

Chapter 14 System Interface

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14.1 Overview

Provided here are the signal format and protocol (communication rules) in case of connection between model 7180 automatic analyzer and an external system via start-stop synchronous serial signal.

(1) Communication specifications

Table 14.1.1 shows the specifications of RS-232C communications.

Table 14.1.1 Communication Specifications

	Item	Specification	Remarks	Default value (standard value)
1	Interface	RS-232C	–	–
2	Communication method	Half duplex	–	–
3	Data bits	7 or 8 bits	Set on [Utility] – [System] – [Host Comm. Set] screen	7 bits
4	Stop bits	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	256/512/1280 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 host	ditto	6
10	Retry time	Retry interval time when no response from host	ditto	2 (s)
11	Communication cycle	Send/receive interval time	ditto	2
12	Code	JIS 7 bits, JIS 8 bits or ASCII	–	
13	Synchronization system	Asynchronous system (start-stop sync)	–	
14	Transmission control procedure	Determined by host	–	
15	Number of ports	1 max.	–	
16	Text mode	Nontransparent mode (ASCII)	–	
17	Cable length	15 m max. (RS-232C)	–	

(2) Features

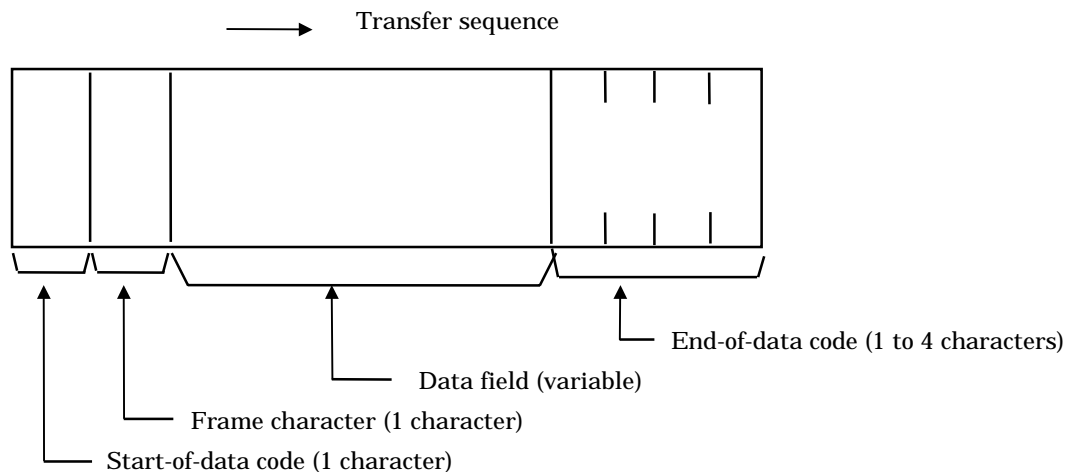
- (a) Since the communication cycle is not synchronized with the analysis cycle, the analyzer will reply upon receiving a response from host.
- (b) The data bit, stop bit, parity check, baud rate, maximum number of transferred data items and end-of-data code can be selected by the user.

(3) Communication rules

The host and analyzer unit (to be abbreviated as AU hereafter) 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 AU to 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 14.3.1.](#)

- (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 data field is present

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 can be selected:

- | | |
|-------------------------------------|----------------------------------|
| (i) ETX + BCC (Note 1) | (ASCII code \$03 + BCC) |
| (ii) CR + LF + ETX | (ASCII code \$0D + \$0A + \$03) |
| (iii) ETX | (ASCII code \$03) |
| (iv) ETX+ CR + LF | (ASCII code \$03 + \$0D + \$0A) |
| (v) ETX + CKSH + CKSL (Note 2) + CR | (ASCII code \$03 + h + I + \$0D) |

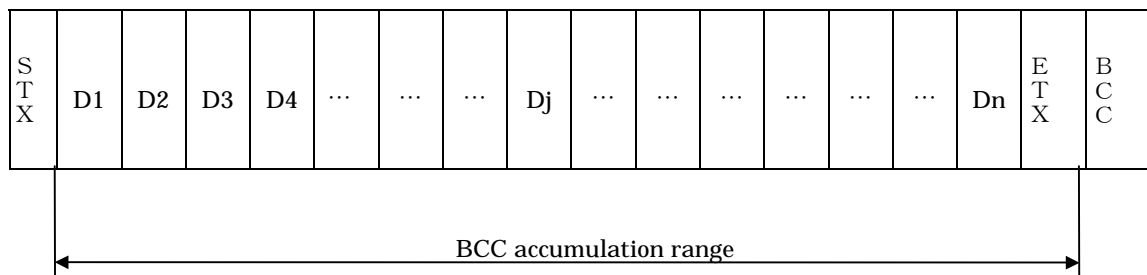
Note 1: BCC (Block Check Character)

The RS-232C communication program is provided with a function to add BCC to the send text and to 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 will start from the character following STX and continue until ETX appears.



[Calculation Method]

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

BCC = Block check character (1 byte)

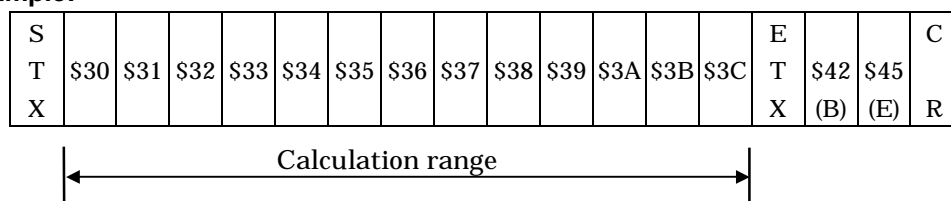
BCC = D1 + D2 + D3 + ... + Dj + ... + Dn + (ETX)₁₆

(+: Exclusive OR)

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

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

Example:



14.2 Communication Functions

- (1) Tables 14.2.1 and 14.2.2 list the host communication functions provided with Model 7180 Automatic Analyzer. Note that the functions listed in the table are realized only when, [Yes], at least, is specified for Comm. Execute on the Start Conditions screen.

Table 14. 2.1 List of Communication Functions for Test Selection Information

Analytical unit \longleftrightarrow HOST

Function		Inquiry	Instruction	Conditions
Test selection information inquiry communication	Routine sample	○	○	Valid when [No] is specified for Test Data Only Transfer, using [Utility] – [System] – [Host Comm. Set] screen.
	Routine sample Manual rerun sample	○	○	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.)
	Routine sample Automatic rerun sample	○	○	Valid when [Yes] is specified for Automatic Rerun Test Selection, using [Utility] – [System] – [Host Comm. Set] screen. (Invalid when [Yes] is specified for Test Data Only Transfer.)
	Stat sample	With ID	○ △ Supplementary Explanation (3)	Valid when [Initial Only] or [Initial & Rerun] 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	×	
	Stat sample Automatic rerun sample	With ID	○ △ Supplementary Explanation (3)	Valid when [Initial & Rerun] 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	×	

Table 14.2.2 List of Communication Functions for Test Result Data

Function		Real-time communication	Batch communication	Specific sample request	Conditions
Measurement result data communication	Routine sample	○	○	○	A specific sample data request is invalid when [Yes] is specified for Test Data Only Transfer.
	Stat sample			○	
	Control sample			×	
	Automatic rerun sample	○	×	×	
				×	
	Calibration measurement result data	○	×	×	
	Absorbance measurement result data in reaction processes	×	○	×	

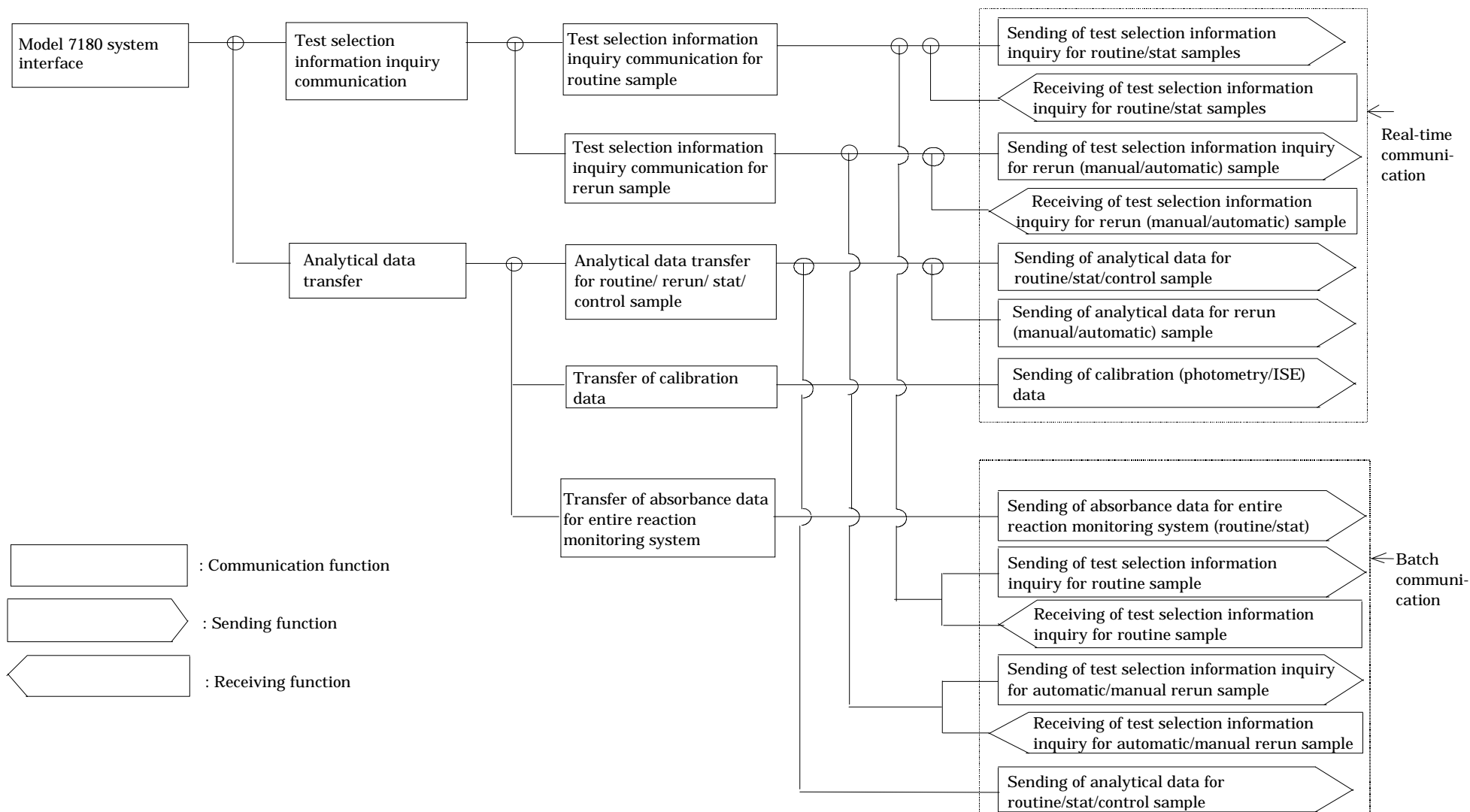
○:Can be executed

×:Cannot be executed

<Supplementary Explanation>

- The above real-time communication indicates a communication carried out while the instrument is engaged in analysis; the batch communication indicates a communication when specified through the screen.
- 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 by the host, in response to inquiry from AU during real-time communication. However, note that a single inquiry from the host is valid for registered samples (initially tested samples during rerun).

Relationship between model 7180 system interface functions



14.3 Frames

The frame represents the purpose of the text (contents of message). Table 14.3.1 lists the frames.

