HARRIER IP CAMERA INTERFACE BOARD

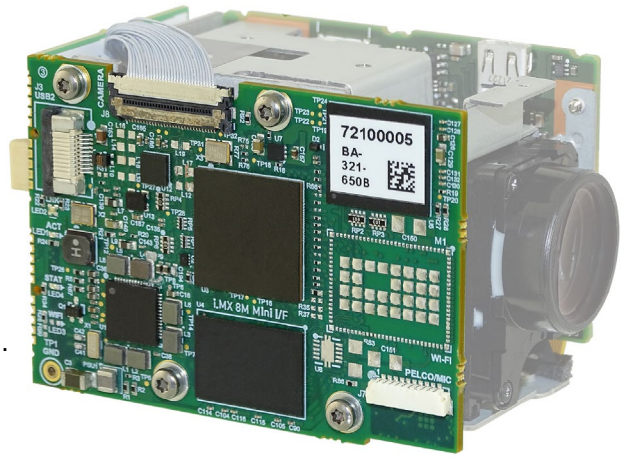
For LVDS AF-Zoom Block Cameras

Active Silicon
COMPUTER IMAGING PRODUCTS
A SOLID STATE PLC GROUP COMPANY

- **IP interface board for Tamron, Sony and Harrier AF-Zoom cameras**
- **Low latency H.264 1080p60 video over IP**
- **Supports ONVIF/RTSP/RTP/VISCA/Pelco-D**
- **PoE and WiFi options for reduced cabling**

FEATURES

- Supports Tamron, Sony FCB-EV-series, Harrier 10x, 36x and 40x AF-Zoom cameras and other LVDS compatible cameras.
- Support for 1080p60/30 video.
- Low latency H.264 RTP streaming video.
- RTSP and ONVIF Profile S.
- Graphical overlay support (text and images).
- Onboard recording to micro SD card.
- Built-in webserver for setup and configuration.
- Software API support for direct (VISCA) camera control.
- Support for audio input.
- Optional PoE and WiFi support.
- Pelco-D serial port to drive local camera pan & tilt.



OVERVIEW

The **Harrier IP Camera Interface Board** (AS-CIB-IP-SOC-001-A or AS-CIB-IP-SOC-002-A) is an interface solution from Active Silicon's Harrier series of camera interface boards; it provides IP (Ethernet) output for Tamron, Sony FCB-EV-series and Harrier 10x/36x/40x AF-Zoom cameras, as well as other LVDS compatible autofocus-zoom (AFZ) block cameras. The interface board is based on a powerful SoC processor that delivers a low latency H.264 video stream over RTP. In addition to the Harrier IP Camera Interface Board (SoC processing board), this IP solution may include an Ethernet connection board. Both boards can be compactly mounted onto a block camera. The camera and SoC board are connected via a KEL 30-way cable. The LVDS video signal is compressed (H.264) on the SoC board and streamed over RTP to the Ethernet connection board (via FFC cable). The Ethernet connection board carries magnetics that enable physical connection to external Gigabit Ethernet systems using CAT5/6 Ethernet cables. A version of the Ethernet connection board that supports Power over Ethernet (PoE) is also available. The SoC board implements ONVIF (Profile S) based control; application examples of how to display text and graphical overlays to the live video stream and send VISCA commands to the camera (enabling full camera control via the ONVIF interface) are available on request.

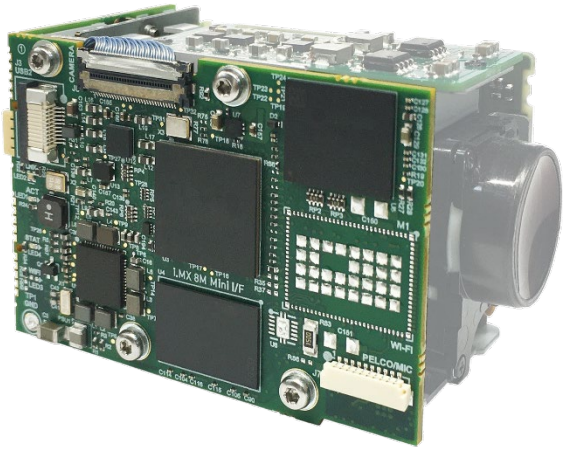


Figure 1. Harrier IP Camera Interface Board and Harrier Ethernet Connection Board mounted on a Tamron camera.

Board Options

A Harrier IP interface solution is usually composed of two boards – a processing/SoC board (**AS-CIP-IP-SOC-001-A**) and an Ethernet connection board. These two boards are connected by an FFC cable (see figure 2) and can be mounted directly on to a block camera or stacked on top of each other. The boards are available separately, as a set or mounted on a camera (see figure 1.).

