

16. SYSTEM INTERFACE

2020

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16. SYSTEM INTERFACE

16.1 Overview

Provided here are the signal form and protocol (communication rules) in case of connection between the Model 7020 and an external system (hereafter referred to as a host) via asynchronous serial signal.

(1) Specifications of communication

The following table lists the specifications of RS-232C communication.

Table 16-1 Specifications of Communication

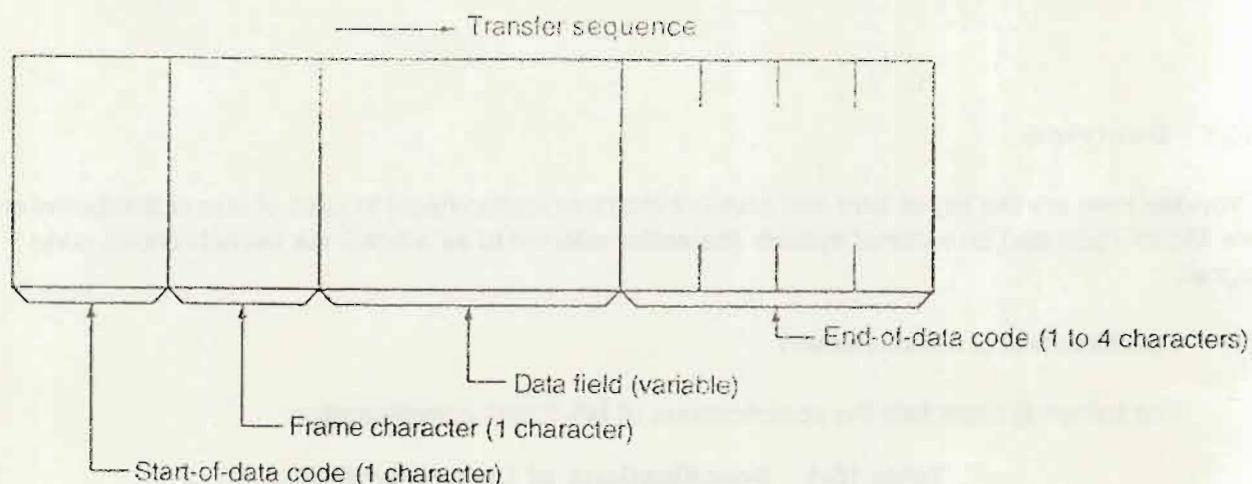
No.	Item	Specifications	Remarks	Default Value (standard value)
1	Interface	RS-232C or 20 mA current loop	—	—
2	Communication method	Half duplex	—	—
3	Data bit	7 or 8 bits	Communication parameter screen	7 bits
4	Stop bit	1 bit/2 bits		2 bits
5	Parity check	Even/odd/no parity		Even parity
6	Baud rate (bit/sec)	4800/9600 <small>NOTE</small>		9600
7	Max. volume of transferred data	256/512 bytes		256
8	End-of-data code	ETX + BCC/CR + LF + ETX/ETX ETX + CR + LF ETX + CKSH + CKSL + CR		ETX + BCC
9	Code	JIS 7 bits, JIS 8 bits or ASCII		
10	Synchronization system	Asynchronous system (Start-stop transmission)		
11	Transmission control procedure	Determined by host		
12	Number of ports	1 max.		
13	Text mode	Nontransparent mode (ASCII)	—	
14	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 volume of transferred data and end-of-data code are selectable by the user.

(3) Outline of text

The format of communication text is shown below.



Each block of text is detailed below.

- (a) Start-of-data code (1 character)

STX code (ASCII code \$02)

- (b) Frame character (1 character)

Refer to Table 16-3.

- (c) Data field (variable)

- (i) When there is no data field (non-specific request text)

There is no data field because MOR, ANY, REP, SUS and REC are control frames.

- (ii) When there is a data field (specific request text)

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 combinations is selectable on the host setting screen.

(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 + l + \$0D)

The text length from (a) to (d) is selectable on the communication parameter screen. (256 or 512 bytes)

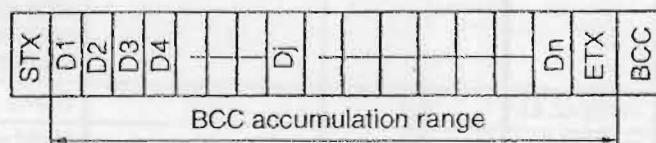
NOTES:

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), and the end-of-text character is ETX (03).
- 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]

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

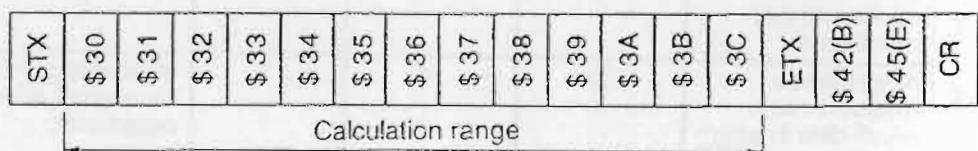
BCC = Block check character (1 byte)

BCC = D₁ + D₂ + D₃ + D₄ + ... + D_n + (ETX)₁₆
(+: Exclusive OR)

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 the 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:



16.2 Communication Functions

- (1) Tables 16-2 and 16-3 list the host communication functions provided with the Model 7020 Automatic Analyzer.

Table 16-2 Communication Function List for Test Selecting Information

				(A): Analyzer side (H): Host side
Function		Inquiry from (A) to (H)	Instruction from (H) to (A)	Conditions
Test selecting information inquiry communication on routine sample	With ID	<input type="radio"/>	<input type="radio"/>	Valid when [NO] is specified for the transfer of analytical data alone on the communication parameter screen.
	Without ID	<input type="radio"/>	<input type="radio"/>	Same as above
Stat sample	With ID	<input type="radio"/>	<input checked="" type="radio"/>	Valid when [NO] is specified for the transfer of analytical data alone and [YES] is specified for stat sample test selection.
	Without ID	<input checked="" type="radio"/>	<input checked="" type="radio"/>	

Table 16-3 Communication Function List for Measurement Result Data

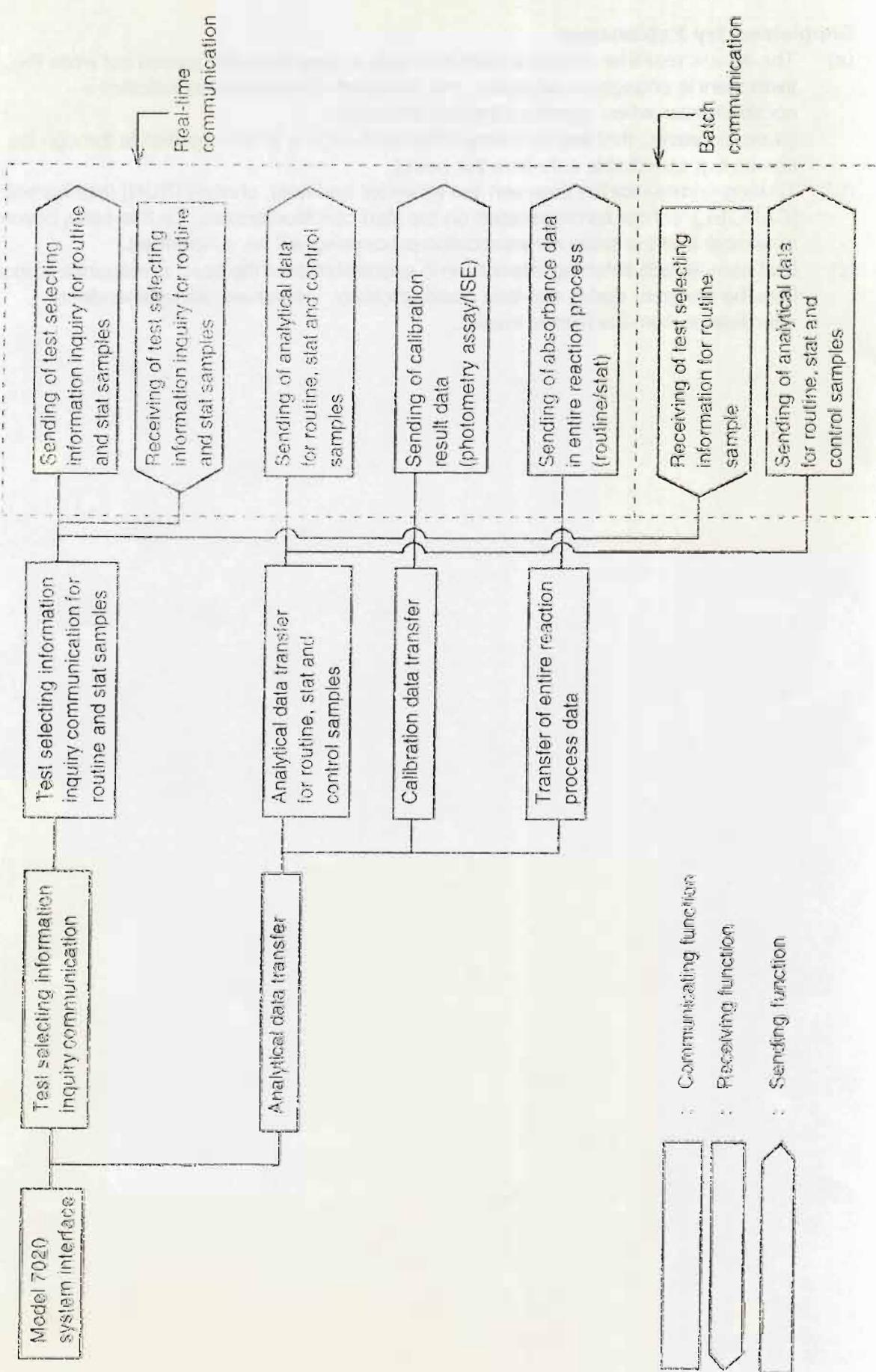
Function		Real-time Communication	Batch Communication	Specific Sample Request	Conditions
Measurement result data communication	Routine and stat samples	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Specific sample request is invalid when [YES] is specified for the transfer of analytical data alone as a system parameter.
	Control sample	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	
	Calibration measurement result data	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	
	Absorbance measurement result data in entire reaction process (original absorbance data)	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	Valid when [YES] is specified for original absorbance parameter.

○: Executable ×: Inexecutable

Supplementary Explanation

- (a) 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.
(Note, however, that test selecting information inquiry is not specifiable through the screen but specifiable only from the host.)
- (b) To stop communication between the analyzer and host, change [RUN] (highlighted) to [CANCEL] for host communication on the start condition screen. In this case, however, remember that the entire communication processing will be suspended.
- (c) Stat sample test selecting information is specifiable from the host, in response to inquiry from the analyzer during real-time communication. However, an independent specification from the host is invalid.

(2) Functional relationship with Model 7020 system interface



16.3 Frames

Each frame represents the purpose of a text (contents of message). Table 16-4 lists the frames.

Table 16-4 Frame List

No.	Mnemonic	Name	Character	ASCII Code	Sender	Meaning
1	FR 1	Frame 1	1	\$ 31	AU	For analytical data transfer
2	FR 2	Frame 2	2	\$ 32		FR1 is used for the first text and END for the final text.
3	END	End Frame	:	\$ 3A		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.
4	SPE	Specific Sample	:	\$ 3B	AU	TS directive inquiry
					HOST	Used for TS inquiry for only one specific sample. (TS: Test selecting information)
5	RES	Results Request	<	\$ 3C	HOST	Used for TS direction from HOST.
6	ANY	Any Inquiry	>	\$ 3E	AU	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.)
7	MOR	More			HOST	Positive response (corresponding to ACK)
8	REP	Repeat	?	\$ 2F	AU, HOST	Used by AU to ask HOST for the following items. (1) TS information possessed by HOST (2) HOST's initiation of rerun sample (3) RES, REC or MOR frame request
						Means that HOST is ready to receive analytical data. (Analytical data can be transferred from AU to HOST only when HOST has sent this frame.)
						Used when resending of the previous communication is requested. HOST can send REP at any time, but AU sends it only when the text from HOST is destroyed and resends the same text in any other case.

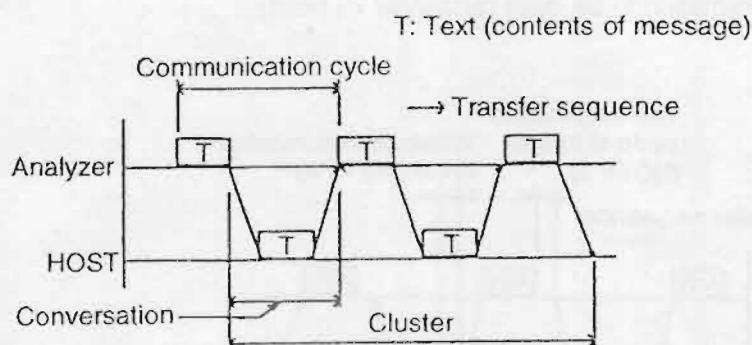
(cont'd)

No.	Mnemonic	Name	Character	ASCII Code	Sender	Meaning
9	SUS	Suspend	@	\$ 40	AU, HOST	Sent by AU to suspend resending of a non-specific inquiry and allow a specific inquiry. Sent by HOST to suspend communication for one communication cycle or longer without recording the last communication by AU.
10	REC	Received	A	\$ 41	HOST	Used to request AU to suspend communication for one communication cycle or longer because HOST is not ready to receive any analytical data.

16.4 Data Transmission Control Procedure

16.4.1 Establishment of Data Link

- (1) Upon input of [YES] for host communication on the start condition screen, the analyzer side transfers ANY frame to the host. This marks the start of communication.
- (2) Once a text has been sent, the direction of transmission is reversed and the receiver can send the next response or text. In subsequent steps, the analyzer and host continue transmission alternately.



16.4.2 Response to Information

- (1) Upon receiving information, the receiver sends a response or text (see Table 16-4) 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) depending on sample. In this case, the text is analyzed, the analyzed text is put between STX and ETX and a frame character to identify the number of transmissions is added in the text.
- (3) After sending a text, sending should be avoided until reception of a response or request to/for the text in a normal condition. If sending is attempted, the analyzer side ignores it. (Trace will not be made either.)
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.
- (4) If the host did not return a response in the communication cycle (NOTE) on communication from the analyzer, alarm is displayed on the screen of analyzer.

