



Automated Hematology Analyzer XN series DPS Host Interface Specifications

Revision 10.0

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1. Scope

This document applies to TCP/IP communications between the XN series automated hematology analyzer and the DPS or SIS (hereinafter called “host computer”).

2. General

The XN series automated hematology analyzer has the capabilities to communicate analysis order information and output analysis results and QC data by connecting and communicating with the host computer.

This document intends to provide information required for communications between the XN series automated hematology analyzer and the host computer. The provided information includes:

- Specifications concerning software and hardware
- Specifications for outputting analysis results and QC data
- Specifications for communicating analysis order information

3. Terminology

Definitions of the terms used in this document are described below.

Table 1: Terminology

Numeric character	Single-byte characters corresponding to ISO/IEC 646 (ASCII) character codes “0” (30h) through “9” (39h).
Alphabetic character	Single-byte characters corresponding to ISO/IEC 646 (ASCII) character codes “A” (41h) through “Z” (5Ah) and “a” (61h) through “z” (7Ah).
Alphanumeric character	Numeric or alphabetical characters.
Single-byte character	ISO/IEC 646 (ASCII) character codes 00h through 7Fh (7-bit codes) except control characters (00h through 1Fh) and DEL (7Fh).
Extended single-byte character	ISO/IEC 8859 character codes 00h through FEh (8-bit codes) except control characters (00h through 1Fh, 80H through 9FH) and DEL (7Fh). For example, single-byte katakana and Latin-1 characters are included.
Any character	An aggregate including extended single-byte characters and double-byte characters.
Repeat analysis	Redoing an analysis due to an analysis error.
Rerun analysis	Running an analysis again with the same parameters, based on results of the initial analysis.
Reflex analysis	Running an analysis again with additional parameters, based on results of the initial analysis.

4. Specifications for Communicating Analysis Order Information

The XN series automated hematology analyzer has the capabilities to obtain analysis order information (i.e. test items and information about the patient) from the host computer and to automatically perform analysis according to the obtained information.

4.1. Overview of Communicating Analysis Order Information

4.1.1. Types of analysis order inquiries

- Real-time inquiries can be conducted immediately before analysis using “the Sample ID Number” or “the Rack Number/Tube Position” as an inquiry key.
- Batch inquiries can be conducted before analysis by specifying a rack number. The collectively obtained analysis order information is imported into the Work List. Batch inquiries use “the Rack Number/Tube Position” as an inquiry key irrespective of settings in the IPU.

Table 2: Specifying Type of Analysis Order Inquiry

Inquiry key	Sample ID Number	
	Rack Number/Tube Position	
Real-time inquiry	Manual analysis	Enables or disables real-time inquiries in manual mode analysis. “Sample ID Number” is always used as an inquiry key.
	Sampler analysis	Enables or disables real-time inquiries in sampler mode analysis. Either option for “Inquiry key” above is used as an inquiry key.

4.1.2. Timing of analysis order inquiries

- Real-time inquiry (manual analysis)

The XN series automated hematology analyzer carries out an inquiry when the [OK] button is clicked to close the manual analysis screen or the Sample ID Number is read by the barcode reader provided with the IPU. However, the analyzer does not conduct an inquiry if the Work List already has the analysis order information of the same inquiry key. In this case the analyzer performs the analysis according to the information in the Work List without inquiring into the host computer.

- Real-time inquiry (sampler analysis)

The XN series automated hematology analyzer inquiries into the host computer at two events: initial analysis and rerun analysis/reflex analysis. The timing of the inquiry is identified by the value in the Inquiry Timing Distinction Code field in the Analysis Order Inquiry text. For information about the communication sequence at rerun analysis or reflex analysis, refer to “XN series automated hematology analyzer Standard Host Interface Specifications”.

[Inquiry at initial analysis]

The XN series automated hematology analyzer carries out the inquiry when the “Sample ID Number” or “Rack Number/Tube Position” is read out. However, the analyzer does not conduct an inquiry if the Work List already has the analysis order information of the same inquiry key. In this case the analyzer performs the analysis according to the information in the Work List without inquiring into the host computer.

[Inquiry at rerun analysis/reflex analysis]

After the initial analysis, if the evaluation result is “Query to host” based on the rerun/reflex rule, the IPU carries out the inquiry for rerun analysis/reflex analysis order. The Service settings allow specifying a time interval between the evaluation “Query to host” and the actual transmission of the inquiry text to the host computer.

- Batch inquiry

The batch inquiry requests order information for Tube Positions 1 to 10 in sequence corresponding to the specified rack and downloads the information into the Work List (registered to the IPU).

If the analysis order information with of same key already exists in the Work List, confirmation is requested as to whether the existing order information is to be overwritten with the imported information.

During the batch inquiry, the transmission procedure (described below) is repeated for the respective tube positions 1 to 10 in the rack.

4.1.3. Handling communication errors

In case a transmission error occurs or the text data containing analysis order information from the host computer has an error, the transmission is aborted, and then one or more help messages are displayed on the IPU. After the displayed messages are confirmed, analysis starts according to the analysis order set on the IPU.

This analysis does not reflect any analysis order or patient information sent from the host computer.

Recovery of transmission is to be carried out by the operator.

For information about conditions of communication errors, refer to “XN series automated hematology analyzer On-board Rule Function Specifications”.

4.2. Communication Specifications

4.2.1. Hardware specifications

- Conforms to IEEE802.3.
- Communications are based on 10/100/1000Base-T.
- The RJ45 socket is used for a hub to connect to the IPU.
- The UTP Category 5 cable is used as a communication cable.

4.2.2. Software specifications

(1) Data link / Network / Transport layer

- Conforms to TCP/IP protocol
- The IP address of the host computer is to be assigned manually. This value can be changed via settings on the IPU. Do not use the address (192.168.28.*), which is reserved in the XN series automated hematology analyzer.
- The TCP port number used for communications with the host computer is to be assigned manually. The factory default is 5000. This value can be changed via settings on the IPU.

(2) Session layer

- To establish TCP/IP connection, the host computer acts as a server and the IPU acts as a client. The IPU checks if connection is established during its startup process. In case of failure to connect to the host computer, the IPU will retry the connection at intervals of 60 seconds. If the server shuts down after the connection, the IPU will retry connection at the same intervals.

(3) Presentation layer

- “STX” (02h) is sent at the beginning of data, and “ETX” (03h) at the end of data.
- In the presentation layer, explicit responses such as ACK and NAK are not given.

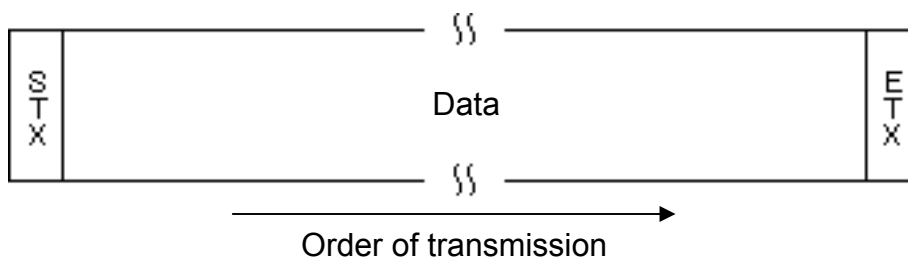


Figure 1: Structure of Text

4.3. Text Format

4.3.1. Types of text format

- Two types of text format are used for communicating analysis order information with the host computer: the Analysis Inquiry Format sent from the IPU and the Analysis Order Information Format sent from the host computer, which are respectively identified by the Text Distinction Code in the text.
 - Analysis Order Inquiry Format
The Text Distinction Code is “R”.
 - Analysis Order Information Format
The Text Distinction Code is “S”.
- The Analysis Order Information Format consists of two text blocks: Analysis Order Information Format 1 and Analysis Order Information Format 2. The order of transmission of these text blocks is identified by the Text Distinction Code 2 (the ETB code is not used).

4.3.2. Analysis Order Inquiry Format

(1) Order of transmission

Parameters in the table are sent from top to bottom; the most significant digit first and the least significant digit last.

(2) Reserved

The “Reserved” parameter is currently not used, but will possibly be used in the future. The “Reserved” parameter is set to “0” as of now; do not check or otherwise operate this value.

Table 3: Analysis Order Inquiry Format

Parameter	No. of characters	Remarks
STX	1	(02h)
Text Distinction Code	1	“R” (Fixed)
Inquiry Mode Distinction Code	1	Identifies the inquiry mode: “1”: Inquiry with Sample ID Number as inquiry key “2”: Inquiry with Rack Number/Tube Position as inquiry key
Reserved	3	“0”s are set to fill the specified number of characters.
Sample ID No.	22	This parameter is valid for inquiry with Sample ID No. used as a key. The number consists of extended single-byte characters, right-aligned with space padding (Service settings allow changing to zero padding). For batch inquiries, spaces (20h) (or “0”s if zero padding is selected) are set to fill the specified number of characters, for any tube position. Ex.) “△△△△△△ABCDE1234567890” (The symbol △ represents a space (20h).)
Reserved	2	“0”s are set to fill the specified number of characters.
Rack Number	6	This parameter is valid for real-time (sampler analysis) or batch inquiries. The number consists of extended single-byte characters, right-aligned with zero padding. For real-time inquiries (manual analysis), “0”s are set to fill the specified number of characters. Ex.) “000012”
Tube Position Number	2	Indicates the sample position in the rack, being valid for real-time (sampler analysis) or batch inquiries. The number consists of numeric characters between “01” and “10”, right-aligned with zero padding. For real-time inquiries (manual analysis), “0”s are set to fill the specified number of characters. Ex.) “05”
Inquiry Timing Distinction Code	1	Indicates the timing of inquiry: “0”: Real-time inquiry (manual analysis) or batch inquiry “1”: Real-time inquiry (sampler analysis) for initial analysis “2”: Real-time inquiry (sampler analysis) for rerun/reflex analysis.
Reserved	23	“0”s are set to fill the specified number of characters.
ETX	1	(03h)
Total	63	

4.3.3. Analysis Order Information Format

(1) Order of transmission

Please return two blocks of text “Analysis Order Information Format 1” and “Analysis Order Information Format 2” consecutively. Parameters in the table are to be sent from top to bottom; the most significant digit first and the least significant digit last.

(2) Reserved

The “Reserved” parameter is currently not used, but will possibly be used in the future. Return all Reserved parameters set to “0”.

4.3.3.1. Analysis Order Information Format 1

Table 4: Analysis Order Information Format 1

Parameter	No. of characters	Remarks
STX	1	(02h)
Text Distinction Code I	1	“S” (Fixed)
Text Distinction Code II	1	“1” (Fixed)
Order Distinction Code	1	Indicates whether the order information for the target sample is registered to the host computer. Return one of the following values: “0”: Not registered “1”: Registered * If “0” (Not Registered) is returned, the analysis module will perform an analysis according to a predefined order.
Date Ordered	8	This is the date when the order to analyze the sample was given. Return the date in the “YYYYMMDD” format. YYYY: year, MM: month, DD: day (month and date to be zero-padded) Ex.) “20060103” (January 3, 2006)
Reserved	3	“0”s are set to fill the specified number of characters.
Sample ID Number	22	For inquiry with Sample ID No. used as inquiry key, return the same number as the one in the Analysis Order Inquiry text. For inquiry with Rack No./Tube Pos. used as inquiry key, assign a number for the sample corresponding to the specified Rack No./Tube Pos. If the host computer does not assign a Sample ID Number, return the same sample number as the one in the Analysis Order Inquiry Format. Extended single-byte characters can be used. The returned number has to be right-aligned with space padding. Ex.) “△△△△△△ABCDE1234567890” (The symbol △ represents a space (20h).) * Sample numbers beginning with “QC” are reserved for QC analysis. Do not assign a sample number beginning with “QC” if QC samples are not going to be analyzed.
Reserved	2	“0”s are set to fill the specified number of characters.
Rack Number	6	Regardless of any inquiry key defined, return the same rack number as the one in the Analysis Order Inquiry Format. The returned number has to be right-aligned with zero padding. Ex.) “000012”
Tube Position Number	2	Regardless of any inquiry key defined, return the same tube position number as the one in the Analysis Order Inquiry Format. The returned number has to be right-aligned with zero padding. Ex.) “05”
Inquiry Mode Distinction Code	1	Return the same inquiry mode distinction code as the one in the Analysis Order Inquiry Format.

PLT-F	1	This is a setting related to the PLT-F channel. Return either “0” (Do not test) or “1” (Do test). * If PLT is set to “0” (Do not test), this field is regarded as being set to “0” (Do not test).
WPC	1	This is a setting related to the WPC channel. Return either “0” (Do not test) or “1” (Do test). * If LYMPH%, MONO%, NEUT%, EO%, BASO%, LYMPH#, MONO#, NEUT#, EO#, and BASO# are all set to “0” (Do not test), this field is regarded as being set to “0” (Do not test).
Low WBC	1	This is a setting related to the Low WBC mode. Return either “0” (Do not test) or “1” (Do test). * If LYMPH%, MONO%, NEUT%, EO%, BASO%, LYMPH#, MONO#, NEUT#, EO#, and BASO# are all set to “0” (Do not test), this field is regarded as being set to “0” (Do not test).
Reserved	7	“0”s are set to fill the specified number of characters.
WBC	1	Return either “0” (Do not test) or “1” (Do test).
RBC	1	Return either “0” (Do not test) or “1” (Do test).
HGB	1	Return either “0” (Do not test) or “1” (Do test).
HCT	1	Return either “0” (Do not test) or “1” (Do test).
MCV	1	Return either “0” (Do not test) or “1” (Do test).
MCH	1	Return either “0” (Do not test) or “1” (Do test).
MCHC	1	Return either “0” (Do not test) or “1” (Do test).
PLT	1	Return either “0” (Do not test) or “1” (Do test).
LYMPH%	1	Return either “0” (Do not test) or “1” (Do test).
MONO%	1	Return either “0” (Do not test) or “1” (Do test).
NEUT%	1	Return either “0” (Do not test) or “1” (Do test).
EO%	1	Return either “0” (Do not test) or “1” (Do test).
BASO%	1	Return either “0” (Do not test) or “1” (Do test).
LYMPH#	1	Return either “0” (Do not test) or “1” (Do test).
MONO#	1	Return either “0” (Do not test) or “1” (Do test).
NEUT#	1	Return either “0” (Do not test) or “1” (Do test).
EO#	1	Return either “0” (Do not test) or “1” (Do test).
BASO#	1	Return either “0” (Do not test) or “1” (Do test).
RDW-CV	1	Return either “0” (Do not test) or “1” (Do test).
RDW-SD	1	Return either “0” (Do not test) or “1” (Do test).
PDW	1	Return either “0” (Do not test) or “1” (Do test).
MPV	1	Return either “0” (Do not test) or “1” (Do test).
P-LCR	1	Return either “0” (Do not test) or “1” (Do test).
Reserved	2	“0”s are set to fill the specified number of characters.
RET%	1	Return either “0” (Do not test) or “1” (Do test).
RET#	1	Return either “0” (Do not test) or “1” (Do test).
IRF	1	Return either “0” (Do not test) or “1” (Do test).
LFR	1	Return either “0” (Do not test) or “1” (Do test).
MFR	1	Return either “0” (Do not test) or “1” (Do test).
HFR	1	Return either “0” (Do not test) or “1” (Do test).
Reserved	1	“0”s are set to fill the specified number of characters.
PCT	1	Return either “0” (Do not test) or “1” (Do test).
NRBC%	1	Return either “0” (Do not test) or “1” (Do test).
NRBC#	1	Return either “0” (Do not test) or “1” (Do test).
Reserved	15	“0”s are set to fill the specified number of characters.
ETX	1	(03h)
Total	255	

Memo:

- If the analysis module receives the Analysis Order Information Format text where Order Distinction Code is set to “1” (Registered) and all test items are set to “0” (Do not test), the analyzer neither performs aspiration on the sample nor saves analysis data in a stored sample list.
- If the sample is already analyzed, its analysis data is notified, and the sample is not going to be analyzed again, the host computer should, in response to a re-inquiry about that sample, return the Analysis Order Information Format text where Order Distinction Code is set to “1” (Registered) and all test items are set to “0” (Do not test). Then the analysis module will neither perform aspiration on the sample nor save analysis data in a stored sample list.

