Professional HD Video System Player

HD-V9000

Technical Manual

Ver. 1.01

April 15, 2010

Pioneer Corporation

Revision History

Version	Date	Description of Changes
1.00	2010/04/07	Original version
1.01	2010/04/14	Addition of detailed explanation of content error detection function during MAP file creation

Table of Contents

1. Introduction

This manual provides precautions and operation tips that can be used when you design and operate an AV system with HD-V9000, a business market HD video system player. Please refer to this manual to perform appropriate operations when using the system.

In addition, refer to the following documents when you use this manual. Go to our website (http://pioneer.jp/biz/) to see this manual and other related documents. Download the latest versions for your use.

■ HD-V9000 Reference Documents

- Technical Manual (this manual)
- User's Manual
- Communication Interface User's Manual
- Content Creation Manual
- HD Pilot User's Manual

2. Features

2.1. Main Features of this Unit

■ **Highly reliable, mechanical-free design using SD/SDHC card as the media**

Using the very flexible all-purpose SD/SDHC card as the media allows you to directly record onto the card and play content. And employing the mechanical-free design without drives, you can freely install a system that is highly resistant to dust and vibration. With this functionality, we have achieved a stable system that can operate for long periods without the need for maintenance.

In addition, using the SD card, with all the advantages of removable media like optical discs, you can easily transfer and take out content, and readily replace content when an error occurs. It also has the strong points of recording type media, such as HDD, and enables you to seamlessly overwrite, make backups, and copy content.

■ **Fully equipped with an array of features proven in business video players**

The system is fully equipped with the RS-232C Pioneer Command, an industry standard adopted for business video players like LD and DVD, and with other functions such as external control terminals, the external synchronized play function and frame control. With these functions, you can easily transfer from existing video systems*, and some peripheral devices can also be used.

*** Some of the RS-232C command function specifications and response timing have been changed to match the media and hardware changes made from previous business DVD players. Please be sure to read the Communication Interface User's Manual for this unit when you design a system.**

■ **Compatible with high profile, high-def playback**

This unit is equipped with a video decoder specifically designed for business use. High profile MPEG-2 and MPEG-4 AVC/H.264 video files are played in high definition, and the system enables stable and smooth playback functionality over long time periods.

*** In this manual and the Content Creation Manual, we provide information including compatible formats, encoders verified to work and setup parameters for you to create content (video files) that can be seamlessly and stably used in this unit. Please be sure to refer to these documents when you create content.**

■ **Video system operation efficiency and cost reduction achieved using network functions**

Network functionality in this unit allows you to remotely perform control operations, diagnoses, content replacement, and schedule changes via the network. This allows for more efficient video system operations at a lower cost.

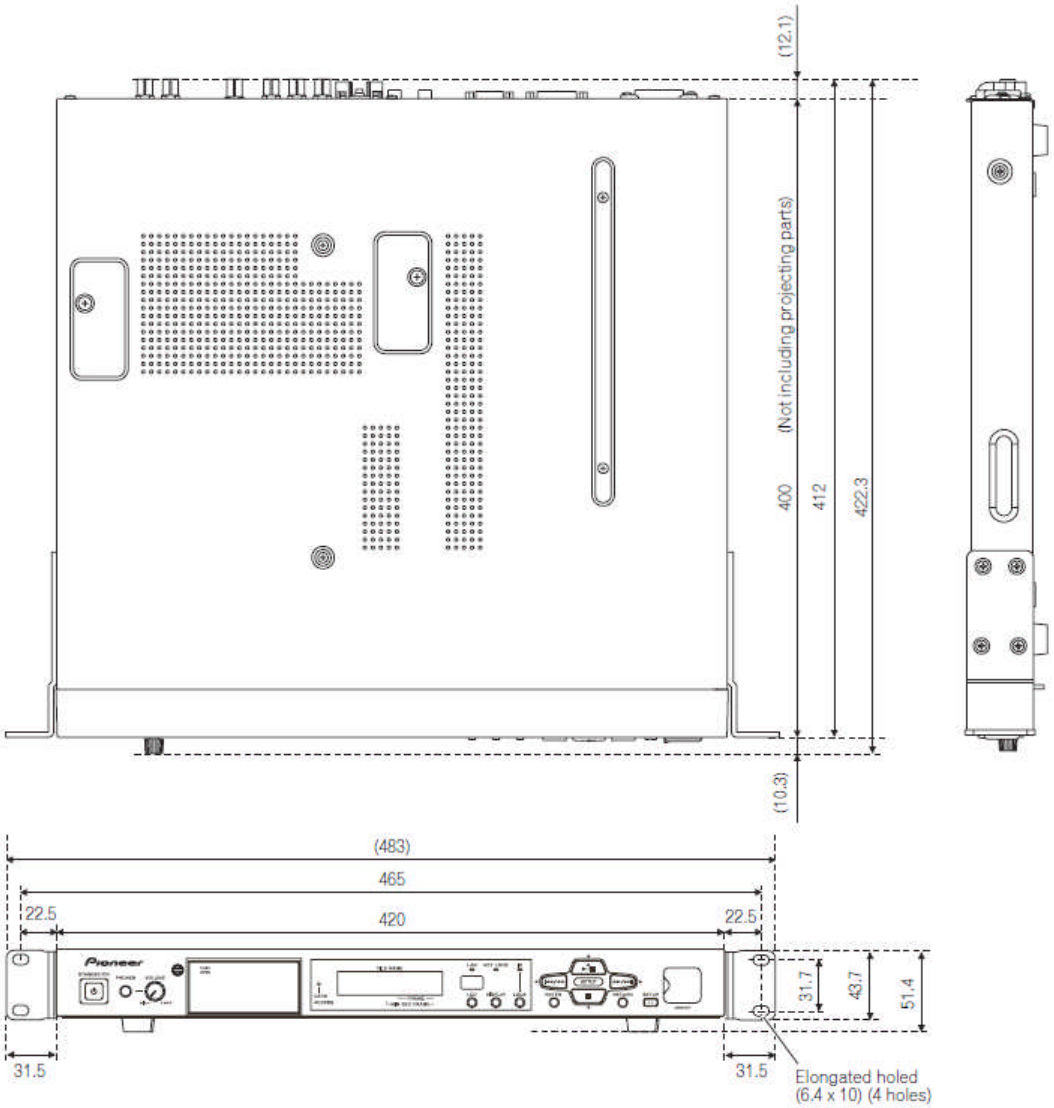
■ **Video Overlay Display function allows more variety in image production**

The unit is equipped with our Video Overlay Display function, which displays content such as text tickers or still images on top of High-Vision video content. This function enables real-time information or information that needs to be immediately displayed in combination with video.

