RT-20 Universal Disc Player
RS-232 Control Guide

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Lexicon
RT-20 Universal Disc Player RS-232 Control Guide

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1. Introduction

1-1. Purpose

This document was written as a reference specification for the Lexicon RT-20 Universal Disc Player RS-232 interface.

1-2. References

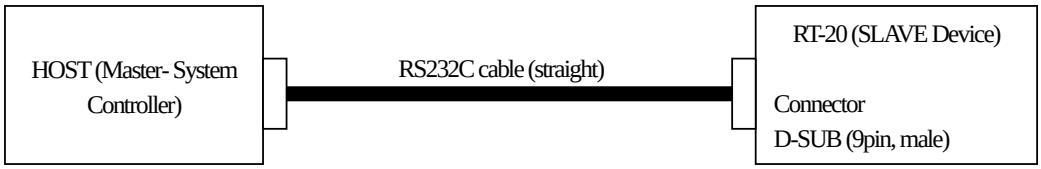
Refer to the RT-20 User Guide for information about the RS-232 connector and RT-20 functionality.
RT-20 User Guide p/n 070-17261.

2. System Description

2-1. Overview

The RT-20 RS-232 interface has been designed as a Master-Slave communication protocol, in which the RT-20 is the slave device. The Master-system controller is referred to as the HOST device.

2-2. Block Diagram



2-3. RT-20 RS-232 Connector Pin Definition

The RT-20 serial RS-232 connector is a male 9-pin D-sub connector. The pin definitions are listed below.

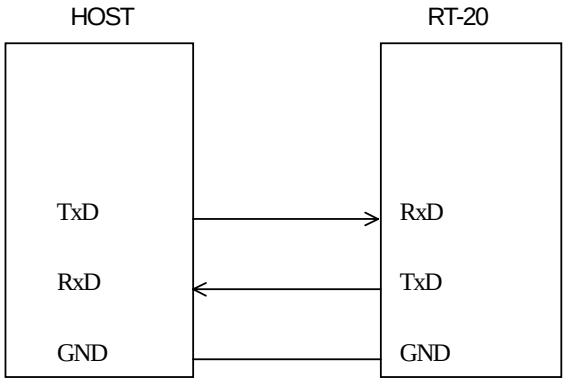
Signal name	D-Sub Pin
N.C.	1
TxD (output)	2
RxD (input)	3
N.C.	4
GND	5
N.C.	6
N.C.	7
N.C.	8
N.C.	9

3. Detailed Description

The RS-232 hardware interface specification between the HOST and the RT-20 is described below.

3-1. Connection format

3-1-1. Physical connection



(Serial Port settings)

Baud Rate : 9600bps
Data Bits : 8bit
Parity : None
Stop bit : 1bit
Handshaking : None

3-2. Transmission data packet formats

3-2-1. Transmission data packets from the HOST to the RT-20

There are two kinds of transmission data packets that are described below.

3-2-1-1. Command Packets

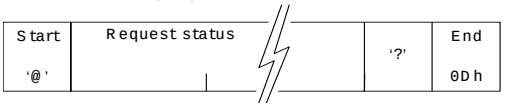
The Command Packets are provided for the Host Controller to request the RT-20 to perform a specific action.

Start character : '@'
COMMAND : see "Data Packet COMMAND List"on page 16
End character (CR) : 0Dh

3-2-1-2. Status Request Packets

The Status Request packets are provided for the Host Controller to request the RT-20 to report specific operating statuses.

Start character : '@'
Request status : see "Status Request and Status Response Data Packets" on page 11
Request character : '?'
End character (CR) : 0Dh



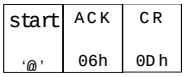
3-2-2. Response data packets from the RT-20 to the HOST

The RT-20 can respond to the HOST in a synchronous and asynchronous mode. The two different response packets are described below.

3-2-2-1. ACK/NAK Response Packets

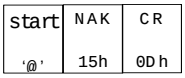
The RT-20 provides an ACK (acknowledge) response to the HOST when the RT-20 has received a correct command packet, and the HOST command packet has requested no other status data.

Start character : '@', ACK : 06h, End character (CR) : 0Dh



The RT-20 will send a NAK response packet if the RT-20 has received an incorrect HOST command packet.

