Automated Coagulation Analyzer
CP3000

Laboratory Information System
Online Specification

Revised history

Day of Revision	Specification Version	Change Pages	Note
2013/11/26	First Edition	-	
2014/8/1	2nd Edition	7	Add the error "P Over" (Piercing times Over)

Table of Contents

1. Introduction

This specification is a summary of the online standards between the Fully Automated Coagulation Analyzer CP3000 (hereafter CP3000) and an external data processing device (hereafter host).

The division of responsibilities between the CP3000 and the host are shown in Figure 1.
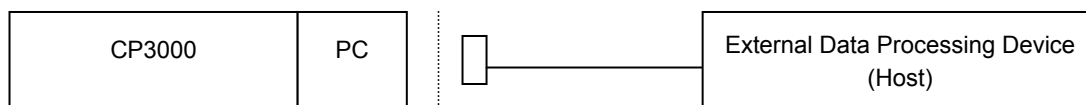

Figure1. Division of Responsibilities

2. Overview

2.1. Overview of Communication Specifications

(1) Uses a 9-pin male connector from an RS-232C expansion board on the PC for controlling the CP3000.

(2) Communication is controlled by protocols using ENQ (ASCII code base-16 $05) and ACK (Same, 06).

(3) Message text is in the format STX-ETX (ETB)[*4] / Checksum (BCC).

2.2. Types of Messages

The following 14 types of messages are used:

Command	Direction	Type	Message Timing and Content
02	CP3000 → Host	Request of analysis request (query by sample ID)	When a sample barcode is read or when a query is made, a request for analysis request is made using the sample barcode
03	CP3000 → Host	Send results (batch)	Sends results of samples specified normally when instructed to do so from a screen
04	CP3000 → Host	Send results (realtime)	During analysis, results of normal samples are sent when they are generated. [*1]
13	CP3000 → Host	Send prioritized measurement results (batch)	Sends results of samples specified as priority when instructed to do so from a screen
14	CP3000 → Host	Send prioritized measurement results (realtime)	During analysis, results of prioritized samples are sent when they are generated. [*1]
23	CP3000 → Host	Send STAT measurement results (batch)	Sends STAT sample results when instructed to do so from a screen
24	CP3000 → Host	Send STAT measurement results (realtime)	During analysis, results of STAT samples are sent when they are generated. [*1]
33	CP3000 → Host	Send together, Multi-point Dilution measurement results (batch)	During analysis, results of Multi-point Dilution samples are sent when they are generated. [*5]
34	CP3000 → Host	Send together ,Multi-point Dilution measurement results (realtime)	During analysis, results of Multi-point Dilution samples are sent when they are generated. [*5]
73	CP3000 → Host	Send control measurement results (batch)	Sends control sample results when instructed to do so from a screen
74	CP3000 → Host	Send control measurement results (realtime)	During analysis, results of control samples are sent when they are generated. [*1]
83	CP3000 → Host	Send calibrator measurement results (batch)	Sends calibrator results when instructed to do so from a screen
84	CP3000 → Host	Send calibrator measurement results (realtime)	During analysis, results of calibrator samples are sent when they are generated. [*1]
0A	Host → CP3000	Receive request	Message can be received anytime or when replying to a request for analysis request [*2]
0B	Host → CP3000	Receive request (with attribute) [*3]	Message can be received anytime or when replying to a request for analysis request [*2]
0F	Host → CP3000	Line check	Message can be received anytime (Not necessary to do so.)

	CP3000 → Host	Reply to line check	When receiving a line check from the host

Table 1. Types of Messages

*1: The following transmission selections can be made with CP3000 settings. (For details see 5.2 Communication Conditions.)
  • Send item data separately.
  • Result of pending test, do not send.
  • Send together, first/rerun.

*2: After a "02" request for analysis, the CP3000 performs other transmission processes without waiting for delivery of "0A" or "0B" messages.

*3: The CP3000 can receive attribute data. (Only displayed on-screen)

*4: When sending request or results for multiple samples in succession, sets ETX in the message for the last sample and sets ETB in the requests until then. (For format details, refer to 4. Transmission Specifications.)

*5: The command is available only when [Send together MDA data] is checked.

3. Message Specifications

3.1. Parameters within Messages

Item	Range of Values	Description
Instrument ID.	1 to 9	Numbers set with the CP3000
Rack position	0 to 8	Information of sample position (compatible for Coapresta 2000: hereafter CP2000) (Ref: CP3000) 0: None/Rack; 8: Transport (Ref: CP2000) 0: None; 1-6: Corresponds to sample table A-F; 7: STAT, 8: Transport
Rack No.	00, 01 to 50	Information of sample position (compatible for Coapresta 2000: hereafter CP2000) (Ref: CP3000) 00: Transport; 01-50: Rack number (Ref: CP2000) 00: STAT, Transport; 01-62: Rack number
Sample position	00, 01 to 05	Information of sample position (compatible for Coapresta 2000: hereafter CP2000) (Ref: CP3000) 00: Transport; 01—05: Positions 1-5 in a 5-sample rack (Ref: CP2000) Positions 1-10 in a 10-sample rack. If STAT, positions 01-03. If Transport, 00.
Host request No.	00000 to 65535	Sample identifying number on the host side. * Not used on the CP2000 side.
Request type	0, 1	*They are not used for CP3000. 0: Normal; 1: Emergency (Specify this when sending a request to STAT.)
Sample ID	16 digits	Left justified, with a space for empty digits (ASCII code: base-16 $20) * Double-byte characters not allowed.
Control No.	7 digits	In the format control number + serial number XX-CXXX
Cup type	0 to 2	0: Std. cup; 1: Micro-cup; 2: Blood collection tube * Anything else is handled as a blood collection tube.

