



[DP19] DN-500CD

**Serial Command Protocol Guide**

Ver. 1.2

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1	Contents	
2	General.....	3
2.1	RS-232C Control.....	3
3	Specification .....	4
3.1	RS-232C Control.....	4
4	Communication Protocol.....	5
4.1	Packet Structure .....	5
4.2	ACK (Acknowledge) and NACK (Not Acknowledge) .....	5
4.2.1	ACK [ Acknowledgement]:.....	5
4.2.2	NACK [Negative Acknowledgement]:.....	6
4.3	Communication Rules.....	7
4.3.1	Initiative of Communication.....	7
4.3.2	Communication Sequence.....	7
4.3.3	Timeout .....	7
4.3.4	ACK .....	8
4.3.5	NACK .....	8
4.3.6	Command Interval time.....	9
4.4	Basic Control Flow .....	10
4.4.1	Device Control Flow .....	10
4.4.2	Status Request Flow .....	11
4.4.3	Status Notification Flow .....	12
5	Command Table.....	0
5.1	Control Command/ Status Request Command List .....	0
5.1.1	Key Control .....	0
5.1.2	Current Status Information.....	2
6	Appendix.....	4
6.1	Acceptable Character.....	4
6.1.1	Acceptable Character Type1 .....	4

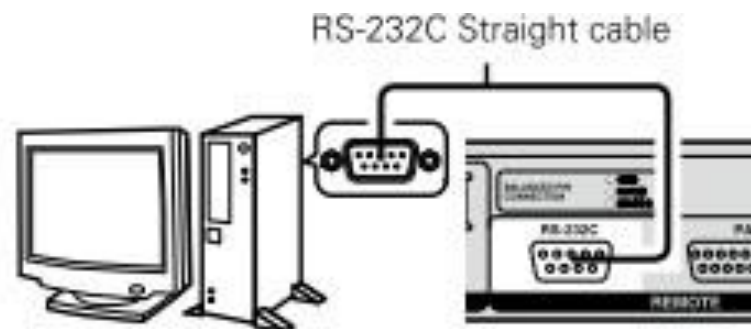
## 2 General

The Serial Remote control function is used by connecting the host machine such as PC to the device (our product). The host can control the device by sending the Control command, and the host can sense the current device status by sending the Status Request command. In addition, in this document, the controlled equipment is called the “Device” (our product) and the controlling equipment is called the “Host (PC etc.)”.

### 2.1 RS-232C Control

The host can control the device by connecting the RS-232C straight cable to the D-sub 9 pins connector on the device surface as shown in the following diagram.

Figure 1-1 RS-232C Connection



### 3 Specification

#### 3.1 RS-232C Control

- Transmission type : Asynchronous / Full duplex
- Connector type : 9 pin D-sub female connector (Straight cable)
- Transfer rate : 9,600 / 38,400/ 115, 200 bps Selectable (via “Serial Bit Rate” in the “System Setting” menu). Set the BAUD rate to 115,200 for all the serial command to work properly.
- Clock accuracy : < +/- 2.0%
- Data length : 8 bits
- Parity : None
- Start bit : 1 bit
- Stop bit : 1 bit
- Flow Control : None
- Maximum data length : 600 Bytes (Start character to End character is included.)

Figure2-1 Pin arrangement

Pin Number	Signal Name
1	GND
6	NC
2	TxD
7	RTS*
3	RxD
8	NC
4	NC
9	NC
5	S. GND

\*5V/500mA power supply can be used for RTS.

## 4 Communication Protocol

### 4.1 Packet Structure

A packet must be started with the Start Character '@' and terminated with the End Character '\r' (0x0D).

Figure 3-1 Packet Structure



There are three kinds of packet, "COMMAND", "REQUEST", and "ANSWER /NOTIFICATION/ERROR".

### 4.2 ACK (Acknowledge) and NACK (Not Acknowledge)

The device sends ACK or NACK to a host according to the following table.

#### 4.2.1 ACK [ Acknowledgement]:

It is an affirmative reply sent to a host from a device. When data transfer completes properly, a device notify of that to a host.

### 4.2.2 NACK [Negative Acknowledgement]:

It is a negative reply sent to a host from a device. When data transfer does not complete properly, a device notifies of that to a host.

