NS-Prime

Online Specifications （Rev.1.02）

Contents

1．Foreword

These specifications compile the online communication standards between NS-Prime and an analytical system computer(hereafter called the "host"). These specifications are applicable when choosing "NS-Prime (NS-Plus)" format or "NS-1000" format as an output format.

Note)　　You can choose and set up a format in the host computer property when making an external output in the system configuration related setup.

2．Summary

NS-Prime can output the measured data to the host. There are two types of transaction processing systems for the transmission timing: batch processing and real time processing. NS-Prime user program makes it possible for you to request for a worksheet from the host, and to receive a worksheet from the host.

2.1　Real time transmission

Measured data transmission to the host immediately on completion of measurements of "In process", "Sample", "Calibrator" and "Control".

2.2　Batch transmission

Measured data compiled transmission to the host after the data confirmation on the measurement result window.

2.3　Request for a worksheet

Requesting a worksheet either by Sample ID position or Rack ID position..

2.4　Receipt of a worksheet

Receiving a worksheet containing information about measurement items.

Note)　You can specify whether or not to perform real time transmission of measurement results, and set up in the host computer property when making an external output in the system configuration related setup.

Note)　If you choose NS-1000 format,　you cannot output the measurement results of calibrator and control.

Note)　If you choose NS-1000 format, you cannot request for a worksheet and receive a worksheet You cannot output results expect hemoglobin, either.

Note)　If you receive a worksheet, the burden on the host may slow its capacity of a computer system

Note)　M Rack doesn't request for a worksheet.

3．Transmission Specifications

3.1 Types of Text Transmission

There are four types of text transmission: measured data output (real time and batch), a request for a worksheet and a receipt of a worksheet

1	Measurement data transmission (Real time)	On completion of measurement	NS-Prime ⇨ The Host	Capable to set up the parameter to specify whether or not to perform real time transmission.
2	Measurement data transmission (Batch)	At the point of execution of online output on the measurement result window	NS-Prime ⇨ The Host	
3	Request for a worksheet	At the start of sampling	NS-Prime ⇨ The Host	Applicable only when NS-Plus format is chosen.
4	Recipt of a worksheet	After requesting for a worksheet	The Host ⇨ NS-Prime	Applicable only when NS-Plus format is chosen.

Note）Capable to set up　the delay time between each byte by the millimeter at the time of measured data transmission. Factory default is 0 msec.

Note）　Request for a worksheet and receipt of a worksheet are applicable to sample only, and are not available for calibrator and control.

Note）In case of the multiple simultaneous measurement、please choose NS-Prime (NS-Plus)format

Note）No request for a worksheet from the host will be made when measuring the rack　which is made dilution registration on the window. (Window registration has a priority.)

3.2 Contents of Text Transmission

The codes appearing in the text are defined as follows:

［Text Segment］

D   Showing that it is the data of measured results

R   Showing that it is the request for a worksheet. Applicable only in (NS-Prime(NS-Plus) format.

W   Showing that it is a worksheet. Applicable only in（NS-Prime(NS-Plus) format.

［Sample Segment］

U   Sample

C   Control

S   Calibrator

［Sequence No.］

The sequence Number, 1〜9999, is the consecutive numbers that NS-Prime Issues automatically to identify Sample, Calibrator and Control Data.

The first numbers of the sequence numbers each for Sample, Priority Sample, Calibrator and Control can be set up using parameters.

Factory defaults of the first numbers are as follows:

Sample：1

Priority Sample：7001

Calibrator：8001

Control：9001

Please note that the sequence numbers are reset when a date is changed, and the mode is shifted into the standby mode.

［Rack ID, Rack Position］

Showing   of a rack ID and position of the measured sample.

［Meas. Method］

Showing One-day method, Two-day method or Three-day method.

［ID］

A code to be basically attached to a sample as a bar code, up to 14 lines.

In a case where the lines are less than 14, the lines are in order from front to back and spaces are put after the last line.

In case of a calibrator and a control, a calibrator ID and a control ID are set respectively.

［Abs. Difference］

Showing   an absorbance difference before or after a response.

［Conc. Value］

A value calculated from an absorbance difference before or after a response based on a standard curve.

［Result］
　　　　A result code calculated from a concentration value based on the cut-off
　　　　In case of a calibrator and a control, spaces are put instead of lines.

［Meas. Date. Meas. Time.］
　　　　Showing a measurement date and a time.

［Remark Code］

　　　　The hexadecimal code showing the occurrence of an error during measurement

　　　　The remark code, "0" shows normal, any other code has no reliable a measurement result.

［Diag Mthd］
　　　　Showing a dilution ratio of a sample.

［Meas. Protocol No.］
　　　　Showing types of measurement items.

Meas. Protocol	Protocol No.
Hemoglobin（A）	1
Transferrin（A）	4
Lactoferrin	9
Saliva Hemoglobin	10

Note）The above diluted ration and measurement protocol number are outputted only when the output
　　　format is set up in NS-Prime(NS-Plus)

3.3 Structure of Text

Data text is framed by STX and ETX characters, and the text is all described in ASCII codes. Each text ends with the 4-digit check character (checksum).

A checksum is making the sum from STX to ETX of, in hex, into the 4-digit text type characters (ASCII).