Note:

- If the analyzer receives the Analysis Order Information Format text where a test item requiring a test channel unavailable in the analyzer is set to “1” (Do test), a help message will be displayed. After the help message is confirmed, the analysis module will neither perform aspiration on the sample nor save analysis data in a stored sample list.

4.3.3.2. Analysis Order Information Format 2

Table 5: Analysis Order Information Format 2

Parameter	No. of characters	Remarks
STX	1	(02h)
Text Distinction Code I	1	“S” (Fixed)
Text Distinction Code II	1	“2” (Fixed)
Order Distinction Code	1	Return the same “order distinction code” as the one in the Analysis Order Information Format 1.
Date Ordered	8	Return the same “date ordered” as the one in the Analysis Order Information Format 1.
Reserved	3	“0”s are set to fill the specified number of characters.
Sample ID Number	22	Return the same “sample ID number” as the one in the Analysis Order Information Format 1.
Reserved	2	“0”s are set to fill the specified number of characters.
Rack Number	6	Return the same “rack number” as the one in the Analysis Order Information Format 1.
Tube Position Number	2	Return the same “tube position number” as the one in the Analysis Order Information Format 1.
Inquiry Mode Distinction Code	1	Return the same “inquiry mode distinction code” as the one in the Analysis Order Information Format 1.
Patient ID	16	Return the same “patient ID” as the one in the Analysis Order Information Format 1.
Comment on Patient	100	This is a comment on the patient whose sample is to be analyzed. Any character can be used. The returned value has to be left-aligned with space padding. * If no information is available about the comment, return spaces (20h) filling the specified number of characters.
Reserved	90	“0”s are set to fill the specified number of characters.
ETX	1	(03h)
Total	255	

5. Specifications for Analysis Data Output

The XN series automated hematology analyzer has the capability to output analysis data to the host computer.

5.1. Overview of Analysis Data Output

5.1.1. Timing of Analysis Data Output

Settings on the IPU allow selecting either automatic output by every test cycle or batch transmission of stored sample data.

5.1.2. Increase in network traffic

If the IPU is configured to output analysis data automatically, the host computer may suffer congestion caused by alternate transmissions of analysis order information and analysis data. To avoid possible delayed responses from the host computer due to excessive burdens, select batch transmission instead of automatic output so that analysis data is collectively transmitted after the analysis.

5.1.3. Handling communication errors

In case a transmission error occurs, the transmission is aborted, and one or more help messages are displayed on the IPU. Recovery of transmission is to be carried out by the operator.

For information about conditions of communication errors, refer to “XN series automated hematology analyzer Standard Host Interface Specifications”.

5.2. Communication Specifications

5.2.1. Hardware specifications

Same as the specifications for communicating analysis order information with the host computer.

5.2.2. Software specifications

(1) Data link / Network / Transport layer

Same as the specifications for communicating analysis order information with the host computer.

(2) Session layer

Same as the specifications for communicating analysis order information with the host computer.

(3) Presentation layer

Same as the specifications for communicating analysis order information with the host computer.

5.3. Text Format

5.3.1. Types of text format

- There are two types of text format used for transmitting analysis data to the host computer: Analysis Data Format and Quality Control Data Format. These are different in text length and content. The types are identified by the Text Distinction Code II indicated in the text.
- Regardless of which format type is used, the Text Distinction Code I is always set to “D” when analysis data is output.
- Analysis Data Format
 - This format is used to output analysis data from an area other than the QC chart.
 - The analysis data format text is output in two blocks: “Analysis Data Format (Reportable Block)” and “Analysis Data Format (Research Block)” *1. The Text Distinction Code II for “Analysis Data Format (Reportable Block)” and “Analysis Data Format (Research Block)” are “I” and “R”, respectively.

*1: If the Service settings define research items not to be output, the text block “Analysis Data Format (Research Block)” will not be transmitted.

- Quality Control Data Format
 - This format is used to output QC data from the QC chart.
 - The QC data format is output in two blocks: “Quality Control Data Format 1” and “Quality Control Data Format 2”. The order of transmission of these text blocks is identified by the Text Distinction Code II (the ETB code is not used).
 - The Sample Distinction Code for Quality Control Data Format is always set to “C”.

5.3.2. Analysis Data Format (Reportable Block)

(1) Order of transmission

Parameters in the table are sent from top to bottom; the most significant digit first and the least significant digit last.

(2) Format structure

The Analysis Data Format consists of several sub-formats. Individual sub-formats are separated by delimiters [CR][LF](0Dh)(0Ah), being transmitted as one text (block).

Table 6: Analysis Data Format (Reportable Block)

Parameter	No. of characters	Description
STX	1	(02h)
Text Distinction Code I	1	“D” (Fixed)
Text Distinction Code II	1	“I” (Fixed) * “I” stands for Image Data.
Block Number	2	Indicates the number for the block conveying information about the sample. Fixed to “01”.
Total Number of Blocks	2	Indicates the total number of (text) blocks conveying the whole information about the sample. This parameter is set to “02”. * If the Service settings define research items not to be output, the text block “Analysis Data Format (Research Block)” will not be transmitted, and thus this parameter is set to “01”.
Communication Protocol Version	4	Indicates version number of the communication protocol. Fixed to “1.00”.
Analyzer Name	10	Indicates the analyzer name for identifying the analyzer. The name consists of alphanumeric characters, right-aligned with space padding. Ex.) “△△△△△XN-20” (The symbol △ represents a space (20h).)
Caret	1	“^” (Fixed)
PS Code	8	Indicates the analyzer code (PS code) for identifying the analyzer, consisting of 8 alphanumeric characters. Ex.) “PS123456”
Caret	1	“^” (Fixed)
Analyzer Number	5	Indicates the analyzer number for identifying the analyzer, consisting of 5 alphanumeric characters. Ex.) “11001”
Sequence No.	10	Indicates the sequence number (serial number) for the sample tested on the same date. This number consists of numeric characters, right-aligned with zero padding. Ex.) “0000000345”
Date Tested	8	The format is fixed to “YYYYMMDD”. YYYY: year, MM: month, DD: day (month and date to be zero-padded) Ex.) “20060103” (January 3, 2006)
Test Time	6	The format is fixed to “HHMMSS”. HH: hour (24-hour basis: “00” – “23”), MM: minute (“00” – “59”), SS: second (“00” – “59”) (to be zero-padded) Ex.) “084510” (8 o’clock 45 minutes 10 seconds)

Rack Number	6	Indicates the number for the rack where analysis was performed. The number consists of extended single-byte characters, right-aligned with zero padding. For manual analysis, spaces (20h) are set to fill the specified number of characters. Ex.) “000012”
Tube Position Number	2	Indicates the tube position in the rack where the sample was analyzed. The number consists of numeric characters between “01” and “10”, right-aligned with zero padding. For manual analysis, “0”s are set to fill the specified number of characters. Ex.) “02”
Sample ID Number	22	The number consists of extended single-byte characters, right-aligned with space padding (Service settings allow changing to zero padding). Ex.) “△△△△△△ABCDE1234567890” (The symbol △ represents a space (20h).) * If a barcode reading error occurs, the ID number for the corresponding sample is expressed as follows: Conveyer not connected: “△△△△△△ERR*****” Conveyer connected: “△△△△△△00ERR*****” (The symbol △ represents a space (20h), and * represents an extended single-byte character).
Delimiter	2	[CR][LF] (0Dh, 0Ah)
Analysis Data D1U	205	See “Analysis Data Format” for details.
Delimiter	2	[CR][LF] (0Dh, 0Ah)
Analysis Data D2U	205	See “Analysis Data Format” for details.
Delimiter	2	[CR][LF] (0Dh, 0Ah)
Flag Data DBU	106	See “Flag Data Format” for details.
Delimiter	2	[CR][LF] (0Dh, 0Ah)
Particle Size Distribution Data (RBC) D3U	241	See “Particle Size Distribution Data Format” for details.
Delimiter	2	[CR][LF] (0Dh, 0Ah)
Particle Size Distribution Data (PLT) D4U	201	See “Particle Size Distribution Data Format” for details.
Delimiter	2	[CR][LF] (0Dh, 0Ah)
Scattergram Data (WDF) D1G	29 – 32,797	See “Scattergram Data Format” for details.
Delimiter	2	[CR][LF] (0Dh, 0Ah)
Scattergram Data (WNR) D2G	29 – 32,797	See “Scattergram Data Format” for details.
Delimiter	2	[CR][LF] (0Dh, 0Ah)
Scattergram Data (WPC) D3G	29 – 32,797	See “Scattergram Data Format” for details.
Delimiter	2	[CR][LF] (0Dh, 0Ah)
Scattergram Data (RET) D4G	29 – 32,797	See “Scattergram Data Format” for details.
Delimiter	2	[CR][LF] (0Dh, 0Ah)
Scattergram Data (PLT-F) D7G	29 - 32,797	See “Scattergram Text Data Format” for details.
ETX	1	(03h)
Total	1,214 – 165,054	

5.3.2.1. Analysis Data Format

(1) Order of transmission

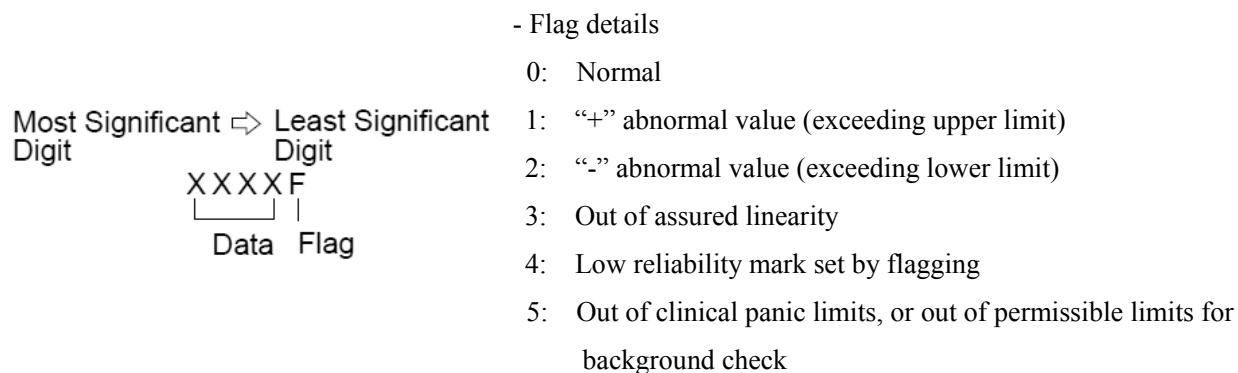
Parameters in the table are sent from top to bottom; the most significant digit first and the least significant digit last.

(2) Decimal point

Output data does not include decimal points; instead values displayed on the IPU screen are expressed in the units shown in the Remarks column in the format table. If necessary, convert the units on the host computer.

(3) Numeric data format and flags

Numeric data is expressed in the following format. Data is assigned to high-order bytes, and a flag is assigned to the least significant byte. The data is output as a character string, right-aligned with zero padding.



(4) Abnormal or inapplicable data

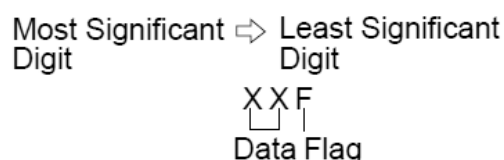
A data value displayed as “----” or “++++” is output in the “*0000” format (an asterisk (*) is assigned to the first digit and 0s to the remaining digits; the number of “0”s is the specified number of characters minus 1). For any item given no analysis order, spaces (20h) filling the specified number of characters are output without zero padding.

(5) Structure of Q-Flag

The Q-Flag data is structured as follows. A grade value is assigned to high-order bytes, and additional information is assigned to the least significant byte. The output grade value, being one tenth of the value displayed on the screen, is expressed with a character string right-aligned with zero padding. If necessary, convert the units on the host computer.

If no Q-Flag judgment is done due to QC samples or flag status other than below, spaces are set to fill the specified number of characters without zero padding.

- Flag details



0: Negative

1: Not judged due to Discrete setting

2: Not judged due to low-value sample

3: Not judged due to analysis error

4: Positive

(6) Reserved

The “Reserved” parameter is currently not used, but will possibly be used in the future. Any “Reserved” parameter is set to “0” or “ ” (space) as of now; do not check or otherwise operate this value.

Note:

Positive/negative judgments and IP messages are intended for use in a clinical laboratory for inspection only, and not for patient diagnosis. These items notify the operator of the possibility of specific sample abnormality confirmed by checking analysis data.

