Boehringer Mannheim GmbH
BM/HITACHI 911 / 904 Automatic Analyzers
Host Interface Manual

System Interface - Functional Specifications

BM / ID.No. 1563173-001

Document Version 2.2

INSTRUMENTATION DIAGNOSTICA
Technical Product Management and Service

Document: *Bmhit911.doc*
Author: *Claus Mahlmann*
Printed: *November 97*

Boehringer Mannheim GmbH
Department LI-TD

1. Introduction

This manual provides the specifications for bidirectional data transmission between an **HITACHI Model 911/904 Automatic Analyzer** by Boehringer Mannheim GmbH and an external laboratory host system via asynchronous serial connection. The hardware components required as well as the communication rules are described. They highlight the general considerations to be taken into account in any approach to realize the data communication between different computer systems.

This specification illustrates the fundamental considerations for the host link and contains information concerning the following:

– Hardware
  - What interface hardware is required?
  - How is the physical connection established?

– Use and control of the data transmission
  - How to set the transfer and communication parameters?
  - What is the formal structure of the strings and values to be transmitted and what influence can be taken on it?
  - What kind of data or variables can be transmitted?
  - How and by which system is the data transfer initiated?

– Software protocol
  - What does the transmission protocol used for communication between the two systems look like?
  - What does the host at the other end of the data link do and what rules has the program at the host link to follow?

Working with the host interface you will find that the data transfer from the host computer to the **HITACHI Model 911/904 Automatic Analyzer** can be done in a very easy, comfortable and reliable way.

If problems with the installation or questions about the transfer should arise please contact the responsible person of Boehringer Mannheim Service Department or directly the Service Management of the Central Marketing Department of Boehringer Mannheim GmbH (Germany):

Boehringer Mannheim GmbH
Technical Productmanagement
Data Technique

Sandhofer Straße 116
D-68305 Mannheim
Phone: (49) 621 / 759-2464
Telefax: (49) 621 / 759-4394

Figure 1 gives an overview about the 911 Interface Data Flow between the Analyzer and the HOST.

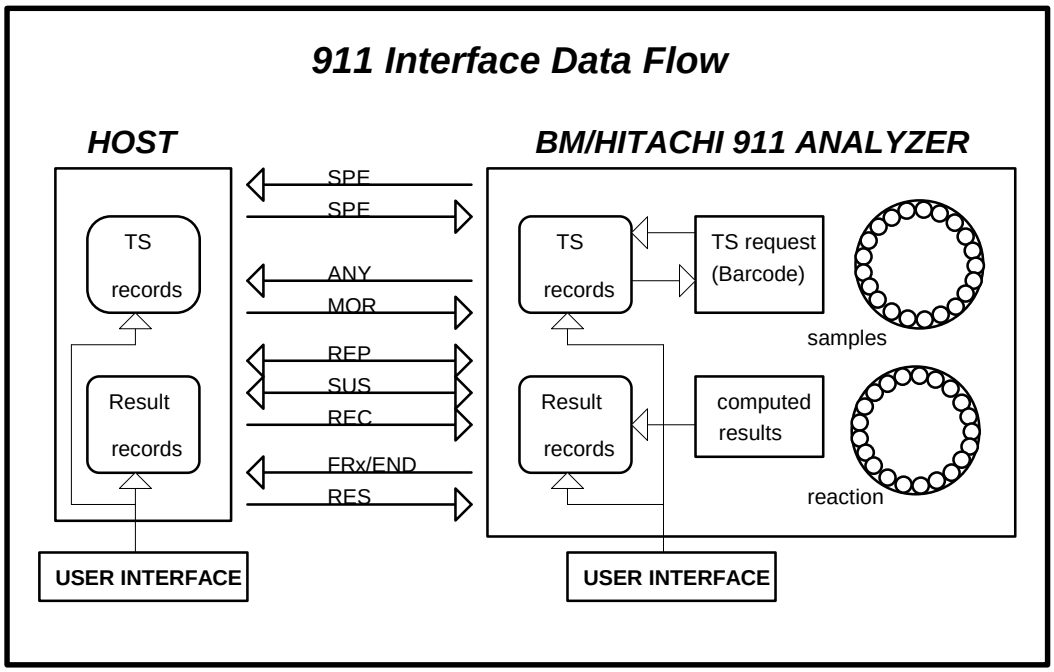


Figure 1: HIT 911 Interface Data Flow

(1) Realtime test selection request is made for:
- Routine samples, if the record is not existing or the test selection is zero.
- Rerun/Autorerun samples, if inquiry is enabled (**SYSTEM PARAMETERS** screen 4-09)
- STAT samples, if inquiry is enabled (**SYSTEM PARAMETERS** screen 4-09) and bar code reader is on.

(2) Realtime result transmission is made for:
- Routine/STAT/Control samples
- Calibration data
- Original absorbance, if requested (**SYSTEM PARAMETERS** screen 4-09)

(3) Batch result transmission can be initiated either by
- the HOST, sending a RES frame
- the operators request for
- Routine or STAT results (**DATA REVIEW** screen 1-06) or
- Control data (**INDIVIDUAL QC LIST** screen 2-03)

The **SYSTEM PARAMETERS** screen 4-09 is shown in Figure 6**.**

2. Interface Setup

2.1. Pin Description and Signal Control

Pin no	Signal	Explanation	Direction
2	Txd	Transmit Data	out
3	Rxd	Receive Data	in
4	RTS	Request to Send	out
5	CTS	Clear to Send	in
6	DSR	Data Set Ready	in
8	DCD	Data Carrier Detect	in
20	DTR	Data Terminal Ready	out
1	FG	Frame Ground	-
7	SG	Signal Ground	-

Table 1: Pin Description for the 25-pin plug of the Model 911

If the wires for hardware handshake (refer to Figure 2) are used and connected to the host the following behaviour must be taken into account:

a) After the selection of **HOST COMMUNICATION** (**START CONDITIONS** screen 1-05) the signals RTS and DTR are active (SPACE: refer to Table 2) from the analyzer side. This condition is also found after an interrupt of the communication due to an input or an error.

   The only use of this signal at the host computer is to check if a physical connection is established.

b) After the selection of **HOST COMMUNICATION** the Hitachi analyzer expects an active signal (SPACE) on the CTS-pin. Otherwise an ***error 111-002*** occurs. With the CTS-signal the Hitachi analyzer recognizes whether the host computer is ready to receive.

c) The Hitachi analyzer expects an active signal (SPACE) on the DCD-pin. This signal activates the receive function of the analyzer. If the signal is missing the ***error 111-001*** occurs, even if the **HOST COMMUNICATION** is enabled and the host is sending.

2.2. Connection Cable

Figure 2 and Figure 3 show two different possibilities to establish the hardware connection. Both connections can be used.

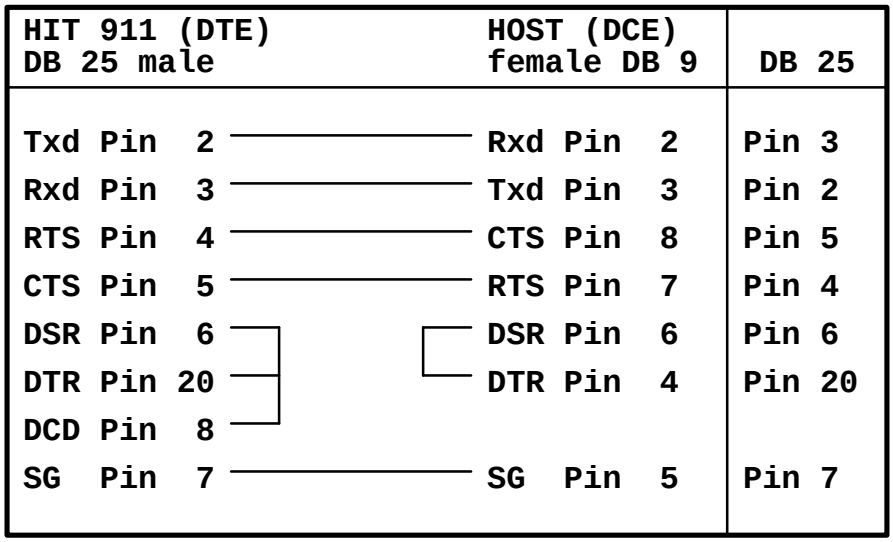


Figure 2: Cable Recommendation from Hitachi

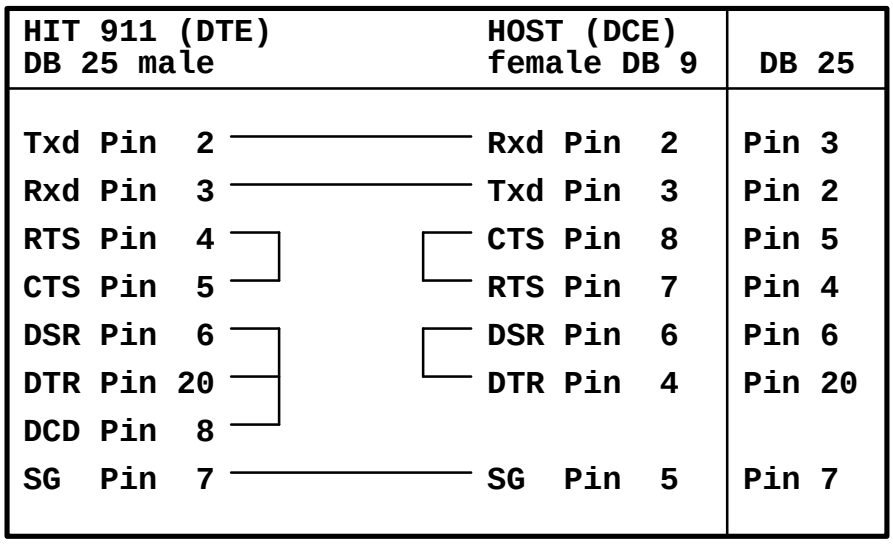


Figure 3: Connection without hardware handshake

Connect the cable to the connector 'H.CPU' on the backside of the analyzer.

Via the connector 'H.MON' it is possible to listen to the data transferred from the analyzer to the host while the host system is connected.

2.3. DIP switch Setting

Figure 4 and Figure 5 show the settings of the DIP switch 3 (on the ADC-SIF board) for the interfaces **RS232-C** or **current loop**.

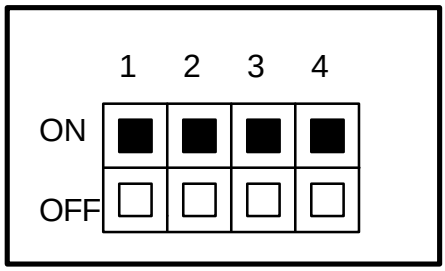


Figure 4: ADC-SIF Dip Switch 3 setting for RS232-C

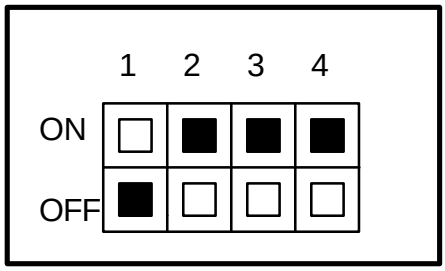


Figure 5: ADC-SIF Dip Switch 3 setting for current loop

2.4. Signal Discrimination

Signal	Binary	Level	RS232 Voltage	Current Loop
MARK (OFF)	ONE (1)	LOW	<= -3V	20mA
SPACE (ON)	ZERO (0)	HIGH	> 3V	0mA

Table 2: Signal discrimination

2.5. Specification of Communication

The table below shows the communication specifications of the host interface.

Item	Specification	Remarks
Interface	RS232C or current loop	Cable max. 15m Cable max. 50m
Communication. method	Half duplex	
Code	ASCII/JIS 7bit/JIS 8bit	

Table 3: Parameters not to be adjusted

2.6. Setup of Communication Parameters

All settings concerning the host interface are made on the **SYSTEM PARAMETERS** screen 4-09 (see Figure 6 and Figure 7) of the AU program.

On selection of this screen, the currently set information is displayed. The display can be changed over by the GUIDANCE key.

