16. SYSTEM INTERFACE

16.1 Overview

Provided here are the signal form and protocol (communication rules) in case of connection between model 7080 automatic analyzer and an external system via start-stop synchronous serial signal.

(1) Communication specifications

Table 1.1 shows the specifications of RS-232C communications.

Table 1.1 Communication Specifications

	Item	Specification	Remarks	Default value (standard value)
1	Interface	RS-232C	-	-
2	Communication method	Half duplex	-	-
3	Data bit	7 bits or 8 bits	Set on [UTILITY] - [SYSTEM] - [HOST COMM. SET] screen	7 bits
4	Stop bit	1 bit/2 bits		2 bits
5	Parity check	Even/odd/no parity		Even parity
6	Baud rate (bits/s)	4800/9600		9600
7	Max. number of transferred data items	256/512/1024 bytes		256
8	End-of-data code	ETX＋BCC/CR＋LF+ETX/ETX ETX+CR+LF ETX+CKSH+CKSL+CR		ETX+BCC
9	Retry count	Number of retries when no response from the host		6
10	Retry time	Retry interval time when no response from the host		5 (s)
11	Code	JIS 7 bits, JIS 8 bits or ASCII	-	
12	Synchronization system	Asynchronous system (start-stop sync)	-	
13	Transmission control procedure	Determined by the host	-	
14	Number of ports	1 max.	-	
15	Text mode	Nontransparent mode (ASCII)	-	
16	Cable length	15 m max. (RS-232C)	-	

(2) Features

(a) The communication cycle is not synchronized with the analysis cycle. So the analyzer replies upon receiving a response from the host.

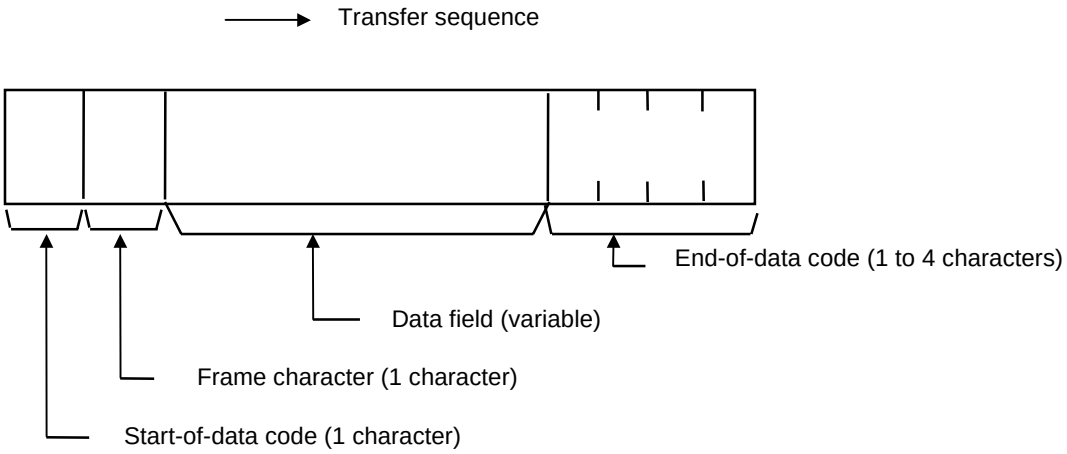
(b) The data bit, stop bit, parity check, baud rate, maximum number of transferred data items and end-of-data code are selectable by the user.

(3) Communication rules

The host and analytical unit (AU) communicate with each other by exchanging the contents of a message called a text.

Communication is started by sending a single text (ANY frame) from the AU to the host. In response to this, the host sends back a single text. We will call this one cycle of text exchange a conversation. The AU and host realize one communication function via two or more conversations, which will be called a cluster.

Each text consists of the following items:



(a) Start-of-data code (1 character)
STX code (ASCII code $02)

(b) Frame Character (1 character)
Refer to Table 3.1.

(c) Data Field (variable)

(i) When there is no data field
There is no data field because MOR, ANY, REP, SUS and REC are control frames.

(ii) When there is a data field
Frames other than in (i) above.
The data field includes a function character.

(d) End-of-data code (1 to 4 characters)

Any of the following five is selectable, using [Utility] - [System] - [Host Comm. Set] screen.

(i) ETX + BCC (Note 1) (ASCII code $03 + BCC)

(ii) CR + LF + ETX (ASCII code $0D + $0A + $03)

(iii) ETX (ASCll code $03)

(iv) ETX+ CR + LF (ASCll code $03 + $0D + $0A)

(v) ETX + CKSH + CKSL (Note 2) + CR (ASCll code $03 + h + I + $0D)

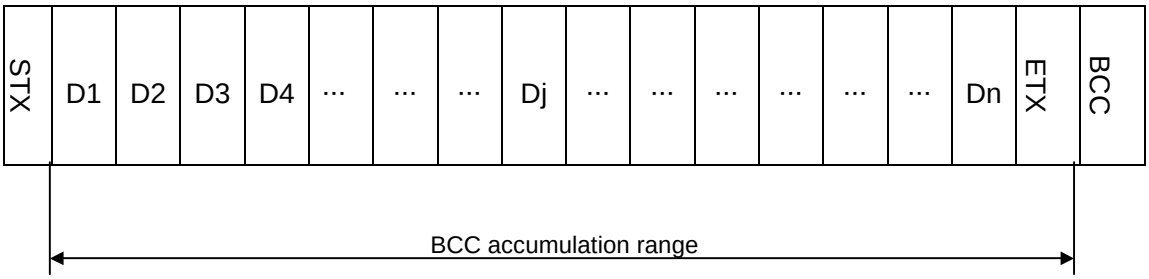
Note 1: BCC (Block Check Character)

The RS-232C communication program is provided with a function to add BCC to the send text and support BCC check of the receive text for detection of an improper message.

Condition (1): The start-of-text character is STX$(02)_{16}$ and the end-of-text character is ETX $(03)_{16}$

Condition (2): The text data consists of characters (nontransparent mode).

At this time, BCC accumulation is started from the character following STX and carried out until ETX appears.



[Calculation Method]

Dn= n-th character in hexadecimal notation (1 byte)

BCC= Block check character (1 byte)

BCC= D1 + D2 + D3 + ... + Dj + ... + Dn + $(ETX)_{16}$

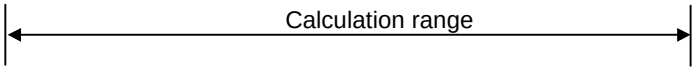
(+: Exclusive OR)

Note 2: CKSH (checksum high) and CKSL (checksum low)

The checksum is calculated by adding all characters between the frame character and the final character in data field (one character before end-of-data code), and the lower two digits of the calculated checksum are converted to the ASCII code.

Example:

S T X	$30	$31	$32	$33	$34	$35	$36	$37	$38	$39	$3A	$3B	$3C	E T X	$42 (B)	$45 (E)	C R



16.2 Communication Functions

(1) Tables 2.1 and 2.2 list the host communication functions provided with Model 7080 Automatic Analyzer. Note that the functions listed in the table are realized only when, at least, [Yes] is specified for Comm. Execute on the Start Conditions screen.

Table 2.1 List of Communication Functions for Test Selection Information

Analytical unit ⟶⟵ HOST

Function			Inquiry	Instruction	Conditions
Test selection information inquiry communication	Routine sample Test selection information inquiry communication		o	o	Valid when [No] is specified for Test Data Only Transfer, using [Utility] – [System] – [Host Comm. Set] screen.
	Stat sample	With ID	o	x	Valid when [Yes] is specified for Stat Sample Test Selection, using [Utility] – [System] – [Host Comm. Set] screen. (Invalid when [Yes] is specified for Test Data Only Transfer.)
		Without ID	x	x	
	Manual rerun sample	Routine sample	o	o	Valid when [Yes] is specified for Manual Rerun Test Selection, using [Utility] – [System] – [Host Comm. Set] screen. (Invalid when [Yes] is specified for Test Data Only Transfer.)
	Automatic rerun sample	Routine sample	o	o	Valid when [Yes] is specified for Auto Rerun Test Selection, using [Utility] – [System] – [Host Ccomm. Set] screen. (Invalid when [Yes] is specified for Test Result Only.)

Table 2.2 List of Communication Functions for Measurement Result Data

<table>
<tr><th colspan="3">Function</th><th>Real-time communication</th><th>Batch communication</th><th>Specific sample request</th><th>Conditions</th></tr>
<tr><td rowspan="6">Measurement result data communication</td><td colspan="2">Routine sample</td><td rowspan="3">o</td><td rowspan="3">o</td><td>o</td><td rowspan="3">A specific sample data request is invalid when [Yes] is specified for Test Result Only.</td></tr>
<tr><td colspan="2">Stat sample</td><td>o</td></tr>
<tr><td colspan="2">Control sample</td><td>x</td></tr>
<tr><td rowspan="2">Automatic rerun sample</td><td>Routine sample</td><td rowspan="2">o</td><td rowspan="2">x</td><td rowspan="2">x</td><td rowspan="2"></td></tr>
<tr><td>Stat sample</td></tr>
<tr><td colspan="2">Calibration measurement result data</td><td>o</td><td>x</td><td>x</td><td></td></tr>
<tr><td colspan="2">Absorbance measurement result data in all reaction processes</td><td>o</td><td>x</td><td>x</td><td>Valid when [Yes] is specified for Original ABS, using [Utility] – [System] – [Host Comm. Set] screen.</td></tr>
</table>

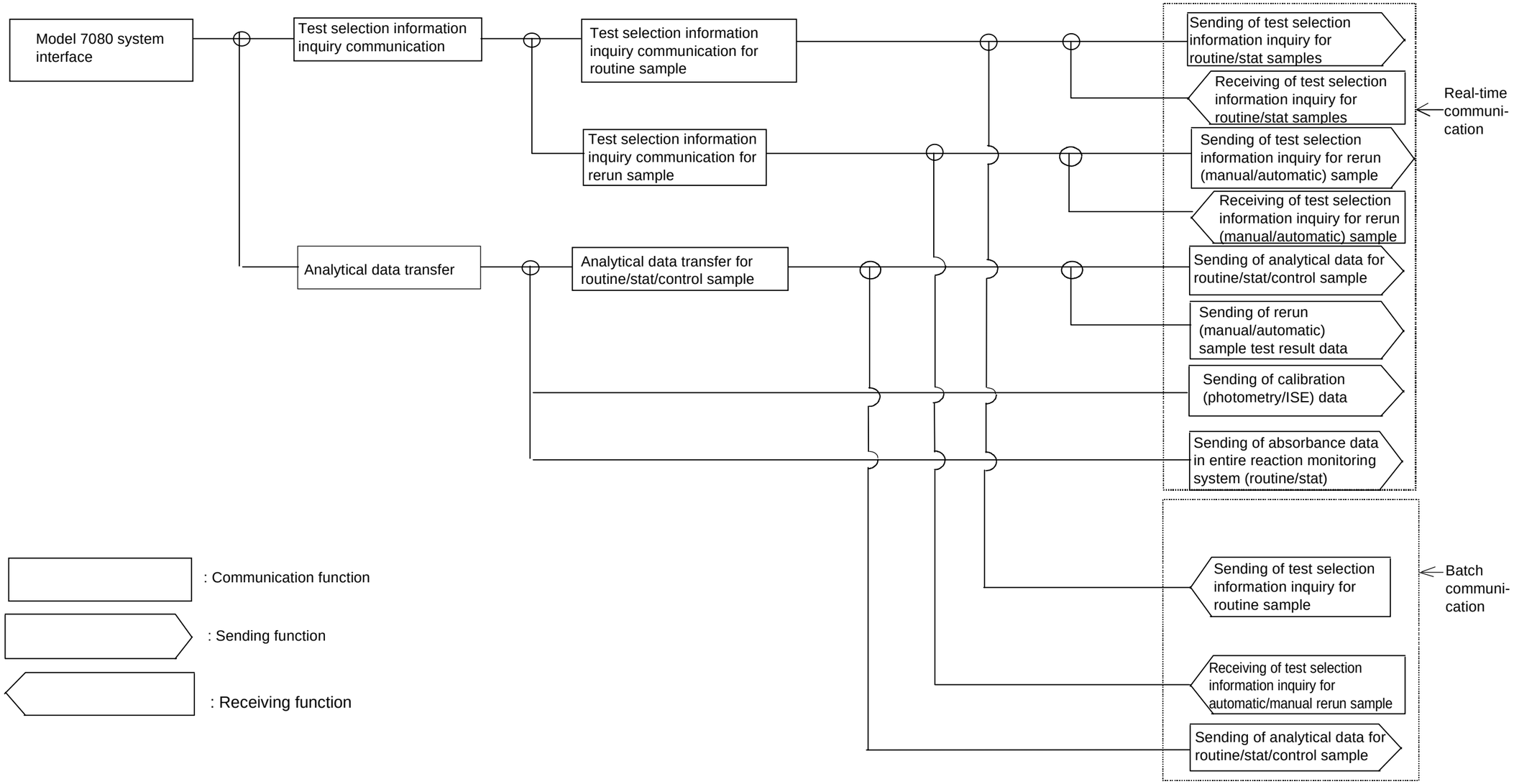
o: Executable
x: Unexecutable

<Supplementary Explanation>

(1) The above real-time communication indicates a communication carried out while the instrument is engaged in analysis, and the batch communication indicates a communication when specified through the screen.
(2) To stop communication between the AU and host, change [Yes] to [No] for Comm. Execute on the Start Conditions screen.

