

This document contains relevant notes for the libflipro API release. In addition, set up procedures and trouble-shooting techniques for specific Windows or Linux issues can also be found here.

API Documentation

The API Documentation is included with the API library. It is located in the `html` folder within the release package. To begin reading the API documentation, launch a web browser and locate and open the file `html/index.html`.

Windows Notes

Getting the Camera Recognized Properly on Windows 7

- The libflipro API uses the standard WinUSB driver to communicate to the camera. WinUSB driver support is found in the OS for versions 8.1 and beyond. In order to get support on Windows 7, you must make sure that ALL the updates have been installed on your machine.
- Make sure your Windows 7 settings are configured to automatically search and get driver updates.
- In addition, you may find that if you plug in the camera prior to installing the updates, that the camera is not recognized properly even after the updates are installed. This is due to the WinUSB driver behavior as documented here <https://docs.microsoft.com/en-us/windows-hardware/drivers/usbcon/microsoft-defined-usb-descriptors> at the time of this writing.

HKLM\SYSTEM\CurrentControlSet\Control\UsbFlags\vvvvpppprrrr

The operating system creates a registry entry, named **osvc**, under this registry key that indicates whether the device supports Microsoft OS Descriptors. If the device does not provide a valid response the first time that the operating system queries it for a Microsoft OS String Descriptor, the operating system will make no further requests for that descriptor.

In this situation, the camera will appear in Device Manager->Other devices->Kepler SCMOS Camera, most likely with a yellow caution icon. In order to fix this, follow the steps below:

1. 'Uninstall' this device from the system.
 - a. Right click on the Device Manager->Other devices->Kepler SCMOS Camera entry and select 'Uninstall'. This device will be removed from Device Manager.
2. Turn off the power to the camera.
3. Edit the registry entry shown above so windows will correctly install the WinUSB device driver for the camera device.
 - a. Run the 'regedit' program as administrator. You can do this by clicking the Start Menu and then just start typing 'regedit'. When you see the 'regedit.exe' program in the Programs window, right click on it and select 'Run as administrator'. If it asks do you want to allow the program to make changes, click Yes.
 - b. Open the Registry key **HKLM\SYSTEM\CurrentControlSet\Control\UsbFlags\vvvvpppprrrr** where **vvvvpppprrrr** is 0F18000E0000 – this is the Camera Device.

- c. Select the `osvc` entry in the right window pane, right click and select 'Modify...'.
 - d. In the edit window, change the value to `01 01`. Make sure you do not add values; `01 01` must be the only numbers in the entry. Click OK.
 - e. Exit the `regedit` program.
4. Now, power up the camera. If Device Manager is still up, you may see the camera appear momentarily in the `Other devices` tree as before. This only occurs while the WinUSB driver is being installed. Once WinUSB is installed for the camera, the device shows up as `Device Manager->Universal Serial Bus devices->WinUsb Device`. Hopefully this will be your last step.
5. If the camera still shows up as an `Other Device`, try and update the driver manually.
 - a. Right click on the `Device Manager->Other devices->Kepler SCMOS Camera` entry and select `Update Driver...`
 - b. Choose the links that automatically search for driver updates.
 - c. Windows should find the WinUSB driver and install it for the camera.
6. Now you should be ready to use the camera on Windows 7!

Visual C++ Redistributable for Visual Studio 2015

It may be necessary to download and install the Visual C++ Redistributable. This can be found at <https://www.microsoft.com/en-us/download/details.aspx?id=48145> at the time of this writing. Download and install the appropriate version (x86 or x64) based on your hardware and operating system.

Linux Notes

Linux Device Permissions

In order for the camera to be accessible to normal users, you need to apply some rules to the `udev` subsystem. Along with your release, you will find a file `'10-fliusbrules.rules'`. Copy this file to the `/etc/udev/rules.d` directory. You may of course modify this file to suit your particular installation needs. It is simply provided as a working sample to get your development started. There is a brief description of its function inside the file so you may read that for more information.