Sample type	0 to 3	0: All, 1: Plasma, 2: Serum, 3: Other
Test No.	00, 01 to 99	00: No test. Each test can be set up with the CP3000.
Sampling condition number	0, 1 to 7,9	Sampling conditions 1-7 for each item. If it is 0 when a request is received, it uses the first sampling condition in the CP3000 test master. Add No.9 : Sampling condition number of MDA request
Unit	1 to 7	(Coagulation tests) 1: sec; 2: %; 3: Ratio; 4: INR; 5: MG/DL; 6: ratio; 7: G/L (Photometric tests) 1: MG/DL; 2: UG/ML; 3: NG/ML, 4: %; 5: U/mL; 6: mABS/min; 7: ratio
Judgement	00-FF	2-digit codes (Listed in 3.2)
Result	5-digit numerical values - - - - - * * * * *	5-digit numerical values (including the decimal point). Right justified, a space for empty digits. Digits extending past the decimal point and not included in the 5 digits are deleted. * The positioning of the decimal point is specified for each unit on the CP3000 test master. The data is sent as is even when it is displayed in the format >200 on the screen of the CP3000. If there is no result. If it is an overflow situation (>100000)
Year	4 digits	Displayed in Western style
MM/DD/HH/MM/SS	2 digits	Output is not justified and each unit has two digits.
Auto-rerun/ Reflection flag	0, 1	0: Auto-rerun, no reflection flag 1: Auto-rerun, has reflection flag
Priority analysis flag	0, 1	0: Not a priority analysis;1: Priority analysis
Attributes	40 digits	Sample attributes field. * CP3000 settings allow for 3 divisions (fixed length). (Noted in 6.4)

3.2. Judgement

1) Analysis Data Alarms

Error Level (E: Error, W: Warning)				Test		
	Judgement Code	Comment	Description	Coag	Photo	Results Field
E	**$02**	SampSH	Insufficient sample to test.	X	X	"- - - - -"
E	**$03**	SampMS	Mistake in dispensing sample.	X	X	"- - - - -"
E	**$05**	DilPSH	Insufficient deficient plasma or normal control plasma.	X		"- - - - -"
E	**$06**	BufSH	Insufficient buffer.	X		"- - - - -"
E	**$07**	DilSH	Insufficient diluents.		X	"- - - - -"
E	**$11**	R1 SH	#1 reagent insufficient.	X	X	"- - - - -"
E	**$12**	R1 MS	Mistake in dispensing #1 reagent.	X	X	"- - - - -"
E	**$19**	R2 SH	#2 reagent insufficient.	X	X	"- - - - -"
E	**$1A**	R2 MS	Mistake in dispensing #2 reagent.	X	X	"- - - - -"
E	**$1F**	NoDetc	Clotting finish point not detected within the specified measuring points.	X		"- - - - -"
E	**$20**	ABS!	Scanned value exceeded all readable range within the specified measuring points.	X	X	"- - - - -"
W	**$21**	High!	Exceeded judgment limit and judged a technical high.	X	X	(Has)
W	**$22**	Noise	Change in absorbency was not smooth within the specified measurement point, or initial absorbance exceeded either upper limit or lower limit	X	X	(Has)
		check S	Determined as initial absorbance failure due to lipemic sample, etc.	X		
		Low P	Determined to be an abnormal profile.	X		
W	**$23**	Prozone	Exceeded the hook effect limit and judged a hook effect		X	(Has)
E, W	**$2A**	NoCAL	No valid calibration curve, so the unit did not allow a quantitative calculation.	X	X	Only seconds, etc. for coagulation
E, W	**$2B**	RegMS	An unobtainable unit for concentration in an approximate calculation using the calibration curve.	X	X	Only seconds, etc. for coagulation
W	**$30**	Meas L	Analysis results were below the analysis range lower limit.	X	X	(Has)
W	**$31**	Meas H	Analysis results were above the analysis range upper limit.	X	X	(Has)
W	**$32**	L	Except control: Analysis results were below the standard range (normal range). Control: Analysis results were below the target value lower limit	X	X	(Has)
W	**$33**	H	Except control: Analysis results were above the standard range (normal range). Control: Analysis results were above the target value upper limit	X	X	(Has)
W	**$34**	Double	The difference in the analysis results from a double analysis exceeded the specified value.	X		(Has)
E	**$35**	pend	Not tested	X	X	"- - - - -"
		Mask	Masked test			
		Dtg MS	insufficient detergent on reagent side/			

			detergent absorbance failure of detergent			
		P Over	sample already pierced twice			
E	**$36**	Time-L	For PT-Fbg test: less than PT value lower limit	X		"- - - - -"
E	**$37**	Time-H	For PT-Fbg: more than PT value upper limit	X		"- - - - -"
	$40	PendRe	Subject to rerun. (Attached to initial results)	X	X	(Depending on other alarms)
	$80	Rerun Added	Rerun data (attached to rerun data) or data from an added reflection test.	X	X	(Depending on other alarms)

2) About Analysis Data Alarms
Analysis Data Alarms Settings
(1) Table 2 judgement code (when finishes w/o error = 00) + rerun/reflection flag ($40)
(2) Judgement code + rerun/reflection data flag ($80)
(3) Judgement code only
One of these is used. The message is set from higher to lower and displayed in base-16 ASCII.

