Picocamera System Manual

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720-515-3720

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Date	Notes
09/02/16	Initial Release
05/01/17	Modified usage to reflect merge with Microraptor firmware
08/12/19	Added sd card, serial, and ffmpeg section
08/20/19	Serial connections and dev cable info added11/
11/20/20	Note: Default IP Address changed to 192.168.168.168

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1 Introduction

This document is a manual covering features and usage of the Airborne Innovations Picoraptor / Picocamera system.

2 Picocamera

Picocamera is a low latency streaming IP camera configurable with a 720P global shutter sensor and removable M12 lens.

It mates well with Picoradio to form a long range capable combined IP camera+datalink system. With M2 standoffs you can mount the Picoradio on the back of Picocamera (but you need to take thermal considerations into account).

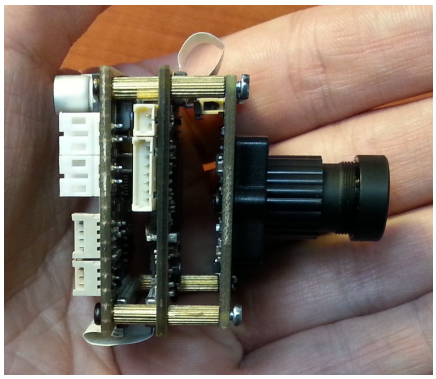


Figure 1: Picocamera photo

Specifications:

Weight 38.5g	
Dimensions:	boards 40x40mm (approx 40x44 mm with connectors), 2
	8mm high board stack with connectors
	approx 52mm long with lens
Sensor:	720p HD video, with global shutter sensor
	1080p rolling shutter sensor option
Power:	12V input
Output:	Ethernet IP video stream, RTSP
Bitrate:	1-5 Mbps @ 720P30, up to 12 Mbps possible
Latency:	End to end latency as low as approximately 100 msec.

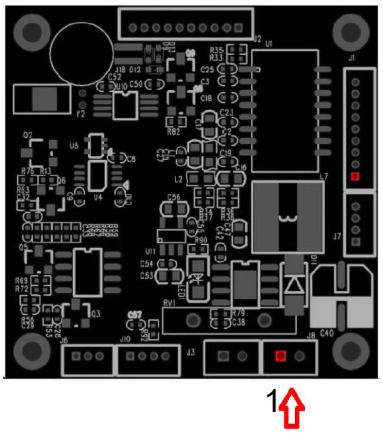
2.1 Global Shutter camera advantages

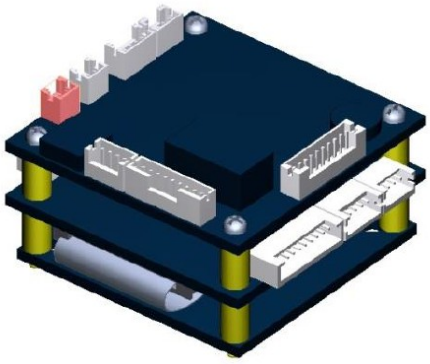
Most cameras such as GoPro etc. use rolling shutter sensors. For rolling shutter sensors the image is exposed as it is read out of the camera from top to bottom. As a result pixels are not all exposed at the same time, and left to right camera movement will result in a trapezoidal warp. Significant image vibration results in a wobbling jello warping effect.

In a global shutter sensor, all of the pixels are exposed simultaneously. Vibration can result in some image blurring depending on the exposure time, but there is no jello warping effect. In full sunlight, exposure times are typically very low (<5 milliseconds) and the image is usually very sharp.

