

Application Note

Serial Interface Protocol for the Catalyst CV Digital Switcher

Overview

The serial interface port of the Ensemble Designs Catalyst CV Digital Component Switcher can implement several protocols. This document describes commands implemented under emulation of the Tektronix/Grass Valley Group Model 100/200/300 production switcher protocols.

The protocol most closely follows the Tek/GVG Model 200 series switcher. Various functions within the Catalyst CV are mapped to different Effects Addresses in the GV200 protocol as follows:

Catalyst CV Background & Key	Effects Address 1
DS-1 Output Routing	Effects Address 7
DS-1 Buffer Routing	Effects Address 8
Catalyst CV Key Layer	GV 200 Key #1

This document provides an overview of the protocol and message structure that should be sufficient for most implementations. As such, it only describes those elements of the GV200 protocol that are supported by the Catalyst CV. Unsupported portions of that protocol will result in a NAK response from the CatalystCV.

Communications Particulars

The CatalystCV serial port is configured through the menu display on the front of the rack mount chassis. When 'GV200' is selected the following will hold:

Data Rate:	38,400 Baud
Start/Stop Bits:	1 / 1
Parity:	Odd

The 9 pin D female connector on the rear of the chassis is wired as a tributary following the SMPTE/EBU ESBUS as follows:

Pin #	Function
2	Tx -
3	Rx +
7	Tx +
8	Rx -
1,4,6,9	Common (Ground)

This serial interface operates at RS-422 signalling levels, where each line swings between approximately -5 and +5 volts. RS-422 is non-inverting.

Connection to an RS-232C dataset (which is inverting) can be accomplished by connecting the RS-422 Tx- and Rx- signals to the corresponding RS-232 signals, and grounding the Rx+ line on the RS-422 side.

No 'Break' Requirement

The SMPTE ESBUS uses a BREAK character (17 to 20 bit times of low) as an attention signal. This allows the ESBUS to support more than one peripheral device in a multi-drop manner.

The CatalystCV, like the GVG 200, does not require this break character. This is referred to as 'Simplified Protocol' by Grass Valley/Tektronix. Because of the heavy communication load and need for precise command execution timing of a production switcher, a dedicated serial port is provided by most edit controllers. Without the need to support multiple peripherals on that serial port, there is no need for an attention signal.

Accordingly, the CatalystCV is always in the Select state. It will respond directly to a serial message. There is a requirement that transmission of the message be accomplished without gaps in excess of six character lengths. If such a gap is detected in an incoming message, the CatalystCV will discard the portion of the message already received and reset its internal byte count. At this point it will expect that the next byte it receives is the first byte of a message.

Message Structure

Each message is formatted as follows:

Byte 0:	Byte Count	BC	Gives number of bytrs that follow
Byte 1:	Efx Address	EX	0 - 8
Byte 2:	Command Code	CC	Code for type of command being issued and Read or Write indication
Bytes 3-n:	Message Data	MD	as required by the command

Every message received by the CatalystCV will generate one of the follow responses:

Command Accept 01H 80H
This is the general response to a Write command. It indicates that the command was received and understood.

Dialect or Protocol Error 01H 40H
This two byte response indicates that the command was not understood or is not supported by the CatalystCV.

Read Response BC EX CC(W) MD
When a control of function in the CatalystCV is read or queried, the reponse will be a message formatted as the Write version of that command.

Command Codes

The CatalystCV supports the following Command Codes:

Transition Mode Command Read: 4AH Write: CAH
Used to read or set the Transition Mode which indicates for key and background layers if they are included in the next transition.

	BC	EX	CC	MB(s)
Read	02h	01h	4Ah	
Write	03h	01h	CAh	nn

Bits of Message Byte: x x x x x b k x
b: 1 to include background in transition
k: 1 to include key in transition

Examples:

Sent to CatalystCV to query the current next transition mode:

02h 01h 4Ah
 Response from CatalystCV to indicate background only transition:
 03h 01h CAh 04h

Sent to CatalystCV to set next transition to background and key:
 03h 01h CAh 06h
 Acknowledge response from CatalystCV:
 01h 80h

Transition Rate Command

Read: 4Ch Write: CCh

Used to read or set the Transition Rate for auto transitions. The rate is specified in video frames, and thus is not a rate but rather it is a duration. The maximum transition rate is 999 frames, which is approximately 33 seconds in 525/60 (NTSC) systems and 40 seconds in 625/50 (PAL) systems.

