Fully Automated Immunoanalyzer

μTASwako i30

External communication specifications (V2.0-R01)

Diagnostics Research Laboratories,
Wako Pure Chemical Industries, Ltd.

Change history

Version	Date	Person in charge	Rev.	Details
Provisional version	Dec.11, 2009	Wako, Hayashi	Provisional	First edition

Contents

1. Overview

This communication specification applies to communication connection means and transmission procedures between μTASwako (hereinafter, referred to the instrument) and external data processing system (hereinafter, referred to as the host computer).

2. Purpose

This specification is designed to improve the operability of sample measurement and eliminate confusion of measurement results and samples by using sample barcodes.
Existing commercially available clinical data processing systems vary in scale and specifications, the number of connectable measuring devices and the type of processable data, and cannot be applied to all devices through specific external communication specifications.
Therefore, on this instrument, one of the two communication methods, bidirectional *1 and unidirectional *2, can be selected according to the operation condition in each facilities.
To strengthen the flexibility of installation location of measuring devices, the instrument enables Ethernet (LAN) connection in addition to the ordinary serial communication (RS232C).

*1 Bidirectional communication: An inquiry is issued to the host computer about measurement information based on the sample information (sample barcode, etc.) in this instrument, and the measurement results are reported to the host computer.

*2 Unidirectional communication: Measurement information is input from the operation panel of this instrument, and the measurement results are reported to the host computer.

3. System configuration

For communication with the host computer, the following two connection modes, serial connection and LAN connection, are available.

3.1. Serial connection

The instrument is connected to the host computer through a serial cable (crossing cable) for communication. On the host computer, an application for serial processing shall be prepared.

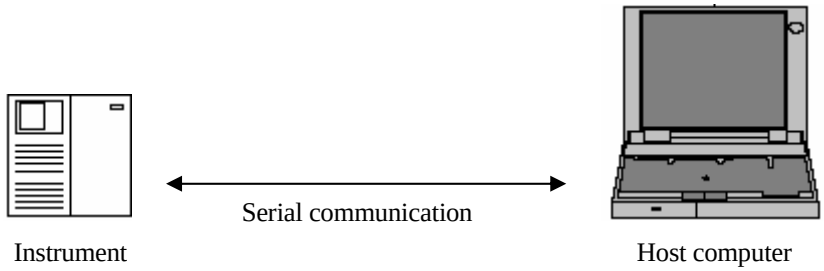


Fig. 3-1 Serial connection

3.2. LAN connection

The instrument is connected to the host computer through a LAN cable (straight, or a crossing cable in the case of direct connection) for communication. On the host computer, an application for LAN communication processing shall be prepared.

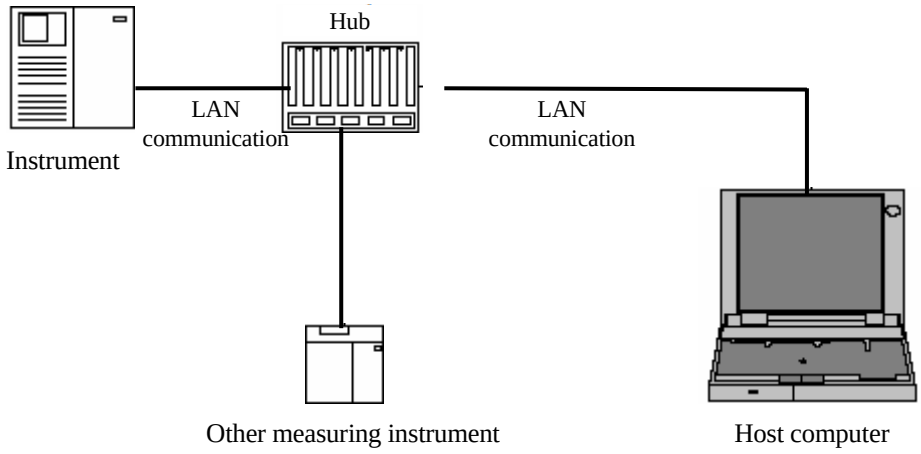


Fig. 3-2 LAN connection

3.3. Connection through LAN adapter (reference)

When the instrument is connected through a LAN adapter, it performs processing in accordance with the serial interface specifications. Since LAN adapters are supplied various manufacturers, we assure the operations in the range of up to the RS232C port of the LAN adapter.

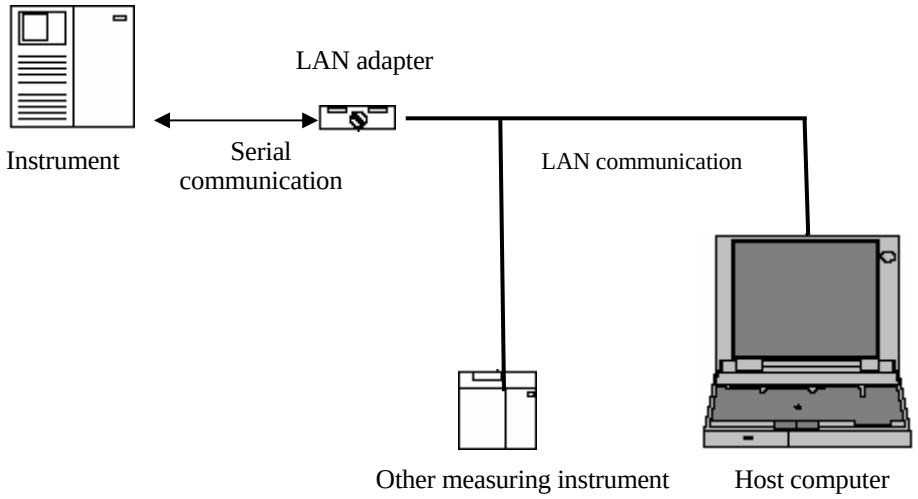


Fig. 3-3 Connection through LAN adapter

4. Serial interface specifications

4.1. Communication specifications

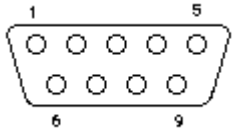
Table 4-1 Serial communication specifications

Item	Setting
Transmission path	RS-232C interface
Synchronization method	Asynchronous method
Transmission speed	4800/9600/**19200bps***
Data bit length	8 bits
Stop bit length	**1** bit/2 bits *
Parity	Provided/**none** *
Flow control	Hardware system (RTS/CTS)
Error detection	BCC (Exclusive OR of all characters except STX)
Connector	D-sub 9-pin

* The settings can be selected by using the communication options on the maintenance screen on the main unit panel. The underlined settings are defaults.

4.2. Connection specifications

On the Instrument, the DTE connector is prepared.



pin	Name of pin on upper stage	Meaning of pin name on upper stage	I/O	pin	Name of pin on lower stage	Meaning of pin name on lower stage	I/O
1	CF(DCD)	Carrier detection	I				
				6	CC(DSR)	Data set ready	I
2	BB(RXD)	Received data	I				
				7	CA(RTS)	Signal request	O
3	BA(TXD)	Transmitted data	O				
				8	CB(CTS)	Transmission enabled	I
4	CD(DTR)	Data terminal ready	O				
				9	CE(RI)	Ring indicator	I
5	AB(GND)	Signal ground					

*I = → computer

*O = ← computer

4.3. Control specifications

4.4. Message transmission sequences

[Normal sequence]

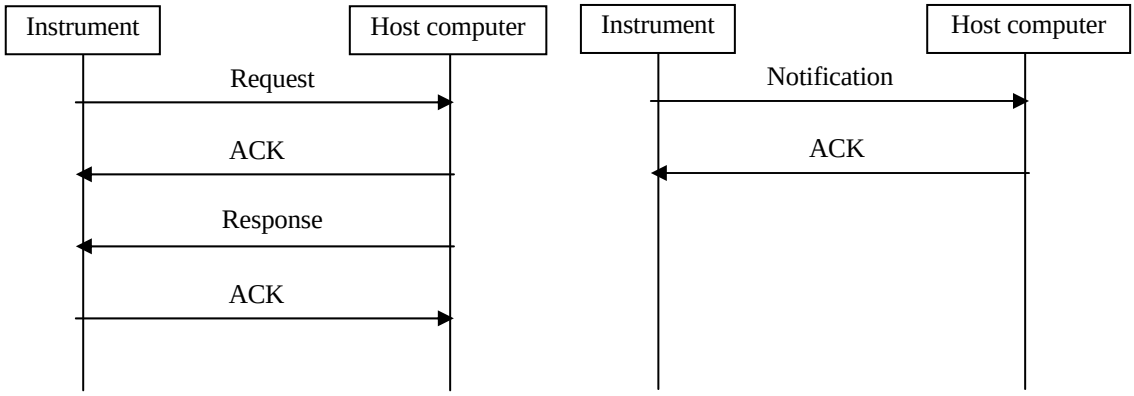


Fig. 4-1 Normal sequence

[Abnormal sequence (request data error)]

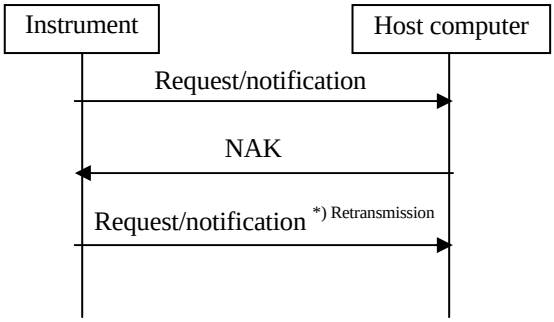


Fig. 4-2 Abnormal sequence (request data error)

[Abnormal sequence (response data error)]

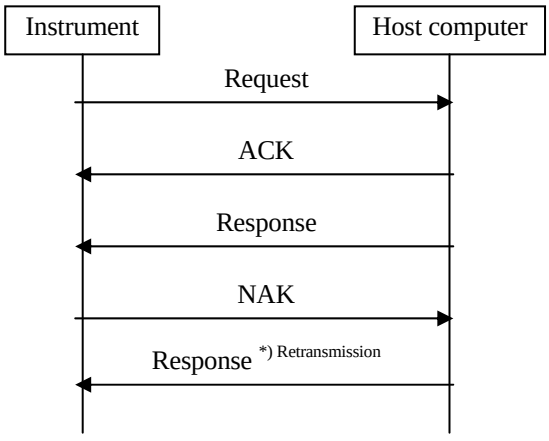
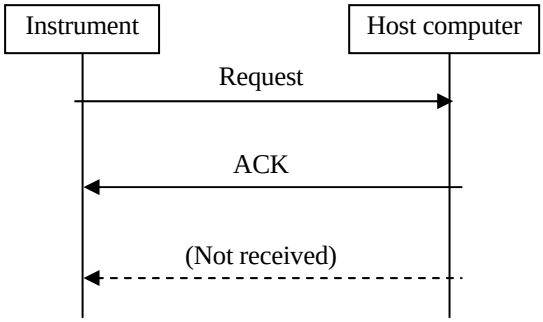


Fig. 4-3 Abnormal sequence (response data error)

[Abnormal sequence (request information command not received)]



Note) If request information has not been received after ACK was received, a retry is not made.

