CA-1500 ASTM

Host Interface Specification

Rev. 2.00

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1. General

This document is intended to supply the information that the CA-1500 Automated Blood Coagulation Analyzer communicates with the host computer using ASTM protocol.

2. Scope

This document describes the Data Communication Specifications for CA-1500 using ASTM "ASTM E1394-95 and ASTM E1381-91"

ASTM (the American Society for Testing and Materials), one of the world largest volunteer non-profit organization, founded in 1898 for the purpose of creating standard regulations for material, products and system services. This specification conforms to the following two standards:

・Specifications for low level protocols to transfer data between clinical laboratory instruments and computer systems.
ASTM E1381-91

・Standard specifications for transferring data between clinical instruments and computer systems.
ASTM E1394-95

3. Revision History

Revision	Date	Major Contents of Changes
2.00	April 10, 2007	RE constraction Version DRAFT

4. Terminology

The definition of the terminology used in this document is described in the following.

Numerics:
Indicates ASCII codes "0" (30h) through "9" (39h)

Alphabet:
Indicates ASCII codes "A" (41h) through "Z" (5Ah) and "a" (61h) through "z" (7Ah)

Alpha-numeric:
Indicates numerical or alphabetical character

5. Communication Specifications

Communication specifications are based on a layer protocol.

(1) Physical Layer

Specifies the sending and receiving of signals between the instrument and the host computer through physical and electrical connections

See the section "4.1 Physical Layer (Hardware)"

(2) Data link layer

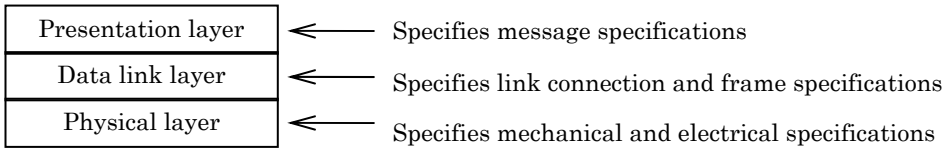
Specifies the sending and receiving of data by link connections and for each frame between the instrument and the host computer

See the section "4.2 Data Link Layer (Transmission Protocol)"

(3) Presentation layer

Specifies the messages that are sent and received by the instrument and the host computer

See the section "4.3 Presentation Layer"



5.1. Physical Layer (Hardware)

5.1.1. Serial Connection

5.1.1.1. Connectors

Although the ASTM standard specifies a DB-25-pin male connector as standard, a DB-9-pin-male I/O connector, which is located on the right side of the instrument, is used to communicate.

Table 1: Connector pin assignment

Pin No.	Signal name		Signal direction
1		NC	
2	Receive data	RxD	To instrument from host
3	Transmit data	TxD	From instrument to host
4	Data terminal ready	DTR	From instrument to host
5	Signal ground	SG	―
6	Data set ready	DSR	To instrument from host
7	Request to send	RTS	From instrument to host
8	Clear to send	CTS	To instrument from host
9		NC	

Pins 1 and 9 are not used. Do not make connections to these pins.
Specific Wiring connections can be found in section 5.1.1.3.

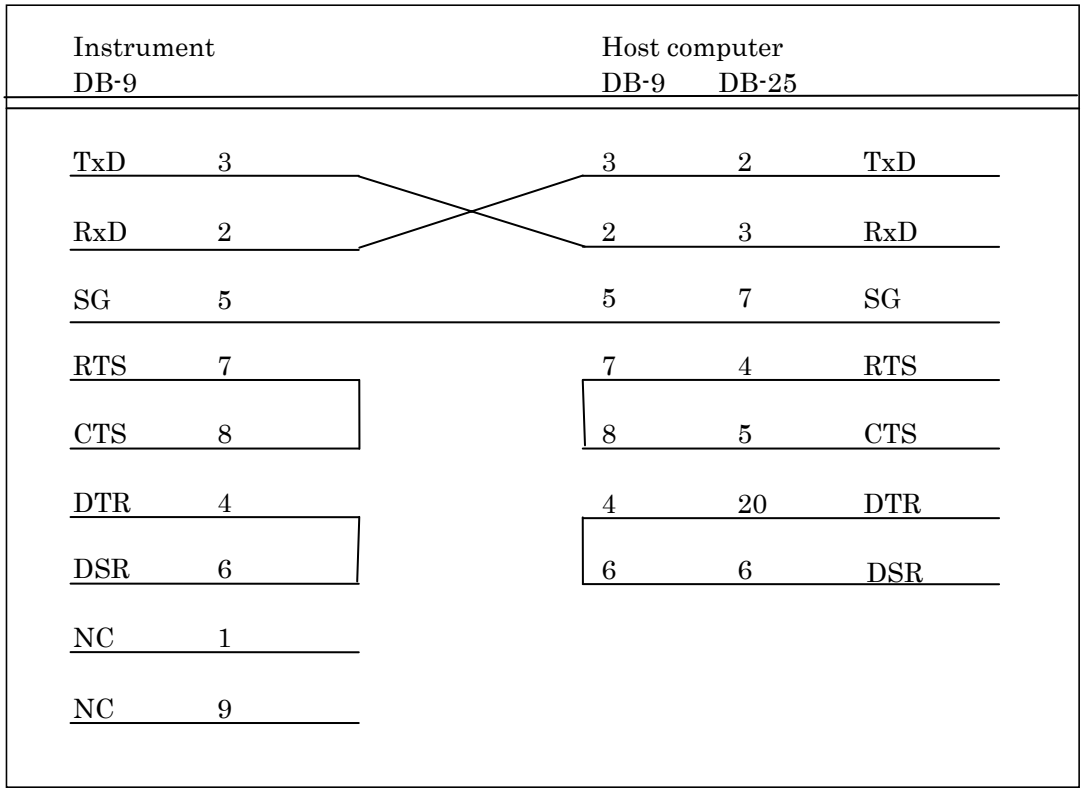
5.1.1.2. Signal identification level

Table 2: Signal identification level

Level	Data signal	Control signal
+3V or more	Logic ”0”, start bit	ON
-3V or less	Logic ”1”, stop bit	OFF

5.1.1.3. Connection cable

Please configure a cable with a DB-9-pin female adaptor for connecting to the instrument's DB-9 male connector in accordance with the following chart.



5.1.1.4. Interface parameters

Table 3: Interface parameters

Parameter	Available Settings
Baud rate	600, 1200, 2400, 4800, 9600*bps
Data length	7bits , 8bits*
Stop bit	1bits* , 2bits
Parity	None* , Even , Odd

The value with asterisk mark (*) allows conformance with the ASTM standard.
[Note] However, 7-bit data lengths, even or odd parity and two stop bits are recognized by the ASTM standard for use with special applications.

5.1.1.5. Standard specifications (ASTM E1381-91)

The physical layer of the instrument conforms to ASTM E1381-91 "5. Physical Layer", except for the connector type.
The instrument uses a D-SUB-9 pin male connector. (The ASTM standard specifies a 25-pin male connector.)

5.2. Data Link Layer (Transmission Protocol)

The data link layer transfers data between systems using a character-based protocol in accordance with ASTM E 1381-91 "6. Data Link layer".

5.2.1. Communication status

The data link layer is consisted of following two states.

