TELEDYNE PRINCETON INSTRUMENTS
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Part of the Teledyne Imaging Group

PICam™ 5.x Programmer's Manual

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Revision History

Issue	Date	List of Changes
Issue 12	November 18, 2021	Issue 12 of this document incorporates the following changes. • Information on the LANSIS camera added.
Issue 11	June 28, 2021	Issue 11 of this document incorporates the following changes. • Evolve camera added • Correction to Sophia in Table A-2. ActiveExtendedHeight setting is not supported • Correction the PicamPulse setting to note the unit is ns.
Issue 10	July 7, 2020	Issue 10 of this document incorporates the following changes. • Added information for TPIR devices. • Added references to IntelliCal SWIR. • Renamed PIoNIR/NIRvana to NIRvana (PIoNIR).
Issue 9	April 14, 2020	Issue 9 of this document incorporates the following changes. • Added NIRvana HS support information. • Added star defect information. • Added PicamParameter_ApplicableStarDefectMapID. • Added ExposeDuringReadout to PicamReadoutControlMode section. • Modified figure 7-1 to include Star Defect Maps. • Added PicamStarDefect and PicamStarDefectMap to the data structures section. • Added PicamStarDefect, PicamStarDefectMap, PicamAdvanced_DestroyStarDefectMaps(), PicamAdvanced_GetStarDefectMap(), PicamAdvanced_GetStarDefectMaps(), • Updated PicamAdvanced_GetUserState(), PicamAdvanced_SetUserState.
Issue 8	January 7, 2020	Issue 8 of this document incorporates the following changes: • Updated the copyright year.
Issue 7	June 27, 2019	Issue 7 of this document incorporates the following changes: • Global removal of Fax number.
Issue 6	March 14, 2019	Issue 6 of this document incorporates the following changes: • Added support for 532 Laser; • Rebranded to Teledyne Princeton Instruments
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Issue 4	January 2, 2018	Issue 4 of this document incorporates the following changes: • Updated the copyright date.
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Issue 1	May 9, 2017	This is the initial release of this document.

Teledyne Princeton Instruments
3660 Quakerbridge Rd
Trenton, NJ 08619
TEL: 800-874-9789 / 609-587-9797

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Chapter 1: About this Manual

This manual describes terms and concepts used in PICam and provides descriptions of functions, parameters, and values used to create a user-designed interface to Teledyne Princeton Instruments cameras and accessories.

This manual includes information about:

- Basic PICam functions (`picam.h`)
- Complex PICam functions (`picam_advanced.h`)
- Accessory Control functions (`picam_accessory.h`)
- EM Gain Calibration functions (`picam_em_calibration.h`)

NOTE:

Functions that are specific to a particular OEM are included in `picam_special.h` and are not described in this manual.

1.1 Manual Organization

This manual includes the following chapters:

- Chapter 1, About this Manual

  This chapter provides general information about this manual, as well as contact information for Princeton Instruments.
- Chapter 2, Introduction to PICam™

  This chapter provides information about concepts, terms, and data types used in PICam. It also provides information about the general sequence of making functions calls when writing a program.
- Chapter 3, General Library APIs

  Provides programming reference information for each of the basic functions (`picam.h`).
- Chapter 4, Identification APIs

  Provides programming reference information for each of the basic functions (`picam.h`).
- Chapter 5, Configuration APIs

  Provides programming reference pages for each of the basic functions (`picam.h`).
- Chapter 6, Data Acquisition APIs

  Provides programming reference pages for each of the basic functions (`picam.h`).
- Chapter 7, Advanced Function APIs

  Provides programming reference information about advanced functions included in `picam_advanced.h`.
- Chapter 8, EM Calibration APIs

  Provides programming reference information for EM Calibration functions included in `picam_em_calibration.h`.

- Appendix A, Available Parameters
  Provides parameter information and camera support for customer-accessible parameters.
- Appendix B, EM Gain Calibration Code Sample
  Provides information about building and using the `EMGainCalibration.exe` sample file included with PICam.
- Appendix C, Firmware Upgrade/Restore
  Provides information about upgrading GigE camera firmware to be compatible with PICam 5.x. Information is also provided about restoring firmware to PICam 3.x.
- Appendix D, Debugging GigE Cameras
  Provides information about using the Heartbeat Timeout system variable.
- Appendix E, PICam 5.0 Compatibility Issues
  Provides information about required code modifications that may be required when upgrading to PICam 5.0 from earlier releases.
- Warranty and Service
  Provides warranty information for Princeton Instruments products. Contact information is also provided.

Wherever possible, this manual uses the headings in the PICam header files (i.e., `pil_platform.h`, `picam.h`, `picam_advanced.h`, `picam_accessory.h`, and `picam_em_calibration.h`,) when grouping functions.

1.2 Potential Compatibility Concerns

Beginning with PICam 5.0, usage of the suite of Left/Right Margin Parameters has been modified for scenarios where Readout Orientation is not Normal. Additional information about this change is provided in Chapter E, PICam 5.0 Compatibility Issues, on page 329.

Although it is extremely rare to change any of these parameters or make coding decisions based on their values, if either of these have been incorporated in code developed for a camera listed in Table 1-1, refer to the specified section for information about coding changes required to maintain current camera behavior when upgrading to PICam 5.0.

Table 1-1: Index to Code Updates for PICam 5.0 Support, by Camera (Sheet 1 of 2)

Camera/Camera Family	Section and Page #
FERGIE: 256F/FT, FERGIE: 256B/FT, FERGIE: 256BR/FT, and eXcelon Variant Cameras	Section E.1 on page 329
PI-MAX4: 2048B, PI-MAX4: 2048B-RF Cameras	Section E.2 on page 331
PI-MAX4: 512B/EM, PI-MAX4: 1024B/EM	Section E.3 on page 332
PI-MAX4: 512EM/1024EM Cameras	Section E.4 on page 334
PI-MTE: 1300B/1300BR Cameras	Section E.5 on page 335
PI-MTE: 1300R Cameras	Section E.6 on page 336
PIXIS: 100B/100BR/400B/400BR/1300B/1300BR, and XO/XF/XB/ eXcelon Variant Cameras	Section E.7 on page 337
PIXIS: 100F/100R/100C/400F/400R/1300F/1300F-2, and XB Variant Cameras	Section E.8 on page 338

Table 1-1: Index to Code Updates for PICam 5.0 Support, by Camera (Sheet 2 of 2)

Camera/Camera Family	Section and Page #
PIXIS: 512F, PIXIS-XO: 512F, PIXIS-XF: 512F Cameras	Section E.9 on page 339
ProEM Cameras (All Models)	Section E.10 on page 340
ProEM-HS: 1KB-10 and eXcelon Variant Cameras	Section E.11 on page 341
ProEM-HS: 512B/512BK/1024B and eXcelon Variant Cameras	Section E.12 on page 342
ProEM+ (All Models)	Section E.13 on page 344
PyLoN: 100B/100BR/400B/400BR/1300B/1300BR, and eXcelon Variant Cameras	Section E.14 on page 345
PyLoN: 100F/400F/1300F/1300R Cameras	Section E.15 on page 346

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Chapter 2: Introduction to PICam™

PICam is an ANSI C library of hardware control and data acquisition functions.

2.1 System Overview

To use PICam, a system must include supported hardware and a host computer with the PICam runtime installed.

2.2 Hardware Support

Version 5.x of the PICam library supports the following Princeton Instruments hardware:

- BLAZE Family
- EVOLVE
- FERGIE
- FERGIE-ISO-81
- FERGIE Accessories
- IntelliCal SWIR QTH
- KURO
- LANSIS
- NIRvana (PioNIR)
- NIRvana HS
- NIRvana-LN
- PI-MAX3
- PI-MAX4
- PI-MAX4:RF
- PI-MAX4:EM
- PI-MTE
- PI-MTE3
- PIXIS Family
- ProEM
- ProEM+
- ProEM-HS
- PyLoN
- PyLoN-IR
- Quad-RO
- SOPHIA Family
- TPIR Family
- TPIR-HR Family

2.2.1 Camera Firmware [GigE Cameras Only]

For GigE cameras, PICam 5.x is not backwards compatible with prior releases of PICam. Therefore, when using PICam 5.x with any GigE camera, the camera's firmware must be PICam 5.x compatible. Upgrading PICam 3.x camera firmware is easily achieved using the Upgrade Tool supplied by Princeton Instruments.

The key symptom of a firmware mismatch between PICam and a GigE camera is the inability to see the camera from within PICam. When this occurs, the firmware within the camera must be updated to be compatible with the version of PICam being used.

- For information about installing PICam 5.x firmware onto a GigE camera with PICam 3.x firmware, refer to Section C.1, Firmware Upgrade Procedure, on page 321.
- For information about restoring firmware, refer to Section C.2, Restore Firmware, on page 323.

2.3 Supported Operating Systems

PICam currently supports the following 64-bit operating systems:

- Windows® 7;
- Windows 8/8.1;
- Windows 10;
- RedHat® Enterprise Linux®, version 7.x (RHEL7.x).

NOTE:

The following hardware is currently not supported by Linux PICam:

- FERGIE Accessories;
- IntelliCal SWIR QTH;
- KURO;
- PI-MTE;
- Quad-RO.

In the future, the functions described in this manual may work with additional operating systems.

2.3.1 WoW64 Support

PICam supports WoW64 which enables 32-bit programs to work with PICam and operate Princeton Instruments detectors in a 64-bit Windows operating system.

NOTE:

64-bit programs link with `picam.dll`.
32-bit programs link with `picam32.dll`.

2.4 Sample Code

Code samples are provided with PICam. When the PICam Software Development Kit (SDK) is installed, these samples are installed, by default, in the PICam installation directory.

NOTE:

The specific directory in which code samples are installed varies by operating system.

Table 2-1: List of Sample Code Files Provided (Sheet 1 of 2)

Sample Name	Description
`Accessory`	This sample demonstrates control of hardware accessories.
`Acquire`	This is the basic data acquisition sample. It calls `Picam_Acquire()` and waits for all frames to be completed. The second part of this sample waits in a loop for N frames, acquiring 1 frame at a time.
`AcquisitionState`	This sample demonstrates an advanced acquisition scenario where the program can be notified when the camera transitions through important acquisition states (e.g., the beginning of readout.)

Table 2-1: List of Sample Code Files Provided (Sheet 2 of 2)

Sample Name	Description
`Advanced`	This sample illustrates features of `picam_advanced.h`.
`Configure`	This sample illustrates how to change settings during camera setup as well as online while polling for data.
`EMGainCalibration`	This sample illustrates how to set up EM Gain Calibration. For additional information about incorporating this sample into production code, refer to Appendix B, EM Gain Calibration Code Sample.
`Gating`	This sample illustrates how to set up repetitive and sequential gating. Also demonstrates RF features on cameras which support RF functionality.
`Kinetics`	This sample provides a sequence of API calls used to request acquisition of image data using the kinetics window capture mode. The demo also illustrates how to make calls to utilize external triggering of captures. The captured pixel data are stored to a raw data file.
`Metadata`	This sample enables metadata (i.e., Time Stamp(s) and Frame Tracking.) It illustrates how to extract metadata from the data stream.
`MultiCam`	This example opens multiple (i.e., 2,) cameras and collects data from all simultaneously.
`ParamInfo`	This sample accesses all parameter information for all hardware parameters, and then prints them to the screen.
`Poll`	This sample illustrates how to use the polling method for collecting data by using `Picam_WaitForAcquisitionUpdate()`.
`Rois`	This sample demonstrates the API for setting a simple single region of interest. It also shows how to set up a camera for multiple regions of interest and then acquires data for the given region(s).
`SaveData`	This sample acquires data synchronously and writes the returned data buffer to disk.
`Spectrograph`	This sample moves the center wavelength asynchronously and waits for it to complete.
`WaitForTrig`	This sample waits for an external trigger to start data acquisition.

2.5 Naming Conventions

The following naming conventions are used in PICam:

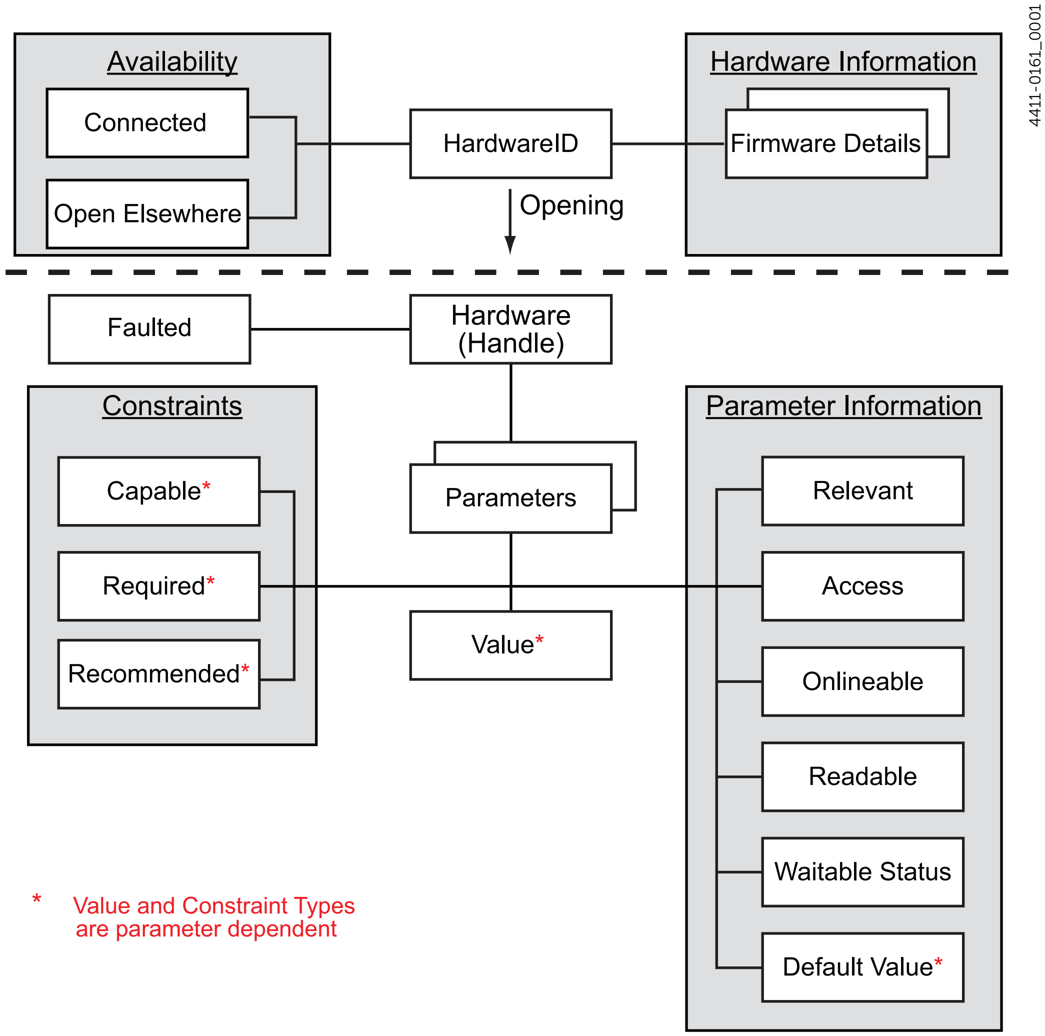
- All primitive types have a typedef with a `pi` prefix (e.g., `piint`, `pi64s`.)
- All functions defined by PICam are prefixed with `Picam_` and return an error code of `PicamError` (e.g., `Picam_GetParameterIntegerValue`, `Picam_CloseCamera`.)
- All functions that allocate memory to store the results of a function call return a pointer to a constant allocation of the appropriate type. For example:
  - `Picam_GetEnumerationString` returns a string by taking the address of a pointer to a constant string. In other words an argument to the function is `const pichar**`.
  - `Picam_GetParameterCollectionConstraint` returns a collection constraint by taking the address of a pointer to a constant collection constraint. In other words, an argument to the function is `const PicamCollectionConstraint**`.
- All functions that allocate an array of memory to store the results of the function call return a pointer to a constant array allocation of the appropriate type as well as the number of items in the array.

  For example, `Picam_GetParameters` returns an array of parameters by taking the addresses of a pointer to a constant parameter array and a count. In other words, two arguments to the function are `const PicamParameter**` and `piint*`.
- All functions that free memory allocated by PICam have a `Picam_Destroy` prefix (e.g., `Picam_DestroyString`, `PicamDestroy_CollectionConstraints`, `PicamDestroyRois`.)
- All types defined by PICam are prefixed with `Picam` and have a typedef to `<TypeName>` (e.g., `PicamParameter`, `PicamRoi`.)
- All enum type members defined by PICam are prefixed with `<EnumName>_` (e.g., `PicamValueType` enum has a `PicamValueType_Integer` constant.)
- All enum types that represent multiple values with bit masks have a `Mask` suffix (e.g., `PicamCcdCharacteristicsMask`, `PicamTimeStampsMask`.)

2.6 Concepts

Figure 2-1 is a high-level block diagram of the basic PICam structure. Hardware that is powered on and plugged into the host computer is initially represented by hardware IDs. The content of the hardware ID will be unique for each piece of hardware. From the hardware ID, basic information can be garnered such as availability and basic information. It is also from a hardware ID that hardware can be opened. Once opened, the hardware can be configured by adjusting the values of its parameters. The permitted values a parameter can take are defined by its constraints. Different hardware items not only possess different parameters, but different rules for interacting with those parameters. This information for each parameter may also be queried. Once a piece of hardware has been configured, data can be acquired from it.

Figure 2-1: Basic PICam Structure



2.6.1 Handles

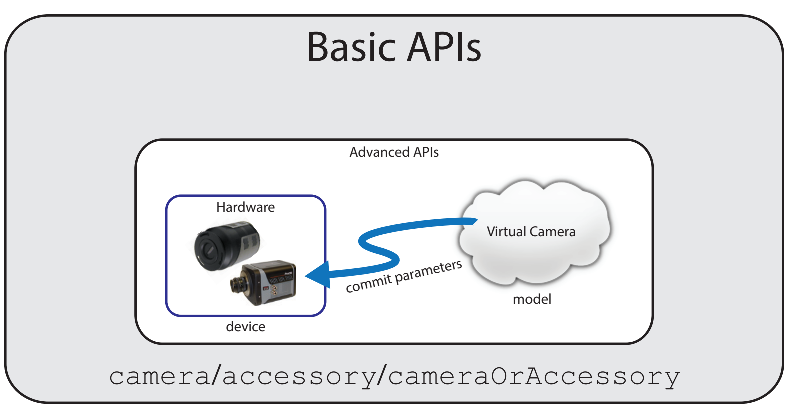
Most PICam APIs require handles to identify the specific hardware with which they are currently interacting. When hardware is brought online, it is assigned a specific handle that is then used to identify it throughout the active session.

The following handle(s) may be passed as an API parameter:

- `accessory`
  Identifies a specific non-camera accessory within the system.
- `camera`
  Identifies a specific camera within the system.
  When `camera` is passed to an API, PICam determines the appropriate actions depending on the API that has been called.
  This handle is passed as a Basic API parameter.
- `camera_or_accessory`
  Identifies hardware within the system that can be either a camera or an accessory.
- `device`
  Identifies a specific PHYSICAL camera within the system.
  When `device` is passed to an API, any resulting interaction or configuration performed by the API is done on a physical camera that is attached to the system.
  This handle is passed as an Advanced API parameter, and must be used in conjunction with `model`.
- `model`
  Identifies a specific VIRTUAL camera within application memory.
  When `model` is passed to an API, any parameter configuration changes are temporarily stored in system memory (i.e., within the host computer.) The actual camera configuration remains unchanged until an API is called that commits values to the `device` (i.e., the physical camera.)
  This handle is passed as an Advanced API parameter, and must be used in conjunction with `device`.

Figure 2-2 illustrates the hierarchical relationship between PICam camera-specific handles and with which set of APIs they are valid.

Figure 2-2: Block Diagram of Camera-Specific Handle Hierarchy



2.7 Defined Data Types

The `typedefs` are given in the header file `pil_platform.h`.

Table 2-2: Data Type Definitions

Type	Definition
piint	Integer native to platform
piflt	Floating point native to platform
pibln	Boolean native to platform
pichar	Character native to platform
pibyte	Byte native to platform
pibool	C++ Boolean native to platform

Table 2-3: Sized Data Type Definitions

Type	Definition
pi8s	8-bit signed integer
pi8u	8-bit unsigned integer
pi16s	16-bit signed integer
pi16u	16-bit unsigned integer
pi32s	32-bit signed integer
pi32u	32-bit unsigned integer
pi64s	64-bit signed integer
pi64u	64-bit unsigned integer
pi32f	32-bit floating point
pi64f	64-bit floating point

2.8 Include Files

Any program using PICam must include the following header files:

- `pil_platform.h`
  Princeton Instruments' library platform support. This is included indirectly via `picam.h`.
- `picam.h`
  Princeton Instruments' camera control Application Programming Interface (API.)

2.8.1 Optional and Advanced Files

The following files are optional and only need to be included when one or more of the functions found within them are required:

- `picam_special.h`
  Only include `picam_special.h` when using a special function defined in that file.
- `picam_advanced.h`
  This is the Princeton Instruments advanced camera control API.
  This header file contains advanced functionality such as camera discovery, change notification, circular buffering, user state, defect map, and data acquisition callbacks.
- `picam_accessory.h`
  This header contains functionality exclusively for accessory control.
- `picam_em_calibration.h`
  This header EM Gain Calibration file provides the APIs and functionality needed to perform EM gain calibration for ProEM and Evolve cameras.

Chapter 3: General Library APIs

The first section of `picam.h` includes functions to:

- Determine if the PICam library has been initialized;
- Initialize the library;
- Uninitialize the library;
- Retrieve the version.

This section also includes error codes that may be returned from any PICam function.

The first step in using the PICam library is library initialization. This is typically done at the start of the program. Once the library has been initialized, PICam function can then be called. The success of every function call is determined by the error code that is returned. It is paramount this error code be checked as most results are invalidated if a function fails. To facilitate debugging, PICam can convert an error code into a string. In fact, any PICam enum can be converted into a string. Once the program is finished with the library, it should clean up and uninitialized the library. This often occurs during program shutdown.

3.1 Data Type Definitions

Refer to Table 3-1 for information about data definitions.

Table 3-1: Data Enumeration Definitions for General Library APIs

Name	Type	Description
`PicamError`	`enum`	The set of error codes returned from all APIs declared as `PICAM_API`.
`PicamEnumeratedType`	`enum`	The set of all PICam enumeration types.

3.2 Programmers' Reference for General Use Library APIs

This section provides a detailed programmers' reference guide for the following APIs, including their syntax and behavior:

- Library Version
  - `Picam_GetVersion()`
- Library Initialization
  - `Picam_IsLibraryInitialized()`
  - `Picam_InitializeLibrary()`
  - `Picam_UninitializeLibrary()`
- General String Handling
  - `Picam_DestroyString()`
  - `Picam_GetEnumerationString()`

3.2.1 `Picam_GetVersion()`

Description

`Picam_GetVersion()` returns PICam version information.

The following version information may be requested:

- Major
  This is the Major release version which is incremented with each major feature addition or breaks backward-compatibility.
- Minor
  This is the Minor release version which is incremented with minor feature additions.
- Distribution
  This is the Distribution version which is incremented with bug fix releases.
- Released
  This is the date of the current official release in the format **YYMM**.
  When a release is classified as a Beta release, requesting this information returns a zero (`0`).

NOTE:

`Picam_GetVersion()` may be called prior to initializing the library with `Picam_InitializeLibrary()`.