Libusb Support

The Linux `libflipro` API relies on the Linux `libusb` library. You must install this on your machine for the API to communicate with the camera. On Ubuntu, you can install this with the command `'sudo apt-get install libusb-1.0'`. If you are running a different Linux variant, run the appropriate command to install the library.

Release Notes

API Version 1.12.59

Date 03/22/2022

General: Bug Fix Feature Enhancements.

Issues Addressed:

1. Fixed intermittent Fibre connection issues.

Features Added:

1. None.

Features Removed:

1. None.

API Version 1.12.58

Date 01/06/2022

General: Bug Fix Feature Enhancements.

Issues Addressed:

1. None.

Features Added:

1. Added FPROAuxIO_GetExposureActivePolarity() and FPROAuxIO_SetExposureActivePolarity() API's.

Features Removed:

1. None.

API Version 1.12.58

Date 01/06/2022

General: Bug Fix Feature Enhancements.

Issues Addressed:

1. Fixed Fiber connection issues. Requires update of PCIE Fiber card FPGA Firmware: fiber_fpga_v1.2.0_0xDE2B0E1F, and pcie_fpga_v1.3.3_0x192B0190 or later versions.

Features Added:

1. None.

Features Removed:

- 1. None.

API Version 1.12.56

Date TBD

General: Bug Fix Feature Enhancements.

Issues Addressed:

- 1. SIGNATURE CHANGE: The FPROAlgo_StackFinish() signature changed. Parameters were added so the user can get the meta data for the stacked frames if desired.
- 2. Fixed API stacking function. The last 384 bytes were not being stacked properly (the size of the meta data).
- 3. Fixed Multi-Camera connection issues around correct capture stopping/abort procedures.

Features Added:

- 1. None.

Features Removed:

- 1. None.

API Version 1.12.54

Date 10/15/2021

General: Bug Fix Feature Enhancements.

Issues Addressed:

- 1. Fixed 2020 Image sizing issues.

Features Added:

- 1. None.

Features Removed:

- 1. None.

API Version 1.12.52

Date 09/01/2021

General: Linux only release to fix image pipe timeout.

Issues Addressed:

1. Fixed Meta Data date string parsing.
2. Fixed image pipe timeout on Linux side. It was being set to no timeout (0) which is an infinite timeout. This fix put it back to the normal camera default (e.g. 10 seconds).

Features Added:

1. Added new debug level `FPRO_DEBUG_REGRW` to help aid in hardware debugging.

Features Removed:

1. None.

API Version 1.12.51

Date 08/12/2021

General: Bug Fix Feature Enhancements.

Issues Addressed:

1. **STRUCTURE CHANGE:** The `FPROUNPACKEDIMAGES` structure did not correctly support FITS and TIFF formats for the Merged Image buffer size. New fields have been added to the structure: `uiLowBufferSize`, `uiHighBufferSize`, and `uiMergedBufferSize`. In each case they represent the size of their corresponding buffer in bytes. The existing `uiLowImageSize`, `uiHighImageSize`, and `uiMergedImageSize` fields are the size of the image data in pixels and do not include whatever header bytes are included for FITS and TIFF formats.
2. **STRUCTURE CHANGE:** In the `FPRO_HWMERGEENABLE` structure, the `bGenerateTIFF` field has been replaced by the `FPRO_IMAGE_FORMAT` enumeration field `eMergeFormat` in order to support the new FITS merging functionality.
3. For the `FPROAlgo_SetHardwareMergeReferenceFiles` API, at least one of the parameters must now point to a valid file. Without a valid file, setting a valid reference image size was not reliable. If you need to create identity frames, use the `FPROAlgo_SetHardwareMergeReferenceFrames` instead.
4. API merging performance and memory footprint issues addressed.
5. Fixed linux libusb issue with multiple cameras connected to the same computer.

6. Fixed linux signal issues with long exposure times. The cancel signal was not being cleared properly causing an erroneous user 'cancel'.
7. Fixed LED Duration settings for various newer camera firmware versions.
8. Fixed Cobalt data read out times causing long exposures to fail.

