

**Alcorn
McBride
Inc.**



Digital Video Machine HD User's Manual

DVMHD-8400

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Every effort has been made to assure the accuracy of the information contained in this manual, and the reliability of the Alcorn McBride Digital Video Machine HD hardware and software. Errors can sometimes go undetected, however. If you find one, please bring it to our attention so that we can correct it for others. Alcorn McBride welcomes comments and suggestions on the content and layout of its documentation.

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Welcome

Thank you for purchasing The Alcorn McBride Digital Video Machine™ HD. The Digital Video Machine HD, or DVMHD for short, is designed to be an ultra reliable HD video playback source for permanent installations. It can provide hours of superb digital video and audio. We've tried to think of everything you'd need in a stand-alone HD video player – five types of video outputs, three types of audio outputs, GPS and numerous control interfaces make the DVMHD incredibly flexible.

The DVMHD was designed to be a solid-state drop-in substitute for many different brands of DVD players and other types of video players, in a wide variety of applications. With no moving parts, it's far more than a DVD player replacement, offering standard features that go way beyond what ordinary video playback solutions can offer including SMPTE 292M HD-SDI digital video, HDMI, RGB, YPbPr or Composite (SD) analog video, unbalanced audio, Dolby Digital bit stream or S/PDIF digital audio, voltage/contact input control, built-in real-time scheduling, playlists, Ethernet, RS-232, and many other features. The DVMHD is the ultimate choice for almost any installation that requires high quality and reliable video playback

We hope you enjoy using it as much as we enjoyed designing it. Have fun with your new Digital Video Machine HD!

For the most recent documentation, firmware upgrades, and other information on the Digital Video Machine HD, please visit our website at:

<http://www.alcorn.com>

Standard Features

The Digital Video Machine HD offers a wide variety of standard features including:

- Playback of several popular video formats, including H.264 (MPEG4), MPEG2, and VC-1
- Bit rate up to 40 Mbps
- Removable solid-state Compact Flash card
- Scheduled playback using built-in Real Time Clock
- Operates from 9VDC to 36VDC (power supply included)
- GPS (Global Positioning Satellite) triggering capability
- HD video on YPbPr component, HDMI, HD-SDI (SMPTE 292M) outputs
- SD composite video output for easy integration with monitoring systems
- Unbalanced analog audio (stereo) on RCA connectors
- Digital Audio on coax (RCA), HDMI and HD-SDI (SMPTE-292M) connectors
- 1080i, 720p, 480p, 576p, 480i, 576i video output resolutions
- Ethernet interface for control and content transfer
- Stores hundreds of individual video files (Compact Flash)
- Serial RS-232 Control is Pioneer LDP compatible.
- 8 isolated inputs (voltage or contact) provide control of up to 255 files, including playlists.
- Relay outputs provide indication of playback status
- 2x16 LCD display and knob for navigation of system settings and playback features.
- External sync input that supports both C-Sync and Blackburst sync sources

Technical Support

You can obtain information about specifying, installing, configuring, updating and programming your Alcorn McBride Digital Video Machine HD from several sources:

For...	Contact...	When?...
Firmware Updates	http://www.alcorn.com/support	Any Time
Knowledge Base	http://www.alcorn.com/kb	Any Time
E-mail Support	support@alcorn.com	Any Time
Fax Support	(407) 296-5801	M-F 9am-5pm (EST)
Telephone Support	(407) 296-5800	M-F 9am-5pm (EST)

Getting Started

Throughout this manual you will find detailed discussions on all the features of this product. However, you're probably anxious to see your DVMHD play some video first before you dive in to all of that. Below are a few easy steps to show you how to play video from DVMHD right out of the box!

Playing a Test Video

Every DVMHD comes with a Compact Flash card that is preloaded with an Alcorn McBride test clip. The card is already installed in the DVMHD's Compact Flash socket. To get the DVMHD to play this test clip, please follow these step-by-step directions.

- Connect the DVMHD to your display using one of the following outputs:
 - Analog Component Video and Analog Audio
 - HDMI
 - HD-SDI



- Power up the DVMHD using the included power supply. The status LED should briefly blink green and then remain off. The LCD display will also indicate that the DVMHD is initializing, and then display its current status when it's finished.
- When the DVMHD has finished initializing, press in the menu knob. This will enter the 'Main Menu' of the DVMHD's display interface.

The image shows the 'Main Menu' screen of the DVMHD. It has a black background with yellow text. The text reads '---MAIN MENU---' at the top, followed by 'Play Menu' and a right-pointing arrow '>'.

- Select 'Play Menu' by pressing in the knob again.

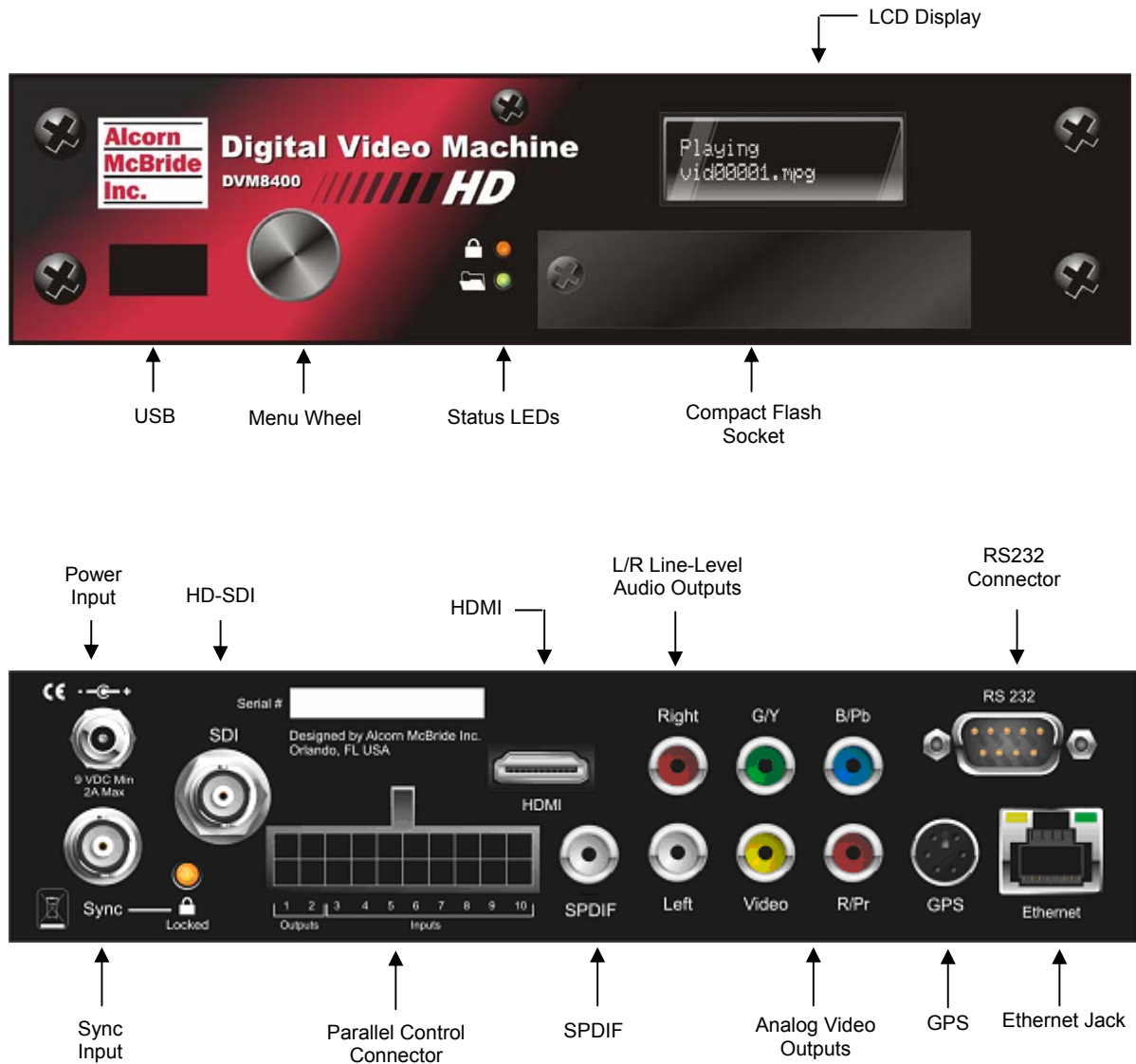
The image shows the 'Play Menu' screen of the DVMHD. It has a black background with yellow text. The text reads '---PLAY MENU---' at the top, followed by 'Play Test File' and a right-pointing arrow '>'.

- Select 'Play Test File' by pressing the knob once more. After this, the DVMHD will begin playing the preloaded test clip. The status LED will turn green to indicate that the DVMHD is playing. Assuming your display is on and configured for the correct video input, you should be seeing video and hearing audio.

NOTE: If you have any trouble identifying any components mentioned in this guide, refer to the diagrams in the **Hardware Information** section.

Hardware Information

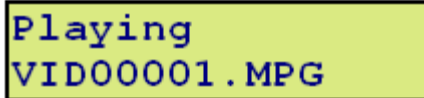
The Digital Video Machine HD provides controls that can accommodate a wide variety of installations. The front panel incorporates a menu wheel, two-line LCD display, status indicators, and a Compact Flash Socket. The rear panel provides the Sync in, HD-SDI, HDMI, Component and composite video, S/PDIF and unbalanced audio outputs, parallel controls as well as GPS, serial and Ethernet ports.



Display and Menu Wheel

Note: The menu wheel 'clicks' when rotated to provide tactile feedback between selections.

The DVMHD is equipped with 2x16 character LCD Display. This display is primarily used to indicate the current status of the DVMHD. Here's an example of that status display:



A rectangular LCD display with a black border. The text is in blue. The top line reads "Playing" and the bottom line reads "VID00001.MPG".

The current playback state is indicated at the top-left of this screen. This state can be any one of the following:

Stopped – Not playing a file

Playing – Playing a file

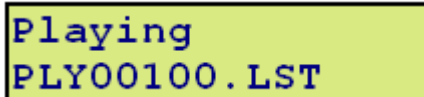
Searched – File is searched and ready to play. 1st video frame on-screen.

Paused – Playback is paused, screen is black.

Stilled – Playback is paused, screen displays stilled image

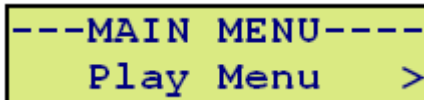
Error – DVMHD has encountered an error (i.e. bad command)

When the DVMHD is **Playing**, **Searched**, **Paused**, or **Stilled** it is actively working with a video or playlist file. Therefore, when in these states the status display also shows the current file on the bottom half of the screen. In the example screen above, the DVMHD is currently playing a file named **VID00001.MPG**. If the DVMHD were playing a playlist, the screen would look something like this instead:



A rectangular LCD display with a black border. The text is in blue. The top line reads "Playing" and the bottom line reads "PLY00100.LST".

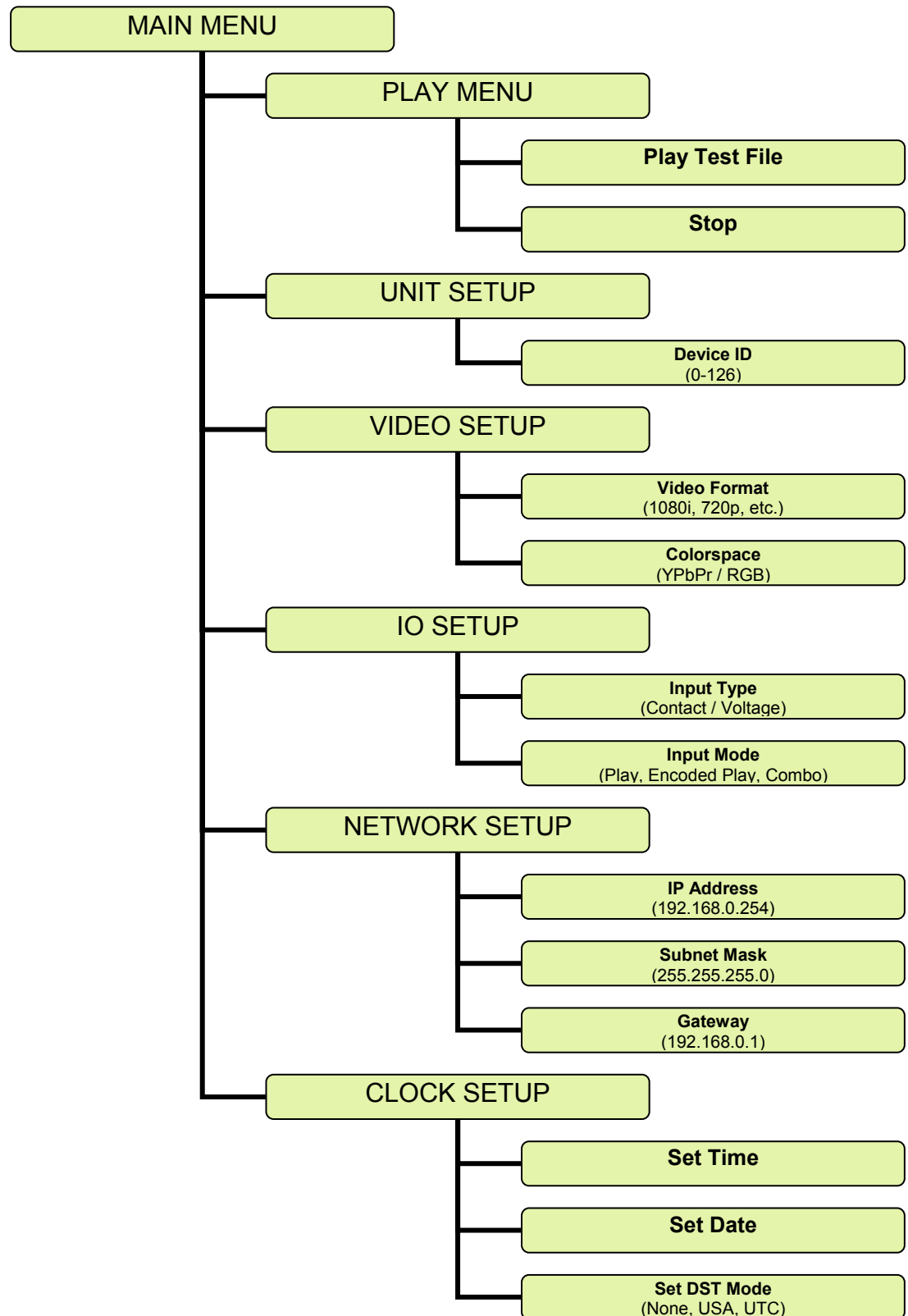
In addition to providing system status, the display can also be used in conjunction with the nearby Menu Wheel to access both configuration settings and simple playback controls for the DVMHD. To enter this menu, simply press in the menu wheel.



A rectangular LCD display with a black border. The text is in blue. The top line reads "---MAIN MENU---" and the bottom line reads "Play Menu >".

After you do this, you can navigate through the various menus of the DVMHD's front-panel interface by rotating the menu wheel to change the selection, and pressing it to select the current item. For a full list of the available menu options, see the **Front-Panel Menu Map** on the following page. When you are finished, simply browse to the 'Exit' selection and push the menu wheel to return to the status screen. If you don't select 'Exit', the menu interface will return to the Status screen automatically after 30 seconds of inactivity.

Front-Panel Menu Map



Indicator LEDs

The Digital Video Machine HD has 3 LEDs that are used to indicate the status of various features of the product. Two of these LEDs are located on the front panel to the left of the Compact Flash socket. The bottom one is the **Status** LED and the top one is the **Lock** LED. The third LED, the **Sync** LED, is located on the rear panel of the DVMHD, and is right next to the Sync input. As you can probably guess, it indicates when a supported video sync source is being detected by the DVMHD's video sync input. Below you will find a detailed description of each LED and their behavior.

Status LED

LED Status	Meaning(s)
Steady green	Playing
Steady orange	Searched, Paused, Stilled, Formatting Media, Updating Firmware
Steady red	Audio Muted
Flashing red	Fault (i.e. bad command, hardware problem, etc.)
Flashing green	Power-on initialization, Search in progress
Single pulse of green	Flash card inserted and detected
Single pulse of red	Flash card removed
Off	Idle (Stopped)

Lock LED

LED Status	Meaning(s)
Off	Not receiving GPS input from GPS antenna
Pulse red	Received message from GPS antenna, but the antenna has not locked on to any GPS satellites.
Pulse green	Received coordinates from GPS antenna

Sync LED

LED Status	Meaning(s)
Off	No video sync detected on sync input
On	Locked to external video sync.