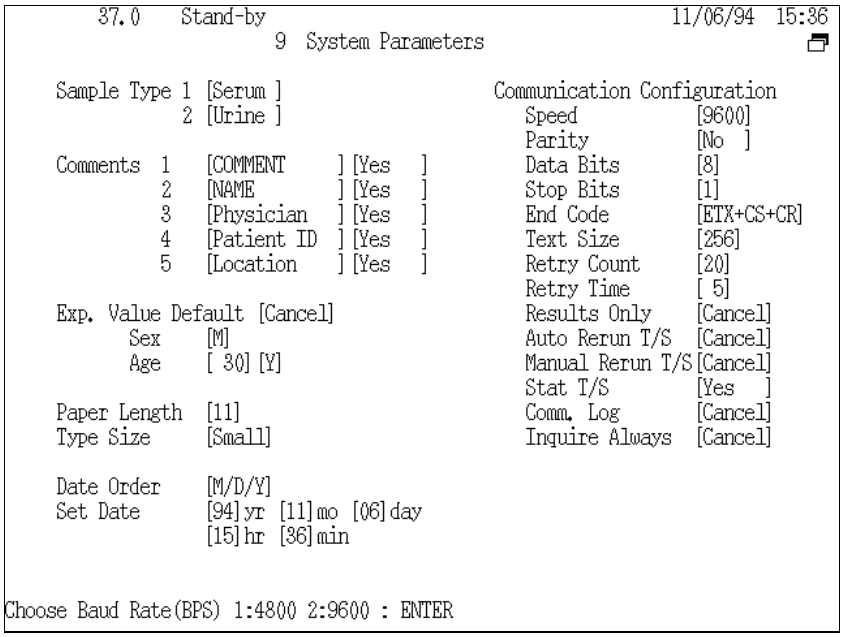


Figure 6: SYSTEM PARAMETERS screen 4-09 / part 1

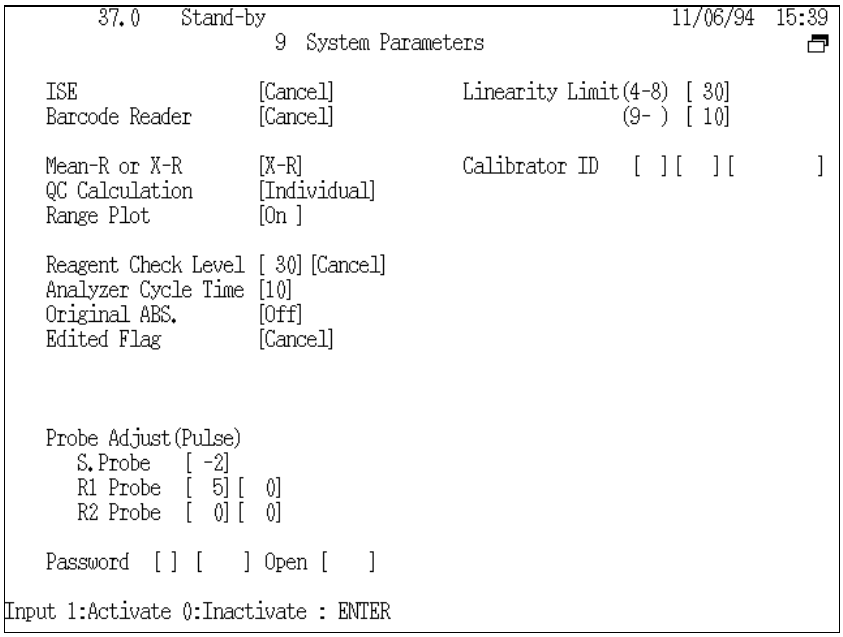


Figure 7: SYSTEM PARAMETERS screen 4-09 / part 2

Serial interface parameters:

- Communication Speed 9600, 4800 baud
- Paritycheck none, odd, even
- Data Bits 7, 8
- Stop Bits 1, 2

HIT 911 specific settings:

- Maximum Text Length 256, 512 bytes (chapter 4.4.5 and 4.4.6)
- End-of-data Code 5 options (chapter 4.5)
- Retry Count 1 to 99 (chapter 5.1)
- Retry Time 1 to 99 seconds (chapter 5.1)

Test selection handling:

- 'Inquire Always' option (chapter 4.4.4)

Optional test selection inquiry for

- Auto Rerun (chapter 6.1)
- Manual Rerun (chapter 6.1)
- STAT (chapter 6.1)

Unidirectional communication mode:

- 'Result Only' mode (chapter 5.4)

Host Communication Trace:

- Option of recording the communication
  (the log is printed and cleared on the **MECHANISM CHECK** screen 5-02)
  (chapter 7)

Communication is switched on/off on the START CONDITIONS screen 1-04.

since Version 4-26:

If the instrument is in 'Sample number mode' (Barcode: Cancel) the 'Host Communication' field on the **START CONDITIONS** screen is protected during operation and probe washing. It is then possible to switch off communication, but it is not possible to switch on again the communication.

3. Basic Workflow

There are two possible ways of workflow on the BM/HITACHI 911 analyzer with a host connection:

- Test selection download in batch mode before starting the RUN
- Test selection download on request during the RUN

Test Selection Download in Batch mode

① The operator places the samples on the instrument

The operator initiates the download of all existing test selections from host side

The operator starts the run

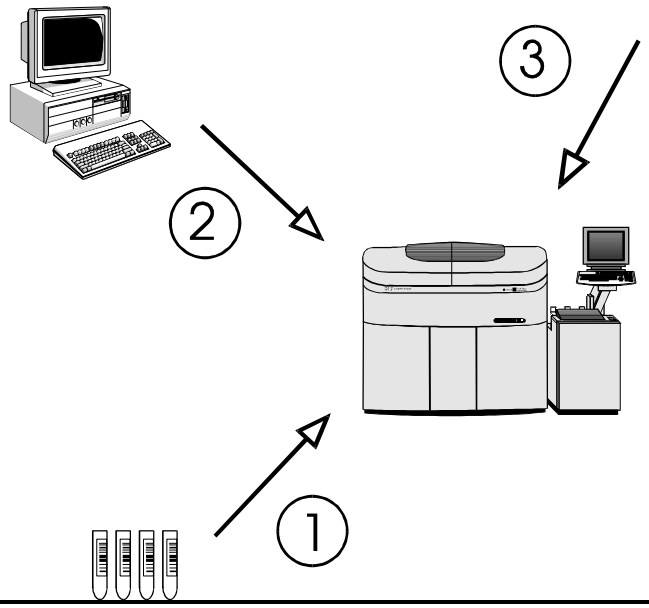


Figure 8: Test selection download in batch mode

Test Selection Download in Realtime mode

① The operator places the samples on the instrument

The operator starts the run

Upon reading the barcode of each sample the analyzer sends a request for each sample to the host

The host sends back the corresponding test selection to the analyzer

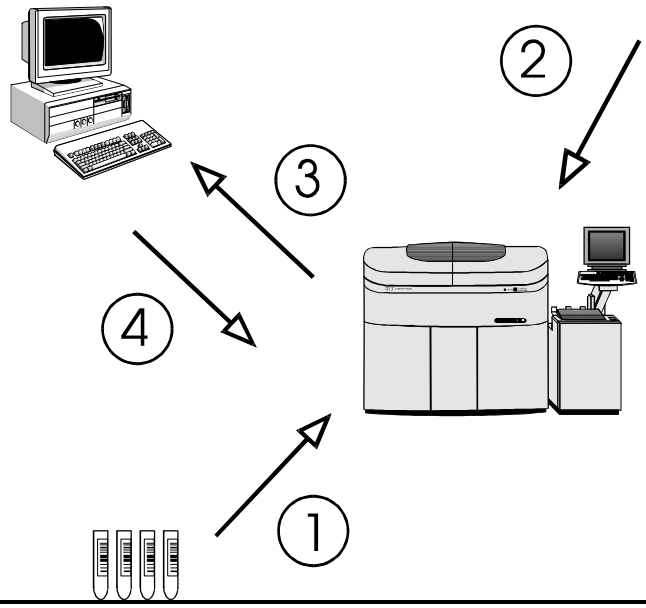


Figure 9: Test selection download in realtime mode

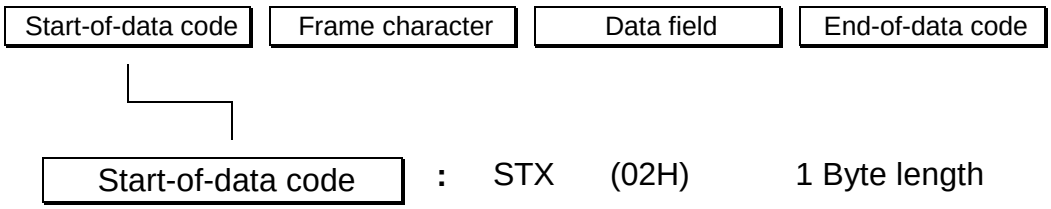
4. Software Protocol

4.1. Common text format

Each message that is sent to the **AU** (analytical unit) or the **HOST** (laboratory computer system) consists of the following items:

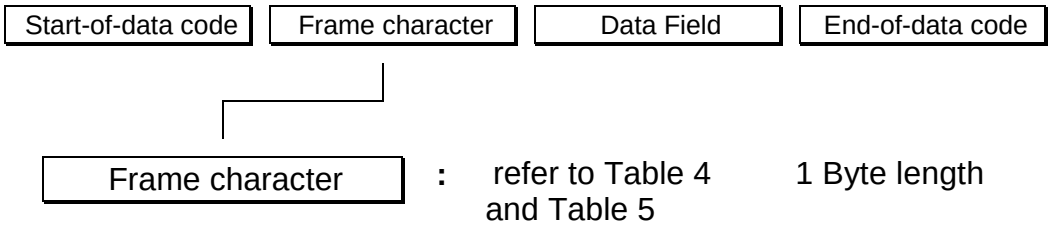
If you have a message without data (control frames ***ANY***, ***REP*** or ***MOR,*** see Table 5) then the field **DATA FIELD** is empty.

4.2. Start-of-data Code



Each message sent from the AU or the HOST starts with the **START-OF-DATA CODE** (STX = 02H).

4.3. Frame Character



The **FRAME CHARACTER** represents the purpose/ contents of the message.

4.3.1. Frame Types

No	Mnemonic	Name	Char.	ASCII Code	Sender	Note
1	FR1	Frame 1	1	31H	AU	1
2	FR2	Frame 2	2	32H		
3	END	End Frame	:	3AH		2
4	SPE	Specific Sample	;	3BH	AU HOST	3
5	RES	Results Request	<	3CH	HOST	4

Table 4: Frame types having a DATA FIELD

Note 1: The frame characters ***FR1*** and ***FR2*** are used, when the analytical data extends over more than one message. ***FR1*** is used for the first message and ***END*** for the final message.

Note 2: ***END*** alone is used when analytical data for one sample can be sent in one single message.

Note 3: The AU uses the frame character ***SPE*** for the test selection inquiry of only one specific sample.

The HOST uses ***SPE*** for the test selection which is being sent in response to the inquiry from the AU.

Note 4: The specific result request ***RES*** is used to request analytical data of a specific sample from the HOST to the AU. (depending on whether the ID is provided or not, only routine and STAT samples are taken as valid. The others are ignored.)

No	Mnemonic	Name	Char.	ASCII Code	Sender	Note
6	ANY	Any inquiry	>	3EH	AU	5
7	MOR	More	>	3EH	HOST	6
8	REP	Repeat	?	3FH	AU, HOST	7
9	SUS	Suspend	@	40H	AU, HOST	8
10	REC	Received	A	41H	HOST	9

Table 5: Frame types having NO DATA FIELD

Note 5: A positive response ***ANY*** is used by the AU to ask the HOST for the following items:

a) a test selection record for any sample that is available by the HOST.

b) rerun samples initiated by the HOST.

c) ***RES*** or ***MOR*** frame requests.

Note 6: ***MOR*** means that the HOST is ready to receive analytical data. (Analytical data can be transferred from the AU to the HOST only when the HOST has sent this frame.)

Note 7: A negative response ***REP*** is used, when resending of the previous communication is requested. The HOST can send ***REP*** at any time. The AU, however, sends ***REP*** only when the response text to ***ANY*** is destroyed and resends the same text in any other case.

Note 8: The Data Bad and Suspend packet (***SUS***) is sent by the HOST to tell the analyzer that the last packet was bad, and that the host does not want to continue at this time. However at the HITACHI 911 analyzer there is no additional delay. This packet only exists because of backward compatibility to previous analyzers. You can also use the ***REP*** packet (see Note 7)

Note 9: With the Data Accepted but Suspend packet (***REC***) the Host tells the analyzer that the last packet was okay and that the HOST needs a break. However at the HITACHI 911 analyzer there is no additional delay. This packet only exists because of backward compatibility to previous analyzers. You can also use the ***MOR*** frame (see Note 6)

4.3.2. Frame Priorities

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

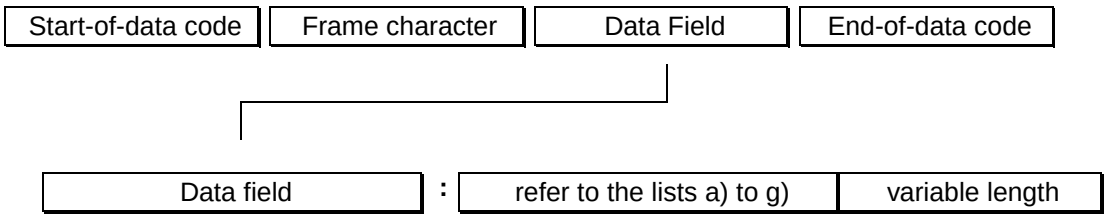
Batch communication is interrupted and suspended if the AU has a text with higher priority. This is restricted to the case where analytical data in the real-time mode is sent from AU and the transfer of analytical data is in response to a ***RES*** frame. After that the batch communication is restarted.

The table below shows the details of each frame and the priority.

Priority	Item
1	SPE frame for STAT samples
2	SPE frame for routine samples
3	REP frame
4	FRx,END frame for realtime results
5	FRx,END frame for specific result request (RES from HOST)
6	FRx,END frame for batch result transmission

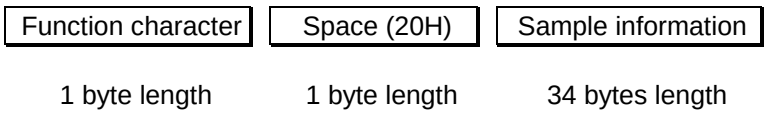
Table 6: Frame priorities

4.4. Data Field

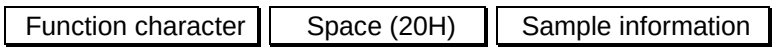


The field **DATA FIELD** can be defined differently and contains any information:

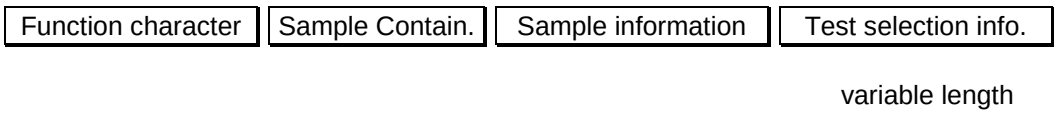
a) Test selection inquiry from AU to HOST (***SPE*** frame)



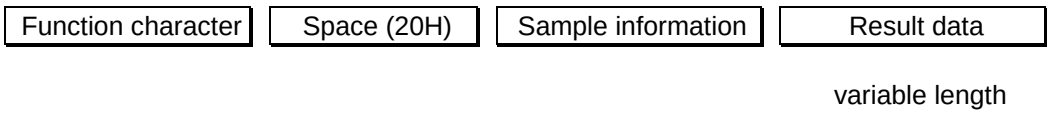
b) Specific result request from HOST to AU (***RES*** frame)



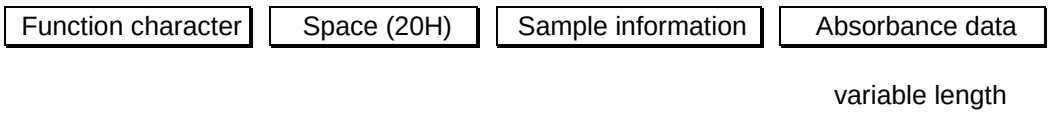
c) Test selection record from HOST to AU (***SPE*** frame)



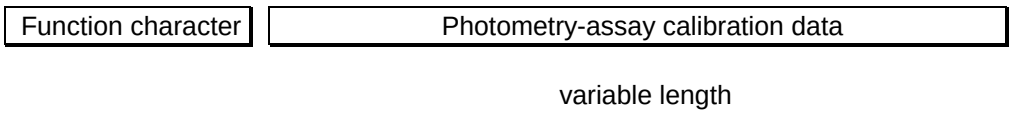
d) Result transfer from AU to HOST (***FRx***/***END*** frame)



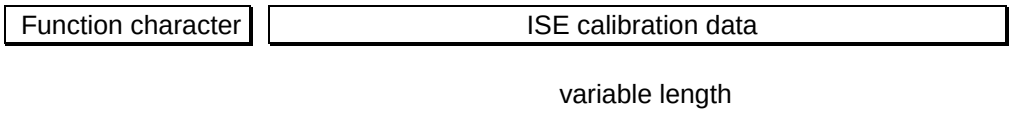
e) Absorbance data from AU to HOST (***END*** frame)



f) Photometry-assay calibration data from AU to HOST (***END*** frame)



g) ISE calibration data from AU to HOST (***END*** frame)



4.4.1. Function Characters

In the function character form for result data, the upper case letters are used for real-time and the lower case letters for batch communication.