Features Added:

1. FITS format support for API merging. See the documentation for `FPROUNPACKEDIMAGES`, and `FPRO_HWMERGEENABLE`. The `FPRO_HWMERGEENABLE` structure has changed as described above.

Features Removed:

1. The dependency on the external `cfitsio` has been removed. **NOTE: Fits support remains, the dependency on the third party library has just been removed.**

API Version 1.12.46

Date 06/16/2021

General: Bug Fix Feature Enhancements.

Issues Addressed:

1. Fixed problems with API merging when not requesting the merged image plane.
2. Fixed TIFF generation issues related to API merging.
3. Fixed image plane statistics computation when not requesting the merged plane statistics.
4. Fixed FTM FPGA Programming.
5. Fixed flushing of Windows side image pipes on aborted image captures.

Features Added:

1. When using the API merging capability and the `FPROMERGE_ALGO_REF_FRAME` algorithm, if no reference frames are sent, the API attempts to compute a set of reference frames from the Meta Data of the image. Previously, straight identity frames were used.
2. Added FITS support through the `FPROFrame_ConvertFile()` API.

Features Removed:

1. None.

API Version 1.12.36

Date 04/30/2021

General: Bug Fix Feature Enhancements.

Issues Addressed:

1. Fixed NV Storage issue with upgrading from very old releases.
2. Fixed HDR mode exposure time readback issue on 400. Exposure time was being reported as twice the actual value.
3. FPROFrame_CaptureAbort() and FPROFrame_CaptureStop() now disables external triggers.

Features Added:

1. Changed the signatures of FPROCtrl_GetExternalTriggerEnable() and FPROCtrl_SetExternalTriggerEnable() The new signatures are now
 - FPROCtrl_GetExternalTriggerEnable(int32_t iHandle, FPROEXTTRIGINFO* pTrigInfo);
 - FPROCtrl_SetExternalTriggerEnable(int32_t iHandle, uint32_t uiFrameCount, FPROEXTTRIGINFO *pTrigInfo);
2. Added FPROEXTTRIGINFO *pTrigInfo structure for above calls and new SingleFramePerTrigger feature.

Features Removed:

1. FPROFrame_CaptureEnd() has been removed (it was never included functionality on any camera.). Use FPROFrame_CaptureAbort() instead.

API Version 1.12.30

Date 03/19/21

General: Bug Fix Feature Enhancements.

Issues Addressed:

1. Cleaned up Fibre card warnings when trying to open a fibre card connection when no fibre card is present.
2. Modified the FPRO_HWMERGEENABLE structure to take an enum for the planes to merge rather than separate Booleans which could not all be set at the same time.

Features Added:

1. Added FPROAlgo_SetHardwareMergeReferenceFiles API function
2. Added FTM support.

Features Removed:

1. None

API Version 1.12.28

Date 02/10/21

General: Bug Fix Feature Enhancements.

Issues Addressed:

1. Fixed erroneous success values being returned from Hardware Merge functions.
2. API Now initializes Hardware Merging Reference Frames on connection.
3. Improved streaming preview performance.
4. Fixed false errors from HWMerge* related functions when using them via the API over USB connection.

Features Added:

1. Added support for Linux PCIE V2 fibre driver.

Features Removed:

1. None

API Version 1.12.22

Date 11/03/2020

General: Added PCIE V2 Fibre support.

Issues Addressed:

1. None.

Features Added:

1. Added Hardware Merging support. Implemented on PCIE Fibre connections with V2 hardware or better. See the FPROAlgo_*HardwareMerge*() functions for details.
2. Added HW Merge emulation support for merging through the API on USB connections or older V1 fibre connections. See the same FPROAlgo_*HardwareMerge*() functions for details.
3. Added FPROCtrl_SetBurstModeEnable() and FPROCtrl_GetBurstModeEnable() API's.
4. Modified FPROCtrl_GetCameraBufferBypass() and FPROCtrl_GetCameraBufferBypass() API's to take both camera and host PCIE card bypass enables.