Start character : '@', NAK : 15h, End character (CR) : 0Dh



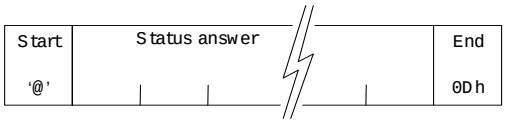
3-2-2-2. Auto Status Feedback Packets

The RT-20 will send to the HOST asynchronous status feedback data packets when applicable RT-20 status changes. The asynchronous status has been divided into levels or groups. The HOST can enable each of the status feedback groups independently.

Start character : '@'

Answer character : see "Status Feedback" on page 14

End character (CR) : 0Dh



3-3. Data Transaction Sequencing and Timing Requirements

3-3-1. Data Packet Transaction Sequencing Requirements

The RT-20/Host Data Packet Transactions can be described in one of the three following sequences:

- The HOST sends a command data packet and the RT-20 responds with an ACK or a NAK data packet.
- The HOST sends a status request data packet and the RT-20 responds with the corresponding status data packet or NAK if the request is invalid.
- The RT-20 sends an auto status feedback data packet if the corresponding RT-20 status has changed (The HOST is not required to respond to the RT-20).

3-3-2. Data Transaction Timing Requirements

Each of the HOST/RT-20 data transactions must meet the following timing requirements:

- Response packet transmission (ACK, NAK or Status) from the RT-20 will be initiated approximately within 50ms following the end of the HOST command packet and transmission will be completed within 500ms following the end of the HOST command packet.
- The HOST should not transmit a command or status request data packet until the RT-20 has responded to the previously sent command. A new command or status request data packet may be initiated if the RT-20 has been unresponsive for at least 1s.
- The RT-20 will complete an auto status feedback data packet within 500ms.

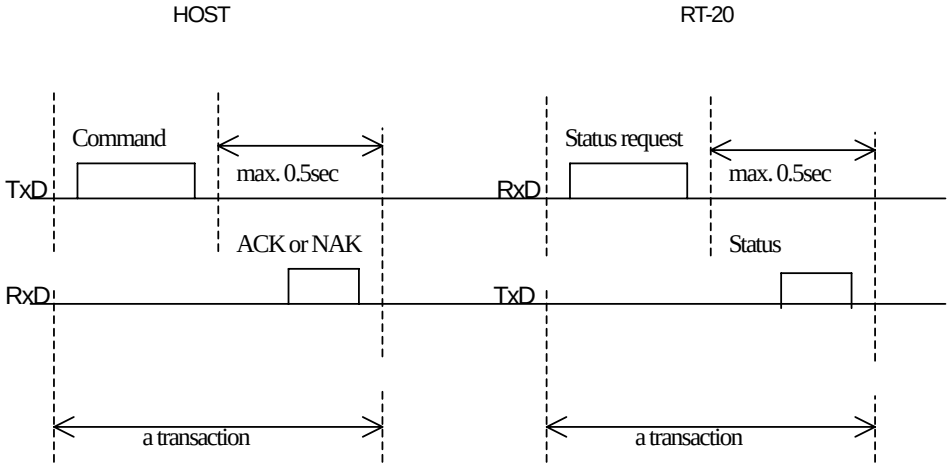
3-3-3. Specific Requirements for Auto Status Feedback

The following items detail specific requirements for the Auto Status Feedback data transactions.

The RT-20 Auto Status Feedback has been grouped into three layers: 1, 2 and 3:

- Layer 1 is the highest priority status. Layer 2 is the second highest priority. Layer 3 is assigned the lowest priority.
- Each layer is independently enabled or disabled by the HOST. The RT-20 will disable all three layers by default.
- The RT-20 initiates the Auto Status Feedback transaction when the corresponding RT-20 status has changed.

