[DP21] DN-500DC

Serial Command Protocol Guide

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Contents

1. 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.)".

1-1. 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
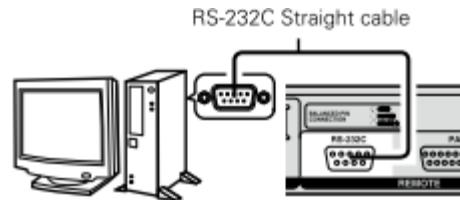
2. Specification

2-1. RS-232C Control

· Transmission type : Asynchronous / Full duplex

· Connector type : 9 pin D-sub female connector (Straight cable)

· Transfer rate : 9,600

· 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.

3. Communication Protocol

3-1. Packet Structure

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

Figure 3-1Packet Structure

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

3-2. ACK (Acknowledge) and NACK (Not Acknowledge)

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

3-2-1. 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.

3-2-2. NACK [Negative Acknowledgement]:

It is a negative reply sent to a host from a device. When data transfer does not complete properly, a device notify 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	· The device received the End Character '¥r'(0x0D) before receiving the Start Character '@(0x40)'. · The device does not receive ID'0(0x30)' just after Start Character'@(0x40)' · The device receives an unknown character just after Start Character '@ (0x40)' and ID'0 (0x30)' · The device receives an unknown command just after Start Character '@ (0x40)' and ID'0 (0x30)'. · Parameter is out of range. · The size of data is abnormal. · 5msec passed before the device receives the next code necessary to complete the command.

3-3. Communication Rules

3-3-1. 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

3-3-2. 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.

3-3-3. Timeout

After a host sends a message to a device, the host waits for a reply from the device for 30ms(IP Control)/300ms(RS-232C). When the host does not receive a reply over 30ms(IP Control)/300ms(RS-232C) 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
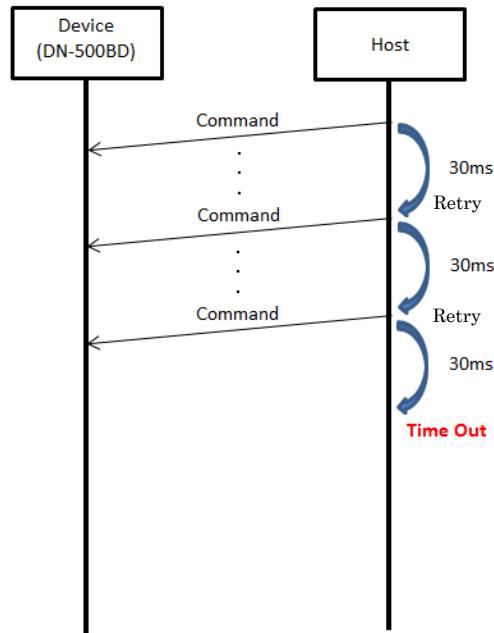
3-3-4. ACK

Refer to " 3-2-1 ACK [Acknowledgement)".

3-3-5. 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.