2.2 Picocamera hardware interface

2.2.1 Power

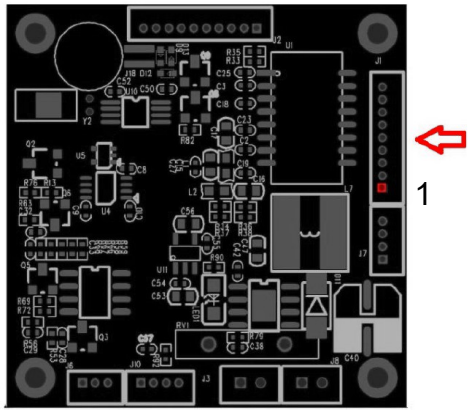


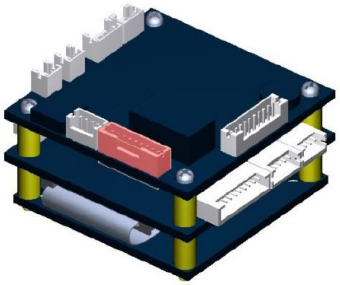


Mating connector: Molex 0873690200

Pin	Description
1	+12V In
2	GND

2.2.2 Ethernet





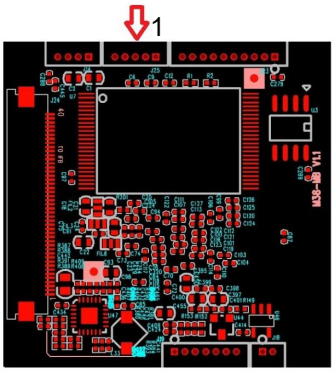
Mating part: Hirose DF13-9S-1.25C

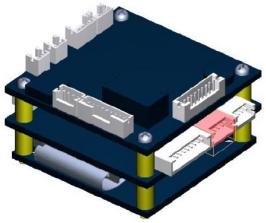
Pre-crimped wires available: Digikey H4BBT-10110-B8-ND

Pin	Description
1	GND
2	Yellow LED out
3	Green LED out
4	48V POE
5	Ethernet Rx-
6	48V POE
7	Ethernet Rx+
8	Ethernet Tx-
9	Ethernet Tx+

2.2.3 Serial

There is a serial port which can be used for passing serial data as well as debug. For more information see the Picoraptor manual.





Pin	Description
1	NC
2	Serial RX
3	GND
4	Serial TX
5	5V out @ 50 mA

2.2.4 Serial Dev Cable

You can make a serial dev cable using a USB to 3.3V TTL adapter, a short 0.1” header, and a 5 pin picoblade housing with crimped wires.

This cable can be used for configuration and debug, as well as testing serial passthrough connectivity.

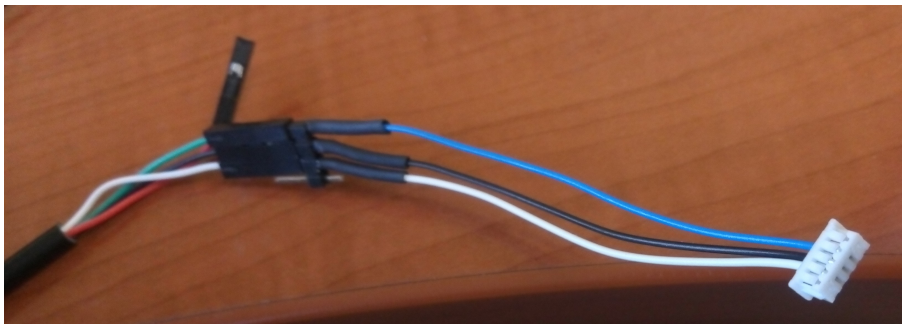


Figure 2: USB Serial cable wired to 5 pin Picoblade serial connector

Qty	Part	Desc	Note
1	JBTek USB-TTL	USB-3.3V TTL cable	https://www.amazon.com/gp/product/B00QT7LQ88
1	PRT-00116	Header, 3 position	https://www.sparkfun.com/products/116
1	Molex 0510210500 / Digikey WM1723-ND	Picoblade 5 position housing	
1	Digikey 0500798000-06-W8-D-ND	pre-crimped 6” leads, white	
1	Digikey 0500798000-06-B8-D-ND	pre-crimped 6” leads, blue	
1	Digikey 0500798000-06-L8-D-ND	pre-crimped 6” leads, black	

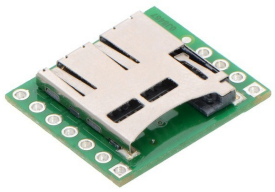
2.2.5 SD Card addon

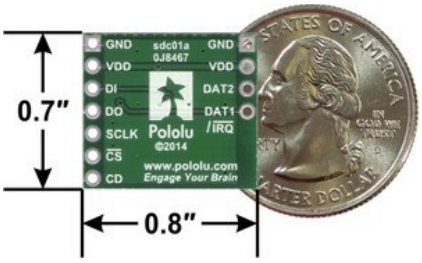
Please note: Picocameras now ship with an SD card interface (and boot from SD card by default), so the below is now legacy information.

You can connect an SD card interface, such as the Pololu 2597 Breakout Board for MicroSD card.