・Measurement Result Data Text （**when choosing NS-Prime(NS-Plus) format**）

S T X	Measurement Result Data（Fixed-length：69 bytes）	E T X	Checksum (4 bytes)

・Measurement Result Data Text （**when choosing NS-1000 format**）

S T X	Measurement Result Data（Fixed-length：63 bytes）	E T X	Checksum (4 bytes)

・Request Text for Worksheet （**when choosing NS-Prime(NS-Plus) format**）

S T X	Measurement Result Data（Fixed-length：15 bytes）	E T X	Checksum (4 bytes)

・Worksheet Text （**when choosing NS-Prime(NS-Plus) format**）

S T X	Measurement Result Data（Variable Length）	E T X	Checksum (4 bytes)

3.3.1 Data Format

（1）Measurement Result Data （when choosing **NS-Prime(NS-Plus)** Format）

Text Discription	Sample Discription	Sequence No.	Rack ID	Meas. Method	ID	Measurement Data	Dilution Ratio	Meas. Protocol No.
1 byte	1	4	5	1	14	38	3	2

```
     Item              Size       Example              Description
-------------------------------------------------------------------------------------------------
Text Description        1         D               Showing text types.
Sample Description      1         U               Differentiating    Sample,   Calibrator    and   Control.
Sequence No.            4         7001            The sequence numbers are allocated for Sample,
                                                  Calibrator and Control
Rack ID                 3         001             Rack ID
                        2         1               Rack position （Right justification）
Meas. Method            1         1               1: One-Day Mthd  2: Two-Day Mthd
                                                  3: Three-Day Method
ID                      14        12345678        Sample ID （Left justification, Right space）
Measurement Data        5         0.012           Abs. Diff. （Right justification）
                        6         100             Conc. Value （Right justification）
                        7         (-/-/-)         Assessment
                        10        2004/10/12      Meas. Date
                        8         10:08:25        Meas. Time
                        2         00              Remark Code（Hex）
Dilution Ratio          3         1               Dilution Ratio （Right justification）
Meas.Protocol No        2         1                Measurement Item （Right justification）
```
.

Total: 69 bytes （Fixed length）

Note） The concentrate value is output to the host multiplying the actual calculating concentrate value by "Conversion Coef." The conversion coef can be set up in the sample property of the system configuration.

Note） *** is output when the concentrate value is over scale.

Note） ????? is set up on ID when the sample ID barcode cannot be read.

Note） When the sample ID barcode is NW7, the codes of "Start" and "Stop" are not included with the sample ID while formatting NS-Prime(NS-Plus).

Note） The concentrate value of items of feces and saliva is the round-off integer type.

(2) Measurement Result Data（when choosing **NS-1000** Format）

Discription	Discription	No.		Method		Data
1 byte	1	4	5	1	14	37

Item	Size	Example	Description
Text Description	1	D	Showing text types.
Sample Description	1	U	Differentiating Sample, Calibrator and Control
Sequence No.	4	7001	The sequence numbers are allocated for Sample, Calibrator and Control
Rack ID	3	001	Rack ID
	2	1	Rack position（Right justification）
Measurement Data	1	1	1: One-Day Mthd 2: Two-Day Mthd 3: Three-Day Mthd.
ID	14	12345678	Sample ID（Left justification, Right space）
Measurement Data	5	0012	Abs.Diff.（Right justification）
	5	100	Conc.Value (Right justification)
	7	(-/-/-)	Assessment
	10	2004/10/12	Meas. Date
	8	10: 8:25	Meas. Times
	2	0	Remark Code (Hex)

Total: 63 bytes（Fixed length）

Note）The concentrate value is output to the host multiplying the actual calculating concentrate value by "Conversion Coef." The conversion coef can be set up in the sample property of the system configuration,

Note）∗∗∗ is output when the concentrate value is over scale.

Note）????? is set up on ID when sample ID barcodes cannot be read.

Note）The remark codes are zero suppressed.

Note）When the sample ID barcodes are NW7, the codes of "Start" and "Stop" are included with the sample ID while formatting NS-1000.

Note）The concentrate value is the round-off integer type.

(3) Request Worksheet （when choosing **NS-Prime(NS-Plus)** Format）

Text Discription	ID
1 byte	14

Item	Size	Example	Description
Text Description	1	R	Showing text types
ID	14	12345678	Sample ID （Left justification, Right space）
		001-05	Rack ID-Position （Left justification）
			The rack, 3 bytes and the position, 2 bytes are hyphenated.

Total: 　　　15 bytes （Fixed length）

Note） When requesting from the sample ID, the sample ID is set up in the ID field.
When requesting from the rack ID position, the ID position is set up in the ID field.
Switching of requesting methods can be made in the host computer property of the system configuration.

Note） The sample ID is set up on the ID when requesting from the sample ID, and the rack ID position is on the ID when requesting from the sample ID. ????? is set up on the ID when the sample ID barcodes cannot be read.

(4) Worksheet （when choosing **NS-Prime(NS-Plus)** format）

Text Discription	Rack ID	SampleID	Meas. No. of Items	Item Direction Data	Item Direction Data	·····
1byte	6	14	1	5	5	

Item	Size	Example	Description
Text Description	1	W	Showing text types
Rack ID	6	001-05	Rack ID-Position （Left justification）
ID	14	12345678	Sample ID （Left justification, Right space）
Meas. No. of Items	1	2	Showing Meas. No. of Items
Item Direction Data	2	1	Protocol No.（Right justification）
	3	1	Dilution Ratio （Right justification）

Total: 　　　　Variable length

Note） The length of worksheets is variable as a function of measurement number of items.
Note） Please refer to P5 for the definition of protocol number.
Note） Please put a space when requesting form the sample ID.

