

**PHILIPS**

**DRAFT**  
**Technical Manual DVD170**

**CONFIDENTIAL**

## INTRODUCTION

This is a first draft of the technical manual for the DVD170

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# I/O port

The DVD170 professional DVD player can be controlled by an external controller (MMC) or a pointing device via the I/O port at the rear of the player. The connector is a D-sub 9 male.

One and the same interface is used for pointing devices as well as for external control.

- The pointing device protocol has an automatic pointing device protocol activated when the transmission speed is 1200 baud.
- The external control via an MMC is activated when the transmission speed is 9600 baud.

### Pointing device protocol

Communications signals follow the RS-232-C specifications. For details of this see the EIA RS-232-C standard.

- 1 start bit
- 7 data bits LSB first
- 2 stop bits
- Speed 1200 bauds

For pointing devices only two signal lines carry data. The first is RTS, which is always output from the player. The second is RXD, which is always input to the player.

### Device identification pointing devices

Every pointing device is to transmit its type identification (ID) byte on request. This allows the player to identify the device type that is connected to it for maximum flexibility and ease of use.

Device ID sequence

Device ID codes		
Device Type	d6 -- d0	ASCII
Relative	1001101	'M'
Maneuvering	1001010	'J'
Absolute	1010100	'T'
Absolute Screen	1010011	'S'

Pinning input (sub-D9 male on the player):		
pin	signal	I/O
1		
2	RXD	I
3	TXD	O
4	+5V	max 200mA
5	GND	
6		
7	RTS	O
8	CTS	I
9		

I = input signal for the Player  
O = output signal from the Player

### RATINGS:

+5V output from the player:

- accuracy: +5V 10%
- supply current: min 200mA

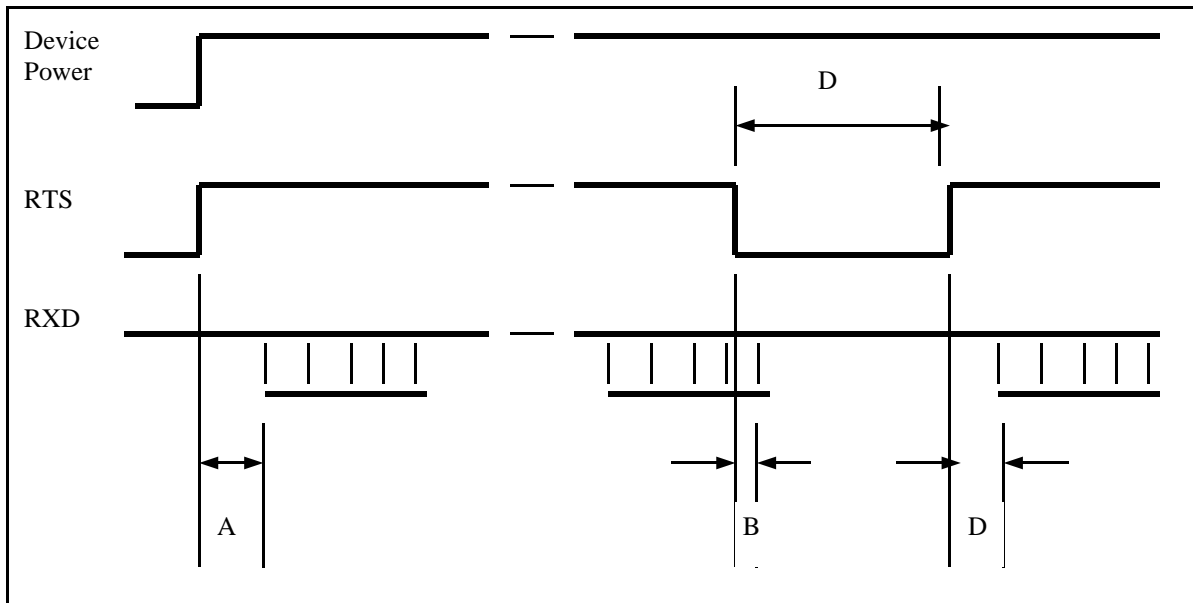
RXD /TXD

- logical 1: -15V < signal level < +0.8V
- logical 0: +2.4V < signal level < +15V  
(Output impedance pointing device max 4.7kOhm)

RTS /CTS

- Off (Negated): -15V < signal level < +0.8V
- On (Asserted): +2.4V < signal level < +15V

This interface allows for pointing devices and accessories which are powered from the player using logic circuits operating on 5V only.