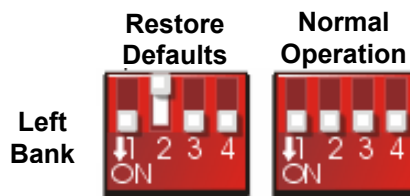
Configuration DIP Switches

Two sets of 4-position configuration DIP switches are located on the side of the DVMHD. These switches allow you to configure various hardware related settings which are explained in this section. In the explanations below, ON refers to the DIP switch being in the DOWN position, while OFF means the UP position.

NOTE: For DVMHD's that are being installed in equipment racks, it's always a good idea to configure the DIP switches before installing the rack mount kit.

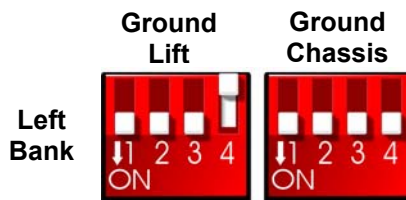
L2 - Restore Factory Defaults

Switch #2 of the left bank of DIP switches allows you to restore all of the DVMHD's configuration settings to the factory default settings. This includes things like IP Address, Username, Password, Video Output Format, etc. For normal operation, this switch should always remain in the ON position. When you wish to restore the settings, simply set the switch to the OFF position for a few moments while the DVMHD is powered on. Leave the switch in the OFF position until the status LED pulses RED to indicate that the settings have been restored, and then return the switch to the ON position.



L4 - Ground Lift

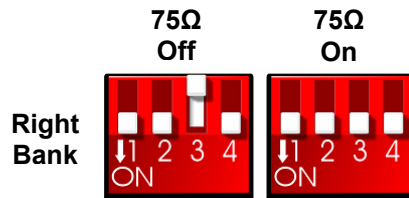
The Ground Lift feature can sometimes help in situations where audio hum, video banding, or other noise is being caused by potential ground loops. A Ground Lift disconnects the internal ground from the DVMHD's metal chassis, reducing the chance of ground noise affecting the DVMHD's electrical systems (i.e. audio outputs, video outputs, etc.). This feature is configured using switch #4 on the left bank of DIP switches. By default, this switch is set to the ON position which grounds the DVMHD to its chassis. You can implement a ground lift by setting this switch to the OFF position. After that, the DVMHD's ground will be isolated from the chassis.



R3 - 75Ω Video Sync Termination

When distributing video sync, it's standard practice to terminate every dedicated video sync line with 75Ω. An ideal system design would provide a dedicated sync line for each DVMHD from the video sync generator. However, there are circumstances where you may need to split a single sync line (typically done using BNC 'T' connectors) so that it can be shared with multiple DVMHD's. In this situation, having termination enabled on every DVMHD in the chain could easily over terminate the line, degrade the signal, and result in the DVMHD's being unable to lock to the sync input. When video sync is distributed in this way, you should disable the 75Ω termination in every DVMHD except for the last one in the chain.

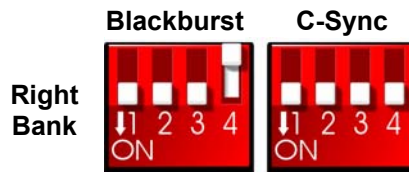
Switch #3 of the right bank of DIP-switch allows you to disable the 75Ω termination if necessary. By default, the DVMHD ships with this switch in the ON position. If you need to disable the termination, just set this switch to the OFF position.



R4 - Sync Input Type (C-Sync/Blackburst)

There are two common types of video sync sources; Composite Sync (C-Sync) and Blackburst. A typical C-Sync signal operates at a peak-to-peak voltage of 4V. However, Blackburst sync signals are typically much lower at less than 1V peak-to-peak. This DIP switch settings allows the DVMHD to reliably support both types despite this drastic difference in signal amplitude.

Switch #4 of the right bank of DIP switches is used to select between the two sync types. By default, the DVMHD ships with this switch in the OFF position, which configures the sync input for Blackburst. If you want to connect a C-Sync generator to the DVMHD, you'll need to set this switch to the ON position for C-Sync operation.



Power Connector

The power input is a captive 2.5x5.5x10mm barrel connector with center pin (+) and the outer rim (-). The Digital Video Machine requires 9.0 VDC to 36.0 VDC at 2 Amp. This is useful for mobile applications where an automotive battery is used to power a DVMHD. An external 100-250 VAC 50/60Hz input universal switching power supply is provided with the unit.

DO NOT EXCEED THE SPECIFIED INPUT VOLTAGE RANGE!

Audio/Video Outputs

The audio RCA outputs provide a standard -10dbu unbalanced signal.

The video output format (1080i, 720p) can be configured using the front-panel menu or with Serial or Ethernet command.

The composite video output always provides a scaled down Standard-Definition output. No configuration necessary.

Every DVMHD comes equipped with many audio and video outputs. Audio is available on the unbalanced RCA, digital coax, HDMI, and HD-SDI connectors. Video is available on the YPbPr component, Composite, HDMI, and HD-SDI connectors.



In most circumstances, all of these outputs are on simultaneously. The only exception is when you are playing content that is encoded with a surround sound format, such as Dolby or DTS. In this case, the analog audio outputs will remain silent.

With the exception of the composite video output, all of the video connectors will output High-Definition video using the configured video format. The composite output, on the other hand, always scales the current output down to a Standard-Definition NTSC or PAL video format. This makes this connector ideal for interfacing to monitoring equipment like rack monitors or touch-panel control systems that accept composite video.

Serial Port: DB-9 Connector

A serial cable is provided with each Digital Video Machine.

This input is a standard DB-9 male RS-232C connector. This port is designed to connect to a Show Controller, Computer, or other control device using a straight-through (**not null-modem**) 9-pin cable. The connector pin assignments are listed in the table below.

Pin	Function
2	TXD (data from DVMHD)
3	RXD (data to DVMHD)
5	GND

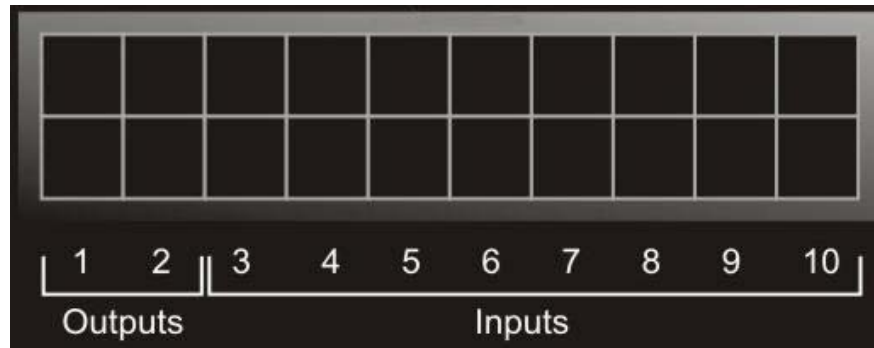
Input/Output Control: 20-pin Connector

Remember to configure the DVMHD's inputs for Voltage or Contact Closure. If you do not, the inputs will not be damaged, but they may not operate correctly. This setting can be configured using the front-panel or via Serial or Ethernet command.

A wiring harness that mates to this connector is included with the DVMHD.

The Input/Output Control connector provides 8 configurable inputs, and 2 dry contact relay outputs. The inputs are software configurable for either Voltage or Contact Closure operation. The behavior of these inputs is also software configurable. The outputs are primarily used to indicate when the DVMHD is in either the **Playing** or **Error** state, although this functionality can be changed in software as well.

For more information on how to use this connector to control the DVMHD, please refer to the **Input/Output Control** section of this manual.



Control Interfaces

Serial Control

The Digital Video Machine HD can be controlled using the male DB-9 RS-232 connector on the rear panel. If you are interfacing to the DVMHD with a PC or other type of controller, you will need to use a straight-through DB-9 Female to DB-9 Female serial cable. For your convenience, this cable has been included with your DVMHD.

This serial interface operates at 9600 baud, no parity, 8 bits per character, and one stop bit (9600,8,N,1).

All serial commands are ASCII based, and are terminated with a carriage return (hexadecimal value 0x0D). The complete list of supported commands can be found in the **Command Protocol** section as well.

For your convenience, Alcorn McBride distributes an application called **AMI Terminal**, which allows you to control the DVMHD via RS-232 with the click of a button. This free application can be obtained at <http://www.alcorn.com>.

Ethernet Control

The Digital Video Machine HD is equipped with an Ethernet interface that allows you to control the DVMHD using a standard Ethernet Protocol called UDP (User Datagram Protocol).

UDP is a very simple Ethernet protocol that allows an Ethernet device to transmit a generic string of data to another Ethernet device. Since UDP is such a broad standard, UDP packets can be generated easily by a large variety of controllers and PC applications. The UDP packet handles all of the complexities of getting the message where it needs to go in one piece. The good news is that you do not have to understand those complexities. As a matter of fact, you only need to know the following information to send a UDP message.

1. **Destination IP Address** – This needs to be the IP address of the DVMHD you intend to control. The default IP address of the DVMHD is **192.168.0.254**.
2. **Destination Port** – This value needs to be the UDP port that the DVMHD is listening to for UDP commands. This value is always **2638**.
3. **Source Port** - This is the UDP port the PC or controller will use to send the UDP message. It does not matter what port you choose, as long as it is a legal UDP port. If you have no idea what a legal UDP port is, just use **2638**.
4. **Data** – This is the actual message that you are sending to the DVMHD. This message needs to be a **Command Protocol** message (i.e. 1PL<CR>).

All UDP commands are ASCII based, and are terminated with a carriage return (hexadecimal value 0x0D). The complete list of supported commands can be found in the **Command Protocol** section.

For your convenience, Alcorn McBride distributes an application called **AMI Terminal**, which allows you to control the DVMHD using UDP with the click of a button. This free application can be obtained at <http://www.alcorn.com>.

Playlist Control

Playlists provide a mechanism for the Digital Video Machine to automatically execute commands in a predefined sequence. Playlists often allow the DVMHD to be used to perform complex functions that would normally require an external controller. Since Playlists can execute any of the commands listed in the **Command Protocol** section, they can perform a variety of functions. These functions could be something as simple as looping a single track, or as complex as user-prompted pacing of playback.

Overview

A playlist zero (PLY00000.LST) will automatically play on power-up.

It is not a good idea to have both a playlist file and a video file with the same number (like PLY00002.LST and VID00002.MPG). If you do, commanding the DVMHD to play file #2 may not produce the desired result (whatever that may be) since the DVMHD is forced to prioritize which file type it should play in that circumstance.

A playlist file is nothing more than a list of DVMHD commands in a text file.

These commands, which are listed in the **Command Protocol** section, are the same commands that are used by all of the DVMHD's control interfaces. Although any of the supported commands can be used, playlists usually contain **Play** commands, which cause the DVMHD to play video clips from the Compact Flash card. When a playlist is being used, the commands are processed in the order in which they appear in the list. The playlist is an ASCII text file and can be made using any ASCII text editor (like notepad) or using the Playlist Builder program available from <http://www.alcorn.com/support/software.html>.

A playlist can be triggered by Serial or Ethernet commands, as well as Inputs on the Input/Output Control connector. As a matter of fact, triggering a playlist is exactly like triggering a video file to play. For example, let's say you send the DVMHD the following serial command:

2PL<CR>

This command will cause the playlist file PLY00002.LST to start playing. Using Input/Output Control to play file #2 will also start PLY00002.LST.

It is a very common requirement in applications for the DVMHD to power up and launch a playlist on its own. This can easily be done by naming the playlist file **PLY00000.LST**. This assigns the playlist file to be clip #0, which directs the DVMHD to play the file upon power up. Since this playlist is associated with clip #0, you can manually start the playlist using any of the control interfaces by specifying clip #0 as the file parameter.

It is also common practice to have one playlist launch another playlist. This is done in the same fashion as playing a video; by using a command like 2PL (where 2 is the number of another playlist). When another playlist is launched, execution of the current playlist will be terminated and the new playlist will begin immediately.

Special Playlist Commands

In addition to regular Digital Video Machine commands listed in the **Command Protocol** section, there are a few additional commands for the Playlist Control interface. These single-character commands further modify the behavior of the playlists to provide additional features that only apply to the Playlist Control interface of the DVMHD. These characters and their functions are listed in the following table:

Command	Description
U	Uninterruptible. Causes the Digital Video Machine to ignore all Input/Output Control triggers (with the exception of 'Stop') and any 'Play' commands. This behavior continues until the playlist becomes interruptible once again using the 'I' command listed below, or by the playlist ending.
I	Interruptible. Restores normal functionality to the Input/Output Control interface as well as the 'Play' command. In this mode, all commands can interrupt the playlist or cause it to advance to the next playlist entry. This is the power-up default.
S	Seamless. Whenever PL commands are located immediately after one another, the playlist will seamlessly transition between video clips. Seamless playlist requires the use of the Play File command. See the Command Protocol section for information on how to use this command. This is the power-up default.
G	Segmented. In this mode, the playlist will not transition between clips seamlessly. There will be a brief delay between clips.
W	Wait. Playlist waits until a 'Resume' input or a 'Play' command occurs before moving on to the next playlist command. This is useful for applications where a user decides when the playlist should move on.
<	Loop. Tells the playlist to loop upon completion. This looping will continue indefinitely until a Stop condition occurs, or another video or playlist file is played.
;	Comment. Ignore all characters until the next line.

Commands may be entered into the Playlist in either upper or lower case. All text following a semicolon (;) is interpreted as comments, until the next line in the file. You may put anything you want in comments, including the special command characters normally used in the Playlist.

One thing to be cautious of when making a playlist is creating an unintended endless loop or uninterruptible wait. For example, if a Playlist contains a '**U**' followed by a Loop Play command, it doesn't matter how many more tracks may occur in it, there is no way to get to them! When using the '**U**' command, always include an '**I**' command before the next **Loop Play** or **W** command, unless this is the desired behavior. Of course, you can always terminate the loop or wait with a **Stop** command.

Example Playlist

Here's an example playlist that will be discussed in detail below to explain the concept of how playlists work in the Digital Video Machine HD.

```
I
1PL    ;You can comment your Playlist file by using
6LP    ;semicolons. All text after a semicolon is
37PL   ;ignored until the end of the line where a
        ;carriage return is encountered.
5PL
<
```

The first command in the playlist is the “I” command. This character places the Digital Video Machine HD into “interruptible” mode, which means that the unit will respond to discrete Select inputs and serial play commands by jumping immediately to the next command in the list. The unit remains in interruptible mode unless a “U” character is encountered.

The next command, which is “1PL”, causes the DVMHD to play video #1. If the user issues a Play command during the playback of video #1, it will be interrupted and the playlist will move on to the next command. If a Play command is not received, the DVMHD will not advance to the next playlist command until video #1 has played to completion.

When video #1 has finished playing, the “6LP” command is executed. This command causes the DVMHD to loop video #6 continuously. This file will continue looping indefinitely until the user issues a Play command or activates the Play input.

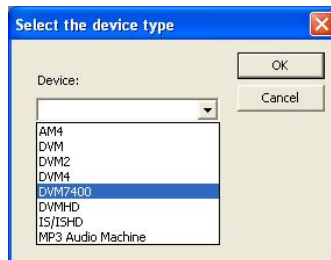
If advanced by the user, video #37 plays followed by video #5. Once video #5 finishes, the “<” character causes the playlist to loop back to the beginning. This means that video #1 will start playing once again.

Using Playlist Builder

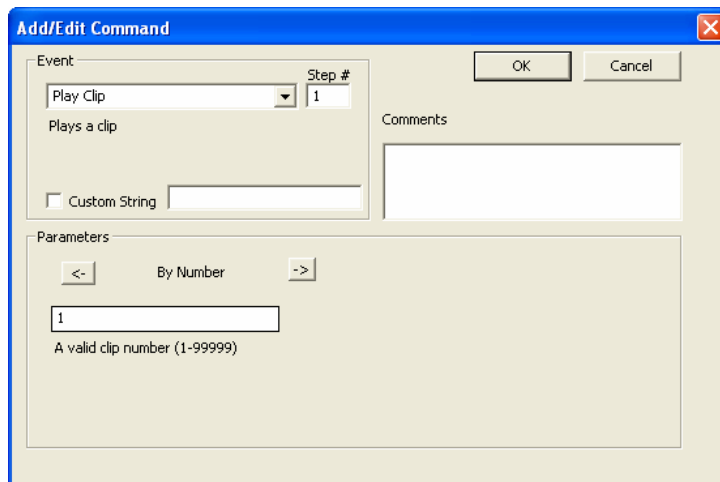
For convenience, Alcorn McBride provides a free Windows application for making playlists using a graphical interface. This program is called Playlist Builder, and it can be downloaded from the software section the Alcorn McBride website at <http://www.alcorn.com>.