	Form	Test Selection Info. Inquiry				Result data			
	Direction of Communi-cation	AU <-->HOST		AU <-- HOST		AU --> HOST			
	ID Provided /	Real-time Communication		Batch Communication		Real-time Communication		Batch Communication	
	Not Provided	Sample Class 1	Sample Class 2	Sample Class 1	Sample Class 2	Sample Class 1	Sample Class 2	Sample Class 1	Sample Class 2
Routine sample	Provided	**A**	**B**	**A**	**B**	**A**	**B**	**a**	**b**
Routine sample (automatic rerun)		**C**	**D**	**C**	**D**	**C**	**D**		
Routine sample (manual rerun)		**E**	**F**	**E**	**F**	**E**	**F**		
Stat sample		**G**	**H**			**G**	**H**	**g**	**h**
Stat sample (automatic rerun)						**I**	**J**		
Control sample	Provided					**K**	**L**	**k**	**l**
Calibration sample	/					**M** (Photometry-assay), **N** (ISE)			
Absorbance data (routine)	Not Provided					**O**	**P**		
Absorbance data (Stat)						**Q**	**R**		
Routine sample	Not Provided	**S**	**T**	**S**	**T**	**S**	**T**	**s**	**t**
Routine sample (automatic rerun)		**U**	**V**	**U**	**V**	**U**	**V**		
Routine sample (manual rerun)		**W**	**X**	**W**	**X**	**W**	**X**		
Stat sample						**G**	**H**	**g**	**h**
Stat sample (automatic rerun)						**I**	**J**		

Table 7: Function characters

4.4.2. Sample Container Information

The sample container information for a specific sample can be sent within the test selection (***SPE*** frame) from the HOST by assigning the second function character as follows.

2. Function Character	Container
1	STD Cup
2	Micro Cup
3	STD Cup on Tube
4	Micro Cup on Tube
5	Tube
Space (20H)	container information specified on the instrument (on **START CONDITIONS** screen 1-04

Table 8: Sample Container Selection

4.4.3. Composition of Sample Information

Sample information

34 bytes length

(included in ***SPE***, ***RES***, ***FR1***, ***FR2***, ***END*** frames)

Sample No	Disk No	Position No	Ident No	Age	Sex	Date	Time

Item	**L**	**Routine sample**	**Stat sample**	**Control sample**	**Note**
Sample No.	3	Format: sss Range: bb1-800*	Format: sss Range: bb1-200	Format: css c: control no. Range: 1 - 8 ss: sequence no. Range: 1 -30	1
Disk No.	1	Format: d Range: 0 - 9	Format: d Range: 0 - 9	Format: b	
Position No.	2	Format: pp Range: b1 - 50	Format: pp Range: 51 - 70	Format: bb	2
Ident No.	13	Format: nnnnnnnnnnnnn n = ident number		Format: bbbbbnnnnnnnn n = control name	3 7
Age	4	Format: aaac aaa: age no. Range: bb0 - 200 c: age unit 1 day 2 month 3 year		Format: bbbb	4
Sex	1	Format: s s: sex no. 0 neutral 1 male 2 female		Format: b	5
Date	6	Format: mmddyy mm: month dd: day yy: year		Format: bbbbbb	6
Time	4	Format: hhmm hh: hour mm: minute		Format: bbbb	6

Table 9: Format of Sample Information / b = space (20H)

Note 1: When the sample number is within 3 digits, it is right justified and preceded by spaces.

Note 2: In case of ID mode, the position number for the STAT sample is within the range 1 - 70.

Note 3: When the ID-No. is within 13 digits, it is right justified and preceded by spaces.

In case of no ID-mode the AU treats the ID-No. as a comment.

Note 4: <AU to HOST>: If the info. is not set, spaces are sent.

<HOST to AU>: Set age information that is sent from the AU.

Note 5: <AU to HOST>: If the info. is not set, a space is sent.

<HOST to AU>: Set sex information that is sent from the AU.

Note 6: <AU to HOST>: The blood collection date/time which the AU has is transferred. If the date/time is not set, the sent one is set.

<HOST to AU>: Set the date/time sent from the HOST. Note, however, that the date/time at the AU side is set if spaces are included in each date/time field.

Note 7: In CLAS mode the ID field contains: bbbbbbbbRRRRP
b = Space (20H)
R = Rack No.
P = Position (1 to 5)

See chapter 7 for examples.

4.4.4. Composition of Test Selection Information

Test selection information

variable length

(included in ***SPE*** frame)

Channel count	Test request	Comment flags	Comments

Item	Length	Range	Note
Channel count	2	'b0' to '48'	1
Test request	48	Format: rrrr....rrrr r: range for each character: 0 no request 1 normal sample volume 2 decreased volume 3 increased volume 4 volume determined by AU	2
Comment flags	5	Format: ccccc c: comment switch/flag 0 absence of corr. comment 1 presence of corr. comment	3
Comment 1	30	Format: cccc....cccc c: comment corresponding to flag 1	4
Comment 2	25	Format: cccc....cccc c: comment corresponding to flag 2	4
Comment 3	20	Format: cccc....cccc c: comment corresponding to flag 3	4
Comment 4	15	Format: cccc....cccc c: comment corresponding to flag 4	4
Comment 5	10	Format: cccc....cccc c: comment corresponding to flag 5	4

Table 10: Format of Test Selection Information / b = space (20H)

Note 1: If the channel count is less than 48, the channels with higher count are ignored.

Note 2: The channels are listed in ascending order.

Channel 1..46: Photometry-assay tests.

Channel 47: ISE channel.

- Request for electrolytes (2 or 3 tests).
- Na/K/Cl is selected when 'ON BOARD' is specified for DATA MODE of the Cl test on the **CHEMISTRY PARAMETER** screen 4-01.
- Na/K is selected when 'MANUAL' is specified for DATA MODE of the Cl test on the **CHEMISTRY PARAMETER** screen 4-01.
- It is impossible to select request for any of Na, K and Cl from the HOST.

Channel 48: Serum index channel:

- Request for serum indices (for 3 tests of L, H and I).

Note 3: Only in case other than '0', the comment name is reflected on the AU. In case of '0', the AU ignores the comment name (previously specified comment is given priority).

Within the comment data fields, the allowed character range is from code 20H to 7EH. (See Appendix A - ASCII Chart)

Note 4: Depending on comment flags. When one or more comments are not used, send the relevant comment names closely.

Deleting a test selection entry:

A test selection with all 48 test positions set to '0' deletes an existing test selection for the specified sample and causes the analyzer to send another test selection inquiry if the corresponding barcode appears again at the barcode reader.

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 analytical data is transfered when the other test is not requested. The additional test data for serum indexes is transfered also.

since Version 4-26:

Inquire Always mode:

If the ‘Inquire Always’ mode is enabled on the **SYSTEM PARAMETERS** screen 4-09 (see Figure 6 on page 10) the CU sends for each sample a test selection inquiry to the host even if there is already a test selection for that sample existing on the system.

See chapter 7 for examples.

4.4.5. Composition of Result Data for Routine, Rerun, STAT, and Control samples

Result data

variable length

(included in ***FR1***, ***FR2***, ***END*** frames)

Test count	Result[i]

with i = 1 to 'Test count'

Item	Length	Range	Note
Test count	2	Format: cc Range: b0 - 52	1
Result[i] with i=1 to 'Test count'	9 each	Format: ccvvvvvva cc: Test no. Range: b1 - 46 Photometry assay 47 - 49 Electrolyte 50 - 52 Serum index vvvvvv: Result value a: Data alarm Refer to the data alarm list (Table 18)	 2 3

Table 11: Format of result data / b = space (20H)

Note 1: The AU transfers data for up to 46 tests respectively for simultaneous measurement in real-time and batch communication .

The results of the electrolytes (three tests of Na, K and Cl) are transfered with the test numbers 47 to 49, the results of serum indexes (three tests of lipemia, hemolysis and icterus) with the test numbers 50 to 52.

For the sample, for which all tests are deleted with the edited data on the **DATA REVIEW** screen 1-06, sample information followed by test count ' **0**' is transferred. At that time result data is not transferred.

Note 2a: Format of the result value:

The position of the negative sign is selectable by dip switch setting on ADC-SIF board as follows:

SW 2-3 ON: `bb-123`

SW 2-3 OFF: `-bb123`

Pos/Neg.	Decimal Point	Max.Digits	Example
Positive	absent	6	`123456`
	present	5	`123.45`
Negative	absent	5	`-12345` `-bb123`
	present	4	`-12.34` `-b12.3`

Table 12: Format of measured value / b = space (20H)

Note 2b: Qualitative Result Transmission

On the **CHEMISTRY PARAMETERS** screen 4-01 it is possible to enter six-character long expressions for definable result ranges. If activated for Class 1, Class 2 or both, the corresponding expression is transferred instead of the result value.

Note 3a: Results that have been modified on the **DATA REVIEW** screen 1-06 get the following marks attached if the option **'EDITED FLAG'** was activated on **SYSTEM PARAMETERS** screen 4-09.

'*' (code 2AH) is displayed on the **DATA REVIEW** screen 1-06 and sent to the HOST as alarm character.

'EDITED' is printed on the monitor printout.

Note 3b: Whenever the calibration of the corresponding test failed, the following marks are attached if the Dip switch 2 (No. 4) is OFF:

'!' (code 31H) is displayed on the **DATA REVIEW** screen 1-06 and sent to the HOST as alarm character.

'CALIB!' is printed on the monitor printout.

Text Size:

Since the text size may be 256 or 512 bytes (selectable on **SYSTEM PARAMETERS** screen 4-09 / see Figure 6 on page 10) it can happen that the analytical data text has to be divided into several (up to 3) frames depending on the text size and the number of test results.

Text Size	256 bytes	512 bytes
Max. no. of test results in one frame	23	52
Tests in ***FR1*** or ***END***	1 to 23	
Tests in ***FR2*** or ***END***	24 to 46	
Tests in ***END***	47 to 52	1 to 52

Table 13: **No. of test results per frame according to the text size.**

See chapter 7 for examples.

Comments:

- Since the text size may be 256 or 512 bytes (settable on **SYSTEM PARAMETERS** screen 4-09 / see Figure 6 on page 10) and the end-code-character is settable up to four characters, calculate the maximum number of transferable channels within one text according to the following expression:

  max number < (Text size - 44) / 9

- When running batch communication in the 256-byte mode, data is sent in up to three texts for each sample. In this case, the AU sends the first text ***(FR1)*** and then the following ***(FR2 / END)*** within 5 seconds after receiving the ***MOR*** frame.

4.4.6. Absorbance Data

Absorbance data

variable length

(included in ***FR1***, ***FR2***, ***END*** frames)

Analyt. data [i]	BLANK[i]	Point count	ABS[k]

with i = 1 to 4 and k = 1 to POINT COUNT

Item	Length	Range	Note
Analytical data [i] with i=1 to 4	9 each	Format: ccvvvvvva cc: Channel no. vvvvvv: Result value a: Data alarm Refer to the data alarm list (see Table 18)	1
Blank data [i] with i=1 to 4	6 each	Format: cccccc	2
Point count	2	Format: pp Range: 0 - 49	3
Absorb. data [k] with k=1 to 'Point count'	6 each	Format: aaaaaa /-aaaaa	4

Table 14: Format of Absorbance Data

Note 1: If two-channel simultaneous measurement is specified, data for two channels is transferred. If serum index measurement is specified, data for up to four channels (1 channel + L, H, I) is transferred.

If there is no relevant test for analytical data, 9 spaces are transferred.

Note 2: The first value is the 'Stopped cell blank', the following three values are the 'Passed cell blanks'. The values are transferred according to the analytical method of this test.

The Unit for the cell blank data is 10^{-4} (10E-4) absolute. An integer is transferred preceded by space with fixed sign position.

Note 3: The point count is the number of photometric points which follow the point count information. The following values may occur:

Reaction time [min]	3	4	5	10	15
Point Count	10	13	15	31	49

Note 4: The absorbance data in the entire reaction monitoring system (data at each photometric point) is transferred in the same format as for the above cell blank data. When the point count is less than 49, the data is closely transferred in sequence starting from ABS 1.

Text Size:

Since the text size may be 256 or 512 bytes (selectable on **SYSTEM PARAMETERS** screen 4-09 / see Figure 6 on page 10) it can happen that the absorbance data text has to be divided into several (up to 2) frames depending on the text size and the number of absorbance values.