3. Specifications

Compatible media		SD/SDHC card 1 slot
Compatible video format		Container: MPEG2-TS Codec: MPEG2, H.264/AVC
Output resolution	720×480i	○
	720×576	○
	1280×720p	○
	1920×1080i	○
	1920×1080p	○ (IP conversion)
IN/OUT terminals	HDMI™ output	1 line (with cable stopper)
	Component video output	BNC 1 line (Y, CV/PB, CR/PR)
	Composite video output	BNC 1 line
	Digital audio output	Coaxial 1 line
	Analog 2ch audio output	Rear: 1 line RCA pin jack Front: Headphone mini jack
	LAN	1 line RJ-45 10BASE-T/100BASE-TX
	USB (A Type)	2 lines
	RS-232C	Switch between 1 line D-sub 9-pin male and 1 line D-sub 15-pin female
	External synchronized input	1 line (With loop through) BNC (with 75Ω terminal SW) Input Signal SD: Black burst HD: Bi-level/Tri-level sync signal
Main functions	RS-232C control	○
	EXT terminal control	○
	Frame search	○
	External synchronized play	○
	Program play	○ (Playlist)
	Backyard monitor	○
	Schedule function	○ (Specify day and date)
	Power On Start	○
	Overlay Display	○ (Text, picture)
	Lip-synch adjust	○
	Save data to USB memory	○
	Support software	○ (HD PILOT)
	Network monitoring/control	○
	Change content via network	○
	Wakeup on LAN	○
Operating temperature		0°C to +45°C
External dimensions (excl. rack mounting hardware)		420 × 51.2 × 422.3 mm (W×H×D)
Weight		5.0 kg
Rack mount compatible		EIA 19 inches 1U compatible (hardware incl.)
Voltage		100V ac, 50 Hz/60 Hz
Power consumption/Standby power consumption		30 W/0.5 W

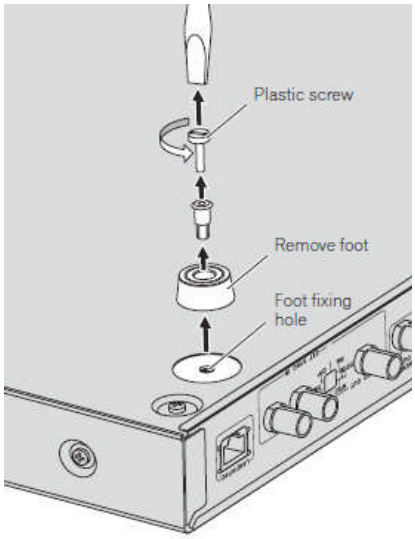
4. External Dimensions and Installation Environment



■ Precautionary notes when mounting rack

When you mount the rack, install the provided brackets on both the left and right sides.

Remove all four legs. After removing them, store the legs for future use.



■ Environmental temperature and humidity requirements for operation

Use this unit in an environment with a temperature range from 0°C through 45°C and with a humidity level of 85%.

When you use multiple units of this system together, up to 3 units may be stacked, with a max target temperature of 35°C. If you mount players in racks, install the units so that a space of at least 1 unit is left empty every 3 units.

5. Precautions during RS-232 Control Operations

5.1. Command Comparison Chart

This is a RS-232C command specification comparison chart for HD-V9000 and DVD-V8000. For further details, refer to the Communication Interface User's Manual for each player.

Command		Command Function Specification Differences	
Mnemonic	**Name**	**DVD-V8000**	**HD-V9000**
RJ	Reject	Stops disc rotation.	Stops file playback.
99RJ	Reject(Option)	Stops disc rotation, but does not open tray even during Park Mode.	Stops file playback. Keeps the file name designated at previous FI. When stopped at 99RJ, Setup Mode (P02) becomes activated instead of Park Mode (P01).
SA	Start	Starts disc rotation, stops at play start position, and returns R. R response time depends on the disc.	Searches 1 frame in the designated file and stops. When a file is not designated, searches in the first file in alphabetical order and stops at frame 1. R response time depends on the content.
(adrs) PL	Play	**R response timing** Returns R when playback is ready. Example: P01=> PL receive => Play ready => Play start (P04) => R send	**R response timing** Activates status P02 and immediately returns R. Example: P01=> PL receive (P02) => R send => Play ready => Play start (P04) *Play ready time varies depending on the content and whether there is a MAP file.*
		Play file designation Not available.	**Play file designation** Designate a file in advance with FI command. Alphabetical order is used if not designated.
		PL send during play Returns R.	PL send during play Returns error E04.
PA	Pause	If PA command is received again, remains in Pause Mode.	If a PA command is received again, it goes into Play Mode.
ST	Still		Same specification
SF	Step Forward		**Playing at multi-speeds** Cycles through the multi-speeds in the order of 1/16→1/8→1/4→1/2 when this command is issued.
SR	Step Reverse		
NF	Scan Forward		Same spec.
NR	Scan Reverse		
NS	Scan Stop		
(adrs) MF	Multi-Speed Forward		Same spec.
(adrs) MR	Multi-Speed Reverse		
arg SP	Speed		Same spec.
adrs SE	Search	Search time Time up to SE > R Ref: Approx. 1.2 sec. (depending on disc)	Search time Time up to SE > R Ref: Approx. 1.1–1.5 sec (depending on the content) Search within file.
adrs SL	Search & Play	Searches the designated address and starts playing.	Same spec.
adrs SM	Stop Marker		**If executed while stopped** Necessary to designate the file name in advance with the FI command.

Command		Command Function Specification Differences	
Mnemonic	**Name**	**DVD-V8000**	**HD-V9000**
LO	Lead Out Symbol	Uses this LO instead of numerical values for search or auto play target addresses. LOPL<CR> → Plays until the end of file and returns R after a stop. LOSMPL<CR> → Returns R, plays until the end of file and stops.	When you want to play to end of file, use this LO instead of address. Can be used without a Map file. **Note: Please do not use LO commands as they do not function according to the specs.**
CL	Clear	**During repeat-playing** Repeat: turns off.	**During repeat-playing** According to repeat setting in Initial Settings.
FR	Frame		Same spec.
TM	Time		Same spec.
arg AU	Select Audio	**Argument** 0: Mute 1-8: Language	**Argument** 0: Mute 1: Cancel Mute.
arg AP	Select Aspect	**Argument** 1: Pan & Scan 2: Letter Box 3: Wide	**Argument** 2: "4:3" 3: "16:9"
arg VD	Video Control	**Setup menu/OSD output** Outputs according to video switch settings.	**Setup menu/OSD output** Always outputs regardless of video switch settings.
arg RF	Output Resolution Set	-	**New**
arg DS	Display Control	**While setup menu is displayed** Executable	**While setup menu is displayed** Returns error E04.
arg KL	Keylock	**Argument (1 digit)** 0: Cancel lock. 1: Lock all keys. 2: Lock tray opening.	**Argument (1 digit)** 0: Cancel lock. 1: Lock all keys.
arg GP	Playlist Number Set (Stack Group Set)	**Argument** 1–300 (decimal integers) *Executes play in combination with BS command.*	**Argument** 1–20 (decimal integers), E06 for others. *Independently executes play.*
BU	Playlist Data Upload (Command Stack Data Upload)	**Data format** V8000 specific	**Data format** V9000 specific (different from V8000)
BD	Playlist Data Download (Command Stack Data Download)	**Data format** V8000 specific	**Data format** V8000 specific
WU	Schedule Data Upload (Weekly Timer Data Upload)	**Data format** V8000 specific	**Data format** V9000 specific (different from V8000)
WD	Schedule Data Download (Weekly Timer Data Download)	**Data format** V8000 specific	**Data format** V8000 specific
GS	Setup Data Upload	-	**New**
PS	Setup Data Download	-	**New**
RM	Repeat Mode	**Function** Sets the following with Address Mode. Title repeat/Chapter repeat/Track repeat/Invalid	**Function** Sets File Repeat Mode.
arg SK	File Skip (Chapter Skip)	**Argument** 1. Searches beginning of next chapter. 2. Searches beginning of previous chapter. 3. Searches beginning of current chapter.	**Argument** 1. Searches beginning of next file. 2. Searches beginning of previous file. 3. Searches beginning of current file. Maintains pre-search Play Mode after search.