A version of the SoC board that supports wireless connectivity is available (**AS-CIP-IP-SOC-002-A**). There are also two versions of the connection board, the Ethernet connection board (**AS-CIP-IP-IFETH-001-A**) and a Power over Ethernet enabled version (**AS-CIP-IP-IFPOE-001-A**). For the specifications of the Ethernet connection boards, please refer to the Harrier PoE/Ethernet Connection Board datasheet on the Active Silicon website (download section of the Harrier IP Camera Interface Board page).

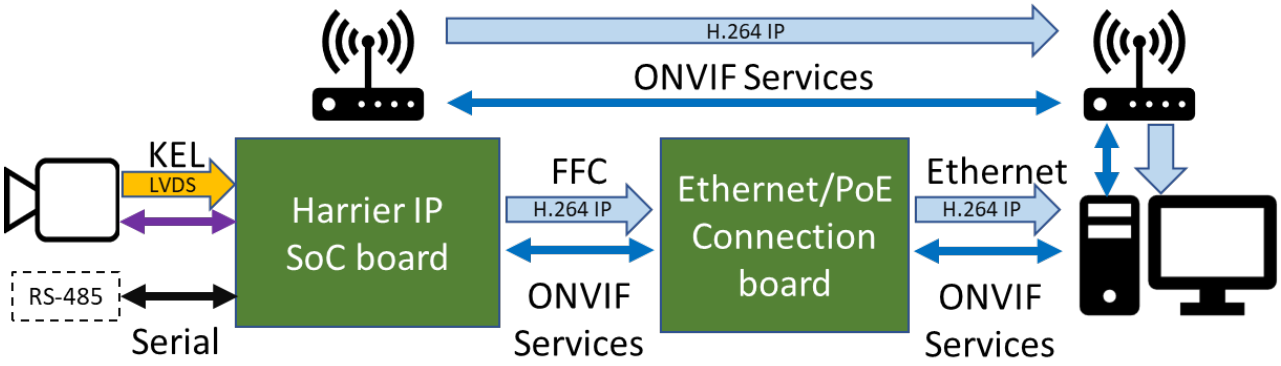


Figure 2. Harrier IP camera system functional block diagram (wireless/PoE features are optional)

The processor and interface boards can be ordered together as a pre-assembled module as shown below:

PART NUMBER	WIRELESS	ETHERNET	COMPONENT BOARDS
AS-CIB-IP-001-A	N	Ethernet	AS-CIP-IP-SOC-001-A + AS-CIP-IP-IFETH-001-A + FFC
AS-CIB-IP-002-A	Y	Ethernet	AS-CIP-IP-SOC-002-A + AS-CIP-IP-IFETH-001-A + FFC
AS-CIB-IP-003-A	N	PoE	AS-CIP-IP-SOC-001-A + AS-CIP-IP-IFPOE-001-A + FFC
AS-CIB-IP-004-A	Y	PoE	AS-CIP-IP-SOC-002-A + AS-CIP-IP-IFPOE-001-A + FFC

Each of these systems can also be purchased ready assembled on an autofocus-zoom block camera (with required connectors and bracket). For these products a code for the model of the camera is added to the system part number.

PART NUMBER	SYSTEM+CAMERA
AS-CIB-IP-001-10LHD-A	AS-CIB-IP-001-A + Harrier 10x AF-Zoom Camera
AS-CIB-IP-001-36GLHD-A	AS-CIB-IP-001-A + Harrier 36x AF-Zoom Camera
AS-CIB-IP-001-40LHD-A	AS-CIB-IP-001-A + Harrier 40x AF-Zoom Camera
AS-CIB-IP-001-3010-A	AS-CIB-IP-001-A + Tamron MP3010M-EV camera
AS-CIB-IP-001-1010-A	AS-CIB-IP-001-A + Tamron MP1010M-VC camera
AS-CIB-IP-001-9520L-A	AS-CIB-IP-001-A + Sony FCB-EV9520L camera
AS-CIB-IP-001-9500L-A	AS-CIB-IP-001-A + Sony FCB-EV9500L camera
AS-CIB-IP-001-7520-A	AS-CIB-IP-001-A + Sony FCB-EV7520 camera

Operation

When connected to a suitable power supply the Harrier IP Camera Interface Board will boot and then power-up the camera. Once the camera has initialized it will start transmitting a video stream; the camera interface board will compress the video (H.264), convert it to RTP format, and stream it to the Ethernet port. Any RTP/ONVIF compatible application (e.g. VLC media player or GStreamer) can then receive and display the video. ONVIF services can be used to control the camera and video stream settings.
When the interface board is connected to the network, any ONVIF compatible application, such as the ONVIF Device Manager (https://sourceforge.net/projects/onvifdm/), can be used to discover the IP address of the board/camera and control the camera/video settings.

IP Address

By default, the Harrier IP Camera Interface Board is automatically assigned an IP address by the DHCP server, but it can be set to a fixed IP address using the Harrier IP Website (the Camera Interface Board administration web pages) or the ONVIF Device Management Service.