Table 14.3.1 List of Frames

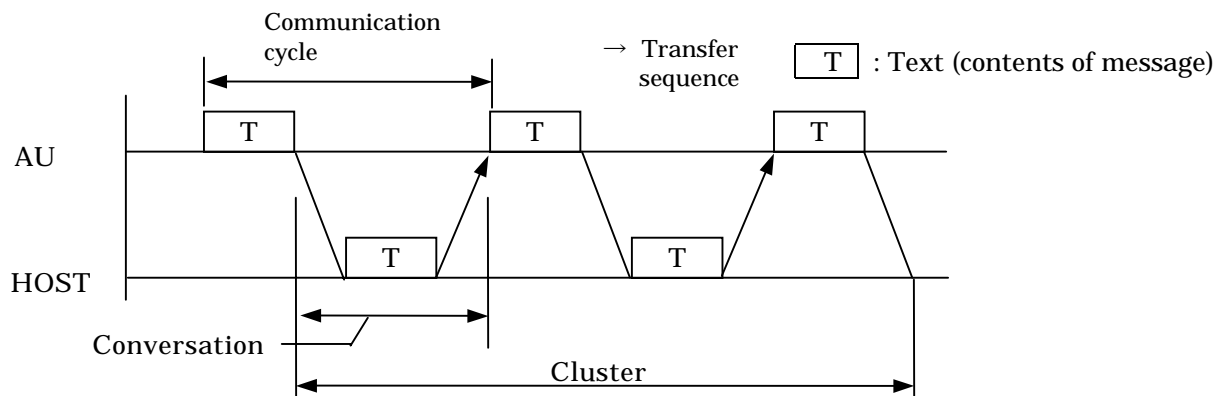
(AU: Analyzer side, HOST: System side)

No.	Mne- monic	Name	Character	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	FR3	Frame 3	3	\$33			
4	FR4	Frame 4	4	\$34			
5	FR5	Frame 5	5	\$35			
6	END	End Frame	:	\$3A			
7	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 directive from HOST. HOST also uses SPE for TS sending in response to TS inquiry using SPE from AU.
8	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 will be taken as valid and the others will be ignored.)
9	ANY	Any Inquiry	>	\$3E	AU	Positive response (corresponding 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).
10	MOR	More			HOST		Sent 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).
11	REP	Repeat	?	\$3F	AU,HOST	Negative response (corresponding to NAK)	Sent when data received by AU is abnormal. When AU receives this text, it will resend the previously sent text.
12	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 at least one communication cycle without recording the last communication by AU.
13	REC	Received	A	\$41	HOST		Used to request AU to suspend communication for at least a communication cycle because HOST is not ready to receive analytical data.

14.4 Data Transmission Control Procedure

14.4.1 Establishment of data link

- (1) Upon input of [Yes] for Comm. Execute on the Start Conditions screen, the AU will transfer the ANY frame to the host, and communication will start from this point.
- (2) With text sending, the direction of transmission is reversed: The receiver can send the next response or text. In subsequent steps, the AU and host continue transmission alternately.



14.4.2 Response to information

- (1) Upon receiving information, the receiver sends a response or text in its place ([see Table 14.3.1](#)) to inform the sender of the receiver status and the validity of the 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 placed between STX and ETX to identify the number of transmissions will be sent in the text.
- (3) The AU continues replying as long as the host returns a response. Even when the text corresponding to any frame character is transferred and there is no data to be sent between the AU and host, the AU continues sending the ANY frame, and the host continues sending the MOR frame. However, the cluster will restart immediately if analytical data transfer, test selection directive or any other transfer is requested.
- (4) After sending a text, cease sending until reception of a response or request to/for the text in normal condition. Otherwise, the AU will output an alarm.
If no response is returned or an invalid response is received, the recovery procedure will be executed. In case of sending from the host, the host must always be kept ready for receiving.
- (5) If the host does not respond to communication from the AU within one communication cycle (Note 1), an alarm will appear on the AU screen. If the alarm appears, the AU will stop communicating.

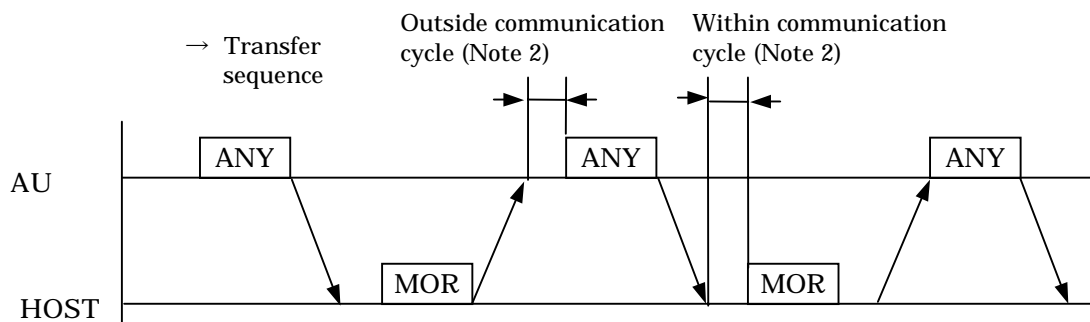
Note: The time can be changed using [Utility] – [System] – [Host Comm. Set] screen. The default value is 2 seconds.

14.4.3 Response to information message

Described below are the typical procedure for returning a response to 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 will continue 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 when the communication cycle (Note 2) has elapsed after receiving the MOR frame from the host (the point when the final end-of-data code is recognized).

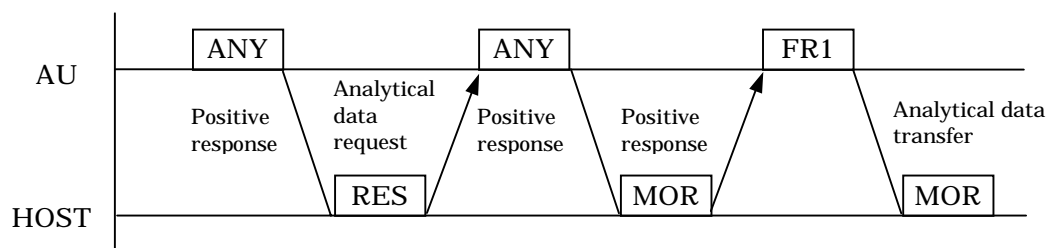
Note 1: When the following conditions are satisfied:

- (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) There is no request for the RES frame.
- (d) Specification through the screen is not made.

Note 2: After receiving from the AU, the host should return a response after waiting for at least 100 ms. If the host cannot return a response within one communication cycle, it should then send the SUS frame to the AU.

The time for communication cycle can be changed using [Utility] – [System] – [Host Comm. Set] screen. The default value is 2 seconds.

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



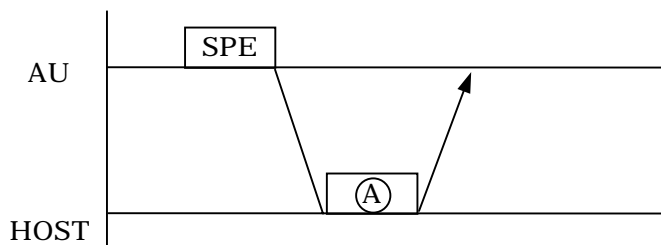
The RES, ANY, MOR, REP, SUS and REC frames are available for a communication control message. For details, [refer to Table 14.3.1](#).

(a) RES frame

The host can use the RES frame to make a request to the AU for analytical data of a specific sample. If the AU has no relevant data, it will send the ANY frame.

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

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



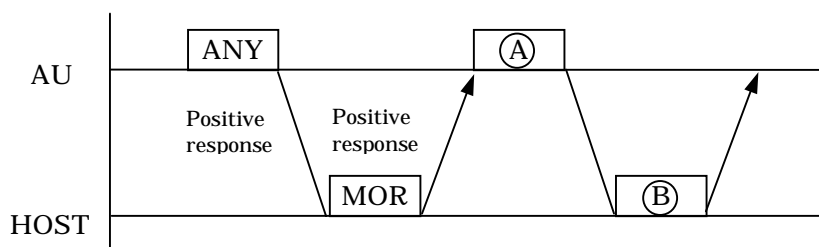
Response from HOST:

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 not only to respond to test selection information inquiry but to 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:

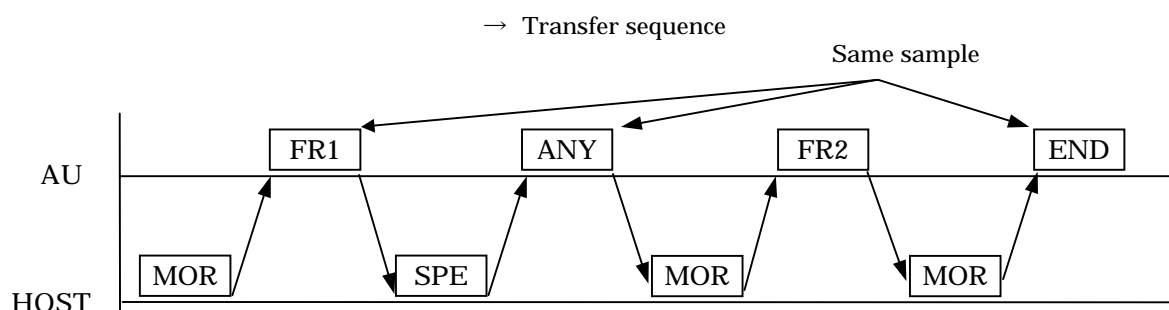
Frame (A)	Description
FR1~END	Analytical data (including calibration result and absorbance data in entire reaction monitoring system)

Response from Host:

Frame (B)	Description
REP	When text in (A) is abnormal
MOR	To receive analytical data next time also
REC	Received analytical data, but will not receive analytical data next time
SUS	To suspend communication
SPE	To designate test selection
RES	To request a specific sample

(b) Transmission procedure in special case

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



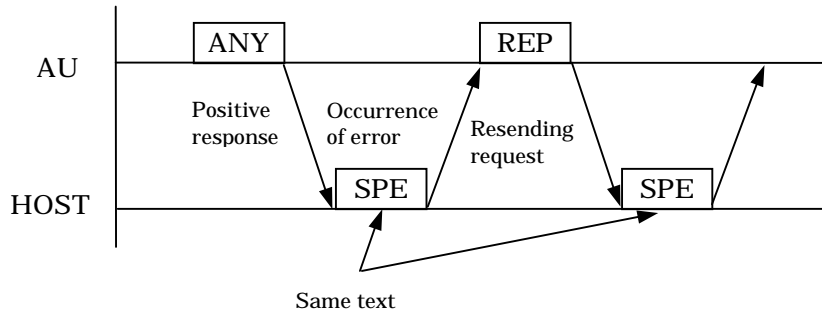
Effect of this system:

- (1) No delay to SPE
- (2) Identifiable by HOST because sample identification information is provided for each text

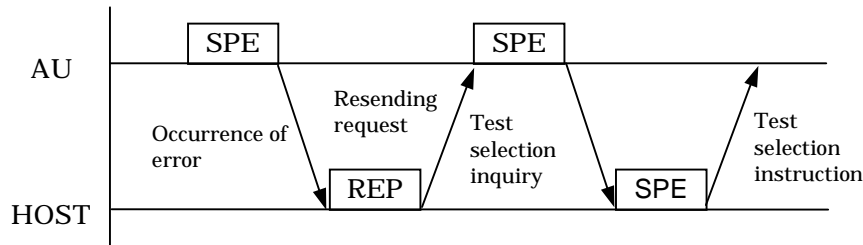
(5) Resending request (AU ↔ HOST)

Resending will be 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.

