ^RDW-SD ^RDW-CV ^PDW ^MPV\ ^P-LCR ^<ETB><CHK1><CHK2><CR><LF>
HC	<ACK>
IPU	<STX>5^^PCT N Q<CR><ETX><CHK1><CHK2><CR><LF>
HC	<ACK>
IPU	<STX>6C 1 specimen_comments<CR><ETX><CHK1><CHK2><CR><LF>
HC	<ACK>
IPU	<STX>7R 1 ^WBC^1 7.81 10*3/uL N 20010806120000<CR> <ETX><CHK1><CHK2><CR><LF>
HC	<ACK>
IPU	<STX>0R 2 ^RBC^1 ---- 10*6/uL A 20010806120000<CR> <ETX><CHK1><CHK2><CR><LF>
HC	<ACK>
IPU	<STX>1R 3 ^HGB^1 20.5 g/dL W 20010806120000<CR> <ETX><CHK1><CHK2><CR><LF>
HC	<ACK>
IPU	<STX>2R 4 ^HCT^1 40.3 % W 20010806120000<CR> <ETX><CHK1><CHK2><CR><LF>
HC	<ACK>
	(Omitted)
IPU	<STX>7R 33 ^PLT_Abn_Distribution A 20010806120000 <CR><ETX><CHK1><CHK2><CR><LF>
HC	<ACK>
IPU	<STX>0R 34 ^Blasts? 0 20010806120000<CR> <ETX><CHK1><CHK2><CR><LF>
HC	<ACK>
IPU	<STX>1R 35 ^Immature_Gran? 40 20010806120000 <CR><ETX><CHK1><CHK2><CR><LF>
HC	<ACK>
IPU	<STX>2R 36 ^Left_Shift? 0 20010806120000 <CR><ETX><CHK1><CHK2><CR><LF>
HC	<ACK>
IPU	<STX>3R 37 ^Atypical_Lympho? 0 20010806120000 <CR><ETX><CHK1><CHK2><CR><LF>
HC	<ACK>
IPU	<STX>4R 38 ^Abn_Lympho? 10 A 20010806120000 <CR><ETX><CHK1><CHK2><CR><LF>
HC	<ACK>
	(Omitted)
IPU	<STX>4R 46 ^ACTION_MESSAGE_Delta A<CR><ETX><CHK1><CHK2> <CR><LF>
HC	<ACK>
IPU	<STX>5R 47 ^SCAT_DIFFPNG&R&20010806&R&2001_08_06_12_00_1234567890_ DIFF.PNG N 20010806120000<CR><ETX><CHK1><CHK2><CR><LF>
HC	<ACK>

	(Omitted)
IPU	<STX>5L 1 N<CR><ETX><CHK1><CHK2><CR><LF>
HC	<ACK>
IPU	<EOT>

4.3.2. Transmitting QC Result in real-time mode:

IPU	<ENQ>
HC	<ACK>
IPU	<STX>1H ^& XS^00-01^11001^^^^12345678 E1394-97<CR><ETX><CHK1><CHK2><CR><LF>
HC	<ACK>
IPU	<STX>2P 1<CR><ETX><CHK1><CHK2><CR><LF>
HC	<ACK>
IPU	<STX>3O 1 ^ QC-12345678^B ^WBC ^RBC ^HGB ^HCT\ ^MCV ^MCH ^MCHC ^PLT ^NEUT%^LYMPH%\ ^MONO%^EO%^BASO%^NEUT# ^LYMPH# ^MONO#\ ^EO# ^BASO# ^RDW-SD ^RDW-CV ^PDW ^MPV\ ^P-LCR ^<ETB><CHK1><CHK2><CR><LF>
HC	<ACK>
IPU	<STX>4PCT Q F<CR> <ETX><CHK1><CHK2><CR><LF>
HC	<ACK>
IPU	<STX>5R 1 ^WBC^1 7.58 10*3/uL ^N 20010806120000<CR> <ETX><CHK1><CHK2><CR><LF>
HC	<ACK>
IPU	<STX>6R 2 ^RBC^1 4.49 10*6/uL ^N 20010806120000<CR> <ETX><CHK1><CHK2><CR><LF>
HC	<ACK>
IPU	<STX>7R 3 ^HGB^1 13.3 g/dL ^N 20010806120000<CR> <ETX><CHK1><CHK2><CR><LF>
HC	<ACK>
IPU	<STX>0R 4 ^HCT^1 37.3 ^N 20010806120000<CR> <ETX><CHK1><CHK2><CR><LF>
HC	<ACK>
	(Omitted)
IPU	<STX>5R 33 ^SCAT_DIFF PNG&R&20010806&R&2001_08_06_12_00_123456789 0_DIFF.PNG ^N 20010806120000<CR><ETX><CHK1><CHK2><CR><LF>
HC	<ACK>
	(Omitted)
IPU	<STX>1L 1 N<CR><ETX><CHK1><CHK2><CR><LF>
HC	<ACK>
IPU	<EOT>