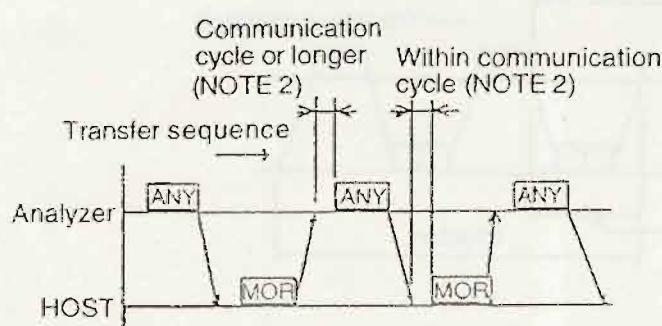
NOTE: Time period is changeable on the communication parameter screen. It is defaulted to 2 sec.

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 (analyzer ↔ host)
- (2) Transfer of communication control message (analyzer ↔ host)
- (3) Transfer of test selecting information (analyzer ↔ host)
- (4) Transfer of analytical data (analyzer → host)
- (5) Resending request (analyzer ↔ host)

- (1) When there is no information to be sent (analyzer ↔ host)

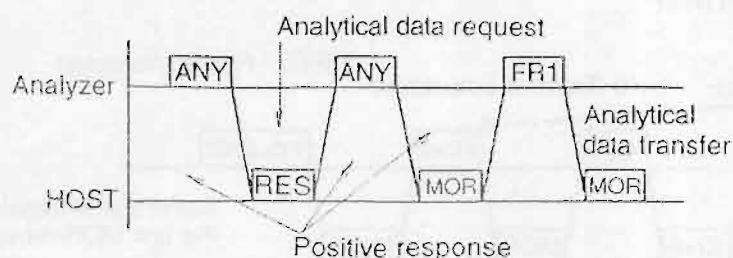


The analyzer continues returning the ANY frame in response to the MOR frame from the host so as to respond to the request from the host at any time even when the analyzer and host have no information to be sent (NOTE 1).

In this case, the analyzer sends the ANY frame at one communication cycle or longer (NOTE 2) after receiving the MOR frame from the host (at time point when the final end-of-data code is recognized).

- NOTES:**
1. When the following conditions are satisfied:
 - (a) There is no test selecting 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.
 2. This time period is changeable on the communication parameter screen.
Default value is 2 sec.

(2) Transfer of communication control message (analyzer ↔ host)



The RES, ANY, MOR, REP, SUS and REC frames are available for the communication control messages.

For details, refer to Table 16-4.

(a) RES frame

The host can make a request to the analyzer side (just called "analyzer" hereafter) for analytical data of a specific sample by use of the RES frame. However, the analyzer sends the ANY frame in the following cases.

(i) The analyzer has no relevant data.

(ii) FD error occurs during access to the relevant sample data.

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

The analyzer is capable of storing data of up to 10 routine samples in each of ID mode and sample No. mode. That is, data of more than 11 samples is ignored.

The analyzer does not transfer measurement data in case of sending from the host in the sample No. mode (without ID) though ID is provided.

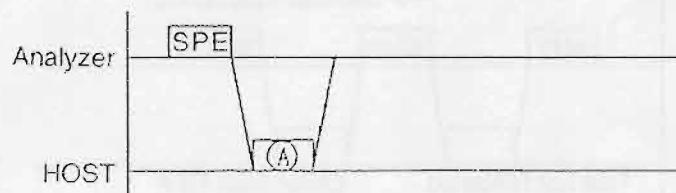
If transferring the RES frame from the host when FD is occupied by a factor, the presence or absence of an FD error is checked with the relevant factor terminated. The result of FD error check is described below. During this process, communication is in the event occurrence status.

1) If FD error is absent.....RES frame is transferred.

2) If FD error is present.....RES frame is not transferred.

When interruption is caused by RES frame during batch transfer, a batch-specified sample may be transferred before one sample because FD access time is allowed. In this case, after the text for one batch-specified sample is transferred, the RES frame will be transferred.

(3) Transfer of test selecting information (analyzer ↔ host)

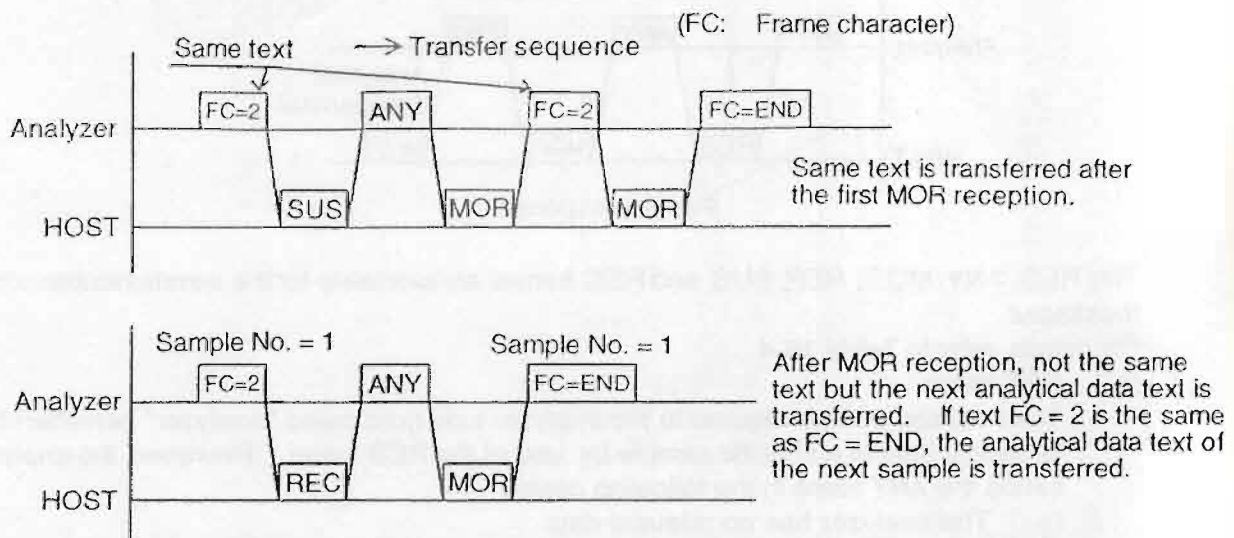


Response from host

Frame A	Description
SPE	To return test selecting information for a sample sent from analyzer
MOR	To indicate that host cannot respond to test selecting information inquiry but is ready to receive analytical data
REC	To suspend communication with analyzer for the specified period of time because host cannot respond to test selecting information inquiry nor receive analytical data

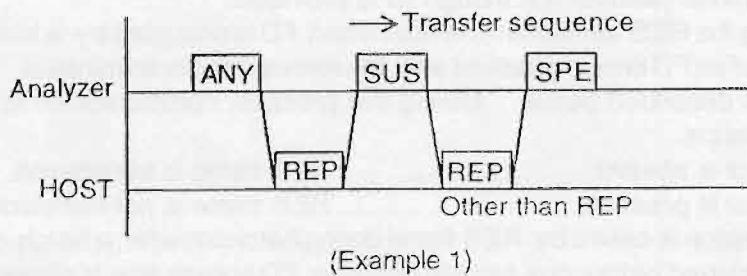
Difference in Transfer between SUS and REC Frames

(a) In sending from host

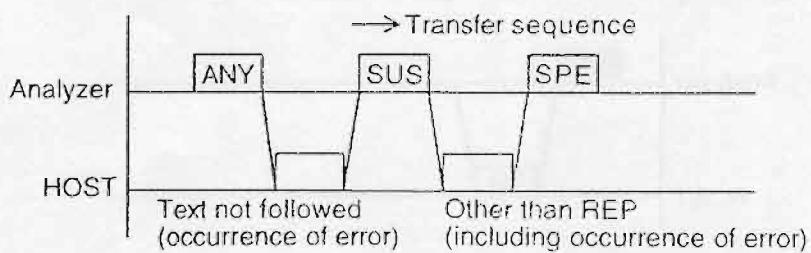


(b) In sending SUS frame from analyzer

Example 1: REP frame is returned for ANY frame from the analyzer.



Example 2: An error occurred on response to ANY frame from the analyzer.

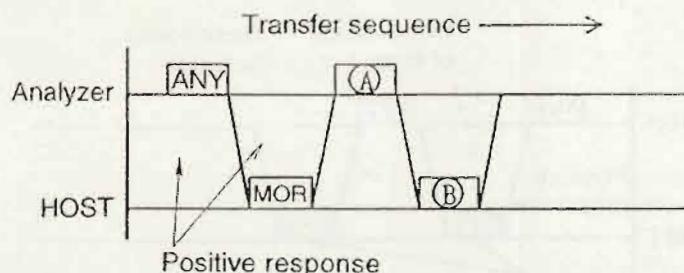


(Example 2)

(4) Transfer of analytical data (analyzer → host)

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

(a) Transmission procedure in normal case



Response from analyzer

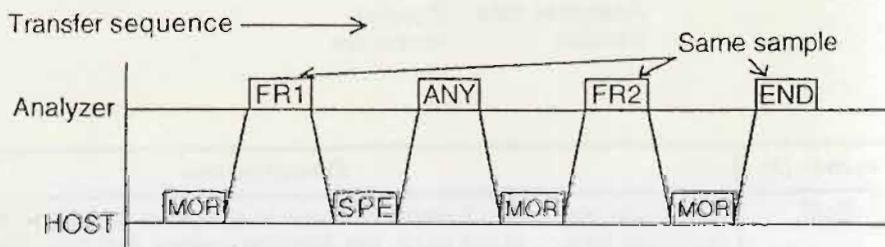
Frame (A)	Description
FR1 to END	Analytical data (including calibration result and absorbance data in entire reaction process)

Response from host

Frame (B)	Description
REP	When text in (A) is abnormal
MOR	To receive analytical data next time as well
REC	To avoid reception of analytical data next time
SUS	To suspend communication
SPE	To specify 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 analyzer is transferring a sample having 2 or more tests to the host, the analyzer responds to the relevant frame and resumes sending from a succeeding text upon receiving the MOR frame.

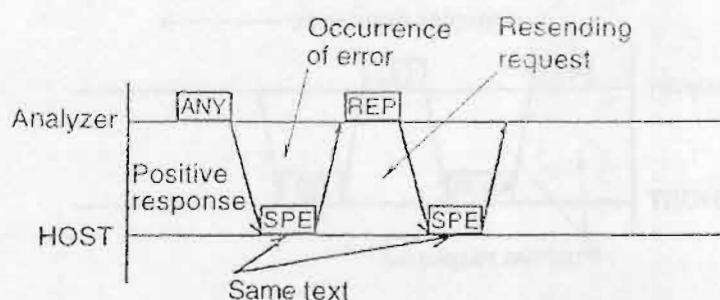


- Effect of this system:
- (1) No delay for SPE
 - (2) Identifiable by host because sample identifying information is provided for each text

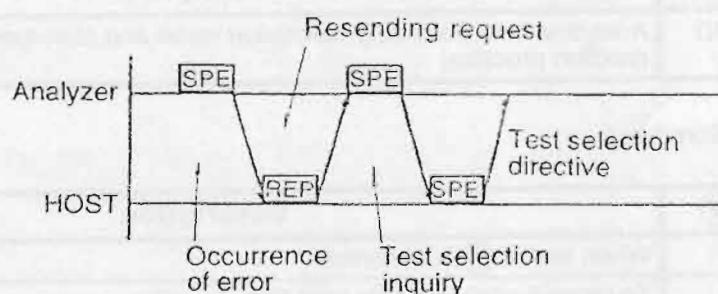
(5) Resending request (analyzer ↔ host)

