

CAMERA INTERFACE BOARD HDMI OUTPUT

For Harrier, Tamron and Sony Block Cameras

- HDMI interface board for Tamron cameras, Sony EV-series and Harrier 10x/36x/40x/55x AF-Zoom cameras
- 1080p/1080i/720p high-definition video output
- HDMI 1.4a output

FEATURES

- HDMI interface solution for Tamron, Sony EV-series and Harrier AF-Zoom cameras.
- HDMI output via (micro) Type D connector.
- Supports HD video modes up to 1080p60.
- Remote camera control (VISCA™) via TTL serial port.
- Video output mode selected by DIP switches or VISCA™ control.
- VISCA programmable PWM output.
- Built-in test pattern generator.
- Kits for mounting the interface board to Tamron, Harrier or Sony cameras are available.
- Interface boards and cameras can be purchased as pre-assembled modules.



OVERVIEW

The **Harrier HDMI Camera Interface Board (AS-CIB-HDMI-001-A)** is a member of Active Silicon's **Harrier series** of camera interface boards; it provides HDMI output for autofocus zoom cameras such as the Tamron autofocus-zoom cameras, the Sony EV-series cameras and the Harrier 10x, 36x, 40x and 55x AF-Zoom cameras. The HDMI output is enabled when an HDMI cable is connected. The DIP switch settings on the board can be used to set the camera video mode on power-up. Camera video modes, along with other camera and interface board functions, may also be controlled by TTL serial communication and the VISCA™ protocol.

The Harrier HDMI Camera Interface Board can also be supplied as USB & HDMI or USB-only variants. The current HDMI product only supports TTL serial communication, but RS-232 communication can be added as a custom build option.

For more details, please contact Active Silicon.



Figure 1. Harrier 10x AF-Zoom HDMI Camera – a camera assembly with side mounted Harrier HDMI Camera Interface Board.



Figure 2. Camera assemblies with rear mounted Harrier HDMI Camera Interface Board
a) Harrier 30x AF-Zoom HDMI Camera (Sony FCB-EV7520),
b) Harrier 36x AF-Zoom HDMI Camera (global shutter),
c) Harrier 40x AF-Zoom HDMI Camera.

HDMI Operation

The HDMI output is enabled when an HDMI cable is plugged in. The video mode of the HDMI output is always the same as the output of the camera. To change the mode of the HDMI output, the mode of the camera should be changed using VISCA serial commands or by changing the DIP switch settings (and power cycling). Video modes up to 1080p60 are supported.

Video Mode on Power-up

On power-up, the camera interface board will read the SW1 DIP switches and set the camera video mode accordingly. If the DIP switches are set for 'Default Camera Mode' then the camera (and camera interface board) will power-up in the video mode last set on the camera.

For more information see the section on [Video Mode DIP Switch](#) settings below.

Status LED (“LED1”)

The interface board is fitted with a multi-color LED to indicate camera status.

- Flashing Yellow: This will occur at power-up; the number of flashes indicates the firmware version.
- Flashing Green: Camera and interface board are powered and in start-up mode. During this period the camera and interface board will not respond to communications and there will be no video output.
- Solid Green: Camera and interface board are powered and working correctly.
- Flashing Red: When there is a fault, the red LED will flash a number of times to indicate the type of problem. The number of flashes will match the error code returned by the VISCA [Error Code query](#) listed in the section [Camera Interface Board VISCA Commands](#). The LED will continue to flash until the error is cleared.

Analog Output

Some cameras can be set to output an analog video signal (e.g. Tamron MP1110M-VC), this signal is accessible as an output on the PWR/CTRL (J3) connector on the camera interface board. When the Tamron camera mode is set to PAL/NTSC (analog) output there is no digital video output from the camera and hence no HDMI output.

Note: the ground for the analog video signal is connected to the camera ground.

Test Pattern

A video test pattern output may be selected by (a) driving pin 1 of connector J2 low, or (b) sending the appropriate VISCA command over serial communications. For interface board operation using extended VISCA serial commands, refer to the section [Camera Interface Board VISCA Commands](#) below.



Figure 3. SMPTE RP-219-2002 test pattern generated by the interface board.

Serial Camera Control

The camera settings (including video mode) can be controlled by TTL serial VISCA commands (via the board PWR/CTRL connector – J3).

The camera VISCA serial signal is routed through the interface board and VISCA commands may be used to control both the camera and the interface board.



Serial port settings are:

parity – none, data bits – 8, stop bits – 1, no hardware handshaking, baud rate is set by the camera but is usually 9600 by default.