4.3.3. Transmitting QC Result in a manual batch mode:

IPU	<ENQ>
HC	<ACK>
IPU	<STX>1H ^& XS^00-01^11001^^^^12345678 E1394-97<CR><ETX><CHK1><CHK2><CR><LF>
HC	<ACK>
IPU	<STX>2P 1<CR><ETX><CHK1><CHK2><CR><LF>
HC	<ACK>
IPU	<STX>3 O 1 ^1 ^^^^WBC\^^^^RBC\^^^^HGB\^^^^HCT\^^^^MCV\^ ^^^MCH\^^^^MCHC\^^^^PLT\^^^^NEUT%\^^^^LYMPH%\^^^^M NO%\^^^^EO%\^^^^BASO%\^^^^NEUT#\^^^^LYMPH#\^^^^MO ONO#\^^^^EO#\^^^^BASO#\^^^^RDW-SD\^^^^RDW-CV\^^^^PD W\^^^^MPV\^^^^P-LCR\^^^^PCT\^^^^DIFF-X\^ <ETB><CHK1><CHK2><CR><LF>
HC	<ACK>
IPU	<STX>4^^^DIFF-Y\^^^^FSC-X Q F<CR> <ETX><CHK1><CHK2><CR><LF>
HC	<ACK>
IPU	<STX>5R 1 ^^^^WBC^1 7.58 10*3/uL N 20010806120000<CR> <ETX><CHK1><CHK2><CR><LF>
HC	<ACK>
IPU	<STX>6R 2 ^^^^RBC^1 4.49 10*6/uL N 20010806120000<CR> <ETX><CHK1><CHK2><CR><LF>
HC	<ACK>
IPU	<STX>7R 3 ^^^^HGB^1 13.3 g/dL N 20010806120000<CR> <ETX><CHK1><CHK2><CR><LF>
HC	<ACK>
IPU	<STX>0R 4 ^^^^HCT^1 37.3 % N 20010806120000<CR> <ETX><CHK1><CHK2><CR><LF>
HC	<ACK>
	(Omitted)
IPU	<STX>0L 1 N<CR><ETX><CHK1><CHK2><CR><LF>
HC	<ACK>
IPU	<EOT>

Appendix A. TCP/IP Communication

A.1 Network Interface Layer

The network interface conforms to IEEE802.3.
 Communication is performed by 10Base-T.
 The RJ45 socket is used in a hub to connect with the IPU of XS.
 The cable of UTP category 5 should be used for communication.

A.2 TCP/IP

The IP address of the IPU for XS is fixed. The default value is 192.168.28.150. When this value is to be changed, please contact a Sysmex technical representative.

The IP address for the host computer can be set using the setting screen in the IPU of XS. This IP address is fixed but can be changed by the setting screen in the IPU. The IP address may be selected other than “192.168.28.*” that is used to communicate with the IPU of the analyzer.

The TCP port number of the IPU of XS for host communication is fixed. The default value is 6000. This value may be changed in the IPU setting screen.

A.3 Transmission Timing

Either a real-time transmission upon completion of each analysis, or a batch transmission from the stored data.

A.4 Transmission Messages

• **When using ASTM E1381-95 mode:**

Based on the TCP/IP protocol, records defined by the presentation layer are transmitted to exchange messages. When transmitting, TCP connection has to be established. If not established, the IPU will start communication session in prior to the transmission. Messages exchanged are the records defined in the presentation layer, as listed in the following example.

(Example) Real-Time Inquiry:

IPU→HC	H \^& XS^00-22^11001^1100112345678 E1394-97<CR> Q 1 2^1^ 1234567890^B 20011001153000<CR> L 1 N<CR>
HC→IPU	H \^& E1394-97<CR> P 1 100 ^Heisei^Taro 20010820 M ^Dr.1 ^WEST<CR> C 1 patient_comments<CR> O 1 2^1^ 1234567890^B ^WBC\^RBC\^HGB\^HCT\ ^MCH\^MCHC\^PLT\^NEUT%\^LYMPH%\ ^MONO%\^EO%\^BASO%\^NEUT#\^LYMPH#\^MONO#\ ^EO#\^BASO#\^RDW-SD\^RDW-CV\^PDW\^MPV\ ^P-LCR\^PCT 20010807101000 N Q<CR> C 1 specimen_comments<CR> L 1 N<CR>

Note that <CR> in the above example indicates “0D”, and no carriage return code is placed at the place where the text line is carriage returned in the above example.

• **When using ASTM E1381-02 mode:**

Sending/receiving of the record defined by the presentation layer based on the protocol of 3.2 Data Link Layer (transmission protocol). When receiving or transmitting a signal, it is necessary that the TCP connection has been established. If it has not been established, the IPU automatically starts a session before sending the signal. For examples of messages sent/received, refer to the samples in 4 Examples of Communication. (However, the record division size sent by the IPU for serial connection is different than the size for TCP/IP. See 3.2.3 Transfer Phase.)

[end of document]