Host Interface Manual

for

Roche/Hitachi

MODULAR SWA
(New Mode)

Version 1.4

Version Control

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1. Overview

1.1. Purpose

This document details the specifications for the Roche/Hitachi MODULAR Analytics DPE Combination host interface. This interface regulates data transmissions between the core of the system and the host computer.
Questions concerning this document should be referred to Technical Support.

1.2. Scope

Detailed information on operation of the system is beyond the scope of this document. The information offered here is strictly to aid programmers in grasping very basic operational features of the analyzer. Please refer to the Operator's Manual for more detailed information.

1.3. Conventions

This document consists primarily of a series of tables that show the information needed to successfully interface to the system. The basic concept of data transfer in this interface is the exchange of data and control frames between the host system and the analyzer.

1.4. Content

This document gives the reader a basic understanding of the system operation with a host, and describes the following:

- Basic System Architecture
- Sample Processing
- Sample Types
- Rerun Modes
- Test Selections
- Operational Modes

2. Roche/Hitachi MODULAR System Architecture

2.1. Overview

Before discussing how the host communication works, it is important to understand the basic architecture of the system. This section provides an overview of the architecture and discusses some specialized items of interest pertaining to the analytical system.

The system consists of three types of devices: (Refer to Figure 1)

- The Control Unit that displays and edits the results of analysis, allows operator interaction with the system, and allows configuration settings
- One or more analytical units (AU), also known as modules, that measure samples using reagents
- A core that physically transfers samples between the analytical units and communicates with the host system.

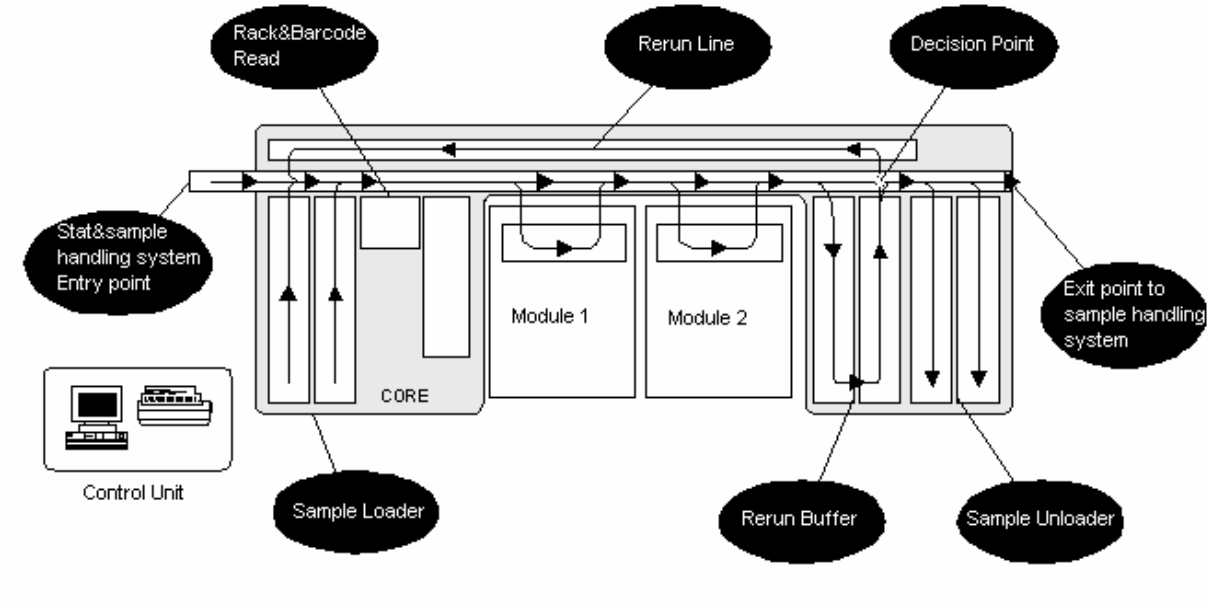


Figure 1: Roche/Hitachi MODULAR System Architecture

2.2. Sample Carriers

The Roche/Hitachi MODULAR Analytics DPE Combination uses 5-position racks to process samples. These racks hold tubes, standard sample cups, micro sample cups, or standard sample cups on tubes. During analysis, the analyzer reads the rack number, identifies the type of samples according to the rack number range, identifies the sample, and then analyzes it according to the test selections for that sample.

The host can download a microcup container type.

Note:
If microcups are used, they are not processed on D-Module(s) or E-Module(s). Refer to Table 1 for the types of samples, racks and their relationships to rack number ranges.

2.3. Samples

Samples that are handled by the analyzer are separated into:

- Standard samples used for calibration
- Control samples for quality control
- Patient samples

2.4. Sample Type

Patient samples and controls are classified into five (5) types. Each type can have separate parameters for calibration, normal ranges, etc., within the system:

- Ser/Pl: Blood Serum/Plasma
- Urine: Urine (not used on E170)
- CSF: Cerebral Spinal Fluid (not used on E170)
- Suprnt: Supernatant (not used on E170)
- Other: Other Fluids

2.5. Automatic vs. Manual Rerun

As seen in Table 2 on page 9, Routine and Stat samples can be processed in a mode called Auto Rerun. This is different from a manual rerun sample. Each mode is described below.

2.5.1. Automatic Rerun

Each test defined on the analyzer can have parameters that indicate when a sample needs to be reprocessed because the result is outside the pre-determined value. Usually, this means running the sample through the system once more while using a different sample volume. When the system is configured with the Auto Rerun mode enabled, a sample rack is held at a rerun buffer until results are available.

Note: Auto Rerun is requested from the Start Conditions/Automatic Rerun window.

When automatic rerun is selected, if one or more of the results falls outside the pre-determined rerun parameter values (data flagged results), the rack is automatically resent through the system and reprocessed, usually with a new sample volume, where on E-Modules the dilutions are made using the original sample volumes only. The host has an opportunity to modify the test selections before Auto Rerun samples are processed (refer to Section 3.1.1.6). A sample with a triggering data alarm attached to the result is automatically rerouted to the rerun line for further processing.

Samples being automatically rerun use either a normal, decreased, increased, or diluted sample volume, depending on the module, type of data alarm, and test parameter configuration. The analyzer applies the appropriate correction to the results of the rerun. Results for the original test and the rerun are reported separately to the host.

A sample is only automatically rerun once; however, any result that causes another applicable data alarm allows the operator to include the sample in a manual rerun process. Rerun samples with tests that still have flags appear on the manual rerun list and can be manually rerun by the operator.

2.5.2. Manual Rerun

The operator can manually process reruns. To do so, the operator can place samples on a rack, program test selections either at the core or at the host, then place the rack onto the system for processing. Any tests with flags from the previous analysis would also process.

2.6. Sample Number and ID Modes

The analyzer can be operated in one of two modes for identifying samples:

- Sample Number Mode
- ID Mode.

The most common mode used is ID Mode, which has provisions for processing samples that have damaged, unreadable or missing barcode labels (see Section 3.1.2.8). The user can switch between ID Mode and Sample Number Mode during standby without clearing the database, but switching is not recommended. Generally, once a mode is decided upon, it is rarely changed.

2.6.1. Sample Number Mode

In this mode, the barcode reader is turned off. Samples are tracked by an internal sample number that increments sequentially as samples are processed, and also by the rack ID and position number.

The sample number mode requires the operator to either load the analyzer by using a load list generated by the host system, or make test selections manually on the analyzer.

2.6.2. ID Mode

This is a random mode that allows barcoded samples to be placed on the system in any order. In ID Mode, samples without barcodes and samples with damaged or unreadable barcodes can be processed by a manual setting. The ID mode is applicable for both routine and Stat samples.

2.7. Rack Types

Patient samples can use three separate racks. These racks indicate to the system how the samples on a particular rack are to be processed. Rack types include:

- Routine rack for routine analysis
- Stat rack that interrupts between routine analysis
- Rerun rack for Manual Rerun.[1]

Rack Type	Rack Numbers	Visible Label	Purpose	Auto Rerun[1]
Routine*	5001 ~ 8999	001 ~ 3999	Routine analysis of patient samples	Yes
Stat*	4001 ~ 4080	S001 ~ S080	Emergency analysis	Yes
Rerun*#	A001 ~ A200	R001 ~ R200	Routine sample manual rerun[1]	No
Control	3001 ~ 3999	Q001 ~ Q999	Quality control	No
Calibration	2001 ~ 2999	C001 ~ C999	Calibration	No

Table 1: Types of Samples and Rack Numbers

Above Rack Numbers are valid if the 'Change Rack ID' option on the Host Communication Setting/Text Setting screen is disabled. See for the alternative Rack IDs.

[1] The differences between Auto and Manual rerun are described in Section 2.5.

* Subsets of the above routine, Stat, and rerun rack ranges are user-definable by sample type (Ser/Pl, Urine, CSF, Suprnt, Other on the Utility/System screen).

Applies only to Sample Number mode. For ID mode use Routine racks for Rerun.

3. Sample Processing

3.1. Realtime Communication

The relationships between Realtime Communication functions and types of samples are shown in Table 2. The following are the details regarding communication procedures and communication functions.

Communication Functions	Patient Samples			Control Sample	Standard Sample
	Routine	Stat	Rerun		
Test selection inquiry	o	o	o	x	x
Analytical data transmission	o	o	o	o	o
Automatic Rerun test selection information reception	o	o	x	x	x
Automatic Rerun test selection inquiry	o	o	x	x	x
Automatic Rerun analytical data transmission	o	o	x	x	x

(o = Possible; x = not possible)

Table 2: Realtime Communication Functions

3.1.1. Rack Flow

The best way to understand the types of communication a host system can have with the Roche/Hitachi MODULAR system is to understand the flow of samples through the system.

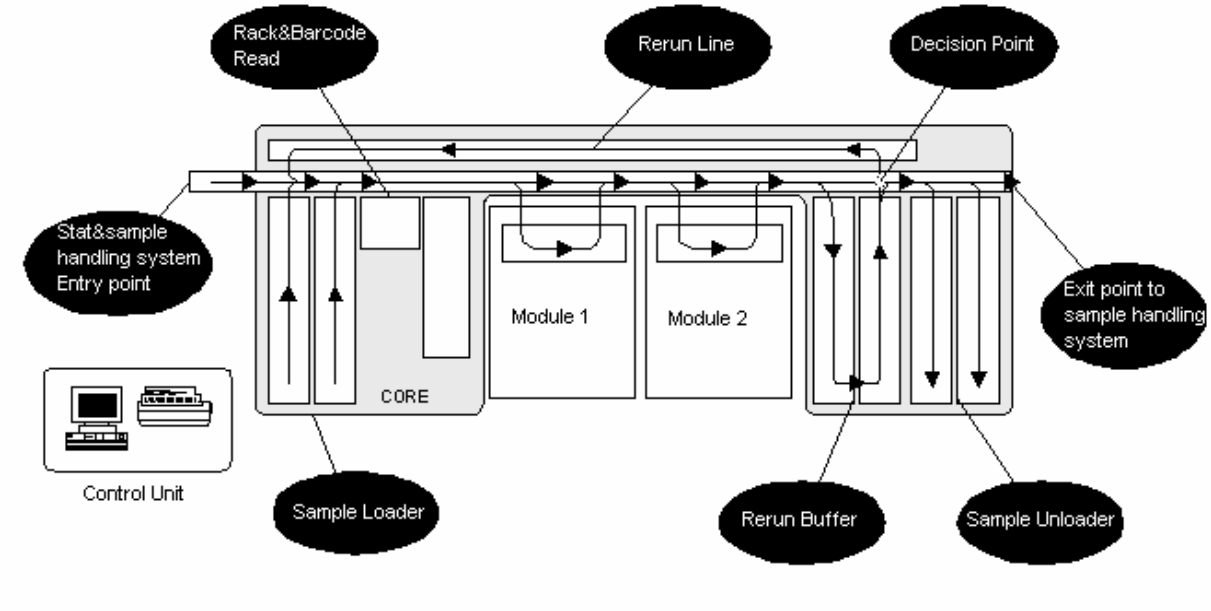


Figure 2: Rack Flow

3.1.1.1. Sample Introduction

Samples are placed into 5-position racks, then onto the sample loader, which consists of two trays. The trays feed racks onto the system sequentially from one tray until it is empty, then from the other.

3.1.1.2. Sample Identification and Test Selecting

Multiple racks (a maximum of five samples per rack) are fed continually from the sample loader. At the read station, the system reads the rack ID and sample ID and uses the information read as the key. The system looks for test selections for each sample, depending on configuration settings. Test selections can come from:

- The host prior to testing
- The host as a result of a TS Information Inquiry initiated by the analyzer
- Manually programmed TS on the analyzer by the operator
- A Default Profile set on the analyzer for any sample without TS information from one of the other sources.

3.1.1.3. Rack Routing

The Roche/Hitachi MODULAR system has a very sophisticated scheduler that determines where a sample should be processed. It is possible to have the same test on more than one analytical unit (module). The scheduler decides the optimal rack routing to maximize throughput. Also, because of different processing times for different tests and multiple modules, it is possible for samples to be completed and results reported in a different order than they were sampled.

3.1.1.4. Sample Aspiration

A rack is sent to one or more of the installed modules for sampling. At each module, a rack with a sample to be processed on a particular module is moved off the main line, then through that module's sampling station. This method allows racks to pass each other, thereby optimizing system throughput.

3.1.1.5. Rerun Buffer

After sampling, when Auto Rerun is enabled, racks are held in a Rerun Buffer until all test results for all samples on that rack are complete.

If Auto Rerun TS is enabled on the Utility/System/Host Communication Setting/Text Setting window and Autorerun is checked for the assay in Utility/Application/Range screen, the host has one of two opportunities to alter test selections for reruns:

- At the decision point
- At the barcode reader.

3.1.1.6. Decision Point

In the Auto Rerun mode with Auto Rerun TS enabled on the Utility/System/Host Communication Setting/Text Setting window, the sample reaches a decision point once results are available. The host can, at this time, modify and download any new and rerun test selections on the sample. Once the results for all samples within the rack are available, the rack moves depending on the following factors:

- If the host does not respond by expiration of the Auto Rerun TS Timeout interval set on the Utility/System/Host Communication Setting/Text Setting window, an alarm is issued (112-002), the rack moves to the rerun line and a rerun TS query is initiated at the barcode reader for all samples.
- If the host responds with test selections for any samples on the rack, the rack moves to the rerun line.

- If the host sends cancellation messages for all samples, the rack moves to the sample unloader. Generally, the host would not do this if any of the samples had a qualifying flag. If no samples have flags, and the host does not want to make additional test selections, the host sends a cancellation message. If the cancellation message is not sent, the rack moves to the rerun line and then to the barcode reader where a test selection query is generated for all samples.

Note: The Auto Rerun TS Timeout can be configured at the analyzer. Great care should be taken when changing the timeout from the default (10 seconds), as increasing this timeout could adversely affect system throughput.

3.1.1.7. Rerun Line

If the analyzer is configured to use the Automatic Rerun Test Selection Inquiry, the host has the opportunity to modify test selections for those samples that had qualifying data alarms when the sample is returned to the barcode reader via the rerun line.

If the host already has sent additional test selections for a given sample at the Decision Point, the analyzer does not send further inquiries to the host for that sample. Also, if the host fails to respond at the Decision Point, the Automatic Test Selection Inquiry is sent for all samples for which the host did not respond.

3.1.1.8. Sample Unloader

Racks that have completed processing are moved to the sample unloader. Eventually, the operator removes the completed racks. On the analyzer, the operator can locate a sample in the sample unloader by checking the Sample Trackingwindow. To access this window, go to the System Overview screen and touch Sample Tracking.

3.1.1.9. Sample Handling System

The system has provisions for integration to a Sample Handling System (SHS). When connected to an SHS, samples coming from the SHS are fed into the Stat position. The normal sample loader then becomes the entry port for Stat samples.

If the analyzer is not the termination point for samples, samples exit the analyzer at the Exit Point rather than being held in the sample unloader. (Refer to Figure 2.)

3.1.2. Communication Types

This section discusses the different types of communications between host and analyzer. Please refer to Figure 3 and Figure 4 throughout the following discussion for flow diagrams demonstrating how test selection works in realtime and for reruns.

3.1.2.1. Test Selection Information Inquiry

If the analyzer needs to ask the host for test selections, it uses a Test Selection Information Inquiry. Each Test Selection Information Inquiry contains information for one sample. Normally, the analyzer looks into its internal database for Test Selection (TS) information. If it finds TS information, processing proceeds using those test selections. Exceptions occur when the TS Inquire Always option is enabled.

3.1.2.1.1. If the Host Does Not Respond

If the analyzer does not receive TS information for a sample within the set timeout, an error is issued and the system shifts to the next sample. If a default profile has been configured on the analyzer, it is used for the sample that did not receive TS information from the host.

It is possible for the host to respond with TS information for samples not requested. The TS information for the sample not requested is registered in the database. The analyzer accepts the TS for samples requested up to the specified timeout period.

3.1.2.1.2. Inquiry Timeout

The Test Selection Information Inquiry has an associated timeout interval that can be set on the Utility/System/Host Communication Setting/Text Setting window of the analyzer. Its range is from 10 seconds to 9999. If the TS Timeout interval is not enabled, the analyzer waits indefinitely until test selections are available from the host.

Note: Increasing the TS Timeout interval from the default of 10 seconds can significantly delay processing. The system delays processing for the time specified if the host has not responded. This can have significant impact on system throughput.

If the host has a good response time, setting the timeout longer should not reduce throughput, but would allow for the occasional delay from the host.

3.1.2.1.3. TS Inquire Always

If TS Inquire Always is enabled, the analyzer sends a TS inquiry to the host regardless of whether test selections exist internally. An alarm (111-002) is issued if the host does not respond, the internal database is searched and test selections are used, if found. If internal test selections are not available, the default profile, if defined, is processed. If no default profile is defined, the sample is skipped and an alarm is issued.

Note: This only applies to samples that do not already have test results.

3.1.2.2. Analytical Data Transmission

At the Analytical Unit (module), the analysis is performed based on the rack and the TS information received from the core. When the analysis is completed, the result of the analysis is reported to the core and then compiled there.

Test results are output to the host sample by sample when all the tests of a sample become available. While this occurs, the rack is held in the Rerun Buffer if Auto Rerun is enabled.

The patient sample test result with *Review by exception* data flag attached is not sent to the host. Control sample test result is sent to the host even with *Review by exception* data flag. The data flags for this feature may be selected on the Utility/System/Review by Exception screen.

For controls, the test results are output to the host test by test as soon as the result becomes available if the corresponding option is set on the Utility/System/Host Communication Setting/Text Setting screen. The data is sent before the real-time QC processing. If this option is disabled, the results are sent module by module.

3.1.2.3. Automatic Rerun Test Selection Information Reception

The host can transmit Automatic Rerun Test Selection Information after receiving results until the specified TS Timeout interval is reached. This occurs at the Decision Point as described in Section 3.1.1.6. The host can select additional tests for any sample on a rack. Racks with samples that do not receive TS information within the timeout interval and that have at least one test with a data flag on at least one sample, become an error and transfer to the rerun line whether there is Rerun Test Selection Information or not.

If no Auto Rerun flags exist for any sample in a rack, and the host does not want to rerun any tests or add any additional tests, the host can send a cancellation message for each sample in the rack. The rack then proceeds to the sample unloader. This can help increase system throughput.

The host also has an opportunity to send the Automatic Rerun Test Selection Information when a rack on the rerun line reaches the barcode/rack ID reader, and the analyzer sends the Automatic Rerun Test Selection Information Inquiry as described in Section 3.1.2.4.

3.1.2.4. Automatic Rerun Test Selection Information Inquiry

The analyzer sends the host a Rerun Test Selection Inquiry for samples on racks that return from the rerun line to the barcode reader. This process occurs only for samples that did not receive information from the host after results were sent. The analyzer then processes the racks as described in Section 3.1.2.3.

During processing, it is not possible for the analyzer to reprocess the samples for Auto Rerun. The analyzer, however, flags results according to the parameters set for each test, allowing the operator to perform a Manual Rerun as needed.

3.1.2.5. Automatic Rerun Analytical Result Data Transmission

The transmission of analytical results from Auto Rerun samples includes results for those tests that have been rerun and any additional tests ordered as explained in Section 3.1.2.3 and 3.1.2.4.

Since Auto Rerun is not repeated, the racks that have finished with a rerun are carried to the sample unloader without waiting for the output of the result.