Table 7: Analysis Data Format 1

Parameter	No. of characters	Description
Text Distinction Code I	1	“D” (Fixed)
Text Distinction Code II	1	“1” (Fixed)
Sample Distinction Code	1	“U” (Fixed)
Data Length	6	The number of bytes for Sample No. Attribute and subsequent parameters is assigned. Fixed to “000195”.
Reserved	1	“0”s are set to fill the specified number of characters.
Sample No. Attribute	1	Indicates the attribute of the sample number. “4”: Sample number is read by barcode reader “2”: Sample number cannot be read by barcode reader “0”: Others
Analysis Mode	1	Indicates the sample analysis mode. “1”: Manual analysis (WB) “2”: Sampler analysis (WB) “4”: Manual analysis (PD) “5”: Manual analysis (HPC) “6”: Manual analysis (BF) “7”: Sampler analysis (LW) “8”: Manual analysis (LW)

Patient ID	16	Indicates the unique identifier of the patient whose sample was analyzed. The ID consists of extended single-byte characters, left-aligned with space padding. Ex.) "1234567890A△△△△△" (The symbol △ represents a space (20h).) * If no information is available about the patient ID, spaces (20h) are set to fill the specified number of characters.
Analysis Status	1	Indicates the status of the analysis. "0": Success "1": Error
Judgment on Sample	1	Indicates judgment on the sample to determine the necessity for repeat analysis. "0": Negative "1": Positive "2": Analysis error "3": Positive and error "Q": QC sample
Positive (Diff)	1	Indicates whether the measured value of a blood cell type is normal. "0": Normal "1": Abnormal
Positive (Morph)	1	Indicates whether there exists abnormality in blood cell morphology. "0": Normal "1": Abnormal
Positive (Count)	1	Indicates whether the blood cell count is normal. "0": Normal "1": Abnormal
Error (Func)	1	Indicates whether Error (Func) occurred. "0": None of the following errors occurred. "1": An error occurred except ID barcode reading error and Error (Result).
Error (Result)	1	Indicates whether Error (Result) occurred. "0": None of the following errors occurred. "1": One of the following analysis errors occurred: "Sample Not Asp Error", "Low Blood Volume", and "Low Count Error".
With/Without Order	1	Indicates whether the sample was analyzed with order. "0": Analyzed without order "1": Analyzed with order
Presence of WBC Abnormal IP Message	1	Indicates whether there is any WBC Abnormal IP message. "0": No IP message "1": IP message present
Presence of WBC Suspect IP Message	1	Indicates whether there is any WBC Suspect IP message. "0": No IP message "1": IP message present
Presence of RBC Abnormal IP Message	1	Indicates whether there is any RBC Abnormal IP message. "0": No IP message "1": IP message present
Presence of RBC Suspect IP Message	1	Indicates whether there is any RBC Suspect IP message. "0": No IP message "1": IP message present
Presence of PLT Abnormal IP Message	1	Indicates whether there is any PLT Abnormal IP message. "0": No IP message "1": IP message present
Presence of PLT Suspect IP Message	1	Indicates whether there is any PLT Suspect IP message. "0": No IP message "1": IP message present

Unit Information	1	Indicates whether SI units and HGB2 units are used. “0”: Neither SI units nor HGB2 units are used “1”: SI units are used, HGB2 units are not used “2”: SI units are not used, HGB2 units are used (only when XN-21/XN-11 is connected)
WBC Information	1	Indicates with which channel the adopted WBC value was analyzed. “0”: WNR channel “1”: WDF channel
PLT Information	1	Indicates with which channel the adopted PLT value was analyzed. “0”: RBC/PLT channel “1”: RET channel “2”: PLT-F channel
WPC Information	1	Indicates whether test was done with the WPC channel. “0”: Not tested “1”: Tested
Order Type	1	Indicates the order type. “0”: Initial “1”: Initial/Repeat “2”: Rerun “3”: Rerun/Repeat “4”: Reflex “5”: Reflex/Repeat “6”: Manual “7”: Manual (Open)
Evaluation Based on Rerun Analysis Rule	1	Indicates the evaluation result based on the Repeat/Rerun/Reflex rule (indicates which action to take next for the sample). “0”: None (there is no applicable rule, or evaluation based on the Repeat/Rerun/Reflex rule is not made) “1”: Repeat “2”: Rerun “3”: Reflex “4”: Query to host * Set to “0” for manual analysis.
Reserved	20	“0”s are set to fill the specified number of characters.
Action Message: The sample might be wrong. Check the sample.	1	Indicates whether the Action Message “The sample might be wrong. Check the sample.” is present. “0”: The Action Message is not present, “1”: The Action Message present
Action Message: Significant change in WBC. Check the sample.	1	Indicates whether the Action Message “Significant change in WBC. Check the sample.” is present. “0”: The Action Message is not present, “1”: The Action Message present
Action Message: Significant change in HGB. Check the sample.	1	Indicates whether the Action Message “Significant change in HGB. Check the sample.” is present. “0”: The Action Message is not present, “1”: The Action Message present
Action Message: Significant change in MCV. Check the sample.	1	Indicates whether the Action Message “Significant change in MCV. Check the sample.” is present. “0”: The Action Message is not present, “1”: The Action Message present
Action Message: Significant change in PLT. Check the sample.	1	Indicates whether the Action Message “Significant change in PLT. Check the sample.” is present. “0”: The Action Message is not present, “1”: The Action Message present

Action Message: Difference between WNR and WDF. Check the results.	1	Indicates whether the Action Message “Difference between WNR and WDF. Check the results.” is present. “0”: The Action Message is not present, “1”: The Action Message present
Action Message: Difference between RBC and RET. Check the results.	1	Indicates whether the Action Message “Difference between RBC and RET. Check the results.” is present. “0”: The Action Message is not present, “1”: The Action Message present
Action Message: The PLT test result may have low reliability.	1	Indicates whether the Action Message “The PLT test result may have low reliability.” is present. “0”: The Action Message is not present, “1”: The Action Message present
QFLAG (Blasts?)	3	(XXF) Indicates the grade value of Q-Flag (Blasts?) and its additional information.
Reserved	3	“0”s are set to fill the specified number of characters.
QFLAG (Left Shift?)	3	(XXF) Indicates the grade value of Q-Flag (Left Shift?) and its additional information.
Reserved	3	“0”s are set to fill the specified number of characters.
QFLAG (Atypical Lympho?)	3	(XXF) Indicates the grade value of Q-Flag (Atypical Lympho?) and its additional information.
Reserved	3	“0”s are set to fill the specified number of characters.
QFLAG (Blasts/Abn Lympho?)	3	(XXF) Indicates the grade value of Q-Flag (Blasts/Abn Lympho?) and its additional information.
QFLAG (RBC Agglutination?)	3	(XXF) Indicates the grade value of Q-Flag (RBC Agglutination?) and its additional information.
QFLAG (Turb/HGB Interference?)	3	(XXF) Indicates the grade value Q-Flag (Turb/HGB Interference?) and its additional information.
QFLAG (Iron Deficiency?)	3	(XXF) Indicates the grade value Q-Flag (Iron Deficiency?) and its additional information.
QFLAG (HGB Defect?)	3	(XXF) Indicates the grade value of Q-Flag (HGB Defect?) and its additional information.
QFLAG (Fragments?)	3	(XXF) Indicates the grade value of Q-Flag (Fragments?) and its additional information.
QFLAG (PLT Clumps?)	3	(XXF) Indicates the grade value of Q-Flag (PLT Clumps?) and its additional information.
Reserved	3	“0”s are set to fill the specified number of characters.
QFLAG (Abn Lympho?)	3	(XXF) Indicates the grade value of Q-Flag (Abn Lympho?) and its additional information.
Action Message: Difference between PLT and PLT-F channels.	1	Indicates whether the Action Message “Difference between PLT and PLT-F. Check the results.” is present. “0”: The Action Message is not present, “1”: The Action Message present
Reserved	16	“0”s are set to fill the specified number of characters.
WBC-BF	7	(XXXXXXF) [/ μ L]
RBC-BF	6	(XXXXXXF) [$\times 10^3$ / μ L]
MN#	7	(XXXXXXF) [/ μ L]
MN%	5	(XXXXF) [$\times 10^{(-1)}$ %]
PMN#	7	(XXXXXXF) [/ μ L]
PMN%	5	(XXXXF) [$\times 10^{(-1)}$ %]

TC-BF#	7	(XXXXXXF) [μL] * If derived software handles the item as a research item, the Service settings (Output_AnalysisInformation) can be configured not to output the item. In this case, “0”s are assigned to this parameter to fill the specified number of characters.
Reserved	23	“0”s are set to fill the specified number of characters.
Total	205	

Table 8: Analysis Data Format 2

Parameter	No. of characters	Description
Text Distinction Code I	1	“D” (Fixed)
Text Distinction Code II	1	“2” (Fixed)
Sample Distinction Code	1	“U” (Fixed)
Data Length	6	The number of bytes for WBC and subsequent parameters is assigned. Fixed to “000195”.
Reserved	1	“0”s are set to fill the specified number of characters.
WBC	6	(XXXXXF) [×10 /μL]
RBC	5	(XXXXF) [×10 ⁴ /μL]
HGB	5	(XXXXF) [g/L] * [10 ⁽⁻¹⁾ mmol/L] in SI units * [10 ⁽⁻¹⁾ g/L] in HGB2 units (only when XN-21/XN-11 is connected)
HCT	5	(XXXXF) [×10 ⁽⁻¹⁾ %]
MCV	5	(XXXXF) [×10 ⁽⁻¹⁾ fL]
MCH	5	(XXXXF) [×10 ⁽⁻¹⁾ pg] *[amol] in SI units
MCHC	5	(XXXXF) [g/L] * [10 ⁽⁻¹⁾ mmol/L] in SI units
PLT	5	(XXXXF) [×10 ³ /μL]
LYMPH%	5	(XXXXF) [×10 ⁽⁻¹⁾ %]
MONO%	5	(XXXXF) [×10 ⁽⁻¹⁾ %]
NEUT%	5	(XXXXF) [×10 ⁽⁻¹⁾ %]
EO%	5	(XXXXF) [×10 ⁽⁻¹⁾ %]
BASO%	5	(XXXXF) [×10 ⁽⁻¹⁾ %]
LYMPH#	6	(XXXXXF) [×10 /μL]
MONO#	6	(XXXXXF) [×10 /μL]
NEUT#	6	(XXXXXF) [×10 /μL]
EO#	6	(XXXXXF) [×10 /μL]
BASO#	6	(XXXXXF) [×10 /μL]
RDW-CV	5	(XXXXF) [×10 ⁽⁻¹⁾ %]
RDW-SD	5	(XXXXF) [×10 ⁽⁻¹⁾ fL]
PDW	5	(XXXXF) [×10 ⁽⁻¹⁾ fL] * If derived software handles the item as a research (Can be displayed in the main screen) item, the Service settings (Output Analysis Information) can be configured not to output the item. In this case, “0”s are assigned to this parameter to fill the specified number of characters.
MPV	5	(XXXXF) [×10 ⁽⁻¹⁾ fL]
P-LCR	5	(XXXXF) [×10 ⁽⁻¹⁾ %] * If derived software handles the item as a research (Can be displayed in the main screen) item, the Service settings (Output Analysis Information) can be configured not to output the item. In this case, “0”s are assigned to this parameter to fill the specified number of characters.
RET%	5	(XXXXF) [×10 ⁽⁻²⁾ %]
RET#	5	(XXXXF) [×10 ² /μL]

IRF	5	(XXXXF) $[\times 10^{(-1)} \text{ \%}]$
LFR	5	(XXXXF) $[\times 10^{(-1)} \text{ \%}]$ * If derived software handles the item as a research item, the Service settings (Output Analysis Information) can be configured not to output the item. In this case, “0”s are assigned to this parameter to fill the specified number of characters.
MFR	5	(XXXXF) $[\times 10^{(-1)} \text{ \%}]$ * If derived software handles the item as a research (Can be displayed in the main screen) item, the Service settings (Output Analysis Information) can be configured not to output the item. In this case, “0”s are assigned to this parameter to fill the specified number of characters.
HFR	5	(XXXXF) $[\times 10^{(-1)} \text{ \%}]$ * If derived software handles the item as a research (Can be displayed in the main screen) item, the Service settings (Output Analysis Information) can be configured not to output the item. In this case, “0”s are assigned to this parameter to fill the specified number of characters.
PCT	5	(XXXXF) $[\times 10^{(-2)} \text{ \%}]$ * If derived software handles the item as a research (Can be displayed in the main screen) item, the Service settings (Output Analysis Information) can be configured not to output the item. In this case, “0”s are assigned to this parameter to fill the specified number of characters.
NRBC%	6	(XXXXXF) $[\times 10^{(-1)} / 100\text{WBC}]$
NRBC#	6	(XXXXXF) $[\times 10 / \mu\text{L}]$
IG#	6	(XXXXXF) $[\times 10 / \mu\text{L}]$ * If derived software handles the item as a research (Can be displayed in the main screen) item, the Service settings (Output Analysis Information) can be configured not to output the item. In this case, “0”s are assigned to this parameter to fill the specified number of characters.
IG%	5	(XXXXF) $[\times 10^{(-1)} \text{ \%}]$ * If derived software handles the item as a research (Can be displayed in the main screen) item, the Service settings (Output Analysis Information) can be configured not to output the item. In this case, “0”s are assigned to this parameter to fill the specified number of characters.
HPC#	6	(XXXXXF) $[/\mu\text{L}]$ * If derived software handles the item as a research (Can be displayed in the main screen) item, the Service settings (Output Analysis Information) can be configured not to output the item. In this case, “0”s are assigned to this parameter to fill the specified number of characters.
RET-He	5	(XXXXF) $[\times 10^{(-1)} \text{ pg}]$ *[amol] in SI units
IPF	5	(XXXXF) $[\times 10^{(-1)} \text{ \%}]$
Total	205	

5.3.2.2.Flag Data Format

(1) Order of transmission

Parameters in the table are sent from top to bottom; the most significant digit first and the least significant digit last.

(2) Reserved

The “Reserved” parameter is currently not used, but will possibly be used in the future. Any “Reserved” parameter is set to “0” or “ ” (space) as of now; do not check or otherwise operate this value.

