

# CAMERA INTERFACE BOARD

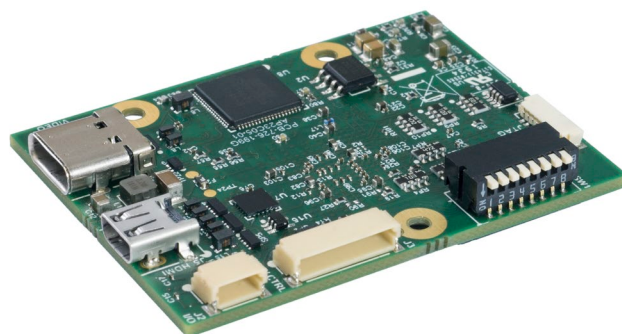
## USB 3.1 & HDMI (USB powered)

### For Harrier, Tamron and Sony Block Cameras

- USB 3.1 & HDMI interface board for Tamron series, Harrier series and Sony EV-series cameras
- 1080p/1080i/720p 60/50/30Hz high-definition video output
- SuperSpeed USB (USB 3.1 Gen 1) Video Class (UVC) output
- HDMI 1.4a output

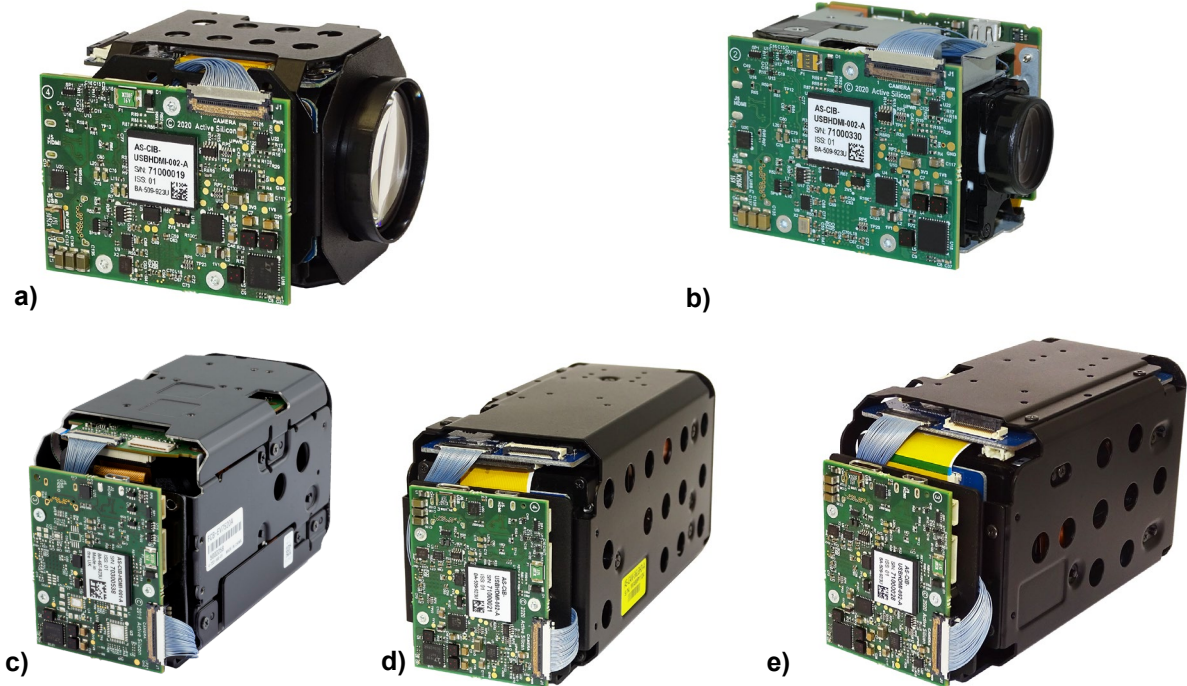
## FEATURES

- USB 3.1 Gen 1 and HDMI interface solution for the Tamron, the Harrier AF-Zoom series (10x, 10x GS, 30x GS, 36x, 40x, 55x) and the Sony EV-series cameras.
- SuperSpeed USB (USB 3.1 Gen 1) USB Video Class output via USB Type C connector.
- HDMI output via (micro) Type D connector.
- Supports HD video modes up to 1080p60.
- Simultaneous display on both video outputs.
- UVC control of camera properties e.g. zoom, etc.
- VISCA camera control over RS-232 / RS-485 / TTL serial port or Harrier Virtual Serial COM port/ Linux API over USB connection.
- Video output mode selected by UVC/VISCA.
- VISCA programmable PWM output.
- Power supplied via USB socket or external connector.
- Interface boards and cameras can be purchased separately or as pre-assembled modules.



## OVERVIEW

The **Harrier USB/HDMI Camera Interface Board (AS-CIB-USBHDMI-002-A)** is a member of Active Silicon's **Harrier series** of camera interface boards; it provides HDMI and USB Video Class (UVC) output for Tamron cameras, all Harrier AF-Zoom cameras and Sony EV-series cameras (with LVDS output). The USB Video output is enabled when the board is connected to a SuperSpeed USB 3.x host. The HDMI output is enabled when an HDMI cable is connected. Camera video modes, along with other camera and interface board functions, are controlled by UVC commands, VISCA commands over serial communications (RS-485/RS-232/TTL), or by VISCA commands sent over the Harrier Virtual Serial COM port/Linux API and USB cable. The USB cable serves as both video output and UVC/VISCA over USB control communications channel.



**Figure 1. Camera assemblies with the Harrier USB/HDMI Camera Interface Board.**

- a) Harrier 10x AF-Zoom USB/HDMI Camera,
- b) Harrier 10x AF-Zoom USB/HDMI Camera (Tamron MP3010M-EV),
- c) Harrier 30x AF-Zoom USB/HDMI Camera (Sony FCB-EV7520),
- d) Harrier 36x AF-Zoom USB/HDMI Camera (global shutter),
- e) Harrier 40x AF-Zoom USB/HDMI Camera.