For interface board operation using extended VISCA serial commands, refer to the section [Camera Interface Board VISCA Commands](#) below.

For information on camera operation using VISCA serial commands please refer to the camera's user/technical manual.

Camera Interface Board VISCA Commands

The VISCA protocol can support connection of up to 8 cameras in a network; each camera is assigned a separate address. The default camera address is 1. To differentiate camera interface board specific commands from camera commands, the interface board is pre-assigned a fixed VISCA address of 2.

VISCA commands are composed of a series of hexadecimal format numbers that are sent to the camera. In this document the commands are formatted with a blank space between each byte to aid legibility, but the numbers sent to the camera/interface board must be sent without blank spaces.

Camera Interface Board VISCA Commands will generate VISCA standard ACK (A0 41 FF) and Complete (A0 51 FF) responses unless the command is not recognised, in which case a syntax error response (A0 60 02 FF) will be returned. Inquiries are returned in the VISCA compliant format A0 50 xx xx xx FF.

Note: Earlier firmware versions (v.1.0.0 and below) responded to interface board commands and inquiries with responses from VISCA address 1, i.e. in the format 90 41 FF (ACK) and 90,50,xx,xx,xx,FF (inquiries).



Camera Interface Board Custom VISCA Commands

FUNCTION	COMMAND STRING (Hex)	REPLY PACKET ⁽¹⁾	DESCRIPTION
Camera hard reset (50ms)	82 01 0A 00 FF	A0 41 FF A0 51 FF	Acknowledge Complete
Set Pattern Generation Output Mode	82 01 0A 01 xx FF Where xx is: 00 – External Control 01 – Pattern Gen off 02 – Pattern Gen on	A0 41 FF A0 51 FF	Acknowledge Complete
Set Cross Hairs On/Off	82 01 0A 03 xx FF Where xx is: 00 – Off (Default) 01 – On	A0 41 FF A0 51 FF	Acknowledge Complete
Set Sync Output Mode	82 01 0A 04 xx FF Where xx is: 00 – Vsync (Default) 01 – Vsync# 02 – Hsync 03 – Hsync# 04 – Fsync 05 – Fsync# 06 – Logic low 07 – Logic high 08 – PWM output enabled ⁽³⁾	A0 41 FF A0 51 FF	Acknowledge Complete
Serial bypass mode ⁽²⁾	82 01 0A 06 00 FF	A0 41 FF A0 51 FF	Acknowledge Complete In serial bypass mode interface board commands are disabled and all serial data received is repeated to the camera.
PWM output setting ⁽³⁾	82 01 0A 09 xx yy 00 FF	A0 41 FF A0 51 FF	xx = frequency divider: range 0x00 to 0xFE Output frequency = 59 kHz / (divider + 1) yy = duty cycle: 0x00 (=0%) to 0x64 (=100%)

Notes:

- 1) Firmware versions 1.0.0 and earlier respond to commands with 90 41 FF.
- 2) Implemented in firmware versions 1.4.0 upwards
- 3) Implemented in firmware versions 2.3.0 upwards.



Camera Interface Board Custom VISCA Inquiries

FUNCTION	INQUIRY STRING (Hex)	REPLY PACKET ⁽¹⁾	DESCRIPTION
Query Interface Board Firmware Version	82 09 0A 00 FF	A0 50 r1 r2 r3 FF	r1 = Major Version r2 = Minor Version r3 = Sub Minor Version
Query Interface Board Hardware Information	82 09 0A 01 FF	A0 50 r1 r2 FF	r1 = Hardware revision r2 = Hardware variant
Query Interface Board Health ⁽³⁾ <i>Note: Temperature (in degrees C) is measured in the FPGA device and is reported in hexadecimal format with a +60°C offset. To calculate the FPGA temperature in degrees C, convert the hexadecimal value reported to decimal, then subtract 60.</i> (e.g. r2 = 0x73 = 115 FPGA temperature = (115-60) = 55°C)	82 09 0A 02 FF	A0 50 r1 r2 FF	r1 = Status (Bit 0-6 set indicates no fault condition) Bit 0 = Voltage OK Bit 1 = LVDS PLL clock OK Bit 2 = Reserved Bit 3 = Pixel PLL clock OK Bit 4 = Reserved Bit 5 = Cam. comms initialized Bit 6 = Running / OK Bit 7 = Error state r2 = Temperature (in hex) +60°C (0x3C) offset. ⁽²⁾
Query Interface Board DIP Switch Status	82 09 0A 03 FF	A0 50 r1 FF	r1 = DIP Switch Settings
Query Interface Board Enhanced Hardware Information	82 09 0A 04 FF	A0 50 r1 r2 r3 r4 r5 FF	r1 = Project code r2 = Project board r3 = Board issue r4 = Build MSB r5 = Build LSB
Query Interface Board Error Code ⁽³⁾	82 09 0A 05 FF	A0 50 r1 FF	r1 = Status Code (Value returned indicates fault condition) 00 = No error 01 = FPGA core temperature 02 = Reserved 03 = Main power rail fault 04 = 1V8 power rail fault 05 = 3V3 power rail fault 06 = 1V1 power rail fault 07 = 2V5 power rail fault 08 = 5V HDMI DDC fault 09 = Camera comms timeout 0A = Camera video mode/ LVDS link width fault 0B = LVDS clock loss of lock 0C = Reserved 0D = Pixel clock loss of lock 0E = Reserved 0F = Firmware type error