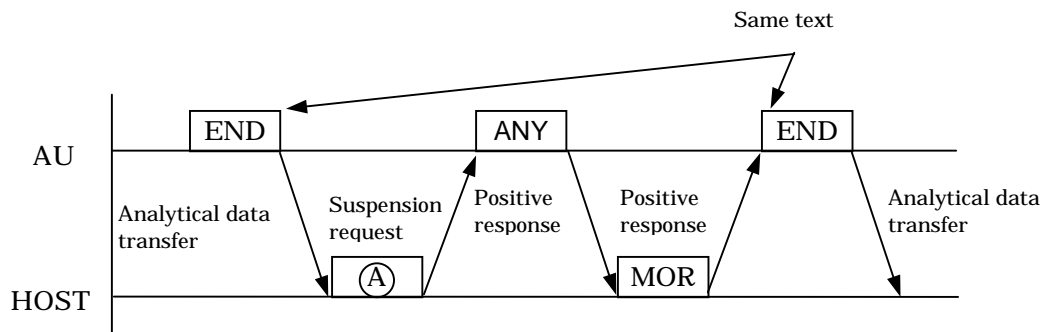
(a) From AU to Host



(b) From Host to AU

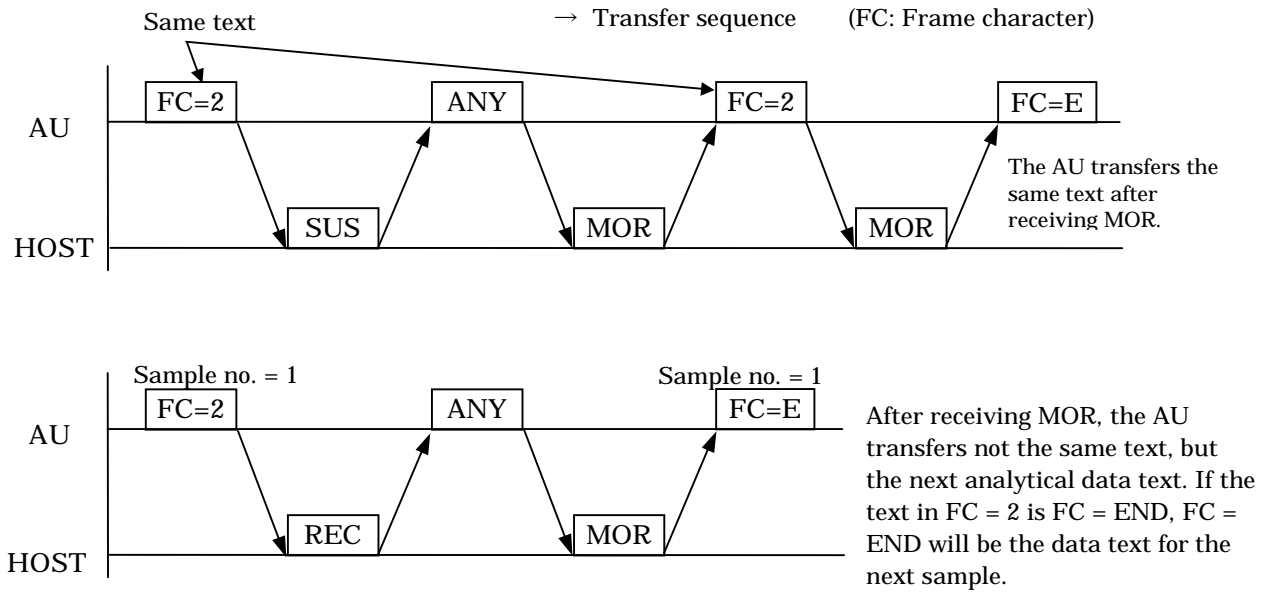


(c) For resending with other than REP



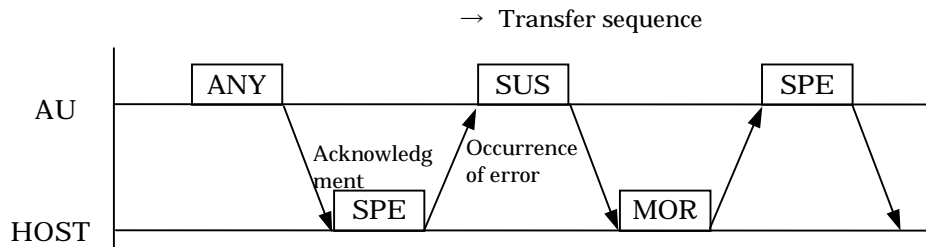
Frame (A)	Description
SUS	Sent from host when it wants AU to suspend communication for a specified time. In this case, note that AU judges that host could not receive the text for some reason. When communication is restored (MOR frame is sent from host), the text sent last, if it was an analytical data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

Difference between SUS frame and REC frame transfer

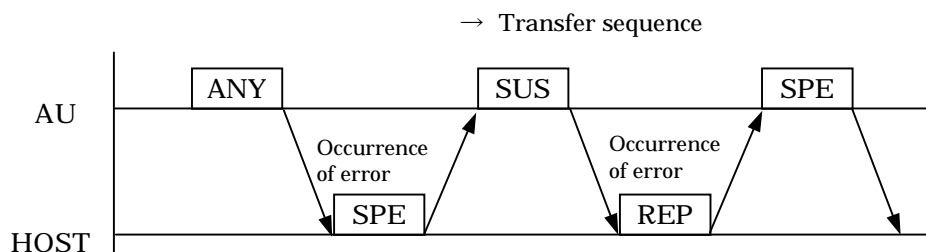


(d) In case of SUS frame sent from AU

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

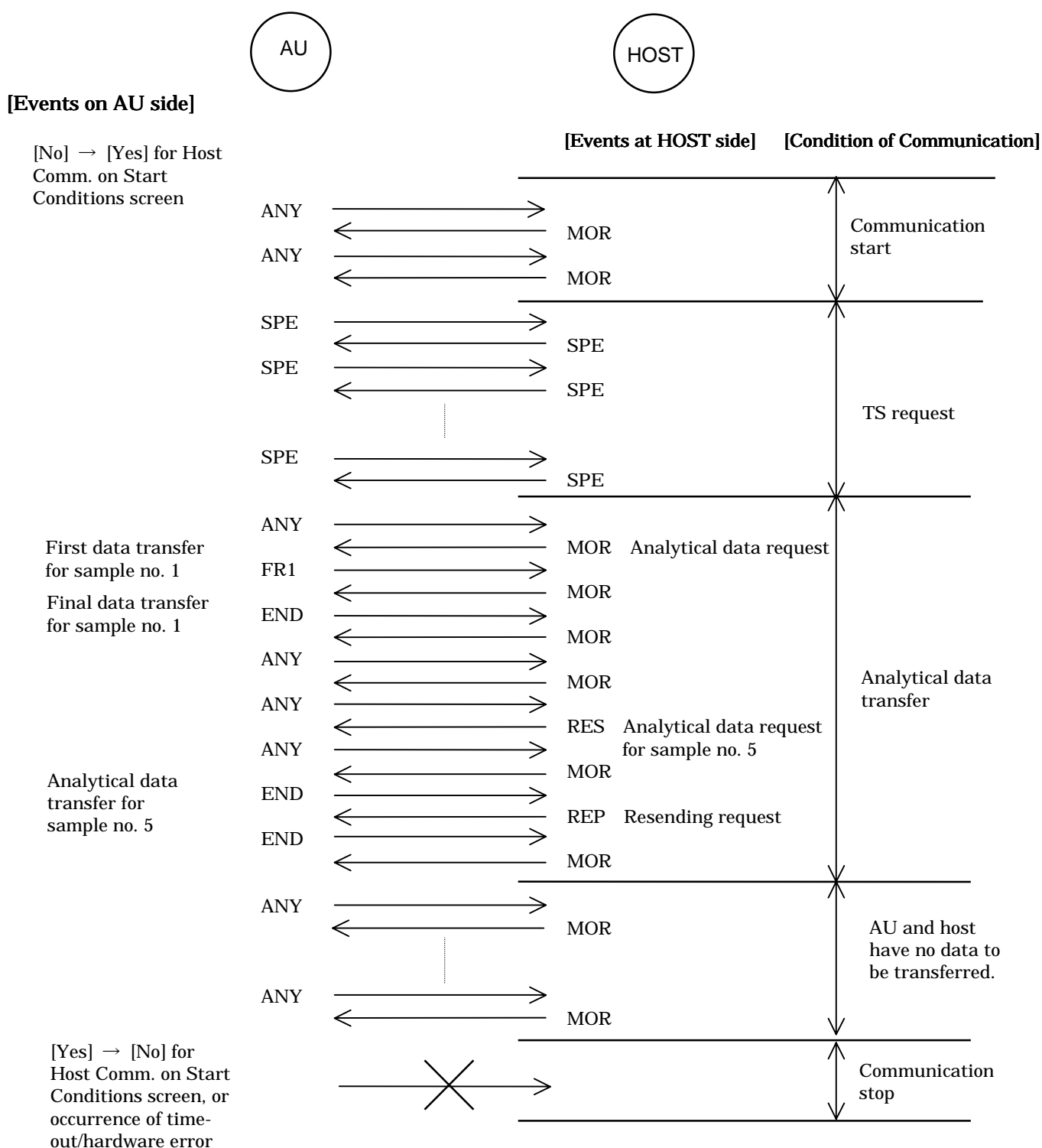


(Example 1)



(Example 2)

Basic Control Procedure



Details of each frame:

	Content
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

14.4.4 Termination and restart of communication

Table 14.4.1 shows the conditions of termination and restart of this protocol.

Table 14.4.1 Termination and Restart of Communication

(○:Communication stopped, ×:Communication continued)

Conditions of termination	Real-time communication	Batch communication	Restart of communication
Specified [No] for Host Comm. on Start Conditions screen, or in that status	○	○	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	○	○	Same as above
Occurrence of hardware error alarm related to communication	○	○	Same as above
Stop instruction via screen during batch sending of analytical data to HOST	×	○	Remaining samples in specified range are not sent. Upon restart, samples in newly specified range are sent.

14.4.5 Priority

When two or more processes 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 will be suspended in a unit of text in order to transfer to the host the text which has a higher priority than batch communication, when it interrupts batch communication under execution (restricted to cases 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.) When this operation is finished, batch communication will be restarted.

Table 14.4.2 shows the details of each frame and the priority.

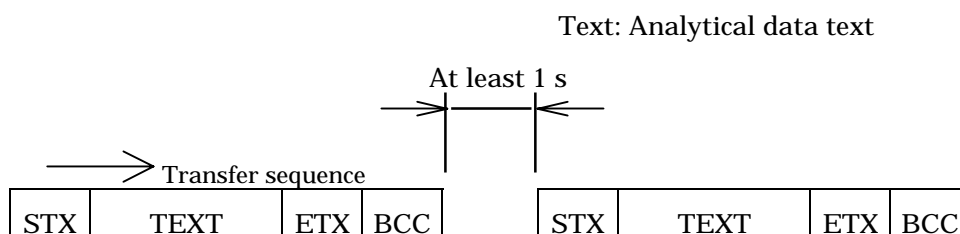
Table 14.4.2 Details of Each Frame and Priority

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
6	Sending of lower-priority analytical data (analytical data in batch communication)

14.4.6 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 or 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 at least one second after sending ETX in the analytical data text and proceeds to transfer to the host, ignoring the communication procedure.