Ex. 1)   With a panic H and a rerun, panic H (31) + rerun (40) equals (71) for the judgement code.
Ex. 2)   With a panic H and the results of the rerun tests shown, panic H (31) + rerun (80) makes the
          setting for the judgement code (B1).

Other
• Requests that are subject to reruns, are valid only when measurements are made by rack.
• Results for items that are on the "E" level are not calculated and its result is output as "-----" with the
  relevant error attached.
• Results sent from the CP3000 when rerunning tests are revised.
  For test items that were not rerun, data is only sent when the test is first run and rerun test item data
  is only sent when tests are rerun.
  Apart from this, a number of different communication patterns can be selected via communication
  condition settings on the CP3000.
  (For details see 5.2 Communication Conditions.)
• Whether to send masked analysis results as "-----" with a rerun error appended.
  (Message settings – Masked test results transmission or normal selected)

Reference: Message settings– Masked test results transmission

| | | Input value to "Message"field | |
		Normal	Masked test results transmission
Item	Types of result transmission message	normal (03,04), priority (13,14), STAT(23,24), control (73,74), calibration (83, 84)	Same as normal
	Control ID	xx-Cxxxx form including control sample number	Same as normal
	Transmission without "second" selection	In case of 3 units usage without selection of "second", transmit 4 units including "second"	Same as normal
	Masked test results	No transmission	Transmission as "pend"

3.3. Messages

For information on the checksum, see 4.1 Computing the Checksum.

(1) Requesting Analysis Requests

STX AA B C DD EE aaaaaaaaaaaaaaaa ETX WW

Text	Description	No. of Bytes
STX	Header (02/H)	1
AA	Command code ("02")	2
B	Instrument ID.	1
C	Rack position	1
DD	Rack No.	2
EE	Sample position	2
aa-a	Sample ID	16
ETX	(03/H)	1
WW	Checksum	2

(2) Result Data Transmission (Batch)

STX AA B FFFFF aaaaaaaaaaaaaaaa bbbb cc dd ee ff gg GG
   hh ii H j lllll hh ii H j lllll repeat ETX WW

Text	Description		No. of Bytes
STX	Header (02/H)		1
AA	Command code ("03")		2
B	Instrument ID.		1
FFFFF	Host request No.		5
aa-a	Sample ID		16
bbbb	Measurement date & time	Year	4
cc		Month	2
dd		Day	2
ee		Hour	2
ff		Minutes	2
gg		Seconds	2
GG	No. of tests		2
hh	Test No.		2
ii	Judgement		2
H	No. of results		1
j	Unit code	Repeat H times Max 4 times	1
lllll	Results		5
ETX	(03/H)		1
WW	Checksum		2

Repeat GG times (No. of tests) Max 20 times

(3) Result Data Transmission (Realtime)

STX AA B FFFFF aaaaaaaaaaaaaaaa bbbb cc dd ee ff gg GG
   hh ii H j lllll hh ii H j lllll repeat ETX WW

Text	Description		No. of Bytes
STX	Header (02/H)		1
AA	Command code ("04")		2
B	Instrument ID.		1
FFFFF	Host request No.		5
aa-a	Sample ID		16
bbbb	Measurement date & time	Year	4
cc		Month	2
dd		Day	2
ee		Hour	2
ff		Minutes	2
gg		Seconds	2
GG	No. of tests		2
hh	Test No.		2
ii	Judgement		2
H	No. of results		1
j	Unit code	Repeat H times Max 4 times	1
lllll	Results		5
ETX	(03/H)		1
WW	Checksum		2

Repeat GG times (No. of tests) Max 20 times

(4) Priority (Flag) Data Transmission (Batch)

STX AA B FFFFF aaaaaaaaaaaaaaaa bbbb cc dd ee ff gg GG

    hh ii H j lllll hh ii H j lllll repeat ETX WW

Text	Description		No. of Bytes
STX	Header (02/H)		1
AA	Command code ("13")		2
B	Instrument ID.		1
FFFFF	Host request No.		5
aa-a	Sample ID		16
bbbb	Measurement date & time	Year	4
cc		Month	2
dd		Day	2
ee		Hour	2
ff		Minutes	2
gg		Seconds	2
GG	No. of tests		2
hh	Test No.		2
ii	Judgement	Repeat GG times (No. of tests) Max 20 times	2
H	No. of results		1
j	Unit code — Repeat H times		1
lllll	Results — Max 4 times		5
ETX	(03/H)		1
WW	Checksum		2