5. Added `FPROCtrl_GetElectricallyBlackPixelEnable()` and `FPROCtrl_SetElectricallyBlackPixelEnable()` API calls.
6. Added host PCIE card Reference Frame support. See `FPROAlgo_SetReferenceFrames()`.
7. Added `FPROCtrl_GetPCIETemperatures()` API call.
8. Added `FPROCtrl_GetFrameDelayMinimum()` API call.

Features Removed:

1. None

API Version 1.12.9

Date 06/04/2020

General: Bug Fix Feature Enhancements.

Issues Addressed:

1. Fixed issue in multithreaded Disk Writer implementation causing Streamer thread failing to start.
2. Added a minimum open to open shutter interval of 2 seconds to protect mechanical limitations.

Features Added:

1. Added `FPROFrame_UnpackFile()` and `FPROFrame_MetaDataToString()` API functions.
2. Added overall throughput measurements to the Streamer statistics. See `FPROSTREAMSTATS`.
3. Added `FPROFrame_StreamGetPreviewImageEx()` function.
4. Added `FPROCtrl_GetCameraBufferBypass()` and `FPROCtrl_SetCameraBufferBypass()` functions.

Features Removed:

1. None

API Version 1.12.3

Date 02/01/2020

General: Bug Fix Feature Enhancements.

Issues Addressed:

1. Fixed intermittent reconnection problems in the event applications do not close down the connection properly- command and image pipes needed to be reset.

Features Added:

1. Added camera command to support active feedback during programming operations. Only used by the Programming Application.

Features Removed:

1. None

API Version 1.11.28

Date 01/15/2020

General: Bug Fix Feature Enhancements.

Issues Addressed:

1. Fixed issue with some Cobalts with `FPROSensor_SetMode()` taking too long to complete causing communications failures. Increased the timeout for the command to allow it to complete on the camera.
2. Fixed 6060 image data unpacking issue. Fixed 6060 Binning Registers.
3. Changed the signature of the unpacking API's `FPROFrame_FreeUnpackedBuffers()` and `FPROFrame_FreeUnpackedStatistics()` to take the camera handle. This was done to support an internal refactor to allow these API's to be used on multiple camera connections.
4. Fixed Unpacking issues with Cobalts when single channel readout modes are used.
5. Updated unpacking API path to always generate latest version of meta data for processed files.
6. Added support for additional hardware (FPGA) version information for 2020 and 6060 cameras.
7. Fixed unpacking issue with Cobalt cameras. Later models changed the Model Name format in the meta data.
8. Changed the signature of the `FPROFrame_ComputeFrameSize()` API. Removed the size parameters because they were not used. The signature is now
`LIBFLIPRO_API FPROFrame_ComputeFrameSize(int32_t iHandle);`

Features Added:

1. Added Bias and Flat Field correction support when using the unpacking API's. See `FPROFrame_SetUnpackingBiasFrames()` and `FPROFrame_SetUnpackingBiasFrames()`.
2. Added support for Sony imx183 sensor based cameras.

Features Removed:

1. None

API Version 1.11.23

Date 10/08/2019

General: Bug Fix Feature Enhancements.

Issues Addressed:

1. Minimum allowed exposure time counts were being violated. Updated so that the minimum setting on the cameras do not go below about 20000 nsecs.
2. Fixed 6060 Black Level adjustment settings.

Features Added:

1. Added Cobalt 230-84 sub-framing, binning, and Sensor readout Configuration support.
2. Added Cobalt 4320 Support.
3. Support added for 6060 Sensor board FPGA programming (internal).
4. Changed the definition of Binning Table entries. See `FPROSensor_GetBinningTable()` in the API documentation for details.

Features Removed:

1. None

API Version 1.11.20

Date 09/09/2019

General: Bug Fix Feature Enhancements.

Issues Addressed:

1. Fixed issue with long exposure times causing a timeout.

Features Added:

1. Added API's allowing application to get unpacked images directly from the cameras. See documentation for `FPROFrame_GetVideoFrameUnpacked()` for more information.