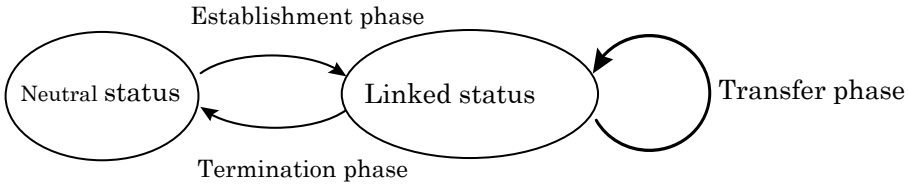
- Neutral Status
- Linked status

Transition to each status is accomplished through the following three phases.

(1) Establishment phase
Establishes communication line, and determines the direction of data transfer. In this way, the sender and the receiver are identified, and the change is made from neutral status to linked status.

(2) Transfer phase
The sender transmits messages to the receiver until all messages are transferred.

(3) Termination phase
Releases the communication line. Changes both the sender and the receiver from linked status to neutral status.

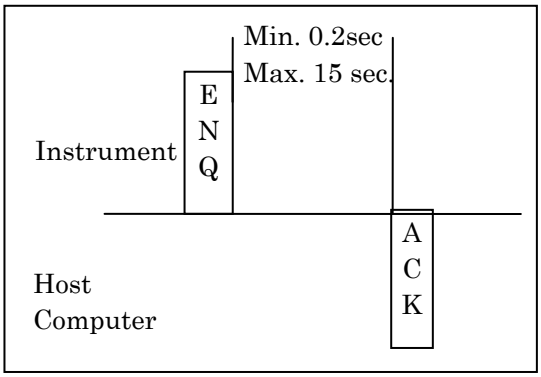


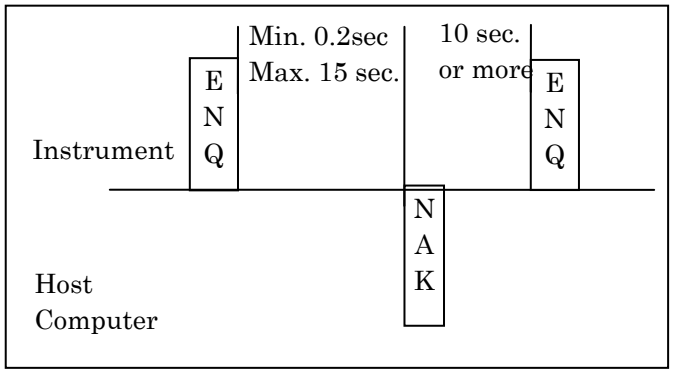
5.2.2. Establishment phase

(1) The sender (instrument) sends an [ENQ] signal to the receiver (host computer). To respond to the sender, the receiver performs the following action.

- Returns an [ACK] signal when the communication is enabled.
- Returns a [NAK] when the communication is disabled.

If the receiver responded [NAK], the sender waits for at least 10 seconds before attempting to send another [ENQ] signal.

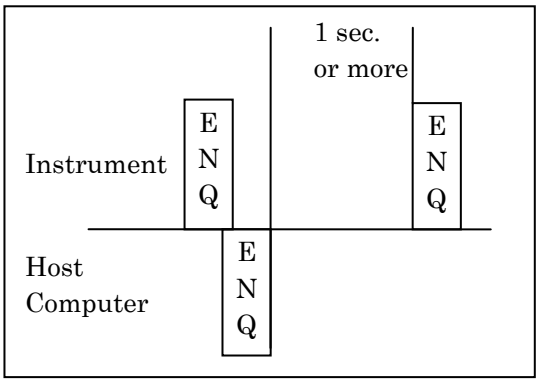


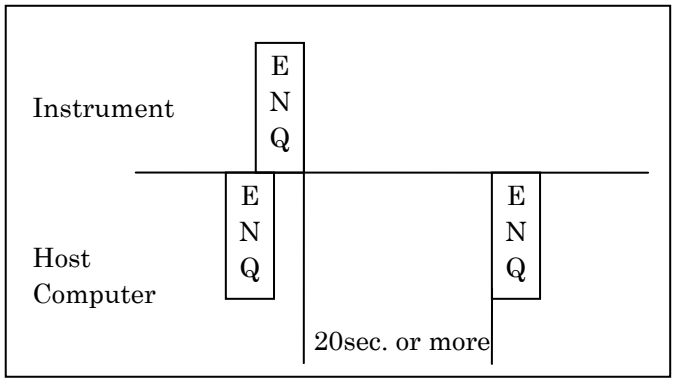


NOTE: CA-1500 requires a 0.2 sec delay between signals.

(2) When both the sender and receiver send [ENQ] signals, the host computer must yield control authority to the instrument.

- The instrument sends [ENQ] again after 1 second.
- The host computer must wait for 20 seconds before sending [ENQ] again.





5.2.3. Transfer phase

During the transfer phase, the sender sends messages to the receiver. The transfer phase continues until all messages have been sent.

(1) Messages are sent in each record with multiple frames. The maximum number of characters in each record is set to 240 characters in the ASTM E1381-91.

(2) Multiple records cannot be included in a single frame.

(3) If the record contains the maximum number of characters or less, a frame with the following structure will be transferred.

[STX] [F#] [Text] [ETX] [CHK1] [CHK2] [CR] [LF]

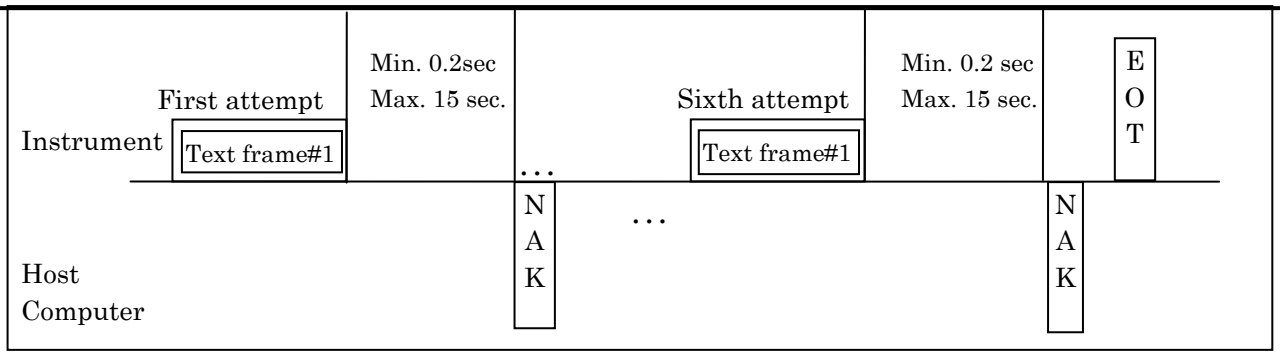
If the record is longer than the maximum number of characters, it is divided into two or more frames. The intermediate frame text termination code is [ETB], and the final frame text termination code is [ETX], as shown below.