- Negate RTS: Current data transmission to the player is stopped.
  - Assert RTS.
  - The device sends its 1-byte device ID.
- Note: It is advisable to send a complete data packet after the identification byte to establish the state of the buttons.

#### Device ID timing

- A:  
device power-on to ID byte timing
  - Min. 100ms
  - Max. 500ms.
- B:  
negate RTS timing:
  - Min. 10ms
  - Max. irrelevant.
- C:  
Residual data transmission time when RTS is negated:
  - Min. 0 ms.
  - Max. 1 byte period (1200 baud = 8.3ms)
- D:  
Assert RTS to ID byte timing when device is powered:
  - Max. 10ms.

### External controller protocol

The MMC communication is done with the following settings:

- 8 data bits,
- 1 stop,
- no parity bit
- speed of 9600 Baud.

Communication between MMC and DVD player consist of 3 different types of information:

- External control commands
- External control status
- Asynchronous responses

The messages between DVD and MMC look like: “[group, command, parameter-list]r”

A group, command and parameter-list between square-brackets, followed by a carriage-return character.

The group and command are not case sensitive; there is no difference in the usage of uppercase and lowercase characters. The parameter-list exists of comma separated parameters, and are case sensitive.

When the player receives a message from the MMC, it will be acknowledged. This acknowledgment will be done in 2 different ways.

- For external control commands, the acknowledgment will look like:
  - group: group specified in the received message (PC)
  - command: command specified in the received message
  - parameter-list ReturnValue

ReturnValue can have one of the following values

- 0: No error
- x: .....

Example:

- player receives: [PC, RC, 66]r
- player sends: [PC, RC, 0]r

When the MMC receives the response, the player has verified the message (syntax), and the command will be executed (It does not imply that the command is executed without errors).

- For external control status messages there is specified a response message on a request. The response is the acknowledgment of the request.

Example:

- Request: [PS, GetAudioStream]r
- Response: [PS, GetAudioStream, 0, 2]r

When the MMC receives the response, the player has executed the command.

- When an external control command causes an error, an asynchronous error message will be send to the MMC.

Example:

- Player receives: [PC, RC, 44]r
- Player sends: [PC, RC, 0]r
- Player sends: [PR, Error, 10]r

When the MMC receives the response, the player has verified the message (syntax), and when no errors occurred, the command will be executed. If an internal error occurs and the command can not be executed, an error message will be send.

- When the command does not cause an error, but execution of this command changes the state of the player, this status change will be send to the MMC. Also other asynchronous responses, e.g. start of chapter, can be expected.

Example:

- Player receives: [PC, RC, 44]r
- Player sends: [PC, RC, 0]r
- Player sends: [PR, StatusChange, 4]r
- Player sends: [PR, SOC, 2]r

The Disc ID and Provider ID mentioned in this document are from the table “Primary volume descriptor of ISO9660” the fields

- Volume set id
- Publisher ID

## RELATIVE COORDINATE AND MANEUVRING DEVICES

Relative Coordinate devices e.g. Mice, Trackballs and Maneuvring devices e.g. Joysticks and joypads

### Data Flow

During normal operation (RTS asserted):

- Data is sent to the player via RXD.
- Every time the device is moved or button state is changed, 3-byte data packets should be transmitted to the player.
- No data should be transmitted when the device is stationary (in center position) and the button state is unchanged (pressed or released).
- A button state change or device position change should not interrupt a data packet transmission.
- To allow for additional buttons on the pointing device, one additional byte (with d6 =0) may be added to the data package. Systems specified to work with the specific device will react to this byte; other systems will ignore it.

bt 1 = button 1: 1 = pressed  
0 = not pressed

bt 2 = button 2: 1 = pressed  
0 = not pressed

X7..X0: 8-bit data horizontal movement. 2's complement. left direction = negative (\$FF..\$80) right direction = positive (\$01 ..\$7F)

	d6	d5	d4	d3	d2	d1	d0
Byte 0	1	bt1	bt2	Y7	Y6	X7	X6
Byte 1	0	X5	X4	X3	X2	X1	X0
Byte 2	0	Y5	Y4	Y3	Y2	Y1	Y0
Byte 3 (optional)	0						

Y7..Y0: 8-bit data vertical movement. 2's complement. up direction = negative (\$FF..\$80) down direction = positive (\$01 ..\$7F)

A value of \$00 for horizontal or vertical movement indicates no movement in that direction.