[Abnormal sequence (time-out)]

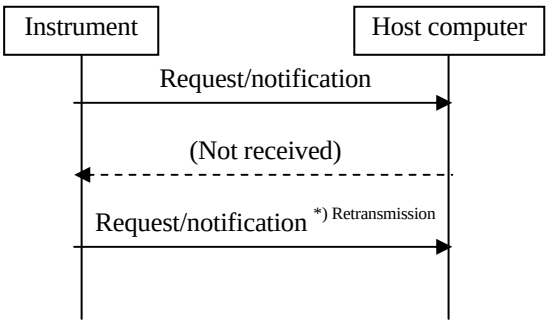


Fig. 4-4 Abnormal sequence (time-out)

4.4.1. Monitoring of transmission time-out

The CTS signal is monitored, and, if the inactive state continues for 5 seconds, the request is cleared.

4.4.2. Monitoring of response receiving time-out

If a response cannot be received for N seconds* after a request command is issued, a retry is made three times*, and the request must be cleared after retry out.

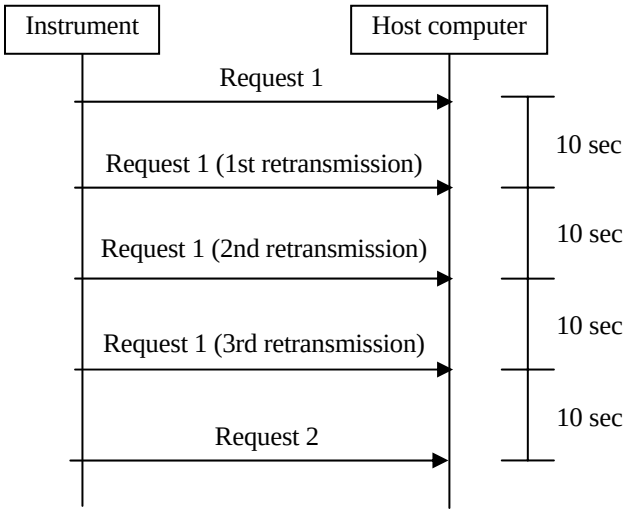


Fig. 4-5 Retransmission sequence

4.4.3. Monitoring of received data

When a request command is received, BCC, format, parameter and command checks are made, and, if any abnormality is found, the relevant data will be discarded, and NAK will be returned to the source. In this case, up to three retries* are made.
If the command is normal, the response data for the request will be returned after ACK is returned. Also when a notification command is received, the command is checked in the same manner (however, no response will be returned after ACK is returned).

* The time-out time, execution of retries and execution of BCC check can be selected in the communication option setting mode on the maintenance screen on the main unit panel. (The following items can be set.)

Communication command option setting

(1) Communication time-out time

Details: The time can be set in the range from 1 to 120 seconds in 1-sec units. (Default: 10 sec)

(2) Communication retry setting

Details: It is possible to determine whether to make retries * or not. (Default: Yes)

* Fixed number of retires: 3

(3) Communication command BCC setting

Details: The BCC field of the communication command is kept, and it is determined whether or not to make a BCC check of the received message on the equipment. (Default: Yes)

5. LAN interface specifications

The equipment establishes TCP/IP communication as a client and a host server.

5.1. Communication specifications

Table 5-1 LAN communication specifications

Item	Setting
Transmission path	Ethernet
Communication method	Communication using TCP/IP (UDP is not supported.)
Transmission speed	10Mbps/100Mbps (10BASE-T/100BASE-TX)
Socket	SOCK_STREAM/PF_INET(IPv4)
Connector	RJ-45
Cable	Category 5

5.2. Control specifications

5.2.1. Connection monitoring

A connection request to the host computer is issued at the following timing (is not issued during equipment initialization). After the completion of processing for each request, the equipment terminates the connection and establishes connection at the next timing of request.

Table 5-2 Connection request timing in each mode

Set mode	Timing
No communication	(None)
Unidirectional	・When measurement results are sent ・When results are re-sent
Bidirectional	・When order information is acquired ・When measurement results are sent ・When results are re-sent
Worksheet (with BCR)	・When the receive button is pressed (when worksheet is acquired) ・When measurement results are sent ・When results are re-sent
Worksheet (without BCR)	・When the receive button is pressed (when worksheet is acquired) ・When measurement results are sent ・When results are re-sent

5.2.2. Connection standby port

The connection standby port of the host computer shall be set as shown below. When the application is started on the host computer, the connection request from µTASwako must be waited at this port.

Table 5-3 Host computer parameter defaults

Parameter	Default
IP address	192.168.1.250
Sub-net mask	255.255.255.0
Port number	40004

5.2.3. Communication procedures

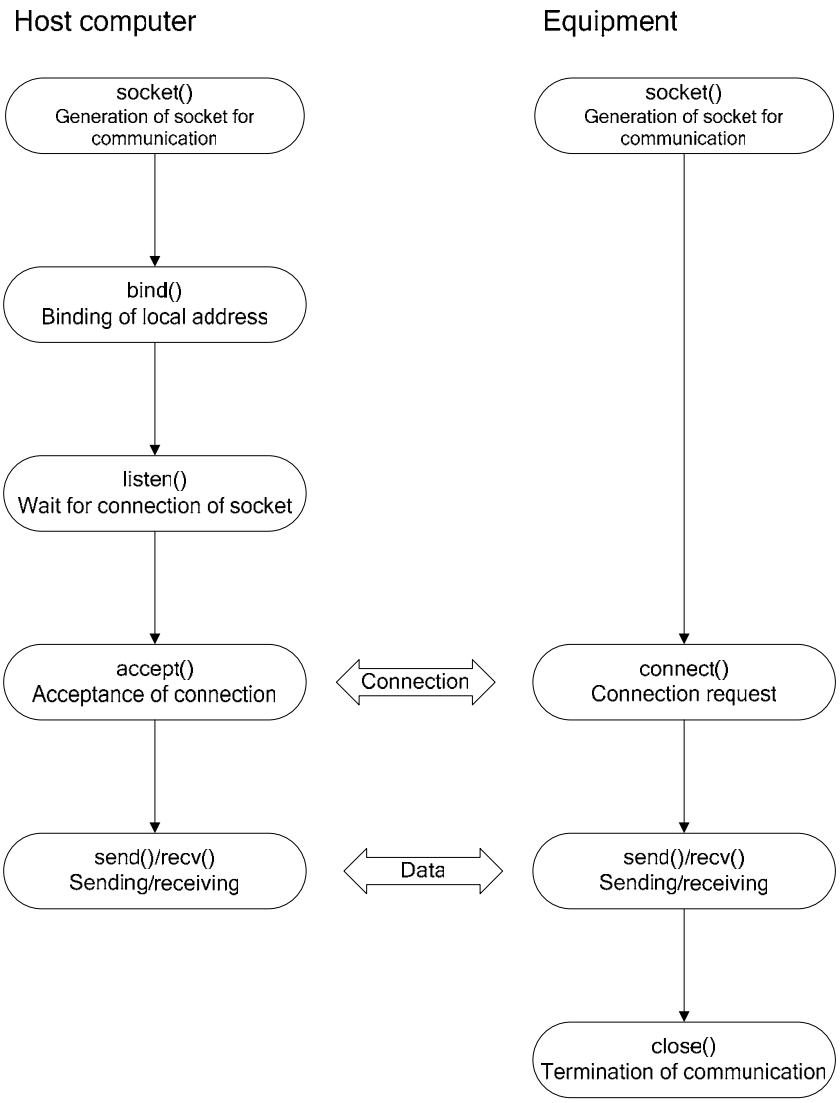


Fig. 5-1 Communication procedures

5.3. Message transmission sequences

[Normal sequence]

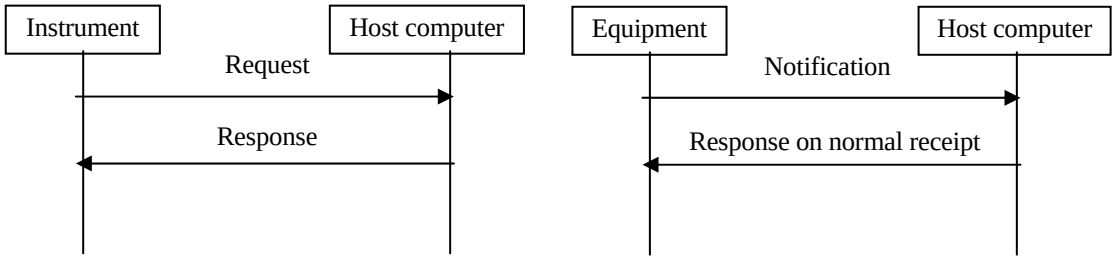


Fig. 5-2 Normal sequence

[Abnormal sequence (request data error)]

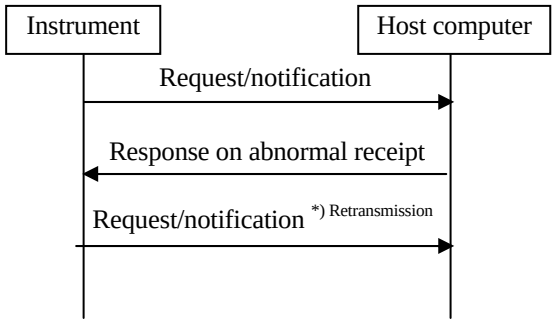


Fig. 5-3 Abnormal sequence (request data error)

[Abnormal sequence (response data error)]

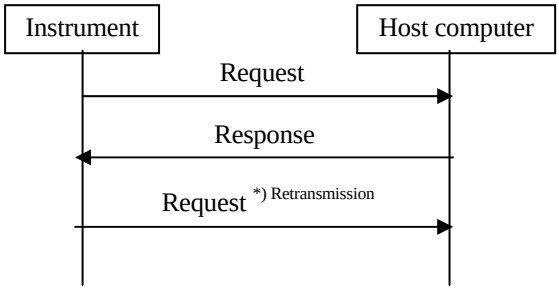
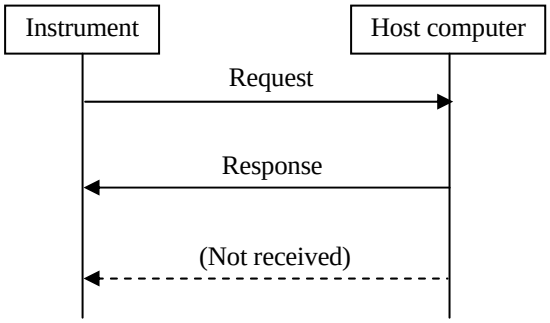


Fig. 5-4 Abnormal sequence (response data error)

[Abnormal sequence (request information command not received)]



Note: If request information has not been received after the response command was received, a retry is not made.