Syntax

The syntax of `Picam_GetVersion()` is:

```
PICAM_API Picam_GetVersion(
                          piint*  major,
                          piint*  minor,
                          piint*  distribution,
                          piint*  released);
```

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Input Parameters

Input parameters for `Picam_GetVersion()` are:

`major`: Used to request Major version.
Valid values are:

- `&major`
  Indicates that the Major version is to be returned.
- `0/null`
  Indicates that the Major version is not to be returned.

`minor`: Used to request Minor version.
Valid values are:

- `&minor`
  Indicates that the Minor version is to be returned.
- `0/null`
  Indicates that the Minor version is not to be returned.

`distribution`: Used to request Distribution version.
Valid values are:

- `&distribution`
  Indicates that the Distribution version is to be returned.
- `0/null`
  Indicates that the Distribution version is not to be returned.

`released`: Used to request official Release date.
Valid values are:

- `&released`
  Indicates that the Release date is to be returned.
- `0/null`
  Indicates that the Release date is not to be returned.

Output Parameters

Output Parameters for `Picam_GetVersion()` are:

`major`: Returns the Major version.

`minor`: Returns the Minor version.

`distribution`: Returns the Distribution version.

`released`: Returns the Released version.

Examples

If the PICam version is **4.2.1.1006**, it indicates the following version information:

- Major version: **4**
- Minor version: **2**
- Distribution version: **1**
- Release Date: **1006** [i.e., June, 2010.]

Similarly, if the PICam version is **5.1.2.0**, it indicates the following version information:

- Major version: **5**
- Minor version: **1**
- Distribution version: **2**
- Release Date: **0** indicating a Beta release.

3.2.2 `Picam_IsLibraryInitialized()`

Description

`Picam_IsLibraryInitialized()` determines if the library has been initialized.

NOTE:

`Picam_IsLibraryInitialized()` may be called prior to initializing the library using `Picam_InitializeLibrary()`.

Syntax

The syntax of `Picam_IsLibraryInitialized()` is:

```
PICAM_API Picam_IsLibraryInitialized  (pibln* inited);
```

Input Parameters

There are no input parameters associated with `Picam_IsLibraryInitialized()`.

Output Parameters

Output parameters for `Picam_IsLibraryInitialized()` are:

`inited`: Indicates the initialization status for the library. Valid values are:

- `True`
  Indicates that the library has been initialized.
- `False`
  Indicates that the library remains uninitialized.

Related APIs

For additional information, refer to the following related APIs:

- `Picam_InitializeLibrary()`

3.2.3 `Picam_InitializeLibrary()`

Description

`Picam_InitializeLibrary()` initializes the library and prepares it for use.

Syntax

The syntax of `Picam_InitializeLibrary()` is:

```
PICAM_API Picam_InitializeLibrary  (void);
```

Usage

Unless specifically noted otherwise, `Picam_InitializeLibrary()` **MUST** be called prior to calling any additional Library API routine.

NOTE:

`Picam_UninitializeLibrary()` **MUST** be called prior to program termination.

Input Parameters

There are no input parameters associated with `Picam_InitializeLibrary()`.

Output Parameters

There are no output parameters associated with `Picam_InitializeLibrary()`.

Related APIs

For additional information, refer to the following related APIs:

- `Picam_UninitializeLibrary()`

3.2.4 Picam_UninitializeLibrary()

Description

Picam_UninitializeLibrary() frees resources that have been used by the API Library, including open cameras and memory.

NOTE:

Picam_UninitializeLibrary() MUST be called prior to program termination.

Syntax

The syntax of Picam_UninitializeLibrary() is:

```
PICAM_API Picam_UninitializeLibrary  (void);
```

Input Parameters

There are no input parameters associated with Picam_UninitializeLibrary().

Output Parameters

There are no output parameters associated with Picam_UninitializeLibrary().

Related APIs

For additional information, refer to the following related APIs:

- Picam_IsLibraryInitialized()
- Picam_InitializeLibrary()

3.2.5 Picam_DestroyString()

Description

Picam_DestroyString() releases PICam- alloted memory that has been associated with a specified character string, s.

NOTE:

If the character string, s, is null, Picam_DestroyString() has no effect.

Syntax

The syntax of Picam_DestroyString() is:

```
PICAM_API Picam_DestroyString(
                const pichar*  s);
```

Input Parameters

Input parameters for Picam_DestroyString() are:

s: Pointer to the character string for which memory is to be released.

Output Parameters

There are no output parameters associated with Picam_DestroyString().

3.2.6 Picam_GetEnumerationString()

Description

Picam_GetEnumerationString() determines what enumeration strings have been defined for the specified enumerated type. Returns an allocated string representation of the enumeration type with value in s.

NOTE:

Picam_DestroyString() must be called to free the allocated memory associated with string s.

Syntax

The syntax of Picam_GetEnumerationString() is:

```
PICAM_API Picam_GetEnumerationString(
                    PicamEnumeratedType  type,
                                  piint  value,
                         const pichar**  s);
```

Input Parameters

Input parameters for Picam_GetEnumerationString() are:

type: The type for which enumeration strings are being requested.

value: The numeric value associated with enumeration string being requested.

Output Parameters

Output parameters for Picam_GetEnumerationString() are:

s: Pointer to the enumeration string.

Related APIs

For additional information, refer to the following related APIs:

- Picam_DestroyString()

Chapter 4: Identification APIs

The APIs in this section of `picam.h` deal with determining what hardware is available or being used in another instance, retrieving information from firmware, opening and closing a hardware, and connecting/disconnecting a demo camera.

Once the library has been initialized, all hardware that is powered on and connected to the host computer will have a corresponding hardware ID. Accessing hardware is as simple as opening available hardware using its corresponding ID.

NOTE:

It is recommended that the Advanced API be used for device discovery if it is necessary to detect newly connected hardware after the library has been initialized.

A demo camera is a software-simulated camera. This allows program development without a camera connected. A demo camera can be instantiated by choosing a particular camera model and connecting it. Once connected, it can be interacted with as any other camera.

Once hardware (possibly a demo camera) is no longer used, it should be closed.

The following factors affect hardware availability to the program:

- Connectivity

  In order for hardware to be detected by the program it must be:

  - Connected to the host computer;
  - The hardware must be powered on.
- Open Elsewhere

  Hardware can only be controlled by a single instance of a program. If hardware has already been opened by another program (i.e., it is open elsewhere,) it is unavailable and cannot be used until it is closed.

Basic information identifies the model, computer interface, and serial number of the hardware (as well as the sensor for cameras.)

Additional information contained in the hardware's firmware can be read if the specified hardware is connected and provides the logic program IDs and revision levels. This information may not be available for hardware that has been opened elsewhere (in another process).

4.1 Data Type Definitions

Refer to Table 4-1 for information about data type definitions for hardware APIs.

Table 4-1: Data Type Definitions for Hardware APIs

Name	Type	Description
`PicamModel`	`enum`	The hardware model. Series models represent a model family and may be used to represent older hardware whose exact model is not known.
`PicamComputerInterface`	`enum`	The interface used to communicate with the hardware.
`PicamStringSize`	`enum`	Fixed sizes limiting the maximum size of some `picam` strings.
`PicamHandle`	`void*`	A PICam allocated resource.

4.2 Structure Definitions

This section provides information about structures required by the hardware APIs.

4.2.1 PicamCameraID

Structure Definition

The structure definition for PicamCameraID is:

```
typedef struct PicamCameraID
{
                 PicamModel  model;
    PicamComputerInterface  computer_interface;
                     pichar  sensor_name [ ];
                     pichar  serial_number [ ];
} PicamCameraID;
```

Variable Definitions

The variables required for PicamCameraID are:

- `model`: This is the camera model.
- `computer_interface`: This is the method by which the camera communicates with the host computer.
- `sensor_name`: This is the name of the sensor in the camera.
- `serial_number`: This is the unique serial number that corresponds with the camera.

4.2.2 PicamAccessoryID

Structure Definition

The structure definition for PicamAccessoryID is:

```
typedef struct PicamAccessoryID
{
                 PicamModel  model;
    PicamComputerInterface  computer_interface;
                     pichar  serial_number [ ];
} PicamAccessoryID;
```

Variable Definitions

The variables required for PicamAccessoryID are:

- `model`: This is the accessory model.
- `computer_interface`: This is the method by which the accessory communicates with the host computer.
- `serial_number`: This is the unique serial number that corresponds with the accessory.

4.2.3 PicamFirmwareDetail

Structure Definition

The structure definition for PicamFirmwareDetail is:

```
typedef struct PicamFirmwareDetail
{
          pichar  name [ ];
          pichar  detail [ ];
} PicamFirmwareDetail;
```

Variable Definitions

The variables required for PicamFirmwareDetail are:

`name`: This is the name of a hardware device containing firmware.

`detail`: This stores information about the hardware device, such as version number.

4.2.4 PicamCalibrationPoint

Structure Definition

The structure definition for PicamCalibrationPoint is:

```
typedef struct PicamCalibrationPoint
{
           piflt  x;
           piflt  y;
} PicamCalibrationPoint;
```

Variable Definitions

The variables required for PicamCalibrationPoint are:

`x`: This is the x-coordinate of the calibration point.

`y`: This is the y-coordinate of the calibration point.

4.2.5 PicamCalibration

Structure Definition

The structure definition for PicamCalibration is:

```
typedef struct PicamCalibration
{
const PicamCalibrationPoint*point_array;
           piint  point_count;
} PicamCalibration;
```

Variable Definitions

The variables required for PicamCalibration are:

`point_array`: This is an array of one or more calibration points.

`point_count`: This is the number of calibration points.

4.3 Programmers' API Reference

This section provides a detailed programmers' reference guide for the following APIs:

- Identification APIs
  - `Picam_DestroyCameraIDs()`
  - `PicamAccessory_DestroyAccessoryIDs()`
  - `Picam_GetAvailableCameraIDs()`
  - `PicamAccessory_GetAvailableAccessoryIDs()`
  - `Picam_GetUnavailableCameraIDs()`
  - `PicamAccessory_GetUnavailableAccessoryIDs()`
  - `Picam_IsCameraIDConnected()`
  - `PicamAccessory_IsAccessoryIDConnected()`
  - `Picam_IsCameraIDOpenElsewhere()`
  - `PicamAccessory_IsAccessoryIDOpenElsewhere()`
- Access APIs
  - `Picam_DestroyHandles()`
  - `Picam_OpenFirstCamera()`
  - `PicamAccessory_OpenFirstAccessory()`
  - `Picam_OpenCamera()`
  - `PicamAccessory_OpenAccessory()`
  - `Picam_CloseCamera()`
  - `PicamAccessory_CloseAccessory()`
  - `Picam_GetOpenCameras()`
  - `PicamAccessory_GetOpenAccessories()`
  - `Picam_IsCameraConnected()`
  - `PicamAccessory_IsAccessoryConnected()`
  - `Picam_IsCameraFaulted()`
  - `Picam_GetCameraID()`
  - `PicamAccessory_GetAccessoryID()`
- Information APIs
  - `Picam_DestroyFirmwareDetails()`
  - `Picam_GetFirmwareDetails()`
  - `PicamAccessory_GetFirmwareDetails()`
  - `Picam_DestroyCalibrations()`
- Demo Camera Identification APIs
  - `Picam_DestroyModels()`
  - `Picam_GetAvailableDemoCameraModels()`
  - `Picam_ConnectDemoCamera()`
  - `Picam_DisconnectDemoCamera()`
  - `Picam_IsDemoCamera()`

4.3.1 Identification APIs

This section provides programming information for camera and accessory Identification APIs.

4.3.1.1 *Picam_DestroyCameraIDs()*

Description

Picam_DestroyCameraIDs() releases PICam-alloted memory associated with id_array.

NOTE:

id_array may be a single PicamCameraID allocated by PICam.

If id_array is a null array, calling Picam_DestroyCameraIDs() has no effect.

Syntax

The syntax for Picam_DestroyCameraIDs() is:

```
PICAM_API Picam_DestroyCameraIDs (
                const PicamCameraID*  id_array);
```

Input Parameters

Input parameters for Picam_DestroyCameraIDs() are:

id_array: Pointer to the id_array for which memory is to be released.

Output Parameters

There are no output parameters associated with Picam_DestroyCameraIDs().

Related APIs

For additional information, refer to the following related APIs:

- Picam_GetAvailableCameraIDs();
- Picam_GetUnavailableCameraIDs().

4.3.1.2 *PicamAccessory_DestroyAccessoryIDs()*

Description

PicamAccessory_DestroyAccessoryIDs() releases PICam-alloted memory associated with id_array.

NOTE:

id_array may be a single PicamAccessoryID allocated by PICam.

If id_array is a null array, calling PicamAccessory_DestroyAccessoryIDs() has no effect.

Syntax

The syntax for PicamAccessory_DestroyAccessoryIDs() is:

```
PICAM_API PicamAccessory_DestroyAccessoryIDs (
                                const PicamAccessoryID*  id_array);
```

Input Parameters

Input parameters for PicamAccessory_DestroyAccessoryIDs() are:

id_array: Pointer to the id_array for which memory is to be released.

Output Parameters

There are no output parameters associated with PicamAccessory_DestroyAccessoryIDs().

Related APIs

For additional information, refer to the following related APIs:

- PicamAccessory_GetAvailableAccessoryIDs();
- PicamAccessory_GetUnavailableAccessoryIDs().

4.3.1.3 *Picam_GetAvailableCameraIDs()*

Description

Picam_GetAvailableCameraIDs() dynamically creates an array of length N. This array stores camera IDs for all available cameras.

NOTE:

Cameras that have been disconnected or are currently open in another process are not available.

NOTE:

Prior to program termination, memory that has been dynamically allocated to id_array must be released by calling Picam_DestroyCameraIDs().

Syntax

The syntax for Picam_GetAvailableCameraIDs() is:

```
PICAM_API Picam_GetAvailableCameraIDs(
                const PicamCameraID**  id_array,
                               piint*  id_count);
```

Input Parameters

There are no input parameters associated with Picam_GetAvailableCameraIDs().

Output Parameters

Output parameters for Picam_GetAvailableCameraIDs() are:

id_array: Pointer to the memory address for the array in which the list of available camera IDs is stored.
When there are no available camera IDs, a null value is returned.

id_count: The total number of available camera IDs stored in id_array. This equals the length of the array that has been created.
When there are no available camera IDs, a value of 0 [zero] is returned.

Related APIs

For additional information, refer to the following related APIs:

- Picam_DestroyCameraIDs().

4.3.1.4 *PicamAccessory_GetAvailableAccessoryIDs()*

Description

PicamAccessory_GetAvailableAccessoryIDs() dynamically creates an array of length N. This array stores accessory IDs for all available accessories.

NOTE:

Accessories that have been disconnected or are currently open in another process are not available.

NOTE:

Prior to program termination, memory that has been dynamically allocated to id_array must be released by calling PicamAccessory_DestroyAccessoryIDs().

Syntax

The syntax for PicamAccessory_GetAvailableAccessoryIDs() is:

```
PICAM_API PicamAccessory_GetAvailableAccessoryIDs(
                          const PicamAccessoryID**  id_array,
                                           piint*   id_count);
```

Input Parameters

There are no input parameters associated with PicamAccessory_GetAvailableAccessoryIDs().

Output Parameters

Output parameters for PicamAccessory_GetAvailableAccessoryIDs() are:

id_array: Pointer to the memory address for the array in which the list of available accessory IDs is stored.
When there are no available accessory IDs, a null value is returned.

id_count: The total number of available accessory IDs stored in id_array.
This equals the length of the array that has been created.
When there are no available accessory IDs, a value of 0 [zero] is returned.

Related APIs

For additional information, refer to the following related APIs:

- PicamAccessory_DestroyAccessoryIDs().

4.3.1.5 *Picam_GetUnavailableCameraIDs()*

Description

Picam_GetUnavailableCameraIDs() dynamically creates an array of length N. This array stores camera IDs for all unavailable cameras.

NOTE:

Cameras that have been disconnected or are currently open in another process are not available.

NOTE:

Prior to program termination, memory that has been dynamically allocated to id_array must be released by calling Picam_DestroyCameraIDs().

Syntax

The syntax for Picam_GetAvailableCameraIDs() is:

```
PICAM_API Picam_GetUnavailableCameraIDs(
                    const PicamCameraID**  id_array,
                                   piint*  id_count);
```

Input Parameters

There are no input parameters associated with Picam_GetUnavailableCameraIDs().

Output Parameters

Output parameters for Picam_GetUnavailableCameraIDs() are:

id_array: Pointer to the memory address for the array in which the list of unavailable camera IDs is stored.
When there are no unavailable camera IDs, a null value is returned.

id_count: The total number of unavailable camera IDs stored in id_array. This equals the length of the array that has been created.
When there are no unavailable camera IDs, a value of 0 [zero] is returned.

Related APIs

For additional information, refer to the following related APIs:

- Picam_DestroyCameraIDs().

4.3.1.6 *PicamAccessory_GetUnavailableAccessoryIDs()*

Description

PicamAccessory_GetUnavailableAccessoryIDs() dynamically creates an array of length N. This array stores accessory IDs for all unavailable accessories.

NOTE:

Accessories that have been disconnected or are currently open in another process are not available.

NOTE:

Prior to program termination, memory that has been dynamically allocated to id_array must be released by calling PicamAccessory_DestroyAccessoryIDs().

Syntax

The syntax for PicamAccessory_GetUnavailableAccessoryIDs() is:

```
PICAM_API PicamAccessory_GetUnavailableAccessoryIDs(
                            const PicamAccessoryID**  id_array,
                                             piint*   id_count);
```

Input Parameters

There are no input parameters associated with PicamAccessory_GetUnavailableAccessoryIDs().

Output Parameters

Output parameters for PicamAccessory_GetUnavailableAccessoryIDs() are:

id_array: Pointer to the memory address for the array in which the list of unavailable accessory IDs is stored.
When there are no unavailable accessory IDs, a null value is returned.

id_count: The total number of unavailable accessory IDs stored in id_array. This equals the length of the array that has been created.
When there are no unavailable accessory IDs, a value of 0 [zero] is returned.

Related APIs

For additional information, refer to the following related APIs:

- PicamAccessory_DestroyAccessoryIDs().

4.3.1.7 *Picam_IsCameraIDConnected()*

Description

Picam_IsCameraIDConnected() determines if a specified camera ID is plugged into the host computer and turned on.

Syntax

The syntax for Picam_IsCameraIDConnected() is:

```
PICAM_API Picam_IsCameraIDConnected(
                const PicamCameraID*  id,
                               pibln*  connected);
```

Input Parameters

Input parameters for Picam_IsCameraIDConnected() are:

id: Specifies the ID of the camera for which the connection status is being tested.

Output Parameters

Output parameters for Picam_IsCameraIDConnected() are:

connected: Returns the connection status for the specified camera ID.
Valid values are:

- True
  Indicates that the specified camera ID is connected to the host computer and is turned on;
- False
  Indicates that the specified camera ID is not connected to the host computer or is not turned on.

4.3.1.8 *PicamAccessory_IsAccessoryIDConnected()*

Description

PicamAccessory_IsAccessoryIDConnected() determines if a specified accessory ID is plugged into the host computer and turned on.

Syntax

The syntax for PicamAccessory_IsAccessoryIDConnected() is:

```
PICAM_API PicamAccessory_IsAccessoryIDConnected(
                                  const PicamAccessoryID*  id,
                                              pibln*  connected);
```

Input Parameters

Input parameters for PicamAccessory_IsAccessoryIDConnected() are:

`id`: Specifies the ID of the accessory for which the connection status is being tested.

Output Parameters

Output parameters for PicamAccessory_IsAccessoryIDConnected() are:

`connected`: Returns the connection status for the specified accessory ID. Valid values are:

- `True`
  Indicates that the specified accessory ID is connected to the host computer and is turned on;
- `False`
  Indicates that the specified accessory ID is not connected to the host computer or is not turned on.

4.3.1.9 *Picam_IsCameraIDOpenElsewhere()*

Description

Picam_IsCameraIDOpenElsewhere() determines if a specified camera ID has been opened by another process.

Syntax

The syntax for Picam_IsCameraIDOpenElsewhere() is:

```
PICAM_API Picam_IsCameraIDOpenElsewhere(
                    const PicamCameraID*  id,
                                  pibln*  open_elsewhere);
```

Input Parameters

Input parameters for Picam_IsCameraIDOpenElsewhere() are:

`id`: Specifies the ID of the camera for which the connection status is being tested.

Output Parameters

Output parameters for Picam_IsCameraIDOpenElsewhere() are:

`open_elsewhere`: Returns the connection status for the specified camera ID. Valid values are:

- `True`
  Indicates that the specified camera ID is currently open in another process;
- `False`
  Indicates that the specified camera ID is not currently open in another process.

4.3.1.10 *PicamAccessory_IsAccessoryIDOpenElsewhere()*

Description

PicamAccessory_IsAccessoryIDOpenElsewhere() determines if a specified accessory ID has been opened by another process.

Syntax

The syntax for PicamAccessory_IsAccessoryIDOpenElsewhere() is:

```
PICAM_API PicamAccessory_IsAccessoryIDOpenElsewhere(
                                const PicamAccessoryID*  id,
                                                 pibln*  open_elsewhere);
```

Input Parameters

Input parameters for PicamAccessory_IsAccessoryIDOpenElsewhere() are:

id: Specifies the ID of the accessory for which the connection status is being tested.

Output Parameters

Output parameters for PicamAccessory_IsAccessoryIDOpenElsewhere() are:

open_elsewhere: Returns the connection status for the specified accessory ID. Valid values are:

- True
  Indicates that the specified accessory ID is currently open in another process;
- False
  Indicates that the specified accessory ID is not currently open in another process.

4.3.2 Access APIs

This section provides programming information for camera and accessory Access APIs.

4.3.2.1 *Picam_DestroyHandles()*

Description

Picam_DestroyHandles() releases memory that has been allocated by PICam for use by handle_array.

NOTE:

handle_array may be a single PicamHandle allocated by PICam.

If handle_array is a null array, calling Picam_DestroyHandles() has no effect.

NOTE:

Picam_DestroyHandles() releases the memory used to store the handles. It does NOT free the resources to which the handles refer.

Syntax

The syntax for Picam_DestroyHandles() is:

```
PICAM_API Picam_DestroyHandles(
            const PicamHandle*  handle_array);
```

Input Parameters

Input parameters for Picam_DestroyHandles() are:

handle_array: Pointer to array memory that is to be released.

Output Parameters

There are no output parameters associated with Picam_DestroyHandles().

4.3.2.2 *Picam_OpenFirstCamera()*

Description

Picam_OpenFirstCamera() opens the first available camera, and returns a handle to the camera.

NOTE:

Prior to program termination, all open cameras must be closed by calling Picam_CloseCamera().

Syntax

The syntax for Picam_OpenFirstCamera() is:

```
PICAM_API Picam_OpenFirstCamera(
                        PicamHandle*  camera);
```

Input Parameters

There are no input parameters associated with Picam_OpenFirstCamera().

Output Parameters

Output parameters for Picam_OpenFirstCamera() are:

camera: The handle corresponding to the camera that has been opened.

Advanced API Usage

When used in conjunction with Advanced APIs, the handle returned is for the model.

Related APIs

For additional information, refer to the following related APIs:

- Picam_CloseCamera().

4.3.2.3 *PicamAccessory_OpenFirstAccessory()*

Description

PicamAccessory_OpenFirstAccessory() opens the first available accessory, and returns a handle to the accessory.

NOTE:

Prior to program termination, all open accessories must be closed by calling PicamAccessory_CloseAccessory().

Syntax

The syntax for PicamAccessory_OpenFirstAccessory() is:

```
PICAM_API PicamAccessory_OpenFirstAccessory(
                                PicamHandle*  accessory);
```

Input Parameters

There are no input parameters associated with PicamAccessory_OpenFirstAccessory().

Output Parameters

Output parameters for PicamAccessory_OpenFirstAccessory() are:

`accessory:` The handle corresponding to the accessory that has been opened.