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

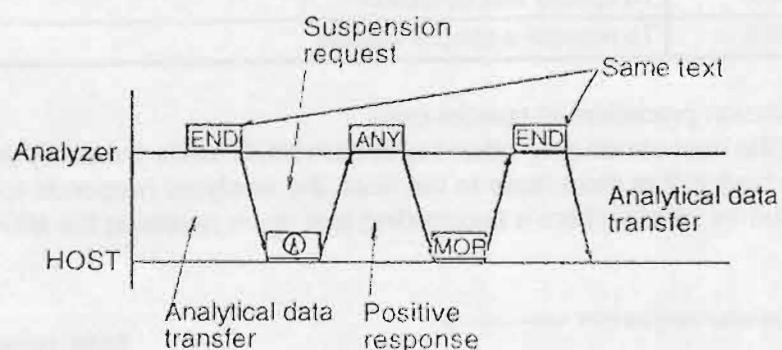
(a) From analyzer to host



(b) From host to analyzer

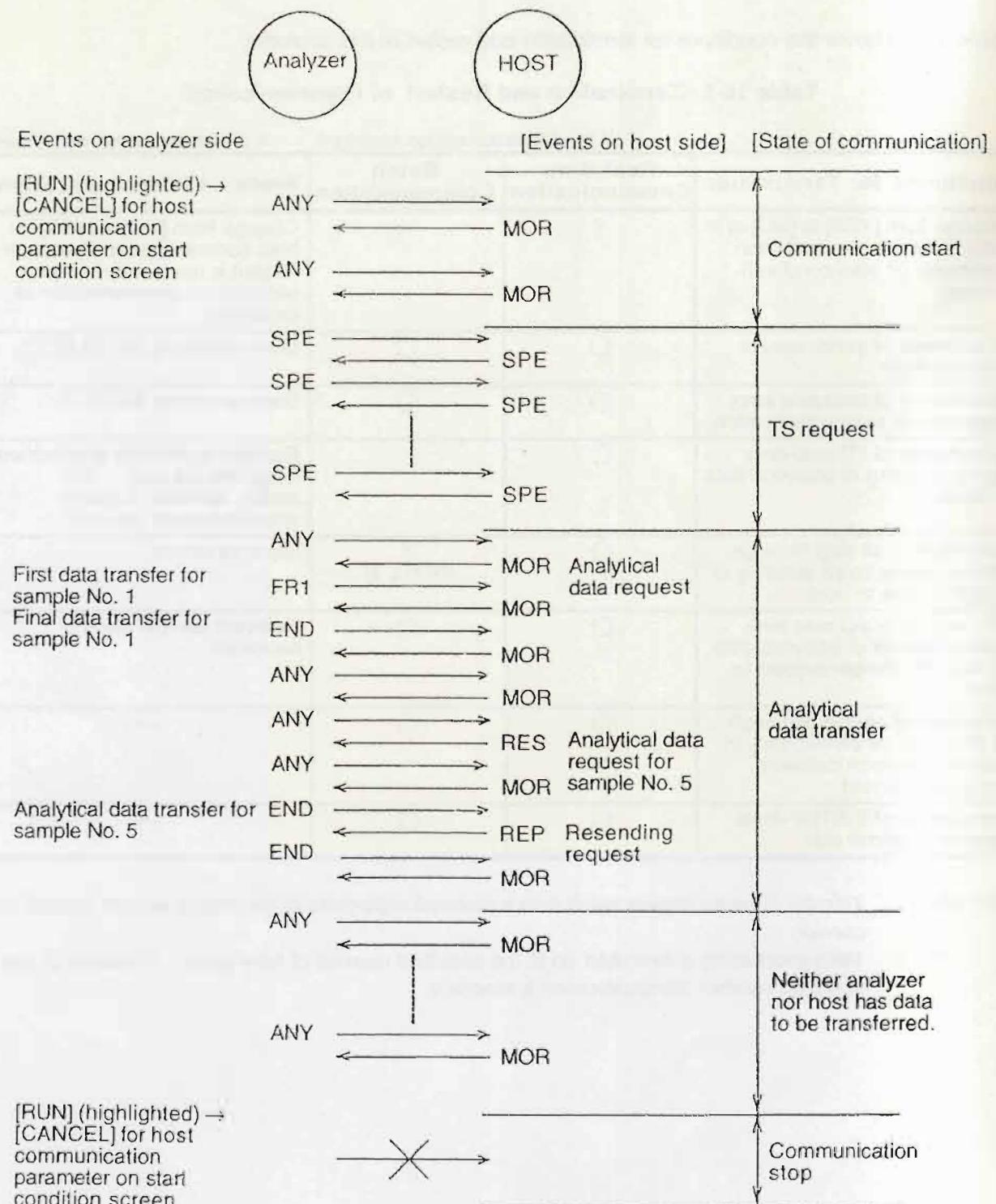


(c) For resending with other than REP



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

Basic Control Procedure



Contents of Each Frame

	Contents
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 and Restart of Communication

Table 16-5 shows the conditions for termination and restart of this protocol.

Table 16-5 Termination and Restart of Communication

Conditions for Termination			○: Communication stopped ×:Communication continued
	Real-time Communication	Batch Communication	Restart of Communication
Change from [YES] to [NO] or in [NO] for host communication parameter on start condition screen	×	×	Change from [NO] to [YES] for host communication parameter. Restart is made with previous contents of communication all canceled.
Occurrence of send/receive time-out error	○	○	Same as above (NOTE 2)
Occurrence of hardware error alarm related to communication	○	○	Same as above (NOTE 2)
Occurrence of FD read error during sending of analytical data to host	○	×	Remaining samples in specified range are not sent. On restart, samples in newly specified range are sent.
Specification of stop through screen during batch sending of analytical data to host	○	× (NOTE 1)	Same as above
Occurrence of FD read error during transfer of analytical data for specific sample request to host	○	○	Relevant sample alone is canceled.
Detection of error in text such as BCC error or discrepancy in end-of-data code between analyzer and host	○	○	—
Occurrence of E.STOP-level alarm on analyzer side	○	○	—

- NOTES:**
1. Transfer of measurement result data is stopped regardless of the kind of sample (routine or control).
 2. Retry processing is executed up to the specified number of retry times. In excess of the specified number, communication is stopped.

16.4.5 Priority

When multiple processings concur in response to a request from the host, the analyzer assigns priority to them for returning its response to the host.

However, batch communication is suspended in units of text for transferring to the host the text which has a higher priority than batch communication when it interrupts batch communication under execution (restricted to the cases where analytical data in the real-time mode is output from analyzer and analytical data alone is transferred in response to RES frame). (Discrimination between real-time communication data and batch communication data depends on the function frame.)

Then, batch communication is restarted.

Table 16-6 gives the details of each frame and the priority.

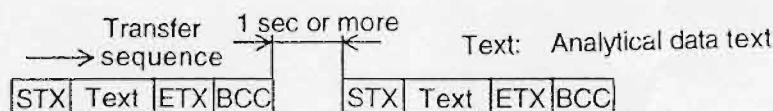
Table 16-6 Details of Each Frame and Priority

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

16.4.6 RESULT ONLY Mode

In this mode, only the measurement result data is transferred to the host. This mode does not accept a resending request (REP frame) from the analyzer or host and a specific sample data request. When [YES] is set for "transfer of analytical data alone" on the communication parameter screen, the analyzer returns response to neither test selecting inquiry for routine/stat samples nor specification of test selection from the host.

The analyzer waits for 1 sec or more after sending ETX in the analytical data text and proceeds to transfer to the host regardless of the communication procedure.



16.4.7 Retry of Communication

Retry is a function for resending the text sent from the analyzer to the host immediately before occurrence of any communication error.

(1) Retry due to time-out

(a) Reception time-out

If response is not received beyond the response wait time limit (NOTE 1) after sending a text from the analyzer, reception time-out occurs and retry is made. When the number of retries (Note 2) exceeds the maximum number of retries allowed for time-out (Note 3), communication will be suspended.

(b) Transmission time-out

If a text cannot be sent from the analyzer, transmission time-out occurs and retry is made after one communication cycle or longer. When the number of retries (NOTE 2) exceeds the maximum number of retires allowed for time-out (NOTE 3), communication will be suspended.

NOTES: 1. Time period is changeable by retry time entry on the communication parameter screen.
2. The number of retries made consecutively
3. Retry time is changeable by entry for the number of retries on the communication parameter screen.

(2) Retry due to communication error

If a communication error (NOTE 4) occurs, retry is made immediately before the end of current communication cycle. When the number of retries (NOTE 5) exceeds the maximum number of retries allowed before communication error (NOTE 6), the relevant resent data will be canceled and the next text will be sent.

NOTES: 4. Hardware error or text error
5. The number of retries made consecutively
6. Same as in (NOTE 3) of (1) above

16.5 Status Transition

16.5.1 Status Transition Matrix (only in non-transfer for analytical data alone)

Table 16-7

No.	Event Status in Analyzer	Event from Analyzer						Event from Host						Time-out/ Hardware Error	Error in Text
		Host Comm. Param. [N] → [Y]	Host Comm. Param. [Y] → [N]	TS Inquiry Req. (TS management task)	Real-time Data Out: Sample from 7020	Transfer Req. for Specific Sample	Batch Transfer Req. from Screen	Cancel or FD Error	MOR (analytical data req.)	REP (resending req.)	SUS (suspension req.)	REC (suspension specification req.)	SPE (TS specification)	RES (specific sample req.)	
1	Initial status (NO) (or host communication parameter)	ANY transfer/2													
2	Idling (no data to be transferred on analyzer and host sides)		1	6	5	4	4								
3	LPR transfer wait (before LPR transfer)		1	7	3	6	5								
4	HPR transfer wait (before HPR transfer)		1	8	5	4	4	2							
5	HPR/LPR transfer wait (before HPR/LPR transfer)		1	9	5	5	5	3							
6	SPE transfer wait (before SPE transfer)		1	SPE (current TS) /13	7	8	8								
7	SPE/LPR transfer wait (before SPE/LPR transfer)		1	SPE (current TS) /14	7	9	9	6							
8	SPE/HPR transfer wait (before SPE/HPR transfer)		1	SPE (current TS) /15	9	3	8	6							
9	SPE/HPR/LPR transfer wait (before SPE/HPR/LPR transfer)		1	SPE (current TS) /16	8	2	9	7							
10	Ready for LPR transfer		1	7	17	12	12	11							
11	Ready for HPR transfer		1	8	12	11	11	2							
12	Ready for HPR transfer LPR transfer wait		1	9	12	12	12	10							
13	Ready for SPE transfer		1	SPE (current TS) /13	1*	15	15								

(cont'd)

No.	Event Status in Analyzer	Event from Analyzer						Event from Host						
		Host Comm. Param. [N] - [Y]	Host Comm. Param. [Y] - [N]	TS Inquiry Req. (ITS management task)	Real-time Req. (ITS management task)	Batch Transfer Req. for Specific Sample	Cancel or FD Error from Screen	MOR (analytical) data req.)	REP (resending Final Data req.)	SUS (suspension req.)	REC (suspension req.)	SPE (ITS specification)	RES (specific sample req.)	Time-out/ Hardware Error
14	Ready for SPE LPR transfer wait		1	SPE (current TS) /14	14	16	16							
15	Ready for SPE transfer		1	SPE (current TS) /15	16	15	15	13						
16	Ready for SPE transfer		1	SPE (current TS) /16	16	16	16	14						
17	Alarm registration (communication stopped)	Alarm display/registration Communication parameter [RUN] (highlighted) --> [CANCEL] To No. 1						NOTE: Upon reception of the SUS or REC frame, each frame is sent after waiting for the specified time.						
18	Alarm registration (communication continued)	Alarm display/registration To previous status												

 : Ignored

- [FRValue] FR : Processing or contents of text to be sent to host
 Value : Number of status to which transition is made
 LPR : Analytical data transfer in real-time communication
 HPR : Analytical data transfer in response to specific sample request (RES), batch transfer specified through screen

16.5.2 Status Transition Matrix (in transfer of analytical data alone)

Table 16-8

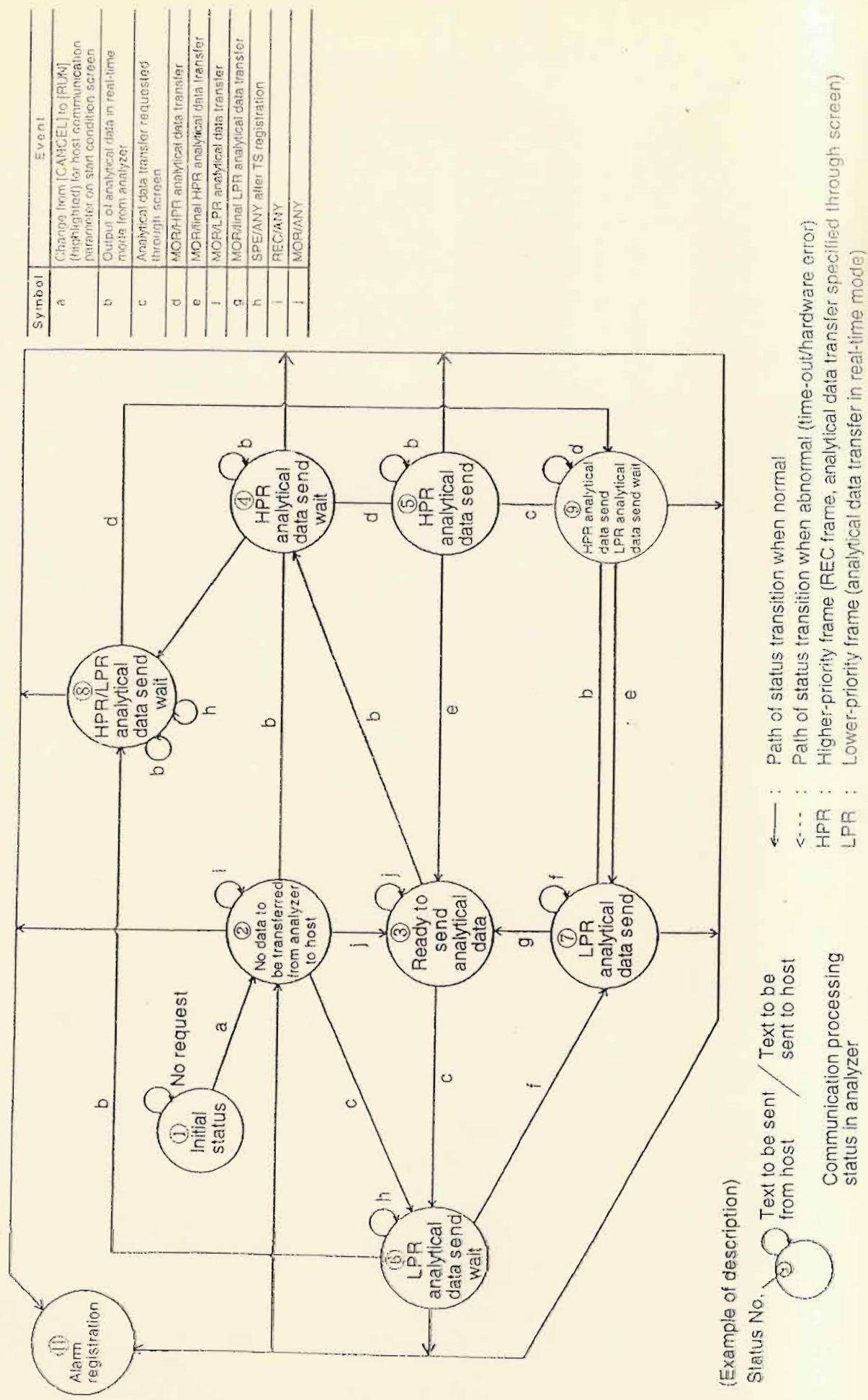
		Event from Analyzer						Event from Host						
No.	Status in Analyzer	Host Comm. Param. [N] → [Y]	Host Comm. Param. [N] → [Y]	TS Inquiry Req. (TS management task)	Real-time Data Out from 7020	Transfer Specific Samples	Cancel or FD Error	MOR (analytical data req.)	Data of 2 or More Final Samples	REC (resending req.)	SUS (suspension req.)	SPE (TS specification)	RES (specific sample req.)	Error in Text (NOTE)
1	Initial status ([NO] for host communication parameter)	To 2 (status)												
2	Idling (no data to be transferred on analyzer and host sides)		1		10	11	11							
3	LPR transfer wait (before LPR transfer)													
4	HPR transfer wait (before HPR transfer)													
5	HPR/LPR transfer wait (before HPR/LPR transfer)													
6	SPE transfer wait (before SPE transfer)													
7	SPE/LPR transfer wait (before SPE/LPR transfer)													
8	SPE/HPR transfer wait (before SPE/HPR transfer)													
9	SPE/HPR/LPR transfer wait (before SPE/HPR/LPR transfer)													
10	Ready for LPR transfer	To 1				To 10 after HPR transfer	To 12 after HPR transfer							
11	Ready for HPR transfer	To 1				To 12 after HPR transfer	To 11 after HPR transfer	To 11 after HPR transfer	To 12 after HPR transfer	To 11 after HPR transfer	To 2 immediately			
12	Ready for HPR transfer	To 1				To 12 after HPR transfer	To 12 after HPR transfer	To 12 after HPR transfer	To 12 after HPR transfer	To 10 after HPR transfer	To 10 after HPR transfer			
13	Ready for SPE transfer													
14	Ready for SPE transfer													
	LPR transfer wait													

(cont'd)

No.	Event	Event from Analyzer								Event from Host						
		Host Comm. Param. [N] → [Y]	Host Comm. Param. [Y] → [N]	TS Inquiry Req. (TS management task)	Real-time Data Out from 7020	Transfer Req. for Specific Sample	Batch Transfer Req. from Screen	Cancel or RD Error	MGR (analytical data req.)	Data of 2 or More Samples	REP (resending req.)	SUS (suspension req.)	REC (suspension req.)	SPE (TS specification)	PES (specific sample req.)	Time-out/ Hardware Error
15	Ready for SPE transfer															
16	Ready for SPE transfer HPGL-PR transfer wait															
17	Alarm registration/registration Communication parameter [RUN] (highlighted) → [CANCEL], To No. 1															
18	Alarm registration (communication continued)			Alarm display/registration	To previous status											

NOTE: Ignore the blank boxes in this table.