[Abnormal sequence (time-out)]

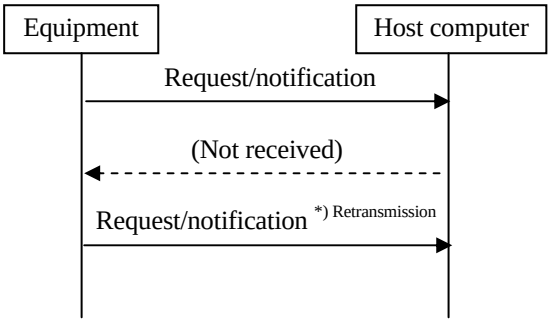


Fig. 5-5 Abnormal sequence (time-out)

5.3.1. Monitoring of response receiving time-out

If a response cannot be received for N seconds* after a request command is issued, a retry is made three times*, and the request must be cleared after retry out.

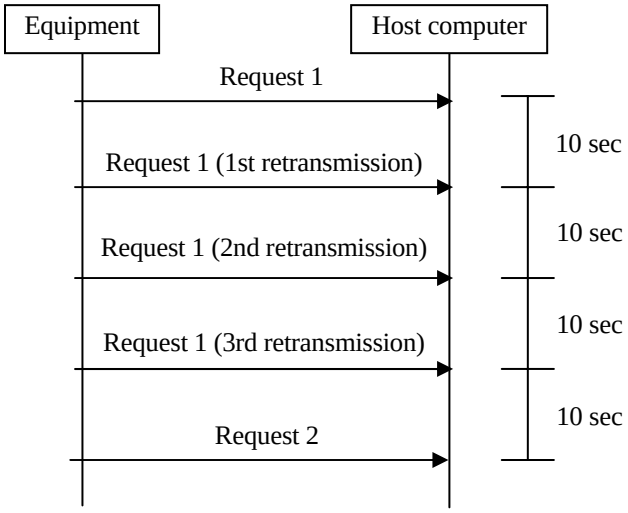


Fig. 5-6 Retransmission sequence

* The time-out time can be selected in the communication option setting mode on the maintenance screen on the main unit panel.

5.3.2. Monitoring of received data

For the LAN interface, ACK/NAK is unnecessary because delivery confirmation is assured on the low-order layer (TCP layer).
If any error is detected when the received data is checked (BCC check, format check, parameter check and command check), the relevant data is discarded, and a response on abnormal receipt is returned to the source. In this case, up to three retires* are made.
If the data is normal, the response data for the request is returned. For notification commands, the checks are made in the same manner.

* The execution of retries can be specified in the communication option setting mode on the maintenance screen on the main unit panel.

6. Specifications for transmitted message format

6.1. Text configuration

6.1.1. Request/notification command

STX(1)	Command division (1)	,	Parameter 1	,	Parameter 2	ETX(1)	BCC(1)

[Common to RS232 and LAN]

- The control codes are as shown below.
  STX: 02H
  ETX: 03H
- Parameters are added as necessary.
- The command division and a parameter and parameters are separated by a comma.
- The numbers in parentheses are byte counts (the length of items without indication of byte count is specified by the command).

6.1.2. Response command

[Serial communication]

- In the case of response on normal receipt, ACK (06H) is returned.
- In the case of response on abnormal receipt, NAK (15H) is returned.

[LAN communication]

STX(1)	Command division (1)	,	Notification parameter (0 or Exxxxx)	ETX(1)	BCC(1)

- In the case of response on normal receipt, the text with '0' (= normal) set in the notification parameter is returned.
- In the case of response on abnormal receipt, the text with an error code 'Exxxxx' (x is an error code) set in the notification parameter is returned.

6.2. Command division and parameters

For the details, see "Detailed specifications for transmitted messages."

6.3. BCC calculation range

The range for BCC calculation is from the command division following STX to ETX. The exclusive OR calculation is performed. The shaded zone in the following figure is used for calculation.

STX	Command division	,	Parameter 1	,	Parameter 2	ETX	BCC

Fig. 6-1 BCC calculation range

Note:

The execution of BCC check can be selected in the communication option setting mode on the maintenance screen on the main unit panel. If "No" is specified for "BCC check," the calculation results are stored in the BCC field in the message transmitted from the equipment to the host computer, and the BCC in the message received from the host computer is not checked and is ignored.

7. Detailed specifications for transmitted messages

Select the communication method (hereinafter, referred to the communication mode) for this equipment from the bidirectional and unidirectional communication modes according to the operating method.
The measurement results are transmitted to the host computer successively (in real time) on a sample by sample basis regardless of the communication mode.
A command for transmitting all measurement results retained in the equipment to the host computer is prepared.

Table 7-1 Communication mode and operating method

Communication mode	Connection mode (method of inquiring for sample information)	Operating method
Bidirectional	Real-time communication (operation with sample BC)	An inquiry about item request information is issued to the host computer based on the information on the sample to be measured (BC information), and measurement is performed.
	Real-time communication (operation without sample BC)	An inquiry about item request information is issued to the host computer based on the information on rack number and sample position in rack, and measurement is performed.
	Worksheet communication (operation with sample BC)	Item request information (= worksheet *) collected in the host computer is read into the equipment before measurement, and measurement is started. The equipment checks the request information on the worksheet based on the sample BC and performs measurement.
	Worksheet communication (operation without sample BC)	Item request information (= worksheet *) collected in the host computer is read into the equipment before measurement, and measurement is started. The operator puts the sample tubes on the sample rack according to the order while seeing the request information on the equipment panel and starts measurement.
Unidirectional	Manual input from operation panel	The operator inputs request information from the operation panel of the equipment and starts measurement.

* Worksheet: Measurement request list containing sample information and measurement items

Note:

Sample barcodes conforming to the following 11 standards (according to the BCR hardware specifications) can be used.

PC-A, UPC-E, EAN(JAN)-13, EAN(JAN)-8, ITF, STF(5BER), NW-7, CODE39, CODE93, CODE128 and EAN128

7.1. Command division

7.1.1. Real-time communication in bidirectional mode

Real-time communication **(inquiry by sample barcode)**			
Request (equipment → host)		**Response (host → equipment)**	
Division	Details	Division	Details
K(0x4B)	Item selection inquiry by sample BC (general sample)	K*	(1) Response on normal/abnormal receipt (2) Return of item selection information (general sample)
E(0x45)	Item selection inquiry by sample BC (urgent sample)	E*	(1) Response about normal/abnormal receipt (2) Return of item selection information (urgent sample)
Real-time communication **(inquiry by rack number and position in rack)**			
Request (equipment → host)		**Response (host → equipment)**	
Division	Details	Division	Details
R(0x52)	Item selection inquiry by rack number and position in rack (general sample)	R*	(1) Response about normal/abnormal receipt (2) Return of item selection information (general sample)
e(0x65) Note) Lower-case characters	Item selection inquiry by rack number and position in rack (urgent sample)	e*	(1) Response about normal/abnormal receipt (2) Return of item selection information (urgent sample)

* The method of responding to the item selection inquiry command in the serial communication and LAN communication modes is stated below.

In the case of serial communication: The host computer must return ACK or NAK to indicate (1) normal or abnormal receipt in response to the item selection inquiry command from the equipment and return the measurement information, (2) item selection information response command, to the equipment.

In the case of LAN communication: The host computer must return the response command shown in Section 6.1.2 to indicate (1) normal or abnormal receipt in response to the item selection inquiry command from the equipment and return the measurement information, (2) item selection information, to the equipment.

Note:
The following functions can be selected as bidirectional mode real-time communication options in the maintenance mode.
(1) Whether or not to make an inquiry about sample information on urgent rack (default: Yes)
(2) Whether or not to transmit measurement data for each rack type
(3) Whether or not to transmit measurement data in the off-line mode (default: Yes)
To specify these options, select Communication setting → Connection setting → Bidirectional in the maintenance mode on the main unit panel.
Operation hierarchy)

Communication setting – Connection setting – Bidirectional (as before)
- – Barcode communication
  - – Yes
  - – No
- – (1) Inquiry about urgent rack
  - – Yes (default)
  - – No
- – (2) Measurement data transmission setting
  - – Urgent rack
    - – Yes (default)
    - – No
  - – QC rack
    - – Yes (default)
    - – No
- – (3) Measurement data in offline mode
  - – Transmit (default)
  - – Not transmit

7.1.2. Worksheet communication in bidirectional mode

Worksheet communication			
Request (equipment → host)		**Response (host → equipment)**	
Division	Details	Division	Details
k(0x6B)	Item selection inquiry (all)	K*	(1) Response about normal/abnormal receipt (2) Return of item selection information (all)

* As stated in 7.1.1, the response to inquiry command and the item selection information must be returned.

7.1.3. Common to bidirectional and unidirectional modes (notification of measurement results)

Measurement results (real-time transmission)			
Notification (equipment → host)		**Response (host → equipment)**	
Division	Details	Division	Details
S(0x53)	Notification of measurement results (general/urgent/re-inspection)	S *	Normal/abnormal
Measurement results (batch transmission)			
Notification (Instrument → host)		**Response (host → Instrument)**	
Division	Details	Division	Details
s(0x73)	Notification of measurement results (general/urgent/re-inspection)	S *	Normal/abnormal

* In the case of serial communication, ACK or NAK must be returned.

7.1.4. Common to bidirectional and unidirectional modes (notification of control measurement results)

Measurement results (real-time transmission)			
Notification (Instrument → host)		**Response (host → Instrument)**	
Q(0x51)	Notification of control measurement results	Q*	Normal/abnormal

* In the case of serial communication, ACK or NAK must be returned.