Related APIs

For additional information, refer to the following related APIs:

- PicamAccessory_CloseAccessory().

4.3.2.4 *Picam_OpenCamera()*

Description

Picam_OpenCamera() opens a specified camera, and returns a handle to the camera.

NOTE:

Prior to program termination, all open cameras must be closed by calling Picam_CloseCamera().

Syntax

The syntax for Picam_OpenCamera() is:

```
PICAM_API Picam_OpenCamera(
        const PicamCameraID*  id,
                PicamHandle*  camera);
```

Input Parameters

Input parameters for Picam_OpenCamera() are:

id: The id for camera to be opened.

Output Parameters

Output parameters for Picam_OpenCamera() are:

camera: The handle corresponding to the open camera.

Advanced API Usage

When used in conjunction with Advanced APIs, the handle returned is for the camera model.

Related APIs

For additional information, refer to the following related APIs:

- Picam_CloseCamera().

4.3.2.5 *PicamAccessory_OpenAccessory()*

Description

PicamAccessory_OpenAccessory() opens a specified accessory, and returns a handle to the accessory.

NOTE:

Prior to program termination, all open accessories must be closed by calling PicamAccessory_CloseAccessory().

Syntax

The syntax for PicamAccessory_OpenAccessory() is:

```
PICAM_API PicamAccessory_OpenAccessory(
                const PicamAccessoryID*  id,
                          PicamHandle*  accessory);
```

Input Parameters

Input parameters for PicamAccessory_OpenAccessory() are:

id: The id for accessory to be opened.

Output Parameters

Output parameters for PicamAccessory_OpenAccessory() are:

accessory: The handle corresponding to the open accessory.

Related APIs

For additional information, refer to the following related APIs:

- PicamAccessory_CloseAccessory().

4.3.2.6 *Picam_CloseCamera()*

Description

Picam_CloseCamera() releases all resources that have been associated with a specified camera.

Syntax

The syntax for Picam_CloseCamera() is:

```
PICAM_API Picam_CloseCamera(
                PicamHandle  camera);
```

Input Parameters

Input parameters for Picam_CloseCamera() are:

camera: The handle associated with the camera that is to be closed.

Output Parameters

There are no output parameters associated with Picam_CloseCamera().

Advanced API Usage

When used in conjunction with Advanced APIs, camera can be a handle to either the:

- device, or
- model.

In either case, when Picam_CloseCamera() is called, it always closes both the specified device and model.

4.3.2.7 *PicamAccessory_CloseAccessory()*

Description

PicamAccessory_CloseAccessory() releases all resources that have been associated with a specified accessory.

Syntax

The syntax for PicamAccessory_CloseAccessory() is:

```
PICAM_API PicamAccessory_CloseAccessory(
                             PicamHandle  accessory);
```

Input Parameters

Input parameters for PicamAccessory_CloseAccessory() are:

accessory: The handle associated with the accessory that is to be closed.

Output Parameters

There are no output parameters associated with PicamAccessory_CloseAccessory().

4.3.2.8 *Picam_GetOpenCameras()*

Description

Picam_GetOpenCameras() dynamically creates an array of length N. This array stores camera handles for all open cameras in the current process.

NOTE:

Prior to program termination, memory that has been dynamically allocated to camera_array must be released by calling Picam_DestroyHandles().

Syntax

The syntax for Picam_GetOpenCameras() is:

```
PICAM_API Picam_GetOpenCameras(
                const PicamHandle**  camera_array,
                             piint*  camera_count);
```

Input Parameters

There are no input parameters associated with Picam_GetOpenCameras().

Output Parameters

Output parameters for Picam_GetOpenCameras() are:

camera_array: Pointer to the memory address for the array in which the list of camera handles is stored.
When there are no available camera handles, a null value is returned.

camera_count: The total number of camera handles stored in camera_array. This equals the length of the array that has been created.
When there are no available camera handless, a value of 0 [zero] is returned.

Advanced API Usage

When used in conjunction with Advanced APIs, this array (camera_array) stores a list of model handles.

Related APIs

For additional information, refer to the following related APIs:

- Picam_DestroyHandles().

4.3.2.9 *PicamAccessory_GetOpenAccessories()*

Description

PicamAccessory_GetOpenAccessories() dynamically creates an array of length N. This array stores accessory handles for all open accessories in the current process.

NOTE:

Prior to program termination, memory that has been dynamically allocated to accessory_array must be released by calling Picam_DestroyHandles().

Syntax

The syntax for PicamAccessory_GetOpenAccessories() is:

```
PICAM_API PicamAccessory_GetOpenAccessories(
                                const PicamHandle**  accessory_array,
                                              piint*
accessory_count);
```

Input Parameters

There are no input parameters associated with PicamAccessory_GetOpenAccessories().

Output Parameters

Output parameters for PicamAccessory_GetOpenAccessories() are:

accessory_array:	Pointer to the memory address for the array in which the list of accessory handles is stored. When there are no available accessory handles, a null value is returned.
accessory_count:	The total number of accessory handles stored in accessory_array. This equals the length of the array that has been created. When there are no available accessory handless, a value of 0 [zero] is returned.

Related APIs

For additional information, refer to the following related APIs:

- Picam_DestroyHandles().

4.3.2.10 *Picam_IsCameraConnected()*

Description

Picam_IsCameraConnected() determines if the specified camera is plugged into the host computer and is turned on.

Syntax

The syntax for Picam_IsCameraConnected() is:

```
PICAM_API Picam_IsCameraConnected(
                                  PicamHandle  camera,
                                       pibln*  connected);
```

Input Parameters

Input parameters for Picam_IsCameraConnected() are:

camera: The handle for the camera for which the status is being determined.

Output Parameters

Output parameters for Picam_IsCameraConnected() are:

connected: Returns the connection status for the specified camera.
Valid values are:

- True
  Indicates that the specified camera is connected to the host computer and is turned on.
- False
  Indicates that the specified camera is not connected to the host computer and/or not turned on.

Advanced API Usage

When used in conjunction with Advanced APIs, camera can be a handle to either the:

- device, or
- model.

Both device and model share the same connected state.

4.3.2.11 *PicamAccessory_IsAccessoryConnected()*

Description

PicamAccessory_IsAccessoryConnected() determines if the specified accessory is plugged into the host computer and is turned on.

Syntax

The syntax for PicamAccessory_IsAccessoryConnected() is:

```
PICAM_API PicamAccessory_IsAccessoryConnected(
                                  PicamHandle  accessory,
                                       pibln*  connected);
```

Input Parameters

Input parameters for PicamAccessory_IsAccessoryConnected() are:

accessory: The handle for the accessory for which the status is being determined.

Output Parameters

Output parameters for PicamAccessory_IsAccessoryConnected() are:

connected: Returns the connection status for the specified accessory. Valid values are:

- True
  Indicates that the specified accessory is connected to the host computer and is turned on.
- False
  Indicates that the specified accessory is not connected to the host computer and/or not turned on.

4.3.2.12 *Picam_IsCameraFaulted()*

Description

Picam_IsCameraFaulted() determines if the specified camera has experienced a critical malfunction and is in need of service. Any acquisition in progress will be stopped and further acquisitions are not possible until the camera has been serviced.

Syntax

The syntax for Picam_IsCameraFaulted() is:

```
PICAM_API Picam_IsCameraFaulted(
                    PicamHandle  camera,
                        pibln*  faulted);
```

Input Parameters

Input parameters for Picam_IsCameraFaulted() are:

camera: The handle for the camera for which the status is being determined.

Output Parameters

Output parameters for Picam_IsCameraFaulted() are:

faulted: Returns the faulted status for the specified camera.
Valid values are:

- True
  Indicates that the specified camera has experienced a critical malfunction.
- False
  Indicates that the specified camera is working properly.

Advanced API Usage

When used in conjunction with Advanced APIs, camera can be a handle to either the:

- device, or
- model.

Both device and model share the same faulted state.

4.3.2.13 *Picam_GetCameraID()*

Description

Picam_GetCameraID() returns the ID associated with a specified camera handle.

Syntax

The syntax for Picam_GetCameraID() is:

```
PICAM_API Picam_GetCameraID(
                    PicamHandle  camera,
                  PicamCameraID*  id);
```

Input Parameters

Input parameters for Picam_GetCameraID() are:

camera: The handle associated with the camera for which the ID is to be determined.

Output Parameters

Output parameters for Picam_GetCameraID() are:

id: The camera ID associated with the specified handle.

Advanced API Usage

When used in conjunction with Advanced APIs, camera can be a handle to either the:

- device, or
- model.

Both device and model share the same camera ID.

4.3.2.14 *PicamAccessory_GetAccessoryID()*

Description

PicamAccessory_GetAccessoryID() returns the ID associated with a specified accessory handle.

Syntax

The syntax for PicamAccessory_GetAccessoryID() is:

```
PICAM_API PicamAccessory_GetAccessoryID(
                    PicamHandle  accessory,
                 PicamAccessoryID*  id);
```

Input Parameters

Input parameters for PicamAccessory_GetAccessoryID() are:

`accessory:` The handle associated with the accessory for which the ID is to be determined.

Output Parameters

Output parameters for PicamAccessory_GetAccessoryID() are:

`id:` The accessory ID associated with the specified handle.

4.3.3 Information APIs

This section provides programming information for camera and accessory Information APIs.

4.3.3.1 *Picam_DestroyFirmwareDetails()*

Description

Picam_DestroyFirmwareDetails() releases memory that has been allocated for use by the `firmware_array`.

NOTE:

`firmware_array` may be a single `PicamFirmwareDetail` allocated by PICam.

If `firmware_array` is a null array, calling `Picam_DestroyFirmwareDetails()` has no effect.

Syntax**Picam_DestroyCalibrations()**

The syntax for `Picam_DestroyFirmwareDetails()` is:

```
PICAM_API Picam_DestroyFirmwareDetails(
              const PicamFirmwareDetail*  firmware_array);
```

Input Parameters

Input parameters for `Picam_DestroyFirmwareDetails()` are:

`firmware_array`: Pointer to the memory location where the array is stored.

Output Parameters

There are no output parameters associated with `Picam_DestroyFirmwareDetails()`.

Related APIs

For additional information, refer to the following related APIs:

- `Picam_GetFirmwareDetails()`

4.3.3.2 *Picam_GetFirmwareDetails()*

Description

Picam_GetFirmwareDetails() dynamically creates an array of length N. This array stores firmware details associated with a specified camera ID.

NOTE:

Prior to program termination, memory that has been dynamically allocated to firmware_array must be released by calling Picam_DestroyFirmwareDetails().

Syntax

The syntax for Picam_GetFirmwareDetails() is:

```
PICAM_API Picam_GetFirmwareDetails(
                const PicamCameraID*  id,
          const PicamFirmwareDetail**  firmware_array,
                               piint*  firmware_count);
```

Input Parameters

Input parameters for Picam_GetFirmwareDetails() are:

id:	Camera id for which firmware details are to be retrieved.

Output Parameters

Output parameters for Picam_GetFirmwareDetails() are:

firmware_array:	Pointer to the memory address for the array in which firmware information is stored. When no information is stored, a null value is returned.
firmware_count:	The total number of firmware details stored in firmware_array. This equals the length of the array that has been created. When no information is available, a value of 0 [zero] is returned.

Related APIs

For additional information, refer to the following related APIs:

- Picam_DestroyFirmwareDetails().

4.3.3.3 *PicamAccessory_GetFirmwareDetails()*

Description

PicamAccessory_GetFirmwareDetails() dynamically creates an array of length N. This array stores firmware details associated with a specified accessory ID.

NOTE:

Prior to program termination, memory that has been dynamically allocated to firmware_array must be released by calling Picam_DestroyFirmwareDetails().

Syntax

The syntax for PicamAccessory_GetFirmwareDetails() is:

```
PICAM_API PicamAccessory_GetFirmwareDetails(
                        const PicamAccessoryID*  id,
                    const PicamFirmwareDetail**  firmware_array,
                                         piint*  firmware_count);
```

Input Parameters

Input parameters for PicamAccessory_GetFirmwareDetails() are:

`id`: Accessory id for which firmware details are to be retrieved.

Output Parameters

Output parameters for PicamAccessory_GetFirmwareDetails() are:

`firmware_array`: Pointer to the memory address for the array in which firmware information is stored.
When no information is stored, a null value is returned.

`firmware_count`: The total number of firmware details stored in firmware_array.
This equals the length of the array that has been created.
When no information is available, a value of 0 [zero] is returned.

Related APIs

For additional information, refer to the following related APIs:

- Picam_DestroyFirmwareDetails().

4.3.3.4 *Picam_DestroyCalibrations()*

Description

Picam_DestroyCalibrations() releases memory that has been allocated for use by the calibrations_array.

NOTE:

calibrations_array may be a single PicamCalibrationDetail allocated by PICam.

If calibrations_array is a null array, calling Picam_DestroyCalibrations() has no effect.

Syntax

The syntax for Picam_DestroyCalibrations() is:

```
PICAM_API Picam_DestroyCalibrations(
                    const PicamCalibration*  calibrations_array);
```

Input Parameters

Input parameters for Picam_DestroyCalibrations() are:

calibrations_array: Pointer to the memory location where the array is stored.

Output Parameters

There are no output parameters associated with Picam_DestroyCalibrations().

4.3.4 Demo Camera Identification APIs

This section provides programming information for Demo Camera Identification APIs.

4.3.4.1 *Picam_DestroyModels()*

Picam_DestroyModels() releases memory that has been allocated for use by the `model_array`.

NOTE:

`model_array` may be a single `PicamModel` allocated by PICam.

If `model_array` is a null array, calling `Picam_DestroyModels()` has no effect.

Syntax

The syntax for `Picam_DestroyModels()` is:

```
PICAM_API Picam_DestroyModels(
        const PicamModel*  model_array);
```

Input Parameters

Input parameters for `Picam_DestroyModels()` are:

`model_array`: Pointer to the memory location where the array is stored.

Output Parameters

There are no output parameters associated with `Picam_DestroyModels()`.

Related APIs

For additional information, refer to the following related APIs:

- `Picam_GetAvailableDemoCameraModels()`

4.3.4.2 *Picam_GetAvailableDemoCameraModels()*

Description

Picam_GetAvailableDemoCameraModels() dynamically creates an array of length N. This array stores a list of virtual camera models which are available for use in Demo Mode.

NOTE:

Prior to program termination, memory that has been dynamically allocated to model_array must be released by calling Picam_DestroyModels().

Syntax

The syntax for Picam_GetAvailableDemoCameraModels() is:

```
PICAM_API Picam_GetAvailableDemoCameraModels(
                          const PicamModel**  model_array,
                                    piint*    model_count);
```

Input Parameters

There are no input parameters associated with Picam_GetAvailableDemoCameraModels().

Output Parameters

Output parameters for Picam_GetAvailableDemoCameraModels() are:

model_array: Pointer to the memory address for the array in which the list of virtual camera models is stored.
When there are no virtual camera models available, a null value is returned.

model_count: The total number of virtual models being stored in model_array.
This equals the length of the array that has been created.
When there are no virtual models available, a value of 0 [zero] is returned.

Related APIs

For additional information, refer to the following related APIs:

- Picam_DestroyModels().

4.3.4.3 Picam_ConnectDemoCamera()

Description

Picam_ConnectDemoCamera() establishes a connection with the specified virtual camera.

Syntax

The syntax for Picam_ConnectDemoCamera() is:

```
PICAM_API Picam_ConnectDemoCamera(
                        PicamModel  model,
                   const pichar*  serial_number,
                  PicamCameraID*  id);
```

Input Parameters

Input parameters for Picam_ConnectDemoCamera() are:

`model`: Model for the virtual camera for which a connection is to be established.

`serial_number`: Serial number of the virtual camera for which a connection is to be established.

Output Parameters

Output parameters for Picam_ConnectDemoCamera() are:

`id`: ID of the virtual camera for which a connection is to be established

NOTE:

`id` is an optional parameter and may be null.

4.3.4.4 *Picam_DisconnectDemoCamera()*

Description

Picam_DisconnectDemoCamera() breaks an established connection with the specified virtual camera.

Syntax

The syntax for Picam_DisconnectDemoCamera() is:

```
PICAM_API Picam_DisconnectDemoCamera(
                    const PicamCameraID*  id);
```

Input Parameters

Input parameters for Picam_DisconnectDemoCamera() are:

id: ID of the virtual camera for which the connection is to be broken.

Output Parameters

There are no output parameters associated with Picam_DisconnectDemoCamera().

4.3.4.5 *Picam_IsDemoCamera()*

Description

Picam_IsDemoCamera() determines if the specified camera is a virtual camera.

Syntax

They syntax for Picam_IsDemoCamera() is:

```
PICAM_API Picam_IsDemoCamera(
        const PicamCameraID*  id,
                     pibln*  demo);
```

Input Parameters

Input parameters for Picam_IsDemoCamera() are:

id: ID of the camera being identified.

Output Parameters

Output parameters for Picam_IsDemoCamera() are:

demo: Indicates if the specified camera is a software-simulated camera. Valid values are:

- True
  Indicates that the specified camera is a virtual camera.
- False
  Indicates that the specified camera is an actual physical camera.

Chapter 5: Configuration APIs

The functions in this grouping set or query parameter values, parameter information, and parameter constraints that characterize hardware. A parameter is a hardware setting. Parameters have varying qualities as well as values and constraints. A parameter may have several different values but constraints determine which kinds of values a parameter can have based on hardware type, read/write capability, or other parameters used or to be used in describing and setting up specific hardware. If a camera has been opened, it can be configured by changing its parameters through software and applying them to the hardware. If an accessory has been opened, it can be configured directly. Each different hardware model has a different set of parameters. Parameters contain different attributes.

The most important parameter attribute is its value. Values are represented by different types (i.e., integer, floating point, enumeration, etc.)

All parameter values can be read, but not all can be written. This is determined by the parameter's value access:

- Read/Write
- Read Only.

NOTE:

A special case of value access is when a parameter value can be written, but only one particular value is permitted. This is called read/write trivial.

Parameter values that can be written have constraints. Constraints describe the set of values a parameter value can take. The nature of this set determines the constraint type (e.g., a numeric range, a set of options, etc.) It is useful to describe a different constraint based on purpose. This is where constraint categories come into play. These categories differentiate "Is this parameter capable of x?" from "Based on the current configuration, is it valid to set parameter to *x*?"

Due to the complex nature of configuration, some parameters override others when certain values are set. A parameter is relevant if it has an effect on the current configuration.

For a camera, most parameters are only used for acquisition setup. However, this is not always the case. Some parameters can be modified while the hardware is acquiring. These parameters are deemed onlineable. Note that accessories are not onlineable since they do not acquire data.

Still other parameters reflect the current state of the hardware. These parameters only have meaning when read directly from hardware and are termed readable.

Another parameter may reflect the status of hardware that is not directly controllable by the software (e.g., may be changed due to external influences,) yet it's value may impact the decisions and/or further progress of the software. Such a parameter is a waitable status.

For a camera, once the parameter values have been adjusted as desired they must be committed to the hardware before the hardware can be used.

5.1 Data Type Definitions

This section provides programming information about PICam data type definitions.

5.1.1 Hardware Parameter Enumerations

This section provides information about the following hardware parameter enumerations:

NOTE:

Enumerations are listed alphabetically.

- PicamActiveShutter
- PicamAdcAnalogGain
- PicamAdcQuality
- PicamCcdCharacteristicsMask
- PicamCenterWavelengthStatus
- PicamConstraintType
- PicamCoolingFanStatus
- PicamEMIccdGainControlMode
- PicamGateTrackingMask
- PicamGatingMode
- PicamGatingSpeed
- PicamGratingCoating
- PicamGratingType
- PicamIntensifierOptionsMask
- PicamIntensifierStatus
- PicamLaserOutputMode
- PicamLaserStatus
- PicamLightSource
- PicamLightSourceStatus
- PicamModulationTrackingMask
- PicamOrientationMask
- PicamOutputSignal
- PicamParameter
- PicamPhosphorType
- PicamPhotocathodeSensitivity
- PicamPhotonDetectionMode
- PicamPixelFormat
- PicamReadoutControlMode
- PicamSensorTemperatureStatus
- PicamSensorType
- PicamShutterStatus
- PicamShutterTimingMode
- PicamShutterType
- PicamTimeStampsMask
- PicamTriggerCoupling
- PicamTriggerDetermination
- PicamTriggerResponse
- PicamTriggerSource
- PicamTriggerStatus
- PicamTriggerTermination
- PicamVacuumStatus
- PicamValueType

5.1.1.1 *PicamActiveShutter*

Data Type

PicamActiveShutter is defined as enum.

Description

PicamActiveShutter is the shutter that will be controlled during an acquisition.

Enumerator Definitions

Refer to Table 5-2 for enumerator definitions.

Table 5-1: PicamActiveShutter Enumerator Definitions

Enumerator	Description
PicamActiveShutter_External	The shutter external to the hardware.
PicamActiveShutter_Internal	The shutter internal to the hardware.
PicamActiveShutter_None	There is no shutter installed.

5.1.1.2 *PicamAdcAnalogGain*

Data Type

PicamAdcAnalogGain is defined as enum.

Description

PicamAdcAnalogGain is the set of electronic gain settings for pixel digitization.

Enumerator Definitions

Refer to Table 5-2 for enumerator definitions.

Table 5-2: PicamAdcAnalogGain Enumerator Definitions

Enumerator	Description
PicamAdcAnalogGain_High	Large amplification. Refer to the user manual for the specific hardware being used for complete information.
PicamAdcAnalogGain_Low	Small amplification. Refer to the user manual for the specific hardware being used for complete information.
PicamAdcAnalogGain_Medium	Average amplification. Refer to the user manual for the specific hardware being used for complete information.

5.1.1.3 *PicamAdcQuality*

Data Type

PicamAdcQuality is defined as enum.

Description

PicamAdcQuality is the set of Analog-to-Digital conversion techniques and quality settings for pixel digitization.

Enumerator Definitions

Refer to Table 5-3 for enumerator definitions.

Table 5-3: PicamAdcQuality Enumerator Definitions

Enumerator	Description
PicamAdcQuality_ElectronMultiplied	Provides electron multiplication.
PicamAdcQuality_HighCapacity	Optimized for sensing high levels of radiation.
PicamAdcQuality_HighSpeed	Provides faster readout speeds.
PicamAdcQuality_LowNoise	Optimized for the lowest noise.

5.1.1.4 *PicamCcdCharacteristicsMask*

Data Type

PicamCcdCharacteristicsMask is defined as enum.

Description

PicamCcdCharacteristicsMask is the set of CCD sensor characteristics.

Enumerator Definitions

Refer to Table 5-4 for enumerator definitions.

Table 5-4: PicamCcdCharacteristicsMask Enumerator Definitions

Enumerator	Description
PicamCcdCharacteristicsMask_AdvancedInvertedMode	The CCD has reduced dark current.
PicamCcdCharacteristicsMask_BackIlluminated	Indicates the type of illumination used. Valid values are: • 1 CCD is back-illuminated • 0 CCD is front-illuminated
PicamCcdCharacteristicsMask_DeepDepleted	The CCD is deep depleted.
PicamCcdCharacteristicsMask_ExcelonEnabled	The CCD is enhanced with eXcelon technology.
PicamCcdCharacteristicsMask_HighResistivity	The CCD is enhanced for sensing infrared radiation.
PicamCcdCharacteristicsMask_Multiport	The CCD has multiple readout ports that can be used simultaneously.
PicamCcdCharacteristicsMask_None	No additional characteristics.
PicamCcdCharacteristicsMask_OpenElectrode	The CCD is open electrode.
PicamCcdCharacteristicsMask_SecondaryMask	The CCD has an additional masked area.
PicamCcdCharacteristicsMask_UVEnhanced	The CCD is enhanced for sensing ultraviolet radiation.