[STX] [F#] [Text] [ETB] [CHK1] [CHK2] [CR] [LF]
[STX] [F#] [Text] [ETB] [CHK1] [CHK2] [CR] [LF]
……
[STX] [F#] [Text] [ETX] [CHK1] [CHK2] [CR] [LF]

Symbol	Explanation
[STX]	Start of a frame
[F#]	Frame number One of the numbers 0 to 7 is used, starting with 1 and repeating 2,3,4,5,6,7,0. In case of retransmission, the same frame number is sent.
[Text]	ASTM E1394-95 records are used. (See the subsequent section “4.3 Presentation Layer”.) For this reason, the codes below will not be used. 0x00-0x06,0x08,0x0A,0x0E-0x1F,0x7F,0xFF
[ETB]	Control code indicating end of text (for intermediate frame)
[ETX]	Control code indicating end of text (for the final frame)
[CHK1] [CHK2]	Expressed by characters “0” - “9” and “A” - “F”. Characters beginning from the character following [STX] and until [ETB] or [ETX] (including [ETB] or [ETX]) are added in binary. The 2-digit numbers, which represent the least significant 8 bits in hexadecimal code, are converted to ASCII characters “0” - “9” and “A” - “F”. The most significant digit is stored in CHK1 and the least significant digit in CHK2.
[CR] [LF]	Control code indicating end of frame

(4) If the receiver has successfully received the frame, and is prepared to receive the next frame, the receiver responds with [ACK]. After the sender receives [ACK], the sender advances the frame number and either sends a new frame or transition to the termination phase.

(5) If the receiver fails to receive the frame and is prepared to receive the same frame again, the receiver responds with [NAK]. After the sender receives [NAK], the sender sends the most recent frame again, using the same frame number. If a total of 6 attempts to send the frame failed, the sender transitions to the termination phase and must end sending of the message.



(6) The instrument processes the response of [EOT] from the Host computer as [ACK]. (Response of [EOT] from the receiver is usually a request to suspend a transmission to the sender. However, the instrument does not support this function.)

NOTE: CA-1500 requires a 0.2 sec delay between signals.

5.2.4. Termination phase

During the termination phase, the status returns to neutral.
The sender sends the [EOT] to inform the receiver that the message transmission has been completed. When the sender sends [EOT], the sender transitions to neutral status. When the receiver receives [EOT], the receiver transitions to neutral status.

5.2.5. Time out

The timer is used to detect a failure to coordinate between the sender and the receiver. The timer is used as a means of recovery for the communication line and communication destination device failure.

(1) During the establishment phase, the timer is set when the sender sends [ENQ]. The time out results if a response of [ACK], [NAK] or [ENQ] is not received within 15 seconds. After time out, the sender transitions to the termination phase.

(2) During transfer phase, the 15-second timer is set when the sender sends the final character of a frame. Time out results if no response is received within 15 seconds. After time out, the sender transitions to the termination phase.
The receiver sets a 30-second timer when first entering the transfer phase or when responding (either [ACK] or [NAK]) to a frame. Time out results if the receiver does not receive a frame or [EOT] from the sender within 30 seconds. After time out, the receiver discards the latest incomplete message and transitions to the termination phase.

5.3. Presentation Layer

5.3.1. Messages, Record and Field

5.3.1.1.Messages

In the presentation layer, all data is transmitted using messages. Messages are composed of record arrays that start with message header record (H) and end with message termination record (L).

5.3.1.2.Records

A record is a series of text, beginning with an ASCII alphabet characters referred to as the identifier, and ending with [CR].

Table 4: Records

Record Type	Record identifier	Level	Contents
Header Record	H	0	Contains the sender and the receiver information.
Patient information Record	P	1	Contains the patient information
Inquiry record	Q	1	Requires test order information requesting to the host computer
Test Order Record	O	2	Contains test order information
Test Result Record	R	3	Contains test result information
Comment Record	C	1－4	Not used.
Manufacturer Information Record	M	1－4	Not used
Scientific Information Record	S	N/A	Not used
Message Terminator Record	L	0	Indicates the end of the message

- A smaller level number indicates a higher level.
- A higher-level record contains information that is common to all lower-level records.

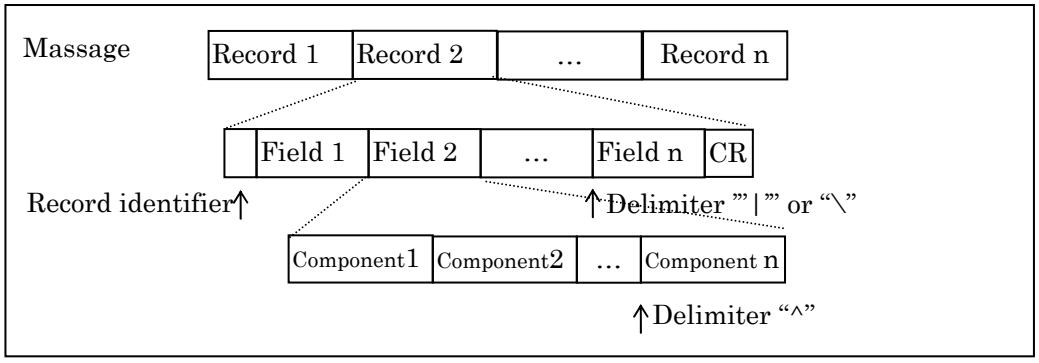
- All levels other than 0 must be located after higher levels. However, the comment record can be inserted at any level. They are considered to be one lower level than the preceding record. However, a consecutive comment records are not allowed.
- Example transmission
  H->P->O->R->L… Correct
  H->R->L…… Incorrect, because P and O must be transmitted in prior to R

5.3.1.3.Field

A record is further divided into multiple fields by field delimiters.
A field is identified by its position within a record and has a variable length. The following is used as delimiters.

Table 5: Fields

Type	Code	Description
Field delimiter	Vertical bar (|)(7Ch)	Separates adjacent field within a record
Repeat delimiter	Back slash (\) (5Ch)	Separates multiple numbers of descriptors in a field.
Component delimiter	Caret ^ (5Eh)	Separates data elements within a field that has a hierarchical or qualifier nature.
Escape delimiter	Ampersand &(26H)	Is used within a text field to identify special case operations.



5.3.2. Communication Protocol

5.3.2.1.Analysis Order inquiry (instrument-> Host computer)

This protocol is used for CA-1500 to inquire to the host computer analysis information to obtain the sample information. Inquiry can be made with keyword of the sample ID Number in CA-1500.

Table 6: Analysis Order Inquiry

Instrument	Direction	Host computer
ENQ	→	
	←	ACK
H (Header Record)	→	
	←	ACK
Q (Inquiry Record)	→	
	←	ACK
L (Message Terminator Record)	→	
	←	ACK
EOT	→	

5.3.2.2.Analysis information (Host computer -> Instrument)

This protocol is used for the host computer to respond analysis information against the inquiry made by the instrument.

Table 7 : Analysis Information

Instrument	Direction	Host computer
	←	ENQ
ACK	→	
	←	H (Header Record)
ACK	→	
	←	P (Patient Record)
ACK	→	
	←	O (Test Order Record)
ACK	→	
	←	L (Message Terminator Record)
ACK	→	
	←	EOT

5.3.2.3. Analysis Results & QC Data (Instrument-> Host computer)

This protocol is used for the instrument to transmit the analysis result, the QC data in a real-time transmission (QC sample Number is "QC01" - "QC20" and transmitted as similar to the normal sample data), and the QC data in the manual output.