3.1.2.6. Analysis Test Masking

The Roche/Hitachi MODULAR system has a function called Auto Masking that stops the analysis of a test if an abnormality should occur in reagent supply or in calibration results. The operator can also stop the analysis of test activities by performing a Manual Masking at the analyzer. Entire Analytical Unit (module) activities can also be stopped by an operator-initiated instruction at the analyzer referred to as Module Masking. Tests masked using these masking functions do not process even if there is a request from the host.

3.1.2.7. Manual Rerun Method

An operator can initiate Manual Rerun by replacing the sample onto the system. This option can be used instead of the Auto Rerun function or with the Auto Rerun function if the operator wishes to make manual test selections at the analyzer. In addition, the analyzer can be configured to ask the host for test selections for Manual Reruns by enabling the Manual Rerun TS field on the Utility/System/Host Communication Setting/Text Setting window. This function works for routine samples and is not available for Stat samples.

3.1.2.8. Analysis of Erred Barcode Reading of the Samples During ID Mode

If a barcode cannot be read or is missing, the operator can manually register the sample on the Workplace/Test Selection/Barcode Read Error window when in barcode mode. An ID is entered for the rack number and position that carries the sample. The analyzer then uses this information to identify and process the sample, including TS inquiries to the host.

3.1.3. Realtime TS Flowchart

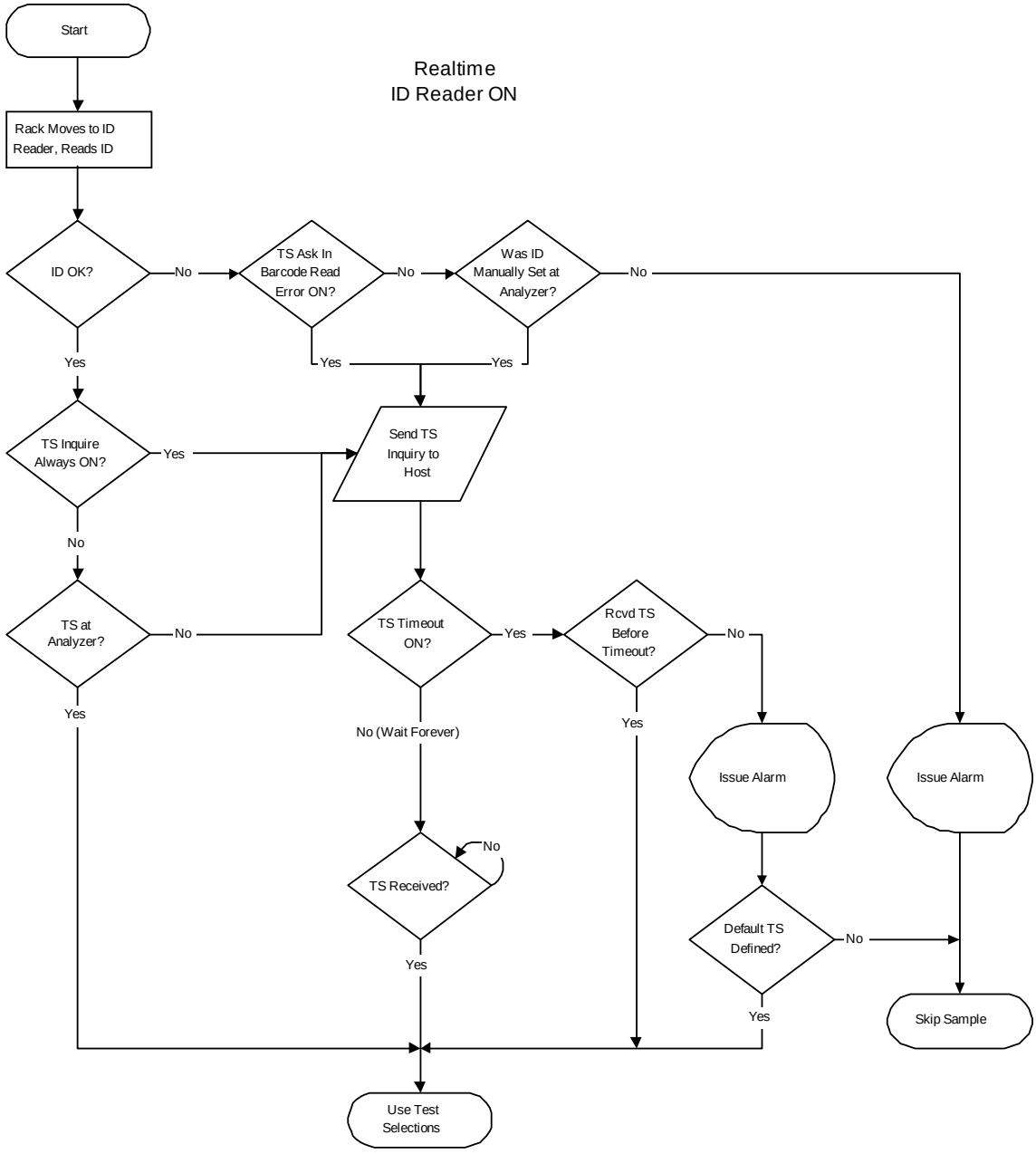


Figure 3: Realtime Test Selection Flow Diagram

3.1.4. Realtime TS Flowchart

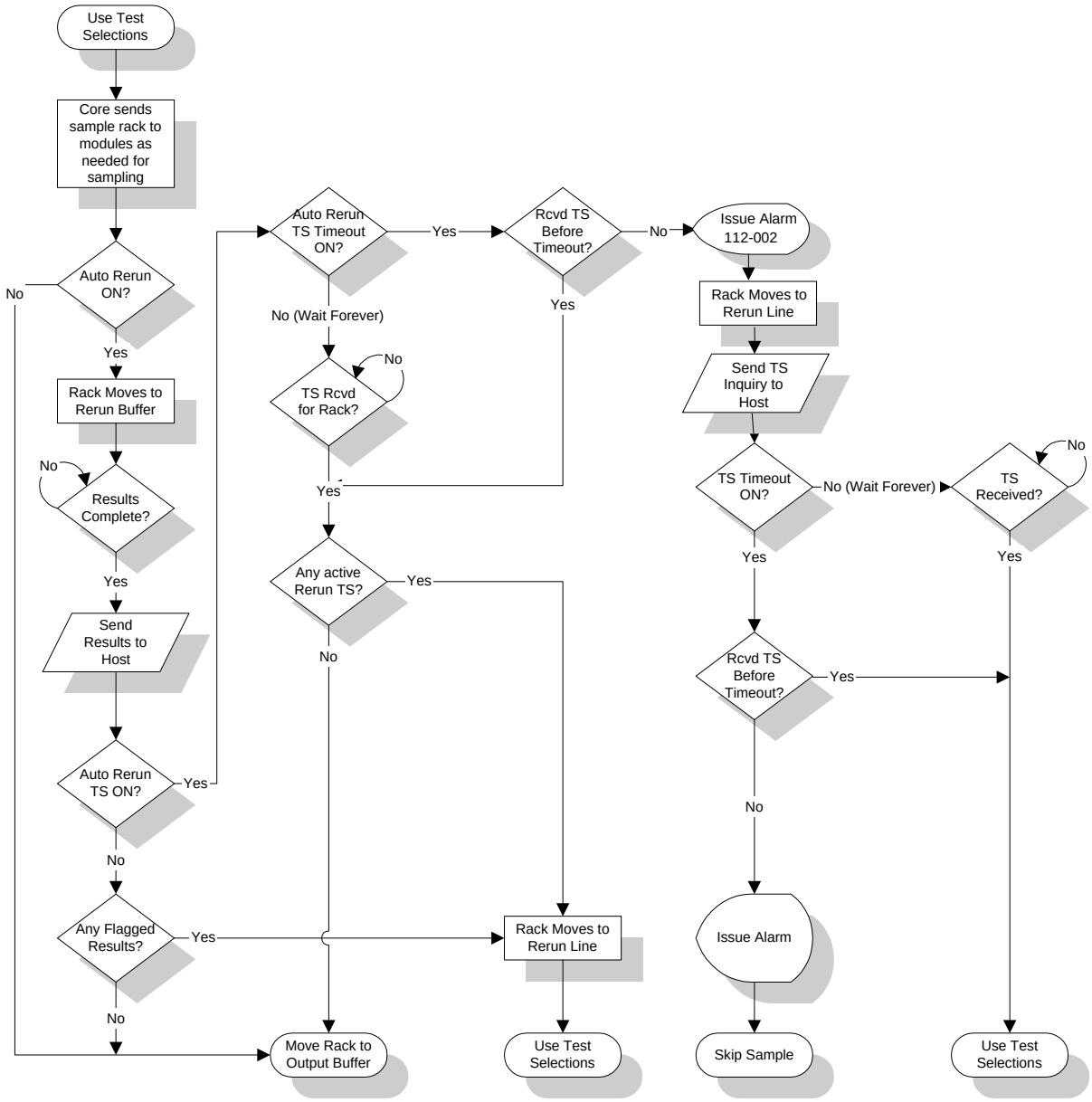


Figure 4: Rerun Test Selection Flow Diagram

3.2. Batch Communication

The Batch Communication function is shown in Table 3. Each of the communication functions is explained in detail below.

Communication Functions	Request Originator	Patient Sample			Standard Sample	Control Sample
		Routine	Stat	Rerun		
Test Selection Information Reception	Host	o	o	o	x	x
Analytical Data Transmission	Host	o	o	o	x	x
	Analyzer	o	o	o	x	o
Photometric and Elecsys Raw Data Transmission	Analyzer	o	o	o	x	o

(o = available; x = not available)

Table 3: Batch Communication Function Table

3.2.1. Test Selection Information Reception

A host can register Test Selection Information for patient sample(s) prior to introduction of the sample(s) on the analyzer. Since there are large amounts of information to be exchanged with a host, it is recommended that the Test Selection Information be registered before introduction of the sample on the analyzer. Performing analysis using this option lightens the communication load.

3.2.1.1. Key Information Used for Registration

In Batch Mode, the type of key information is the same as in Realtime Mode. If key information of a patient sample is the same as the one already registered, the patient sample is over-written; otherwise, it is registered as a new sample. Key information to be registered on the analyzer's database for Batch Communications is shown in Table 4.

Analysis Mode	Key Information				
	Type of Sample	Sample Type*	Sample Number	ID Number	Rack Position
Sample Number Mode	Routine Sample	o	o	x	x
	Stat Sample	o	o	x	o
	Rerun Sample	o	o	x	x
ID Mode	Routine Sample	o	x	o	x
	Stat Sample	o	x	o	x
	Rerun Sample	o	x	o	x

(o = key Information used)

Table 4: Key Information Used to Register in the System Database

3.2.1.2. Number of Samples Possible for Registration

The system database holds a maximum of 10,000 samples for both routine and Stat records, combined. Due to this restriction, an error occurs if the TS information received from a host exceeds this limit. If the limit is exceeded, the TS information is not registered.

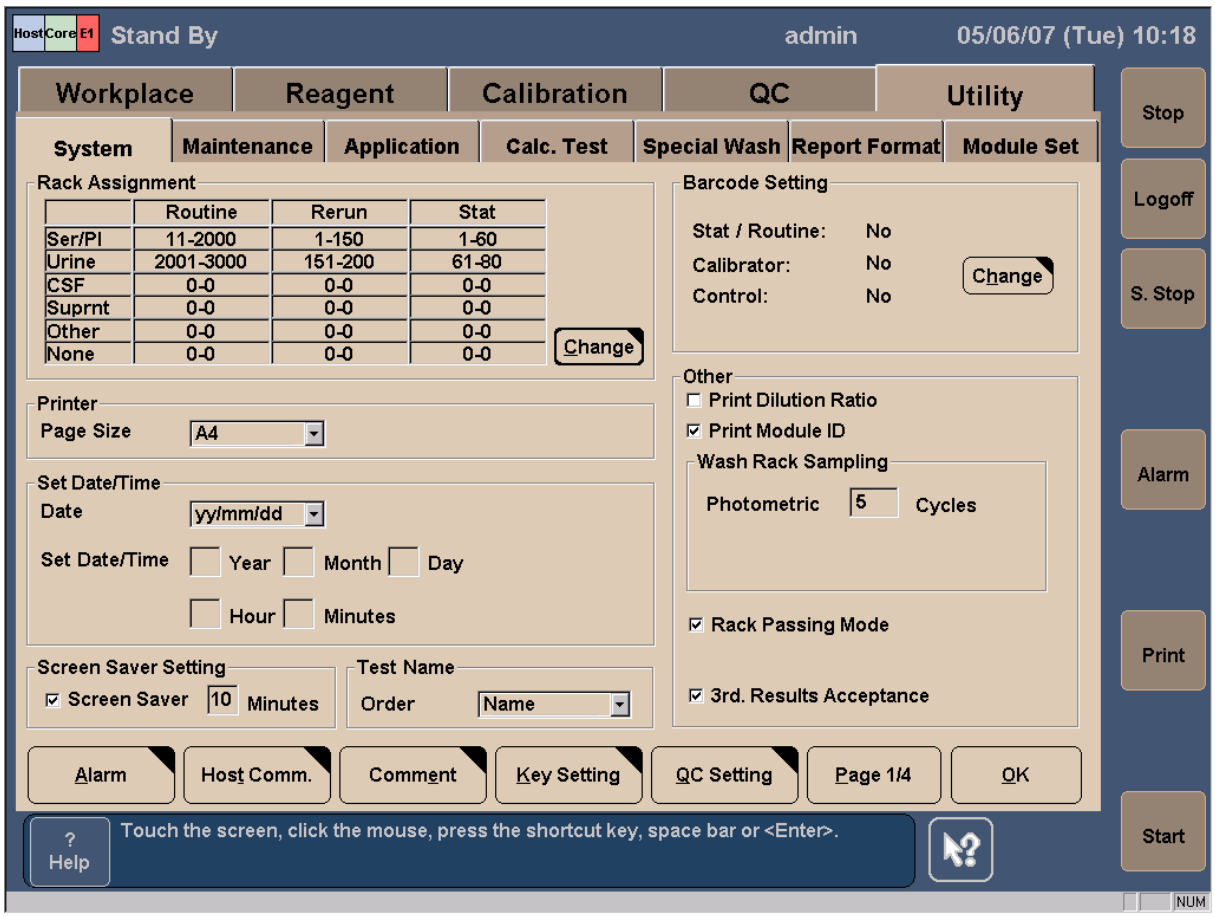
* Set the rack number ranges at the analyzer for every sample type, otherwise an error occurs.

3.2.2. Batch Analytical Data Transmission

The operator can initiate a Batch Data Transmission of routine results and of control sample results from the Workplace/Data Review screen on the analyzer. The host can also request results for a given sample, but control sample results cannot be requested from the host.

3.3. 3rd Result Acceptance

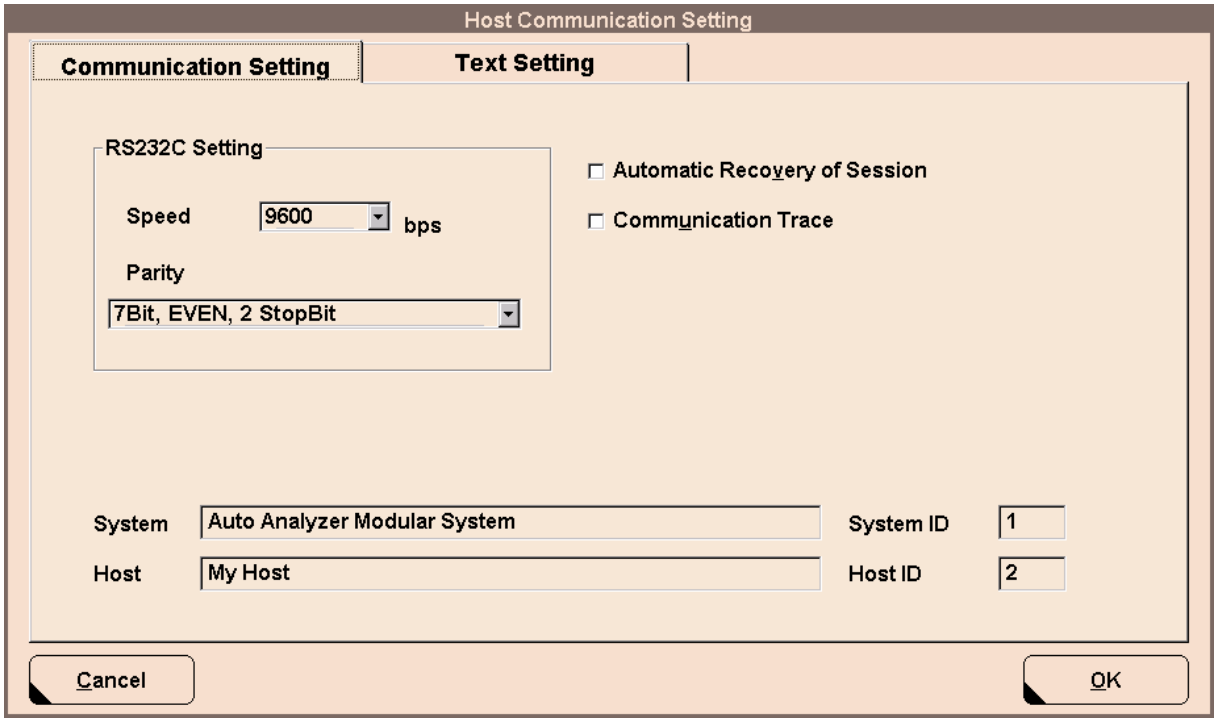
The latest one overwrites 2nd and further result if the 3rd Results Acceptance setting is ON in Utility/System screen. In case only the rerun result is already sent to the host computer, 3rd or further measurement is available.



4. Host Communication Settings

4.1. Host Communication Setting Screen

The Utility/System/Host Communication Setting screen is viewable only with an analyzer logon of administrator level or above.



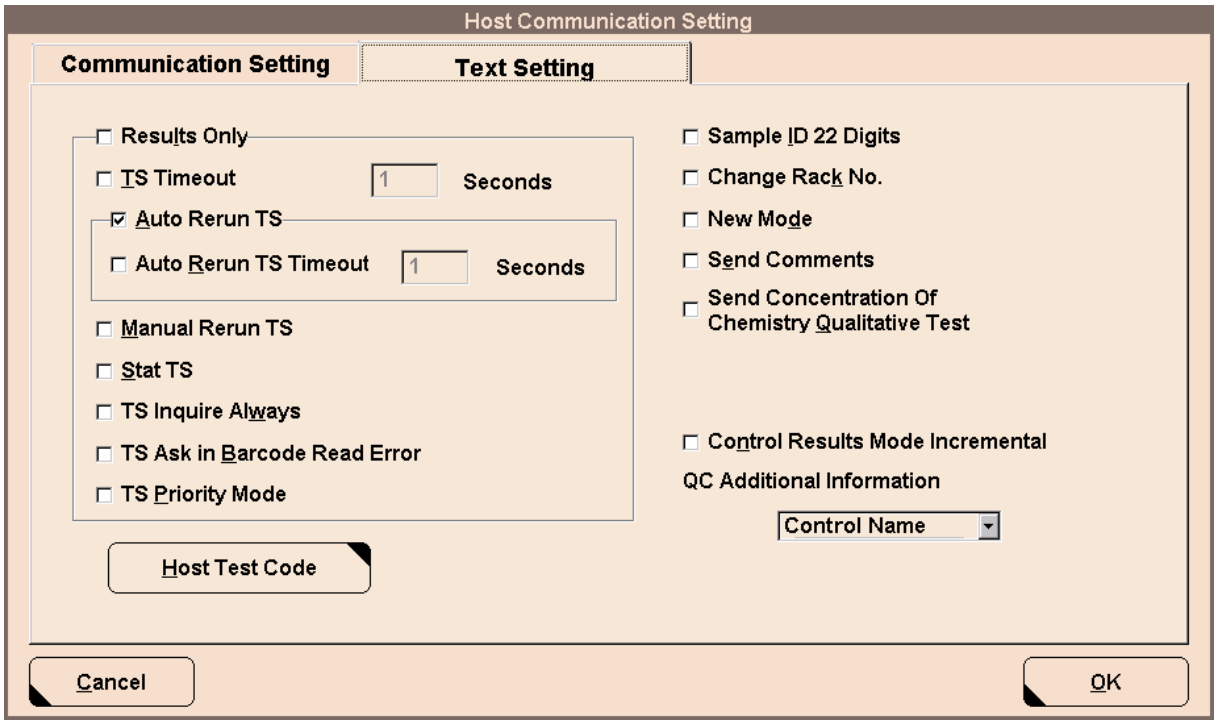


Figure 5: Host Communication Setting Screen

4.2. Definitions

RS232C Settings
Description in chapter 5.