When setting fixed IP addresses please ensure that the address is correct and that you make a record of the new address before making the changes as it can be very difficult to locate a device at an unknown/incorrect IP address.

On the very first power up the Harrier IP board will also have an additional fixed IP address of 192.168.189.100. This is a temporary additional IP address used to program/configure the board during

manufacture. Once you have selected a network configuration for the board (DHCP or fixed) this additional address will not be used unless you set it manually as a fixed IP address.

ONVIF and RTSP Services

The Harrier IP Camera Interface Board platform supports an RTSP server for streaming video and the ONVIF profile S standard for camera control. The RTSP/ONVIF servers enables connected host devices to receive and control the H.264 video stream.

ONVIF is a SOAP webservice that standardizes the network interface for network video products. The ONVIF services include the following areas:

- IP configuration
- Device discovery
- Device management
- H.264 encoder configuration
- Camera control

The ONVIF and RTSP services can be consumed from many programming languages and several software frameworks already exist to use those services.

For example:

- ONVIF can be readily used from C# using Visual Studio's 'Add Service Reference' utility.
- There are several Python modules available to consume ONVIF services
    - Valkka – "Python Media Streaming Framework for Linux" – supports both ONVIF and RTSP https://elsampsa.github.io/valkka-examples/_build/html/onvif.html
    - Zeep is a SOAP client for Python, which can be used to consume the ONVIF WSDL files. https://docs.python-zeep.org/en/master/client.html
- The GStreamer library includes an RTSP client and can be used to decode and display the live video. GStreamer is a C library with C# and Python bindings.

Visual Studio can load the WSDL files that describe the various ONVIF SOAP services and generate a C# class with methods for the various ONVIF functions.

The ONVIF services supported are listed below:

- Device Management service: allows control of the platform (e.g. set time and date, etc.).
- Media service: Media configurations are used to determine the streaming properties of requested media streams; this enables control of the H.264 encoder and on-screen displays (OSD).
- Imaging service: provides configuration and control data for imaging specific properties.
- DeviceIO service: provides direct communication to the camera serial ports (this enables VISCA communication with an attached camera to allow full control of the camera and all its features).

For detailed information on these services please refer to the ONVIF documentation at https://www.onvif.org/profiles/specifications/ .

Camera Control

The camera video mode and H.264 compression parameters can be managed using the ONVIF media service. The ONVIF Imaging service enables any ONVIF-compliant third-party software/application to control the camera settings.

However, most AF-zoom block cameras have many more settings than those available through the ONVIF Imaging service. These additional settings are usually managed using VISCA commands sent over a serial interface. The Harrier IP Camera Interface Board supports direct serial communication with cameras; applications can access this serial interface via the ONVIF DeviceIO service.

Function *GetSerialPorts()* is used to query the list of available serial ports. The Harrier IP has two ports.

- SERIAL_PORT_000: this port is connected to the block camera (VISCA communication).
- SERIAL_PORT_001: this port is connected to the RS-485 port on connector J7.

Function *SendReceiveSerialCommand()* is used to send and receive data to the ports.

This function allows applications to send, and optionally receive, data to/from the camera. Please refer to the ONVIF DeviceIO specification for the complete documentation of this function. This means that all camera features supported by the VISCA protocol can be controlled by the end application over the Ethernet interface. For examples, please refer to the Harrier IP Example Software. For more information on VISCA control and camera features, please refer to the documentation for your camera.

Harrier IP Website

The Harrier IP Camera Interface Board hosts an administration website, the Harrier IP Website, which can be used to control the board and camera.

When the board is connected, the website can be accessed by connecting to the IP Address of the camera using a web browser.