Table 8 : Analysis results and QC data

Instrument	Direction	Host computer
ENQ	→	
	←	ACK
H (Header Record)	→	
	←	ACK
P (Patient Record)	→	
	←	ACK
O (Test Order Record)	→	
	←	ACK
R : Result Record (Replicating the No. of parameters)	→	
(Replicating the No. of parameters)	←	ACK (Replicating the No. of receiving parameters)
L (Message Terminator Record)	→	
	←	ACK
EOT	→	

5.3.3. Details of Record

5.3.3.1.Header Record

[Example of transmission]

- Instrument -> Host computer
  H|\^&|||CA-1500^00-18^A1001^^^ ||||||||1<CR>
- Host computer -> Instrument
  H|\^&|||||||||||1<CR>

Table 9 : Details of Header record

ASTM Field	Field Name	Instrument -> Host	Host -> Instrument	Max. size (Bytes)	Remarks
7.1.1	Record type	H	H	1	Fixed
7.1.2	Delimiter definition	|\^&	|\^&	4	Fixed
7.1.3	Message control ID	Not used	Not used	-	
7.1.4	Access password	Not used	Not used	-	
7.1.5	Sender name or ID	Analyzer name^ Software version^ Analyzer serial No.^ Interface version^ Logical ID number ^ Nickname^ PS code	Not used	8^ 13^ 5^ ^ ^ 15^ 8	
7.1.6	Sender street address	Not used	Not used	-	
7.1.7	Reserved field	Not used	Not used	-	
7.1.8	Sender Telephone No.	Not used	Not used	-	
7.1.9	Sender characteristics	Not used	Not used	-	
7.1.10	Receiver ID	Not used	Not used	-	
7.1.11	Comment	Not used	Not used	-	
7.1.12	Processing ID	Not used	Not used	-	
7.1.13	ASTM Version No.	ASTM Version No.	ASTM Version No.	1	Fixed as 1
7.1.14	Date and Time of message	Not used	Not used	-	

[Detailed explanation of the fields]

1) 7.1.2 Delimiter definition
   "|\^&" is used as a fixed character string. No field delimiter is required between 7.1.1 and 7.1.2

2) 7.1.5 Sender name or ID
   Analyzer name: Fixed as "CA-1500"
   Software version: Refers to the software version loaded on the CA-1500.
   Analyzer Serial No.: Analyzer serial number is output
   Interface version: Not used
   Logical ID number: Not used
   Nickname: Analyzer nickname is output
   PS code: Not used

3) 7.1.13 ASTM Version No.
   The layer is E1394-95, the version number is “1”.

5.3.3.2.Patient information Record

[Example of transmission]

- Instrument -> Host computer
  P|1|||100|Thomas Johnson <CR>
- Host computer -> Instrument
  P|1|||100|Thomas Johnson||20010820|M|||||^Dr.|||||||||||^^^EAST<CR>

Table 10 : Details of Patient Information Record

ASTM Field	Field Name	Instrument -> Host *1	Host -> Instrument	Max. size (Bytes)	Remarks
8.1.1	Record type	P	P	1	Fixed
8.1.2	Sequence No.	Sequence No.	Sequence No.	4	Sequence No. of records
8.1.3	Practice assigned Patient ID	Not used	Not used	-	
8.1.4	Laboratory assigned patient ID	Not used	Not used	-	
8.1.5	Patient ID No.	Not used	Patient ID	16	
8.1.6	Patient name	Patient Name	Patient name	32	CA-1500 displays only 15 characteres from left.
8.1.7	Mother's maiden name	Not used	Not used	-	
8.1.8	Birth date	Not used	YYYYMMDD	8	EX) 20010802 for 2nd of August 2001
8.1.9	Patient sex	Not used	M,F or U	1	Male, Female or unknown
8.1.10	Patient race	Not used	Not used	-	
8.1.11	Patient address	Not used	Not used	-	
8.1.12	Reserved	Not used	Not used	-	
8.1.13	Patient telephone No.	Not used	Not used	-	
8.1.14	Attending physician name	Not used	^Physician name	^20	
8.1.15	Special field 1	Not used	Not used	-	
8.1.16	Special field 2	Not used	Not used	-	
8.1.17	Patient height	Not used	Not used	-	
8.1.18	Patient weight	Not used	Not used	-	
8.1.19	Patient's known or suspected diagnosis	Not used	Not used	-	
8.1.20	Patient active medications	Not used	Not used	-	
8.1.21	Patient diet	Not used	Not used	-	
8.1.22	Practice field 1	Not used	Not used	-	
8.1.23	Practice field 2	Not used	Not used	-	
8.1.24	Admission and discharge dates	Not used	Not used	-	
8.1.25	Admission status	Not used	Not used	-	
8.1.26	Location	Not used	^^^ Ward	^^^20	
8.1.27	DRG or AVG	Not used	Not used	-	
8.1.28	DRG or AVG2	Not used	Not used	-	
8.1.29	Patient religion	Not used	Not used	-	
8.1.30	Marital status	Not used	Not used	-	
8.1.31	Isolation status	Not used	Not used	-	
8.1.32	Language	Not used	Not used	-	
8.1.33	Hospital service	Not used	Not used	-	

ASTM Field	Field Name	Instrument > Host *1	Host > Instrument	Max. size (Bytes)	Remarks
8.1.34	Hospital institution	Not used	Not used	-	
8.1.35	Dosage category	Not used	Not used	-	

*1 To output the QC data, all fields other than 8.1.1 “Record Type” and 8.1.2 “Sequence number” are not used.

[Detailed Explanation of the fields]

1) 8.1.2 Sequence No.

The sequence number starts with 1 and indicates sequence position in which the record appeared in the message. This number is reset to 1 when a higher-level record appears in the message.

2) 8.1.5 Patient ID No.

The patient ID is a unique patient identification and may contain a maximum of 16 digits of alpha-numeric and a hyphen “-“(2Dh).
This is not supported by CA-1500.

3) 8.1.6 Patient name

The patient name is up to 32 characters with consisting of alpha-numeric.
This is displayed only 15 characters from left on the CA-1500.

4) 8.1.8 Birth date

This is the date of birth of the patient, and the date format is fixed with "YYYYMMDD".
Here, YYYY indicates the year, MM the month, and DD the day.
This is not supported by CA-1500.

5) 8.1.9 Patient sex

The patient sex is indicated with M, F or U. Here, M indicates male, F female, and U unknown.
This is not supported by CA-1500.

6) 8.1.14 Attending physician name

The attending physician name may be entered with a maximum of 20 characters of alpha-numeric.
This is not supported by CA-1500.

7) 8.1.26 Location

The patient ward name may be entered with a maximum of 20 characters of alpha-numeric.
This is not supported by CA-1500.