Table 3-1 ACK and NACK

Name	Value (HEX)	Transmission Requirement
ACK	0x06	The device acknowledged that the command was received normally from the host.
NACK	0x15	<ul style="list-style-type: none"><li>· The device received the End Character '\r'(0x0D) before receiving the Start Character '@(0x40)'.</li><li>· The device does not receive ID'0(0x30)' just after Start Character '@(0x40)'</li><li>· The device receives an unknown character just after Start Character '@ (0x40)' and ID'0 (0x30)'</li><li>· The device receives an unknown command just after Start Character '@ (0x40)' and ID'0 (0x30)'.</li><li>· Parameter is out of range.</li><li>· The size of data is abnormal.</li><li>· 5msec passed before the device receives the next code necessary to complete the command.</li></ul>

### 4.3 Communication Rules

#### 4.3.1 Initiative of Communication

In the communication between a host and a device, the host must have the initiative. However, the Status Information notification automatically from the device is an exception.

When the device receives a command from the host, the device returns the following.

- When receiving the command which doesn't require a status information ACK
- When receiving the command which requires a status information ACK + Status information (ANSWER)
- For the communication failure or an unknown commands etc.(Refer to Table 3-2): NACK

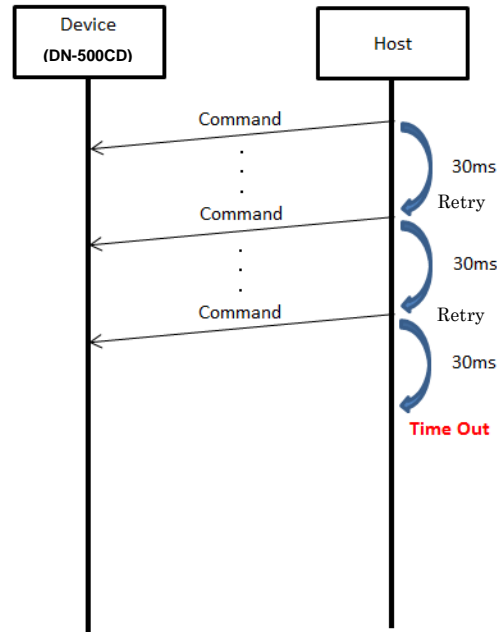
#### 4.3.2 Communication Sequence

The host must not send any new command after the previous command before the host receives ACK or NACK, or the timeout (see "3-3-3 Timeout") has expired.

#### 4.3.3 Timeout

After a host sends a message to a device, the host waits for a reply from the device for 300ms. When the host does not receive a reply over 300ms from the device, the host sends the same message to the device. However, when the host does not receive a reply from the device after sending the same message 3 times (that means Tim Out), the host sends End character '\r' (0x0D) to the device. After that, the host should execute the recovery process such as retry.

Figure 3-3 Time Out



#### 4.3.4 ACK

Refer to "[3-2-1 ACK \[Acknowledgement\]](#)".

#### 4.3.5 NACK

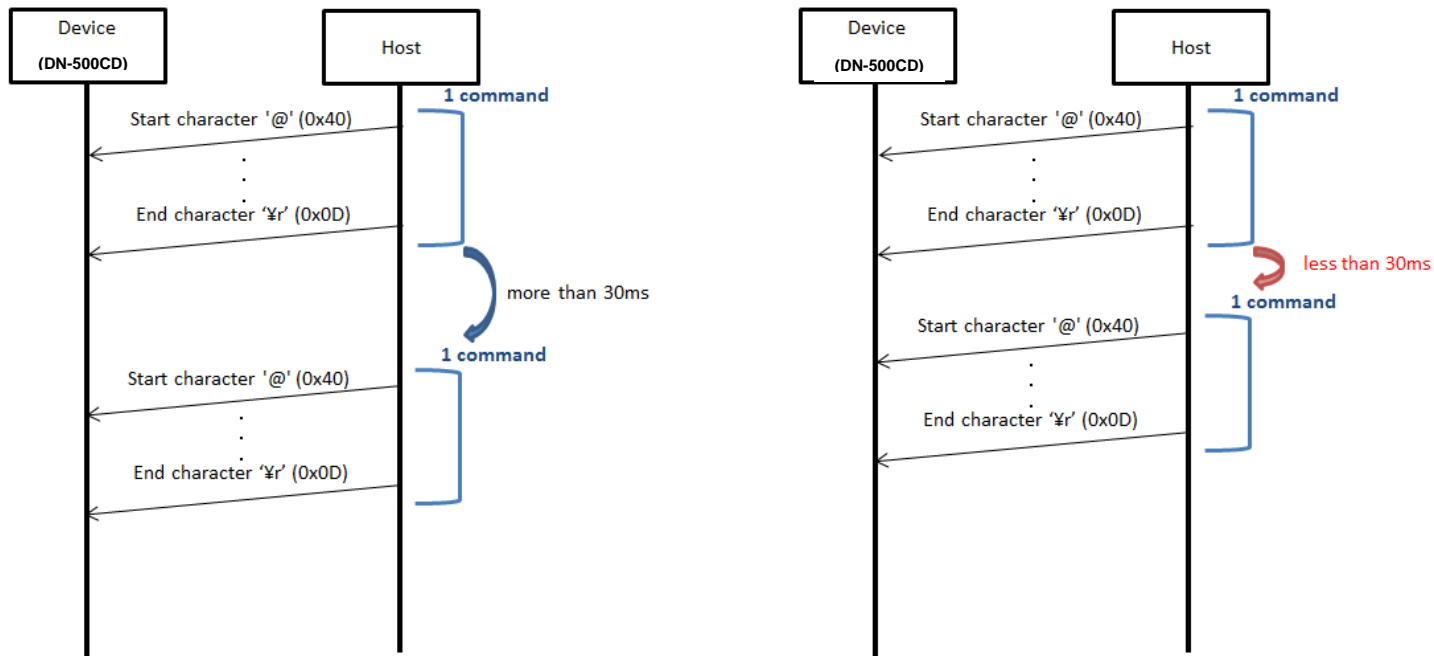
The device returns a NACK immediately after detecting a failure in the communication with the host (see ("[3-2-2 NACK \[Negative Acknowledgement\]](#)"). If the host receives a NACK, it must stop sending the current remaining command immediately and execute the recovery process such as retry.