## ABSOLUTE SCREEN DEVICES AND ABSOLUTE COORDINATE DEVICES

Absolute screen devices and absolute coordinate devices e.g. Touch Screens, Light Pens.

### Data flow

During normal operation (RTS asserted):

- Data is sent to the player via RXD.
- Every time the pointing indicator is in motion in the active area or a button state is changed, 4-byte data packets should be transmitted to the player.
- No data should be transmitted when the pointing indicator is not in the active area and the button state is unchanged (pressed or released).
- A button state change or device position change should not interrupt a data packet transmission.
- To allow for additional buttons on the pointing device, one additional byte (with d6 =0) may be added to the data package. Systems specified to work with the specific device will react to this byte; other systems will ignore it.

bt 1 = button 1: 1 = pressed  
0 = not pressed

bt 2 = button 2: 1 = pressed  
0 = not pressed

pd 1 = pointing indicator in active area  
0 = pointing device not in active area

X9..X0: 10-bit absolute horizontal

	d6	d5	d4	d3	d2	d1	d0
Byte 0	1	bt1	bt2	X9	X8	X7	X6
Byte 1	0	pd	0	Y9	Y8	Y7	Y6
Byte 2	0	X5	X4	X3	X2	X1	X0
Byte 3	0	Y5	Y4	Y3	Y2	Y1	Y0
Byte 4 (optional)	0						

position. Outermost left position \$000. Outermost right position \$3FF

Y9..Y0: 10-bit absolute vertical position. Outermost upper position \$000. Outermost

**ADDITIONAL BYTES  
POINTING DEVICES**

<b>Key</b>	<b>Value</b>
Keys released	\$00
Menu	\$10
Stand-by	\$11
Mute on/off	\$12
Help	\$1C
Player/TV	\$1D
Volume up	\$1E
Volume down	\$1F
Play	\$20
Stop	\$21
Pause	\$22
next	\$23
Previous	\$24
Search forward	\$25
Search reverse	\$26
Repeat	\$27
Next disc	\$28
Previous disc	\$29
Still forward	\$2A
Still reverse	\$2B
Slow forward	\$2C
Slow reverse	\$2D
Return	\$2E
Open/close	\$3B
#0	\$30
#1	\$31
#2	\$32
#3	\$33
#4	\$34
#5	\$35
#6	\$36
#7	\$37
#8	\$38
#9	\$39
Zoom	\$40
Angle	\$41

## EXTERNAL CONTROL COMMANDS

### External control commands

#### Remote control commands

group: PC  
 command: RC  
 parameter list: RCCode

RCCode: The RC6 code of the remote control signal to execute. See Appendix for the list of commands supported.

Example: [PC, RC, 66]\r

Player will react like the Open/Close button is pressed.

#### Play title

group: PC  
 command: PlayT  
 parameter list: TitleNumber

TitleNumber: Number of the title (DVD) or track (VCD or CDDA) to play

Example: [PC, PlayT, 3]\r

Player will start playing the first chapter of title 3 (in the case of a DVD disc). Player will start playing from the beginning of track 3 (in the case of a VCD or CD-DA disc).

Note: The behaviour of the PlayT and PlayC commands are influenced by the SetPlayMode command.

#### Play chapter

group: PC  
 command: PlayC  
 parameter list: TitleNumber, ChapterNumber

TitleNumber: Number of the title (DVD) or track (VCD) to play  
 ChapterNumber: Number of the chapter (DVD) or entry (VCD) to start in the specified title or track.

Example: [PC, PlayC, 3, 2]\r

Player will start playing chapter 2 of title 3 (DVD) or entry 2 of track 3 (VCD).

Note: The behaviour of the PlayT and PlayC commands are influenced by the SetPlayMode command.

#### Switch on/off OSD

group: PC  
 command: OSD  
 parameter list: Mode

Mode can have one of the following values:

“OFF”: OSD is switched OFF

“ON”: OSD is switched ON

Example: [PC, OSD, ON]\r

OSD is switched ON.