Automatic Recovery of Session
If this function is enabled, the analyzer restarts the communication session if an error occurs. When this happens, the current communication message is lost.

During the initial setup of the host, it is recommended that this function not be enabled so errors can be detected. After the host interface has been successfully established, this function can be enabled, and can help resolve occasional interface errors without requiring operator intervention.

Communication Trace
This function applies to all host communications. When this function is enabled, the content of the communication with the host can be stored at the analyzer. The Communication Trace report can be printed from the global Print screen. This report can be used as an analysis tool if a problem occurs.

Note: Due to the trace file size, it is recommended that the Communication Trace report not be routinely used. When enabled for troubleshooting purposes, it is recommended that the print buffer be printed prior to printing this report, as the size of it might overwrite other buffered printouts.

How to store a host communication trace file

It is possible to get a host communication trace by the following procedure.

- Touch the Print button.
- Select Utility tab.
- Select the Communication Trace in the list box.
- Select the radio button „Print“.
- Touch OK button.

After above procedure, touch View button, and backup the communication trace in the view on the media.

System
Name used on reports and in communications for the Roche/Hitachi MODULAR system.

Host
Name used on reports and in communications for the host system.

System ID
The ID number used to identify the system in communications with the host.

Host ID
The ID number used to identify the host in communications with the analyzer.

Results Only

This function applies to all Realtime Communications. This does not apply to the Batch Mode. When this function is enabled, communication during analysis is limited only to the analytical data transmissions. Inquiries for the Test Selection Information or Auto Rerun Selection Information are not made. Test selections would need to be made either manually by the operator at the analyzer, by Batch Mode from the host, or by use of the Default Profile.

TS Timeout

This function allows the operator to set a timeout interval for Test Selection Information Inquiry for Realtime Communications and for routine, Stat and rerun samples. The specified timeout interval determines how long the analyzer will wait for a 'Response from the host'. The range is 10-9999 seconds, with a default of 10 seconds. Enabling this function optimizes the throughput of the system. If the function is not enabled, the analyzer will wait indefinitely for Test Selection Information.

Auto Rerun TS

This function applies to Auto Rerun TS inquiry within the Realtime Communications. When this function is enabled in the Auto Rerun mode during analysis, an inquiry is made for the Auto Rerun selections. When this function is not enabled, no inquiry for the Auto Rerun Selection is made.

Auto Rerun TS Timeout

This function applies to the reception of Auto Rerun Test Selection Information in Realtime Communications at the Decision Point. Racks with any samples to which the host did not respond within the timeout interval are carried to the rerun line whether or not there is rerun TS information. The range is 10-9999 seconds, with a default of 10 seconds. If the function is not enabled, the analyzer waits indefinitely for Rerun Test Selection Information.

Manual Rerun TS

This function applies to the Test Selection Information inquiry for Manual Rerun samples in Realtime Communication. When this function is enabled, an inquiry is made for the test selections for rerun samples during analysis. Any samples that have previously been processed create a TS inquiry to the host. When this function is not enabled, no TS inquiry for Manual Rerun samples is made.

Stat TS

This function applies to the Test Selection Information inquiry for Stat samples in Realtime Communications. When this function is enabled, an inquiry is made for the test selections for Stat samples during analysis. When this function is not enabled, no TS inquiry for Stat samples is made.

TS Inquire Always

This function applies to the Test Selection Information inquiry for routine and Stat samples in Realtime Communications. This does not apply to TS information inquiry for rerun samples or Auto Rerun Selection inquiries. When this function is enabled, an inquiry is made whether the TS information is in the analyzer or not. When not enabled, an inquiry is made only for the samples that do not have test selections.

TS Ask in Barcode Read Error

(only available if BC Reader = YES)

If this function is enabled, and the analyzer cannot read a sample barcode, it will send the rack ID and position to the host as key information. The sample ID is sent as '***...' [13 or 22 characters of '*']. If the host has the table of the rack ID, position and Sample ID, the host can send the analyzer the correct Sample ID instead of '***...'.

The only currently known use for this function is with a Sample Handling System that ‘manufactures’ sample aliquots for the analyzer. This type of system would track samples by rack and position numbers. Unless the Sample Handling System can perform this function, it is strongly recommended that it not be used

In this mode, rerun by gray racks (racks for 1st run) is not permitted, as the analyzer cannot tell if this is the first or second presentation of the rack.

TS Priority Mode

If this function is enabled, after a Test Selection inquiry the analyzer will stop sending any information, i.e. result data, until the analyzer receives the answer to the inquiry from the host or the TS timeout period passes. This option applies to both the inquiry at the bar code reader and the implied inquiry at the decision point.

The range of the TS Timeout and Auto Rerun TS Timeout is from 1 to 18 seconds with this mode on. With this mode off the TS Timeout options remain at 10 to 9999 seconds. If this mode is enabled and the TS Timeout checkbox is off, TS timeout is handled as 18 seconds.

Sample ID 22 Digits

The maximum length of the sample ID is increased from 13 to max. 22 characters.

Change Rack ID

The rack ID occurs in field 4 of the Order record (O) and field 3 of the Request record (Q). The following table shows which Rack Ids the Modular sends if the 'Change Rack ID' option is on or off:

Rack Type	Change Rack ID = OFF	Change Rack ID = ON
Normal	5001	0001
STAT	4001	S0001
Rerun	A001	R0001
QC	3001	Q0001
Calibration	2001	C0001

Table 5: Rack IDs according to 'Change Rack ID' setting

New Mode

The host interface protocol description in this manual is based on this 'New Mode' setting enabled.

If disabled the protocol is identical with the protocol of the Clinchem Modular software for purpose of 100% compatibility with already connected CC Modular systems.

Concerning detail of the CC Modular host interface specification refer to

Roche/Hitachi MODULAR System
Host Interface Document Version 1.0
Ident. No. 011632701 (US ID)

Refer to Appendix E for a list of differences between the two specifications.

Send Comments

This function applies to host communications. When this function is enabled, the host can send patient comments to the analyzer. Patient comments stored in the analyzer can also be transmitted to the host along with analytical data and Reaction Monitor data. When this function is not enabled, no patient comments are accepted or sent.

Send Concentration Of Chemistry Qualitative Test

With this mode enabled, the concentration of the chemistry qualitative tests is sent to the host.

Control Results Mode Incremental

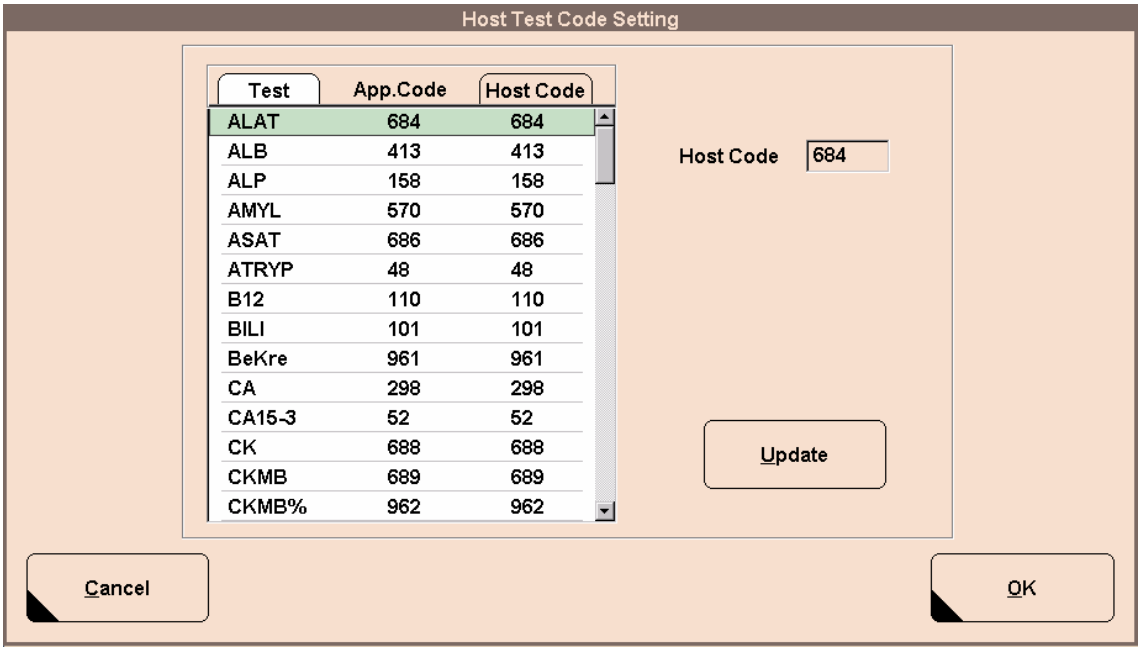
With this mode enabled, the control results are sent test oriented; i.e. as soon as one test result is available it is sent to the host.

QC Additional Information

With this function it is possible to select if 'Control Name' or 'Lot Number' shall be sent in field 3 of the Order record within a control result message.

Host Test Code

Use the Host Test Code Setting window to edit the test code sent to the host.



Host Code

Use this text box to edit the host code for the test selected in the Test list. After editing the code, touch Update to save the change.

Update

Changes are saved and the updated contents of the list is displayed.

5. Physical Layer Specifications

5.1. Communication Options

Host communication options such as baud rate can be found on the Utility/System/Host Communication Setting/ Communication Setting screen.

Item	Specifications	Remarks
Communication Speed	4800, 9600, 19200 bps	Specified on Analyzer
Character Configurations	Refer to diagram below	Specified on Analyzer
Communication Port	1	
Electrical Signal	In accordance with EIA-232-D-1986	
Cable Length	Maximum 15m	

Table 6: Physical Level Specifications

One character is made up of one start bit + data bit + parity bit + stop bit. Data bit, parity bit and stop bit are selected from the table below.

No.	Data Bit	Parity Bit	Stop Bit
1	7 bits	Even	2 bits
2	7 bits	Odd	2 bits
3	7 bits	Even	1 bit
4	7 bits	Odd	1 bit
5	8 bits	None	2 bits
6	8 bits	None	1 bit
7	8 bits	Even	1 bit
8	8 bits	Odd	1 bit

Table 7: Character Configurations

5.2. Analyzer/Host Communication Cable

Figure 6 shows the wiring diagram of the connection cable between the analyzer and the host. The plug for the RS232 host interface cable is on the backside of the core unit.

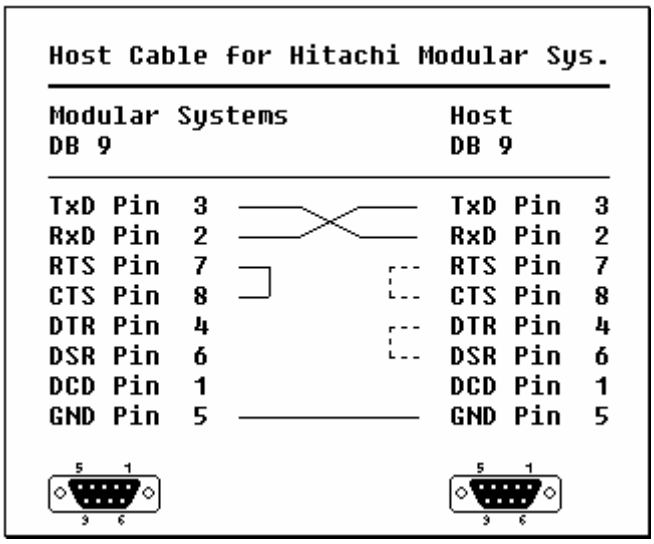


Figure 6: Host Interface Connection Cable

The dashed lines indicate jumpers at host if required by the host system.

6. ASTM Protocol

6.1. Background

ASTM (American Society of Testing and Material) has a plan for communications between automatic analyzers and host computers for standards E1381-91 (Specification for Low-Level Protocol to Transfer Messages Between Clinical Laboratory Instruments and Computer Systems) and E1394-91 (Standard Specifications for Transferring Information Between Clinical Instruments and Computer Systems). The basic specifications of the standards are regulated on X12 of ANSI.

The host communication interface installed in the Roche/Hitachi MODULAR system meets the standards of ASTM.

6.2. Communication Processing Layers

The communication process between the system and the host is divided into three layers as shown below. This specification explains the processing and operation methods for the application layer.

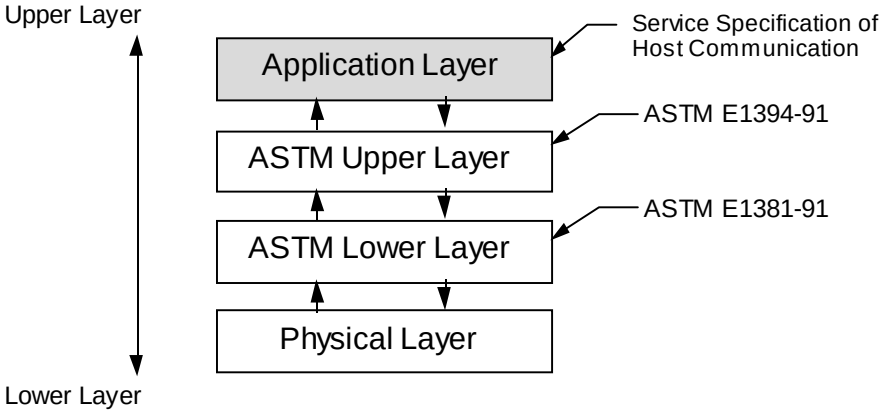


Figure 7: Host Communication Processing Layers

Details of the ASTM protocol can be found in the Annual Book of ATSM Standards.

Copyright American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, USA.

- **ASTM E1381-91 Low Level Protocol**
  Specification for Low Level Protocol to Transfer Messages Between Clinical Laboratory Instruments and Computer Systems
- **ASTM E1394-91 High Level Protocol**
  Standard Specification for Transferring Information Between Clinical Instruments and Computer Systems.

6.3. ASTM Lower Layer

ASTM lower layer receives messages for a transmission request from the upper layer. These messages are then split into frames and sent to a communication medium to be transmitted to other parties. ASTM lower layer also constructs frames received from a communication medium to recreate messages to be transferred to the ASTM upper layer as reception messages. Configuration and communication procedures for transmission and reception of frames are explained in the following chapters.

Item	Method	Explanation
Frame Configurations	For Middle Frame <STX> FN text <ETB> C1 C2 <CR><LF> For Last Frame <STX> FN text <ETX> C1 C2 <CR><LF>	• Control character (characters enclosed in <>): <STX> is control character (HEX 02) <ETB> is control character (HEX 17) <CR> is control character (HEX 0D) <LF> is control character (HEX 0A) <ETX> is control character (HEX 03) • FN: FN is a single ASCII number. FN indicates the sequence number for a frame (the frame number modulus 8). Frames of a single transmission phase are consecutively numbered beginning with 1, so FN runs from 1 to 7, then continues with 0, 1, and so on. • Text: the data content of a frame (maximum 240 characters). Records are sub-divided into intermediate (middle) frames with 240 or fewer characters. Text is part of a split message. • C1 and C2: When 1 byte resulting from adding each byte, FN to <ETB> for the middle frame and FN to <EXT> for the last frame, is expressed in hexadecimal, the upper character (16^1) is C1 and the lower character (16^0) is C2. Characters used are '0' to '9' or 'A' to 'F'.
Frame Character Configuration of Text	Characters other than <SOH><STX><ETX> <EOT><ENQ><ACK> <DLE><NAK><SYN> <ETB><CR><LF> <DC1><DC2><DC3><DC4>	<SOH> is control character (HEX 01) <EOT> is control character (HEX 04) <ENQ> is control character (HEX 05) <ACK> is control character (HEX 06) <DLE> is control character (HEX 10) <NAK> is control character (HEX 15) <SYN> is control character (HEX 16) <DC1> ~ <DC4> are control characters (HEX 11 ~ 14)
Maximum Length of the Frame	247 characters	For one frame, maximum of 240 characters for text, 7 characters for frame control characters. Messages equal to or less than 240 characters are transmitted as one final frame. Messages greater than 240 characters are split into frames that have character lengths that fall within the 240-character limit. The only or final remaining frame becomes the last frame and is indicated by <ETX>. All others are intermediate (middle) frames and are indicated by <ETB>.

Table 8: ASTM Lower Layer Communication Methods

6.4. ASTM Syntax

The structure of the sentences to be transferred, according to ASTM Communication Regulation, is explained in this section. Between the analyzer and the host, various data such as Test Requests and Results are transferred back and forth. All of these data conform to this syntax.

6.4.1. Definitions

Message A message is constructed with an arrangement of several records (refer to the next item). It is the smallest unit of information transferred between a host and an analyzer. Messages begin with a 'Message Header Record' that indicates the beginning of a message and end with a 'Message Termination Record' that indicates the end of a message.

Record A record is constructed from several fields and expresses a single purpose (such as to specify result reports or test requests). A record may be repeated or used singularly in a message. Code that indicates the purpose of a record is noted in the first character of that record.

Field A field is the ASTM's smallest element to construct information. Attributes for a field (name, format, and meanings) are defined in units in a record.

6.4.2. Coding Rules for the Messages

This section deals with message coding rules as well as special characters, such as delimiters, used to develop messages provided by records and fields.

6.4.2.1. End of Record Character

The ASCII CR character (HEX 0D) is always used to indicate the end of a record.

6.4.2.2. Field Delimiter = Vertical Bar '|'

A Field delimiter is a character used to separate fields that are next to each other in a record. This is also a delimiter for the first Record ID (character that appears in the beginning of a record) and the next field. According to the 2nd character that appears in the Message Header Record (record that appears in the front of a message), a Field delimiter can be defined with an optional character through the Message Header Record; however, it is recommended that a vertical bar '|' be used.

6.4.2.3. Repeat Delimiter = Backslash '\'

When a field is constructed by the same data repeated several times, it is referred to as a Repeated Field. The delimiter between the repeated items for the Repeated Field is called the Repeat delimiter. Repeat delimiters can be defined with an optional character through the Message Header Record; however, it is recommended that a backslash '\' be used.

6.4.2.4. Component Delimiter = caret '^'

When a field is constructed by several elements, it is referred to as a Component Field. The delimiter between these elements is the Component delimiter. The Component delimiter can be defined with an optional character through the Message Header Record; however, it is recommended that a caret '^' be used.

6.4.2.5. Escape Character = Ampersand '&'

An Escape character is provided to indicate a delimiter for the fields that include general text. When this character occurs in a relevant field, the next character holds a special meaning (discussed below). An Escape character can be defined with an optional character through the Message Header Record; however, it is recommended that an ampersand '&' be used.

6.4.2.6. Expression of Special Characters with Escape Character

The following Escape sequence (starting with & and ending with &) is defined. When this sequence is detected in a field, it is changed to a corresponding character and deleted.

Escape sequences other than these are skipped and treated as NULL value.

&F&	Indicates Field delimiter
&S&	Indicates Component delimiter
&R&	Indicates Repeat delimiter
&E&	Indicates Escape

6.4.3. Message Transmission Phases

To establish which system sends and which system receives information and to assure the actions of sender and receiver are well coordinated, there are three distinct phases in transferring information:

- Establishment Phase
- Transfer Phase
- Termination Phase

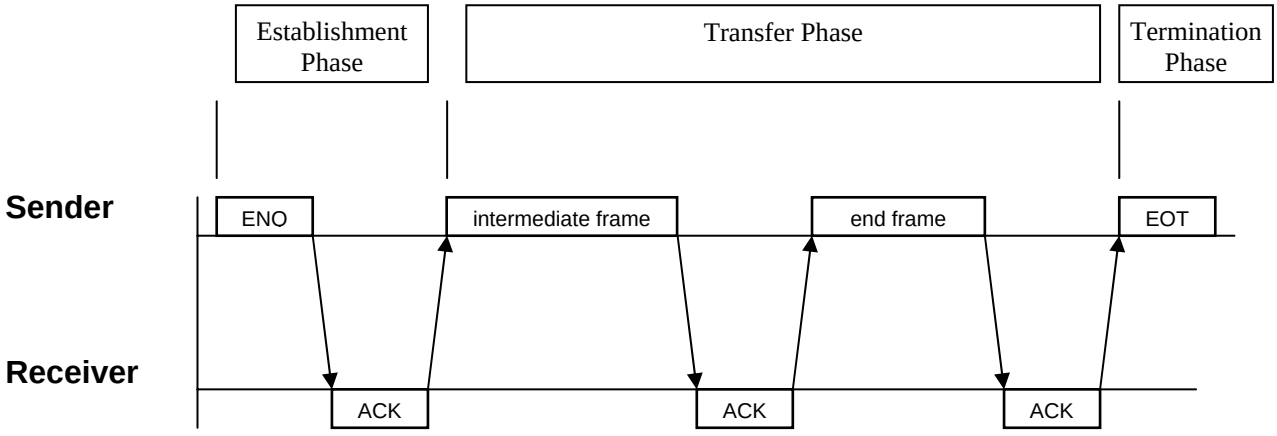


Figure 8: Message Transmission Phases

Within the transfer phase, all records of the corresponding message are grouped into longer frames to increase speed. The records are separated through a [CR] character. Therefore, to obtain pure ASTM records again, the receiver must concatenate all the frames and wait for a [EOT] character. Then, finally, he can process the frame and split it into different records using the [CR] as separator.