4. Transmission Methods

NS-Prime uses Transmission Control Protocol using control codes, ACK, NAK, etc.
There are two methods: batch and real-time processing..

4.1 Transmission Control Protocol

Making a response from the receiving side and adding the following protocol for the transmission of information.
The utility of 4-byte check characters (checksum) to detect errors.
A checksum is a count of number of making the sum of codes from STX to ETX into 4-digit text type characters.

4.2 Transmission Protocol

1.   When NS-Prime sends the data, ENQ (05H) is sent first to wait for ACK(06H), the approval of the host computer Get the transmission rights following this protocol.
   ENQ is resent when ACK isn't returned from the host for more than 3 seconds, or NAK is received. (The number of times for the retry: 6 times)

2.   Next, NS-Prime sends the data text to the host. The host checks with the checksum with the text to verify whether the data is received correctly or not.

3.   When the data is received correctly, ACK is returned, or otherwise NAK (15H) is returned. When the host returns ACK, NS-Prime returns EOT(04H) immediately. In case of NAK or no response for more than 3 seconds, the text is reset. (The number of times for the retry: 6 times) Termination after sending out EOT when ACK isn't retuned even after 6-time-retry.

The data text is transmitted as shown below:

Transmitting Side   Receiving Side
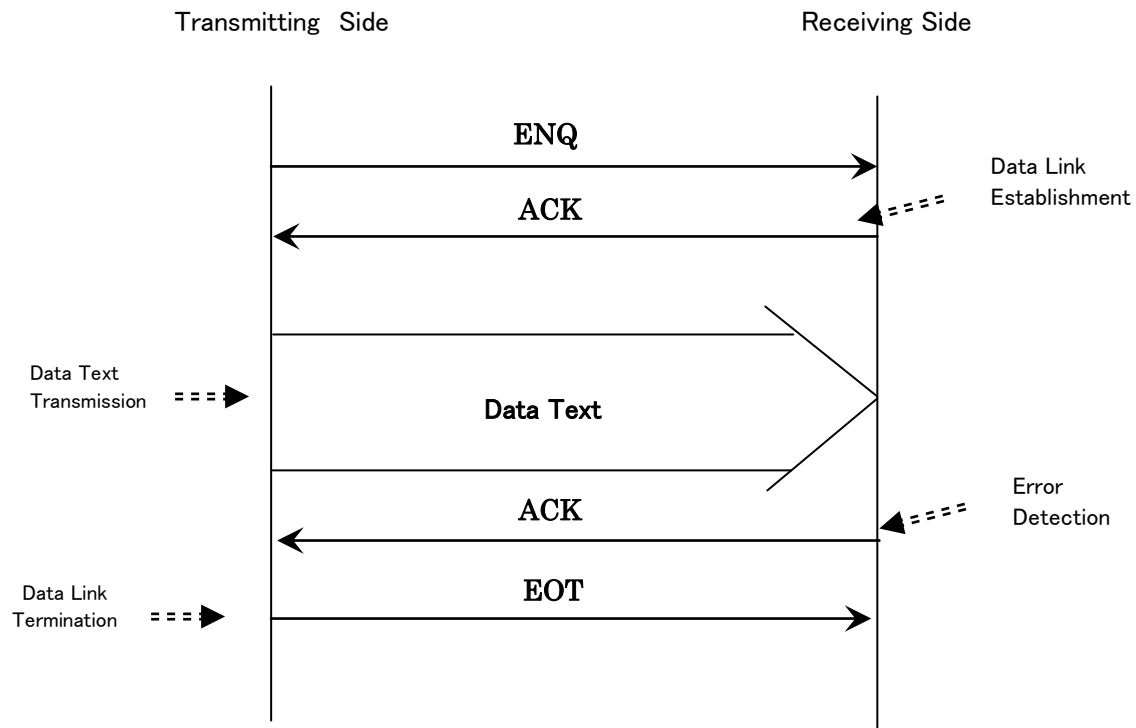
The specific transmission protocol is as follows:
     （1）Data Link Establishment
     （2）Data Text Transmission
     （3）Error Detection and Retransmission Control
     （4）Data Link Termination

（1）Data Link Establishment

  In this protocol, ENQ(05H) is sent from the transmission side first, when establishing the data link..
The ENQ sequence checks whether the receiving side can receive the data text or not. After that,
ACK(06H) returns from the other side and then the data link is established, and the transmission
right is acquired.
In case of no-response (*1) or returning of NAK(15H), the data link isn't established.(*2).
In case an analytical instrument receives ENQ from the host right after ENQ transmission, the
analytical instrument becomes the receiving side, and the host retransmits ENQ immediately.
The analytical instrument transmits ACK after receiving ENQ, and receives the data text from the
host first, and retransmits ENQ after terminating the data link to establish the data link..

 *1)　Wait time of ACK（Time-out period）is 3 seconds.
 *2)　In case of no-response on the other side, or returning of NAK(15H) in ENQ sequence, ENQ is retransmitted.
     Numbers of retrials are 6 times. Exceeding 6 times causes communication errors. The transmission error puts
     the state back to the initial stage (idle).