*The Harrier USB/HDMI Camera Interface Board can also be supplied as HDMI or USB-only variants. For more details contact Active Silicon.*

## Video Mode Selection

The interface board video output mode is always the same as the output mode of the camera (for supported video modes). On power-up, the camera and the camera interface board, will start in the video format/mode that was operating/set when they were last powered down.

The video mode output of the board/camera is normally set using the UVC controls. VISCA commands (sent over the serial connection or Harrier Virtual Serial COM port) can be used to change video mode, but in order to get working USB video, the camera video mode has to match the USB video mode expected by the host USB application. For this reason, when using USB video, changing the video mode using VISCA commands is not recommended.

Video modes up to 1080p60 (with camera dual LVDS mode setting) are supported by the camera interface board. However, due to the high data bandwidth required to output video modes above 1080p30, cameras must support, and be set to, dual LVDS mode. For 1080p30 and below, the camera must be set to single LVDS mode. When using VISCA commands to change the camera video mode the LVDS mode must also be set correctly, otherwise there will be no video output from the camera/board.

For example:

Set Single LVDS mode: 81 01 04 24 74 00 00 FF    Set Dual LVDS mode: 81 01 04 24 74 00 01 FF

Note: these modes/commands are not available with cameras that do not support LVDS mode (e.g. AS-CAM-55LHD and AS-CAM-36LGHD).

**Video formats and outputs supported by the Harrier USB/HDMI Camera Interface Board:**

| Video Format | HDMI | USB |
|--------------|------|-----|
| 1080p60 *    | ✓    | ✓   |
| 1080p59.94 * | ✓    |     |
| 1080p50 *    | ✓    | ✓   |
| 1080p30      | ✓    | ✓   |
| 1080p29      | ✓    |     |
| 1080p25      | ✓    | ✓   |
| 1080i60      | ✓    |     |
| 1080i59.94   | ✓    |     |
| 1080i50      | ✓    |     |
| 720p60       | ✓    | ✓   |
| 720p59.94    | ✓    |     |
| 720p50       | ✓    | ✓   |
| 720p30       | ✓    |     |
| 720p29       | ✓    |     |
| 720p25       | ✓    |     |

\*= dual LVDS modes

## USB/UVC Operation

The SuperSpeed USB video port (USB Type C, J6) can be used to stream/acquire image data in parallel with the HDMI display output. The USB port provides a UVC compliant (YUV422) video stream, and video data may be viewed on any UVC compliant host application such as VLC, Microsoft Camera or Active Silicon's HarrierView UVC Application.

**Note:** A Superspeed host USB port and Superspeed USB cable with a supported data rate  $\geq 5\text{Gbps}$  **must** be used.

The HarrierView example UVC application for Windows, demonstrates how to display/record video from the USB Video Class driver and implement UVC camera controls. The HarrierView application is part of the Harrier USB SDK; this can be downloaded from the Active Silicon website.

<https://www.activesilicon.com/wp-content/uploads/DATASHEET-Harrier-USB-SDK.pdf>

There is also sample UVC code and documentation at:

<https://docs.microsoft.com/en-us/windows-hardware/drivers/stream/usb-video-class-driver>

Video modes up to 1080p60 (with camera dual LVDS mode setting) are supported. The camera must be set to a supported UVC video mode (listed above). Please also consult the documentation for your camera to confirm which video modes are supported by the camera model you are using (as this varies between cameras). The video mode of the camera can be changed using UVC camera control. Some UVC applications will reset the video mode to a default value on start-up.

To enable UVC camera control DIP switch SW1 [7] must be set ON.



For optimum USB video performance under **Windows**, it is important to set the Windows performance/power settings to high performance. Similarly, the computer BIOS settings should be set to high processor performance with power saving modes disabled (including features like Speed Step, P States, etc.).

For support on host computers that are running **Linux** you will need to ensure that you have installed applications and drivers that support UVC (e.g. V4L drivers), please consult the documentation for your Linux distribution. Listed below are some helpful links:

<http://www.ideasonboard.org/uvic/>

<https://www.kernel.org/doc/html/v4.13/media/v4l-drivers/uvicvideo.html>

<https://github.com/libuvic/libuvic>

[https://www.linuxtv.org/wiki/index.php/How\\_to\\_Obtain,\\_Build\\_and\\_Install\\_V4L-DVB\\_Device\\_Drivers](https://www.linuxtv.org/wiki/index.php/How_to_Obtain,_Build_and_Install_V4L-DVB_Device_Drivers)

<https://help.ubuntu.com/community/Webcam>

The default USB configuration of the Harrier USB camera/board reports that the camera is self-powered. Most modern Superspeed USB sockets are able to deliver 1.5A of current (see section: Camera Interface Board Power Supply) but Linux USB drivers often still report these USB ports as only 900mA capability; this means that the Linux driver may shut down the USB port and the camera/device will not start as it expects that the USB port cannot deliver enough power to drive the camera. Regardless of the capability of the actual USB hardware, or use of an external power supply, in this situation Linux will detect that the device requires too much power and will shut down the USB port.

This problem can be seen in DMESG:

```
[14256.348342] usb 2-1: New USB device strings: Mfr=1, Product=2, SerialNumber=7
[14256.348345] usb 2-1: Product: Active Silicon Harrier T1110-2
[14256.348348] usb 2-1: Manufacturer: Active Silicon
[14256.348351] usb 2-1: SerialNumber: 1-1602772708-TNMP1110-1
[14256.348644] usb 2-1: rejected 1 configuration due to insufficient available bus power
[14256.348647] usb 2-1: no configuration chosen from 1 choice
[14289.711761] usb 2-1: USB disconnect, device number 3
```

The workaround is to change the Linux USB power configuration to ignore the power warnings and allow the devices to start (udev rules). For more information see the Harrier USB SDK (downloads section) and download the Linux zip file:

<https://www.activesilicon.com/wp-content/uploads/PRODUCT-SOFTWARE-Harrier-USB-Linux-API-including-arm.zip>

Note: You must ensure that the USB socket can provide enough power to drive the camera under all operating conditions (zoom and focus actions usually increase the camera power consumption)

To operate correctly, the camera interface board needs to be configured correctly to match the camera that is connected. For more information see the section below.