6.5. Checksum Calculation/ Message Frame

The Intermediate Frame

[STX]	FN	Text first char.	.....	Text last char.	ETB	CH	CL	[CR]	[LF]

The End Frame

[STX]	FN	Text first char.	.....	Text last char.	ETX	CH	CL	[CR]	[LF]

[STX] The ASCII code 2, indicating the beginning of a frame transmission.

FN The frame number modulus 8. Frames of a single Transmission Phase are consecutively numbered beginning with 1. So FN runs from 1 to 7, continues with 0, 1, and so on. Use ASCII codes for the digits '0' to '7' (48-55).

Text The data content of a frame (max. 240 characters).

Records are sub-divided into intermediate frames with 240 characters.

Maximum is indicated by [ETB]. The only or last remaining frame is indicated by [ETX]. Different records must be sent in different frames.

[ETB] The ASCII code 23 (17hex), indicating the end of the text block of an intermediate frame.

[ETX] The ASCII code 3, indicating the end of the text block of an end frame.

CH, CL Represents the high nibble (= most significant 4 bit) respectively, the low nibble (=least significant 4 bit) of the 8-bit checksum. CH and CL are represented as two digits of hex numbers. The checksum is the modulus 8 of the sum of ASCII values of the frame characters starting with and including 'FN' and completing with [ETX] respectively [ETB].

Example for Checksum Calculation

```
[STX]1Test[ETX]
```

Character	Value (hex)	Sum
[STX]	02h	00h
'1'	31h	31h
'T'	+54h	85h
'e'	+65h	EAh
's'	+73h	15Dh
't'	+74h	1D1h
[ETX]	+03h	1D4h
	= 1D4h	
	Mod 100h	
	= **D4**h	

to be sent:

```
[STX]1Test[ETX]D4[CR][LF]
```

7. Communication Text Content

7.1. Record Levels

The following table shows the Standard Record types and levels (see ASTM E 1394-91 Section 5, 'Information Requirements in Clinical Testing')

Level	Record Name	Identifier
0	Message Header Record	H
1	Patient Information Record	P
2	Test Order Record	O
3	Result Record	R
1...3	Comment Record	C
1...3	Manufacturer Information Record	M
0	Message Termination Record	L
1	Request Information Record	Q

Table 9: Standard Record Types and Levels

The Manufacturer Specific Records are specific for the Roche Diagnostics Modular instrument and must be received by the host

Level	Record Name	Identifier
1	Photometry Calibration Result	M-PCR
1	ISE Calibration Result	M-ICR
1	Elecsys Calibration Result	M-ECR
3	Photometric Raw Data	M-ABS
3	Elecsys Raw Data	M-EFS

Table 10: Manufacturer Defined Record Types and Levels

7.2. Messages used in Modular Communication

All messages are shown in Table 11. The following section shows detailed descriptions of each of the message and the included ASTM records.

Communication Text	Communication Direction	Realtime Communication	Batch Communication
Test Selection Inquiry	Analyzer → Host	o	x
Auto Rerun Selection Inquiry	Analyzer → Host	o	x
Test Selection Information	Host → Analyzer	o	o
Automatic Rerun Selection Information	Host → Analyzer	o	x
Patient Sample Analytical Data	Analyzer → Host	o	o
Control Sample Analytical Data	Analyzer → Host	o	o
Photometric Calibration Data	Analyzer → Host	o	x
ISE Calibration Data	Analyzer → Host	o	x
Elecsys Calibration Data	Analyzer → Host	o	x
Photometric Raw Data	Analyzer → Host	x	o
Elecsys Raw Data	Analyzer → Host	x	o
Analytical Data Transmission Request	Host → Analyzer	x	o

(o = available; x = not available)

Table 11: Communication Text Table

7.2.1. Messages Transmitted by the Analyzer

Messages transmitted by the analyzer (messages received by the host) are indicated in the table below.

The identifier is set in the Comment or Special Instruction Field in the Message Header Record with the reason for the messages.

Messages	Syntax / Records	Comment or Special Instructions	Reasons
Inquiry for the Requested Tests	H Q L	TSREQ^REAL	Inquiry is made for the requested test just before loading the sample rack (passing through the ID reader).
Result Report	H P O C {R C}$_n$ L n = 0~160	RSUPL^REAL RSUPL^REPLY RSUPL^BATCH	Reports on the result at the point when the results for the sample have been accumulated. Reports on the result as a response for the inquiry from a host. Transmits results of the selected sample(s) by instruction at the analyzer.
Photometry Calibration Result Report	H M-PCR L	PCUPL^REAL	Reports at the point when the Photometry calibration results are output.
ISE Calibration Result Report	H M-ICR L	ICUPL^REAL	Reports at the point when the ISE calibration result is output.
Elecsys Calibration Result Report	H M-ECR L	ECUPL^REAL	Reports at the point when the Elecsys calibration result is output.
Photometric Raw Data Report	H P O C R C M-ABS L	ABUPL^BATCH	Reports absorbance of the photometric tests
Elecsys Raw Data Report	H P O C R C M-EFS L	EFUPL^BATCH	Reports absorbance of the Elecsys tests

Table 12: Messages Transmitted by the Analyzer

7.2.2. Messages Transmitted by the Host

Messages transmitted by the host are shown in the table below (messages received by the analyzer).

Messages	Syntax / Records	Comment or Special Instructions	Reasons
Order for Test Request	H P O C L	TSDWN ^ REPLY TSDWN ^ BATCH	Orders test request for a sample as answer to a Test Selection Inquiry Orders test request for a sample by instruction at the host
Inquiry of Result	H Q L	RSREQ ^ REAL	Makes inquiry for the result of a test.

Table 13: Messages Transmitted by the Host

7.3. Record Description

7.3.1. Field Attributes

Types of attributes held by a field are explained below.

No.	Attribute	Description
1	Field Name	Name of the relevant field.
2	Reference	Position of the field. Order in which the relevant fields appear in a record.
3	Format	The format for a field is one of the following: • ST: String: A character string • TX: Text: A group of character strings that can be printed at the terminal. It is an optional character string; however, a special escape sequence is defined for a display at the terminal. • NM: Numeric: A numeric value. Positive (+) or negative (-) is indicated before the numeric value. If it is not indicated, it is treated as positive (+). If a decimal point is not included, the numeric value is treated as an integer. There are no restrictions for placing '0' in the front and for '0s' placed at the end of numbers with decimal points. • DT: Date. Always use the 4-digit Christian year. The format is YYYYMMDD (YYYY is the 4-digit Christian year, MM is the month, DD is the day). For example, September 5, 1998 is indicated 19980905. • TM: Time: Military time. The format is HHMMSS (HH is the hour, MM is the minute, and SS is the second). • TS: Time Stamp. A combination of DT and TM. The format is: YYYYMMDDHHMMSS. • CM: Combination. A field in which multiple data are combined by a component delimiter.
4	Maximum Length	The maximum value of the number of valid characters for the relevant field excluding escape delimiters.
5	Comments (Data Content)	Contains field contents and any relevant field comments. **Note:** A field with the message 'Field does not contain data' in the column means that even though it is provided by ASTM, it may be ignored when received.

Table 14: Field Attributes

7.3.2. Message Header Record

This record occurs in the front of a message and indicates the goal of the message, such as origination and destination.

`H|\^&|||H7600^1||||host|RSUPL^BATCH|P|1`

Field Name	Reference	Format	Max Length	Comments (Data Content) **H|7.1.**
Record Type ID (H)*	07.1.01	ST	1	Use 'H'
Delimiter Definition*	07.1.02	ST	4	Defines Field delimiter, Repeat delimiter, Component delimiter, and four (4) Escape characters. The first character defines the Field delimiter and also corresponds to the Field delimiter of the Record Type ID. Four characters for this are: | \ ^ & *
Message Control ID	07.1.03			*Field does not contain data*
Access Password	07.1.04			*Field does not contain data.*
Sender Name or ID	07.1.05	CM	36	Name of the machine transmitting this message. When transmitting from the analyzer, the registered name of the Roche/Hitachi MODULAR system[2] communication program version is transmitted.
Sender Street Address	07.1.06			*Field does not contain data.*
Reserved Field	07.1.07			*Field does not contain data.*
Sender Telephone Number	07.1.08			*Field does not contain data.*
Characteristics of Sender	07.1.09			*Field does not contain data.*
Receiver ID	07.1.10	ST	30	Name of the machine receiving this message. ***Roche/Hitachi MODULAR system transmission process*** Enter registered host name[3]. ***Roche/Hitachi MODULAR system reception process*** Currently, the receiving machine uses this field to confirm whether or not the message is addressed to it. However, this field is not sent by the analyzer. This field, therefore, is relevant for Communication Log use only.

* Indicates a field or field component required in ID and Sample No. modes.

[2]The name of the Roche/Hitachi Hybrid MODULAR System is registered on the Utility/System/Host Communication Setting window. Characters that can be used are either numbers or the minus sign '-'.

[3]The name of the host computer registered on the Utility/System/Host Communication Setting window. Characters that can be used are either numbers or the minus sign '-'.

Message Header Record, **Continued**

Field Name	Reference	Format	Max Length	Comments (Data Content) **H|7.1.**
Comment or Special Instructions	07.1.11	CM	11	A comment regarding the message is entered here. ***Roche/Hitachi MODULAR system transmission process*** To indicate classification of the transmitted message from the analyzer, one of the following is transmitted. TSREQ^REAL PCUPL^REAL RSUPL^REAL ICUPL^REAL RSUPL^BATCH ECUPL^REAL RSUPL^REPLY ABUPL^BATCH EFUPL^BATCH The first component element indicates the purpose for the message. TSREQ: Test request inquiry RSUPL: Result report PCUPL: Photometry calibration report ICUPL: ISE calibration report ECUPL: Elecsys calibration report ABUPL: Absorbance report EFUPL: Effective signal report The second component element indicates the cause of the message. REAL: Message automatically generated by the analyzer. BATCH: Message generated with an instruction by an operator from the working terminal. REPLY: Response message for inquiry from a host. ***Roche/Hitachi MODULAR system reception process*** To indicate classification of the transmitted message from the host, one of the following is transmitted. TSDWN^REPLY RSREQ^REAL TSDWN^BATCH The first component element indicates the purpose for the message. TSDWN: Registration of test request RSREQ: Inquiry for the result The second component element indicates the cause of the message. REAL: Message automatically generated by a host. BATCH: Message to indicate downloading from a host. REPLY: Response message for the inquiry from the analyzer.
Processing ID	07.1.12	ST	1	Indicates the processing method for the messages. Currently 'P' is always used.
Version No.	07.1.13	NM	1	Enter version number of the communication program. Currently '1' is always used.
Date and Time of Message	07.1.14			Send only in debugging mode

7.3.3. Message Termination Record

This record occurs at the end of a message to indicate the end of a message.

L|1|N

Field Name	Reference	Format	Max Length	Comments (Data Content) **L|13.1.**
Record Type ID (L)*	13.1.01	ST	1	Use 'L'
Sequence Number*	13.1.02	NM	1	Always '1'.
Termination Code*	13.1.03	ST	1	Input the value shown below. N Normal termination T Forced termination of the transmitting side R Forced termination of the receiving side E System error Q Request error for the last reception (request is rejected) I No information that corresponds to the inquiry in the last reception F The last request was processed

* Indicates a field or field component required in ID and Sample No. modes.

* Indicates a field or field component required in ID and Sample No. modes.

7.3.4. Patient Information Record

This record is used to transfer patient sex and age to the analyzer (within test selection message) or to the host (within result message).

P|1|||||||M||||||35^Y

Field Name	Reference	Format	Max Length	Comments (Data Content) **P|7.1.**
Record Type ID (P)*	08.1.01	ST	1	Use 'P'
Sequence Number*	08.1.02	NM	6	Sequence number of the Patient Information Record in the message. It begins with '1'.
Practice Assigned Patient ID	08.1.03			*Field does not contain data.*
Laboratory Assigned Patient ID	08.1.04			Patient ID - same length as sample ID
Patient ID No.3	08.1.05			*Field does not contain data.*
Patient Name	08.1.06			*Field does not contain data.*
Mothers Maiden Name	08.1.07			*Field does not contain data.*
Date of Birth	08.1.08	DT	8	Date as defined by ASTM 6.6.2
Patient Sex	08.1.09	ST	1	**Field Value** / **Description** M — Male F — Female U — Unknown
Patient Race-Ethnic Origin	08.1.10			*Field does not contain data.*
Patient Address	08.1.11			*Field does not contain data.*
Reserved Field	08.1.12			*Field does not contain data.*
Patient Telephone Number	08.1.13			*Field does not contain data.*
Attending Physician ID	08.1.14			*Field does not contain data.*
Special Field 1	08.1.15	CM	5	**Format** <Age>^<Age Unit> **Element** / **Max Length** / **Format** Age — 3 — NM Age Unit — 1 — ST **Element** / **Description** Age — Age of the Patient from whom the sample was collected. Range 1-200 Age Unit — Specify 'Y', 'M' or 'D'. Indicates unit of the age. 'Y' is the year, 'M' is the month, and 'D' is the day.
Special Field 2	08.1.16			*Field does not contain data.*
Patient Height (in cm)	08.1.17			*Field does not contain data.*

* Indicates a field or field component required in ID and Sample No. modes.

* Indicates a field or field component required in ID and Sample No. modes.

Patient Information Record, **Continued**

Field Name	Reference	Format	Max Length	Comments (Data Content) **P|7.1.**
Patient Weight in kg	08.1.18			*Field does not contain data.*
Patient's Known or Suspected Diagnosis	08.1.19			*Field does not contain data.*
Patient Active Medications	08.1.20			*Field does not contain data.*
Patient's Diet	08.1.21			*Field does not contain data.*
Practice Field No.1	08.1.22			*Field does not contain data.*
Practice Field No.2	08.1.23			*Field does not contain data.*
Admission and Discharge Dates	08.1.24			*Field does not contain data.*
Admission Status	08.1.25			*Field does not contain data.*
Location	08.1.26			*Field does not contain data.*
Nature of Alternative Diagnostic Code and Classifiers	08.1.27			*Field does not contain data.*
Alternative Diagnostic Code and Classification	08.1.28			*Field does not contain data.*
Patient Religion	08.1.29			*Field does not contain data.*
Marital Status	08.1.30			*Field does not contain data.*
Isolation Status	08.1.31			*Field does not contain data.*
Language	08.1.32			*Field does not contain data.*
Hospital Service	08.1.33			*Field does not contain data.*
Hospital Institution	08.1.34			*Field does not contain data.*
Dosage Category	08.1.35			*Field does not contain data.*

7.3.5. Test Order Record

This record holds information regarding analysis request and sample information to the analyzer (within test selection message) and to the host (within result message).

```
O|1|000003·····················|3^5238^3^^S1^SC|^^^2^1|R||20000529125
556||||N||||1|||||||20000529125645|||F
```

Field Name	Reference	Format	Max Length	Comments (Data Content) **O|9.4.**
Record Type ID (O)*	09.4.01	ST	1	Use 'O'
Sequence Number*	09.4.02	NM	6	Indicates the sequence number of the Test Order Record at the current layer. This record is in the layer following the Patient Information Record and is reset to 1 for each occurrence of a new Patient Information Record. It is numbered consecutively; 1, 2, etc., for each occurrence of this record.
Specimen ID*	09.4.03	ST	22	Identification procedure for samples by the analyzer. Sample ID — Barcode attached to the test tube. The barcode label is read by the system's barcode reader. The total valid character number is 13/22 (see Host Communication Setting/text Setting screen). **Note:** In S.No. mode, becomes patient comment Control: Control name

* Indicates a field or field component required in ID and Sample No. modes.

Test Order Record, **Continued**

Field Name	Reference	Format	Max Length	Comments (Data Content) **O|9.4.**
Instrument Specimen ID*	09.4.04	ST	20	Identification procedure for samples by the analyzer. **Format** <Sample No>^<Rack ID>^<Position No>^^<Rack Type>^<Container Type> **Element** / **Max Length** / **Format** Sample No$^{\Phi}$ — 5 — NM Rack ID — 5 — ST Position No$^{\Phi}$ — 1 — NM Rack Type* — 2 — ST Container Type — 2 — ST **Element** / **Description** Sample: Confirmation number when samples are numbered in sequence in order of input. In case of QC material, 'Control Number * 1000+ Sequence No. sample' is used. ex. Control No. = 1, Sequence No. = 2 is written as 1002 In ID mode, the number is reserved. In S. No. mode, the range is 1 – 60000. Control No. range is 1-100. Control Seq. No. range is 1-150. Rack ID: ID of the Sample Rack with 5 samples. There are two ways of reading: reading from the opening in the rack or from the barcode on the side of the rack. Position No: Values 1 ~ 5. Counting from the rack's forward direction, the position of the first sample is 1 and the last sample is 5. Rack Type: S1: Blood serum / Plasma S2: Urine S3: CSF S4: Suprnt S5: Others Container Type: QC: Control MC Micro cup SC Standard cup no value Priority is given to the information inputted on the instrument.

* Indicates a field or field component required in ID and Sample No. modes.

$^{\Phi}$ Indicates a field or field component required in Sample No. mode only.

Test Order Record, **Continued**

Field Name	Reference	Format	Max Length	Comments (Data Content) **O|9.4.**
Universal Test ID*	09.4.05	CM	10	Repeat Field (example: ^^^2^1\^^^1000^2\^^^7^5) Specifies test request. **Format** ^^^<Application Code>^<Dilution> The first, second and third component elements for this format are empty. These are referred to as the Universal Test ID. Value is reserved until Standard Code is made that uniquely identifies the future tests. This format is used repeatedly with delimiters when ordering several tests. Maximum of 160 tests can be specified. **Element** / **Max Length** / **Format** Application Code$^{\Omega}$ — 5 — NM Dilution — 3 — ST **Element** / **Description** Application Code: The analyzer identifies the test with 3-digit numbers. Specify these 3-digit numbers. The range of application code is expanded to 5-digit. Photometrics: 1-910 ISEs: Na=989, K=990, Cl=991 Serum Index: L=992, H=993, I=994 Dilution: CC Test: Inc, Dec,3,5,10,20,50,100 E Test: 1,2,5,10,20,50,100,400 When not specified, pipetting and testing is done using the standard analysis parameters.
Priority*	09.4.06	ST	1	Indicates the priority order of the Patient Samples. Not used for Control Samples. Values are one of the following: **Field Value** / **Description** R — Indicates routine analysis of the patient samples S — Indicates Stat analysis of the patient samples

$^{\Omega}$ The record should be sent with this field left blank when the host has no Test Selections. See example on page 80.