3-3-6. 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
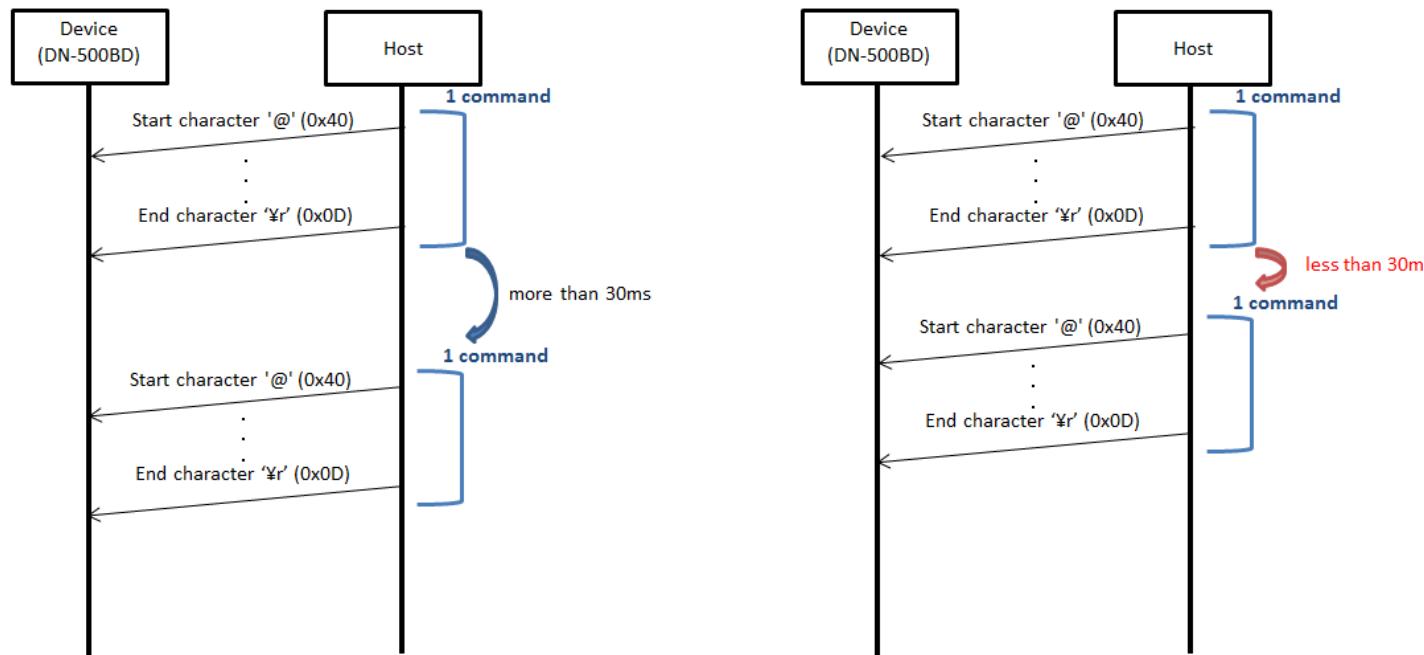
In case of less than 30ms as interval time between commands,

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.

3-4. Basic Control Flow

3-4-1. 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".

Figure 3-5 Device Control Flow
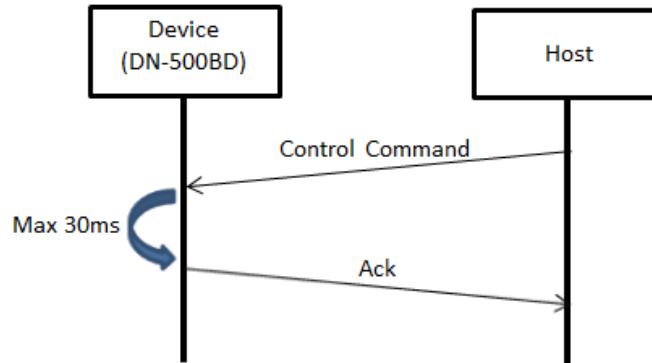
If the device receives an unknown command or an End Character '¥r' (0x0D) without a Start Character '@', it causes transmission failure and the device returns a NACK (Not Acknowledgement). Refer to "3-2-2 NACK [Negative Acknowledgement)" about NACK transmission condition.

3-4-2. 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

When a device receives Status Request from a host, the device sends an ACK to the host. After that, the device gets the current status, and then sends it to the host.

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.