(5) Priority (Flag) Data Transmission (Realtime)

STX AA B FFFFF aaaaaaaaaaaaaaaa bbbb cc dd ee ff gg GG

    hh ii H j lllll hh ii H j lllll repeat ETX WW

Text	Description		No. of Bytes
STX	Header (02/H)		1
AA	Command code ("14")		2
B	Instrument ID.		1
FFFFF	Host request No.		5
aa-a	Sample ID		16
bbbb	Measurement date & time	Year	4
cc		Month	2
dd		Day	2
ee		Hour	2
ff		Minutes	2
gg		Seconds	2
GG	No. of tests		2
hh	Test No.		2
ii	Judgement	Repeat GG times (No. of tests) Max 20 times	2
H	No. of results		1
j	Unit code — Repeat H times		1
lllll	Results — Max 4 times		5
ETX	(03/H)		1
WW	Checksum		2

(6) STAT Data Transmission (Batch)

STX AA B FFFFF aaaaaaaaaaaaaaaa bbbb cc dd ee ff gg GG
hh ii H j lllll hh ii H j lllll repeat ETX WW

Text	Description		No. of Bytes
STX	Header (02/H)		1
AA	Command code ("23")		2
B	Instrument ID.		1
FFFFF	Host request No.		5
aa-a	Sample ID		16
bbbb	Measurement date & time	Year	4
cc		Month	2
dd		Day	2
ee		Hour	2
ff		Minutes	2
gg		Seconds	2
GG	No. of tests		2
hh	Test No.		2
ii	Judgement		2
H	No. of results		1
j	Unit code	Repeat H times Max 4 times / Repeat GG times (No. of tests) Max 20 times	1
lllll	Results		5
ETX	(03/H)		1
WW	Checksum		2

(7) STAT Data Transmission (Realtime)

STX AA B FFFFF aaaaaaaaaaaaaaaa bbbb cc dd ee ff gg GG
hh ii H j lllll hh ii H j lllll repeat ETX WW

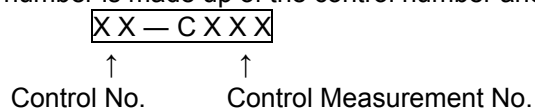| Text	Description		No. of Bytes
STX	Header (02/H)		1
AA	Command code ("24")		2
B	Instrument ID.		1
FFFFF	Host request No.		5
aa-a	Sample ID		16
bbbb	Measurement date & time	Year	4
cc		Month	2
dd		Day	2
ee		Hour	2
ff		Minutes	2
gg		Seconds	2
GG	No. of tests		2
hh	Test No.		2
ii	Judgement		2
H	No. of results		1
j	Unit code	Repeat H times Max 4 times / Repeat GG times (No. of tests) Max 20 times	1
lllll	Results		5
ETX	(03/H)		1
WW	Checksum		2

(8) Control Data Transmission (Batch)

STX AA B FFFFF aaaaaaakkkkkkkkk bbbb cc dd ee ff gg GG

      hh ii H j lllll hh ii H j lllll repeat ETX WW

Text	Description		No. of Bytes
STX	Header (02/H)		1
AA	Command code ("73")		2
B	Instrument ID.		1
FFFFF	Host request No.		5
aa-akk-k	Control No. 7 digits (see below), space 9 digits		16
bbbb	Measurement date & time	Year	4
cc		Month	2
dd		Day	2
ee		Hour	2
ff		Minutes	2
gg		Seconds	2
GG	No. of tests		2
hh	Test No.	Repeat GG times (No. of tests) Max 20 times	2
ii	Judgement		2
H	No. of results		1
j	Unit code — Repeat H times Max 4 times		1
lllll	Results		5
ETX	(03/H)		1
WW	Checksum		2

The control number is made up of the control number and the control measurement number.

                   X X — C X X X

                     ↑   ↑

           Control No.   Control Measurement No.

Control Measurement Number:

A consecutive number of the registered controls measured on the day.

Control Number:

Position number (sample number) registered on the [Control Sample] screen of the CP2000.

Ex.) If 3 tests were run on control 1, which was registered in control sample number 1:
    Data from the 1st time: 01-C001
    Data from the 2nd time: 01-C002
    Data from the 3rd time: 01-C003

(9) Control Data Transmission (Realtime)
STX AA B FFFFF aaaaaaakkkkkkkkk bbbb cc dd ee ff gg GG
      hh ii H j lllll hh ii H j lllll repeat ETX WW

Text	Description		No. of Bytes
STX	Header (02/H)		1
AA	Command code ("74")		2
B	Instrument ID.		1
FFFFF	Host request No.		5
aa-akk-k	Control No. 7 digits (see below), space 9 digits		16
bbbb	Measurement date & time Year		4
cc	Month		2
dd	Day		2
ee	Hour		2
ff	Minutes		2
gg	Seconds		2
GG	No. of tests		2
hh	Test No.		2
ii	Judgement	Repeat GG times (No. of tests) Max 20 times	2
H	No. of results		1
j	Unit code	Repeat H times Max 4 times	1
lllll	Results		5
ETX	(03/H)		1
WW	Checksum		2

The control number is made up of the control number and the control measurement number.

$$\boxed{X\,X - C\,X\,X\,X}$$
        ↑   ↑
    Control No.   Control Measurement No.

