

*AccuPel*

HDG-4000 Documentation – Serial Interface Manual

# HDG-4000

## Analog/Digital Video Calibration Generator

# **AccuPel HDG-4000 Analog/Digital Video Calibration Generator**

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## **SERIAL INTERFACE MANUAL**

**Preliminary Version 0.96**

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## USB and RS-232 Serial Control Ports

The USB and RS-232 Serial Interfaces provide complete control of all HDG-4000 functions. Refer to the HDG-4000 User Manual for a description of all generator functions and calibration patterns.

The HDG-4000 USB Control Port provides easy connectivity with the many computers that no longer provide RS-232 connectors. The HDG-4000 USB port emulates an RS-232 interface to provide easy compatibility with common PC or Macintosh terminal programs such as HyperTerminal, and provides compatibility with previous RS-232 based software written to control the AccuPel HDG-3000 Video Generator. RS-232 emulation also provides a serial control interface that is easily accessible from software development tools for users that write their own custom control programs.

The HDG-4000 RS-232 Control port provides backward compatibility with systems that are already physically wired to support the AccuPel HDG-3000 Video Generator's RJ-12 port. It also allows long connections (50-100 feet or more) using inexpensive, standard 4-wire telephone cables in new installations.

### 1 USB Port - USB Driver

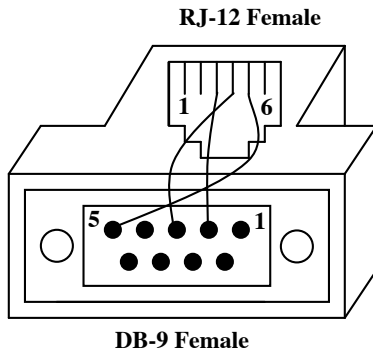
To use the HDG-4000 USB port you must first download and install a USB Driver on your computer. The USB driver is available from the AccuPel website ([www.accupel.com](http://www.accupel.com)). Full instructions for installing the driver are included with the download. You may then connect the HDG-4000 to a computer using a USB cable with Type A Male connectors on both ends.

### 2 RS-232 Port – RJ-12 Connector

No software driver is necessary to use the HDG-4000 RJ-12 port, but you will need to configure an inexpensive (\$1-\$5) DB9 Female to RJ-12 (RJ-11) adapter. A standard 4-wire telephone cable can then be used to connect the HDG-4000 RJ-12 port to the RS-232 serial port of a personal computer. Adapters that can be configured without any soldering are available from many on-line sources, some computer stores, and electronic parts suppliers such as Fry's.

The diagram shows the three wires to insert into the holes in the DB-9 connector housing. Pin 1 is on the left side of the RJ-12 connector when facing the rear of the HDG-4000, or when looking inside the adapter.

RS-232 Connector  
Pin-out



PC DB9 Connector	PC Function	HDG-4000 RJ-12 Connector	HDG-4000 Function
2	Rx	3	Tx
3	Tx	4	Rx
5	Ground	5	Ground

### 3 Serial Protocol

#### *Serial Protocol*

The USB port emulates an RS-232 connection, so the computer (controller) must be set to the proper Com Port protocols when using the RJ-12 RS-232 port or the USB port. The controller (computer) should be set to 8 bits, no parity, and 1 stop bit. It must also be set to match the HDG-4000 baud rate, which can be selected from 9600 baud to 230.4K baud in the OSD menu. Xon/Xoff flow control, or no flow control for the RS-232 port can be selected in the OSD menu, and DTS/RTS, Xon/Xoff, or no flow control can be selected for the USB port.

Note: It is often easier to start with a slow baud rate (e.g. 19200 baud) and no flow control when initially setting up a connection. The high baud rates of the HDG-4000 are primarily for use when adding new features through firmware updates. Slower baud rates (e.g. 19200 or 9600 baud) are perfectly adequate in normal use, and will permit very long connections (50-100 ft or more) over inexpensive 4-wire telephone cables.

### 4 HDG-3000 Compatibility

Programs previously written for the HDG-3000 Video Generator may only support 9600 baud, which was the only baud rate available in the HDG-3000.

### 5 HDG-4000 Command Syntax

#### *Serial Command Syntax*

The HDG-4000 accepts ASCII text commands. Each command is 2 to 12 characters in length and must be followed by a carriage return (CR) character (ASCII 13). You may not send multiple commands with a single CR. Partial command strings are not valid.

Capital and non-capital characters are accepted, i.e. a = A, B= b.