Notes:

- 1) Firmware versions 1.0.0 and earlier respond to interface board inquiries with responses from VISCA address 1, i.e. in the format 90,50,xx,xx,xx,FF.
- 2) Temperature (in degrees C) is measured in the FPGA device and is reported with a +60°C offset in hexadecimal format. To calculate the temperature in the FPGA convert hexadecimal value reported by extended VISCA command to decimal then subtract 60 to calculate the FPGA temperature in degrees C.



3) Implementation changed in firmware versions 2.3.0 upwards

CONNECTOR SPECIFICATION

KEL30 Connector (“CAMERA”): 30 way (J1)

The interface board is fitted with a 30-way miniature connector to link to the matching connector on the camera.

Connector type: KEL USL00-30L

Mating cable: KEL USL20-30SS-010-C (100mm length) or
KEL USL20-30SS-005-C (50mm length) 30-way micro coaxial cable.

This cable can be supplied with the interface board (see ordering information below)
Other lengths also available (subject to minimum order quantities).

Input/Output Connector (“I/O”): 4-way (J2)

The interface board is fitted with an industry standard 4-way connector for Vsync signal output and test pattern/reset control inputs.

Connector type: JST SM04B-SRSS-TB

Mating cable: Suitable cable can be purchased as part of a cable kit (see ordering information).

PIN	SIGNAL	LEVEL	NOTES
1	PGEN#	TTL compatible 5V tolerant. Active low signaling.	Input pin with 10kΩ pullup resistor. Drive low to enable the SMPTE test pattern output.
2	SYNC OUT / PWM output	TTL (3.3V CMOS compatible with 5V TTL).	Sync active high by default. Alternate configurations selectable by extended VISCA command.
3	GND	0V	GND
4	RESET#	TTL compatible 5V tolerant. Active low signaling.	Input pin with 10kΩ pullup resistor. Drive low to reset the camera and interface board.

Note: After some signal conditioning to remove noise, the RESET# input is also fed into the camera; hence a reset from this input will reset both the camera and the camera interface board.

**Power and Control Connector (“PWR/CTRL”): 10-way (J3)**

The interface board is fitted with an industry standard 10-way connector for power and serial control.

Connector type: JST SM10B-SRSS-TB

Mating cable: Suitable cable can be purchased as part of a cable kit (see ordering information).

PIN	SIGNAL	LEVEL	NOTES
1	No Connection		
2	No Connection		
3	Analog SD video out ⁽¹⁾	PAL/NTSC levels	Sourced direct from camera. <i>Note: not available with Sony FCB EV cameras.</i>
4	Power GND	0V	Also used as analog ground.
5	Power GND	0V	GND
6	DC Power In	8.25V to 15V ⁽²⁾	Power supply, nominal 9V.
7	VISCA GND	0V	GND for VISCA Comms.
8	Logic RxD input	3.3V CMOS (3.3V / 5V TTL compatible, with internal 10k pull up to 3.3.V).	VISCA communications.
9	Logic TxD output	3.3V CMOS (3.3V / 5V TTL compatible)	VISCA communications.
10	DC Power In	8.25V to 15V	Power supply, nominal 9V.

Note:

- 1) Analog SD output for Tamron cameras is only available when the camera is set in PAL/NTSC mode, in this mode there is no digital output from the camera or on the HDMI output connector (J5). Sony EV-series cameras do not support Analog SD output.
- 2) The interface board supports input voltages up to 15V, note that this supply is also used to power the connected block camera. To avoid damage to the camera the voltage supplied to the interface board must be within the specification of the camera connected to the board.

JTAG Connector (J4)

Test connector used in manufacturing for circuit verification.