16.5.3 Status Transition Diagram (analytical data)



16.6 Text Configuration Table

Table 16-9 shows the text configuration corresponding to the contents of each frame.

Table 16-9 Text Configuration Corresponding to Contents of Each Frame

Text Type	Text Item	Relevant Frame	Maximum Number of Characters	Sender	Contents of Text (Fu: Function character)				Reference page
Text to indicate feature of communication	Positive response	ANY MOR	4	Analyzer HOST	STX	>	ETX	BCC	
	Negative response (resending request)	REP	4	Analyzer HOST	STX	?	ETX	BCC	
	Suspension request	SUS	4	Analyzer HOST	STX	@	ETX	BCC	
	REC	4	HOST	STX	A	ETX	BCC		
	Analytical data request for specific sample	RES	40	HOST	STX	<	Fu	Sample information	ETX BCC
Test selection inquiry text	Inquiry request	SPE	40	Analyzer	STX	:	Fu	Sample information	ETX BCC
Test selection specifying text	Specification request	SPE	Variable	HOST	STX	:	Fu	Sample information	ETX BCC
Analytical data text	Routine, stat and control samples	FR1 to END	Variable	Analyzer	STX	:	Fu	Sample information	Channel count
	Absorbance data in entire reaction process	FR1 to END	Variable	Analyzer	STX	:	Fu	Sample information	Comment selecting information
	Photometry-assay calibration	END	Variable	Analyzer	STX	:	G	Test No.	Analytical data of 50 tests
	ISE calibration	END	Variable	Analyzer	STX	:	H	ISE type	STD data 6
								SD value information	ETX BCC

Supplementary Explanation

- Table 16-9 shows the text configuration when text size is 512 bytes.
- When a text size of 256 bytes is specified for analytical data text, two or more texts may be constituted. So refer to the description concerned.
- Since there are 4 end-of-data codes besides ETX alone, attention should be paid when setting or referring to a text.

16.6.1 Composition of Each Text

- (1) Text for non-specific request (text having no data area)
 (a) Composition of text

STX	FR	ETX	(FR: Frame character)
-----	----	-----	-----------------------

- (b) Table 16-10 shows the frame name and frame character according to the sending direction.

Table 16-10

Frame Name	Frame Character	From Analyzer to Host	From Host to Analyzer
ANY	>	○	×
MOR	>	×	○
REP	?	○	○
SUS	@	○	○
REC	A	×	○

○: Sent

×: Not sent

- (2) RES: Text of analytical data request for specific sample (from host to analyzer)
 (a) Composition of text

STX	<	Fu	Sample information	ETX	(Fu: Function character)
-----	---	----	--------------------	-----	--------------------------

- (b) Table 16-11 shows the contents of the text. Note that alarm is issued on the analyzer side if any other than routine and stat sample information (control sample or calibration information) is sent from the host to analyzer.

"Ignored" in the table means that the analyzer ignores relevant sample information even if it is specified by the host.

Table 16-11

Sample Name	With/without ID	Function Character		Sample Information			
		From Analyzer to Host	From Host to Analyzer	From Host to Analyzer (For "from analyzer to host," refer to (5) below.)			
				Sample No.		Position No.	ID No.
Routine sample	With	a	a	Ignored		ID No. set (blank unallowable)	
Routine sample	Without	n	n	Sample No. set (1 to 400)		Ignored	
Stat sample	With	d	d			ID No. set (blank unallowable)	
Stat sample	Without	g	g	Sample No. set (1 to 50)	Ignored		

- (3) SPE: Text for test selecting information inquiry (from analyzer to host)
- (a) Composition of text

STX	:	Fu	Sample information	ETX
(Fu: Function character)				

- (b) Contents of text
For the contents of text, refer to "16.6.2 Contents of Text."
- (c) Text type
Text for a routine or stat sample alone is sent.
- (d) Condition for inquiry to host
- 1) When test selection on the analyzer side includes a sample for which no test is requested (provided [YES] is specified for full-time inquiry)
 - 2) When an ID read error has occurred with the barcode reader is provided. At this time, ID No. becomes blank.
- (e) Condition for rejecting inquiry to host
[YES] is specified for the transfer of analytical data alone on the communication parameter screen.
- (f) Whether test selection inquiry is made to the host for every sample or only when no test is selected on the analyzer side is selectable by the full-time inquiry parameter on the communication parameter screen.
- 1) When [YES] is specified for full-time inquiry, inquiry is made regardless of test selecting registration on the analyzer side.
 - 2) When [NO] is specified for full-time inquiry, inquiry is made only when test selection on the analyzer side includes a sample for which no test is requested.
- (g) When [YES] is specified for the original Abs., test selection inquiry is not made to the host.
- (h) At inquiry in the real-time mode with or without ID, a sample No. is added. (Sample information is detailed below.)
- 1) Items to be set with ID Sample No., position No., ID No.
 - 2) Items to be set without ID Sample No., position No., ID No. (treated as comment) (allowed even if inquiry ID is different)

- (4) SPE: Specification of test selection (from host to analyzer)

- (a) The composition of SPE text is shown below. For the contents of text, refer to "16.6.2 Contents of Text."

STX	:	Fu	Sample information	Channel count	Test selecting information	Space (5)	ETX	BCC
-----	---	----	--------------------	---------------	----------------------------	-----------	-----	-----

- (b) Test selecting information request from the host will correspond to sample information sent upon test selection inquiry. If not, however, it is taken into the analyzer and inquiry is not made again.
- (c) If a time-out error, hardware error or any other error occurs, the relevant sample is considered to have not been received and is ignored after occurrence of the alarm.
- (d) When no request is made for all of the test selecting information received on the host side, it is registered that none is requested.
- (e) When the barcode reader is provided, the analyzer ignores the sample No. of routine sample even if it is sent from the host.
- (f) Even when the same ID No. is transferred to the analyzer multiple times with the barcode reader provided, registration will be made in response to position No.

- (g) Where the barcode reader is not provided, a test selection response from the host to the real-time inquiry should be made within two cycles (= 36 seconds). If this period of time is exceeded, the analyzer does not accept the test selection request.
- (h) Unless the barcode reader is provided, the same position No. as on the analyzer side is set and transferred.
- (i) Specification of test selection made from the host is ignored if the analyzer is set in the original Abs. mode. In test selection, priority is given to the analyzer side.
- (j) Sample No., position No. and ID No. sent from the host may become invalid depending on the mode of analyzer.

○: Host's specification followed ×: Invalid

Sample	With or Without ID	Sample No.	Position No.	ID No.	Remarks
Routine sample	With (ID mode)	×	×	○	
	Without (sample No. mode)	○	○	○	
Stat sample	With (ID mode)	×	○	○	As disk position No., send the same No. as the inquiry No. from analyzer.
	Without (sample No. mode)	×	×	×	Inquiry is not made in this mode.

Table 16-12 Detailed Information about "SPE: Text for test selecting information inquiry (from analyzer to host)"

Operation Mode	Instrument Mode	Sample Name	Inquiry Condition		2 Characters		5 Characters		1 Character		3 Characters		13 Characters		15 Characters		Remarks
			Function	Character	Sample No.	Unassigned	Position	No.	ID No.	Space	ID read with barcode reader	Space	ID read with barcode reader	Space	ID registered on screen [handled as comment]	Space	
Simple analysis mode	ID mode	Routine sample	Press the registration key on the screen by the same times as the sample count for inquiry.	Sample unregistered Sample registered	A ↴	1 to 400	Space	1 to 35	ID read with barcode reader	Space	Inquiry is not made when [No.] is specified for full-time inquiry and TS request lasts 1 channel or more.	Same as above	Same as above	Same as above	Same as above	Same as above	
			When [RUN] (highlighted) is specified for stat sample test selection, inquiry is made while reading barcode from the position specified for stat sample position setting parameter.		D ↴	1 to 50	Space	2 to 35	Space	Same as above	Same as above	Same as above	Same as above	Same as above	Same as above	Same as above	
		Routine sample	Press the registration key on the screen by the same times as the sample count for inquiry.	Sample unregistered Sample registered	N ↴	1 to 400	Space	1 to 35	ID registered on screen [handled as comment]	Space	Same as above	Same as above	Same as above	Same as above	Same as above	Same as above	
	Sample No. mode	Stat sample	Inquiry is not made.														
		Routine sample	Inquiry is made by reading barcodes sequentially from position No. 1.	Sample unregistered Sample registered	A ↴	Space	Space	1 to 35	ID read with barcode reader	Space	Inquiry is not made when an unregistered sample causes barcode read error.	Same as above	Same as above	Same as above	Same as above	Same as above	
		Stat sample	When [RUN] (highlighted) is specified for stat sample test selection, inquiry is made while reading barcode from the position specified for stat sample position setting parameter.		D ↴	Space	Space	2 to 35 (position screen)	Nos. read by barcode reader	Space	Inquiry is not made when [No.] is specified for full-time inquiry and TS request lasts 1 channel or more.	When barcode reading is successful, inquiry is made via the read ID. When unsuccessful, inquiry is made via the ID specified on screen.	Same as above	Same as above	Same as above	Same as above	
	Routine analysis mode	Routine sample	Inquiry is made for the specified number of samples sequentially starting from the sample specified in the analysis start No. on start condition screen.	Sample unregistered Sample registered	N ↴	1 to 400	Space	1 to 35	ID registered on screen [handled as comment]	Space	Same as above	Same as above	Same as above	Same as above	Same as above	Same as above	
		Stat sample	Inquiry is not made.														

Supplementary Explanation

- If no response is available from the host within 2 cycles (36 sec) after inquiry to the host, analysis is carried out according to the TS of main frame.
- If the main frame has no TS request, the relevant sample will not be analyzed.

Table 16-13 Detailed Information about "SPE: Specification of test selection (from host to analyzer)"

Operation Mode	Instrument Mode	Sample Name	Basic Condition for TS Specification		Sample Information, Recommended Character in Paren		Stop Specification from Host	Remarks		
			Characters	Character	5 Characters	1 Characters	3 Characters	13 Characters	15 Characters	
Simple analysis mode	ID mode	Routine sample	Function Character	Sample No.	Unassigned	Position No.	ID No.	Unassigned		[Caution 1] The position No. specified from the host must be within the range specified on the start sample position setting screen. If the position No. is outside the range or 0 is specified, sample information error occurs.
		New sample (Press the registration key on screen by the number of samples to be analyzed.)	A ↵	(Space) Ignored	(Space) Ignored	1 to 35	Desired ID No. (blank unallowable)	(Space) Ignored	Unallowable	
		Sample registered for stat TS through screen	D ↵	(Space) Ignored	(Space) Ignored	2 to 35 [Caution 1]	Sample and ID No. registered on screen (blank unallowable)			
	Routine analysis mode	New sample (Press the registration key on screen by the number of samples to be analyzed.)	N ↵	1 to 400	(Space) Ignored	1 to 35	Desired 13 characters [blank unallowable]	(Space) Ignored		
		Stat sample								
		Routine sample	New sample (Specify the analysis start No. and the number of samples to be analyzed through screen.)	A ↵	(Space) Ignored	(Space) Ignored	1 to 35	Desired ID No. (blank unallowable)	(Space) Ignored	
Peculine analysis mode	Stat sample	Sample registered for stat TS through screen	D ↵	(Space) Ignored	(Space) Ignored	2 to 35 [Caution 1]	Sample and ID No. registered on screen (blank unallowable)	(Space) Ignored	Unallowable	
		1. New sample 2. Registered sample	N ↵	1 to 400	(Space) Ignored	1 to 35	Desired 13 characters [blank unallowable]	(Space) Ignored		
	Sample No. mode	Sial sample	Sending is unallowable.							

Supplementary Explanation

1. Basically, text should be transferred with TS and comment presence/absence information added to the same sample information (excluding ID No.) as for inquiry from the analyzer.

(5) Analytical data transfer (from analyzer to host)

Shown below are the contents of each text.