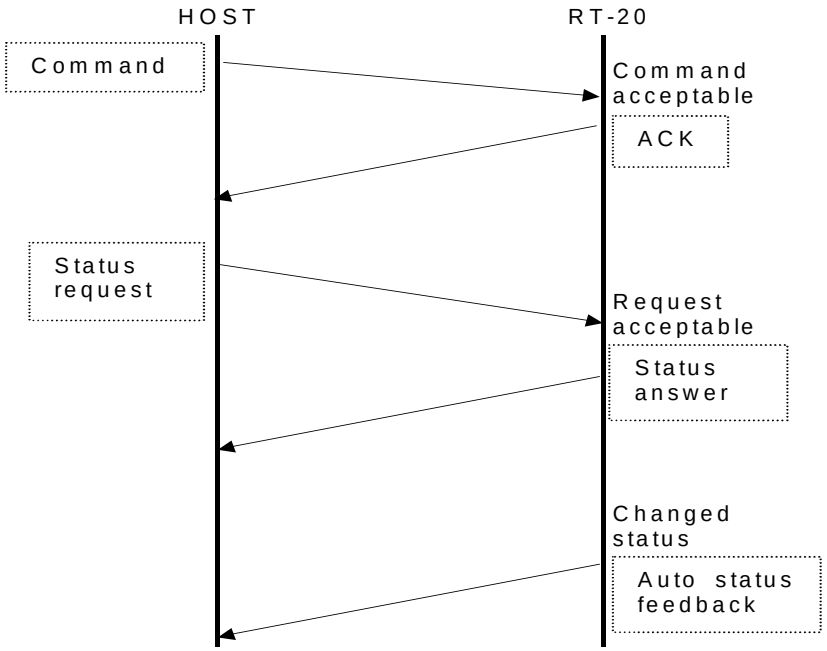
3-3-4. Example of the transactions



Example Data Packet Transactions

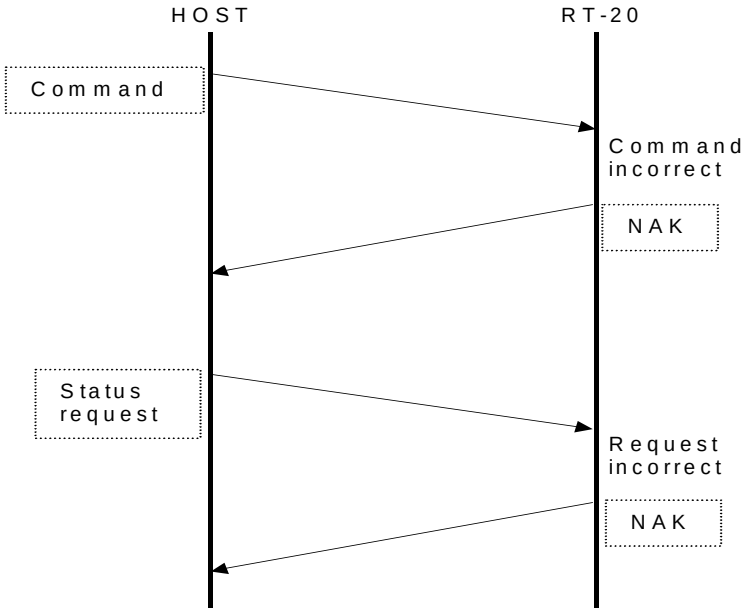
3-3-5. Examples of HOST/RT-20 handshaking

3-3-5-1. Example of successful handshaking



The RT-20 may reply with an ACK instead of requested status, if the RT-20 cannot send the requested status immediately.

3-3-5-2. Examples of handshaking errors



3-4. Commands

The following tables detail the available HOST commands.

3-4-1. HOST Command list

Command			Reply from RT-20
POWER	OFF	"PWR:1"	ACK
	ON	"PWR:2"	
TRAY	Toggle	"TRY:0"	ACK
	OPEN	"TRY:1"	
	CLOSE	"TRY:2"	
STOP		"STP:0"	ACK
PLAY		"PLY:0"	ACK
PAUSE		"PPS:0"	ACK
SLOW FWD		"PSF:0"	ACK
SLOW REV		"PSR:0"	ACK
FAST FWD		"PFF:0"	ACK
FAST REV		"PFR:0"	ACK
NEXT		"GOT:1"	ACK
PREV		"GOT:2"	ACK
STEP	Toggle	"PST:0"	ACK
SEARCH	Toggle	"SCH:0"	ACK
REPEAT	Step	"RPT:0"	ACK
A-B REPEAT	Step	"A-B:0"	ACK
PROGRAM	Toggle	"PRG:0"	ACK
RANDOM	Step	"RDM:0"	ACK
MARKER	Toggle	"MRK:0"	ACK
PAGE	+	"PAG:1"	ACK
	-	"PAG:2"	