7.1.5. Common to bidirectional and unidirectional modes (version check command)

Connection status confirmation (-)			
Notification (Instrument → host)		**Response (host → Instrument)**	
V(0x56)	Version check request	V*	Normal/abnormal

* In the case of serial communication, ACK or NAK must be returned.

7.2. Parameter definitions

Table 7-2 Parameter definitions

Name	Description
Processing classification	Processing classification indicated by one alphabetic character
Sample number (PID)	Unique number assigned to each sample by the host computer (barcode number in the case where barcodes are used)
Serial number (SID)	5-digit numbers sequentially assigned by the instrument (00001 to 09999) To urgent samples, 5-digit numbers starting from E are assigned (E0001 to E9999). For controls, 5-digit numbers starting from C are assigned (C0001 to C9999). Note: 5-digit numbers without zero suppression For general samples, add 0 to the first digit.
Rack number	General sample rack numbers (01 to 20) Urgent sample rack numbers (E1 to E5) QC rack numbers (Q1 to Q5) Note) 2-digit numbers without zero suppression
Position number	Number determining the position on a rack (front: 01 to 10) Note) 2-digit numbers without zero suppression
Sample type *1	Serum: 1 (fixed) * Plasma (2), urine (3), whole blood (4) and others (5) are not used.
Measurement item number *2	Numbers corresponding to requested measurement items (00 to 99) Note) 2-digit numbers without zero suppression Note) 00: No relevant item * Only in the bidirectional mode or when there are no worksheets When there are worksheets, 00 cannot be set.
Operator ID	Operator's ID number. When ID is used: 0000 to 9999 When ID is not used: The field shall be filled with spaces (20h). Note) 4-digit numbers without zero suppression
Comments	The comment field can be used freely to input names, numbers, etc. However, the comments are used only for reference and are not used for sample identification.
Dilution ratio	Specify the dilution ratio for the sample to be measured. 1 to 10000 times Note) 5-digit number without zero suppression
Host computer name	Name of the host computer of the instrument. Up to 20 characters Note) When the name is less than 20 characters long, all remaining digits are padded with spaces (20h).
Serial number (Instrument)	Instrument number. Up to 16 characters Note) When the number is less than 16 characters long, all remaining digits are padded with spaces (20h).
Version number	Instrument software version. Up to 8 characters Note) When the number is less than 8 characters long, all remaining digits are padded with spaces (20h).

*1 As the sample type, only the serum (= 1) is subject to measurement. Other types will be handled as "1."

*2 For the sample measurement item numbers, see Table 6.6.

7.3. Definitions of measurement item names and item numbers

For the measurement items and numbers, use the following correspondence table.

Table 7-3 Correspondence between item numbers and names

Item number	Item name	Item number	Item name	Item number	Item name
01	AFP	05	PCT	25	HCCScore1
02	AFP-L3	06	Beta-Glucan	26	HCCScore2
03	PIVKA	* 07 to 24: undefined		* 27 and after: undefined	
04	DCP				

7.4. Details of transmitted messages

7.4.1. Item selection inquiry

Inquiries about measurement items (order, patient information, measurement item numbers, etc.) are issued from the instrument to the host computer.
Note) Inquiries about items of calibration/control measurement or re-inspection are not issued.

7.4.1.1.1. Real-time communication in bidirectional mode "inquiry for sample barcode information"

Inquiries about measurement items are made based on the sample information, sample number (PID), of the sample to be measured (general sample or urgent sample). The classification into general sample and urgent sample is specified by the processing classification code.

Table 7-4 Item selection inquiry based on sample BC

Item	Characters	Size	Description
Header	STX	1	STX: 02h
Processing classification	'K' or 'E'	1	General sample ('K': 4Bh) or Urgent sample ('E': 45h)
Separation	','	1	
Sample number (PID) *1	Numeral	1-13	Sample ID (value read from sample barcode) 1 to 13 numeric characters (variable length)
Delimiter	ETX	1	ETX: 03h
BCC	Numeral	1	

*1 The sample number (PID) is contained in the sample BC information read by the instrument.
If the sample number cannot be read because the sample BC has not been applied or the code is invalid (unsupported standard or length exceeding the number of significant digits), the item selection inquiry is not made.

Note:
Information on rack number and sample position can be added to this command by setting the optional function of the command. This function can be enabled and disabled in the definition file* in the instrument. (Default: Disabled)
* The function will be implemented by our serviceman. For the definition file in the instrument and the format, see Appendix B.

◆ Item selection inquiry (real-time communication) "Information on rack number and sample position"

Item	Characters	Size	Description
Header	STX	1	STX: 02h
Processing classification	'K' or 'E'	1	General sample ('K': 4Bh) or Urgent sample ('E': 45h)
Separation	','	1	
Sample number (PID) *1	Numeral	1-13	Sample ID (value read from sample barcode) 1 to 13 numeric characters (variable length)
Separation	','	1	
Rack number	Numeral	2	General sample: 01 to 20 Urgent sample: E1 to E5
Separation	','	1	
Position number	Numeral	2	01 to 10
Delimiter	ETX	1	ETX: 03h
BCC	Numeral	1	

* When the information on rack number and sample position has been enabled, the field enclosed by a heavy line will be added.

7.4.1.1.2. Real-time communication in bidirectional mode “Inquiry for information on rack number and position in rack”

Inquiries about measurement items are made based on the rack number and the sample position in rack (1 to 10) of the sample to be measured (general sample or urgent sample). In this mode, as in the case of the inquiry for sample barcode information stated above, the classification into general sample and urgent sample is specified by the processing classification code.

Table 7-5 Item selection inquiry based on rack number and position in rack

Item	Characters	Size	Description
Header	STX	1	STX: 02h
Processing classification	‘R’ or ‘e’	1	General sample (‘R’: 52h) or Urgent sample (’e’:65h)
Separation	‘,’	1	
Rack number	Numeral	2	General sample: 01 to 20 Urgent sample: E1 to E5
Separation	‘,’	1	
Position number	Numeral	2	01 to 10
Delimiter	ETX	1	ETX: 03h
BCC	Numeral	1	

Notes:

(1) This command issues an inquiry about the requests for ten samples in the rack when the instrument recognizes rack information.

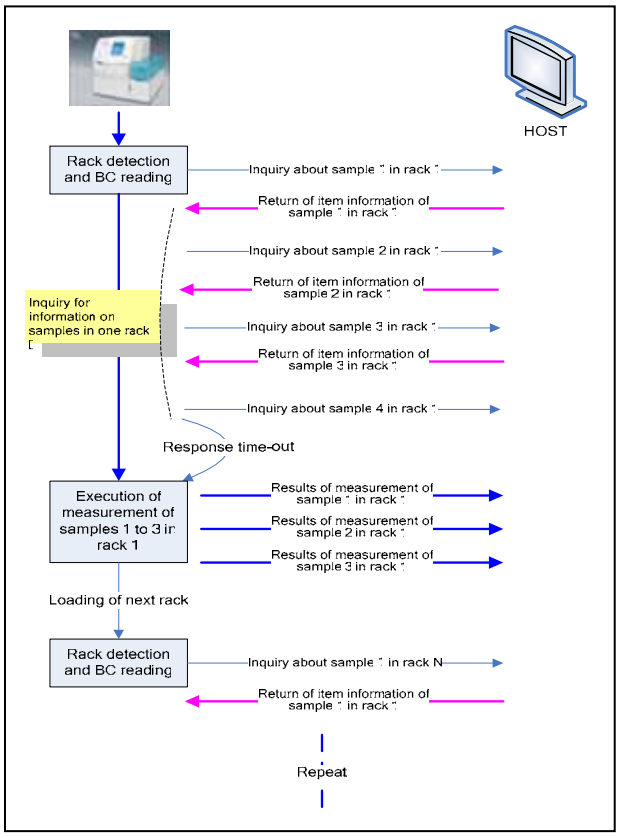
* If order information for the relevant rack number and position in rack is not found, the item selection information response command must be returned with “00” (no relevant item) set in the “selection information 1” field.

* If the response for indicating receipt of command or the response to the item selection information response command is not given during continuous inquiring, the measurement information which has been received will be enabled, and measurement of the samples in the rack will be started.

(2) As an optional function, continuous inquiring about 10 samples in rack or intermittent inquiry about each sample can be selected in the definition file* in the instrument. (Default: Continuous inquiry)

* The function will be implemented by our serviceman. For the definition file in the instrument and the format, see Appendix B.

Example) When the information on measurement of up to sample 3 in rack 1 has been normally received but the response to sample 4 has not been given owing to a time-out, measurement will be started with the measurement request information for samples 1 to 3. Samples 4 and after will be handled as those without measurement order, and re-inquiries will not be made until the next rack is loaded. (See the sequence chart shown left.)



7.4.1.2. Worksheet communication in bidirectional mode

An inquiry for item selection information (worksheet) of unmeasured items is issued to this instrument. Worksheet information on up to 100 samples is acquired.

Table 7-6 Item selection inquiry (batch communication)

Item	Characters	Size	Description
Header	STX	1	STX: 02h
Processing classification	'k'	1	Batch inquiry for request information ('k': 6Bh)
Delimiter	ETX	1	ETX: 03h
BCC	Numeral	1	

Note 1: The information on remaining requests in the instrument is updated to the latest one upon receipt of the worksheet.

Note 2: Item selection inquiries for urgent samples shall be made not through batch communication, but through real-time communication.

7.4.2. Return of item selection information

When this instrument issues an inquiry for sample barcode information (hereinafter, referred to as the BC mode) or an inquiry for information on rack number and position in rack (hereinafter, referred to as the rack mode) stated in "Item selection inquiry," the host computer returns the item selection information of the sample in response to the request.

7.4.2.1. Real-time communication in bidirectional mode

The instrument receives the item selection information of each sample in response to the item selection inquiry given in the real-time communication mode.