Stat sample test selection information is specifiable from the host, in response to inquiry from AU during real-time communication. In this case, however, note that a single inquiry from the host is invalid.

(2) Relationship between model 7080 system interface functions



16.3 Frames

The frame represents the purpose of the text (contents of message). Table 3.1 lists the frames.

Table 3.1 List of Frames (AU: Analytical side, HOST: System side)

No.	Mne-monic	Name	Char-acter	ASCII code	Sender	Meaning	
1	FR1	Frame 1	1	$31	AU	For analytical data transfer	Used when send data extends over more than one text. FR1 is used for the first text and END for the final text. END alone is used when analytical data for one sample can be sent in a single text. These frames are used to send analytical data.
2	FR2	Frame 2	2	$32			
3	END	End Frame	:	$3A			
4	SPE	Specific Sample	;	$3B	AU	TS directive inquiry	Used for TS inquiry for only one specific sample. (TS: Test selection information)
					HOST		Used for TS sending in response to TS inquiry by use of SPE from AU. / HOST uses SPE for TS sending in response to TS inquiry using SPE from AU as well.
5	RES	Results Request	<	$3C	HOST	Specific sample request	Used to request analytical data of a specific sample from HOST to AU. (Whether ID is provided or not, routine and stat samples alone are taken as valid and the others are ignored.)

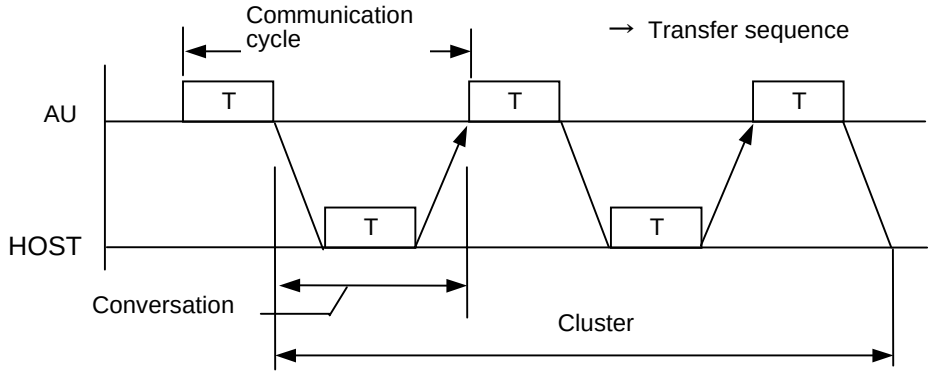
No.	Mne-monic	Name	Char-acter	ASCII code	Sender	Meaning	
6	ANY	Any Inquiry	>	$3E	AU	Positive Inquiry (correspond-ing to ACK)	Sent when AU has previously received data from HOST normally and is also in the idle status (when AU does not have data to be sent to HOST).
7	MOR	More			HOST		Send this when HOST has previously received data from AU normally and is also in the idle status (when HOST does not have data to be sent to AU).
8	REP	Repeat	?	$3F	AU, HOST	Negative response (correspond-ing to NAK)	Sent when data received by AU is abnormal. When AU has received this text, it will resend the previously received text.
9	SUS	Suspend	@	$40	AU, HOST	Suspension request	Sent by AU to suspend resending of a non-specific inquiry and allow a specific inquiry. Sent by HOST to suspend communication for 5 seconds without recording the last communication by AU.
10	REC	Received	A	$41	HOST		Used to request AU to suspend communication for 5 seconds because HOST is not ready to receive analytical data.

16.4 Data Transmission Control Procedure

16.4.1 Establishment of data link

(1) Upon input of [Yes] for Comm. Execute on the Start Conditions screen, the AU transfers the ANY frame to the host. Communication is started from this point.

(2) With test sending, the direction of transmission is reversed and the receiver can send the next response or text. In subsequent steps, the AU and host continue transmission alternately.



16.4.2 Response to information

(1) Upon receiving information, the receiver sends a response or text in its place (see Table 3.1) to inform the sender of the receiver status and the validity of received information.

(2) Used for response is a text in which a character identifying its purpose (frame character) is put between STX and ETX. When the 256-byte mode is selected for the transferred byte count, the analytical data text may exceed 256 bytes (including STX and end-of-data code) according to the sample. In this case also, a frame character which is put between STX and ETX to identify the number of transmissions is sent in the text.

(3) The AU continues replying as far as the host returns a response. Even when the text corresponding to an optional frame character is transferred and there is no data to be sent between the AU and host, they continue sending the ANY frame and MOR frame respectively. However, the cluster is restarted immediately if analytical data transfer, test selection directive or any other transfer is requested.

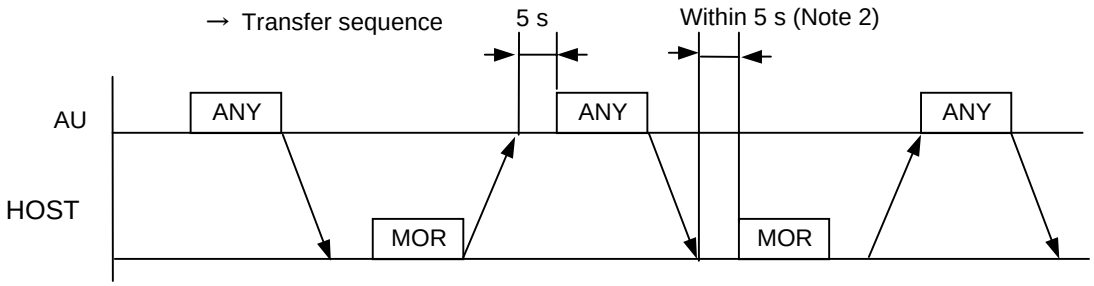
(4) After sending a text, avoid sending until reception of a response or request to/for the text in a normal condition. Otherwise the AU will output an alarm.
If no response is returned or an invalid response is received, the recovery procedure is executed. In case of sending from the host, it must always be kept ready for receiving.

16.4.3 Response to information message

Described below are the typical procedure for returning a response to the information message and the procedure upon receiving the response.

(1) When there is no information to be sent	(AU ⟷ HOST)
(2) Transfer of communication control message	(AU ⟷ HOST)
(3) Transfer of test selection information	(AU ⟷ HOST)
(4) Transfer of analytical data	(AU ⟷ HOST)
(5) Resending request	(AU ⟷ HOST)

(1) When there is no information to be sent (AU ⟷ HOST)



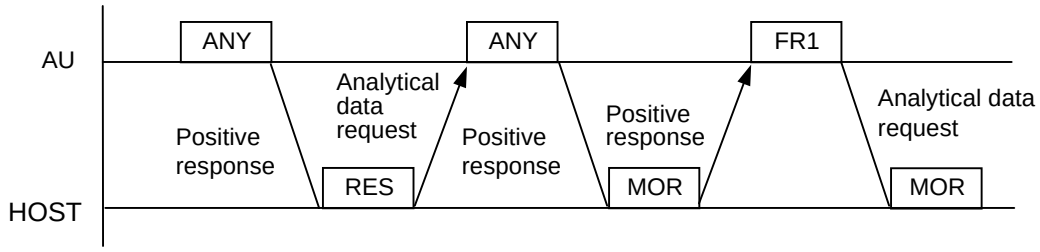
The AU continues returning the ANY frame in response to the MOR frame from the host so as to respond to the request from the host at any time even when the AU and host have no information to be sent (Note 1).
In this case, the AU sends the ANY frame in the lapse of five seconds after receiving the MOR frame from the host (a point when the final end-of-data code is recognized).

Note 1: When the following conditions are satisfied:

(a) There is no test selection information to be sent to the host.
(b) Analytical data is not output in the real time mode.
(c) Analytical data is not output in the real time mode.
(d) There is no request for the RES frame.

Note 2: After receiving from the AU, the host should return a response after waiting for at least 100 ms. If the host may not return a response within five seconds, then send the SUS frame to the AU.

(2) Transfer of communication control message (AU ⟷ HOST)



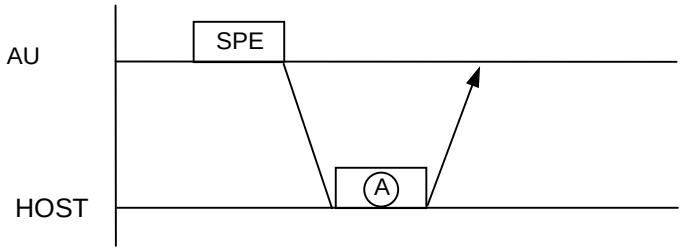
The RES, ANY, MOR, REP, SUS and REC frames are available for the communication control message. For details, refer to Table 3.1.

(a) RES frame

The host can make a request to the AU for measurement data of a specific sample by use of the RES frame. However, if the AU has no relevant data, it sends the ANY frame.

Data is transferred in the received sequence, starting from completion of transmitting the measurement result data in real-time mode.

(3) Transfer of test selection information (AU ⟷ HOST)



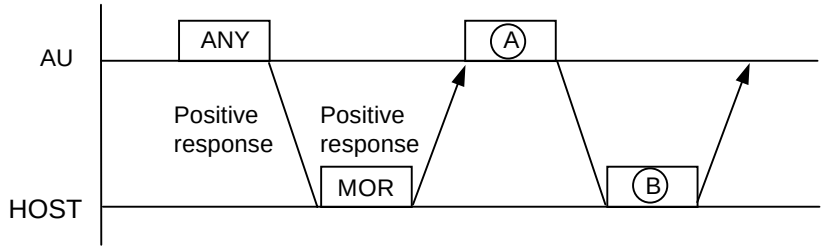
Response from HOST:

Frame (A)	Description
SPE	To return a response to test selection information inquiry for a sample sent from AU
MOR	To indicate that host cannot respond to test selection information inquiry but is ready to receive analytical data
REC	To suspend communication with AU for a specified time because it is impossible to not only respond to test selection information inquiry but receive analytical data

(4) Transfer of analytical data (AU −→ HOST)

The AU can send analytical data to the host only when the host has transferred the MOR frame to the AU.

(a) Transmission procedure in normal case



Response from AU:

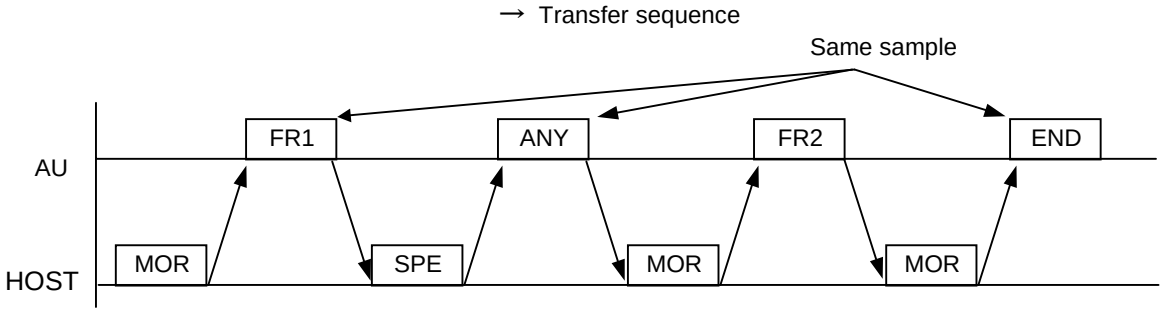
Frame (A)	Description
FRI to END	Analytical data (including calibratiion result and absorbance data in entire reaction monitoring system)

Response from Host:

Frame (B)	Description
REP	When text in (A) is abnormal
MOR	To receive analytical data next time also
REC	Not to receive analytical data next time
SUS	To suspend communication
SPE	To indicate test selection
RES	To request a specific sample

(b) Transmission procedure in special case

Even if the host sends any other frame than MOR while the AU is transferring to the host samples which have two or more texts each, the AU responds to the relevant frame, and restarts sending from a succeeding text upon receiving the MOR frame.