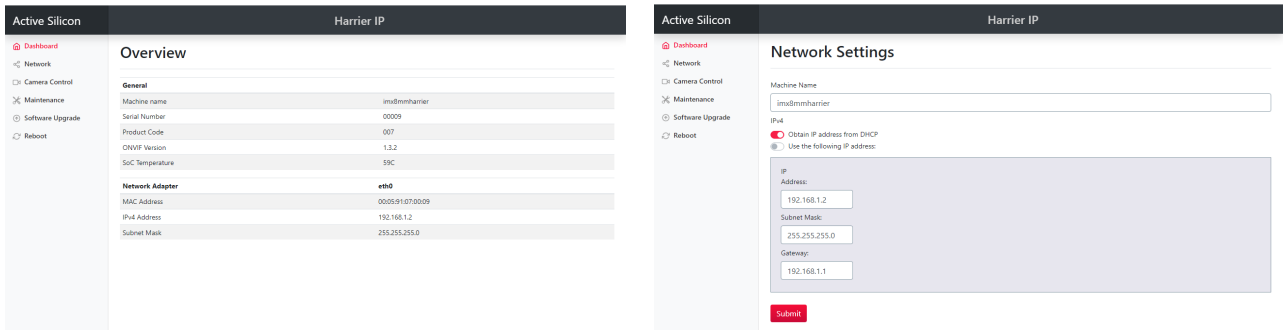


Figure 3. Harrier IP Website - Dashboard and Network settings pages

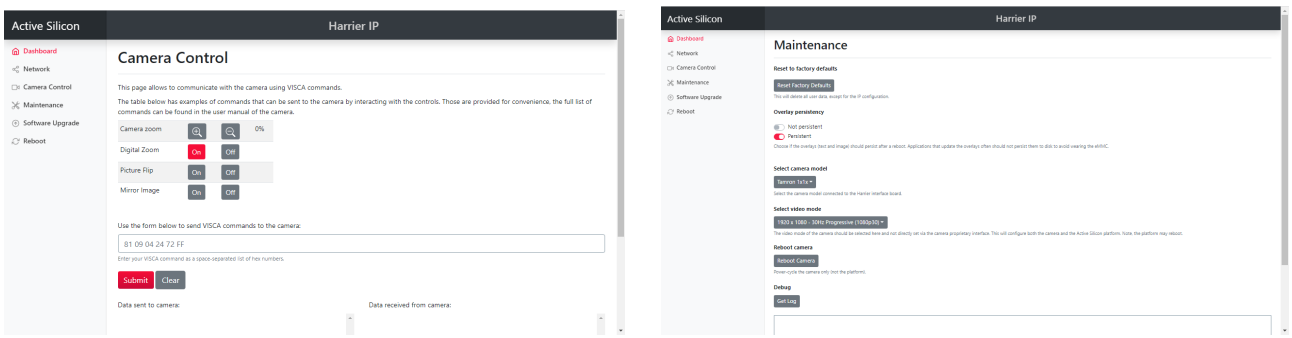


Figure 4. Harrier IP Website: Camera Control and Maintenance pages

Video Graphical Overlay Control

The Harrier IP Camera Interface Board is able to superimpose graphics and text on the live video stream. This includes graphics with transparent/alpha blended pixels. The application manages these overlays using an API from the ONVIF Media service. The overlays can be stored in system memory (volatile) or in the flash on the platform (non-volatile). The flash has a high but limited number of guaranteed writes, hence in applications where the overlays are frequently changed it is recommended that the volatile setting be used. The functions *CreateOSD()* and *SetOSD()* of the media profile have had an optional boolean element added to select if the OSD should be volatile (saved to memory) or not (saved to flash).

This element goes in the 'any' element listed in media.wsdl for those functions and takes this form:

```
<xs:element name="IsPersistent" type="xs:boolean"/>
```

Below, an example of the SOAP envelope containing the element.

```
<s:Envelope
      xmlns:s=http://www.w3.org/2003/05/soap-envelope>
    <s:Header>
    </s:Header>
    <s:Body
          xmlns:xsi=http://www.w3.org/2001/XMLSchema-instance
          xmlns:xsd=http://www.w3.org/2001/XMLSchema>
        <CreateOSD
             xmlns=http://www.onvif.org/ver10/media/wsdl>
              <OSD>
                    <Type
                     xmlns=http://www.onvif.org/ver10/schema>
                     Text
                    </Type>
                    <Position
                     xmlns=http://www.onvif.org/ver10/schema>
                         <Type>
                         UpperRight
                         </Type>
                    </Position>
                    <TextString
                     xmlns=http://www.onvif.org/ver10/schema>
                         <Type>
                         Plain
                         </Type>
                          <PlainText>
                         Hello
                          </PlainText>
                    </TextString>
              </OSD>
              <IsPersistent
                 xmlns=http://www.onvif.org/ver10/schema>
                 1
              </IsPersistent>
        </CreateOSD>
    </s:Body>
</s:Envelope>
```

SD Card interface

The SD card interface supports all standard micro SD cards (up to 512GB) and operates them in SDR25 mode. High data rates that come with UHS II cards are not supported and UHS II cards will operate in UHS I modes (lower data rate).

The SD card can be used to store recordings of the camera video. [To be implemented.]

Harrier IP Example Software

The Harrier IP Example Software from Active Silicon contains sample application code that shows how to use the ONVIF services for adding text and graphical overlays to the live video stream and sending VISCA commands to the camera to enable full camera control.

Status LEDs (“LED1/2/3/4”)

The Harrier IP Camera Interface Board is fitted with several multi-color LEDs that indicate board status.

- LED1 – ACT
  - indicates activity on the Ethernet link (flashing=activity, steady on=no activity).
- LED2 – LNK
  - indicates the state of the Ethernet link (Green=1G link OK, Red= 100 M link OK, Off=no link). [for issue 03 boards this is Green=100M link OK, Red= 1M link OK, Off=no link)
- LED3 – WiFi
  - [To be implemented].
- LED4 – STAT
  - indicates the status of the board system (steady green=board has booted successfully).