### 4.3.6 Command Interval time

- Interval time between Characters from a host must be less than 5ms. The device sends NACK when 5msec passed before the device receives the next character code.
- Interval time between Commands is more than 30ms.

Figure 3-4 Interval time between each command



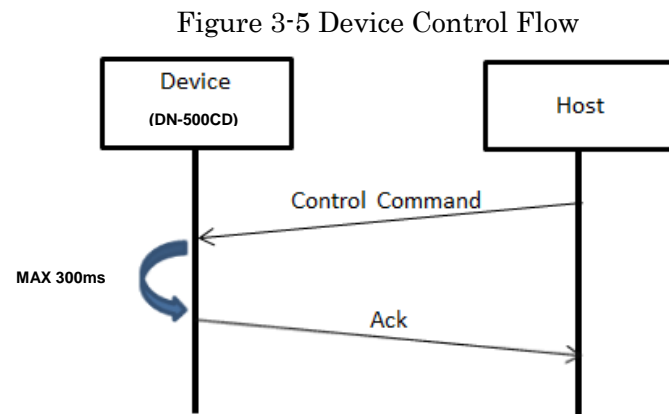
In case of less than 300ms as interval time between commands,

- 1) Executing the subsequent command is not guaranteed.
- 2) When there are buffer spaces of a device for a command, the device will execute the command.
- 3) When there is no buffer space of a device for a command, the device does not execute the command, and will send Busy (@0BDERBUSY) to the host instead.

### 4.4 Basic Control Flow

#### 4.4.1 Device Control Flow

The device sends the host an ACK (Acknowledgement) and executes that command when the device receives a Control command from the host. The list of the Control command is shown in “[Control Command List](#)”.