## Configuring the Board for Your Camera

The configuration of a Harrier USB/HDMI Camera Interface board depends on the DIP switch settings and USB configuration of the board. For information on the DIP switch settings please see the section below.

By default, the USB interface of the board is configured for the Tamron MP3010M-EV camera, if you are using a different camera the USB settings of the board need to be re-configured to support the properties of the other camera. If you have purchased a pre-assembled camera unit then the board will already be correctly configured for the camera.

To change the configuration of your Harrier USB/HDMI Camera Interface Board you will need the HarrierControl software. Please go to the software section of [www.activesilicon.com](http://www.activesilicon.com) and locate the HarrierControl page:

<https://www.activesilicon.com/products/harriercontrol-camera-software/>

Download the HarrierControl software and read the instructions for how to change the USB board configuration.

Note that issue 02 boards and above require the HarrierControl v1.5 distribution (or above). Issue 01 boards require previous distributions of HarrierControl (v.1.42).

When the interface board is connected by a USB3 cable, the board/camera will appear in the camera section of the Windows Device Manager. Depending on how it is configured it will appear with a different name. See the list below.

### Cameras supported by the Harrier USB/HDMI Camera Interface Board:

| CAMERA                        | WINDOWS DEVICE MANAGER NAME   |
|-------------------------------|-------------------------------|
| Tamron MP3010M-EV             | Active Silicon Harrier T3010  |
| Sony FCB-EV9520L              | Active Silicon Harrier S9520  |
| Sony FCB-EV9500L              | Active Silicon Harrier S9500  |
| Harrier 10x AF-Zoom Camera    | Active Silicon Harrier 10LHD  |
| Harrier 10x AF-Zoom Camera GS | Active Silicon Harrier 10LGHD |
| Harrier 30x AF-Zoom Camera GS | Active Silicon Harrier 30LGHD |
| Harrier 36x AF-Zoom Camera GS | Active Silicon Harrier 36LGHD |
| Harrier 40x AF-Zoom Camera    | Active Silicon Harrier 40LHD  |
| Harrier 55x AF-Zoom Camera    | Active Silicon Harrier 55LHD  |

## HDMI Operation

The HDMI output is enabled when an HDMI cable is plugged in. For details of supported HDMI video modes please see section: [Video Mode Selection](#) above, and the documentation for your camera. The video mode of the camera can be changed using VISCA commands (over serial, USB or Harrier Virtual Serial COM port), or UVC camera control (see the section on [Camera Control](#) below).

## Analog Output

Some cameras can output an analog video signal on pin 25 of the KEL connector (J1). If present, this signal is accessible as an output on the PWR/CTRL connector (J3) on the camera interface board. For example, if the Tamron MP3010M-EV camera mode is set to PAL/NTSC video mode it will generate an analog video output on J3 (note: while the camera is in this mode there is no LVDS output so there will also be no digital video output from the Harrier camera interface board).

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

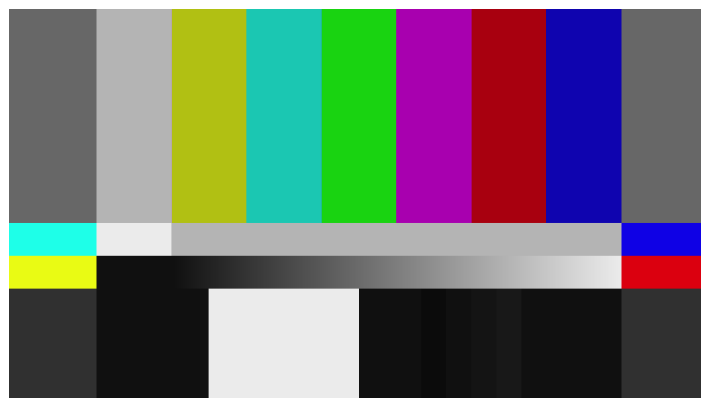
## Status LED (“LED1”)

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 are not accessible 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 <a href="#">Error Code/Status query</a> listed in the section <a href="#">Camera Interface Board VISCA Commands</a> . The LED will continue to flash until the error is cleared. |

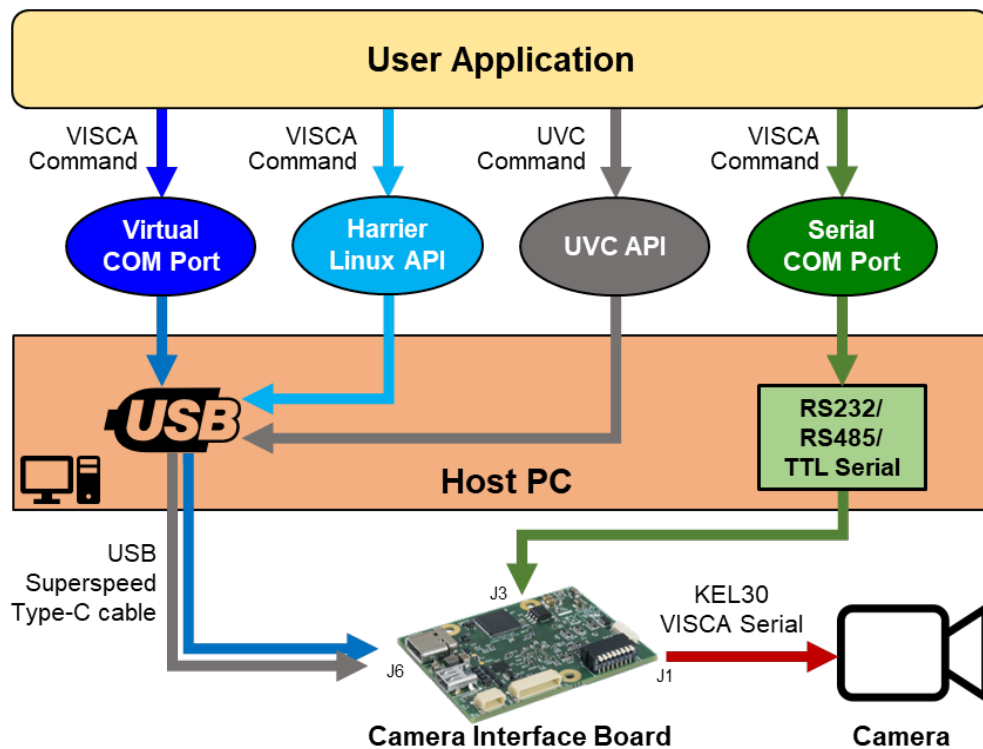
## Test Pattern

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



**Figure 2. SMPTE RP-219-2002 test pattern generated by the interface board.**

## Camera Control



**Figure 3. User application protocol options and channels for camera control.**

The camera module is controlled by VISCA commands, but there are several routes for commands to get to the camera. VISCA commands can be sent directly over the interface boards serial interface or through the USB cable using the Virtual COM Port or Linux API. However, the camera can also be controlled by UVC commands; these are sent over USB to the interface board, and the board translates them into VISCA commands that get sent to the camera.