Text Size	256 bytes	512 bytes
ABS values in ***FR1*** or ***END***	1 to 25	1 to 49
ABS values in ***END***	26 to 49	

Table 15: **No. of absorbance values per frame according to the text size.**

The sample information is sent in each frame; the analytical data and blank values are only sent in the first frame.

See chapter 7 for examples.

Photometric Points

1 cycle = 10 sec

#	Time (sec)	Remarks	#	Time (sec)	Remarks
1	0,00	R1 stirring	**26**	490,43	
2	19,92		**27**	510,35	
3	39,94		**28**	530,27	
4	59,76	R2 discharge	**29**	550,20	
5	79,69	R2 stirring	**30**	570,12	
6	99,61		**31**	590,04	R4 discharge
7	119,53		**32**	609,96	
8	159,37		**33**	629,88	
9	179,29		**34**	649,80	
10	199,21		**35**	669,73	
11	219,14		**36**	689,65	
12	239,06		**37**	709,57	
13	255,74		**38**	729,49	
14	275,66		**39**	749,41	
15	295,59	R3 discharge	**40**	769,33	
16	315,51		**41**	789,25	
17	335,43		**42**	809,18	
18	355,35		**43**	829,10	
19	375,27		**44**	865,70	
20	395,19		**45**	885,63	
21	415,11		**46**	905,55	
22	435,04		**47**	925,47	
23	454,96		**48**	945,39	
24	472,16		**49**	965,31	
25	490,43				

4.4.7. Photometry-assay Calibration Data

Photometry-assay Calibration data

variable length

(included in frame)

Channel no.	STD count	Calib. alarm	STD data [k]	SD value

with k = 1 to STD count

Item	Length	Range	Note
Channel no.	2	Format: cc Range: b1 - 46	1
STD count	1	Format: s No. of standards according to the calibration method Range: 1 - 6	2
Calib. alarm	1	Format: a Refer to the data alarm list (see Table 18)	3
STD[k]	32 each	Format: kaaaaaaddddddbbbbbb eeeeeeuppppp k: STD no.; Range: 1 - 6 aaaaaa 1st absorbance data dddddd 1st initial absorbance data bbbbbb 2nd absorbance data eeeeee 2nd initial absorbance data u data alarm Refer to the data alarm list (see Table 18) pppppp Prozone value	4 3
SD value	8	Format: pvvvvvvd p 'Y' = SD value present 'N' = SD value absent vvvvvv SD value d decimal point position	5

Table 16: Format of Photometry-assay Calib. Data / b = space (20H)

Note 1: The test code in photometry-assay calibration which corresponds to the test code in the AU.

Note 2: When the STD count is 1, STD data 1 is followed by SD value information.

Note 3: Refer to the data alarm list (see Table 18 on page 35)

Note 4: Each standard is measured twice. (1st and 2nd abs. values). The 1st and 2nd absorbance values are the results of the bichromatic measurements at the corresponding measuring point; the initial absorbance values are the results of the monochromatic measurements with only the main wavelength. (Each standard is measured with two different wavelengths).

Each absorbance data is right-justified and preceded by space. The unit is 10^{-4} (10E-4) absolute. It is a 6-digit integer with sign.

Note 5: The SD value is only calculated for nonlinear and linear multi-point calibrations (3 to 6 standards). It is right-justified and preceded by space. It has no unit and the decimal point position is settable on **CHEMISTRY PARAMETERS** screen 4-01.

See chapter 7 for examples.

4.4.8. ISE Calibration Data

ISE Calibration data

(included in ***END*** frame)

Type A: Tests Na, K (152 bytes)

ISE type	Space	Na alarm	Na data	K alarm	K data

Type B: Tests Na, K, Cl (225 bytes)

ISE type	Space	Na alarm	Na data	K alarm	K data	Cl alarm	Cl data

Item	**Length**	**Range**	**Note**
ISE type	1	Format: p 'A' : Tests Na, K (n = 2) 'B' : Tests Na, K, Cl (n = 3)	
Data alarm + Calib. data [i] with i=1 to n	1 + 8 * 9 each	Format: a Refer to the data alarm list (see Table 18) Format: ddvvvvvva dd: Data identification. Range: b1 - b8 vvvvv: measured value a: Data alarm Refer to the data alarm list (Table 18)	1 2

Table 17: Format of ISE Calibration Data / b = space (20H)

Note 1: Refer to the data alarm list (see Table 18 on page 35).

Note 2: Each data field consists of the following eight data items:

- electromotive force of internal standard solution
- electromotive force of LOW solution
- electromotive force of HIGH solution
- electromotive force of M solution
- slope level for display
- concentration of internal standard solution
- concentration of M solution
- compensation factor

The unit for the measured value is mV. It has a sign and a decimal point. Spaces are given, when there is no relevant data.

See chapter 7 for examples.

4.4.9. Data Alarm List

No.	Data Alarm Name	Printer	CRT	I/F	Photometry Assay			ISE			Note
					R/S	C	Std	R/S	C	Std	1
1	ADC abnormal	ADC?	A	A	o	o	o	o	o	o	
2	Cell blank abnormal	CELL?	Q	Q	o	o	o				
3	Sample short	SAMPL	V	V	o	o	o	o	o	o	2
4	Reagent short	REAGN	T	T	o	o	o				2
5	Absorbance over	ABS?	Z	Z	o	o	o				
6	PROZONE error	.....P	P	P	o	o	o				3
7	Reac limit over at all points	LIMT0	I	I	o	o	o				
8	Reaction limit over except at 1 point	LIMT1	J	J	o	o	o				
9	Reaction limit over except at 2 or 3 points	LIMT2	K	K	o	o	o				
10	Linearity abnormal for 9 points or more	LIN.	W	W	o	o	o				
11	Linearity abnormal for 8 points or less	LIN.8	F	F	o	o	o				
12	Standard 1 absorbance abnormal	S1ABS?		H			o				
13	Duplicate error	DUP		U			o				
14	STD error	STD?		S			o				
15	Sensitivity error	SENS		Y			o				
16	Calibration error	CALIB		B			o				
17	SD error	SD?		G			o				
18	Noise error	NOISE	N	N				o	o	o	
19	Level error	LEVEL	L	L				o	o	o	
20	Slope abnormal	SLOPE?		E						o	
21	Preparation abnormal	PREP.		R						o	
22	Internal standard concentration abnormal	I.STD		D						o	

Table 18: Data alarm list (part 1)

No	Data Alarm Name	Printer	CRT	I/F	Photometry Assay			ISE			Note
					R/S	C	Std	R/S	C	Std	1
23	Sample value abnormal	R.OVER	&	&				o	o		
24	Test-to-test comp. error	CMP.T	C	C	o	o		o	o		
25	Test-to-test compensation disabled	CMP.T!	M	M	o	o		o	o		4
26	Panic value upper limit over	LIMTH	$	$	o			o			
27	Panic value lower limit over	LIMTL	$	$	o			o			
28	Random error (R-4s)	RANDOM	@	@		o			o		
29	Systematic error 1 (2-2sA)	SYSTM1	#	#		o			o		
30	Systematic error 2 (2-2sW)	SYSTM2	#	#		o			o		
31	Systematic error 3 (4-1sA)	SYSTM3	#	#		o			o		
32	Systematic error 4 (4-1sW)	SYSTM4	#	#		o			o		
33	Systematic error 5 (10xA)	SYSTM5	#	#		o			o		
34	Systematic error 6 (10xW)	SYSTM6	#	#		o			o		
35	QC error 1	QCERR1	+	+		o			o		
36	QC error 2	QCERR2	+	+		o			o		
37	Calculation test error	CALC?			o	o		o	o		
38	Overflow	OVER	O	O	o	o		o	o		4
39	Calculation disabled	???	X	X	o	o	o	o	o		4
40	Expected value upper limit over	H			o			o			5
41	Expected value lower limit over	L			o			o		o	5
42	Edited Results	EDITED	*	*	o	o		o	o		
43	Calibration failed	CALIB!	!	!	o	o		o	o		

Table 19: Data alarm list (part 2)

Note 1. R/S = Routine/STAT C = Control Std = Calibration

Note 2. Data may be blanked.

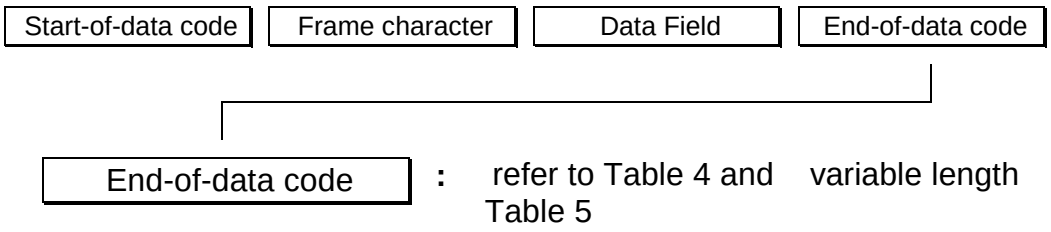
Note 3. Prozone value is output on printer only in real-time monitor mode.

Note 4. Data is blanked.

Note 5. Can exist with any other alarm.

Note: When two or more data alarms are given for a single data item, the one registered first is output.

4.5. End-of-data Code



The **End-of-data** code represents the end of each text that is sent from the AU or the HOST. Its format is selectable in the **SYSTEM PARAMETERS** screen 4-09 (see Figure 6 on page 10).

4.5.1. Options

No	Code	ASCII	Bytes
1	[ETX][BCC]	03H [BCC]	2
2	[CR][LF][ETX]	0DH 0AH 03H	3
3	[ETX]	03H	1
4	[ETX][CR][LF]	03H 0DH 0AH	3
5	[ETX][CKSH][CKSL][CR]	03H [high][low] 0DH	4

Table 20: End-of-data codes

[BCC] = Block Check Character

The calculation is made as follows:

All characters excluding [STX] and including [ETX] are XOR accumulated. This results in the BCC character (with code in the range 00H to FFH).

Example:

SPE from HOST to AU:

Routine Sample, Class 1, with barcode reader

Sample No.: 123, Disk No.: 0 , Position: 1

Ident No.: 0123456789123, Age: 36 years, Sex: male

Date: September, 23th, 1991, Time 9:30

[STX];A_1230_50123456789123_36310923910930[ETX]check-string

BCC-calculation: result = 50H / transferred: "P"

[CKSH][CKSL] = Checksum high/low

The calculation is made as follows:

The checksum is generated as the elementary sum of all data bytes excluding [STX] and [ETX]. The result of the calculation is a 4-digit hexadecimal value. The two low order digits of that number are converted to ASCII characters. These two characters build the checksum high/low.

Example:

SPE from HOST to AU:

[STX];A_1230_50123456789123_36310923910930[ETX]check-string[CR]

Checksum-calculation: result = 4BH / transferred: "4B"

5. Data Transmission Control Procedure

5.1. Establishment of Data Link

After activating **HOST COMMUNICATION** on the **START CONDITIONS** screen 1-04, the AU transfers the ***ANY*** frame to the HOST. Communication is started from this point. The HOST has to answer within 5 seconds, usually with a ***MOR*** frame.

If the host does not answer, the AU sends another ***ANY*** frame (even if the host does not answer to a result transmission the AU does not repeat the result but sends the ***ANY*** frame). On the **SYSTEM PARAMETERS** screen 4-09 (see Figure 6) the number of attempts to establish the data link (RETRY COUNT) can be set from 1 to 99. Also the time between these retries (RETRY TIME) can be set from 1 to 99 seconds on this screen.

In subsequent steps, the AU and HOST continue transmission alternately.

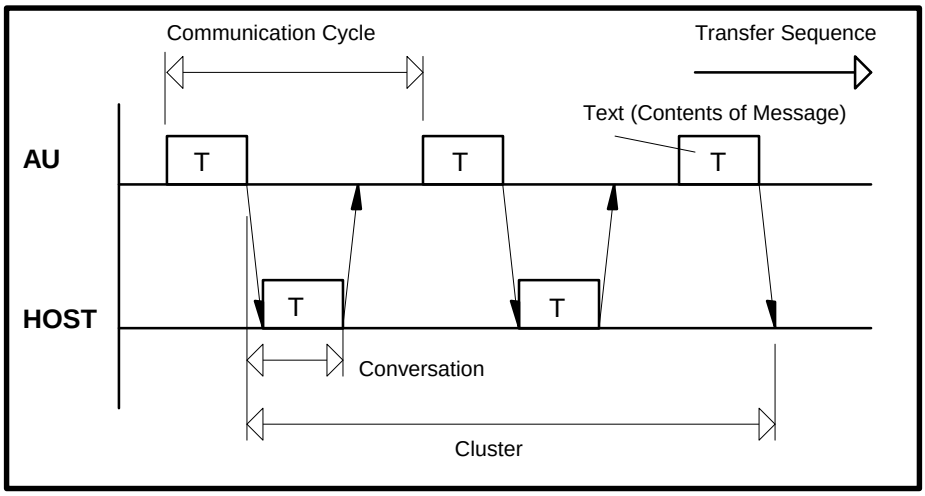


Figure 10: **Common communication timing**

Conversation	One message sent from the HOST or the AU
Communication cycle	One request from the AU with the corresponding answer from the HOST
Cluster	A group of conversations between the AU and the HOST

5.2. Response to Information Message

After receiving information, the receiver sends a response or message in its place to inform the sender of the receiver status and the validity of received information.

The format of the various messages is described above. When the 256-byte mode is selected for the transferred byte count, the analytical data text may exceed 256 bytes (including start-of-data code and end-of-data code) according to the sample. In this case, the frame character identifies the number of transmission which is sent in the text.

The AU continues replying as far as the HOST returns a response. Even when the text, corresponding to an optional frame character is transferred and there is no

more data to be sent between the AU and HOST, they continue sending the ***ANY*** frame and ***MOR*** frame respectively. However, the cluster is restarted immediately if analytical data transfer, test selection directive or any other transfer is requested.

After sending a text, the HOST should avoid sending until reception of a response or request to/for the next in a normal condition. Otherwise the AU will output an alarm.

If no response is returned or an invalid response is received, the recovery procedure is executed. In case of sending from the HOST, the HOST must always be kept ready for receiving the response.