5.1.1.5 *PicamCenterWavelengthStatus*

Data Type

PicamCenterWavelengthStatus is defined as enum.

Description

PicamCenterWavelengthStatus is the set of center wavelength statuses.

Enumerator Definitions

Refer to Table 5-5 for enumerator definitions.

Table 5-5: PicamCenterWavelengthStatus Enumerator Definitions

Enumerator	Description
PicamCenterWavelengthStatus_Faulted	The grating drive has malfunctioned.
PicamCenterWavelengthStatus_Moving	The center wavelength is moving.
PicamCenterWavelengthStatus_Stationary	The center wavelength is stationary.

5.1.1.6 *PicamConstraintType*

Data Type

PicamConstraintType is defined as enum.

Description

PicamConstraintType is the set of constraints that may be placed on a parameter's value.

Enumerator Definitions

Refer to Table 5-6 for enumerator definitions.

Table 5-6: PicamConstraintType Enumerator Definitions

Enumerator	Description
PicamConstraintType_Collection	The value can be one in a collection of choices.
PicamConstraintType_Modulations	The value is a custom modulation sequence.
PicamConstraintType_None	The value is read-only and not constrained.
PicamConstraintType_Pulse	The value is a gate pulse.
PicamConstraintType_Range	The value is numeric and naturally constrained within a linear range.
PicamConstraintType_Rois	The value is a set of regions of interests.

5.1.1.7 *PicamCoolingFanStatus*

Data Type

PicamCoolingFanStatus is defined as enum.

Description

PicamCoolingFanStatus is the set of cooling fan statuses.

Enumerator Definitions

Refer to Table 5-7 for enumerator definitions.

Table 5-7: PicamCoolingFanStatus Enumerator Definitions

Enumerator	Description
PicamCoolingFanStatus_ForcedOn	The cooling fan has been forced on to prevent overheating.
PicamCoolingFanStatus_Off	The cooling fan is off.
PicamCoolingFanStatus_On	The cooling fan is on.

5.1.1.8 *PicamEMIccdGainControlMode*

Data Type

PicamEMIccdGainControlMode is defined as enum.

Description

PicamEMIccdGainControlMode is the set of Control Modes which control intensifier gain and electron multiplication gain for emICCD hardware.

Enumerator Definitions

Refer to Table 5-8 for enumerator definitions.

Table 5-8: PicamEMIccdGainControlMode Enumerator Definitions

Enumerator	Description
PicamEMIccdGainControlMode_Manual	Allows each gain to be controlled independently.
PicamEMIccdGainControlMode_Optimal	Controls both gains simultaneously as a single emICCD gain.

5.1.1.9 *PicamGateTrackingMask*

Data Type

PicamGateTrackingMask is defined as enum.

Description

PicamGateTrackingMask is the set of sequential gate pulse components that are to be tracked.

Enumerator Definitions

Refer to Table 5-9 for enumerator definitions.

Table 5-9: PicamGateTrackingMask Enumerator Definitions

Enumerator	Description
PicamGateTrackingMask_Delay	The delay of the gate pulse is tracked.
PicamGateTrackingMask_None	No components are tracked.
PicamGateTrackingMask_Width	The width of the gate pulse is tracked.

5.1.1.10 *PicamGatingMode*

Data Type

PicamGatingMode is defined as enum.

Description

PicamGatingMode is the set of supported gate pulse timing modes.

Enumerator Definitions

Refer to Table 5-10 for enumerator definitions.

Table 5-10: PicamGatingMode Enumerator Definitions

Enumerator	Description
PicamGatingMode_Custom	Custom gate timing.
PicamGatingMode_Disabled	Gating is disabled.
PicamGatingMode_Repetitive	The same gate timing is repeated for each frame.
PicamGatingMode_Sequential	Get timing varies for each frame.

5.1.1.11 *PicamGatingSpeed*

Data Type

PicamGatingSpeed is defined as enum.

Description

PicamGatingSpeed is the set of classifications of the narrowest gate pulse.

Enumerator Definitions

Refer to Table 5-11 for enumerator definitions.

Table 5-11: PicamGatingSpeed Enumerator Definitions

Enumerator	Description
PicamGatingSpeed_Fast	The gate pulse can be very narrow.
PicamGatingSpeed_Slow	The gate pulse width is limited by the intensifier.

5.1.1.12 *PicamGratingCoating*

Data Type

PicamGratingCoating is defined as enum.

Description

PicamGratingCoating is the coating on the grating.

Enumerator Definitions

Refer to Table 5-12 for enumerator definitions.

Table 5-12: PicamGratingCoating Enumerator Definitions

Enumerator	Description
PicamGratingCoating_Al	Aluminum coated.
PicamGratingCoating_AlMgF2	Aluminum and magnesium fluoride coated.
PicamGratingCoating_Ag	Silver coated.
PicamGratingCoating_Au	Gold coated.

5.1.1.13 *PicamGratingType*

Data Type

PicamGratingType is defined as enum.

Description

PicamGratingType is the type of grating.

Enumerator Definitions

Refer to Table 5-13 for enumerator definitions.

Table 5-13: PicamGratingType Enumerator Definitions

Enumerator	Description
PicamGratingType_Ruled	Ruled grating.
PicamGratingType_HolographicVisible	Holographic grating for the visible range.
PicamGratingType_HolographicNir	Holographic grating for the near infrared range.
PicamGratingType_HolographicUV	Holographic grating for the ultraviolet range.
PicamGratingType_Mirror	Grating is a mirror.

5.1.1.14 *PicamIntensifierOptionsMask*

Data Type

PicamIntensifierOptionsMask is defined as enum.

Description

PicamIntensifierOptionsMask is the set of intensifier characteristics.

Enumerator Definitions

Refer to Table 5-14 for enumerator definitions.

Table 5-14: PicamIntensifierOptionsMask Enumerator Definitions

Enumerator	Description
PicamIntensifierOptionsMask_ Modulation	The intensifier can be modulated.
PicamIntensifierOptionsMask_ SubNanosecondGating	The pulse can be gated narrower than a nanosecond.
PicamIntensifierOptionsMask_ McpGating	The microchannel plate is gated instead of the photocathode.
PicamIntensifierOptionsMask_None	No additional options.

5.1.1.15 *PicamIntensifierStatus*

Data Type

PicamIntensifierStatus is defined as enum.

Description

PicamIntensifierStatus is the set of intensifier power statuses.

Enumerator Definitions

Refer to Table 5-15 for enumerator definitions.

Table 5-15: PicamIntensifierStatus Enumerator Definitions

Enumerator	Description
PicamIntensifierStatus_PoweredOff	The physical switch is in the off position.
PicamIntensifierStatus_PoweredOn	The physical switch is in the on position.

5.1.1.16 *PicamLaserOutputMode*

Data Type

PicamLaserOutputMode is defined as enum.

Description

PicamLaserOutputMode is when the laser produces light.

Enumerator Definitions

Refer to Table 5-16 for enumerator definitions.

Table 5-16: PicamLaserOutputMode Enumerator Definitions

Enumerator	Description
PicamLaserOutputMode_Disabled	The laser is off.
PicamLaserOutputMode_ContinuousWave	Output is constant.
PicamLaserOutputMode_Pulsed	output is gated on and off.

5.1.1.17 *PicamLaserStatus*

Data Type

PicamLaserStatus is defined as enum.

Description

PicamLaserStatus is the laser output status.

Enumerator Definitions

Refer to Table 5-17 for enumerator definitions.

Table 5-17: PicamLaserStatus Enumerator Definitions

Enumerator	Description
PicamLaserStatus_Disarmed	The hardware key is missing.
PicamLaserStatus_Unarmed	The laser is off.
PicamLaserStatus_Arming	The laser will be enabled momentarily.
PicamLaserStatus_Armed	The laser is ready.

5.1.1.18 *PicamLightSource*

Data Type

PicamLightSource is defined as enum.

Description

PicamLightSource is the type of light source.

Enumerator Definitions

Refer to Table 5-18 for enumerator definitions.

Table 5-18: PicamLightSource Enumerator Definitions

Enumerator	Description
PicamLightSource_Disabled	No Light Source
PicamLightSource_Hg	Mercury Light Source
PicamLightSource_NeAr	Neon and Argon mixed light source
PicamLightSource_Qth	Quartz Tungsten Halogen light source.

5.1.1.19 *PicamLightSourceStatus*

Data Type

PicamLightSourceStatus is defined as enum.

Description

PicamLightSourceStatus is the light source stability.

Enumerator Definitions

Refer to Table 5-19 for enumerator definitions.

Table 5-19: PicamLightSourceStatus Enumerator Definitions

Enumerator	Description
PicamLightSourceStatus_Unstable	The light source is unstable.
PicamLightSourceStatus_Stable	The light source is stable.

5.1.1.20 *PicamModulationTrackingMask*

Data Type

PicamModulationTrackingMask is defined as enum.

Description

PicamModulationTrackingMask is the set of modulation parameters that are to be tracked.

Enumerator Definitions

Refer to step 5-20 for enumerator definitions.

Table 5-20: PicamModulationTrackingMask Enumerator Definitions

Enumerator	Description
PicamModulationTrackingMask_Duration	The modulation duration is tracked.
PicamModulationTrackingMask_Frequency	The modulation frequency is tracked.
PicamModulationTrackingMask_None	No components are tracked.
PicamModulationTrackingMask_Output SignalFrequency	The modulation output signal frequency is tracked.
PicamModulationTrackingMask_Phase	The modulation phase is tracked.

5.1.1.21 *PicamOrientationMask*

Data Type

PicamOrientationMask is defined as enum.

Description

PicamOrientationMask is the set of image orientation descriptors.

Enumerator Definitions

Refer to Table 5-21 for enumerator definitions.

Table 5-21: PicamOrientationMask Enumerator Definitions

Enumerator	Description
PicamOrientationMask_Flipped Horizontally	The data is flipped about the centered, vertical axis relative to normal.
PicamOrientationMask_Flipped Vertically	The data is flipped about the centered, horizontal axis relative to normal.
PicamOrientationMask_Normal	This defines a standard orientation.

5.1.1.22 *PicamOutputSignal*

Data Type

PicamOutputSignal is defined as enum.

Description

PicamOutputSignal is the set of parameters defining the hardware's **MONITOR OUTPUT** signal.

Enumerator Definitions

Refer to Table 5-22 for enumerator definitions.

Table 5-22: PicamOutputSignal Enumerator Definitions

Enumerator	Description
PicamOutputSignal_Acquiring	The signal is high when the hardware is acquiring or ready to receive the first trigger.
PicamOutputSignal_AlwaysHigh	The signal is always high.
PicamOutputSignal_AlwaysLow	The signal is always low.
PicamOutputSignal_AuxOutput	The signal is high during an AUX output pulse.
PicamOutputSignal_Busy	The signal is high when the hardware is busy.
PicamOutputSignal_EffectivelyExposing	The signal is high for the entire duration the sensor is exposed.
PicamOutputSignal_EffectivelyExposingAlternation	The signal is high for the entire duration the sensor is exposed; every other frame beginning with the first.
PicamOutputSignal_Exposing	The signal is high when the sensor is exposed as requested.
PicamOutputSignal_Gate	The signal is high during a gate pulse.
PicamOutputSignal_InternalTriggerT0	The signal is high during t_0 of the internal trigger.
PicamOutputSignal_NotReadingOut	The signal is low when the sensor is reading out.
PicamOutputSignal_ReadingOut	The signal is high when the sensor is reading out.
PicamOutputSignal_ShiftingUnderMask	The signal is high when the image is shifting under the sensor's mask.
PicamOutputSignal_ShutterOpen	The signal is high when the shutter is open.
PicamOutputSignal_WaitingForTrigger	The signal is high when the hardware is waiting for a trigger.

5.1.1.23 *PicamParameter*

Data Type

`PicamParameter` is defined as `enum`.

Description

`PicamParameter` is the set of user-accessible hardware parameters.

Enumerator Definitions

Refer to Table 5-23 for enumerator definitions.

Table 5-23: `PicamParameter` Enumerator Definitions (Sheet 1 of 11)

Enumerator	Description
PicamParameter_Accumulations	Controls the number of on-sensor accumulations
PicamParameter_ActiveBottomMargin	Controls the inactive number of rows on the bottom.
PicamParameter_ActiveExtendedHeight	Controls the number of additional active rows that can be used for storage. ***NOTE:*** These rows cannot be imaged directly.
PicamParameter_ActiveHeight	Controls the active number of rows.
PicamParameter_ActiveLeftMargin	Controls the inactive number of columns on the left.
PicamParameter_ActiveRightMargin	Controls the inactive number of columns on the right.
PicamParameter_ActiveShutter	Selects the shutter via the `PicamActiveShutter` data enumeration. Refer to Section 5.1.1.1, PicamActiveShutter, on page 71 for additional information.
PicamParameter_ActiveTopMargin	Controls the inactive number of rows on the top.
PicamParameter_ActiveWidth	Controls the active number of columns.
PicamParameter_AdcAnalogGain	Controls the electronic gain of the pixel digitization via the `PicamAdcAnalogGain` data enumeration. Refer to Section 5.1.1.2, PicamAdcAnalogGain, on page 71 for additional information.
PicamParameter_AdcBitDepth	Controls the resolution of the pixel digitization in bits-per-pixel.
PicamParameter_AdcEMGain	Controls the electromagnetic gain in terms of multiples.
PicamParameter_AdcQuality	Controls the nature of pixel digitization via the `PicamAdcQuality` data enumeration. Refer to Section 5.1.1.3, PicamAdcQuality, on page 72 for additional information.
PicamParameter_AdcSpeed	Controls the rate pixels are digitized, in MHz.
PicamParameter_Age	Reports the age measured in minutes.
PicamParameter_AnticiapteTrigger	Uses an external pre-trigger to anticipate an external trigger.
PicamParameter_ApplicableStarDefectMap ID	Reports the ID of the star defect map that could be used for pixel correction.
PicamParameter_AuxOutput	Controls the auxiliary output gate pulse.
PicamParameter_BracketGating	Enables bracket pulsing for intensified hardware.

Table 5-23: `PicamParameter` Enumerator Definitions (Sheet 2 of 11)

Enumerator	Description
`PicamParameter_CcdCharacteristics`	Reports characteristics of a CCD sensor via the `PicamCcdCharacteristicsMask` data enumeration. Refer to Section 5.1.1.4, PicamCcdCharacteristicsMask, on page 73 for additional information.
`PicamParameter_CenterWavelengthReading`	Reports the actual position of the center wavelength in nanometers (nm).
`PicamParameter_CenterWavelengthSetPoint`	Controls the target position of the center wavelength in nanometers (nm). Refer to Section 5.1.1.5, PicamCenterWavelengthStatus, on page 74 for additional information.
`PicamParameter_CenterWavelengthStatus`	Reports if the center wavelength is moving.
`PicamParameter_CleanBeforeExposure`	Controls cleaning before each exposure.
`PicamParameter_CleanCycleCount`	Controls the number of clean cycles to run before acquisition begins.
`PicamParameter_CleanCycleHeight`	Controls the number of rows in a clean cycle.
`PicamParameter_CleanSectionFinalHeight`	Controls the final height rows for exponential decomposition cleaning.
`PicamParameter_CleanSectionFinalHeightCount`	Controls the final height iterations for exponential decomposition cleaning.
`PicamParameter_CleanSerialRegister`	Controls the cleaning of the serial register itself.
`PicamParameter_CleanUntilTrigger`	Controls the nature of cleaning while waiting for an external trigger.
`PicamParameter_CoolingFanStatus`	Reports the status of the cooling fan via the `PicamCoolingFanStatus` data enumeration. Refer to Section 5.1.1.7, PicamCoolingFanStatus, on page 75 for additional information.
`PicamParameter_CorrectPixelBias`	Enables pixel bias correction.
`PicamParameter_CustomModulationSequence`	Customizes a modulation sequence.
`PicamParameter_DelayFromPreTrigger`	Specifies the delay from pre-trigger to trigger in microseconds (µS).
`PicamParameter_DifEndingGate`	Controls the second gate pulse in DIF readout in nanoseconds (nS).
`PicamParameter_DifStartingGate`	Controls the initial gate pulse in DIF readout in nanoseconds (nS).
`PicamParameter_DisableCoolingFan`	Enables/disables the thermoelectric cooling fan.
`PicamParameter_DisableDataFormatting`	Controls the basic processing necessary to receive data in the expected format.
`PicamParameter_EMIccdGain`	Optimally controls the intensifier gain and electron multiplication gain in emICCD hardware in terms of multiples.

Table 5-23: PicamParameter Enumerator Definitions (Sheet 3 of 11)

Enumerator	Description
PicamParameter_EMIccdGainControlMode	Determines how the intensifier gain and electron multiplication gain are controlled in emICCD hardware via the PicamEMIccdGainControlMode data enumeration. Refer to Section 5.1.1.8, PicamEMIccdGainControlMode, on page 75, for additional information.
PicamParameter_EnableAuxOutput	Enables the AUX output pulse.
PicamParameter_EnableIntensifier	Enables the intensifier. ***NOTE:*** The intensifier must be enabled and powered on for it to function.
PicamParameter_EnableModulation	Enables RF modulation for intensified hardware.
PicamParameter_EnableModulationOutput Signal	Enables an RF output signal from intensified hardware to be used as the user sees fit.
PicamParameter_EnableNondestructive Readout	Allows the hardware to periodically readout while exposing.
PicamParameter_EnableSensorWindow Heater	Enables the sensor window to heat up in an effort to prevent condensation.
PicamParameter_EnableSyncMaster	Enables SyncMASTER1 and SyncMASTER2 gate pulses.
PicamParameter_ExactReadoutCount Maximum	Reports the maximum number of readouts the hardware can acquire. ***NOTE:*** This does not include non-destructive readouts from hardware that supports the feature.
PicamParameter_ExposureTime	Controls the time the sensor is exposed in milliseconds (mS).
PicamParameter_ExternalShutterStatus	Reports the status of the shutter that is external to the hardware via the PicamShutterStatus data enumeration. Refer to Section 5.1.1.31, PicamShutterStatus, on page 97 for additional information.
PicamParameter_ExternalShutterType	Reports the type of shutter that is external to, and can be driven by, the hardware via the PicamShutterType data enumeration. Refer to Section 5.1.1.33, PicamShutterType, on page 99 for additional information.
PicamParameter_FocalLength	Reports the optical path length from the focusing mirror to the sensor in millimeters (mm).
PicamParameter_FrameRateCalculation	Reports the estimated frame rate in frames-per-second. ***NOTE:*** If there is more than one frame-per-readout, this represents the burst frame rate within the readout. ***NOTE:*** If the hardware is being externally triggered, this represents the fastest possible rate.
PicamParameter_FrameSize	Reports the size, in bytes, of a data frame.
PicamParameter_FramesPerReadout	Reports the number of frames contained in one readout.
PicamParameter_FrameStride	Reports the length, in bytes, necessary to traverse to the next frame.

Table 5-23: `PicamParameter` Enumerator Definitions (Sheet 4 of 11)

Enumerator	Description
`PicamParameter_FrameTrackingBitDepth`	Controls the frame tracking number size in bits-per-pixel.
`PicamParameter_GateTracking`	Controls the tracking of a sequential gate pulse in metadata via the `PicamGateTrackingMask` data enumeration. Refer to Section 5.1.1.9, PicamGateTrackingMask, on page 76 for additional information.
`PicamParameter_GateTrackingBitDepth`	Controls the size of one component in a varying sequential gate pulse. ***NOTE:*** This metadata is floating point.
`PicamParameter_GatingMode`	Controls the nature of gate pulse timing via the `PicamGatingMode` data enumeration. Refer to Section 5.1.1.10, PicamGatingMode, on page 76 for additional information.
`PicamParameter_GatingSpeed`	Classifies the narrowest gate pulse. Refer to Section 5.1.1.11, PicamGatingSpeed, on page 77 for additional information.
`PicamParameter_GratingBlazing Wavelength`	Reports the blaze at a particular wavelength.
`PicamParameter_GratingCoating`	Reports the coating on the grating. Refer to Section 5.1.1.12, PicamGratingCoating, on page 77 for additional information.
`PicamParameter_GratingGrooveDensity`	Reports the groove density of the grating in grooves per millimeter.
`PicamParameter_GratingType`	Reports the type of grating. Refer to Section 5.1.1.13, PicamGratingType, on page 78 for additional information.
`PicamParameter_InactiveShutterTiming ModeResult`	Reports the state of the inactive shutter via the `PicamShutterTimingMode` data enumeration. Refer to Section 5.1.1.32, PicamShutterTimingMode, on page 98 for additional information.
`PicamParameter_InclusionAngle`	Reports the sum of the incident and diffracted ray angles relative to the grating normal vector in degrees.
`PicamParameter_InputTriggerStatus`	Reports if an external trigger source is connected. Refer to Section 5.1.1.39, PicamTriggerStatus, on page 102 for additional information.
`PicamParameter_IntensifierDiameter`	Reports the diameter of the intensifier in millimeters (mm).
`PicamParameter_IntensifierGain`	Controls the gain of the intensifier in terms of multiples.
`PicamParameter_IntensifierOptions`	Reports additional features of intensified hardware via the `PicamIntensifierOptionsMask` data enumeration. Refer to Section 5.1.1.14, PicamIntensifierOptionsMask, on page 78 for additional information.

Table 5-23: PicamParameter Enumerator Definitions (Sheet 5 of 11)

Enumerator	Description
PicamParameter_IntensifierStatus	Reports the status of the intensifier power via the PicamIntensifierStatus data enumeration. Refer to Section 5.1.1.15, PicamIntensifierStatus, on page 79 for additional information.
PicamParameter_InternalShutterStatus	Reports the status of the shutter that is internal to the hardware via the PicamShutterStatus data enumeration. Refer to Section 5.1.1.31, PicamShutterStatus, on page 97 for additional information.
PicamParameter_InternalShutterType	Reports the type of shutter that is internal to, and can be driven by, the hardware via the PicamShutterType data enumeration. Refer to Section 5.1.1.33, PicamShutterType, on page 99 for additional information.
PicamParameter_InvertOutputSignal	Controls if the timing signal is inverted when viewed from the hardware monitor.
PicamParameter_InvertOutputSignal2	Controls if the timing signal is inverted when viewed from the second hardware monitor.
PicamParameter_KineticsWindowHeight	Controls the number of rows used for the sensing window in a kinetics readout.
PicamParameter_LaserOutputMode	Controls when the laser produces light. Refer to Section 5.1.1.16, PicamLaserOutputMode, on page 79 for additional information.
PicamParameter_LaserPower	Controls the laser power as a multiplier.
PicamParameter_LaserStatus	Reports if the laser is ready. Refer to Section 5.1.1.17, PicamLaserStatus, on page 79 for additional information.
PicamParameter_LaserWavelength	Reports the wavelength of the laser as measured at the factory.
PicamParameter_LifeExpectancy	Reports the expected lifetime measured in minutes.
PicamParameter_LightSource	Controls the light source on the lamp. Refer to Section 5.1.1.18, PicamLightSource, on page 80 for additional information.
PicamParameter_LightSourceStatus	Reports if the light source has stabilized. Refer to Section 5.1.1.19, PicamLightSourceStatus, on page 80 for additional information.
PicamParameter_MaskedBottomMargin	Controls the number of masked rows akin to active bottom margin.
PicamParameter_MaskedHeight	Controls the number of masked rows akin to active height.
PicamParameter_MaskedTopMargin	Controls the number of masked rows akin to active top margin.
PicamParameter_ModulationDuration	Controls the time the intensifier is modulating in milliseconds (mS).