All spaces and line feed (LF) characters are ignored.

### 6 Confirmation and Error Messages

#### *"OK" Message*

The HDG-4000 will return "OK" (without quotes), followed by CRLF (ASCII 13, ASCII 10), after executing each valid serial interface command.

#### *"ER " Message*

If the HDG-4000 receives an unrecognized character string of 12 characters or less it will return "ER " followed by the unrecognized character string, followed by CRLF. If more than 12 characters are received only the first 12 chars are returned in the error message, and the remaining characters are discarded.

### 7 Query Commands

#### *Query Commands*

Query commands end with a question mark (?). Query commands return one or more text strings (each 14 characters maximum), each followed by a CRLF. "OK" followed by CRLF will be returned after the last text string.

To avoid a possible buffer overrun when sending multiple Query commands, wait for the "OK" response before sending the next Query command.

## 8 Analog Embedded Sync & HV Sync Modes

### *Automatically Recalled Sync States*

The analog embedded Sync (BiLevel, TriLevel, or None) and HV sync (Pos, Neg, or None) states are stored and automatically recalled when changing the Output or Format modes. This is necessary because certain sync modes are required by some video standards, but prohibited by others. For instance, embedded Bi-Level sync is always required for the 480i or 480p formats when using YPbPr or YPbPrs output modes, but embedded Bi-Level sync is not required for RGB or RGBs output modes. Tri-Level sync is never permitted for 480i or 480p formats.

Hence, to conform to the various video standards, the sync modes must follow several rules when the Format mode is changed between HD (720p/1080i/1080p) and SD (480i/480p/576i/576p), or the Output mode is changed between RGB/RGBs and YPbPr/YPbPrs. The generator stores 4 states for the (embedded) Sync mode, and 4 states for the analog HV Sync mode, which each depend on the current Output and Format modes.

Sync\_Mode [Output] [Format] = Bi-Level, Tri-Level or None

HV\_Mode [Output] [Format] = Pos, Neg or SoG (None)

where Output = YPbPr/YPbPrs or RGB/RGBs

Format = HD or SD

### *Send Sync Commands After Format or Output Commands*

The HDG-4000 will recall the previous Embedded Sync and HV Sync states when changing Format or Output, or you can send new Embedded Sync and HV Sync modes **after** changing Format and/or Output. But don't send a new Embedded Sync or HV Sync mode **before** sending a new Format or Output mode, because the Sync mode may be changed when the previous states are recalled.

## Serial Interface Command Tables

### Output Commands

Output	Command	Notes
Output Types	YPbPr	Analog YPbPr signals without 7.5 IRE setup. Digital YCbCr 4:4:4 signals.
	YCbCr444	Same signal types as YPbPr command.
	RGB	Analog RGB signals without 7.5 IRE setup. Digital RGB-video signals (levels: 16-235).
	RGBVideo	Same signal types as RGB command.
	YPbPrs	Analog YPbPr signals with 7.5 IRE setup. Digital YCbCr 4:2:2 signals
	YCbCr422	Same signal types as YPbPrs command.
	RGBs	Analog RGB signals with 7.5 IRE setup. Digital RGB-PC signals (levels: 0-255).
	RGBPC	Same signal types as RGBs command.
	YC	Y/C (S-video) signals (forces 480i or 576i format)
	CVBS	CVBS (Composite video) (forces 480i or 576i format)

Output  
Commands

### Format Commands

Format  
Commands

Formats	Command	Notes
Formats	480i 480p 720p 720p60 1080i 1080i60  1080p24 1080p24sf 1080p30 1080p48 1080p60  576i 576p 720p50 1080i50 1080p25 1080p50	Don't use – will be removed in the future Produces 720p59.94 or 720p60 Don't use – will be removed in the future Produces 1080i59.94 or 1080i60  Produces 1080p23.98 or 1080p24 Produces 1080p23.98sf or 1080p24sf Produces 1080p29.97 or 1080p30 Produces 1080p47.95 or 1080p48 Produces 1080p59.94 or 1080p60  only available on HDG-4000 L2 only available on HDG-4000 L2 only available on HDG-4000 L2 only available on HDG-4000 L2 only available on HDG-4000 L2 only available on HDG-4000 L2  Only 480i or 576i are permitted in Y/C or CVBS modes, other formats commands are ignored.
HD Frame/Field Rate	HDFR59.94 HDFR60.00	59.94 based field/frame rates (default) 60.00 based field/frame rates

### Group Commands

Group  
Commands

Groups	Command	Notes
Groups	Color75 Color100 Special PLUGE Grayscale Grayfield	These commands are usually not needed. Send Pattern commands instead.
	NormalGs LowGS HighGS  LowIREOff LowIREOn	10% - 100% Grayscale patterns (default) 1% - 10% Grayscale patterns 100% - 109% Grayscale patterns  Do not use – will be removed in the future. Do not use – will be removed in the future.