（2）Data Text Transmission
  The transmitting side starts the data text transmission once the data link is established. (*1) (*2)
  Please refer to 3.3 Structure of Text for the structure of data text.

*1) The receive time-out period of 1 byte data at the receiving side is 3 seconds.
*2) In case of exceeding the receive time-out period, a communication error occurs, and the data text terminates the discarded data to return to the initial state (idle).

(3) Error detection and Retransmission Control
In this protocol, 4-byte checksum is added to the end of each text data to detect errors.
In case of no error in the data, the receiving side transmits ACK.
When receiving ACK, the transmitting side determines that there is no error occurs to terminate the data link.
When there is an error in the data, the receiving side transmits NAK.
When receiving NAK or no-response (*1), the transmission side determines that there is an error occurs and retransmits the data text. (*2)
After that, in case of receiving ACK, the data link is terminated. In case of exceeding the data text time-out period, the data link is also terminated in the same manner.

*1) Wait time of ACK (Time-out period) is 3 seconds.
*2) When the transmitting side receives no-response or NAK after transferring the data text, the data text is retransmitted. Numbers of retrials are 6 times. In case of exceeding the number of retrials, a communication error occurs. The transmission error puts the state back to the initial stage (idle).

(4) Data Link Termination

The data text transfer is finished, the transmitting side transmits EOT(04H) (*1)(*2) to terminate the data link.
*1) EOT receiving time-out period at the receiving side is 3 seconds.
*2) In case of exceeding the receive time-out period, a communication error occurs, and the data text terminates the discarded data to return to the initial state (idle).

Measurement Result Transmission Phase
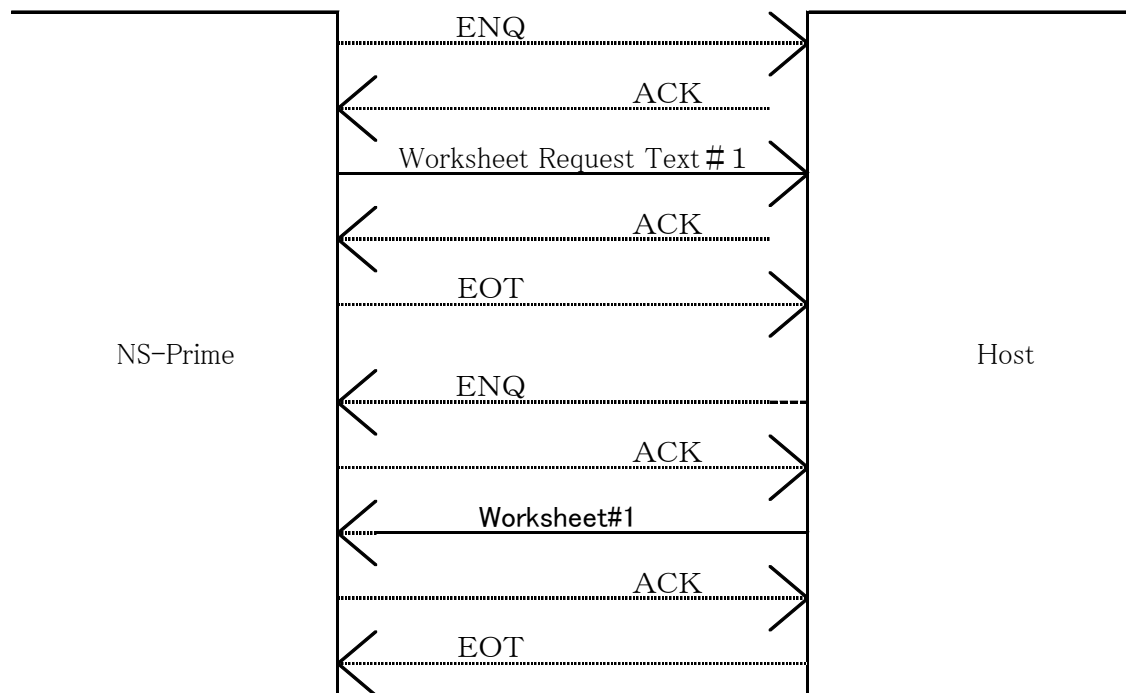
```
                                   ACK
NS-Prime        Measurement Data Text         EOT        Host
                                   ENQ
                                   ACK
                    Measurement Data Text ＃n
                                   ACK
                                   EOT
```
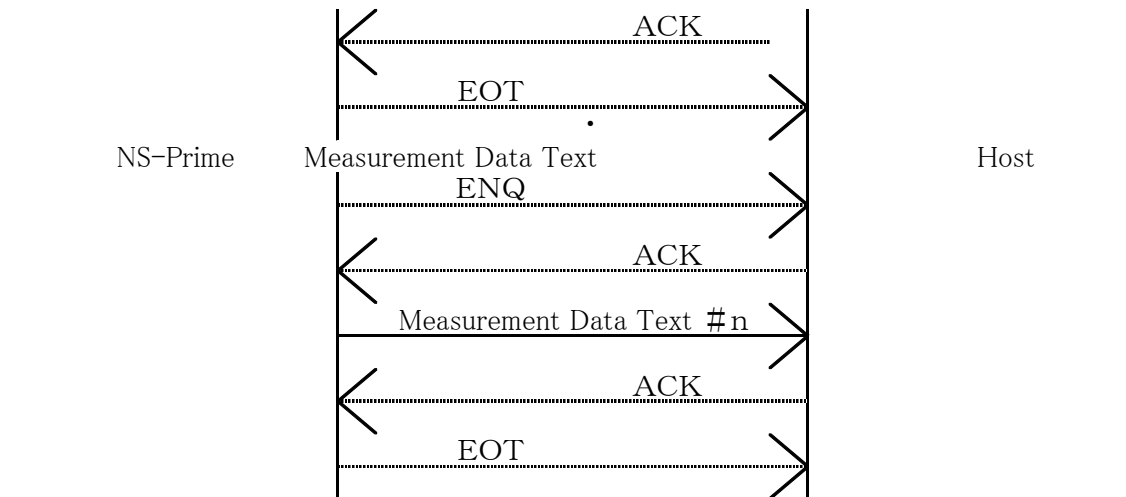
Request for   worksheet, Receiving phase

```
                                   ENQ
                                   ACK
                    Worksheet Request Text ＃1
                                   ACK
                                   EOT
NS-Prime                           ENQ                   Host
                                   ACK
                        Worksheet#1
                                   ACK
                                   EOT
```
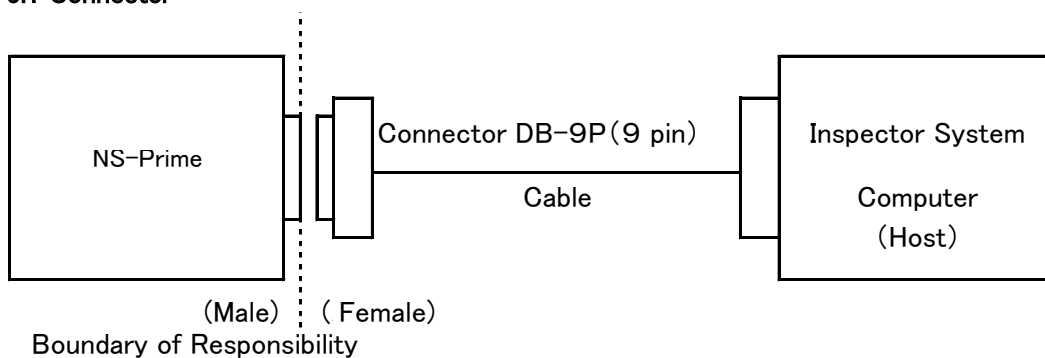
Note) After the request for a worksheet, the measurement data may be transmitted before receiving the worksheet.