Table 9: Flag Data Format

Parameter		No. of characters	Description
Text Distinction Code I		1	“D” (Fixed)
Text Distinction Code II		1	“B” (Fixed)
Sample Distinction Code		1	“U” (Fixed)
Data Length		6	The number of bytes for WBC Abnormal and subsequent parameters is assigned. Fixed to “000096”.
Reserved		1	“0”s are set to fill the specified number of characters.
WBC Abnormal	WBC Abn Scattergram	1	“0”: Not applicable to flag, “1”: Applicable to flag
	Neutropenia	1	“0”: Not applicable to flag, “1”: Applicable to flag
	Neutrophilia	1	“0”: Not applicable to flag, “1”: Applicable to flag
	Lymphopenia	1	“0”: Not applicable to flag, “1”: Applicable to flag
	Lymphocytosis	1	“0”: Not applicable to flag, “1”: Applicable to flag
	Leukocytosis	1	“0”: Not applicable to flag, “1”: Applicable to flag
	Monocytosis	1	“0”: Not applicable to flag, “1”: Applicable to flag
	Eosinophilia	1	“0”: Not applicable to flag, “1”: Applicable to flag
	Basophilia	1	“0”: Not applicable to flag, “1”: Applicable to flag
	Leukocytopenia	1	“0”: Not applicable to flag, “1”: Applicable to flag
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	NRBC Present	1	“0”: Not applicable to flag, “1”: Applicable to flag
	IG Present	1	“0”: Not applicable to flag, “1”: Applicable to flag
	Reserved	1	“0”s are set to fill the specified number of characters.
WBC Suspect	Blasts?	1	“0”: Not applicable to flag, “1”: Applicable to flag
	Reserved	1	“0”s are set to fill the specified number of characters.
	Left Shift?	1	“0”: Not applicable to flag, “1”: Applicable to flag
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Atypical Lympho?	1	“0”: Not applicable to flag, “1”: Applicable to flag
	Reserved	1	“0”s are set to fill the specified number of characters.
	Blasts/Abn Lympho?	1	“0”: Not applicable to flag, “1”: Applicable to flag
	Abn lympho?	1	“0”: Not applicable to flag, “1”: Applicable to flag
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.

RBC Abnormal	RBC Abn Distrib.	1	“0”: Not applicable to flag, “1”: Applicable to flag
	Dimorphic Population	1	“0”: Not applicable to flag, “1”: Applicable to flag
	Anisocytosis	1	“0”: Not applicable to flag, “1”: Applicable to flag
	Microcytosis	1	“0”: Not applicable to flag, “1”: Applicable to flag
	Macrocytosis	1	“0”: Not applicable to flag, “1”: Applicable to flag
	Hypochromia	1	“0”: Not applicable to flag, “1”: Applicable to flag
	Anemia	1	“0”: Not applicable to flag, “1”: Applicable to flag
	Erythrocytosis	1	“0”: Not applicable to flag, “1”: Applicable to flag
	RET Abn Scattergram	1	“0”: Not applicable to flag, “1”: Applicable to flag
	Reticulocytosis	1	“0”: Not applicable to flag, “1”: Applicable to flag
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
RBC Suspect	RBC Agglutination?	1	“0”: Not applicable to flag, “1”: Applicable to flag
	Turbidity/HGB Interf?	1	“0”: Not applicable to flag, “1”: Applicable to flag
	Iron Deficiency?	1	“0”: Not applicable to flag, “1”: Applicable to flag
	HGB Defect?	1	“0”: Not applicable to flag, “1”: Applicable to flag
	Reserved	1	“0”s are set to fill the specified number of characters.
	Fragments?	1	“0”: Not applicable to flag, “1”: Applicable to flag
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
PLT Abnormal	PLT Abn Distrib.	1	“0”: Not applicable to flag, “1”: Applicable to flag
	Thrombocytopenia	1	“0”: Not applicable to flag, “1”: Applicable to flag
	Thrombocytosis	1	“0”: Not applicable to flag, “1”: Applicable to flag
	PLT Abn Scattergram	1	“0”: Not applicable to flag, “1”: Applicable to flag
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
PLT Suspect	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	PLT Clumps?	1	“0”: Not applicable to flag, “1”: Applicable to flag
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.

	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
	Reserved	1	“0”s are set to fill the specified number of characters.
Total		106	

5.3.2.3. Particle Size Distribution Data Format

(1) Order of transmission

Parameters in the table are sent from top to bottom; the most significant digit first and the least significant digit last.

(2) Reserved

The “Reserved” parameter is currently not used, but will possibly be used in the future. Any “Reserved” parameter is set to “0” or “ ” (space) as of now; do not check or otherwise operate this value.

Table 10: RBC Particle Size Distribution Data Format

Parameter	No. of characters	Description
Text Distinction Code I	1	“D” (Fixed)
Text Distinction Code II	1	“3” (Fixed)
Sample Distinction Code	1	“U” (Fixed)
Data Format	3	Fixed to “△SE” (The symbol △ represents a space (20h)). The value is right-aligned with space padding.
Data Item Name	10	Indicates the type of particle size distribution data. Fixed to “RBC△DISCRI” (the symbol △ represents a space (20h)).
Data X-axis Size	3	Indicates the data count in the X-axis (horizontal) direction. The data count for RBC particle distribution is 50, and thus this parameter is fixed to “△50” (the symbol △ represents a space (20h)). Data values are assigned to “DISCRI 1” through “DISCRI 50”. The value is right-aligned with space padding.
Data Y-axis Size	3	Indicates the maximum data value in the Y-axis (vertical) direction, that is, the maximum value in the data assigned to “DISCRI 1” through “DISCRI 50”. The value is right-aligned with space padding.
Data Length	6	The number of bytes for LOWER DISCRI and subsequent parameters is assigned. Fixed to “000212” for RBC particle size distribution.
Reserved	1	“0”s are set to fill the specified number of characters.
LOWER DISCRI	4	Indicates the lower discrete limit position. For example, LOWER DISCRI value “5” means the lower discrete limit is positioned at DISCRI 5. The output value is right-aligned with zero padding.
UPPER DISCRI	4	Indicates the upper discrete limit position. For example, UPPER DISCRI value “25” means the upper discrete limit is positioned at DISCRI 25. The output value is right-aligned with zero padding.
RATIO (dividing ratio)	4	Indicates the ratio for normalization. Data at discrete positions “DISCRI 1” to “DISCRI 50” multiplied by Ratio equals to the particle size distribution data. The value is right-aligned with zero padding.
DISCRI 1	4	Indicates the frequency of DISCRI 1. The value is right-aligned with zero padding.
DISCRI 2	4	Indicates the frequency of DISCRI 2. The value is right-aligned with zero padding.
· · ·	184	· ...omitted... ·
DISCRI 49	4	Indicates the frequency of DISCRI 49. The value is right-aligned with zero padding.
DISCRI 50	4	Indicates the frequency of DISCRI 50. The value is right-aligned with zero padding.
Total	241	

Table 11: PLT Particle Size Distribution Data Format

Parameter	No. of characters	Description
Text Distinction Code I	1	“D” (Fixed)
Text Distinction Code II	1	“4” (Fixed)
Sample Distinction Code	1	“U” (Fixed)
Data Format	3	Fixed to “△SE” (the symbol △ represents a space (20h)). The value is right-aligned with space padding.
Data Item Name	10	Indicates the type of particle size distribution data. Fixed to “PLT△DISCRI” (the symbol △ represents a space (20h)).
Data X-axis Size	3	Indicates the data count in the X-axis (horizontal) direction. The data count for PLT particle distribution is 40, and thus this parameter is fixed to “△40” (the symbol △ represents a space (20h)). Data values are assigned to “DISCRI 1” through “DISCRI 40”. The value is right-aligned with space padding.
Data Y-axis Size	3	Indicates the maximum data value in the Y-axis (vertical) direction, that is, the maximum value in the data assigned to “DISCRI 1” through “DISCRI 40”. The value is right-aligned with space padding.
Data Length	6	The number of bytes for LOWER DISCRI and subsequent parameters is assigned. Fixed to “000172” for PLT particle size distribution.
Reserved	1	“0”s are set to fill the specified number of characters.
LOWER DISCRI	4	Indicates the lower discrete limit position. For example, LOWER DISCRI value “5” means the lower discrete limit is positioned at DISCRI 5. The value is right-aligned with zero padding.
UPPER DISCRI	4	Indicates the upper discrete limit position. For example, UPPER DISCRI value “25” means the upper discrete limit is positioned at DISCRI 25. The value is right-aligned with zero padding.
RATIO (dividing ratio)	4	Indicates the ratio for normalization. Data at discrete positions “DISCRI 1” to “DISCRI 40” multiplied by Ratio equals to the particle size distribution data. The value is right-aligned with zero padding.
DISCRI 1	4	Indicates the frequency of DISCRI 1. The value is right-aligned with zero padding.
DISCRI 2	4	Indicates the frequency of DISCRI 2. The value is right-aligned with zero padding.
· · ·	144	· ...omitted... ·
DISCRI 39	4	Indicates the frequency of DISCRI 39. The value is right-aligned with zero padding.
DISCRI 40	4	Indicates the frequency of DISCRI 40. The value is right-aligned with zero padding.
Total	201	

Example

Data X-axis Size = 10

Data Y-axis Size = 255

LOWER DISCRI = 4

UPPER DISCRI = 9

Ratio = 3

DISCRI 1 = 3

DISCRI 2 = 4

DISCRI 3 = 4

DISCRI 4 = 6

DISCRI 5 = 9

DISCRI 6 = 15

DISCRI 7 = 27

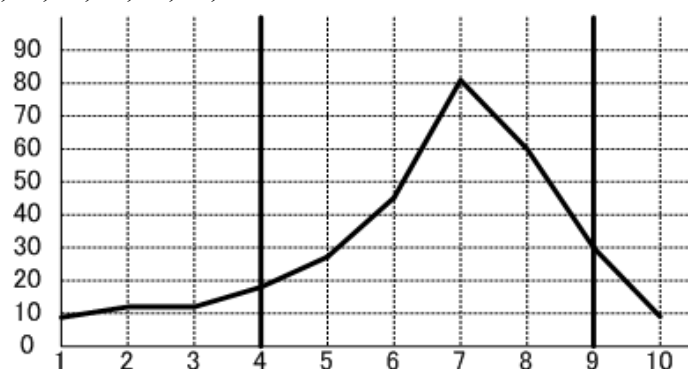
DISCRI 8 = 20

DISCRI 9 = 10

DISCRI 10 = 3

Based on the Ratio 3 as above, the line chart will be drawn as below.

Line chart data: 9, 12, 12, 18, 27, 45, 81, 60, 30, 9



Note: This is a conceptual graph illustrating how to draw a particle size distribution graph. The horizontal and vertical scales and relevant numbers are hidden on the IPU display.

5.3.2.4.Scattergram Data Format

(1) Order of transmission

Parameters in the table are sent from top to bottom; the most significant digit first and the least significant digit last.

Table 12: Scattergram Data Format

Parameter	No. of characters	Description
Text Distinction Code	3	One of the following scattergram types is assigned: “D1G”: WDF “D2G”: WNR “D3G”: WPC “D4G”: RET “D7G”: PLT-F
Data Format	3	Fixed to “△SE”.
Data Item Name	10	Indicates the name of the scattergram. One of the following names is assigned depending on the scattergram type (the symbol △ represents a space (20h)). The value is left-aligned with space padding. “WDF△SCAT△△” “WNR△SCAT△△” “WPC△SCAT△△” “RET△SCAT△△” “PLT-F△SCAT”
Data X-axis Size	3	Indicates the scattergram size in the X-axis direction. Fixed to “256”.
Data Y-axis Size	3	Indicates the scattergram size in the Y-axis direction. Fixed to “256”.
Data Length	6	Indicates the size of the data section in the scattergram. If there is no scattergram, “000000” is assigned. The value is right-aligned with zero padding. “000000” – “032768”
Scattergram Compression Info	1	Indicates whether the scattergram is compressed (Run-Length and Huffman). (See Appendix A “Specifications for Scattergrams Compression” for decompressing scattergrams.) “0”: Not compressed, “1”: Compressed *If there is no scattergram, “0” is assigned.
Scattergram Data	0 – 32,768	The scattergram data is converted to ASCII code text before output. (See Appendix A “Specifications for Scattergrams Compression” for information about scattergram data including converting into ASCII text.) If there is no scattergram data, the data size is regarded as “0”.
Total	29 – 32,797	

5.3.3. Analysis Data Format (Research Block)

(1) Order of transmission

Parameters in the table are sent from top to bottom; the most significant digit first and the least significant digit last.

(2) Format structure

The test data format (research block) consists of several sub-formats. Individual sub-formats are separated by delimiters [CR][LF](0Dh)(0Ah), being transmitted as one text (block).

Table 13: Analysis Data Format (Research Block)

Parameter	No. of characters	Description
STX	1	(02h)
Text Distinction Code I	1	“D” (Fixed)
Text Distinction Code II	1	“R” (Fixed) * “R” stands for Research Data.
Block Number	2	Indicates the number for the block conveying information about the sample. Fixed to “02”.
Total Number of Blocks	2	Indicates the “total number of blocks” conveying the whole information about the sample. This parameter is set to “02”.
Communication Protocol Version	4	The same “communication protocol version” is assigned as the one in the Analysis Data Format (Reportable Block).
Analyzer Name	10	The same “analyzer name” is assigned as the one in the Analysis Data Format (Reportable Block).
Caret	1	“^” (Fixed)
PS Code	8	The same “PS code” is assigned as the one in the Analysis Data Format (Reportable Block).
Caret	1	“^” (Fixed)
Analyzer Number	5	The same “analyzer number” is assigned as the one in the Analysis Data Format (Reportable Block).
Sequence No.	10	The same “sequence number” is assigned as the one in the Analysis Data Format (Reportable Block).
Date Tested	8	The same “date tested” is assigned as the one in the Analysis Data Format (Reportable Block).
Test Time	6	The same “test time” is assigned as the one in the Analysis Data Format (Reportable Block).
Rack Number	6	The same “rack number” is assigned as the one in the Analysis Data Format (Reportable Block).
Tube Position Number	2	The same “tube position number” is assigned as the one in the Analysis Data Format (Reportable Block).
Sample ID Number	22	The same “sample ID number” is assigned as the one in the Analysis Data Format (Reportable Block).
Delimiter	2	[CR][LF] (0Dh, 0Ah)
Analysis Data (Research) 1 D5U	1005	See “Analysis Data (Research) Format” for details.
Delimiter	2	[CR][LF] (0Dh, 0Ah)
Particle Size Distribution Data (RBC (FSC)) D6U	297	See “Particle Size Distribution Data (Research) Format” for details.
Delimiter	2	[CR][LF] (0Dh, 0Ah)
Particle Size Distribution Data (WDF (FSC)) D7U	297	See “Particle Size Distribution Data (Research) Format” for details.