Here is a step-by-step guide to get started making playlists with Playlist Builder.

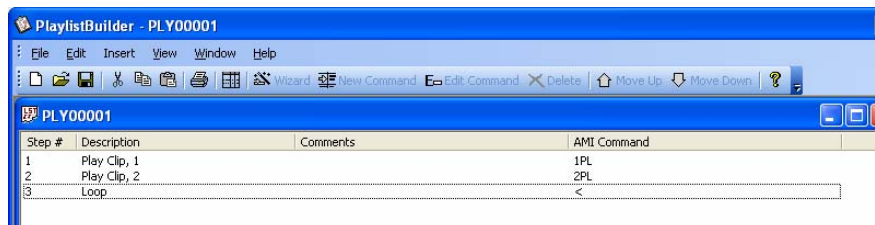
1. Open the Playlist Builder application
2. Select the DVM8400 in the list of supported devices and click OK.



3. Select the event you wish to insert into the playlist. Since "Play Clip" is the event used to play a video, we will use it for this example.
4. Using the arrows in the 'parameters' box, you can select which type of Play command you wish to use. For example, "By Number" would allow you to enter a clip number. "By File" would allow you to enter the actual file name. If you are using the compact flash card that shipped inside your DVMHD, select 'By Number' and enter the number '1' in the field.



5. Click OK to add the event to the playlist



6. Add as many commands as you like! Once you are done, you can save the playlist file and transfer it to your DVMHD!

Scheduler Control

If you plan on using the Scheduler, you should verify that the DVMHD's time and date are set correctly.

The Digital Video Machine has a built-in real-time clock, which can be used to trigger events based on time and/or date. For example, a schedule could be created to play a video at exactly 3:00PM on January 15th 2015, or start looping a video at 8AM every morning and stop looping it at 8PM every night.

The DVMHD can accomplish this type of task using a feature called the **Scheduler**. With a user-created schedule file, the Scheduler can execute any event listed in the **Command Protocol** section of this manual. These scheduled events are accurate down to the minute, and can be programmed to execute once, or repeat periodically (i.e. repeat every Monday, every January 1st, every morning, etc.).

The Digital Video Machine HD obtains schedule information from a file on the Compact Flash card named **schedule.scl**. This file is created using either a text editor (i.e. Notepad) or a free Alcorn McBride application called **Schedule Builder**. The remainder of this section contains information on how to make this schedule file using either method.

Schedule File Format

The **schedule.scl** file itself is nothing more than a formatted ASCII text file. In this file, each line contains a DVMHD command as well as data fields that specify when that command should be executed. This section covers these fields and how they are used to schedule command execution.

Field Summary

Here is a list of the fields that can be used within a scheduled event. Below this table, there are several examples that show how these fields can be used to change the behavior of a scheduled event.

Delimiter	Field
T:	Starting time (hh:mm) (military time – leading zeros for hours required)
D:	Starting date (mm/dd/yy or mm/dd/yyyy . You can use periods, slashes, or dashes to separate dates)
I:	Ending time (hh:mm) (military time)
A:	Ending date (mm/dd/yy or mm/dd/yyyy . You can use periods, slashes, or dashes to separate dates)
E:	Event – This field always contains the COMMAND event
1:	Parameter 1 – This always contains the DVMHD command wrapped in quotes.
R:	Repeat Number: repeat after this number of periods has expired
P:	Repeat Period: Time to wait between executions, used with Repeat Number and Set when necessary
S:	Repeat Set: special case usage described below
;	Although not a field, this marks a comment

Example 1

T:13:46 D:01/1/2010 E:COMMAND 1:"1PL"

This is the simplest possible example because it contains the minimum number of fields needed to execute a scheduled event. Notice that the example occupies only one line of text, and that each field is separated by a space. In order, this is exactly what each field means.

Start Time(T): 1:46pm in the afternoon (**13:46** military)

Start Date(D): January 1st 2010

Event(E): COMMAND – Specifies that parameter 1 contains a DVMHD command

Parameter 1(1): The command string "1PL" will cause the DVMHD to play file #1.

Example 2

T:14:46 D:01/1/2010 E:COMMAND 1:"RJ" ;Stop Playback

Two things have changed in this example.

Start Time(T): 2:46pm in the afternoon (**14:46** military)

Start Date(D): January 1st 2010. (same as Example 1)

Event(E): COMMAND (same as Example 1)

Parameter 1(1): The command string "RJ" will cause the DVMHD to stop playback.

Using Example #1 and Example #2 together in a schedule file will cause file #1 to begin playback at 1:46PM on January 1st, 2010 and stop playback at 2:46PM the same day.

One other thing that is special about this event is that the comment "**Stop Playback**" has been added at the end of the line using a semicolon(;). **Anything found after a semicolon is ignored by the scheduler.** You can even place a comment on its own line, if you like.

Example 3

T:14:46 D:01/1/2010 R:30 P:minute A:1/3/2010 I:3:00 E:COMMAND 1:"1PL"

We've now added:

Repeat Number(R): 30

Repeat Period(P): minute

Ending Time(I): 3am in the morning (**3:00** military)

Ending Date(A): January 3rd 2010

The **Repeat Number** acts as a multiplier of the **Repeat Period**. They should be read in conjunction like this: "**Repeat this event every 30 minutes**".

The **Ending Time** and **Ending Date** fields specify the time and date that the repeating will stop. In this example, the DVMHD will play file #1 on 1/1/2010 at exactly 2:46PM. It will then play the file again 30 minutes later (3:16PM) and will continue to repeat until 3:00AM on 1/3/2010.

Example 4

T:1:00 D:11-28-02 R:4 P:Thursday S:November E:COMMAND 1:"1PL"

The only thing that is new with this example is the **Set** field:

Repeat Set(S): November

A **set** defines a certain range of valid repeat periods. For this example, only the Thursdays in November are eligible for this event. When a **Set** is used in an event, the **Repeat Number** takes on a different meaning. Instead of being a multiplier of the **Repeat Period**, **it and the Repeat Period become an index of the set**. These three fields should be read in conjunction like this: **"Repeat this event every 4th Thursday in November."**

Fields in Detail

There is a summary table in the **Scheduled Events** section that lists all the fields for your reference. Since the Command Event, and event Parameter fields have been discussed, we'll discuss the rest of the fields here.

T: Start Time

The Start Time is the hour and minute your event becomes active. For most cases being active simply means gets executed. You can specify it in military or standard time where 00:00 is midnight, 23:59 or 11:59pm is last minute of the day something can be scheduled. You can also specify **sunrise** or **sunset**. In order to take advantage of sunrise/sunset calculations in the DVMHD, you need to determine you longitude, latitude, and time zone. All three of these settings can be configured remotely using the **Command Protocol** of the DVMHD.

Example:

T:13:30

T:Sunrise

T:Sunset

D: Start Date

The Start Date is the month, day, and year your event becomes active. For most cases being active simple means gets executed. You specify it in a variety of ways. You can use periods, slashes, or dashes to separate the fields of the dates. Dates from the year 2000 to the year 2099 are supported. Leap years are handled automatically.

Examples:

D:01.01.2001

D:01/01/2001

D:01-1-2001

I: End Time

The End Time is the hour and minute your event stops being active. See the T: Start Time section for syntax.

Examples:

I:1:30

I:Sunset

I:Sunrise

A: End Date

The End Date is the month, day, and year your event stops being active. See the D: Start Date section for syntax.

Examples:

D:01.01.2001

D:01/01/2001

D:01-1-2001

R: Repeat Number

The Repeat Number acts differently depending on what other fields it is used with:

- With no Repeat set field present.
- With a Repeat Set field present:

1. With no Repeat set field present:

This is the most common usage of the Repeat Number. It acts as a multiplier of the Repeat Period. They should be read in conjunction like this: **“Repeat this event every <repeat number> <repeat period>”**. Ex. “Repeat this event every 30 minutes”.

The repeat number can be anywhere from 1 to over 4 billion. You can specify repeating a number of minutes, which is why this is so huge. Realistically though, you would specify repeating in years, if it got that large. Whatever combination you choose between Repeat Number and Repeat Period should not multiply out to be greater than a century.

Example:

R:1 ;do it every period

R:117 ;do it every 117 periods

2. With a Repeat Set field present: The Repeat Number and the Repeat Period become an index of the set. These three fields should be read in conjunction like this: **“Repeat this event every <repeat number> <repeat period> in <set>.”**

Ex. “Repeat this event every 4th Thursday in November.”

Although there are many possibilities, we can use an example of holidays to explain what using a set can do for you. Over the period of a year, you may want to schedule events for some holidays. Unfortunately, not all holidays land on the same date every year. By defining a set, along with the repeat number and repeat period, you can choose the first Monday of the month, or whatever you like. Sets can be specific or general.

Example:

R:2 P:Sunday S:May E:Command 1:“1PL” ;Every 2nd Sunday in May Play video #1

R:1 P:Day S:Month E:Command 1:“2PL” ;Every 1st day of every month play video #2

R:2 P:Day S:Month E:Command 1:“4PL” ;Every 2nd day of every month play video #4

R:3 P:Day S:Month E:Command 1:“5PL” ;Every 3rd day of every month play video #5.

....

P: Repeat Period

The Repeat Period defines how long to wait. It is multiplied or indexed according to the presence of a Repeat Set field. (See the Repeat Set and Repeat Number sections for details)

Periods can be one of the following:

Sunrise, Sunset
Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday
Minute
Hour
Day
Year

Notes: Month is not a valid period. If you want to make a monthly schedule, use a combination of repeat number, period and set to do so. See the example in the Repeat Number section for details. You can also specify **sunrise** or **sunset**. In order to take advantage of sunrise/sunset calculations in the DVMHD, you need to determine you longitude, latitude, and time zone. All three of these settings can be configured remotely using the **Command Protocol** of the DVMHD.

Examples:

R:sunday
R:year
R:sunset

I: Repeat Set

Using the Repeat Set field changes the way Repeat Number and Repeat Period operate. Together they act as an index into the Repeat Set. Please read the Repeat Number section above, for a detailed explanation of the different behaviors they take on when the Repeat Set field is present.

For example, in order to create a monthly schedule, you can specify the Repeat Set as **month**.

Sets can be one of the following:

Month
January, February, March, April, May, June, July, August, September, October, November, and December

Examples:

R:5 P:day S:month	;repeat 5 th day of every month
R:2 P:monday S:month	;repeat 2 nd Monday of every month
R:4 P:Thursday S:November	;repeat 4 th Thursday in November

Restrictions

Since the Scheduler is very flexible, it is easier to explain what it cannot do, than to explain what it can.

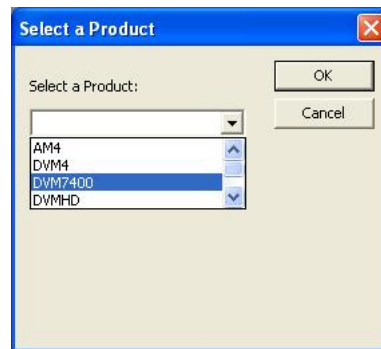
1. Whatever combination you choose between Repeat Number and Repeat Period should not multiply out to be greater than a century. For example, you can't repeat an event every 102 years.
2. One event executes per minute. If you want to execute more than one event, you should launch a playlist with the schedule event. Playlists can execute an unlimited number of commands once they are triggered.

Schedule Builder

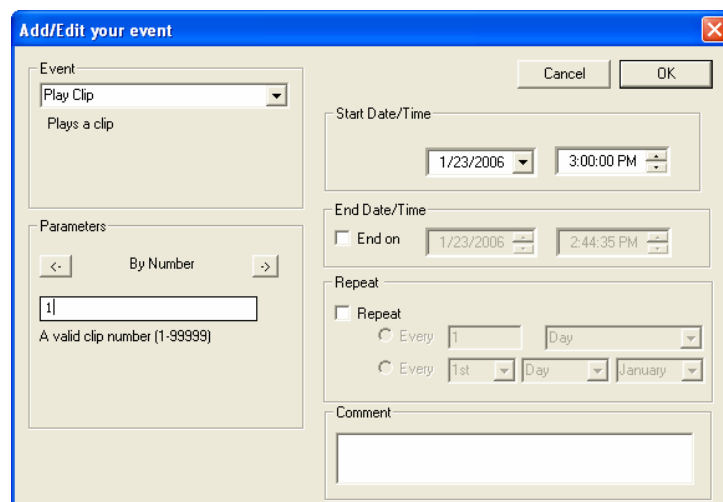
To make creating schedules more convenient, Alcorn McBride provides a free Windows application for making schedules using a graphical interface. This program is called **Schedule Builder**, and it can be downloaded from the software section the Alcorn McBride website at <http://www.alcorn.com>.

Here is a step-by-step guide to get started making schedules with Schedule Builder.

1. Open the Schedule Builder application
2. Select the DVM8400 in the list of supported devices and click OK.



3. The Add/Edit Event window will appear automatically. This is where you select the event you wish to insert into the schedule. Since "Play Clip" is the event used to play a video, we will use it for this example.
4. Using the arrows in the 'parameters' box, you can select which type of Play command you wish to use. For example, "By Number" would allow you to enter a clip number. "By File" would allow you to enter the actual file name. If you are using the compact flash card that shipped inside your DVMHD, select 'By Number' and enter the number '1' in the field.



5. Select the time and date you wish to execute the command in the Start Date/Time section on the right side of this screen.

6. If you only want the command to be executed once, just click OK. However, if you want the command to be repeated (say every hour or every day) you can specify that in the repeat box on the right side of the screen. For the sake of this example, we are going to repeat this command every hour.

Add/Edit your event

Event: Play Clip
Plays a clip

Parameters: By Number: 1
A valid clip number (1-99999)

Start Date/Time: 1/23/2006 3:00:00 PM

End Date/Time: End on 1/23/2006 2:44:35 PM

Repeat: ☒ Repeat
☒ Every 1 Hour
☐ Every 1st Day January

Comment:

Cancel OK

7. Click OK and the event will be added to the schedule.

ScheduleBuilder - sch000001

File Edit View Window Help

New Event New Section Edit Event Delete Event Test Schedule ?

Description of Schedule

Main Show

	StartDate	StartTime	EndDate	EndTime	RepeatNum	RepeatPer	RepeatSet	Event
1	05/12/2005	09:10			1	Day		Play Clip

Play Clip, myvideo.mpg

7. In this screen, you are free to Add/Edit/Delete Scheduled events as needed.
8. Once you are finished creating the schedule, all you need to do is **save** the schedule file as **schedule.scl** and copy it to the Digital Video Machine's Compact Flash card.

GPS Control

Overview

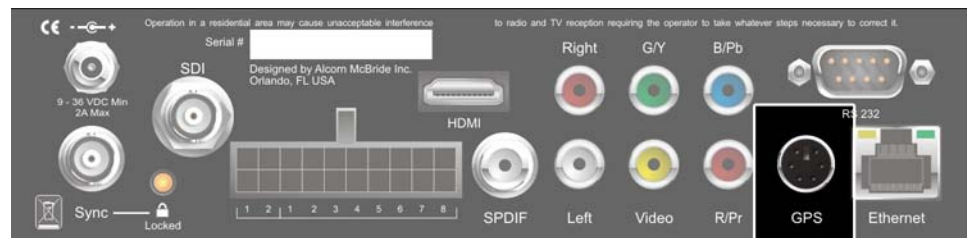
The DVMHD accepts a standard NMEA-0183 data stream at 4800 baud.

Thanks to GPS (Global Positioning System) technology, the Digital Video Machine can automatically trigger videos or playlists whenever it enters into a predetermined geographical area. With this feature you can easily design a “No Operator-Intervention Required” A/V system on a tour bus or tram that automatically plays pre-recorded spiels or videos whenever it enters a specified area.

The DVMHD accomplishes this by reading a data stream from a GPS sensor. This sensor is often in the form of a “GPS Mouse” or pod that outputs Longitude and Latitude data obtained from orbiting GPS satellites. These sensors are commonly used to connect via RS-232 Serial or USB to a laptop computer running mapping or direction-finding software. In the case of the DVMHD, the sensor connects directly to a 6-pin mini-DIN port located on the rear-panel.