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

5.2.1. No Information to be sent

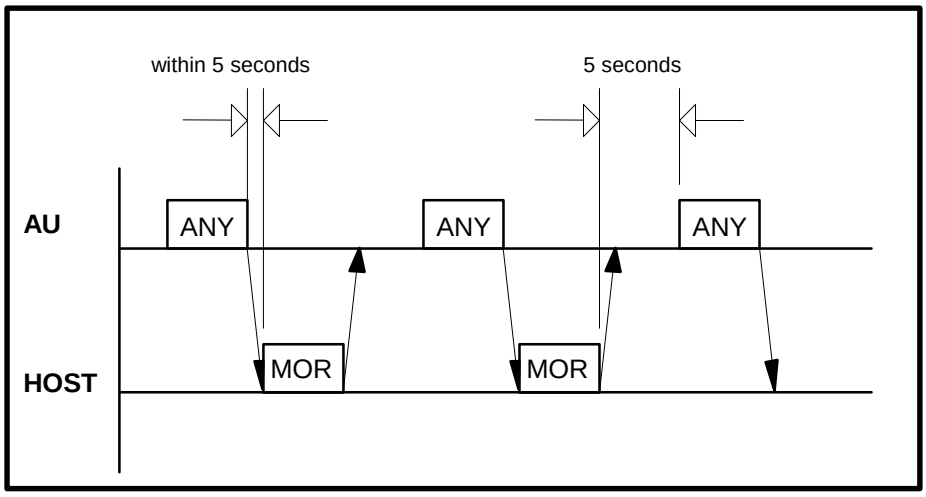


Figure 11: **Communication timing without information exchange**

The AU continues returning the ***ANY*** frame in response to the ***MOR*** frame from the HOST. This procedure continues even when the AU and HOST have no information to be sent. Following conditions must be 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.

In this case, the AU sends the ***ANY*** frame in the lapse of five seconds after receiving the ***MOR*** frame from the HOST (a point when the final end-of-data code is recognized).

After receiving from the AU, the HOST should return a response as soon as possible within the following 5 seconds.

5.2.2. Transfer of Communication Control Message

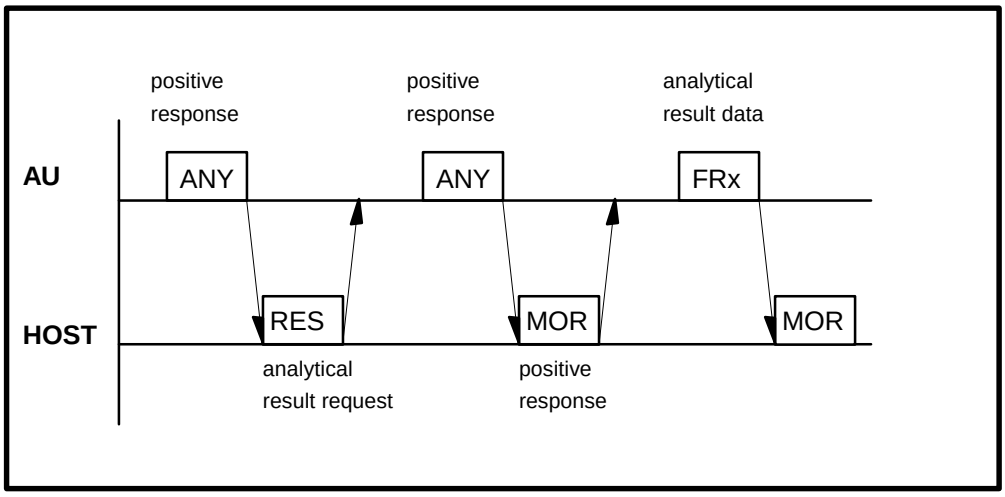


Figure 12: **Transfer of communication control message**

The ***RES***, ***ANY***, ***MOR***, ***REP*** frames are available for the communication control message.

For details, refer to the Frame types in Table 4 and Table 5.

5.2.3. Transfer of Test Selection Information

(a) Test selection directive from the HOST to the AU

Usually the HOST will send test selections in advance of the sample's arrival on the analyzer. The HOST can send the test selection packet in response to the ***ANY*** frame from the AU.

(b) Test selection inquiry from the AU to the HOST

If the test selection is not sent by the HOST, the AU can ask for specific test selections from the HOST. The test selection inquiries are sent to the HOST when samples are ready for processing and no test selections are available at the AU. This case is shown in Figure 13.

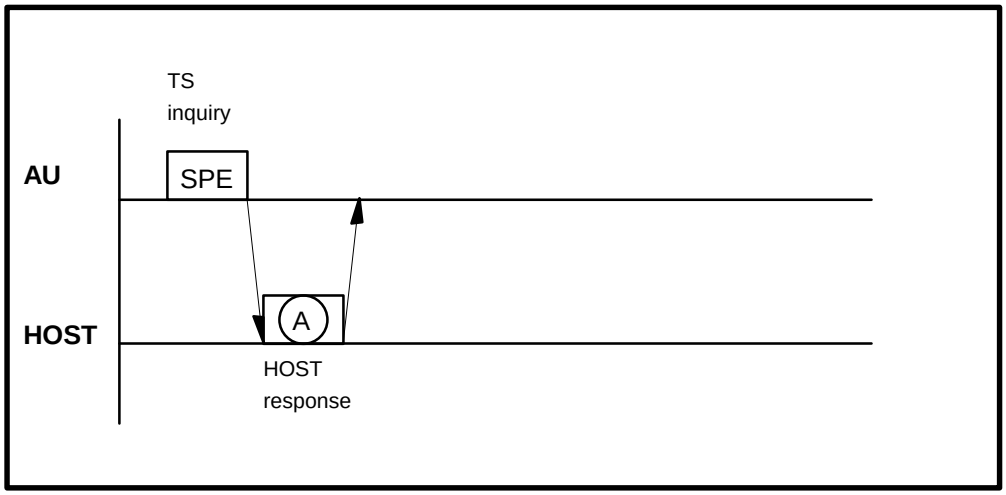


Figure 13: **Test selection inquiry**

The possible HOST responses to the specific test selection inquiry are listed in Table 21.

Frame A	Description
SPE	Respond with test selection for the sample requested. If the test selection is received correctly and in time, then this test selection will be used for the sample. If the test selection is not received, then the Default test selection will be used if one has been configured by the operator. If no Default test selection has been configured, then no tests will be selected.
MOR	The HOST indicates that it cannot respond to test selection information inquiry but is ready to receive analytical data. In this case the alarm message 'T/S Availability Error' is displayed on the screen.

Table 21: HOST response to test selection inquiry

5.2.4. Transfer of Result Data

(a) Result request with the ***RES*** frame from the HOST to the AU

The HOST can make a request to the AU for the analytical data of a specific sample by use of the ***RES*** frame. The request could be for results which have not been received yet or for results which the AU has already sent.

The AU will respond with the ***ANY*** frame, to indicate that the request was received. The result will be returned to the HOST. If the AU cannot find the requested sample's result, no response will be given to the HOST to indicate this. The request was accepted by the AU, but this does not mean that the result is available to the AU.

The AU will store up to ten requests in an internal buffer. This buffer is periodically checked by the AU. The buffer will only hold ten requests, and subsequent requests are ignored. A request slot is cleared when a result is sent. All slots are cleared when the system is reset by switching off/on.

Because of the limit of ten slots, the HOST should be circumspect about using this feature. If requests are made for samples that do not exist, the request will never be fulfilled, and if all slots are used, this feature will become essentially disabled. This feature need not be implemented because the AU sends the result in realtime as soon as possible after completion.

(b) Result transfer from the AU to the HOST

The target is of course, getting results back to the HOST. For this the AU uses result frames.

There are three cases for result-sending:

- Real-time mode; the results are sent as soon as they are available at the AU side. This is the normal way.
- Batch mode; the results are transferred manually by the operator (see the **DATA REVIEW** screen 1-06)
- After result request; this method is described above (see (a)).

Figure 14 shows the result transmission procedure in normal case and in Table 23 the possible HOST responses to result frames are listed.

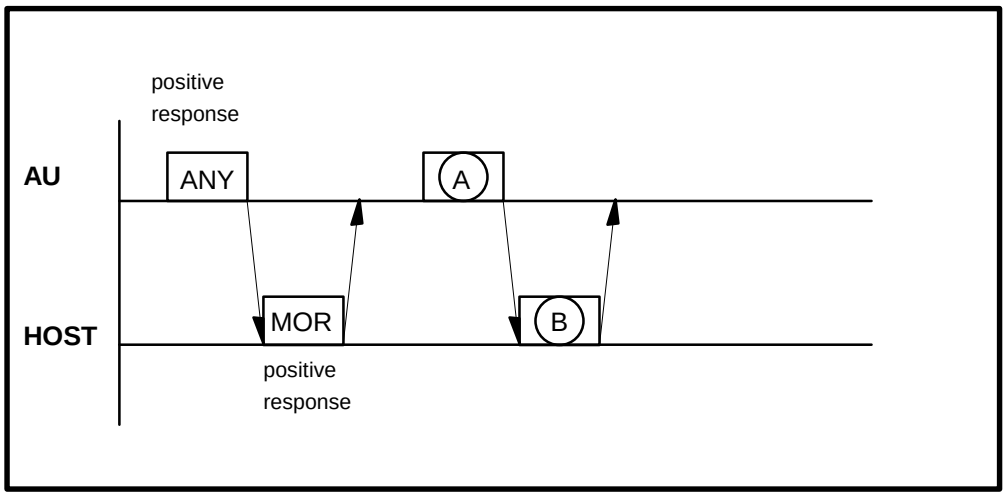


Figure 14: **Result transmission**

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

Table 22: AU result frames

Frame B	**Description**
REP	when text in A is abnormal
MOR	to receive analytical data next time also
SPE	to indicate test selection
RES	to request a specific sample

Table 23: HOST response to FR1/END

Transmission Procedure in Special Case.

Results from a patient's sample can be sent in up to three result frame packets (depending on the number of results and the maximum message length). Each frame requires a ***MOR*** from the HOST before the next frame will be sent. Ideally, the AU will try to transfer all packets for a sample without sending any other type of packet. There are instances, such as the analyzer needing test selection information, in which the AU can afford to wait for the current sample's result frames to transfer. One effect of this system is, that there is no delay for ***SPE*** frames. This case is shown in Figure 15.

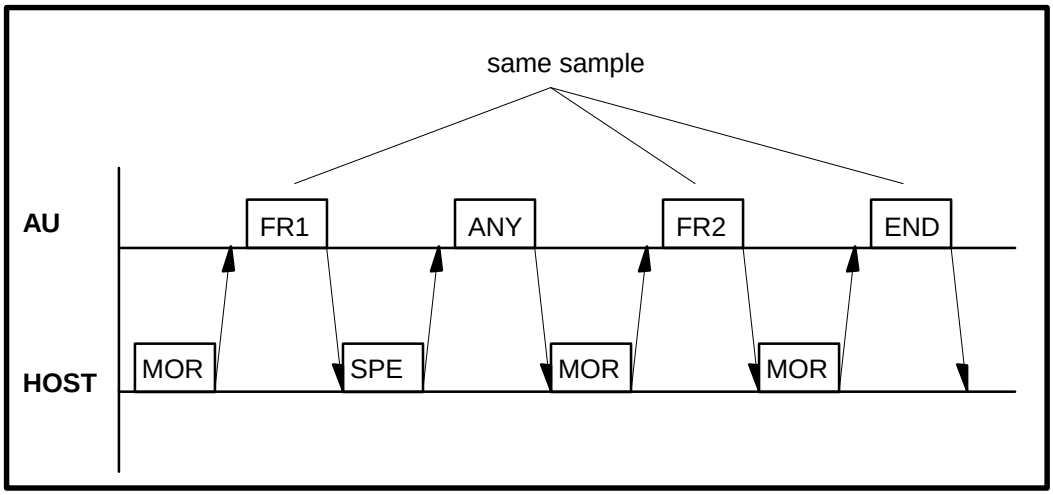


Figure 15: **Result transmission with three frames and SPE interrupt**

5.2.5. Resending Request

If there is any abnormality in the contents of the text received from the AU or the HOST, resending is requested with the ***REP*** frame. Figure 16 shows this procedure if the AU sends the ***REP*** frame; in Figure 17 the HOST sends the ***REP*** frame.