## VISCA Camera Control

For information on VISCA serial commands for your camera please refer to the user manual for your camera.

**Note:** when using USB video, changing video modes using VISCA commands is not recommended.

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

The Harrier camera interface board supports camera control via the UVC API and VISCA protocol (RS232/RS485/TTL/USB - Harrier Virtual Serial COM port/Linux API). The control communication channel selected is set by the configuration of the DIP switch settings (SW1 [5,6,7]) at board power-up; for more information see the section on [DIP switch functions](#) below.

VISCA commands can be used to control the camera settings in two ways:

### 1. RS232/RS485/TTL serial communication:

VISCA commands can be sent to the camera over RS232/RS485/TTL serial via the interface board PWR/CTRL connector (J3). Software control of these interfaces are usually implemented using COM ports or direct control of the serial interface via the host computer's operating system. Serial port settings are: parity - none, data bits - 8, stop bits - 1, baud rate is set by the camera but is usually 9600 by default.

### 2. USB connection using Harrier Virtual Serial COM Port / Linux API

If the Harrier USB SDK is installed (Windows only), a Harrier Virtual Serial COM port will appear when the USB port (J6) on the interface board is connected to a SuperSpeed USB port on the host computer (using a SuperSpeed USB cable). The Harrier Virtual Serial COM port can be used to



send and receive VISCA data in the same way as a standard serial COM port. Although the Harrier Virtual Serial COM port looks and acts like a serial COM port, there is no actual serial port hardware and changing the serial port hardware settings (baud rate, etc.) will have no effect. (Note: DIP switch SW1 [7] must be set ON.) Responses to VISCA inquiries should always be read before sending the next command. The Linux API can be downloaded from the Active Silicon website.

## UVC Based Camera Control

UVC is a USB device class, defined by the USB Implementers Forum, that describes USB devices capable of streaming video. For more information on UVC implementation please consult the USB Video Class specification (revision 1.1), Microsoft Windows documentation and the HarrierView application.

The ability to support specific UVC camera control features (e.g. setting a function to automatic or manual control) are dependent on the camera's feature set and capabilities. UVC value ranges used, and the specific functionality of each feature is camera specific, and it is therefore necessary to configure the interface board to match the model of camera it is connected to. In the camera certain features may be mutually exclusive or co-dependent, this needs to be considered when implementing the UVC application.

Note: the values for camera properties used in UVC commands are not the same as the values used in the VISCA commands.

| UVC CAMERA FEATURE     | UVC RANGE<br>(e.g. for Sony FCB-EV7520)                   | COMMENT                                                                                                |
|------------------------|-----------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| Focus                  | 4096 (far) – 61440 (near)                                 | Maximum values for focus vary per camera. Higher values are nearer focus.                              |
| Zoom                   | Optical Zoom: 0 – 16,384<br>Digital Zoom: 16,384 – 31,424 | When the optical zoom reaches its maximum value, the camera will automatically switch to digital zoom. |
| Brightness             | -14 – 14                                                  | Will be disabled when manual Gain control is enabled.                                                  |
| Hue                    | -14 – 14                                                  | -                                                                                                      |
| Saturation             | 60 – 200                                                  | -                                                                                                      |
| Sharpness              | 0 – 15                                                    | -                                                                                                      |
| Gamma                  | 0 – 1                                                     | Values match camera VISCA command parameters.                                                          |
| White Balance          | 0 – 9                                                     | Values match camera VISCA command parameters (values 3/5 [auto] are not supported).                    |
| Iris                   | 160 – 1400                                                | Auto control setting enabled by default.                                                               |
| Exposure               | -13 – 0                                                   | Auto control setting enabled by default.                                                               |
| Gain                   | 1 – 15                                                    | Can only be manually controlled when both Exposure and Iris are in manual control mode (Auto set OFF). |
| Backlight Compensation | 0 – 1                                                     | This is disabled when Gain is set to manual control.                                                   |

## Camera Interface Board Custom VISCA Commands/Inquiries

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 has a pre-assigned 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 Custom VISCA Commands