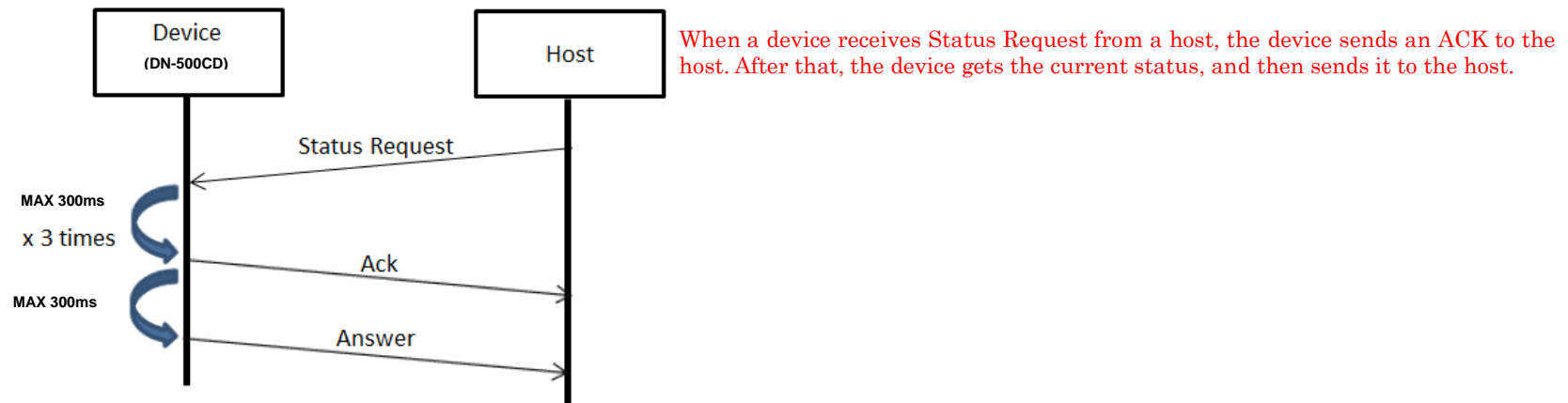


If the device receives an unknown command or an End Character ‘`\r`’ (0x0D) without a Start Character ‘`@`’, it causes transmission failure and the device returns a NACK (Not Acknowledgement). Refer to “[3-2-2 NACK \[Negative Acknowledgement\]](#)” about NACK transmission condition.

### 4.4.2 Status Request Flow

The device returns an ACK and the ANSWER requested by the host when the device receives the Status Request from the host. The list of the Status Request and the corresponding answer is shown in “[Status Request List](#)”.

Figure 3-6 Status Request Flow

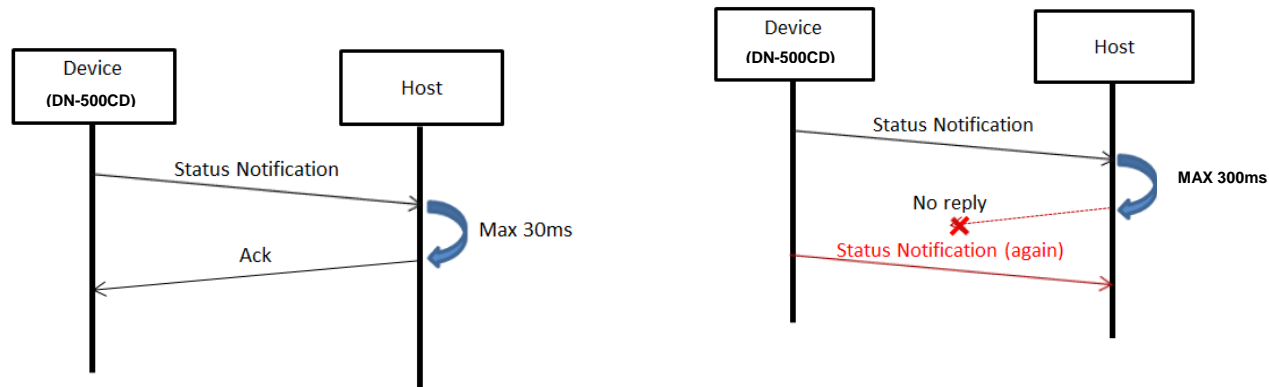


If the device receives an unknown command or an End Character ‘r’ (0x0D) without a Start Character ‘@’, it causes transmission failure and the device returns a NACK (Not Acknowledgement). Refer to “[3-2-2 NACK \[Negative Acknowledgement\]](#)” about NACK transmission condition.

### 4.4.3 Status Notification Flow

A device notifies of Status Information listed in “[Status Information List](#)” whenever the status of the device is changed, such as the transport status, the current track, the storage media status, and other status.

Figure 3-7 Status Notification Flow



A device sends Status Notification to a host. The host replies ACK to the device. The device waits for the ACK for Max 300ms. When the device does not receive the ACK from the host, the device sends the same Status Notification to the host again. After that, the device does not send the same Status Notification even if it does not receive an ACK from the host.

The Status Information is same as the answer for the Status Request listed in “[Status Request List](#)”.

