

OUTRIDER DVR™

Digital Video Recorder

Hardware Technical Reference

Revision 2.5

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fast forward video

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OUTRIDER DVR
CIRCUIT BOARD

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Overview

Fast Forward Video's *OUTRIDER DVR*™ circuit board is a high quality digital video recording and playback device designed for standalone operation. It was designed as a subsystem for applications requiring video conforming to National Television Standards Committee (NTSC) or Phase Alternation by Line (PAL) specifications. The *OUTRIDER DVR* performs compression and decompression at user-specified ratios as low as 4:1 at 30 frames (60 fields) per second in NTSC. The compression method conforms to the Joint Photographic Experts Group (JPEG) standard. The primary design goal was professional image quality. In addition, the *OUTRIDER DVR* adheres strictly to standards including RS-170A (NTSC) and CCIR-601.

When recording, the *OUTRIDER DVR* converts an analog NTSC or PAL video signal to a component digital format, compresses the digital video signal to a JPEG data stream, and sends the compressed video directly to an ATA/IDE (ATA/ATAPI-4) Compact Flash or hard disk. Video files are downloadable to a computer via USB port for editing in a non-linear editor or playback with QuickTime video player.

Control of the board is available through a serial port RS-232 interface.

When playing back, the *OUTRIDER DVR* retrieves the compressed video data from an IDE Compact Flash or hard disk, decodes the JPEG data into digital component video, and converts the digital video to an analog NTSC or PAL video signal.

Composite video and Y/C connectors, decoder, and encoder are included on the *OUTRIDER DVR*. The board's pixel resolution is full bandwidth CCIR-601; 720 X 486 or 720 X 480 in NTSC and 720 X 576 in PAL. Sampling is maintained at 4:2:2.

Configuration

Prior to use, set the configuration to verify operation as expected. The included DVR Master software aids configuration and basic operation. Specific settings that should be checked:

Resolution: PAL, NTSC (either 720 X 486 or 720 X 480) or NTSC-Japan.
Video Input selection: Composite or Y/C

Disk Format: MOE (Fast Forward Proprietary) or FAT32
File Format: MOE (Fast Forward Proprietary) or QuickTime
Following any change in the Disk or File formats, "Delete All Video" to invoke.

Character Overlay Settings: Set as desired.

Other settings as shown in the Serial Control Protocol Document, Section 3.1. The document, serialxx.pdf, is available from the Technical Support page of www.ffv.com.

Architecture

The *OUTRIDER DVR*'s primary design goal was to maintain video quality at a level suitable for use in professional video applications. This goal dictated that the sync timing of the output signal must conform strictly to the RS-170 standard (NTSC).

Most important, however, is image quality. Based on subjective evaluation of JPEG compressed video, Fast Forward Video determined that a compression ratio of 5:1 or lower would yield image quality comparable to the Betacam SP™ format, and thus satisfy most professional video users.

To support a sustained data rate at this level, the designers of the *OUTRIDER DVR* included an IDE hard disk controller on the circuit board.

The design includes an on-board 80386EX microprocessor to oversee the hardware and to provide a control interface over the serial ports.