| FUNCTION                                                                                                                                  | COMMAND STRING                                                                                                                                                                                                           | REPLY PACKET         | DESCRIPTION                                                                                                                                                                                                                      |
|-------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Camera hard reset (50ms)                                                                                                                  | 82 01 0A 00 FF                                                                                                                                                                                                           | A0 41 FF<br>A0 51 FF | Acknowledge<br>Complete                                                                                                                                                                                                          |
| Set Pattern Generation Output Mode                                                                                                        | 82 01 0A 01 <b>xx</b> FF<br>Where xx is:<br>00 - External Control<br>01 - Pattern Gen off<br>02 - Pattern Gen on                                                                                                         | A0 41 FF<br>A0 51 FF | Acknowledge<br>Complete                                                                                                                                                                                                          |
| Set Cross Hairs On/Off                                                                                                                    | 82 01 0A 03 <b>xx</b> FF<br>Where xx is:<br>00 – Off (Default)<br>01 – On                                                                                                                                                | A0 41 FF<br>A0 51 FF | Acknowledge<br>Complete                                                                                                                                                                                                          |
| Set Sync Output Mode                                                                                                                      | 82 01 0A 04 <b>xx</b> FF<br>Where xx is:<br>00 – Vsync (Default)<br>01 – Vsync#<br>02 – Hsync<br>03 – Hsync#<br>04 – Fsync<br>05 – Fsync#<br>06 – Logic low<br>07 – Logic high<br>08 – PWM output enabled <sup>(1)</sup> | A0 41 FF<br>A0 51 FF | Acknowledge<br>Complete                                                                                                                                                                                                          |
| Serial bypass mode<br>(Firmware v1.0.0 and above)<br><b>Note:</b> this command is not supported over the Harrier Virtual Serial COM port. | 82 01 0A 06 00 FF                                                                                                                                                                                                        | A0 41 FF<br>A0 51 FF | Acknowledge<br>Complete<br><br>In serial bypass mode interface board commands are disabled and all serial data received is repeated to the camera.                                                                               |
| USB VISCA response filter                                                                                                                 | 82 01 0A 07 <b>xx</b> FF<br>Where x is:<br>00 – All VISCA responses enabled.<br>01 – VISCA command Acknowledge and Complete responses disabled (default).<br>02 – All VISCA responses disabled.                          | A0 41 FF<br>A0 51 FF | Acknowledge<br>Complete<br><br>Filtering out camera responses reduces the transaction traffic on the USB port to optimize video performance. Responses to VISCA inquiries should always be read before sending the next command. |
| PWM output setting <sup>(1)</sup>                                                                                                         | 82 01 0A 09 <b>xx yy</b> 00 FF                                                                                                                                                                                           | A0 41 FF<br>A0 51 FF | <b>xx</b> = frequency divider:<br>range 0x00 to 0xFE<br>Output frequency =<br>59 kHz / (divider + 1)<br><b>yy</b> = duty cycle:<br>0x00 (=0%) to 0x64 (=100%)                                                                    |

**Notes:**

1) Implemented in firmware versions 3.3.0 upwards.



## Camera Interface Board Custom VISCA Inquiries

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

**Notes:**

1) Implementation changed in firmware versions 2.3.0 upwards.



## Camera Interface Board Power Supply

The Harrier USB/HDMI Camera Interface Board can be powered via the Power and Control Connector (J3) or by the USB Type C (J6) connector.

If DIP switch SW1 [8] is set OFF the camera interface board will automatically switch power source between the J6 USB and J3 header connectors. If both are connected, the Power and Control Connector (J3) will be the selected supply.

If DIP switch SW1 [8] is set ON the camera J3 header connector is set as the power source; the USB power supply is disabled.

The camera (connected via the KEL cable to J1) is also powered by the selected supply, hence the power source must be able to supply enough current to drive both the camera and the camera interface board.

Note that cameras usually use more power when running at high resolution/frequency, and when zooming and focusing - this must be considered when designing the system.

The PC USB 3.0 port specification describes three power output levels:

- Type A socket rated at 900mA/~4.5W.
- Type C socket rated at 1.5A/~7.5W.
- Type C socket rated at 3.0A/~15W.

Note that the voltage specification of a USB 3.0 port is nominally 5V but may vary between 4.75 and 5.25V (hence the power output of a 1.5A Type C rated socket could in theory be as low as 7.125W). There will also be a small amount of power dissipation/voltage loss across the USB connectors and cable, typically this is around 50mW, but it will depend on the quality of your cable and connectors.

USB ports are often designed to be able to support higher currents than the USB specification and systems with both Type C and Type A sockets often share the same power supply, but this cannot be guaranteed. To power your camera/ interface board via the USB connector you must ensure that the host USB socket can supply enough current to power both the interface board and camera under all expected modes of operation, e.g. power-up, zoom and focus.

If the intended USB socket cannot supply enough current to drive the camera, then an externally powered USB 3.0 hub can be used to supply the power over the USB cable (e.g. StarTech ST4300MINI).

For example, taking typical values measured on a Sony FCB-EV9520A camera in 1080p60 mode:

| ITEM                           | CURRENT (Amps@4.75V) | POWER (W) |
|--------------------------------|----------------------|-----------|
| Camera (not zooming)           | 1.22A                | 5.8W      |
| Camera (zooming and focussing) | 1.35A                | 6.40W     |

Hence powering a Sony FCB-EV9520A camera and Harrier USB/HDMI Camera Interface Board by USB will require a USB socket that can provide 1.5 Amps.

To prevent the operating system from shutting down the USB port, camera systems that require more than 7.5W/1.5 Amps (or 900mA for Linux USB camera configurations) are configured to report that the camera is self-powered. Please see [USB/UVC Operation](#). In this situation you must ensure that the host USB socket can supply enough current to power both the interface board and camera under all expected modes of operation; e.g. power-up, zoom and focus.



## 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.  
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.<br>Active low signalling. | Input pin with 10k $\Omega$ pullup resistor.<br>Drive low to enable the SMPTE test pattern output. |
| 2   | SYNC OUT /<br>PWM output | TTL<br>(3.3V CMOS compatible with 5V TTL.)            | Sync active high by default.<br>Alternate configurations selectable by software.                   |
| 3   | GND                      | 0V                                                    | GND                                                                                                |
| 4   | RESET#                   | TTL compatible 5V tolerant.<br>Active low signalling. | Input pin with 10k $\Omega$ pullup resistor.<br>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 (if it supports this feature); hence a reset from this input may 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   | RS-232 RxD / RS-485 B | TIA/EIA-232-F / TIA/EIA-485-A                                            | VISCA communication selectable by DIP switch setting. See below.                    |
| 2   | RS-232 TxD / RS-485 A | TIA/EIA-232-F / TIA/EIA-485-A                                            | VISCA communication selectable by DIP switch setting. See below.                    |
| 3   | Analog SD video out   | PAL/NTSC levels                                                          | Sourced direct from camera (Pin 25 of J1).<br>Note: not available with all cameras. |
| 4   | Power GND             | 0V                                                                       | Also used as analog ground.                                                         |
| 5   | Power GND             | 0V                                                                       | GND                                                                                 |
| 6   | DC Power In           | 8.25V to 15V                                                             | Power supply, nominal 9V.                                                           |
| 7   | VISCA GND             | 0V                                                                       | GND for VISCA serial comms.                                                         |
| 8   | Logic RxD input       | 3.3V CMOS (3.3V / 5V TTL compatible, with internal 10k pull-up to 3.3V). | VISCA communication selectable by DIP switch setting. See below.                    |
| 9   | Logic TxD output      | 3.3V CMOS (3.3V / 5V TTL compatible)                                     | VISCA communication selectable by DIP switch setting. See below.                    |
| 10  | DC Power In           | 8.25V to 15V                                                             | Power supply, nominal 9V.                                                           |

**Note:** 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.

### USB 3.0 Connector (“USB VIDEO”) (J6)

This USB Type C connector provides a USB Video Class (UVC) v1.1 video stream for connection to a host PC. The connector also provides a UVC control port for camera control (optional). It can also provide power to the camera or board if the USB connection has a high enough current/power rating.