RS-485 Interface

The Harrier IP Camera Interface Board supports direct RS-485 serial communication with external devices. Applications can access the serial port via the ONVIF DeviceIO service.

Function *GetSerialPorts()* is used to query the list of available serial ports. The Harrier IP has two ports.

- SERIAL_PORT_000: this port is connected to the block camera (VISCA communication).
- SERIAL_PORT_001: this port is connected to the RS-485 port on connector J7.

Function *SendReceiveSerialCommand()* is used to send and receive data to the port.

This function allows applications to send, and optionally receive, data to/from RS-485 devices attached to the RS-485 port. Please refer to the ONVIF DeviceIO specification for the complete documentation of this function. For serial port examples, please refer to the Harrier IP Example Software.

Wireless/WiFi Interface

If your Harrier IP Camera Interface Board supports WiFi it will have a wireless module fitted and will have a serial number that starts with 724. The title of the Harrier IP Website will also indicate that the board has Wireless/WiFi support.

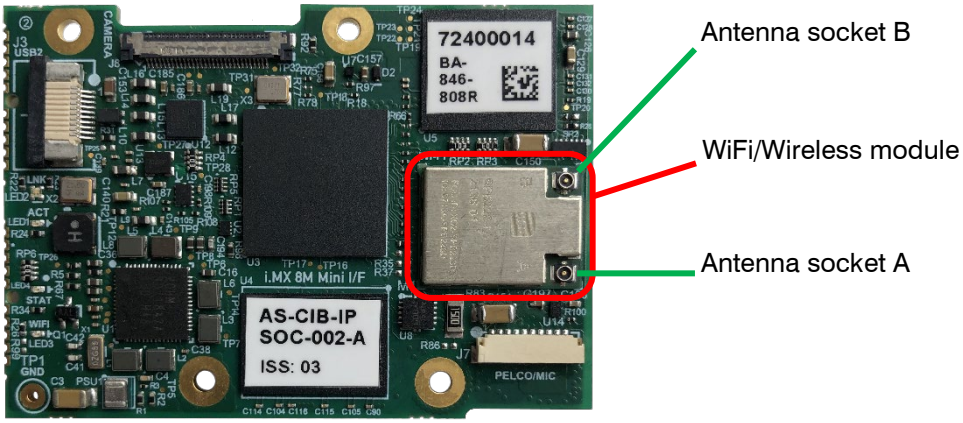


Figure 5. Harrier IP Camera Interface Board with WiFi/wireless communications module fitted

To receive WiFi signals there must be at least one antenna fitted to the wireless module. The antennae fit to the small microcoaxial MHF4 connectors (A and B) on the module. The connection to a wireless network is achieved using the Wireless page on the Harrier IP Website. On the Wireless page you can scan for available wireless networks, select a suitable network/SSID and enter the password. The Harrier IP will then connect to the network and update the WiFi status on the page. The network SSID and password will be stored and used next time the Harrier IP is powered up. Only one SSID and password is stored.

The wireless network you connect to must be running a DHCP server as, by default, the Harrier IP wireless connection is set to obtain its IP address from a DHCP server. This can be changed by accessing the Harrier IP Website, opening the 'Network Setting' web page, selecting the wireless interface, changing the appropriate settings and then clicking on Select. When setting fixed IP addresses please ensure that the address is correct and that you have a note of it before changing it, as it can be very difficult to locate a device at an unknown/incorrect IP address.

Note: when you click on 'Submit' the IP address will change, and you will need to use the new address to access steaming video and the Harrier IP Website.