Command		Command Function Specification Differences	
Mnemonic	**Name**	**DVD-V8000**	**HD-V9000**
FI	File Name Input	-	**New**
arg TD	Text Crawl Display	-	**New**
TK	Text Crawl Erase	-	**New**
arg OD	Overlay Image Display	-	**New**
OE	Overlay Image Erase	-	**New**
FD	Delete File	-	**New**
FC	File Copy	-	**New**
PN	Power On	-	**New**
(arg) PF	Power Off	-	**New**
(arg) RB	Reboot	-	**New**
>A,>B,・・・>Z	General Purpose Parameter		Same spec.
_A,_B,・・・_Z			Same spec.
<A,<B,・・・<Z			Same spec.
?D	File Information Request	-	**New**
?R	File Name Request (Title/Track Number Request)	**Function** Returns **Title/Track Number** currently being played.	**Function** Returns **Video file name** currently being played.
?T	Time Code Request		Same spec.
?F	Frame Number Request		Same spec.
?Y	Total Frame Request	**Function** Returns total number of frames of **title** currently being played.	**Function** Returns total number of frames of **file** currently being played.
arg RA	Register A Set (Display)	**Display element** • Frame number or time code • **Title & Chapter number/Track number** • User area	**Display element** • Frame number or time code • **File name** • User area
arg RD	Register D Set (TxD Term)		Same spec.
arg PR	Print Character	**Line number**: 0–9 Max number of letters: 32 letters	**Line number**: 0–17 Max number of letters: 40 letters
CS	Clear Screen		Same spec.
WW	Real Time Clock Set	**Error** None	**Error** Returns Error E04 when NTP setting (Network Settings>>NTP) is enabled.
arg CM	Communication Control Set		Same spec.
?P	Player Active Mode Request	Refer to the following "Operating Modes" for the status.	Refer to the following "Operating Modes" for the status. (P00 and P03 are deleted)
?L	Player Model Number Request	-	**New**
?X	Player Model Name Request		Same spec.
?W	Real Time Clock Request		Same spec.
?M	CCR Mode Request		Same spec.
?N	Input Number Request		Same spec.
?E	Error Code Request		Same spec.
#I	Input Unit Request		Same spec.
$A	Register A Request		Same spec.
$D	Register D Request		Same spec.

Command		Command Function Specification Differences	
Mnemonic	**Name**	**DVD-V8000**	**HD-V9000**
?Z	Get Information (Firmware Version Request)		Same spec.
?O	System Property Request	-	**New**
?B	File List Request	**Function** Requests block number currently being played.	**Function** Requests file list and attribute information stored in SD card and USB memory.
EL	Error Log Upload	-	**New**
?U	NTP Status Request	-	**New**
arg SS	15pin Status Set	-	**New** Play status (P04) can be detected at 15-pin STOP_ST. (This command must be used to make setting.)
#S	15pin Status Request	-	**New**
OP	Open		Not available.
CO	Close		Not available.
BK	Block Number		Not available.
CH	Chapter		Not available.
TI	Title		Not available.
IX	Index		Not available.
TR	Track		Not available.
arg SU	Select Subtitle		Not available.
arg AG	Select Angle		Not available.
arg PT	Select Parental-Level		Not available.
arg AD	Audio Control		Not available.
arg BS	Command Stack Play		Not available.
?A	P-Block Number Request		Not available.
?C	Chapter Number Request		Not available.
?I	Index Number Request		Not available.
?Q	TOC Information Request		Not available.
?G	Disc Region Code Request		Not available.
?V	DVD Disc Status Request		Not available.
?K	CD Disc Status Request		Not available.
WW	Real Time Clock Set		Not available.
arg MS	Advanced Setup		Not available.
?S	Advanced Setup Request		Not available.
?H	Player Region Code Request		Not available.
arg MC	Menu Call		Not available.
arg NB	Numeric Button		Not available.
arg CU	Button Select		Not available.
(arg) ET	ENTER Button		Not available.
arg GI	Get Information		Not available.
MU	Memory Data Upload		Not available.
arg OS	Output Select *1		Not available.
arg VP	VR Play Mode *1		Not available.

Command Response Time		DVD-V8000	HD-V9000
?F	"?F"⇒"*******<CR>" response time	(Normal) 10 msec, (Max) 16 msec	(Normal) 20 msec, (Max) 600 msec
?P	"?P"⇒"P**<CR>" response time	(Normal) 10 msec, (Max) 16 msec	(Normal) 20 msec, (Max) 600 msec

Timing During Synchronized Play Control		DVD-V8000	HD-V9000
Search time	Time from "SE"to "R"	Reference value (approx. 1.2 sec)	Reference value (approx. 3.5 sec) … Varies depending on the content.
Wait when PL is sent	Wait time from Search Complete to Send PL.	300 msec	No wait time is needed in FW Ver. 2.00 (0 msec). Wait time of 1500 msec is needed in previous FW versions.
Video start position	Video start position after "PL" command.	2nd Field after 4 Field.	At 1000 ms + 3 frames, after approx. 1.1 sec. Approx. 0.1 sec when synchronization is off.
Unspecified area during synchronized play	Area where video output timing for PL <CR> Send is unspecified.	7 msec. from 2nd field start point.	480i/576i/1080i: 2nd Field period 720P: 5 msec onward from frame start point

Player Function Mode		DVD-V8000	HD-V9000
P00	Open	Disc table is out.	Not available.
P01	Park	Disc table is closed and disc rotation is stopped (including cases where there is no disc).	Currently not playing (or there may be no SD Card). This requires that no file is designated. This mode also becomes activated when an error occurs during Play preparation.
P02	Setup	Play ready status. Disc is rotating to prepare for Play.	Play ready status. Status where video and audio playback become ready after Play start command (PL) is received from Park Mode. This mode also becomes activated when the file to be played is designated.
P03	Unload	Opening.	Not available.
P04	Play	Video and audio are being played at normal speed.	Same spec.
P05	Still	Image is still as output.	Same spec.
P06	Pause	Image is deleted and in still state.	Same spec.
P07	Search	Designated address is being searched.	Same spec.
P08	Scan	Fast forward/fast rewind	Same spec.
P09	Multi-speed	Playing at multi-speed.	Same spec.