Delimiter	2	[CR][LF] (0Dh, 0Ah)
Scattergram Data (PLT-O) D5G	29 – 32,797	See “Scattergram Data (Research) Format” for details.
Delimiter	2	[CR][LF] (0Dh, 0Ah)
Scattergram Data (RET (EXT)) D6G	29 – 32,797	See “Scattergram Data (Research) Format” for details.
Delimiter	2	[CR][LF] (0Dh, 0Ah)
Scattergram Data (WDF (EXT)) D8G	29 – 32,797	See “Scattergram Data (Research) Format” for details.
Delimiter	2	[CR][LF] (0Dh, 0Ah)
Analysis Data (Service) 1 DSU	607	See “Analysis Data (Service) Format” for details. The DSU sub-format parameter is not output if the Service settings are configured not to output service parameters.
ETX	1	(03h)
Total	2,376 – 100,680	

5.3.3.1. Analysis Data (Research) Format

(1) Order of transmission

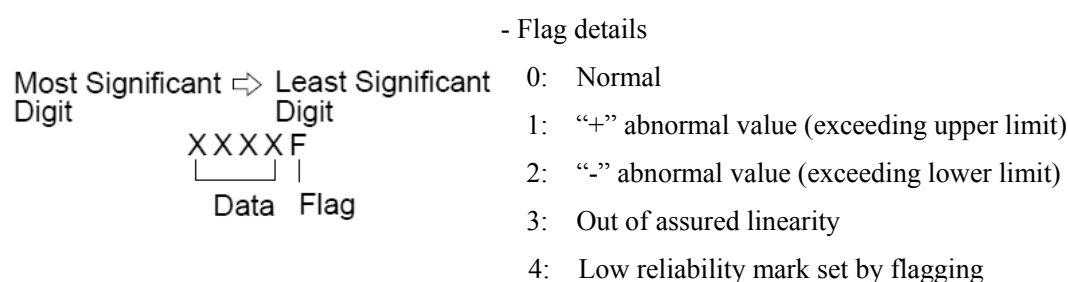
Parameters in the table are sent from top to bottom; the most significant digit first and the least significant digit last.

(2) Decimal point

Output data does not include decimal points; instead values displayed on the IPU screen are expressed in the units shown in the Remarks column in the format table. If necessary, convert the units on the host computer.

(3) Numeric data format and flags

Numeric data is expressed in the following format. Data is assigned to high-order bytes, and a flag is assigned to the least significant byte. The data is output as a character string, right-aligned with zero padding.



As for Delta-He numerical data, a sign is assigned to the most significant byte and a flag is assigned to the least significant byte. The data is output as a character string, right-aligned with zero padding. Flag details are the same as above.

(MSD)△XXXXF(LSD)

△ : Indicates a sign. "-" (2Dh) is output for a negative value, and "0" (30h) is output for a positive value.

XXXX : Indicates the absolute value of the data, output as a character string right-aligned with zero padding.

F : Indicates a flag. Flag details are the same as above.

Example) If the Delta-He value is "-23" and normal, "-00230" is output. If the value is 23 and normal, "000230" is output.

(4) Abnormal data or non-analyzed items

A data value displayed as "----" or "++++" is output in the "*0000" format (an asterisk (*) is assigned to the most significant digit and 0s to the remaining digits; the number of "0"s is the specified number of "characters minus 1").

For any item which is not analyzed, spaces (20h) filling the specified number of characters are output without zero padding.

Similarly, a non-analyzed Delta-He parameter is output as "*00000", where the most significant digit indicates a sign.

(5) Reserved

The "Reserved" parameter is currently not used, but will possibly be used in the future. Any "Reserved" parameter is set to "0" or " " (space) as of now; do not check or otherwise operate this value.

Table 14: Analysis Data (Research) Format

Parameter	No. of characters	Description
Text Distinction Code I	1	“D” (Fixed)
Text Distinction Code II	1	“5” (Fixed)
Sample Distinction Code	1	“U” (Fixed)
Data Length	6	The number of bytes for WBC-N and subsequent parameters is assigned. Fixed to “000995”.
Reserved	1	“0”s are set to fill the specified number of characters.
WBC-N	6	(XXXXXF) $[\times 10 / \mu\text{L}]$
WBC-D	6	(XXXXXF) $[\times 10 / \mu\text{L}]$
NEUT#&	6	(XXXXXF) $[\times 10 / \mu\text{L}]$
NEUT%&	5	(XXXXF) $[\times 10^{(-1)} \text{ \%}]$
LYMP#&	6	(XXXXXF) $[\times 10 / \mu\text{L}]$
LYMP%&	5	(XXXXF) $[\times 10^{(-1)} \text{ \%}]$
HFLC#	6	(XXXXXF) $[\times 10 / \mu\text{L}]$
HFLC%	5	(XXXXF) $[\times 10^{(-1)} \text{ \%}]$
PLT-F2	6	(XXXXXF) $[\times 10^2 / \mu\text{L}]$
Reserved	5	“0”s are set to fill the specified number of characters.
WBC-P	6	(XXXXXF) $[\times 10 / \mu\text{L}]$
HGB-O	5	(XXXXF) $[\text{g/L}] * [10^{(-1)} \text{ mmol/L}]$ in SI units $* [10^{(-1)} \text{ g/L}]$ in HGB2 units (only when XN-21/XN-11 is connected)
RBC-O	5	(XXXXF) $[\times 10^4 / \mu\text{L}]$
PLT-O	5	(XXXXF) $[\times 10^3 / \mu\text{L}]$
PLT-I	5	(XXXXF) $[\times 10^3 / \mu\text{L}]$
PLT-F	5	(XXXXF) $[\times 10^3 / \mu\text{L}]$
TNC-N	6	(XXXXXF) $[\times 10 / \mu\text{L}]$
TNC-D	6	(XXXXXF) $[\times 10 / \mu\text{L}]$
TNC-P	6	(XXXXXF) $[\times 10 / \mu\text{L}]$
HPC%	5	(XXXXF) $[\times 10^{(-2)} \text{ \%}]$
Reserved	2	“0”s are set to fill the specified number of characters.
FRC#	5	(XXXXF) $[\times 10^2 / \mu\text{L}]$
FRC%	5	(XXXXF) $[\times 10^{(-2)} \text{ \%}]$
RBC-He	5	(XXXXF) $[\times 10^{(-1)} \text{ pg}] * [\text{amol}]$ in SI units
Delta-He	6	(Δ XXXXF) $[\times 10^{(-1)} \text{ pg}] * [\text{amol}]$ in SI units Δ represents a sign. “-” (2Dh) is output for a negative value, and “0” (30h) for a positive value. XXXX represent the absolute value of the data, right-aligned with zero padding. F represents a flag.
RET-Y	5	(XXXXF) $[\times 10^{(-1)} \text{ ch}]$
RET-RBC-Y	5	(XXXXF) $[\times 10^{(-1)} \text{ ch}]$
IRF-Y	5	(XXXXF) $[\times 10^{(-1)} \text{ ch}]$
RPI	5	(XXXXF) No unit
HYP0-He	5	(XXXXF) $[\times 10^{(-1)} \text{ \%}]$
HYP0R-He	5	(XXXXF) $[\times 10^{(-1)} \text{ \%}]$
MicroR	5	(XXXXF) $[\times 10^{(-1)} \text{ \%}]$
MacroR	5	(XXXXF) $[\times 10^{(-1)} \text{ \%}]$
H-IPF	5	(XXXXF) $[\times 10^{(-1)} \text{ \%}]$
IPF#	5	(XXXXF) $[\times 10^2 / \mu\text{L}]$
TNC	6	(XXXXXF) $[\times 10 / \mu\text{L}]$
RET-UPP	5	(XXXXF) No unit

RET-TNC	5	(XXXXF) No unit
Reserved	6	“0”s are set to fill the specified number of characters.
Reserved	5	“0”s are set to fill the specified number of characters.
Reserved	5	“0”s are set to fill the specified number of characters.
Reserved	5	“0”s are set to fill the specified number of characters.
Reserved	5	“0”s are set to fill the specified number of characters.
Reserved	5	“0”s are set to fill the specified number of characters.
Reserved	5	“0”s are set to fill the specified number of characters.
Reserved	5	“0”s are set to fill the specified number of characters.
LYMPH%	5	(XXXXF) $[\times 10^{(-1)} \text{ \%}]$ * The value “LYMPH%” displayed in the IPU’s Laboratory-Use-Only tab is output.
MONO%	5	(XXXXF) $[\times 10^{(-1)} \text{ \%}]$ * The value “MONO%” displayed in the IPU’s Laboratory-Use-Only tab is output.
NEUT%	5	(XXXXF) $[\times 10^{(-1)} \text{ \%}]$ * The value “NEUT%” displayed in the IPU’s Laboratory-Use-Only tab is output.
EO%	5	(XXXXF) $[\times 10^{(-1)} \text{ \%}]$ * The value “EO%” displayed in the IPU’s Laboratory-Use-Only tab is output.
BASO%	5	(XXXXF) $[\times 10^{(-1)} \text{ \%}]$ * The value “BASO%” displayed in the IPU’s Laboratory-Use-Only tab is output.
LYMPH#	6	(XXXXXF) $[\times 10 / \mu\text{L}]$ * The value “LYMPH#” displayed in the IPU’s Laboratory-Use-Only tab is output.
MONO#	6	(XXXXXF) $[\times 10 / \mu\text{L}]$ * The value “MONO#” displayed in the IPU’s Laboratory-Use-Only tab is output.
NEUT#	6	(XXXXXF) $[\times 10 / \mu\text{L}]$ * The value “NEUT#” displayed in the IPU’s Laboratory-Use-Only tab is output.
EO#	6	(XXXXXF) $[\times 10 / \mu\text{L}]$ * The value “EO#” displayed in the IPU’s Laboratory-Use-Only tab is output.
BASO#	6	(XXXXXF) $[\times 10 / \mu\text{L}]$ * The value “BASO#” displayed in the IPU’s Laboratory-Use-Only tab is output.
Reserved	5	“0”s are set to fill the specified number of characters.
Reserved	5	“0”s are set to fill the specified number of characters.
PDW	5	(XXXXF) $[\times 10^{(-1)} \text{ fL}]$ * The value “PDW” displayed in the IPU’s Laboratory-Use-Only tab is output.
Reserved	5	“0”s are set to fill the specified number of characters.
P-LCR	5	(XXXXF) $[\times 10^{(-1)} \text{ \%}]$ * The value “P-LCR” displayed in the IPU’s Laboratory-Use-Only tab is output.
Reserved	5	“0”s are set to fill the specified number of characters.
Reserved	5	“0”s are set to fill the specified number of characters.
Reserved	5	“0”s are set to fill the specified number of characters.
LFR	5	(XXXXF) $[\times 10^{(-1)} \text{ \%}]$ * The value “LFR” displayed in the IPU’s Laboratory-Use-Only tab is output.
MFR	5	(XXXXF) $[\times 10^{(-1)} \text{ \%}]$ * The value “MFR” displayed in the IPU’s Laboratory-Use-Only tab is output.
HFR	5	(XXXXF) $[\times 10^{(-1)} \text{ \%}]$ * The value “HFR” displayed in the IPU’s Laboratory-Use-Only tab is output.
PCT	5	(XXXXF) $[\times 10^{(-2)} \text{ \%}]$ * The value “PCT” displayed in the IPU’s Laboratory-Use-Only tab is output.
Reserved	6	“0”s are set to fill the specified number of characters.
Reserved	6	“0”s are set to fill the specified number of characters.
IG#	6	(XXXXXF) $[\times 10 / \mu\text{L}]$ * The value “IG#” displayed in the IPU’s Laboratory-Use-Only tab is output.
IG%	5	(XXXXF) $[\times 10^{(-1)} \text{ \%}]$ * The value “IG%” displayed in the IPU’s Laboratory-Use-Only tab is output.
Reserved	6	“0”s are set to fill the specified number of characters.

Reserved	5	“0”s are set to fill the specified number of characters.
Reserved	5	“0”s are set to fill the specified number of characters.
Reserved	4	“0”s are set to fill the specified number of characters.
HF-BF#	7	(XXXXXXF) [/ μ L]
HF-BF%	5	(XXXXF) [$\times 10^{(-1)}$ /100WBC]
NE-BF#	7	(XXXXXXF) [/ μ L]
NE-BF%	5	(XXXXF) [$\times 10^{(-1)}$ %]
LY-BF#	7	(XXXXXXF) [/ μ L]
LY-BF%	5	(XXXXF) [$\times 10^{(-1)}$ %]
MO-BF#	7	(XXXXXXF) [/ μ L]
MO-BF%	5	(XXXXF) [$\times 10^{(-1)}$ %]
EO-BF#	7	(XXXXXXF) [/ μ L]
EO-BF%	5	(XXXXF) [$\times 10^{(-1)}$ %]
RBC-BF2	7	(XXXXXXF) [$\times 10^2$ / μ L]
Reserved	7	“0”s are set to fill the specified number of characters.
Reserved	6	“0”s are set to fill the specified number of characters.
Reserved	7	“0”s are set to fill the specified number of characters.
Reserved	5	“0”s are set to fill the specified number of characters.
Reserved	7	“0”s are set to fill the specified number of characters.
Reserved	5	“0”s are set to fill the specified number of characters.
TC-BF#	7	(XXXXXXF) [/ μ L]
Reserved	88	“0”s are set to fill the specified number of characters.
NE-SSC	5	(XXXXF) [$\times 10^{(-1)}$ ch]
NE-SFL	5	(XXXXF) [$\times 10^{(-1)}$ ch]
NE-FCS	5	(XXXXF) [$\times 10^{(-1)}$ ch]
BA-N#	6	(XXXXXXF) [$\times 10$ / μ L]
BA-N%	5	(XXXXF) [$\times 10^{(-1)}$ %]
BA-D#	6	(XXXXXXF) [$\times 10$ / μ L]
BA-D%	5	(XXXXF) [$\times 10^{(-1)}$ %]
LY-X	5	(XXXXF) [$\times 10^{(-1)}$ ch]
LY-Y	5	(XXXXF) [$\times 10^{(-1)}$ ch]
LY-Z	5	(XXXXF) [$\times 10^{(-1)}$ ch]
MO-X	5	(XXXXF) [$\times 10^{(-1)}$ ch]
MO-Y	5	(XXXXF) [$\times 10^{(-1)}$ ch]
MO-Z	5	(XXXXF) [$\times 10^{(-1)}$ ch]
NE-WX	5	(XXXXF) No unit
NE-WY	5	(XXXXF) No unit
NE-WZ	5	(XXXXF) No unit
LY-WX	5	(XXXXF) No unit
LY-WY	5	(XXXXF) No unit
LY-WZ	5	(XXXXF) No unit
MO-WX	5	(XXXXF) No unit
MO-WY	5	(XXXXF) No unit
MO-WZ	5	(XXXXF) No unit
Reserved	87	“0”s are set to fill the specified number of characters.
Reserved	199	“0”s are set to fill the specified number of characters.
Total	1005	

5.3.3.2. Particle Size Distribution Data (Research) Format

(1) Order of transmission

Parameters in the table are sent from top to bottom; the most significant digit first and the least significant digit last.