Our version 1.0.54 software is the first version designed to use only the SD card (boot and nonvolatile params) for added reliability (previous versions were able to boot from SD but still used NAND)..

https://www.pololu.com/product/2597





This connects to the 10 pin connector (Picoblade 10 pin).

Connection:

Pin	Description	SD card connection	Pololu 2567 connection
1	D0	DAT0/DATA_OUT/D0	DO
2	D1	DAT1	DAT1/IRQ
3	D2	DAT2	DAT2
4	D3	CS	/CS
5	VSS/GND	GND	GND
6	CLK	SCLK	SCLK
7	VDD	VDD	VDD
8	CMD	DATA_IN	DI
9	DETECT	CD	CD
10	WRITEPROT	WP	N.C.

In addition, you need two 10K resistors, one connected from DI to VDD, and one connected from CD to VDD.

3 Usage

3.1 IP address

Please Note:
As of ver 1.0.56 firmware, the default IP address is now 192.168.168.168, mostly for better default compatibility with Picoradio.
The below refers to the previous IP address / subnet of 192.168.1.x. Please change the default subnet of your PC etc. accordingly.

In v1.0.55 firmware and earlier the default IP address was 192.168.1.168.

3.2 Configuration

Configuration interface is
http://192.168.168.168/config.html

user: admin
pwd: 9999

Note that the input interface is set to 'Micro global shutter camera.'

Output resolution should be set to 720p or 720max60 (which will be 60 fps mode).

3.3 VLC

VLC is a popular freeware video client which may be used to stream and record video from the MicroraptorHD.

It is available for Windows / Mac / Linux / Android.

Download it from http://videolan.org

Once installed, you can enable the 'record' button by toggling on View/Advanced Controls. After it is enabled, the record button will toggle video recording. The destination directory depends on the platform, but is usually the Videos directory of the active user.

To stream video, select Media/Open Network Stream, and enter the following URL:

rtsp://192.168.168.168:8557/PSIA/Streaming/channels/2?videoCodecType=H.264

You can also set the network caching parameter to 200 or 250 msec.

3.4 Ffmpeg

You can use ffmpeg as a video client.

For ultra low latency, select 720max60 mode in the picocam/picoraptor settings for 60fps encoding. This may need a bit more bandwidth for motion detail (~5 Mbps)

Install ffmpeg from https://ffmpeg.org/

you can click through the windows builds and download one at https://ffmpeg.zeranoe.com/builds/

Once you install ffmpeg, create a script / batch file:

For example on windows:

ffmpeg_pico.bat:

```
cd ffmpegdir\bin   [replace ffmpegdir with where you installed ffmpeg]
ffplay -fflags nobuffer -flags low_delay -framedrop -strict experimental
-rtsp_transport tcp
rtsp://192.168.168.168:8557/PSIA/Streaming/channels/2?videoCodecType=H.264
```

With 720p60 mode, latency is very very low (on the order of 100 msec or less).

3.5 Gstreamer

For low latency you can also use the Gstreamer media dev kit.

Under Windows, install:

https://gstreamer.freedesktop.org/data/pkg/windows/1.9.2/

gstreamer-1.0-x86-1.9.2.msi

Install Gstreamer.

Create a batch file called 'picocam.bat' in c:\gstreamer\1.0\x86\bin\

picocam.bat:

```
gst-launch-1.0 rtspsrc location=rtsp://192.168.168.168:8557/PSIA/Streaming/channels/2?
videoCodecType=H.264 latency=50 ! queue ! rtph264depay ! avdec_h264 ! autovideosink
```

3.6 Android tablet interface

You may download the freeware Android client QtGStreamerHUD at:
https://www.dropbox.com/s/iq65z4ab5b3vf8h/QtGStreamerHUD.apk?dl=0

If you connect a router to a Picoradio or Microhard base station, (ideally running OpenWRT, such as TP-Link, VoCORE, and, with patience, others), you can then connect the tablet to wifi and then to Picocamera or our PicoHDMI encoder.

QtGStreamerHUD allows you to enter a custom Gstreamer pipeline. The pipeline to use is:

rtspsrc location=rtsp://192.168.168.168:8557/PSIA/Streaming/channels/2?videoCodecType=H.264 latency=50 ! queue ! rtph264depay ! avdec_h264

QtGStreamerHUD also allows you to connect to a Pixhawk / APM stream to display a HUD.

Note to get proper colors you have to 'reverse' the color bytes in this interface (there is an option to do this in the QtGStreamerHUD interface).