Test Order Record, **Continued**

Field Name	Reference	Format	Max Length	Comments (Data Content) **O|9.4.**
Requested/Ordered Date and Time	09.4.07			*Field does not contain data.*
Specimen Collection Date and Time	09.4.08	TS	14	Date and time specimens were collected is designated by YYYYMMDDHHMMSS.
Collection End Time	09.4.09			*Field does not contain data.*
Collection Volume	09.4.10			*Field does not contain data.*
Collector ID	09.4.11			*Field does not contain data.*
Action Code*	09.4.12	ST	1	Indicates type of information for the report. **Value** / **Communication Direction** / **Description** A — Transmit by the host — Indicates an add-on request for the test item. C — Transmit by the host — to cancel an order N — Transmit by the analyzer — Indicates report for the routine sample's analytical data. Q — Transmit by the analyzer — Indicates report for the control sample's analytical data.
Danger Code	09.4.13			*Field does not contain data.*
Relevant Clinical Information	09.4.14			*Field does not contain data.*
Date/Time Specimen Received	09.4.15			*Field does not contain data.*
Specimen Descriptor*	09.4.16	NM	1	This field indicates the type of sample **Field Value** / **Description** 1 Serum/Plasma 2 Urine 3 CSF 4 Suprnt 5 Others
Ordering Physician	09.4.17			*Field does not contain data.*
Physician's Telephone Number	09.4.18			*Field does not contain data.*
User Field No. 1	09.4.19			*Field does not contain data.*
Users Field No. 2	09.4.20			*Field does not contain data.*
Laboratory Field No. 1	09.4.21			*Field does not contain data.*

* Indicates a field or field component required in ID and Sample No. modes. If the sample type is missing in the Specimen Descriptor, an Alarm 340/102 "Host receiving Error/Class outside the range" is generated.

Test Order Record, **Continued**

Field Name	Reference	Format	Max Length	Comments (Data Content) **O|9.4.**
Laboratory Field No. 2	09.4.22			*Field does not contain data.*
Date/Time Results Reported or Last Modified	09.4.23	TS	14	Indicates the date and time the result was obtained. This field is not specified by a host.
Instrument Charge to Computer System	09.4.24			*Field does not contain data.*
Instrument Section ID	09.4.25			*Field does not contain data.*
Report Types*	09.4.26	ST	1	Indicates type of communications. **Value** / **Communication Direction** / **Description** O — Transmit by the host — Indicates request for the test item. F — Transmit by the analyzer — Indicates a report for the analytical data.
Reserved Field	09.4.27			*Field does not contain data.*
Location or Ward of Specimen Collection	09.4.28			*Field does not contain data.*
Nosocomial Infection Flag	09.4.29			*Field does not contain data.*
Specimen Service	09.4.30			*Field does not contain data.*
Specimen Institution	09.4.31			*Field does not contain data.*

* Indicates a field or field component required in ID and Sample No. modes.

7.3.6. Comment Record (following the order record)

Record to transfer comments regarding the patient's demographic data. This record is transmitted by the host (within test selection message) and the analyzer (within result message).

```
C|1|I|·····························^HSP1·····················^.
···················^·············^·········|G
```

Field Name	Reference	Format	Max Length	Comments (Data Content) **C|11.1.**
Record Type ID*	11.1.01	ST	1	Use 'C'.
Sequence Number	11.1.02	NM	6	Indicates the sequence number of the Test Request Record in the current layer. Since this record is in the layer following the Test Request Record, it is reset to '1' each time a new Test Request Record is presented and then numbered consecutively; 1, 2, etc.
Comment Source	11.1.03	ST	1	Indicates the source of the Comment. If issued by the analyzer, it is 'I', if issued by the host it is 'L'.
Comment Text	11.1.04	CM	104	**Format** <Comment1>^<Comment2>^<Comment3>^Comment4>^<Comment5> 5 types of comments regarding the sample can be specified. These comments can be read or edited at the analyzer. From Host to Analyzer **Element** / **Max Length** / **Format** Comment1 30 ST Comment2 25 ST Comment3 20 ST Comment4 15 ST Comment5 10 ST From Analyzer to Host **Element** / **Length (fixed)** / **Format** Comment1 30 ST Comment2 25 ST Comment3 20 ST Comment4 15 ST Comment5 10 ST **Note:** In the case of analyzer to host, each comment is a fixed length string. If the length of the comment is less than the specified number, the string must be right-filled with an adequate number of spaces. ex. <Comment 5> 'ABCDEF' is sent as: 'ABCDEF ' from the analyzer. **Important:** **Even if one or all comments are empty the host must send 4 component delimiters in this field.**
Comment Type	11.1.05	ST	1	Always G for generic/free text comment

* Indicates a field or field component required in ID and Sample No. modes.

7.3.7. Result Record

Record to transmit analytical data.

R|1|^^^2/1/not|8.60|nmol/L||N||F||BMSERV|||E11

Field Name	Reference	Format	Max Length	Comments (Data Content) **R|10.1.**
Record Type ID	10.1.01	ST	1	Use 'R'.
Sequence Number	10.1.02	NM	6	Indicates sequence numbers for the Test Request Record in the current layer. Since this record is the layer that follows the Test Request Record, it resets to 1 for each occurrence of a new Test Request Record. It is numbered consecutively; 1, 2, etc., for each occurrence of this record.
Universal Test ID	10.1.03	CM	22	*Example*: ^^^10310/2 Specifies test request. **Format** ^^^<Application Code>/<Dilution>/<Pre-Dil.> The first, second and third component elements for this format are empty. These are referred to as the Universal Test ID. These values are reserved until Standard Code is made that will uniquely identify the future tests. **Element** / **Max Length** / **Format** Application Code: 5: NM Dilution: 3: ST Pre-Dilution: 11: ST **Element** / **Description** Application Code: The analyzer identifies the test with 3-digit numbers. Specify these 3-digit numbers. The range of application code is expanded to 5-digit. Photometrics: 1-910 ISEs: Na=989, K=990, Cl=991 Serum Index: L=992, H=993, I=994 Calculated Tests: 961-968 Dilution: CC Test: Inc, Dec,3,5,10,20,50,100 E Test: 1,2,5,10,20,50,100,400 When not specified, pipetting and testing is done using the standard analysis parameters. Pre-Dilution: (only E-test) 'pre-diluted' or 'not' Application code 961 and 965 means calculated Test. A total of eight (8) calculated tests can be set as application code 961~968. When all tests requiring calculation are ordered and successfully measured, the analyzer automatically transmits the calculated tests. However, the host may not send the calculated test order. When tests required for calculation are measured on separate analytical units, the 'Module ID' field of the 'R' record of the message is filled with 'NULL'.

Result Record, **Continued**

Field Name	Reference	Format	Max Length	Comments (Data Content) **R|10.1.**
Data or Measurement Value	10.1.04	NM	15	DP module results: Quantitative: 6-digit measurement value or 6 spaces if no result Qualitative: -2, -1, 0, 1, 2, 3 or 6 spaces if no result If an option of "Send concentration of chemistry qualitative test" is selected on the Host Communication Setting/Text Setting screen, the following rule is applied. qualitative value ^ measurement vaule In case that qualitative value is 0 and concentration is 8.60, example is as follows.. Example : 0^8.60 E module results: Quantitative: 7-digit measurement value or 7 spaces if no result Qualitative: qualitative value ^ cut off index or 7 spaces if no result qualitative value: 1 (positive) 0 (border line) -1 (negative) See Table 15 below for qualitative result information.
Units	10.1.05	ST	6	Indicates units of the analytical data.
Reference Ranges	10.1.06			*Field does not contain data.*
Result Abnormal Flags	10.1.07	ST	2	**Field Value** / **Description** LL Lower than Repeat Limit HH Higher than Repeat Limit L Lower value than normal H Higher value than normal A Abnormal N Normal
Nature of Abnormality Testing	10.1.08			*Field does not contain data.*
Result Status	10.1.09	ST	1	Indicates the number of the test conducted for the analytical data. **Field Value** / **Description** F Indicates analytical data from the first test C Indicates analytical data from the rerun
Date of Change in Instrument Normative Values Units	10.1.10			*Field does not contain data.*
Operator Identification	10.1.11	ST	6	Identifies the operator. This field is not specified by a host.
Date/Time Test Started	10.1.12			*Field does not contain data.*
Date/Time Test Completed	10.1.13			*Field does not contain data.*

Instrument Identification	10.1.14	ST	4	Indicates the ID of the analytical unit (module) that performed the analysis. **Module** — **Description** P1 to P4 — P Module D1 to D4 — D Module Exy — E Module Analyzer with x=1 to 4 module no. y=1 to 2 measuring cell e.g: E11, E12) If the measurement is canceled before detection, y becomes 0. e.g: E10)

Qualitative result format for D and P tests can be activated on the Utility/Application/Range screen.

Analytical Result Range	**Transmis-sion Data**
Analytical Result ≤ Qualitative Analysis Concentration 1	-2
Qualitative Analysis Concentration 1 < Analytical Result ≤ Qualitative Analysis Concentration 2	-1
Qualitative Analysis Concentration 2 < Analytical Result ≤ Qualitative Analysis Concentration 3	0
Qualitative Analysis Concentration 3 < Analytical Result ≤ Qualitative Analysis Concentration 4	1
Qualitative Analysis Concentration 4 < Analytical Result ≤ Qualitative Analysis Concentration 5	2
Qualitative Analysis Concentration 5 < Analytical Result	3

Table 15: Qualitative Analysis Transmission Data

7.3.8. Comment Record (following the result record)

Record to transfer comments regarding the analytical data. This record is transmitted by the analyzer only; it is not transmitted by the host.

C|1|I|43|I

Field Name	Reference	Format	Max Length	Comments (Data Content) **C|11.1.**
Record Type ID	11.1.01	ST	1	Use 'C'.
Sequence Number	11.1.02	NM	6	Indicates the sequence number of the Test Request Record in the current layer. Since this record is in the layer following the Test Request Record, it is reset to '1' each time a new Test Request Record is presented and then numbered consecutively; 1, 2, etc.
Comment Source	11.1.03	ST	1	Indicates the source of the Comment. Currently, this record is issued only from the analyzer, so 'I' is always used.
Comment Text	11.1.04	NM	3	Data Flag number for the results confirmed by the analyzer. (See Appendix A.)
Comment Type	11.1.05	ST	1	Character limiting the comment format. Currently, this record is issued only from the analyzer, so 'I' is always used.

7.3.9. Request Information Record

Record to request information from the other device. It is sent by the analyzer (within test selection request message) and the host (within result request message)

Q|1|^^.....^1^5032^1^^S1^SC||ALL|||||||O

Field Name	Reference	Format	Max Length	Comments (Data Content) **Q|12.1.**
Record Type ID	12.1.01	ST	1	Use 'Q'.
Sequence Number	12.1.02	NM	6	Indicates the sequence numbers for the Test Request Record in the current layer. Since this record is the layer that follows the Test Request Record, it resets to '1' each time a new Test Request Record is presented, and then it is numbered consecutively; 1, 2, etc.

Request Information Record, **Continued**

Field Name	Reference	Format	Max Length	Comments (Data Content) **Q|12.1.**
Starting Range ID Number	12.1.03	CM	45	^^<Sample ID>^<Sample No>^<Rack ID>^<Position No>^^<Rack Type>^<Container Type>

Element	Max Length	Format
Sample ID	22	ST
Sample No	5	NM
Rack ID	5	ST
Position No	1	NM
Rack Type	2	ST
Container Type	2	ST

Element	Description
Sample ID	The sample ID is found on a barcode attached to the test tube. It is read by a barcode reader in the analyzer. Total valid character number is 13/22 (see Host Communication Setting/Text setting screen). In S. No. mode, this becomes the patient comment.
Sample No	In ID mode, this number is reserved. In S. No. mode, the range is 1-60000.
Rack ID	ID of the sample rack containing 5 samples. The ID can be read two ways: from the opening in the rack or from the barcode on the side of the rack.
Position No	Values 1 ~ 5, counting from the rack's forward direction. The position of the first sample is '1' and the last sample is '5'.
Rack Type	Type of sample. Sample type is identified by S1 ~ S5. S1: Blood Serum/Plasma S2: Urine S3: CSF S4: Suprnt S5: Others S0: None rack QC: Control
Container Type	MC: Micro cup SC: Standard cup no value: Standard cup

Request Information Record, **Continued**

Field Name	Reference	Format	Max Length	Comments (Data Content) **Q|12.1.**
Ending Range ID Number	12.1.04			*Field does not contain data.*
Universal Test ID	12.1.05		3	'ALL'
Nature of Request Time Limits	12.1.06			*Field does not contain data.*
Beginning Request Results Date and Time	12.1.07			*Field does not contain data.*
Ending Request Results Date and Time	12.1.08			*Field does not contain data.*
Requesting Physician Name	12.1.09			*Field does not contain data.*
Requesting Physician Telephone Number	12.1.10			*Field does not contain data.*
User Field No. 1	12.1.11			*Field does not contain data.*
User Field No. 2	12.1.12			*Field does not contain data.*
Request Information Status Codes	12.1.13	ST	1	**Field Value** / **Description** F — The final result. A — Rejects the previous request and accepts the new request. Information can only be requested through the Request Record one at a time. To use this code, it is necessary to reject a current request for information before requesting the next. O — Request for Test Request only (no results). Inquiry is sent to a host from the analyzer using this code.

7.3.10. Photometric Calibration Result Record

Record used to transfer results of photometric calibration measurement.

M|1|PCR|adm···|^^^675|P1|15||5953^6009^5948^6009^^\10005^10535^1
0059^10589^^\^^^^^\^^^^^\^^^^^\^^^^^

Field Name	Reference	Format	Max Length	Comments (Data Content) **BM.PCR**
Record Type ID	BM.PC.01	ST	1	Use 'M'.
Sequence Number	BM.PC.02	NM	6	This record appears as the next layer of the Message Header Record. For one record, the field value is '1'; for specifying several, sequence numbers starting from 1 are assigned.
Record Type Sub ID	BM.PC.03	ST	3	Use 'PCR'.
Operator ID	BM.PC.04	ST	6	ID of the operator who performed the calibration at the analyzer.
Test Code	BM.PC.05	CM	10	Format ^^^<AppCode> Photometrics: 1-910 The range of application code is expanded to 5-digit.
Module ID	BM.PC.06	ST	2	ID of the analytical unit (module) the test belongs to. The ID gives the first character of the module that performed the analysis, then the number from the loader side (example: P1, P2, D3, D4, etc.).
Calibration Alarm	BM.PC.07	NM	3	Calibration alarm. See Appendix A.
SD Data Field	BM.PC.08	NM	6	SD value data.
STD Data	BM.PC.09	CM	38	Repeat Field. Repeated from STD1 to STD6 for as many as there are. Format<Absorbance Data for the first time>^<First time for the first one or the final absorbance data>^<Absorbance Data of the second time>^<Second time for the first one or the final absorbance data>^<Data Alarm>^<Prozone Value> Detail specification is shown below; **Element** / **Max Length** / **Format** <Absorbance Data for the first time> / 6 / NM <First time for the first one or the final absorbance data> / 6 / NM <Absorbance Data of the second time> / 6 / NM <Second time for the first one or the final absorbance data> / 6 / NM <Data Alarm> (See Appendix A) / 3 / NM <Prozone Value> / 6 / NM

7.3.11. ISE Calibration Result Record

Record used to transfer results of ISE calibration measurement.

```
M|1|ICR|adm···|ISE1|||^^^^^^^|^^^^^^^|^^^^^^^|-32.4^-35.1^-28.1
^-32.2^56.0^134.2^135.2^-0. 7|-34.9^-46.3^-25.8^-33.7^55.7^4.8^5
.04^-0.06|121.4^125.8^118.4^121.9^-42.0^102.0^99.5^-3.7
```

Field Name	Reference	Format	Max Length	Comments (Data Content) **BM.ICR**
Record Type ID	BM.IC.01	ST	1	Use ‘M’.
Sequence Number	BM.IC.02	NM	6	This record appears as the next layer of the Message Header Record. The field value is ‘1’ for one record. To specify several records, a sequence number starting from 1 is assigned.
Record Type Sub ID	BM.IC.03	ST	3	Use ‘ICR’.
Operator ID	BM.IC.04	ST	6	ID of the operator that performed the calibration at the analyzer.
Module ID	BM.IC.05	ST	5	ID of the analytical unit (module) the test belongs to. Either ISE10 or ISE20 is transmitted.
Na Calibration Alarm	BM.IC.06	NM	3	Na test calibration alarm. (See Appendix A.)
K Calibration Alarm	BM.IC.07	NM	3	K test calibration alarm. (See Appendix A.)
Cl Calibration Alarm	BM.IC.08	NM	3	Cl test calibration alarm. (See Appendix A.)

ISE Calibration Result Record, **Continued**

Field Name	Reference	Format	Max Length	Comments (Data Content) **BM.ICR**
Na Data Alarm	BM.IC.09	CM	31	Na test data alarm. (See Appendix A.) <Internal standard solution electromotive force data alarm>^<Low solution electromotive force data alarm>^<High solution electromotive force data alarm>^<Calibrator solution electromotive force data alarm>^<Slope for display data alarm>^<Internal standard solution concentration data alarm>^<Calibrator solution concentration data alarm>^<Numbers for compensation data alarm> Detail specification is shown below: **Element** — **Max Len** — **Format** <Internal standard solution electromotive force data alarm> — 3 — NM <Low solution electromotive force data alarm> — 3 — NM <High solution electromotive force data alarm> — 3 — NM <Calibrator solution electromotive force data alarm> — 3 — NM <Slope for display data alarm> — 3 — NM <Internal standard solution concentration data alarm> — 3 — NM <Calibrator solution concentration data alarm> — 3 — NM <Numbers for compensation data alarm> — 3 — NM
K Data Alarm	BM.IC.10	CM	31	K test data alarm. Refer to Na data alarm. (See Appendix A.)
Cl Data Alarm	BM.IC.11	CM	31	Cl test data alarm. Refer to Na data alarm. (See Appendix A.)
Na Data	BM.IC.12	CM	55	Na test calibration analytical data. (All Elements: Max Length = 6, Type =NM) <Internal standard solution electromotive force data>^<Low solution electromotive force data>^<High solution electromotive force data>^<Calibrator solution electromotive force data>^<Slope for display data>^<Internal standard solution concentration data>^<Calibrator solution concentration data>^<Numbers for compensations data>
K Data	BM.IC.13	CM	55	K test calibration analytical data. Refer to Na data.
Cl Data	BM.IC.14	CM	55	Cl test calibration analytical data. Refer to Na data.