(2) Reserved

The “Reserved” parameter is currently not used, but will possibly be used in the future. Any “Reserved” parameter is set to “0” or “ ” (space) as of now; do not check or otherwise operate this value.

Table 15: RBC (FSC) Particle Size Distribution Data Format

Parameter	No. of characters	Description
Text Distinction Code I	1	“D” (Fixed)
Text Distinction Code II	1	“6” (Fixed)
Sample Distinction Code	1	“U” (Fixed)
Data Format	3	Fixed to “△SE” (the symbol △ represents a space (20h)). The value is right-aligned with space padding.
Data Item Name	10	Indicates the type of particle size distribution data. Fixed to “RBCYDISCRI”.
Data X-axis Size	3	Indicates the data count in the X-axis (horizontal) direction. The data count for RBC (FSC) particle distribution is 64, and thus this parameter is fixed to “△64” (the symbol △ represents a space (20h)). Data values are assigned to “DISCRI 1” through “DISCRI 64”. The value is right-aligned with space padding.
Data Y-axis Size	3	Indicates the maximum data value in the Y-axis (vertical) direction, that is, the maximum value in the data assigned to “DISCRI 1” through “DISCRI 64”. The value is right-aligned with space padding.
Data Length	6	The number of bytes for LOWER DISCRI and subsequent parameters is assigned. Fixed to “000268” for WBC (FSC) particle size distribution.
Reserved	1	“0”s are set to fill the specified number of characters.
LOWER DISCRI	4	Indicates the LSc discrete position. The output value is right-aligned with zero padding.
UPPER DISCRI	4	Indicates the HSc discrete position. The output value is right-aligned with zero padding.
RATIO (dividing ratio)	4	Indicates the ratio for normalization. Data at discrete positions “DISCRI 1” to “DISCRI 64” multiplied by Ratio equals to the particle size distribution data. The value is right-aligned with zero padding.
DISCRI 1	4	Indicates the frequency of DISCRI 1. The value is right-aligned with zero padding.
DISCRI 2	4	Indicates the frequency of DISCRI 2. The value is right-aligned with zero padding.
· · ·	240	· ...omitted... ·
DISCRI 63	4	Indicates the frequency of DISCRI 63. The value is right-aligned with zero padding.
DISCRI 64	4	Indicates the frequency of DISCRI 64. The value is right-aligned with zero padding.
Total	297	

Table 16: WDF (FSC) Particle Size Distribution Data Format

Parameter	No. of characters	Description
Text Distinction Code I	1	“D” (Fixed)
Text Distinction Code II	1	“7” (Fixed)
Sample Distinction Code	1	“U” (Fixed)
Data Format	3	Fixed to “△SE” (the symbol △ represents a space (20h)). The value is right-aligned with space padding.
Data Item Name	10	Indicates the type of particle size distribution data. Fixed to “WDFYDISCRI” (the symbol △ represents a space (20h)).
Data X-axis Size	3	Indicates the data count in the X-axis (horizontal) direction. The data count for WDF (FSC) particle distribution is 64, and thus this parameter is fixed to “△64” (the symbol △ represents a space (20h)). Data values are assigned to “DISCRI 1” through “DISCRI 64”. The value is right-aligned with space padding.
Data Y-axis Size	3	Indicates the maximum data value in the Y-axis (vertical) direction, that is, the maximum value in the data assigned to “DISCRI 1” through “DISCRI 64”. The value is right-aligned with space padding.
Data Length	6	The number of bytes for LOWER DISCRI and subsequent parameters is assigned. Fixed to “000268” for WDF (FSC) particle size distribution.
Reserved	1	“0”s are set to fill the specified number of characters.
LOWER DISCRI	4	Indicates the lower discrete limit position. For example, LOWER DISCRI value “5” means the lower discrete limit is positioned at DISCRI 5. The value is right-aligned with zero padding.
UPPER DISCRI	4	Indicates the upper discrete limit position. For example, UPPER DISCRI value “25” means the upper discrete limit is positioned at DISCRI 25. The value is right-aligned with zero padding.
RATIO (dividing ratio)	4	Indicates the ratio for normalization. Data at discrete positions “DISCRI 1” to “DISCRI 64” multiplied by Ratio equals to the particle size distribution data. The value is right-aligned with zero padding.
DISCRI 1	4	Indicates the frequency of DISCRI 1. The value is right-aligned with zero padding.
DISCRI 2	4	Indicates the frequency of DISCRI 2. The value is right-aligned with zero padding.
· · ·	240	· ...omitted... ·
DISCRI 63	4	Indicates the frequency of DISCRI 63. The value is right-aligned with zero padding.
DISCRI 64	4	Indicates the frequency of DISCRI 64. The value is right-aligned with zero padding.
Total	297	

5.3.3.3.Scattergram Data (Research) Format

(1) Order of transmission

Parameters in the table are sent from top to bottom; the most significant digit first and the least significant digit last.

Table 17: Scattergram Data Format

Parameter	No. of characters	Description
Text Distinction Code	3	One of the following scattergram types is assigned: “D5G”: PLT-O “D6G”: RET-EXT “D8G”: WDF-EXT
Data Format	3	Fixed to “△SE”.
Data Item Name	10	Indicates the name of the scattergram. One of the following names is assigned depending on the scattergram type (the symbol △ represents a space (20h)). The value is left-aligned with space padding. “PLT-O△SCAT” “RET-E△SCAT” “WDF-E△SCAT”
Data X-axis Size	3	Indicates the scattergram size in the X-axis direction. Fixed to “256”.
Data Y-axis Size	3	Indicates the scattergram size in the Y-axis direction. Fixed to “256”.
Data Length	6	Indicates the size of the data section in the scattergram. If there is no scattergram, “000000” is assigned. The value is right-aligned with zero padding. “000000” – “032768”
Scattergram Compression Info	1	Indicates whether the scattergram is compressed (Run-Length and Huffman). (See Appendix A “Specifications for Scattergrams Compression” for decompressing scattergrams.) “0”: Not compressed, “1”: Compressed If there is no scattergram, “0” is assigned.
Scattergram Data	0 – 32,768	The scattergram data is converted to ASCII code text before output. (See Appendix A “Specifications for Scattergrams Compression” for information about scattergram data including converting into ASCII text.) If there is no scattergram data, the data size is regarded as “0”.
Total	29 – 32,797	

5.3.3.4. Analysis Data (Service) Format

(1) Order of transmission

Parameters in the table are sent from top to bottom; the most significant digit first and the least significant digit last.

(2) Decimal point

Output data does not include decimal points; instead values displayed on the IPU screen are expressed in the units shown in the Remarks column in the format table. If necessary, convert the units on the host computer.

(3) Abnormal data or non-analyzed items

A data value displayed as “----” or “++++” is output in the “*0000” format (an asterisk (*) is assigned to the most significant digit and 0s to the remaining digits; the number of “0”s is the specified number of “characters minus 1”).

For any item which is not analyzed, spaces (20h) filling the specified number of characters are output without zero padding.

(4) Reserved

The “Reserved” parameter is currently not used, but will possibly be used in the future. Any “Reserved” parameter is set to “0” or “ ” (space) as of now; do not check or otherwise operate this value.

Table 18: Analysis Data (Service) Format

Parameter	No. of characters	Description
Text Distinction Code I	1	“D” (Fixed)
Text Distinction Code II	1	“S” (Fixed)
Sample Distinction Code	1	“U” (Fixed)
Data Length	6	The number of bytes for R-MFV and subsequent parameters is assigned. Fixed to “000597”.
Reserved	1	“0”s are set to fill the specified number of characters.
HGB-BLANK	5	(XXXXX) No unit
HGB-SAMPLE	5	(XXXXX) No unit
R-MFV	4	(XXXX) [$\times 10^{(-1)}$ fL]
S-RBC	4	(XXXX) [$\times 10^4$ / μ L]
S-MCV	4	(XXXX) [$\times 10^{(-1)}$ fL]
L-RBC	4	(XXXX) [$\times 10^4$ / μ L]
L-MCV	4	(XXXX) [$\times 10^{(-1)}$ fL]
P-MFV	4	(XXXX) [$\times 10^{(-1)}$ fL]
WNR-X	4	(XXXX) [$\times 10^{(-1)}$ ch]
WNR-Y	4	(XXXX) [$\times 10^{(-1)}$ ch]
WNR-Z	4	(XXXX) [$\times 10^{(-1)}$ ch]
WNR-WX	4	(XXXX) No unit
WNR-WY	4	(XXXX) No unit
WDF-X	4	(XXXX) [$\times 10^{(-1)}$ ch]
WDF-Y	4	(XXXX) [$\times 10^{(-1)}$ ch]
WDF-Z	4	(XXXX) [$\times 10^{(-1)}$ ch]
WDF-WX	4	(XXXX) No unit
WDF-WY	4	(XXXX) No unit

WBC-FX	4	(XXXX)	[$\times 10^{-1}$ ch]
DLT-WBCD	4	(XXXX)	[$\times 10^{-2}$]
WPC-X	4	(XXXX)	[$\times 10^{-1}$ ch]
WPC-Y	4	(XXXX)	[$\times 10^{-1}$ ch]
WPC-Z	4	(XXXX)	[$\times 10^{-1}$ ch]
DLT-WBCP	4	(XXXX)	[$\times 10^{-2}$]
WPC-AREA1#	5	(XXXXX)	No unit
WPC-AREA2#	5	(XXXXX)	No unit
WPC-AREA3#	5	(XXXXX)	No unit
RET-RBC-X	4	(XXXX)	[$\times 10^{-1}$ ch]
RET-X	4	(XXXX)	[$\times 10^{-1}$ ch]
RET-RBC-Z	4	(XXXX)	[$\times 10^{-1}$ ch]
RET-RBC-WX	4	(XXXX)	No unit
RET-RBC-WY	4	(XXXX)	No unit
DLT-RBC	4	(XXXX)	[$\times 10^{-2}$]
DLT-PLTO	4	(XXXX)	[$\times 10^{-2}$]
Unclassified	4	(XXXX)	No unit
PLT-F-AREA1#	5	(XXXXX)	No unit
PLT-F-X	4	(XXXX)	[$\times 10^{-1}$ ch]
PLT-F-Y	4	(XXXX)	[$\times 10^{-1}$ ch]
PLT-F-Z	4	(XXXX)	[$\times 10^{-1}$ ch]
PLT-F-RBC-X	4	(XXXX)	[$\times 10^{-1}$ ch]
PLT-F-RBC-Y	4	(XXXX)	[$\times 10^{-1}$ ch]
PLT-F-RBC-Z	4	(XXXX)	[$\times 10^{-1}$ ch]
PLT-F-RBC-WX	4	(XXXX)	No unit
PLT-F-RBC-WY	4	(XXXX)	No unit
DLT-PLT-F	4	(XXXX)	[$\times 10^{-2}$]
NRBC-1%	5	(XXXXX)	[$\times 10^{-1}$ /100WBC]
NRBC-2%	5	(XXXXX)	[$\times 10^{-1}$ /100WBC]
Reserved	3	“0”s are set to fill the specified number of characters.	
WBC-N2	6	(XXXXXX)	[μ L]
TNC-N2	6	(XXXXXX)	[μ L]
WBC-D2	6	(XXXXXX)	[μ L]
TNC-D2	6	(XXXXXX)	[μ L]
WBC-P2	6	(XXXXXX)	[μ L]
TNC-P2	6	(XXXXXX)	[μ L]
HGB_NONSI	4	(XXXX)	[g/L]
HGB_SI	4	(XXXX)	[10^{-1} mmol/L]
HGB_SI2	4	(XXXX)	[10^{-2} mmol/L]
WNR_TOTAL_COUNT	8	(XXXXXXXX)	No unit
WDF_TOTAL_COUNT	6	(XXXXXX)	No unit
WDF_PLOT_COUNT	6	(XXXXXX)	No unit
WPC_TOTAL_COUNT	8	(XXXXXXXX)	No unit
WPC_PLT_COUNT	6	(XXXXXX)	No unit
RET_TOTAL_COUNT	8	(XXXXXXXX)	No unit
PLT-F_SIGNAL_COUNT_A	8	(XXXXXXXX)	No unit
PLT-F_DATA_COUNT_A	6	(XXXXXX)	No unit
PLT-F_PLOT_COUNT_A	6	(XXXXXX)	No unit
PLT-F_PLOT_COUNT_B	6	(XXXXXX)	No unit
AREA-F#	6	(XXXXXX)	No unit
HGB_NONSI2	4	(XXXX)	[$\times 10^{-1}$ g/L]
Reserved	73	“0”s are set to fill the specified number of characters.	
Reserved	5	“0”s are set to fill the specified number of characters.	