Error Code		DVD-V8000	HD-V9000
E00	Communication error		Same spec.
E01	System Error	-	**New**
E04	Feature not available		Same spec.
E06	Missing argument		Same spec.
E10	File already exists	-	**New**
E11	File does not exist		Same spec.
E12	Search error		Same spec.
E15	Picture stop		Not available.
E16	Interrupt by other device		Same spec.
E99	Panic		Same spec.

5.2. Detailed Explanation of Response "R" Timing when "PL" Command is Issued

DVD-V8000 “R” Response

R is returned when Play is ready.

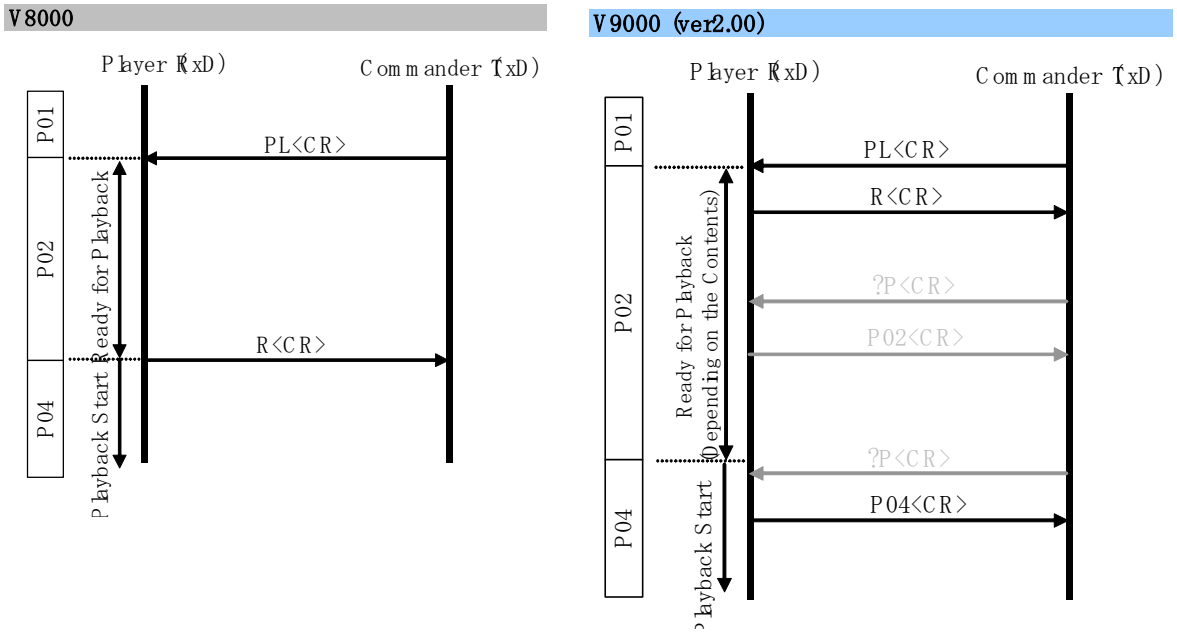
Example: P01 => PL Receive => Play Ready => Play Start (P04) => R Send

HD-V9000 “R” Response — Firmware Version 2.00 or later

Status goes to P02 and R is immediately returned.

Example: P01=> PL Receive (P02) => R Send => Play Ready => Play Start (P04)

The Play ready time in V9000 varies depending on factors like the content format, bit rate, and whether or not a MAP file exists.



5.3. Command Issuance Interval when ?F ?P Commands are Used

?F and ?P response times are longer in HD-V9000 as compared to DVD-V8000.

As a result, when commands are sent at the same interval as that for DVD-V8000, there may be cases where player function response is drastically reduced due to overloaded internal processing.

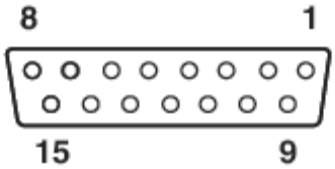
Therefore, when you use a status command, develop a program so that the next command is issued after the response status comes in from the V9000, or so that the command-send intervals are set sufficiently long.

Command Response Time		DVD-V8000	HD-V9000
?F	"?F"⇒"*******<CR>" response time	(Normal) 10msec (Max) 16msec	(Normal) 20msec (Max) 600msec
?P	"?P"⇒"P**<CR>" response time	(Normal) 10msec (Max) 16msec	(Normal) 20msec (Max) 600msec

5.4. Setting Details for 15-pin D-sub Connector Pin 15 STOP_ST Status

You can use the output STOP_ST (tally signal) of Pin 15 on the 15-pin D-sub connector to detect that video playing has stopped, instead of using 232C Command "?P" Player Active Mode Request or "?F" Frame Number Request.

When you use this method, you may be able to detect the transition of Play Mode (Example: Play → Still) faster than by using ?P or?F.



There are 2 types of STOP_ST: one is the Play status detection mode that detects the Play status and the other is the Stop status detection mode that detects the Stop status (including Still). You can switch between the 2 modes using the RS-232C Command. The Play status is set as the factory default mode.

Arg	Detection Mode	Function
0	Stop status detection mode	Stopped status (P01) => "L" is output.
		All other statuses => "H" is output.
1 (Default)	Play status detection mode	Play status (P04) => "L" is output.
		All other statuses => "H" is output.

The Play status is set up as the factory default mode. The system maintains the setup values even after the power is turned off.

The following shows the relationship between the player function mode, "?P" Command status, and output values for this detection mode.

Status	?P Command	DVD-V8000	HD-V9000		
			Ver. 1.04	Ver. 2.00	
				"1SS"(Play)	"0SS" (Stop)
Standby	P01	H	H	H	H
Stop (No Disc)	P01	L			
Stop (Disc)	P01	L	L	H	L
Play	P04	H	H	L	H
Pause	P06	H	H	H	H
Still	P05	H	H	H	H
Search	P07	H	Unspecified	Unspecified	Unspecified

Notes

This function is included in V9000 firmware Ver. 2.00 or later. Only the Stop status detection mode is available in versions older than Ver. 2.00.

This terminal is an open collector output. It can use a maximum up to a 12 V (50mA) external pull-up resistor.

6. Synchronized Playback Precautions

This chapter summarizes the information required and the precautions to be observed in designing synchronized playback systems using multiple HD-V9000 units. Be sure to also read the instruction manual and the communications interface manual.

6.1. Basic Precautions for Synchronized Playback

For perfect frame synchronization, be sure to heed the following conditions.

■ **Set the following to the same frequencies.**

- Video frequency of the playback video file
- Frequency of input external synchronized signals
- Scalar setting of HD-V9000 output video *
- NTSC/PAL switch

* Be sure to set the same aspect ratio for all playback video files. Select 1920 × 1080i for 1440 × 1080i.