5. Hardware Specifications

5.1 Connector

NS-Prime

Connector DB-9P(9 pin)

Cable

Inspector System

Computer

(Host)

(Male) (Female)
Boundary of Responsibility

5.2 Transmission Method

1. Signal Format ———— RS-232CC
2. Synchro System ———— Start-Stop Synchronization-Type, Full-Duplex
3. Transfer Rate ———— 9600 bps(Switchable to 19200、4800、2400 bps)
4. Bit Construction ———— Start bit：1 bit
Data bit：8 bits(Switchable to 7 bits)
Parity bit：None(Switchable to even numbers and odd numbers)
Stop bit：1 bit(Switchable to 2 bits)

5.3 Signal Level

Level	Data Signal		Control System
Or more than +3V	Theory 0	Start Bit	ON
Or less than −3V	Theory 1	Stop Bit	OFF

Space   "0"
Mark   "1"

↑ 1 2 3 4 5 6 7 P ↑ ↑
　　　　　　　　↑ ‖
　　　　　　　　‖ -- ———Stop・Bit
Start・Bit　　　Parity・Bit

14
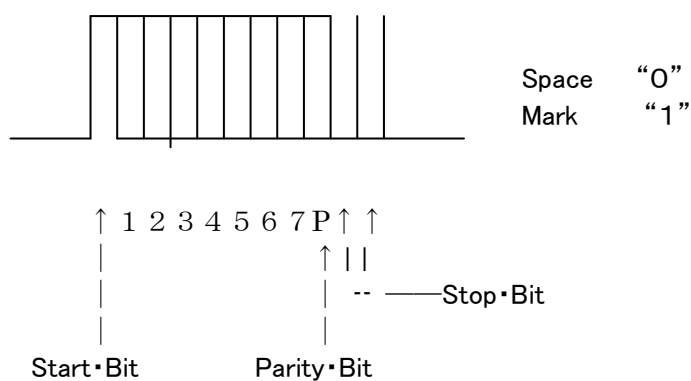
5.4 Input Signal Interface （25-Pin Specifications at Host Side）

（1）　Terminal Number and Signal Name

Terminal Number	Code	Name		Signal Direction
9	NC	No Connect		－－－
3	TXD	Data Transmis	（SD）	OUT
2	RXD	Transmit Data	（RD）	IN
7	RTS	Request to Send	（RS）	OUT
8	CTS	Clear to Send	（CS）	IN
6	DSR	Data Set Ready	（DR）	IN
5	SG	Signal Ground	（SG）	－－－
1	CD	Carrier Detect	（CD）	IN
4	DTR	Data Terminal Ready	（ER）	OUT