Effect of this system:

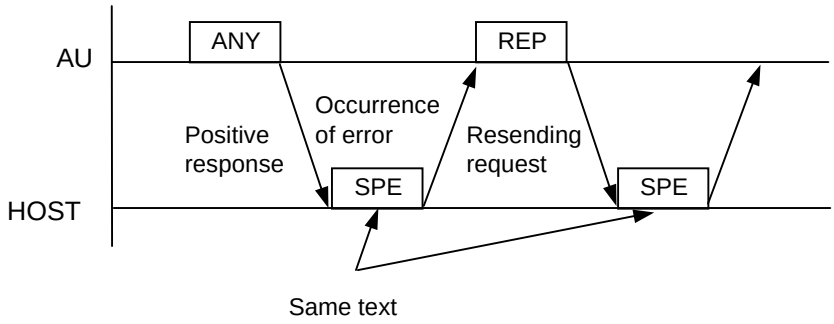
(1) No delay to SPE

(2) Identifiable by HOST because sample identification information is provided for each text

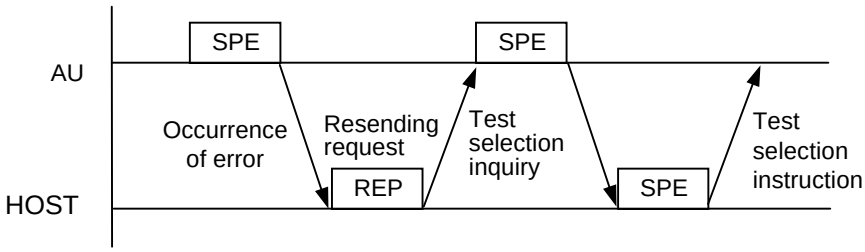
(5) Resending request (AU ⟷ HOST)

Resending is requested if there is any abnormality in the contents of the text received from the AU/host or to request the same text again for some reason.

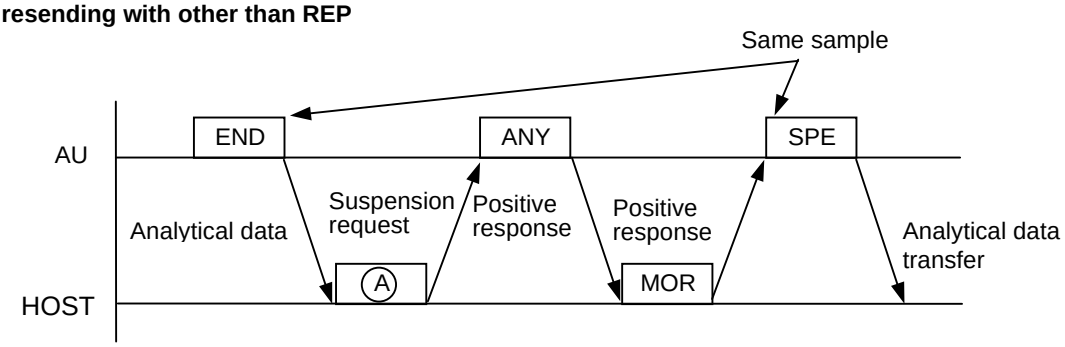
(a) From AU to Host



(b) From Host to AU

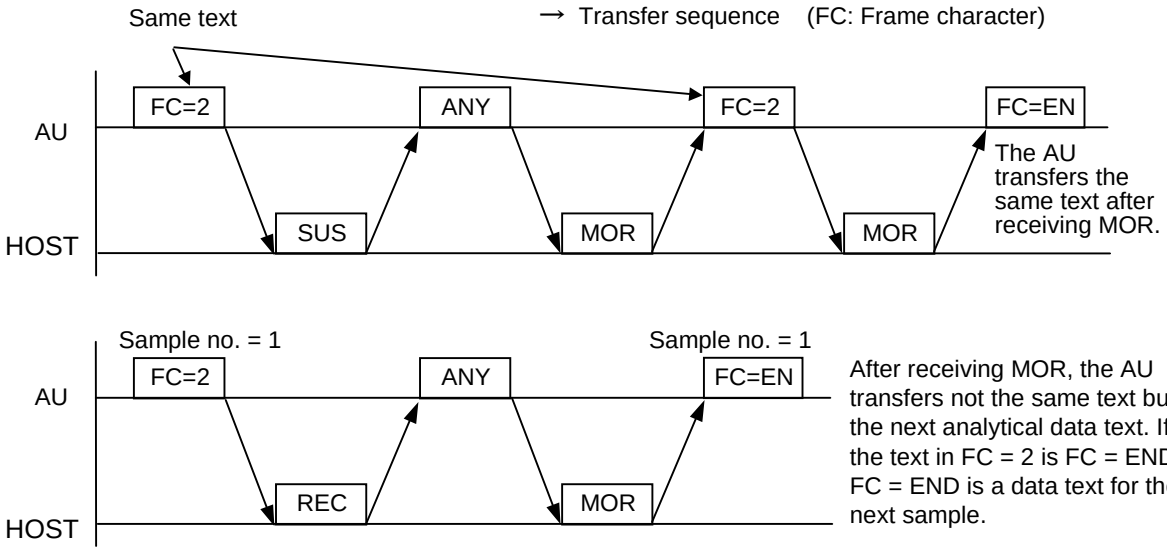


(c) For resending with other than REP



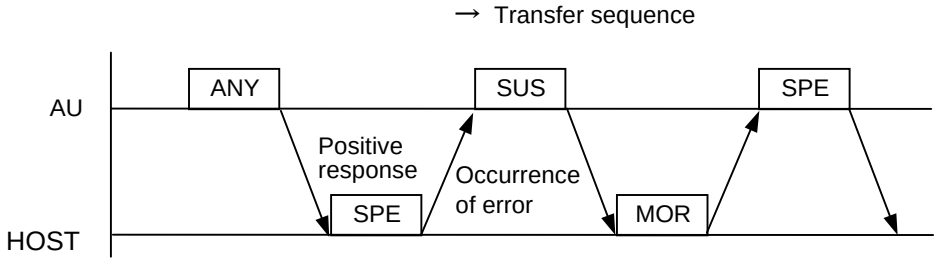
Frame (A)	Description
SUS	Sent from host when it wants AU to suspend communication for a specified time. In this case, note that AU judges that host could not receive the text for some reason, and when communication is retrieved (MOR frame is sent from host), the lastly sent text, if it is an analytical data text, is resent to restart communication.
REC	Sent from host when it wants AU to suspend communication for a specified time. In this case, note that AU judges that host could receive the analytical data text normally and after reception of MOR frame, the analytical data text is not resent.

Difference between SUS frame and REC frame transfer

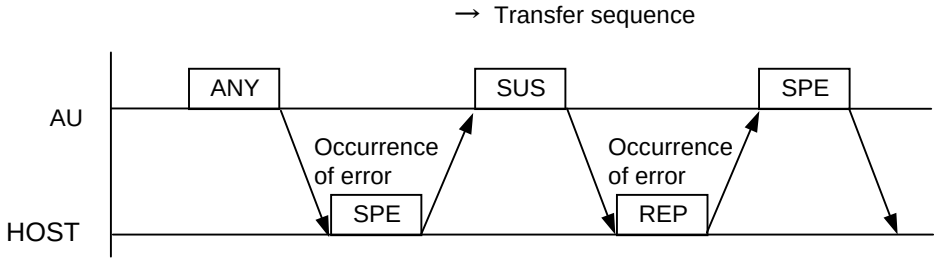


(d) In case of SUS frame sending from AU

If the AU receives an abnormal text, it must transfer the REP frame (resending request) to the host. However, the AU transfers not the SPE frame but the SUS frame to the host if TS inquiry request is made at the AU side.

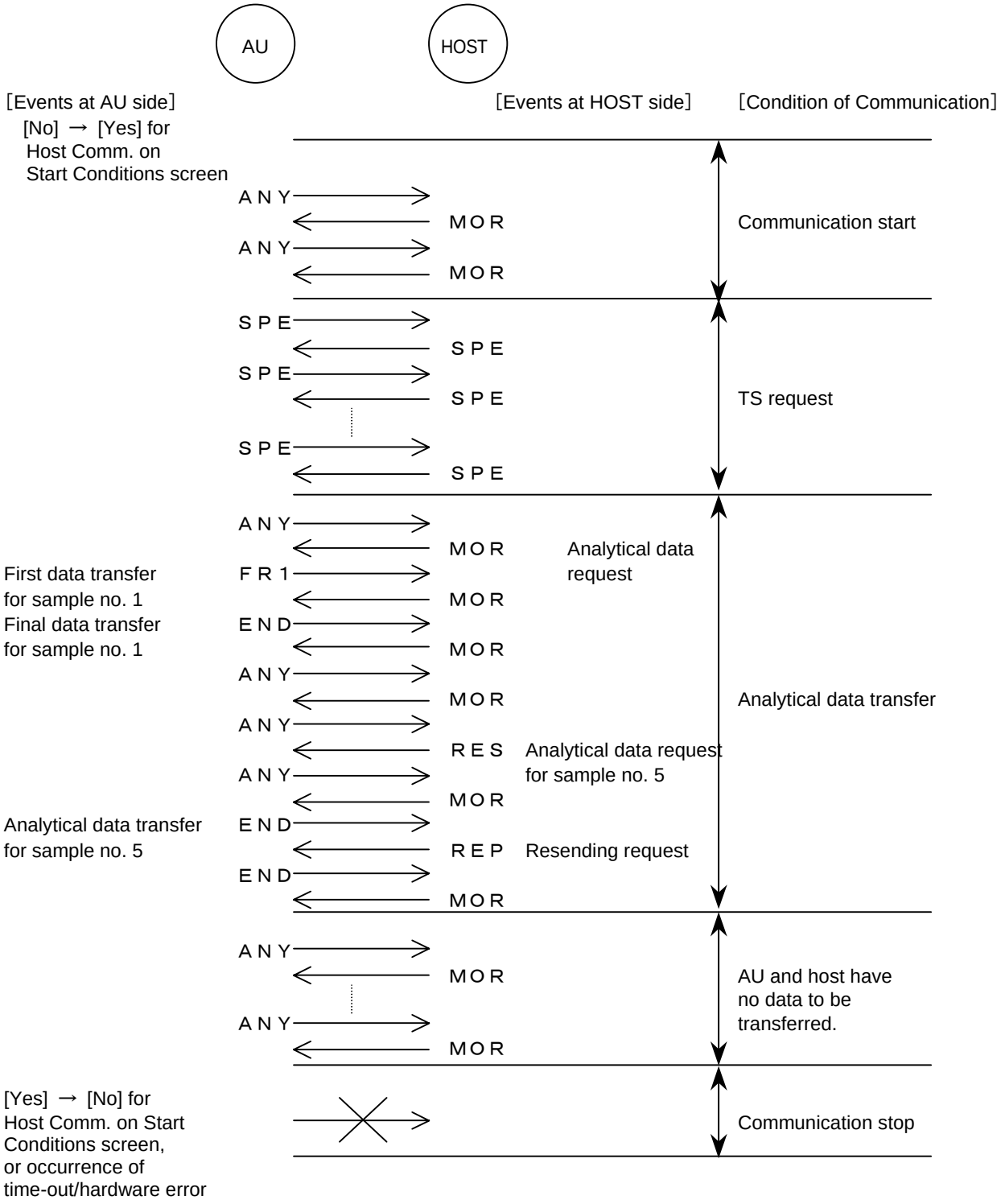


(Example 1)



(Example 2)

Basic Control Procedure



Details of each frame:

	Description
SPE	TS request for one specific sample
SPE	TS response for one specific sample
FR1/END	Analytical data transfer
RES	Analytical data request for specific sample
REP	Resending request

16.4.4 Termination

Table 4.1 shows the conditions of termination and restart of this protocol.

Table 4.1 Termination and Restart of Communication

(o: Communication stopped, x: Communication continued)

Conditions of termination	Real-time communication	Batch communication	Restart of communication
Specification of [No] for Host Comm. on Start Conditions screen	o	o	Change of [No] to [Yes] for Host Comm. on Start Conditions screen. Previous contents of communication are all canceled and restart is given.
Occurrence of send/receive time-out error	o	o	Same as above
Occurrence of hardware error alarm related to communication	o	o	Same as above
Stop directive through screen during batch sending of analytical data to HOST	x	o	Remaining samples in specified range are not sent. Upon restart, samples in newly specified range are set.

16.4.5 Timer

For details, refer to the retry code table for the system interface.