■ **Use the same type of monitor.**

TV monitors, projectors and other video display devices are often affected by input lag, the time between the input of a video signal into a display and the time it is shown by the display. Since input lag varies with monitor model, it is essential that the same monitor models be used.

■ **Control line**

Use RS-232C to control synchronized start.
Note that Extend Terminal or Network will not enable synchronized playback control.

■ **Multiplexer (MPLX)**

Use a multiplexer that can send RS-232C broadcast commands.
When perfect frame synchronization is required, use a multiplexer that allows you to send commands at a consistent preset time.

■ **Sending a PL command (sending CR) avoiding unspecified areas**

There is a duration when playback video frames cannot be synchronized (they are 1 frame out of sync) to enable issuing simultaneous PL commands after completing a search during synchronized playback. To avoid this so called unspecified area, issue the PL command outside the following unspecified areas.

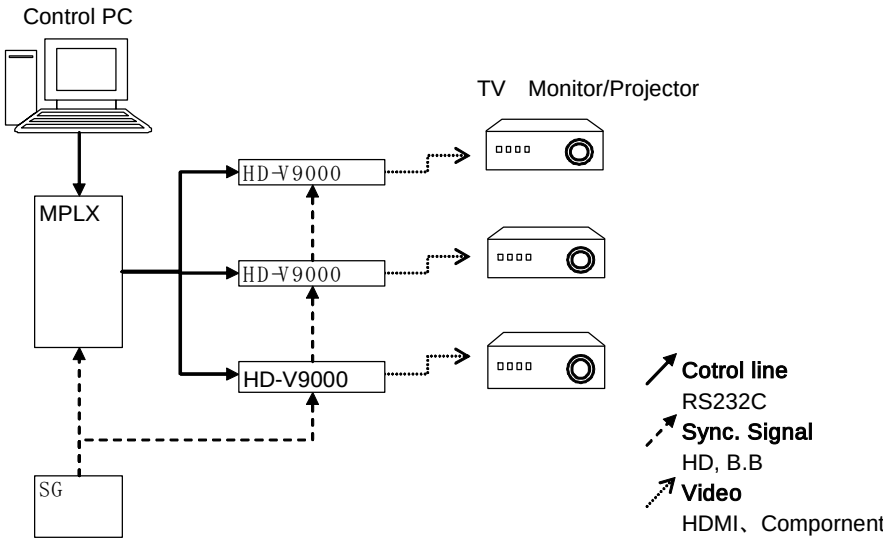
1080i, 480i and 576i unspecified areas: Duration of the 2nd field
720P unspecified area: 5 msec from start of frame

Note: The unspecified area for DVD-V8000 lasts for 7 msec from the start of the second field. Issuing a PL command to a DVD-V8000 during this interval will result in out of sync playback.

■ **Other details**

- When video switchers or other devices are used between the HD-V9000 and the monitors, it is essential that equipment selection and system configuration take frame synchronization into account.
- HD-V9000 Video Out terminal is set to either NTSC or PAL. The external synchronizing function cannot be used.

6.2 Example Showing Configuration of a Basic Synchronized Playback System



Conditions for equipment selection

■ **Multiplexer (MPLX)**

Use a multiplexer that can send broadcast commands.

When perfect frame synchronization is required, use a multiplexer that allows you to send commands at a consistent preset time.

■ **TV monitors and projectors**

For perfect frame synchronization use the same TV monitor and projector models.

■ **Signal generator (SG)**

The HD-V9000 can handle bi-level BB sync in addition to HD tri-level sync signals.

The table below lists playback formats and supported sync signals.

Playback format	Lockable external sync signals	
720×480/59.94i	720×480/59.94i	← Recommended
1280×720/59.94p	720×480/59.94i *	
	1280×720/59.94p	← Recommended
1440×1080/59.94i	720×480/59.94i *	
	1920×1080/59.94i *	
1920×1080/59.94i	720×480/59.94i	
	1920×1080/59.94i	← Recommended
720×576/50i	720×576/50i	← Recommended
1280×720/50p	720×576/50i *	
	1280×720/50p	← Recommended
1440×1080/50i	720×576/50i *	
	1920×1080/50i *	
1920×1080/50i	720×576/50i	
	1920×1080/50i	← Recommended

* indicates support for player firmware Ver. 2.00

6.3 External sync signal input specifications

Supported sync signals			Bi-level (Black Burst) Tri-level (HD tri-level sync signals)	
Supported formats			720×576/50i	Conforms to ITU-R BT.470 (black)
			720×480/59.94i	Conforms to SMPTE 170M (black)
			1280×720/50p	Conforms to SMPTE 296M (black)
			1280×720/59.94p	Conforms to SMPTE 296M (black)
			1920×1080/50i	Conforms to SMPTE 274M (black)
			1920×1080/59.94i	Conforms to SMPTE 274M (black)
Input level	SD Format	720×576/50i	0.450 Vp-p +/-6 dB or less (Negative Sync: 0.300Vp-p, Burst: 0.300Vp-p)	75Ω Load
		720×480/59.94i	0.429 Vp-p +/-6 dB or less (Negative Sync: 0.286Vp-p, Burst: 0.286Vp-p)	75Ω Load
	HD Format		0.600 Vp-p +/-6 dB or less (Negative Sync: 0.300Vp-p, Positive Sync: 0.300Vp-p)	75Ω Load
Pull-in range	720×576/50i		Line frequency 15.625 kHz +/-10 ppm or less	
	720×480/59.94i		Line frequency 15.734kHz +/-10 ppm or less	
	1280×720/50p		Line frequency 37.500kHz +/-10 ppm or less	
	1280×720/59.94p		Line frequency 44.955kHz +/-10 ppm or less	
	1920×1080/50i		Line frequency 28.125kHz +/-10 ppm or less	
	1920×1080/59.94i		Line frequency 33.716kHz +/-10 ppm or less	

Notes:

- For stable system operation, be sure to set the 75 Ω termination switch to On on the product before input of external sync signals. (To prevent excessive signal input)
- To prevent malfunction, turn on an external sync signal generator before turning on the HD-V9000.
- Restart the HD-V9000 when any settings have been modified.

■ **Known compatible sync generators**

Note: The following is information on sync generators that have been confirmed to work with the HD-V9000.
However, the listed devices are not guaranteed to operate under all operating conditions or environments.

ASTRODESIGN SG-7810A Sync Generator	HD Tri-level and BB sync
AJA GEN10	HD Tri-level and BB sync
IMAGENICS SG-701	BB sync

6.4 Example of Commands for Sync Generation

The following provides examples of commands used for controlling synchronized playback.

1. "FI" command for selecting files
   Not required when there is only one video file in a video folder on an SD card
   Not required for repeat play of the same file

2. "SE" command for finding playback start
3. Set "SM" stop marker Set 1 to 3 markers for each player
4. When each player has been set up, send the PL command (including CR) to all players (broadcast transmission)
5. Make sure that all players play up to the set stop markers and then enter STILL mode.