Reserved	5	“0”s are set to fill the specified number of characters.
Reserved	5	“0”s are set to fill the specified number of characters.
Reserved	5	“0”s are set to fill the specified number of characters.
LY-BF1#	6	(XXXXXX) [μL]
LY-BF2#	6	(XXXXXX) [μL]
MO-BF1#	6	(XXXXXX) [μL]
MO-BF2#	6	(XXXXXX) [μL]
MO-BF3#	6	(XXXXXX) [μL]
HF-BF1#	6	(XXXXXX) [μL]
HF-BF2#	6	(XXXXXX) [μL]
LY-BF1%	4	(XXXX) [$\times 10^{(-1)}$ %]
LY-BF2%	4	(XXXX) [$\times 10^{(-1)}$ %]
MO-BF1%	4	(XXXX) [$\times 10^{(-1)}$ %]
MO-BF2%	4	(XXXX) [$\times 10^{(-1)}$ %]
MO-BF3%	4	(XXXX) [$\times 10^{(-1)}$ %]
HF-BF1%	4	(XXXX) [$\times 10^{(-1)}$ /100WBC]
HF-BF2%	4	(XXXX) [$\times 10^{(-1)}$ /100WBC]
WPC-GR-X	4	(XXXX) [$\times 10^{(-1)}$ ch]
WPC-GR-Y	4	(XXXX) [$\times 10^{(-1)}$ ch]
WPC-GR-Z	4	(XXXX) [$\times 10^{(-1)}$ ch]
WPC-LY-X	4	(XXXX) [$\times 10^{(-1)}$ ch]
WPC-LY-Y	4	(XXXX) [$\times 10^{(-1)}$ ch]
WPC-LY-Z	4	(XXXX) [$\times 10^{(-1)}$ ch]
WPC-MO-X	4	(XXXX) [$\times 10^{(-1)}$ ch]
WPC-MO-Y	4	(XXXX) [$\times 10^{(-1)}$ ch]
WPC-MO-Z	4	(XXXX) [$\times 10^{(-1)}$ ch]
WPC-LY2-X	4	(XXXX) [$\times 10^{(-1)}$ ch]
WPC-LY2-Z	4	(XXXX) [$\times 10^{(-1)}$ ch]
WPC-SC-X	4	(XXXX) [$\times 10^{(-1)}$ ch]
WPC-SC-Z	4	(XXXX) [$\times 10^{(-1)}$ ch]
WPC-GR#	5	(XXXXX) No unit
WPC-LY#	5	(XXXXX) No unit
WPC-MO#	5	(XXXXX) No unit
WPC-LY2#	5	(XXXXX) No unit
WPC-SC#	5	(XXXXX) No unit
WPC-FL-H1#	5	(XXXXX) No unit
WPC-FL-H2#	5	(XXXXX) No unit
WPC-FL-H3#	5	(XXXXX) No unit
WPC-FL-L1#	5	(XXXXX) No unit
WPC-LC1#	5	(XXXXX) No unit
WPC-LC2#	5	(XXXXX) No unit
Reserved	2	“0”s are set to fill the specified number of characters.
Total	607	

5.3.4. Quality Control Data Format

(1) Order of transmission

Two text blocks “Quality Control Data Format 1” and “Quality Control Data Format 2” are consecutively transmitted. Parameters in the table are sent from top to bottom; the most significant digit first and the least significant digit last.

(2) Decimal point

Numeric values do not include decimal points; instead values displayed on the screen are converted to the units shown in the Remarks column in the format table, and then output the converted values, right-aligned with zero padding. If necessary, convert the units on the host computer.

(3) Abnormal or inapplicable data

Any data value displayed as “----” is output as “0”s filling the specified number of characters. Any value exceeding the number of digits for display is output as “9”s filling the specified number of characters. For any item given no analysis order, spaces (20h) filling the specified number of characters are output without zero padding.

(4) Reserved

The “Reserved” parameter is currently not used, but will possibly be used in the future. Any “Reserved” parameter is set to “0” or “ ” (space) as of now; do not check or otherwise operate this value.

5.3.4.1. Quality Control Data Format 1

Table 19: Quality Control Data Format 1

Parameter	No. of characters	Remarks
STX	1	(02h)
Text Distinction Code I	1	“D” (Fixed)
Text Distinction Code II	1	“1” (Fixed)
Sample Distinction Code	1	“C” (Fixed)
QC File Number	2	The QC file number is assigned. The number consists of single-byte characters, right-aligned with zero padding. For XbarM QC files, one of “X1” – “X5” is assigned.
Date of QC Analysis	8	The format is fixed to “YYYYMMDD”. YYYY: year, MM: month, DD: day (month and date to be zero-padded) Ex.) “20060103” (January 3, 2006)
QC Analysis Time	4	The format is fixed to “HHMM”. HH: hour (24-hour basis: “00” – “23”), MM: minute (“00” – “59”) (hour and minute to be zero-padded) Ex.) “0845” (8 o’clock 45 minutes)
Analyzer Name	10	Indicates the analyzer name for identifying the analyzer. The name consists of alphanumeric characters, right-aligned with space padding. Ex.) “△△△△△XN-10” (The symbol △ represents a space (20h).)
Caret	1	“^” (Fixed)
Analyzer Number	5	Indicates the analyzer number for identifying the analyzer, consisting of 5 alphanumeric characters. Ex.) “11001”
RBC	4	(XXXX) $[\times 10^4 / \mu\text{L}]$
HGB	4	(XXXX) $[\text{g/L}] * [10^{(-1)} \text{ mmol/L}]$ in SI units $* [10^{(-1)} \text{ g/L}]$ in HGB2 units (only when XN-21/XN-11 is connected)
HCT	4	(XXXX) $[\times 10^{(-1)} \text{ \%}]$
MCV	4	(XXXX) $[\times 10^{(-1)} \text{ fL}]$
MCH	4	(XXXX) $[\times 10^{(-1)} \text{ pg}] * [\text{amol}]$ in SI units
MCHC	4	(XXXX) $[\text{g/L}] * [10^{(-1)} \text{ mmol/L}]$ in SI units
RDW-CV	4	(XXXX) $[\times 10^{(-1)} \text{ \%}]$
RDW-SD	4	(XXXX) $[\times 10^{(-1)} \text{ fL}]$
PLT	4	(XXXX) $[\times 10^3 / \mu\text{L}]$
PDW	4	(XXXX) $[\times 10^{(-1)} \text{ fL}]$
MPV	4	(XXXX) $[\times 10^{(-1)} \text{ fL}]$
P-LCR	4	(XXXX) $[\times 10^{(-1)} \text{ \%}]$
PCT	4	(XXXX) $[\times 10^{(-2)} \text{ \%}]$
WBC	5	(XXXXX) $[\times 10 / \mu\text{L}]$
NEUT%	4	(XXXX) $[\times 10^{(-1)} \text{ \%}]$
LYMPH%	4	(XXXX) $[\times 10^{(-1)} \text{ \%}]$
MONO%	4	(XXXX) $[\times 10^{(-1)} \text{ \%}]$
EO%	4	(XXXX) $[\times 10^{(-1)} \text{ \%}]$
BASO%	4	(XXXX) $[\times 10^{(-1)} \text{ \%}]$
NEUT#	5	(XXXXX) $[\times 10 / \mu\text{L}]$
LYMPH#	5	(XXXXX) $[\times 10 / \mu\text{L}]$
MONO#	5	(XXXXX) $[\times 10 / \mu\text{L}]$
EO#	5	(XXXXX) $[\times 10 / \mu\text{L}]$
BASO#	5	(XXXXX) $[\times 10 / \mu\text{L}]$
NRBC%	5	(XXXXX) $[\times 10^{(-1)} / 100\text{WBC}]$
RET#	4	(XXXX) $[\times 10^2 / \mu\text{L}]$

RET%	4	(XXXX)	[$\times 10^{-2}$] %]
HFR	4	(XXXX)	[$\times 10^{-1}$] %]
MFR	4	(XXXX)	[$\times 10^{-1}$] %]
LFR	4	(XXXX)	[$\times 10^{-1}$] %]
IRF	4	(XXXX)	[$\times 10^{-1}$] %]
NRBC#	5	(XXXXX)	[$\times 10$ / μ L]
IG#	5	(XXXXX)	[$\times 10$ / μ L]
IG%	4	(XXXX)	[$\times 10^{-1}$] %]
HPC#	5	(XXXXX)	[/ μ L]
RET-He	4	(XXXX)	[$\times 10^{-1}$] pg] *[amol] in SI units
IPF	4	(XXXX)	[$\times 10^{-1}$] %]
Reserved	5	“0”s are set to fill the specified number of characters.	
Reserved	5	“0”s are set to fill the specified number of characters.	
WBC-D	5	(XXXXX)	[$\times 10$ / μ L]
Reserved	45	“0”s are set to fill the specified number of characters.	
Number of XbarM Batches	2	Indicates the number of samples (batches) per plot in XbarM QC. The number consists of numeric characters, right-aligned with zero padding. If non-XbarM QC data is output, this parameter is set to “0”.	
ETX	1	(03h)	
Total	255		

5.3.4.2. Quality Control Data Format 2

Table 20: Quality Control Data Format 2

Parameter	No. of characters	Remarks
STX	1	(02h)
Text Distinction Code I	1	“D” (Fixed)
Text Distinction Code II	1	“2” (Fixed)
Sample Distinction Code	1	“C” (Fixed)
QC File Number	2	The same “QC File Number” is assigned as the one in the Quality Control Data Format 1.
Date of QC Analysis	8	The same “Date of QC Analysis” is assigned as the one in the Quality Control Data Format 1.
QC Analysis Time	4	The same “QC Analysis Time” is assigned as the one in the Quality Control Data Format 1.
Analyzer Name	10	The same “Analyzer Name” is assigned as the one in the Quality Control Data Format 1.
Caret	1	The same “Caret” is assigned as the one in the Quality Control Data Format 1.
Analyzer Number	5	The same “Analyzer Number” is assigned as the one in the Quality Control Data Format 1.
WNR-X	4	(XXXX) [$\times 10^{-1}$] ch]
WNR-Y	4	(XXXX) [$\times 10^{-1}$] ch]
WDF-X	4	(XXXX) [$\times 10^{-1}$] ch]
WDF-Y	4	(XXXX) [$\times 10^{-1}$] ch]
Reserved	5	“0”s are set to fill the specified number of characters.
Reserved	4	“0”s are set to fill the specified number of characters.
Reserved	4	“0”s are set to fill the specified number of characters.
Reserved	5	“0”s are set to fill the specified number of characters.
Reserved	4	“0”s are set to fill the specified number of characters.
Reserved	4	“0”s are set to fill the specified number of characters.
RBC-O	4	(XXXX) [$\times 10^4$ / μ L]
PLT-O	4	(XXXX) [$\times 10^3$ / μ L]

RET-RBC-X	4	(XXXX)	[$\times 10^{-1}$ ch]
RET-RBC-Y	4	(XXXX)	[$\times 10^{-1}$ ch]
DLT-RBC	4	(XXXX)	[$\times 10^{-2}$]
DLT-PLTO	4	(XXXX)	[$\times 10^{-2}$]
Reserved	4	“0”s are set to fill the specified number of characters.	
Reserved	4	“0”s are set to fill the specified number of characters.	
RET-RBC-WX	4	(XXXX)	No unit
RET-RBC-WY	4	(XXXX)	No unit
WBC-P	5	(XXXXX)	[$\times 10$ / μ L]
WPC-X	4	(XXXX)	[$\times 10^{-1}$ ch]
WPC-Y	4	(XXXX)	[$\times 10^{-1}$ ch]
PLT-F	4	(XXXX)	[$\times 10^3$ / μ L]
PLT-F-X	4	(XXXX)	[$\times 10^{-1}$ ch]
PLT-F-Y	4	(XXXX)	[$\times 10^{-1}$ ch]
WBC-BF	6	(XXXXXX)	[/ μ L]
RBC-BF	5	(XXXXX)	[$\times 10^3$ / μ L]
MN#	6	(XXXXXX)	[/ μ L]
MN%	4	(XXXX)	[$\times 10^{-1}$ %]
PMN#	6	(XXXXXX)	[/ μ L]
PMN%	4	(XXXX)	[$\times 10^{-1}$ %]
TC-BF#	6	(XXXXXX)	[/ μ L]
WNR-Z	4	(XXXX)	[$\times 10^{-1}$ ch]
WDF-Z	4	(XXXX)	[$\times 10^{-1}$ ch]
WPC-Z	4	(XXXX)	[$\times 10^{-1}$ ch]
RET-RBC-Z	4	(XXXX)	[$\times 10^{-1}$ ch]
PLT-F-Z	4	(XXXX)	[$\times 10^{-1}$ ch]
PLT-F-RBC-X	4	(XXXX)	[$\times 10^{-1}$ ch]
PLT-F-RBC-Y	4	(XXXX)	[$\times 10^{-1}$ ch]
Reserved	48	“0”s are set to fill the specified number of characters.	
ETX	1	(03h)	
Total	255		

Table 21: QC Numbers and Corresponding File Numbers

QC No.	QC File No.
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
A	10
B	11
C	12
D	13
E	14
F	15
G	16
H	17
I	18
J	19
K	20
L	21
M	22
N	23
O	24
P	25
Q	26
R	27
S	28
T	29
U	30
V	XbarM-1
W	XBarM-2
X	XBarM-3
Y	XBarM-4
Z	XBarM-5

6. Appendix 1 Specifications for Scattergrams Compression

6.1. Objective

Scattergrams image data is compressed before transmitted from the XN series automated hematology analyzer to the host computer (such as SIS). The host computer has to uncompress the data to obtain desired images. This appendix provides information about decompressing the image data sent from the IPU.

6.2. Process Flow

Figure A-1 shows a flow of scattergram image data from the XN series automated hematology analyzer to the host computer. First the image data is converted from the XN image format to the SE image format. Next, the data goes through Run-Length compression, and then Huffman coding. The compressed and coded binary data is converted to ASCII code text, and then sent to the host computer with a necessary header added. Upon receipt of the text data, the host computer is to convert into binary data, decode and decompress the data, and obtain the image data (in SE image format).