## Pattern Commands

Pattern  
Commands

Pattern Group	Command	Notes
Color75	SplitCB75 CB75 Red75 Green75 Blue75 Yellow75 Cyan75 Magenta75 White75 UColorWin	Split 75% Color Bars 75% Color Bars 75% Red Window 75% Green Window 75% Blue Window 75% Yellow Window 75% Cyan Window 75% Magenta Window 75% White Window User Color Window
Color100	SplitCB100 CB100 Red100 Green100 Blue100 Yellow100 Cyan100 Magenta100 White100 UColorField	Split 100% Color Bars 100% Color Bars 100% Red Field 100% Green Field 100% Blue Field 100% Yellow Field 100% Cyan Field 100% Magenta Field 100% White Field User Color Field
Special	XHatch InvXHatch NeedlePulse CMultiBurst CBandwidth MultiBurst CrossHair Sharpness CheckerBrd InvChkerBrd UCheckerBd UInvChkerBd	Crosshatch Inverse Crosshatch Dual Needle Pulses Color Pixel Multiburst (Non-YC/CVBS) * Chroma Bandwidth Sweep (YC/CVBS) * Pixel Multiburst Cross Hair and 4:3 Sizing Sharpness & Detail Enhancement Checkerboard Inverse Checkerboard User Checkerboard User Inverse Checkerboard  * Both commands produce the same results now, but each command may produce a unique pattern in the future

## Pattern Commands (cont)

Pattern  
Commands

Pattern Groups	Command	Notes
PLUGE	PLUGE0 PLUGE50 PLUGE100 PLUGEW25 PLUGEW50 PLUGEW75 PLUGEW100 PLUGEW10098 PLUGEW10050	0%/0%, 0% APL, +/-4% PLUGE 0%/50%, 25% APL, +/-4% PLUGE 0%/100%, 50% APL, +/-4%, 98/102% PLUGE 25% Window, +/-4% PLUGE 50% Window, +/-4% PLUGE 75% Window, +/-4% PLUGE 100% Window, +/-4% PLUGE 100% Window, +/-4%, 98/100% PLUGE 100%/50% Window, +/-4%, 98/100% PLUGE
Gray Scale	GSVert GSSplitVert GSHoriz GSUser GS10 GS20 GS30 GS40 GS50 GS60 GS70 GS80 GS90 GS100	10-step Vertical Grayscale Bars 10-step Split Vertical Grayscale Bars 10-step Horizontal Grayscale Bars User Value Grayscale Window 10%, 1%, or 100.9% Grayscale Window 20%, 2%, or 101.8% Grayscale Window 30%, 3%, or 102.7% Grayscale Window 40%, 4%, or 103.6% Grayscale Window 50%, 5%, or 104.5% Grayscale Window 60%, 6%, or 105.4% Grayscale Window 70%, 7%, or 106.3% Grayscale Window 80%, 8%, or 107.2% Grayscale Window 90%, 9%, or 108.1% Grayscale Window 100 %, 10%, or 109% Grayscale Window  Use NormalGS, LowGS, or HighGS command to select 10%-100%, 1%-10%, or 100%-109% patterns.
Gray Field	Overscan InvOverscan GFUser GF0 GF25 GF50 GF75 GF100	Overscan 1% Lines Inverse Overscan 1% Lines User Value Gray Field 0% Gray Field 25% Gray Field 50% Gray Field 75% Gray Field 100% Gray Field