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

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

Table 16-14 Text Size and Composition

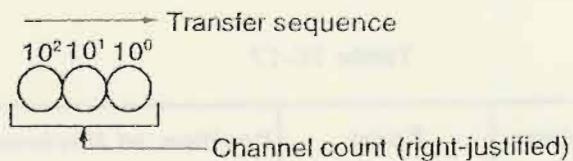
Text Size	Mode	Text Composition (B: Byte count)								Max. Text Count	Channel Count	Remarks	
		1b	1b	2b	37b	3b	10b × text count n	1b	1b	ETX	BCC	(1 ch to 20 ch)	
256 Real time or batch	1st	STX	1	Fu	Sample information	Channel count	Analytical data	ETX	BCC	(21 ch to 40 ch)	20	Within 41 to 51	
	Final	STX	:	Fu	†	†	†	ETX	BCC	(21 ch to 40 ch)	2	Within 41 to 51	
	1st	STX	1	Fu	†	†	†	ETX	BCC	(1 ch to 20 ch)	20	Within 41 to 51	
	2nd	STX	2	Fu	†	†	†	ETX	BCC	(21 ch to 40 ch)	2	Within 41 to 51	
512 Real time or batch	Final	STX	:	Fu	†	†	†	ETX	BCC	(41 ch to 51 ch)	46	51 or less	
	1st	STX	1	Fu	†	†	†	ETX	BCC	(1 ch to 46 ch)	46	51 or less	
	Final	STX	:	Fu	†	†	†	ETX	BCC	(47 ch to 51 ch)	2	51 or less	

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

- NOTES: 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. (Fractions are rounded down and a numerical value '48' indicates the total byte count of fixed length n in Table 6-4.)
Text size: 256 or 512 bytes

$$\text{Maximum number of transferable channels} < \frac{\text{Text size} - 48}{10}$$

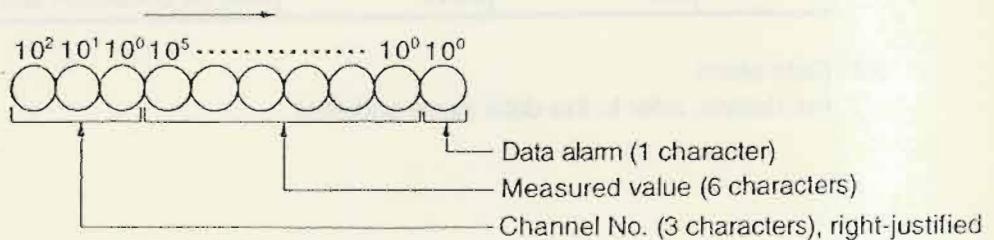
2. In batch communication in the 256-byte mode, data is sent in up to five texts for each sample.
In this case, the analyzer sends the first text and then the next one soon after reception of the MOR frame from the host.
3. The total number of analytical data to be transferred is variable according to the number of specified channels.
4. When ISE data or serum indexes extend into the next text, they are set in it for transfer.
5. When the absence of ISE unit is set on the system setting screen or by the DIP switch, the analytical data of ISE tests will not be sent.
① Channel count (3 characters)
The number of channels to be transferred in one text is sent.



Example: "bb1" or "001"
"b10"

NOTE: The analyzer transfers data for up to 36 channels in both real-time communication and batch communication. When including serum indexes (three tests of lipemia, hemolysis and icterus), electrolytes (three tests of Na, K and Cl) and calculation tests (8 tests), data for up to 50 channels is transferable.

- ② Analytical data 1 to n (10 characters each)



(i) Channel No.

Table 16-15

Channel No.	Description	Remarks
" b31 " to " b36 "	Photometry assay	1 to 36 without ISE
" b38 " to " b40 "	Electrolyte	
" b41 " to " b43 "	Serum index	
" b44 " to " b51 "	Calculation test	

(ii) Measured value

Table 16-16

Positive/negative	Decimal Point	Max. Digit Count	Example
Positive	Absent	6	123456
	Present	5	123.45
Negative	Absent	5	-12345 (b: Space)
			b b - 123
	Present	4	-12.34
			b - 12.3

Table 16-17

Channel No.	Description	Form	Position of Decimal Point	Remarks
1 to 36	Concentration value in photometry assay	6 digits with sign and decimal point	Decimal point position in concentration value of standard 1 on chemistry parameter screen	
38 to 40	Concentration value of electrolyte	Same as above	Decimal point position in concentration value of LOW solution on ISE parameter screen	
41 to 43	Measured value for serum index	6-digit integer with sign	Zero at any time	
44 to 51	Calculated value in calculation test	6 digits with sign and decimal point	Decimal point position in standard value range (lower limit) on calculation test screen	

(iii) Data alarm

For details, refer to the data alarm code list.

- (b) Transfer of absorbance data in entire reaction process (from analyzer to host)

① Specification of size

The size of text is specifiable on the communication parameter screen. Select either 256 or 512 bytes. On selection of 256 or 512 bytes, text is transferred divided as shown below.

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

	1B	1B	2B	37B	10 B × 4	
First	STX	1	Fu	Sample information	Analytical data 1	{

	6B × 4			3B	6B × point count			
	{	Analytical data 4	BLANK1	}	BLANK4	Point count	ABS1	}

	1B	1B		
	{	ABS24	ETX	BCC

	1B	1B	2B	37B	3B	6B × point count	
Final	STX	:	Fu	Sample information	Point count	ABS25	{
	{	ABS35	ETX	BCC			}

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

	1B	1B	2B	37B	10 B × 4	
Final	STX	:	Fu	Sample information	Analytical data 1	{

	6B × 4			3B	6B × point count			
	{	Analytical data 4	BLANK1	}	BLANK4	Point count	ABS1	}

	1B	1B		
	{	ABS35	ETX	BCC

② 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 24 or less. The frame character at that time is not '1' but ':'.

③ Sample information

Refer to "sample information" in (2) of 16.6.2.

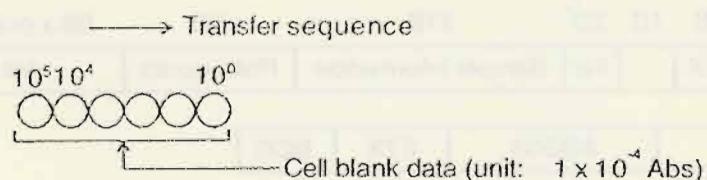
- ④ Analytical data 1 to 4 (10 characters each)
- For transfer format, refer to (2) of 16.6.1.
 - Table 16-18 is followed when there is no relevant test for analytical data 1 to 4.
 - When two-channel simultaneous measurement is specified, data for two channels is transferred, and data for up to four channels (1 channel + L, H, I) is transferred when serum index measurement is specified.

Table 16-18

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

- ⑤ BLANK 1 to 4 (6 characters each)

The transfer format of each cell blank data is shown below.



(Example) bbb-50

- ⑥ Point count (3 characters)

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

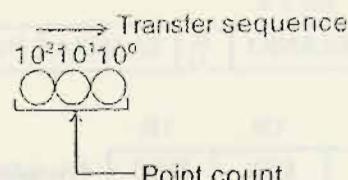


Table 16-19

Reaction Time	3 min	4 min	5 min	10 min
Point Count	11	14	17	35

- ⑦ ABS 1 to 35

Absorbance data in the entire reaction process (difference data between two wavelengths at each photometric point) is transferred in the same format as of the above cell blank data. When the point count is less than 35, data is closely transferred in sequence starting from ABS 1.

(c) Transfer of photometry-assay calibration data (from analyzer to host)

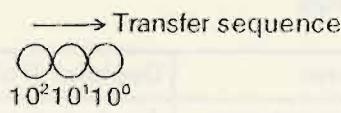
Composition of text

STX (1)	:	G ₁₂ (2)	Channel No. (3)	STD count (1)	Calibration alarm (1)	STD data 1 (32)	
------------	---	------------------------	--------------------	------------------	--------------------------	--------------------	--

Each parenthesized numeral indicates the byte count.

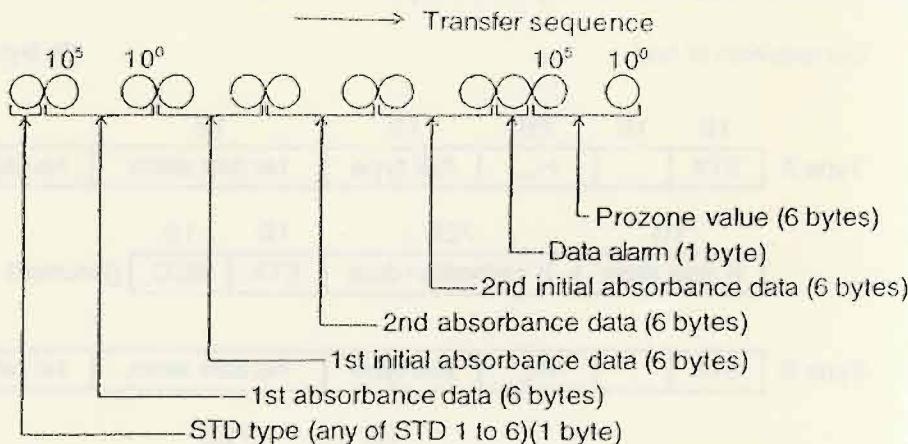
	STD data 6 (32)	SD value information (8)	ETX (1)	BCC (1)	(Variable)
--	--------------------	-----------------------------	------------	------------	------------

- ① Frame character (1 character)
':' is transferred.
- ② Function character (2 characters)
'G₁₂' is transferred.
- ③ Channel No. (3 characters)



A test code in photometry-assay calibration is indicated in a three-digit integer. Test numbers are "bb1" to "b36" which correspond to test codes in the analyzer.

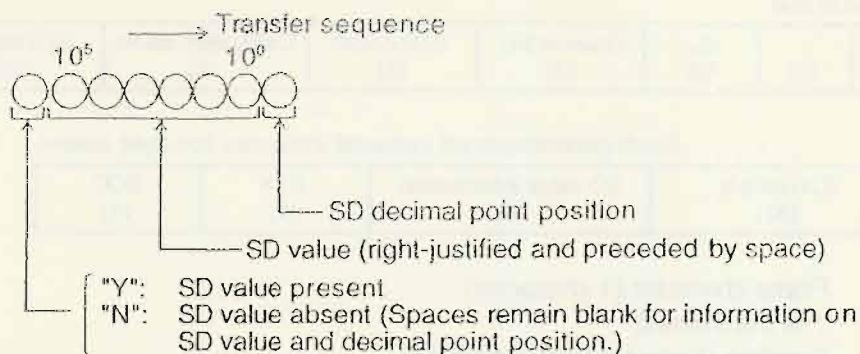
- ④ STD count (1 character)
STD count is any of '1' to '6' and variable according to the calibration method.
When STD count is '1,' STD data is followed immediately by SD value information.
- ⑤ STD data 1 to 6 (32 characters each)
The data for each STD has the composition below.



Each absorbance data is right-justified and preceded by one more spaces.

- ⑥ Calibration alarm (1 character)
Refer to the data alarm code list.

⑦ SD value information (8 characters)



⑧ Data composition

Table 16-20

Data Item	Unit	Form	Decimal Point Position
Absorbance data	10 ⁴ ABS	6-digit integer with sign	No decimal point
Initial absorbance data	10 ⁴ ABS	6-digit integer with sign	No decimal point
SD value	No	6 digits with decimal point (positive)	Decimal point position of SD limit on chemistry parameter screen

⑨ Transfer unit

Transfer in units of channel

(d) Transfer of ISE calibration data (from analyzer to host)

Composition of text (B: Byte count)

Type A	1B	1B	2B	1B	1B	72B
	STX	:	H _u	ISE type	Na data alarm	Na calibration data

1B	72B	1B	1B	(Unused)		(153 bytes)
K data alarm	K calibration data	ETX	BCC			

Type B	1B	72B
STX	:	H _u ISE type Na data alarm Na calibration data

1B	72B	(226 bytes)	
K data alarm	K calibration data	Cl data alarm	Cl calibration data ETX BCC

① Frame character (1 character)

'.' is transferred.

② Function character (2 characters)

'H_u' is transferred.

- ③ ISE (electrolyte) type (1 character)

Table 16-21

ISE Type	Test
'A'	Na, K (Unused)
'B'	Na, K, Cl

- ④ Data alarm for each channel (1 character)

A data alarm corresponding to each channel is transferred.

For details of data alarm, refer to the data alarm code list.

- ⑤ ISE calibration data (72 characters)

This data area has eight data items; electromotive force of internal standard solution, electromotive force of LOW solution, electromotive force of HIGH solution, electromotive force of calibrator, slope level for display, concentration of internal standard solution, concentration of calibrator and compensation factor. Each data item is composed as shown below. Space remains blank when there is no relevant data.

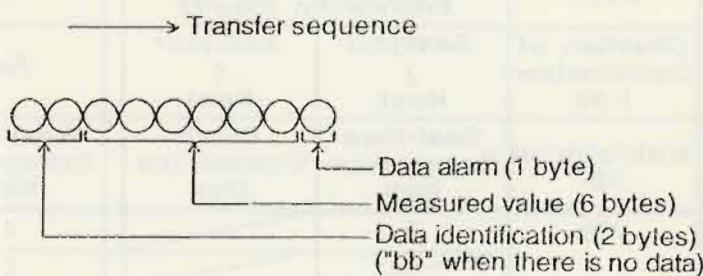


Table 16-22

Item	Data Identification	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 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"	mEg/L	6 digits with sign and decimal point	Same position as for LOW solution on ISE parameter screen
Concentration of calibrator	"b7"	mEg/L	6 digits with sign and decimal point	Decimal point position in calibrator
Compensation factor	"b8"	mEg/L	6 digits with sign and decimal point	concentration on ISE parameter screen

- (6) Data for up to three tests is collectively transferred to the host.
 (7) 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)

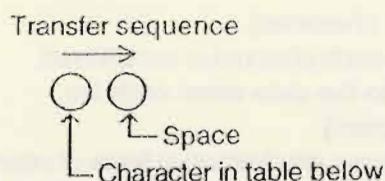


Table 16-23 Function Characters for Test Selecting Information Inquiry and Analytical Data

Sample Name	Form	Test Selecting Information Inquiry		Analytical Data		
		Direction of Communication	Analyzer ↓ Host	Analyzer ↑ Host	Analyzer → Host	
			Real-time Communication	Batch Communication	Real-time Communication	Batch Communication
Routine sample	With	D			A	a
Stat sample					D	d
Control sample	With or without				F	f
Calibration sample (photometry assay)	Both				G	
Calibration sample (ISE)					H	
Routine sample	Without	N			N	n
Stat sample					Q	q
Absorbance in entire reaction process (routine)	Both			I		
Absorbance in entire reaction process (stat)				K		

Supplementary Explanation

1. In the function character form for analytical data, the upper-case letters are used for real-time communication and the lower-case letters for batch communication.
2. In transfer from the analyzer to the host, batch communication for test selecting information inquiry is not carried out. (Only in simple analysis mode setting)
3. Batch communication for analytical data transfer indicates a communication when specified through the screen.