7.3.12. Elecsys Calibration Result Record

Record used to transfer results of E-module calibration measurement.

```
M|1|ECR|BMSERV|^^^1|RackPack|E12|198781|710|0|196420|O|I^O^-----
--------------\M^O^-----\S^O^-------------------\R^1.00\D^O^--
---\F^O\Y^O^-----|1242^1185^0.000^0.000\24581^24542^0.000^0.000\
\\|0.000^1.51^0.000^0.000^0.000|uIU/mL|||20000529175246
```

Field Name	Reference	Format	Max Length	Comments (Data Content) **BM.ECR**
Record Type ID	BM.EC.01	ST	1	Use ‘M’.
Sequence Number	BM.EC.02	NM	6	This record appears as the next layer of the Message Header Record. The field value is ‘1’ for one record. To specify several records, a sequence number starting from 1 is assigned.
Record Type Sub ID	BM.EC.03	ST	3	Use ‘ECR’.
Operator ID	BM.EC.04	ST	6	ID of the operator that performed the calibration at the analyzer.
Test Code	BM.EC.05	ST	6	^^^App code
Calibration Method	BM.EC.06	ST		LOT, RackPack
Module ID	BM.EC.07	ST	3	ID of the analytical unit (module) the test belongs to (Format: Exy with x=1 to 4 module no. y=1 to 2 measuring cell e.g: E11, E12)
Rack Pack Lot No.	BM.EC.08	NM	8	1 to 99999999
Rack Pack No.	BM.EC.09	NM	5	1 to 199999
Expired Rack Pack Flag	BM.EC.10	NM	1	0 Calibration performed with 'Not Expired Rack Pack'' 1 Calibration performed with 'Expired Rack Pack'
Calibrator Lot No.	BM.EC.11	NM	8	1 to 99999999
Result Status	BM.EC.12	ST	1	O Ok Q Question F Failed
Result Characteristics	BM.EC.13			Repeat Field *1 Characteristic ID^Criteria result^Detail\
Calibrator Signals	BM.EC.14			Repeat Field *2
Target Value	BM.EC.15			Level1^Level2^Level3^Level4^Level5 (quantitative test only)
Unit	BM.EC.16	ST		Unit
Cut off	BM.EC.17			(qualitative test only)
Border Line Area	BM.EC.18			Lower Limit^Upper Limit (qualitative test only)
Measurement Date	BM.EC.19	TS	14	Date and time measurement was performed is designated by YYYYMMDDHHMMSS

*1 Result characteristics Criteria result

[For Quantitative tests]

Criteria	Characteristic ID	Criteria result	Detail
Missing Values	I	O:OK Q:Questionable F:Failed	*1-1
Monotony of curve	M	O:OK F:Failed	*1-2
Minimum signal	S	O:OK Q:Questionable F:Failed	*1-1
Calibration factor	R	Value of Calibration factor	[NONE]
Deviation of dupl.measurement	D	O:OK Q:Questionable F:Failed	*1-2
Minimum acceptable difference	F	O:OK F:Failed	[NONE]
System Error	Y	O:OK Q:Questionable	*1-2

[For Qualitative tests]

Criteria	Characteristic ID	Criteria result	Detail
Missing Values	I	O:OK Q:Questionable F:Failed	*1-3
Deviation of dupl.measurement	D	O:OK Q:Questionable F:Failed	*1-4
Slope	L	O:OK F:Failed	[NONE]
Min/Max signal	B	O:OK Q:Questionable F:Failed	*1-5
Minimum acceptable difference	F	O:OK F:Failed	[NONE]
System Error	Y	O:OK Q:Questionable	*1-4

***1-1 : Flag string with 20 positions:**
Format: <Level1 1st><Level1 2nd><Level1 3rd><Level1 4th>.....<Level5 1st><Level5 2nd><Level5 3rd><Level5 4th>

each flag can be '-' (= ok) or <level no.> (= not ok)

example: 11------33----------

meaning:

Level	1st	2nd	3rd	4th
1	not ok	not ok	ok	ok
2	ok	ok	ok	ok
3	not ok	not ok	ok	ok
4	ok	ok	ok	ok
5	ok	ok	ok	ok

***1-2 : Flag string with 5 positions:**
Format: <Level 1><Level 2><Level3><Level4><Level5>

each flag can be '-' (= ok) or <level no.> (= not ok)

example 1-34-

meaning:

Level	
1	not ok
2	ok
3	not ok
4	not ok
5	ok

***1-3 : Flag string with 8 positions:**
Format: <Level1 1st><Level1 2nd><Level1 3rd><Level1 4th><Level2 1st><Level2 2nd><Level2 3rd><Level2 4th>

each flag can be '-' (= ok) or <level no.> (= not ok)

example: 1---22--

meaning:

Level	1st	2nd	3rd	4th
1	not ok	ok	ok	ok
2	not ok	not ok	ok	ok

***1-4 : Flag string with 2 positions:**
Format: <Level 1><Level 2>

each flag can be '-' (= ok) or <level no.> (= not ok)

example: 1-

meaning:

Level	
1	not ok
2	ok

***1-5 : Flag string with 8 positions:**
Format: <Level1 1st><Level1 2nd><Level1 3rd><Level1 4th><Level2 1st><Level2 2nd><Level2 3rd><Level2 4th>

each flag can be '-' (= ok), '>' (= signal > Max signal) or '<' (= signal < Min signal)

example: >-<->-<-

meaning:

Level	1st	2nd	3rd	4th
1	>max	ok	<min	ok
2	>max	ok	<min	ok

***2 Calibrators signals**
Format:
<Level1 1st signal>^<Level1 2nd signal>^<Level1 3rd signal>^<Level1 4th signal>\
<Level2 1st signal>^<Level2 2nd signal>^<Level2 3rd signal>^<Level2 4th signal>\
.....
<Level5 1st signal>^<Level5 2nd signal>^<Level5 3rd signal>^<Level5 4th signal>

7.3.13. Photometric Absorbance Data Record

Record used to transfer raw absorbance data of photometric tests.

M|1|ABS|D1|1|I|10|50|1495\1497\1499\1499|13140\12828\12760\12699\12646\12605\12571\12545\12526\12504\12495\12481\12474\12472\12465\12463\12459\12454\12453\12449\12448\12442\\\12594\12986\12993\12992\12987\12987\12980\12982\12975\12973\12974\12970\12972\12970\12969\12969\12965\12970\12966\12970\12971\12974\12972\12977\12976\12982

Field Name	Reference	Format	Max Length	Comments (Data Content) **BM.AD**
Record Type ID	BM.AD.01	ST	1	Use 'M'.
Sequence Number	BM.AD.02	NM	6	This record appears as the next layer of the Message Header Record. The field value is '1' for one record. To specify several records, sequence numbers starting from 1 are assigned.
Record Type Sub ID	BM.AD.03	ST	3	Use 'ABS'.
Module ID	BM.AD.04	ST	2	ID of the analytical unit (module) the test belongs to. The ID gives the first character of the module that performed the analysis, then the number from the loader side (example: P1, P2, D3, D4, etc.).
Cell No	BM.AD.05	NM	3	Number of the Reaction Cell. Input value P module: 1-160 D module:.1-240
In Out Information	BM.AD.06	ST	1	Internal/External information. There is no value in this field when no distinction is made between internal or external. **Field Value** **Description** I Internal reaction cell line O External reaction cell line
Reaction Time	BM.AD.07	NM	2	Reaction time (Unit: minutes). Input values 1 to 22.
Point Num	BM.AD.08	NM	2	Reaction point number. Input values 1 to 73.
Cell Blank Data	BM.AD.09	ST	6	Repeat field. Cell blank absorbance. The difference between the main wavelength and sub-wavelength absorbance data [(main wavelength absorbance data) - (sub-wavelength absorbance data)] can be repeated up to 4 points.
Delta ABS Data	BM.AD.10	NM	6	Repeat field. The difference between the main wavelength and the sub-wavelength absorbance data [(main wavelength absorbance data) - (sub-wavelength absorbance data)] repeated up to the value indicated by Point Num.

7.3.14. Elecsys Raw Data (Effective Signal)

Record used to transfer raw absorbance data of E-module tests.

```
M|1|EFS|E11|4965\5786\5719\6553\8006\8050\6724\5765\5982\7806\87
21\9716\9948\9243\8396\6998\6045\5440\6130\6604\7431\7841\7567\7
398\6836\6472\69446139\6091\6800\7223\7013\7170\7855\8799\9128\8
763\8129\7112\7916\7246\6655\5967\5660\5260\5474\5730\7462\8610\
8777\8041\7779\7869\7995\8563\9204\8519\6994\5938\5551\6600\7292
\7869\7516\6955\7403\7295\7583\7670\6714\5653\5662\5965\7502\780
8\7210\6652\6808\6741\8256\8071\29512\40715\45306\47094\47755\47
944\47931\47852\47731\47604\47473\47340\47226\47098\46980\46861\
46750\46642\46530\46440\46340\46238\46147\46058\45975\45898\4581
3\45742\45653\45563\45488\45429\45356\45284\45235\45150\45102\45
025\44967\44909\44849\44794\44733\44681\44623\44553\44507\44460\
44407\44356\44317\44260\44210\44166\44134\44071\44030\43983\4394
9\43899\43862\43821\43786\43740\43686\43645\43620\43580\43534\43
496\43463\43418\43387\43346\43313\43284\43253\43210\43223\43225\
43241\43243\43188\43171\43144\43074\43026\42960\42871\42833\4279
2\42761\42720\42678\42649\42621\42606\42580\42541\42511\42486\42
439\42440\42503\42500\42509\42509\42481\42414\42361\42332\42282\
42268\42236\42192\42178\42164\42164\42148|1095000
```

Field Name	Reference	Format	Max Length	Comments (Data Content) **BM.EFS**
Record Type ID	BM.EFS.01	ST	1	Use ‘M’.
Sequence Number	BM.EFS.02	NM	6	This record appears as the next layer of the Message Header Record. The field value is ‘1’ for one record. To specify several records, sequence numbers starting from 1 are assigned.
Record Type Sub ID	BM.EFS.03	ST	3	Use ‘EFS’.
Module ID	BM.EFS.04	ST	3	ID of the analytical unit (module) the test belongs to. (Format: Exy with x=1 to 4 module no. y=1 to 2 measuring cell e.g: E11, E12)
Raw Data	BM.EFS.05	ST	6	Repeat field.
Effective Signal	BM.EFS.06	NM	6	

8. Indexes

8.1. Tables

8.2. Figures

Appendix A - Data Alarm List

All the test results are checked by the criteria of the system and if the result is not normal, one of the reason for the abnormal result is attached to the result as data flag.

Following table describes what alarms are applicable to photometry, ISE and Elecsys test and what are the presentation for each alarm when it is output to the printer, screen and the host. When sending results to the host, the number in the 'Host' column of the following table is sent in field 4 of the comment record (C) that follows the result record (R).

Alarm code	Alarm	Result Data	Photo-metry	ISE	Elecsys	Printer	Screen	Host
	no alarm							0
1	ADC abnormal		X	X	X	ADC?	A	1
2	Cell blank abnormal		X			Cell?	Q	2
3	Sample short	SPACE*	X	X	X	Sampl	V	3
4	Reagent short	SPACE*	X	X	X	Reagn	T	4
5	ABS over		X			ABS?	Z	5
6	Prozone error		X			P	P	6
7	Reaction limit over(all photometry points)		X			Limt0	I	7
8	Reaction limit over(second and subsequent photometry points)		X			Limt1	J	8
9	Reaction limit over(third and fourth and subsequent photometry points)		X			Limt2	K	9
10	Linearity abnormal(nine or more)		X			Lin.	W	10
11	Linearity abnormal(eight or less)		X			Lin8.	F	11
12	Standard Solution 1 Absorbance Abnormal		X			S1Abs?	H	12
13	Duplicate Error		X		X	Dup	U	13
14	STD Error		X	X		Std?	S	14
15	Sensitivity Error		X			Sens	Y	15
16	Calibration Error		X	X		Calib	B	16
17	Convergence Error		X			SD?	G	17
18	Noise error			X		Noise	N	18
19	Level error			X		Level	L	19
20	Slope Error			X	X	Slope?	E	20
21	ISE Slope Marginal			X		Margin	R	21
22	Internal Concentration Abnormal			X		I.STD	D	22
23	Sample range over			X		R.over	&	23
24	Data error in Compensate test		X	X		Cmp.T	C	24
25	Unable to calculate compensate test	SPACE	X	X		Cmp.T!	M	25
26	PANIC value over (upper)		X	X	X	LIMTH	$	26
27	PANIC value over (lower)		X	X	X	LIMTL	$	27
28	Random Error [R-4s]		X	X		Random	@	28
29	System Error 1 [2-2sA]		X	X		Systm1	#	29
30	System Error 2 [2-2sW]		X	X		Systm2	#	30
31	System Error 3 [4-1sA]		X	X		Systm3	#	31
32	System Error 4 [4-1sW]		X	X		Systm4	#	32
33	System Error 5 [10xA]		X	X		Systm5	#	33
34	System Error 6 [10xW]		X	X		Systm6	#	34
35	QC Error 1		X	X		QCErr1	+	35
36	QC Error 2		X	X		QCErr2	+	36
37	Calculated test error		X	X		Calc?	%	37
38	Overflow	SPACE	X	X		Over	O	38
39	Calculation not possible	SPACE	X	X	X	???	X	39
40	Outside of expected value(upper)		X	X		H		
41	Outside of expected value(lower)		X	X		L		
42	Edited test		X	X		Edited	*	42
43	Calibration result abnormal		X	X	X	CalErr	!	43
44	Repeat limit over(upper)		X	X	X	ReptH	=	44
45	Repeat limit over(lower)		X	X	X	ReptL	=	45
46	ABS maximum over	SPACE	X			>AMAX	>	46
51	Response Error 1			X		Resp1	:	51
52	Response Error 2			X		Resp2	;	52
53	Conditioning Error			X		Condi	/	53
55	ISE Range over			X		Range	r	55

Data Alarm List, Continued

Alarm code	Alarm	Result Data	Photo-metry	ISE	Elecsys	Printer	Screen	Host
62	System Reagent short	SPACE			X	SysRg	g	62
63	AB level range over				X	ABover	a	63
64	AB level check error				X	ABerr	b	64
65	Current range over				X	CurOvr	p	65
66	Current range check error				X	CurErr	q	66
67	Sample hovering	SPACE			X	Smp.h	h	67
68	Sample air bubble	SPACE			X	Smp.b	k	68
69	Reagent hovering	SPACE			X	Reag.h	m	69
70	Reagent film detection	SPACE			X	Reag.f	f	70
71	Potential carry over				X	CarOvr	d	71
72	Sample Clot	SPACE			X	Smp.s	e	72
74	Reagent disk temperature				X	Reag.T	y	74
75	Incubator temperature				X	Inc.T	t	75
76	System reagent temperature				X	SysR.T	s	76
77	Cell temperature				X	Cell.T	c	77
86	Sample LLD abnormal				X	SLLD.a	u	86
87	Sample LLD noise				X	SLLD.n	n	87
93	Washing buffer temperature				X	WB.T	z	93
94	Washing buffer short	SPACE			X	WB	]	94
95	Clot pressure sensor ADC underflow	SPACE			X	ClotL	[	95
96	Clot pressure sensor ADC overflow	SPACE			X	ClotH	[	96
97	Clot pressure abnormal	SPACE			X	ClotX	}	97
98	Sample pipetter air bubble	SPACE			X	Smp.ib	v	98
99	Current range over (during Operation)				X	OpeC.O	w	99
100	Lower signal level	SPACE			X	LowSig	<	100

[Result Data]

In case a column of “Result Data” is blank, result is outputted as value.

In case a column of “Result Data” is “SPACE”, result is outputted as space.

In case a column of “Result Data” is “SPACE*”, it is dependent on a case whether a result is outputted as a value or it is outputted as a space.

Appendix B - Application Codes

B-1: Application Codes - CC Modules

App Code	CHEMISTRY	Short names
144	a-1-Microglobulin	1M
21	Acid Phos Total	ACP
5	Albumin (Tina-quant) urine (former MAU)	ALB
188	Albumin (Tina-quant) serum	ALB
413	Albumin plus	ALB
680	Alk. Phosphatase (AMP)	ALP
681	Alk Phosphatase IFCC (SYS Kit)	ALP
683	Alk. Phosphatase (opt.)	ALP
426	ALT opt	ALT
684	ALT IFCC with PP	ALT
685	ALT IFCC	ALT
478	Ammonia	AMM
509	Amylase liquid urine only	AMYL
570	Amylase liquid	AMYL
74	APO A1	APOA1
210	APO B	APOB
37	ASLO	ASLO
111	AST IFCC STAT	AST
425	AST opt	AST
686	AST IFCC with PP	AST
466	AT III new formulation	ATIII
48	a-1 Antitrypsin	ATRYP
261	BUN (liquid) only for RDC urine only	BUN
421	BUN (liquid) only for RDC	BUN

App Code	CHEMISTRY	Short names
36	C3c (without sample predilution)	C3c
32	C4 (without sample predilution)	C4
522	Calcium large urine only STAT	CA
706	Calcium - Oleary, large STAT	CA
749	Calcium cal convenience - large STAT	CA
31	Carbamazepine II (new formulation)	CARB
434	Cholinesterase RDG	CHE
725	Cholinesterase RDC	CHE
433	Cholesterol liquid	CHOL
688	CK granulate	CK
689	CK-MB granulate	CK-MB
763	Bicarbonate (new RDC Kinetic) STAT	CO2
30	Ceruloplasmin	CPLAS
503	Creatinine plus urine only	CREA
652	Creatinine plus	CREA
690	Creat Jaffe rate blank harmonized	CREA
691	Creat Jaffe rate blank, urine only	CREA
773	Creat Jaffe non rate blank STAT	CREA
774	Creat Jaffe non RB, urine only STAT	CREA
109	CRP 96, #1551922	CRP
476	CRP 96, large #1730371/1929372	CRP
704	CRP 96, large #1730371/1929372	CRP
93	Cyclosporine, (unisys)	CSA
294	Bilirubin, Direct (Jendrassik);	DBIL

App Code	CHEMISTRY	Short names
123	D. Dimer (unisys)	DD
81	Digoxin TQ	DIG
69	Digitoxin	DIGIT
552	Alcohol for urine	ETH
703	Alcohol	ETH
661	Iron liquid (new)	FE
164	Ferritin Tinaquant new	FERRI
667	Fructosamine	FRUC
87	Gentamicin	GENT
505	GGT R1/R2 (granulate)	GGT
588	GLDH	GLDH
525	Glucose GOD (liquid)	GLU
597	Glucose HK liquid STAT (urine only)	GLU
767	Glucose HK STAT	GLU
229	a-1-acid Glycoprotein	GPROT
125	Hemoglobin new (unisys)	HB
803	Hemoglobin new special System Kit	HB
27	HbA1c new (unisys)	HBA1C
802	HbA1c Kit	HBA1C
567	HBDH liquid	HBDH
449	HDL Cholesterol plus	HDL-C
228	Haptoglobin	HGLOB
777	IgA	IGA
453	IgE	IGE

App Code	CHEMISTRY	Short names
779	IgG	IGG
789	IgM	IGM
283	Kappa	KAPPA
40	Lactate STAT	LAC
284	Lambda	LAMBD
811	LD RDC	LD
810	LD1	LD-1
672	LDH liquid	LDH
682	LDH SFBC SYS Kit	LDH
96	LDL Cholesterol plus	LDL
731	Lipase liquid	LIP
62	Lp(a)	LPA
693	Magnesium	MG
695	Magnesium add code f. urine	MG
222	B 2 Microglobulin	MICGL
287	Myoglobin	MYOGB
26	NAPA	NAPA
22	Acid Phos-Non Prostatic	NPP
181	Prealbumin	PALB
517	p-Amylase liquid urine only	P-AMY
571	p-Amylase liquid	P-AMY
277	Phenobarbital	PHENO
278	Phenytoin	PHENY
714	Phosphorus	PHOS

App Code	CHEMISTRY	Short names
716	Phosphorus (add. code f. urine)	PHOS
135	Procainamide	PROC
136	RF	RF
780	Salicylate	SAL
245	Tuptake new	T UP
752	T4 new	T4
101	Bilirubin, Total (DPD) granulate	TBIL
781	Triglycerides (liquid)	TG
783	Triglycerides/GB	TG
280	Theophylline improved	THEO
185	Tobramycin	TOBR
678	Total Protein	TP
216	Transferrin	TRANS
119	Urinary CSF Protein	U/CSF
585	Uric Acid plus urine only	UA
700	Uric Acid plus	UA
785	UIBC	UIBC
418	BUN (liquid)	UREA
470	BUN (liquid) urine	UREA
190	Valproic Acid	VPA
850	NaCL for Serum Index	S.I

App Cod	CHEMISTRY	Short names

B-2: Application Codes - E Modules

Test no. Reference 2010	ACN E170	Test name
1	1	TSH
2	2	T4
3	4	FT4
4	8	T-UP
5	7	T3
6	10	FT3
10	12	E2
11	13	TESTO
12	16	PROG
13	14	PRL
14	20	LH
15	23	FSH
16	24	CORT
18	33	HCG
19	44	P1NP
22	39	TN-T
23	43	CK-MB
24	56	MYO
26	129	Digitoxin
27	91	pro-BNP
28	29	Vitamin D
30	49	CEA
31	50	AFP
32	51	PSA
33	52	CA15-3

Test no. Reference 2010	ACN E170	Test name
34	53	CA125
35	54	CA19-9
36	55	CA72-4
37	63	CYFRA
38	67	FERR
39	68	FPSA
40	61	HBSAG
41	64	A-HBS
42	65	A-HCV
43	66	A-HBE
44	73	HBEAG
45	77	A-HBC
46	86	A-HBCIGM
47	88	A-HAV
48	85	A-HAVIGM
49	89	A-HIV
50	90	HIVAG
52	98	A-TOXIGG
53	95	A-TOXIGM
54	105	A-RUBIGG
55	106	A-RUBIGM
56	104	HIVCOM
57	107	A-HGVENV
58	108	A-HELICO
60	110	B12

Test no. Reference 2010	ACN E170	Test name
61	114	FOL
62	115	DIG
63	116	IGE
65	120	INSULIN
66	122	OSTEOC
67	127	CROSSL
68	126	PTH
70	130	TG
71	133	A-TG
72	137	A-TPO
73	141	A-TSHR
74	142	DHEA-S
75	146	SHBG
76	148	HCG-BETA
77	155	NSE
78	25	S-100

Appendix C - Instrument Alarms

Alarm Type	Alarm No	Alarm Message	Alarm Description	Alarm Remedy
110	001	Abnormal Receiving Text from Host	Abnormal Text has been received from Host.	a. Check the host computer. Is it ON? b. Verify Host Communication on Start Conditions. c. Check cable connections between the analyzer and host computer. d. Check the host computer transmit condition. e. Ensure that the host and the analyzer are utilizing the same communication configuration. f. Resume operation; if alarm recurs, call Technical Support.
111	002	Abnormal TS from Host	No response for the inquiry within a set time in GUI: [Utility]-[System]-[Host Communication].	a. Check the host computer. Is it ON? b. Verify Host Communication on Start Conditions. c. Check cable connections between the analyzer and host computer. d. Check the host computer transmit condition. e. Ensure that the host and the analyzer are utilizing the same communication configuration. f. Resume operation; if alarm recurs, call Technical Support.
111	003	Abnormal TS from Host	No response for the inquiry within 10 minutes.	a. Check the host computer. Is it ON? b. Verify Host Communication on Start Conditions. c. Check cable connections between the analyzer and host computer. d. Check the host computer transmit condition. e. Ensure that the host and the analyzer are utilizing the same communication configuration. f. Resume operation; if alarm recurs, call Technical Support.
111	005	Abnormal TS from Host	Application code requested by the host is not registered in the analyzer; or received application code other than Photometric test, ISE test or serum index test.	a. Check the host computer. Is it ON? b. Verify Host Communication on Start Conditions. c. Check cable connections between the analyzer and host computer. d. Check the host computer transmit condition. e. Ensure that the host and the analyzer are utilizing the same communication configuration. f. Resume operation; if alarm recurs, call Technical Support.
111	006	Abnormal TS from Host	Received request for other than pair of Na, K or Na, K, Cl for ISE.	a. Check the host computer. Is it ON? b. Verify Host Communication on Start Conditions. c. Check cable connections between the analyzer and host computer. d. Check the host computer transmit condition. e. Ensure that the host and the analyzer are utilizing the same communication configuration. f. Resume operation; if alarm recurs, call Technical Support.