The Longitude and Latitude data supplied by the GPS sensor is compared to geographical points stored in a GPS playlist which you create based on your application. Each entry in a GPS playlist contains a command supported by the DVMHD’s **Command Protocol** as well as GPS coordinates that are associated with that command. The incoming coordinates from the GPS sensor are compared to those listed in the GPS Playlist, and when a match is found the specified command is executed. Typically, this command is a ‘Play’ command, so when the vehicle drives into a GPS waypoint a video is automatically triggered to play.

GPS Playlists can be easily created using an Alcorn McBride’s free Windows application called **GPS Builder**.



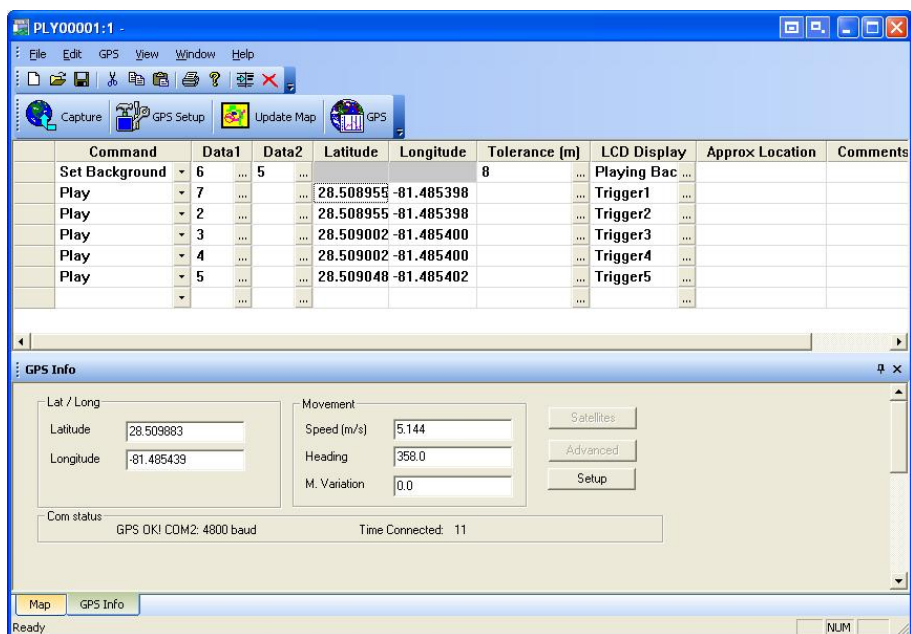
GPS Input

Using GPS Builder Software

What is GPS Builder?

GPS Builder is a graphical tool used to create GPS Playlists for the Digital Video Machine. To accomplish this, GPS Builder has some features that make this process a snap:

- **Direct Support for GPS Input** – GPS Builder automatically detects any NMEA 0183 GPS input source. What this means is that you can connect any GPS sensor to your Laptop, and get real-time geographical information within the GPS Builder application itself. This includes information such as Latitude, Longitude, Speed, Heading, etc.
- **Real-Time Capturing of GPS Points** – When a GPS sensor is connected to your PC, GPS Builder can capture GPS points with the click of a button. This makes programming your GPS trigger points a piece of cake. All you have to do is drive the actual route using a laptop, and record each trigger point as you pass through them. Later, you can fill in the commands that you want to associate with each point.
- **Online Map Support** – GPS Builder interfaces directly with an online map database. This database allows you to click on a location to obtain its longitude and latitude. This information can then be entered into your GPS Playlist. This feature allows users to program GPS Playlists without traveling the actual route.
- **DVMHD Integration** – This application contains a complete list of built-in commands for the DVMHD. There is no need to enter them manually, and all command parameters (i.e. File Name, etc.) are described in plain English.



Main Spreadsheet

The program uses a spreadsheet layout with horizontal rows that represent specific tasks for the DVMHD to execute, and vertical columns that contain the various parameters associated with the particular task. Clicking the small buttons to the right of each cell will provide further help with that cell's contents. The following explains each column in detail.

Command

The Command column contains the command to be executed at a particular Longitude and Latitude (if specified). A pull-down menu of available commands is provided. Often, this command is a Play command because you normally want to play a particular video at a specified location. Other commands such as Set Relay ON/OFF are available as well.

Data Columns

The Data columns are used to supply additional data for commands that require it. For example, a Play command would require data to specify which file to play.

Direction

The Direction column specifies the direction the vehicle must be traveling in order for the trigger to occur. The DVMHD allows for 45 degrees of tolerance for this field, so there's no need to worry about the direction of the vehicle being absolutely perfect. For example, if the heading field is 90 degrees, the DVMHD will accept any heading between 67 degrees and 113 degrees as a valid condition for the trigger.

If you don't require direction to be a factor in the GPS triggers, you can make the GPS trigger Omni-directional by leaving the contents of this field blank.

This field can be filled manually, but is also inserted automatically when using the capture feature of GPS Builder.

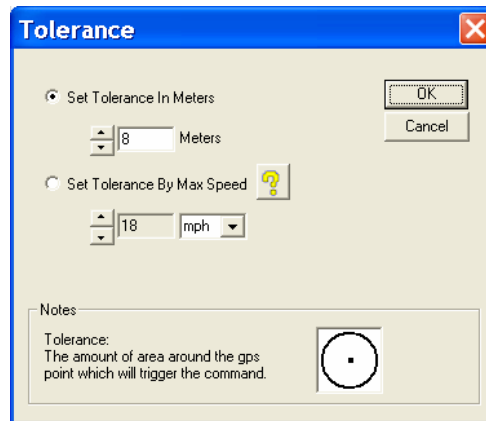
Latitude and Longitude

The Latitude and Longitude fields specify the coordinates the command will be executed. These fields can be entered manually, or they can be inserted automatically using the Capture feature of GPS Builder.

Tolerance

Longitude and Latitude data provided by the GPS sensor is updated at one-second intervals (this is a function of all GPS sensors). As a result, it is extremely unlikely that the exact coordinates entered in the Latitude and Longitude fields will be encountered.

The Tolerance field is used to define the size of a circular GPS 'Zone' around the specified coordinates. The size of this zone can vary greatly depending on the speed at which the vehicle is traveling as well as how far the vehicle can possibly stray from the center of the zone (i.e. a vehicle traveling on a multi-lane highway may not always be in the same lane). Clicking on the button located in this field will reveal a helpful utility for setting the Tolerance based on the size of the zone or speed of travel.



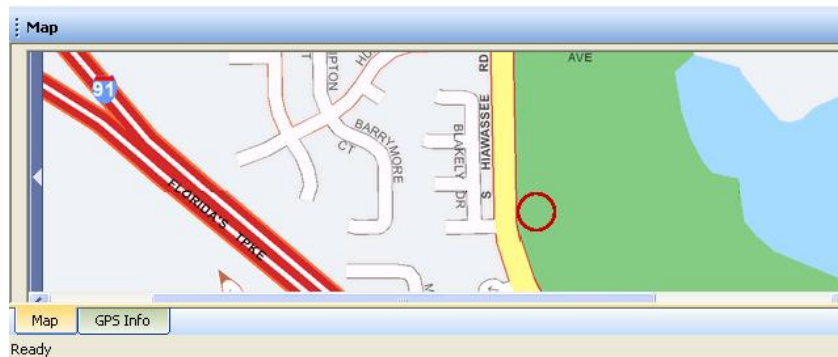
Tolerance can be changed at any time in the playlist. For example, you might want to tighten tolerance for a trigger that occurs while the vehicle is moving slower (or stopped), and need to open it up for when the vehicle is traveling faster. When setting the tolerance, just keep in mind that GPS coordinates are only updated once per second. This update must happen at least once inside the zone for the GPS trigger to occur.

Comments

Both the Approx Location and Comments field are solely for the purpose of describing the location and function of each GPS point. They are not used by the DVMHD.

Map Display

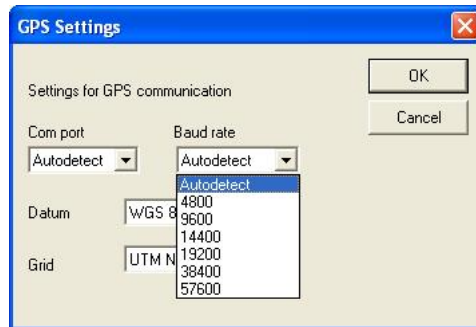
If an Internet connection is present, you can view the location of your GPS point on a map. Click on the map tab at the bottom of your screen. Select the GPS point you wish to view on the map by clicking its row in the spreadsheet. Once you click on the "Update Map" button located at the top of the screen, you should see a red circle indicating the exact location of the selected point.



Aside from displaying coordinates, the Map Display is also useful for entering coordinates. If you click a specific location on the map, the Latitude and Longitude of that location will appear below the map. These coordinates can then be copied and pasted into the spreadsheet.

GPS Device Setup

GPS Builder typically detects when a GPS receiver is connected to your PC. However, if this is not the case, click on the 'GPS Setup' button located at the top of the screen. This screen allows you to specify the COM port and baud rate of the GPS device.



Connecting a GPS Sensor to a PC

In order for GPS Builder to detect latitude and longitude, a GPS sensor must be connected to your computer. This is typically done using a USB→GPS adapter. GPS sensors and supporting USB adapters are commonly available from a variety of companies and distributors. However, for your convenience Alcorn McBride stocks and sells GPS accessories that have been verified to be compatible with GPS Builder and the DVMHD. Be sure to contact Alcorn McBride to get the latest information and availability for these accessories.

Creating a GPS Playlist

Enter subsequent commands on the following rows until you've completed your "tour." Each command can be any of the commands listed in the pull-down menu available in the Commands column.

If you want this GPS Playlist to launch automatically when the DVMHD powers up, name the file "PLY00000.GPS".

GPS sensors need a "line-of-sight" to the sky in order to receive strong satellite signals. For optimal reliability, operation indoors or in long underground tunnels is not recommended.

This is a step-by-step guide on how to use GPS Builder to make a playlist for the Digital Video Machine. Basically what we're going to do is make a "boilerplate" GPS playlist by filling in some DVMHD commands. Afterwards, we will enter GPS coordinates for these commands.

1. Click on the little "down" arrow in the first cell in the **Command** column. Select the **Play** command.
2. Specify the video or playlist number in the Data1 column.
3. Select an initial Tolerance by clicking on the "..." inside the Tolerance cell. This will take you to a convenient screen that allows you to set the tolerance based on certain factors. The primary factor in determining tolerance is usually the speed at which the vehicle is traveling at the moment the trigger is supposed to occur. Other factors might be wide multilane roads, or no roads (i.e. field, lake, ocean, etc.).
4. Repeat this process for all the commands you wish to program. Once all of the commands have been entered, save your GPS Playlist by clicking on **File→Save As...**
5. Connect the GPS sensor/mouse to your laptop. GPS Builder will begin detecting the GPS input stream and will display "GPS OK!" once detection has occurred. When the GPS sensor successfully locks onto the satellite signal, Longitude and Latitude values will begin to update the appropriate fields in GPS Builder. **Note: No Longitude or Latitude information will appear until the sensor locks onto a satellite signal. For some GPS sensors, this may take a few minutes. If your GPS sensor is indoors or otherwise obstructed from satellites it may not lock on at all.**
6. You're now ready to begin entering GPS trigger points. Get in your vehicle! Place the GPS sensor on the roof of your vehicle (or other mounting location recommended by the GPS sensor manufacturer). Click on the first entry in your GPS playlist. Drive to the first desired trigger point and hit the Space Bar when you reach it. GPS Builder will record the coordinate and advance to the next line. After this point all you need to do is hit the Space Bar each time you want to log another coordinate.
7. Drive to the next trigger point and hit the Space Bar again. GPS Builder will record the next coordinate. Keep doing this until all of your coordinates have been entered.
8. Click on File...Save...to save your file. Make sure you name the file in a way that makes it easy to use (i.e. PLY00000.GPS).
9. Copy the playlist to the Compact Flash card you're going to use in the DVMHD, along with all of the videos referenced in the playlist.

Proceed to the next section to learn how to use this playlist in your DVMHD.

Configuring the DVMHD for GPS Operation

The DVMHD is compatible with any serial GPS sensor which outputs a NMEA-0183 data stream at 4800 baud.

The 'Lock LED' of the DVMHD will pulse Green every second whenever an active GPS input is detected.

Unless you are launching a GPS Playlist by other means (i.e. Playlist, Ethernet, etc.), make sure that your GPS playlist is named "PLY00000.GPS".

Now that you have created a GPS playlist file complete with the GPS coordinates, you're ready to use it in the DVMHD. Here's how.

1. First, connect the GPS sensor to the mini DIN connector of the GPS harness.
2. Mount the GPS sensor on the vehicle using the GPS sensor manufacturer's recommendations.
3. Connect the DVMHD A/V outputs to the onboard Audio and Video systems of the vehicle.
4. Insert the Compact Flash card that contains the GPS playlist you prepared in the previous section. Make sure that it also contains all of the videos referenced in the playlist.
5. Connect the DVMHD to the 12VDC vehicle power using a captive barrel power connector (like the one that ships with the DVMHD). The tip of this connector is positive (+), and the shell is negative (-). These connectors can be obtained from Alcorn McBride.
6. After applying power to the DVMHD, wait for it to finish its power up routine. Shortly afterwards, the unit should indicate that it is receiving GPS data from the GPS sensor. At first, the sensor is not likely to be locked on to any satellites so the Lock LED of the DVMHD will pulse RED every second. When the sensor acquires a lock, the LED will start to pulse GREEN every second. At this point, you're ready to go!

Now as you drive around to the programmed Longitude and Latitude points your videos will automatically trigger.

Overlapping GPS Routes

GPS Playlists are not executed in linear fashion. In other words, the order in which GPS Commands are listed within the GPS Playlist is of no importance. That means that you can go through the first trigger in the GPS playlist, and then skip to the fifth trigger for example. There is no need to go in any specific order.

There is only one catch to this mode of operation. What if you want to have the DVMHD play a different video the second time passing through the same point, or what if you only want it to play a video when traveling in one direction? For example, say you want to play an "Arrival" video when passing through a point in one direction, and then play a "Departure" video when passing the same point in the opposite direction.

Fortunately for you, this is handled automatically in most circumstances. Along with Longitude and Latitude, any GPS points you capture with GPS Builder will also record the direction in which you were traveling. As long as you leave this direction information in your GPS playlist, it is factored in when the DVMHD is analyzing the GPS data and comparing it to the GPS playlist. So, if you created a trigger while you were traveling west, the vehicle must be traveling west for the GPS trigger to occur on the DVMHD.

In situations where you don't want direction to be a factor for your GPS triggers, you can delete the contents of the **Direction** field in GPS Builder. When you do this, the GPS trigger becomes Omni-directional. If the vehicle enters the specified coordinates, the trigger will occur no matter what direction the vehicle is traveling.

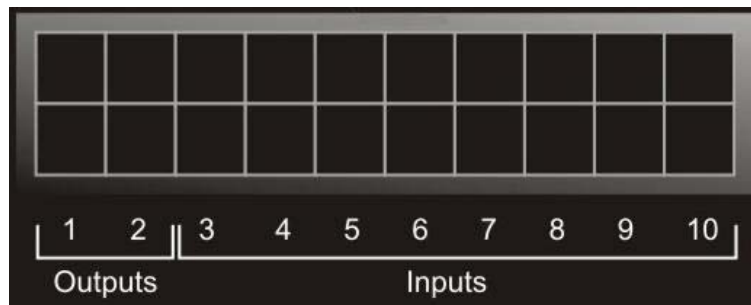
Input/Output Control

Input Control

The inputs can be configured for Voltage or Contact Closure operation using the front-panel menu of the DVMHD.

In addition to the many other methods of control, the Digital Video Machine can also be controlled using 8 programmable inputs. This interface gives you the power to interface the DVMHD directly to kiosk buttons, or other IO based systems (such as PLC's) without the need for additional control devices.

These inputs are accessible on the 20-pin Input/Output Control connector located on the rear-panel of the product. Using software settings, they can be configured to accept either voltage (5-24VDC) or contact closure inputs. The behavior of these inputs can also be changed to suit your application using software settings.



As you can see from this image, the inputs occupy positions 3-10 of the Input/Output connector. Position 3 is Input 1, and position 10 is Input 8. Each position has two contacts; a top and a bottom. When in Contact Closure mode, creating a short-circuit between these two contacts triggers the input. When in Voltage mode, applying the negative (-) terminal of a DC power source to the bottom contact and the positive (+) terminal to the top contact will trigger the input.