5.3.3.3. Request Information Record

[Example of transmission]

- Instrument-> Host computer
  Q|1|1^1^ 1234567890^B|||^^^040^PT|0|20010905150000<CR>
- Host computer -> Instrument
  Not used

Table 11 : Details of Request Information Record

ASTM Field	Field Name	Instrument -> Host	Host -> Instrument	Max. size (Bytes)	Remarks
12.1 1	Record Type	Q	Not used	1	
12.1.2	Sequence No.	1	Not used	4	
12.1.3	Starting Range ID No.	Rack No.^ Tube position^ Sample ID No.^ Sample ID No. attribute	Not used	6^ 2^ 15^ 1^	
12.1.4	Ending Range ID No.	Not used	Not used	-	
12.1.5	Universal test ID	^^^Test code (See the Table 12) Test name When requesting multiple parameters, use the repeat symbol as below: Test parameter information1 \Test parameter information 2\Test parameter information 3\Test parameter information4\…	Not used	^^^3 ^8	
12.1.6	Nature of request day limit	0	Not used	1	0: Request date Request date is not defined in the ASTM.
12.1.7	Beginning request date and time	YYYYMMDDHHMMSS	Not used	14	
12.1.8-12.1 13	Ending request result date through Requested information status code	Not used	Not used	-	

[Detailed Explanation of the field]

1) 12.1.2 Sequence No.
   The sequence number starts with 1 and indicates the sequence position in which the record appeared in the message. The number is reset to 1 when a higher-level record appears in the message.

2) 12.1.3 Starting Range ID No.

Rack No.: Assigned to the rack. STAT table, reagent table are described as below.
Normal sample: Consisted of 6-digit alpha-numeric (The rack number will be fixed 6-digit number by aligning to the right and padding zero's to the most significant digits if the number is less than 6-digit.)
STAT sample: Describes with "STAT ΔH" (Δ indicates a space character.)
Reagent table: Describes with "D1" –"D14".

Tube Position No.: The sample rack position number within a rack, with consisting of 2-digit number.
Normal sample: 01 - 10
STAT sample: 01- 05

Sample ID number: Consisted of 15-digit of alpha-numeric. Depends on the direction for use, the hyphen "-"(2DH) can be inserted between characters. "-"is included in 15-digit number. The zero suppression function is not performed. If the number is less than 15-digit, it is aligned to the right and spaces (20H) are padded to the most significant digit. If the sample barcode can not be read, the sample ID number starting from ERR000000000001" is sequentially assigned as the sample number. A sample number starting with "QC" allows for QC analysis..

Sample ID No. attribute: M : Sample ID No. is manually entered through the touch panel.
A : Analyzer automatically assigned number; begins with "ERR".
B : Barcode reader read number. This is used when the sample ID number is read by the ID barcode reader.
C : ID number is set by the host computer.

3) 12.1.5 Universal test ID

Test code: Suffixing 0 to the "Host ID" in the "Assay Setting" makes the test code. See Table 12.

Table 12 : Test code (For the requested information record)

Test code	Test name	Test code	Test name	Test code	Test name
040	PT	190	Ⅸ	600	FDP
050	APTT	200	Ⅹ	610	DD
060	Fbg	210	XI		
080	TTO	220	XII		
090	NT	510	TT		
120	II	300	AT3		
150	V	310	APL		
170	VII	320	Plg		
180	VIII	330	PC		

* The test code and Test name are the settings when shipping from the factory.

Test name: The test name is the "Assay Setting". It consists of up to 8 characters. See Table 12.

4) 12.1.7 Beginning request result date and time

The date format is fixed with "YYYYMMDDHHMMSS".
Here, YYYY indicates the year, MM the month, DD the day, HH the hour in the 24-hour system (00-23), MM the minute (0—59), SS the second (0—59).

5.3.3.4.Test Order Record

[Example of transmission]

- Instrument -> Host computer
  O|1||000001^01^123456789012345^B^E||R|||||N<CR>
- Host computer -> Instrument
  O|1|000001^01^123456789012345^B||^^^040^^100.00\^^^050^^100.00\・・・
  \^^^060^^100.00|R|20010807101000||||N<CR>

Table 13 : Details of Test Order Record

ASTM Field	Field name	Instrument-> Host computer	Host computer -> Instrument	Max. size (Byte)	Remarks
9.4.1	Record type	O	O	1	Fixed
9.4.2	Sequence No.	Sequence No.	Sequence No.	4	Sequence No. of records
9.4.3	Specimen ID	Not used	Rack NO.^ Tube Position^ Sample ID No.^ Sample ID No. attribute	6^ 2^ 15^ 1	Sample ID No. attribute is one of the followings: M: Manual entry A: Automatically assigned by analyzer B: Barcode reader
9.4.4	Instrument specimen ID	Rack NO.^ Tube Position^ Sample ID No.^ Sample ID No. attribute^ Extended order request flag	Not used	6^ 2^ 15^ 1^ 1	
9.4.5	Universal Test ID	Not used	^^^Test code ^^Dilution ratio^Option When requesting multiple parameters, use the repeat symbol as below: Test parameter information1 \Test parameter information2\Test parameter information 3\Test parameter information4\…	^^^3 ^^8^3	
9.4.6	Priority	Priority	Priority	1	S(STAT, STAT sample) R(Routine, Normal sample)
9.4.7	Requested/order date and time	Not used	YYYYMMDDHHMMSS	14	
9.4.8 - 9.4.11	Specimen collection date and time through Collector ID	Not used	Not used	-	
9.4.12	Action code	Action code	Action code	1	N Normal sample Q QC material
9.4.13 - 9.4.31	Danger code through Material institution	Not used	Not used	-	

[Detailed explanation of the field]

1) 9.4.2 Sequence No.

The sequence starts with 1 and indicates the sequence position in which the record appeared in the message. This number is reset to 1 when a higher-level record appears in the message.

2) 9.4.3 Specimen ID

Rack No.: Up to 6-digit alpha-numeric assigned to the rack. Return the same number that was inquired.

Tube Position No.: The sample position number within a rack consisting of a 2-digit number. Return the same number that was inquired.

Sample ID number: Consisted of 15-digit of alpha-numeric and hyphen "-"(2Dh). Return the same number that was inquired.

Sample ID No. attribute: Indicates how the ample ID No.was registered.
Return the same number that was inquired.

3) 9.4.4 Instrument Specimen ID

Rack No.: Assigned to the rack. In the STAT table and reagent table, Rack No. is described as below.
Normal sample: 6-digit alpha-numeric (The rack number will be fixed 6-digit number by aligning to the right and padding zero's to the most significant digits if the number is less than 6-digit.)
STAT sample: STATΔH (Δ indicates a space character.)
Reagent table: D1 -D14

Tube Position No.: The sample position number with in a rack with consisting of 2-digit number.
Normal sample: 01 - 10
STAT sample: 01 - 05

Sample ID number: Consisted of 15-digit alpha-numeric. Depends on the direction for use, the hyphen "-"(2DH) can be inserted between characters. "-"is included in 15-digit number. The zero suppression function is not performed. If the number is less than 15-digit, it is aligned to the right and spaces (020H) are padded to the most significant digit. If the sample barcode can not be read, the sample ID number stating from ERR000000000001" is assigned sequentially to the sample number. The sample number starting with "QC" is reserved to use for the QC analysis.

Sample ID No. attribute:
- M: sample ID No. is manually entered through the touch panel.
- A: Automatically assigned number by the analyzer. This number is assigned by the automatic-increment function, and is used to set the sample number that bigins with "ERR", which is used when the ID Read error occurred.
- B: Barcode reader read number. This is used when the sample ID number is read by the ID barcode reader.
- C: ID number is set by the host computer.