16.4.6 Priority

When two or more processings are carried out in response to a request from the host, the AU assigns priorities to them and returns a response to the host.

However, batch communication is suspended in a unit of text, to transfer to the host the text which has a higher priority than batch communication when it interrupts batch communication under execution (restricted to the case where analytical data in the real-time mode is output from AU and transfer of analytical data in response to RES frame). (It can be judged from the function frame whether it is real-time communication data or batch communication data.) After that, batch communication is restarted.

Table 4.2 shows the details of each frame and the priority.

Table 4.2 Details of Each Frame and Priority

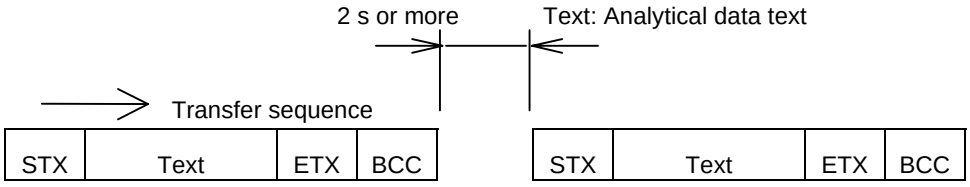
Priority	Item
1	Sending of SPE (stat sample) frame
2	Sending of SPE (routine sample) frame
3	Sending of REP (resending request) frame
4	Sending of high-priority analytical data (analytical data in real-time communication)
5	Sending of analytical data in response to RES from HOST (transfer of data read from FD)
6	Sending of lower-priority analytical data (analytical data in batch communication)

16.4.7 Result Only mode

In this mode, only the measurement result data is transferred to the host. This mode does not accept a request for re-transfer (REP frame) from the host and an answer to specific sample data request.

When [No] is specified for Result Only, using [Utility] – [System] – [Host Comm. Set] screen, the AU returns no response to test selection inquiry or test selection directive even when [Yes] is specified for the test selection inquiry.

The AU waits for two seconds or more after sending ETX in the analytical data text and proceeds to transfer to the host regardless of the communication procedure.



16.5 Status Transition

16.5.1 Status transition matrix

No.	Event / Status in AU	Event from AU: Host Comm. on Start Conditions screen: [No] → [Yes]	Event from AU: Host Comm. on Start Conditions screen: [Yes] → [No]	Event from AU: TS inquiry request (TS management task)	Event from AU: Real-time data output from AU	Event from AU: Batch transfer request via screen	Event from AU: Occurrence of HD or FD error	Event from HOST: MOR: Data for 2 or more samples	Event from HOST: MOR: Final data	Event from HOST: REP (resending request)	Event from HOST: SUS (suspension request)	Event from HOST: REC (suspension request)	Event from HOST: SPE (TS instruction)	Event from HOST: RES (specific sample request)	Event from HOST: Time-out/ hardware error or REP 7 or more times	Event from HOST: Occurrence of error in text (Note 1)
1	Initial status ([No] specified for Comm. Execute)	To ANY transfer/2														
2	Idling (no data to be transferred at AU or HOST)		1	6	4	3		ANY transfer/2		Previous frame/2	ANY transfer/2			ANY transfer after RES save/3	10	REP transfer/11
3	LPR transfer wait (before LPR transfer)		1	7	5	3	2	LPR transfer/2	LPR transfer/2	Previous frame/3	ANY transfer/3			ANY transfer after RES save/3	10	REP transfer/11
4	HPR transfer wait (before HPR transfer)		1	8	4	5		HPR transfer/4	HPR transfer/2	Previous frame/4	ANY transfer/4			ANY transfer after RES save/5	10	REP transfer/11
5	HPR/LPR transfer wait (before HPR/LPR transfer)		1	9	5	5	4	HPR transfer/5	HPR transfer/3	Previous frame/5	ANY transfer/5			ANY transfer after RES save/5	10	REP transfer/11
6	SPE transfer wait (before SPE transfer)		1	6	8	7		SPE transfer/6	SPE transfer/2	SPE transfer/6	SPE transfer/6, SPE transfer (final)/2			SPE transfer/7, SPE transfer (final)/3	10	REP transfer/11
7	SPE/LPR transfer wait (before SPE/LPR transfer)		1	7	9	7	6	SPE transfer/7	SPE transfer/3	SPE transfer/7	SPE transfer/7, SPE transfer (final)/3			SPE transfer/7, SPE transfer (final)/3	10	REP transfer/11
8	SPE/HPR transfer wait (before SPE/HPR transfer)		1	8	8	9		SPE transfer/8	SPE transfer/4	SPE transfer/8	SPE transfer/8, SPE transfer (final)/4			SPE transfer/9, SPE transfer (final)/5	10	REP transfer/11
9	SPE/HPR/LPR transfer wait (before SPE/HPR/LPR transfer)		1	9	9	9	8	SPE transfer/9	SPE transfer/5	SPE transfer/9	SPE transfer/9, SPE transfer (final)/5			SPE transfer/9, SPE transfer (final)/5	10	REP transfer/11
10	Alarm registration (communication stopped)	Alarm display/registration Host Comm. on Start Conditions screen: [Yes] → [No] To no. 1														
11	Alarm registration (communication continued)	Alarm display/registration To previous status														

Note 1: In case of alarm subcode 13, an alarm is issued, but REP frame is not transferred.

Note 2: Upon receiving the SUS or REC frame, each frame is sent after waiting for a specified time.

: Ignored

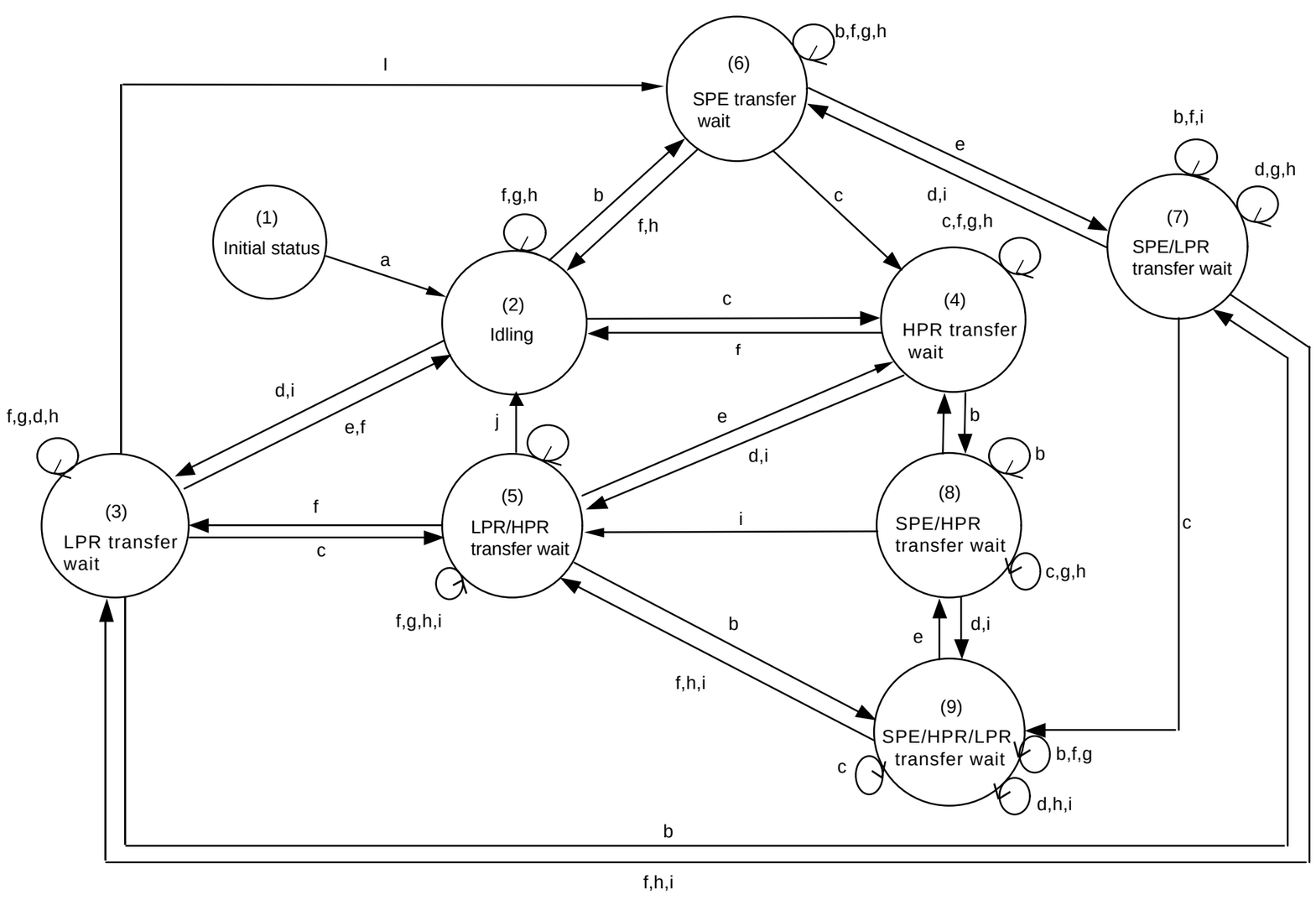
HPR: Analytical data transfer in real-time communication

LPR: Analytical data transfer in response to specific sample request (RES), batch transfer specified through screen.

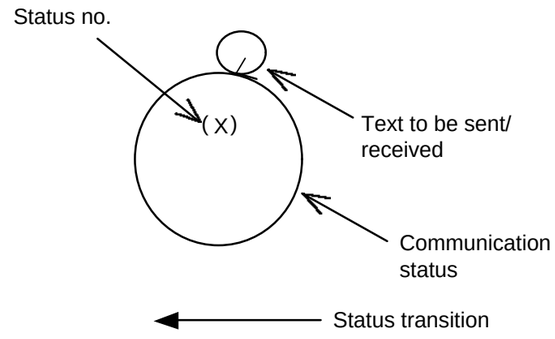
FR/value FR: Contents or processing of text to be sent to HOST

value: Number of status to which transition is made

16.5.2 Status transition diagram



Symbol	Event
a	Host Comm. on Start Conditions screen: [Yes]→[No]
b	TS inquiry requested
c	Real-time data output from AU
d	Batch transfer requested via screen
e	HD or FD error occurred
f	MOR received
g	REP received
h	SUS, REC or SPE received
i	RES received



16.6 Text Configuration Table

Table 6.1 shows the text configuration, corresponding to the contents of each frame.

Table 6.1

(Note 2) (FU: Function character)

Text type	Text item	Relevant frame	Total number of bytes	Sender	Contents of text (Note 1)
Text indicating feature of communication	Positive response	ANY / MOR	4	AU / HOST	STX | > | ETX | BCC
	Negative response (resending request)	REP	4	AU HOST	STX | ? | ETX | BCC
	Suspension request	SUS	4	AU HOST	STX | @ | ETX | BCC
		REC	4	HOST	STX | A | ETX | BCC
	Analytical data request for specific sample	RES	43	HOST	STX | < | F U | Sample data | ETX | BCC
Test selection inquiry text	Inquiry request	SPE	43	AU	STX | ; | F U | Sample data | ETX | BC
Test selection directive text	Directive request	↑	Variable	HOST	STX | : | F U | Sample data | Channel count | Test selection data | Comment | ETX | BCC
Analytical data text	Routine/rerun/stat/ control sample	FR1 ~ END	↑	AU	STX | : | F U | Sample data | Operator ID | Channel count | 52-test result data | ETX | BCC
	Absorbance data in entire reaction	↑	↑	↑	STX | : | F U | Sample data | Analytical data 1 | … | Analytical data 4 | BLANK1 | … | BLANK4 | Point count | ABS1 | … | ABS49 | ETX | BCC
	Photometry-assay calibration	END	↑	↑	STX | : | F U | Operator ID | Test no. | STD count | Calib. alarm | STD data 1 | … | STD data 6 | SD value data | ETX | BCC
	ISE calibration	END	↑	↑	STX | : | F U | Operator ID | ISE type | Total alram | ISE calibration data | ETX | BCC

Note 1: Table 6.1 shows the text configuration when the text size is 512 bytes. When a 256-byte text size is specified, refer to the contents of text item concerned.

Note 2: When the end-of-data code is four characters, a value plus 2 is calculated as the number of total bytes.

16.6.1 Composition of each text

1. Text for non-specific request

(1) Composition of text

STX	FR	ETX

(FR: Frame character)

(2) Table 6.2 shows the frame name and frame character according to the sending direction.