Connector type: USB Type C (5 Gbps)

Mating Connector: Standard USB 3.x Type A/C to Type C cable (5 Gbps min.)



## DIP SWITCH (SW1) FUNCTIONS

The Harrier USB/HDMI Camera Interface Board has an 8-way DIP switch (SW1). The functionality of the switches can be split into 4 groups:

- SW1 [1, 2, 3]: configuration of the board compatibility with different cameras
- SW1 [4]: forces the camera into 1080p30 mode on power up.
- SW1 [5, 6, 7]: configuration of the communication mode (TTL/RS-232/RS-485/USB)
- SW1 [8]: Enables/disables the USB power supply

Note that for issue 01 boards some of the functions were different (see below).

### DIP switch SW1 [8]: Power Supply Control

DIP switch SW1 [8] enables/disables the USB power supply:

| SW1 [8] | Function                                                                                                                                                |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| OFF     | The power supply will be taken from the J3 header, but if there is no power on J3, the board will switch to taking the power supply from the USB socket |
| ON      | The board can only be powered through the J3 header socket.<br>The USB power supply is disabled.                                                        |

**Note:** this only applies to Issue 02 boards. In issue 01 boards SW1 position 8 is not used and the board is always powered from the USB socket if there is no power supply from J3.

### DIP switch SW1 [5, 6, 7]: Communications Mode

DIP switch SW1 [5, 6, 7] configure the interface board communications mode

| SW1 [7] | SW1 [6] | SW1 [5] | Communications Mode                                         |
|---------|---------|---------|-------------------------------------------------------------|
| OFF     | OFF     | OFF     | J3: RS-232 VISCA                                            |
| OFF     | OFF     | ON      | J3: RS-485 VISCA termination disabled                       |
| OFF     | ON      | OFF     | J3: RS-485 VISCA termination enabled                        |
| OFF     | ON      | ON      | J3: TTL VISCA                                               |
| ON      | OFF     | OFF     | J6: USB3.0 SuperSpeed (UVC/Harrier Virtual Serial COM port) |

**Note:** The board can only be configured to use one communications mode at a time.

### DIP switch SW1 [4]: Set Camera Video Mode On Power-up

DIP switch SW1 [4] configures the action of the board on power up. If set ON, on power up the board will set the camera video format to 1080p30. Note that this depends on the camera type (see below) being set correctly. If not, the camera may change to a different mode, or not change mode at all.

| SW1-4 | Function                                                                                                                                                                 |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| OFF   | No action                                                                                                                                                                |
| ON    | On power up the board will set the camera to 1080p30 mode (dependent on the camera type being set correctly). Use of this is not recommended for USB video applications. |

**Note:** this only applies to Issue 02 boards, see below for board issue 01 functions.

**DIP switch SW1 [1, 2, 3]: Camera Type**

DIP switch SW1 [1, 2, 3] configure the camera interface board to be compatible with different AF zoom cameras.

| SW1 [3] | SW1 [2] | SW1 [1] | Type | Compatible Camera(s)                                                                                                |
|---------|---------|---------|------|---------------------------------------------------------------------------------------------------------------------|
| OFF     | OFF     | OFF     | 0    | Tamron MP3010M-EV                                                                                                   |
| OFF     | OFF     | ON      | 1    | Sony FCB EV-9520L and EV-9500L                                                                                      |
| OFF     | ON      | OFF     | 2    | Harrier 10x (10LHD)                                                                                                 |
| OFF     | ON      | ON      | 3    | Harrier 10x GS (10LGHD), Harrier 30x GS (30LGHD), Harrier 36x GS (36LGHD), Harrier 40x (40LHD), Harrier 55x (55LHD) |
| ON      | OFF     | OFF     | 4    | Reserved                                                                                                            |

**Note:** this only applies to Issue 02 boards, see below for board issue 01 functions.

**DIP switch SW1 [1, 2, 3, 4]: Set Video Mode On Power-up [issue 01 boards only]**

On issue 01 interface boards DIP switch SW1 [1, 2, 3, 4] configure the action of the board on power-up. If, on power-up, any of the switches are set ON, the board will set the camera video format according to the table below.

| SW1-4 | SW1-3 | SW1-2 | SW1-1 | Video Format                       | Mode | HDMI | USB      |
|-------|-------|-------|-------|------------------------------------|------|------|----------|
| OFF   | OFF   | OFF   | OFF   | Default Camera Mode <sup>(1)</sup> | 0    | ✓    | As below |
| OFF   | OFF   | OFF   | ON    | 1080p60 <sup>(2)</sup>             | 1    | ✓    | ✓        |
| OFF   | OFF   | ON    | OFF   | 1080p59.94 <sup>(2)</sup>          | 2    | ✓    |          |
| OFF   | OFF   | ON    | ON    | 1080p50 <sup>(2)</sup>             | 3    | ✓    | ✓        |
| OFF   | ON    | OFF   | OFF   | 1080p30                            | 4    | ✓    | ✓        |
| OFF   | ON    | OFF   | ON    | 1080p29                            | 5    | ✓    |          |
| OFF   | ON    | ON    | OFF   | 1080p25                            | 6    | ✓    | ✓        |
| OFF   | ON    | ON    | ON    | 1080i60                            | 7    | ✓    |          |
| ON    | OFF   | OFF   | OFF   | 1080i59.94                         | 8    | ✓    |          |
| ON    | OFF   | OFF   | ON    | 1080i50                            | 9    | ✓    |          |
| ON    | OFF   | ON    | OFF   | 720p60                             | 10   | ✓    | ✓        |
| ON    | OFF   | ON    | ON    | 720p59.94                          | 11   | ✓    |          |
| ON    | ON    | OFF   | OFF   | 720p50                             | 12   | ✓    | ✓        |
| ON    | ON    | OFF   | ON    | 720p30                             | 13   | ✓    |          |
| ON    | ON    | ON    | OFF   | 720p29                             | 14   | ✓    |          |
| ON    | ON    | ON    | ON    | 720p25                             | 15   | ✓    |          |