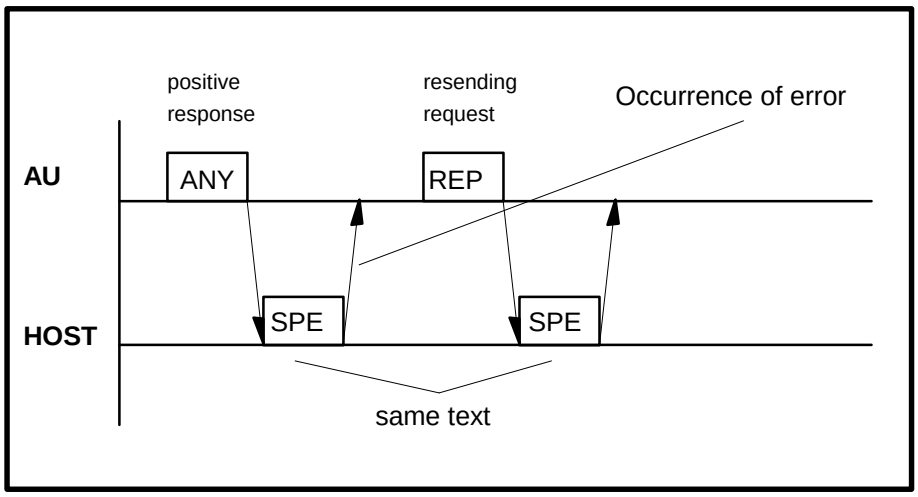


Figure 16: **Resending request with REP frame from AU to HOST**

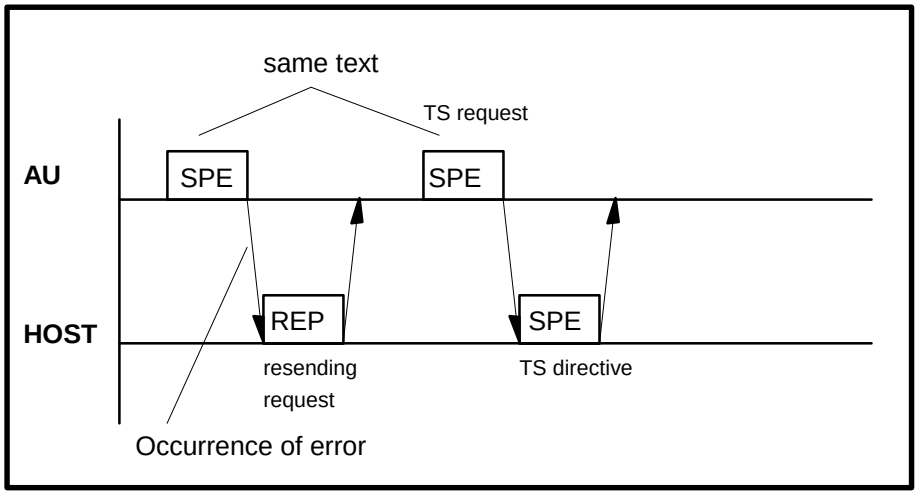


Figure 17: **Resending request with REP frame from HOST to AU**

5.3. Termination and Restart of Communication

Condition of Termination	Real-time Communication	Batch Communication	Restart of Communication
Specification of (OFF) for **HOST COMM**. on **START CONDITIONS** screen 1-04	STOP	STOP	Change from (OFF) to (ON) for **HOST COMM**. Previous contents of communication are all canceled.
Occurrence of send/receive time-out error	STOP	STOP	Same as above
Occurrence of hardware error alarm related to communication	STOP	STOP	Same as above
Occurrence of FD read error during sending of analytical data to HOST		STOP	Remaining samples in specified range are not sent. Upon restart, samples in newly specified range are sent.
Stop directive through screen during sending of analytical data to HOST		STOP *	Same as above
Occurrence of FD read error during transfer of analytical data for specific sample to HOST			Relevant sample alone is canceled.
Detection of abnormality in text (BCC error or discrepancy in end-of-data code between AU and HOST for example)			----------
Occurrence of E. STOP-Level alarm at AU side			----------

Table 24: Termination and Restart of Communication

Note*:

Transfer of analytical data is stopped regardless of sample type (routine, STAT or control sample).

Example: Cancellation during batch transfer of analytical data for the control sample is possible through the **DATA REVIEW** screen 1-06 as well as the **INDIVIDUAL QC LIST** screen 2-03.

5.4. RESULT-ONLY mode

In this mode, analytical data alone is transferred to the HOST and resending request (***REP*** frame) from the AU or HOST or response to specific sample request is not made.

With (YES) specified for RESULT ONLY on the **SYSTEM PARAMETERS** screen 4-09 (see Figure 6 on page 10), the AU returns no response to test selection inquiry or test selection directive even when (YES) is specified for the test selection inquiry. The AU waits for two seconds or more after sending ETX in the analytical data text and proceeds to transfer to the HOST regardless of the communication procedure.

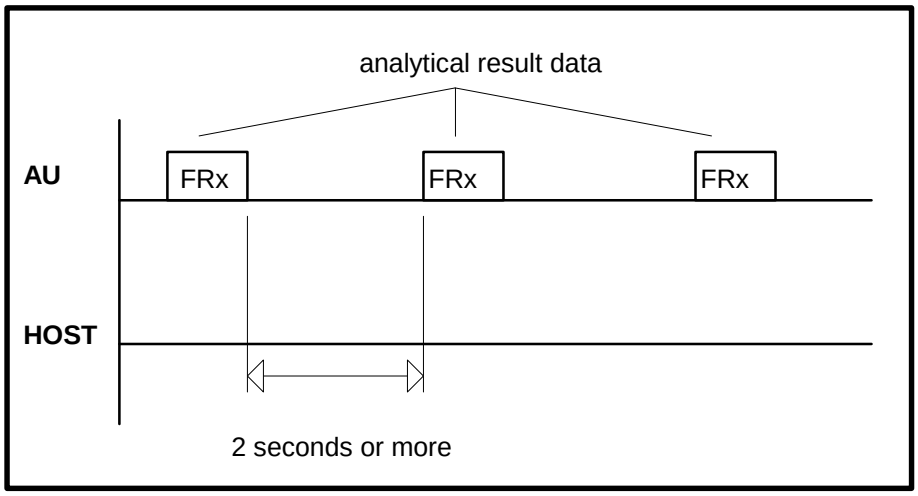


Figure 18: **Timing in RESULT ONLY mode**

6. Communication Functions

6.1. Function List for Test Selection Data

Function		Inquiry	Directive	Conditions
Routine sample				Invalid when (YES) is specified for RESULT ONLY on **SCREEN 4-09** (see Figure 6)
STAT sample	with ID			Valid when (YES) is specified for STAT T/S on **SCREEN 4-09**
	without ID			Invalid when (YES) is specified for RESULT ONLY
Manual Rerun sample	Routine sample			Valid when (YES) is specified for RERUN ONLY T/S on **SCREEN 4-09**. Invalid when (YES) is specified for RESULT ONLY
Automatic Rerun sample	Routine sample			Valid when (YES) is specified for AUTO RERUN T/S on **SCREEN 4-09** Invalid when (YES) is specified for RESULT ONLY

Table 25: Function list for test selection data

6.2. Function List for Result Data

Function		Real-time Commu-nication	Batch Commu-nication	Specific Sample Request from HOST	Conditions
Routine sample					Specific sample re-quest is invalid when (YES) is specified for RESULT ONLY on **SCREEN 4-09** (see Figure 6)
STAT sample					
Control sample					
Automatic/ Manual	Routine sample				
Rerun sample	STAT sample				
Calibration					
Original absorbance					Valid when (YES) is specified for ORIGINAL ABS.on **SCREEN 4-09**

Table 26: Function list for result data

Comments:

- The above real-time communication indicates a communication carried out while the instrument is busy in analysis, and the batch communication indicates a communication when specified through the screen.

  (Note, however, that test selection information inquiry is not specified through the screen and specification through the HOST is accepted.)

- To stop communication between the AU and HOST, change (ON) to (OFF) for **HOST COMMUNICATION** on the **START CONDITIONS** screen 1-04. In this case, however, note that all communication processing is stopped.

7. Communication Trace

7.1. Overview

The contents of communication between the AU and HOST are stored in the I/O RAM provided with backup battery (hereafter referred to as I/O RAM). To check the contents of communication, the stored data is output onto the printer as a report. This function is selectable on the **SYSTEM PARAMETERS** screen 4-09 (see Figure 6).

7.2. Trace Data

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

The data to be stored differs between the following two cases.

a) In normal communication.

   The frame character, function character and sample information (sample no., disk no., position no. and ID no. alone) are stored.

   Note, however, that only the frame character and function character are stored for the text which does not contain sample information.

b) Upon Occurrence of any error during communication.

   The details of the error and all characters up to occurrence of the error are stored.

   Note, however, that only the frame character, function character and sample information (same as in a) above) are stored the same as in normal communication if send time-out occurs during sending from the AU to the system.

7.3. Reset and Printout of Trace Data

The trace data is printed out and reset with the **HOST COMMUNICATION LOG** function on the **MECHANISM CHECK** screen 5-02. Not actual trace data but storing pointers and cyclic information are cleared to zero with the reset function.

7.4. Trace Data Storing Performance

	Max. Storing Cycle Count (conversation)	**Max. Storage Time (min)**
in normal case	256	Approx. 40
if error occurs every cycle	128	Approx. 20

Table 27: Trace data storage performance

8. Examples for Traces

Example 1: Test Selection record from HOST to AU
Example 2: Test Selection inquiry from AU to HOST
Example 3: Result data from AU to HOST
Example 4: Absorbance data from AU to HOST
Example 5: Photometry assay Calibration data from AU to HOST
Example 6: ISE Calibration data from AU to HOST
Example 7: Control data from AU to HOST
Example 8: Specific Result Request from HOST to AU

Common explanations for the following HIT911 trace lists:

Format

1st column	Sender of text (AU=Analyzer Unit)
2nd column	Sending time
3rd column	Trace data

Control charcters

Mnemonic	meaning	ASCII code
[STX]	start of text	02H
[ETX]	end of text	03H
[CR]	carriage return	0DH
[LF]	line feed	0AH
^	space	20H
<$..>	Block check character	

Table 28: Communication trace details

The communication trace was aquired with the Host Interface Testprogram 'HOST911.EXE' (from Technical Productmanagement / Data Technique)

8.1. Test Selection record from HOST to AU (batchmode)

(Detailed format of first conversation on the next page)

```
AU   10:23:25  [STX]>[ETX]3E[CR]
HOST 10:23:25  [STX];A^^^^^^^^^^^^^^000042^3031031992083348001000110000000000
               0000000000000000000000000000001011111Test^1^mit^Identnummer^
               ^^^^^^^Hugo^^^^^^^^^^^^^^^^^^^Arzt^^^^^^^^^^^^^^^Patient^
               1^^^^^^Station^1^[ETX]C4[CR]

AU   10:23:30  [STX]>[ETX]3E[CR]
HOST 10:23:30  [STX];A^^^^^^^^^^^^^^000043^2432031992083448001000110000000000
               0000000000000000000000000000001011111Test^1^mit^Identnummer^
               ^^^^^^^Brigitte^^^^^^^^^^^^^^^^Arzt^^^^^^^^^^^^^^^Patient^
               2^^^^^^Station^1^[ETX]F2[CR]

AU   10:23:36  [STX]>[ETX]3E[CR]
HOST 10:23:36  [STX];A^^^^^^^^^^^^^^000044^6631031992083548001000110000000000
               0000000000000000000000000000001011111Test^1^mit^Identnummer^
               ^^^^^^^Opa^Fritz^^^^^^^^^^^^^^^Arzt^^^^^^^^^^^^^^^Patient^
               3^^^^^^Station^1^[ETX]EF[CR]

AU   10:23:41  [STX]>[ETX]3E[CR]
HOST 10:23:41  [STX];A^^^^^^^^^^^^^^000022^^^^^^^^^^^^^^480010001100000000000
               0000000000000000000000000000001011111Test^1^mit^Identnummer^
               ^^^^^^^Der^Unbekannte^^^^^^^^^^Arzt^^^^^^^^^^^^^^^Patient^
               4^^^^^^Station^1^[ETX]2B[CR]

AU   10:23:46  [STX]>[ETX]3E[CR]
HOST 10:23:46  [STX];A^^^^^^^^^^^^^^000046^2811031992083648001000110000000000
               0000000000000000000000000000001011111Test^1^mit^Identnummer^
               ^^^^^^^Baby^^^^^^^^^^^^^^^^^^^Arzt^^^^^^^^^^^^^^^Patient^
               5^^^^^^Station^1^[ETX]BF[CR]

AU   10:23:51  [STX]>[ETX]3E[CR]
HOST 10:23:51  [STX]>[ETX]3E[CR]

.......
```

Text format of example 1:

Inquiry: Analyzer sends ANY frame. AU 10:23:25 [STX]>[ETX]3E[CR]	
[STX] > [ETX] 3E [CR]	Start of text (ASCII code 02H) Frame character: ANY inquiry End of text (ASCII code 03H) Checksum Carriage return (ASCII code 0DH)
Answer: HOST sends the next available Test selection to the AU. HOST 10:23:25 [STX];A^^^^^^^^^^^^^^000042^303103199208334800100011000000000000000000000000000000000001011111Test^1^mit^Identnummer^^^^^^^Hugo^^^^^^^^^^^^^^^^^^^^Arzt^^^^^^^^^^^^^^^Patient^1^^^^^^Station^1^[ETX]C4[CR]	
[STX] ; A ^ [Sample information] ^^^ ^ ^^ ^^^^^^^000042 ^303 1 031992 0833 [Test selection information] 48 00100011000000000000000 00000000000000000000010 11111 Test 1 mit Identnummer Hugo Arzt Patient 1 Station 1 [ETX] C4 [CR]	Start of text (ASCII code 02H) Frame character: TS inquiry Function character: Class1 / Routine sample / Batch communication / Barcode mode Space Sample number (3 spaces) Disk number (space) Position (2 spaces) Identnumber Age 30 = Years Sex = male Date = March, 19th 1992 Time = 8:33 Channel count Test request with normal volume for tests 3,7, 8 and 47. Comment flags 1 to 5 set Comment 1 with max. 30 char. Comment 2 with max. 25 char. Comment 3 with max. 20 char. Comment 4 with max. 15 char. Comment 5 with max. 10 char. End of text (ASCII code 03H) Checksum Carriage return (ASCII code 0DH)

8.2. Test Selection inquiry from AU to HOST (realtimemode)

(Detailed format of first conversation on the next page)

```
AU   11:46:36  [STX];A^^^11^1^^^^^^^000042^^^3^0319921147[ETX]4D[CR]
HOST 11:46:37  [STX];A^^^11^1^^^^^^^000042^^^3^03199211474800100011000000000
               00000000000000000000000000001011111Test^1^mit^Identnummer^
               ^^^^^^^Hugo^^^^^^^^^^^^^^^^^^^Arzt^^^^^^^^^^^^^^^Patient^
               1^^^^^^Station^1^[ETX]C2[CR]

AU   11:46:42  [STX];A^^^21^2^^^^^^^000043^^^3^0319921147[ETX]50[CR]
HOST 11:46:42  [STX];A^^^21^2^^^^^^^000043^^^3^03199211474800100011000000000
               00000000000000000000000000001011111Test^1^mit^Identnummer^
               ^^^^^^^Brigitte^^^^^^^^^^^^^^^^Arzt^^^^^^^^^^^^^^^Patient^
               2^^^^^^Station^1^[ETX]ED[CR]

AU   11:46:47  [STX]>[ETX]3E[CR]
HOST 11:46:47  [STX]>[ETX]3E[CR]

AU   11:46:53  [STX];A^^^31^3^^^^^^^000044^^^3^0319921147[ETX]53[CR]
HOST 11:46:53  [STX];A^^^31^3^^^^^^^000044^^^3^03199211474800100011000000000
               00000000000000000000000000001011111Test^1^mit^Identnummer^
               ^^^^^^^Opa^Fritz^^^^^^^^^^^^^^^Arzt^^^^^^^^^^^^^^^Patient^
               3^^^^^^Station^1^[ETX]E6[CR]

AU   11:46:58  [STX]>[ETX]3E[CR]
HOST 11:46:58  [STX]>[ETX]3E[CR]
```