- (2) Sample information
 (a) Composition of sample information

COMPOSITIONS: SAINTES INFORMATIONS

Sample No. (5 characters)	Unassigned (1 character)	Position No. (3 characters)	PCB (13 characters)	Unassigned (5 characters)	Unassigned (6 characters)	Unassigned (4 characters)
S S S S S		P P P	1111111111111	11111	11111	

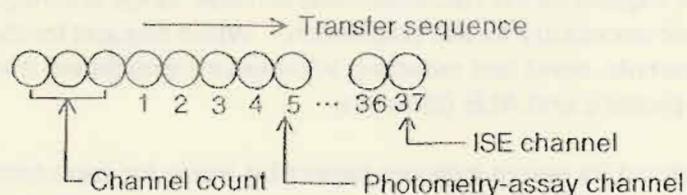
b) Details of sample information

Table 15-24 Details of Sample Information

Item	Sample Name	Sample Name	Remarks
	Routine Sample	Stat Sample	Control Sample
Sample No. (5 characters)	Transfer sequence $10^4 \bullet 10^5 \bullet 10^6$ S S S S S	Transfer sequence $10^4 \bullet 10^5 \bullet 10^6$ S S S S S	<From analyzer to host> TS inquiry in the ID mode is made in space, for routine sample.
Unassigned (1 character)	Sequence No. (bbbbb1 to b9400) Space	Sequence No. (bb01 to bb50) Space	<From host to analyzer> Sample No. is ignored for TS specification in the ID mode.
Position No. (3 characters)	Transfer sequence $10^4 \bullet 10^5 \bullet 10^6$ P P P	Transfer sequence $10^4 \bullet 10^5 \bullet 10^6$ P P P	<From host to analyzer> Blank space for control sample
ID No. (13 characters)	ID mode and sample No. mode Transfer sequence $10^{12} \bullet 10^{13} \bullet 10^{14}$ I I I I I I I I I I I I I	Position No. (bb1 to b35); Position No. (bb1 to bb210) Space	<From host to analyzer> (1) For space, the analyzer side is followed. (2) Position No. is ignored for TS indication in the ID mode. (1) When ID No. is within 13 digits, it is right-justified and preceded by one or more spaces. (2) In the NC ID mode, the analyzer treats ID No. as a comment. (3) In transmitting the analytical data of control samples in the ID mode, the ID No. of this sample is sent in space from the analyzer to host.

- (3) Test selecting information (from host to analyzer)

Send test selecting information corresponding to sample information.



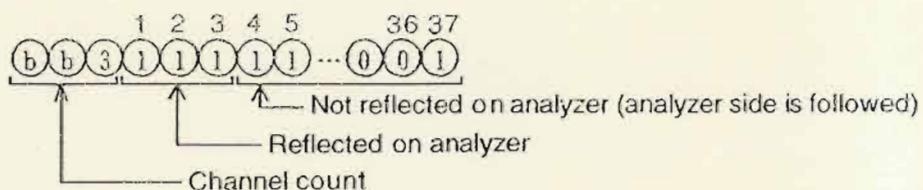
Details of Request for Each Channel

(b: Space)

	Function Character	Details of Request
Initial measurement	"Ab"	0: No request
	"b"	1: Normal sample volume
	"Db"	2: Unused 3: Unused 4: Volume determined by analyzer side (left to analyzer)

NOTES: 1. The above channel count ("bb0" to "b37") is the number of effective channels from photometry-assay channel 1. If "bb3" is specified, channels 1 to 3 are reflected on the analyzer with channels 4 to 37 ignored. When there is at least one requested test, it is desirable to set "37."

Example:

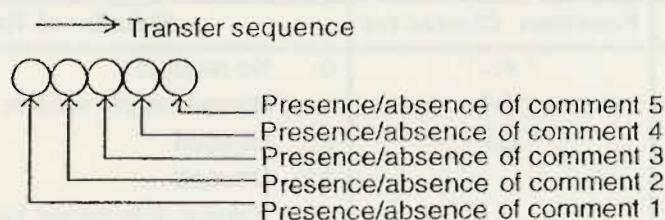


The analyzer side is obeyed if test request is made in a channel number beyond the specified channel count. To avoid analysis for an unnecessary test, set channel count "37" and request for only a test to be specified.

2. Request for ISE is specifiable in the 37th channel.
 (i) Specification of any other than "0" ... Select Na, K and Cl on the screen.
 (ii) Specification of "0" ... No request
 Note that it is impossible to select a request for any of Na, K and Cl from the host.

3. 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, and tests added for serum indexes are transferred as well.
4. 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 selecting information considering the channels for TP (total protein) and ALB (albumin).
5. TS request for serum indexes cannot be made for each sample. For request, specify serum index test on the parameter screen and serum indexes on the start condition screen.

(4) Comment information (from host to analyzer)



Set "0" for all comment presence/absence information items.

16.7 Error Check Function

If the contents of the received text fall under any condition shown in Table 16-25, the analyzer judges that there is an abnormal character and outputs an alarm.

Table 16-25

Attribute	Item	Details of Check	Remarks																				
Text information	Frame character	An irrelevant frame character is received. (For details, refer to Table 16-3.)																					
	Function character	Function character does not correspond to sample. (For details, refer to the contents of text in 16.2.)																					
		<p>Example</p> <table style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">Analyzer</td> <td style="text-align: center;">HOST</td> <td style="text-align: center;">Analyzer</td> <td style="text-align: center;">HOST</td> </tr> <tr> <td style="text-align: center;">"A"</td> <td style="text-align: center;">→</td> <td style="text-align: center;">"n"</td> <td style="text-align: center;">→</td> </tr> <tr> <td colspan="2"></td> <td colspan="2"></td> </tr> <tr> <td colspan="2"></td> <td style="text-align: center;">(alarm not output)</td> <td style="text-align: center;">(alarm output)</td> </tr> <tr> <td colspan="4" style="text-align: center;">"A": Routine sample</td> </tr> </table> <p>(1) An irrelevant frame character is received. (2) In test selecting information inquiry, a function character differing from the contents sent from the analyzer to host is received. (3) Character check in the unassigned area of text is not made on the analyzer side and alarm is not output.</p>	Analyzer	HOST	Analyzer	HOST	"A"	→	"n"	→							(alarm not output)	(alarm output)	"A": Routine sample				
Analyzer	HOST	Analyzer	HOST																				
"A"	→	"n"	→																				
		(alarm not output)	(alarm output)																				
"A": Routine sample																							
Sample information	Sample No. Position No.	<p>Each number is outside the specified range excluding the following cases.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <th></th> <th style="text-align: center;">Routine Sample</th> <th style="text-align: center;">Stat Sample</th> </tr> <tr> <td>Disk No.</td> <td style="text-align: center;">1 to 400 or space</td> <td style="text-align: center;">1 to 50 or space</td> </tr> <tr> <td>Position No.</td> <td style="text-align: center;">1 to 35 or space</td> <td style="text-align: center;">2 to 35 or space</td> </tr> </table>		Routine Sample	Stat Sample	Disk No.	1 to 400 or space	1 to 50 or space	Position No.	1 to 35 or space	2 to 35 or space	Error occurs when the position No. of a stat sample is outside the specified range or 0 on the stat sample position setting screen.											
	Routine Sample	Stat Sample																					
Disk No.	1 to 400 or space	1 to 50 or space																					
Position No.	1 to 35 or space	2 to 35 or space																					
	ID No.	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">ID Mode</td> <td style="text-align: center;">\$20 to \$7E (right-justified)</td> </tr> <tr> <td style="text-align: center;">NO ID Mode</td> <td style="text-align: center;">Same as above</td> </tr> </table> <p>Error occurs when the control code of each test is any of \$00 to \$1F. If any test is outside the specified range, error occurs.</p>	ID Mode	\$20 to \$7E (right-justified)	NO ID Mode	Same as above																	
ID Mode	\$20 to \$7E (right-justified)																						
NO ID Mode	Same as above																						
Inquiry information	Test selecting information	<p>(1) Test selecting information for a routine/stat sample is any other than '0' to '4.'</p> <p>(2) Channel count is outside the specified range.</p>																					

16.8 Specifications of Communication Trace

16.8.1 Overview

This is an auxiliary function for outputting the stored data onto the printer as a logging in order to check the contents of communication between the analyzer and host. This function is selectable on the communication parameter screen.

16.8.2 Trace Data

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

The data to be stored differs between the cases below.

(1) In normal communication

Frame character, function character and sample information are stored. However, only frame character and function character are stored for the text without sample information (NOTE).

NOTE: Storage is made according to the following rule.

- 1) Text without function character
Frame character and one character after it (2 characters in total)
- 2) Photometry-assay calibration text
Frame character, function character, channel No., STD count and calibration alarm (8 characters in total)
- 3) ISE calibration text
Frame character, function character and ISE type (4 characters in total)

(2) Upon occurrence of any error during communication

The details of the error and all characters up to occurrence of the error are stored. However, if send time-out occurs during sending from the analyzer to host, only frame character, function character and sample information are stored the same as in normal communication (in (1) above).

16.8.3 Trace Data Storage Timing

(1) In any other than transfer of analytical data alone

- (a) The trace function is activated after sending a text from the analyzer and receiving a corresponding text from the host (after receiving the end-of-data code).
- (b) The trace function is activated upon change from [YES] to [NO] for communication trace on the communication parameter screen.

(2) Transfer of analytical data alone

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

16.8.4 Resetting of Trace Data

Trace data is reset when [CLEAR] is specified for "communication trace printout" on the mechanism check screen.

16.8.5 Trace Data Storage Capacity

Data of 1200 cycles max. (conversation) can be stored.

16.8.6 Other

Communication trace data is not stored under the following conditions.

- (1) During printout of communication trace data
- (2) During deletion of communication trace data

16.9 Hardware Specifications

16.9.1 Overview

The Model 7020 can select the RS-232C interface or 20 mA current loop interface and can monitor the sent data via each interface.

(1) RS-232C

Use the connector J402 on the RSDIST circuit board provided on the rear panel of Model 7020.

(2) 20 mA current loop

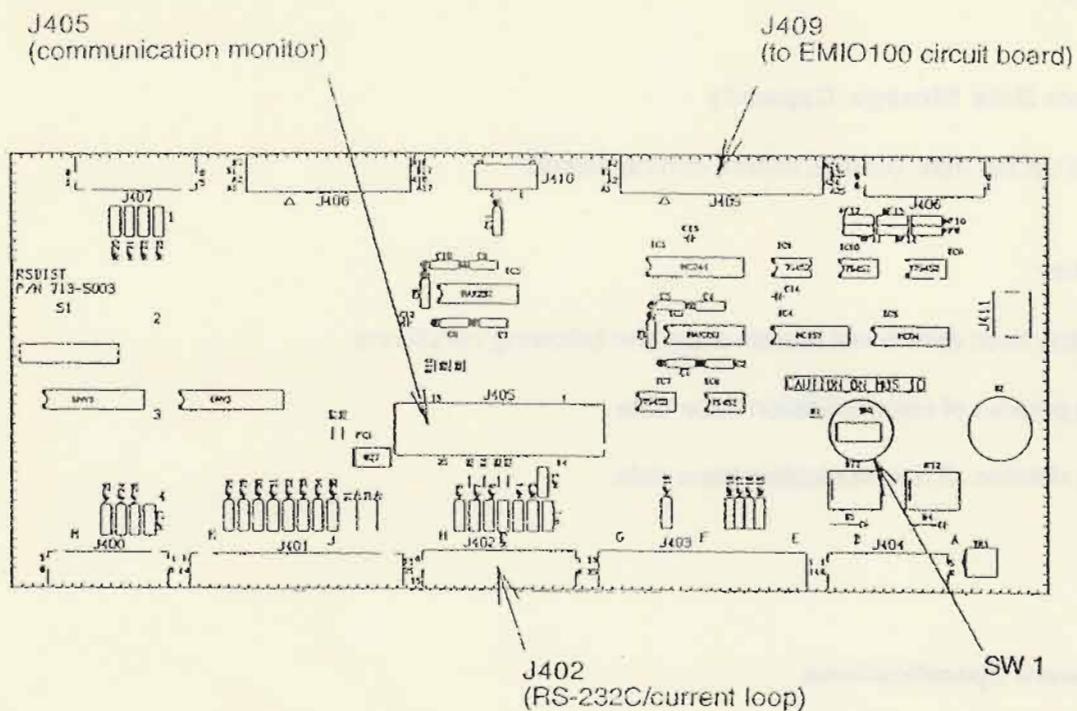
Use the same connector J402 as for RS-232C. (Either RS-232C or 20 mA current loop is selectable by switch No. 1 on the RSDIST board.)

(3) Communication monitor

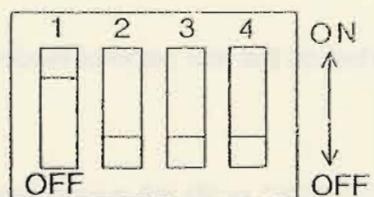
The data sent from the Model 7020 can be monitored by using the connector J405 on the RSDIST board.