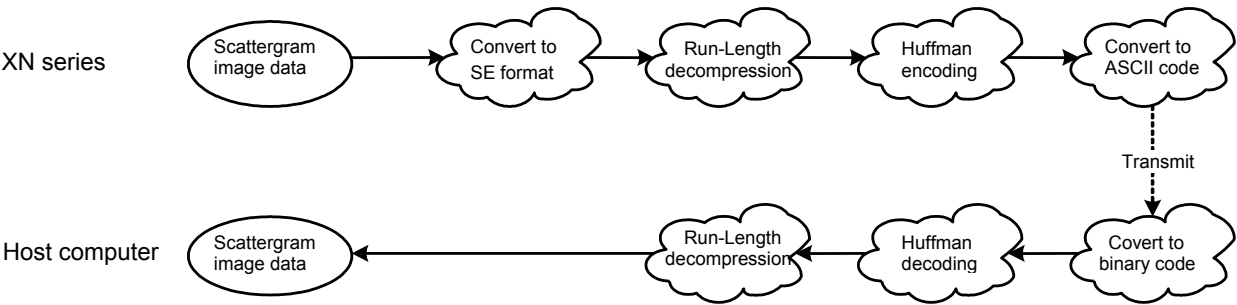


Figure A-1

The resolution of a scattergram is 256 x 256; i.e. a scattergram has 65,536 dots. Each dot of a scattergram image has color information, represented by 4 bits (see Figure A-2). To obtain image data in the same structure as in the sender, prepare an array of unsigned char type consisting of 32,768 elements, and write the decompressed image data into the array so that every one byte is used for 2 dots as shown in Table A-1. Figure A-3 shows the relationship between dot numbers in Table A-1 and the actual image.

To reproduce images in similar color hue to those on the IPU display, use the color palette shown in Table A-2.

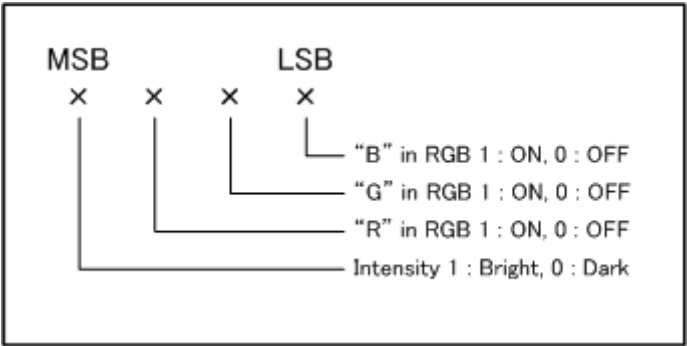


Figure A-2

Address +0000h
Address +0001h
Address +0002h

Table A-1

Dot No. 1 color info	Dot No. 0 color info
Dot No. 3 color info	Dot No. 2 color info
Dot No. 5 color info	Dot No. 4 color info
Dot No. 65535 color info	Dot No. 65534 color info

Address +FFFFh

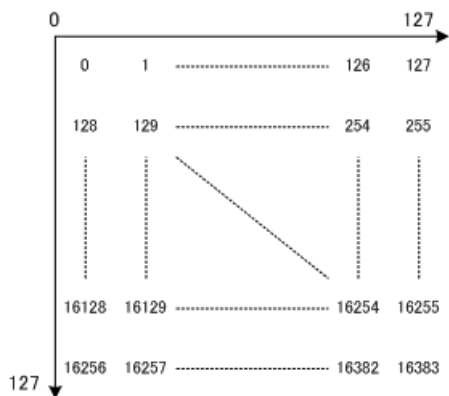


Figure A-3

Table A-2

Color Info		Color	RGB Value		
bin	hex		R	G	B
0000	0	BLACK	0	0	0
0001	1	BLUE	0	0	128
0010	2	GREEN	0	128	0
0011	3	CYAN	0	128	128
0100	4	RED	128	0	0
0101	5	MAGENTA	128	0	128
0110	6	YELLOW	128	128	0
0111	7	WHITE	192	192	192
1000	8	GRAY	128	128	128
1001	9	LIGHT BLUE	0	0	255
1010	A	LIGHT GREEN	0	255	0
1011	B	LIGHT CYAN	0	255	255
1100	C	LIGHT RED	255	0	0
1101	D	LIGHT MAGENTA	255	0	255
1110	E	LIGHT YELLOW	255	255	0
1111	F	LIGHT WHITE	255	255	255

6.3. How to Decompress Image Data

The host computer will receive analysis data according to the Analysis Results Text described in the Online Communication Specifications. The host computer will also import scattergrams data according to the Scattergram Text Data Format described in the Specifications. The Scattergram Compression Info parameter in the format indicates whether the scattergram data is compressed. “1” indicates the data is compressed, and “0” indicates the scattergram data is not compressed. Note that the host computer is required to convert into binary code data irrespective of whether the image data is compressed or not.

6.3.1. Converting to binary code

Scattergrams image data from the IPU is converted to ASCII character codes before transmitted to the host computer. The binary data is divided into units of 4 bits; with each high-order 4-bit unit is given 3. The host computer has to retrieve the low-order 4 bits from every incoming character, and convert them into binary data.

[Steps to convert into binary code]

Step 1.

Retrieve the low-order 4 bits from each incoming character data.

Step 2.

Create binary data so that each byte consists of odd-numbered data in the high-order 4 bits and even-numbered data in the low-order 4 bits, and then write the binary data into a buffer for received data.

Table A-3 shows ASCII characters and their corresponding binary data values (0h – Fh).

Table A-3

ASCII	text	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
	code	30h	31h	32h	33h	34h	35h	36h	37h	38h	39h	3Ah	3Bh	3Ch	3Dh	3Eh	3Fh
Binary		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F

Example: 1? (31h 3Fh) -> 1F

6.3.2. Decompressing

Scattergram images are compressed via Huffman coding and Run-Length compression. Accordingly, the compressed data has to be decompressed in the steps illustrated below.



The compressed data sent from the analyzer is structured as follows:

Header (32 bytes)	Header: Contains data sizes before/after compression and the number of tables generated during Huffman coding (see Table A-4).
Table (7 bytes)	Table: Huffman codes are represented by bit sequences. A table contains a 32-bit code word, a code length indicating how many lower bits are valid codes, and an intermediate code corresponding to the code word. A table appears n times, where n is the number of tables as indicated in the header (see Table A-5).
Table (7 bytes)	
...	
Compressed image data	Byte sequences have to be converted to bit sequences because decompression is performed in units of bit.

Table A-4 Header

Name	Data Type (C language)	Size (byte)	Contents
type	unsigned long	4	Not used (*Note 1)
dsiz	unsigned long	4	Size of decompressed image data
tsiz	unsigned long	4	The number of tables
comprssiz	unsigned long	4	Size of compressed image data
dm[4]	unsigned long	4 x 4	Not used (*Note 1)

Note 1: Currently these areas are not used, filled with 00h.

Table A-5 Table

Name	Data Type (C language)	Size(byte)	Contents
ptn	unsigned long	4	Code word
ptnq	unsigned char	1	Code length (bit)
no	unsigned short	2	Intermediate code (*Note 2)

Note 2: An intermediate code contains binary data for 2 dots (00h - FFh) corresponding to the code word in the low-order byte, and contains a value indicating whether the data is Run-Length compressed (01h: Yes, 00h: No) in the high-order byte.

[Steps to decompress the data]

Step 1. Read the header

The first 32 bytes of the incoming binary data represent the header. Read the parameters of type, dsiz, tsiz, comprssiz, and dm[4] listed in Table A-4, keeping in mind that the byte order is reversed.

The dsiz parameter, for instance, is determined by the 5th through the 8th bytes in the binary data converted from ASCII text, and it should be noted that the 5th byte data comes to the low-order byte and the 8th byte data comes to the high-order byte. For example, 00h 20h 00h 00h turns into 00002000h.

Step 2. Read the table(s)

The subsequent 7 x tsiz (the number of tables) bytes of the binary data represent tables. Read the parameters of ptn, ptnq, and no listed in Table A-5, keeping in mind that the byte order is reversed. Repeat this operation tsiz times to create tables.

Step 3. Decompress the data

- (1) Expand the binary data subsequent to tables into a bit sequence. Placing the retrieved binary data in a line from right to left, process the data from right to left. (See Figure A-4.)

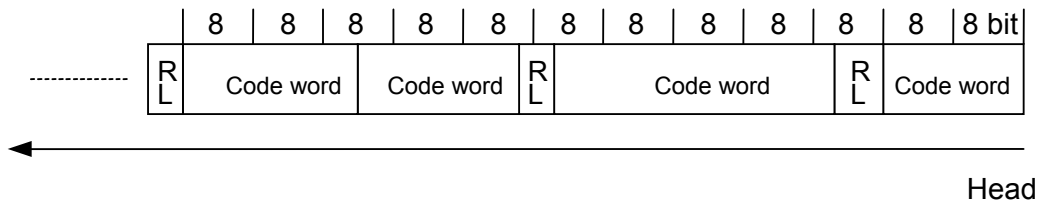


Figure A-4

A code word is a sequence of 0 or 1 forming 1 to 32 bits. The intermediate code corresponding to the code word is determined by reference to the table, in order to find whether Run-Length compression was performed. The high-order byte 0 of an intermediate code means Run-Length compression was not performed and RL is 0 bit. In this case, Run-Length decompression is not needed. If the high-order byte of an intermediate code is 1 (Run-Length compression performed), RL is either 3 or 6 bits depending on the low-order byte (2 dots of image). The RL indicates the number of repetitions. If the low-order byte is “00h”, the number of repetitions is indicated in 6 bits; otherwise the number of repetitions is indicated in 3 bits (See Figure A-5).

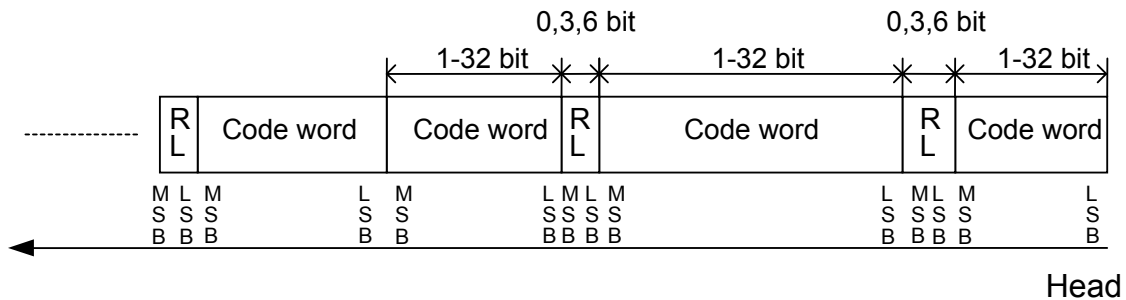


Figure A-5

- (2) Compare the bit sequence from the top with the code word. If the bit pattern matches the code word, obtain actual image dots based on the intermediate code. If the intermediate code indicates “Run-Length performed”, obtain the number of repetitions based on the 3 or 6 bits following the code word. The actual number of repetitions is the read out value plus 1. Obtain the actual 2 dots of an image according to the intermediate code, and then output the dot value n times, where n is the number of repetitions. Even if “Run-Length not performed” is indicated, values of the actual 2 image dots have to be obtained and output according to the intermediate code. It is recommended the obtained image dots should be stored in an array shown in Table A-1.
- (3) Compare the subsequent bit sequence with the code word in the table, obtain the intermediate code, and decompress the Run-Length compressed data if necessary. Repeating these steps retrieves the scattergram image from the compressed data.

6.3.3. Examples of Decompression

The following communication log examples show how scattergram images for the WPC channel on the XN series automated hematology analyzer are decompressed after transmitted to the host computer.

(1) Content of communication log (actual character strings has no carriage returns)

[illegible]

The first 29 bytes including spaces “D3G SEWPC SCAT 2562560004941” is the header inserted during transmission to the host computer. Information indicated by this header includes the format (SE) and the size of the WPC scattergram image data. For more information, refer to “Scattergram Data Format”.

(2) Converting compressed data into binary data

Example: ASCII character codes “1?” (31h 3Fh) -> Binary data 1Fh

```
00000000000200000080000000F70000000000000000000000
0000000000000000010000000100010400000003990002000000
031000060000000401000E0000000411000000000004910018
0000000519000800000000500007DFDFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
3FD2FFFAFEBFFFFF07B4B77FDfCCFF77F59597A4BDF2B2BD3C
6FBE9790DFDD7597BBE24248EE790753DD1DDB1DE809B5817E
17B1D705C45617E97720CDE622B1D745E23B90760762AB8BC4
7720ED0EA4DD497C17697720EF02E2BB48BB8BD8EEA223D585
3DEFBE97FDFFFFFFFFFFFFFFFFFEB
```

(3) Reading the header

The header (the first 32 byte data

“000000000020000008000000F70000000000000000000000000000000000”) is read.

The header content is summarized in Table A-6.

Table A-6

Size(byte)	Contents	Value
4	Not used	00000000h(0)
4	Size of decompressed image data	00002000h (8192) bytes
4	The number of tables	00000008h (8)
4	Size of compressed image data	000000F7h (247) bytes
4 x 4	Not used	00000000h ×4

(4) Reading tables

As the number of tables is 8 and each table size is 7 bytes, the data following the header: “01000000010001”, “04000000039900”, “02000000031000”, “06000000040100”, “0E000000041100”, “00000000049100”, “18000000051900”, and “08000000050000” is read. The content of tables is summarized in Table A-7.

Table A-7

Code word (binary notation)	Code length	Intermediate code (hexadecimal notation)
00000001	1	0100
00000100	3	0099
00000010	3	0010
00000110	4	0001
00001110	4	0011
00000000	4	0091
00011000	5	0019
00001000	5	0000

(The underline portion is significant bits indicated by the code length.)

(5) Decompressing

The data following the tables “7DFDFFFF...” is shown below in a bit sequence, notated in binary format, arranged from right to left, and separated by every byte.

“...11111111 11111111 11111111 11111111 11111101 01111101”

Now start processing from right to left.

The initial bit matches the word code in the first table. The corresponding intermediate code “0100” indicates a dot pattern of “black and black”, Run-Length compressed. If the low-order byte is “00”, the number of repetitions is expressed in 6 bits. Thus the 6 bits starting from the 2nd bit “111110” represent the number of repetitions. As the binary number “111110” is equal to decimal 62, the number of repetitions is 63 (62 plus 1). Next, you will find the bits starting from the 8th bit match the word code “010” in the third table. The corresponding intermediate code “0010” indicates a dot pattern of “blue and black”, which is not Run-Length compressed.

The number “1” repeatedly appears from the 11th bit. This indicates a dot pattern of “black black” (1) appears 64 times (111111), the group of which further appears repeatedly.

In short, the above decompression results in “black and black” dots appearing 63 times, followed by “blue and black” dots, and then “black and black” appearing repeatedly. As the SE format expresses dot patterns in the reverse order, “blue and black” dots are actually displayed in the order of “black and blue”. In the output image (256 x 256 dots), almost all the upper area is black and one blue dot appears at the upper right corner. The whole scattergram image can be obtained by repeating the above steps until the end of the input data is reached.

[end of document]