Instrument Alarm List, Continued

Alarm Type	Alarm No	Alarm Message	Alarm Description	Alarm Remedy
111	007	Abnormal TS from Host	Received request for increased or decreased quantity for other than Sample Type 2 (Urine) of ISE test.	a. Check the host computer. Is it ON? b. Verify Host Communication on Start Conditions. c. Check cable connections between the analyzer and host computer. d. Check the host computer transmit condition. e. Ensure that the host and the analyzer are utilizing the same communication configuration. f. Resume operation; if alarm recurs, call Technical Support.
111	008	Abnormal TS from Host	Received request for ISE test is wrong.	a. Check the host computer. Is it ON? b. Verify Host Communication on Start Conditions. c. Check cable connections between the analyzer and host computer. d. Check the host computer transmit condition. e. Ensure that the host and the analyzer are utilizing the same communication configuration. f. Resume operation; if alarm recurs, call Technical Support.
111	009	Abnormal TS from Host	Received request for serum index test is wrong.	a. Check the host computer. Is it ON? b. Verify Host Communication on Start Conditions. c. Check cable connections between the analyzer and host computer. d. Check the host computer transmit condition. e. Ensure that the host and the analyzer are utilizing the same communication configuration. f. Resume operation; if alarm recurs, call Technical Support.
111	010	Abnormal TS from Host	Received comment even though the mode was set for no transmission of comments.	a. Check the host computer. Is it ON? b. Verify Host Communication on Start Conditions. c. Check cable connections between the analyzer and host computer. d. Check the host computer transmit condition. e. Ensure that the host and the analyzer are utilizing the same communication configuration. f. Resume operation; if alarm recurs, call Technical Support.
111	011	Abnormal TS from Host	One or more tests requested by the host are not accepted because the requests are for the 3rd or further processing of the tests.	a. Check the 3rd. Results Acceptance setting on the Utility/System screen and set it if necessary. b. Check the previous tests results were sent to the HOST.
112	002	Abnormal Automatic Rerun TS from Host	No response for the inquiry within a set time in GUI: [Utility]-[System]-[Host Communication].	a. Check the host computer. Is it ON? b. Verify Host Communication on Start Conditions. c. Check cable connections between the analyzer and host computer. d. Check the host computer transmit condition. e. Ensure that the host and the analyzer are utilizing the same communication configuration. f. Resume operation; if alarm recurs, call Technical Support.

Instrument Alarm List, Continued

Alarm Type	Alarm No	Alarm Message	Alarm Description	Alarm Remedy
112	003	Abnormal Automatic Rerun TS from Host	No response for the inquiry within 10 minutes.	a. Check the host computer. Is it ON? b. Verify Host Communication on Start Conditions. c. Check cable connections between the analyzer and host computer. d. Check the host computer transmit condition. e. Ensure that the host and the analyzer are utilizing the same communication configuration. f. Resume operation; if alarm recurs, call Technical Support.
112	005	Abnormal Automatic Rerun TS from Host	Application code requested by the host is not registered in the analyzer; or received application code other than Photometric test, ISE test or serum index test.	a. Check the host computer. Is it ON? b. Verify Host Communication on Start Conditions. c. Check cable connections between the analyzer and host computer. d. Check the host computer transmit condition. e. Ensure that the host and the analyzer are utilizing the same communication configuration. f. Resume operation; if alarm recurs, call Technical Support.
112	006	Abnormal Automatic Rerun TS from Host	Received request for other than pair of Na, K or Na, K, Cl for ISE.	a. Check the host computer. Is it ON? b. Verify Host Communication on Start Conditions. c. Check cable connections between the analyzer and host computer. d. Check the host computer transmit condition. e. Ensure that the host and the analyzer are utilizing the same communication configuration. f. Resume operation; if alarm recurs, call Technical Support.
112	007	Abnormal Automatic Rerun TS from Host	Received request for increased or decreased quantity for other than Sample Type 2 (Urine) of ISE test.	a. Check the host computer. Is it ON? b. Verify Host Communication on Start Conditions. c. Check cable connections between the analyzer and host computer. d. Check the host computer transmit condition. e. Ensure that the host and the analyzer are utilizing the same communication configuration. f. Resume operation; if alarm recurs, call Technical Support.
112	008	Abnormal Automatic Rerun TS from Host	Received request for ISE test is wrong. Received request for other than pair of Na, K or Na, K, Cl for ISE test.	a. Check the host computer. Is it ON? b. Verify Host Communication on Start Conditions. c. Check cable connections between the analyzer and host computer. d. Check the host computer transmit condition. e. Ensure that the host and the analyzer are utilizing the same communication configuration. f. Resume operation; if alarm recurs, call Technical Support.

Instrument Alarm List, Continued

Alarm Type	Alarm No	Alarm Message	Alarm Description	Alarm Remedy
112	009	Abnormal Automatic Rerun TS from Host	Received request for serum index test is wrong. Received request for increased or decreased quantity.	a. Check the host computer. Is it ON? b. Verify Host Communication on Start Conditions. c. Check cable connections between the analyzer and host computer. d. Check the host computer transmit condition. e. Ensure that the host and the analyzer are utilizing the same communication configuration. f. Resume operation; if alarm recurs, call Technical Support.
112	010	Abnormal Automatic Rerun TS from Host	Received comment even though the mode was set for no transmission of comments.	a. Check the host computer. Is it ON? b. Verify Host Communication on Start Conditions. c. Check cable connections between the analyzer and host computer. d. Check the host computer transmit condition. e. Ensure that the host and the analyzer are utilizing the same communication configuration. f. Resume operation; if alarm recurs, call Technical Support.
112	011	Abnormal Automatic Rerun TS from Host	One or more tests requested by the host are not accepted because the requests are for the 3rd or further processing of the tests.	a. Check the 3rd. Results Acceptance setting on the Utility/System screen and set it if necessary. b. Check the previous tests results were sent to the HOST.
126	001	Host Communication Error	The analyzer failed to open session.	a. Check the host computer. Is it ON? b. Verify Host Communication on Start Conditions. c. Check cable connections between the analyzer and host computer. d. Check the host computer transmit condition. e. Ensure that the host and the analyzer are utilizing the same communication configuration. f. Resume operation; if alarm recurs, call Technical Support.
126	004	Host Communication Error	When analyzer has sent <ENQ> but Host sent <NAK>. Analyzer stop transmission.	a. Check the host computer. Is it ON? b. Verify Host Communication on Start Conditions. c. Check cable connections between the analyzer and host computer. d. Check the host computer transmit condition. e. Ensure that the host and the analyzer are utilizing the same communication configuration. f. Resume operation; if alarm recurs, call Technical Support.
126	005	Host Communication Error	When analyzer has sent <ENQ>, but host did not send <ACK> nor <NAK>. (Link Time Out)	a. Check the host computer. Is it ON? b. Verify Host Communication on Start Conditions. c. Check cable connections between the analyzer and host computer. d. Check the host computer transmit condition. e. Ensure that the host and the analyzer are utilizing the same communication configuration. f. Resume operation; if alarm recurs, call Technical Support.

Instrument Alarm List, Continued

Alarm Type	Alarm No	Alarm Message	Alarm Description	Alarm Remedy
126	006	Host Communication Error	When analyzer has sent <STX> with text frame, but host sent <NAK>. Analyzer sent again.	a. Check the host computer. Is it ON? b. Verify Host Communication on Start Conditions. c. Check cable connections between the analyzer and host computer. d. Check the host computer transmit condition. e. Ensure that the host and the analyzer are utilizing the same communication configuration. f. Resume operation; if alarm recurs, call Technical Support.
126	007	Host Communication Error	When analyzer has sent <STX> with text frame, but host did not send <ACK> or <NAK>. (Receiving time out) 15 Seconds	a. Check the host computer. Is it ON? b. Verify Host Communication on Start Conditions. c. Check cable connections between the analyzer and host computer. d. Check the host computer transmit condition. e. Ensure that the host and the analyzer are utilizing the same communication configuration. f. Resume operation; if alarm recurs, call Technical Support.
126	008	Host Communication Error	Re-transmission has gone over the limit (6 times).	a. Check the host computer. Is it ON? b. Verify Host Communication on Start Conditions. c. Check cable connections between the analyzer and host computer. d. Check the host computer transmit condition. e. Ensure that the host and the analyzer are utilizing the same communication configuration. f. Resume operation; if alarm recurs, call Technical Support.
126	009	Host Communication Error	When analyzer has sent <ENQ> as transmission request, host sent <ENQ> as transmission request (Link Contention).	a. Check the host computer. Is it ON? b. Verify Host Communication on Start Conditions. c. Check cable connections between the analyzer and host computer. d. Check the host computer transmit condition. e. Ensure that the host and the analyzer are utilizing the same communication configuration. f. Resume operation; if alarm recurs, call Technical Support.
126	011	Host Communication Error	When the analyzer has received <ACK> or <NAK> as a reception request from the host and has become ready for reception, but the host did not transmit <STX> nor <EOT> in 30 sec. (Reception Timeout).	a. Check the host computer. Is it ON? b. Verify Host Communication on Start Conditions. c. Check cable connections between the analyzer and host computer. d. Check the host computer transmit condition. e. Ensure that the host and the analyzer are utilizing the same communication configuration. f. Resume operation; if alarm recurs, call Technical Support.

Instrument Alarm List, Continued

Alarm Type	Alarm No	Alarm Message	Alarm Description	Alarm Remedy
126	012	Host Communication Error	Analyzer received reception request from host, but not in condition to receive.	a. Check the host computer. Is it ON? b. Verify Host Communication on Start Conditions. c. Check cable connections between the analyzer and host computer. d. Check the host computer transmit condition. e. Ensure that the host and the analyzer are utilizing the same communication configuration. f. Resume operation; if alarm recurs, call Technical Support.
126	016	Host Communication Error	Buffer Over Flow Over Flow occurred in the receiving buffer during message receiving. Communication stopped between analyzer and host.	a. Check the host computer. Is it ON? b. Verify Host Communication on Start Conditions. c. Check cable connections between the analyzer and host computer. d. Check the host computer transmit condition. e. Ensure that the host and the analyzer are utilizing the same communication configuration. f. Resume operation; if alarm recurs, call Technical Support.
126	017	Host Communication Error	Retry Over in Error message receiving When the analyzer received incorrect message and sent <NAK> to host. Analyzer retried this process more than 12 times (Upper Retry Limit). Communication stopped between analyzer and host.	a. Check the host computer. Is it ON? b. Verify Host Communication on Start Conditions. c. Check cable connections between the analyzer and host computer. d. Check the host computer transmit condition. e. Ensure that the host and the analyzer are utilizing the same communication configuration. f. Resume operation; if alarm recurs, call Technical Support.
126	018	Host Communication Error	Undefined Error is detected in MBSI	a. Check the host computer. Is it ON? b. Verify Host Communication on Start Conditions. c. Check cable connections between the analyzer and host computer. d. Check the host computer transmit condition. e. Ensure that the host and the analyzer are utilizing the same communication configuration. f. Resume operation; if alarm recurs, call Technical Support.

Instrument Alarm List, Continued

Alarm Type	Alarm No	Alarm Message	Alarm Description	Alarm Remedy
126	019	Host Communication Error	Although '7 Bit' format is selected in Utility/System/Host Setting screen, transmitted data contain the character that can only be represented in '8 bit' format. The character is converted into '#' in 7 bit code.	a. Check the host communication setting in Utility/System/Host Setting screen. b. Verify the characters sent to the host. c. Resume operation; if alarm recurs, call Technical Support.
126	020	Host Communication Error	Automatic recovery of connection between host and the analyzer occurs 5 times consecutively. Host communication has stopped.	a. Check the host computer. Is it ON? b. Verify Host Communication on Start Conditions. c. Check cable connections between the analyzer and host computer. d. Check the host computer transmit condition. e. Ensure that the host and the analyzer are utilizing the same communication configuration. f. Resume operation; if alarm recurs, call Technical Support.
126	021	Host Communication Error	No valid Record.	a. Check the host computer. Is it ON? b. Verify Host Communication on Start Conditions. c. Check cable connections between the analyzer and host computer. d. Check the host computer transmit condition. e. Ensure that the host and the analyzer are utilizing the same communication configuration. f. Resume operation; if alarm recurs, call Technical Support.
126	022	Host Communication Error	First Record is not a Header Record.	a. Check the host computer. Is it ON? b. Verify Host Communication on Start Conditions. c. Check cable connections between the analyzer and host computer. d. Check the host computer transmit condition. e. Ensure that the host and the analyzer are utilizing the same communication configuration. f. Resume operation; if alarm recurs, call Technical Support.

Instrument Alarm List, Continued

Alarm Type	Alarm No	Alarm Message	Alarm Description	Alarm Remedy
126	023	Host Communication Error	Undefined Record.	a. Check the host computer. Is it ON? b. Verify Host Communication on Start Conditions. c. Check cable connections between the analyzer and host computer. d. Check the host computer transmit condition. e. Ensure that the host and the analyzer are utilizing the same communication configuration. f. Resume operation; if alarm recurs, call Technical Support.
126	024	Host Communication Error	Data other than specified.	a. Check the host computer. Is it ON? b. Verify Host Communication on Start Conditions. c. Check cable connections between the analyzer and host computer. d. Check the host computer transmit condition. e. Ensure that the host and the analyzer are utilizing the same communication configuration. f. Resume operation; if alarm recurs, call Technical Support.
126	025	Host Communication Error	Data other than specified.	a. Check the host computer. Is it ON? b. Verify Host Communication on Start Conditions. c. Check cable connections between the analyzer and host computer. d. Check the host computer transmit condition. e. Ensure that the host and the analyzer are utilizing the same communication configuration. f. Resume operation; if alarm recurs, call Technical Support.

Alarm Type	Alarm No	Alarm Message	Alarm Description	Alarm Remedy
340	1	Host Receiving Text Error	A field pause of L record is insufficient.	Please check L record.
340	2	Host Receiving Text Error	There is no record end of L record.	Please check whether '<CR>' (0x0d) is in the terminus of L record.
340	3	Host Receiving Text Error	Termination Code of L record is not effective value.	Please check Termination Code of L record.
340	4	Host Receiving Text Error	There is no record end of P record.	Please check whether '<CR>' (0x0d) is in the terminus of P record.
340	5	Host Receiving Text Error	A field pause of P record is insufficient.	Please check P record.
340	6	Host Receiving Text Error	Sequence Number of P record is not effective value.	Please check Sequence Number of P record.
340	7	Host Receiving Text Error	A field pause of O record is insufficient.	Please check O record.

340	8	Host Receiving Text Error	Sequence Number of O record is not effective value.	Please check Sequence Number of O record.
340	9	Host Receiving Text Error	Specimen ID is not effective value.	Please check Specimen ID.
340	10	Host Receiving Text Error	Instrument Specimen ID is not effective value.	Please check Instrument Specimen ID.
340	11	Host Receiving Text Error	Universal Test ID is not effective value.	Please check Universal Test ID.
340	12	Host Receiving Text Error	Priority is not effective value.	Please check Priority.
340	13	Host Receiving Text Error	Specimen Collection Data and Time is not effective value.	Please check Specimen Collection Data and Time.
340	14	Host Receiving Text Error	Action Code is not effective value.	Please check Action Code.
340	15	Host Receiving Text Error	Relevant Clinical Information is not effective value.	Please check Relevant Clinical Information.
340	16	Host Receiving Text Error	Specimen Descriptor is not effective value.	Please check Specimen Descriptor.
340	17	Host Receiving Text Error	User Field No.2 is not effective value.	Please check User Field No.2.
340	18	Host Receiving Text Error	There is no record end of O record.	Please check whether '<CR>' (0x0d) is in the terminus of O record.
340	19	Host Receiving Text Error	Report Type is not effective value.	Please check Report Type.
340	20	Host Receiving Text Error	A field pause of Q record is insufficient.	Please check Q record.
340	21	Host Receiving Text Error	Sequence Number of Q record is not effective value.	Please check Sequence Number of Q record.
340	22	Host Receiving Text Error	Starting Range ID Number is not effective value.	Please check Starting Range ID Number.
340	23	Host Receiving Text Error	There is no record end of Q record.	Please check whether '<CR>' (0x0d) is in the terminus of Q record.
340	24	Host Receiving Text Error	Request Information Status Code is not effective value.	Please check Request Information Status.
340	25	Host Receiving Text Error	Specimen ID is not effective value.	Please check Specimen ID.
340	26	Host Receiving Text Error	Sample No. is not effective value.	Please check Sample No.
340	27	Host Receiving Text Error	Sample ID is not effective value.	Please check Sample ID.
340	28	Host Receiving Text Error	Sample Type is not effective value.	Please check Sample Type.

340	29	Host Receiving Text Error	Rack ID is not effective value.	Please check Rack ID.
340	30	Host Receiving Text Error	Rack Position No. is not effective value.	Please check Rack Position No.
340	31	Host Receiving Text Error	A component pause of Universal Test ID is insufficient.	Please check Universal Test ID.
340	32	Host Receiving Text Error	Action Code & Value is not effective value.	Please check Action Code & Value.
340	33	Host Receiving Text Error	A component pause of User Field No. 2 is insufficient.	Please check User Field No. 2.
340	34	Host Receiving Text Error	Instrument Specimen ID is not effective value.	Please check Instrument Specimen ID.
340	35	Host Receiving Text Error	A component pause of Comment or Special Instructions.	Please check Comment or Special Instructions.
340	36	Host Receiving Text Error	Comment or Special Instructions is not effective value.	Please check Comment or Special Instructions.
340	37	Host Receiving Text Error	A field pause of H record is insufficient.	Please check H record.
340	38	Host Receiving Text Error	Comment or Special Instructions is not effective value.	Please check Comment or Special Instructions.
340	39	Host Receiving Text Error	There is no record end of H record.	Please check whether '<CR>' (0x0d) is in the terminus of H record.
340	40	Host Receiving Text Error	A field pause of P record is insufficient.	Please check P record.
340	41	Host Receiving Text Error	Sequence Number of P record is not effective value.	Please check Sequence Number of P record.
340	42	Host Receiving Text Error	Specimen ID is not effective value.	Please check Specimen ID.
340	43	Host Receiving Text Error	Specimen ID is not effective value.	Please check Specimen ID.
340	44	Host Receiving Text Error	There is no record end of P record.	Please check whether '<CR>' (0x0d) is in the terminus of P record.
340	45	Host Receiving Text Error	Application Code is not effective value.	Please check Application Code.
340	46	Host Receiving Text Error	Dilution is not effective value.	Please check Dilution.
340	47	Host Receiving Text Error	A field pause of O record is insufficient.	Please check O record.
340	48	Host Receiving Text Error	Sequence Number of O record is not effective value.	Please check Sequence Number of O record.
340	49	Host Receiving Text Error	Specimen ID is not effective value.	Please check Specimen ID.