# Sync Commands

Sync Modes	Command	Notes
HD Y Sync (Analog YPbPr)	BiHDYSync TriHDYSync	Bi-level HD Y Sync Tri-level HD Y Sync (default)
HD G Sync (Analog RGB SoG)	BiHDGSync TriHDGSync	Bi-level HD G Sync Tri-level HD G Sync (default)
HV/SoG Sync (Analog RGB)	HVCOFF SoG  NegASync PosASync	Same as SoG, Don't use – will be removed Analog RGB Sync-on-Green  Negative Analog RGB HV Sync (default) Positive Analog RGB HV Sync
HD Analog HV Sync Position (Analog RGB)	NormHDHVPos SyncPosFall  SMPTEHDHVPos SyncPosRise	Consumer Analog HV sync position (default) Don't use – will be removed in the future  SMPTE Analog HV sync position Don't use – will be removed in the future
HV HD Sync (Digital output)	NegDHDSync PosDHDSync	Negative Digital HV HD sync Positive Digital HV HD sync (std mode)
HV SD Sync (Digital output)	NegDSDSync PosDSDSync	Negative Digital HV HD sync (std mode) Positive Digital HV HD sync
Analog Embedded Sync Phase	SyncDel+5 SyncDel0 SyncDel-5	Plus Delay Zero Delay Minus Delay
Scope Trigger	VTrigOff VTrigOn	Normal/Calibration Analog HV Sync (default) Scope Trigger Analog HV Sync

Sync  
Commands

## Y/C &amp; CVBS Commands

Y/C & CVBS  
Commands

Y/C & CVBS Modes	Command	Notes
480i CVBS/YC Setup	CVBSYC0 CVBSYC7.5	Disable 7.5 IRE black level setup Enable 7.5 IRE black level setup (default)
CVBS Chroma BW	CVBSCBW0.65 CVBSCBW1.0 CVBSCBW1.3 CVBSCBW2.0 CVBSCBW3.0	0.65 MHz Chroma Bandwidth 1.0 MHz Chroma Bandwidth (default) 1.3 MHz Chroma Bandwidth 2.0 MHz Chroma Bandwidth 3.0 MHz Chroma Bandwidth
Y/C Chroma BW	YCCBW0.65 YCCBW1.0 YCCBW1.3 YCCBW2.0 YCCBW3.0	0.65 MHz Chroma Bandwidth 1.0 MHz Chroma Bandwidth 1.3 MHz Chroma Bandwidth 2.0 MHz Chroma Bandwidth 3.0 MHz Chroma Bandwidth (default)

## User Value Commands

User Value  
Commands

User Value Commands	Command	Notes
User Field Value	UvalField	Send command, wait for OK, send integer % text value from 0 to 109 ex. "UvalField"(CR), ["OK"], "65"(CR)
User Window Value	UvalWindow	Send command, wait for OK, send integer % text value from 0 to 109 ex. "UvalWindow"(CR), ["OK"], "83"(CR)
User Checkerboard Value	UvalChkrBd	Send command, wait for OK, send integer % text value from 0 to 109 ex. "UvalChkrBd"(CR), ["OK"], "70"(CR)
User R Color Value	UvalColorR	Send command, wait for OK, send integer % text value from 0 to 109 ex. "UvalColorR"(CR), ["OK"], "80"(CR)
User G Color Value	UvalColorG	Send command, wait for OK, send integer % text value from 0 to 109 ex. "UvalColorG"(CR), ["OK"], "60"(CR)
User B Color Value	UvalColorB	Send command, wait for OK, send integer % text value from 0 to 109 ex. "UvalColorB"(CR), ["OK"], "40"(CR)
User Factory Value	UvalColorF	Restores User Color75 Window to 75% gray. Restores User Color100 Field to 100% white.

**Special Features Commands***Special Features  
Commands*

Special Features	Command	Notes
Enable Channels	ChGBR ChG ChB ChR ChGB ChGR ChBR	All channels enabled G or Y channel only enabled B or Pb channel only enabled R or Pr channel only enabled G/B or Y/Pb channels only enabled G/R or Y/Pr channels only enabled B/R or Pb/Pr channels only enabled
Color Matrix Encoding (YCbCr/PbPr CVBS/YC)	CMatrixStd CMatrixRev	Standard color matrix encoding (default) Reverse Standard color matrix encoding
Edge Transition Rates	YFilterOff FastEdge YFilterOn SlowEdge	Don't use – will depreciate in future Fast video edges (default) Don't use – will depreciate in future Slower video edges  Output LEDs will blink when slow edge mode is enabled
Mute	MuteOn MuteOff	Produces black screen
Reset	ResetAll	Resets all settings to power up state

**Serial Port Commands***Serial Port  
Commands*

Flow Control	Command	Notes
RS-232 Flow Control	RS232FlowNo RS232FlowXP	None Xon/Xoff Flow Control (default)
USB Flow Control	USBFlowNo USBFlowXP USBFlowCTSP	None Xon/Xoff Flow Control CTS/RTS Flow Control (default)

**Query Commands***Query  
Commands*

Query Commands	Command	Notes
	Ver?	Returns software version number