3-4-3. 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.
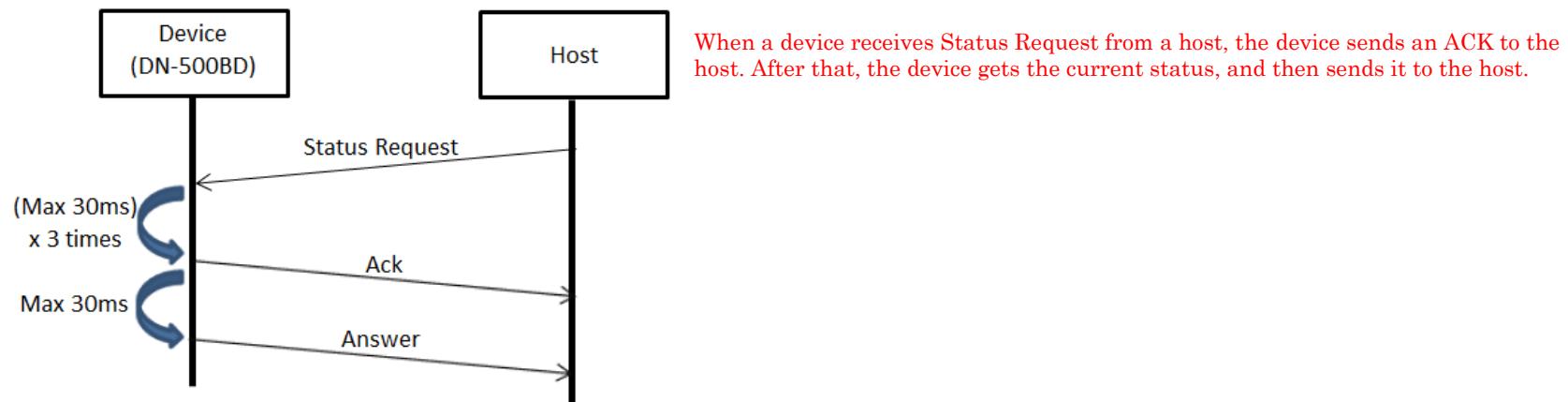
Figure 3-7 Status Notification Flow
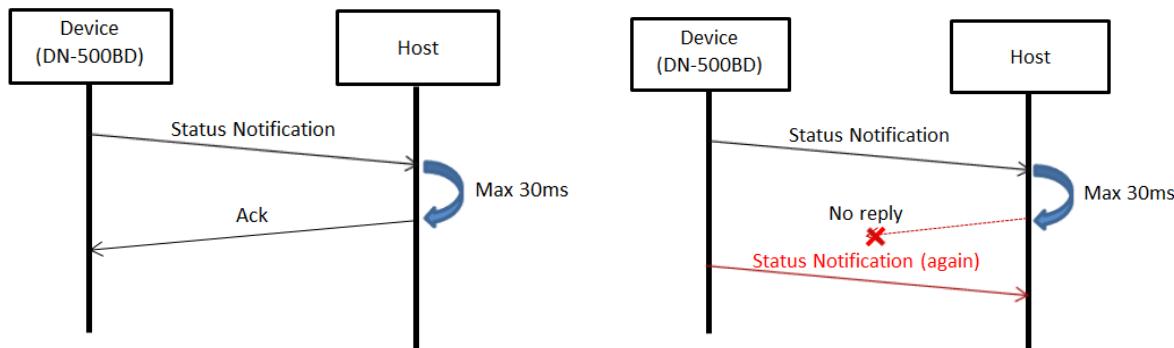
A device sends Status Notification to a host. The host replies ACK to the device. The device waits for the ACK for Max 30ms. When the device does not receive the ACK from the host, the device sends the same Status Notification to the host again. After that, the device does not send the same Status Notification 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".

4. Command Table

Italic characters of command mean parameter. (Ex: Frame "@0fr*XX*¥r'" -> Parameter: *XX*)

*Note- "Track" means "Chapter" during the DVD or BD playback. "Group" means "Title" (DVD or BD playcak) and "Folder" (USB and other Playback).