#### Switch on/off LKC

group: PC  
 command: LKC  
 parameter list: Mode

Mode can have one of the following values:

“OFF”: Local keyboard is switched OFF

“ON”: Local keyboard is switched ON

Example: [PC, LKC, ON]\r

Local keyboard is switched ON.

#### Switch on/off RC

group: PC  
 command: RCC  
 parameter list: Mode

Mode can have one of the following values:

“OFF”: RC is switched OFF

“ON”: RC is switched ON

Example: [PC, RCC, OFF]\r

RC is switched OFF. The DVD player will not react on a RC command. RC commands sent via RS232 will be handled.

#### Switch on/off UOPs

group: PC  
 command: UOP  
 parameter list: Mode

Mode can have one of the following values:

“OFF”: the check on UOPs is switched OFF

“ON”: the check on UOPs is switched ON

Example: [PC, UOP, OFF]\r

The DVD player will ignore the UOPs.

#### Set audio stream

group: PC  
 command: SetAST  
 parameter list: AudioStreamNumber

AudioStreamNumber: Number of the selected audio stream

Example: [PC, SetAST, 1]\r

The DVD player will change the audio stream to stream number 1.

**Set sub-picture stream**

group: PC  
 command: SetSPST  
 parameter list: SubPictureStreamNumber

SubPictureStreamNumber: Number of the selected sub-picture stream

Example: [PC, SetSPST, 4]\r

The DVD player will change the sub-picture stream to stream number 4.

**CD-DA lock**

group: PC  
 command: CDDALock  
 parameter list: Lock

Lock can have one of the following values:

- “OFF”: Lock is switched off.
- “ON”: Lock is switched on.

Example: [PC, CDDALock, ON]\r

The DVD player will not play any CD-DA disc until the lock is switched off.

**Provider lock**

group: PC  
 command: PVRLock  
 parameter list: Lock, ProviderID

Lock can have one of the following values:

- “OFF”: Lock is switched off.
- “ON”: Lock is switched on,

ProviderID: Identification of the provider. When Lock is “OFF”, this parameter is ignored.

Example: [PC, PVRLock, ON, Philips]\r

The DVD player will only play DVD discs from the specified publisher. This lock will be activated after closing the tray.

Note: The provider ID is stored on the disc. There is no interface function available to retrieve this information. Furthermore, the provider lock implies a CD-DA Lock.

**Set general parameters**

group: PC  
 command: SetGPRM  
 parameter list: DiscID, Parameter, Value

DiscID: Identification of the disc of which the parameter will be changed

Parameter: Number of the parameter to change

Value: New value of the specified parameter

Example: [PC, SetGPRM, Disc 123, 3, 255]\r

General parameter 3 of the specified disc is set to 255. The new setting will be used when playing is (re-) started and the specified disc is in the tray. When the specified disc is playing, the application will be restarted automatically.

Note: The general parameters are set to 0 upon creation. The general parameters are saved in NVRAM.

**Set all general parameters**

group: PC  
 command: SetGPRMs  
 parameter list: DiscID, Value1, ..., Value16

DiscID: Identification of the disc of which the general parameters will be changed.

Value1: New value of the general parameter 1

...

Value16: New value of the general parameter 16

Example: [PC, SetGPRMs, Disc 123, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16]\r

General parameter 1 is set to 1, ..., general parameter 16 is set to 16. The new setting will be active when playing is (re-)started with the specified disc in the tray. When the specified disc is playing, the application will be restarted automatically.

Note: The general parameters are set to 0 upon creation. The general parameters are saved in NVRAM.

**Set play mode**

group: PC  
 command: SetPlayMode  
 parameter list: PlayMode,

PlayMode is on of the following strings

- “CHAPTER”: The disc will stop when a chapter is played
- “TITLE”: The disc will stop when a title is played
- “DISC”: The disc will start the next title when a title is played

Example: [PC, SetPlayMode, CHAPTER]\r

The play mode is set to chapter play.

Note: The parameter list is case sensitive, thus the mode must be in uppercase



**External control status**

**Player status**

Message from MMC to DVD  
 group: PS  
 command: GetStatus

Message from DVD to MMC  
 group: PS  
 command: GetStatus  
 parameter list: ReturnValue, Status

Status can have one of the following values:

- 0: Error
- 1: Opened
- 2: No Disc
- 3: Stopped
- 4: Playing
- 5: Paused

Example:  
 Request: [PS, GetStatus]\r  
 Response: [PS, GetStatus, 0, 4]\r

The player is in the play state.