Notes:

- Confirm that a response to a previously sent command has been received before sending the next command.
- Use a controller or multiplexer that enables broadcast transmission of the "PL" command.
  * The above command examples do not describe multiplexer control commands.
- For perfect synchronization (with no frames out of sync), select devices and design a system where the "PL" command is not issued in an unspecified area.
  If a "PL" command is issued in an unspecified area, broadcast transmission may result in out of sync playback.
- Commands for starting synchronized playback should be as short as possible.
  Send PL first before broadcast transmission of <CR>.
- To accurately set start of synchronized playback, make settings when the players are not under a heavy operating load (not during GUI or OSD display or LAN communications).

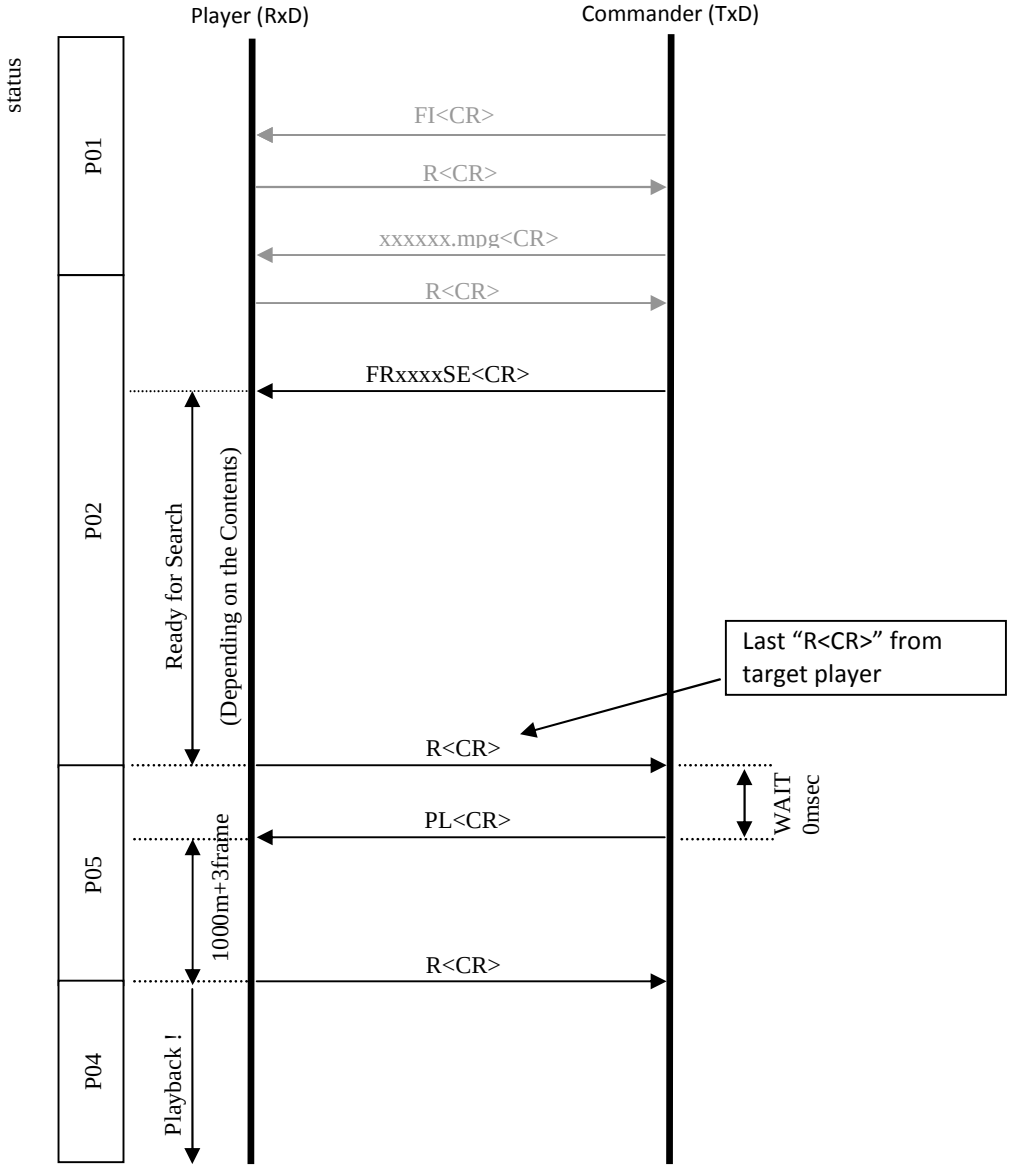
6.5 When to Issue Synchronized Playback Commands

The following compares the timing of synchronized playback commands and response time for the HD-V9000 and the DVD-V8000.

Timing of synchronized playback control			DVD-V8000	HD-V9000 Ver. 2.0）
	Search time	Time from "SE" → "R"	Approx. 1.2 sec	Approx. 3 to 3.5 sec
	PL send wait	Wait time from completion of Search and until sending PL	300 msec	In firmware Ver. 2.00, no wait time is necessary (0 msec), in earlier firmware a wait time of 1500 msec is required
	Location of video start	Location of video start after sending "PL" command	2nd field after 4 fields	After 1000 ms + 3 frames or after 1.1 sec The time when synchronization is off is approx. .0.1 sec
	Unspecified area for synchronized playback	Area when time from sending PL <CR> and until video is output is unspecified	A period of 7 msec from start of the 2nd field	480i/576i/1080i: During the 2nd field 720P: 5 msec after frame start

* The same table appears also on page 9.

Timing Chart when Starting Synchronized Play



The differences in command response times based on the external synchronization ON/OFF settings are shown below.

Firmware version	Version 1.04		Version 2.00	
External synchronization setting	**OFF**	**ON**	**OFF**	**ON**
Time until Search time (within file) "SE" -> "R"	Approx. 1.2 to 2.0 sec	Approx. 1.2 to 2.0 sec	Approx. 1.0 to 1.5 sec	Approx. 3 to 3.5 sec
Wait during issuing of "PL" command after search is completed (after "R" is returned for "SE")	Not needed	1500 ms Wait time for preventing frame shift due to multi-screen or other causes	Not needed	Not needed Wait time for preventing frame shift is not needed.
Video start position after "PL" command	After approx. 0.1 sec	After approx. 1.1 sec (1000 ms + 3rd frame) *A wait of 1000 ms is applied for preventing frame shift.	After approx. 0.1 sec	After approx. 1.1 sec (1000 ms + 3rd frame) *A wait of 1000 ms is applied for preventing frame shift.

When version 2.00 synchronization is set, the time from when the search command is received until "R" is returned becomes longer, but no waiting time is needed for issuing the "PL" command for the "R" reply.