Features Removed:

1. None

API Version 1.11.15

Date 07/17/2019

General: Bug Fix and internal feature enhancements.

Issues Addressed:

1. Changed the FPGA Version number check for the Image Block Size (internal).

2. Fixed bug in FPROFrame_ComputeFrameSize() for Cobalt Cameras. Reference rows were not being counted correctly.

Features Added:

1. Support for 6060 Sensor Introduced.

Features Removed:

2. None

API Version 1.11.9

Date 06/21/2019

General: Bug Fix and internal feature enhancements.

Issues Addressed:

1. Decreased camera detection time on Fibre side.
2. Fixed bugs in ComputeFrameSize() API.
3. Force Frame Count to 1 for External Trigger.
4. Fixed Fibre command transaction timeouts at the end of a streaming session.
5. Streamed file name number now begins with '1' rather than '0'.

Features Added:

1. Added support for generic camera configuration (internal). Updated camera configuration file format accordingly.

Features Removed:

1. None

API Version 1.11.3

Date 05/16/2019

General: Bug Fix and internal feature enhancements.

Issues Addressed:

1. Fixed non streaming side of fibre interface during preview support.

Features Added:

1. Added FPROFrame_ComputeFrameSize() function to API to help users determine how many bytes will be received for a frame.
2. Added Generic Camera Configuration support (internal).

Features Removed:

1. None

API Version 1.10.33

Date 03/27/2019
General: Bug Fix.

Issues Addressed:

1. Fixed Fibre PCIe soft reset issue that was causing connection problems.
2. Fixed Streaming Abort transfer cleanup.

Features Added:

1. None.

Features Removed:

1. None

API Version 1.10.30

Date 03/07/2019
General: Feature Enhancements.

Issues Addressed:

1. None.

Features Added:

1. Added Windows PCIE Fibre Card support.

Features Removed:

1. None

API Version 1.10.24

Date 12/13/2018
General: Feature Enhancements.

Issues Addressed:

1. None.

Features Added:

1. Added Generic camera support (internal only).
2. Added following API calls:
 - FPROFrame_GetFrameType
 - FPROFrame_SetFrameType
 - FPROCtrl_GetLED
 - FPROCtrl_SetLED (not new but included for completeness)
 - FPROCtrl_GetLEDDuration
 - FPROCtrl_SetLEDDuration

- FPROSensor_GetTrainingEnable
- FPROSensor_SetTrainingEnable

Features Removed:

1. None

API Version 1.10.21

Date 11/16/2018

General: Bug fix.

Issues Addressed:

1. Fixed issue with retrieving Exposure setting on 4040 cameras - FPROCtrl_GetExposure() was returning incorrect value.

Features Added:

1. None.

Features Removed:

1. None

API Version 1.10.20

Date 11/09/2018

General: Development update.

Issues Addressed:

1. None.

Features Added:

1. Added support for Cobalt DC230 cameras.

Features Removed:

1. None

API Version 1.10.19

Date 10/26/2018

General: Development update.

Issues Addressed:

1. Fixed logging issue in x64 builds of the API.

Features Added:

1. (Internal) Added support for Simple (Generic) Camera type with minimal configuration and settings.

Features Removed:

1. None

API Version 1.10.17

Date 10/12/2018

General: Development update.

Issues Addressed:

1. Fixed issue with updating DAC values when gain index values are changed in HDR modes.

Features Added:

1. None.

Features Removed:

1. None

API Version 1.10.15

Date 09/20/2018

General: Development update primarily for support of 4040 Sensor. Requires camera firmware update to version 1.10.1 or newer. The following API items have changed:

- FPROGAINTABLE enumeration. The names within the enumeration have changed to reflect the correct use of the gain tables. See the documentation for a complete description
- The signature for the following function has changed in order to support the new 4040 Gain Tables. This includes the addition of the new FPROGAINVALUE enumeration.
 - FPROSensor_GetGainTable(int32_t, FPROGAINTABLE, FPROGAINVALUE *, uint32_t *);
- Added additional Black Level access functions to support 4040 functionality:
 - FPROSensor_GetBlackLevelAdjustEx(iHandle, FPROBLACKADJUSTCHAN, uint32_t *);
 - FPROSensor_SetBlackLevelAdjustEx(int32_t, FPROBLACKADJUSTCHAN, uint32_t);

Issues Addressed:

1. None.

Features Added:

1. Added Support for Gains, Black Level, and Black Sun on 4040 Camera
1. Refactored and moved Gain tables up into API (deprecated in camera firmware). No operational change to application software. Fixed 4040 gain index conversion issue.