**Disc type**

Message from MMC to DVD  
 group: PS  
 command: GetDiscType

Message from DVD to MMC  
 group: PS  
 command: GetDiscType  
 parameter list: ReturnValue, DiscType

DiscType can have one of the following values

- 0: No disc
- 1: DVD
- 2: VCD
- 3: CD-DA

Example:  
 Request: [PS, GetDiscType]\r  
 Response: [PS, GetDiscType, 0, 3]\r

There is a CD-DA disc in the tray

Note: When the player does not recognise the disc, asking the disc type will result in 0: No disc

**Current audio stream**

Message from MMC to DVD  
 group: PS  
 command: GetAST

Message from DVD to MMC  
 group: PS  
 command: GetAST  
 parameter list: ReturnValue, AudioStream-Number

AudioStreamNumber: Number of the current audio stream.

Example:

Request: [PS, GetAST]\r  
 Response: [PS, GetAST, 0, 2]\r

The current audio stream is audio stream number 2.

**Current sub-picture stream**

Message from MMC to DVD  
 group: PS  
 command: GetSPST

Message from DVD to MMC  
 group: PS  
 command: GetSPST  
 parameter list: ReturnValue, SubPictureStreamNumber

SubPictureStreamNumber: Number of the current sub-picture stream.

Example:  
 Request: [PS, GetSPST]\r  
 Response: [PS, GetSPST, 0, 2]\r

The current sub-picture stream is sub-picture stream number 2.

**Number of titles**

Message from MMC to DVD  
 group: PS  
 command: GetNrT

Message from DVD to MMC  
 group: PS  
 command: GetNrT  
 parameter list: ReturnValue, NrTitles

NrTitles: Number of titles (DVD) or number of tracks (VCD, CD-DA) of the current disc.

Example:  
 Request: [PS, GetNrT]\r  
 Response: [PS, GetNrT, 0, 32]\r

The current disc contains 32 titles (DVD) or tracks (VCD, CD-DA).

**Number of chapters**

Message from MMC to DVD  
 group: PS  
 command: GetNrC  
 parameter list: TitleNr

TitleNr: Number of the title (DVD) or track (VCD).

Message from DVD to MMC  
 group: PS  
 command: GetNrC  
 parameter list: ReturnValue, NrChapters

NrChapters: Number of chapters (DVD) or entries (VCD) of the requested title or track.

Example:  
 Request: [PS, GetNrC, 2]\r  
 Response: [PS, GetNrC, 0, 13]\r

Title 2 contains 13 chapters (DVD) or track 2 contains 13 entries (VCD).

### Current title

Message from MMC to DVD  
 group: PS  
 command: GetT

Message from DVD to MMC  
 group: PS  
 command: GetT  
 parameter list: ReturnValue, TitleNr

TitleNr: Number of the current title (DVD) or track (VCD, CD-DA).

Example:  
 Request: [PS, GetT]\r  
 Response: [PS, GetT, 0, 6]\r

The current title (DVD) or track is 6 (VCD, CD-DA).

### Current chapter

Message from MMC to DVD  
 group: PS  
 command: GetC

Message from DVD to MMC  
 group: PS  
 command: GetC  
 parameter list: ReturnValue, TitleNr, ChapterNr

TitleNr: Title (DVD) or track (VCD) number of the current title or track  
 ChapterNr: Chapter (DVD) or entry (VCD) number of the current chapter or entry.

Example:  
 Request: [PS, GetC]\r  
 Response: [PS, GetC, 0, 1 7]\r

Current chapter is chapter 7 of title 1 (DVD) or the current entry is entry 7 of track 1 (VCD).

### Disc ID

Message from MMC to DVD  
 group: PS  
 command: GetDiscID

Message from DVD to MMC  
 group: PS  
 command: GetDiscID  
 parameter list: ReturnValue, DiscID

DiscID: ID of the disc

Example:  
 Request: [PS, GetDiscID]\r  
 Response: [PS, GetDiscID, 0, Disc 123]\r

The ID of the current disc id "Disc 123"

### Download data from DVD disc

Message from MMC to DVD

group: PS  
 command: GetSector  
 parameter list: SectorNr

SectorNr: Address of the sector to start downloading

Message from DVD to MMC  
 group: PS  
 command: GetSector  
 parameter list: ReturnValue, NumOfBytes

NumOfBytes: Number of bytes read from the disc  
 <binary data>: Binary data from the DVD disc found at the specified sector.