＊Signal Direction

OUT————　　　NS-Prime　　　　　⇨　　　　Host
IN ————　　　NS-Prime　　　　　⇦　　　　Host

（2）　Connector Pin Connection （If used with a crossing cable）

←　Boundary of Responsibility
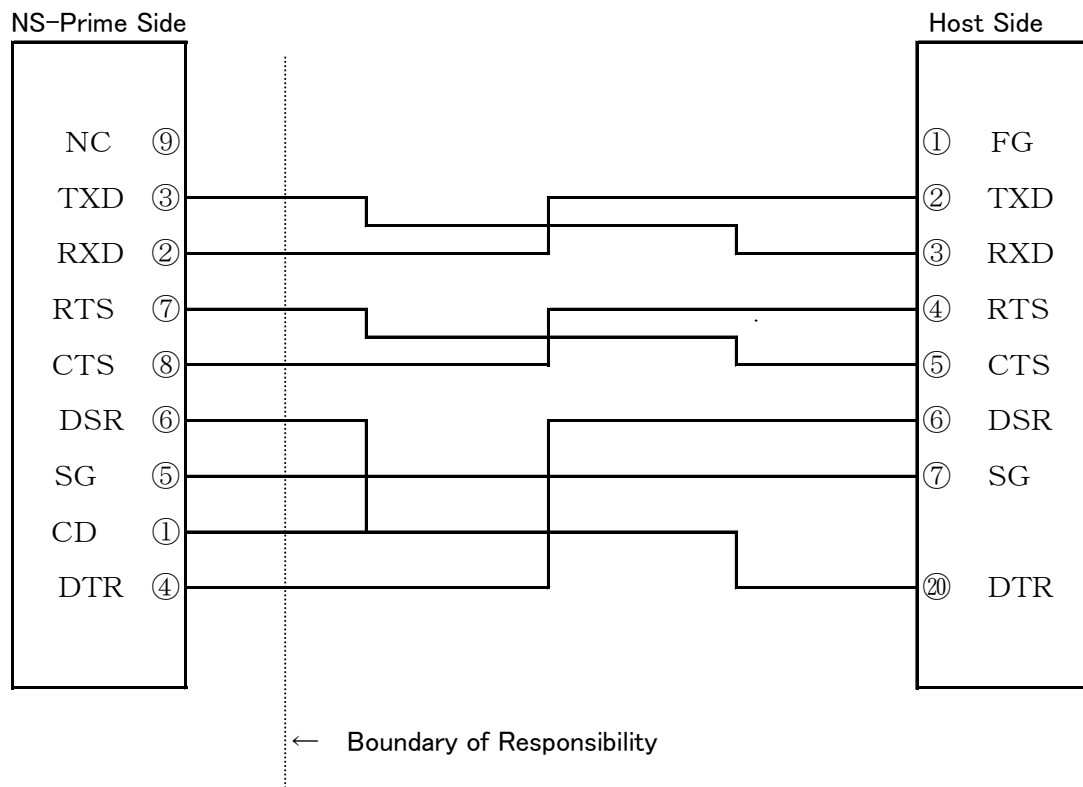
※　Not connected with FG
※　① and ⑥ at NS-Primes side are connected. （Not connected with ⑤）

15

（3） Connecter Pin Connection （In used with a folded cable）

NS-Prime Side

Host Side

NS-Prime Side		Host Side	
NC	⑨	①	FG
TXD	③	②	TXD
RXD	②	③	RXD
RTS	⑦	④	RTS
CTS	⑧	⑤	CTS
DSR	⑥	⑥	DSR
SG	⑤	⑦	SG
CD	①		
DTR	④	⑳	DTR

← Boundary of Responsibility
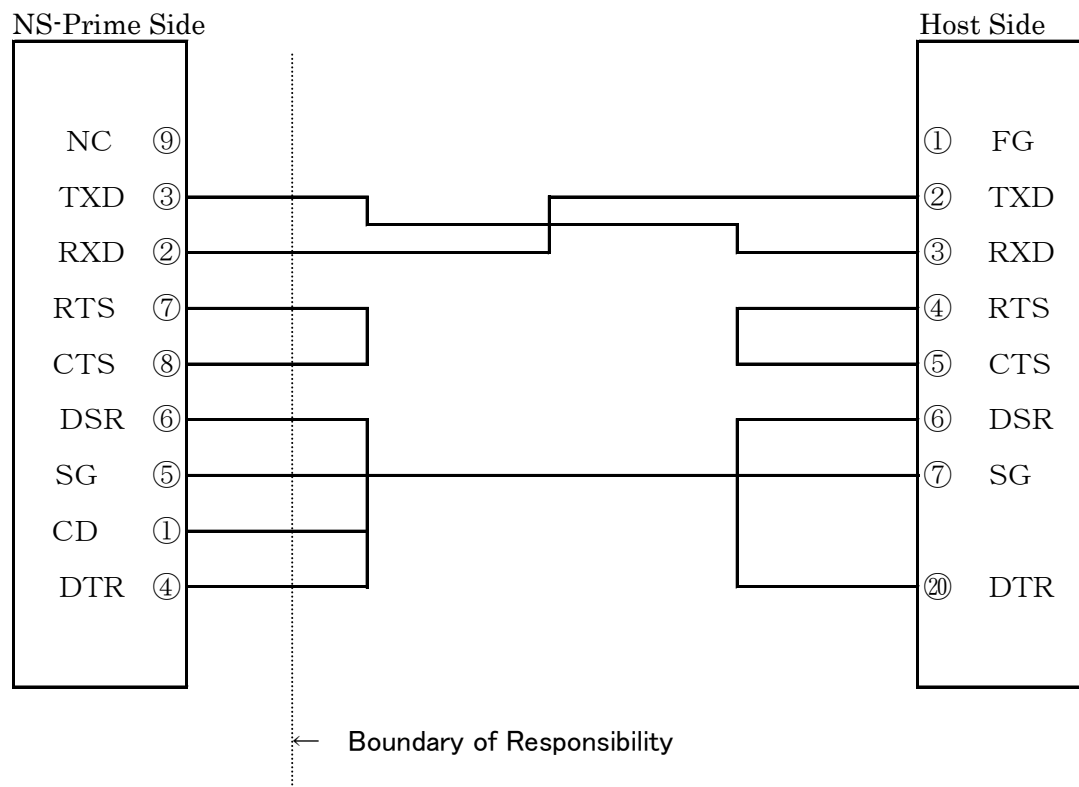
※ Not connected with FG.
※ ①,④ and ⑥ are short circuited.（Not connected with ⑤）
※ ⑥ and ⑳ are short circuited.（Not connected with ⑦.）