How the DVMHD responds to triggered inputs depends entirely upon which mode the Input Control interface is configured to use. Currently, the available modes are as follows:

1. **Play Mode**
2. **Encoded Play Mode**
3. **Combo Mode**

Detailed information about these modes can be found in the following sections.

Play Mode

This is the simplest of the DVMHD's input modes. In this mode, each input is capable of triggering a video or playlist with the same number as the input. For example, triggering input 5 will command the DVMHD to play file 5. This mode gives you the ability to play or loop up to 8 clips. This is the default mode of operation.

The following table summarizes the input behavior when operating in **Play Mode**. As you can see, triggering an input triggers playback of a file. If the input trigger is maintained indefinitely, the file will loop.

Input Number	Function	Description
1	Play File 1	Play Video or Playlist 1 (Hold to loop)
2	Play File 2	Play Video or Playlist 2 (Hold to loop)
3	Play File 3	Play Video or Playlist 3 (Hold to loop)
4	Play File 4	Play Video or Playlist 4 (Hold to loop)
5	Play File 5	Play Video or Playlist 5 (Hold to loop)
6	Play File 6	Play Video or Playlist 6 (Hold to loop)
7	Play File 7	Play Video or Playlist 7 (Hold to loop)
8	Play File 8	Play Video or Playlist 8 (Hold to loop)

Encoded Play Mode

This mode is a little more complex than the default **Play Mode**, but it provides the ability to play up to 255 files using the 8 inputs of the DVMHD. This is accomplished by using the 8 inputs as an 8-bit binary encoded input where Input 1 is the least-significant bit (LSB) and Input 8 is the most-significant bit (MSB).

To make it work, simply apply an 8-bit binary value representing the clip number to the inputs. For example, to play clip number **42** you would apply a binary value of **00101010** to the inputs. The inputs are change-sensitive; that is, when a change is detected, the new file will be played. It is therefore important that the 8-bits change at the same time (<50ms from each other to be exact).

If a file is triggered during playback, the DVMHD will normally interrupt playback and begin playing the triggered clip. The only exception to this rule is when a playlist is currently running and is in an Uninterruptible state. In this situation, the file input will be completely ignored (see the **Playlist Control** section for more information).

The following table summarizes input behavior with **Encoded Play Mode**.

Input Number	Function	Description
1	Play File – Bit 0	Least significant bit of clip number (LSB)
2	Play File – Bit 1	...
3	Play File – Bit 2	...
4	Play File – Bit 3	...
5	Play File – Bit 4	...
6	Play File – Bit 5	...
7	Play File – Bit 6	...
8	Play File – Bit 7	Most significant bit of clip number (MSB)

Combo Mode

The **Combo Mode** gives you access to playback features in addition to Play commands. Specifically, this mode allows you to play up to 15 different videos or playlists. It also allows you to Still, Resume, Stop, or Loop those videos. As a matter of fact, if you've worked with any of the predecessors of the DVMHD-8400, you'll realize that this mode is identical to the mode that those products (i.e. DVMHD-7400, DVM2, PK-8001, etc.) use.

Playing files in this mode is very similar to the Encoded Play, except that you have 4-bits to specify the clip number instead of 8-bits. This allows you to play any clip from **1** (0001 in binary) to **15** (1111 in binary). The inputs are change-sensitive; that is, when a change is detected, the new file will be played. It is therefore important that the four bits change at the same time (<50ms from each other to be exact).

If a file is triggered during playback, the DVMHD will normally interrupt playback and begin playing the triggered clip. The only exception to this rule is when a playlist is currently running and is in an Uninterruptible state. In this situation, the file input will be completely ignored (see the **Playlist Control** section for more information).

The 4 remaining inputs provide direct access to Resume, Still, Stop, and Loop the clip. This functionality is covered in more detail in the following table, which describes how each input behaves in the **Combo Mode**.

Input Number	Function	Description
1	Play File – Bit 0	Least significant bit of clip number (LSB)
2	Play File – Bit 1	...
3	Play File – Bit 2	...
4	Play File – Bit 3	Most significant bit of clip number (MSB)
5	Resume	Resumes playing if paused or stilled. If a playlist is running and is interruptible, this input will skip to the next playlist entry, advance from a playlist Wait command, or advance out of a Loop command (LP).
6	Still	Stills the playlist and/or video that is currently playing. Still image remains on-screen.
7	Stop	Stops the currently playing file. If the file is a playlist, it is aborted even if it's uninterruptible.
8	Loop	This input is intended to be held during activation of the Play File inputs. Doing so causes the specified video or playlist to loop indefinitely from beginning to end.

Status Outputs

In addition to 8 inputs, there are two status outputs provided on the Input/Output connector of the Digital Video Machine. These outputs are dry-contact relay outputs that are rated at 24 VDC and 0.9 amps. Their default function is described below.

Output Number	Function	Description
1	Playing	Closed when the DVMHD is in the 'playing' state
2	Error	Closed when the DVMHD is in the 'error' state

If the default functions of these relays are not useful for your application, you have the ability to manually control these outputs using the **Set Relay Output** command. One practical application is to embed this command in a playlist along with **Play File** commands. This way you can close or open a relay when a video plays or stops. For more advanced applications, the Set Relay Output command can be sent via Serial or Ethernet command at any time.

Please refer to the **Command Protocol** section for details on the Set Relay Output command.

Command Protocol

The Serial, Ethernet, Playlist, Scheduler, and GPS control interfaces use the Pioneer Alcorn McBride Enhanced protocol. This protocol implements nearly all of the Pioneer Laser Disc player command set, but adds commands to access advanced features of the DVMHD as well. This section discusses the most commonly used commands in detail.

The protocol is ASCII-based. Upper or lower case characters can be used interchangeably. **All commands and responses are terminated with the Carriage Return character. This character is represented by the hexadecimal value of 0x0D.**

Addressing Commands

Commands sent to individual units using the address operator (@) will receive a message response, but a wildcard message will not.

Although it is not necessary, any command can be preceded by <ID>@ where <ID> is the ASCII representation of the unit's Device ID ('0'-'126'). This allows commands to be sent to individual units in a control line of multiple units. The address '127' and '*' act as wildcard ID's; a command sent using '127' or '*' as the ID will cause all units in the control line to execute the command. The Device ID can be assigned at any time using the Set Device ID command listed in the later in this section.

Playback Commands

Search File

Description:	This command causes the DVMHD to search the specified A/V clip or Playlist. If a video clip is specified, the first frame of video is displayed on the video output when the search is complete. After a successful search, a Play will cause the specified file to play immediately (meaning less than 1 frame of latency) from the beginning.	
Command Bytes:	nnnnnSE or "<filename>"SE	
Parameters:	nnnnn is the ASCII file number between 0-99999. <filename> is an ASCII file name surrounded by quotation marks.	
Message Response:	R	
Comments:	This is similar to the "Search to Address" command in chapter addressing mode used in Pioneer Laser Disc protocol. The maximum file number is 99999.	
Examples:	Search file 215:	215SE
	Search file 4:	4SE or "vid00004.mpg"SE
	Search file alcorn.mpg:	"alcorn.mpg"SE

Play

Description:	This command causes the DVMHD to play a file that has been searched using the Search File command. This command is also used to resume playback of a clip that has been stilled or paused. If this command is issued while a Playlist is being played, the DVMHD will advance to the next Playlist entry. When this command is sent after a successfully Search, playback will begin immediately (with less than 1 frame of latency).	
Command bytes:	PL	
Message Response:	R	
Comments:	When playback of a video is complete, the DVMHD holds the last decoded frame of video on-screen. This means that if the video ends with a non-black screen, that picture will be displayed until another video file is played.	
Example:	Search File 22:	22SE
	Play Searched File:	PL

Loop Play

Description:	This command works exactly like the Play command in every way except that the searched video or playlist file will continue to loop back to the beginning of the file whenever the end is reached.	
Command bytes:	LP	
Message Response:	R	
Example:	Select File 35:	35SE
	Loop Currently Selected File:	LP

Play File

Description:	This command is very similar to the Play command, except that the file number or name is included in the command. This means that no prior Search File command is required. The other key difference is that this command does not result in instantaneous playback due to the search time that is required prior to playback.	
Command bytes:	nnnnnPL or " <filename> " PL	
Parameters:	nnnnn is the ASCII file number between 0-99999. <filename> is an ASCII file name surrounded by quotation marks.	
Message Response:	R	
Comments:	If the video material ends with a non-black screen, that picture will be displayed until another video file is played. Also, this command is not recommended for use with applications that require precise synchronization with other DVMHD's or other products. Since this command has the Search built-in, there will be an inconsistent delay between the time the command is received and playback actually begins. For synchronous applications, you should use the Search command in conjunction with the Play command.	
Examples:	Play file 215:	215PL
	Play file 4:	4PL or " vid00004.mpg " PL
	Play files alcorn.mpg:	"alcorn.mpg" PL

Loop File

Description:	This command is the same as the Play File command in every way except that the searched video or playlist file will continue to loop back to the beginning of the file whenever the end is reached.	
Command bytes:	nnnnnLP or " <filename> " LP	
Parameters:	nnnnn is the ASCII file number between 0-99999. <filename> is an ASCII file name surrounded by quotation marks.	
Message Response:	R	
Examples:	Loop file 215:	215LP
	Loop file 4:	4LP or " vid00004.mpg " LP
	Loop file alcorn.mpg:	"alcorn.mpg" LP

Play Next

Description:	This command causes the specified video file to be "queued" for playback at the completion of the current activity. If a video is currently playing, the queued transition to the specified file will be seamless. If a file is currently looping, the seamless transition will occur at the next loop point. Playback stops when the end of this video file is reached.	
Command bytes:	nnnnnPN or " <filename> " PN	
Parameters:	nnnnn is the ASCII file number between 0-99999. <filename> is an ASCII file name surrounded by quotation marks.	
Message Response:	R	
Example:	Play File 1:	1PL
	Play File 2 when File 1 is complete:	2PN

Loop Next

Description:	This command works exactly like the Play Next command except that the specified file loops indefinitely.	
Command bytes:	nnnnnLN or " <filename> " LN	
Parameters:	nnnnn is the ASCII file number between 0-99999. <filename> is an ASCII file name surrounded by quotation marks.	
Message Response:	R	
Example:	Play File 1:	1PL
	Loop File 2 when File 1 is complete:	2LN

Still

Description:	This command causes the DVMHD to stop playback at the current position and display a still frame on-screen. Playback will resume from this position on the next Play command. Because the video image is held in a digital buffer, the still frame will be rock solid, and may be held indefinitely without media wear.
Command bytes:	ST
Message Response:	R
Comments:	If a Search File or Play File command is issued while the DVMHD is stilled, it will no longer be possible to resume playback from the stilled point.

Pause

Description:	This command functions exactly like the Still command except that it causes the video output to display black. When a Play command is received, playback will resume and the video output will be restored.
Command bytes:	PA
Message Response:	R
Comments:	If a Search File or Play File command is issued while in Pause mode, it will no longer be possible to resume playback from the paused position.

Stop

Description:	This command causes the DVMHD to stop video playback. The last frame displayed will remain on screen. If a playlist is in progress, this command will cause the playlist to abort.
Command bytes:	RJ
Message Response:	R
Comments:	Once a Stop command has been issued, the only way to start video playback again is to issue a Search File , Play File , or Loop File command.

Audio Mute

Description:	This command can be used to mute and unmute the audio.	
Command bytes:	nAD	
Parameters:	n is 0 (Mute) or 1 (Unmute).	
Message Response:	R	
Comments:	Muting the audio will cause the front-panel status LED to turn red.	
Examples:	Mute Audio:	0AD

Video Mute

Description: This command causes the DVMHD to mute or unmute the video.

Command bytes: **nVD**

Parameters: **n** is 0 (Black screen) or 1 (Normal Output).

Message Response: **R**

Status Request

Description: This command causes the DVMHD to report its current status.

Command bytes: **?P**

Message Response: **Pnn**

Response Data: **nn** is an ASCII number that represents the current playback mode

Response	State
P00	Error
P01	Stopped
P04	Playing
P05	Stilled/Searched
P06	Paused

Examples: Response when DVMHD is Playing: **P04**
Response when DVMHD is Searched: **P05**

Clip Request

Description: This command causes the DVMHD to report the currently playing file.

Command bytes: **?C**

Message Response: **<Filename>**

Response Data: **<Filename>** is the filename of the video or playlist that is active

Examples: Response when vid00001.mpg is active: **vid00001.mpg**
Response when ply00400.lst is active: **ply00400.lst**
Response when alcorn.mpg is active: **alcorn.mpg**

Configuration Commands

Set Colorspace

Description:	This command configures the colorspace format for the component video output of the DVMHD. You can configure this output to use either the RGB or YPbPr colorspace formats.	
Command Bytes:	nVC	
Parameters:	n is a numeric value that represents the colorspace. 0=RGB, 1=YPbPr	
Message Response:	R	
Comments:	The DVMHD is configured with the YPbPr colorspace by default	
Examples:	Set Colorspace to RGB:	0VC
	Set Colorspace to YPbPr:	1VC

Set Video Output Format

Description:	This command configures the video output format of the DVMHD. This output format applies to all of the DVMHD's video outputs, which includes the analog component, HDMI, and HD-SDI outputs. The composite video output will configure itself for NTSC or PAL automatically depending on the output format you specify.	
Command Bytes:	ffffffVO	
Parameters:	ffffff is one of the following ASCII strings that represent the video output format: 1080I29 – 1080i @ 29.97fps 720P59 – 720p @ 59.94fps 480P – 480p @ 59.94fps 480I – 480i @ 29.97 1080I25 – 1080i @25fps 720P50 – 720p @ 50fps 576P – 576p @ 50fps 576I – 576i @ 25fps	
Message Response:	R	
Comments:	The DVMHD is configured with the 1080I29 video output format by default. Although the DVMHD does not natively support a 24p output, it will play 24p encoded videos and perform a pull down conversion to properly display the video.	
Examples:	Set Video Output Format to 720p:	720P59VO
	Set Video Output Format to 1080i:	1080I29VO

Set User Name

Description:	This command sets the user name of the DVMHD. The user name is used to access the DVMHD via the FTP interface over the Ethernet connection. The default user name is admin .	
Command Bytes:	<username>US	
Parameters:	<username> represents a string of ASCII characters that make up the user name.	
Comments:	This string of characters is case-sensitive, and must be between 4 and 32 characters in length.	
Message Response:	R	
Examples:	Set user name to "Administrator":	AdministratorUS
	Set user name to "Fred":	FredUS

Set Password

Description:	This command sets the password of the DVMHD. The password is used to access the DVMHD via the FTP interface over the Ethernet connection. The default password is password .	
Command Bytes:	<password>PW	
Parameters:	<password> represents a string of ASCII characters that make up the password	
Comments:	This string of characters is case-sensitive, and must be between 4 and 32 characters in length.	
Message Response:	R	
Examples:	Set password to "1234":	1234PW
	Set password to "Stretch":	StretchPW

Miscellaneous Commands

Format Media

Description:	This command causes the DVMHD to format the Compact Flash card media that is installed in the Compact Flash socket. This will erase the contents of the flash card!!!	
Command Bytes:	FO	
Parameters:	None	
Message Response:	R	
Comments:	The Message Response is received when the format is complete. All flash cards are formatted using the FAT32 file system.	

Set Device ID

Description:	This command is used to configure the Device ID of the DVMHD. The Device ID can optionally be used to individually address DVMHD's that share the same control line.	
Command Bytes:	nID	
Parameters:	n is a numeric value between 0 and 126 that represents the Device ID	
Message Response:	R	
Examples:	Set the Device ID to 4:	4ID

Software Reset

Description:	This command will reset the DVMHD, just as if the power were cycled.	
Command Bytes:	XX	
Parameters:	None	
Message Response:	None (System will immediately reset without responding)	

Send Serial String

Description:	This command causes the DVMHD to send a user-defined serial string out of its RS-232 control port. This can be handy for using the DVMHD to activate other RS-232 controlled devices (ie. Turning on Displays, Projectors, etc.)	
Command Bytes:	<serial string code>SS	
Parameters:	<serial string code> is a string of coded ASCII characters that tell the DVMHD how to assemble the actual serial message.	
Comments:	The serial string code gives you the capability to assemble any kind of serial message, even those containing non-displayable ASCII characters (ie. Carriage Return, Line Feed, etc.). To include alpha-numeric ASCII characters in your serial string, you simply wrap them in quotation marks. To send hexadecimal bytes, you simply precede the Hexadecimal value with the letter 'h'. To understand exactly how this is done, see the examples below.	
Message Response:	R	
Examples:	Send the ASCII string "Start": Send the ASCII string "Start" terminated by a CR: Send the hexadecimal characters 0x01 0x02 0x03:	"Start"SS "Start"h0dSS h01h02h03SS

Set Relay Output

Description: This command allows you to manually control the 2 relay outputs on the DVMHD's Parallel control connector.