14.5 Status Transition

14.5.1 Status transition matrix

No	Event Status in AU	Event from AU						Event from HOST								
		Host Comm. on Start Conditions screen: [No] → [Yes]	Host Comm. on Start Conditions screen: [Yes] → [No]	TS inquiry request (TS manage- ment task)	Real-time data output from AU	Batch transfer request via screen	Occur- rence of HD or FD error	MOR		REP (resending request)	SUS (suspension request)	REC (suspension request)	SPE (TS instruc- tion)	RES (specific sample request)	Time- out/hard- ware error or REP at least 7 times	Occurrence of error in text (Note 1)
								Data for 2 or more samples	Final data							
1	Initial status ([No] specified for Comm. Execute)	To ANY transfer/2														
2	Idling (AU or HOST has no data to transfer)		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/ 3	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	

No	Event Status in AU	Event from AU						Event from HOST								
		Host Comm. on Start Conditions screen: [No] → [Yes]	Host Comm. on Start Conditions screen: [Yes] → [No]	TS inquiry request (TS manage- ment task)	Real-time data output from AU	Batch transfer request via screen	Occur- rence of HD or FD error	MOR		REP (resending request)	SUS (suspension request)	REC (suspension request)	SPE (TS instruc- tion)	RES (specific sample request)	Time- out/hard- ware error or REP at least 7 times	Occurrence of error in text (Note 1)
								Data for 2 or more samples	Final data							
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						Note 1: In case of alarm sub-code 13, an alarm is issued, but REP frame is not transferred.								
11	Alarm registration (communication continued)	Alarm display/registration To previous status						Note 2: Upon receiving the SUS or REC frame, each frame is sent after waiting for a specified time.								

: Ignored

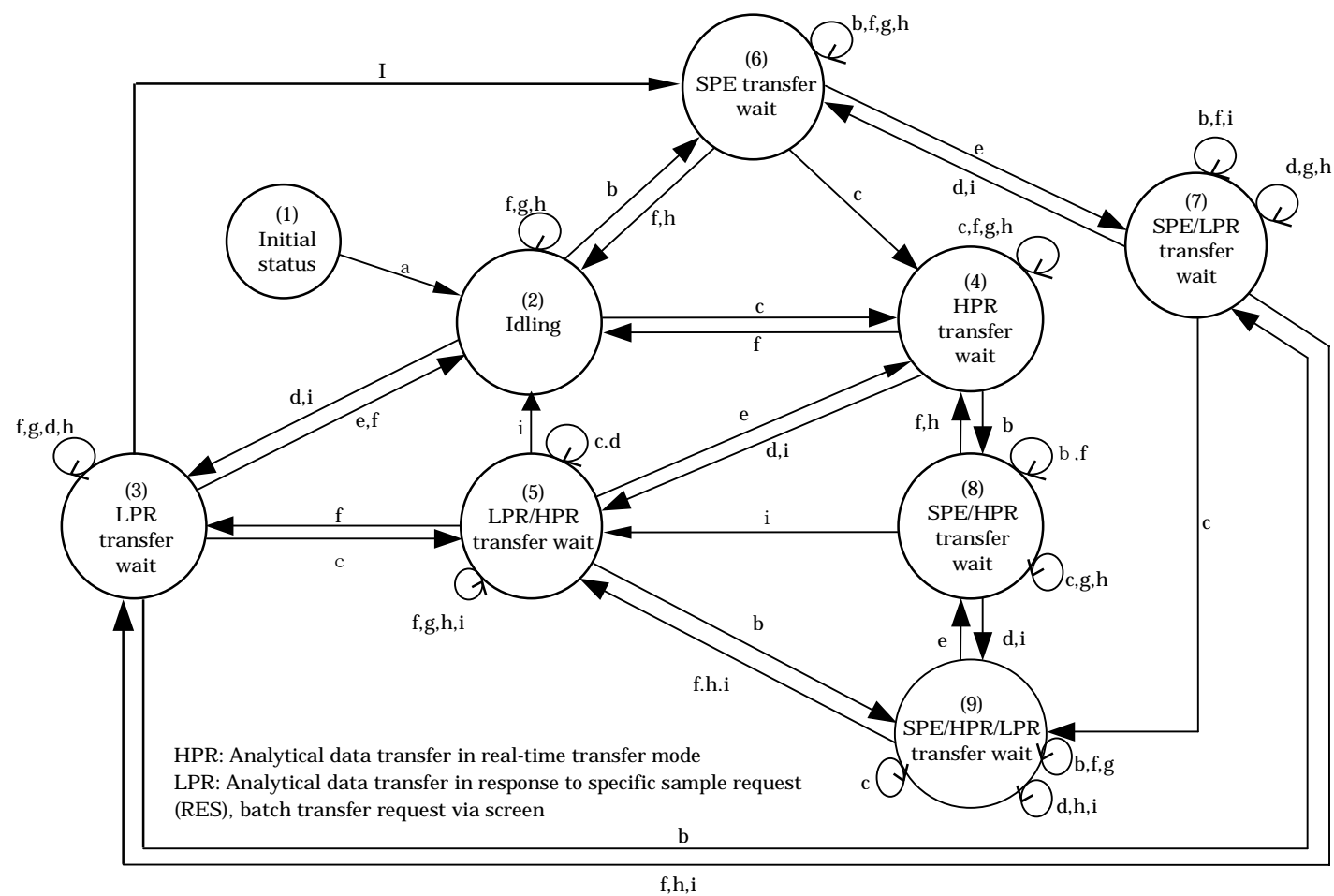
FR/ value FR : Contents or processing of text to be sent to HOST

Value : Number of status to which transition is made

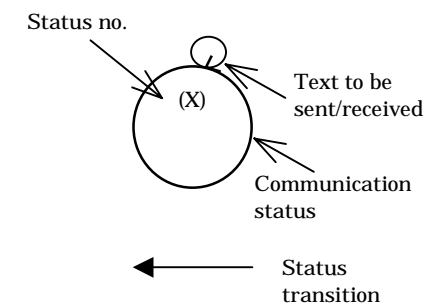
HPR: Analytical data transfer in real-time communication

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

14.5.2 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



14.6 Text Configuration Table

Table 14.6.1 shows the text configuration, corresponding to the contents of each frame.

Table 14.6.1

(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	44	HOST	STX < F U Sample data ETX BCC
Test selection inquiry text	Inquiry request	SPE	44	AU	STX ; F U Sample data ETX BCC
Test selection directive text	Directive request	SPE	Variable	HOST	STX ; F U Sample data Channel count Test { selection data } { Comment } ETX BCC

Text type	Text item	Relevant frame	Total number of bytes	Sender	Contents of text (Note 1)																																						
Analytical data text	Routine/rerun/stat/control sample	FR1 ~END	Variable	AU	<table><tr><td>STX</td><td>:</td><td>F</td><td>U</td><td>Sample data</td><td>Operator ID</td><td>Channel count</td><td colspan="6">Analytical data of 100 tests</td></tr><tr><td colspan="7"></td><td>Comment</td><td>ETX</td><td>BCC</td><td colspan="3"></td></tr></table>												STX	:	F	U	Sample data	Operator ID	Channel count	Analytical data of 100 tests													Comment	ETX	BCC				
	STX	:	F	U	Sample data	Operator ID	Channel count	Analytical data of 100 tests																																			
								Comment	ETX	BCC																																	
	Absorbance data for entire reaction	FR1 ~END	Variable	AU	<table><tr><td>STX</td><td>:</td><td>F</td><td>U</td><td>Sample data</td><td>Analytical data 1</td><td colspan="2"></td><td>Analytical data 4</td><td>BLANK1</td><td colspan="3"></td></tr><tr><td colspan="5"></td><td>BLANK4</td><td>Point count</td><td>ABS1</td><td colspan="2"></td><td>ABS73</td><td>ETX</td><td>BCC</td><td colspan="2"></td></tr></table>												STX	:	F	U	Sample data	Analytical data 1			Analytical data 4	BLANK1									BLANK4	Point count	ABS1			ABS73	ETX	BCC	
STX	:	F	U	Sample data	Analytical data 1			Analytical data 4	BLANK1																																		
					BLANK4	Point count	ABS1			ABS73	ETX	BCC																															
Photometry-assay calibration	END	Variable	AU	<table><tr><td>STX</td><td>:</td><td>G</td><td>b</td><td>Operator ID</td><td>Channel no.</td><td>STD count</td><td>Calib.</td><td colspan="2">STD data 1</td><td colspan="3"></td></tr><tr><td colspan="7"></td><td>STD data 6</td><td>SD value data</td><td>ETX</td><td>BCC</td><td colspan="3"></td></tr></table>												STX	:	G	b	Operator ID	Channel no.	STD count	Calib.	STD data 1												STD data 6	SD value data	ETX	BCC				
STX	:	G	b	Operator ID	Channel no.	STD count	Calib.	STD data 1																																			
							STD data 6	SD value data	ETX	BCC																																	
ISE calibration	END	233	AU	<table><tr><td>STX</td><td>:</td><td>H</td><td>b</td><td>Operator ID</td><td>ISE type</td><td>Total</td><td colspan="5">ISE calibration data</td><td>ETX</td><td>BCC</td></tr></table>												STX	:	H	b	Operator ID	ISE type	Total	ISE calibration data					ETX	BCC														
STX	:	H	b	Operator ID	ISE type	Total	ISE calibration data					ETX	BCC																														

Note 1: Table 14.6.1 shows the text configuration when the text size is 512 bytes. When a 256-byte text size is specified, refer to the contents of designated text item.

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

14.6.1 Composition of each text

14.6.1.1 Text for non-specific request

(1) Composition of text

STX	FR	ETX
-----	----	-----

(FR: Frame character)

(2) Table 14.6.2 shows the frame name and frame character according to the sending direction.

Table 14.6.2

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

(○: Sent, ×: Not sent)

14.6.1.2 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 14.6.3 shows the contents of the text.

Table 14.6.3

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 section 14.6.1.5)								
				Sample no.	Disk no.	Position no.	Sample cup no.	ID no.	Age	Sex	Date	Time
Routine sample	Provided	a1～a5	a1～a5	Ignored				ID no. set (blank not allowed)	Ignored			
Stat sample	Provided	d1～d5	d1～d5									
Routine Sample	Not provided	n1～ n5	n1～ n5	Sample no. set (1-10000)	Ignored (Set the sample no. even for stat samples with ID)							
Stat sample	Not provided	q1～ q5	q1～ q5									

Note that the AU will ignore any other than routine and stat samples (rerun sample, control sample and calibration) when they are 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.

14.6.1.3 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 “[14.6.2 Contents of text](#)”.

STX	;	F	U	Sample data	ETX	BCC
-----	---	---	---	-------------	-----	-----

- (2) Inquiry to the host is sent for a routine sample, routine automatic/manual rerun sample, stat sample, stat rerun sample. If Constant Inquiry is not specified (Note), inquiry will be made only when the AU has a sample for which TS is not sent from the host to the AU.
- (3) When the sample type is not specified for each sample, the sample type specified by default will be used as a default function character for all.
- (4) Inquiry to the host will not be made under the following conditions:
- (a) Failure in ID reading on the AU side when a barcode reader is provided.
 - (b) When a 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 ‘sample short’ alarm in 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 any sample for which initial analysis has been completed.

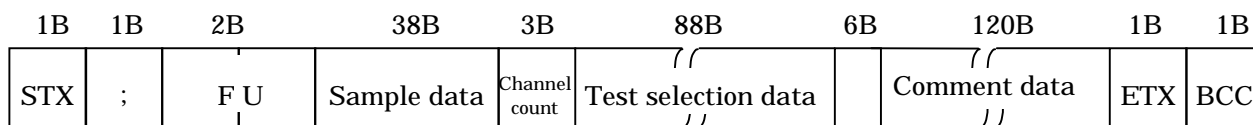
Note: Specify, using [Utility] – [System] – [Host Comm. Set] screen.

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

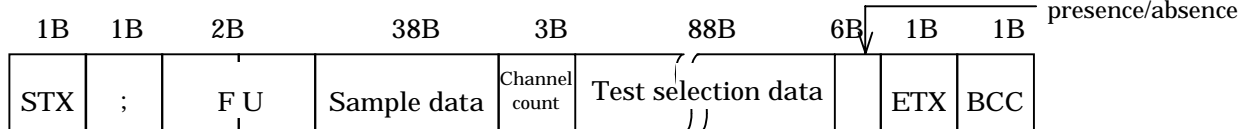
(1) The following shows the composition of SPE text.