Table 5-23: PicamParameter Enumerator Definitions (Sheet 6 of 11)

Enumerator	Description
PicamParameter_ModulationFrequency	Controls the frequency of the intensifier modulation in MHz.
PicamParameter_ModulationOutputSignal Amplitude	Controls the peak-to-peak amplitude of the user RF output signal in volts (V).
PicamParameter_ModulationOutputSignal Frequency	Controls the frequency of the user RF output signal in MHz
PicamParameter_ModulationTracking	Controls the tracking of a sequential phase or custom modulation sequence in metadata via the PicamModulationTrackingMask data enumeration. Refer to Section 5.1.1.20, PicamModulationTrackingMask, on page 81 for additional information.
PicamParameter_ModulationTrackingBit Depth	Controls the size of one component in a varying sequential modulation phase or custom modulation sequence. ***NOTE:*** This metadata is floating point.
PicamParameter_NondestructiveReadout Period	Controls the rate at which the hardware will non-destructively readout during exposure in seconds (S). ***NOTE:*** This duration must be less than exposure time for any non-destructive readouts to occur.
PicamParameter_NormalizeOrientation	Controls automatic orientation correction for data due to readout ports used.
PicamParameter_OnlineReadoutRate Calculation	Reports the fastest possible readout rate that could occur given the current setup and accounting for possible changes to online hardware parameters while acquiring
PicamParameter_Orientation	Reports the orientation of the data via the PicamOrientationMask data enumeration. Refer to Section 5.1.1.21, PicamOrientationMask, on page 81 for additional information.
PicamParameter_OutputSignal	Controls what timing signal is issued from the hardware monitor via the PicamOutputSignal data enumeration. Refer to Section 5.1.1.22, PicamOutputSignal, on page 82 for additional information.
PicamParameter_OutputSignal2	Controls what timing signal is issued from the second hardware monitor via the PicamOutputSignaldata enumeration. Refer to Section 5.1.1.22, PicamOutputSignal, on page 82 for additional information.
PicamParameter_PhosphorDecayDelay	Controls the length of time the hardware waits for the phosphor to decay before reading out. The time unit depends on PicamParameter_PhosphorDecayDelay Resolution.
PicamParameter_PhosphorDecayDelay Resolution	Controls the time unit used for phosphor decay delay. This value is in microseconds (µS). Example: A resolution of: • 1 signifies delay is in microseconds (µS); • 1000 for milliseconds (mS); • 0.01 for tens-of-nanoseconds (nS).

Table 5-23: PicamParameter Enumerator Definitions (Sheet 7 of 11)

Enumerator	Description
PicamParameter_PhosphorType	Reports the type of phosphor used in intensified hardware. Refer to Section 5.1.1.24, PicamPhosphorType, on page 94 for additional information.
PicamParameter_PhotocathodeSensitivity	Classifies the wavelength sensitivity of the photocathode. Refer to Section 5.1.1.25, PicamPhotocathodeSensitivity, on page 94 for additional information.
PicamParameter_PhotonDetectionMode	Enables/disables photon detection and controls how it is done via the PicamPhotonDetectionMode data enumeration. Refer to Section 5.1.1.26, PicamPhotonDetectionMode, on page 95 for additional information.
PicamParameter_PhotonDetection Threshold	The threshold, in counts, used to distinguish photons from background for each pixel.
PicamParameter_PixelBitDepth	Reports the size of a data pixel in bits-per-pixel.
PicamParameter_PixelFormat	Controls the format of a data pixel via the PicamPixelFormat data enumeration. Refer to Section 5.1.1.27, PicamPixelFormat, on page 95 for additional information.
PicamParameter_PixelGapHeight	Reports the vertical distance between pixels, in microns.
PicamParameter_PixelGapWidth	Reports the horizontal distance between pixels, in microns.
PicamParameter_PixelHeight	Reports the pixel height, in microns.
PicamParameter_PixelWidth	Reports the pixel width, in microns.
PicamParameter_ReadoutControlMode	Controls how the sensor is read out via the PicamReadoutControlMode data enumeration. Refer to Section 5.1.1.28, PicamReadoutControlMode, on page 96 for additional information.
PicamParameter_ReadoutCount	Controls the number of readouts to acquire before stopping the hardware. ***NOTE:*** The hardware may acquire more than the readouts requested for large requests (i.e., more readouts than those specified by PicamParameter_ExactReadoutCount Maximum). ***NOTE:*** This does not include non-destructive readouts from hardware that supports such a feature. ***NOTE:*** [Advanced-API Usage Only] The value 0 indicates the hardware will run forever until explicitly stopped or an error occurs.
PicamParameter_ReadoutOrientation	Reports the orientation of the data due to readout port location via the PicamOrientationMask data enumeration. Refer to Section 5.1.1.21, PicamOrientationMask, on page 81 for additional information.
PicamParameter_ReadoutPortCount	Controls the number of readout ports from which the hardware should simultaneously read data.

Table 5-23: `PicamParameter` Enumerator Definitions (Sheet 8 of 11)

Enumerator	Description
`PicamParameter_ReadoutRateCalculation`	Reports the estimated rate of data in readouts-per-second. ***NOTE:*** If the hardware is being externally triggered, this represents the fastest possible rate.
`PicamParameter_ReadoutStride`	Reports the length, in bytes, necessary to traverse to the next readout.
`PicamParameter_ReadoutTimeCalculation`	Reports the duration of time it takes for the hardware to read out one readout in milliseconds (mS).
`PicamParameter_RepetitiveGate`	Controls the constant gate pulse in nanoseconds (nS).
`PicamParameter_RepetitiveModulation Phase`	Controls the constant phase of the intensifier with respect to the modulation output signal in degrees.
`PicamParameter_Rois`	Controls the area of the sensor to be digitized via the `PicamRois` structure. Refer to Section 5.2.1.2, PicamRois, on page 109 for additional information.
`PicamParameter_SecondaryActiveHeight`	Controls the number of secondary active rows.
`PicamParameter_SecondaryMaskedHeight`	Controls the number of secondary masked rows.
`PicamParameter_SensorActiveBottom Margin`	Reports the inactive rows on the bottom.
`PicamParameter_SensorActiveExtended Height`	Reports the number of additional active rows that can be used for storage. ***NOTE:*** These rows cannot be imaged directly.
`PicamParameter_SensorActiveHeight`	Reports the active number of rows.
`PicamParameter_SensorActiveLeftMargin`	Reports the inactive columns on the left.
`PicamParameter_SensorActiveRightMargin`	Reports the inactive columns on the right.
`PicamParameter_SensorActiveTopMargin`	Reports the inactive rows on the top.
`PicamParameter_SensorActiveWidth`	Reports the active number of columns.
`PicamParameter_SensorAngle`	Reports the angle between rays striking the sensor relative to the sensor normal vector in degrees.
`PicamParameter_SensorMaskedBottom Margin`	Reports the number of masked rows akin to active bottom margin.
`PicamParameter_SensorMaskedHeight`	Reports the number of masked rows akin to active height.
`PicamParameter_SensorMaskedTopMargin`	Reports the number of masked rows akin to active top margin.
`PicamParameter_SensorSecondaryActive Height`	Reports the number of secondary active rows.
`PicamParameter_SensorSecondaryMasked Height`	Reports the number of secondary masked rows.
`PicamParameter_SensorTemperature Reading`	Reports the temperature of the sensor in degrees C.

Table 5-23: `PicamParameter` Enumerator Definitions (Sheet 9 of 11)

Enumerator	Description
`PicamParameter_SensorTemperatureSetPoint`	Controls the target temperature for the sensor in degrees C.
`PicamParameter_SensorTemperatureStatus`	Reports the status of the sensor temperature via the `PicamSensorTemperatureStatus` data enumeration. Refer to Section 5.1.1.29, PicamSensorTemperatureStatus, on page 96 for additional information.
`PicamParameter_SensorType`	Reports the kind of sensor being used via the `PicamSensorType` data enumeration. Refer to Section 5.1.1.30, PicamSensorType, on page 97 for additional information.
`PicamParameter_SeNsRWindowHeight`	Controls the height of the unmasked area used in SeNsR readout.
`PicamParameter_SequentialEndingGate`	Controls the last gate pulse in a sequence in nanoseconds (nS).
`PicamParameter_SequentialEndingModulationPhase`	Controls the last modulation phase of the intensifier with respect to the modulation output signal in a sequence in degrees.
`PicamParameter_SequentialGateStepCount`	Controls the number of gate pulse steps in a sequence.
`PicamParameter_SequentialGateStepIterations`	Controls the number of gate pulses at each step in a sequence.
`PicamParameter_SequentialStartingGate`	Controls the first gate pulse in a sequence in nanoseconds (nS).
`PicamParameter_SequentialStartingModulationPhase`	Controls the first modulation phase of the intensifier with respect to the modulation output signal in a sequence in degrees.
`PicamParameter_ShutterClosingDelay`	Controls the duration of time the hardware waits for the shutter to close before reading out. The time unit depends on `PicamParameter_ShutterDelayResolution`.
`PicamParameter_ShutterDelayResolution`	Controls the time unit used for shutter opening/closing delay. This value is in microseconds. Example: A resolution of: • 1 signifies delay is in microseconds (µS); • 1000 for milliseconds (mS); • 0.01 for tens-of-nanoseconds (nS).
`PicamParameter_ShutterOpeningDelay`	Controls the duration of time the hardware waits for the shutter to open before exposing. The time unit depends on `PicamParameter_ShutterDelayResolution`.
`PicamParameter_ShutterTimingMode`	Controls the behavior of the shutter during acquisition. Refer to Section 5.1.1.32, PicamShutterTimingMode, on page 98 for additional information.
`PicamParameter_StopCleaningOnPreTrigger`	Stops sensor cleaning when an external pre-trigger is acknowledged.

Table 5-23: `PicamParameter` Enumerator Definitions (Sheet 10 of 11)

Enumerator	Description
`PicamParameter_SyncMaster2Delay`	Controls the delay of SyncMASTER2 relative to SyncMASTER1 in microseconds (µS).
`PicamParameter_TimeStampBitDepth`	Controls the time stamp size in bits-per-pixel. ***NOTE:*** Because time stamps may be negative one bit is reserved for sign.
`PicamParameter_TimeStampResolution`	Controls the time stamp resolution in ticks-per-second. ***NOTE:*** This value is computer-dependent when time stamps are software generated.
`PicamParameter_TimeStamps`	Controls time stamp metadata via the `PicamTimeStampsMask` data enumeration. Refer to Section 5.1.1.34, PicamTimeStampsMask, on page 99 for additional information.
`PicamParameter_TrackFrames`	Controls frame tracking metadata.
`PicamParameter_TriggerCoupling`	Controls the coupling between an external trigger source and the camera input via the `PicamTriggerCoupling` data enumeration. Refer to Section 5.1.1.35, PicamTriggerCoupling, on page 100 for additional information.
`PicamParameter_TriggerDelay`	Controls the delay between an external trigger and the camera's response in nanoseconds.
`PicamParameter_TriggerDetermination`	Controls what the hardware recognizes as an external trigger via the `PicamTriggerDetermination` data enumeration. Refer to Section 5.1.1.36, PicamTriggerDetermination, on page 100 for additional information.
`PicamParameter_TriggerFrequency`	Controls the internal trigger and SyncMASTER frequency in Hz.
`PicamParameter_TriggerResponse`	Controls the hardware's behavior in response to a trigger via the `PicamTriggerResponse` data enumeration. Refer to Section 5.1.1.37, PicamTriggerResponse, on page 101 for additional information.
`PicamParameter_TriggerResponse`	Controls the hardware's behavior in response to an external trigger via the `PicamTriggerResponse` data enumeration. Refer to Section 5.1.1.37, PicamTriggerResponse, on page 101 for additional information.
`PicamParameter_TriggerSource`	Controls the source of a trigger via the `PicamTriggerSource` data enumeration. Refer to Section 5.1.1.38, PicamTriggerSource, on page 101 for additional information.
`PicamParameter_TriggerTermination`	Controls the termination of an external trigger source at the hardware input via the `PicamTriggerTermination` data enumeration. Refer to Section 5.1.1.40, PicamTriggerTermination, on page 102 for additional information.
`PicamParameter_TriggerThreshold`	Controls the voltage threshold necessary for the hardware to recognize a trigger in volts (V).

Table 5-23: `PicamParameter` Enumerator Definitions (Sheet 11 of 11)

Enumerator	Description
`***PicamParameter_VacuumStatus`	Reports the status of the vacuum chamber containing the sensor.
`PicamParameter_VerticalShiftRate`	Controls the rate to shift one row towards the serial register in a CCD in microseconds (µS).

5.1.1.24 *PicamPhosphorType*

Data Type

PicamPhosphorType is defined as enum.

Description

PicamPhosphorType is the set of phosphor types within intensified hardware.

Enumerator Definitions

Refer to Table 5-24 for enumerator definitions.

Table 5-24: PicamPhosphorType Enumerator Definitions

Enumerator	Description
PicamPhosphorType_P43	The phosphor is P43.
PicamPhosphorType_P46	The phosphor is P46.

5.1.1.25 *PicamPhotocathodeSensitivity*

Data Type

PicamPhotocathodeSensitivity is defined as enum.

Description

PicamPhotocathodeSensitivity is the set of parameters used to define the photocathode's wavelength range.

Enumerator Definitions

Refer to Table 5-25 for enumerator definitions.

Table 5-25: PicamPhotocathodeSensitivity Enumerator Definitions

Enumerator	Description
PicamPhotocathodeSensitivity_HighBlueFilmless	Improved quantum efficiency and optimized for blue wavelengths.
PicamPhotocathodeSensitivity_HighQEFilmless	Improved quantum efficiency.
PicamPhotocathodeSensitivity_HighRedFilmless	Improved quantum efficiency and optimized for red wavelengths.
PicamPhotocathodeSensitivity_InGaAsFilmless	Extends into near-infrared wavelengths.
PicamPhotocathodeSensitivity_RedBlue	Spans red and blue wavelengths.
PicamPhotocathodeSensitivity_SolarBlind	Optimized only for ultraviolet wavelengths.
PicamPhotocathodeSensitivity_SuperBlue	Optimized for blue wavelengths.
PicamPhotocathodeSensitivity_SuperRed	Optimized for red wavelengths.
PicamPhotocathodeSensitivity_Unigen2Filmless	Coated with UNIGEN2.
PicamPhotocathodeSensitivity_UV	Optimized for ultraviolet wavelengths.

5.1.1.26 *PicamPhotonDetectionMode*

Data Type

PicamPhotonDetectionMode is defined as enum.

Description

PicamPhotonDetectionMode is the set of photon detection modes.

Enumerator Definitions

Refer to Table 5-26 for enumerator definitions.

Table 5-26: PicamPhotonDetectionMode Enumerator Definitions

Enumerator	Description
PicamPhotonDetectionMode_Clipping	Each pixel whose intensity is greater than or equal to the threshold is a photon and retains its original value. Otherwise the value is 0.
PicamPhotonDetectionMode_Disabled	Photon detection is disabled.
PicamPhotonDetectionMode_Thresholding	Each pixel whose intensity is greater than or equal to the threshold is a photon and replaced with a count of 1. Otherwise the value is 0.

5.1.1.27 *PicamPixelFormat*

Data Type

PicamPixelFormat is defined as enum.

Description

PicamPixelFormat is the set of characteristics that defines the format of a data pixel.

Enumerator Definitions

Refer to Table 5-27 for enumerator definitions.

Table 5-27: PicamPixelFormat Enumerator Definitions

Enumerator	Description
PicamPixelFormat_Monochrome16Bit	16 bits of monochrome data
PicamPixelFormat_Monochrome32Bit	32 bits of monochrome data

5.1.1.28 *PicamReadoutControlMode*

Data Type

PicamReadoutControlMode is defined as enum.

Description

PicamReadoutControlMode is the set of sensor readout modes.

Enumerator Definitions

Refer to Table 5-28 for enumerator definitions.

Table 5-28: PicamReadoutControlMode Enumerator Definitions

Enumerator	Description
PicamReadoutControlMode_Dif	The Dual Imaging Feature where the sensor acquires two frames rapidly and then reads them both out.
PicamReadoutControlMode_ExposeDuringReadout	The sensor is reading out a frame while exposing the next frame.
PicamReadoutControlMode_FrameTransfer	The sensor is reading out a frame while exposing the next frame.
PicamReadoutControlMode_FullFrame	The sensor is read one frame at a time.
PicamReadoutControlMode_Interline	The sensor is reading out a frame while exposing the next frame.
PicamReadoutControlMode_Kinetics	The sensor rapidly stores multiple frames and then reads those out.
PicamReadoutControlMode_RollingShutter	The sensor is reading out a row while exposing the next row.
PicamReadoutControlMode_SeNsR	The sensor accumulates frames by alternating between two different phases
PicamReadoutControlMode_SpectraKinetics	Same as kinetics, but optimized to capture a larger burst of spectral frames.

5.1.1.29 *PicamSensorTemperatureStatus*

Data Type

PicamSensorTemperatureStatus is defined as enum.

Description

PicamSensorTemperatureStatus is the set of sensor temperature statuses.

Enumerator Definitions

Refer to Table 5-29 for enumerator definitions.

Table 5-29: PicamSensorTemperatureStatus Enumerator Definitions (Sheet 1 of 2)

Enumerator	Description
PicamSensorTemperatureStatus_Faulted	Sensor cooling has malfunctioned.
PicamSensorTemperatureStatus_Locked	The temperature has stabilized at the set point.

Table 5-29: PicamSensorTemperatureStatus Enumerator Definitions (Sheet 2 of 2)

Enumerator	Description
PicamSensorTemperatureStatus_ Unlocked	The temperature has not stabilized at the set point.

5.1.1.30 *PicamSensorType*

Data Type

PicamSensorType is defined as enum.

Description

PicamSensorType is the set of sensor types.

Enumerator Definitions

Refer to Table 5-30 for enumerator definitions.

Table 5-30: PicamSensorType Enumerator Definitions

Enumerator	Description
PicamSensorType_Ccd	The sensor is a CCD.
PicamSensorType_Cmos	The sensor is a CMOS.
PicamSensorType_InGaAs	The sensor is an InGaAs.

5.1.1.31 *PicamShutterStatus*

Data Type

PicamShutterStatus is defined as enum.

Description

PicamShutterStatus is the set of shutter statuses.

Enumerator Definitions

Refer to Table 5-31 for enumerator definitions.

Table 5-31: PicamShutterStatus Enumerator Definitions

Enumerator	Description
PicamShutterStatus_Connected	A shutter is connected.
PicamShutterStatus_NotConnected	No shutter is connected.
PicamShutterStatus_Overheated	A connected shutter has overheated and is temporarily disabled. ***NOTE:*** If a shutter becomes overheated, data acquisition will stop and cannot be started again until the shutter is no longer overheated.

5.1.1.32 *PicamShutterTimingMode*

Data Type

PicamShutterTimingMode is defined as enum.

Description

PicamShutterTimingMode is the set of shutter behaviors during data acquisition.

Enumerator Definitions

Refer to Table 5-32 for enumerator definitions.

Table 5-32: PicamShutterTimingMode Enumerator Definitions

Enumerator	Description
PicamShutterTimingMode_ Normal	The shutter only opens during exposure time. ***NOTE:*** During PicamReadoutControlMode_Kinetics readout, the shutter stays open while storing frames.
PicamShutterTimingMode_ AlwaysClosed	The shutter is always closed. ***NOTE:*** This mode is also valid when not acquiring data.
PicamShutterTimingMode_ AlwaysOpen	The shutter is always open. ***NOTE:*** This mode is also valid when not acquiring data.
PicamShutterTimingMode_ OpenBeforeTrigger	The shutter opens ahead of time while waiting for a trigger. This is different from PicamShutterTimingMode_ Normal where the shutter opens in reaction to a trigger.

5.1.1.33 *PicamShutterType*

Data Type

PicamShutterType is defined as enum.

Description

PicamShutterType is the set of shutter types.

NOTE:

This does not indicate the presence of a shutter, only the kind of shutter that could be driven. PicamShutterStatus indicates the presence of a shutter.

Enumerator Definitions

Refer to Table 5-33 for enumerator definitions.

Table 5-33: PicamShutterType Enumerator Definitions

Enumerator	Description
PicamShutterType_None	No shutter.
PicamShutterType_ProntorMagnetic0	PRONTOR magnetic 0 shutter.
PicamShutterType_ProntorMagneticE40	PRONTOR magnetic E/40 shutter.
PicamShutterType_VincentCS25	Vincent CS25 shutter
PicamShutterType_VincentCS45	Vincent CS45 shutter
PicamShutterType_VincentCS90	Vincent CS90 shutter
PicamShutterType_VincentDSS10	Vincent DSS10 shutter
PicamShutterType_VincentVS25	Vincent VS25 shutter
PicamShutterType_VincentVS35	Vincent VS35 shutter

5.1.1.34 *PicamTimeStampsMask*

Data Type

PicamTimeStampsMask is defined as enum.

Description

PicamTimeStampsMask is the set of time stamp metadata.

Enumerator Definitions

Refer to Table 5-34 for enumerator definitions.

Table 5-34: PicamTimeStampsMask Enumerator Definitions

Enumerator	Description
PicamTimeStampsMask_None	No time stamps are generated during acquisition.
PicamTimeStampsMask_ExposureStarted	The time will be stamped when exposure starts.
PicamTimeStampsMask_ExposureEnded	The time will be stamped when exposure ends.

5.1.1.35 *PicamTriggerCoupling*

Data Type

`PicamTriggerCoupling` is defined as `enum`.

Description

`PicamTriggerCoupling` is the set of coupling modes between an external trigger and the hardware's input.

Enumerator Definitions

Refer to Table 5-35 for enumerator definitions.

Table 5-35: `PicamTriggerCoupling` Enumerator Definitions

Enumerator	Description
`PicamTriggerCoupling_AC`	The components are AC-coupled.
`PicamTriggerCoupling_DC`	The components are DC-coupled.

5.1.1.36 *PicamTriggerDetermination*

Data Type

`PicamTriggerDetermination` is defined as `enum`.

Description

`PicamTriggerDetermination` is the set external trigger styles that are recognized by hardware.

Enumerator Definitions

Refer to Table 5-36 for enumerator definitions.

Table 5-36: `PicamTriggerDetermination` Enumerator Definitions

Enumerator	Description
`PicamTriggerDetermination_AlternatingEdgeRising`	The first trigger is a signal's rising edge and subsequent triggers alternate direction.
`PicamTriggerDetermination_AlternatingEdgeFalling`	The first trigger is a signal's falling edge and subsequent triggers alternate direction.
`PicamTriggerDetermination_FallingEdge`	The trigger is a signal's falling edge.
`PicamTriggerDetermination_NegativePolarity`	The trigger is initially a signal's falling edge and then level-sensitive to a low signal for the rest of the acquisition.
`PicamTriggerDetermination_PositivePolarity`	The trigger is initially a signal's rising edge and then level-sensitive to a high signal for the rest of the acquisition.
`PicamTriggerDetermination_RisingEdge`	The trigger is a signal's rising edge.

5.1.1.37 *PicamTriggerResponse*

Data Type

PicamTriggerResponse is defined as enum.

Description

PicamTriggerResponse is the set of the hardware's responses to an external trigger.

Enumerator Definitions

Refer to Table 5-37 for enumerator definitions.

Table 5-37: PicamTriggerResponse Enumerator Definitions

Enumerator	Description
PicamTriggerResponse_ExposeDuringTriggerPulse	Each trigger controls when exposure begins and ends.
PicamTriggerResponse_GatePerTrigger	The hardware generates a gate pulse after the trigger.
PicamTriggerResponse_NoResponse	The hardware does not respond to triggering.
PicamTriggerResponse_ReadoutPerTrigger	The hardware reads out the sensor after each trigger. ***NOTE:*** For hardware that can non-destructively readout, all non-destructive readouts associated with the normal readout will occur on the same trigger as the normal readout.
PicamTriggerResponse_ShiftPerTrigger	Each trigger moves to the next frame on the sensor.
PicamTriggerResponse_StartOnSingleTrigger	The hardware begins acquisition after a single trigger.