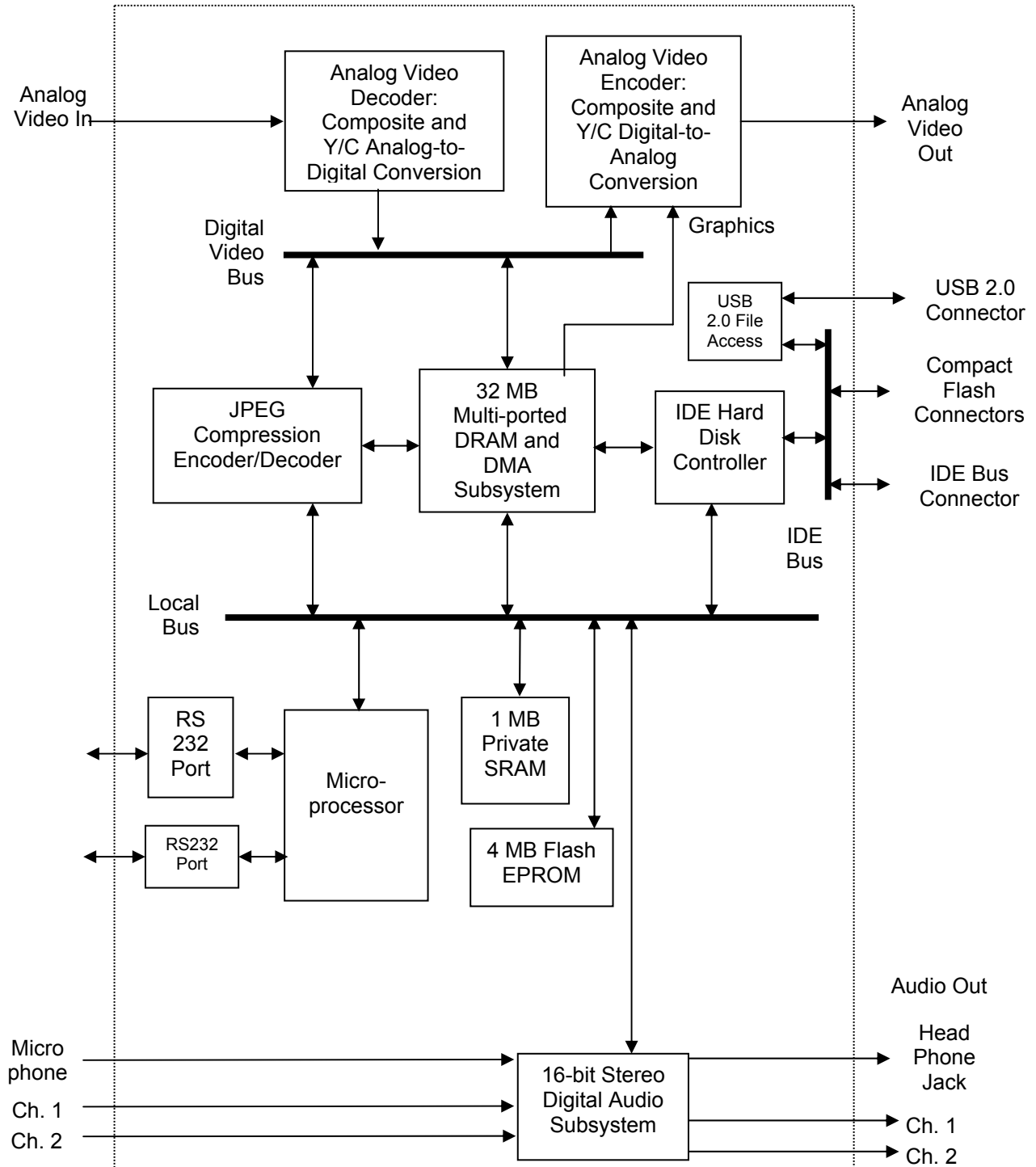
All of the *OUTRIDER DVR*'s subsystems share thirty-two (32) megabytes of dynamic random access memory. This memory is based on a true multi-port architecture that allows direct access by the JPEG codec, the disk controller, and the local 80386EX microprocessor. Direct access to this memory permits each of the subsystems to perform to their maximum potential without concern for DMA contention.

Following is a block diagram of the *OUTRIDER DVR*.

SPECIFICATIONS

OUTRIDER DVR CIRCUIT BOARD

HARDWARE BLOCK DIAGRAM



SPECIFICATIONS

OUTRIDER DVR **CIRCUIT BOARD**

Specifications

VIDEO INPUT

Analog Input: Composite and S-Video (Y/C).
Levels: 1.0Vp-p, 75 ohms
Standards: 525/60 (NTSC) or 625/50 (PAL)

VIDEO OUTPUT

Analog Output: Composite and S-Video (Y/C).
Horizontal Resolution: 550 TV lines (at 5:1 compression)
Levels: 1.0Vp-p, 75 ohms
Standards: 525/60 (NTSC) or 625/50 (PAL)
Connections: multi-pin for component

VIDEO INPUT DECODER

Format: Digital 4:2:2 YCrCb
60 fields per second NTSC
50 fields per second PAL

Digital Color Space: YUV
Sampling: 13.5 MHz
Pixel Resolution: 720 x 486 pixels (525/60)
720 x 576 pixels (625/50)

S/N Ratio: 50 dB
Bandwidth: 7 MHz (-3 dB)
Differential Gain: 2%
Differential Phase: 2 deg.
ADC Differential Linearity: +/- 0.7 LSB
ADC Integral Linearity: +/- 1.0 LSB

VIDEO OUTPUT ENCODER

Digital Color Space: Digital 4:2:2 YCrCb
Analog Bandwidth: Y: 6.75 MHz
C: 1.3 MHz

Composite: 4.5 MHz
DAC Resolution: 10 bits x 3
S/N Ratio: 60 dB

VIDEO COMPRESSION

Codec: Zoran
Method: JPEG (Joint Photographic Experts Group)
Compression Ratio: Variable from 20:1 to 4:1.