For the contents of text, refer to “14.6.2 Contents of text”

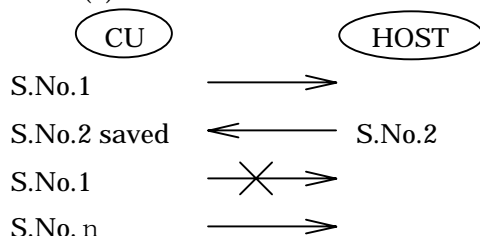
(a) With comment



(b) Without comment



Details of (2):



- (2) The test selection data from the host should correspond to the sample data sent upon test selection inquiry. If it does not, however, the test selection data will be read into the AU and inquiry will not be made again. Even if the ID transmitted by the AU is not returned from the host in the ID mode, the test selection data will be read into the AU.
- (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 a barcode reader is provided, the AU ignores the sample no., disk no. and position no. of the routine/rerun sample, even if they were sent from the host.
- (5) In manual rerun, the AU does not accept TS for the manual rerun sample if the sample bearing the sample no. specified by the host was not measured.
- (6) With 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.
- (7) 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 was not made) on the AU side.

(8) The Host Comm. Set screen can be used to specify whether test selection inquiry should be communicated by giving priority to the host side:

(a) Priority to host is not specified:

If the communication cycle is set to at least 3 seconds, or the host is late in answering the inquiry from the AU, the sample may not be analyzed (if default profile is specified, the item will be analyzed), but the analysis of subsequent samples may be performed. However, if TS response from the host is late, analysis may be delayed up to 2 cycles.

(b) Priority to host is specified:

Until the host responds to the inquiry from the AU, the analysis of subsequent samples will be interrupted. Since the response from host restarts analysis, be sure to respond to the sample inquired by AU. Even for samples that do not need analysis, make a response, by specifying no request to test selection data.

However, if the analysis of a routine sample has been completed during a wait for TS response of stat sample, the sampling stop status will be set, and the wait for TS response of stat sample will be canceled.

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

The following shows 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 in two ways as shown below.

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

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

Table 14.6.4 Text Size and Composition

Text size	Text composition (B: Byte count)										Max. test count/text	Max. text count	Channel count	
256	Final	1B	1B	2B	38B	6B	3B	10B x test count	1B	1B	(1ch~20ch)	20	1	20 or less
		STX	:	FU	Sample data	Operator ID	Channel count	Analytical data	ETX	BCC				
	1 st	1B	1B	2B	38B	6B	3B	10B x test count	1B	1B	(1ch~20ch)	20	2	21 or more, 40 or less
		STX	1	FU	Sample data	Operator ID	Channel count	Analytical data	ETX	BCC				
	Final	STX	:	FU	↑	↑	↑	↑	ETX	BCC	(21ch~40ch)			
	1 st	1B	1B	2B	38B	6B	3B	10B x test count	1B	1B	(1ch~20ch)	20	3	41 or more, 60 or less
		STX	1	FU	Sample data	Operator ID	Channel count	Analytical data	ETX	BCC				
	2 nd	STX	2	FU	↑	↑	↑	↑	ETX	BCC	(21ch~40ch)			
	Final	STX	:	FU	↑	↑	↑	↑	ETX	BCC	(41ch~60ch)			
	1 st	1B	1B	2B	38B	6B	3B	10B x test count	1B	1B	(1ch~20ch)	20	4	61 or more, 80 or less
		STX	1	FU	Sample data	Operator ID	Channel count	Analytical data	ETX	BCC				
	2 nd	STX	2	FU	↑	↑	↑	↑	ETX	BCC	(21ch~40ch)			
3 rd	STX	3	FU	↑	↑	↑	↑	ETX	BCC	(41ch~60ch)				
Final	STX	:	FU	↑	↑	↑	↑	ETX	BCC	(61ch~80ch)				

Text size	Text composition (B: Byte count)										Max. test count/text	Max. text count	Channel count	
256		1B	1B	2B	38B	6B	3B	10B x test count	1B	1B		20	5	81 or more, 100 or less
	1 st	STX	1	FU	Sample data	Operator ID	Channel count	Analytical data	ETX	BCC	(1ch~20ch)			
	2 nd	STX	2	FU	↑	↑	↑	↑	ETX	BCC	(21ch~40ch)			
	3 rd	STX	3	FU	↑	↑	↑	↑	ETX	BCC	(41ch~60ch)			
	4 th	STX	4	FU	↑	↑	↑	↑	ETX	BCC	(61ch~80ch)			
	Final	STX	:	FU	↑	↑	↑	↑	ETX	BCC	(81ch~100ch)			
512		1B	1B	2B	38B	6B	3B	10B x test count	1B	1B		45	1	45 or less
	Final	STX	:	FU	Sample data	Operator ID	Channel count	Analytical data	ETX	BCC	(1ch~45ch)			
		1B	1B	2B	38B	6B	3B	10B x test count	1B	1B		45	2	46 or more, 90 or less
	1 st	STX	1	FU	Sample data	Operator ID	Channel count	Analytical data	ETX	BCC	(1ch~45ch)			
	Final	STX	:	FU	↑	↑	↑	↑	ETX	BCC	(46ch~90ch)			
		1B	1B	2B	38B	6B	3B	10B x test count	1B	1B		45	3	91 or more, up to 100
	1 st	STX	1	FU	Sample data	Operator ID	Channel count	Analytical data	ETX	BCC	(1ch~45ch)			
	2 nd	STX	2	FU	↑	↑	↑	↑	ETX	BCC	(46ch~90ch)			
	Final	STX	:	FU	↑	↑	↑	↑	ETX	BCC	(91ch~100ch)			
1280		1B	1B	2B	38B	6B	3B	10B x test count	1B	1B		100	1	
	Final	STX	:	FU	Sample data	Operator ID	Channel count	Analytical data	ETX	BCC	(1ch~100ch)			

Text size	Text composition (B: Byte count)											
Common	Final with comment	1B	1B	2B	38B	6B	3B	10B x test count	6B	120B max.	1B	1B
		STX	:	FU	Sample data	Operator ID	Channel count	Analytical data	Comment presence/absence flag	Comment	ETX	BCC

Note 1: Since end code character can be set using up to four characters, calculate the maximum number of transferable channels according to the formula shown below:

$$(\text{Maximum number of transferable channels}) < \frac{\text{Text size}-55}{10} \quad (\text{Round off fractions})$$

(The numerical value '55' indicates the total byte count of fixed length n in Table 14.6.4.)

Note 2: With batch communication in 256-byte mode, data is divided into up to five texts for each sample and then sent.

However, if [Yes] is specified for Send Comment, using [Utility] - [System] – [Host Comm. Sent] screen, data is divided into up to six texts and sent.

Note 3: With such text division, the AU will send the first text and then the following one(s) within the communication cycle after receiving the MOR frame.

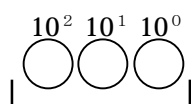
The total amount of analytical data to be transferred is variable according to the number of measured channels.

(a) Channel count (3 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”.

→ Transfer sequence



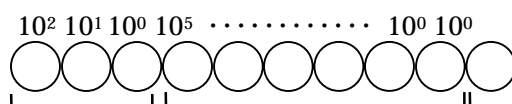
Channel count (right-justified and preceded by spaces)

Example: “bb1” or “001” “b10” “010” “100”

The AU transfers data of up to 100 channels, including serum indexes (three tests of lipemia, hemolysis and icterus), electrolytes (three tests of Na, K and Cl) and calculation items (8).

(b) Analytical data 1 to n (10 characters each)

→ Transfer sequence



Data alarm (1 character)

Measured value (6 characters)

Channel count (3 characters)

(i) Channel no.

Table 14.6.5

Channel no.	Description
bb1 to b86	Photometry assay
b87 to b89	Electrolyte
b90 to b92	Serum index
b93 to 100	Calculation item

(ii) Analytical data

Table 14.6.6

(b: Space) The 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 14.6.6-1

Dip SW	Code position	Example
OFF	Variable	bb-123 or b-1.23
ON	Fixed at far left	-bb123 or -b1.23

Table 14.6.7

Channel no.	Description	Form	Position of decimal point
1 to 86	Concentration value in photometry assay	6 digits with sign and decimal point	Decimal point position for standard 1 on Analytical Parameters screen
87 to 89	Concentration value of electrolyte	Ditto	Decimal point position for LOW solution on Analytical Parameters screen
90 to 92	Measured value for serum index	6-digit integer with sign	Zero at any time
93 to 100	Calculated value of calculation item	6 digits with sign and decimal point	Decimal point for lower limit value of males' lowest age in normal value range setting of calculation item

Note 1: When the type of measured sample coincides with the specification for "Qualitative Test" on the Analytical Parameters screen, the specified character string will be transferred to the host instead of the measured value.

Value input for qualitative test and transmitted character

Qualitative test []	Measured value range	Transmitted character
(1) [a] [l]	Measured value \leq a	'l' is transmitted as result
(2) [b] [m]	a < Measured value \leq b	'm' is transmitted as result
(3) [c] [n]	b < Measured value \leq c	'n' is transmitted as result
(4) [d] [o]	c < Measured value \leq d	'o' is transmitted as result
(5) [e] [p]	d < Measured value \leq e	'p' is transmitted as result
(6) [q]	e < Measured value	'q' is transmitted as result

(iii) Data alarm

For details, refer to “[14.10.2 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

1 st	1B	1B	2B	38B	10B×4			6B×4	
	STX	1	FU	Sample data	Analytical data 1		Analytical data 4	BLANK1	
					2B	6B x Point count		1B	1B
					BLANK4	Point count	ABS1	ABS24	ETX BCC (Variable)
2 nd	1B	1B	2B	38B					
	STX	2	FU	Sample data	Point count	ABS25		ASB60	ETX BCC
Final	1B	1B	2B	38B					
	STX	:	FU	Sample data	Point count	ABS61		ASB73	ETX BCC

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

1 st	1B	1B	2B	38B	10B×4			6B×4	
	STX	1	FU	Sample data	Analytical data 1		Analytical data 4	BLANK1	
					2B	6B x Point count		1B	1B
					BLANK4	Point count	ASB1	ASB66	ETX BCC (Variable)
Final	1B	1B	2B	38B					
	STX	:	FU	Sample data	Point count	ABS67		ASB73	ETX BCC

(iii) When 512-byte mode is specified for text size

Final	1B	1B	2B	38B	10B×4			6B×4	
	STX	:	FU	Sample data	Analytical data 1		Analytical data 4	BLANK1	
					2B	6B x Point count		1B	1B
					BLANK4	Point count	ASB1	ASB73	ETX BCC

(b) Transfer unit

This text is transferred in units of channel: Even when the text size is 256 bytes, transfer will be completed in a single text if the point count is 24 or less.

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

(c) Sample data

Refer to “[14.6.2.2 Sample data](#)”.

(d) Analytical data 1 to 4 (10 characters each)

(i) For the transfer format, refer to (1)–(b) of section 14.6.1.5.

(ii) Table 14.6.8 should be followed when there is no relevant test for analytical data 1 to 4.

Table 14.6.8

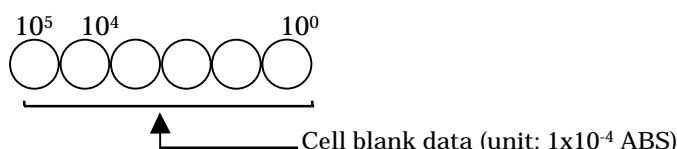
	Setting
Channel no.	" bbb "
Measured value	" bbbbbb "
Data alarm	" b "

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

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

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

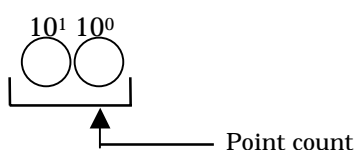
→ Transfer sequence



(f) Point count (2 characters)

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

→ Transfer sequence



Reaction time	3 min	4 min	5 min	10 min	15 min	22 min
Point count	11	14	17	34	50	73

(g) ABS 1 to 73 (6 characters each)

Absorbance data for 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 73, data is closely transferred in sequence, starting from ABS 1.