Extended order request flag:
E: Extended order
Indicates the analysis is continued, based on the rules of the analyzer. If the analysis is not continued, it is skipped.

4) 9.4.5 Universal Test ID

When an order is sent from the host computer to the instrument, set the Universal Test ID which is sent in the "Universal Test ID" in the section "4.3.3.3 Details the Request Information Record". If there are no parameters, it can be skipped or sending 000 as test parameter.

Test code: Suffixing 0 to the "Host ID" in the "Assay Settings" makes the test code.

Table 14 : Test code for the test order record

Test code	Test name	Test code	Test name	Test code	Test name
040	PT	190	IX	600	FDP
050	APTT	200	X	610	DD
060	Fbg	210	XI		
080	TTO	220	XII		
090	NT	510	TT		
120	II	300	AT3		
150	V	310	APL		
170	VII	320	Plg		
180	VIII	330	PC		
000: There is no analysis parameter for the inquired sample.					

* The test code and test name are the settings when shipping from the factory.

Dilution ratio: Specifies the dilution ratio used in analysis. If it is not specified, follows the instrument setting. The dilution ratio can be specified with 2-digit to the right of decimal point.
The dilution ratio in the CA-1500 which differs from the ordered dilution ratio by less than 0.01 percent is used for analysis.
If the unregistered dilution ratio in the CA-1500 is ordered, the default dilution ratio is used for analysis.

Warning:
The setting of the dilution ratio may have a critical impact on analysis results. Set the standard setting of the dilution ratio to 100 percent. If other than 100 percent is set for the dilution ratio, make sure that it is the correct value. The instrument will accept a dilution ratio of 0%.

Option: Sets the performance of the redilution, re-analysis and reflex test. More than 1 option can be set with the combinations of "D", "R" and "F". If there are no settings, follows the instrument settings
D: No redilution
R: No re-analysis
F: No reflex test

5) 9.4.6 Priority
S : STAT, STAT sample
R : Routine, Normal sample

6) 9.4.7 Requested/order date and time
Indicates the date and time of the analysis for the inquiry sample.

~~The date format is fixed with "YYYYMMDDHHMMSS".~~

Here, YYYY indicates the year, MM the month, DD the day, HH the hour in the 24-hour system (00-23), MM the minute (0—59), SS the second (0—59).

7) 9.4.12 Action code

Indicates the contents of the result record to be sent.

N Normal sample

Q QC sample

5.3.3.5.Result record

[Example of transmission]

- Instrument -> Host computer

R|1|^^^041^PT
sec^100.00^9^^^|10.2|sec||N|||||20070328135056<ETX>5E<CR><LF>
R|2|^^^042^PT %^100.00^9^^^|
99.4|%||N|||||20070328135056<ETX>48<CR><LF>
……

- Host computer -> Instrument

Not used

Table 15 : Details of the Result record

ASTM Field	Field name	Instrument -> Host computer	Host computer -> Instrument	Max. size (Byte)	Remarks
10.1.1	Record type	R	Not used	1	
10.1.2	Sequence No.	Sequence No.	Not used	4	Sequence No. starting with 1
10.1.3	Universal Test ID	^^^Test code^ Parameter ^Dilution ratio^ Analysis result type^Extended order request^ Extended order result^ Reflex test request	Not used	^^^3^ 24^6^ 1^ 1 ^1^1	Test code: Described in Test code (Table 16) : Parameter: Up to 24 characters
10.1.4	Data or measurement value	Value	Not used	6	Up to 6 characters
10.1.5	Units	Units	Not used	7	
10.1.6	Reference ranges	Not used	Not used	-	
10.1.7	Result abnormal flags	Result abnormal flags	Not used	1	
10.1.8	Nature of abnormality testing	Not used	Not used	-	
10.1.9	Result status	Not used	Not used	-	
10.1.10	Date of change in instrument normative values	Not used	Not used	-	
10.1.11	Operator identification	Not used	Not used	-	
10.1.12	Date/Time test started	Not used	Not used	-	
10.1.13	Date/Time test completed	YYYYMMDDHHMMSS	Not used	14	
10.1.14	Instrument identification	Not used	Not used	-	

[Detailed explanation of the field]

1) 10.1.2 Sequence No.

The sequence number starts with 1 and indicates the sequence position in which the record appeared in the message. This number is reset to 1 when a higher-level record appears in the message.

2) 10.1.3 “Universal test ID” through 10.1.13 “Date time test completed”
Fields to be set will vary depending on the contents to be transmitted.

Test code: Indicates the assay parameter.
Consisted of the combination between the “Host ID” in the “Assay Settings” and the “Host ID” in the “Assay Settings”

See the Table 16

Table 16 : Test code

Test code	Test name	Units	Format	Test code	Test name	Units	Format
041	PT sec	sec	####.#	202	X %	percent	####.#
042	PT %	%	####.#	211	XI sec	sec	####.#
043	PT R		###.##	212	XI %	%	####.#
044	PT INR		###.##	221	XII sec	sec	####.#
051	APTT sec	sec	####.#	222	XII %	%	####.#
061	Fbg sec	sec	####.#	301	AT3 dOD	dOD	##.###
062	Fbg C.	g/L	##.###	302	AT3 %	%	####.#
081	TTO sec	sec	####.#	311	APL dOD	dOD	##.###
082	TTO %	%	####.#	312	APL %	%	####.#
084	TTO INR		###.##	321	Plg dOD	dOD	##.###
091	NT sec	sec	####.#	322	Plg %	%	####.#
092	NT %	%	####.#	331	PC dOD	dOD	##.###
093	NT INR		###.##	332	PC %	%	####.#
121	II sec	sec	####.#	511	TT sec	sec	####.#
122	II %	%	####.#	601	FDP dOD	dOD	#.####
151	V sec	sec	####.#	602	FDP C.	ug/mL	####.#
152	V %	%	####.#	611	DD dOD	dOD	#.####
171	VII sec	sec	####.#	612	DD C.	ug/L	####.#
172	VII %	%	####.#	621	FDP dOD	dOD	#.####
181	VIII sec	sec	####.#	622	FDP C.	ug/mL	####.#
182	VIII %	%	####.#				
191	IX sec	sec	####.#				
192	IX %	%	####.#				
201	X sec	sec	####.#				

*) The test code and test name are the settings when shipping from the factory.

Parameter: Consisted of up to 24 characters. The characters in the “Abbreviation” in the “Assay Group Settings” are output. See the Table 16.

Dilution ratio: Outputs the dilution ratio used in analysis with percent. It is indicated with including 2-digit of decimal number.

Analysis result type

1 :Normal (real)

2 :Average (real)
3 :Re-analysis (real)
4 :Average of re-analysis (real)
5 :Normal (batch)
6 :Average (batch)
7 :Re-analysis (batch)
8 :Average of re-analysis (batch)
9 :Final information (real)
A Final information (batch)

Extended order request: Indicates the redilution analysis and re-analysis are performed by the analyzer, based on the rules of the analyzer. Other than that, the extended order request is not added.
D :Redilution request
R :Re-analysis request

Extended order results: Indicates the analysis result is one of the followings: the result of the redilution analysis, or reanalysis or reflex test. Other than that, the result is not output.
D :Results of redilution analysis
R :Results of re-analysis
F :Results of reflex test

Reflex test request: Indicates the reflex test is performed by the analyzer, based on the Westgard rules of the analyzer. Other than that, the extended order request is not added.
F :Reflex test request

3) 10.1.4 Data or measurement value

Up to 6-digit number. Data format is described in the Table 16.
If the analysis results can not be obtained, the mask characters are input in part of the integral number. The mask characters are as follows.