Note: The binary data is not within the '[' and ']\r' pair.

Example:  
 Request: [PS, GetSector, 123456789]\r  
 Response: [PS, GetSector, 0, 2048]\r<binary data>

2048 Bytes of <binary data> is read from the DVD disc started from sector 123456789.

Note: The data is only sent in the case the ReturnValue is 0.

### Get general parameters

Message from MMC to DVD  
 group: PS  
 command: GetGPRM  
 parameter list: DiscID, Parameter

DiscID: Identification of the disc of which the parameter will be retrieved  
 Parameter: Number of the parameter to be read

Message from DVD to MMC  
 group: PS  
 command: GetGPRM  
 parameter list: ReturnValue, Value

ReturnValue can have one of the following values  
 0: No error  
 x: .....

Value: Value of the specified parameter.

Example:  
 Request: [PS, GetGPRM, Disc 123, 3]\r  
 Response: [PS, GetGPRM, 0, 255]\r

General parameter 3 of disc with ID Disc 123 is 255.

### Get all general parameters

Message from MMC to DVD  
 group: PS  
 command: GetGPRMs  
 parameter list: DiscID

DiscID: Identification of the disc of which the parameters will be retrieved

Message from DVD to MMC  
 group: PS  
 command: GetGPRMs

parameter list:     ReturnValue, Value1, Value2,  
... Value16

ReturnValue can have one of the following values

0:     No error  
x:     .....  
Value1:     Value of the general parameter 0  
Value2:     Value of the general parameter 1  
...  
Value16:    Value of the general parameter 15

Example:

Request:    [PS, GetGPRMs, Disc 123]\r

Response:   [PS, GetGPRMs, 0, 1, 2, 3, 4, 5, 6, 7,  
8, 9, 10, 11, 12, 13, 14, 15, 16]\r

General parameter 0 has the value 1, general parameter 1 has the value 2, ... and parameter 15 has value 16 of the specified disc.

**Get cyclic buffer**

Message from MMC to DVD

group:        PS  
command:      GetCyclicBuffer

Message from DVD to MMC

group:        PS  
command:      GetCyclicBuffer  
parameter list:   ReturnValue, NumOfBytes

NumOfBytes:    Number of bytes read from the cyclic buffer

<binary data>    Binary data from the cyclic buffer.

Note: The binary data is not within the '[' and ']\r' pair.

Example:

Request:    [PS, GetCyclicBuffer]\r

Response:   [PS, GetCyclicBuffer, 0,  
1920]\r<binary data>

1920 Bytes of <binary data> is read from the cyclic buffer in NVRAM.

The data in the 1920 is organised as follows:

- 60 entries (each 32 bytes) containing sets of general parameter
- each set of general parameters containing 16 general parameters of 2 bytes each.
- the general parameters set are placed in this buffer on basis of most recent set first.

Note: The data is only sent in the case the ReturnValue is 0.

## Asynchronous responses

### End of a title

Message from DVD to MMC  
 group: PR  
 command: EOT  
 parameter list: ReturnValue, TitleNr

TitleNr: Number of the title (DVD) or track (VCD, CD-DA) of which the end is reached

Example: [PR, EOT, 3]\r

End of title 3 (DVD) or end of track 3 (VCD, CD-DA) is reached

Note: This message will be sent if a new title is started or if the disc is finished. It can not be guaranteed that no frames from the next title are played when the stop command is given immediately after the End of title message is received and the disc mode is DISC.

### End of a chapter

Message from DVD to MMC  
 group: PR  
 command: EOC  
 parameter list: ReturnValue, ChapterNr

ChapterNr: Number of the chapter of which the end is reached

Example: [PR, EOC, 2]\r

End of chapter 2 is reached

Note: This message will be sent if a new chapter is started or if the disc is finished. It can not be guaranteed that no frames from the next title are played when the stop command is given immediately after the End of chapter message is received and the disc mode is TITLE or DISC.