HDMI Output Connector (“HDMI”) (J5)

The interface board is fitted with a micro HDMI display output connector. HDMI output is active when an HDMI cable is connected.

Connector type: HDMI Type D (micro)

Mating Connector: Standard micro HDMI cable



Video Mode DIP Switch (SW1)

The interface board is fitted with an 8-way DIP switch (SW1) to enable selection of camera video format on power-up. Switches 5-8 are reserved for future use.

SW1-4	SW1-3	SW1-2	SW1-1	VIDEO FORMAT	MODE	HDMI
OFF	OFF	OFF	OFF	Default Camera Mode ⁽¹⁾	0	



CONFORMANCE

HDMI: Compliant with HDMI specification v.1.4a

Approvals: Active Silicon makes the following approval statements:

CE In accordance with the CE Marking regulations, the **Harrier HDMI Camera Interface Board** is not a finished product and is supplied for further integration into a finished product that will be CE marked by the final manufacturer/integrator. Therefore, no CE marking or Declaration of Conformity is required or allowed.

RoHS3 This product is compliant with the RoHS3 requirements (Directive 2015/863/EU).

REACH Please contact Active Silicon for the latest formal REACH declaration (EC 1907/2006).

EMC This product is designed to be compliant with the following requirements when housed in a suitable enclosure:

- EN 55022:2010 (Class A) and EN 55024:2010 (EU Directive 2014/30/EU Electromagnetic Compatibility)
- FCC Rules for Class A digital devices

UL All printed circuit boards used in this product are manufactured by UL recognized manufacturers and have a flammability rating of 94-V0.

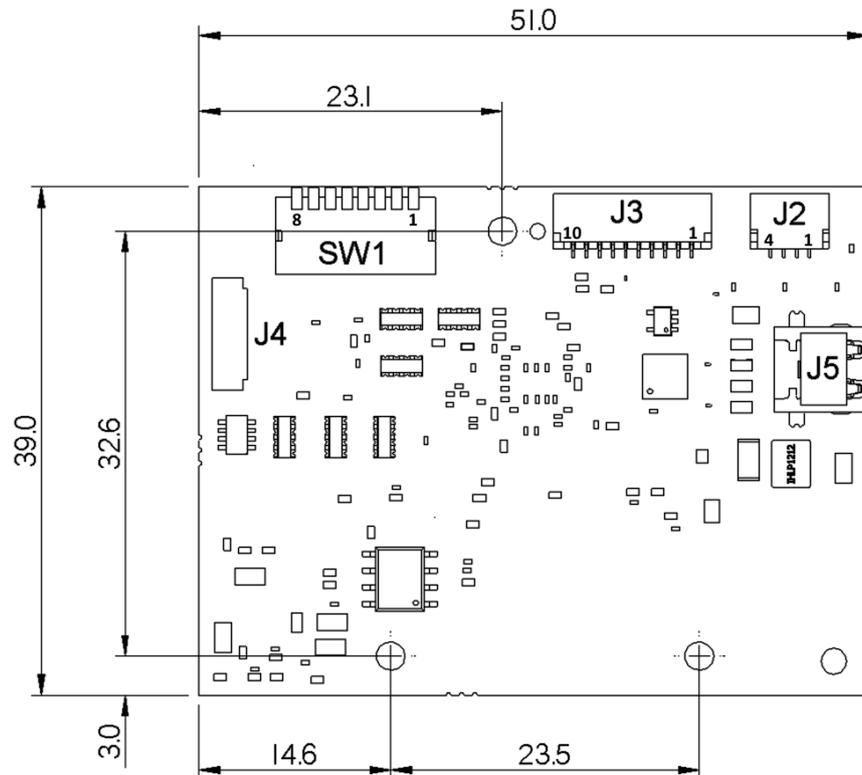


Figure 4. Mechanical overview, side B
(Note – when mounted on a camera, this side faces the camera)