## 5 Command Table

*Italic characters of command mean parameter. (Ex: Frame “@0frXXYr” -> Parameter: XX)*

### 5.1 Control Command/ Status Request Command List

#### 5.1.1 Key Control

#	Function	Command/Response	Status	Description
1.	Power On	@0PW00		Power On
2.	Power Off	@0PW01	-	Power Off
3.	Stop	@02354	-	Stop
4.	Play	@02353	-	Play
5.	Play Pause	@02348	-	Playback is Paused
6.	Track	@0Trnnnn	-	<i>nnnn</i> : Track No ('0001'-'2000')
7.	Track/Jump Next	@02332	-	Track skip forward
8.	Track/ Jump Prev	@02333	-	Track skip reverse
9.	Time Mode Code	@0PCTMDXX	@0?PCTMD	<i>XXXX</i> : Time Mode Code 'TL': Total Elapsed, 'TR': Total Remain, 'EL': Elapsed, 'RM': Remain,
10.	Disc	@0PCDTRYOP	-	XX: Disc Tray Open/Close 'OP': Empty 'CL': Disc
11.	Ten Key	@0PCTKEYX	-	Inputs 0-9

# Serial Command Protocol Guide

## DN-500CD

				<p>X: Number            '1': 1, '2': 2, '3': 3, '4': 4, '5': 5, '6': 6, '7': 7, '8': 8,            '9': 9, '0': 0</p>
12.	Slow/Search	@0PCSLs <i>d</i>	@0?PCSLs <i>d</i>	<p><i>d</i>: Direction            'F': Forward            'R': Reverse</p>
13.	MUTE	@0mt <i>XX</i>	@0?mt	<p><i>XX</i>: On/Off            '00': Mute on.            '01': Mute off.</p>

### 5.1.2 Current Status Information

#	Request	Command	Answer	Command	Description	Notification
1.	Power Status	@0?PW	On	ACK	See "Key Control"	No
			Off	No response		
2.	Media Status	@0?CD	No Disc	@0CDNC	There is not media	No
			Disc In	@0CDCI	There is media.	
3.	Status	@0?ST	Play	@0STPL	See "Key Control"	
			Pause	@0STPP	See "Key Control"	
			Fast Play	@0STDVFX	Show scanning in process. X: Direction 'R' : Reverse, 'F': Forward	
4.	Total Track Number(4digit)	@0?Tt	Total Track Number	@0TtXXXX	XXXX: Total Track '0000' to '9999' 'UNKN': Unknown	
5.	Track Number	@0?Tr	Track Number	@0TrXXXX	XXXX: Track No '0000' to '9999' 'UNKN': Unknown	No
6.	Elapse Time	@0?ET	Elapse Time	@0ET <hhmmss< h=""></hhmmss<>	hhmmss: Time	No
7.	Remain Time	@0?RM	Remain Time	@0RM <hhmmss< h=""></hhmmss<>	hhmmss: Time	No
8.					MMM: Minute ('000'-'999')	

# Serial Command Protocol Guide

## DN-500CD

	Current Track Time	@0?tl	Current Track Time	@0tIMMMSS	SS: Second ('00'-'59')	
9.	Artist of Current Track	@0?at	Artist name	@0atxxx	xxx: Artist (64 bytes max, *Note-1)	No
10.	Title of Current Track	@0?ti	Title	@0tixxx	xxx: Title (64 bytes max, *Note-1)	No
11.	Album of Current Track	@0?al	Album name	@0alxxx	xxx: Album (64 bytes max, *Note-1)	No

(Note-1: Please refer to [5 Appendix](#))



## 6 Appendix

### 6.1 Acceptable Character

The acceptable character set is ISO/IEC 8859-1.

#### 6.1.1 Acceptable Character Type1

- Acceptable characters are shown in Table 6-1. (The characters that are colored in gray are not acceptable.)

Table 6-1-1 Acceptable Character

	X0	X1	X2	X3	X4	X5	X6	X7	X8	X9	XA	XB	XC	XD	XE	XF
0X																
1X																
2X	<i>SP</i>	!	“	#	\$	%	&	‘	( )	*	+	,	-	.	/	
3X	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
4X	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
5X	P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	^	_
6X	`	a	B	c	D	e	f	g	h	I	j	k	l	m	n	o
7X	p	q	R	s	T	u	v	w	x	Y	z	{		}	~	<i>DEL</i>
8X																
9X																
AX	<i>NBSP</i>	ı	¢	£	¤	¥	¦	§	¨	©	ª	«	¬	-	®	¯
BX	°	±	²	³	´	µ	¶	·	,	ı	°	»	¼	½	¾	¿
CX	À	Á	Â	Ã	Ä	Å	Æ	Ç	È	É	Ê	Ë	Ì	Í	Î	Ï
DX	Ð	Ñ	Ò	Ó	Ô	Õ	Ö	×	Ø	Ù	Ú	Û	Ü	Ý	Þ	ß
EX	à	á	â	ã	Ä	å	æ	ç	è	É	ê	ë	ì	í	î	ï
FX	ð	ñ	ò	ó	Ô	õ	ö	÷	ø	Ù	ú	û	ü	ý	þ	ÿ