MEMORY

Multi-port Frame Buffer: 32 MB DRAM

SPECIFICATIONS

OUTRIDER DVR ***CIRCUIT BOARD***

ATAPI/IDE DISK CONTROLLER

Protocol:	ATAPI DMA mode 3
Maximum Data Rate:	16.6 MB/sec
Maximum Hard Drives:	2
Supported Hard Drives:	IBM Travelstar; Fujitsu MHS/MHT Series; Solid State disks available DMA mode 2 Compact Flash

MICROPROCESSOR

Type:	Intel 80386EX
Clock Speed:	40 MHz
Local ROM/EPROM:	4MB Flash EEPROM
Local SRAM:	1MB 0 wait state

COMMUNICATIONS INTERFACE

RS-232:	Conforms to Sony "Remote-1 (9 pin)" protocol. 38400 baud, 8 data bits, odd parity, 1 stop bit.
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AUDIO SPECIFICATIONS

Resolution:	16 bits
Sampling Rate, FS:	48 Khz
Channels:	2 Line or 1 Microphone, 2 out
Dynamic Range:	90 dB
Total Harmonic Distortion:	-80 dB
Crosstalk:	-80 dB
Input Voltage:	1 VRMS nominal
Input Impedance:	35K ohms
Input Programmable Gain Span:	22.5 dB
Full Scale Output Voltage:	1.0 VRMS
Output Impedance:	10K ohms
Output Attenuation Range:	80 dB

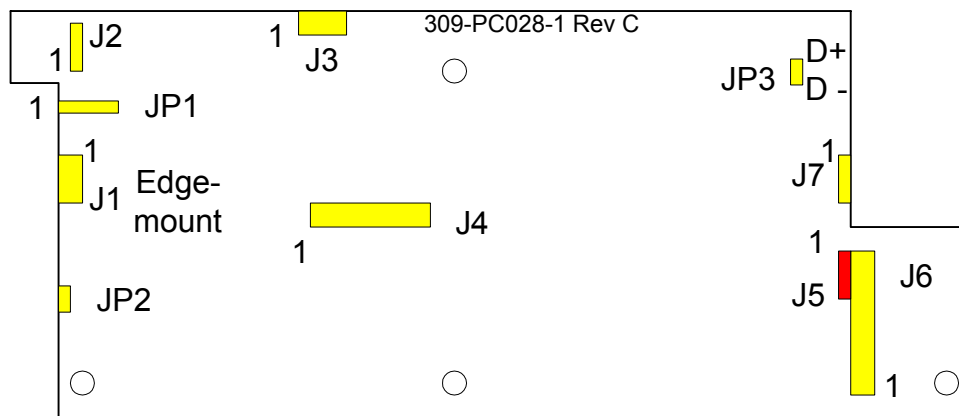
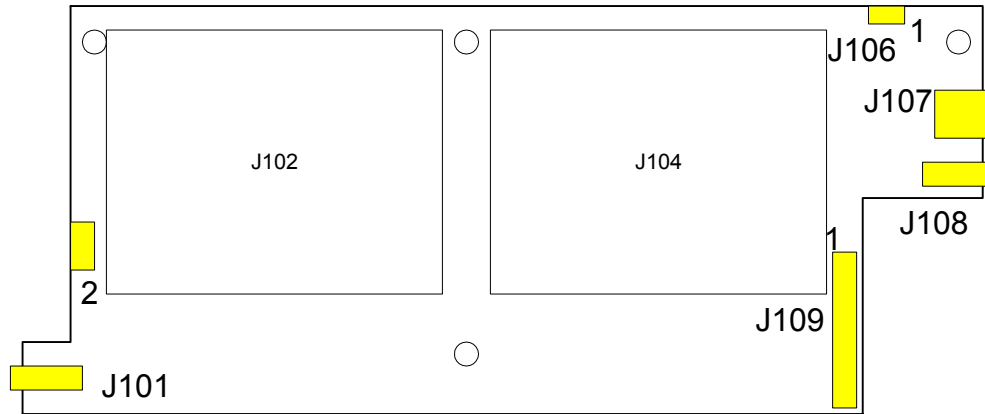
GENERAL