5.1.1.38 *PicamTriggerSource*

Data Type

PicamTriggerSource is defined as enum.

Description

PicamTriggerSource is the set of trigger sources.

Enumerator Definitions

Refer to Table 5-38 for enumerator definitions.

Table 5-38: PicamTriggerSource Enumerator Definitions

Enumerator	Description
PicamTriggerSource_External	Triggers originate from an external source.
PicamTriggerSource_Internal	Triggers originate from the hardware itself.
PicamTriggerSource_None	No triggers.

5.1.1.39 *PicamTriggerStatus*

Data Type

PicamTriggerStatus is defined as enum.

Description

PicamTriggerStatus is the presence of an external trigger source.

Enumerator Definitions

Refer to Table 5-39 for enumerator definitions.

Table 5-39: PicamTriggerStatus Enumerator Definitions

Enumerator	Description
PicamTriggerStatus_NotConnected	No trigger source is connected.
PicamTriggerStatus_Connected	A trigger source is connected.

5.1.1.40 *PicamTriggerTermination*

Data Type

PicamTriggerTermination is defined as enum.

Description

PicamTriggerTermination is the set of input terminations provided by the hardware for an external trigger source.

Enumerator Definitions

Refer to Table 5-40 for enumerator definitions.

Table 5-40: PicamTriggerTermination Enumerator Definitions

Enumerator	Description
PicamTriggerTermination_FiftyOhms	The trigger terminates into 50 ohms.
PicamTriggerTermination_HighImpedance	The trigger terminates into very high impedance.

5.1.1.41 *PicamVacuumStatus*

Data Type

PicamVacuumStatus is defined as enum.

Description

PicamVacuumStatus reports the status of the vacuum chamber containing the sensor.

Enumerator Definitions

Refer to Table 5-41 for enumerator definitions.

Table 5-41: PicamVacuumStatus Enumerator Definitions

Enumerator	Description
PicamVacuumStatus_Sufficient	The chamber has sufficient vacuum.
PicamVaccuumStatus_Low	The chamber has low or no vacuum.

5.1.1.42 *PicamValueType*

Data Type

PicamValueType is defined as enum.

Description

PicamValueType is the set of parameter value data types.

Enumerator Definitions

Refer to Table 5-42 for enumerator definitions.

Table 5-42: PicamValueType Enumerator Definitions

Enumerator	Description
PicamValueType_Boolean	Accessed as piint. • FALSE = 0 • TRUE = 1
PicamValueType_Enumeration	Any enum accessed as piint.
PicamValueType_FloatingPoint	Accessed as piflt.
PicamValueType_Integer	Accessed as piint.
PicamValueType_LargeInteger	Accessed as pi64s.
PicamValueType_Modulations	Accessed as PicamModulations
PicamValueType_Pulse	Accessed as PicamPulse.
PicamValueType_Rois	Accessed as PicamRois.

5.1.2 Parameter Access Enumerations

This section provides detailed information about the following parameter access enumerations:

- PicamValueAccess

5.1.2.1 *PicamValueAccess*

Data Type

PicamValueAccess is defined as enum.

Description

PicamValueAccess is the set of permitted parameter access.

Enumerator Definitions

Refer to Table 5-43 for enumerator definitions.

Table 5-43: PicamValueAccess Enumerator Definitions

Enumerator	Description
PicamValueAccess_ReadOnly	The stored parameter value can only be read.
PicamValueAccess_ReadWriteTrivial	The stored parameter value can be read and/ or overwritten, but there is only one value for this parameter.
PicamValueAccess_ReadWrite	The stored parameter value can be read and/ or overwritten.

5.1.3 Parameter Constraint Enumerations

This section provides detailed information about the following parameter constraint enumerations:

- PicamConstraintScope
- PicamConstraintSeverity
- PicamConstraintCategory
- PicamRoisConstraintRulesMask

5.1.3.1 *PicamConstraintScope*

Data Type

PicamConstraintScope is defined as enum.

Description

PicamConstraintScope is the set of constraint dependencies.

Enumerator Definitions

Refer to Table 5-44 for enumerator definitions.

Table 5-44: PicamConstraintScope Enumerator Definitions

Enumerator	Description
PicamConstraintScope_Independent	The constraint has no dependencies and is therefore constant.
PicamConstraintScope_Dependent	The constraint has dependencies and therefore is variable.

5.1.3.2 *PicamConstraintSeverity*

Data Type

PicamConstraintSeverity is defined as enum

Description

PicamConstraintSeverity is the set of severities when failing a constraint.

Enumerator Definitions

Refer to Table 5-45 for enumerator definitions.

Table 5-45: PicamConstraintSeverity Enumerator Definitions

Enumerator	Description
PicamConstraintSeverity_Error	Failure indicates the value is in error.
PicamConstraintSeverity_Warning	Failure indicates the value is in warning and notice should be taken.

5.1.3.3 *PicamConstraintCategory*

Data Type

PicamConstraintCategory is defined as enum.

Description

PicamConstraintCategory is the set of constraint categories.

Enumerator Definitions

Refer to Table 5-46 for enumerator definitions.

Table 5-46: PicamConstraintCategory Enumerator Definitions

Enumerator	Description
PicamConstraintCategory_Capable	Which set of values are ultimately possible.
PicamConstraintCategory_Required	Which set of values are currently permissible.
PicamConstraintCategory_Recommended	Which set of values fall within a recommended range for most scenarios.

5.1.3.4 *PicamRoisConstraintRulesMask*

Data Type

PicamRoisConstraintRulesMask is defined as enum.

Description

PicamRoisConstraintRulesMask is the set of complex rules that defines a valid set of regions of interest.

Enumerator Definitions

Refer to Table 5-47 for enumerator definitions.

Table 5-47: PicamRoisConstraintRulesMask Enumerator Definitions

Enumerator	Description
PicamRoisConstraintRulesMask_None	No additional rules.
PicamRoisConstraintRulesMask_X BinningAlignment	Regions sharing columns must bin those columns equally. This means not only must they contain equal x-binning values, the regions must also begin on x-binning boundaries.
PicamRoisConstraintRulesMask_Y BinningAlignment	Regions sharing rows must bin those rows equally. This means not only must they contain equal y-binning values, the regions must also begin on y-binning boundaries.
PicamRoisConstraintRulesMask_ HorizontalSymmetry	Regions must be symmetrical about the line between the two center-most columns. Either one region must bisect this line or two regions must be reflective to each other about this line.
PicamRoisConstraintRulesMask_ VerticalSymmetry	Regions must be symmetrical about the line between the two center-most rows. Either one region must bisect this line or two regions must be reflective to each other about this line.
PicamRoisConstraintRulesMask_ SymmetryBoundsBinning	A region required to bisect a line of symmetry may not bin pixels together that fall on both sides of the line.

5.2 Data Structure Definitions

This section provides programming information for the following PICam data structure definitions:

- Camera-Specific Parameter Data Structures
  - PicamRoi
  - PicamRois
  - PicamPulse
  - PicamModulation
  - PicamModulations
- Shared Camera/Accessory Parameter Data Structures
  - PicamStatusPurview

5.2.1 Camera-Specific Parameter Data Structures

This section provides detailed programming information about camera-specific parameter data structures.

5.2.1.1 *PicamRoi*

Description

`PicamRoi` defines a single Region of Interest (ROI.)

Structure Definition

The structure definition for `PicamRoi` is:

```
typedef struct PicamRoi
{
            piint  x;
            piint  width;
            piint  x_binning;
            piint  y;
            piint  height;
            piint  y_binning;
}       PicamRoi;
```

Variable Definitions

The variables required by `PicamRoi` are:

`x:`	The left-most column coordinate (zero-based).
`width:`	The number of columns.
`x_binning:`	The number of columns to group into a sum.
`y:`	The top-most row coordinate (zero-based).
`height:`	The number of rows.
`y_binning:`	The number of rows to group into a sum.

5.2.1.2 *PicamRois*

Description

PicamRois defines a set of non-overlapping Regions of Interest (ROIs.)

Structure Definition

The structure definition for PicamRois is:

```
typedef struct PicamRois
{
       PicamRoi*  roi_array;
           piint  roi_count;
}      PicamRois;
```

Variable Definitions

The variables required by PicamRois are:

- `roi_array`: An array of one or more regions.
- `roi_count`: The number of regions.

5.2.1.3 *PicamPulse*

Description

PicamPulse defines a gate pulse in ns.

Structure Definition

The structure definition for PicamPulse is:

```
typedef struct PicamPulse
{
           piflt  delay;
           piflt  width;
}     PicamPulse;
```

Variable Definitions

The variables required by PicamPulse are:

- `delay`: The delay in ns until a gate pulse begins.
- `width`: The width of the gate pulse in ns.

5.2.1.4 *PicamModulation*

Description

PicamModulation defines a custom intensifier modulation sequence point.

Structure Definition

The structure definition for PicamModulation is:

```
typedef struct PicamModulation
{
            piflt  duration;
            piflt  frequency;
            piflt  phase;
            piflt  output_signal_frequency;
} PicamModulation;
```

Variable Definitions

The variables required by PicamModulation are:

`duration:`	The time, in mS, the intensifier is modulating.
`frequency:`	The frequency, in MHz, of the intensifier modulation.
`phase:`	The phase, in degrees, of the intensifier with respect to the modulation output signal.
`output_signal_frequency:`	The frequency, in MHz, of the user RF output signal

5.2.1.5 *PicamModulations*

Description

PicamModulations defines a sequence of intensifier modulation sequence points.

Structure Definition

The structure definition for PicamModulations is:

```
typedef struct PicamModulations
{
           PicamModulation*  modulation_array;
                      piint  modulation_count;
} PicamModulations;
```

Variable Definitions

The variables required by PicamModulations are:

`modulation_array:`	An array of one or more sequence points.
`modulation_count:`	The number of sequence points.

5.2.2 Shared Camera/Accessory Parameter Data Structures

This section provides detailed programming information about shared camera/ accessory parameter data structures.

5.2.2.1 *PicamStatusPurview*

Description

PicamStatusPurview defines the scope of a status.

Structure Definition

The structure definition for PicamStatusPurview is:

```
typedef struct PicamStatusPurview
{
              const piint*  values_array;
                     piint  values_count;
} PicamStatusPurview;
```

Variable Definitions

The variables required by PicamStatusPurview are:

values_array: The allowable status values.

values_count: The number of allowable status values.

5.3 Parameter Constraints

This section provides programming information for the following PICam parameter constraints:

- `Camera-Specific Parameter Constraints`
  - `PicamRoisConstraint`
  - `PicamPulseConstraint`
  - `PicamModulationsConstraint`
- `Shared Camera/Accessory Parameter Constraints`
  - `PicamCollectionConstraint`
  - `PicamRangeConstraint`

5.3.1 Camera-Specific Parameter Constraints

This section provides detailed programming information about the following camera-specific parameter constraint data structures:

- `PicamRoisConstraint`
- `PicamPulseConstraint`
- `PicamModulationsConstraint`

5.3.1.1 PicamRoisConstraint

Description

`PicamRoisConstraint` defines the constraints placed on a set of Regions of Interest (ROIs).

NOTE:

Regions of Interest may not overlap.

Structure Definition

The structure definition for `PicamRoisConstraint` is:

```
typedef struct PicamRoisConstraint
{
           PicamConstraintScope  scope;
        PicamConstraintSeverity  severity;
                          pibln  empty_set;
    PicamRoisConstraintRulesMask  rules;
                          piint  maximum_roi_count;
           PicamRangeConstraint  x_constraint;
           PicamRangeConstraint  width_constraint;
                   const piint*  x_binning_limits_array;
                          piint  x_binning_limits_count;
           PicamRangeConstraint  y_constraint;
           PicamRangeConstraint  height_constraint;
                   const piint*  y_binning_limits_array;
                          piint  y_binning_limits_count;
} PicamRoisConstraint;
```

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Variable Definitions

The variables required by `PicamRoisConstraint` are:

`scope`: The scope of the constraint.

`severity`: The severity of the constraint.

`empty_set`: Indicates when there are no valid Regions of Interest defined.
Valid values are:
- `TRUE`
  There are no valid ROIs defined.
  When TRUE, only scope and severity are relevant.
- `FALSE`
  There is at least one valid ROI defined.

`rules`: Complex set of rules to which a parameter of this type must adhere.

`maximum_roi_count`: The maximum number of ROIs permitted.

`x_constraint`: The constraint governing the value of `PicamRoi.x`.

`width_constraint`: The constraint governing the value of `PicamRoi.width`.

`x_binning_limits_array`: The list of valid values for `PicamRoi.x_binning`.
NOTE: An additional requirement is that `PicamRoi.x_binning` must always divide evenly into `PicamRoi.width`.
This is null when no additional limits are required.

`x_binning_limits_count`: The number of items in `x_binning_limits_array`.
This is 0 when no additional limits are required.

`y_constraint`: The constraint governing the value of `PicamRoi.y`.

`height_constraint`: The constraint governing the value of `PicamRoi.height`.

`y_binning_limits_array`: The list of valid values for `PicamRoi.y_binning`.
NOTE: An additional requirement is that `PicamRoi.y_binning` must always divide evenly into `PicamRoi.height`.
This is null when no additional limits are required.

`y_binning_limits_count`: The number of items in `y_binning_limits_array`.
This is 0 when no additional limits are required.

5.3.1.2 *PicamPulseConstraint*

Description

PicamPulseConstraint defines the constraints placed on a valid gate pulse.

Structure Definition

The structure definition for PicamPulseConstraint is:

```
typedef struct PicamPulseConstraint
{
      PicamConstraintScope  scope;
   PicamConstraintSeverity  severity;
                     pibln  empty_set;
      PicamRangeConstraint  delay_constraint;
      PicamRangeConstraint  width_constraint;
                     piflt  minimum_duration;
                     piflt  maximum_duration;
} PicamPulseConstraint;
```

Variable Definitions

The variables required by PicamPulseConstraint are:

`scope`: The scope of the constraint.

`severity`: The severity of the constraint.

`empty_set`: Indicates when there are no valid Pulses defined.
Valid values are:

- `TRUE`
  There are no valid Pulses defined.
  When TRUE, only scope and severity are relevant.
- `FALSE`
  There is at least one valid Pulse defined.

`delay_constraint`: The constraint governing the value of `PicamPulse.delay`.

`width_constraint`: The constraint governing the value of `PicamPulse.width`.

`minimum_duration`: The minimum numeric value for:
`[PicamPulse.delay + PicamPulse.width]`

`maximum_duration`: The maximum numeric value for:
`[PicamPulse.delay + PicamPulse.width]`

5.3.1.3 *PicamModulationsConstraint*

Description

PicamModulationsConstraint defines the constraints placed on custom intensifier modulation sequence points.

Structure Definition

The structure definition for PicamModulationsConstraint is:

```
typedef struct PicamModulationsConstraint
{
        PicamConstraintScope  scope;
    PicamConstraintSeverity  severity;
                      pibln  empty_set;
                      piint  maximum_modulation_count;
        PicamRangeConstraint  duration_constraint;
        PicamRangeConstraint  frequency_constraint;
        PicamRangeConstraint  phase_constraint;
        PicamRangeConstraint  output_signal_frequency_constraint;
} PicamModulationsConstraint;
```

Variable Definitions

The variables required by PicamModulationsConstraint are:

`scope`: The scope of the constraint.

`severity`: The severity of the constraint.

`empty_set`: Indicates when there are no valid modulation points defined.
Valid values are:
- `TRUE`
  There are no valid modulation points defined.
  When TRUE, only scope and severity are relevant.
- `FALSE`
  There is at least one valid modulation point defined.

`maximum_modulation_count`: The maximum number of modulation sequence points.

`duration_constraint`: The constraint governing the value of `PicamModulation.duration`.

`frequency_constraint`: The constraint governing the value of `PicamModulation.frequency`.

`phase_constraint`: The constraint governing the value of `PicamModulation.phase`.

`output_signal_frequency_constraint`: The constraint governing the value of `PicamModulation.output_signal_frequency`.

5.3.2 Shared Camera/Accessory Parameter Constraints

This section provides detailed programming information about the following shared camera and accessory parameter constraints data structures:

- PicamCollectionConstraint
- PicamRangeConstraint

5.3.2.1 PicamCollectionConstraint

Description

PicamCollectionConstraint defines the constraints placed on a variable whose value is selected from a list of predefined values.

Structure Definition

The structure definition for PicamCollectionConstraint is:

```
typedef struct PicamCollectionConstraint
{
        PicamConstraintScope  scope;
    PicamConstraintSeverity  severity;
               const piflt*  values_array;
                      piint  values_count;
} PicamCollectionConstraint;
```

Variable Definitions

The variables required by PicamCollectionConstraint are:

scope:	The scope of the constraint.
severity:	The severity of the constraint.
values_array:	The allowable values.
values_count:	The number of allowable values.

5.3.2.2 *PicamRangeConstraint*

Description

PicamRangeConstraint defines the constraints placed a numeric variable whose value lies within a linear range of numeric values.

Structure Definition

The structure definition for PicamRangeConstraint is:

```
typedef struct PicamRangeConstraint
{
      PicamConstraintScope  scope;
   PicamConstraintSeverity  severity;
                     pibln  empty_set;
                     piflt  minimum;
                     piflt  maximum;
                     piflt  increment;
              const piflt*  excluded_values_array;
                     piint  excluded_values_count;
              const piflt*  outlying_values_array;
                     piint  outlying_values_count;
} PicamRangeConstraint;
```

Variable Definitions

The variables required by PicamRangeConstraint are:

`scope`: The scope of the constraint.

`severity`: The severity of the constraint.

`empty_set`: Indicates when there are no valid values within the range. Valid values are:

- `TRUE`
  There are no valid values within the range.
  When TRUE, only scope and severity are relevant.
- `FALSE`
  There is at least one valid value within the range.

`minimum`: The smallest value within the range.
NOTE: outlying_values_array may include a smaller value.

`maximum`: The largest value within the range.
NOTE: outlying_values_array may include a larger value.

`increment`: The numeric gap between consecutive values within the range.

`excluded_values_array`: The set of values within the range (excluding minimum and maximum) that is not valid.
This is null when all values within the range are valid.

`excluded_values_count`: The number of items within excluded_values_array.
This is 0 when there are no excluded values.

`outlying_values_array`: The set of valid values that lie outside of the range of values.
This is null when no valid values fall outside of the range.

`outlying_values_count`: The number of items within outlying_values_array.
This is 0 when there are no outlying values.

5.4 Programmers' Reference for Configuration APIs

This section provides a detailed programmers' reference guide for the following configuration APIs:

- Camera-Specific Parameter Value APIs
  - Picam_GetParameterLargeIntegerValue()
  - Picam_CanSetParameterLargeIntegerValue()
  - Picam_SetParameterLargeIntegerValue()
  - Picam_DestroyRois()
  - Picam_GetParameterRoisValue()
  - Picam_CanSetParameterRoisValue()
  - Picam_SetParameterRoisValue()
  - Picam_DestroyPulses()
  - Picam_GetParameterPulseValue()
  - Picam_CanSetParameterPulseValue()
  - Picam_SetParameterPulseValue()
  - Picam_DestroyModulations()
  - Picam_GetParameterModulationsValue()
  - Picam_CanSetParameterModulationsValue()
  - Picam_SetParameterModulationsValue()
  - Picam_GetParameterLargeIntegerDefaultValue()
  - Picam_GetParameterRoisPointDefaultValue()
  - Picam_GetParameterPulseDefaultValue()
  - Picam_GetParameterModulationsDefaultValue()
  - Picam_SetParameterIntegerValueOnline()
  - Picam_SetParameterFloatingPointValueOnline()
  - Picam_SetParameterPulseValueOnline()
- Shared Camera/Accessory Parameter Value APIs
  - Picam_GetParameterIntegerValue()
  - Picam_CanSetParameterIntegerValue()
  - Picam_SetParameterIntegerValue()
  - Picam_GetParameterFloatingPointValue()
  - Picam_CanSetParameterFloatingPointValue()
  - Picam_SetParameterFloatingPointValue()
  - Picam_GetParameterIntegerDefaultValue()
  - Picam_GetParameterFloatingPointDefaultValue()
  - Picam_RestoreParametersToDefaultValues()
  - Picam_CanSetParameterOnline()
  - Picam_CanReadParameter()
  - Picam_ReadParameterIntegerValue()
  - Picam_ReadParameterFloatingPointValue()
  - Picam_CanWaitForStatusParameter()
  - Picam_GetStatusParameterPurview()
  - Picam_DestroyStatusPurviews()
  - Picam_EstimateTimeToStatusParameterValue()
  - Picam_WaitForStatusParameterValue()
- Shared Camera/Accessory Parameter Information APIs
  - Picam_DestroyParameters()
  - Picam_GetParameters()
  - Picam_DoesParameterExist()
  - Picam_IsParameterRelevant()
  - Picam_GetParameterValueType()
  - Picam_GetParameterEnumeratedType()
  - Picam_GetParameterValueAccess()
  - Picam_GetParameterConstraintType()

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- Camera-Specific Parameter Constraints APIs
  - Picam_DestroyRoisConstraints()
  - Picam_GetParameterRoisConstraint()
  - Picam_DestroyPulseConstraints()
  - Picam_GetParameterPulseConstraint()
  - Picam_DestroyModulationsConstraints()
  - Picam_GetParameterModulationsConstraint()
- Shared Camera/Accessory Parameter Constraints APIs
  - Picam_DestroyCollectionConstraints()
  - Picam_GetParameterRangeConstraint()
  - Picam_GetParameterCollectionConstraint()
  - Picam_DestroyRangeConstraints()
- Shared Camera/Accessory Parameter Commitment APIs
  - Picam_AreParametersCommitted()
  - Picam_CommitParameters()

5.4.1 Camera-Specific Parameter Value APIs

This section provides programming information for APIs used when working with camera-specific parameter values.

5.4.1.1 *Picam_GetParameterLargeIntegerValue()*

Description

Picam_GetParameterLargeIntegerValue() returns the current large integer value for a specified parameter.

Syntax

The syntax for Picam_GetParameterLargeIntegerValue() is:

```
PICAM_API Picam_GetParameterLargeIntegerValue(
                                    PicamHandle  camera,
                                 PicamParameter  parameter,
                                         pi64s*  value);
```

Input Parameters

Input parameters for Picam_GetParameterLargeIntegerValue() are:

camera: Handle for the camera for which the large integer value is being requested.

parameter: Specifies the parameter that is to be queried. Valid parameters are those of type PicamValueType_LargeInteger.

Output Parameters

Output parameters for Picam_GetParameterLargeIntegerValue() are:

value: Pointer to the large integer value of the specified parameter.

Advanced API Usage

When used in conjunction with Advanced APIs, camera may be a handle to either the:

- model, or
- device.

Stored values for any specific parameter are not necessarily the same for the device and model instances.

5.4.1.2 *Picam_CanSetParameterLargeIntegerValue()*

Description

Picam_CanSetParameterLargeIntegerValue() determines if a large integer value is valid for a specified parameter.

Syntax

The syntax for Picam_CanSetParameterLargeIntegerValue() is:

```
PICAM_API Picam_CanSetParameterLargeIntegerValue(
                                 PicamHandle  camera,
                              PicamParameter  parameter,
                                       pi64s  value,
                                      pibln*  settable);
```

Input Parameters

Input parameters for Picam_CanSetParameterLargeIntegerValue() are:

- camera: Handle for the camera for which the value/parameter combination is being tested.
- parameter: Specifies the parameter which is to be tested.
- value: The large integer value that is to be tested.