Table 6.2

Frame name	Frame character	From AU to HOST	From HOST to AU
ANY	>	o	x
MOR		x	o
REP	?	o	o
SUS	@	o	o
REC	A	x	o

(o: Sent, x: Not sent)

2. RES: Text of analytical data for specific sample (from HOST to AU)

(1) Composition of text

STX	<	Fu	Sample data	ETX

(Fu: Function character)

(2) Contents of text

Table 6.3 shows the contents of the text.

Table 6.3

Sample name	ID provided or not	Function character		Sample data								
		From AU to HOST	From HOST to AU	From HOST to AU (For 'from AU to HOST', refer to item 5 in 16.6.1.)								
				Sample no.	Disk no.	Position no.	Sample cup no.	ID no.	Age	Sex	Date	Time
Routine sample	Provided	a1 to a5	a1 to a5	Ignored				ID no. set (blank not allowed)	Ignored			
Stat sample	Provided	d1 to d5	d1 to d5									
Routine sample	Not provided	n1 to n5	n1 to n5	Sample no. set (1-10000)	Ignored (Set the sample no. even for stat sample with ID)							
Stat sample	Not provided	q1 to q5	q1 to q5									

Note that the AU ignores any other than routine and stat samples (rerun sample, control sample and calibration) when it is sent from the host to the AU.

'Ignored' in the table means that the AU ignores relevant sample data even if it is specified by the host.

3. SPE: Test selection data inquiry (from AU to HOST)

(1) The following shows the composition of SPE text.
For the contents of text, refer to 16.6.2.

STX	;	F	U	Sample data	ETX	BCC

(2) Inquiry to the host is sent for the routine sample, routine automatic/manual rerun sample and stat sample. If Constant Inquiry is not specified (Note), inquiry is made only when the AU has a sample for which TS is not sent from the host to the AU.

(3) When the sample class is not specified for each sample, sample class 1 is used as a default function character for all.

(4) Inquiry to the host is not made under the following conditions:
Countermeasure: The sample corresponding to a read error should be handled as a stat sample. Enter its ID through the screen for analysis.
   (a) Failure in ID reading at the AU side when the barcode reader is provided.
   (b) When the barcode reader is provided, the ID-provided manual rerun sample corresponding to the ID no. is not measured.
   (c) When [Yes] is specified for Test Result Only (Note)
   (d) For a sample which has the alarm of 'sample short' at the first analysis in the automatic rerun mode.

(5) Inquiry for the automatic rerun sample is made after sampling of the routine sample is completed and data is sent to the host (after the AU receives MOR in response to sending of the analytical data for the relevant sample).

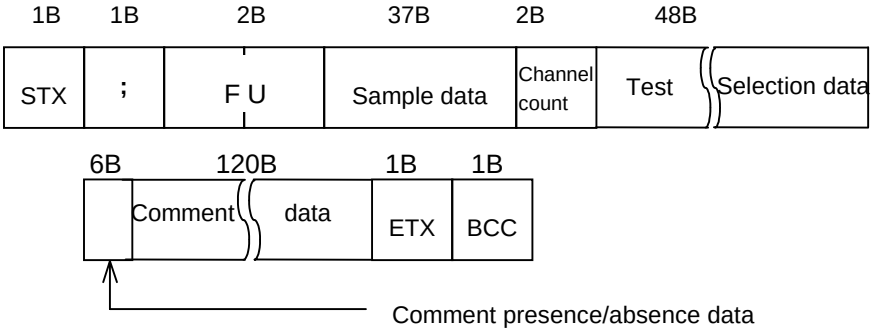
(6) Inquiry for the manual rerun sample is made for the sample for which initial analysis has been completed.

Note: Specify, using [Utulity] – [System] – [Host Comm. Set] screen.

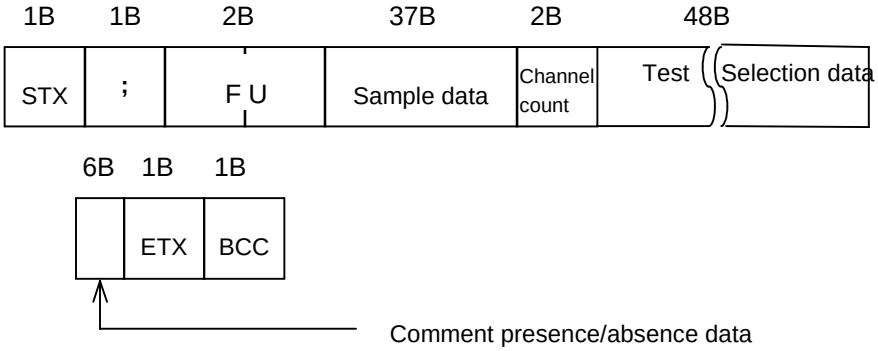
4. SPE: Test selection data instruction (from HOST to AU)

(1) The following shows the composition of SPE text.
For the contents of text, refer to 16.6.2.

(a) With comment

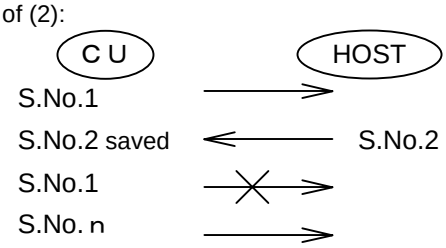


(b) Without comment



(2) The test selection data from the host will correspond to the sample data sent upon test selection inquiry. If not, however, the test selection data is read into the AU and inquiry is not made again. Even if the ID transmitted by the AU is not returned from the host in the ID mode, the test selection data is also read into the AU.

Details of (2):



(3) If an error, such as time-out error or hardware error, has occurred, it is judged that the reception of relevant sample has failed, and the sample is ignored.
In subsequent steps, communication is stopped.

(4) When no request is made for all channels indicated by the received test selection data, it is judged that test data for the relevant sample is undecided and test data stored in the AU is used.
(5) When the barcode reader is provided, the AU ignores the sample no., disk no. and position no. of the routine/rerun sample even if they are sent from the host.
(6) In manual rerun, the AU does not accept TS for the manual rerun sample when the sample bearing the sample no. specified from the host is not measured.
(7) With the barcode reader provided, when the same ID no. is transferred to the AU two or more times, TS registered to the final ID no. is given priority.
(8) When ISE tests are requested from the host with the AU in 'NO ISE' mode, the request is ignored (it is judged that the request is not made) at the AU side.

5. Transfer and contents of analytical data (from AU to HOST)

Shown below are the contents of each text.

(1) Analytical data transfer for routine, rerun, stat, and control samples

The text size (number of transferred words between STX code and end code) is designated between the four given below.

If [Yes] is specified for Send Comment, using [Utility] – [System] – [Host Comm. Set] screen, comment is added to the final text.

If the comment cannot be included in the final text (exceeding the text size), the comment is not delimited, but it is included in following text to be transferred.

Table 6.4 Text Size and Composition

Text size	Text composition (B: Byte count)	Max. test count/text	Max. text count	Channel count
256	Final: 1B STX | 1B : | 2B FU | 37B Sample data | 6B Operator ID | 2B Channel count | 9B x test count n Analytical data | 1B ETX | 1B BCC (1ch ~ 22ch)	22	1	22 or less
	1st: 1B STX | 1B 1 | 2B FU | 37B Sample data | 6B Operator ID | 2B Channel count | 9Bx test count n Analytical data | 1B ETX | 1B BCC (1ch ~ 22ch) Final: STX | : | FU | ↑ | ↑ | ↑ | ↑ | ETX | BCC (23ch ~ 44ch)	22	2	23 or more, 44 or less
	1st: STX | 1 | FU | Sample data | Operator ID | Channel count | Analytical data | ETX | BCC (1ch ~ 22ch) 2nd: STX | 2 | FU | ↑ | ↑ | ↑ | ↑ | ETX | BCC (23ch ~ 44ch) Final: STX | : | FU | ↑ | ↑ | ↑ | ↑ | ETX | BCC (45ch ~ 60ch)			
512	Final: 1B STX | 1B : | 2B FU | 37B Sample data | 6B Operator ID | 2B Channel count | 9B x test count n Analytical data | 1B ETX | 1B BCC (1ch ~ 51ch)	51	1	51 or less
	1st: 1B STX | 1B 1 | 2B FU | 37B Sample data | 6B Operator ID | 2B Channel count | 9Bx test count n Analytical data | 1B ETX | 1B BCC (1ch ~ 51ch) Final: STX | : | FU | ↑ | ↑ | ↑ | ↑ | ETX | BCC (52ch ~ 60ch)	51	2	52 - 60
1024	Final: 1B STX | 1B : | 2B FU | 37B Sample data | 6B Operator ID | 2B Channel count | 9B x test count n Analytical data | 1B ETX | 1B BCC (1ch ~ 60ch)	60	1	
Common	Final with comment: 1B STX | 1B : | 2B FU | 37B Sample data | 6B Operator ID | 2B Channel count | 9B x test count n Analytical data | 6B Comment presence/absence flag | 120B max. Comment | 1B ETX | 1B BCC			

Note 1: The end code character is settable up to four characters. So calculate the maximum number of transferable channels according to the expression shown below:

(Maximum number of transferable channels) < Text size–44/9 (Round off fractions)

(A numerical value ‘44’ indicates the total byte count of fixed length n in Table 6.4.)

Note 2: In batch communication in the 256-byte mode, data is sent in up to three texts for each sample.

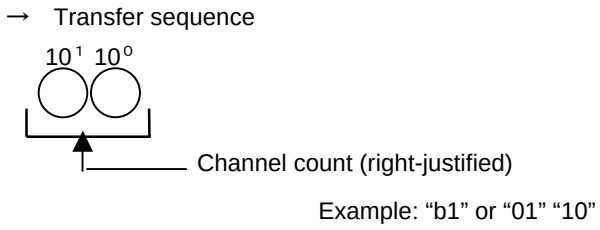
In this case, the AU sends the first text and then the following one within five seconds after receiving the MOR frame.

Note 3: The total number of analytical data to be transferred is variable according to the number of measured channels.

(a) Channel count (2 characters)

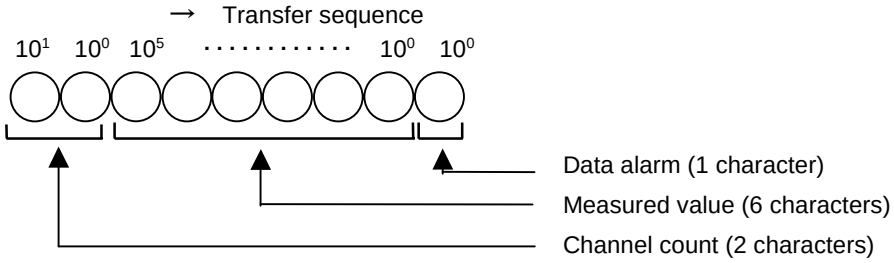
The number of channels to be transferred in one text is sent.

If [Yes] is specified for Send Comment, using [Utility] – [System] – [Host Comm. Set] screen and only comment is transferred, the text is transmitted with channel count “0”.



The AU transfers data of up to 60 channels including serum indexes (three tests of lipemia, hemolysis and icterus) and electrolytes (three tests of Na, K and Cl).

(b) Analytical data 1 to n (9 characters each)



(i) Channel no.

Table 6.4

Channel no.	Description
B1 to 46	Photometry assay
47 to 49	Electrolyte
50 to 52	Serum index
53 to 60	Calculation item

(ii) Analytical data

Table 6.5

The (b: Space) sign position can be switched as follows, using Dip SW:

Positive/ Negative	Decimal point	Max. digit count	Example
Positive	Absent	6	123456
	Present	5	123.45
Negative	Absent	5	-12345
			-bb123
	Present	4	-12.34
			-b12.3

Table 6.5.1

Dip SW No. 2-3	Code position	Example
ON	Variable	bb – 123 or b – 1.23
OFF	Fixed at utmost left	-bb123 or –b1.23

Table 6.6

Channel no.	Description	Form	Position of decimal point
1 to 46	Concentration value in photometry assay	6 digits with sign and decimal point	Decimal point position for standard 1 on Analytical Parameters screen
47 to 49	Concentration value of electrolyte	Ditto	Decimal point position for LOW solution on Analytical Parameters screen
50 to 52	Measured value for serum index	6-digit integer with sign	Zero at any time

Note 1: When the kind of measured sample coincides with the specification for “QUALITATIVE” test on the ANALYTICAL PARAMETERS screen, the specified character string is transferred to the host instead of the measured value.