6.6 Unspecified Areas

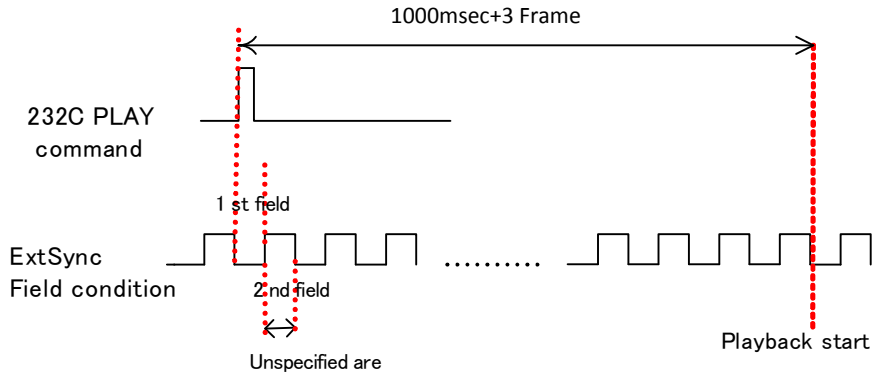
When PL commands are issued simultaneously after completing a search during synchronized play, the frames of the playback video may not be aligned (shifted by 1 frame) depending on the timing of the command (CR send). (This is called an unspecified area.)

To prevent this from occurring, avoid issuing PL commands in the unspecified areas below.

Unspecified area for 480i, 576i, 1080i

After the PL command is received, the video is started at the **1000 msec + 3rd frame** location.

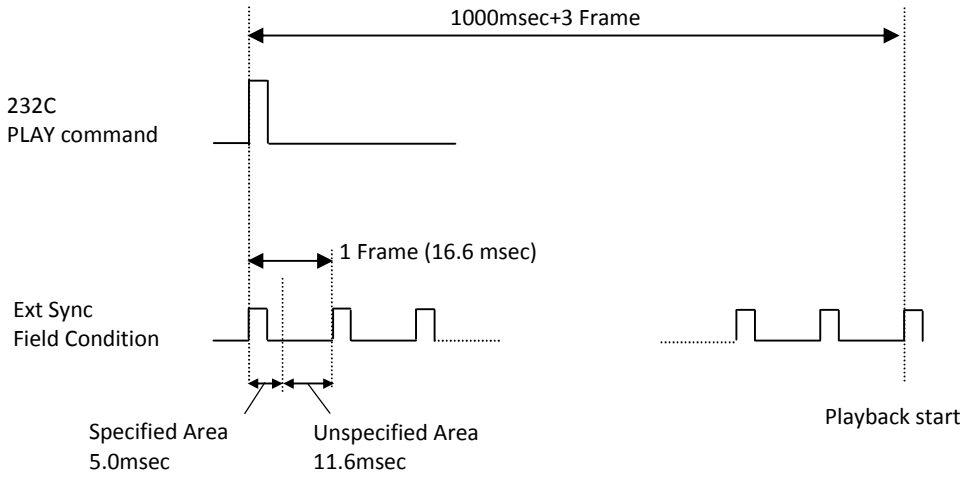
The unspecified area is the period of the 2nd field. If the PL command end <CR> is received within this unspecified area, the video start is unspecified.



Unspecified area for 1280*720p@50/59.94

After the PL command is received, the video is started at the **1000 msec + 3rd frame** location.

As shown in the figure below, the 5-msec period after the frame is started is a specified area, and the 11.6-msec period that follows is an unspecified area. If the PL command end <CR> is received within this unspecified area, the video start is unspecified.



7. Notes When Creating Content

When creating content (video files) to be used by the HD-V9000, pay attention to the points below, and be sure to always check operation in the actual equipment.
For details, please refer to the HD-V9000 Content Creation Manual.

7.1. Basic Notes When Creating Video Files

- Be sure to encode in a format supported by the HD-V9000.
  Formats for decoder specifications used by the HD-V9000 must satisfy the conditions below.
  Regular playback is not possible in formats that do not satisfy the conditions below.

  1. The only supported container for video files is MPEG2-TS (Transport Stream).

  2. Refer to section 7.2 for the supported video formats and audio formats.

  3. An audio stream must also be included. If there is no audio, a mute audio stream must be included.

  4. The field order of the interlaced video is TFF (Top Field First).

  5. The start of the GOP must include a SH (Sequence Header) for MPEG, and a SPS (Sequence Parameter Set) for H.264.

  6. The cycle for I (IDR) and P picture is 3. (Example: I B B P B B P B B P ….)

- Encoding must be performed using parameters and an encoder where HD-V9000 operation has been verified.

- A time map table must be used.
  A time map table data file (called “map file” below) for conducting searches of video files in the HD-V9000 is required. The playback start response is also delayed when there is no map file. Therefore, be sure to always create a map file, and insert it onto the SD card with the video file as a set.
  A map file can be easily created using HD PILOT.

  Also, HD PILOT version 2.00 and later include a function that checks if a video file was created in a HD-V9000-compatible format when creating a map file.

7.2. Supported Formats

The video and audio formats for video files that can be played in the HD-V9000 are shown below.

Supported Video Formats

Container	Video				Audio
	Codec	Profile@Level	Bit rate (max.)	Format	Codec
MPEG2-TS (ISO/IEC 13818-1)	MPEG-2 (ISO/IEC 13818-2)	MP@ML	15Mbps	720×480/59.94i 720×576/50i	LPCM MPEG-1 Audio Layer II (MP2) Dolby Digital
		422P@ML	50Mbps		
		MP@HL	60Mbps	1280×720/50p,59.94p 1440×1080/50i,59.94i 1920×1080/50i,59.94i	
		422P@HL	60Mbps		
	H.264/AVC (ISO/IEC 14496-10)	MP@L3.1	14Mbps	720×480/59.94i 720×576/50i	LPCM MPEG-1 Audio Layer II (MP2) Dolby Digital AAC (MPEG-4 AAC LC)
		MP@L4.1	50Mbps (CAVLC)	1280×720/50p,59.94p 1440×1080/50i,59.94i 1920×1080/50i,59.94i	
			30Mbps (CABAC)		
		HP@L4.1	50Mbps (CAVLC)	1280×720/50p,59.94p 1440×1080/50i,59.94i 1920×1080/50i,59.94i	
			30Mbps (CABAC)		
		H422@L4.0	50Mbps (CAVLC)	1280×720/50p,59.94p 1440×1080/50i,59.94i 1920×1080/50i,59.94i	
			20Mbps (CABAC)		

Supported Audio Formats

Codec	Number of channels	Sampling frequency	Number of quantization bits/ Bit rate (max.)	Notes
LPCM	2 channels	48 kHz	16 bits	Compliant with SMPTE 302M-2002
MPEG-1 Audio Layer II	2 channels	48 kHz	384 kbps	ISO/IEC 11172-3
Dolby Digital	2 channels	48 kHz	448 kbps	Dolby Digital Decoder Implementation Kit Version 3.0
AAC (MPEG-4 AAC LC)	2 channels	48 kHz	288 kbps	ISO/IEC 14496-3

*Files in 1440x1080 video format are converted to 1920x1080 during video output.
*An audio stream must also be included. If there is no audio, a mute audio stream must be included.
*This device was manufactured based on a license from Dolby Laboratories.
Dolby and the double-D symbol are trademarks of Dolby Laboratories.
*Use of the file extensions ".m2t" and ".mpg" is recommended.
*ASCII-format filenames only are recognized.
*During playback of high bit-rate video files, performing menu operations, connecting to a network, and other operations can cause stopping or distortion of the video and audio.