Output Parameters

Output parameters for Picam_CanSetParameterLargeIntegerValue() are:

- settable: Pointer to the test results. Indicates if the large integer value is a valid value for the specified parameter.
  Valid values are:
  - TRUE
    Indicates that the large integer value is a valid value for the specified parameter.
  - FALSE
    Indicates that the large integer value is an invalid value for the specified parameter.

Advanced API Usage

When used in conjunction with Advanced APIs, camera may be a handle to either the:

- model, or
- device.

5.4.1.3 *Picam_SetParameterLargeIntegerValue()*

Description

Picam_SetParameterLargeIntegerValue() sets a parameter to a specified large integer value during camera setup.

Syntax

The syntax for Picam_SetParameterLargeIntegerValue() is:

```
PICAM_API Picam_SetParameterLargeIntegerValue(
                                    PicamHandle  camera,
                                 PicamParameter  parameter,
                                          pi64s  value);
```

Input Parameters

Input parameters for Picam_SetParameterLargeIntegerValue() are:

camera:	Handle for the camera being configured.
parameter:	Specifies the parameter that is to be set with a large integer value. Valid parameters are those of type PicamValueType_LargeInteger.
value:	The large integer value to which the parameter is to be set.

Output Parameters

There are no output parameters associated with Picam_SetParameterLargeIntegerValue().

Advanced API Usage

When used in conjunction with Advanced APIs, camera may be a handle to either the:

- model;

  The model parameter may be set independently from the corresponding device parameter. However, doing so requires that all parameters be committed to the device prior to starting any data acquisition by calling Picam_CommitParameters().
- device.

  Setting a device parameter automatically sets the corresponding model parameter to the same value.

Related APIs

For additional information, refer to the following related APIs:

- Picam_CommitParameters()

5.4.1.4 *Picam_DestroyRois()*

Description

Picam_DestroyRois() releases memory that has been allocated by PICam for use by the array rois.

If rois is null, calling Picam_DestroyRois() has no effect.

Syntax

The syntax for Picam_DestroyRois() is:

```
PICAM_API Picam_DestroyRois(
                const PicamRois*  rois);
```

Input Parameters

Input parameters for Picam_DestroyRois() are:

rois: Pointer to array memory that is to be released.

Output Parameters

There are no output parameters associated with Picam_DestroyRois().

5.4.1.5 *Picam_GetParameterRoisValue()*

Description

Picam_GetParameterRoisValue() returns the current value for a specified Rois parameter.

Syntax

The syntax for Picam_GetParameterRoisValue() is:

```
PICAM_API Picam_GetParameterRoisValue(
                            PicamHandle  camera,
                         PicamParameter  parameter,
                      const PicamRois**  value);
```

Input Parameters

Input parameters for Picam_GetParameterRoisValue() are:

`camera`: Handle for the camera for which the Rois parameter value is being requested.

`parameter`: Specifies the Rois parameter for which the current value is to be returned.
Valid parameters are those of type PicamValueType_Rois.

Output Parameters

Output parameters for Picam_GetParameterRoisValue() are:

`value`: Pointer to the memory location in which the value of the specified Rois parameter has been stored.

NOTE: This memory is allocated by PICam and must be released by calling Picam_DestroyRois().

Advanced API Usage

When used in conjunction with Advanced APIs, `camera` may be a handle to either the:

- `model`, or
- `device`.

Stored values for any specific parameter are not necessarily the same for the `device` and `model` instances.

Related Structures

For additional information, refer to the following ROI structures:

- PicamRoi;
- PicamRois.

Related APIs

For additional information, refer to the following related APIs:

- Picam_DestroyRois()

5.4.1.6 *Picam_CanSetParameterRoisValue()*

Description

Picam_CanSetParameterRoisValue() determines if a value is valid for a specified Rois parameter.

Syntax

The syntax for Picam_CanSetParameterRoisValue() is:

```
PICAM_API Picam_CanSetParameterRoisValue(
                           PicamHandle  camera,
                        PicamParameter  parameter,
                      const PicamRois*  value,
                                pibln*  settable);
```

Input Parameters

Input parameters for Picam_CanSetParameterRoisValue() are:

- camera: Handle for the camera for which the value/parameter combination is being validated.
- parameter: Specifies the Rois parameter.
- value: The value that is to be tested.

Output Parameters

Output parameters for Picam_CanSetParameterRoisValue() are:

settable: Pointer to the test results. Indicates if the value is valid for the specified Rois parameter.
Valid values are:

- TRUE
  Indicates that the value is valid for the specified Rois parameter.
- FALSE
  Indicates that the value is not valid for the specified Rois parameter.

Advanced API Usage

When used in conjunction with Advanced APIs, camera may be a handle to either the:

- model, or
- device.

Related Structures

For additional information, refer to the following ROI constraint structures:

- PicamRoisConstraint.

5.4.1.7 *Picam_SetParameterRoisValue()*

Description

Picam_SetParameterRoisValue() configures an Rois parameter to a specified value during camera setup.

Syntax

The syntax for Picam_SetParameterRoisValue() is:

```
PICAM_API Picam_SetParameterRoisValue(
                      PicamHandle  camera,
                   PicamParameter  parameter,
                 const PicamRois*  value);
```

Input Parameters

Input parameters for Picam_SetParameterRoisValue() are:

camera:	Handle for the camera being configured.
parameter:	Specifies the Rois parameter that is to be configured. Valid parameters are those of type PicamValueType_Rois.
value:	The value to which the Rois parameter is to be set.

Output Parameters

There are no output parameters associated with Picam_SetParameterRoisValue().

Advanced API Usage

When used in conjunction with Advanced APIs, camera may be a handle to either the:

- model;
  The model parameter may be set independently from the corresponding device parameter. However, doing so requires that all parameters be committed to the device prior to starting any data acquisition by calling Picam_CommitParameters().
- device.
  Setting a device parameter automatically sets the corresponding model parameter to the same value.

Related Structures

For additional information, refer to the following ROI structures:

- PicamRoi;
- PicamRois.

Related APIs

For additional information, refer to the following related APIs:

- Picam_CommitParameters()

5.4.1.8 *Picam_DestroyPulses()*

Description

Picam_DestroyPulses() releases memory that has been allocated by PICam for use by pulses.

If pulses is null, calling Picam_DestroyPulses() has no effect.

Syntax

The syntax for Picam_DestroyPulses() is:

```
PICAM_API Picam_DestroyPulses(
        const PicamPulse*  pulses);
```

Input Parameters

Input parameters for Picam_DestroyPulses() are:

pulses: Pointer to array memory that is to be released.

Output Parameters

There are no output parameters associated with Picam_DestroyPulses().

5.4.1.9 *Picam_GetParameterPulseValue()*

Description

Picam_GetParameterPulseValue() returns the current value for a specified Pulse parameter.

Syntax

The syntax for Picam_GetParameterPulseValue() is:

```
PICAM_API Picam_GetParameterPulseValue(
                          PicamHandle  camera,
                       PicamParameter  parameter,
                   const PicamPulse**  value);
```

Input Parameters

Input parameters for Picam_GetParameterPulseValue() are:

camera: Handle for the camera for which the specified pulse parameter value is being requested.

parameter: Specifies the Pulse parameter for which the current value is to be returned.
Valid parameters are those of type PicamValueType_Pulse.

Output Parameters

Output parameters for Picam_GetParameterPulseValue() are:

value: Pointer to the memory location where the value of the specified Pulse parameter has been stored.

NOTE: This memory is allocated by PICam and must be released by calling Picam_DestroyPulses()

Advanced API Usage

When used in conjunction with Advanced APIs, camera may be a handle to either the:

- device, or
- model.

Stored values for any specific parameter are not necessarily the same for the device and model instances.

Related Structures

For additional information, refer to the following Pulse structure:

- PicamPulse.

Related APIs

For additional information, refer to the following related APIs:

- Picam_DestroyPulses()

5.4.1.10 *Picam_CanSetParameterPulseValue()*

Description

Picam_CanSetParameterPulseValue() determines if a value is valid for a specified Pulse parameter.

Syntax

The syntax for Picam_CanSetParameterPulseValue() is:

```
PICAM_API Picam_CanSetParameterPulseValue(
                              PicamHandle  camera,
                           PicamParameter  parameter,
                        const PicamPulse*  value,
                                   pibln*  settable);
```

Input Parameters

Input parameters for Picam_CanSetParameterPulseValue() are:

camera: Handle for the camera for which the value/parameter combination is being validated.

parameter: Specifies the Pulse parameter.

value: The value that is to be tested.

Output Parameters

Output parameters for Picam_CanSetParameterPulseValue() are:

settable: Pointer to the test results. Indicates if the value is valid for the specified Pulse parameter.
Valid values are:

- TRUE
  Indicates that the value is valid for the specified Pulse parameter.
- FALSE
  Indicates that the value is not valid for the specified Pulse parameter.

Advanced API Usage

When used in conjunction with Advanced APIs, camera may be a handle to either the:

- device, or
- model.

Related Structures

For additional information, refer to the following Pulse constraint structure:

- PicamPulseConstraint.

5.4.1.11 *Picam_SetParameterPulseValue()*

Description

Picam_SetParameterPulseValue() configures a Pulse parameter to a specified value during camera setup.

Syntax

The syntax for Picam_SetParameterPulseValue() is:

```
PICAM_API Picam_SetParameterPulseValue(
                         PicamHandle  camera,
                      PicamParameter  parameter,
                   const PicamPulse*  value);
```

Input Parameters

Input parameters for Picam_SetParameterPulseValue() are:

camera:	Handle for the camera being configured.
parameter:	Specifies the Pulse parameter that is to be configured. Valid parameters are those of type PicamValueType_Pulse.
value:	The value to which the Pulse parameter is to be set.

Output Parameters

There are no output parameters associated with Picam_SetParameterPulseValue()

Advanced API Usage

When used in conjunction with Advanced APIs, camera may be a handle to either the:

- model;
  The model parameter may be set independently from the corresponding device parameter. However, doing so requires that all parameters be committed to the device prior to starting any data acquisition by calling Picam_CommitParameters().
- device.
  Setting a device parameter automatically sets the corresponding model parameter to the same value.

Related Structures

For additional information, refer to the following Pulse structure:

- PicamPulse.

Related APIs

For additional information, refer to the following related APIs:

- Picam_CommitParameters()

5.4.1.12 *Picam_DestroyModulations()*

Description

Picam_DestroyModulations() releases memory that has been allocated by PICam for use by modulations.

If modulations is null, calling Picam_DestroyModulations() has no effect.

Syntax

The syntax for Picam_DestroyModulations() is:

```
PICAM_API Picam_DestroyModulations(
            const PicamModulations*  modulations);
```

Input Parameters

Input parameters for Picam_DestroyModulations() are:

modulations: Pointer to array memory that is to be released.

Output Parameters

There are no output parameters associated with Picam_DestroyModulations().

5.4.1.13 *Picam_GetParameterModulationsValue()*

Description

Picam_GetParameterModulationsValue() returns the current value for a specified intensifier modulation sequence parameter.

Syntax

The syntax for Picam_GetParameterModulationsValue() is:

```
PICAM_API Picam_GetParameterModulationsValue(
                                  PicamHandle  camera,
                               PicamParameter  parameter,
                     const PicamModulations**  value);
```

Input Parameters

Input parameters for Picam_GetParameterModulationsValue() are:

camera: Handle for the camera for which the intensifier modulation sequence parameter value is being requested.

parameter: Specifies the intensifier modulation sequence parameter for which the current value is to be returned.
Valid parameters are those of type PicamValueType_Modulations.

Output Parameters

Output parameters for Picam_GetParameterModulationsValue() are:

value: Pointer to the memory location in which the value of the specified intensifier modulation sequence parameter is stored.

NOTE: This memory is allocated by PICam and must be released by calling Picam_DestroyModulations()

Advanced API Usage

When used in conjunction with Advanced APIs, camera may be a handle to either the:

- device, or
- model.

Stored values for any specific parameter are not necessarily the same for the device and model instances.

Related Structures

For additional information, refer to the following intensifier modulation sequence structures:

- PicamModulation;
- PicamModulations.

Related APIs

For additional information, refer to the following related APIs:

- Picam_DestroyModulations().

5.4.1.14 Picam_CanSetParameterModulationsValue()

Description

Picam_CanSetParameterModulationsValue() determines if a value is valid for a specified intensifier modulation sequence parameter.

Syntax

The syntax for Picam_CanSetParameterModulationsValue() is:

```
PICAM_API Picam_CanSetParameterModulationsValue(
                                PicamHandle  camera,
                             PicamParameter  parameter,
                    const PicamModulations*  value,
                                     pibln*  settable);
```

Input Parameters

Input parameters for Picam_CanSetParameterModulationsValue() are:

`camera`: Handle for the camera for which the value/parameter combination is being validated.

`parameter`: Specifies the intensifier modulation sequence parameter.

`value`: The value that is to be tested.

Output Parameters

Output parameters for Picam_CanSetParameterModulationsValue() are:

`settable`: Pointer to the test results. Indicates if the value is valid for the specified intensifier modulation sequence parameter.
Valid values are:

- `TRUE`
  Indicates that the value is valid for the specified intensifier modulation sequence parameter.
- `FALSE`
  Indicates that the value is not valid for the specified intensifier modulation sequence parameter.

Advanced API Usage

When used in conjunction with Advanced APIs, `camera` may be a handle to either the:

- `device`, or
- `model`.

Related Structures

For additional information, refer to the following intensifier modulation sequence structures:

- `PicamModulation`;
- `PicamModulations`.

5.4.1.15 *Picam_SetParameterModulationsValue()*

Description

Picam_SetParameterModulationsValue() configures an intensifier modulation sequence parameter to a specified value during camera setup.

Syntax

The syntax for Picam_SetParameterModulationsValue() is:

```
PICAM_API Picam_SetParameterModulationsValue(
                                    PicamHandle  camera,
                                 PicamParameter  parameter,
                        const PicamModulations*  value);
```

Input Parameters

Input parameters for Picam_SetParameterModulationsValue() are:

camera:	Handle for the camera being configured.
parameter:	Specifies the Pulse parameter that is to be configured. Valid parameters are those of type PicamValueType_Pulse.
value:	The value to which the intensifier modulation sequence parameter is to be set.

Output Parameters

There are no output parameters associated with Picam_SetParameterModulationsValue()

Advanced API Usage

When used in conjunction with Advanced APIs, camera may be a handle to either the:

- model;
  The model parameter may be set independently from the corresponding device parameter. However, doing so requires that all parameters be committed to the device prior to starting any data acquisition by calling Picam_CommitParameters().
- device.
  Setting a device parameter automatically sets the corresponding model parameter to the same value.

Related Structures

For additional information, refer to the following intensifier modulation sequence structures:

- PicamModulation;
- PicamModulations.

Related APIs

For additional information, refer to the following related APIs:

- Picam_CommitParameters()

5.4.1.16 *Picam_GetParameterLargeIntegerDefaultValue()*

Description

Picam_GetParameterLargeIntegerDefaultValue() returns the large integer default value for a specified parameter.

Syntax

The syntax for Picam_GetParameterLargeIntegerDefaultValue() is:

```
PICAM_API Picam_GetParameterLargeIntegerDefaultValue(
                                       PicamHandle  camera,
                                    PicamParameter  parameter,
                                             pi64s*  value);
```

Input Parameters

Input parameters for Picam_GetParameterLargeIntegerDefaultValue() are:

camera: Handle for the camera for which the default parameter value is being requested.

parameter: Specifies the parameter for which the default value is to be returned. Valid parameter are those of type PicamValueType_LargeInteger.

Output Parameters

Output parameters for Picam_GetParameterLargeIntegerDefaultValue() are:

value: Pointer to the memory location in which the large integer default value for the specified parameter has been stored.

Advanced API Usage

When used in conjunction with Advanced APIs, camera may be a handle to either the:

- device, or
- model.

Both the device and model share the same default value.

5.4.1.17 *Picam_GetParameterRoisPointDefaultValue()*

Description

Picam_GetParameterRoisPointDefaultValue() returns the default value for a specified Rois parameter.

Syntax

The syntax for Picam_GetParameterRoisPointDefaultValue() is:

```
PICAM_API Picam_GetParameterRoisDefaultValue(
                                     PicamHandle  camera,
                                  PicamParameter  parameter,
                               const PicamRois**  value);
```

Input Parameters

Input parameters for Picam_GetParameterRoisPointDefaultValue() are:

camera: Handle for the camera for which the default parameter value is being requested.

parameter: Specifies the Rois parameter for which the default value is to be returned.
Valid parameters are those of type PicamValueType_Rois.

Output Parameters

Output parameters for Picam_GetParameterRoisPointDefaultValue() are:

value: Pointer to the memory location in which the default value for the specified Rois parameter has been stored.

NOTE: This memory is allocated by PICam and must be released by calling Picam_DestroyRois().

Advanced API Usage

When used in conjunction with Advanced APIs, camera may be a handle to either the:

- device, or
- model.

Both the device and model share the same default value.

Related Structures

For additional information, refer to the following ROI structures:

- PicamRoi;
- PicamRois.

Related APIs

For additional information, refer to the following related APIs:

- Picam_DestroyRois().

5.4.1.18 *Picam_GetParameterPulseDefaultValue()*

Description

Picam_GetParameterPulseDefaultValue() returns the default value for a specified Pulse parameter.

Syntax

The syntax for Picam_GetParameterPulseDefaultValue() is:

```
PICAM_API Picam_GetParameterPulseDefaultValue(
                                   PicamHandle  camera,
                                PicamParameter  parameter,
                            const PicamPulse**  value);
```

Input Parameters

Input parameters for Picam_GetParameterPulseDefaultValue() are:

`camera`: Handle for the camera for which the default parameter value is being requested.

`parameter`: Specifies the Pulse parameter for which the default value is to be returned.
Valid parameters are those of type PicamValueType_Pulse.

Output Parameters

Output parameters for Picam_GetParameterPulseDefaultValue() are:

`value`: Pointer to the memory location in which the default value for the specified Pulse parameter has been stored.

NOTE: This memory is allocated by PICam and must be released by calling Picam_DestroyPulses().

Advanced API Usage

When used in conjunction with Advanced APIs, `camera` may be a handle to either the:

- `device`, or
- `model`.

Both the `device` and `model` share the same default value.

Related Structures

For additional information, refer to the following Pulse structure:

- PicamPulse.

Related APIs

For additional information, refer to the following related APIs:

- Picam_DestroyPulses().

5.4.1.19 *Picam_GetParameterModulationsDefaultValue()*

Description

Picam_GetParameterModulationsDefaultValue() returns the default value for a specified intensifier modulation sequence parameter.

Syntax

The syntax for Picam_GetParameterModulationsDefaultValue() is:

```
PICAM_API Picam_GetParameterModulationsDefaultValue(
                                  PicamHandle  camera,
                               PicamParameter  parameter,
                     const PicamModulations**  value);
```

Input Parameters

Input parameters for Picam_GetParameterModulationsDefaultValue() are:

`camera`: Handle for the camera for which the default parameter value is being requested.

`parameter`: Specifies the intensifier modulation sequence parameter for which the default value is to be returned.
Valid parameters are those of type PicamValueType_Modulations.

Output Parameters

Output parameters for Picam_GetParameterModulationsDefaultValue() are:

`value`: Pointer to the memory location in which the default value for the specified intensifier modulation sequence parameter has been stored.

NOTE: This memory is allocated by PICam and must be released by calling Picam_DestroyModulations().

Advanced API Usage

When used in conjunction with Advanced APIs, `camera` may be a handle to either the:

- `device`, or
- `model`.

Both the `device` and `model` share the same default value.

Related Structures

For additional information, refer to the following intensifier modulation sequence structures:

- PicamModulation;
- PicamModulations.

Related APIs

For additional information, refer to the following related APIs:

- Picam_DestroyModulations().

5.4.1.20 *Picam_SetParameterIntegerValueOnline()*

Description

Picam_SetParameterIntegerValueOnline() configures the specified parameter with an integer value during data acquisition.

NOTE:

The specified parameter must be capable of being configured during data acquisition.

Refer to Picam_CanSetParameterOnline() for additional information.

Syntax

The syntax for Picam_SetParameterIntegerValueOnline() is:

```
PICAM_API Picam_SetParameterIntegerValueOnline(
                                   PicamHandle  camera,
                                PicamParameter  parameter,
                                         piint  value);
```

Input Parameters

Input parameters for Picam_SetParameterIntegerValueOnline() are:

camera:	Handle for the camera being configured.
parameter:	Specifies the parameter that is to be configured. Valid parameters are those of type PicamValueType_Integer.
value:	The integer value with which the specified parameter is to be configured.

Advanced API Usage

When used in conjunction with Advanced APIs, camera may be a handle to either the:

- device, or
- model.

Picam_SetParameterIntegerValueOnline() effectively sets parameter on the camera device.

Output Parameters

There are no output parameters associated with Picam_SetParameterIntegerValueOnline()

Related APIs

For additional information, refer to the following related APIs:

- Picam_CommitParameters().

5.4.1.21 *Picam_SetParameterFloatingPointValueOnline()*

Description

Picam_SetParameterFloatingPointValueOnline() configures the specified parameter with a floating point value during data acquisition.

NOTE:

The specified parameter must be capable of being configured during data acquisition.

Refer to Picam_CanSetParameterOnline() for additional information.

Syntax

The syntax for Picam_SetParameterFloatingPointValueOnline() is:

```
PICAM_API Picam_SetParameterFloatingPointValueOnline(
                                          PicamHandle  camera,
                                       PicamParameter  parameter,
                                                piflt  value);
```

Input Parameters

Input parameters for Picam_SetParameterFloatingPointValueOnline() are:

- camera: Handle for the camera being configured.
- parameter: Specifies the parameter that is to be configured during data acquisition. Valid parameters are those of type PicamValueType_FloatingPoint.
- value: The floating point value with which the specified parameter is to be configured.

Advanced API Usage

When used in conjunction with Advanced APIs, camera may be a handle to either the:

- device, or
- model.

Picam_SetParameterFloatingPointValueOnline() effectively sets parameter on the camera device.

Output Parameters

There are no output parameters associated with Picam_SetParameterFloatingPointValueOnline()

Related APIs

For additional information, refer to the following related APIs:

- Picam_CommitParameters().

5.4.1.22 *Picam_SetParameterPulseValueOnline()*

Description

Picam_SetParameterPulseValueOnline() configures the specified Pulse parameter during data acquisition.

NOTE:

The specified parameter must be capable of being configured during data acquisition.

Refer to Picam_CanSetParameterOnline() for additional information.

Syntax

The syntax for Picam_SetParameterPulseValueOnline() is:

```
PICAM_API Picam_SetParameterPulseValueOnline(
                                   PicamHandle  camera,
                                PicamParameter  parameter,
                             const PicamPulse*  value);
```

Input Parameters

Input parameters for Picam_SetParameterPulseValueOnline() are:

- `camera`: Handle for the camera being configured.
- `parameter`: Specifies the Pulse parameter that is to be configured during data acquisition.
  Valid parameters are those of type PicamValueType_Pulse.
- `value`: Pointer to the memory location in which the desired configuration value is stored.

Output Parameters

There are no output parameters associated with Picam_SetParameterPulseValueOnline().

Advanced API Usage

When used in conjunction with Advanced APIs, `camera` may be a handle to either the:

- `device`, or
- `model`.

Picam_SetParameterPulseValueOnline() effectively sets `parameter` on the camera device.

5.4.2 Shared Camera/Accessory Parameter Value APIs

This section provides programming information for APIs used when working with shared camera/accessory parameter values.

5.4.2.1 *Picam_GetParameterIntegerValue()*

Description

Picam_GetParameterIntegerValue() returns the integer value for a specified parameter.