Value input for qualitative analysis and transmitted character

Qualitative test [ ]

(1) [a] [l]
(2) [b] [m]
(3) [c] [n]
(4) [d] [o]
(5) [e] [p]
(6) [q]

Measured value range	Transmitted character
Measured value ≦ a	‘l’ is transmitted to result
a < Measured value ≦ b	‘m’ is transmitted to result
b < Measured value ≦ c	‘n’ is transmitted to result
c < Measured value ≦ d	‘o’ is transmitted to result
d < Measured value ≦ e	‘p’ is transmitted to result
e < Measured value	‘q’ is transmitted to result

(iii) Data alarm

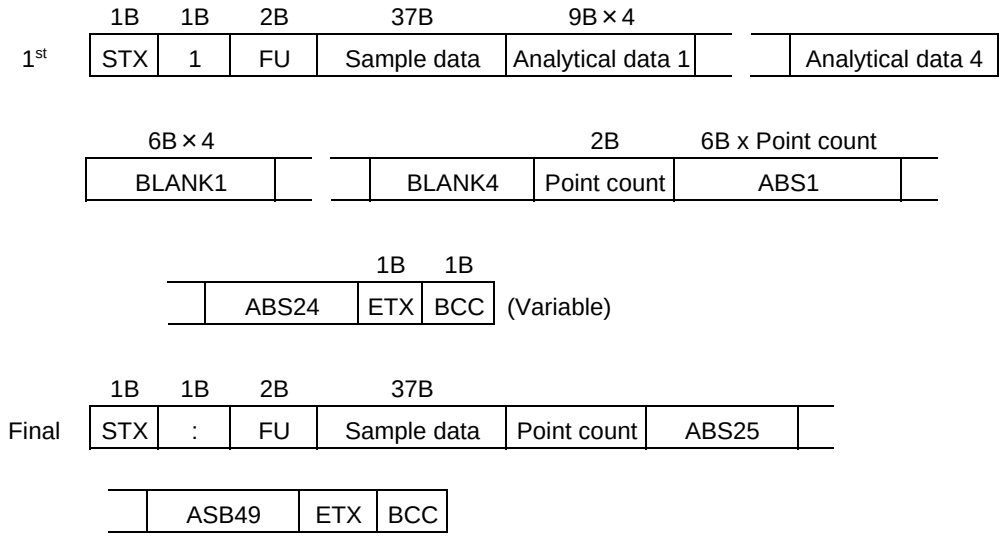
For details, refer to “16.10.2 List of data alarms”.

‘*’ is set at the Data Alarm position to judge whether the test has been edited or not on the host. In this function, ‘*’ is added only to the tests edited with the DATA REVIEW screen.

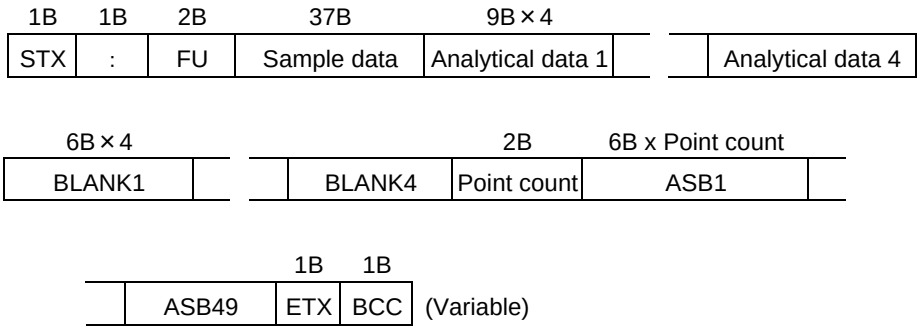
(2) Transfer of absorbance data in entire reaction monitoring system (from AU to HOST)

(a) Specification of size

(i) When 256-byte mode is specified for text size



(ii) When 512 or 1024-byte mode is specified for text size



(b) Transfer unit

This text is transferred in units of channel. Even when the text size is 256 bytes, transfer is completed in a single text if the point count is 25 or less.

The frame character at that time is not ‘1’ but ‘:’.

(c) Sample data

Refer to “2. Sample data” in 16.6.2.

(d) Analytical data 1 to 4 (9 characters each)

(i) For the transfer format, refer to (1) – (b) of item 5 in 16.6.1.

(ii) Table 6.9 is followed when there is no relevant test for analytical data 1 to 4.

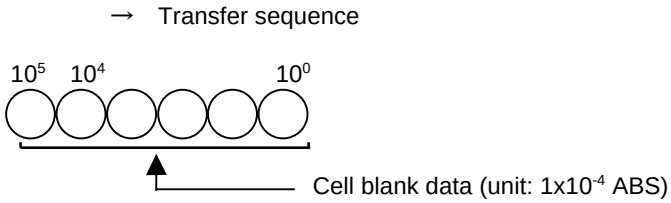
Table 6.9

	Setting
Channel no.	“bb"
Measured value	"bbbbbb"
Data alarm	"b"

(iii) When two-channel simultaneous measurement is specified, data for two channels is transferred, and when serum index measurement is specified, data for up to four channels (1 channel + L, H, l) is transferred.

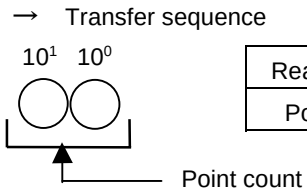
(e) BLANK 1 to 4 (6 characters each)

The transfer format for each cell blank data is as follows:



(f) Point count (2 characters)

The number of photometric points to be transferred in one text is transferred.



Reaction time	3 min	4 min	5 min	10 min	15 min
Point count	10	13	15	31	49

(g) ABS 1 to 49 (6 characters each)

Absorbance data in the entire reaction monitoring system (data at each photometric point) is transferred in the same format as for the above cell blank data.

When the point count is less than 49, data is closely transferred in sequence, starting from ABS 1.

(3) Transfer of photometry-assay calibration data (from AU to HOST)

Composition of text Each parenthesized numeral indicates the byte count. (b: Space)

1B	1B	2B	6B	2B	1B	1B	32B	
STX	:	Gb	Operator ID	Channel no.	STD count	Calibration alarm	STD data 1	

	32B	8B	1B	1B	
	STD data 6	SD value data	ETX	BCC	(Variable)

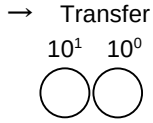
(a) Frame character (1 character)

':' is transferred.

(b) Function characters (2 characters)

'Gb' is transferred. (b: Space)

(c) Chanel no. (2 characters)



A two-digit integer in decimal notation indicates a test code in photometry-assay calibration.

The test no. is 'b1' to '46', which corresponds to the test code in AU.

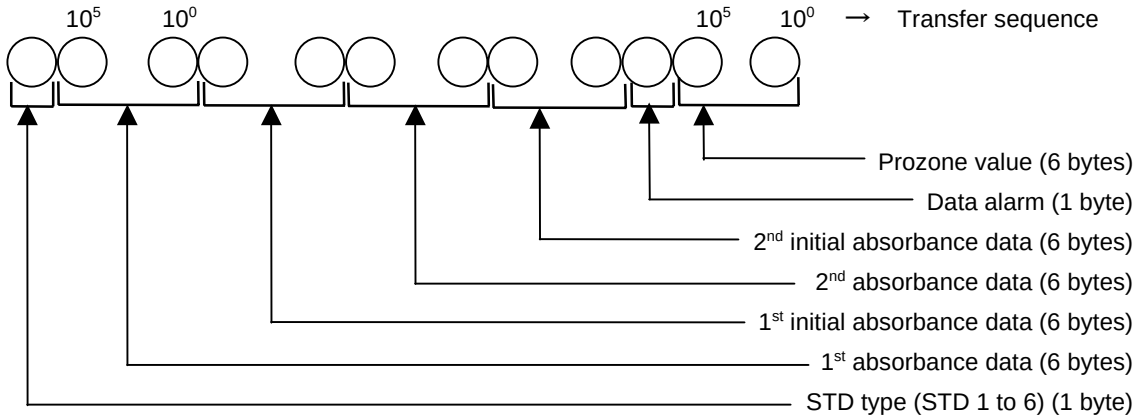
(d) STD count (1 character)

The STD count is ‘1’ to ‘6’ and variable according to the calibration method.

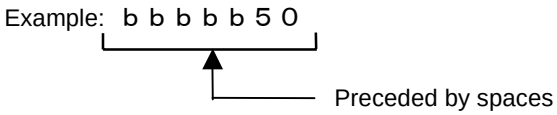
When the STD count is ‘1’, STD data 1 is followed by SD value data.

(e) STD data 1 to 6 (32 characters each)

(i) The data for each STD is composed as follows:



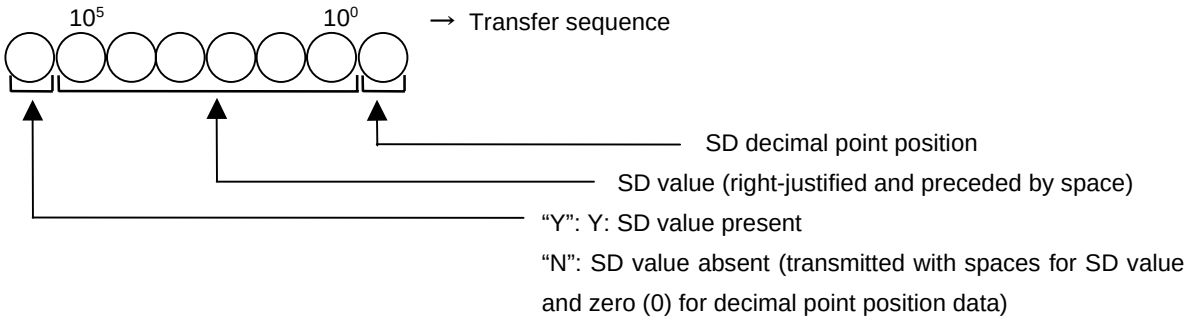
(ii) Each absorbance data is right-justified and preceded by one or more spaces.



(f) Calibration alarm (1 character)

Refer to “16.10.2 Lists of data alarms”.

(g) SD value data (8 characters)



(h) Data composition

Table 6.8

Data item	Unit	Form	Decimal point position
Absorbance data	10^{-4} ABS	6-digit integer with sign	0 (no decimal point)
Initial absorbance data	10^{-4} ABS	ditto	0 (no decimal point)
SD value	None	6 digits with decimal point (positive)	Decimal point position of SD limit on PHOTOMETRY PARAMETERS screen

(i) Transfer unit: Channel

(4) Transfer of ISE calibration data (from AU to HOST)

Composition of text (B: Byte count) (b: Space)

Type A

1B	1B	2B	6B	1B	1B	1B
STX	:	Hb	Operator ID	ISE type	b	Na data alarm

72B	1B	72B	1B	1B
Na calibration data	K data alarm	K calibration data	ETX	BCC

Type B

6B						
STX	:	Hb	Operator ID	ISE type	b	Na data alarm

			1B	72B		
Na calibration data	K data alarm	K calibration data	Cl data alarm	Cl calibration data	ETX	BCC

(a) Frame character (1 character)

':' is transferred.

(b) Function characters (2 characters)

'Hb' is transferred. (b: Space)

(c) ISE (electrolyte) type (1 character)

Table 6.9

ISE type	Test
'A'	Na, K
'B'	Na, K, Cl

(d) Space (1 character)

(e) Data alarm for each channel (1 character)

A data alarm corresponding to each channel is transferred.

For details of (d) and (e) above, refer to “16.10.2 Lists of data alarms”.

(f) ISE calibration data (72 characters)

This data area has eight data items of electromotive force of internal standard solution, electromotive force of LOW solution, electromotive force of HIGH solution, electromotive force of M solution, slope level for display, concentration of internal standard solution, concentration of M solution and compensation factor, which are transferred in this order.

Each data item is composed as shown below.

Spaces are given when there is no relevant data.

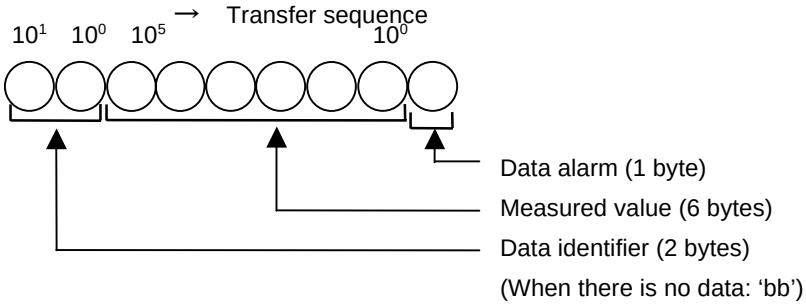


Table 6.10 (b: Space)

Item	Data identifier	Unit	Form	Decimal point position
Electromotive force of internal standard solution	"b1"	mV	6 digits with sign and decimal point	1 digit
Electromotive force of LOW solution	"b2"	mV	6 digits with sign and decimal point	1 digit
Electromotive force of HIGH solution	"b3"	mV	6 digits with sign and decimal point	1 digit
Electromotive force of STD 3	"b4"	mV	6 digits with sign and decimal point	1 digit
Slope level for display	"b5"	mV	6 digits with sign and decimal point	1 digit
Concentration of internal standard solution	"b6"	mEq/l	6 digits with sign and decimal point	Same position as for LOW solution on Analytical Parameters screen
Concentration of STD 3	"b7"	mEq/l	6 digits with sign and decimal point	Align with decimal point position of calibrator concentration
Compensation factor	"b8"	mEq/l	6 digits with sign and decimal point	

(g) Data for up to three tests is collectively transferred to the host.