Command			Reply from RT-20
SETUP	Toggle	“OSD:0”	ACK
TOP MENU	Toggle	“MNU:1”	ACK
MENU	Toggle	“MNU:0”	ACK
SUBTITLE		“SBT:0”	ACK
AUDIO		“AUD:0”	ACK
DISPLAY (OSD)	Toggle	“DIP:0”	ACK
DIMMER (FL/LCD)	Step	“DIM:0”	ACK
	OFF	“DIM:1”	
	DIMMER	“DIM:2”	
	ON	“DIM:3”	
CURSOR	RETURN	“CUR:0”	ACK
	UP	“CUR:1”	
	DOWN	“CUR:2”	
	LEFT	“CUR:3”	
	RIGHT	“CUR:4”	
NUMBER	0	“NUM:0”	ACK
	1	“NUM:1”	
	2	“NUM:2”	
	3	“NUM:3”	
	4	“NUM:4”	
	5	“NUM:5”	
	6	“NUM:6”	
	7	“NUM:7”	
	8	“NUM:8”	
	9	“NUM:9”	
	+10	“NUM:P”	
ENTER		“ENT:0”	ACK
CLEAR		“CLR:0”	ACK

Command			Reply from RT-20
SACD MODE	Toggle	“SCD:0”	ACK
	SACD Stereo	“SCD:1”	
	SACD Multi	“SCD:2”	
	SACD CD	“SCD:3”	
HP MODE	Toggle	“HPM:0”	ACK

Command			Reply from RT-20
TV SYSTEM	Toggle	“TVS:0”	ACK
PROGRESSIVE /INTERLACE	Toggle	“PGR:0”	ACK
ASPECT	Letter Box	“ASP:1”	ACK
	Panscan	“ASP:2”	
	Wide	“ASP:3”	
	Squeeze	“ASP:4”	
VIDEO MUTE	Toggle	“VMT:0”	ACK
	Mute OFF	“VMT:1”	
	Mute ON	“VMT:2”	
VIDEO ADJ	Toggle	“VAJ:0”	ACK
ZOOM	Toggle	“ZOM:0”	ACK

Command			Reply from RT-20
HDMI ON/OFF	Toggle	“HDM:0”	ACK
	OFF	“HDM:1”	
	ON	“HDM:2”	
HDMI RESET		“HDR:0”	ACK
CONDITION MEMORY		“CND:0”	ACK
AUTO POWER OFF	Disable	“ATP:1”	ACK
	Enable	“ATP:2”	
REMOTE CODE	DVD 1	“RC6:1”	ACK
	DVD 2	“RC6:2”	
ECO MODE	Disable	“ECO:1”	ACK
	Enable	“ECO:2”	

3-4-2. Specific Commands

Command from Host					Reply from RT-20
Auto status feedback (The RT-20 default will disable all auto status feedback.)	“AST:x” (x = ‘0’ ~ ’7’) ex)”@AST:7r” (r = CR)				ACK
	‘x’	Layer1	Layer2	Layer3	
	‘0’	Disable.	Disable.	Disable.	
	‘1’	Enable.	Disable.	Disable.	
	‘2’	Disable.	Enable.	Disable.	
	‘3’	Disable.	Disable.	Enable.	
	‘4’	Enable.	Enable.	Disable.	
	‘5’	Enable.	Disable.	Enable.	
	‘6’	Disable.	Enable.	Enable.	
	‘7’	Enable.	Enable.	Enable.	

3-5. Status Request and Status Response Data Packets

3-5-1. HOST Status request and Status Response/feedback list AST Layer: 1

Status request		Status answer and feedback	
POWER	"PWR:?"	OFF	"PWR:1"
		ON	"PWR:2"
TRAY MODE	"TRY:?"	OPEN	"TRY:1"
		CLOSE	"TRY:2"
PLAY MODE	"MOD:?"	TOC (LOADING)	"MOD:0"
		STOP	"MOD:1"
		PLAY	"MOD:2"
		PAUSE	"MOD:3"
		SLOW FWD	"MOD:4"
		SLOW REV	"MOD:5"
		FAST FWD	"MOD:6"
		FAST REV	"MOD:7"
DISC	"DSC:?"	UNDEFINE	"DSC:-"
		No DISC	"DSC:0"
		CD	"DSC:1"
		VCD	"DSC:2"
		DVD-VIDEO	"DSC:3"
		DVD-AUDIO	"DSC:4"
		SACD	"DSC:5"
		MP3 / JPEG	"DSC:6"