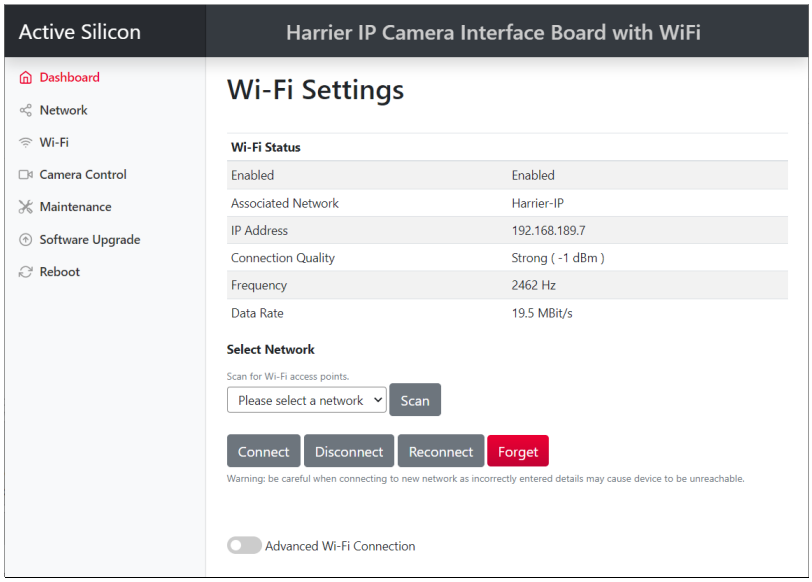


Figure 6. Harrier IP WiFi Settings web page

Encoding Interval – Low Latency 1080p30

Typically, AF-Zoom cameras have a latency of a fixed number of video frames, making the latency frame rate dependent. This means that the latency of a 60Hz video is lower than that of a 30Hz video. Using the ONVIF 'Encoding Interval' element the Harrier IP camera interface board can be configured to receive a low latency 60Hz video and convert it to a 30Hz video, reducing the latency, network bandwidth and recording space required. The 'Encoding Interval' value can be set in ONVIF Device Manager as shown below.

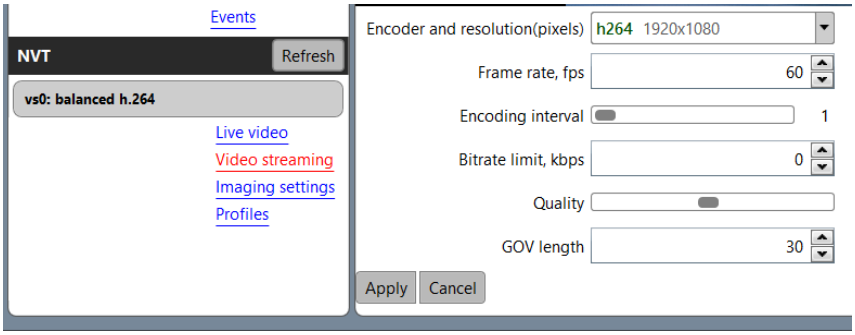


Figure 7. ONVIF Device Manager control for Encoding Interval

By default, the Encoding Interval is set to 1 and every video frame from the AF-Zoom camera is sent to the H.264 encoder; but if it is set to 2, then only every other frame is sent to the encoder. Hence, when the camera is set to 60Hz frame rate and the Encoding Interval is set to 2, the encoder/interface board will generate a 30Hz IP video but with the lower latency of a 60Hz camera video.
For a camera with a 3 frame latency, a change from 30Hz to 60Hz video means a reduction in latency of:

(30Hz latency) - (60Hz latency) = (3x33.3ms) - (3x16.6ms) = 50ms latency reduction

Encoding Interval is a standard ONVIF feature in `VideoEncoderConfiguration:: RateControl`.

```
<xs:complexType name="VideoRateControl"/>
<xs:element name="FrameRateLimit" type="xs:int"/>
<xs:element name="EncodingInterval" type="xs:int"/>
<xs:element name="BitrateLimit" type="xs:int"/>
</xs:complexType>
```

CONNECTOR SPECIFICATION

Power Connector: 2-way (J1)

The Harrier IP Camera Interface Board is fitted with a 2-way JST connector for connection to an external power supply. Power is also supplied by J2 so this connector is not used when the camera interface board is connected to an Ethernet connection board.

Connector type: JST - BM02B-SRSS-TB(LF)(SN)

Mating cable: JST - A02SR02SR30KW152A (SHR-02V-S-B - ASSHSSH28K152)

PIN	SIGNAL	PIN	SIGNAL
1	Power (9V to 16.5V)	2	GND

Ethernet Connection Board Connector: 24-way (J2)

The Harrier IP Camera Interface Board is fitted with a 24-way 0.5mm pitch vertical FFC connector (with clamp) for connection to a Harrier Ethernet Connection Board or a Harrier PoE Connection Board.

Connector type: Valcon - FFC5-24-VSM-TR

Mating cable: 24-way 0.5mm pitch FFC with same side connection

PIN	SIGNAL	PIN	SIGNAL
1	GND	13	GND
2	ETH_TRX0_P	14	I2C2_SDA
3	ETH_TRX0_N	15	I2C2_SCL
4	GND	16	GND
5	ETH_TRX1_P	17	GND
6	ETH_TRX1_N	18	GND
7	GND	19	GND
8	ETH_TRX2_P	20	NC
9	ETH_TRX2_N	21	Power (9V to 16.5V)
10	GND	22	Power (9V to 16.5V)
11	ETH_TRX3_P	23	Power (9V to 16.5V)
12	ETH_TRX3_N	24	Power (9V to 16.5V)

USB Connector: 10-way (J3)

The Harrier IP Camera Interface Board is fitted with a 10-way 0.5mm pitch FFC connector for connection to external devices. Support for this interface is in development.