(h) This text is transferred only when the ISE unit is provided at option.

16.6.2 Contents of text

1. Details of function character (Fu)

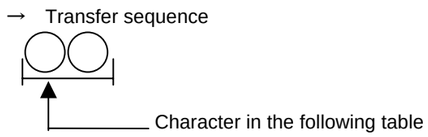


Table 6.11 Function Characters for Test Selection Information Inquiry and Analytical Data **(_: Space)**

Sample name	Form	Test selection data inquiry		Analytical data	
	Direction of communica-tion	AU←→HOST	AU ← HOST	AU → HOST	
	ID provided or not	Real-time communication	Batch communication	Real-time communication	Batch communication
Routine sample	Provided	A1 to A5	A1 to A5	A1 to A5	a1 to a5
Routine sample (automatic rerun)		B1 to B5	B1 to B5	B1 to B5	
Routine sample (manual rerun)		C1 to C5	C1 to C5	C1 to C5	
Stat sample		D1 to D5		D1 to D5	d1 to d5
Stat sample (automatic rerun)				E 1～E 5	
Routine sample	Not provided	N1 to N5	N1 to N5	N1 to N5	n1 to n5
Routine sample (automatic rerun)		O1 to O5	O1 to O5	O1 to O5	
Routine sample (manual rerun)		P1 to P5	P1 to P5	P1 to P5	
Stat sample				Q1 to Q5	q1 to q5
Stat sample (automatic rerun)				R1 to R5	
Control sample	Provided/Not provided			F_	f_
Calibration sample				G_ (photometry assay) H_(ISE)	
Absorbance data in entire reaction monitoring system (routine)				I1 to I5	
Absorbance data in entire reaction monitoring system (stat)				K1 to K5	

Supplementary Explanation:

Numerals 1-5 in the table show the kinds of sample (1: Serum, 2: Urine, 3: Plasma, 4: Cerebrospinal fluid, 5: Other).

2. Sample data

(1) Composition of sample data

Sample no. (5 characters) s s s s s	Disk no. (1 character) d	Position no. (2 characters) p p	Sample cup identifier (1 characters) C	ID no. (13 characters) i i i i i i i i i i i i i	Age (4 characters) a a a c	Sex (1 character) x	Blood collection date (6 characters) m m d d y y	Blood collection time (4 characters) h h m m

(2) Details of sample data

Table 6.12 and Table 6.13 show the details of sample data.

Table 6.12 Details of Sample Data

Item	Sample name			Remarks
	Routine sample (including automatic/manual rerun sample)	**Stat sample (including automatic rerun sample)**	**Control sample**	
Sample no. (5 characters)	→Transfer sequence 10^4 10^3 10^2 10^1 10^0 s s s s s Sequence no. (1 - 10000)	→Transfer sequence 10^4 10^3 10^2 10^1 10^0 s s s s s Sequence no. (1 - 10000)	→Transfer sequence 10^4 10^3 10^2 10^1 10^0 c c s s s Sequence no. (001 - 150) Control no. (1 - 60)	
Disk no. (1 character)	10^0 d Disk no. (0 - 9)	10^0 d Disk no. (0 - 9)	Space	Invalid if space is assigned for HOST → AU: Analysis is made with the disk no. used for inquiry.
Position no. (2 characters)	→Transfer sequence 10^1 10^0 p p Position no. (b1 - 50)	→Transfer sequence 10^1 10^0 p p Position no. (b1 - 70)	Space	(1) In the ID mode, the position no. for stat sample can be 1 to 70. (2) Right-justified and preceded by space Invalid if space is assigned for HOST → AU: Analysis is made with the position no. used for inquiry.
Sample cup identifier (1 character)	→Transfer sequence 10^0 c Sample cup identifier (1 - 5)		Space	1: Standard volume 2: Minute volume 3: Standard volume (on test tube) 4: Minute volume (on test tube) 5: Test tube
ID no. (13 characters)	→Transfer sequence 10^{12} 10^0 i i i i i i i i i i i i i ID no.		→Transfer sequence 10^4 10^0 10^7 10^0 i i i i i i i i i i i i i Control name Space	(1) When the ID no. is within 13 digits, it is right-justified and preceded by one or more spaces. (2) In case of the NO ID mode, the AU treats the ID no. as a comment. (3) In analytical data transfer for the control sample in the I D mode, the control name in 8 characters (based upon screen specifications) is sent as an ID no. of the control sample from the AU to the host in right-justified and space-preceded condition.

Table 6.13 Details of Sample Data

Item	Sample name			Remarks
	Routine sample (including automatic/manual rerun sample)	Stat sample (including automatic rerun sample)	Control sample	
Age (4 characters)	→Transfer sequence 10^2 10^1 10^0 10^0 a a a c 3: Year 2: Month 1: Day Age (bb0 to 200) (right-justified and preceded by space)		Space	<From AU to HOST> Age data that the AU has is transferred in the sequence given at left. If data is not yet set, spaces are set for it. (Spaces are always given in analytical data transfer of the control sample.) <From HOST to AU> In case Age or age code is space, the AU is obeyed. (1-3) (Note 1)
Sex (1 character)	→Transfer sequence 10^0 x 1: Male 2: Female 0: Other		Space	<From AU to HOST> Sex data that the AU has is transferred in the sequence given at left. If data is not yet set, zero (0) is transmitted. (A space is always given in analytical data transfer of the control sample.) <From HOST to AU> In case Sex is “0” or space, the AU is obeyed. (Note 1)
Blood collection date (6 characters)	→Transfer sequence $10^1$$10^0$ $10^1$$10^0$$10^1$$10^0$ m m d d y y Year (00 to 99) Day (01 to 31) Month (01 to 12)		Space	<From AU to HOST> The blood collection date that the AU has is transferred in the sequence given at left. If the date is not yet set, the sent one is set. (Spaces are always given in analytical data transfer for the control sample.) <From HOST to AU> In case of space, the AU is obeyed.
Blood collection time (4 characters)	→Transfer sequence $10^1$$10^0$ $10^1$$10^0$ h h m m Minute (00 to 59) Hour (00 to 23)		Space	<From AU to HOST> The blood collection time that the AU has is transferred in the sequence given at left. If the time is not yet set, the sent one is set. (Spaces are always given in analytical data transfer for the control sample.) <From HOST to AU > Set the time sent from the AU. In case of space, the AU is obeyed.

Note 1: The default age and sex on [UTILITY] – [APPLICATION] screen are obeyed.

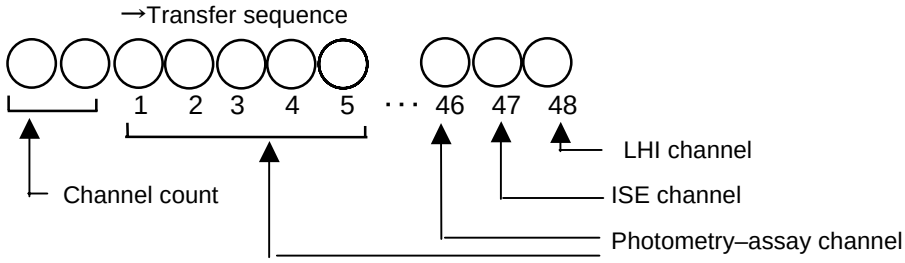
Conditions when the data on blood collection date and time is stored in AU:

Previous data	HOST→AU	Details of data to be stored
Not registered (initial)	Space	Data received by AU is set
	Other than space	Data in text received by AU is set
Registered	Space	AU is obeyed (sent data is not used)
	Other than space	Data in text received by AU is set

3. Test selection data (from HOST to AU)

(1) Contents of test selection data

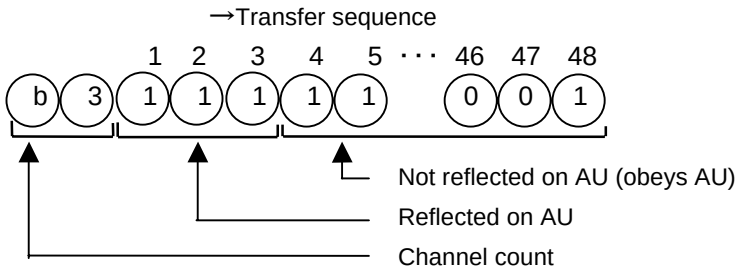
Send test selection data corresponding to sample data.



Details of request for each channel
0: No request
1: Normal sample volume (same volume)
2: Decreased volume
3: Increased volume
4: Volume determined by AU (left to AU)

Note 1: The above channel count (b0 to 48) is the number of elective channels from photometry-assay channel 1.
If 'b3' is specified, channels 1 to 3 are reflected on the AU and channels 4 to 48 are not.
In case of 'b0', request from the host is considered to be undecided and the AU is obeyed.
When there is at least one requested test, it is desirable to set '48'.

Example:



Note 2: Request for electrolytes (for 2 or 3 tests) is specified for channel 47.

(i) Specification of any other than '0': Use [Utility] – [Application] – Range screen to specify for Data Mode.

(ii) Specification of '0': No request
Note that it is impossible to select request for any of Na, K and CI from the host.

Note 3: Request for serum indexes (for 3 tests of L, H and I) is specified for channel 48.

Note 4: In request for the isozyme test or compensation test, the other test necessary for isozyme calculation or test-to-test calculation is automatically supplied for analysis but analytical data is not transferred when the other test is not requested.

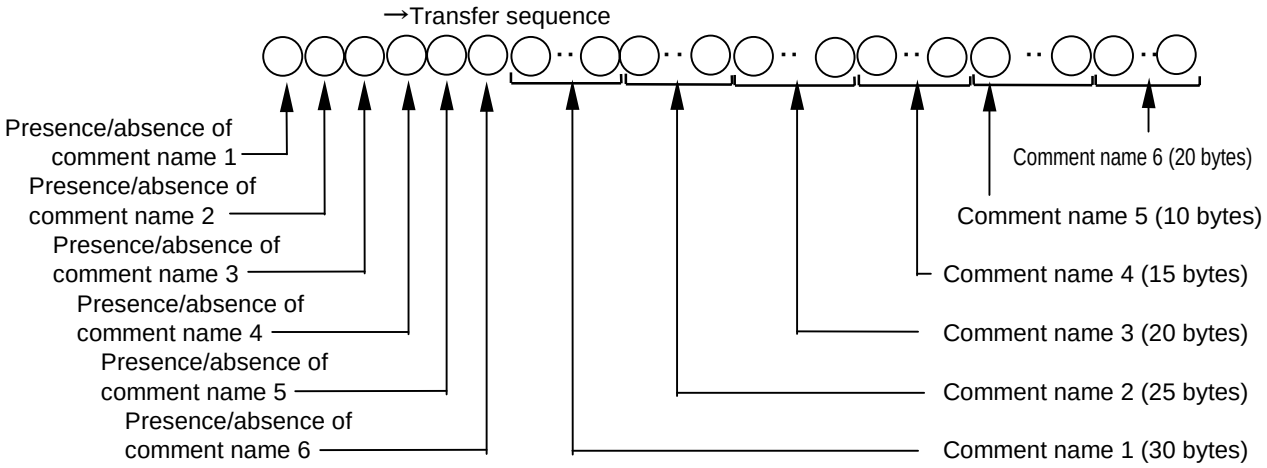
Note 5: When request for the calculation test is made, judge and request the channel for the test necessary for the calculation. When request for the A/G ratio is made for example, send test selection data, considering the channels for TP (total protein) and ALB (albumin) to be requested.

Note 6: The function for analysis with the sample volume for rerun and data compensation by use of the sample volume ratio in rerun is available (ISE tests excluded).
Send with reference to the details for rerun measurement in the above table.

[How to cancel tests requested]

Note 7: To cancel all the test selection data (1 to 48 channels) for a sample from the host (no request specified), set "48" to the channel count, specify '0' for all 1 to 48 channels, and transfer them to the AU.