Text format of example 2:

Inquiry: Analyzer sends Test selection inquiry.

```
AU   11:46:36  [STX];A^^^11^1^^^^^^^000042^^^3^0319921147[ETX]4D[CR]
```

[STX]	Start of text (ASCII code 02H)
;	Frame character: TS inquiry
A	Function character: Class1 / Routine sample / Realtime communication / Barcode mode
^	Space
[Sample information]	
^^1	Sample number 1
1	Disk number 1
^1	Position 1
^^^^^000042	Identnumber
^^^3	Age factor = Years
^	Sex = undefined
031992	Date = March, 19th 1992
1147	Time = 11:47
[ETX]	End of text (ASCII code 03H)
4D	Checksum
[CR]	Carriage return (ASCII code 0DH)

Answer: If available, the HOST sends the according Test selection to the AU.

```
HOST 11:46:37  [STX];A^^^11^1^^^^^^^000042^^^3^03199211474800100011000000000
               0000000000000000000000000000001011111Test^1^mit^Identnummer^
               ^^^^^^^Hugo^^^^^^^^^^^^^^^^^^^^Arzt^^^^^^^^^^^^^^^^Patient^
               1^^^^^^Station^1^[ETX]C2[CR]

Format see Example 1
```

8.3. Result data from AU to HOST

(Detailed format of first conversation on the next page)

```
AU   12:05:52  [STX]:A^^^11^1^^^^^^^000042^^^3^0319921147^6^3^^5.10^^7-
               ^^^^2I^8^^^0.5I47^288.4&48^^5.40^49^^96.8L[ETX]42[CR]
HOST 12:05:53  [STX]>[ETX]3E[CR]

AU   12:05:58  [STX]>[ETX]3E[CR]
HOST 12:05:58  [STX]>[ETX]3E[CR]

...

AU   12:06:28  [STX]>[ETX]3E[CR]
HOST 12:06:28  [STX]>[ETX]3E[CR]

AU   12:06:28  [STX]:A^^^21^2^^^^^^^000043^^^3^0319921147^6^3^^5.01^^7-
               ^^^^2I^8^^^0.7I47^287.1&48^^5.35^49^^96.8L[ETX]47[CR]
HOST 12:06:29  [STX]>[ETX]3E[CR]

AU   12:06:34  [STX]>[ETX]3E[CR]
HOST 12:06:34  [STX]>[ETX]3E[CR]
```

Text format of example 3:

```
Analyzer sends Result data in Realtime mode.

AU   12:05:52  [STX]:A^^^11^1^^^^^^^000042^^^3^0319921147^6^3^^5.10^^7-
               ^^^^2I^8^^^0.5I47^288.4&48^^5.40^49^^96.8L[ETX]42[CR]
```

[STX]	Start of text (ASCII code 02H)
:	Frame character: data frame
A	Function character: Class1 / Routine sample / Realtime communication / Barcode mode
^	Space
[Sample information]	
^^1	Sample number 1
1	Disk number 1
^1	Position 1
^^^^^^^000042	Identnumber
^^^3	Age factor = Years
^	Sex = undefined
031992	Date = March, 19th 1992
1147	Time = 11:47
[Result data]	
^6	Test count (6 results follow)
^3	Test No. 3
^^5.10	value = 5,10
^	data alarm
^7	Test No. 7
^^^^^2	value = 2
I	data alarm (Reac. limit over at all points)
^8	Test No. 8
^^^0.5	value = 0,5
I	data alarm (Reac. limit over at all points)
47	Test No. 47
^288.4	value = 288,4
&	data alarm (Sample value abnormal)
48	Test No. 48
^^5.40	value = 5,4
^	data alarm
49	Test No. 49
^^96.8	value = 96,8
L	data alarm (Level error)
[ETX]	End of text (ASCII code 03H)
42	Checksum
[CR]	Carriage return (ASCII code 0DH)

8.4. Absorbance data from AU to HOST

(Detailed format of first conversation on the next page)

```
AU   12:56:36  [STX]:O^^^11^1^^^^^^^000042^^^3^0319921250^7-^^^^1I^^^^^^^^^
               ^^^^^^^^^^^^^^^^^^^^432^^^^^^^^^^^^^^^^^^13^^1341^^^^41^^^^
               47^^^648^^3818^^3986^^3985^^3985^^3987^^3988^^3987^^3987^^39
               90[ETX]8D[CR]
HOST 12:56:36  [STX]>[ETX]3E[CR]

AU   12:56:41  [STX]>[ETX]3E[CR]
HOST 12:56:41  [STX]>[ETX]3E[CR]

...

AU   12:56:56  [STX]>[ETX]3E[CR]
HOST 12:56:56  [STX]>[ETX]3E[CR]

AU   12:56:57  [STX]:O^^^21^2^^^^^^^000043^^^3^0319921251^7^^^^^0I^^^^^^^^^
               ^^^^^^^^^^^^^^^^^^^400^^^^^^^^^^^^^^^^^^13^^1354^^^^44^^^^
               47^^^658^^3866^^4013^^4014^^4013^^4015^^4014^^4014^^4016^^40
               14[ETX]04[CR]
HOST 12:56:57  [STX]>[ETX]3E[CR]

AU   12:57:02  [STX]>[ETX]3E[CR]
HOST 12:57:02  [STX]>[ETX]3E[CR]

AU   12:57:07  [STX]>[ETX]3E[CR]
HOST 12:57:07  [STX]>[ETX]3E[CR]

AU   12:57:08  [STX]:O^^^11^1^^^^^^^000042^^^3^0319921250^3^^5.12^^^^^^^^^^
               ^^^^^^^^^^^^^^^^^^^^70^^^^^^^^^^^^^^^^^^15^^^^73^^^^69^^^^
               68^^^^67-^^280^^^^45^^^194^^^285^^^348^^^394^^^429^^^459^^^4
               81^^^495^^^511[ETX]52[CR]
HOST 12:57:08  [STX]>[ETX]3E[CR]

AU   12:57:13  [STX]>[ETX]3E[CR]
HOST 12:57:13  [STX]>[ETX]3E[CR]

AU   12:57:18  [STX]>[ETX]3E[CR]
HOST 12:57:18  [STX]>[ETX]3E[CR]

AU   12:57:23  [STX]>[ETX]3E[CR]
HOST 12:57:23  [STX]>[ETX]3E[CR]

AU   12:57:24  [STX]:O^^^21^2^^^^^^^000043^^^3^0319921251^3^^5.11^^^^^^^^^^
               ^^^^^^^^^^^^^^^^^^^^51^^^^^^^^^^^^^^^^^^15^^^161^^^^74^^^^
               72^^^^69-^^253^^^^53^^^199^^^289^^^349^^^396^^^430^^^459^^^4
               80^^^495^^^510[ETX]5C[CR]
HOST 12:57:24  [STX]>[ETX]3E[CR]
```

Text format of example 4:

```
Analyzer sends Absorbance data in realtime mode.

AU   12:56:36  [STX]:O^^^11^1^^^^^^^000042^^^3^0319921250^7-^^^^1I^^^^^^^^^
               ^^^^^^^^^^^^^^^^^^^^432^^^^^^^^^^^^^^^^^^13^^1341^^^^41^^^^
               47^^^648^^3818^^3986^^3985^^3985^^3987^^3988^^3987^^3987^^39
               90[ETX]8D[CR]
```

[STX]	Start of text (ASCII code 02H)
:	Frame character: data frame
O	Function character: Class1 / Routine sample / Realtime communication / Barcode mode
^	Space
[Sample information]	
^^1	Sample number 1
1	Disk number 1
^1	Position 1
^^^^^^^000042	Identnumber
^^^3	Age factor = Years
^	Sex = undefined
031992	Date = March, 19th 1992
1250	Time = 12:50
[Analytical data 1 to 4]	
^7	Channel No.
-^^^^1	value = -1
I	data alarm (React. limit over at all points)
^^	Channel No.
^^^^^^	no value
^	data alarm
^^	Channel No.
^^^^^^	no value
^	data alarm
^^	Channel No.
^^^^^^	no value
^	data alarm
[Blank values 1 to 4]	
^^^432	Stopped cell blank 1
^^^^^^	Passed cell blank 1
^^^^^^	Passed cell blank 2
^^^^^^	Passed cell blank 3
[Absorbance values]	
13	Point count = 13
^^1341	Abs. data 1
^^^^41	Abs. data 2
^^^^47	Abs. data 3
^^^648	Abs. data 4
^^3818	Abs. data 5
^^3986	Abs. data 6
^^3985	Abs. data 7
^^3985	Abs. data 8
^^3987	Abs. data 9
^^3988	Abs. data 10
^^3987	Abs. data 11
^^3987	Abs. data 12
^^3990	Abs. data 13
[ETX]	End of text (ASCII code 03H)
8D	Checksum
[CR]	Carriage return (ASCII code 0DH)

8.5. Photometry-assay Calibration data from AU to HOST

(Detailed format of first conversation on the next page)

```
AU   11:59:18  [STX]:M^42S1-^^111^^6406-^^102^^6345I^^^^^^2-^^102^^6201-^^102
               ^^6284I^^^^^^N^^^^^^^[ETX]42[CR]
HOST 11:59:19  [STX]>[ETX]3E[CR]

AU   11:59:24  [STX]:M192S1^^^^^1^^^106^^^^^0^^^101^^^^^^^2^^^^21^^^724-^^^^2
               ^^^105V^^^^^^N^^^^^^^[ETX]3C[CR]
HOST 11:59:24  [STX]>[ETX]3E[CR]

AU   11:59:29  [STX]>[ETX]3E[CR]
HOST 11:59:29  [STX]>[ETX]3E[CR]

AU   11:59:34  [STX]>[ETX]3E[CR]
HOST 11:59:34  [STX]>[ETX]3E[CR]

AU   11:59:39  [STX]>[ETX]3E[CR]
HOST 11:59:39  [STX]>[ETX]3E[CR]

AU   11:59:39  [STX]:M^71S1^^^^^3^^3605^^^^^0^^3634I^^^^^^N^^^^^^^[ETX]8B[CR]
HOST 11:59:40  [STX]>[ETX]3E[CR]

AU   11:59:45  [STX]>[ETX]3E[CR]
HOST 11:59:45  [STX]>[ETX]3E[CR]

...

AU   12:01:30  [STX]>[ETX]3E[CR]
HOST 12:01:30  [STX]>[ETX]3E[CR]

AU   12:01:30  [STX]:M^81S1^^^^^0^^5403^^^^15^^5427I^^^^^^N^^^^^^^[ETX]9F[CR]
HOST 12:01:30  [STX]>[ETX]3E[CR]
```

Text format of example 5:

Analyzer sends Photometry assay Calibration data to the HOST.

```
AU   11:59:18  [STX]:M^42S1-^^111^^6406-^^102^^6345I^^^^^^2-^^102^^6201
               -^^102^^6284I^^^^^^N^^^^^^^[ETX]42[CR]
```

[STX]	Start of text (ASCII code 02H)
:	Frame character: data frame
M	Function character: Photom. cal data
^4	Channel 4
2	No. of standards
S	Calibration alarm
1	STD No. 1
-^^111	1st absorbance data
^^6406	1st initial absorbance data
-^^102	2nd absorbance data
^^6345	2nd initial absorbance data
I	data alarm
^^^^^^	Prozone value
2	STD No. 2
-^^102	1st absorbance data
^^6201	1st initial absorbance data
-^^102	2nd absorbance data
^^6284	2nd initial absorbance data
I	data alarm
^^^^^^	Prozone value
N	N for 'no SD value'
^^^^^^	value
^	decimal point position
[ETX]	End of text (ASCII code 03H)
42	Checksum
[CR]	Carriage return (ASCII code 0DH)

8.6. ISE Calibration data from AU to HOST

```
AU   11:51:25  [STX]:NB^^^1-^32.8^^2-^38.7^^3-^32.2^^4-^35.8^^5^^52.0^^6^15
               6.0^^7^136.6^^8^^^7.4^^^1-^33.5^^2-^49.7^^3-^30.7^^4-^41.0^^
               5^^51.6^^6^^6.20^^7^^4.43^^8^^0.27^S^1-343.0L^2-343.0^^3-343
               .0^^4-^76.1L^5^^^^^^E^6^^^^^^D^7^^^^^^X^8^^^^^^^[ETX]DC[CR]
HOST 11:51:25  [STX]>[ETX]3E[CR]

AU   11:51:30  [STX]>[ETX]3E[CR]
HOST 11:51:30  [STX]>[ETX]3E[CR]

...
```

Text format of example 6:

```
Analyzer sends ISE Calibration data to the HOST.

AU   11:51:25  [STX]:NB^^^1-^32.8^^2-^38.7^^3-^32.2^^4-^35.8^^5^^52.0^^6^15
               6.0^^7^136.6^^8^^^7.4^^^1-^33.5^^2-^49.7^^3-^30.7^^4-^41.0^^
               5^^51.6^^6^^6.20^^7^^4.43^^8^^0.27^S^1-343.0L^2-343.0^^3-343
              .0^^4-^76.1L^5^^^^^^E^6^^^^^^D^7^^^^^^X^8^^^^^^^[ETX]DC[CR]
```

[STX]	Start of text (ASCII code 02H)
:	Frame character: data frame
N	Function character: ISE cal data
B	Typ B = Tests Na, K, Cl
^	Space
^	Na data alarm
^1	Cal. data 1
-^32.8	value = -32,8
^	data alarm 1
^2	Cal. data 2
-^38.7	value = -38,7
^	data alarm 2
^3	Cal. data 3
-^32.2	value = -32,2
^	data alarm 3
^4	Cal. data 4
-^35.8	value = -35,8
^	data alarm 4
^5	Cal. data 5
^^52.0	value = 52,0
^	data alarm 5
^6	Cal. data 6
^156.0	value = 156,0
^	data alarm 6
^7	Cal. data 7
^136.6	value = 136,6
^	data alarm 7
^8	Cal. data 8
^^^7.4	value = 7,4
^	data alarm 8