With a measurement of 15, 22-min reaction, the absorbance at the following jump points will be made spaces:

Jump points: 5, 6, 15, 16, 25, 26, 35, 44, 45, 54, 55, 64, 65

(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	3B	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)

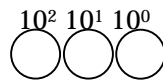
'.' is transferred.

(b) Function characters (2 characters)

'Gb' is transferred. (b: Space)

(c) Channel no. (3 characters)

→ Transfer sequence



The test no. is 'bb1' to 'b86', which corresponds to the test code in AU.

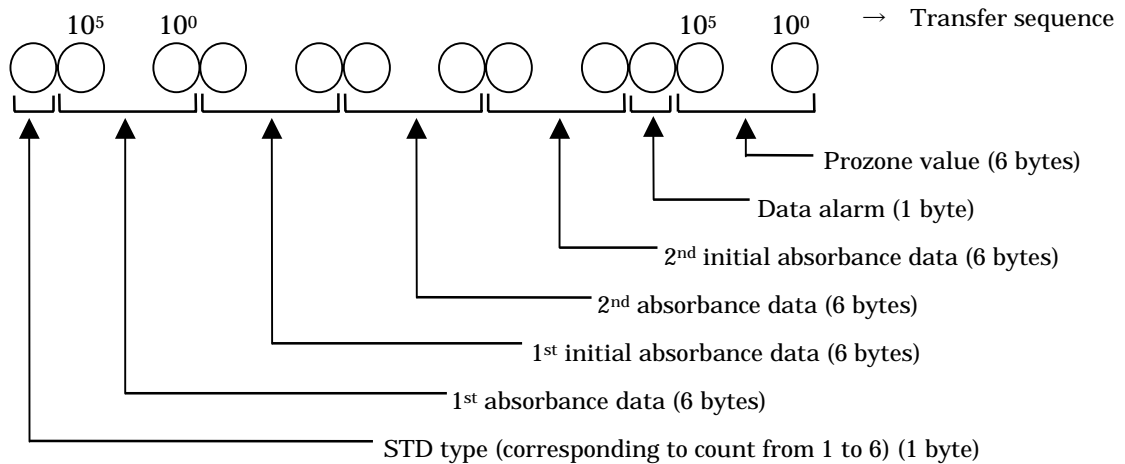
(d) STD count (1 character)

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

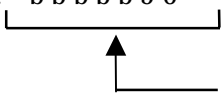
When the STD count is '1', STD data 1 is followed by SD value data.

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

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



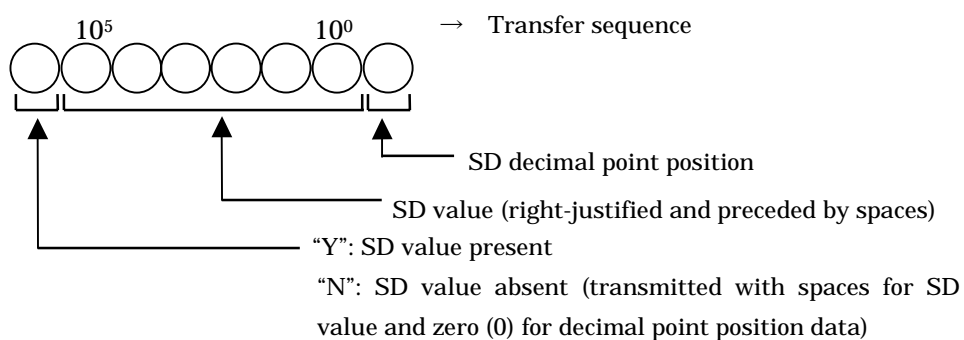
(ii) Each absorbance data item is right-justified and preceded by spaces.

Example: b b b b 5 0

 Preceded by spaces

(f) Calibration alarm (1 character)

Refer to “[14.10.2 Lists of data alarms](#)”.

(g) SD value data (8 characters)



(h) Data composition

Table 14.6.9

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)	
1B	1B	2B	6B	2B	1B	72B	1B	
STX	:	Hb	Operator ID	b b	Na data alarm	Na calibration data	K data alarm	

72B	1B	72B	1B	1B
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) Space (2 characters)
- (d) Data alarm for each channel (1 character)
A data alarm corresponding to each channel is transferred.
For details, refer to “[14.10.2 Lists of data alarms](#)”.

(e) ISE calibration data (72 characters)

This data area has eight data items of electromotive force for internal standard solution, electromotive force for Low solution, electromotive force for High solution, electromotive force of calibrator, slope level for display, concentration of internal standard solution, concentration of calibrator and compensation factor, and data will be transferred in this order.

Each data item is composed as shown below.

Spaces are given when there is no relevant data.

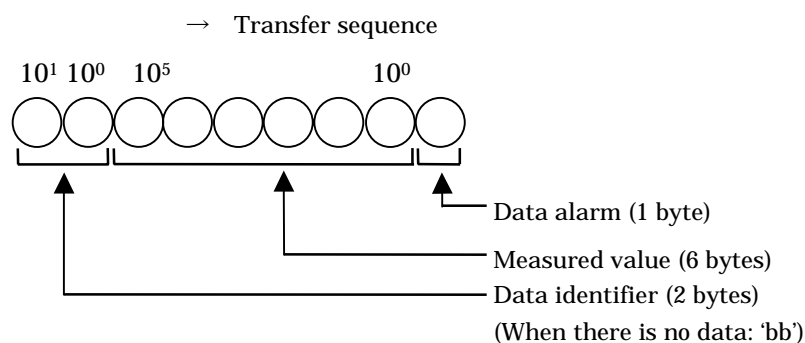


Table 14.6.10

(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 for Low solution	" b2 "	mV	6 digits with sign and decimal point	1 digit
Electromotive force for High solution	" b3 "	mV	6 digits with sign and decimal point	1 digit
Electromotive force of calibrator	" 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 calibrator	" 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	

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

(g) This text is transferred only when the electrode is provided by option.

14.6.2 Contents of text

14.6.2.1 Details of function character (Fu)

→ Transfer sequence



↑ Characters in the following table

Table 14.6.11 Function Characters for Test Selection Information Inquiry and Analytical Data (_ : Space)

Sample name	Form	Test selection data inquiry		Analytical data	
	Direction of communication	AU ↔ HOST	AU ← HOST	AU → HOST	
	ID provided or not	Real-time communication	Batch communication	Real-time communication	Batch communication
Routine sample	Provided	A1~A5	A1~A5	A1~A5	a1~a5
Routine sample (automatic rerun)		B1~B5	B1~B5	B1~B5	
Routine sample (manual rerun)		C1~C5	C1~C5	C1~C5	
Stat sample		D1~D5		D1~D5	d1~d5
Stat sample (automatic rerun)		E1~E5		E1~E5	
Routine sample	Not provided	N1~N5	N1~N5	N1~N5	n1~n5
Routine sample (automatic rerun)		O1~O5	O1~O5	O1~O5	
Routine sample (manual rerun)		P1~P5	P1~P5	P1~P5	
Stat sample				Q1~Q5	q1~q5
Stat sample (automatic rerun)				R1~R5	
Control sample	Not provided			F _	f _
Calibration sample				G _ (photometry assay) H _ (ISE)	
Absorbance data in entire reaction monitoring system (routine)	Provided/Not provided				i1~i5
Absorbance data in entire reaction monitoring system (routine rerun)					j1~j5
Absorbance data in entire reaction monitoring system (stat)					k1~k5
Absorbance data in entire reaction monitoring system (stat rerun)					l1~l5
Absorbance data in entire reaction monitoring system (control)					m1~m5

Supplementary Explanation:

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

14.6.2.2 Sample data

(1) Composition of sample data

Sample no. (5 characters)	Disk no. (1 character)	Position no. (3 characters)	Sample cup identifier (1 character)	ID no. (13 characters)	Age (4 characters)	Sex (1 character)	Blood collection date (6 characters)	Blood collection time (4 characters)
s s s s s	d	p p p	C	i i i i i i i i i i i i i	a a a c	x	m m d d y y	h h m m

(2) Details of sample data

Table 14.6.12 and Table 14.6.13 show the details of sample data.

Table 14.6.12 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)	<p>→Transfer sequence $10^4 10^3 10^2 10^1 10^0$ <div style="border: 1px solid black; display: inline-block; padding: 2px;">s s s s s</div> Sequence no. (1 - 10000)</p>	<p>→Transfer sequence $10^4 10^3 10^2 10^1 10^0$ <div style="border: 1px solid black; display: inline-block; padding: 2px;">s s s s s</div> Sequence no. (1 - 10000)</p>	<p>→Transfer sequence $10^4 10^3 10^2 10^1 10^0$ <div style="border: 1px solid black; display: inline-block; padding: 2px;">c c s s</div> Sequence no. (001 - 150) Control no. (01 - 60)</p>	
Disk no. (1 character)	<p>10^0 <div style="border: 1px solid black; display: inline-block; padding: 2px;">d</div> Disk no. (0 - 9)</p>	<p>10^0 <div style="border: 1px solid black; display: inline-block; padding: 2px;">d</div> Disk no. (0 - 9)</p>	Space	Invalid if space is assigned for HOST → AU: Analysis is made with the disk no. used for inquiry.
Position no. (3 characters)	<p>→Transfer sequence $10^2 10^1 10^0$ <div style="border: 1px solid black; display: inline-block; padding: 2px;">p p p</div> Position no. (b1 - 110)</p>	<p>→Transfer sequence $10^2 10^1 10^0$ <div style="border: 1px solid black; display: inline-block; padding: 2px;">p p p</div> Position no. (b1 - 110)</p>	Space	(1) In the ID mode, the position no. for stat sample can be from 1 to 110. (2) Right-justified and preceded by spaces Invalid if space is assigned for HOST → AU: Analysis is made with the position no. used for inquiry.
Sample cup identifier (1 character)	<p>→Transfer sequence 10^0 <div style="border: 1px solid black; display: inline-block; padding: 2px;">c</div> Sample cup identifier (1 - 2)</p>		Space	1: Standard volume 2: Minute volume
ID no. (13 characters)	<p>→Transfer sequence $10^{12} \quad \quad \quad 10^0$ <div style="border: 1px solid black; display: inline-block; padding: 2px;">i i i i i i i i i i i i i</div> ID no.</p>		<p>→Transfer sequence $10^4 \quad 10^0 10^7 \quad \quad \quad 10^0$ <div style="border: 1px solid black; display: inline-block; padding: 2px;">i i i i i i i i i i i i i</div> Control name Space</p>	(1) When the ID no. is within 13 digits, it is right-justified and preceded by spaces. (2) In case of the NO ID mode, the AU treats the ID no. as a comment. (3) In analytical data transfer for control sample in the ID mode, the control name of 8 characters (based upon screen specifications) is sent as the ID no. of the control sample from the AU to the host in right-justified and space-preceded status.