Control Measurement Number:
A consecutive number of the registered controls measured on the day.

Control Number:
Position number (sample number) registered on the Control screen of the CP2000.

Ex.) If 3 tests were run on control 1, which was registered in control sample number 1:
    Data from the 1st time: 01-C001
    Data from the 2nd time: 01-C002
    Data from the 3rd time: 01-C003

(10) Calibrator Data Transmission (Batch)

STX AA B FFFFF aaaaaaaaaaaaaaaa bbbb cc dd ee ff gg GG
     hh ii H j lllll hh ii H j lllll repeat ETX WW

Text	Description			No. of Bytes
STX	Header (02/H)			1
AA	Command code ("83")			2
B	Instrument ID.			1
FFFFF	Host request No.			5
aa-a	Sample ID			16
bbbb	Measurement date & time	Year		4
cc		Month		2
dd		Day		2
ee		Hour		2
ff		Minutes		2
gg		Seconds		2
GG	No. of tests			2
hh	Test No.		⎤	2
ii	Judgement		Repeat GG times	2
H	No. of results		(No. of tests)	1
j	Unit code	⎤ Repeat H times	Max 20 times	1
lllll	Results	⎦ Max 4 times	⎦	5
ETX	(03/H)			1
WW	Checksum			2

(11) Calibrator Data Transmission (Realtime)

STX AA B FFFFF aaaaaaaaaaaaaaaa bbbb cc dd ee ff gg GG
     hh ii H j lllll hh ii H j lllll repeat ETX WW

Text	Description			No. of Bytes
STX	Header (02/H)			1
AA	Command code ("84")			2
B	Instrument ID.			1
FFFFF	Host request No.			5
aa-a	Sample ID			16
bbbb	Measurement date & time	Year		4
cc		Month		2
dd		Day		2
ee		Hour		2
ff		Minutes		2
gg		Seconds		2
GG	No. of tests			2
hh	Test No.		⎤	2
ii	Judgement		Repeat GG times	2
H	No. of results		(No. of tests)	1
j	Unit code	⎤ Repeat H times	Max 20 times	1
lllll	Results	⎦ Max 4 times	⎦	5
ETX	(03/H)			1
WW	Checksum			2

(12) Receiving Analysis Requests
STX AA B FFFFF L M N C DD EE aaaaaaaaaaaaaaaa P Q GG
hh R (repeat) ETX WW

Text	Description		No. of Bytes
STX	Header (02/H)		1
AA	Command code ("0A")		2
B	Instrument ID.		1
FFFFF	Host request No.		5
L	Request type		1
M	Auto-rerun/Reflection flag		1
N	Priority analysis flag		1
C	Rack position		1
DD	Rack No.		2
EE	Sample position		2
aa-a	Sample ID		16
P	Cup type		1
Q	Sample type		1
GG	No. of tests (If no requests, input "00".)		2
hh	Test No.	Repeat GG times (No. of tests) Max 20 times	2
R	Sampling conditions No.		1
ETX	(03/H)		1
WW	Checksum		2

* If the No. of tests (GG) is "00", no value is input into the Test No. (hh) or the Sampling conditions No. (R)
* For the Rack No. and Sample position, reply with the same numbers sent from the CP2000.

(13) Receiving Analysis Requests (With Attributes)
STX AA B FFFFF L M N C DD EE aaaaaaaaaaaaaaaa P Q GG
hh R (repeat) SSS-SSS ETX WW

Text	Description		No. of Bytes
STX	Header (02/H)		1
AA	Command code ("0B")		2
B	Instrument ID.		1
FFFFF	Host request No.		5
L	Request type		1
M	Auto-rerun/Reflection flag		1
N	Priority analysis flag		1
C	Rack position		1
DD	Rack No.		2
EE	Sample position		2
aa-a	Sample ID		16
P	Cup type		1
Q	Sample type		1
GG	No. of tests (If no requests, input "00".)		2
hh	Test No.	Repeat GG times (No. of tests) Max 20 times	2
R	Sampling conditions No.		1
SS-S	Attributes (40 digits)		40
ETX	(03/H)		1
WW	Checksum		2

* If the No. of tests (GG) is "00", no value is input into the Test No. (hh) or the Sampling conditions No. (R)
* For the Rack No. and Sample position, reply with the same numbers sent from the CP3000.