340	50	Host Receiving Text Error	Instrument Specimen ID is not effective value.	Please check Instrument Specimen ID.
340	51	Host Receiving Text Error	Universal Test ID is not effective value.	Please check Universal Test ID.
340	52	Host Receiving Text Error	Priority is not effective value.	Please check Priority.
340	53	Host Receiving Text Error	Specimen Collection Data and Time is not effective value.	Please check Specimen Collection Data and Time.
340	54	Host Receiving Text Error	Action Code is not effective value.	Please check Action Code.
340	55	Host Receiving Text Error	Specimen Descriptor is not effective value.	Please check Specimen Descriptor.
340	56	Host Receiving Text Error	Date/Time Results Reported or Last Modified is not effective value.	Please check Date/Time Results Reported or Last Modified.
340	57	Host Receiving Text Error	There is no record end of O record.	Please check whether '<CR>' (0x0d) is in the terminus of O record.
340	58	Host Receiving Text Error	Report Type is not effective value.	Please check Report Type.
340	59	Host Receiving Text Error	Sample ID is not effective value.	Please check Sample ID.
340	60	Host Receiving Text Error	Sample No. is not effective value.	Please check Sample No.
340	61	Host Receiving Text Error	Rack ID is not effective value.	Please check Rack ID.
340	62	Host Receiving Text Error	Rack Position is not effective value.	Please check Rack Position.
340	63	Host Receiving Text Error	A field pause of Q record is insufficient.	Please check Q record.
340	64	Host Receiving Text Error	Sequence Number of Q record is not effective value.	Please check Sequence Number of Q record.
340	65	Host Receiving Text Error	Specimen ID is not effective value.	Please check Specimen ID.
340	66	Host Receiving Text Error	Request Information Status Code is not effective value.	Please check Request Information Status Code.
340	67	Host Receiving Text Error	There is no record end of Q record.	Please check whether '<CR>' (0x0d) is in the terminus of Q record.
340	68	Host Receiving Text Error	A field pause of C record is insufficient.	Please check C record.
340	69	Host Receiving Text Error	Sequence Number of C record is not effective value.	Please check Sequence Number of C record.

340	70	Host Receiving Text Error	Comment Source is not effective value.	Please check Comment Source.
340	71	Host Receiving Text Error	Comment Text is not effective value.	Please check Comment Text.
340	72	Host Receiving Text Error	Comment Type is not effective value.	Please check Comment Type.
340	73	Host Receiving Text Error	There is no record end of C record.	Please check whether '<CR>' (0x0d) is in the terminus of C record.
340	74	Host Receiving Text Error	Age is not effective value.	Please check Age.
340	75	Host Receiving Text Error	Age Unit is not effective value.	Please check Age Unit.
340	101	Host Receiving Text Error	Sample No. is outside the range.	Please check Sample No.
340	102	Host Receiving Text Error	Class is outside the range.	Please check Class.
340	103	Host Receiving Text Error	Rack ID is outside the range.	Please check Rack ID.
340	104	Host Receiving Text Error	Cup Position is outside the range.	Please check Cup Position.
340	105	Host Receiving Text Error	First run/rerun is not specified.	Please confirm whether to be the First run or rerun.
340	106	Host Receiving Text Error	Application Code is outside the range.	Please check Application Code.
340	107	Host Receiving Text Error	Sample Volume is outside the range.	Please check Sample Volume.
340	108	Host Receiving Text Error	Draw Time (Year) is outside the range.	Please check Draw Time (Year).
340	109	Host Receiving Text Error	Draw Time (Month) is outside the range.	Please check Draw Time (Month).
340	110	Host Receiving Text Error	Draw Time (Day) is outside the range.	Please check Draw Time (Day).
340	111	Host Receiving Text Error	Draw Time (Hour) is outside the range.	Please check Draw Time (Hour).
340	112	Host Receiving Text Error	Draw Time (Min) is outside the range.	Please check Draw Time (Min).
340	113	Host Receiving Text Error	Draw Time (Second) is outside the range.	Please check Draw Time (Second).
340	114	Host Receiving Text Error	Age is outside the range.	Please check Age.
340	115	Host Receiving Text Error	Age Unit is outside the range.	Please check Age Unit.

340	116	Host Receiving Text Error	Sex is outside the range.	Please check Sex.
340	117	Host Receiving Text Error	Cup size is outside the range.	Please check Cup size.
340	118	Host Receiving Text Error	Sample ID is outside the range.	Please check Sample ID.
340	119	Host Receiving Text Error	Dilution Rate is outside the range.	Please check Dilution Rate.
340	120	Host Receiving Text Error	The number of TS exceeds the number of the regulations.	Please check number of TS.
340	121	Host Receiving Text Error	Sample ID is not effective value.	Please check Sample ID.
340	122	Host Receiving Text Error	Dilution Rate is outside the range.	Please check Dilution Rate.
340	123	Host Receiving Text Error	Sample Type is not Routine or Stat.	Please check Sample Type.
340	124	Host Receiving Text Error	Sample ID is outside the range.	Please check Sample ID.
340	125	Host Receiving Text Error	Class is outside the range.	Please check Class.
340	126	Host Receiving Text Error	Sample No is outside the range.	Please check Sample No.
340	127	Host Receiving Text Error	Rack ID is outside the range.	Please check Rack ID.
340	128	Host Receiving Text Error	Rack Position is outside the range.	Please check Rack Position.
340	129	Host Receiving Text Error	Sample ID is outside the range.	Please check Sample ID.
340	130	Host Receiving Text Error	Sample ID is outside the range.	Please check Sample ID.
340	131	Host Receiving Text Error	Age is outside the range.	Please check Age.
340	132	Host Receiving Text Error	Sample Type is not Routine or Stat.	Please check Sample Type.
340	133	Host Receiving Text Error	Application Code is not effective value.	Please check Application Code.
340	134	Host Receiving Text Error	Dilution Rate is outside the range.	Please check Dilution Rate.

341	-1	App. Code Conversion Error. (To HOST)	An application code is not convertible at the time of HOST communication. * Subcode indicates the application code in [Utility]-[Application] screen.	Please check whether the application code for HOST is set up correctly.
342	1	App. Code Conversion Error. (From HOST)	An application code is not convertible at the time of HOST communication.	Please check whether the application code for HOST is set up correctly.

Appendix D - Communication Examples

In this section, some examples of communication on ASTM Upper Layer are shown.

Space Character (ASCII CODE 0x20) in any text is shown as '·'.

This example text contains some non-realistic cases for standard clinical chemistry analysis to show variable examples of communication.

In this section, the analyzer is shown as 'HYBRI', External system is shown as 'HOST'.

The following words are used:

- 'S.No' means Sample Number.
- 'TS' means Test Selection.

TS Inquiry / Realtime / Barcode - YES / Analyzer to Host

```
HYBRI 17:22:41,34 [ENQ]
HOST  17:22:41,35 [ACK]
HYBRI 17:22:41,48 [STX]1H|\^&|||H7600^1|||||host|TSREQ^REAL|P|1[C
                  R]Q|1|^^···············000016^0^5230^1^^S1^SC|
                  |ALL|||||||O[CR]L|1|N[CR][ETX]E0[CR][LF]
HOST  17:22:41,49 [ACK]
HYBRI 17:22:41,50 [EOT]
```

TS Inquiry (BC Read Error) / Realtime / Barcode - YES / Analyzer to Host

If barcode cannot be read and 'TS Ask in Barcode Read error' option is enabled on the Host Communication Setting/Text Setting screen, the analyzer sends 13/22 * characters in the Sample ID field. According to the Rack and Position number the host may send back the Sample ID in its test selection message.

```
HYBRI 07:56:29,23 [ENQ]
HOST  07:56:29,24 [ACK]
HYBRI 07:56:29,38 [STX]1H|\^&|||H7600^1|||||host|TSREQ^REAL|P|1[C
                  R]Q|1|^^**********************^0^0230^4^^S1^||A
                  LL||||||||A[CR]L|1|N[CR][ETX]AF[CR][LF]
HOST  07:56:29,39 [ACK]
HYBRI 07:56:29,40 [EOT]
```

TS / Realtime / Barcode - YES / Host to Analyzer

```
HOST  17:22:43,51 [ENQ]
HYBRI 17:22:43,52 [ACK]
HOST  17:22:43,74 [STX]1H|\^&|||ASTM-Host^||||||TSDWN^REPLY[CR]P|
                  1||PatID|||||M||||||40^Y[CR]O|1|000016|0^5230^1
                  ^^S1^SC|^^^2^1|R||20000530143741||||A||||1|||||
                  |||||O[CR]C|1|L|C1^C2^C3^C4^C5|G[CR]L|1|N[CR][E
                  TX]C7[CR][LF]
HYBRI 17:22:43,76 [ACK]
HOST  17:22:43,77 [EOT]
```

Routine Result / Realtime / Barcode - YES / Analyzer to Host

```
HYBRI 17:42:52,89 [ENQ]
HOST  17:42:52,90 [ACK]
HYBRI 17:42:53,20 [STX]1H|\^&|||H7600^1|||||host|RSUPL^REAL|P|1[C
                  R]P|1|||||||M||||||40^Y[CR]O|1|···············
                  000016|0^5230^1^^S1^SC|^^^2^1|R||20000530143741
                  ||||N||||1|||||||20000530172344|||F[CR]C|1|I|C1
                  ·························^C2·············
                  ·······^C3·········[ETB]4C[CR][LF]
HOST  17:42:53,22 [ACK]
HYBRI 17:42:53,36 [STX]2········^C4·············^C5········|G[CR]
                  R|1|^^^2/1/not|8.98|nmol/L||N||F||BMSERV|||E11[
                  CR]C|1|I|0|I[CR]L|1|N[CR][ETX]6D[CR][LF]
HOST  17:42:53,37 [ACK]
HYBRI 17:42:53,38 [EOT]
```

Routine Result / Batch / Barcode - NO / Analyzer to Host

```
HYBRI 13:59:13,78 [ENQ]
HOST  13:59:13,79 [ACK]
HYBRI 13:59:14,09 [STX]1H|\^&|||H7600^1|||||host|RSUPL^BATCH|P|1[
                  CR]P|1|||||||U||||||^[CR]O|1|000004···········
                  ····|4^5238^4^^S1^SC|^^^2^1|R||20000529125557||
                  ||N||||1|||||||20000529125646|||F[CR]C|1|I|····
                  ·························^HSP1·············
                  ·····^·············[ETB]36[CR][LF]
HOST  13:59:14,11 [ACK]
HYBRI 13:59:14,25 [STX]2·····^·············^·········|G[CR]R|
                  1|^^^2/1/not|0.000|nmol/L||A||F||BMSERV|||E12[C
                  R]C|1|I|43|I[CR]L|1|N[CR][ETX]00[CR][LF]
HOST  13:59:14,26 [ACK]
HYBRI 13:59:14,26 [EOT]
```

QC Result / Realtime / Analyzer to Host

```
HYBRI 18:00:14,54 [ENQ]
HOST  18:00:14,55 [ACK]
HYBRI 18:00:14,85 [STX]1H|\^&|||H7600^1|||||host|RSUPL^REAL|P|1[C
                  R]P|1|||||||U||||||^[CR]O|1|PC·U1·············
                  ···|1001^3002^1^^QC^SC|^^^1^1\^^^114^1|||||||Q|
                  |||1|||||||20000529160920|||F[CR]C|1|I|^^^^|G[C
                  R]R|1|^^^1/1/not|0.018|uIU/mL||L||||BMSERV|||E1
                  1[CR]C|1|I|0|I[CR]R|2|^^^114/[ETB]CE[CR][LF]
HOST  18:00:14,87 [ACK]
HYBRI 18:00:14,95 [STX]21/not|0.000|nmol/L||L||||BMSERV|||E11[CR]
                  C|1|I|43|I[CR]L|1|N[CR][ETX]62[CR][LF]
HOST  18:00:14,96 [ACK]
HYBRI 18:00:14,97 [EOT]
```

E-Module Raw Data / Batch / Barcode - YES / Analyzer to Host

```
HYBRI 13:59:35,89 [ENQ]
HOST  13:59:35,89 [ACK]
HYBRI 13:59:36,20 [STX]1H|\^&|||H7600^1|||||host|EFUPL^BATCH|P|1[
                  CR]P|1|||||||U||||||^[CR]O|1|000001···········
                  ····|1^5238^1^^S1^SC|^^^2^1|R||20000529125554||
                  ||N||||1||||||20000529125643|||F[CR]C|1|I|····
                  ·····················^HSP1·····************
                  *****^·************[ETB]0D[CR][LF]
HOST  13:59:36,23 [ACK]
HYBRI 13:59:36,53 [STX]2·····^·************^·********|G[CR]R|
                  1|^^^2/1/not|8.60|nmol/L||N||F||BMSERV|||E11[CR
                  ]C|1|I|0|I[CR]M|1|EFS|E11|4965\5786\5719\6553\8
                  006\8050\6724\5765\5982\7806\8721\9716\9948\924
                  3\8396\6998\6045\5440\6130\6604\7431\7841\7567\
                  7398\6836\6472\6944\[ETB]0C[CR][LF]
HOST  13:59:36,54 [ACK]
HYBRI 13:59:36,84 [STX]36139\6091\6800\7223\7013\7170\7855\8799\9
                  128\8763\8129\7112\7916\7246\6655\5967\5660\526
                  0\5474\5730\7462\8610\8777\8041\7779\7869\7995\
                  8563\9204\8519\6994\5938\5551\6600\7292\7869\75
                  16\6955\7403\7295\7583\7670\6714\5653\5662\5965
                  \7502\7808\[ETB]5B[CR][LF]
HOST  13:59:36,86 [ACK]
HYBRI 13:59:37,16 [STX]47210\6652\6808\6741\8256\8071\29512\40715
                  \45306\47094\47755\47944\47931\47852\47731\4760
                  4\47473\47340\47226\47098\46980\46861\46750\466
                  42\46530\46440\46340\46238\46147\46058\45975\45
                  898\45813\45742\45653\45563\45488\45429\45356\4
                  5284\45235\[ETB]E8[CR][LF]
HOST  13:59:37,18 [ACK]
HYBRI 13:59:37,48 [STX]545150\45102\45025\44967\44909\44849\44794
                  \44733\44681\44623\44553\44507\44460\44407\4435
                  6\44317\44260\44210\44166\44134\44071\44030\439
                  83\43949\43899\43862\43821\43786\43740\43686\43
                  645\43620\43580\43534\43496\43463\43418\43387\4
                  3346\43313\[ETB]6D[CR][LF]
HOST  13:59:37,50 [ACK]
HYBRI 13:59:37,80 [STX]643284\43253\43210\43223\43225\43241\43243
                  \43188\43171\43144\43074\43026\42960\42871\4283
                  3\42792\42761\42720\42678\42649\42621\42606\425
                  80\42541\42511\42486\42439\42440\42503\42500\42
                  509\42509\42481\42414\42361\42332\42282\42268\4
                  2236\42192\[ETB]F9[CR][LF]
HOST  13:59:37,81 [ACK]
HYBRI 13:59:37,88 [STX]742178\42164\42164\42148|1095000[CR]L|1|N[
                  CR]L|1|N[CR][ETX]E1[CR][LF]
HOST  13:59:37,89 [ACK]
HYBRI 13:59:37,90 [EOT]
```

Photometric Calibrator Result / Realtime / Analyzer to Host

```
MODUL 16:40:02,09 [ENQ]
HOST  16:40:02,12 [ACK]
MODUL 16:40:02,29 [STX]1H|\^&|||sys^1|||||hos|PCUPL^REAL|P|1[CR]M
                  |1|PCR|HITSRV|^^^521|P1|||345^33^340^32^^\1178^
                  105^1165^114^^\^^^^^\^^^^^\^^^^^\^^^^^[CR]L|1|N
                  [CR][ETX]C3[CR][LF]
HOST  16:40:02,35 [ACK]
MODUL 16:40:02,36 [EOT]
```

ISE Calibrator Result / Realtime / Analyzer to Host

```
MODUL 16:35:25,76 [ENQ]
HOST  16:35:25,79 [ACK]
MODUL 16:35:26,05 [STX]1H|\^&|||sys^1|||||hos|ICUPL^REAL|P|1[CR]M
                  |1|ICR|HITSRV|ISE1|14|14|14|^^^4^0^0^0^0|^^^4^0
                  ^0^0^0|^^^4^21^0^0^0|-30.6^-31.5^-25.2^-29.0^^^
                  ^|-33.4^-42.9^-22.6^-33.3^^^^|124.1^125.7^118.7
                  ^122.5^^^^[CR]L|1|N[CR][ETX]A6[CR][LF]
HOST  16:35:26,11 [ACK]
MODUL 16:35:26,13 [EOT]
```

E-Module Calibrator Result / Realtime / Analyzer to Host

```
HYBRI 17:48:38,63 [ENQ]
HOST  17:48:38,64 [ACK]
HYBRI 17:48:38,93 [STX]1H|\^&|||H7600^1|||||host|ECUPL^REAL|P|1[C
                  R]M|1|ECR|BMSERV|^^^1|RackPack|E12|198781|710|0
                  |196420|O|I^O^--------------------\M^O^-----\S^
                  O^--------------------\R^1.00\D^O^-----\F^O\Y^O
                  ^-----|1242^1185^0.000^0.000\24581^24542^0.000^
                  0.000\\\|0.000[ETB]75[CR][LF]
HOST  17:48:38,94 [ACK]
HYBRI 17:48:39,02 [STX]2^1.51^0.000^0.000^0.000|uIU/mL|||20000529
                  175246[CR]L|1|N[CR][ETX]CF[CR][LF]
HOST  17:48:39,02 [ACK]
HYBRI 17:48:39,03 [EOT]
```

Cancellation of TS Inquiry / Realtime / Barcode - NO / Analyzer to Host

The analyzer sends this message to cancel inquiry when the timeout interval is reached. An end ‘A’ in a Q record means the inquiry is cancelled.

```
HYBRI 16:16:31,24 [ENQ]
HOST  16:16:31,24 [ACK]
HYBRI 16:16:31,38 [STX]1H|\^&|||H7600^1|||||host|TSREQ^REAL|P|1[C
                  R]Q|1|^^.....................^1^5032^1^^S1^SC|
                  |ALL||||||||A[CR]L|1|N[CR][ETX]6C[CR][LF]
HOST  16:16:31,39 [ACK]
HYBRI 16:16:31,40 [EOT]
```

When the host receives a cancel message from the analyzer, the host can no longer respond with the original TS request order. However, the host can transmit TS as a Batch TS Transmission after the cancel message is received.

Appendix E – Differences* between CC Modular and 'New Mode' Protocol

For more differences, please check the Recordstructure (Page 36 – 63) and compare it with the Recordstructure in the Hostinterfacemanual of the CC-Modular (Page 32 – 55).

E-module specific

New information	Remarks	Record & Field	Software switch
Number of test	change 100 to 160	O-5	Yes(auto switch)
Dilution ratio	change component	O-5, R-3	Yes(auto switch)
Pre-dilution flag	add component	R-3	Yes(auto switch)
Detection channel	change component	R-14	Yes(auto switch)
Result data/value	change digits 6 to 7	R-4	Yes(auto switch)
Data flag code	change component	C-4	Yes(auto switch)
Effective signal data	add record	H-11, M-EFS	Yes(auto switch)
Elecsys calib data	add message	M-ECR	Yes(auto switch)

Auto switch : DPE Combination software automatically recognizes when the system includes E-module.

CC Modular enhancement

New information	Remarks	Record & Field	Software switch
AppCode conversion	change digit 3 to 5	O-5, R-3	Yes(function switch)
Rack ID definition	change component	O-3, Q-3	Yes(function switch)
As soon as cooked	add functionality	no change	Yes(function switch)
Review by exception	add functionality	no change	Yes(function switch)
22 characters ID	change digit 13 to 22	O-3, Q-3	Yes(function switch)
Rack type	change description	O-3, Q-3	Yes(function switch)
ISE individual request	add functionality	no change	Yes(function switch)
Dilution request for P	change component	O-5, R-3	Yes(function switch)

Function switch : DPE Combination software works only when the function switch is on.

Appendix F - ASCII Table

Char Hex Dec	Char Hex Dec	Char Hex Dec	Char Hex Dec	Char Hex Dec	Char Hex Dec	Char Hex Dec	Char Hex Dec
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