Command Bytes: **<Code>RL**

Parameters: **<Code>** is one or more characters that define which relay to control, and what state it should be in. The available codes are:

1P = Turns ON Play Relay
0P = Turns OFF Play Relay
1F = Turns ON Fault Relay
0F = Turns OFF Fault Relay
XP = Returns Play Relay to default operation
XF = Returns Fault Relay to default operation

Comments: Once a relay is manually set or cleared, it will no longer resume its default operation. For example, the Play relay will no longer turn on and off automatically depending on the playback mode. The relays will remain in the commanded state until they are changed manually once again, or until the **X** parameter is used to return them to default operation

Message Response: **R**

Examples: Turn ON Play Relay **1PRL**
Turn OFF Fault Relay: **0FRL**
Return Play Relay to default operation: **XPRL**

Command Protocol Summary

The following tables list all of the commands that are supported by the DVMHD. Additional playlist commands can be found in the Playlist Control section of this manual.

Playback Command List

Description	Command Bytes	Response	Comments
Search File (Number)	nnnnnSE	R	n = File number (0-99999)
Search File (Name)	"<filename>"SE	R	<filename> = filename with extension (ie. Test.mpg)
Play	PL	R	Plays selected file
Loop Play	LP	R	Plays and loops selected file
Play File (Number)	nnnnnPL	R	n = File number (0-99999)
Play File (Name)	"<filename>"PL	R	<filename> = filename with extension (ie. Test.mpg)
Loop File (Number)	nnnnnLP	R	n = File number (0-99999)
Loop File (Name)	"<filename>"LP	R	<filename> = filename with extension (ie. Test.mpg)
Play Next (Number)	nnnnnPN	R	n = File number (0-99999)
Play Next (Name)	"<filename>"PN	R	<filename> = filename with extension (ie. Test.mpg)
Loop Next (Number)	nnnnnLN	R	n = File number (0-99999)
Loop Next (Name)	"<filename>"LN	R	<filename> = filename with extension (ie. Test.mpg)
Still	ST	R	Picture remains
Pause	PA	R	Picture goes black
Stop	RJ	R	Picture remains
Audio Mute	nAD	R	n=0(Mute), n=1(Unmute)
Video Mute	nVD	R	n=0(Black Screen), 1=(Normal)
Status Request	?P	P0n	n=0(Error), 1(Stopped), 4(Playing), 5(Stilled/Searched), 6(Paused)
Clip Request	?C	<filename>	<filename> = ASCII filename

Configuration Command List

Video Configuration Commands			
Description	Command Bytes	Response	Comments
Set Colorspace	nVC	R	n=0(RGB), n=1(YPbPr)
Get Colorspace	VC	n	n=0(RGB), n=1(YPbPr)
Set Video Output Format	ffffVO	R	ffff=1080i29,720p59,480p,480i,1080i25,720p50,576p, or 576i
Get Video Output Format	VO	ffff	ffff=1080i29,720p59,480p,480i,1080i25,720p50,576p, or 576i

Ethernet Configuration Commands			
Description	Command Bytes	Response	Comments
Set IP Address	xxx.xxx.xxx.xxxIP	R	
Set Subnet Mask	xxx.xxx.xxx.xxxSM	R	
Set Gateway	xxx.xxx.xxx.xxxGW	R	
Get IP Address	IP	xxx.xxx.xxx.xxx	
Get Gateway Address	GW	xxx.xxx.xxx.xxx	
Get Subnet Mask	SM	xxx.xxx.xxx.xxx	
Set FTP User Name	<Username>US	R	<Username> = ASCII user name (up to 32 characters)
Get FTP User Name	US	<Username>	
Set FTP Password	<Password>PW	R	<Password> = ASCII password (up to 32 characters)
Get FTP Password	PW	<Password>	

Scheduler & GPS Commands			
Description	Command Bytes	Response	Comments
Set Time Zone	nTZ	R	n=GMT time offset (ex. EST is -5TZ)
Get Time Zone	TZ	n	n=GMT time offset (ex. EST is -5TZ)
Set Longitude	nLO	R	n=Longitude ex. 26LG, n26LG, -15LG, s15LG
Get Longitude	LO	n	
Set Latitude	nLA	R	n= latitude ex. 26LA, w26LA, -15LA, e15LA
Get Latitude	LA	n	
Set Date	mm/dd/yyDA	R	
Get Date	DA	mm/dd/yy	
Set Time	hh:mm:ssTI	R	Military time (ie. 23:01:02)
Get Time	TI	hh:mm:ss	Military time (ie. 23:01:02)
Set DST Enable	nSD	R	n=1(DST On),n=0(DST Off)
Get DST Enable	SD	n	n=1(DST On),n=0(DST Off)
Set DST Type	nnnDT	R	nnn = USA, UTC, or AUS
Get DST Type	DT	nnn	nnn = USA, UTC, or AUS

Miscellaneous Commands			
Description	Command Bytes	Response	Comments
Format Media	FO	R (upon completion)	All data on media will be erased!
Send Serial String	<string>SS	R	Sends string out serial port. See detailed command for information on how to build the string.
Set Device ID	nID	R	n = Device ID (0-126)
Get Device ID	ID	n	n = Device ID (0-126)
Get Firmware Version	?V	DVMHD-8400 Vx.xx	x.xx = Firmware Version
Set Relay Output	nnRL	R	nn = 1P (turns on Play relay) nn = 0P (turns off Play relay) nn = XP (auto Play relay) nn = 1F (turns on Fault relay) nn = 0F (turns off Fault relay) nn = XF (auto Fault relay)
Software Reset	XX	--	Same as power-on reset.

Command Error Codes

If an error occurs, any **R** response will be replaced by a message in the form of **Enn** (where **nn** represents the error code). These error codes are listed in the following table.

Error Code	Description	What to Do:
E01	Hardware Error	System experienced an error when applying the specified setting or attempting the specified action.
E04	Feature Not Available	Have you entered the correct command? Make sure your DVMHD's firmware is up to date, and double-check that you have entered the command correctly.
E06	Invalid Argument	The parameters of the command are not formatted correctly. Double-check the syntax of the command and make sure you have entered everything exactly as this documentation indicates.
E12	Search Error	The DVMHD is unable to find the specified file, or is unable to play the specified file due to an incompatibility issue. Make sure you have named and encoded the video file according to the specifications covered in the Media Files section of this manual.

Media Files

The DVMHD supports a variety of common industry-standard video and audio formats. However, the files loaded onto the Compact Flash cards must adhere to some specific encoding and file-naming requirements in order to playback properly in the DVMHD. This section provides detailed information on those requirements so that you can successfully create and load content into the DVMHD.

Supported Video File Types

The possibilities of storing audio and video content in a digital file format are nearly endless, so it's impossible for the DVMHD to support everything. Instead, the DVMHD supports a few specific file types, which are listed below:

- **MPEG2 Video Elementary Stream** (Video Only)
- **H.264 Video Elementary Stream** (Video Only)
- **VC-1 Video Elementary Stream** (Video Only)
- **MPEG Transport Stream** (Video and Audio)

The first three types are easy to explain. A video elementary stream is a **video-only** file that is encoded using the associated video format. For example, an H.264 elementary stream is a video file that contains nothing more than H.264 video (no audio, no channel data, etc.).

An MPEG Transport Stream is a little more involved. A Transport Stream can contain both Video and Audio tracks that are intended to play simultaneously. This is because a Transport Stream is actually both a Video Elementary Stream and Audio Elementary Stream combined (multiplexed) into single file. The Video and Audio streams contained within the transport stream can be any of the formats supported by the DVMHD (listed later in this section). For example, the DVMHD will play an MPEG Transport Stream that contains an H.264 video stream and an AAC audio stream. It will just as easily play a file that contains an MPEG2 video stream and an MPEG1 audio stream. The combinations of video and audio formats you choose to use are entirely up to you, as long as you use formats that are supported by the DVMHD.

File Naming

A specific file naming convention is used so that the DVMHD can identify the file type, as well as associate the any supported file types with a number. Here is a table that shows the naming conventions based on the type of file that is being named:

File Type	File Naming Style
MPEG2 Video Elementary Stream	VIDnnnnn.M2V
H.264 Video Elementary Stream	VIDnnnnn.H264
VC-1 Video Elementary Stream	VIDnnnnn.VC1
MPEG Transport Stream	VIDnnnnn.MPG
Playlist	PLYnnnnn.LST
GPS Playlist	PLYnnnnn.GPS
Schedule	SCHEDULE.SCL

As you can see from this table, the files are identified based on the file extension. For example, the DVMHD will identify a file with an extension of **H264** as an H.264 Elementary Stream.

The file number is determined by the 5-digit '**nnnnn**' portion of the file name. The DVMHD supports files that are assigned numbers between 0 and 1023, so this part of the filename is always represented as **00000** through **01023**.

Just as an example, let's say you wanted to create a Transport Stream that you wanted to associate as file #123. To do this, you would need to rename the video file to VID00123.MPG.

The one exception to the numbering method is the schedule file. The DVMHD only supports a single schedule, and therefore there is only one file name permitted for this file. As you can see in the table above, this filename is **SCHEDULE.SCL**.

Note: Every file on the media must have a unique number in the file name, no duplications are allowed. If you have duplicate file numbers (i.e. two files associated as file #1), the DVMHD would consistently choose only one of those files when told to play the associated number.

Auto-executing Media Files – File Number 0

By naming your media files a certain way, you can get them to run automatically after the DVMHD powers up. This is accomplished by assigning a video clip, playlist, or GPS playlist with a file number of 0. For example, if you named a video **VID00000.MPG** it would automatically play once on power up.

For situations where you want to play a video more than once (i.e. loop) or you want to play many different videos, you can use a playlist instead. A playlist named **PLY00000.LST** will automatically start running after power up.

Regarding the schedule feature, this method does not apply. Instead, the schedule file **SCHEDULE.SCL** is automatically launched upon power up.

Video Formats

The DVMHD supports a variety of different video formats including MPEG-2, H.264, and VC-1. As discussed previously in this section, these formats can be encoded as Video Elementary stream files (**h264**, **m2v**, or **vc1**) or within Transport stream files (**mpg**).

MPEG-2 Video Specifications

The decoder within the DVMHD is compliant with **Main Profile/High Level** MPEG-2 specified in ISO/IEC 11172-2 and ISO/IEC 13818-2. The table below summarizes the encoding parameters necessary for creating MPEG-2 video that is compatible with the DVMHD. Keep in mind that MPEG-2 video can be encoded for the DVMHD in one of two different forms. You can encode it as an MPEG-2 Video Elementary Stream (like VID00001.M2V), or you can encode it within an MPEG Transport Stream (like VID00001.MPG).

Setting	Values
Profile	Main
Level	High
Max Bitrate*	40Mbps (40000kbps)
Resolutions	1080p** – 1920x1080 1080i – 1920x1080 720p – 1280x720 480p, 480i – 720x480 576p, 576i – 720x576
Frame Rates***	NTSC – 23.976fps, 29.97fps , 59.94fps PAL – 24fps, 25fps, 50fps
Aspect Ratios	16:9 & 4:3
Chroma Format	4:2:0

* Both Constant (CBR) and Variable (VBR) bitrate are supported, so long as the bitrate does not exceed the maximum.

** Although the DVMHD supports playback of 1080p24, 1080p25 and 1080p30 files, it does not support playback of 1080p60 files.

*** The DVMHD will perform framerate conversions based on the Video Output format for which it has been configured. However, in some cases this conversion is very difficult and may result in unsatisfactory playback. For example, playing a 24fps file on a 29.97fps output will work nicely. However, playing a 25fps (PAL) video on a 29.97fps(NTSC) output usually produces undesirable results. Keep this in mind when configuring the DVMHD's video output and encoding content.

H.264/MPEG-4 Video Specifications

The decoder within the DVMHD supports level 4.1 high profile H.264 video, also known as MPEG-4 part 10 or AVC. The table below summarizes the encoding parameters necessary for creating H.264 video that is compatible with the DVMHD. Keep in mind that H.264 video can be encoded for the DVMHD in one of two different forms. You can encode it as an H.264 Video Elementary Stream (like VID00001.H264), or you can encode it within an MPEG Transport Stream (like VID00001.MPG).

Setting	Values
Profile	High
Level	4.1
Max Bitrate*	30Mbps (30000kbps)
Resolutions	1080p** – 1920x1080 1080i – 1920x1080 720p – 1280x720 480p, 480i – 720x480 576p, 576i – 720x576
Frame Rates***	NTSC – 23.976fps, 29.97fps , 59.94fps PAL – 24fps, 25fps, 50fps
Aspect Ratios	16:9 & 4:3
Chroma Format	4:2:0

* Both Constant (CBR) and Variable (VBR) bitrate are supported, so long as the bitrate does not exceed the maximum.

** Although the DVMHD supports playback of 1080p24, 1080p25 and 1080p30 files, it does not support playback of 1080p60 files.

*** The DVMHD will perform framerate conversions based on the Video Output format for which it has been configured. However, in some cases this conversion is very difficult and may result in unsatisfactory playback. For example, playing a 24fps file on a 29.97fps output will work nicely. However, playing a 25fps (PAL) video on a 29.97fps(NTSC) output usually produces undesirable results. Keep this in mind when configuring the DVMHD's video output and encoding content.

VC-1 Video Specifications

The decoders within the DVMHD support advanced profile level 3 Microsoft VC-1 (WMV9) video. The following table summarizes the recommended encoding parameters for creating VC-1 video that is compatible with the DVMHD:

Setting	Values
Profile	Advanced
Level	3
Max Bitrate*	8Mbps (8000kbps)
Resolutions	1080p** – 1920x1080 1080i – 1920x1080 720p – 1280x720 480p – 720x480 576p – 720x576
Framerates***	NTSC – 23.976fps, 29.97fps , 59.94fps PAL – 24fps, 25fps, 50fps
Aspect Ratios	16:9 & 4:3
Chroma Format	4:2:0

* Both Constant (CBR) and Variable (VBR) bitrate are supported, so long as the bitrate does not exceed the maximum.

** Although the DVMHD supports playback of 1080p24, 1080p25 and 1080p30 files, it does not support playback of 1080p60 files.

*** The DVMHD will perform framerate conversions based on the Video Output format for which it has been configured. However, in some cases this conversion is very difficult and may result in unsatisfactory playback. For example, playing a 24fps file on a 29.97fps output will work nicely. However, playing a 25fps (PAL) video on a 29.97fps(NTSC) output usually produces undesirable results. Keep this in mind when configuring the DVMHD's video output and encoding content.

Audio Formats

When encoding video files as Transport Streams, it is possible to play audio along with video. Here are the supported audio formats:

Format	Variations
MPEG	MPEG-1 Layer I/II, MPEG-2 Layer II
AAC	MPEG-2 AAC, MPEG-4 AAC LC 2-Channel
AC3*	Dolby® Digital EX, Pro Logic® II, MLP and DTS®

*AC3 audio streams are not decoded in the DVMHD. They are only streamed from the digital audio outputs of the DVMHD, and must be decoded using an external AC3 decoder or receiver.

File System Limitation – 4GB File Size

The Digital Video Machine HD uses the FAT32 file system to store files on the Compact Flash card. This file system is widely used, and will allow your flash cards to be accessible from any Windows based PC or MAC computer.

Although the supported volume size of Compact Flash cards is much larger, the maximum file size supported by FAT32 is 4GB. Your computer will prevent you from copying a file any larger than this to the Compact Flash card.

If your application requires a longer playback time than a 4GB limitation will allow, the best solution is 'split' your file into several segments using a file-splitting program. One suggestion is a software package called File Splitter, which can be downloaded at <http://www.filesplitter.org/>. Using this method, a large file can be separated into several segments which the DVMHD can treat as a single coherent video file. Here's how it works.

Let's say that you have encoded a 10GB Transport Stream file that you want to play in the DVMHD. First, you will need to use a utility (like File Splitter) to divide this file into several chunks smaller than 4GB. To be safe, you could divide the file into 2GB chunks. When the splitting process is complete, you should have 5 files. Rename those files like this:

VID00001.MPG

VID00001.001

VID00001.002

VID00001.003

VID00001.004

Keep in mind that VID00001.MPG is the first segment, VID00001.001 is the second segment, and so on. When you are finished renaming the files, copy them to the DVMHD's Compact Flash card.