Features Removed:

1. None

API Version 1.10.1

Date 04/10/2018

General: Development Update. Requires camera firmware update to version 1.10.1 or newer.

Issues Addressed:

1. Updated Windows 7 Setup notes in this document to include Windows settings for automatically searching and installing new device drivers.

Features Added:

1. Updated capabilities to version 2.
 - a. Added Meta Data Size to camera capabilities.
 - b. Updated sample programs to reflect new Meta Data use.
2. DAC Value translation was added internal to the API in order to present an ‘increasing’ list to the user of DAC values.
3. Added GPS Detection on camera and support in API to retrieve the GPS state
`FPROCtrl_GetGPSState(int32_t iHandle, FPROGPSSTATE *pState);`

Features Removed:

1. None

API Version 1.7.5

Date 2/20/2018

General: Development Update. Requires camera firmware update to version 1.7.3 or newer.

The following API functions have changed names in this release:

- `FPROFrame_GetDummyRowPostFrameEnable()` changed to `FPROFrame_GetReferenceRowPostFrameCount()`
- `FPROFrame_GetDummyRowPreFrameEnable()` changed to `FPROFrame_GetReferenceRowPreFrameCount()`

- FPROFrame_SetDummyRowPostFrameEnable() changed to FPROFrame_SetReferenceRowPostFrameCount()
- FPROFrame_SetDummyRowPreFrameEnable() changed to FPROFrame_SetReferenceRowPreFrameCount()

Issues Addressed:

1. When in an LDR imaging mode, setting the LDR gain index now also sets the HDR gain index to the same index value. Image artifacts result if they are different. The API returns an error when attempting to set an HDR gain index when in an LDR imaging mode. Different LDR and HDR gain settings are still possible when in an HDR imaging mode.
2. Fixed internal issue of serial number string descriptor request failing. The Setup packet was being built incorrectly with the Interface as the target. The target must be Device for a descriptor request. Does not affect execution of any other commands. This only happens on device enumeration and a work around was already in place.
3. Fixed internal issue of failure to transmit image frames properly if the frame size was not a multiple of 32 bits (4 bytes).
4. Added pointer to API documentation in this file.

Features Added:

1. Added Non Volatile Storage available, Pre/Post Reference Row fields to the capabilities structure. Bumped the version for the structure to 2 for this change.
2. Added Non Volatile Storage API's to allow users to save camera specific information directly on the camera.
3. Added API use of Image Size, Binning values, and Reference Rows through Capabilities Structure.
4. Added initial 4040 sensor support to API through Camera Capabilities structure.

Features Removed:

1. None

API Version 1.6.1

Date 11/29/2017

General: Development Update. Requires Camera firmware update to version 1.6.1 or better.

Issues Addressed:

1. Abort processing was not reliable and could cause USB communications failure to the camera. Internal API processing was modified with custom 'reset pipes' command to the camera.

Features Added:

1. Added the release notes (this file) to the Linux Release script.

Features Removed:

1. None

API Version 1.5.6

Date 10/30/2017

General: Development Update

Issues Addressed:

1. Shutter close delay changed to signed magnitude on camera.
2. Removed low level pop up on USB Read error. Error is now just logged at ERROR level and FPROFrame_GetVideoFrame() API call returns error code.

Features Added:

1. Added linux release generation script.

Features Removed:

1. None

API Version 1.5.5

Date 10/12/2017

General: Initial Release

Issues Addressed:

1. None

Features Added:

1. None

Features Removed:

1. None

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