4-1. Control Command/ Status Request Command List

4-1-1. Control

#	Function	Command/Response	Status	Description
1.	CD1 Folder Skip -	@EAA		Folder Skip -
2.	CD1 Folder Skip +	@EAB	-	Folder Skip +
3.	CD1 Down	@EAC	-	Down
4.	CD1 Up	@EAD	-	Up
5.	CD1 Stop	@EAE	-	Stop
6.	CD1 Play/Pause	@EAF	-	Play/Pause
7.	CD1 Eject	@EAG	-	Eject
8.	CD1 Prog	@EAH	-	Prog
9.	CD1 ID3	@EAI	-	ID3
10.	CD1 Find	@EAJ	-	Find
11.	CD1 Mute	@EAK	-	Mute
12.	CD1 Repeat	@EAL	-	Repeat
13.	CD1 Funct	@EAM	-	Funct
14.	CD1 Display	@EAN	-	Display

15.	CD1 A-B	@EAO	-	A-B
16.	CD1 Card	@EAR	-	Card
17.	CD1 CD	@EAS	-	CD
18.	CD1 USB	@EAT	-	USB
19.	CD1 Play 1	@EAU	-	Play 1
20.	CD1 Remain	@EAV	-	Remain
21.	CD1 0	@EA0	-	0
22.	CD1 1	@EA1	-	1
23.	CD1 2	@EA2	-	2
24.	CD1 3	@EA3	-	3
25.	CD1 4	@EA4	-	4
26.	CD1 5	@EA5	-	5
27.	CD1 6	@EA6	-	6
28.	CD1 7	@EA7	-	7
29.	CD1 8	@EA8		8
30.	CD1 9	@EA9	-	9

#	Function	Command/Response	Status	Description
1.	CD2 Folder Skip -	@EBA		Folder Skip -
2.	CD2 Folder Skip +	@EBB	-	Folder Skip +
3.	CD2 Down	@EBC	-	Down
4.	CD2 Up	@EBD	-	Up
5.	CD2 Stop	@EBE	-	Stop
6.	CD2 Play/Pause	@EBF	-	Play/Pause
7.	CD2 Eject	@EBG	-	Eject
8.	CD2 Prog	@EBH	-	Prog
9.	CD2 ID3	@EBI	-	ID3
10.	CD2 Find	@EBJ	-	Find
11.	CD2 Mute	@EBK	-	Mute
12.	CD2 Repeat	@EBL	-	Repeat
13.	CD2 Funct	@EBM	-	Funct
14.	CD2 Display	@EBN	-	Display
15.	CD2 A-B	@EBO	-	A-B
16.	CD2 Card	@EBR	-	Card
17.	CD2 CD	@EBS	-	CD
18.	CD2 USB	@EBT	-	USB
19.	CD2 Play 1	@EBU	-	Play 1

20.	CD2 Remain	@EBV	-	Remain
21.	CD2 0	@EB0	-	0
22.	CD2 1	@EB1	-	1
23.	CD2 2	@EB2	-	2
24.	CD2 3	@EB3	-	3
25.	CD2 4	@EB4	-	4
26.	CD2 5	@EB5	-	5
27.	CD2 6	@EB6	-	6
28.	CD2 7	@EB7	-	7
29.	CD2 8	@EB8		8
30.	CD2 9	@EB9	-	9

5. Appendix

5-1. Acceptable Character

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

5-1-1. Acceptable Character Type1

• Acceptable characters are shown in Table 5-1. (The characters that are colored in gray are not acceptable.)

Table 5-1-1 Acceptable Character

	X0	X1	X2	X3	X4	X5	X6	X7	X8	X9	XA	XB	XC	XD	XE	XF
0X																
1X																
2X	SP	!	"	#	$	%	&	'	(	)	*	+	,	-	.	/
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	{	|	}	~	DEL
8X																
9X																
AX	NBSP	¡	¢	£	¤	¥	¦	§	¨	©	ª	«	¬	-	®	¯
BX	°	±	²	³	´	µ	¶	·	¸	¹	º	»	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