Size:	2.2" W x 4.9" L x 0.6" D – D depends on config.
Power Consumption:	3 watts not including storage device(s). Input Voltage - +3.5 to 6.5V. – CF Input Voltage - +3.5 to 9.5V. – CF by Request Input Voltage – Reg. +5Vdc - IDE Hard Drive
Warranty:	1 year

Specifications subject to change without notice

JUMPER AND CONNECTOR LOCATIONS

Part Number 309-PC028-1, Revision C



LEGEND		
REF #	FUNCTIONAL DESCRIPTION	MFR. P/N OR DESCRIPTION
J1	PUSH BUTTONS / LEDs	SAMTEC P/N FTS-106-01-F-D; 50MIL HDR
J2 / J7	HEADPHONE / STEREO OUTPUT	3 Pos., .050" Through Hole
J3	RS-232 PORT F. P.	MOLEX P/N 53398-0490
J4	Bus Expansion	50 POS., .5MM SURFACE MOUNT
J5	TIME CODE	3 POS., 2MM THROUGH HOLE
J6	VIDEO / CONTROL IN/OUT; AUDIO IN	26 POS., .050" HEADER - SAMTEC CABLE
J101/108	HEADPHONE / STEREO OUTPUT	MINI PHONE JACK RIGHT ANGLE SMT
J102/104	COMPACT FLASH	50 Pos., Compact Flash Type I or II
J106	POWER IN – USE FOR +5V DRIVE.	STD. 2 PIN IDE, .100 SPACING
J107	USB 2.0	USB Mini-B Receptacle
J109	IDE	32 POS., .050" HEADER
JP1	PROGRAMMING JUMPER HEADER	4 POS., SINGLE ROW, 2MM HEADER
JP2	DVR RESET – SHORT THE PINS	STD. 2 PIN IDE, .100 SPACING
JP3	USB 2.0 DATA – D+, D-	2 POS., 2MM THROUGH HOLE

CONNECTOR PIN-OUTS

PUSH BUTTON INPUTS/LED OUTPUTS

Connector Pin-Outs

PUSH BUTTON INPUTS/LED OUTPUTS			
J1			
Functional Documentation – Operation Section			
Pin	Source/Sink (I)	Name	Function
1	7 mA max.	LED 1	Pass-Thru / Record
2	7 mA max.	LED 2	Playback Mode
3	7 mA max.	LED 3	Record Start / Stop
4	7 mA max.	LED 4	Not Defined
5	7 mA max.	LED 5	Not Defined
6	.14 mA max.	PB1	⏮ Fast Reverse
7	.14 mA max.	PB2	◀ Step Reverse
8	.14 mA max.	PB3	● Record
9	.14 mA max.	PB4	▶ Play / Stop
10	.14 mA max.	PB5	▶ Step Forward
11	.14 mA max.	PB6	⏭ Fast Forward
12			Ground

HEADPHONE OUTPUT / JACK	
J2 / J101	
Pin	Function
1	Left Headphone Out
2	Right Headphone Out
3	Ground

RS-232 F.P.	
J3	
Pin	Function
1	Transmit Data (TXD)
2	Receive Data (RXD)
3	DTR
4	GROUND

CONNECTOR PIN-OUTS

**TIME CODE – NOT
IMPLEMENTED
J5**

TIME CODE – NOT IMPLEMENTED J5	
Pin	Function
1	Time Code Input
2	Ground
3	Time Code Output

INPUT / OUTPUT J6			
Pin	Function	Pin	Function
1	Power In – Note below	14	Ground
2	Receive Data (RXD)	15	Ground
3	Power In – Note below	16	Composite / Y In
4	Trigger In 1	17	Ground
5	Transmit Data (TXD)	18	C Out
6	Trigger In 2	19	Audio In – Right Line
7	DTR	20	Ground
8	Microphone In	21	Ground
9	Battery Alarm	22	Y Out
10	Reference Video In	23	Audio In – Left Line
11	Ground	24	Ground
12	C In	25	Power Status
13	Ground	26	Composite Video Output

NOTE: Input Voltage: - Compact Flash or 3.3Vdc IDE Hard Drive - +3.5 to 6.5 or 9.5V.
- 5Vdc IDE Hard Drive - Regulated +5Vdc (Use J106)