Connector type: Samtec - ZF5S-10-01-T-WT

Mating cable: 10-way 0.5mm pitch FFC

PIN	SIGNAL	PIN	SIGNAL
1	GND	6	GND
2	USB VBUS	7	USB Data +
3	USB VBUS	8	GND
4	GND	9	USD ID
5	USB Data -	10	GND

Micro SD socket (J5)

The Harrier IP Camera Interface Board is fitted with a standard micro SD socket.

External Micro SD extension socket (J6)

The Harrier IP Camera Interface Board is fitted with a 12-way 0.5mm pitch FFC connector to enable connection to external/remote SD card sockets.

Connector type: Samtec - ZF5S-12-01-T-WT

Mating cable: 12-way 0.5mm pitch FFC

PIN	SIGNAL	PIN	SIGNAL
1	SD2_DATA2	7	VDD
2	GND	8	SD2_DATA0
3	SD2_DATA3	9	GND
4	SD2_CMD	10	SD2_DATA1
5	VDD	11	SD2_DET
6	SD2_CLK	12	GND

PELCO/Microphone Connector: 10-way (J7)

The Harrier IP Camera Interface Board is fitted with a 10-way 0.8mm pitch connector to enable connection to a PELCO controller and microphone. Support for this interface is in development.

Connector type: JST - SM10B-SURS-TF(LF)(SN)

Mating cable: JST - A10SUR10SUR32W102A

PIN	SIGNAL	LEVEL	NOTES
1	Analog GND (Mic)		
2	Microphone Input +		With bias voltage (3mA max.) suitable for electret type microphones
3	Microphone Input -		
4	Analog GND (Mic)		
5	GPIO 1	3v3	
6	GPIO 2	3v3	
7	GND		
8	RS-485 -	EIA/TIA-485	
9	RS-485 +	EIA/TIA-485	
10	GND		

KEL30 Connector (“CAMERA”): 30-way (J8)

The Harrier IP Camera Interface Board is fitted with a 30-way miniature connector that is used to connect to compatible LVDS cameras.

Connector type: KEL USL00-30L

Mating cable: KEL USL20-30SS-010-C (100mm length) 30-way micro coaxial cable.
Actual length supplied will vary depending on the camera model/assembly.
Other lengths also available (subject to minimum order quantities).

SPECIFICATION

Video resolution/rate:	1080p 60/30 fps	**Video Compression:**	H.264
Protocols:	ONVIF, IPv4/v6, HTTP, HTTPS, RTSP, RTP, TCP, UDP, RTCP, ICMP, DHCP	**Wireless Protocols:**	802.11 a b g n and ac Dual 2.4 and 5GHz bands
Camera control:	ONVIF profile S, VISCA (via Ethernet connection and ONVIF DeviceIO service)	**Audio:**	Mono microphone

CONFORMANCE

Ethernet IEEE802.11, POE, RT

Approvals: Active Silicon makes the following approval statements:

CE In accordance with the CE Marking regulations, the **Harrier IP 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.