Table 7-7 Return of item selection information in response to inquiry for sample barcode information or inquiry for information on rack number and position in rack

Item	Characters	Size	Description
Header	STX	1	STX: 02h
Processing classification	(1) BC mode: 'K' or 'E' (2) Rack mode: 'R' or 'e'	1	(1) BC mode General sample ('K': 4Bh) or Urgent sample ('E': 45h) (2) Rack mode General sample ('R': 52h) or Urgent sample ('e': 65h)
Separation	','	1	
Sample number (PID) *1	Numeral	1-13	(1) BC mode Sample ID (value read from sample barcode) 1 to 13 numeric characters (variable length) (2) Rack mode Fixed to 13 characters. The field shall be filled with spaces.
Separation	','	1	
Serial number (SID) *2	Numeral	5	General sample: 00001 to 09999 Urgent sample: E0001 to E9999
Separation	','	1	
Dilution ratio	Numeral	5	Specify the dilution ratio for the sample to be measured. 00001 to 10000 times
Separation	','	1	
Sample type	Numeral	1	Serum: 1 (fixed)
Separation	','	1	
Number of measurement items	Numeral	2	N in selection information (Nmax = 12) 00 to 12
Separation	','	1	
Selection information 1 *3	Numeral	2	First item number of measurement (00 to 99) *00: No relevant item *4 *5
Separation	','	1	

Selection information N	Numeral	2	Nth item number
Separation	','	1	
Comments	Alphanumeric characters	16	When this field is not used, the field shall be filled with spaces (20h).
Delimiter	ETX	1	ETX: 03h
BCC	Numeral	1	

*1 The same sample number (PID) as the number transmitted from this instrument is returned.

*2 The instrument uses not the serial number (SID) in this field, but the automatically assigned SID. Unless otherwise specified, this field shall be filled with spaces (20h).

*3 When the results of measurement of more than one item can be obtained with one kind of reagent, set all item numbers in the selection information fields 1 to N. Set the item numbers related to the results of calculation using measurement results.

*4 Select Communication setting → Setting of measurement operation during communication in the maintenance mode on the main unit panel, and specify whether or not to continue the following measurement if there are no measurement items relevant to the inquiry about measurement request from the instrument.

*5 In the case of bidirectional communication without BC in the rack mode, the specification of continuation of measurement without relevant items stated in *4 is made ineffective, and measurement is continued. However, if the intermittent inquiry about each sample has been selected by the optional function in the rack mode, the operation is performed in accordance with the specification stated in *4.

Note:

◆ Specification of measurement operation during communication by optional function

When there is not a reagent bottle for measurement or an unsupported item has been specified on the Instrument or no request has been given to the host computer, whether or not to continue the following measurement can be determined in the definition file in the Instrument*.

* The function will be implemented by our serviceman. For the definition file in the Instrument and the format, see Appendix B.

7.4.2.2. Worksheet communication in bidirectional mode (batch communication)

In response to an item selection inquiry in the batch communication mode, the item selection information of the specified number of samples is returned.

Table 7-8 Return of item selection information (batch communication)

Item	Characters	Size	Description
Header	STX	1	STX: 02h
Processing classification	'k'	1	Collective inquiry ('k': 6Bh)
Separation	','	1	
Number of samples	Numeral	3	Number of samples whose selection information will be transmitted (Mmax = 100) 001 to 100
Separation	','	1	
Selection information 1	Numeral	*1	The details are stated in the following table.
Separation	','	1	Unnecessary for the last selection information
---			
Selection information M	Numeral	*1	
Delimiter	ETX	1	ETX: 03h
BCC	Numeral	1	

*1 According to the number of items

Table 7-9 Selection information of sample number m

Item	Characters	Size	Description
Rack number *1	Numeral	2	General sample: 01 to 20, Urgent sample: E1 to E5 *4
Separation	','	1	
Position number *1	Numeral	2	01 to 10 *4
Separation	','	1	
Sample number (PID)	Numeral	1-13	Sample ID (value read from sample barcode) 1 to 13 numeric characters (variable length)
Separation	','	1	
Serial number (SID) *2	Numeral	5	General sample: 00001 to 09999 Urgent sample: E0001 to E9999
Separation	','	1	
Dilution ratio	Numeral	5	Specify the dilution ratio for the sample to be measured. 00001 to 10000 times
Separation	','	1	
Sample type	Numeral	1	Serum: 1 (fixed)
Separation	','	1	
Number of measurement items	Numeral	2	Figure of item number N (N_{max} = 12) 01 to 12
Separation	','	1	
Item number 1 *3	Numeral	2	Selected item number 00 to 99 *00: No relevant item *5
Separation	','	1	

Item number N	Numeral	2	
Separation	','	1	
Comments	Characters	16	When comments are not required, the field shall be filled with spaces (20h).

Note:

*1 When communication is made with worksheet and sample BC in the bidirectional mode, the rack number and position number fields are ignored.

*2 The instrument uses not the serial number (SID) in this field, but the automatically assigned SID.
When the serial number is not specified, the field shall be filled with spaces (20h).

*3 When the results of measurement of more than one item can be obtained with one kind of reagent, set all item numbers in the selection information fields 1 to N. Set the item numbers related to the results of calculation using measurement results.

*4 The rack number and sample position information is ignored regardless of the bidirectional communication/worksheet communication mode.

*5 Select Communication setting → Setting of measurement operation during communication in the maintenance mode on the main unit panel, and specify whether or not to continue the following measurement if there are no measurement items relevant to the inquiry about measurement request from the instrument.

◆ Specification of measurement operation during communication by optional function

When there is not a reagent bottle for measurement or an unsupported item has been specified on the Instrument or no request has been given to the host computer, whether or not to continue the following measurement can be determined in the definition file in the Instrument*.

* The function will be implemented by our serviceman. For the definition file in the Instrument and the format, see Appendix B.

7.4.3. Transmission of measurement results (general/urgent/re-inspection)

This instrument reports the results of measurement of a sample to the host computer (upon completion of measurement of one sample).
The measurement results are sent successively (in real time) on a sample by sample basis regardless of the communication mode.
To ensure the notification in such a case where the results could not be sent owing to improper host computer operating condition or communication line condition or the results of re-measurement must be reported, the batch transmission function for transmitting the measurement results information specified on the instrument operation panel to the host computer is available.

7.4.3.1. Real-time communication (notification of measurement results) common to bidirectional and unidirectional modes

In response to an item selection inquiry in the real-time communication or worksheet communication mode, the item selection information of each sample (measurement results) is returned to the host computer.

Table 7-10 Notification of measurement results (real-time communication)

Item	Characters	Size	Description
Header	STX	1	STX: 02h
Processing classification *1	'S'	1	Transmission of measurement results (general/urgent/re-inspection) ('S': 53h)
Separation	','	1	
Date of measurement	Numeral	6	YYMMDD (last 2 digits of year, 2 digits of month, 2 digits of day)
Separation	','	1	
Time of measurement	Numeral	4	HHMM (on a 24-hour basis, 2 digits of hour, 2 digits of minute)
Separation	','	1	
Operator ID	Numeral	4	0000 to 9999 * When the ID is not used, the field shall be filled with spaces (20h).
Separation	','	1	
Rack number	Numeral	2	General sample: 01 to 20, Urgent sample: E1 to E5
Separation	','	1	
Position number	Numeral	2	01 to 10
Separation	','	1	
Sample number (PID) *2 *5	Numeral	1-13	Sample ID (value read from sample barcode) 1 to 13 numeric characters (variable length)
Separation	','	1	
Serial number (SID) *3	Numeral	5	General sample: 00001 to 09999 Urgent sample: E0001 to E9999
Separation	','	1	
Dilution ratio	Numeral	5	00001 to 10000 times
Separation	','	1	
Measurement result count	Numeral	1	Figure of item number N (N_{max} = 12) 01 to 12
Separation	','	1	
Measurement result 1 *4	Numeral		See the following description.
Separation	','	1	

Measurement result N	Numeral		
Delimiter	ETX	1	ETX: 03h
BCC	Numeral	1	

Note:

*1 The measurement results of one sample are transmitted as the results of up to 12 items (= 12 tests). (The results of reproducibility measurement are not transmitted.)

*2 In the case of worksheet communication (without BC) in the bidirectional mode or manual input in the unidirectional mode, whether or not to use the results of reading of sample BC can be determined on the instrument setting screen. If the BC cannot be read when the use of the results has been specified, the same value as that in the PID field in the item information inquiry is set in the same manner as in other modes.

*3 For a sample for re-inspection, the same value as that used for the previous measurement is set.

*4 When the results of measurement of more than one item (AFP, L3, etc.) are obtained with one kind of reagent, all measurement results are transmitted.

*5 In the case of bidirectional communication without BC in the rack mode, the following information is set in the PID field.

(1) When the read sample BC is 13 characters or less long:

The read code is set. (Variable length)

(2) When the read sample BC is 14 characters or more long or cannot be read or there is no BC:

The field for 13 characters are filled with spaces.

Table 7-11 Detailed information on measurement result n

Item	Characters	Size	Description
Item number	Numeral	2	01 to 99
Separation	‘,’	1	
Measurement	Numeral	8	The value is as one of the following results of measurement. (1) Measurement (up to 7 digits, with a decimal point) (2) Detection upper limit (When the measurement result is more than the detection upper limit: up to 7 digits, with a decimal point) (3) Detection lower limit (When the measurement result is less than the detection lower limit: up to 6 digits, with a decimal point) (4) No measurement owing to measurement error (Filled with spaces (20h)) (5) L3% cannot be calculated because L1 or L3 is less than the detection lower limit. (6 spaces (20h) and string ‘NC’) * In the case of (1) to (3), if the number of digits of the value is less than the specified number, ‘0’ are added to the front. *** For the detailed information on measurement errors, see Appendix A.**
Separation	‘,’	1	
Measurement information	Numeral	**2**	The measurement is evaluated to determine to which it corresponds among the followings. 1) Normal measurement (without error, without measurement information): 00 2) General measurement information ◆ AnaLight peak not detected (concentration: ND, ratio of concentration: ND): 01 ◆ AnaLight over range (concentration: HH!, ratio of concentration: NR): 02 ◆ Measurement result more than detection upper limit (concentration: H!, ratio of concentration: NR): 03 ◆ Measurement result less than detection lower limit (concentration: ND, ratio of concentration: ND): 04 ◆ Measurement result exceeding upper limit of reference range (concentration: *, ratio of concentration: *): 05 ◆ Measurement result less than lower limit of reference range: (concentration: *, ratio of concentration: *): 06 ◆ Arithmetic error (for calculation of HC1 or HC2): 07 ◆ Measurement result more than measurement upper limit: (concentration: H, ratio of concentration: H): 08 ◆ L3 less than detection lower limit, L3% cannot be calculated (ratio of concentration: L1!): 09 ◆ L1 less than detection lower limit, L3% cannot be calculated (ratio of concentration: L3!): 10 3) Measurement information upon detection of abnormal peak (+30) The type of measurement obtained upon detection of abnormal peak is indicated. ◆ Normal measurement result, abnormal peak detected (concentration: A, ratio of concentration: A): 30 ◆ AnaLight peak not detected (concentration: ND A, ratio of concentration: ND A): 31 ◆ AnaLight over range (concentration: HH! A, ratio of concentration: NR A): 32 ◆ Measurement result more than detection upper limit (concentration: H! A, ratio of concentration: NR A): 33 ◆ Measurement result less than detection lower limit (concentration: ND A, ratio of concentration: ND A): 34 ◆ Measurement result exceeding upper limit of reference range (concentration: * A, ratio of concentration: * A): 35 ◆ Measurement result less than lower limit of reference range: (concentration: * A, ratio of concentration: * A): 36 ◆ Arithmetic error (for calculation of HC1 or HC2): 37 ◆ Measurement result more than measurement upper limit: (concentration: H A, ratio of concentration: H A): 38 ◆ L3 less than detection lower limit, L3% cannot be calculated (ratio of concentration: L1! A): 39 ◆ L1 less than detection lower limit, L3% cannot be calculated (ratio of concentration: L3! A): 40 4) Measurement error (including measurement processing error and instrument error): 99 * When a measurement error is caused by a reason not shown in 2) or 3), this code is set. For the details of the causes, see “Measurement error codes.”
Separation	‘,’	1	
Measurement result 3 [recalculation information]	Numeral	1	It is indicated whether or not the value is the re-measurement result. Regular: 0 Recalculation: 1
Separation	‘,’	1	
Measurement result 4 [re-inspection information]	Numeral	1	It is indicated whether or not the value is the re-inspection result. Regular: 0 Re-inspection: 1
Separation	‘,’	1	
Measurement error code	Numeral	6	E00001 to EFFFFF Note) 6 digits without zero suppression For the error codes, see the error list.