Table 14.6.13

Item	Sample name			Remarks
	Routine sample (including automatic/manual rerun sample)	Stat sample (including automatic rerun sample)	Control sample	
Age (4 characters)	<p>→Transfer sequence</p> <p>10² 10¹ 10⁰ 10⁰</p> <p>a a a c</p> <p>3: Year 2: Month 1: Day Age (bb0 to 200) (right-justified and preceded by space)</p>		Space	<p><From AU to HOST></p> <p>Age data from the AU is transferred in the sequence shown at left.</p> <p>If data is not yet set, spaces are set for it. (Spaces are always given in analytical data transfer of control sample.)</p> <p><From HOST to AU></p> <p>If age or age code is a space, the AU will be obeyed. (1-3) (Note 1)</p>
Sex (1 character)	<p>→Transfer sequence</p> <p>10⁰</p> <p>x</p> <p>1: Male 2: Female 0: Other</p>		Space	<p><From AU to HOST></p> <p>Sex data from the AU is transferred in the sequence shown at left.</p> <p>If data is not yet set, zero (0) will be transmitted. (A space is always given in analytical data transfer of the control sample.)</p> <p><From HOST to AU></p> <p>If sex is "0" or a space, the AU will be obeyed. (Note 1)</p>
Blood collection date (6 characters)	<p>→Transfer sequence</p> <p>10¹10⁰10¹10⁰10¹10⁰</p> <p>m m d d y y</p> <p>Year (00 to 99) Day (01 to 31) Month (01 to 12)</p>		Space	<p><From AU to HOST></p> <p>The blood collection date from the AU is transferred in the sequence shown at left.</p> <p>If the date is not yet set, the date of sending will be set. (Spaces are always given in analytical data transfer for the control sample.)</p> <p><From HOST to AU></p> <p>In case of a space, the AU will be obeyed.</p>
Blood collection time (4 characters)	<p>→Transfer sequence</p> <p>10¹10⁰10¹10⁰</p> <p>h h m m</p> <p>Minute (00 to 59) Hour (00 to 23)</p>		Space	<p><From AU to HOST></p> <p>The blood collection time from the AU is transferred in the sequence shown at left.</p> <p>If the time is not yet set, the time of sending will be set. (Spaces are always given in analytical data transfer for the control sample.)</p> <p><From HOST to AU ></p> <p>Set the time sent from the AU.</p> <p>In case of a space, the AU will be obeyed.</p>

Note 1: The default age and sex on [Utility] – [Application] screen will be obeyed.

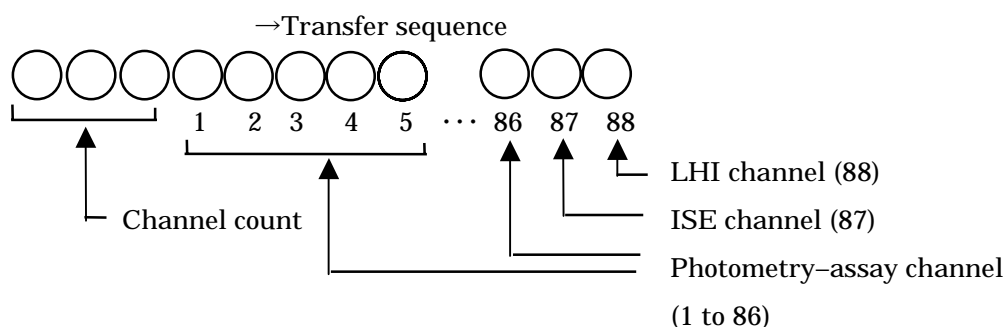
Circumstances in which the data on blood collection date and time is stored in AU:

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

14.6.2.3 Test selection data (from HOST to AU)

(1) Details of test selection data

Send test selection data corresponding to sample data.



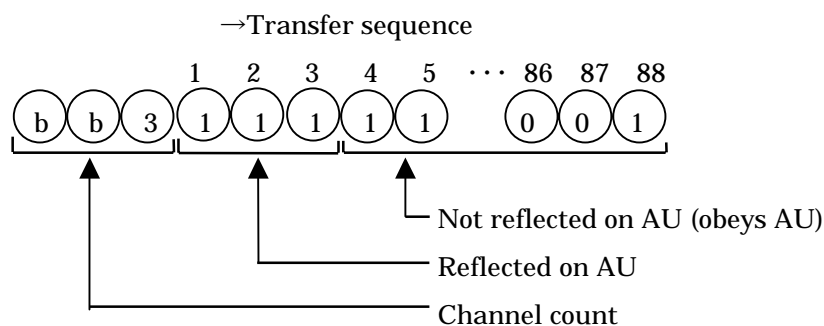
Details of request for each channel
0: No request
1: Normal sample volume (same volume)
2: Decreased volume
3: Increased volume
4: Volume determined by AU (left to AU)

Note 1: The above channel count (bb0 to b88) is the number of effective channels from photometry-assay channel 1. If 'bb3' is specified, channels 1 to 3 will be reflected on the AU (no request is made for channels 4 to 88).

In case of 'bb0', request from the host is considered to be undecided and the AU will be obeyed.

When there is at least one requested test, setting 'b88' is recommended.

Example:



Note 2: Request for electrolytes is specified for channel 87.

(i) Specification of '1': Request is made (electrolyte is analyzed with sample volume fixed at 15 µl)

(ii) Specification of '0': No request

(iii) Specification of '4': Request is made (judged on the AU side)

Note that it is impossible to select request for Na, K or Cl from the host.

Note 3: Request for serum indexes (for 3 tests of L, H and I) is specified for channel 88.

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

Note 5: When request for the calculation test is made, consider it and request the channel for the test that is 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.

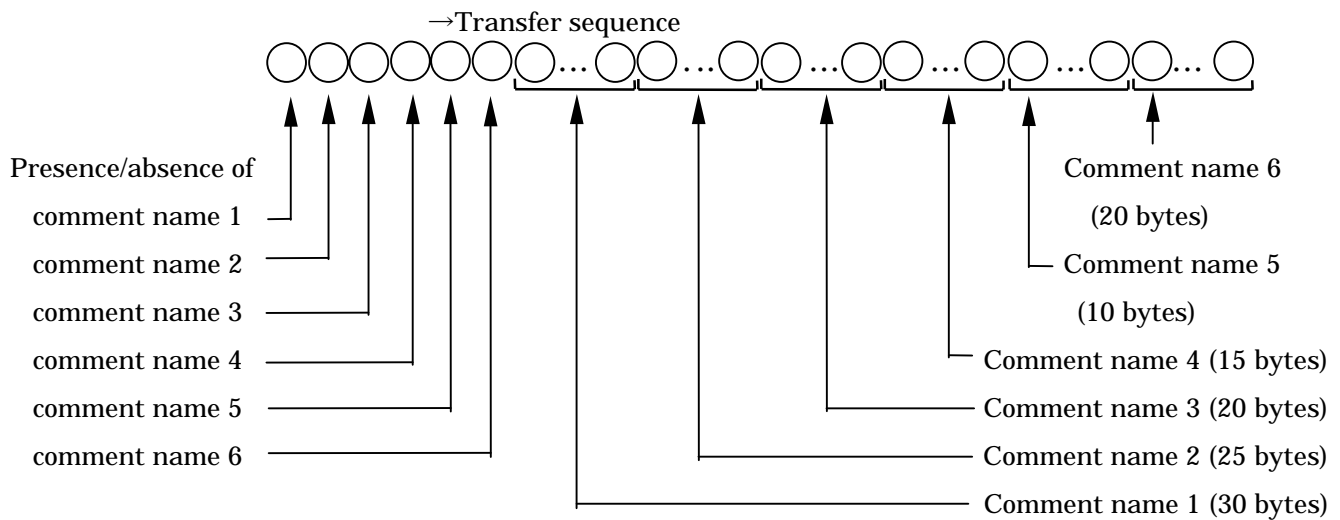
Note 6: Analysis with the sample volume for rerun and data compensation by use of the sample volume ratio in rerun is available (ISE tests excluded).

Send with reference to the details for rerun measurement in the above table.

Note 7: How to cancel tests requested

To cancel all the test selection data (1 to 88 channels) for a sample from the host (no request specified), set "88" to the channel count, specify '0' for all 1 to 88 channels, and transfer them to the AU.

(2) 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'; when it is not present, send '0'.

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

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

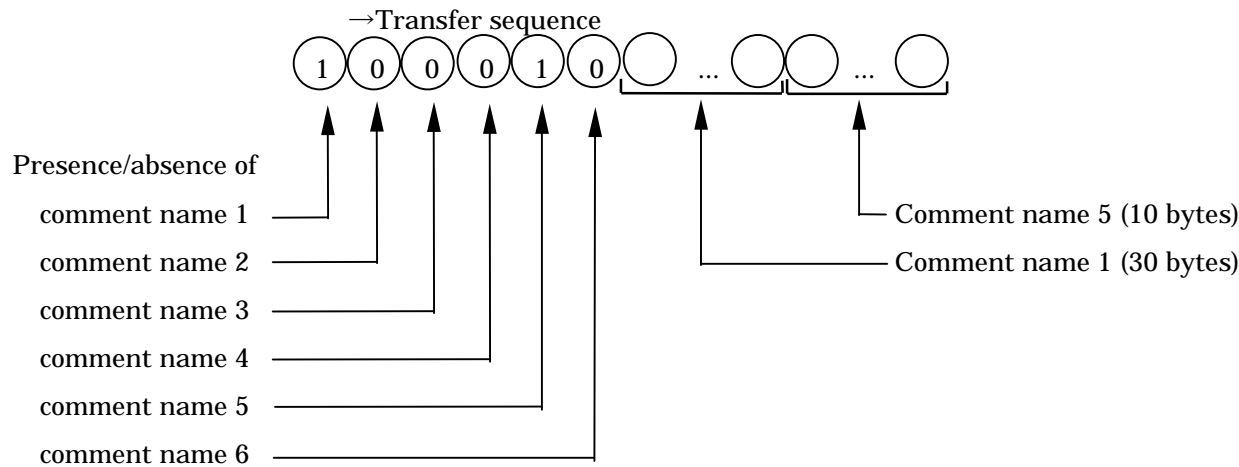
(b) Comment name 1 to 6

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

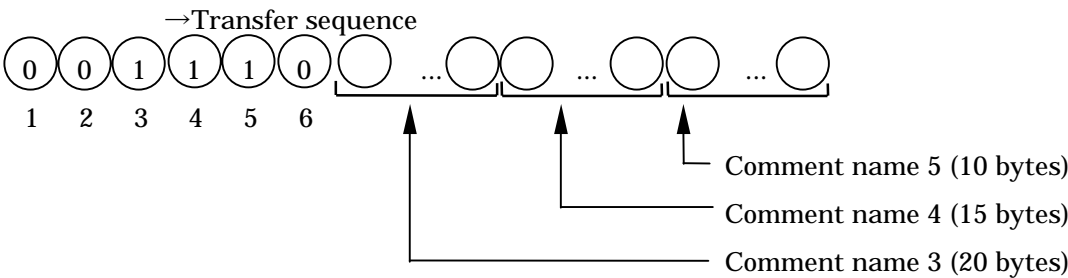
Note that the range of characters usable for the comment is as shown in [Table 14.7.1](#).

When no comment is used, send the relevant comment names closely in sequence (refer to the [setting examples](#)).

Setting example 1:



Setting example 2:



14.7 Error Check Function

If the contents of the received text fall under any condition shown in Table 14.7.1, the AU judges that there is an abnormal character and returns REP. If REP is returned consecutively three times, a system alarm will appear on the screen of analytical unit, and communications will cease.