(14) Line Check
STX AA B ETX WW

Test	Description	No. of Bytes
STX	Header (02/H)	1
AA	Command code ("0F")	2
B	Instrument ID.	1
ETX	(03/H)	1
WW	Checksum	2

(15) MDA Data Transmission (Batch)
STX AA B FFFFF aaaaaaaaaaaaaaaa bbbb cc dd ee ff gg hh I
JJJJJ ii H j IIIII JJJJJ ii H j IIIII repeat ETX WW

Text	Description			No. of Bytes
STX	Header (02/H)			1
AA	Command code ("33")			2
B	Instrument ID.			1
FFFFF	Host request No.			5
aa-a	Sample ID			16
bbbb	Measurement date & time	Year		4
cc		Month		2
dd		Day		2
ee		Hour		2
ff		Minutes		2
gg		Seconds		2
hh	Test No.			2
I	No. of MDA points (1-7)			1
JJJJJ	Sample Plasma Ratio		Repeat I times (No. of MDA points) Max 7 times	5
ii	Judgement			2
H	No. of results			1
j	Unit code	Repeat H times Max 4 times		1
IIIII	Results			5
ETX	(03/H)			1
WW	Checksum			2

(16) MDA Data Transmission (Realtime)
STX AA B FFFFF aaaaaaaaaaaaaaaa bbbb cc dd ee ff gg hh I
JJJJJ ii H j IIIII JJJJJ ii H j IIIII repeat ETX WW

Text	Description		No. of Bytes
STX	Header (02/H)		1
AA	Command code ("34")		2
B	Instrument ID.		1
FFFFF	Host request No.		5
aa-a	Sample ID		16
bbbb	Measurement date & time	Year	4
cc	Month		2
dd	Day		2
ee	Hour		2
ff	Minutes		2
gg	Seconds		2
hh	Test No.		2
I	No. of MDA points (1-7)		1

JJJJJ	Sample Plasma Ratio		5
ii	Judgement		2
H	No. of results	Repeat I times (No. of MDA points) Max 7 times	1
j	Unit code		1
IIIII	Results	Repeat H times Max 4 times	5
ETX	(03/H)		1
WW	Checksum		2

* The beginning request No. is sent as Host request No.

* Dilution ratio is the five digits including the decimal point (0.0000-99999).

* Data is sent by test.

4. Transmission Specifications

4.1. Computing the Checksum

- **A two-byte check code calculated from the text after 1) STX until ETX is appended after ETX. The check code can be switched between the checksum and BCC via CP3000 settings.**
- **The BCC takes XOR from the text after STX until ETX (or ETB, including ETX or ETB).**
  Ex.) The method for computing XOR in C is shown below. (with 100 data sets)

```
unsigned   char   uc__data[100], uc__sum;
      uc__sum=0;
      for(i=0;i<100;itt){
            uc__sum^=uc__data[i];
                  }
```

  If BCC is $05, it becomes the two characters "0" and "5".
- **To arrive at the checksum, the text after STX until ETX (including ETX) is added and the low 8 bits are taken.**
- **The calculated values of BCC and the checksum are converted into an ASCII base-16 number, which is appended in order with high (CSH) and low bits (CSL).**
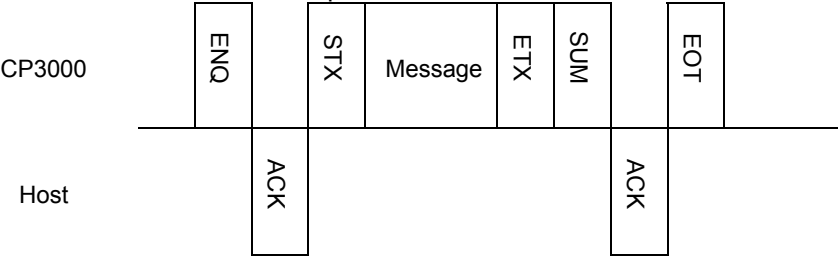
4.2. Transmission Control Matrix

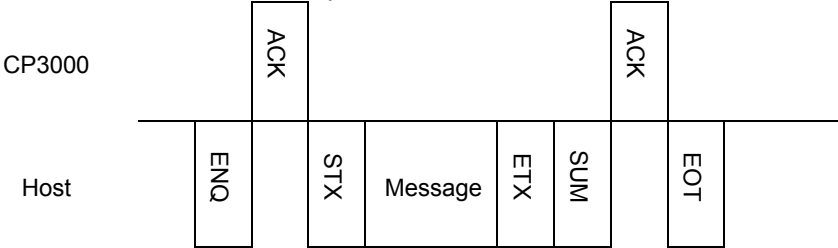| Receive	Status				
	S1 (Neutral)	S2 (Awaiting STX)	S3 (Awaiting ETX, ETB)	S4 (Awaiting reply after sending ENQ)	S5 (Awaiting reply after sending text)
ENQ (05)	ACK→S2	Ignore	Save	(CP) ACK→S2 (Host) Ignore[3]	Ignore
STX (02)	Ignore	→S3	Save	Ignore	Ignore
ETX (03) ETB (17)	Ignore	Ignore	(Normal) ACK→S2 (Error) NAK→S2	Ignore	Ignore
ACK (06)	Ignore	Ignore	Save	Send text →S5	(has text) Send→S5 (no text) EOT→S1
NAK (15)	Ignore	Ignore	Save	ENQ→S4[1]	Resend→S5[1]
EOT (04)	Ignore	→S1	Save	EOT→S1[2]	EOT→S1[2]
Text	Ignore	Ignore	Save	Ignore	Ignore
Note	(Is sent) ENQ→S4	(Timeout) NAK→S2[1]	(Timeout) NAK→S2[1]	(Timeout) ENQ→S4[1]	(Timeout) Resend→S5[1]