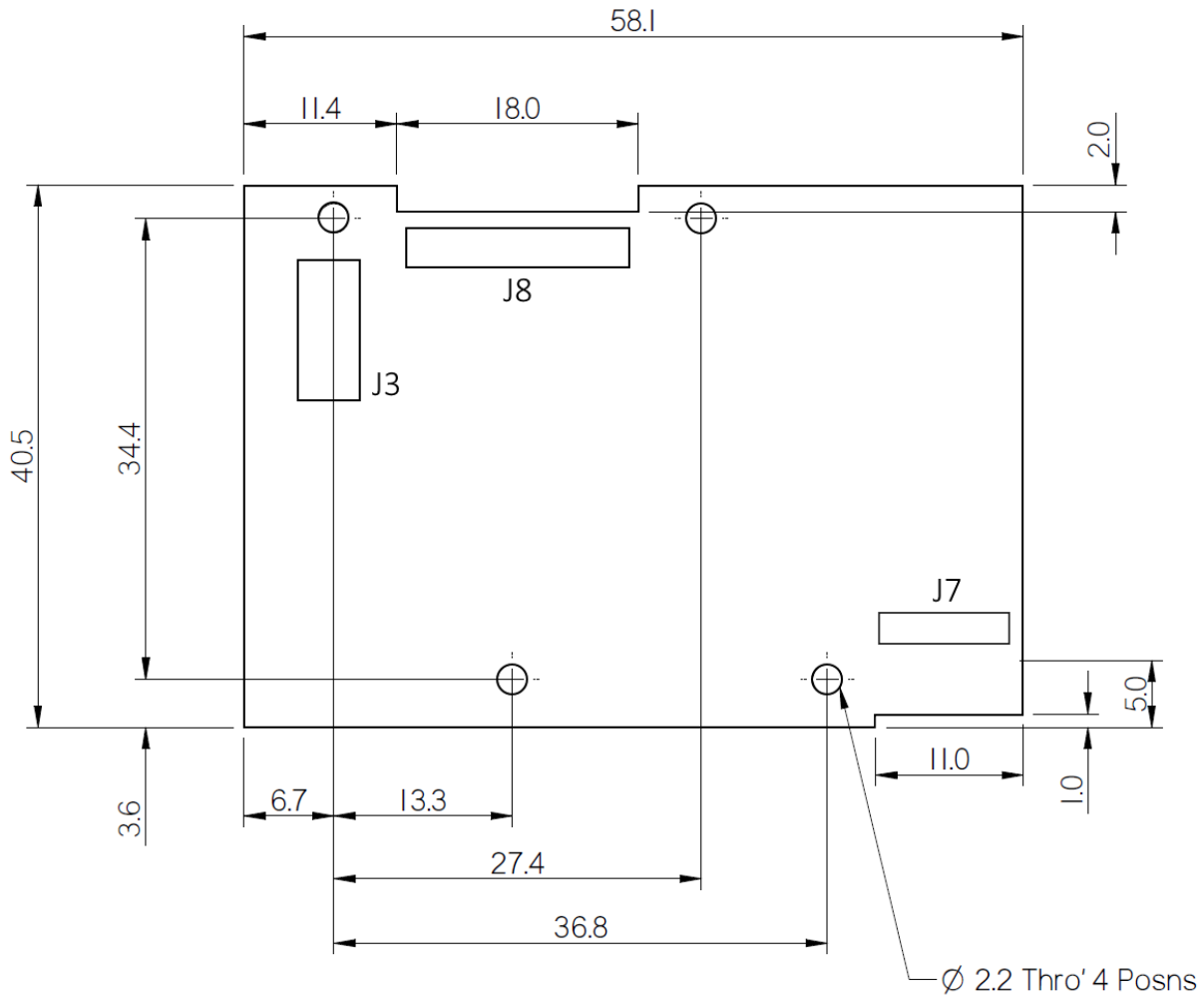


Figure 8. Mechanical overview of the Harrier IP Camera Interface Board; dimensions in mm. (Note – when mounted on a camera, this side usually faces away from the camera)

PHYSICAL AND ENVIRONMENTAL DETAILS

Dimensions:	58.1mm x 40.5mm.
Weight:	12g (interface board and SD card only, no cables).
Power Supply:	9V to 16.5V
Power Consumption:	1.9 – 2.1W (typical 1080p30) 2.6 – 2.8W (typical 1080p60) (Note: does not include camera power).
Storage Temperature:	-20°C to +70°C
Operating Temperature:	0°C to +60°C (ambient environment).
Relative Humidity:	10% to 90% non-condensing (operating and storage).

ORDERING INFORMATION

PART NUMBER	DESCRIPTION
AS-CIB-IP-SOC-001-A	Harrier IP Camera Interface Board.
AS-CIB-IP-SOC-002-A	Harrier IP Camera Interface Board (with WiFi module, wireless option).
AS-CIB-IP-IFPOE-001-A	Harrier Ethernet Connection Board (PoE version).
AS-CIB-IP-IFETH-001-A	Harrier Ethernet Connection Board.
AS-CIB-IP-001-A	AS-CIB-IP-SOC-001-A, AS-CIB-IP-IFETH-001-A and FFC cable.
AS-CIB-IP-002-A	AS-CIB-IP-SOC-002-A, AS-CIB-IP-IFETH-001-A and FFC cable.
AS-CIB-IP-003-A	AS-CIB-IP-SOC-001-A, AS-CIB-IP-IFPOE-001-A and FFC cable.
AS-CIB-IP-004-A	AS-CIB-IP-SOC-002-A, AS-CIB-IP-IFPOE-001-A and FFC cable.
AS-CIB-IP-001-EVAL-A	Evaluation kit for Harrier IP (does not include boards).
AS-CBL-935-153S	Ethernet interface adapter cable, JST to RJ45 socket.
AS-CBL-020-731U	Ethernet interface adapter cable, Molex to RJ45 socket (PoE).
AS-CBL-549-503Y	Power adapter cable, barrel socket to 4-way JST connector.
AS-CIB-USL30-100MM	30-way micro-coax cable for connecting the interface board to the camera. Length 100mm; manufacturer: KEL.

More camera options and custom builds are available, please contact Active Silicon for more information.

Active Silicon
COMPUTER IMAGING PRODUCTS
A SOLID STATE PLC GROUP COMPANY

CONTACT DETAILS

Headquarters:

Active Silicon Ltd
Pinewood Mews, Bond Close, Iver,
Bucks, SL0 0NA, UK.

Tel: +44 (0)1753 650600
Fax: +44 (0)1753 651661
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
Fax: +1 410-696-7643
Email: info@activesilicon.com
Website: www.activesilicon.com

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