COMPACT FLASH SLOTS - J102 (MASTER) / J104 (SLAVE)
Standard Compact Flash connections

POWER IN – +5 V IN DRIVES J106	
Pin 1 - Power In	Pin 2 - Ground

CONNECTOR PIN - OUTS

USB 2.0 FILE ACCESS J107

USB 2.0 FILE ACCESS J107	
Pin	Function
1	USBPWRV
2	USBD-
3	USBD+
4	
5	Ground

STEREO OUTPUT / JACK J7 / J108	
Pin	Function
1	Left Line Out
2	Right Line Out
3	Ground

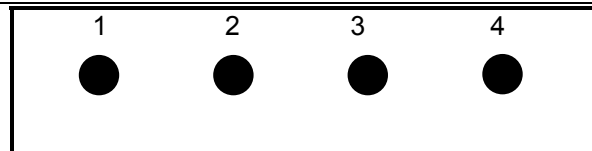
IDE HARD DRIVE J109			
Pin	Function	Pin	Function
1	RESET	17	DD00
2	DD08	18	DD15
3	DD07	19	ATAIRQ
4	DD09	20	GROUND
5	DD06	21	DMARQ
6	GROUND	22	DIOW
7	DD05	23	DIOR
8	DD10	24	DIORDY
9	DD04	25	DA1
10	DD11	26	DMACK
11	DD03	27	DA0
12	DD12	28	DA2
13	DD02	29	+ 5V
14	DD13	30	CS0
15	DD01	31	+ 5V
16	DD14	32	CS1

PROGRAMMING JUMPER BLOCK JP1

Update Protocol - 38400 baud, 8 data, ODD parity, 2 stop bits

Jumper 1-2 – installed to update Boot Code.

Jumper 3-4 - installed on power-up, forces unit into firmware update mode.



Operation

PUSHBUTTON / LED CONNECTION

There are six level-sensitive, fully de-bounced inputs available for user control. These inputs are suitable to be connected directly to off-the-shelf pushbuttons. The action described below occurs immediately upon contact closure, that is, when the input is shorted to ground.

LED OPERATION

Each LED output supplies a maximum of 7mA current. The LEDs should be connected between the output and GND.

MODE	ACTION	LED	DISPLAY
Pass-Thru	Pause	1	High - 0.1 Sec. per Sec. - Single short blink per second.
Pass-Thru	Record	1	High Output - LED On.
Playback	Stop	2	High - 0.1 Sec. per Sec. - Single short blink per second.
Playback	Play (1:1)	2	High Output - LED On.
Playback	Forward - non 1:1	2	LED high in a pattern short, short, long, short
Playback	Reverse - non 1:1	2	LED high in a pattern short, long, short
Confirm Video Delete		1 & 2	Alternate short blinks.
Pass-Thru	At Record Start	3	High for 3 seconds.
Pass-Thru	At Record Stop	3	High for (3) 0.3 second pulses separated by 1 second

TRIGGER OPERATION		
Input #	Action Required	DVR Response
1	Momentary Ground (100msec. minimum)	Start Record
2	Momentary Ground (100msec. minimum)	Stop Record

OPERATION

PUSHBUTTON OPERATION

PUSHBUTTON OPERATION			
Function	Required State*	Keys	Notes
Start Record	Any but Record	●	
Stop Record	Record	▶ + ●	Hold Play/Stop and tap Record
Change to Pass-Thru	Play or Stop	◀ + ▶	Simultaneous
Play forward – 1x	Stop	▶	
Pause (or Stop)	Play	▶	
Step Fwd 1 frame	Play or Stop	▶	
Step Rev 1 frame	Play or Stop	◀	
Seek start next clip	Play or Stop	»	
Seek to end	Play or Stop	»	Hold for ½ second
Seek start previous clip	Play or Stop	«	
Seek to beginning	Play or Stop	«	Hold for ½ second
Scan Fwd – 5x	Play ≠ 5x	▶ + »	Simultaneous
Scan Fwd – 30x	Play = 5x	▶ + »	Simultaneous
Scan Rev – 5x	Play ≠ -5x	◀ + «	Simultaneous
Scan Rev – 30x	Play = -5x	◀ + «	Simultaneous
Clear Disk	Any but Record	« + » + ● then ●	Push and hold « and », then press ● and release all three (LED1 & 2 flash quickly), then press and hold ● for 5 seconds. LED will flash fast red, until last two seconds of format - it changes to fast green blink. Returns to slow red blink when ready to record.