16.9.2 RSDIST PC Board

(1) External view



(2) Switch setting



No. 1	ON : Current loop OFF : RS-232C
No. 2	
No. 3	
No. 4	Always OFF

(3) Pin arrangement

Table 16-26 Signal Assignment

Pin No.	J402 (RDAD-15P female side)		J405 (RDBB-25S female side)	
1	SG		Unused	
2	TXD	RS-232C (from host)	TXD	
3	RXD		Unused	
4	RTS		RTS	Communication monitor
5	CTS		Unused	(RS-232C)
6	TXD +		Unused	
7	TXD -		SG	
8	RTS +		TXD +	
9	RTS -	Current loop (from host)	TXD -	
10	CTS +		RTS +	Communication monitor
11	CTS -		RTS -	(current loop)
12	RXD +		DTR +	
13	RXD -		DTR -	
14	Unused		14, 15	Unused
15	Unused			

(4) Connection diagram

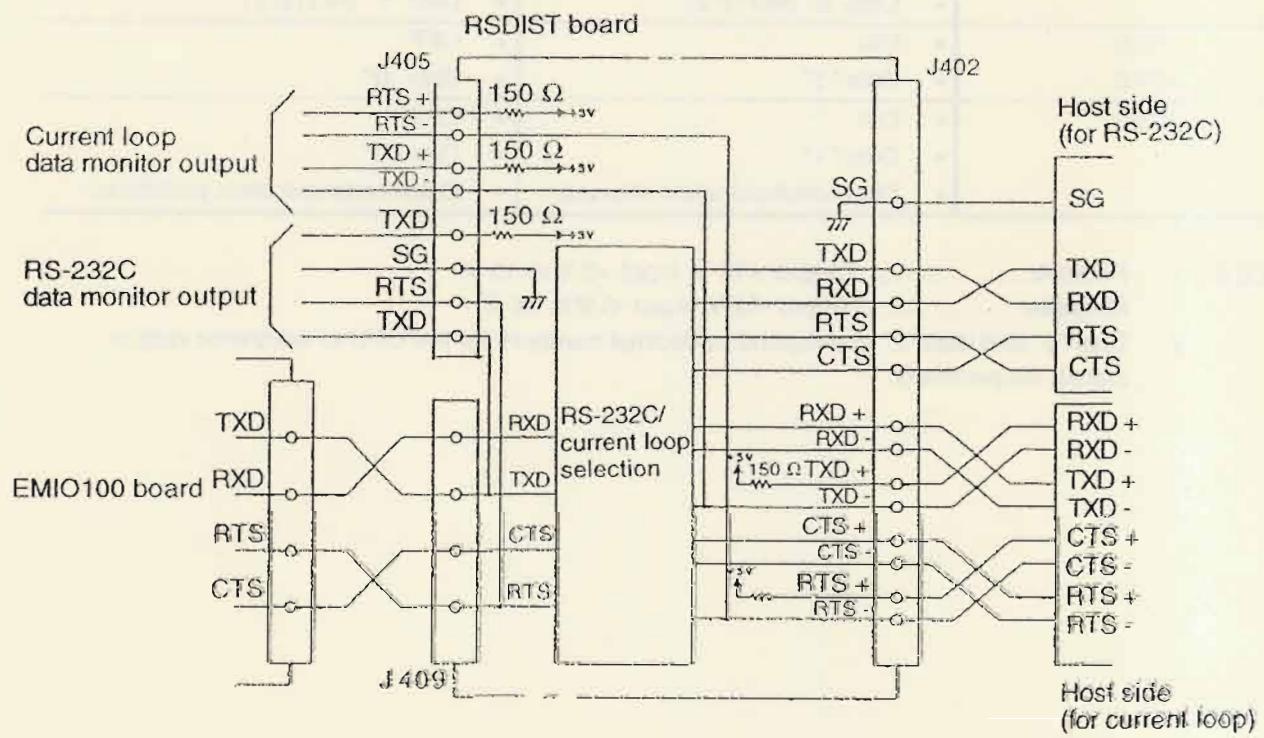


Fig. 16-1 Connection Diagram

16.9.3 Interface Signal

Table 16-27 lists the meanings of interface signals, and Tables 16-28 and 16-29 list signal levels and their meanings.

Table 16-27 Meaning of Interface Signal

Abbreviation	Signal Name	Meaning of Signal	Direction of Signal (7020 side) (Host side)
FG	Frame Ground	Frame ground	
TXD	Trans Data	Transmission data	→
RXD	Receive Data	Reception data	←
RTS	Request To Send	Request to send	→
CTS	Clear To Send	Clear to send	←
SG	Signal Ground	Signal ground	

Table 16-28 RS-232C Interface Signal Level and Meaning

Signal Name \ Signal Level	Positive (NOTE 1)	Negative (NOTE 1)
TXD	• SPACE	• MARK (no signal)
	• Start bit	• Stop bit
RXD	• Data "0" (NOTE 2)	• Data "1" (NOTE 2)
RTS	• ON	• OFF
	• Data "1"	• Data "0"
CTS	• ON	• OFF
	• Data "1"	• Data "0"
	• Data communication allowed	• Data communication prohibited

- NOTES: 1. Positive..... Output +12 V, input +3 V to 15 V
 Negative Output -12 V, input -3 V to 15 V
 2. Data "0" and data "1" correspond to decimal numbers for the CPU to read/write data or status, respectively.

Table 16-29 20 mA Current Loop Interface Signal Level and Meaning

Signal Name	Signal	
	Current ON (20 mA)	Current OFF (0 mA)
TXD	<ul style="list-style-type: none"> • MARK 	<ul style="list-style-type: none"> • SPACE
RXD	<ul style="list-style-type: none"> • Stop bit • Data 1 	<ul style="list-style-type: none"> • Stop bit • Data 0
CTS	<ul style="list-style-type: none"> • OFF • Data 0 • Data transfer prohibited 	<ul style="list-style-type: none"> • ON • Data 1 • Data transfer allowed
RTS	<ul style="list-style-type: none"> • OFF • Data 0 	<ul style="list-style-type: none"> • ON • Data 1

NOTE: Data 0 and data 1 correspond to decimal numbers for the CPU to read/write data, respectively.

16.9.4 RS-232C Communication

(1) Connector position

Use the connector J402 on the rear panel of Model 7020.

(2) Connecting cable and cable length

J402 uses a 15-pin interface connector (female).

On the cable side, use the following.

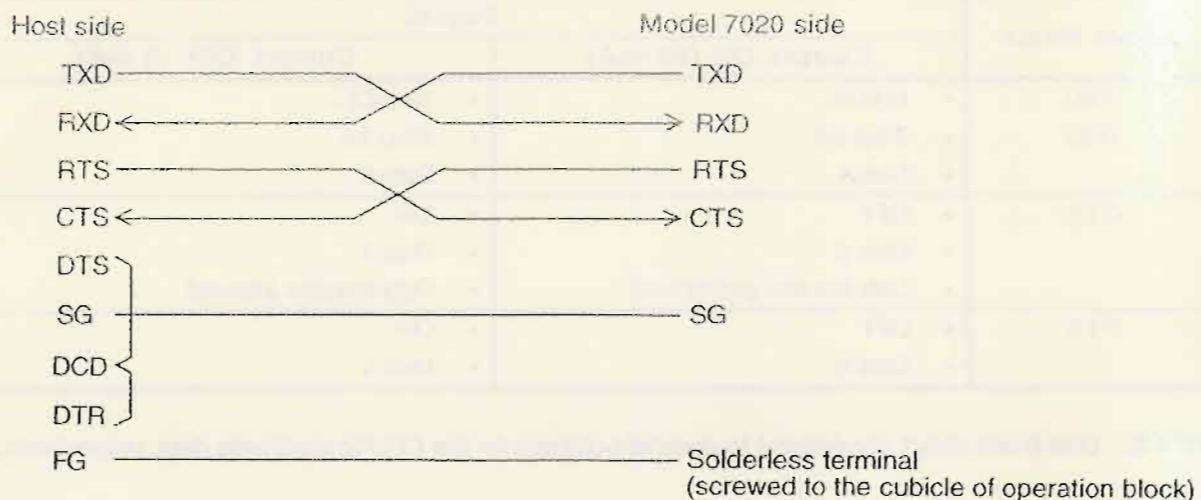
HDAB-15P (made by Hirose Denki)

Cable length is limited to 15 m at maximum.

(3) Pin arrangement

Refer to (3) of 16.9.2.

(4) Example of connection



NOTE: For solderless terminal, refer to (5) below.

Fig. 16-2 Example Connection for RS-232C Communication

(5) Measure for FG

FG is not assigned to the J402 connector. So attach a solderless terminal to the FG cable of host computer and screw it on the cubicle of operation block as detailed below.

Requirements for FG cable (See Fig. 16-3.)

- Cable length: 100 mm or longer
- Solderless terminal: For M4 screw

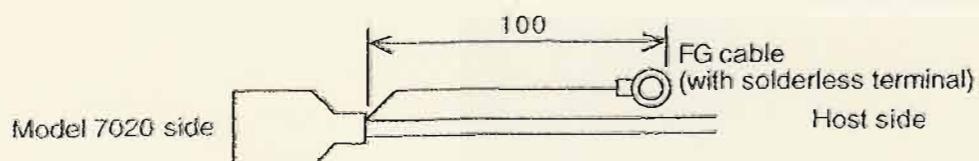


Fig. 16-3 Requirements for FG Cable

- Fixing position
Fix in the screw hole under J402.

16.9.5 Current Loop

Current loop is selected by turning on the switch No. 1 on the PC board. In the current loop mode, the J402 connector is used as in the RS-232C mode.

(1) Connection diagram

Refer to (4) in 16.9.2.

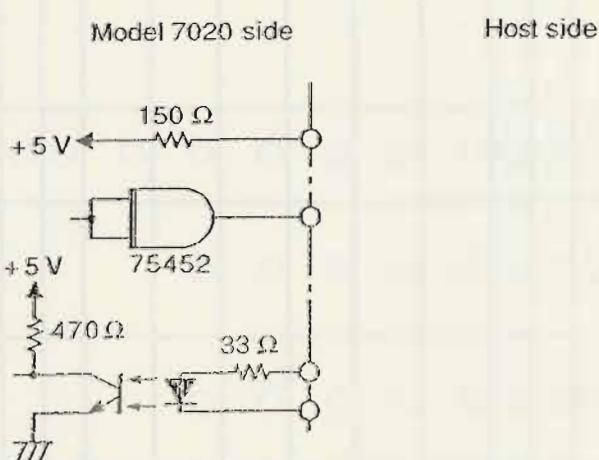
(2) Connecting cable

The J402 connector side uses a 15-pin interface connector (female) of type RDAD-15S. The cable side should use the following.
HDAB-15P (made by Hirose Denki) or equivalent

(3) Pin arrangement

Refer to (3) in 16.9.2.

(4) Signal input circuit



16.9.6 Communication Monitor

Data transferred between the Model 7020 and host can be monitored by connecting a personal computer or other monitor to J405 on the RSDIST board. For monitoring, turn off the switch No. 1 on the PC board.

(1) Connection diagram

Refer to (4) in 16.9.2.

(2) Connecting cable

The J405 connector side of RSDIST board is a 25-pin interface connector (female) of type SDDB-25S. The cable side should use the following.
HDBB-25P (made by Hirose Denki) or equivalent

16.9.7 Data Alarm Code List

Table 16-30 Data Alarm Code List

No.	Data Alarm	Output String	Photometry Assay						ISE			Remarks
			S I/F	Routine	Stat	Control	STD	Routine	Stat	Control	STD	
1	ADC abnormal	A	O	O	O	O	O	O	O	O	O	O
2	Cell blank abnormal	Q	O	O	O	O	O	O	O	O	O	O
3	Sample short	V	O	O	O	O	O	O	O	O	O	O
4	Reagent short	T	O	O	O	O	O	O	O	O	O	O
5	Absorbance over	Z	O	O	O	O	O	O	O	O	O	O
6	Prozone error	P	O	O	O	O	O	O	O	O	O	O
7	Reaction limit over at all points	I	O	O	O	O	O	O	O	O	O	O
8	Reaction limit over except 1 point	J	O	O	O	O	O	O	O	O	O	O
9	Reaction limit over except 2 or 3 points	K	O	O	O	O	O	O	O	O	O	O
10	Linearity abnormal at 9 points or more	W	O	O	O	O	O	O	O	O	O	O
11	Linearity abnormal at 8 points or less	F	O	O	O	O	O	O	O	O	O	O
12	Standard 1 absorbance abnormal	H						O				
13	Duplicate error	U						O	O	O	O	O
14	STD error	S						O	O	O	O	O
15	Sensitivity error	Y						O	O	O	O	O
16	Calibration error	B						O	O	O	O	O
17	SD error	G						O	O	O	O	O
18	Noise error	N						O	O	O	O	O

(cont'd)

No.	Data Alarm	Output String	Photometry Assay						ISE			Remarks
			S I/F	Routine	Stat	Control	STD	Routine	Stat	Control	STD	
19	Level error	L						○	○	○	○	
20	Slope error	E								○		
21	Internal standard concentration abnormal	D								○		
22	Sample value abnormal	&						○	○			
23	Test-to-test compensation error	C	○	○	○	○	○	○	○			
24	Test-to-test compensation disabled	M	○	○	○	○	○	○	○	○	● Data becomes blank space.	
25	Calculation test error	%	○	○	○	○	○	○	○	○	● Data becomes blank space.	
26	Overflow	O	○	○	○	○	○	○	○	○	● Data becomes blank space.	
27	Calculation disabled	X	○	○	○	○	○	○	○	○	● Data becomes blank space.	