^ ^1 -^33.5 ^ ^2 -^49.7 ^ ^3 -^30.7 ^ ^4 -^41.0 ^ ^5 ^^51.6 ^ ^6 ^^6.20 ^ ^7 ^^4.43 ^ ^8 ^^0.27 ^	K data alarm Cal. data 1 value = -33,5 data alarm 1 Cal. data 2 value = -49,7 data alarm 2 Cal. data 3 value = -30,7 data alarm 3 Cal. data 4 value = -41,0 data alarm 4 Cal. data 5 value = 51,6 data alarm 5 Cal. data 6 value = 6,2 data alarm 6 Cal. data 7 value = 4,43 data alarm 7 Cal. data 8 value = 0,27 data alarm 8
S ^1 -343.0 L ^2 -343.0 ^ ^3 -343.0 ^ ^4 -^76.1 L ^5 ^^^^^^ E ^6 ^^^^^^ D ^7 ^^^^^^ X ^8 ^^^^^^ ^ [ETX] DC [CR]	Cl data alarm (STD error) Cal. data 1 value = -343,0 data alarm 1 (Level error) Cal. data 2 value = -343,0 data alarm 2 Cal. data 3 value = -343,0 data alarm 3 Cal. data 4 value = -76,1 data alarm 4 (Level error) Cal. data 5 no value data alarm 5 (Slope abnormal) Cal. data 6 no value data alarm 6 (Int. std. concentr. abnormal) Cal. data 7 no value data alarm 7 (Calculation disable) Cal. data 8 no value data alarm 8 End of text (ASCII code 03H) Checksum Carriage return (ASCII code 0DH)

8.7. Control data from AU to HOST

```
AU   13:44:55  [STX]:K^101^^^^^^^^PNU^^^^^^^^^^^^^^^^^^^^^1^8^^^0.5I[ETX]8F[CR]
HOST 13:44:55  [STX]>[ETX]3E[CR]

AU   13:45:05  [STX]:K^201^^^^^^^^PNP^^^^^^^^^^^^^^^^^^^^^1^8^^^0.2I[ETX]88[CR]
HOST 13:45:05  [STX]>[ETX]3E[CR]

AU   13:45:07  [STX]:K^102^^^^^^^^PNU^^^^^^^^^^^^^^^^^^^^^1^3^^5.08^[ETX]7A[CR]
HOST 13:45:08  [STX]>[ETX]3E[CR]

AU   13:45:10  [STX]:K^202^^^^^^^^PNP^^^^^^^^^^^^^^^^^^^^^1^3^^4.43^[ETX]74[CR]
HOST 13:45:10  [STX]>[ETX]3E[CR]
```

Text format of example 7:

Analyzer sends Control data to the HOST.

```
AU   13:44:55  [STX]:K^101^^^^^^^^PNU^^^^^^^^^^^^^^^^^^^^^1^8^^^0.5I[ETX]
               8F[CR]
```

[STX]	Start of text (ASCII code 02H)
:	Frame character: data frame
K	Function character: Control sample
^	Space
[Sample Information]	
1	Control No. 1
01	Sequence No. 1
^	Disk No (space)
^^	Position (2 spaces)
^^^^^PNU^^^^^	Control name
^^^^	Age (4 spaces)
^	Sex (space)
^^^^^^	Date (6 spaces)
^^^^	Time (4 spaces)
[Result data]	
^1	Test count (one result follows)
^8	Test No. 8
^^^0.5	value = 0,5
I	data alarm (Reac. limit over at all points)
[ETX]	End of text (ASCII code 03H)
8F	Checksum
[CR]	Carriage return (ASCII code 0DH)

8.8. Specific Result Request from HOST to AU

```
Manuell communication Starttime: 12:13:05

AU   12:13:20  [STX]>[ETX]
HOST 12:13:20  [STX]>[ETX]

AU   12:13:25  [STX]>[ETX]
HOST 12:13:25  [STX]>[ETX]

AU   12:13:30  [STX]>[ETX]
HOST 12:13:30  [STX]<a^^^^^^^^^^^^^^000043^^^^^^^^^^^^^^^[ETX]64[CR]

AU   12:13:31  [STX]>[ETX]
HOST 12:13:31  [STX]>[ETX]

AU   12:13:32  [STX]>[ETX]
HOST 12:13:32  [STX]>[ETX]

AU   12:13:33  [STX]>[ETX]
HOST 12:13:33  [STX]>[ETX]

AU   12:13:34  [STX]>[ETX]
HOST 12:13:34  [STX]>[ETX]

AU   12:13:35  [STX]>[ETX]
HOST 12:13:35  [STX]>[ETX]

AU   12:13:36  [STX]:a^^^20^2^^^^^^^000043^15310410920955^1^7-^^^^4I[ET
               X]75[CR]
HOST 12:13:36  [STX]>[ETX]

AU   12:13:41  [STX]>[ETX]
HOST 12:13:41  [STX]>[ETX]

AU   12:13:46  [STX]>[ETX]
HOST 12:13:46  [STX]>[ETX]

.......
```

Text format of example 8:

HOST sends specific result request / AU sends the result HOST 12:13:30 [STX]<a^^^^^^^^^^^^^^000043^^^^^^^^^^^^^^^[ETX]64[CR]	
[STX] < a ^ [Sample Information] ^^^ ^ ^^ ^^^^^^^000043 ^^^^ ^ ^^^^^^ ^^^^ [ETX] 64 [CR]	Start of text (ASCII code 02H) Frame character: Result Request Function character: Class1 / Routine sample / Batchmode / Barcode mode Space Sample No. undefined Disk No undefined Position No undefined Ident No. Age undefined Sex undefined Date undefined Time undefined End of text (ASCII code 03H) Checksum Carriage return (ASCII code 0DH)

9. Figures and Tables

Appendix A - ASCII Chart

Char Hex Dez	Char Hex Dez	Char Hex Dez	Char Hex Dez	Char Hex Dez	Char Hex Dez	Char Hex Dez	Char Hex Dez
NUL 00 0	DLE 10 16	Space 20 32	0 30 48	@ 40 64	P 50 80	` 60 96	p 70 112
SOH 01 1	DC1 11 17	! 21 33	1 31 49	A 41 65	Q 51 81	a 61 97	q 71 113
STX 02 2	DC2 12 18	" 22 34	2 32 50	B 42 66	R 52 82	b 62 98	r 72 114
ETX 03 3	DC3 13 19	# 23 35	3 33 51	C 43 67	S 53 83	c 63 99	s 73 115
EOT 04 4	DC4 14 20	$ 24 36	4 34 52	D 44 68	T 54 84	d 64 100	t 74 116
ENQ 05 5	NAK 15 21	% 25 37	5 35 53	E 45 69	U 55 85	e 65 101	u 75 117
ACK 06 6	SYN 16 22	& 26 38	6 36 54	F 46 70	V 56 86	f 66 102	v 76 118
BEL 07 7	ETB 17 23	' 27 39	7 37 55	G 47 71	W 57 87	g 67 103	w 77 119
BS 08 8	CAN 18 24	(28 40	8 38 56	H 48 72	X 58 88	h 68 104	x 78 120
HT 09 9	EM 19 25	) 29 41	9 39 57	I 49 73	Y 59 89	i 69 105	y 79 121
LF 0A 10	SUB 1A 26	* 2A 42	: 3A 58	J 4A 74	Z 5A 90	j 6A 106	z 7A 122
VT 0B 11	ESC 1B 27	+ 2B 43	; 3B 59	K 4B 75	[5B 91	k 6B 107	{ 7B 123
FF 0C 12	FS 1C 28	, 2C 44	< 3C 60	L 4C 76	\ 5C 92	l 6C 108	| 7C 124
CR 0D 13	GS 1D 29	- 2D 45	= 3D 61	M 4D 77	] 5D 93	m 6D 109	} 7D 125
SO 0E 14	RS 1E 30	. 2E 46	> 3E 62	N 4E 78	^ 5E 94	n 6E 110	~ 7E 126
SI 0F 15	US 1F 31	/ 2F 47	? 3F 63	O 4F 79	_ 5F 95	o 6F 111	DEL 7F 127

Appendix B - Differences between the HIT 747 and 911

Item	HIT 747	HIT 911
Cable connection	No handshake connection necessary	Pins DSR, DCD, DTR have to be connected on analyser side
Communication status after CU power off/on while host communication on	Communication still ON; CU starts with REP frame	Communication ON if system parameters were stored
Communication cycle time	3 sec	5 sec
Delay after receiving REC/SUS frame from Host	8 sec	no effect
Delay of ANY frame from analyser after receiving a test selection in batch mode	~0	5 sec
Frame types	OPC and SPM frames available	No OPC and SPM frames
End-of-data type	Only one fixed type: [ETX]<CKSH><CKSL>[CR]	One of five options selectable on system parameters screen 1. [ETX] <BCC> 2. [CR] [LF] [ETX] 3. [ETX] 4. [ETX] [CR] [LF] 5. [ETX]<CKSH><CKSL>[CR]
Result transmission of calculated tests	Results of calculated tests are sent with the test counts 53 to 60	Results of calculated tests are not sent to the host
Transmission of test assignment information	The TNNA array contains the 60 names for the 60 tests. It is sent when program is started or testnames are changed or testcode to channel relation is changed by operator. The TCA array contains up to 4 test codes for each of the 32 channels. It is sent when program is started or testcode to channel relation is changed by the operator.	No transmission of test assignment information
Data alarm characters	different - refer to the corresponding interface manual	
Function characters	different - refer to the corresponding interface manual	

Item	**HIT 747**	**HIT 911**
Identification of transmission mode for result transmission	seperate character following the function character instead of space: realtime transmission A batch transmission B high priority transm. C	transmission mode information is included in function character
Format of sample information	different - refer to the corresponding interface manual	
Format of test selection information	different - refer to the corresponding interface manual	
Test request values for rerun samples	reduced volume 2 analyser decided vol 3	reduced volume 2 increased volume 3 analyser decided vol 4
Format of ISE calibration results	different - refer to the corresponding interface manual	
Format of photometry-assay calibration results	different - refer to the corresponding interface manual	

Appendix C - Tabel of System I/F Alarms (Category 111)

Sub code	Description	Possible cause	Comm. stopped
1	The text cannot be received from the Host within the specified period of time	(HOST > 911) timeout error	**X**
2	The data cannot be transmitted to the system within the specified period of time	(911 > HOST) timeout error	**X**
3	Communication is attempted when the buffered controller has not been initialized properly.		**X**
4	A command cannot be issued to the buffered controller.		**X**
5	The end-of-command interrupt is not returned from the buffered controller.		**X**
6	An illegal command or invalid data has been written to the buffered controller.		**X**
7	An error has occured in accessing the FIFO buffer (buffered controller)		**X**
8	The serial interface LSI circuit of the buffered controller is defective.		**X**
9	An illegal interrupt has been attempted from the buffered controller.		**X**
10	In response to frame-by-frame transmission request from the analyser, REP frames have been transmitted from the Host in succession beyond the specified limit.		**X**
11	An illegal character has been found in the received text.	(HOST > 911) character error	
12	The character count between STX and ETX in the received text is out of the predetermined allowable range.	(HOST > 911) format error	
13	The transmission protocol procedure has been ignored in text transmission from the Host.	(HOST > 911) format error	
14	A vertical parity error has been found in the received data.	(HOST > 911) receiving error	
15	An overrun error has been found in the received data.	(HOST > 911) receiving error	
16	A framing error has been found in the received data.	(HOST > 911) receiving error	
17	The BCC value of the received text does not agree with the counted by the analyser.	(HOST > 911) BCC error	
18	The check sum value of the received text does not agree with the counted by the analyzer.	(HOST > 911) check sum error	

Appendix D - Text Configuration Table

The columns and rows of the following tables have the following contents:

Frame type	Frame	Frame items				
Sender	bytes	Item length in bytes				
Positive response	ANY	STX	>	End-of-data code		
CU	9	1	1	1 to 4		
Positive response	MOR	STX	>	End-of-data code		
Host	2+end	1	1	1 to 4		
Negative response	REP	STX	?	End-of-data code		
CU / Host	2+end	1	1	1 to 4		
Bad and suspend	SUS	STX	@	End-of-data code		
CU / Host	2+end	1	1	1 to 4		
Ok and suspend	REC	STX	A	End-of-data code		
Host	2+end	1	1	1 to 4		
TS Request	SPE	STX	;	Fu	Sample Information	End-of-data code
CU	38+end	1	1	2	34	1 to 4

Result Request	RES
Host	38+end

STX	<	Fu	Sample Information	End-of-data code
1	1	2	34	1 to 4

Test selection	SPE
Host	193+end

STX	;	Fu	Sample Information	Channel Count	Test selection	Comments	End-of-data code
1	1	2	34	2	48	105	1 to 4

Analytical data	FR1 to END
AU	508+end

STX	:	Fu	Sample Information	Channel count	Analytical data 1 to 52	End-of-data code
1	1	2	34	2	468	1 to 4

Absorbance data	FR1 to END
AU	394+end

STX	:	Fu	Sample Information	Analytical data 1 to 4	Blank data 1 to 4	Point count	ABS values 1 to 49	End-of-data code
1	1	2	34	36	24	2	294	1 to 4

Photometry assay Calib	END
AU	207+end

STX	:	M	Test no.	STD count	Calib alarm	STD data 1 to 6	SD value	End-of-data code
1	1	1	2	1	1	192	8	1 to 4

ISE Calib	END
AU	224+end

STX	:	N	ISE type	ISE calibration data 1 to 3	ETX	CSH	CSL	CR
1	1	2	1	219	1	1	1	1

The above tables show the text configuration when the maximum text length is set to 512 bytes.
For details about the format of the data items refer to the corresponding chapter in this document.