### Execution of a command

Notification of a status changes:

Message from DVD to MMC  
 group: PR  
 command: StatusChange  
 parameter list: ReturnValue, ReturnStatus

Status can have one of the following values, and is only valid in the case no error has occurred:

- 0: Error
- 1: Opened
- 2: No Disc
- 3: Stopped
- 4: Playing
- 5: Paused

Example: [PR, StatusChange, 5]\r

Note: The player distinguishes internally more detailed status information, e.g. search forward, search backward, slow forward, slow backward, menu, or setup. This data is not made available. When the player goes to a state which is not made available, no message is sent to the MMC.

### Error notification

Notification of an error:

Message from DVD to MMC  
 group: PR  
 command: Error  
 parameter list: ReturnValue, Error code

A list with error codes is appended

Example: [PR, Error, 4]\r

A command is send to the player which caused an error. Error code 4 identifies the occurred error.

Error codes		
Name	Code	Description
ecEXT_ERR_OK	0	No error
ecEXT_ERR_UNKNOWN	1	Cause of error not known
ecEXT_ERR_INVALID_PARAM	2	Invalid parameter
ecEXT_ERR_INV_BUF_SIZE	3	Message exceeds buffer size
ecEXT_ERR_INV_MSG	4	Message syntax not valid
ecEXT_ERR_INV_CMD	5	Command not valid
ecEXT_ERR_COMM_ERROR	6	Communication error
ecEXT_ERR_FLOW_OFF	7	No more commands can be sent
ecEXT_ERR_FLOW_ON	8	Commands can be sent again
ecEXT_ERR_UOP_ERROR	9	Command not executed due to UOP
ecEXT_ERR_INVALID_NA_DISC_ERROR	10	Command not valid for current disc
ecEXT_ERR_DISC_ERROR	11	Disc read error
ecEXT_ERR_DIRTY_DISC_ERROR	12	Disc error due to dirty disc
ecEXT_ERR_INVALID_COMMAND_STATE	13	Command not allowed in this state of the player
ecEXT_ERR_NO_GPRM_AVAILABLE	14	Requested GPRMs not available
ecEXT_ERR_CMD_NOT_ALLOWED	15	Command to deliver binary data not allowed

Supported RC commands	
Description	RC Code
Standby	012
Stop	049
Play Forward	044
Play Reverse	045
Pause/Step	048
Step Forward	246
Step Backward	245
Fast Run Forward x2	040
Fast Run Forward x4	223
Fast Run Forward x8	224
Fast Run Reverse x2	041
Fast Run Reverse x4	222
Fast Run Reverse x8	221
Slow Run Forward x1/2	034
Very Slow Forward x1/4	217
Slow Run Reverse x1/2	035
Very Slow Reverse x1/4	218
Next	032
Previous	033
Step Up	088
Step Down	089
Step Left	090
Step Right	091
OK	092
TV/DVD	067
FTS	251
Open/Close	066
Reserver for Zoom	247

Description	RC Code
0	000
1	001
2	002
3	003
4	004
5	005
6	006
7	007
8	008
9	009
Select T-C	200
Angle	133
Audio	078
Subtitle	075
Subtitle On/Off	227
C-Menu	084
T-Menu	113
Menu	209
Settings	130
OSD	015
Return	131
Resume	215
Scan	042
Shuffle Play	028
Repeat	029
Repeat A-B	059
Reserved for Aspect Ratio	249
Reserverd for 3D Sound	082

**OVERVIEW OF COMMANDS**

<b>Overview external control commands (group PC)</b>	
command	parameter-list
RC	RCCode
PlayT	TitleNumber
PlayC	TitleNumber, ChapterNumber
OSD	Mode
LKC	Mode
RCC	Mode
UOP	Mode
SetAST	AudioStreamNumber
SetSPST	SubPictureStreamNumber
CDDALock	Lock
PVRLock	Lock, ProviderID
SetGPRM	DiscID, Parameter, Value
SetGPRMs	DiscID, Value1, Value2, ..., Value16
SetPlayMode	CHAPTER   TITLE   DISC

<b>Overview asynchronous response (group PR)</b>	
command	parameter-list
EOT	ReturnValue, TitleNr
EOC	ReturnValue, ChapterNr
StatusChange	ReturnValue, Status
Error	ReturnValue, ErrorNr