*: Analysis failure
/: Average calculation failure
+: Display Digit Overflow
-: Calculation failure
X: No validated calibration curve in the calculation

4) 10.1.5 Units

Up to 7 characters
In the CA-1500, the units set in the instrument are output. (The ASTM describes the abbreviation of ISO standard should be used.) See the Table 16. If the unit is “Ratio” or “INR”, they are not output.

5) 10.1.7 Result abnormal flag

L: Below lower patient limit
H: Above upper patient limit
<: Below lower report limit.
>: Above upper report limit
N: Normal test result
A: Analysis error

6) 10.1.13 Date /time test completed

indicates the date and time the test was completed.
The date format is fixed with "YYYYMMDDHHMMSS".

Here, YYYY indicates the year, MM the month, DD the day, HH the hour in the 24 hour system (00-23), MM the minute (0—59), SS the second (0—59).

5.3.3.6.Message termination record

[Example of transmission]

- Instrument -> Host computer

  L|1|N<CR>

- Host computer -> Instrument

  L|1|N<CR>

Table 17 : Message termination record

ASTM Field	Field name	Instrument -> Host computer	Host computer -> Instrument	Max. size (Byte)	Remarks
13.1.1	Record type	L	L	1	Fixed
13.1.2	Sequence No.	1	1	4	Always 1
13.1.3	Termination cord	N	N	1	N: Normal termination

6. Examples of Communication

6.1. Inquiry of Analysis Order (Instrument => Host Computer)

・When the order inquiry is performed from Instrument

Instrument	<ENQ>
Host	<ACK>
Instrument	<STX>1H|\^&|||CA-1500^00-17^A1100^^^NO1||||||||1<ETX>01<CR><LF>
Host	<ACK>
Instrument	<STX>2Q|1|000001^01^ 1^B||^^^040^PT\^^^060^Fbg\^^^120^II\^^^150^V\^^^170^VII\^^^180^VIII\^^^ 190^IX\^^^200^X\^^^210^XI\^^^300^AT3\^^^310^APL|0|20070328133318<ETX>84<CR><LF>
Host	<ACK>
Instrument	<STX>3L|1|N<ETX>F9<CR><LF>
Host	<ACK>
Instrument	<EOT>

・When the host computer sends orders to Instrument

Instrument	<ENQ>
Host	<ACK>
Instrument	<STX>1H|\^&|||||||||||1|<CR><ETX>68<CR><LF>
Host	<ACK>
Instrument	<STX>2P|1|||100|^Heisei^Jiro||20010820|M||||^Dr.2|||||||||||^^^EAST|||| ||||<CR><ETX>08<CR><LF>
Host	<ACK>
Instrument	<STX>3O|1|000001^01^ 1^B||^^^040^^100.00^DF\^^^050^^100.00\^^^060^^100.00\^^^040^^100.00^DR|R|200 70330123159||||N|||||||||||||||||||<CR><ETX>95<CR><LF>
Host	<ACK>
Instrument	<STX>4L|1|<CR><ETX>B9<CR><LF>
Host	<ACK>
Instrument	<EOT>

6.2. Analysis Results (Instrument=> Host Computer)

6.2.1. When analysis is performed 1 time

Instrument	<ENQ>
Host	<ACK>
Instrument	<STX>1H|\^&|||CA-1500^00-17^A1100^^^NO1||||||||1<ETX>01<CR><LF>
Host	<ACK>
Instrument	<STX>2P|1||||<ETX>22<CR><LF>
Host	<ACK>
Instrument	<STX>3O|1||000001^01^ 1^B^||R|||||N<ETX>D7<CR><LF>
Host	<ACK>
Instrument	<STX>4R|1|^^^041^PT sec^100.00^9^^^| 10.2|sec||N|||||20070328135056<ETX>5E<CR><LF>
Host	<ACK>
Instrument	<STX>5R|2|^^^042^PT %^100.00^9^^^| 99.4|%||N|||||20070328135056<ETX>48<CR><LF>
Host	<ACK>
Instrument	<STX>6R|3|^^^043^PT R.^100.00^9^^^| 0.57|||N|||||20070328135056<ETX>77<CR><LF>
Host	<ACK>
Instrument	<STX>7R|4|^^^044^PT INR^100.00^9^^^| 0.81|||N|||||20070328135056<ETX>E0<CR><LF>
Host	<ACK>
Instrument	<STX>0R|5|^^^051^APTT sec^100.00^9^^^| 27.4|sec||N|||||20070328135056<ETX>FE<CR><LF>
Host	<ACK>
Instrument	<STX>1R|6|^^^061^Fbg sec^100.00^9^^^| 8.5|sec||N|||||20070328135056<ETX>C7<CR><LF>
Host	<ACK>
Instrument	<STX>2R|7|^^^062^Fbg C.^100.00^9^^^| 588.2|mg/dL||N|||||20070328135056<ETX>A2<CR><LF>
Host	<ACK>
Instrument	<STX>3L|1|N<ETX>F9<CR><LF>
Host	<ACK>
Instrument	<EOT>

6.2.2. Transmitting Analysis Results (When there is the re-analysis)

- Transmitting Analysis Results (The first analysis)

Instrument	<ENQ>
Host	<ACK>
Instrument	<STX>1H|\^&|||CA-1500^00-17^A1100^^^NO1||||||||1<ETX>01<CR><LF>
Host	<ACK>
Instrument	<STX>2P|1||||<ETX>22<CR><LF>
Host	<ACK>
Instrument	<STX>3O|1||000001^01^ 1^B^||R|||||N<ETX>D7<CR><LF>

Host	<ACK>
Instrument	<STX>4R|1|^^^041^PT sec^100.00^1^R^^| 10.2|sec||N|||||20070328135407<ETX>9A<CR><LF>
Host	<ACK>
Instrument	<STX>5R|2|^^^042^PT %^100.00^1^R^^| 99.4|%||N|||||20070328135407<ETX>84<CR><LF>
Host	<ACK>
Instrument	<STX>6R|3|^^^043^PT R.^100.00^1^R^^| 0.57|||N|||||20070328135407<ETX>B3<CR><LF>
Host	<ACK>
Instrument	<STX>7R|4|^^^044^PT INR^100.00^1^R^^| 0.81|||N|||||20070328135407<ETX>1C<CR><LF>
Host	<ACK>
Instrument	<STX>0R|5|^^^051^APTT sec^100.00^1^^^| 27.4|sec||N|||||20070328135407<ETX>F6<CR><LF>
Host	<ACK>
Instrument	<STX>1R|6|^^^061^Fbg sec^100.00^1^^^| 8.5|sec||N|||||20070328135407<ETX>BF<CR><LF>
Host	<ACK>
Instrument	<STX>2R|7|^^^062^Fbg C.^100.00^1^^^| 588.2|mg/dL||N|||||20070328135407<ETX>9A<CR><LF>
Host	<ACK>
Instrument	<STX>3L|1|N<ETX>F9<CR><LF>
Host	<ACK>
Instrument	<EOT>