3-5-2. HOST Status request and Status Response/feedback list AST Layer: 2

Status request		Status answer and feedback	
REPEAT	"RPT:?"	OFF	"RPT:1"
		Track/Chapter REPEAT	"RPT:2"
		All/Group/Title REPEAT	"RPT:3"
A-B REPEAT	"A-B:?"	OFF	"A-B:1"
		SET A	"A-B:2"
		SET A-B	"A-B:3"
RANDOM	"RDM:?"	OFF	"RDM:1"
		ON	"RDM:2"

Status request		Status answer and feedback	
COUNTER	"TTL:?"	TITLE	"TTL:???"
	"GRP:?"	GROUP	"GRP:???"
	"CHP:?"	CHAPTER	"CHP:???"
	"TRK:?"	TRACK	"TRK:???

Status request		Status answer and feedback	
DIMMER (FL/LCD)	None	OFF	"DIM:1"
		DIMMER	"DIM:2"
		ON	"DIM:3"

Status request		Status answer and feedback	
SACD MODE	"SCD:?"	SACD Stereo	"SCD:1"
		SACD Multi	"SCD:2"
		SACD CD	"SCD:3"

Status request		Status answer and feedback	
TV SYSTEM	"TVS:?"	NTSC	"TVS:1"
		PAL	"TVS:2"
		MULTI	"TVS:3"
PROGRESSIVE /INTERLACE	"PGR:?"	Progressive	"PGR:1"
		Interlace	"PGR:2"
ASPECT	"ASP:?"	Letter Box	"ASP:1"
		Panscan	"ASP:2"
		Wide	"ASP:3"
		Squeeze	"ASP:4"
VIDEO MUTE	"VMT:?"	Mute OFF	"VMT:1"
		Mute ON	"VMT:2"

Status request		Status answer and feedback	
HDMI ON/OFF	"HDM:?"	HDMI OFF	"HDM:1"
		HDMI ON	"HDM:2"
AUTO POWER OFF	"ATP:?"	Disable	"ATP:1"
		Enable	"ATP:2"
REMOTE CODE	"RC6:?"	DVD1	"RC6:1"
		DVD2	"RC6:2"
ECO MODE	"ECO:?"	Disable	"ECO:1"
		Enable	"ECO:2"

3-5-3. HOST Status request and Status Response/feedback list AST Layer: 3

Send Slave status		example	Expected reply from Host
COUNTER	"TIM:?"	TIME (DVD, DVD-Audio)	"TIH:H.MM.SS"
		TIME (CD, SACD, MP3, VCD)	"TIM:MMM.SS"

3-5-4. Special Status request and Status Response list AST Layer: None

Status request		Status answer and feedback			
		Layer1	Layer2	Layer3	send data
Auto status feedback	"AST:?"	Disable.	Disable.	Disable.	"AST:0"
		Enable.	Disable.	Disable.	"AST:1"
		Disable.	Enable.	Disable.	"AST:2"
		Disable.	Disable.	Enable.	"AST:3"
		Enable.	Enable.	Disable.	"AST:4"
		Enable.	Disable.	Enable.	"AST:5"
		Disable.	Enable.	Enable.	"AST:6"
		Enable.	Enable.	Enable.	"AST:7"

Status request		Status answer and feedback	
Read Version Number	"RV0:?"	RS-232C Soft Version	"VR0:?????????????"
	"RV1:?"	B/E Soft Version	"VR1:?????????????"
	"RV2:?"	Panel Soft Version	"VR2:?????????????"
	"RV3:?"	AUDIO DSP Soft Version	"VR3:?????????????"