4. Comment data (from HOST to AU)



(a) Presence/absence of comment

Send six characters representing the comment presence/absence data regardless of whether it is reflected or not.

When the relevant comment is present for the inquired sample, send '1', and when it is not present, send '0'.

Only in case of other than '0', the comment name is reflected on the AU

In case of '0', the AU ignores the comment name (previously specified comment is given priority).

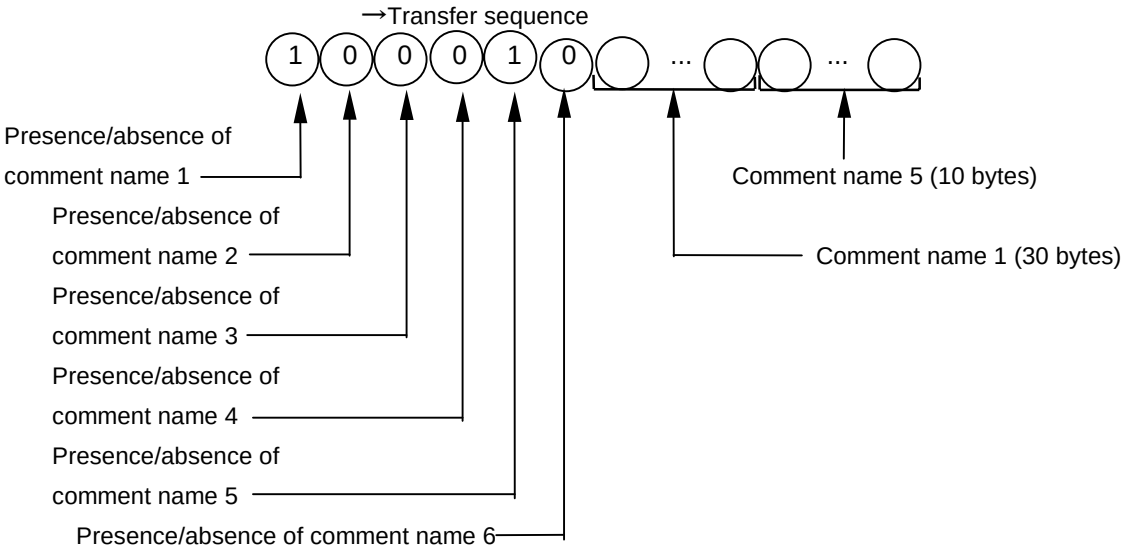
(b) Comment name 1 to 6

Send the comments on the inquired sample in 30, 25, 20, 15, 10 and 20 characters respectively.

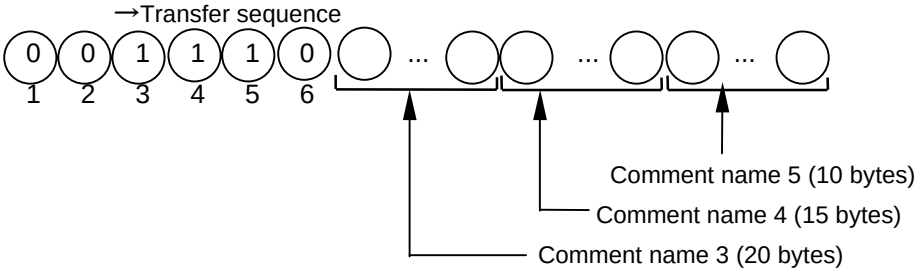
Note that the range of characters usable for the comment is as shown below.

When one or more comments are not used, send the relevant comment names closely (refer to the setting examples).

Setting example 1:



Setting example 1:



16.7 Error Check Function

If the contents of the received text fall under any condition shown in Table 7.1, the AU judges that there is an abnormal character and returns REP. If REP is returned consecutively three times, a system alarm appears on the screen of analytical unit, and communications stop.

Table 7.1

<table>
<tr><th>Attribute</th><th>Item</th><th>Details of check</th><th>Remarks</th></tr>
<tr><td rowspan="2">Text data</td><td>Frame character</td><td>An unrelevaht frame character is received. (For details, refer to Table 3.1.)</td><td></td></tr>
<tr><td>Function character</td><td>The function character does not correspond to class 1/2 of various samples. (For details, refer to “Table 6.3 Contents of text”.)
Note that upon reception of a function character which differs from the contents sent from the AU to the host in test selection data inquiry, the AU does not output an alarm when the samples are of the same type.
Example:
</td><td></td></tr>
<tr><td rowspan="3">Sample data</td><td>Sample no.
Disk no.
Position no.</td><td>Each no. is out of the specified range. Note that no alarm is output in the following cases:
<table><tr><td>Disk No.</td><td>0 to 9, space</td></tr><tr><td>Position No.</td><td>0 to 50, space</td></tr></table></td><td></td></tr>
<tr><td>Age, sex</td><td>The contents of each item are not as specified.</td><td>When spaces are provided, processing is made according to AU.</td></tr>
<tr><td>Date, time</td><td>(1) Each item is a control code ($00 to $1F).
(2) Each item is out of the specified range.
(3) No check is made on whether a date is or is not in a year.</td><td>Same as above</td></tr>
<tr><td rowspan="2">Inquiry data</td><td>Test selection data</td><td>(1) Test selection data for the routine/stat sample is any other than ‘0’ to ‘4’.
(2) Any other than ‘0’ to ‘4’ in case of the automatic/manual rerun sample
(3) The channel count is out of the specified range.</td><td>Same as above</td></tr>
<tr><td>Channel data</td><td>Any other than ‘b0’ to ‘48’</td><td></td></tr>
</table>

16.8 Specifications of Communication Trace

16.8.1 Overview

This auxiliary function outputs the contents of communication between the AU and host onto the printer as a report.

This function can be specified, using [Utility] – [System] – [Host Comm. Set] screen.

16.8.2 Trace data

The time of communication execution, the direction of communication and the contents of the message are stored.

16.8.3 Methods for storing trace data

(1) In Any Other than RESULT ONLY Mode

(a) The trace function is activated after receiving the text sent from the AU and the text returned from the host in response to it (after receiving the end-of-data code).

(2) In RESULT ONLY Mode

The trace function is activated upon completion of transferring the text sent from the AU (after sending the end-of-data code).

16.8.4 Trace data storage capacity

The trace data of up to 2000 cycles can be stored.

16.8.5 Other

The codes displayed on [Utility] – [Comm. Trace] screen are expressed by the form [X, Y] as follows:

Code Table

X: End code		Y: Error code	
1	ETX+BCC	1	Time-out error
2	CR+LF+ETX	2	I/O error
3	ETX	3	Character error
4	ETX+CR+LF	4	Format error
5	ETX+CS+CR	5	BCC error
		6	Checksum error

16.9 Cautions on Connection with External System

(1) For connection with this protocol, adopt the point-to-point system.

(2) The end-of-data code is changeable using [Utility] – [System] – Host Comm. Set] screen. Note, however, that the host should send the same end-of-data code as at the AU side.
In the event of an unmatch, a resending request (REP) is transmitted.

(3) 'EXT' is added to the end-of-data code in each text without fail.
When the text size is set to 256 bytes, therefore, the AU adds not 'ETB' but 'ETX' whenever data beyond 256 bytes is transferred.
For the host a frame character ':' is a final message when the data for one sample is sent in more than one text. So pay attention when reading in the data.

(4) As a rule, the AU sends the ANY frame to the host in response to a request from it in the following cases.

(a) Upon request for analytical data transfer from the host, the relevant sample is not stored on the HD.

(b) Analytical data cannot be read from the HD due to occurrence of an error in it during batch transfer of analytical data.

(5) When an abnormality is detected in a transferred text from the host to the AU. REP (request for resending) is transferred until the text becomes normal status.

(6) Set 100 ms minimum as a period of delay in response to the AU side after receiving a text in the host.

16.10 Supplementation

16.1.1 Terminology

(1)	Conversation	:	An exchange of texts transmitted between the analytical instrument and HOST computer.
(2)	Cluster	:	A group of conversations between the analytical instrument and HOST computer.
(3)	Text	:	A message transmitted between the analytical instrument and HOST computer.
(4)	Framing of text	:	To provide a start character and end character at the beginning and end of the text so as to receive it without fail and facilitate its check.
(5)	Length of text	:	The total number of characters constituting a text.
(6)	Test selection	:	Analysis not for all tests but only for the tests selected through external directive by the instrument for multi-test analysis.
(7)	Point-to-point system	:	A system in which two instruments for data sending, receiving or processing are connected via the communication line, any other instrument is not connected between them and there is no instrument for control of data transmission for the whole system.
(8)	Response	:	To send to one of the instruments that communicate with each other whether the other is ready for receiving or not and whether the received data is normal or not, and a character to be transmitted for that purpose.
(9)	Recovery	:	To escape from deadlock that is caused by abnormality in the sending device, receiving device or line.
(10)	Frame character	:	Identifies the purpose of the text and functions like a command no.
(11)	Data link	:	A general term for the physical transmission path from the sending device to the receiving device via the data transmission line and the logically set data transfer path
(12)	Data field	:	An area for the contents of a message excluding the control code, frame character and end-of-data code in the text.
(13)	Specific sample	:	A sample requested to the AU from the host.
(14)	Specific request text	:	A text that makes a request to the other side for a text having a data field. (Example: SPE, FR1, FR2, END, RES)
(15)	Non-specific request text	:	A text that makes a request to the other side for a text having no data field. (Example: ANY, MOR, REP, SUS, REC)
(16)	ID mode	:	[Yes] is specified for Barcode Reader and [No] is specified for Barcode T/S on the System Parameters screen.
(17)	Sample no. mode	:	[No] is specified for Barcode Reader on the System Parameters screen. Or, [Yes] is specified for both Barcode Reader and Barcode T/S on the System Parameters screen.

16.10.2 List of data alarms

No.	Name of data alarm	Output string	Photometry-assay				ISE				
		S. I/F	Routine	Stat	Control	STD	Routine	Stat	Control	STD	
1	ADC abnormality	A	○	○	○	○	○	○	○	○	
2	Cell blank abnormality	Q	○	○	○	○					
3	Sample short	V	○	○	○	○	○	○	○	○	In some cases, data is replaced with space.
4	Reagent short	Z	○	○	○	○					In some cases, data is replaced with space.
5	Absorbance over	P	○	○	○	○					
6	Prozone error	I	○	○	○	○					
7	Reaction limit over at all points	J	○	○	○	○					
8	Reaction limit over at points other than one	K	○	○	○	○					
9	Reaction limit over at points other than 2 to 3	W	○	○	○	○					
10	Linearity abnormality at 9 points or more	F	○	○	○	○					
11	Linearity abnormality at 8 points or more	H				○					
12	1st standard solution absorbance abnormality	U				○					
13	DUPLICATE error	S				○				○	
14	STD error	Y				○					
15	SENSITIVE error	B				○				○	
16	CALIB error	G				○					
17	SD limit error	N					○	○	○	○	
18	Noise error	L					○	○	○	○	
19	Level error	E								○	
20	Slope abnormality	R								○	
21	Prepare abnormality	D								○	
22	Internal standard solution concentration abnormality	&					○	○	○		
23	Sample value abnormality	C	○	○	○		○	○	○		
24	Test-to-test compensation error	M	○	○	○		○	○	○		Data is replaced with space.
25	Test-to-test compensation disable error	$	○	○			○	○			
26	Upper technical limit value over	$	○	○			○	○			
27	Lower technical limit value over	@			○				○		

No.	Name of data alarm	Output string	Photometry-assay				ISE				
		S. I/F	Routine	Stat	Control	STD	Routine	Stat	Control	STD	
28	Accidental error [R−4 s]	#			○				○		
29	Systematic error 1 [2−2 sA]	#			○				○		
30	Systematic error 2 [2−2 sW]	#			○				○		
31	Systematic error 3 [4−1 sA]	#			○				○		
32	Systematic error 4 [4−1 sW]	#			○				○		
33	Systematic error 5 [10 x A]	#			○				○		
34	Systematic error 6 [10 x W]	#			○				○		
35	QC error 1	+			○				○		
36	QC error 2	+			○				○		
37	Calculation item errer	%	○	○			○	○			Data is replaced with space.
38	Overflow	O	○	○	○		○	○	○		Data is replaced with space.
39	Calculation disable	X	○	○	○	○	○	○	○	○	Data is replaced with space.
40	Upper normal value limit over		○	○	○		○	○	○		Another alarm can coexists.
41	Lower normal value limit over		○	○	○		○	○	○		Another alarm can coexists.
42	Edited item	*	○	○			○	○			
43	Calibration result abnormality	!	○	○	○		○	○	○		

Note 1: If two or more data alarms occur with one data item, the alarm registered first is output.