7.4.3.2. Batch communication common to bidirectional and unidirectional modes (notification of measurement results)

This function is used to report all measurement results (when the measurement results are selected on the operation panel and the Resend button is pressed). The message format is the same as in the case of real-time communication. However, the processing classification is 's' as shown below.

Table 7-5 Notification of measurement results (batch communication)

Item	Characters	Size	Description
Header	STX	1	STX: 02h
Processing classification	's'	1	Transmission of measurement results ('s': 73h)
* The data to be set are the same as in the case of the real-time communication. ・ The range from the processing classification 'S' to the measurement result N field in the measurement results (real-time communication) is regarded as the measurement results of one sample. [STX] "processing classification" ~ "measurement result N" [EOT][STX] "processing classification" ~ "measurement result N" [EOT] …			
Delimiter *1	EOT/ ETX	1	EOT: 04h ETX: 03h
BCC	Numeral	1	

*1 When the measurement results of some samples are reported, ETX(03h) is set as the delimiter for the last sample. EOT is set as the delimiter for the samples between the first and last ones. When the host computer receives ETX, it returns a response (does not return a response when receiving EOT).

7.4.4. Notification of control measurement results

7.4.4.1. Real-time communication common to bidirectional and unidirectional modes (control measurement results)

This function is used to report the results of control measurement from this instrument to the host computer.

Table 7-6 Notification of QC measurement results (real-time communication)

Item	Characters	Size	Description
Header	STX	1	STX: 02h
Processing classification	'Q'	1	Transmission of results of control measurement ('Q': 51h)
Separation	','	1	
Date of measurement	Numeral	6	YYMMDD (last 2 digits of year, 2 digits of month, 2 digits of day)
Separation	','	1	
Time of measurement	Numeral	4	HHMM (on a 24-hour basis, 2 digits of hour, 2 digits of minute)
Separation	','	1	
Operator ID	Numeral	4	0000 to 9999 * When the ID is not used, the field shall be filled with spaces (20h).
Separation	','	1	
Rack number	Numeral	2	QC rack: Q1 to Q5
Separation	','	1	
Position number	Numeral	2	01 to 10
Separation	','	1	
Serial number (SID)	Numeral	5	Control: C0001 to C9999
Separation	','	1	
Reagent serial number	Numeral	4	0001 to 9999
Separation	','	1	
Reagent lot number	Alphanumeric	15	Note) 15 digits without zero suppression
Separation	','	1	
Item number	Numeral	2	01 to 99
Separation	','	1	
Results of control measurement	Numeral		See below.
Delimiter	ETX	1	ETX: 03h
BCC	Numeral	1	

Table 7-14 Detailed information on control

Item	Characters	Size	Description
Shelf life of control	Numeral	4	YYMM (2 digits of year and 2 digits of month) * When control barcodes are not used for operation, the field shall be filled with spaces (20h).
Separation	‘,’	1	
Liquid type	Numeral	1	0: CTR1 1: CTR2 2: CTR3
Separation	‘,’	1	
Displayed value	Numeral	4	0000 to 9999 Note) 4 digits without zero suppression Note) For the handling of measurement items which may give results with decimals, see Note given below.
Separation	‘,’	1	
Control range	Numeral	7	Up to 5 digits (with a decimal point) * If the number of digits is less than the specified number, ‘0’ are added.
Separation	‘,’	1	
Control range (upper limit)	Numeral	8	Up to 7 digits (with a decimal point) * If the number of digits is less than the specified number, ‘0’ are added.
Separation	‘,’	1	
Control range (lower limit)	Numeral	8	Up to 7 digits (with a decimal point) * If the number of digits is less than the specified number, ‘0’ are added.
Separation	‘,’	1	
Number of times of control measurement N	Numeral	1	1 to 3
Separation	‘,’	1	
Measurement result N=1 *1	Numeral	8	Measurement up to 7 digits long (with a decimal point) * If the number of digits is less than the specified number, ‘0’ are added.
Separation	‘,’	1	
Measurement result N=2 *1	Numeral	8	Measurement up to 7 digits long (with a decimal point) * If the number of digits is less than the specified number, ‘0’ are added.
Separation	‘,’	1	
Measurement result N=3 *1	Numeral	8	Measurement up to 7 digits long (with a decimal point) * If the number of digits is less than the specified number, ‘0’ are added.
Separation	‘,’	1	
Average of measurement results *1	Numeral	8	Measurement up to 7 digits long (with a decimal point) * If the number of digits is less than the specified number, ‘0’ are added.
Separation	‘,’	1	
Result of evaluation of control measurement	Numeral	1	OK: 0/NG: 1 * When even one of the measurement results N1 to N3 is out of the control range, NG is set.
Separation	‘,’	1	
Measurement error code	Numeral	6	E00001 to EFFFFF Note) 5 digits without zero suppression

*1 When a measurement error (data calculation error) occurs or no measurement results are obtained (N = 1), hyphens are set in all fields.

Note: Handling of displayed values of measurement items which may give results with decimals

As the results of control measurement, only integers can be displayed to ensure the compatibility between the new and old commands.

However, in case that values with decimals must be displayed, it is possible to specify “with decimal point” or “without decimal point” in the definition file in the instrument*. (Default: “without decimal point”)

When “with decimal point” is selected, the size of the displayed value field shown in Table 7.14 “Detailed information on control” is increased from 4 bytes to 8 bytes (fixed), and values up to 7 digits long (with a decimal point) can be displayed.

* The function will be implemented by our serviceman. For the definition file in the instrument and the format, see Appendix B.

⊙ Displayed value field in Table 7.14 “Detailed information on control” (extract)

◆ Without decimal point

Item	Characters	Size	Description
Displayed value	Numeral	4	0000 to 9999 Note) 4 digits without zero suppression

↓

◇ With decimal point

Item	Characters	Size	Description
Displayed value	Numeral	8	Up to 7 digits (with a decimal point) * If the number of digits is less than the specified number, ‘0’ are added.

7.4.5. Version check command (for confirmation of connection condition)

This command is designed to check whether the LAN or serial connection has been normally established (the command can be transmitted at any timing as well as at the instrument initialization). The instrument sends the version check request to the host computer, and the host computer returns a positive response (ACK in the case of serial connection) if the host computer permits the connection. If the connection is not permitted or a format error or a BCC trouble occurs, it returns a negative response (NAK in the case of serial connection). When the instrument receives the abnormal response, it executes the retry processing. Communication between the instrument and the host computer cannot be implemented unless a positive response to this command is received.

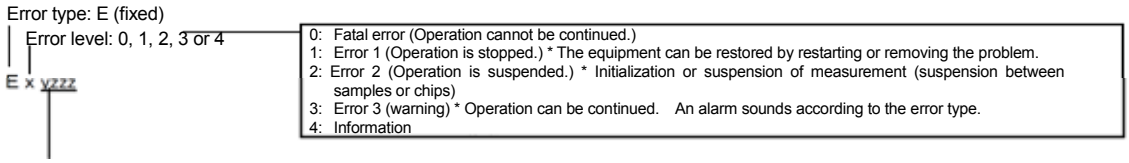
Table 7-15 Version check command

Item	Characters	Size	Description
Header	STX	1	STX: 02h
Processing classification	'V'	1	Version check command ('V': 56h)
Separation	','	1	
Host computer name	Alphanumeric	20	* When the name is less than 20 characters long, the remaining field is filled with spaces (20h).
Separation	','	1	
Serial number	Alphanumeric	16	* When the name is less than 16 characters long, the remaining field is filled with spaces (20h).
Separation	','	1	
Version number	Numeral	8	* When the name is less than 8 characters long, the remaining field is filled with spaces (20h).
Delimiter	ETX	1	ETX: 03h
BCC	Numeral	1	

7.5. Error list

The details of error information returned when measurement results are sent are shown below.

Error code system



Error code classification: The highest-order digit (4th digit) is the function identification code, and the error type is indicated in the 1st to 3rd digits.
* Function identification code: 0 to 4 for physical (control) system, 5 to 8 for logic (software) system, and 9 for others

Function identification code [yzzz]	Classification	Example
0	Main unit, temperature control and functional parts	Covers, fan wire break, etc.
1	Chips, racks and transfer	Chip jamming, full rack, head error, etc.
2	Sampler and reagent compartment	Liquid level detection error, reagent information error, etc.
3	Air	Pressure error, opening error, etc.
4	Detection	Focus error, handoff error, etc.
5	System	CF card error, measurement data error, etc.
6	Measurement control	BC data error, reagent shelf life error, etc.
7	Measurement analysis	Calibration error, measurement result error, etc.
8	External communication	Host computer and maintenance
9	Others	Other errors (no relevant ones)

This document defines only the error codes, Ex8zzz, relating to communication.
For the details of other errors, see the service manual. These codes are indicated in the measurement error code field in the measurement result information.