- "→" indicates a transition in status. The ENQ, ACK, etc., indicates the transmission code before transition.
- In the S3 status, when ETX/ETB are received, it processes the next two bytes received as the SUM.
- Timeout setting is 3 seconds. (The setting can be changed)
- [1] indicates retries are executed. On the 7th retry, it shifts to EOT→S1 (Error handling).
- [2] indicates error handling.
- [3] indicates that the CP3000 side changes to the receiving side and the host side waits for ACK, so send body text.
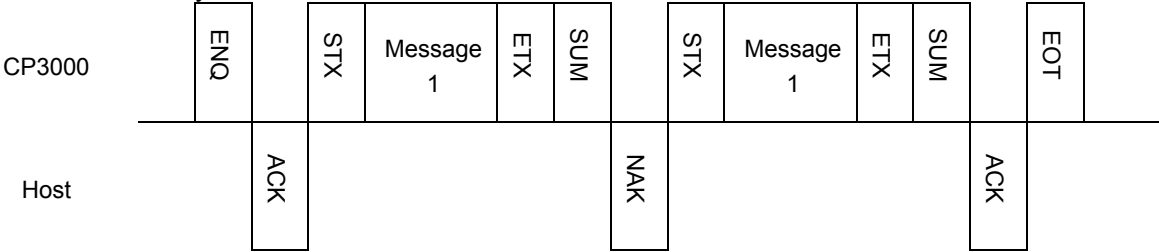- ENQ (Base16 $05), ACK (06), NAK (15), EOT (04), ETB (17) etc.
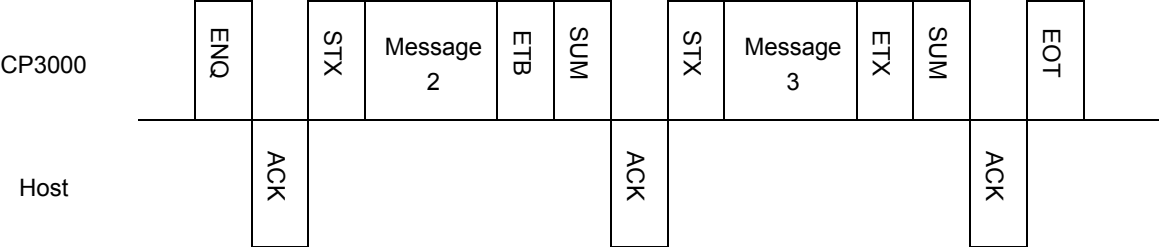
4.3. Sample Flows

A: Normal communication example 1

CP3000	ENQ		STX	Message	ETX	SUM	EOT
Host		ACK					ACK

B: Normal communication example 2

CP3000	ACK					ACK	
Host	ENQ		STX	Message	ETX	SUM	EOT

C: After an error, retry communication

CP3000	ENQ		STX	Message 1	ETX	SUM		STX	Message 1	ETX	SUM	EOT
Host		ACK				NAK					ACK	

D: Consecutive exchanges

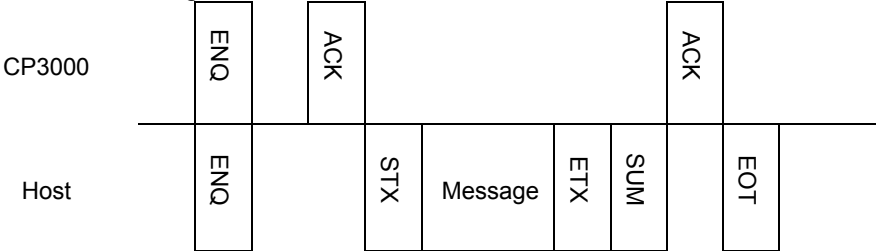|												
CP3000	ENQ		STX	Message 2	ETB	SUM		STX	Message 3	ETX	SUM	EOT
Host		ACK				ACK					ACK	

If communication stops due to an error after the 2nd message or later is sent, the messages received up to that point are treated as valid.

E: Conflict in sending ENQ

CP3000	ENQ	ACK				ACK	
Host	ENQ		STX	Message	ETX	SUM	EOT

5. Hardware Specifications and Communication Settings

Connect to the RS232C port on the back of the PC that controls the CP3000.
Refer to the PC's user's manual to make the connection.

5.1. Connecting Cable

• Connector: D-SUB 9-pin male (Obtain a cable with a female connector)

Pin Assignment Table

Pin No.	Signal Name	Abbreviation	Direction	Description
1	Data Carrier Detect (DCD)	DCD	ME←H	Acknowledgment of carrier detection
2	Receive Data (RD)	RD	ME←H	Data received
3	Transmit Data (TD)	TD	ME→H	Data transmitted
4	Data Terminal Ready (DTR)	DTR	ME→H	Acknowledgement that it can be used
5	Signal Ground (SG)	SG	–	SD/RD grounded
6	Data Set Ready (DSR)	DSR	ME←H	Acknowledgement that it can be used
7	Request to Send (RS)	RS	ME→H	Request to stop/retry sending
8	Clear to Send (CS)	CS	ME←H	Acknowledgment of stop/retry receiving
9	Ring Indicate (RI)	RI	ME←H	Acknowledgment that transmission arrived

5.2. Communication Conditions

(Make settings via the Host Setting screen under Environment/Options in the CP3000 operating software.)