	BC	EX	CC	MB(s)		
Read	02h	01h	4Ch			
Write	03h	01h	CCh	Byte1	Byte2	Byte3

Message Bytes:

- Byte 1 Value of 100's digit of rate
 Note: if MSbit of Byte 1 is set, the transition will be executed immediately
- Byte 2 Value of 10's digit
- Byte 3 Value of 1's digit

Examples:

Sent to CatalystCV to query the current transition rate:
 02h 01h 4Ch
 Response from CatalystCV indicating a 129 frame rate (duration):
 05h 01h CCh 01h 02h 09h

Sent to CatalystCV to set rate to 54 frames:
 05h 01h CCh 00h 05h 04h
 Acknowledge response from CatalystCV:
 01h 80h

Sent to CatalystCV to set rate to 42 frames AND start transition:
 05h 01h CCh 80h 04h 02h
 Acknowledge response from CatalystCV:
 01h 80h

Transition Pushbutton Select

Read: none Write: FBh

This write-only command is used to initiate an auto transition. Note that this command is the preferred means to start a transition.

BC	EX	CC	MB(s)
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Write 03h 01h FBh 1Bh

Message Byte is always 1Bh

Example:

Sent to CatalystCV to start an autotransition:

03h 01h FBh 1Bh

Acknowledge response from CatalystCV:

01h 80h

Crosspoint Bus Command

The DS1/CatalystCV has 12 addressable crosspoint busses. This four crosspoint bus command codes are used with three different efx addresses to control these busses:

EX Address 01:

A Bus	Read: 41H	Write: C1H
B Bus	Read: 42H	Write: C2H
Key Fill Bus	Read: 43H	Write: C3H
Key Source Bus	Read: 44H	Write: C4H

EX Address 07: (This corresponds to Aux Bus on the GV200)

Chassis Output 1	Read: 41H	Write: C1H
Chassis Output 2	Read: 42H	Write: C2H
Chassis Output 3	Read: 43H	Write: C3H
Chassis Output 4	Read: 44H	Write: C4H

EX Address 08:

Buffer 1 Input	Read: 41H	Write: C1H
Buffer 2 Input	Read: 42H	Write: C2H
Buffer 3 Input	Read: 43H	Write: C3H
Buffer 4 Input	Read: 44H	Write: C4H

The larger set of inputs on the GV200 are interpreted to the DS1/CatalystCV sources as follows:

DS-1 External Inputs 1-4:GV200 Crosspoints 1-4	(leaving 0 for black on '200')
DS-1 Buffers 1-4:	GV200 5-8
CatalystCV Pgm Out:	ME1 Reentry (GV200 value 0x15)
CatalystCV Pvw Out:	ME2 Reentry (GV200 value 0x16)
CatalystCV Black:	GV200 xpt 0
CatalystCV Bkgd:	GV200 xpt 20
	(Xpt 9 is also received as BKGD to emulate GV100)

	BC	EX	CC	MB
Read	02h	01h	4xh	
Write	03h	01h	Cxh	Xpt

Examples:

Ask the CatalystCV what the current A bus xpt is:

02h 01h 41h

Response from CatalystCV to indicate external input #2 on A bus:

03h 01h C1h 02h

Sent to CatalystCV to select the CatalystCV Pgm output on Chassis Out 3:

03h 07h 43h 15h

Acknowledge response from CatalystCV:

01h 80h

Sent to DS1 to select input #4 to feed input of Buffer #1:

03h 08h 41h 04h

Acknowledge response from CatalystCV:

01h 80h

Pushbutton/Lamp Command Read: 46h/47h Write: C6h/C7h

Used to read or set the status of different 'button' type controls. Only a subset of the GV200 buttons are implemented on the CatalystCV. In order to make this implementation less troublesome for edit controllers which are expecting the full button/lamp set, the CatalystCV will acknowledge all button/lamp numbers under this command code.

Note that although there are two read commands, 46h and 47h, they both do exactly the same thing. The Write commands, C6h and C7h, differ in whether the button/lamp is turned on (C6) or turned off (C7).

	BC	EX	CC	MB
Read	03h	01h	46h/47h	PB/L Num
Write On	03h	01h	C6h	PB/L Num
Write Off	03h	01h	C7h	PB/L Num

PB/L Numbers which are meaningful for the CatalystCV:

Name	Function	Code
Key On	Turns key on/off	06h
Mix	Selects Mix	0Fh
Mix (1)	also selects Mix	15h
Wipe	Selects Wipe	17h
Mask	Turns Mask on/off	07h
KeyInv	Turns Key Invert on/off	08h
Shadow	Turns Shadow on/off	09h
Lin Key	Selects Linear Key	10h
Lum Key	Selects Luminance Key	0Eh
Chr Key	Selects Chroma Key	11h
Cut	Performs Cut	18h
Cut (2)	also performs Cut	4Ah
Wipe Nor	Selects Wipe Dir Normal	5Eh

AutoTran (3) Read for Auto Tran State 00h

Notes:

(1), (2): The GVG 200 protocol has two codes for each of these functions. We support both transparently for compatibility.

(3): Use this lamp read command to determine if an Auto Transition is in process (response is button ON). Use the special Transition Pushbutton Select Command to start an auto transition.