5.5 Input Signal Interface (9-Pin Specifications at Host Side)

（1） Terminal Number and Signal Name

3	TXD	Data Transmis	（SD）	OUT
2	RXD	Transmit Data	（RD）	IN
7	RTS	Request to Send	（RS）	OUT
8	CTS	Clear to Se	（CS）	IN
6	DSR	Data Set Ready	（DR）	IN
5	SG	Signal Ground	（SG）	―――
1	CD	Carrier Detec	（CS）	IN
4	DTR	Data Terminal Ready	（ER）	OUT

＊ Signal Direction
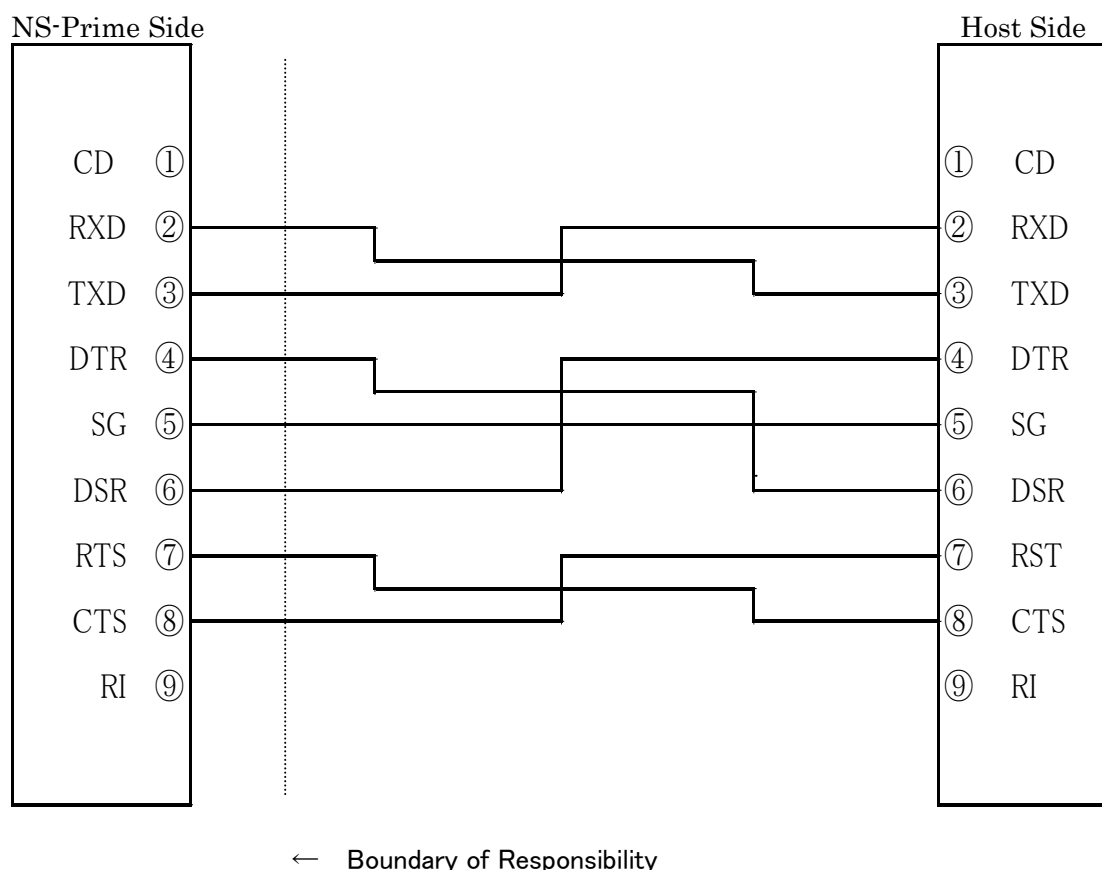
OUT ――― NS-Prime ⇨ Host
IN ――― NS-Prime ⇦ Host

（2）Connect Pin Connection(If used with an interlink cable)

NS-Prime Side   Host Side

CD	①	①	CD
RXD	②	②	RXD
TXD	③	③	TXD
DTR	④	④	DTR
SG	⑤	⑤	SG
DSR	⑥	⑥	DSR
RTS	⑦	⑦	RST
CTS	⑧	⑧	CTS
RI	⑨	⑨	RI

← Boundary of Responsibility

※ In case of a hardware flow control at the host side, the communication between NS-Prime and the host may not be able to be established. Please use a crossing cable shown in the following page.