Details on each parameter:

Parameter	Choices
Baud rate	Sets the communication speed between the host and the instrument. 1200, 2400, 4800, *9600, 19200
Parity	Sets the parity bit for transmitted messages. *None, even, odd
Data length	Specifies the transmission data length. 7-bit, *8-bit
Stop Bit Length	Specifies the stop bit for transmissions. *1-bit, 2-bit
Port	Specifies the port to use for communications. *COM2
BCC	Specifies the check code. *SUM, EOR
Waiting time (Sec)	Specifies the timeout for command transmissions, such as ENQ/ACK. *3 (wait time within communication sequence)
Instrument ID.	Specifies separate ID numbers when multiple instruments are connected to the host. *1, 2, 3, 4, 5, 6, 7, 8, 9
Style	Sets how the host and the instrument communicate with each other. *Normal, Mask test result transmission
ID query	Sets to automatically query the host when reading bar codes during analysis. Default is to not set this.
Timeout (Sec)	Up to 120 seconds. (Time from the sending of a "Request for analysis request" until a warning that there is no request)
Requery after S-Stop	Sets to requery the host after an S-stop, even for samples that have finished measurement within the same analysis. If this is not check-marked, a host query is made only if the instrument stops. Default is to not set this.
Set rerun flag on all samples	Sets an auto rerun flag on request messages, regardless of whether it is a request from the host. Default is to not set this.
Realtime transmission	Sets to automatically send data to the host once the results have been calculated (for one sample). Default is to not set this.
Send item data separately	Sets to send results test by test. Default is to not set this.
Results of pending test, do not send	Specifies that data for items awaiting a retest not be sent. Default is to not set this.
Send together, First/Rerun	Specifies that when the status of a test is "first results pending rerun," the data be held and that initial and retest data be sent together to the host after rerun results are put together. (Data is sent just once, for tests with just the first test, as first test results, for tests that are rerun, the rerun results are sent after rerunning the test. The first results of tests that are rerun are not sent.) Default is to not set this.

• * indicates the default setting.

6. Operating Methods and Warnings

(1)	Line check	[Host→CP3000]
(2)	Line check	[CP3000→Host]
(3)	Request for analysis request (batch)	[CP3000→Host]
	* A query can be made when the CP2000 is started up. Not necessary to do so.	
(4)	Receipt of analysis request	[Host→CP3000]
	* The CP2000 can receive requests as they are made.	
(5)	Start analysis (sets the sample and starts analysis)	
(6)	Request for analysis request (realtime)	[CP3000→Host]
	* When a barcode is scanned or a query made, if there is no request in the CP3000, it queries the host.	
	* At such time, the CP3000 does not wait to receive the request from the host. (to process other messages)	
(7)	Receipt of analysis request	[Host→CP3000]
	* The CP3000 makes measurements as per the request.	
(8)	Send results data (realtime)	[CP3000→Host]
	* Only when the CP3000 has been instructed to send realtime.	
(9)	Analyze auto-rerun/reflection requests	
(10)	Send results data (realtime)	[CP3000→Host]
(11)	Finish analysis	
(12)	Send results data (realtime)	[CP3000→Host]
	* CP3000 can be instructed to send data from its screen.	

6.1. Sample Identification

Identification of samples between the CP3000 and the host is accomplished by comparing the host request number (host specified) or the sample ID (barcode, etc.).

Comparison of analysis requests and samples on the CP3000:

(1) Using barcodes:
   The content of scanned barcodes is treated as the sample ID, then the request is searched for and the numbers are compared. If a request cannot be found, and if the Query box is checkmarked, then the host is queried for the sample ID.

(2) Without a barcode:
   Specify the rack number and sample position and send a request from the host. The CP3000 then compares the request and sample via the rack number and sample position.

6.2. Data Transmission Timing

By specifying Normal messages and Send Item Data Separately, when realtime transmissions are being made, it does not wait for other tests to finish and sends the results as they come out.

6.3. Send Auto-rerun/Reflection Results

When handling auto-rerun and reflection requests, only rerun tests and added tests are sent.
* When sending auto-rerun and reflection results, the data of other test items in the original request are not sent.

6.4. Adding Attributes to Requests

Although a 40 byte attribute field can be added to each request, the CP3000 can only display 24 bytes in its display area. The field can be split into three by specifying separation positions with the CP3000. (Make settings via the Environment/Options screen in the CP3000 operating software.)
* Attributes 1 and 2 can have up to 24 bytes. 16 bytes of attribute 3 can be displayed. Chinese characters use two bytes per character.

Ex.) Attribute field: aaaaaaaaaaaaaaaaaaaabbbbbbbbbbccccccccccc

Sets the data in the attribute fields: aa–a: 20 digits, bb–b:10 digits, cc–c: 10 digits in fixed positions.
→ The data field is displayed on the CP3000 in three segments as follows:

aaaaaaaaaaaaaaaaaaaa

bbbbbbbbbb

cccccccccc

In the interest of making improvements, please note that this specification may be changed without advanced notice.