Examples:

Sent to CatalystCV to query the Key On status:

03h 01h 46h 06h

Response from CatalystCV to indicate key is off:

03h 01h C7h 06h

Sent to CatalystCV to force key on air:

03h 01h 46h 06h

Acknowledge response from CatalystCV:

01h 80h

Wipe Pattern Select Command Read: 48H Write: C8H

This command is used to query or change the currently selected wipe pattern.

	BC	EX	CC	MB
Read	02h	01h	48h	
Write	03h	01h	C8h	WipeNum

The CatalystCV responds to the same wipe numbers as the GVG 200. If a user requests a GV200 wipe pattern for which there is no direct match on the CatalystCV, a simple Horizontal Wipe will be selected. Similarly, if the wipe selection is queried and the current CatalystCV wipe pattern doesn't correspond to a valid GV200 pattern, a Horizontal Wipe will be reported back.

Examples:

Sent to CatalystCV to query the current wipe selection:

02h 01h 48h

Response from CatalystCV to indicate box wipe:

03h 01h C8h 17h

Sent to CatalystCV to select Circle Wipe:

03h 01h C8h 03h

Acknowledge response from CatalystCV:

01h 80h

Analog Control Command Read: 45H Write: C5H

This command is used to read or set the value associated with an analog-style

(adjustable knob) control.

	BC	EX	CC	MB		
Read	02h	01h	45h	CntlNum		
Write	05h	01h	C5h	CntlNum	MSByte	LSByte

The numerical data for the analog control is carried as a 16 bit twos complement binary number in two bytes following the Control number. The Most Significant byte is sent first, followed by the least significant. The high byte of the MSByte is the sign bit.

Analog Controls which are supported under this command are:

Name	Code
Key Fill Matte Hue	06h
Key Fill Matte Lum	07h
Key Fill Matte Chroma	05h
Key Gain	0Bh
Key Clip	0Ah
Mask Top Edge Position (1)	0Ch
Mask Bottom Edge Position	0Fh
Mask Left Edge Position	0Dh
Mask Right Edge Position	0Eh
Background Matte Hue	1Ah
Background Matte Lum	1Bh
Background Matte Chroma	19h
Wipe Softness	1Fh
Chroma Key Hue	27h
Last Memory Register Num (2)	FFh

Notes:

(1) Mask values are in lines vertically, and 13.5 Mhz clocks horizontally.

(2) The CatalystCV takes advantage of an unused analog control number in the GV200 protocol to report the last effects memory register recalled. This is a read only value.

Examples:

Sent to CatalystCV to query the Background Matte Lum:

03h 01h 45h 1Bh

Response from CatalystCV showing value (0245h):

05h 01h C5h 1Bh 02h 45h

Sent to CatalystCV to set Mask Top Edge to line 160 (A0h):

05h 01h C5h 0Ch 00h A0h

Acknowledge response from CatalystCV:

01h 80h

Effects Memory Learn Command Read: none

Write: DAH

This write only command causes the CatalystCV to save the current effects setup into an effects memory register. Although the original GV200 protocol is limited to 30 registers, the CatalystCV recognizes 100 registers.

	BC	EX	CC	MB
Write	03h	01h	DAh	RegNum

Examples:

Sent to CatalystCV to save effects into Register 27 (1Bh):
 03h 01h DAh 1Bh
 Acknowledge response from CatalystCV:
 01h 80h

Effects Memory Recall Command Read:none Write: DBH
 This write only command causes a recall from an effects register.

	BC	EX	CC	MB
Write	03h	01h	DBh	RegNum

Examples:

Sent to CatalystCV to recall Register 11 (0Bh):
 03h 01h DBh 0Bh
 Acknowledge response from CatalystCV:
 01h 80h

Transfer Efx Memory Register Read: 5EH Write: DEH
 Used to transfer the contents of a effects memory register to and from the CatalystCV.

	BC	EX	CC	MB
Read (from)	03h	01h	5Eh	RegNum
Write (to)	03-FFh	01h	CAh	nn - nn

The length of a memory register, and thus the bytecount of the Write command may vary with changes in product feature set. An edit controller using this command must be able to deal with the maximum size message.

Examples:

Sent to CatalystCV to request contents of register 17 (11h):
 02h 01h 5Eh 11h
 Response from CatalystCV:
 xxh 01h 5Eh 11h data - data

All Stop Command Read: none Write: DEH

This write only command is sent by an edit controller to set the CatalystCV to a known state, with all transitions ended.

	BC	EX	CC	MB
Write	03h	01h	F2h	FFh

Example:

Issue All Stop to CatalystCV:
03h 01h F2h FFh
Acknowledge response from CatalystCV:
01h 80h

Software Version Command Read: 6C Write: none

This read only command is used to determine the current software revision of the CatalystCV.

	BC	EX	CC	MB
Read	02h	01h	6Ch	

Example:

Query Software Version:
02h 01h 6Ch
Response from CatalystCV:
0Bh 01h ECh data