## Notes:

- 1) “Default Camera Mode”: The camera video mode can be changed by a VISCA command, followed by a camera reset/re-initialization (there is a camera hard reset in the extended VISCA commands that may serve this purpose). On power-up, the camera will start in the video format/mode that was being used, or set, when it was last powered down. The USB and HDMI video outputs will be in the same video mode as the camera output.
- 2) Due to the high data bandwidth required to output these video modes (above 1080p30) cameras **must** be set to dual LVDS mode. For other modes (1080p30 and below) the camera must be set to single LVDS mode. **When using VISCA commands to change camera video mode the LVDS mode must be set correctly, otherwise there will be no video output from the camera.**  
e.g. Set Single LVDS mode: 81 01 04 24 74 00 00 FF Set Dual LVDS mode: 81 01 04 24 74 00 01 FF  
Note: these modes are not available with cameras that do not support dual LVDS mode (e.g. AS-CAM-55LHD and AS-CAM-36LGHD).
- 3) **The DIP switches to select the Video Format are only read on power-up.** To change mode using the DIP switches, power down the camera, set the switches and then power-up the camera. DIP switches will only be effective for operating modes supported by the camera currently in use.
- 4) Once the camera has completed power-up and is in the video mode selected by the DIP switches, VISCA serial or UVC commands can change the camera video mode and select any of the modes supported by the camera. Note: modes not supported by the interface board will not generate USB/HDMI video output, also see note 2).
- 5) On power-up, if the video mode DIP switches are set the interface board will attempt to change the camera mode and VISCA communications to the camera will be temporarily blocked. If the interface board fails to set the camera into the mode set on the DIP switches after 40 seconds, it will stop attempting to change the camera mode and send an error message (A0 DE AD FF); after this it will be possible to communicate with the camera. This enables the use of VISCA commands/inquiries to diagnose problems and manually set the video mode.