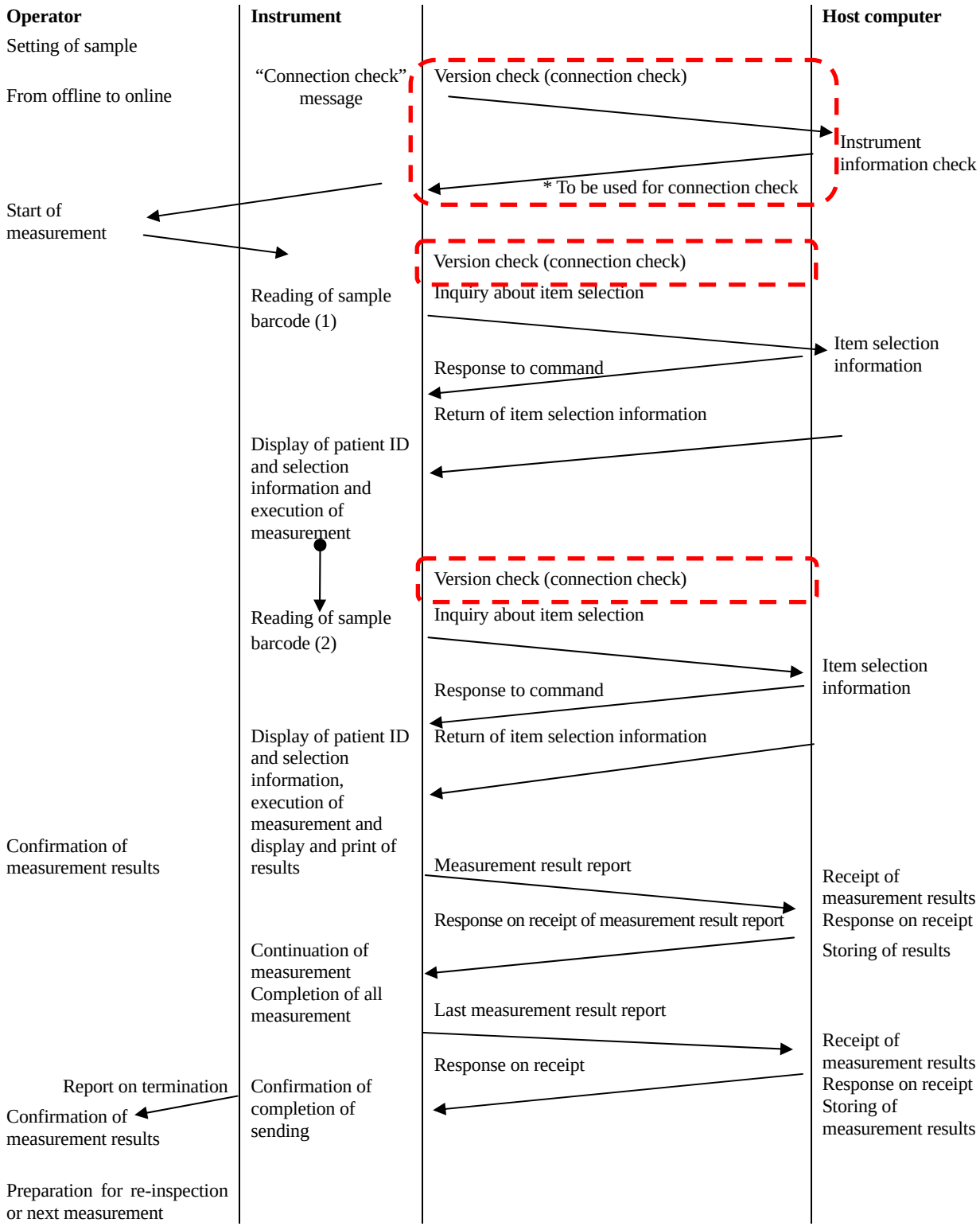
Table 7-7 Details and codes of errors

Error code	Details	Meaning
Communication errors		
E48F04	Message receiving error	The format of the received data is not correct (after retry out).
E48F0A	Received data command error	An out-of-standard (-specification) command was received (after retry out).
E48F0B	Received data parameter error	A parameter in the received data was out of the specified range (after retry out).
E48F0C	Received data BCC error	The checksum of the received data was abnormal (after retry out).
E48F0D	LAN communication connection error	Connection in response to the TCP connection request could not be established.
E48F0F	LAN transmitted message sending error	An error occurred during sending of TCP packet (after retry out).
E48F10	LAN transmitted message receiving error	An error occurred during receiving of TCP packet (after retry out).
E48F11	LAN time-out error	A receiving time-out occurred (after retry out).
E48F12	No relevant measurement item	The items contained in the measurement request information from the host computer cannot be measured by this instrument (no relevant reagents or measurement items out of support), and there are no measurement results.
E48F14	Rack number error	Measurement request information with a rack number not supported by this instrument (out of range of specification) was received. (This error occurs only in the bidirectional mode without barcodes and with worksheets.)
E48F15	Sample position error	Measurement request information with a sample position out of support (other than 1 to 10) was received. (This error occurs only in the bidirectional mode without barcodes and with worksheets.)

8. Transmission/operation flows

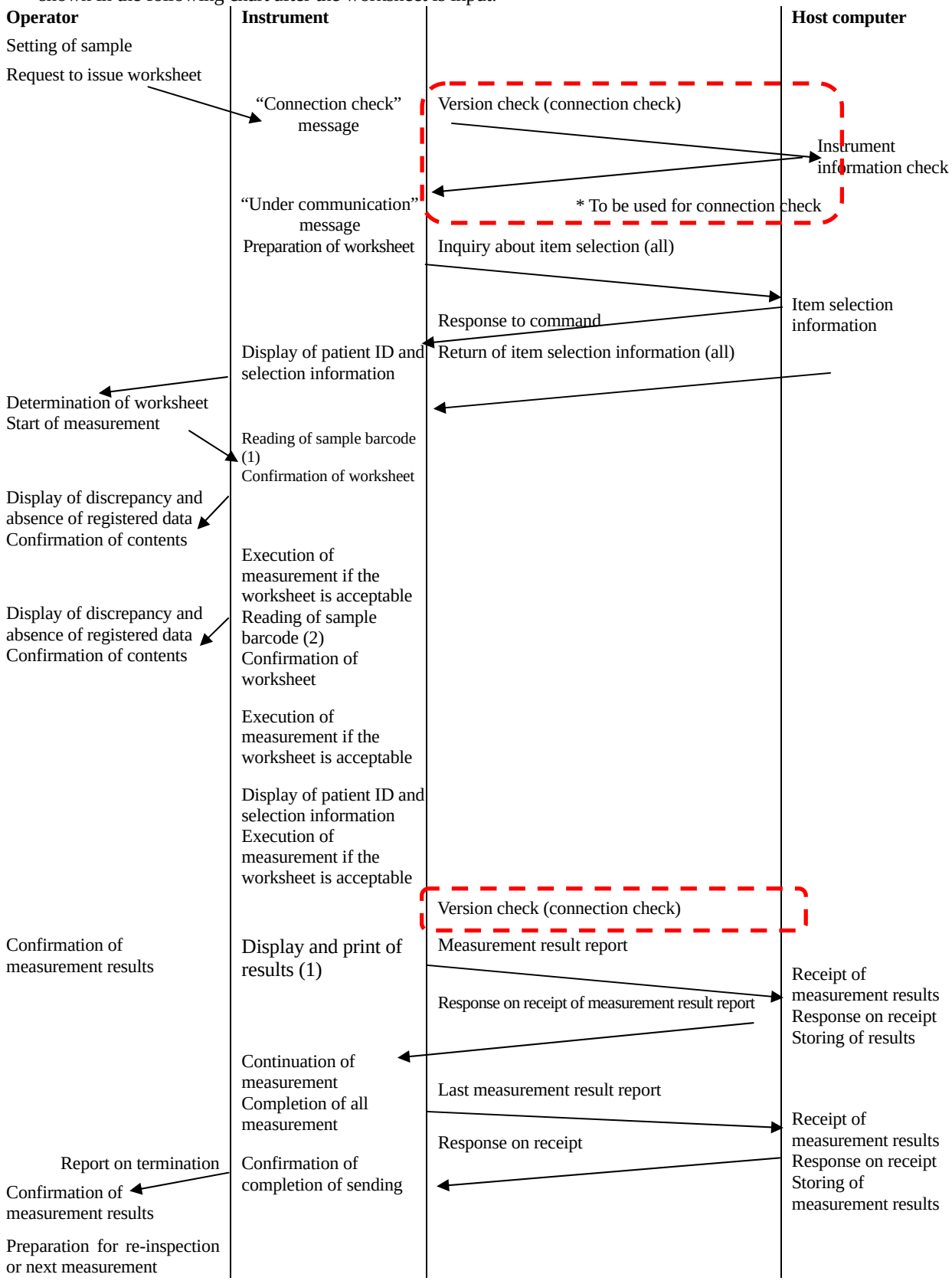
The processing flows among operator, instrument and host computer are shown below.

8.1. Real-time communication in bidirectional mode (both worksheet and measurement results)



8.2. Real-time transmission of measurement results in bidirectional communication mode with worksheet

When the worksheet is received through batch communication and the measurement results are transmitted successively through real-time communication, the operation is conducted as shown below.
When the operator manually inputs the worksheet, the operation is started from the “Start of measurement” step shown in the following chart after the worksheet is input.