(3)Connector Pin Connection （If used with a crossing cable）

NS-Prime Side

CD	①		①	CD
RXD	②		②	RXD
TXD	③		③	TXD
DTR	④		④	DTR
SG	⑤		⑤	SG
DSR	⑥		⑥	DSR
RTS	⑦		⑦	RST
CTS	⑧		⑧	CTS
RI	⑨		⑨	RI

Host Side
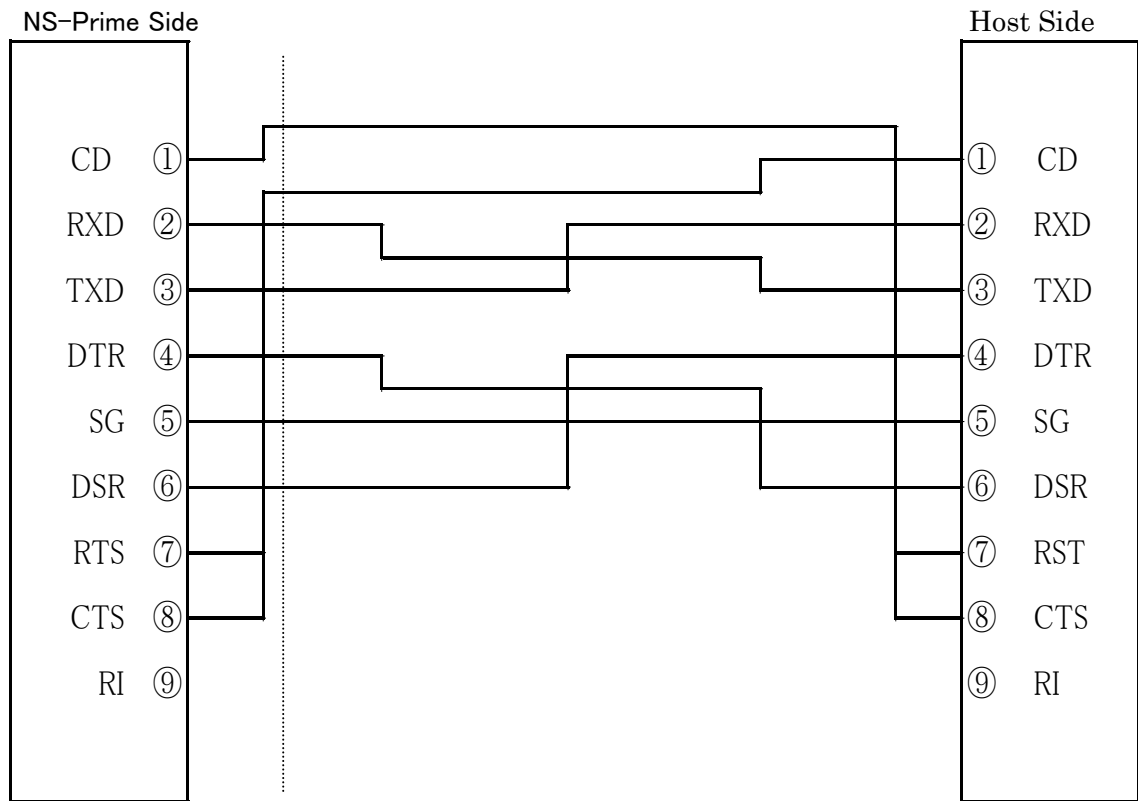
←　Boundary of Responsibility

6. Remark Codes （ASCII、2bytes）

In case of an error such as an insufficient of sample or reagent during measurement that may affect the measured result, enter the following codes into remark codes for measured data. When there is not an error, "00" appears on the remark code.

The remark codes are as follows. In case of occurring multiple errors during the same sample measurement, codes combined of bits from 01 to 80 are displayed in the double-digit ASCII codes.
 (Example: In case of occurring R1suction error and a sample suction error during the same sample measurement, the code "41" appears.)

But only under the following conditions, FF code appears aside form combinations of each bit.
【Special Code】

FF：Absorbance error after 1 minute

（Occur when the absolute absorbance after one minute is above a certain threshold after R2 divided injection.）

Errors	Codes	Code Value
Sample（R1, R2）Suction Error	01	×××× ×××1
Dilution Suction Error	02	×××××1×
Washing Solution, Distillated Water Error	04	×××× ×1××
Optical System Error	08	×××× 1×××
Sample Prozoe Detection Error	10	×××1 ××××
Sample Lot Error	20	××1× ××××
Sample Suction Error	40	×1×× ××××
Measurement Result Error	80	1××× ××××

＊）A sample lot error occurs when the standard curve of the sample lot using at the time of sample measurements doesn't exist.

Please note that these specifications may change without prior notice due to continual improvements.

＜Revision of History＞

Date	Rev.	Changed Contents
2013/1/29	1.00	First Edition
2013/5/9	1.01	4.2 Transmission Protocol, Addition of Detailed Presentation
2013/9/17	1.02	5.5 Input Signal Interface Addition of Note (＊) to (2). Addition of (3) Crossing cable connecting diagram.