At this point, all you have to do is treat VID00001.MPG as you normally would. For example, if you send a command to Play File #1, the DVMHD will automatically play through all of the file chunks without you having to do anything special. You can also send a command to Loop File #1, and the entire file will loop from start to finish just as you would expect.

If the File Splitter software is no longer available, please obtain the latest manual from the Alcorn McBride website, or contact technical support for the latest recommended method for splitting files.

Transferring Files to the DVMHD

There are 2 ways to transfer files to the Digital Video Machine. The most common way is to copy the files to the Compact Flash card directly using a USB or PCMCIA Compact Flash card reader. You can also transfer files over an Ethernet connection using the DVMHD's File Transfer Protocol (FTP) interface.

Copying Files Using a Compact Flash Card Reader

Here is a step-by-step procedure for copying files from your computer to the Compact Flash card using a Compact Flash card reader:

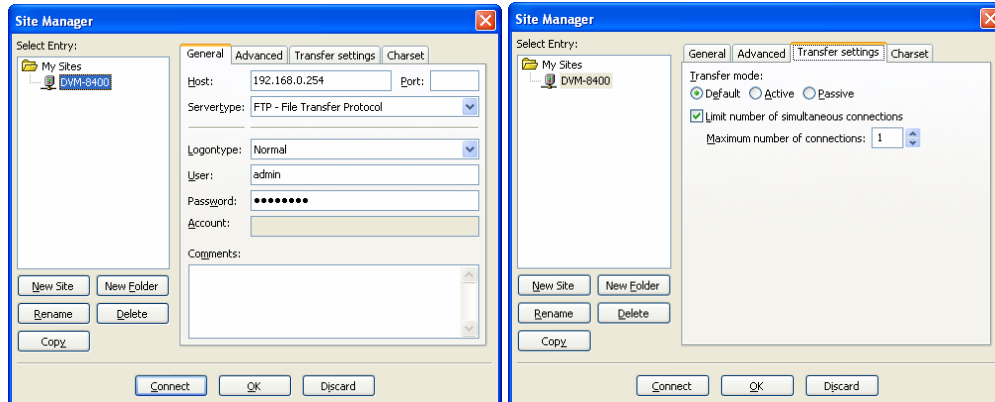
- You will need a Compact flash card reader for your computer. Most of these are available with a USB interface, but there are also some available for IEEE-1394 (Firewire) and PCMCIA.
- Remove the card from the DVMHD (Power off the unit. Remove the front panel's metal plate, and look inside and push the square ejector button to get it out.)
- Insert the Compact Flash card into your computer's card reader, and look for the drive letter your computer has assigned to your Compact Flash Card drive. In Windows, you can do this in the 'My Computer' window. The computer will see the Compact Flash card as an extra drive, like **F:**.
- Copy and Paste your media files to the Compact Flash card. Again, in Windows this can be done with 'My Computer' or 'Windows Explorer'.
- When you are finished copying files to the flash card, **DO NOT REMOVE IT FROM THE CARD READER**. You must first tell your computer that you will be removing the device. In Windows, you do this by double-clicking on the 'Safely Remove Hardware' icon on the right side of the windows taskbar (system tray). Select the Compact Flash card reader from the list, and click the 'Stop' button. Do not remove the card until Windows says that you may do so safely. ***Removing the card too soon may corrupt the contents of the flash card.***
- Remove the card from your computer, and place it back in the Digital Video Machine.

Copying Files Using an FTP Connection (FileZilla)

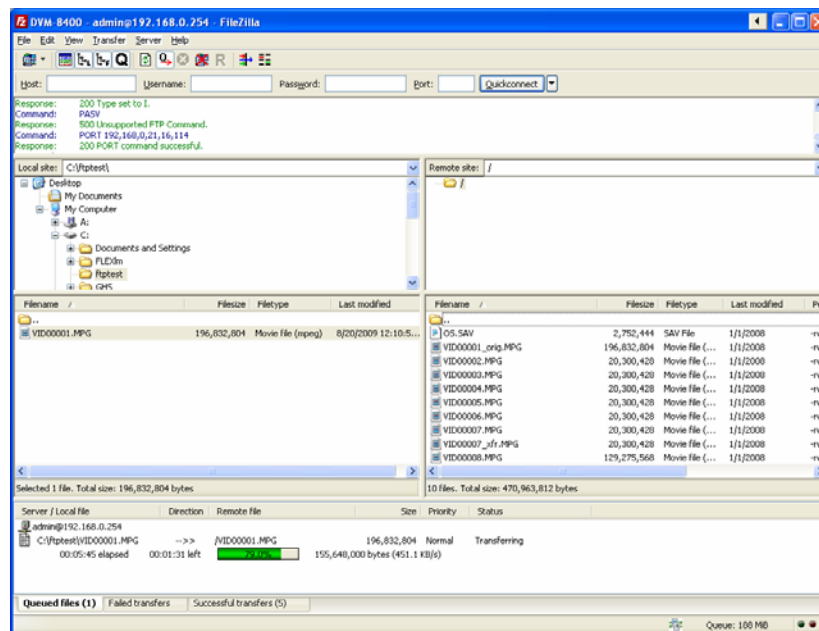
This procedure provides step-by-step instructions on transferring files to the Digital Video Machine over Ethernet using the File Transfer Protocol (FTP) protocol. This procedure assumes that you already have the DVMHD configured to operate on the same network as your computer. You can do this by configuring your computer to be on the same network as the DVMHD's default IP address of 192.168.0.254 and using the including red crossover cable, or you can configure the DVMHD's IP address to integrate it with your network. Either way, make sure your DVMHD is networked properly with the computer before proceeding with this procedure.

- Also, there are many different FTP software packages out there. In this example, we're going to use a very common free FTP client program called **FileZilla**.
- Download and Install the FileZilla software from <http://filezilla-project.org/>

- Launch FileZilla and then open the Site Manager by clicking **File→Site Manager...**
- Click on the **New Site** button and enter **DVMHD-8400** as the site name.
- Enter the DVMHD's IP address in the **Host** field. The default IP address of the DVMHD is **192.168.0.254**.
- Select **FTP – File Transfer Protocol** as the **ServerType**, and select **Normal** as the **LogonType**.
- Enter the username and password. The default username for the DVMHD is **admin** and the default password is **password**.



- Click on the **Transfer Settings** tab, and then check the box labeled **Limit Number of Simultaneous Connections**. Make sure the number of simultaneous connections is set to 1.
- Now, click on the **Connect** button to establish an FTP connection.
- Once you are connected, the contents of the DVMHD's Compact Flash card will be display on the right side of the program. You can now use this interface to drag and drop files to/from the DVMHD from your PC. The status of the transfer is displayed at the bottom of the window.



- When you are finished transferring files, click the **Disconnect** button at the top of the FileZilla program.

Synchronization

One of the most powerful features of the Digital Video Machine is its ability to synchronize to an external video source. This ability makes the DVMHD a perfect solution for the following type of applications:

- **Synchronized playback on multiple displays** – Any application that entails side-by-side displays, edge-blended projectors, or 3D projection require perfect frame synchronization between multiple video sources. Without it, each display would be playing a different portion of the video at different times, ruining the desired effect.
- **Tightly Synchronized Shows** – Since the DVMHD can slave to an external video clock; it has the ability to keep perfect time with other devices that are slaved to the video clock as well. Some examples of these devices might be other video players, audio players, SMPTE Generators, or Show Controllers.
- **Broadcast Applications** – For reasons that are beyond the scope of this manual, broadcasters typically require all of their video equipment to be slaved to an external sync source.

Configuring the DVMHD for External Sync

Sync Mode

In order to lock several DVMHD's together with External Sync, you will need a Video Sync Generator. If you require advice or product recommendations, please contact your Alcorn McBride representative.

The Digital Video Machine is designed to accept either of the two most widely used types of sync; Composite sync and Blackburst sync. Once you determine what type of sync source you intend to use, you must set the Sync Mode DIP-Switch to the corresponding type. If you are using Composite sync (typically referred to as C-Sync), the Sync Mode DIP-switch must be in the ON position. Therefore, setting the DIP-switch to the UP position would configure the DVMHD for Blackburst sync. Setting this switch is necessary for the DVMHD to interpret the sync signal reliably.

75Ω Termination

It is always good practice to terminate every active sync line with 75Ω. This means that the 75Ω DIP-switch should always be ON whenever the DVMHD is receiving sync directly from a sync generator or video distribution amplifier. The only occasion where you would want to disconnect the 75Ω termination is when you are 'splitting' a sync line. An example of this would be daisy-chaining a single sync line to multiple DVMHD's using BNC T-Connectors. In this scenario, you would only want to terminate the last DVMHD in the chain.

Video Format

The last important step in configuring a Digital Video Machine to receive external sync is verifying that the video format of the DVMHD matches that of the incoming sync signal. For example, you do not want to feed a PAL sync signal into a DVMHD configured for an NTSC video format (like 1080i29.97 or 720p59.94). If you were to do so, the DVMHD would reject the sync signal and generate its own instead. The DVMHD would indicate this by turning OFF the yellow sync LED. The DVMHD's video format can be changed at any time using the front-panel configuration menu or Serial/Ethernet commands.

The yellow LED located next to the sync connectors only illuminates when a sync signal is detected. This indicates that the DVMHD is using that sync signal to generate video.

Synchronizing Multiple DVMHD's

The most common application of Digital Video Machines equipped with the External Sync option is synchronizing multiple machines. When implemented properly, this capability allows several DVMHD's to maintain perfect frame synchronization with one another. This is a critical requirement for applications that involve:

- Adjacent Displays intended to form a larger image (Video Wall)
- Edge-blended projectors (same concept)
- 3-D Theatres (require separate video sources for the left and right eye)

In order to accomplish perfect frame synchronization between DVMHD's, two requirements must be fulfilled. First, **all DVMHD's must be locked to the same video sync source**. This is the only way to guarantee that they will display each frame at exactly the same moment. It is also the only way to keep the machines from 'drifting', which results from them playing at slightly different speeds. The second requirement is that **all DVMHD's must be told to play at exactly the right moment, and at exactly the same time**. To be more specific, this moment is just after a new video frame is encountered. Telling the DVMHD's to play at this precise moment ensures that they all have time to process the 'Play' command and make preparations to begin playback when the next video frame is encountered. If the Play command is issued too close to the end of a frame, this will likely result in the players starting at slightly different times. This is because some players might process the 'Play' command in time for the next video frame, while others might still be processing the 'Play' command (forcing them to wait until the next frame). The result of this is that each video has the potential to be out of sync by +/-1 video frame. For many synchronized applications, that is an unacceptable margin of error.

The following sections contain information on how to meet these requirements and achieve perfect frame synchronization between multiple DVMHD's.

Sharing Video Sync Between DVMHD's

The first step in sharing video sync between DVMHD's is to obtain a Video Sync generator. Although Alcorn McBride does not manufacture this product, they are commonly available from many different manufacturers. Once you have a generator, sharing video sync is just a matter of wiring the sync generator to the DVMHD's. Here's how it's done:

1. First, verify that each DVMHD is configured to receive the type of sync outputted from the sync generator. Blackburst is the most common, but C-Sync is also supported.
2. Verify that the 75 Ω sync termination of each DVMHD is enabled.
3. Using standard BNC cables connect the sync input of each DVMHD to a dedicated output on the sync generator. Verify that the yellow sync LED of each DVMHD illuminates when the connection is made.

If you've successfully completed these steps, you're ready to move on to the next section about triggering these DVMHD's to play in sync.

Triggering Synchronized DVMHD's Simultaneously

If you remember the discussion at the beginning of the **Synchronizing Multiple DVMHD's** section, you'll recall that there are two requirements for playing synchronous video. We've already taken care of the first requirement in the **Sharing Video Sync Between DVMHD's** section, so now it's time to take care of the second part; telling the DVMHD's to play simultaneously at the correct moment.

Accomplishing this requires a control system with enough RS-232 control ports or Ethernet capability to interface to each DVMHD as well as the ability to accept an external video sync source. Alcorn McBride specializes in designing and manufacturing these types of controllers. Each of our show controllers has feature sets that allow them to support different applications. To determine which controller is best for your application, be sure to check out our website at <http://www.alcorn.com> and/or contact an Alcorn McBride representative.

When you are ready to install the controller, you should connect its sync input to the same sync source you are using for your DVMHD's. Once you have done that, you just need to establish communications between the DVMHD and Show Controller using the appropriate cabling.

The only remaining work is to write a script, or program, using a Windows application called WinScript. This script is what is eventually transferred to the controller to tell it what to do and when. Although writing scripts for our show controllers is beyond the scope of this manual, there is an example script called *SYNC2UNITS* included with WinScript that implements synchronized playback between 2 video players. This is a great place to pick up the basics without the need to create a script from scratch.

Power Up Operation

When power is first applied to the Digital Video Machine, it briefly blinks the Status LED green. It then checks to see if a new firmware file exists, or if a track or Playlist should be played, according to the following priority:

- Check the Compact Flash card for an OS.NEW file. If found, the firmware is updated and the file is renamed to OS.SAV.
- Launch schedule (schedule.scl)
- Launch GPS Playlist #0 (PLY00000.GPS)
- Launch Playlist #0 or Video #0 (Playlist gets priority)

Updating Firmware

You can download the latest firmware upgrades for your Digital Video Machine HD (DVMHD-8400) from the firmware section of our website at <http://www.alcorn.com>.

Follow these directions to update the DVMHD's firmware:

- First, determine the firmware version of your DVMHD-8400 by watching the LCD display as you power up the machine. Compare that version number to the version number listed on the website. If you need an upgrade, continue.
- Download and extract the zipped firmware update file to your PC from the Alcorn McBride website.
- Copy the **OS.NEW** file to your Compact Flash Card. Use the **Transferring Files to the DVMHD** section if you need help doing this.
- Load the Compact Flash Card into the DVMHD
- Power on the DVMHD
- The status LED will turn ORANGE during the update process, and the LCD will display the current status of the update.
- Wait firmware update to finish (usually takes 30 seconds or so).
- You're done. If you wish to verify the version, you can power off the DVMHD and repeat the first step in this procedure.

Troubleshooting Guide / FAQ

If you don't find an answer to your question here, have a look at our Knowledge Base at <http://www.alcorn.com/kb/index.html>. We're always updating it with new answers and useful information!

Q: I have several files on my Digital Video Machine HD. When I try to play one of them, a different file plays.

A: All file names and numbers should be unique. You should not have, for instance, two files named VID00005 (ie. VID00005.MPG and VID00005.H264, or have a file named VID00003.MPG, along with a PLY00003.LST).

Q: I have created a playlist using Windows, but the DVMHD reports an error when I try to play it. What's going on?

A: Windows sometimes uses its own filename extensions, or adds extensions that are hidden when viewed in Windows Explorer. Make sure that Windows Explorer is configured to show file extensions, and make sure that file does not have two extensions (i.e. ply00010.lst.txt).

Q: Can I control the Digital Video Machine with your show controller?

A: Yes. There is a protocol file specifically designed to operate the Digital Video Machine (DVMHD-8400). If it is not already bundled in your version of WinScript, check the protocols section located in our Library at <http://www.alcorn.com>.

Q: What brands of Compact Flash Cards do you recommend? Where do I get one?

A: We don't have a brand we endorse, but we know cards from SanDisk work in the DVMHD. You can typically get them from a local camera shop, computer supply store, or online. They need to be ATA compatible. Also check our Knowledge Base at <http://www.alcorn.com/kb/index.html>. Once there, type in Compact Flash to see if we have added anymore supported brands to our list.

Q: I copied video files to a flash card, but when I press select the 'Play Test File' option on the front-panel menu the status LED just flashes red. Why isn't it playing my file?

A: The DVMHD's 'Play Test File' feature plays the lowest numbered video file on the flash card. Do the files you've copied follow the DVMHD numbering convention (vidxxxxx.mpg)? Have you encoded the video files according to the information provided in the **Media Files** section of this manual?

Q: I am trying to play a video file, but the DVMHD seems to have trouble playing it. The video is playing slow and/or I am seeing distortion or 'blocking'. What am I doing wrong?