Table 14.7.1

Attribute	Item	Details of check	Remarks									
Text data	Frame character	An inappropriate frame character is received. (For details, refer to Table 14.3.1 .)										
	Function character	<p>The function character does not correspond to the type of any of the various samples. (For details, refer to Table 14.6.11.)</p> <p>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 judge it as an error when the samples are of the same type.</p> <p>Example:</p> <div><div><div>AU</div><div>HOST</div><div>'A1'</div><div>'A2'</div><div>(Not judged as error)</div></div><div><div>AU</div><div>HOST</div><div>'A1'</div><div>Other than 'A1'-'A5'</div><div>(Judged as error)</div></div></div>										
Sample data	Sample no. Disk no. Position no.	<p>Sample no. or disk no. is outside the specified range, except for the following cases:</p> <table><tr><td>Disk No.</td><td>0 to 9, space</td></tr></table> <p>Position no. is outside the following range:</p> <table><tr><td rowspan="3">Position no.</td><td>Routine ID present/absent</td><td>0 to 100, space</td></tr><tr><td>Stat ID absent</td><td>101 to 110, space</td></tr><tr><td>Stat ID present</td><td>0 to 110, space</td></tr></table>	Disk No.	0 to 9, space	Position no.	Routine ID present/absent	0 to 100, space	Stat ID absent	101 to 110, space	Stat ID present	0 to 110, space	
	Disk No.	0 to 9, space										
	Position no.	Routine ID present/absent	0 to 100, space									
Stat ID absent		101 to 110, space										
Stat ID present		0 to 110, space										
Age, sex	The contents of each item are outside the specified ranges.	When spaces are provided, it is not judged as an error, but processing will be done according to AU.										
Date, time	(1) If each item is a control code (\$00 to \$1F), it is judged as error. (2) If each item is outside the specified range, it is judged as error. (3) No check is made on whether a date is or is not in a specified year.	Same as above										
Inquiry data	Test selection data	(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 outside the specified range.	Same as above									
	Comment data	<table><tr><td>Japanese version</td><td>\$20 to \$FE</td></tr></table> <p>It is judged as error when data is outside the above range.</p>	Japanese version	\$20 to \$FE								
	Japanese version	\$20 to \$FE										
Channel data	Any other than 'bb0' to 'b88'											

14.8 Specifications of Communication Trace

14.8.1 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.

14.8.2 Trace data

The time of communication execution, the direction of communication and the contents of the message will be stored in memory.

14.8.3 Methods for storing trace data

(1) In any modes other than Result Only

- (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 transfer of the text sent from the AU (after sending the end-of-data code).

14.8.4 Trace data storage capacity

Trace data of up to 4000 cycles can be stored.

14.9 Cautions on Connection with External System

- (1) For connection with this protocol, adopt the point-to-point system.
- (2) The end-of-data code can be changed using [Utility] – [System] – [Host Comm. Set] screen: Note, however, that the host should send the same end-of-data code as on the AU side.
If the codes do not match, a resending request (REP) will be transmitted.
- (3) 'EXT' is added to the end-of-data code in each text, without fail.
Therefore, when the text size is set to 256 bytes, the AU adds not 'ETB' but 'ETX' whenever data of more than 256 bytes is transferred.
For the host, the frame character ':' is the final message when data for one sample has been sent in more than one text: Pay close 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 host in the following cases:
 - (a) When, upon request for analytical data transfer from the host, the relevant sample is not stored on the HD.
 - (b) When 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) will be transferred until the text gains normal status.
- (6) Set at least 100 ms as the period of delay in response to the AU side after the host receives a text.

14.10 Supplementation

14.10.1 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 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, where no other instrument is connected between them and there is no instrument for control of data transmission for the whole system. |
| (8) Response | : To send to one of two communication instruments whether the other is ready for receiving or not and whether the received data is normal or not, along with a character to be transmitted for that purpose. |
| (9) Recovery | : To escape from deadlock that is caused by an abnormality in the sending device, receiving device or line. |
| (10) Frame character | : Identifies the purpose of the text and functions as the 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 that has 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 that has no data field.
(Example: ANY, MOR, REP, SUS, REC) |
| (16) ID mode | : [Yes] is specified for Barcode Reader on the System Parameters screen. |
| (17) Sample no. mode | : [No] is specified for Barcode Reader on the System Parameters screen. |

14.10.2 List of data alarms

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

No.	Name of data alarm	Output string	Photometry-assay				ISE				
		S./F	Rou-tine	Stat	Con-trol	STD	Rou-tine	Stat	Con-trol	STD	
28	Random error [R-4s]	@			○				○		Data is replaced with space. Data is replaced with space. Data is replaced with space. Can coexist with another alarm. Can coexist with another alarm.
29	Systematic error 1 [2-2sA]	#			○				○		
30	Systematic error 2 [2-2sW]	#			○				○		
31	Systematic error 3 [4-1sA]	#			○				○		
32	Systematic error 4 [4-1sW]	#			○				○		
33	Systematic error 5 [10xA]	#			○				○		
34	Systematic error 6 [10xW]	#			○				○		
35	QC error 1	+			○				○		
36	QC error 2	+			○				○		
37	Calculation item error	%	○	○			○	○			
38	Overflow	○	○	○	○		○	○	○		
39	Calculation disable	X	○	○	○	○	○	○	○	○	
40	Upper expected value limit over		○	○	○		○	○	○		
41	Lower expected value limit over		○	○	○		○	○	○		
42	Edited item	*	○	○			○	○			
43	Calibration result abnormality	!	○	○	○		○	○	○		
44	Repeat upper limit over	=	○	○			○	○			
45	Repeat lower limit over	=	○	○			○	○			

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

14.11 Wiring Diagram

14.11.1 Overview

Model 7180 uses the RS-232C interface. The Serial A/1 connector in control unit PC Vectra is used for connections.

14.11.2 Interface signals

Table 14.11.1 shows the functions of interface signals, and Table 14.11.2 shows the signal levels and functions.

Table 14.11.1 Functions of Interface Signals

Abbreviation	Signal name	Signal direction	
		(7180)	(Partner device)
FG	Frame Ground		
TxD	Trans Data		→
RxD	Recieve Data		←
RTS	Request To Send		→
CTS	Clear To Send		←
DSR	Data Set Ready		←
SG	Signal Ground		
DCD	Data Carrier Detect		←
DTR	Data Terminal Ready		→

Table 14.11.2 RS-232C Interface Signal Levels and Functions

Signal level Signal name	Positive (Note 1)		Negative (Note 1)	
TxD	• SPACE		• MARK (no signal)	
RxD	• Start bit		• Start bit	
	• Data "0" (Note 2)		• Data "1" (Note 2)	
RTS	• ON		• OFF	
DTR	• Data "1"		• Data "0"	
CTS	• ON		• OFF	
	• Data "1"		• Data "0"	
	• Data communication enable		• Data communication disable	
DCD	• ON		• OFF	
	• Data "1"		• Data "0"	
	• Data communication enable		• Data communication disable	

Note 1: Positive: Output +12 V, Input +3 - +15 V

Negative: Output -12 V, Input -3 - -15 V

Note 2: Data "0" and data "1" correspond to binary digits when the CPU reads or writes data or status.

(1) Location of connector

Use the Serial A/1 connector (|O|OA/1) in control unit PC Vectra.

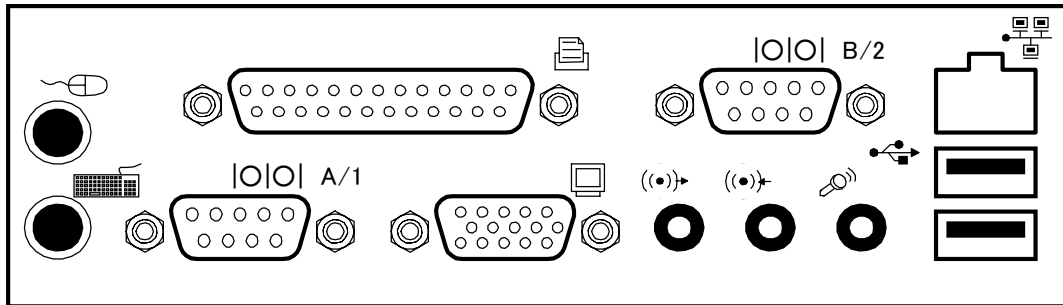


Fig. 14.11.1 Rear Panel of PC Vectra

(2) Connection cable and cable length

The Serial A/1 connector in PC Vectra is a 9-pin interface (D-Sub male). Use the following connector on the cable side:

HDEB-9S (made by Hirose Electronics) or equivalent.

The cable length is up to 15 m.

(3) Pin allocations

Table 14.11.3 PC Vectra Serial A/1 Connector Pin allocations

Pin no.	Signal	Pin no.	Signal
1	DCD	6	DSR
2	RxD	7	RTS
3	TxD	8	CTS
4	DTR	9	RI
5	SG		

(4) Example of connections

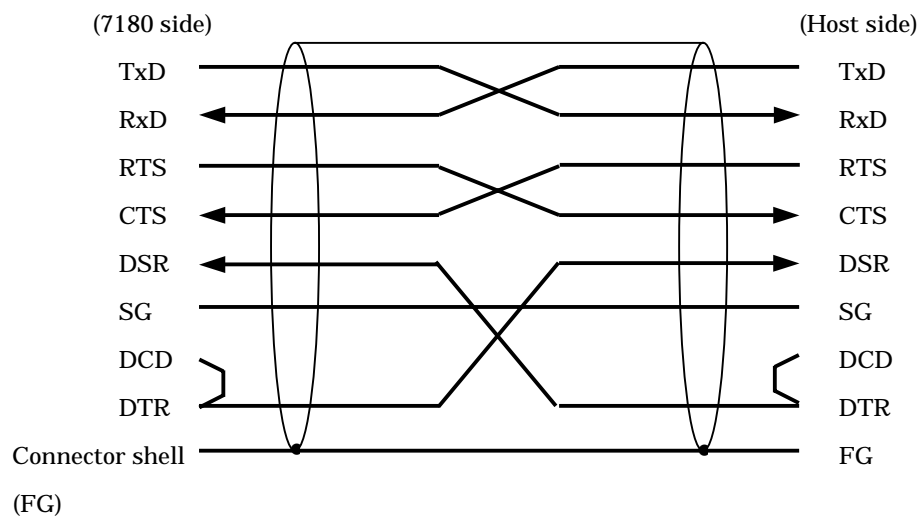


Fig. 14.11.2 Example 1 of RS-232C Communication Connections

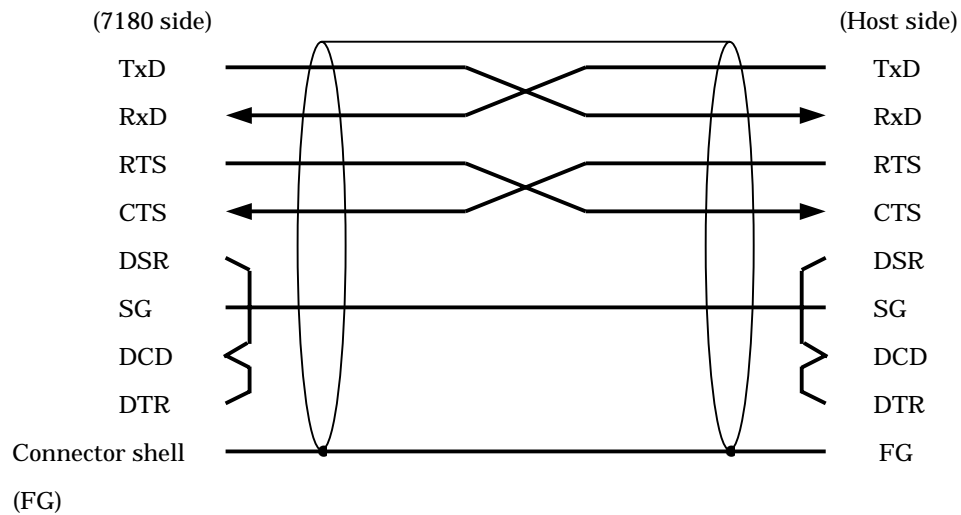


Fig. 14.11.3 Example 2 of RS-232C Communication Connections
(Wiring when DSR, DCD and DTR are not used)

(5) Treatment of FG

The connector shell of Serial A/1 connector on control unit PC Vectra is allocated to FG. Connect FG to the connector shell with wiring in connector.