* - Required State – The state the device must be in to have that function active...

Simultaneous – press and hold the first key and press the second also works.

USB OPERATION

The USB connection is used to view recorded video using the QuickTime player on a computer. The files must be recorded using the FAT32 Disk format and the QT file format. These settings MUST be set on the DVR and the "Delete All Video" command used to format the drives prior to recording. The USB drivers are included in Windows 2000 and Windows XP for the connection. The drive should show up as an external drive when the USB cable is connected and the DVR is powered On, unless the unit is in Record. The DVR will not allow USB access when recording since all data on the drive could be damaged / deleted by doing so. Connecting the USB cable during Play will Stop the DVR because the DVR and the USB cannot access the drive simultaneously.

The files containing video will be FAT32 long filenames using the Clip Title, a space, and AAAABB.mov, where the Clip Title is the settable Title message or the incrementing default "CLIP0000", and 'AAAA' and 'BB' are hexadecimal numbers. The numbers are added at the end of the long filename to differentiate files of the same clip when the drive space required exceeds the FAT32 2GB file size limitation. All other files on the drive are not video files, and therefore, are not playable. Long video clips will span file boundaries. The filenames will indicate sequential files in a clip by incrementing the digits 'AAAABB' in ascending numbers for each file in one clip.

Video requires a fast computer to play smoothly in real time. If your video does not play smoothly, QuickTime Pro has a setting under the Movie tab to Play all frames. This slows the video to the speed of the computer, but shows all of the frames recorded.

The following tidbits are answers to customer questions...

Please use the DVR to erase video files from the drive. The DVR performs more tasks during the delete / format process than a computer does. These tasks are important for proper storage of your video.

The computer does not control the file write process the same as the DVR, therefore, we do NOT recommend moving video files from computer to disk for play on the Outrider DVR.

A newly formatted disk will have all usable space assigned to files, so it will appear to be full when viewed using a computer.

The computer and the DVR can not both access the drive at the same time. Please unplug the USB cable to attempt to operate the DVR.

The USB cable is ONLY usable for file transfer. No control functions work via USB.

Early Outriders used a USB IC that only accessed the Master IDE device. All Compact Flash versions of the board now use a successor IC that reads both IDE devices. When all current stock of the early device is used, the Hard Drive version will automatically start using the Dual-Device reading IC.

Order options

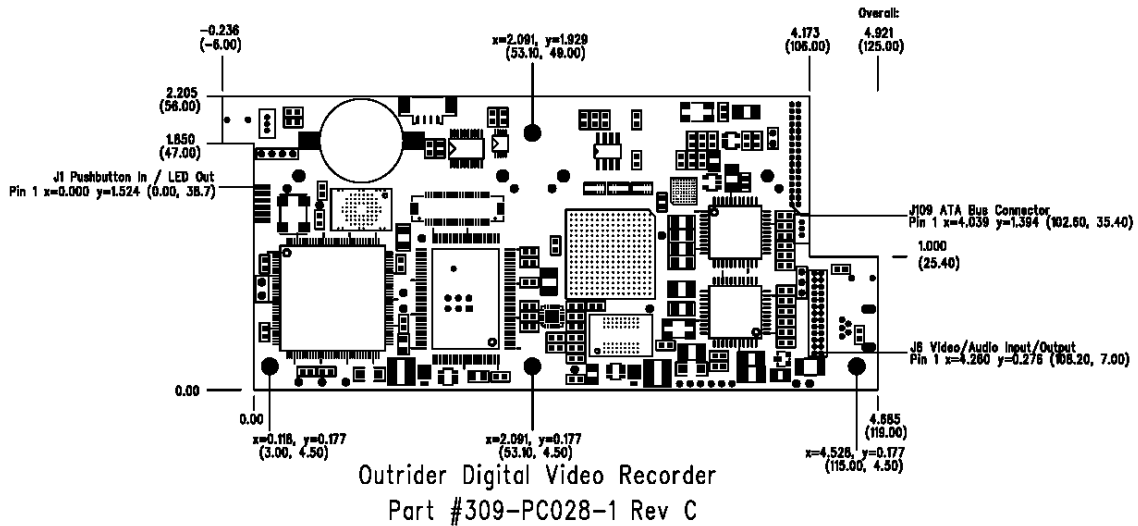
CONFIGURATION

Description	Media Type	Media Interface
Outrider CF	Record on two Compact Flash devices	Compact Flash sockets on board
Outrider IDE – 5 V.	Record to 5 V. IDE hard drive.	44 pin header for IDE hard drive cable
Outrider IDE – 3.3V	Record to 3.3 V. IDE hard drive.	44 pin header for IDE hard drive cable
V. In range to 6.5V	Compact Flash Only – Std.	
V. In range to 9.5V	Compact Flash Only – By Request	