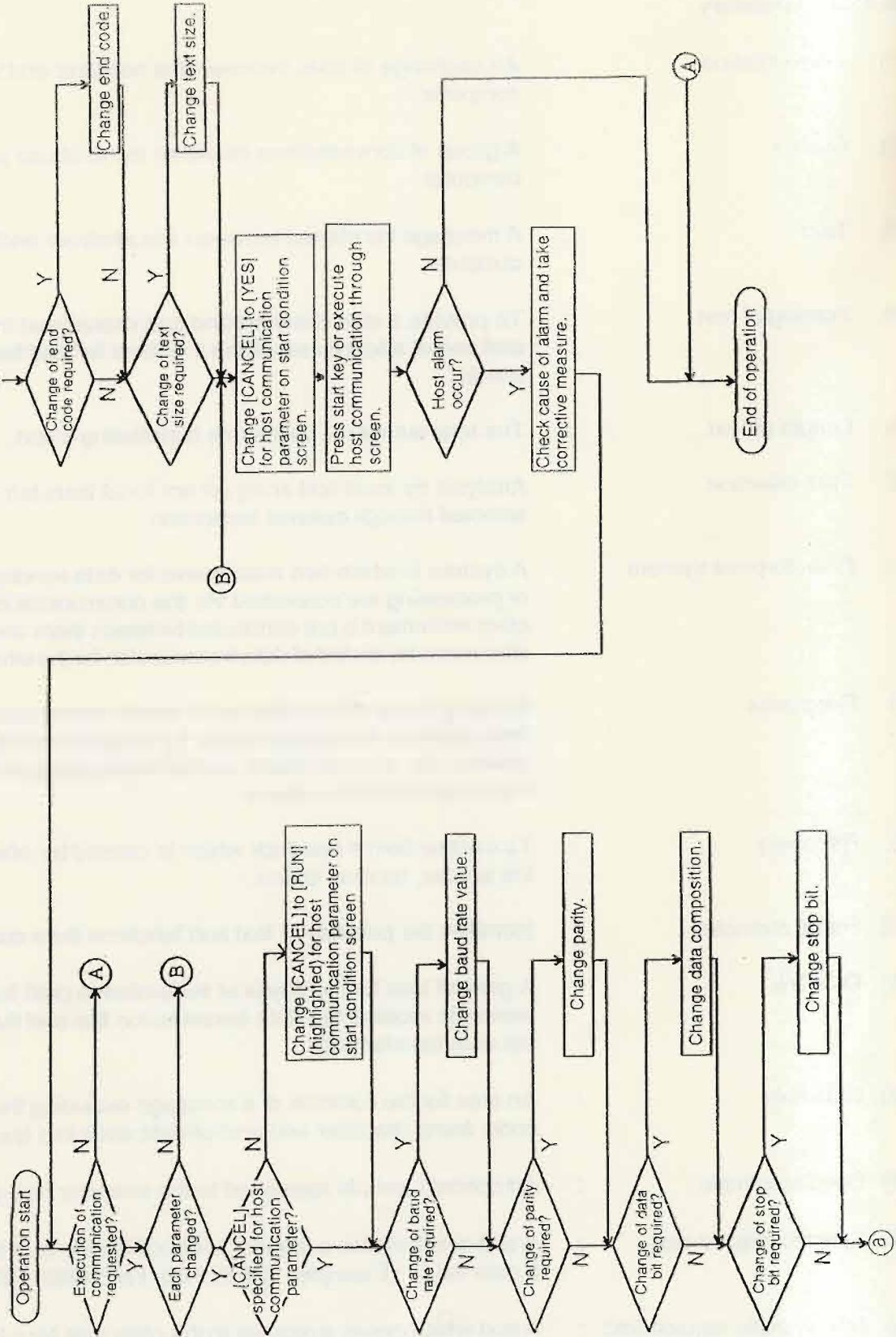
NOTE: If any data caused multiple data alarms, the alarm registered first will be output.

16.10 Cautions on Connection with External System

- (1) For connection with this protocol, adopt the point-to-point system.
- (2) Although the end-of-data code is changeable on the system setting screen, the host must send the same end-of-data code as on the analyzer side. If the code does not match between them, alarm is issued.
- (3) EXT is always added to the end-of-data code in each text. Whenever data beyond 256 bytes is transferred, therefore, the analyzer adds not ETB but ETX.
For the host, a frame character ‘‘’ is the final message when the data for one sample is sent in more than one text. So pay attention when taking in the data.
- (4) As a rule, the analyzer sends the ANY frame to the host in response to a request from it in the following cases.
 - (a) On request for analytical data transfer from the host, the relevant sample is not stored on the FD.
 - (b) Analytical data cannot be read from the FD due to occurrence of an error in it during batch transfer of analytical data.
- (5) The communication controller in the analyzer is initialized in the following cases.
 - (a) Power supply is turned on.
 - (b) [RUN] (highlighted) is specified for host communication parameter (any of baud rate, parity data bit, stop bit, end-of-data code and text length is changed through the screen). At this time, the first event request (RES, SPE) from the host is ignored. After changing a communication parameter, attention should be paid to event.
- (6) If an error is detected on a text transferred from the host, the analyzer sends REP (resending request) until the normal text is received.
- (7) Secure at least 100 msec before transfer from the host to analyzer.

16.11 Operation Flow Diagram

Operation flow for use of this host communication is shown below.



16.12 Supplementation

16.12.1 Glossary

- | | |
|--------------------------------|--|
| (1) Conversation | : An exchange of texts between the analyzer and host computer. |
| (2) Cluster | : A group of conversations between the analyzer and host computer. |
| (3) Text | : A message transferred between the analyzer and host computer. |
| (4) Framing of text | : To provide a start character and end character at the beginning and end of a text for receiving it without fail and facilitating its check. |
| (5) Length of text | : The total number of characters constituting a text. |
| (6) Test selection | : Analysis by multi-test analyzer not for all tests but for the tests selected through external instruction. |
| (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 | : Sending to one of the instruments which communicate with each other whether the other is ready for reception 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 a deadlock which is caused by abnormality in the sender, receiver or line. |
| (10) Frame character | : Identifies the purpose of text and functions like a command No. |
| (11) Data link | : A general term for the physical transmission path from the sender to receiver via 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 a text. |
| (13) Specific sample | : An optional sample requested to the analyzer from the host. |
| (14) Specific request text | : A text which makes a request to the other side for a text having a data field. (Example: SPE, FR4, FR2, END, RES) |
| (15) Non-specific request test | : A text which makes a request to the other side for a text having no data field. (Example: ANY, MOR, REP, SUS, REC) |

- (16) ID mode : [RUN] (highlighted) is specified for barcode reader test on the SYSTEM PARAMETERS screen and [CANCEL] is specified for barcode T/S test.
- (17) Sample No. Mode : [CANCEL] is specified for barcode reader test on the SYSTEM PARAMETERS screen. Or, [RUN] (highlighted) is specified for both barcode reader test and barcode T/S test on the SYSTEM PARAMETER screen.

16.12.2 Differences in Communication Specification between Conventional Analyzers and Model 7020

Communication timing chart	Conventional Analyzers (Model 7250, 7150, 7050, etc.)	Host Manual Drive System (Model 7170/7020)																				
Composition of message	<p>(1) With less than 255 bytes (TS inquiry, analytical data transfer)</p> <table border="1"> <tr> <td>STX</td> <td>FN</td> <td>Data filed</td> <td>ETX</td> <td>BCC</td> </tr> </table> <p>(FN: Function No.)</p> <p>(2) With 255 bytes or more (analytical data transfer)</p> <table border="1"> <tr> <td>STX</td> <td>FN</td> <td>Data field</td> <td>ETX</td> <td>BCC</td> </tr> </table>	STX	FN	Data filed	ETX	BCC	STX	FN	Data field	ETX	BCC	<p>(1) With less than 254 bytes (TS inquiry, analytical data transfer, other)</p> <table border="1"> <tr> <td>STX</td> <td>FN</td> <td>Data filed</td> <td>ETX</td> <td>BCC</td> </tr> </table> <p>FR..... Frame character</p> <p>(2) With 254 bytes or more (only transfer of analytical data)</p> <table border="1"> <tr> <td>1st STX</td> <td>1</td> <td>Data filed</td> <td>ETX</td> <td>BCC</td> </tr> </table> <p>Frame character</p> <p>Final STX : Data filed ETX BCC</p> <p>(NOTE 1)</p> <p>NOTES 1: Usually on receiving response from host (within 5 sec)</p> <p>2: 2 sec or more in RESULT ONLY mode</p>	STX	FN	Data filed	ETX	BCC	1st STX	1	Data filed	ETX	BCC
STX	FN	Data filed	ETX	BCC																		
STX	FN	Data field	ETX	BCC																		
STX	FN	Data filed	ETX	BCC																		
1st STX	1	Data filed	ETX	BCC																		
Characteristics	<p>(1) A communication cycle is divided into the first and second halves where TS inquiry and analytical data transfer are made, respectively.</p> <p>(2) Function is simple due to discrimination with real-time transfer and batch transfer.</p>	<p>(1) As a rule, response is made to each request.</p> <p>(2) Text has a frame No. corresponding to command No. and control code (ACK, NAK) in it for communication control.</p> <p>(3) Applicable to multiple jobs because there is basically no discrimination between real-time communication (communication under analysis) and batch communication (specified through screen).</p> <p>(4) Because protocol need not be changed among instruments, a high maintainability is ensured.</p> <p>(5) Reducing the burden of host can be expected.</p>																				

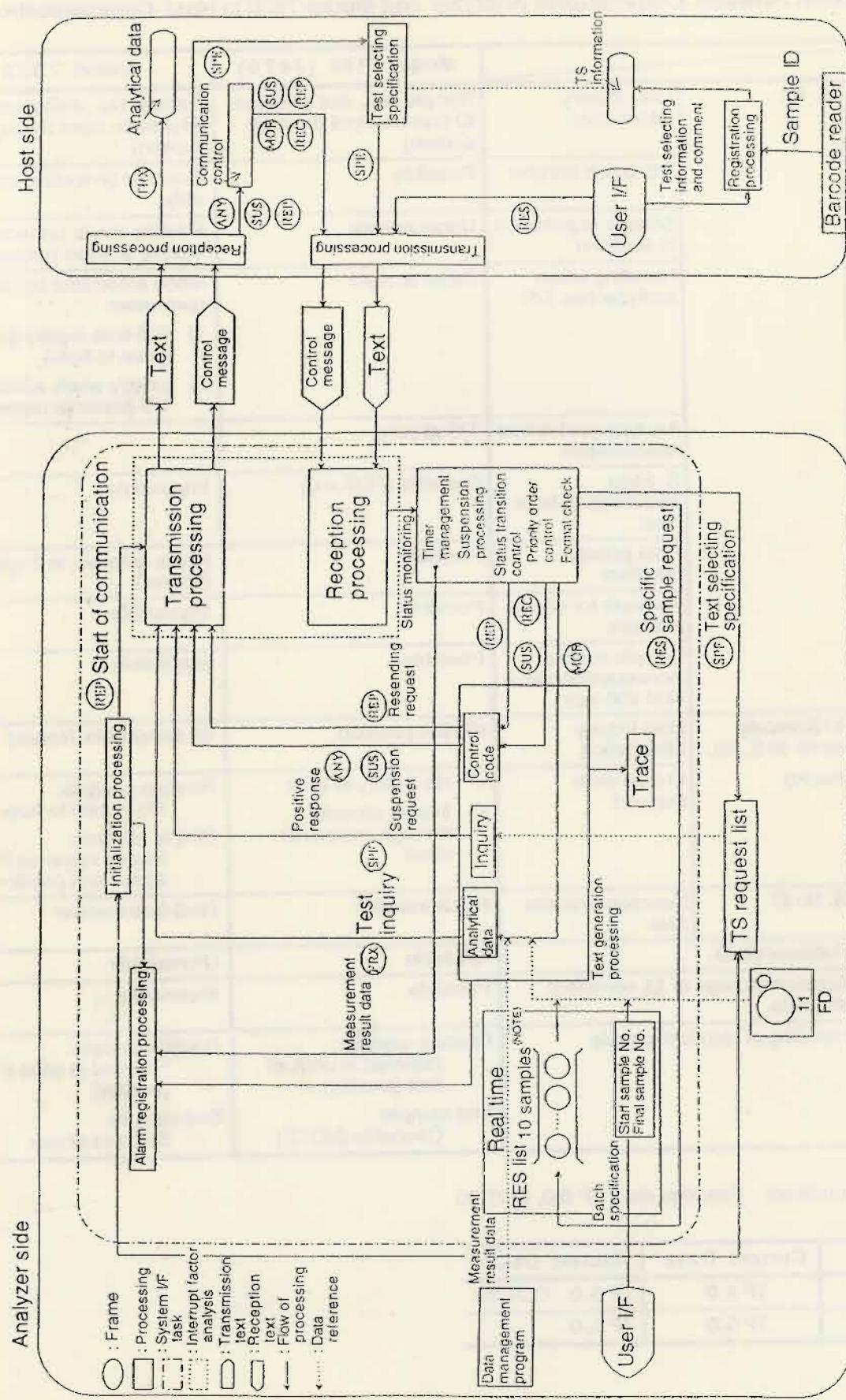
Comparison between Conventional Analyzer and Model 7020 in Host Communication

			Model 7170 (7070)	Model 7020
Test inquiry	S. No	Host inquiry information	Sample No., disk position, ID (can be input through screen)	Sample No., disk position, ID (can be input through screen)
		T/S batch transfer	Possible	Possible (in routine mode only)
		Sample registration to analyzer	Unnecessary	Routine mode unnecessary Simple analysis necessary
		Handling when analyzer has T/S	Same as right	Mode selectable by system parameter 1) Full-time inquiry (priority given to host) 2) Inquiry when without T/S (same as before)
		Analysis prohibitive specification	T/S all zero	←
		S. Stop specification from host	Possible (POS = 0)	Impossible
		Host-priority function	Possible	None, time-out in 2 cycles (36 sec)
		Request for serum indexes	Possible	Impossible
		Sample volume increase/decrease, kind and age	Possible	Impossible
ID (basically same as S. No. mode)		Host inquiry information	ID, disk position	ID, sample No. (space)
		ID read error support	<ul style="list-style-type: none"> • No inquiry to host • Inquiry allowed through manual ID input 	Routine analysis: No inquiry to host Simple analysis: Inquiry made via ID space and position No.
Data transfer	S. No ID	Reaction process data	Batch transfer	Real-time transfer
Data review	Retrieval via ID		Available	Unavailable
	Addition/change of ID, comment and data		Possible	Impossible
	Handling of identical sample		Routine sample: Handled in units of test (overlay) Stat sample: Overwrite (NOTE)	Routine sample: Handled in units of test (overlay) Stat sample: Same as above

NOTE: Condition: Previous data, TP 8.0, GOT 30

	Current Data	Stored Data
Over lay	TP 5.0	TP 5.0 GOT 30
Over write	TP 5.0	TP 5.0

16.12.3 Processing Flow Diagram of System Interface



NOTE: Data of up to 10 samples is stored in both ID and sample No. modes.