- **Transmitting Analysis Results (The re-analysis)**

Instrument	<ENQ>
Host	<ACK>
Instrument	<STX>1H|\^&|||CA-1500^00-17^A1100^^^NO1||||||||1<ETX>01<CR><LF>
Host	<ACK>
Instrument	<STX>2P|1||||<ETX>22<CR><LF>
Host	<ACK>
Instrument	<STX>3O|1||000001^01^ 1^B^E||R|||||N<ETX>1C<CR><LF>
Host	<ACK>
Instrument	<STX>4R|1|^^^041^PT sec^100.00^3^^R^| 10.2|sec||N|||||20070328135407<ETX>9C<CR><LF>
Host	<ACK>
Instrument	<STX>5R|2|^^^042^PT %^100.00^3^^R^| 99.4|%||N|||||20070328135407<ETX>86<CR><LF>
Host	<ACK>
Instrument	<STX>6R|3|^^^043^PT R.^100.00^3^^R^| 0.57|||N|||||20070328135407<ETX>B5<CR><LF>
Host	<ACK>
Instrument	<STX>7R|4|^^^044^PT INR^100.00^3^^R^| 0.81|||N|||||20070328135407<ETX>1E<CR><LF>
Host	<ACK>
Instrument	<STX>0L|1|N<ETX>F6<CR><LF>
Host	<ACK>
Instrument	<EOT>

- **Transmitting Analysis Results (The final analysis)**

Instrument	<ENQ>
Host	<ACK>
Instrument	<STX>1H|\^&|||CA-1500^00-17^A1100^^^NO1||||||||1<ETX>01<CR><LF>
Host	<ACK>
Instrument	<STX>2P|1||||<ETX>22<CR><LF>
Host	<ACK>
Instrument	<STX>3O|1||000001^01^ 1^B^||R||||||N<ETX>D7<CR><LF>
Host	<ACK>
Instrument	<STX>4R|1|^^^041^PT sec^100.00^9^^R| 10.2|sec||N||||||20070328135407<ETX>A2<CR><LF>
Host	<ACK>
Instrument	<STX>5R|2|^^^042^PT %^100.00^9^^R| 99.4|%||N||||||20070328135407<ETX>8C<CR><LF>
Host	<ACK>
Instrument	<STX>6R|3|^^^043^PT R.^100.00^9^^R| 0.57|||N||||||20070328135407<ETX>BB<CR><LF>
Host	<ACK>
Instrument	<STX>7R|4|^^^044^PT INR^100.00^9^^R| 0.81|||N||||||20070328135407<ETX>24<CR><LF>
Host	<ACK>
Instrument	<STX>0R|5|^^^051^APTT sec^100.00^9^^^| 27.4|sec||N||||||20070328135407<ETX>FE<CR><LF>
Host	<ACK>
Instrument	<STX>1R|6|^^^061^Fbg sec^100.00^9^^^| 8.5|sec||N||||||20070328135407<ETX>C7<CR><LF>
Host	<ACK>
Instrument	<STX>2R|7|^^^062^Fbg C.^100.00^9^^^| 588.2|mg/dL||N||||||20070328135407<ETX>A2<CR><LF>
Host	<ACK>
Instrument	<STX>3L|1|N<ETX>F9<CR><LF>
Host	<ACK>
Instrument	<EOT>

6.2.3. When analysis is performed 2 times

Example: Analysis result (The first analysis)

Instrument	<ENQ>
Host	<ACK>
Instrument	<STX>1H|\^&|||CA-1500^00-17^A1100^^^NO1||||||||1<ETX>01<CR><LF>
Host	<ACK>
Instrument	<STX>2P|1||||<ETX>22<CR><LF>
Host	<ACK>
Instrument	<STX>3O|1||000001^01^ 1^M^||R|||||N<ETX>E2<CR><LF>
Host	<ACK>
Instrument	<STX>4R|1|^^^041^PT sec^100.00^1^^^| 10.2|sec||N|||||20070328150948<ETX>5D<CR><LF>
Host	<ACK>
Instrument	<STX>5R|2|^^^042^PT %^100.00^1^^^| 99.4|%||N|||||20070328150948<ETX>47<CR><LF>
Host	<ACK>
Instrument	<STX>6R|3|^^^043^PT R.^100.00^1^^^| 0.57|||N|||||20070328150948<ETX>76<CR><LF>
Host	<ACK>
Instrument	<STX>7R|4|^^^044^PT INR^100.00^1^^^| 0.81|||N|||||20070328150948<ETX>DF<CR><LF>
Host	<ACK>
Instrument	<STX>0R|5|^^^051^APTT sec^100.00^1^^^| 27.4|sec||N|||||20070328150948<ETX>FD<CR><LF>
Host	<ACK>
Instrument	<STX>1R|6|^^^061^Fbg sec^100.00^1^^^| 7.9|sec||N|||||20070328150948<ETX>C9<CR><LF>
Host	<ACK>
Instrument	<STX>2R|7|^^^062^Fbg C.^100.00^1^^^| 632.9|mg/dL||N|||||20070328150948<ETX>9E<CR><LF>
Host	<ACK>
Instrument	<STX>3L|1|N<ETX>F9<CR><LF>
Host	<ACK>
Instrument	<EOT>

Example: Analysis result (The second analysis)

Instrument	<ENQ>
Host	<ACK>
Instrument	<STX>1H|\^&|||CA-1500^00-17^A1100^^^NO1||||||||1<ETX>01<CR><LF>
Host	<ACK>
Instrument	<STX>2P|1||||<ETX>22<CR><LF>
Host	<ACK>
Instrument	<STX>3O|1||000001^01^ 1^M^||R|||||N<ETX>E2<CR><LF>
Host	<ACK>

Instrument	<STX>4R|1|^^^061^Fbg sec^100.00^1^^^| 7.9|sec||N|||||20070328150948<ETX>C7<CR><LF>
Host	<ACK>
Instrument	<STX>5R|2|^^^062^Fbg C.^100.00^1^^^| 632.9|mg/dL||N|||||20070328150948<ETX>9C<CR><LF>
Host	<ACK>
Instrument	<STX>6L|1|N<ETX>FC<CR><LF>
Host	<ACK>
Instrument	<EOT>

Example: Analysis result (The third analysis)

Instrument	<ENQ>
Host	<ACK>
Instrument	<STX>1H|\^&|||CA-1500^00-17^A1100^^^NO1||||||||1<ETX>01<CR><LF>
Host	<ACK>
Instrument	<STX>2P|1||||<ETX>22<CR><LF>
Host	<ACK>
Instrument	<STX>3O|1||000001^01^ 1^M^||R|||||N<ETX>E2<CR><LF>
Host	<ACK>
Instrument	<STX>4R|1|^^^041^PT sec^100.00^9^^^| 10.2|sec||N|||||20070328150948<ETX>2C<CR><LF>
Host	<ACK>
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Host	<ACK>
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Host	<ACK>
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Instrument	<STX>3L|1|N<ETX>F9<CR><LF>
Host	<ACK>
Instrument	<EOT>