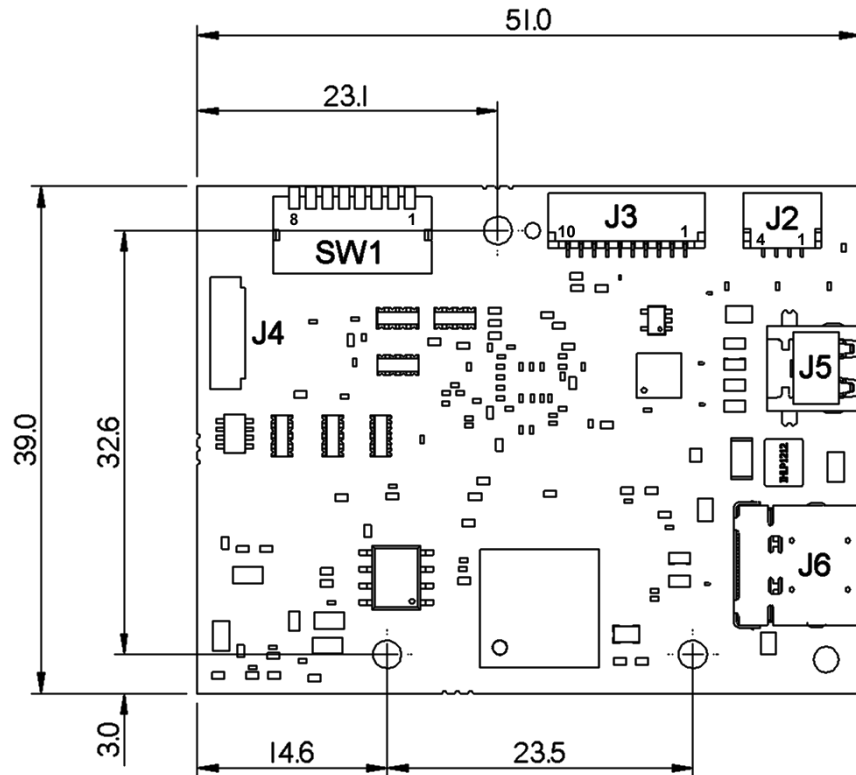


## CONFORMANCE

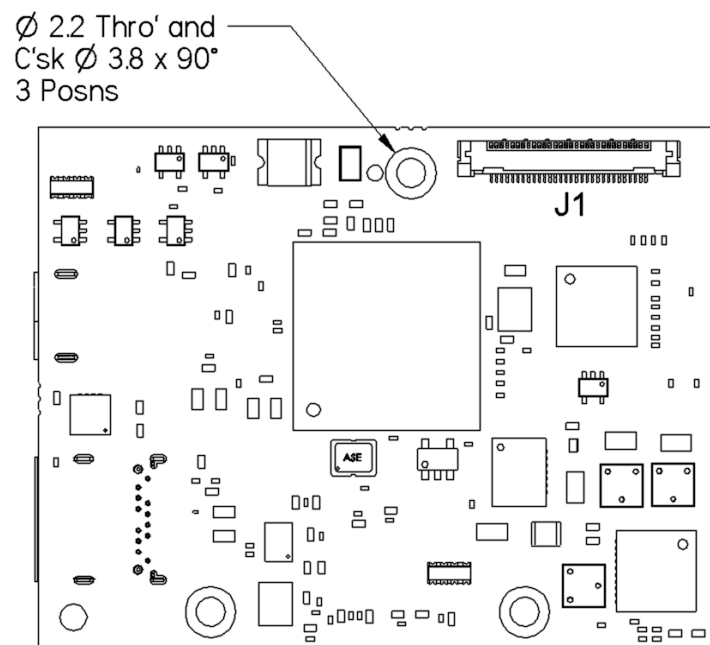
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|                   |                                                                                                                                                                                                                                                                                                                                        |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>USB Video:</i> | Compliant with SuperSpeed USB 3.1 (UVC v.1.1).                                                                                                                                                                                                                                                                                         |
| <i>HDMI:</i>      | Compliant with HDMI specification 1.4a                                                                                                                                                                                                                                                                                                 |
| <i>Approvals:</i> | Active Silicon makes the following approval statements:                                                                                                                                                                                                                                                                                |
| <i>CE</i>         | In accordance with the CE Marking regulations, the <b>Harrier USB/HDMI Camera Interface Board</b> 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. |
| <i>RoHS3</i>      | This product is compliant with the RoHS3 requirements (Directive 2015/863/EU).                                                                                                                                                                                                                                                         |
| <i>REACH</i>      | Please contact Active Silicon for the latest formal REACH declaration (EC 1907/2006).                                                                                                                                                                                                                                                  |
| <i>EMC</i>        | This product is designed to be compliant with the following requirements when housed in a suitable enclosure: <ul style="list-style-type: none"><li>• EN 55022:2010 (Class A) and EN 55024:2010 (EU Directive 2014/30/EU Electromagnetic Compatibility)</li><li>• FCC Rules for Class A digital devices</li></ul>                      |
| <i>UL</i>         | All printed circuit boards used in this product are manufactured by UL recognized manufacturers and have a flammability rating of 94-V0.                                                                                                                                                                                               |

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**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>          | 9.25V to 15V                                                                              |
| <i>Power Consumption:</i>     | 1.6W typical @1080p60 with USB and HDMI active.<br>(Note: does not include camera power). |
| <i>Storage Temperature:</i>   | -40°C to +125°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

| <b>PART NUMBER</b>                 | <b>DESCRIPTION</b>                                                                                                                                                                                                                                                                                                              |
|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>AS-CIB-USBHDMI-002-A</b>        | Harrier USB/HDMI Camera Interface Board for autofocus-zoom block cameras; provides simultaneous USB 3 video (UVC) and HDMI video output. Board only, no cables included.                                                                                                                                                        |
| <b>AS-CIB-USBHDMI-002-3010-A</b>   | Harrier 10x AF-Zoom USB/HDMI Camera (Tamron MP3010M-EV).                                                                                                                                                                                                                                                                        |
| <b>AS-CIB-USBHDMI-002-9520L-A</b>  | Harrier 30x AF-Zoom USB/HDMI Camera (Sony FCB-EV9520L).                                                                                                                                                                                                                                                                         |
| <b>AS-CIB-USBHDMI-002-9500L-A</b>  | Harrier 30x AF-Zoom USB/HDMI Camera (Sony FCB-EV9500L).                                                                                                                                                                                                                                                                         |
| <b>AS-CIB-USBHDMI-002-10LHD-A</b>  | Harrier 10x AF-Zoom USB/HDMI Camera.                                                                                                                                                                                                                                                                                            |
| <b>AS-CIB-USBHDMI-002-10LGHD-A</b> | Harrier 10x AF-Zoom USB/HDMI Camera with global shutter.                                                                                                                                                                                                                                                                        |
| <b>AS-CIB-USBHDMI-002-30LGHD-A</b> | Harrier 30x AF-Zoom USB/HDMI Camera with global shutter.                                                                                                                                                                                                                                                                        |
| <b>AS-CIB-USBHDMI-002-36LGHD-A</b> | Harrier 36x AF-Zoom USB/HDMI Camera with global shutter.                                                                                                                                                                                                                                                                        |
| <b>AS-CIB-USBHDMI-002-40LHD-A</b>  | Harrier 40x AF-Zoom USB/HDMI Camera.                                                                                                                                                                                                                                                                                            |
| <b>AS-CIB-USBHDMI-002-55LHD-A</b>  | Harrier 55x AF-Zoom USB/HDMI Camera.                                                                                                                                                                                                                                                                                            |
| <b>AS-CIB-USBHDMI-001-EVAL-A</b>   | Evaluation Kit for Harrier USB/HDMI, and all Harrier USB/HDMI camera assemblies. The kit contains power supply, cables ( <b>AS-CIB-CBLKIT-003-A</b> and micro-coax cable <b>AS-CIB-USL30-100MM</b> ) and the Harrier Evaluation Board with PC serial interface (via USB UART). Not included: Camera and camera interface board. |
| <b>AS-CIB-USL30-100MM</b>          | 30-way micro-coax cable for connecting the interface board (J1) to the camera. Length 100mm.<br>(Manufacturer: KEL, part number: USL20-30SS-010-C).                                                                                                                                                                             |
| <b>AS-CIB-USL30-50MM</b>           | 30-way micro-coax cable for connecting the interface board (J1) to the camera. Length 50mm. Note if the board is mounted on the side of the camera this cable is too short, the 100mm cable is required.(Manufacturer: KEL, part number: USL20-30SS-005-C).                                                                     |



| PART NUMBER                | DESCRIPTION                                                                                                                                 |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| <b>AS-CIB-CBLKIT-003-A</b> | Cable kit for <b>AS-CIB-USBHDMI-002-A</b> containing cables for J2 and J3 that connect to the Harrier Evaluation Kit board.                 |
| <b>AS-CIB-FIXKIT-001-A</b> | Plastic clip, screws and spacers for mounting <b>AS-CIB-USBHDMI-002-A</b> board to a Tamron MP3010M camera.                                 |
| <b>AS-CIB-BRK-007-A</b>    | Metal bracket, screws and spacers for mounting the <b>AS-CIB-USBHDMI-002-A</b> to Sony FCB-EV-series and Harrier 36x or 40x AF-Zoom Camera. |
| <b>AS-CIB-BRK-009-A</b>    | Metal bracket, screws and spacers for mounting the <b>AS-CIB-USBHDMI-002-A</b> to the Harrier 10x AF-Zoom Camera.                           |

Note: The Harrier USB/HDMI Camera Interface Board warranty cover is twelve months from the date of shipment.

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.



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