Appendix

MECHANICAL DIMENSIONS

Dimensions in inches (millimeters)

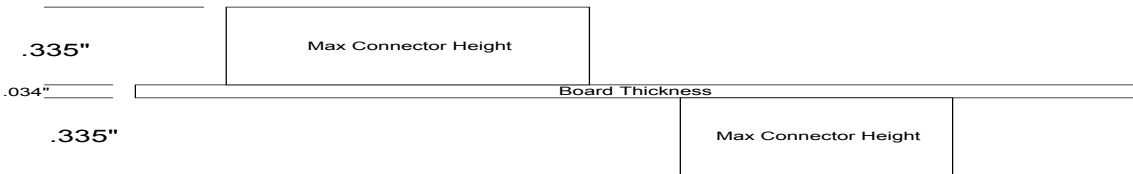


Center position of Compact Flash connectors (Hirose P/N MI21A-50PD-SF-EJL or EJL) is:
J102 – X=28mm; J104 – X=78.5mm.

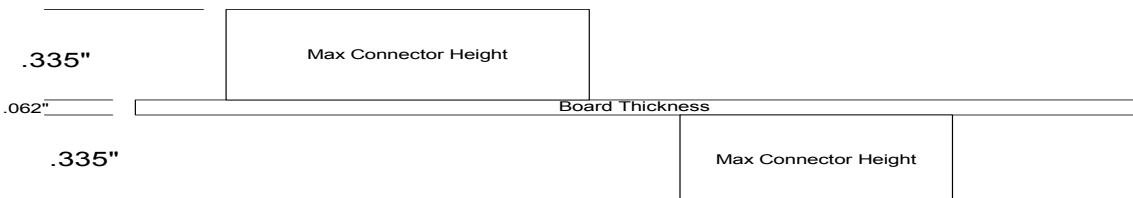
ELEVATION

The following dimensions assume all connectors are used. Non-use of connectors will vary total installed height.

Part Number: CF – 302-CA044-4G IDE – No Longer Available.



Part Number: CF – 302-CA044-3G IDE – 302-CA045-4F



REVISION HISTORY

- Rev. 1.0 – September 9, 2004 - New Release
- Rev. 1.1 – September 27, 2004 – Added Pushbutton, LED, USB, and Trigger definitions.
Several typos corrected.
- Rev. 1.2 – October 29, 2004 – Corrected Key indicators in Push Button connections and operations tables. Changed Mechanical Dimension information to reflect Rev C size.
Changed connector Designations to match Rev. C board.
- Rev. 1.3 – November 18, 2004 – Added USB device 1 accessibility note and Order configuration.
- Rev. 1.4 – February 1, 2005 – Corrected Manufacturer and P/N information for J1.
- Rev. 1.5 – February 10, 2005 – Added position and Type Information for Compact Flash sockets.
- Rev. 1.6 – May 25, 2005 – Added pulse information for Trigger inputs.
- Rev. 1.7 – July 20, 2005 – Changed “Delete all video” button sequence to match July 11, 2005 firmware release.
- Rev. 1.8 – August 31, 2005 – Added Configuration section to explain basic configuration requirements. Changed the FAT32 filename information to show the long name.
- Rev. 1.9 – January 27, 2006 – Changed paragraph about USB IC only reading one IDE device.
- Rev. 2.0 – June 7, 2006 – Corrected J6 and J109 spacing dimension.
- Rev. 2.1 – October 5, 2006 – Corrected Maximum input voltage for CF version to 6.5Vdc.
- Rev. 2.2 – January 31, 2007 – Change Maximum input voltage for CF version to 9.5Vdc. for boards manufactured after December 2006.
- Rev. 2.3 – November 28, 2007 – Corrected pin-out information for J3 connector. Clarified power input for +5V IDE drives. Change CF 9.5V Voltage In range to optional by request.
- Rev. 2.4 – May 14, 2008 – Corrected J2/J7 spacing to .050”. Added details under USB.
- Rev. 2.5 – Oct. 9, 2008 – Added board thickness .062”.