3-6. Status Feedback

	Auto Status feedback Layer	Request	Status	Notes
A-B REPEAT	Layer2	@A-B:?\x0d,	@A-B:1\x0d	OFF
			@A-B:2\x0d	SET A
			@A-B:3\x0d	SET A-B
ASPECT	Layer2	@ASP:?\x0d,	@ASP:1\x0d	LetterBox
			@ASP:2\x0d	Panscan
			@ASP:3\x0d	Wide
			@ASP:4\x0d	SQUEEZE
AutoPowerOff	Layer2	@ATP:?\x0d,	@ATP:1\x0d	OFF
			@ATP:2\x0d	ON
REMOTE CODE	Layer2	@RC6:?\x0d,	@RC6:1\x0d	DVD1
			@RC6:2\x0d	DVD2
EcoMode	Layer2	@ECO:?\x0d,	@ECO:1\x0d	OFF
			@ECO:2\x0d	ON
PLAY MODE	Layer1	@MOD:?\x0d	@MOD:6\x0d	PLAY FAST FWD
			@MOD:7\x0d	PLAY FAST REV
			@MOD:2\x0d	PLAY
			@MOD:3\x0d	PLAY PAUSE
			@MOD:4\x0d	PLAY SLOW FWD
			@MOD:5\x0d	PLAY SLOW REV
			@MOD:1\x0d	STOP
			@MOD:0\x0d	TOC (LOADING)
POWER	Layer1	@PWR:?\x0d,	@PWR:1\x0d	OFF
			@PWR:2\x0d	ON
RANDOM	Layer2	@RDM:?\x0d,	@RND:1\x0d	OFF
			@RND:2\x0d	ON1
			@RND:2\x0d	ON2
REPEAT	Layer2	@RPT:0\x0d,	@RPT:1\x0d	OFF
			@RPT:2\x0d	Rep1
			@RPT:3\x0d	Rep2
			@RPT:3\x0d	Rep3
S.MODE	Layer2	@SCD:?\x0d,	@SCD:1\x0d	SACD
			@SCD:2\x0d	SACD
			@SCD:3\x0d	SACDCD
TRAY	Layer1	@TRY:?\x0d,	@TRY:1\x0d	OPEN
			@TRY:2\x0d	CLOSE
NTSC/PAL	Layer2	@TVS:?\x0d,	@TVS:1\x0d	NTSC
			@TVS:2\x0d	PAL
			@TVS:3\x0d	AUTO
VIDEO MUTE	Layer2	@VMT:?\x0d,	@VMT:1\x0d	OFF
			@VMT:2\x0d	ON

	Auto Status feedback Layer	Request	Status	Notes
DISC	Layer1	@DSC:?\x0d,	@DSC:-\x0d	UNDEFINE (ERROR)
			@DSC:0\x0d	NoDisc
			@DSC:1\x0d	CD
			@DSC:2\x0d	VCD
			@DSC:3\x0d	DVD
			@DSC:4\x0d	DVD Audio
			@DSC:5\x0d	SACD
			@DSC:6\x0d	MP3/JPEG
COUNTER	Layer2	@TTL:?\x0d	@TTL:???\x0d	Title
	Layer2	@GRP:?\x0d	@GRP:???\x0d	Group
	Layer2	@CHP:?\x0d	@CHP:???\x0d	Chapter
	Layer2	@TRK:?\x0d	@TRK:???\x0d	Track
	Layer3	@TIM:?\x0d	@TIH:?.??.??\x0d	Time
			@TIM:???.??\x0d	
PROGRESSIVE/	Layer2	@PGR:?\x0d	@PGR:1\x0d	Progressive
INTERLACE			@PGR:2\x0d	Interlace
DIMMER (FL/LCD)	Layer2		@DIM:1\x0d,	OFF
			@DIM:2\x0d,	DIMMER
			@DIM:3\x0d,	ON
HDMI ON/OFF	Layer2	@HDM:?\x0d	@HDM:1\x0d	OFF
			@HDM:2\x0d	ON
Read Ver Number	AST layer	@RV0:?\x0d	@VR0:????????????\x0d	RS-232C Ver. No.
		@RV1:?\x0d	@VR1:????????????\x0d	BE Ver. No.
		@RV2:?\x0d	@VR2:????????????\x0d	Panel ucom Ver. No.
		@RV3:?\x0d	@VR3:????????????\x0d	DSP Ver. No.
Auto status feedback	AST layer	@AST:?\x0d	@AST:0\x0d	all layer OFF
			@AST:1\x0d	layer1 ON
			@AST:2\x0d	layer2 ON
			@AST:3\x0d	layer3 ON
			@AST:4\x0d	layer1,layer2 ON
			@AST:5\x0d	layer1,layer3 ON
			@AST:6\x0d	layer2,layer3 ON
			@AST:7\x0d	all layer ON