7.3. Operation-Verified Encoders and Parameter Settings

Information about encoders where operation has been verified and parameter setting values in the categories shown in the table below are provided in the HD-V9000 Content Creation Manual.
Be sure to check this information when performing or requesting encoding operations.

TV System	Codec	Usage
NTSC Frame Rate 29.97fps (for Japan and North America)	H.264/AVC	Normal HD
		High Quality HD
		Long Time HD
	MPEG2	Normal HD
		High Quality HD
		Long Time HD
		SD (Standard Definition)
PAL Frame Rate 25fps (for Europe)	H.264/AVC	Normal HD
		High Quality HD
		Long Time HD
	MPEG2	Normal HD
		High Quality HD
		Long Time HD
		SD (Standard Definition)

7.4. Splitting Files over 4 GB

When an SDHC card is in the standard format (FAT32), file of 4GB or greater cannot be handled.
For that reason, it is necessary to split movie files that are 4GB or larger.
When the HD PILOT support software is used, it automatically splits files that are 4 GB or larger when the MAP file is created. Subsequently the split file is treated by HD PILOT and by the HD-V9000 as one file, so the movie plays seamlessly.
For more detailed information, refer to the HD PILOT user's manual and/or HD PILOT Help screens.

When you wish to divide a file that is 4 GB or larger with HD PILOT, put a check next to "When the file division is possible, it divides." on the setting screen at right.

Note: When this checkbox is turned on, it requires an additional 1 MB of free disk space in addition to the file size on the HDD being used, even if the file is less than 4 GB.

When files are split, in addition to the original movie file, split movie files, a MAP file and a list file for managing the split files are created.
For more detailed information, refer to the Content Creation Manual and/or HD PILOT Help screens.

8. Recommended SD card

We recommend using the following SD cards to ensure stability when playing video on the HD-V9000 as well as for playing high bit-rate videos.

Type of Card: SDHC 4 GB/8 GB/16 GB/32 GB
CLASS 6 or CLASS 10

Card Maker Panasonic, Toshiba, SanDisk

✧ A Class 6 SDHC card is guaranteed to provide a 48 Mbps or faster transfer rate, while a Class 10 guarantees at least 80 Mbps, so the actual transfer rate (during play) will be even higher.
However, the value of the data transfer rate of the SD card is not always guaranteed as the video bit rate of the content that this unit plays.
Therefore, when playing a 50 or 60 Mbps high bit-rate video on the HD-V9000, measure the transfer rate of the actual SD card being used and confirm its real performance.
To ensure stable video play, use of an SD card with a relay rate capability more than twice the bit rate of the video being played is recommended.

Example: When playing a 60 Mbps video file, try to use an SDHC card with an actual transfer rate of about double that, or 120 Mbps.

✧ The transfer speed of an SD card can be measured by the player or by the special HD PILOT support software.
For details, refer to the User's Manual and/or the HD PILOT manual.

✧ • Before using an SD/SDHC card, first initialize it with HD PILOT.
During the initialization process, Video, Picture, Text and System folders are created automatically.

✧ If an error occurs when the SD card is connected to the PC via the card reader and the data in the card is deleted and then new data is written to the card, initialize or format the card using HD Pilot or the application provided by the card manufacturer.

✧ Before copying data from the HDD, etc. to the SD card, compare the data size to ensure that the data will be copied reliably to the card.

9. Precautions When Creating a Time Map Table

The following precautions should be observed when creating a time map table using the HD-V9000 support software, HD Pilot.

- Save and manage the created time map table with the video file.
- If the video file is **re-edited, re-encoded or renamed** after the time map table has been created, be sure to create the time map table again.
- If an error occurs when the time map table is created, it may be due to a stream problem with the video file or
- the video file format may not be supported by the HD-V9000. In this case, check the video file settings or make a stream check.

9.1 Errors Before Creation of the Time Map Table

Before time map table creation is executed using the HD Pilot [Make Time Mat Table] menu, the user is warned that the file is not the prescribed file and the time map table cannot be created.
In this case, the file name is displayed in red.

[Error Conditions]
An error (displayed in red) occurs in the event of failure to comply with the following conditions.(Judgment of file name only)
・The file name contains no more than 120 characters
・The file name consists solely of ASCII characters (halfwidth alphabet or digit characters and symbols: 0x20-0x7f).
(Japanese characters, etc. are not allowed)
・The file name has an extension.
・The extension is .mpeg, .mpg, .m2t or .ts.
・The file name does not contain the following characters: $, ‘, `, @, ~ (tilde), [,]

9.2 Errors During Creation of the Time Map Table

If any of the following errors occurs while creating the time map table with HD Pilot, an error message is displayed in the message column. If a time map table could not be created for a file, “Failed to create Time Map Table for all files” is displayed in the bottom row in the message column and on the pop-up screen. And the Time Map Table is not created.
(Messages in the message column are recorded in the log and can be viewed later.)

Errors

No.	Cause	Error Message
Video format-related		
1-1	The container format is not MPEG-2 TS. AVI, ASF, OGM, MOV, MP4, etc. It is not a video file. (The container cannot be identified.)	Failed to create Time Map Table. This container format is not supported, or it is not a video file.

1-2	The video codec is outside the product specifications (*1) It is not MPEG2 or H.264/AVC.	Failed to create Time Map Table. This video codec is not supported.
1-3	The profile is outside the product specifications (*1). <Product spec profiles> MP/422/422p/HP/H422	Failed to create Time Map Table. This Profile is not supported.
1-4	The signal format is outside the product specifications (*1). <Product spec signal formats> 720*480i/29.97fps 720*576i/25fps 1280*720p/50fps 1280*720p/59.94fps 1440*1080i/25fps 1440*1080i/29.97fps 1920*1080i/25fps 1920*1080i/29.97fps	Failed to create Time Map Table. This video signal format is not supported.
Encoding settings-related		
2-1	Bottom Field First The field order has been encoded with “Bottom Field First.”	Failed to create Time Map Table. Set parameter of "Field Order" to "Top Field First" when encoding.
2-2	There is no sequence header. The GOP sequence header has not been added.	Failed to create Time Map Table. The Sequence Header is not added.
2-3	The interlace cording is MBAFF. The video has been encoded with [Interlace Cording = MBAFF] in the H.264 interlace content.	Failed to create Time Map Table. This video signal format is not supported.
Other		
3-1	The video file is corrupted. (*2) The video file is broken midway .	Failed to create Time Map Table. The file may be corrupted.

*1: Please refer to 7.2. Supported Formats.

*2: All the malfunction of a stream is undetectable.
Therefore, even if the Time Map Table is made, when there is a problem in actual behavior, please carry out stream Check of the video file.

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