A: First, verify that you have not exceeded the maximum bitrate for the video codec you have used to encode the video file. If you have done so and this problem persists, it may be possible that the encoder is going beyond the bitrate you have specified. If so, try reducing the bitrate or using Constant Bitrate (CBR) instead of Variable Bitrate (VBR). It's also very important that the DVMHD's Compact Flash memory is fast enough to maintain the high transfer speeds required for playback.

Q: I am trying to play a video file on the DVMHD. I hear audio, but the video output is black. What's happening?

A: *The video portion of your file is most likely not compatible with the DVMHD for one reason or another. Perhaps it was encoded with a 4:2:2 chroma format (whereas the DVMHD only supports 4:2:0)? Another common mistake is encoding the file for 1080p60, which is not supported by the DVMHD. To fix the problem, use the information provided in the Media Files section to change the appropriate setting(s) of your encoding software, and re-encode the video with a supported format.*

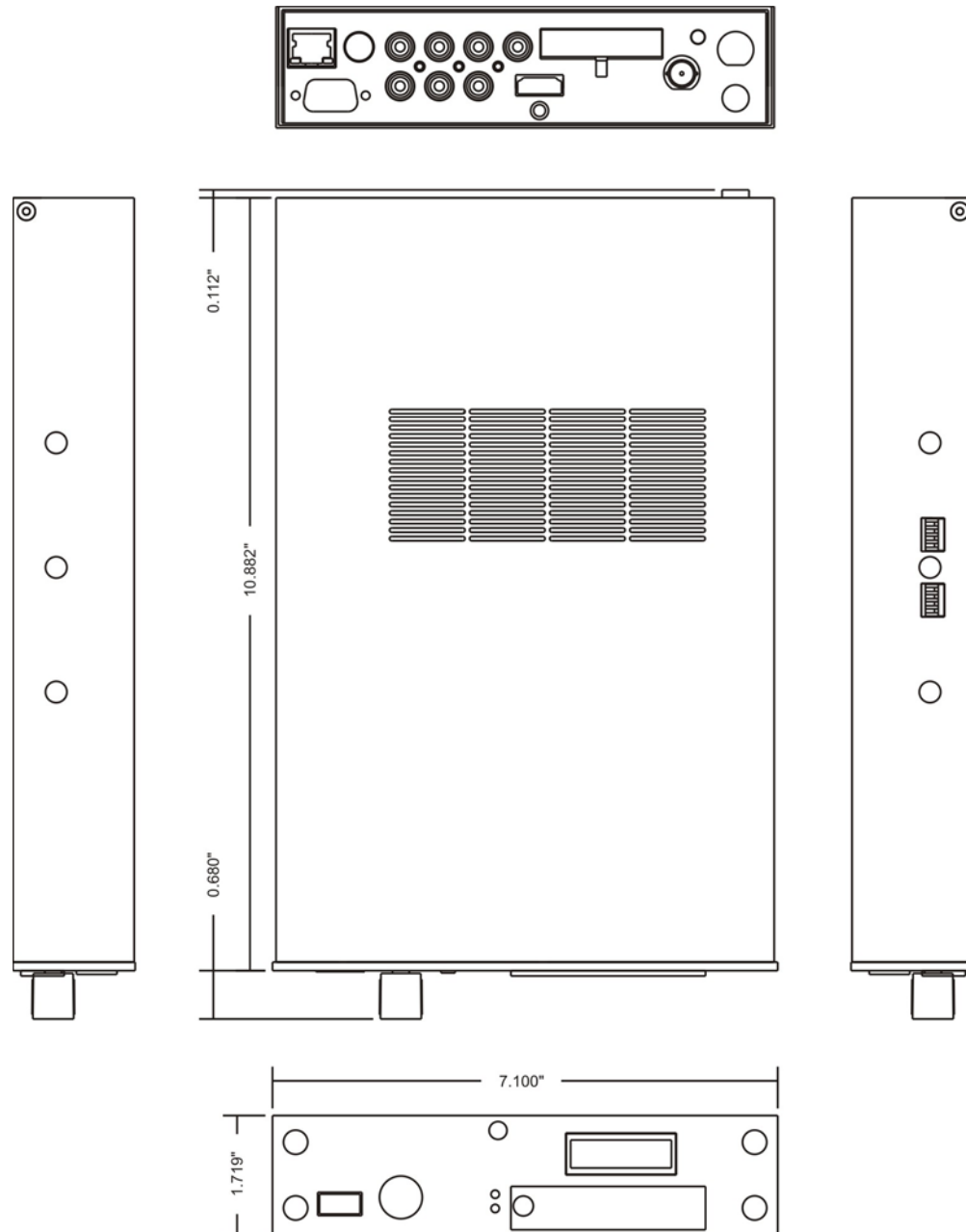
Q: Do you have a basic checklist I can go by in order to figure out what's wrong?

A: *Here's a checklist we have compiled of typical things you can check to make sure all the bases are covered:*

- *Is the unit plugged in? (bear with us)*
- *Does the unit have a Compact Flash card in it at all? (remove the front metal plate & check)*
- *Is the Compact Flash card pressed in all the way?*
- *Validate you've used the A/V cables somewhere else successfully. Verify your display works, etc...*
- *If you are using a serial cable, is it straight through (as opposed to a null modem)?*
- *Are your video files compatible with the DVMHD? See **Media Files** section.*
- *Are your file name formats valid? See **Media Files** section.*
- *Take every other piece of control equipment away from the unit, making it stand-alone until you get it running. Try to make sure it operates using the 'Play Test File' function on the front-panel menu. You can also send serial or Ethernet commands from a laptop or PC.*
- *If the unit does not respond to serial messages typed by hand or from another system:*
 - *Are you sure you've chosen the correct COM port on your PC? Are you communicating using 9600 baud, 8 data bits, no parity, and 1 stop bit (9600,8,N,1)?*
 - *Are you using a straight-through (not NULL) RS-232 cable?*
 - *Are you using the correct commands listed in the **Command Protocol** Section? Can you get a version number from the box by using a terminal emulator, or AMI Terminal?*
- *Is the Compact Flash Card damaged? Do you have a second Compact Flash card you can temporarily use to make sure the Compact Flash Card isn't just damaged? Go through the file copying process with the new Compact Flash Card, and try to play the file.*
- *Is the unit damaged? If you can put another Digital Video Machine in the circuit, you can rule out the possibilities of a damaged unit. **Remember to use the same Compact Flash card.***

Mechanical Information

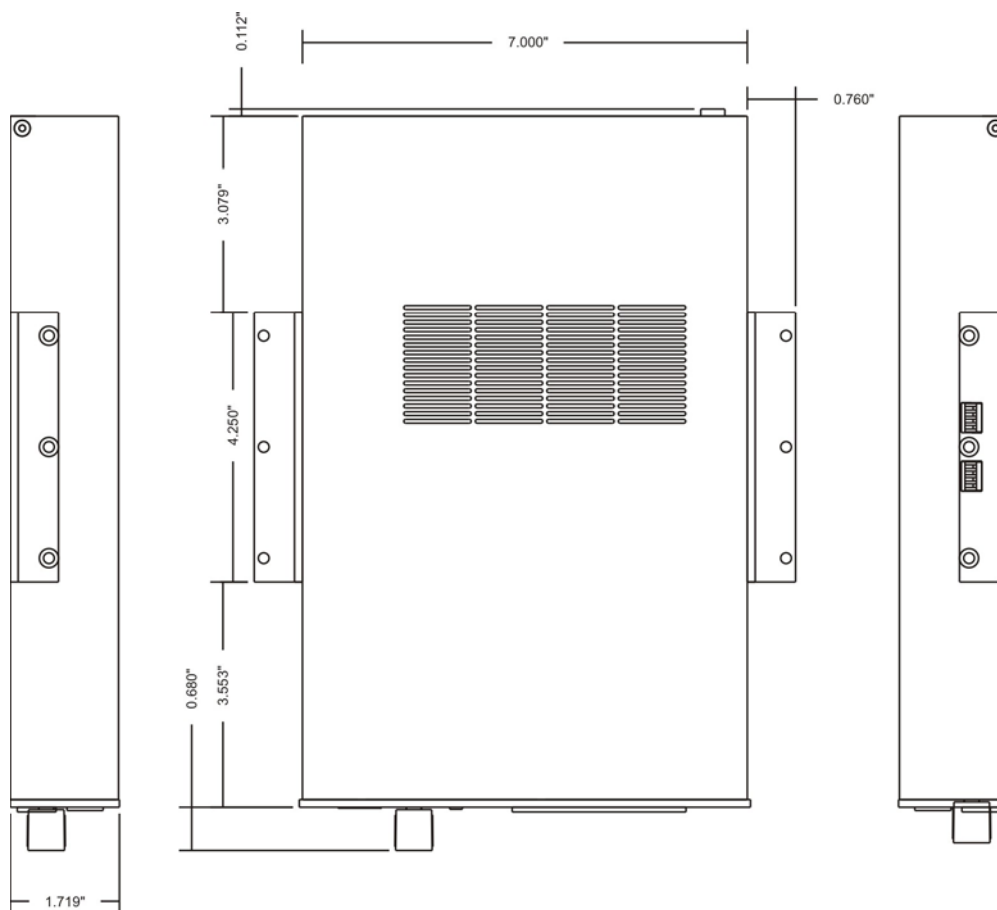
Mechanical Dimensions



Surface Mounting

The Digital Video Machine is capable of being mounted to a flat surface, like a wall or kiosk, with an optional surface mounting kit.

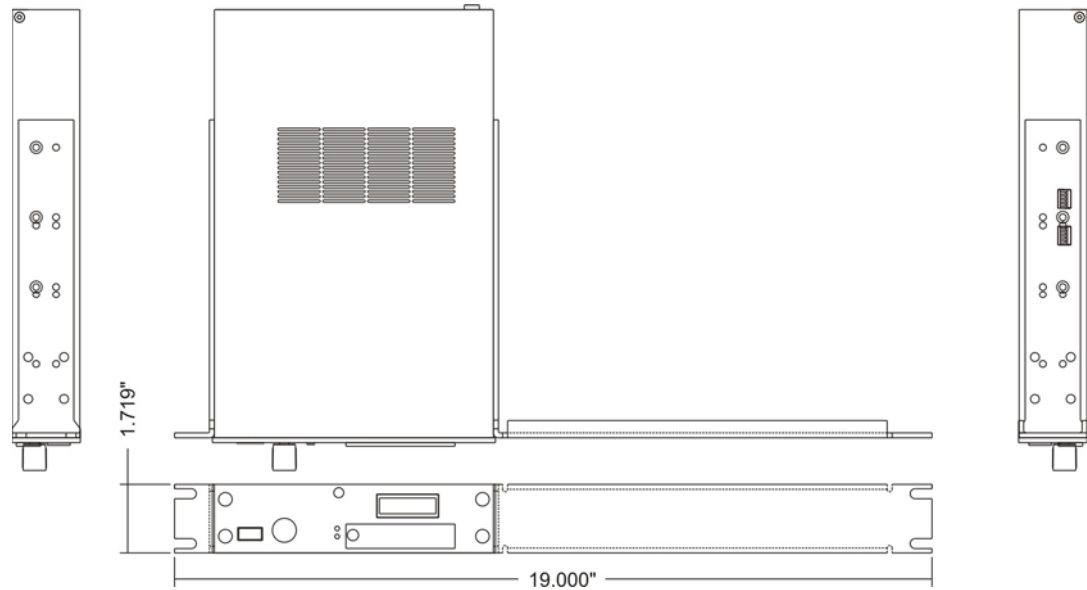
Surface Mount Kit, Part Number 231-101290



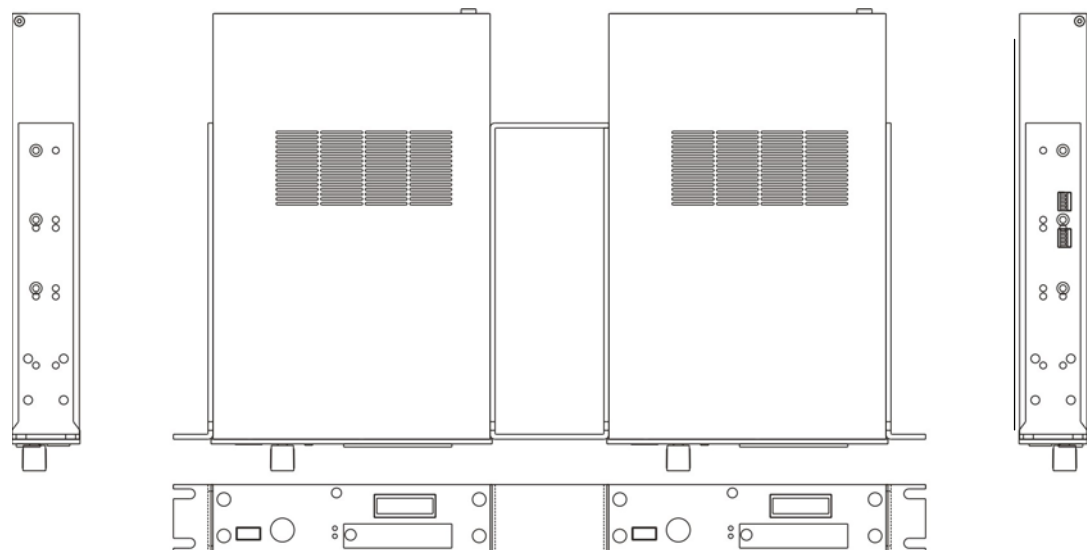
Rack Mounting

You can mount one or two Digital Video Machines in a 1U rack mount space. We have 2 kits available that will allow you to do either.

Rack Mount Kit, 1 Unit, Part Number 230-103487



Rack Mount Kit, 2 Unit, Part Number 230-103488



Specifications

Video

Video Formats:	Microsoft VC1 MP@HL (WMV9) & AP@L3 H.264 (MPEG-4 part 10) MP & HP Level 4.1 MPEG-2 MP@HL
Max Bit Rate:	40Mbps (MPEG-2), 30Mbps(H.264), 8Mbps(VC-1)
Resolutions:	1080i, 720p, 576p, 480p, 576i, 480i

Audio

Audio Formats:	WMA-9, WMA-9 PRO, MPEG-1 Layer I/II, MPEG-2 Layer II, MPEG-2 AAC, MPEG-4 AAC LC2-Channel/5.1 Channel MPEG-4 AAC+SBR 2-Channel/5.1 Channel Dolby® Digital EX, Pro Logic® II, MLP and DTS®
Channels:	2 or 5.1(digital output only)
Sample Rate:	48 KHz, 44.1kHz, 32kHz
DAC Resolution:	16 bits or 24 bits
Total Harmonic Distortion:	0.003%
Dynamic Range:	104dB
Frequency Response:	10 to 20 KHz +/- 0.1 dB
Line Out Level:	Unbalanced, 2V P-P max into 20K

Response Time

Search time:	100-2000 milliseconds (Depends on encoding)
Trigger Time:	<1 video frame (when Search File is performed in advance)

Power

Voltage:	12 VDC to 25.0 VDC
Current:	2 Amp max
Connector:	2.5 mm I. D., 5.5 mm O. D., 10 mm shaft length.

Controls, Switches and Indicators

Front panel:	Bi-color Status LED (Red/Green) Bi-color GPS Lock LED (Red/Green) 16x2 Character LCD Display Menu Wheel (/w Push to Select)
Side panel:	DIP switches for ground lift, default settings, sync input type, sync termination.
Rear panel:	Sync Status LED (Yellow)

Connectors

Rear Panel:	DB-9M serial I/O connector RJ45 jack for Ethernet connection Mini-DIN connector for GPS 20-pin Input/Output Control connector Analog component video connectors (3 x RCA – Red, Blue, Green) Analog composite video connector (RCA - Yellow) Analog unbalanced audio connectors (2 x RCA – Red, White) Digital audio coax connector (RCA – Orange) HD-SDI connector for SMPTE-292M Digital Video and embedded audio (BNC) HDMI connector for Digital Video and embedded audio (HDMI) Captive barrel-style power connector (2.5 mm x 5.5 mm x 10 mm) Composite/Blackburst Sync input connector (BNC)
Front Panel:	USB Host connector

Ethernet

Connection Type:	10/100BaseT
Protocols:	FTP, ARP, UDP, TCP, ICMP, SNMP protocols

Physical

Product Dimensions:	10.882" x 7.0000" x 1.7190" (DxWxH)
Product Weight:	4 lbs
Operating Temperature:	0°C (32°F) to 38°C (100°F), free air circulation.
Operating Humidity:	0-90% relative humidity, non-condensing
Shock Resistance:	20 g max Vibration (with removable Compact Flash Card)

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