3-7. Data Packet COMMAND List

	COMMAND	Notes
A-B REPEAT	@A-B:0\x0d,	Step
ANGLE	@AGL:0\x0d	Toggle
ASPECT	@ASP:1\x0d,	LetterBox
	@ASP:2\x0d	Panscan
	@ASP:3\x0d	Wide
	@ASP:4\x0d	SQUEEZE
AutoPowerOff	@ATP:1\x0d,	OFF
	@ATP:2\x0d	ON
AUDIO	@AUD:0\x0d	Toggle
CLEAR	@CLR:0\x0d	
CONDITION	@CND:0\x0d	Toggle
RETURN	@CUR:0\x0d	RETURN
CURSOR	@CUR:1\x0d	UP
	@CUR:2\x0d	DOWN
	@CUR:3\x0d	LEFT
	@CUR:4\x0d	RIGHT
DIMMER (FL/LCD)	@DIM:0\x0d	Step
	@DIM:1\x0d	OFF
	@DIM:2\x0d	DIMMER
	@DIM:3\x0d	ON
DISPLAY (OSD)	@DIP:0\x0d	Toggle
REMOTE CODE	@RC6:1\x0d	DVD1
	@RC6:2\x0d	DVD2
EcoMode	@ECO:1\x0d	OFF
	@ECO:2\x0d	ON
ENTER	@ENT:0\x0d	
GO TO TRACK	@GOT:1\x0d	NEXT
	@GOT:2\x0d	PREV
I.REPLAY SKIP	@IGT:1\x0d	I.SKIP
	@IGT:2\x0d	I.REPLY
MARKER	@MRK:0\x0d	Toggle
MENU	@MNU:0\x0d	Toggle
TOP MENU	@MNU:1\x0d	Toggle
NUMBER	@NUM:0\x0d	0
	@NUM:1\x0d	1
	@NUM:2\x0d	2
	@NUM:3\x0d	3
	@NUM:4\x0d	4
	@NUM:5\x0d	5
	@NUM:6\x0d	6
	@NUM:7\x0d	7
	@NUM:8\x0d	8
	@NUM:9\x0d	9

	COMMAND	Notes
	@NUM:P\x0d	+10
SETUP	@OSD:0\x0d	Step
PAGE	@PAG:1\x0d	+
	@PAG:2\x0d	-
PLAY MODE	@PFF:0\x0d	PLAY FAST FWD
	@PFR:0\x0d	PLAY FAST REV
	@PLY:0\x0d	PLAY
	@PPS:0\x0d	PLAY PAUSE
	@PSF:0\x0d	PLAY SLOW FWD
	@PSR:0\x0d	PLAY SLOW REV
	@STP:0\x0d	STOP
PROGRAM	@PRG:0\x0d	Toggle
PROGRESSIVE/ INTERLACE	@PGR:0\x0d	Toggle
POWER	@PWR:1\x0d	OFF
	@PWR:2\x0d	ON
RANDOM	@RDM:0\x0d	Step
REPEAT	@RPT:0\x0d	Step
S.MODE	@SCD:0\x0d	Toggle
	@SCD:1\x0d	SACD Stereo
	@SCD:2\x0d	SACD Multi
	@SCD:3\x0d	SACDCD
SEARCH	@SCH:0\x0d	Toggle
STEP	@PST:0\x0d	Toggle
SUBTITLE	@SBT:0\x0d	Toggle
TRAY	@TRY:0\x0d	Toggle
	@TRY:1\x0d	OPEN
	@TRY:2\x0d	CLOSE
NTSC/PAL/AUTO	@TVS:0\x0d	Toggle
VIDEO ADJ	@VAJ:0\x0d	Toggle
VIDEO MUTE	@VMT:0\x0d	Toggle
	@VMT:1\x0d	OFF
	@VMT:2\x0d	ON
ZOOM	@ZOM:0\x0d	Toggle
INFORMATION	@INF:0\x0d	Toggle
HDMI ON/OFF	@HDM:0\x0d	Toggle
	@HDM:1\x0d	OFF
	@HDM:2\x0d	ON
HDMI RESET	@HDR:0\x0d	RESET

	COMMAND	Notes
Auto status feedback	@AST:0\x0d	all layer OFF
@AST:7x0d	@AST:1\x0d	layer1 ON
	@AST:2\x0d	layer2 ON
	@AST:3\x0d	layer3 ON
	@AST:4\x0d	layer1,layer2 ON
	@AST:5\x0d	layer1,layer3 ON
	@AST:6\x0d	layer2,layer3 ON
	@AST:7\x0d	all layer ON

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