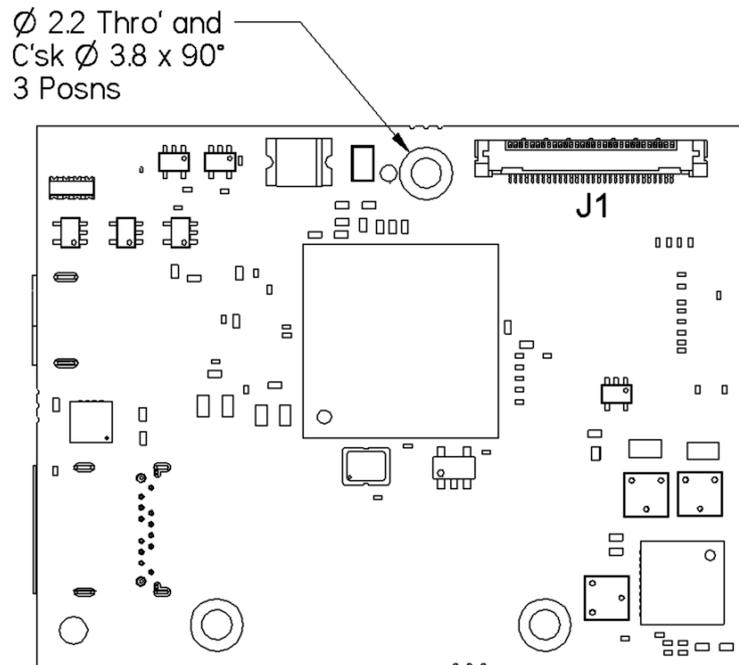


Figure 5. Mechanical overview, side A
(Note – when mounted on a camera, this side faces away/out from the camera)

PHYSICAL AND ENVIRONMENTAL DETAILS

<i>Dimensions:</i>	51mm x 39mm.
<i>Weight:</i>	~10g (interface board only, no cables).
<i>Power Supply:</i>	8.25V to 15V
<i>Power Consumption:</i>	0.2 - 0.4W typical with HDMI active @1080p60. (Note: does not include camera power).
<i>Storage Temperature:</i>	-20°C to +100°C
<i>Operating Temperature:</i>	0°C to +70°C (ambient environment).
<i>Relative Humidity:</i>	10% to 90% non-condensing (operating and storage).



ORDERING INFORMATION

PART NUMBER	DESCRIPTION
AS-CIB-HDMI-001-A	Harrier HDMI Camera Interface Board. Board only, no cables included.
AS-CIB-HDMI-001-10LHD-A	Harrier 10x AF-Zoom HDMI Camera.
AS-CIB-HDMI-001-9520L-A	Harrier 30x AF-Zoom HDMI Camera (Sony FCB-EV9520L).
AS-CIB-HDMI-001-36LGHD-A	Harrier 36x AF-Zoom HDMI Camera with global shutter.
AS-CIB-HDMI-001-40LHD-A	Harrier 40x AF-Zoom HDMI Camera.
AS-CIB-HDMI-001-55LHD-A	Harrier 55x AF-Zoom HDMI Camera.
AS-CIB-USBHDMI-001-EVAL-A	Evaluation Kit for Harrier USB/HDMI, and all Harrier HDMI camera assemblies. The kit contains power supply, board cables (AS-CIB-CBLKIT-003-A and micro-coax cable AS-CIB-USL30-100MM) and the Harrier Evaluation Board with PC serial interface (via USB UART). Not included: Camera and camera interface board.
AS-CIB-USL30-100MM	30-way micro-coax cable for connecting the interface board (J1) to the camera. Length 100mm. (Manufacturer: KEL, part number: USL20-30SS-010-C).
AS-CIB-USL30-50MM	30-way micro-coax cable for connecting the interface board (J1) to the camera. Length 50mm. (Manufacturer: KEL, part number: USL20-30SS-005-C).
AS-CIB-CBLKIT-003-A	Cable kit for AS-CIB-HDMI-001-A containing cables for J2, and J3 that connect to the Harrier Evaluation Board.
AS-CIB-FIXKIT-001-A	Plastic clip, screws and spacers for mounting AS-CIB-HDMI-001-A to a Tamron MP3010M-EV camera.
AS-CIB-BRK-007-A	Metal bracket, screws and spacers for mounting AS-CIB-HDMI-001-A to Sony FCB-EV-series and Harrier 36x or 40x AF-Zoom Camera.
AS-CIB-BRK-009-A	Metal bracket, screws and spacers for mounting AS-CIB-HDMI-001-A to Harrier 10x AF-Zoom Camera.

Active Silicon offer custom design services and can adapt the product if it does not meet all your requirements. We are happy to discuss your system requirements and are looking forward to delivering the product you need.



CONTACT DETAILS

Headquarters:

Active Silicon Ltd
1 Waterside Court, Waterside Drive,
Langley, Berks, SL3 6EZ, UK.

Tel: +44 (0)1753 650600
Email: info@activesilicon.com
Website: www.activesilicon.com

North America:

Active Silicon, Inc.
479 Jumpers Hole Road, Suite 301,
Severna Park, MD 21146, USA.

Tel: +1 410-696-7642
Email: info@activesilicon.com
Website: www.activesilicon.com