<b>Overview external control status (group PS)</b>			
command	parameter-list request	parameter-list response	binary data
GetStatus		ReturnValue, Status	-
GetDiscType		ReturnValue, DiscType	-
GetAST		ReturnValue, AudioStreamNumber	-
GetSPST		ReturnValue, SubPictureStreamNumber	-
GetNrT		ReturnValue, NrTitles	-
GetNrC	TitleNr	ReturnValue, NrChapters	-
GetT		ReturnValue, TitleNr	-
GetC		ReturnValue, TitleNr, ChapterNr	-
GetDiscID		ReturnValue, DiscID	-
GetSector	SectorNr	ReturnValue, NumBytes	Yes
GetGPRM	DiscID, ParameterNr	ReturnValue, Value	-
GetGPRMs	DiscID	ReturnValue, Value1, Value2, ... Value16	-
GetCyclicBuffer		ReturnValue, NumBytes	Yes

## NAVIGATION AND HANDLING NON VOLATILE MEMORY

Navigation commands provides DVD's interactive features.

To provide more complex structures the 24 defined System parameters are available and 16 General parameters.

The 16 general parameters each 16 bit are freely available for uses such as keeping scores, track the status or as a count down timer.

Standard DVD specifies that these registers are set to zero when

- at start-up
- return to a title menu

The following type of Navigation commands are available. They can use the parameters.

- Mathematical operations: Add, Subtract, Multiply, Divide, Modulo, Random
- Logical operations: And, Or, Xor
- Comparison: equal, not equal, less / greater than, etc
- Register operations: Load, Move, Swap, Set-System
- Flow control: Goto, Link, Jump.
- Timer: Count down.

These functions are standard DVD functions available on all DVD-Video players.

The DVD170 has implemented special features allowing to store parameters in a Non Volatile RAM memory area.

These functions are activated using the Disc ID and Provider ID. They are from the table "Primary volume descriptor of ISO9660" the fields

- Volume set id
- Publisher ID

These specific PRODVD features are activated when a DVD-Video disc contains a provider ID ending with "GPRM". The functions described are for such PRODVD discs.

We have defined a "Storage\_Area" and a "Cyclic Buffer"

For a number of different discs we have entries in the "Storage\_Area" each identified by the disc id. Two discs with the same Disc ID are sharing the same "Storage\_Area".

The DVD application can save the set of General Parameters in the "Storage\_Area" and load it at any desired moment controlled by navigation commands.

The following commands are used for that:

- Save all GPRMs, by adding 0 to GPRM[0]
- Load all GPRMs, by subtracting 0 to GPRM[0]

This mechanism allows you to author DVD discs using this feature without special equipment. standard equipment authoring to

Every time the DVD application saves the general parameters in the "Storage\_Area" an entry with the same General parameters is added to the so called "Cyclic\_Buffer".

The data in the "Cyclic\_Buffer" can only be accessed via an external device via the I/O port.

For both the "Storage\_Area" as well as the "Cyclic\_Buffer" a max amount of entries is defined.

When a new entry is placed and the maximum is reached data the oldest data will be deleted.

This means for:

"Cyclic buffer" only the last n-entries are available. (the Disc ID is not relevant). N=60 for the DVD170 "Storage\_Area" the data for the M most recent used Disc\_ID's are available. M=5 for the DVD170.

### Applications

These DVDPRO features allow DVD applications to use features not available on standard DVD players and if desired still have an acceptable functionality on standard DVD players. To trigger your creative ideas the following considerations:

- It allows the DVD application to transfer data from one session to another session. So keep data for the next time the same application is used.
- The progress of on a certain disc can be stored for the next time the same disc is loaded again. This can be a bookmark for restart, the test-results of an educational title, or the total time the application is played.
- Initialising routines (e.g. executed only once or via a hidden hotspot) to define the title behaviour. Allowing validation and/or invalidating after a certain period. Allowing selected parts of the disc to be shown.
- Programming the playback. Favourites selection.
- It allows the DVD application to transfer data from one disc to another disc.
- External devices can read, modify or pre-load the non volatile "Storage\_Area". This allows external systems to read (and if needed reset) accumulated data e.g. scores of tests, hours of title use.
- This allows external systems to load data to influence the playback of the DVD title. E.g. Replace sequence A by B, start-up every morning with sequence C or execute the program for weeknumber x. Start the afternoon program. (note: All these parameters can also be set by an application on a DVD disc.
- The described functions can be combined if needed.