9. Appendix

9.1. Appendix A Detailed information on measurement error

◇ Results of measurement of AFP

●AFP

Results of measurement of AFP			AFP output	Error symbol	AFP-L3 output	Error symbol	Meaning and results of print	Item No.	Measurement (8-digit value or string)	Measurement information (1) Normal measurement error	(2) Abnormal measurement error	Measurement error (6-digit string 000000 or E00001 to EFFFFE)
			Output					Host computer communication specifications Table 7.11 "Detailed information on measurement result n" in Section 7.4.3.1 Information returned upon occurrence of measurement error				
Total AFP Less than detection lower limit			< detection lower limit	ND	-	ND	Total AFP is less than the detection lower limit. [Example of output] AFP = <0.3 ND [ng/mL] AFP-L3 = ------ ND [%]	1	12345678 "0000<0.3"	"01" Meaning: AnaLight peak is not detected.	"31" Meaning: ◇An abnormal peak exists, and AnaLight peak is not detected.	123456 "000000"
								2	12345678 " " * The field is filled with spaces.	"01" Meaning: AnaLight peak is not detected.	"31" Meaning: ◇An abnormal peak exists, and AnaLight peak is not detected.	123456 "000000"
Total AFP Less than measurement upper limit	Total AFP is less than the measurement upper limit.											
	Total AFP Less than error threshold value	L1 Detection lower limit or more L3 Less than detection lower limit	Measurement		**NC**	L1!	Since L3 is less than the detection lower limit, L3% cannot be calculated. L1 is the detection lower limit or more. (Normal value) L3 is less than the detection lower limit. [Example of output] AFP = 100.00 [ng/mL] AFP-L3 = NC L1!	1	12345678 "00100.00" * Actual measurement results	"00" Meaning: ◆No error	"30" Meaning: ◇Although an abnormal peak exists, but no error has occurred.	123456 "000000"
								2	12345678 " NC"	"09" Meaning: ◆L3 is less than the detection lower limit, and L3% cannot be	"39" Meaning: ◇An abnormal peak exists, L3 is less than the detection lower limit, and L3% cannot be	123456 "000000"
		L1 Less than detection lower limit L3 Detection lower limit or more	Measurement		**NC**	L3!	Since L1 is less than the detection lower limit, L3% cannot be calculated. L1 is less than the detection lower limit. L3 is the detection lower limit or more. [Example of output] AFP = 100.00 [ng/mL] AFP-L3 = NC L3! [%]	1	12345678 "00100.00" * Actual measurement results	"00" Meaning: ◆No error	"30" Meaning: ◇Although an abnormal peak exists, but no error has occurred.	123456 "000000"
								2	12345678 " NC"	"10" Meaning: ◆L1 is less than the detection lower limit, and L3% cannot be	"40" Meaning: ◇An abnormal peak exists, L1 is less than the detection lower limit, and L3% cannot be	123456 "000000"
	Total AFP Error threshold value or more	L1 Detection lower limit or more L3 Less than detection lower limit	Measurement		**NC**	**L1!**	Since L3 is less than the detection lower limit, L3% cannot be calculated. L1 is the detection lower limit or more. L3 is less than the detection lower limit. [Example of output] AFP = 200.00 [ng/mL] AFP-L3 = NC L1! [%] * The value is checked to confirm whether it is within the reference range.	1	12345678 "00200.00" * Actual measurement results	"00" Meaning: ◆No error	"30" Meaning: ◇Although an abnormal peak exists, but no error has occurred.	123456 "000000"
								2	12345678 " NC"	"09" Meaning: ◆L3 is less than the detection lower limit, and L3% cannot be calculated.	"39" Meaning: ◇An abnormal peak exists, L3 is less than the detection lower limit, and L3% cannot be calculated.	123456 "000000"
		L1 Less than detection lower limit L3 Detection lower limit or more	Measurement		**NC**	**L3!**	Since L1 is less than the detection lower limit, L3% cannot be calculated. L1 is less than the detection lower limit. L3 is the detection lower limit or more. [Example of output] AFP = 200.00 [ng/mL] AFP-L3 = NC L3! [%] * According to the user setting, the value is checked to confirm whether it is within the reference range. If the value is out of the reference range, an error marker '*' is	1	12345678 "00100.00" * Actual measurement results	"00" Meaning: ◆No error Out of reference range: 35 or 36	"30" Meaning: ◇Although an abnormal peak exists, but no error has occurred. Out of reference range: 35 or 36	123456 "000000"
								2	12345678 " NC"	"10" Meaning: ◆L1 is less than the detection lower limit, and L3% cannot be	"40" Meaning: ◇An abnormal peak exists, L1 is less than the detection lower limit, and L3% cannot be	123456 "000000"
	L1 Detection lower limit or more L3 Detection lower limit or more * Normal value not related to error threshold value		Measurement		**Corrected measurement** **< detection lower limit** **〜** **> detection upper limit**		L1 is the detection lower limit or more. L3 is the detection lower limit or more. [Example of output] AFP = 300.00 [ng/mL] AFP-L3 = 50.00 [%] * According to the user setting, the value is checked to confirm whether it is within the reference range. If the value is out of the reference range, an error marker '*' is displayed.	1	12345678 "00300.00" * Actual measurement results	"00" Meaning: ◆No error Out of reference range: 05 or 06	"30" Meaning: ◇Although an abnormal peak exists, but no error has occurred. Out of reference range: 35 or 36	123456 "000000"
								2	12345678 "00050.00" * Actual measurement results	"00" Meaning: ◆No error Out of reference range: 05 or 06	"30" Meaning: ◇Although an abnormal peak exists, but no error has occurred. Out of reference range: 35 or 36	123456 "000000"
Total AFP Measurement upper limit or more			Measurement	H	Measurement < detection lower limit 〜 > detection upper limit	H	Total AFP is the measurement upper limit (new) or more. "The value is out of the measurement range. Handle it as a reference value." [Example of output] AFP = 1500.00 H [ng/mL] AFP-L3 = 50.0 H [%]	1	12345678 "01500.00" * Actual measurement results	"08" Meaning: ◆The measurement result is the measurement	"38" Meaning: ◇An abnormal peak exists, and the measurement result is the measurement upper limit	123456 "000000"
								2	12345678 "00050.00" * Actual measurement results	"08" Meaning: ◆The measurement result is the measurement	"38" Meaning: ◇An abnormal peak exists, and the measurement result is the measurement upper limit	123456 "000000"
Total AFP Measurement upper limit or more			> detection upper limit	H!	–	NR	Total AFP is the measurement upper limit or more. "The value is out of the measurement range." [Example of output] AFP = >2000.00 H! [ng/mL] AFP-L3 = ------ NR [%]	1	12345678 ">2000.00" * Detection upper limit of equipment	"03" Meaning: ◆The measurement result is the detection upper	"33" Meaning: ◇An abnormal peak exists, and the measurement result is the detection upper limit or	123456 "000000"
								2	12345678 " " * The field is filled with spaces.	"03" Meaning: ◆The measurement result is the detection upper	"33" Meaning: ◇An abnormal peak exists, and the measurement result is the detection upper limit or	123456 "000000"
AnaLight peak over range			> detection upper limit	HH!	–	NR	AnaLight peak over the range is detected. "The value considerably exceeds the measurement range." [Example of output] AFP = >2000.00 HH! [ng/mL] AFP-L3 = ------ NR [%]	1	12345678 ">2000.00" * Detection upper limit of equipment	"02" Meaning: ◆The measurement result is the detection upper	"32" Meaning: ◇An abnormal peak exists, and the measurement result is the detection upper limit or	123456 "000000"
								2	12345678 " " * The field is filled with spaces.	"02" Meaning: ◆The measurement result is the detection upper	"32" Meaning: ◇An abnormal peak exists, and the measurement result is the detection upper limit or	123456 "000000"

◇ Results of measurement of PIVKA

Results of measurement of PIVKA	PIVKA output	Error symbol			Meaning and results of print	Host computer communication specifications Table 7.11 "Detailed information on measurement result n" in Section 7.4.3.1 Information returned upon occurrence of measurement error Item No.	Measurement (8-digit value or string)	Measurement information (1) Normal measurement error	(2) Abnormal measurement error	Measurement error (6-digit string 000000 or E00001 to EFFFFF)
Less than detection lower limit	< detection lower limit	ND			The concentration is less than the detection lower limit. [Example of output] PIVKA = <5 ND [mAU/mL]	3	12345678 "000000<5"	"01" Meaning: ✦ AnaLight peak is not detected.	"31" Meaning: ◇An abnormal peak exists, and AnaLight peak is not detected.	123456 "000000"
Less than measurement upper limit	Measurement				The concentration is less than the measurement upper limit. PIVKA = 10000 [mAU/mL] * The value is checked to confirm whether it is within the reference range. If the value is out of the reference range, an error marker '*' is displayed.	3	12345678 "00010000" * Actual measurement results	"00" Meaning: ◆No error Out of reference range: 05 or 06	"30" Meaning: ◇Although an abnormal peak exists, but no error has occurred. Out of reference range: 35 or 36	123456 "000000"
Measurement upper limit or more	Measurement	H			The concentration is the measurement upper limit or more. [Example of output] PIVKA = 20000 H [mAU/mL]	3	12345678 "00020000" * Actual measurement results	"08" Meaning: ◆The measurement result is the measurement upper limit or more.	"38" Meaning: ◇An abnormal peak exists, and the measurement result is the measurement upper limit or more.	123456 "000000"
Measurement upper limit or more	> detection upper limit	H!			The concentration is the detection upper limit or more. [Example of output] PIVKA = >50000 H! [mAU/mL]	3	12345678 "00>50000" * Detection upper limit of equipment	"03" Meaning: ◆The measurement result is the detection upper limit or more.	"33" Meaning: ◇An abnormal peak exists, and the measurement result is the detection upper limit or more.	123456 "000000"
AnaLight peak over range	> detection upper limit	HH!			AnaLight peak over the range is detected. [Example of output] PIVKA = >50000 HH! [mAU/mL]	3	12345678 "00>50000" * Detection upper limit of equipment	"02" Meaning: ◆The measurement result is the detection upper limit or more.	"32" Meaning: ◇An abnormal peak exists, and the measurement result is the detection upper limit or more.	123456 "000000"

9.2. Appendix B Communication optional function setting

These functions are prepared as options to be set by the servicemen. The definition file in the instrument can be edited from the maintenance PC. The settings will be reflected after restart.

Definition file name: ./conf/RRParameter.conf

Function name	Section name	Key name	Value
Setting of inquiry command in bidirectional mode with BC (BC mode) ('K': 4Bh, 'E': 45h)	ParamCommonInfo	HostFormatExpansionFlag	**0: Use of command without rack number and sample position information (default)** 1: Use of command to which rack number and sample position information has been added
Setting of action to be taken when a request to measure an unsupported item or an item for which the reagent has not been loaded is received from the host computer	ParamCommonInfo	HostNoItemContinue	**0: Suspension of measurement (default)** 1: Continuation of measurement
Action to be taken when the quantity of the reagent for the measurement item requested by the host computer is insufficient	ParamCommonInfo	HostNoSupplyContinue	**0: Suspension of measurement (default)** 1: Continuation of measurement

Definition file name: ./conf/RRConfigrationInfo.conf

Function name	Section name	Key name	Value
Setting of method of obtaining request information in bidirectional mode without BC (rack mode)	ConfigConnection	DuplexGetRequestMode	0: Sample by sample **1: Continuously 10 samples (default)**
Setting of validity of decimal point in field for displaying control measurement results	ConfigConnection	DecimalDataSend	**0: Not transmitted (default)** 1: Transmitted