Syntax

The syntax for Picam_GetParameterIntegerValue() is:

```
PICAM_API Picam_GetParameterIntegerValue(
                                  PicamHandle  camera_or_accessory,
                               PicamParameter  parameter,
                                       piint*  value);
```

Input Parameters

Input parameters for Picam_GetParameterIntegerValue() are:

camera_or_accessory:	Handle for the hardware for which the integer value is being requested.
parameter:	Specifies the parameter that is to be queried. Valid parameters are those of type: • PicamValueType_Integer; • PicamValueType_Boolean; • PicamValueType_Enumeration.

Output Parameters

Output parameters for Picam_GetParameterIntegerValue() are:

value:	Pointer to the integer value of the specified parameter.

Advanced API Usage

When used in conjunction with Advanced APIs, if camera_or_accessory is a camera handle, it may be a handle to either the:

- model, or
- device.

Stored values for any specific parameter are not necessarily the same for the device and model instances.

5.4.2.2 *Picam_CanSetParameterIntegerValue()*

Description

Picam_CanSetParameterIntegerValue() determines if an integer value is valid for a specified parameter.

Syntax

The syntax for Picam_CanSetParameterIntegerValue() is:

```
PICAM_API Picam_CanSetParameterIntegerValue(
                                PicamHandle  camera_or_accessory,
                             PicamParameter  parameter,
                                      piint  value,
                                     pibln*  settable);
```

Input Parameters

Input parameters for Picam_CanSetParameterIntegerValue() are:

`camera_or_accessory`: Handle for the hardware for which the value/parameter combination is being validated.

`parameter`: Specifies the parameter which is to be tested.

`value`: The integer value that is to be tested.

Output Parameters

Output parameters for Picam_CanSetParameterIntegerValue() are:

`settable`: Pointer to the test results. Indicates if the integer value is a valid value for the specified parameter.
Valid values are:

- `TRUE`
  Indicates that the integer value is a valid value for the specified parameter.
- `FALSE`
  Indicates that the integer value is an invalid value for the specified parameter.

Advanced API Usage

When used in conjunction with Advanced APIs, if `camera_or_accessory` is a camera handle, it may be a handle to either the:

- `model`, or
- `device`.

5.4.2.3 *Picam_SetParameterIntegerValue()*

Description

Picam_SetParameterIntegerValue() sets a parameter to a specified integer value during hardware setup.

Syntax

The syntax for Picam_SetParameterIntegerValue() is:

```
PICAM_API Picam_SetParameterIntegerValue(
                              PicamHandle  camera_or_accessory,
                           PicamParameter  parameter,
                                    piint  value);
```

Input Parameters

Input parameters for Picam_SetParameterIntegerValue() are:

camera_or_accessory: Handle for the hardware being configured.

parameter: Specifies the parameter that is to be set with an integer value. Valid parameters are those of type:
- PicamValueType_Integer;
- PicamValueType_Boolean;
- PicamValueType_Enumeration.

value: The integer value to which the parameter is to be set.

Output Parameters

There are no output parameters associated with Picam_SetParameterIntegerValue().

Advanced API Usage

When used in conjunction with Advanced APIs, if camera_or_accessory is a camera handle, it may be a handle to either the:

- model;

  The model parameter may be set independently from the corresponding device parameter. However, doing so requires that all parameters be committed to the device prior to starting any data acquisition by calling Picam_CommitParameters().
- device.

  Setting a device parameter automatically sets the corresponding model parameter to the same value.

Related APIs

For additional information, refer to the following related APIs:

- Picam_CommitParameters().

5.4.2.4 *Picam_GetParameterFloatingPointValue()*

Description

Picam_GetParameterFloatingPointValue() returns the current floating point value for a specified parameter.

Syntax

The syntax for Picam_GetParameterFloatingPointValue() is:

```
PICAM_API Picam_GetParameterFloatingValue(
                          PicamHandle  camera_or_accessory,
                       PicamParameter  parameter,
                               piflt*  value);
```

Input Parameters

Input parameters for Picam_GetParameterFloatingPointValue() are:

camera_or_accessory:	Handle for the hardware for which the floating point value is being requested.
parameter:	Specifies the parameter that is to be queried. Valid parameters are those of type PicamValueType_FloatingPoint.

Output Parameters

Output parameters for Picam_GetParameterFloatingPointValue() are:

value:	Pointer to the floating point value of the specified parameter.

Advanced API Usage

When used in conjunction with Advanced APIs, if camera_or_accessory is a camera handle, it may be a handle to either the:

- model, or
- device.

Stored values for any specific parameter are not necessarily the same for the device and model instances.

5.4.2.5 *Picam_CanSetParameterFloatingPointValue()*

Description

Picam_CanSetParameterFloatingPointValue() determines if a floating point value is valid for a specified parameter.

Syntax

The syntax for Picam_CanSetParameterFloatingPointValue() is:

```
PICAM_API Picam_CanSetParameterFloatingValue(
                                  PicamHandle  camera_or_accessory,
                               PicamParameter  parameter,
                                        piflt  value,
                                       pibln*  settable);
```

Input Parameters

Input parameters for Picam_CanSetParameterFloatingPointValue() are:

camera_or_accessory: Handle for the hardware for which the value/parameter combination is being validated.

parameter: Specifies the parameter which is to be tested.

value: The floating point value that is to be tested.

Output Parameters

Output parameters for Picam_CanSetParameterFloatingPointValue() are:

settable: Pointer to the test results. Indicates if the floating point value is a valid value for the specified parameter.
Valid values are:

- TRUE
  Indicates that the floating point value is a valid value for the specified parameter.
- FALSE
  Indicates that the floating point value is an invalid value for the specified parameter.

Advanced API Usage

When used in conjunction with Advanced APIs, if camera_or_accessory is a camera handle, it may be a handle to either the:

- model, or
- device.

5.4.2.6 *Picam_SetParameterFloatingPointValue()*

Description

Picam_SetParameterFloatingPointValue() sets a parameter to a specified floating point value during hardware setup.

Syntax

The syntax for Picam_SetParameterFloatingPointValue() is:

```
PICAM_API Picam_SetParameterFloatingValue(
                           PicamHandle  camera_or_accessory,
                        PicamParameter  parameter,
                                 piflt  value);
```

Input Parameters

Input parameters for Picam_SetParameterFloatingPointValue() are:

camera_or_accessory:	Handle for the hardware being configured.
parameter:	Specifies the parameter that is to be set with a floating point value. Valid parameters are those of type PicamValueType_FloatingPoint.
value:	The floating point value to which the parameter is to be set.

Output Parameters

There are no output parameters associated with Picam_SetParameterFloatingPointValue().

Advanced API Usage

When used in conjunction with Advanced APIs, if camera_or_accessory is a camera handle, it may be a handle to either the:

- model;
  The model parameter may be set independently from the corresponding device parameter. However, doing so requires that all parameters be committed to the device prior to starting any data acquisition by calling Picam_CommitParameters().
- device.
  Setting a device parameter automatically sets the corresponding model parameter to the same value.

Related APIs

For additional information, refer to the following related APIs:

- Picam_CommitParameters()

5.4.2.7 *Picam_GetParameterIntegerDefaultValue()*

Description

Picam_GetParameterIntegerDefaultValue() returns the integer default value for a specified parameter.

Syntax

The syntax for Picam_GetParameterIntegerDefaultValue() is:

```
PICAM_API Picam_GetParameterIntegerDefaultValue(
                                PicamHandle   camera_or_accessory,
                             PicamParameter   parameter,
                                     piint*   value);
```

Input Parameters

Input parameters for Picam_GetParameterIntegerDefaultValue() are:

camera_or_accessory: Handle for the hardware for which the default parameter value is being requested.

parameter: Specifies the parameter for which the integer default value is to be returned.
Valid parameters are those of type:
- PicamValueType_Integer;
- PicamValueType_Boolean;
- PicamValueType_Enumeration.

Output Parameters

Output parameters for Picam_GetParameterIntegerDefaultValue() are:

value: Pointer to the memory location in which the integer default value for the specified parameter has been stored.

Advanced API Usage

When used in conjunction with Advanced APIs, if camera_or_accessory is a camera handle, it may be a handle to either the:

- device, or
- model.

Both the device and model share the same default value.

5.4.2.8 *Picam_GetParameterFloatingPointDefaultValue()*

Description

Picam_GetParameterFloatingPointDefaultValue() returns the floating point default value for a specified parameter.

Syntax

The syntax for Picam_GetParameterFloatingPointDefaultValue() is:

```
PICAM_API Picam_GetParameterFloatingPointDefaultValue(
                                    PicamHandle  camera_or_accessory,
                                 PicamParameter  parameter,
                                        piflt*  value);
```

Input Parameters

Input parameters for Picam_GetParameterFloatingPointDefaultValue() are:

camera_or_accessory:	Handle for the camera for which the default parameter value is being requested.
parameter:	Specifies the parameter for which the default value is to be returned. Valid parameters are those of type PicamValueType_FloatingPoint.

Output Parameters

Output parameters for Picam_GetParameterFloatingPointDefaultValue() are:

value:	Pointer to the memory location in which the floating point default value for the specified parameter has been stored.

Advanced API Usage

When used in conjunction with Advanced APIs, if camera_or_accessory is a camera handle, it may be a handle to either the:

- device, or
- model.

Both the device and model share the same default value.

5.4.2.9 *Picam_RestoreParametersToDefaultValues()*

Description

Picam_RestoreParametersToDefaultValues() will set all read/write parameters to default values.

Syntax

The syntax for Picam_RestoreParametersToDefaultValues() is:

```
PICAM_API Picam_RestoreParametersToDefaultValues(
                                PicamHandle  camera_or_accessory);
```

Input Parameters

Input parameters for Picam_RestoreParametersToDefaultValues() are:

camera_or_accessory: Handle for the hardware for which parameters are to be restored.

Output Parameters

There are no output parameters associated with Picam_RestoreParametersToDefaultValues()

Advanced API Usage

When used in conjunction with Advanced APIs, if camera_or_accessory is a camera handle, it may be a handle to either the:

- device, or
- model.

5.4.2.10 *Picam_CanSetParameterOnline()*

Description

Picam_CanSetParameterOnline() determines if the specified parameter can be configured during data acquisition.

Syntax

The syntax for Picam_CanSetParameterOnline() is:

```
PICAM_API Picam_CanSetParameterOnline(
                           PicamHandle  camera_or_accessory,
                        PicamParameter  parameter,
                                pibln*  onlineable);
```

Input Parameters

Input parameters for Picam_CanSetParameterOnline() are:

camera_or_accessory:	Handle for the hardware under test.
parameter:	Specifies the parameter for which the ability to be configured during data acquisition is to be determined.

Output Parameters

Output parameters for Picam_CanSetParameterOnline() are:

onlineable: Pointer to the test results. Indicates if the specified parameter value can be set during data acquisition with this hardware.

Valid values are:

- TRUE
  Indicates that the specified parameter can be configured during data acquisition.
- FALSE
  Indicates that the specified parameter cannot be configured during data acquisition.

Advanced API Usage

When used in conjunction with Advanced APIs, if camera_or_accessory is a camera handle, it may be a handle to either the:

- device, or
- model.

5.4.2.11 *Picam_CanReadParameter()*

Description

Picam_CanReadParameter() determines if a parameter value can be read directly from hardware connected to the system.

Syntax

The syntax for Picam_CanReadParameter() is:

```
PICAM_API Picam_CanReadParameter(
                    PicamHandle  camera_or_accessory,
                 PicamParameter  parameter,
                         pibln*  readable);
```

Input Parameters

Input parameters for Picam_CanReadParameter() are:

camera_or_accessory: Handle for the hardware under test.

parameter: Specifies the parameter for which the ability to read its value directly from the hardware is to be determined.

Output Parameters

Output parameters for Picam_CanReadParameter() are:

readable: Pointer to the test results. Indicates if the specified parameter value can be read directly from the hardware.
Valid values are:

- TRUE
  Indicates that the value for the specified parameter can be read from the hardware.
- FALSE
  Indicates that the value for the specified parameter cannot be read from the hardware.

Advanced API Usage

When used in conjunction with Advanced APIs, if camera_or_accessory is a camera handle, it may be a handle to either the:

- device, or
- model.

5.4.2.12 *Picam_ReadParameterIntegerValue()*

Description

Picam_ReadParameterIntegerValue() returns the integer value for a specified parameter as read directly from hardware connected to the system.

NOTE:

The specified parameter must be capable of being read directly from the hardware.

Refer to Picam_CanReadParameter() for additional information.

Syntax

The syntax for Picam_ReadParameterIntegerValue() is:

```
PICAM_API Picam_ReadParameterIntegerValue(
                                PicamHandle  camera_or_accessory,
                             PicamParameter  parameter,
                                     piint*  value);
```

Input Parameters

Input parameters for Picam_ReadParameterIntegerValue() are:

camera_or_accessory: Handle for the camera under test.

parameter: Specifies the parameter that is to have its value read from hardware.

NOTE: The specified parameter must be capable of being read directly from hardware. Refer to Picam_CanReadParameter() for additional information.

Valid parameters are those of type:

- PicamValueType_Integer;
- PicamValueType_Boolean;
- PicamValueType_Enumeration.

Output Parameters

Output parameters for Picam_ReadParameterIntegerValue() are:

value: Pointer to the memory location in which the parameter value is stored.

Advanced API Usage

When used in conjunction with Advanced APIs, if camera_or_accessory is a camera handle, it may be a handle to either the:

- device, or
- model.

Picam_ReadParameterIntegerValue() effectively gets parameter from the hardware.

Related APIs

For additional information, refer to the following related APIs:

- Picam_CanReadParameter().

5.4.2.13 *Picam_ReadParameterFloatingPointValue()*

Description

Picam_ReadParameterFloatingPointValue() returns the floating point value for a specified parameter as read directly from hardware connected to the system.

NOTE:

The specified parameter must be capable of being read directly from the hardware.

Refer to Picam_CanReadParameter() for additional information.

Syntax

The syntax for Picam_ReadParameterFloatingPointValue() is:

```
PICAM_API Picam_ReadParameterFloatingPointValue(
                                      PicamHandle  camera_or_accessory,
                                   PicamParameter  parameter,
                                           piflt*  value);
```

Input Parameters

Input parameters for Picam_ReadParameterFloatingPointValue() are:

camera_or_accessory: Handle for the hardware under test.

parameter: Specifies the parameter that is to have its value read from hardware.

NOTE: The specified parameter must be capable of being read directly from hardware. Refer to Picam_CanReadParameter() for additional information.

Valid parameter are those of type:

- PicamValueType_FloatingPoint.

Output Parameters

Output parameters for Picam_ReadParameterFloatingPointValue() are:

value: Pointer to the memory location in which the parameter value is stored.

Advanced API Usage

When used in conjunction with Advanced APIs, if camera_or_accessory is a camera handle, it may be a handle to either the:

- device, or
- model.

Picam_ReadParameterFloatingPointValue() effectively gets parameter from the hardware.

Related APIs

For additional information, refer to the following related APIs:

- Picam_CanReadParameter().

5.4.2.14 *Picam_CanWaitForStatusParameter()*

Description

Picam_CanWaitForStatusParameter() determines if a parameter is a waitable status.

Syntax

The syntax for Picam_CanWaitForStatusParameter() is:

```
PICAM_API Picam_CanWaitForStatusParameter(
                          PicamHandle  camera_or_accessory,
                       PicamParameter  parameter,
                              pibln*   waitable);
```

Input Parameters

Input parameters for Picam_CanWaitForStatusParameter() are:

camera_or_accessory: Handle for the hardware under test.

parameter: Specifies the parameter to check as a waitable status.

Output Parameters

Output parameters for Picam_CanWaitForStatusParameter() are:

waitable: Pointer to the test results. Indicates if the specified parameter is a waitable status.
Valid values are:

- TRUE
  Indicates that the parameter is a waitable status.
- FALSE
  Indicates that the parameter is not a waitable status.

Advanced API Usage

When used in conjunction with Advanced APIs, if camera_or_accessory is a camera handle, it may be a handle to either the:

- device, or
- model.

5.4.2.15 *Picam_GetStatusParameterPurview()*

Description

Picam_GetStatusParameterPurview() returns the scope of a waitable status.

Syntax

The syntax for Picam_GetStatusParameterPurview() is:

```
PICAM_API Picam_GetStatusParameterPurview(
                                  PicamHandle  camera_or_accessory,
                               PicamParameter  parameter,
                   const PicamStatusPurview**  purview);
```

Input Parameters

Input parameters for Picam_GetStatusParameterPurview() are:

camera_or_accessory: Handle for the hardware for which the status purview is being requested.

parameter: Specifies the parameter whose status purview is being requested.

NOTE: The specified parameter must be a waitable status.

Refer to Picam_CanWaitForStatusParameter() for additional information.

Output Parameters

Output parameters for Picam_GetStatusParameterPurview() are:

purview: Pointer to the allocated status purview.

NOTE: This memory is allocated by PICam and must be released by calling Picam_DestroyStatusPurviews().

Advanced API Usage

When used in conjunction with Advanced APIs, if camera_or_accessory is a camera handle, it may be a handle to either the:

- device, or
- model.

Related APIs

For additional information, refer to the following related APIs:

- Picam_CanWaitForStatusParameter()
- Picam_DestroyStatusPurviews()

5.4.2.16 *Picam_DestroyStatusPurviews()*

Description

Picam_DestroyStatusPurviews() releases memory that has been allocated by PICam for use by the purviews_array.

If the purviews_array is null, calling Picam_DestroyStatusPurviews() has no effect.

Syntax

The syntax for Picam_DestroyStatusPurviews() is:

```
PICAM_API Picam_DestroyStatusPurviews(
            const PicamStatusPurview*  purviews_array);
```

Input Parameters

Input parameters for Picam_DestroyStatusPurviews() are:

purviews_array: Pointer to array memory that is to be released.

Output Parameters

There are no output parameters associated with Picam_DestroyStatusPurviews().

5.4.2.17 *Picam_EstimateTimeToStatusParameterValue()*

Description

Picam_EstimateTimeToStatusParameterValue() returns the estimated time, in milliseconds, for a particular status to be reached.

Syntax

The syntax for Picam_EstimateTimeToStatusParameterValue() is:

```
PICAM_API Picam_EstimateTimeToStatusParameterValue(
                                  PicamHandle  camera_or_accessory,
                               PicamParameter  parameter,
                                        piint  value,
                                       piint*  estimated_time);
```

Input Parameters

Input parameters for Picam_EstimateTimeToStatusParameterValue() are:

camera_or_accessory: Handle for the hardware whose time to status will be estimated.

parameter: Specifies the parameter whose time to status will be estimated.

NOTE: The specified parameter must be a waitable status.
Refer to Picam_CanWaitForStatusParameter() for additional information.

value: Specifies the status for which the time is to be estimated.

NOTE: The specified value must be in the status purview.
Refer to Picam_GetStatusParameterPurview() for additional information.

Output Parameters

Output parameters for Picam_EstimateTimeToStatusParameterValue() are:

estimated_time: Pointer to the estimated time in milliseconds.

NOTE: If the time cannot be estimated, -1 is returned.

Advanced API Usage

When used in conjunction with Advanced APIs, if camera_or_accessory is a camera handle, it may be a handle to either the:

- device, or
- model.

Related APIs

For additional information, refer to the following related APIs:

- Picam_CanWaitForStatusParameter()
- Picam_GetStatusParameterPurview()

5.4.2.18 *Picam_WaitForStatusParameterValue()*

Description

Picam_WaitForStatusParameterValue() waits for a particular status to be reached or until time_out milliseconds has elapsed.

PicamError_TimeOutOccurred is returned if time_out has elapsed.

Syntax

The syntax for Picam_WaitForStatusParameterValue() is:

```
PICAM_API Picam_WaitForStatusParameterValue(
                               PicamHandle  camera_or_accessory,
                            PicamParameter  parameter,
                                     piint  value,
                                     piint  time_out);
```

Input Parameters

Input parameters for Picam_WaitForStatusParameterValue() are:

camera_or_accessory: Handle for the hardware whose status will be awaited.

parameter: Specifies the parameter whose status will be awaited.

NOTE: The specified parameter must be a waitable status. Refer to Picam_CanWaitForStatusParameter() for additional information.

value: Specifies the status to await.

NOTE: The specified value must be in the status purview. Refer to Picam_GetStatusParameterPurview() for additional information.

time_out: Specifies the time to wait, in milliseconds.

NOTE: Use –1 to wait indefinitely.

Output Parameters

There are no output parameters associated with Picam_WaitForStatusParameterValue().

Related APIs

For additional information, refer to the following related APIs:

- Picam_CanWaitForStatusParameter()
- Picam_GetStatusParameterPurview()

5.4.3 Shared Camera/Accessory Parameter Information APIs

This section provides programming information for APIs used to configure and retrieve shared camera and accessory parameter information.

5.4.3.1 *Picam_DestroyParameters()*

Description

Picam_DestroyParameters() releases memory that has been allocated by PICam for use by parameter_array.

If parameter_array is null, calling Picam_DestroyParameters() has no effect.

NOTE:

parameter_array may be a single PicamParameter allocated by PICam.

Syntax

The syntax for Picam_DestroyParameters() is:

```
PICAM_API Picam_DestroyParameters(
            const PicamParameter*  parameter_array);
```

Input Parameters

Input parameters for Picam_DestroyParameters() are:

parameter_array: Pointer to array memory that is to be released.

Output Parameters

There are no output parameters associated with Picam_DestroyParameters().

Related Structures

For additional information, refer to the following parameter structure:

- PicamParameter.

5.4.3.2 *Picam_GetParameters()*

Description

Picam_GetParameters() returns a list of parameters that are available for the specified hardware. The number of parameters is also returned.

Syntax

The syntax for Picam_GetParameters() is:

```
PICAM_API Picam_GetParameters(
                         PicamHandle  camera_or_accessory,
               const PicamParameter** parameter_array,
                              piint*  parameter_count);
```

Input Parameters

Input parameters for Picam_GetParameters() are:

camera_or_accessory:	Handle for the hardware under test.

Output Parameters

Output parameters for Picam_GetParameters() are:

parameter_array:	Pointer to the allocated array in which the list of parameters associated with the specified hardware is stored. ***NOTE:*** This memory is allocated by PICam and must be released by calling Picam_DestroyParameters().
parameter_count:	Pointer to the memory location in which the number of available parameters associated with the specified hardware is stored.

Advanced API Usage

When used in conjunction with Advanced APIs, if camera_or_accessory is a camera handle, it may be a handle to either the:

- device, or
- model.

Related APIs

For additional information, refer to the following related APIs:

- Picam_DestroyParameters().

Related Structures

For additional information, refer to the following parameter structure:

- PicamParameter.

5.4.3.3 *Picam_DoesParameterExist()*

Description

Picam_DoesParameterExist() determines if a specified parameter is available for the specified hardware.

Syntax

The syntax for Picam_DoesParameterExist() is:

```
PICAM_API Picam_DoesParameterExist(
                        PicamHandle  camera_or_accessory,
                     PicamParameter  parameter,
                             pibln*  exists);
```

Input Parameters

Input parameters for Picam_DoesParameterExist() are:

camera_or_accessory:	Handle for the hardware under test.
parameter:	Specifies the parameter for which availability is being determined.

Output Parameters

Output parameters for Picam_DoesParameterExist() are:

exists: Pointer to the test results. Indicates if the specified parameter is available on the specified hardware.
Valid values are:

- TRUE
  Indicates that the specified parameter is available on the specified hardware.
- FALSE
  Indicates that the specified parameter is not available on the specified hardware.

Advanced API Usage

When used in conjunction with Advanced APIs, if camera_or_accessory is a camera handle, it may be a handle to either the:

- device, or
- model.

Related Structures

For additional information, refer to the following parameter structure:

- PicamParameter.

5.4.3.4 *Picam_IsParameterRelevant()*

Description

Picam_IsParameterRelevant() determines if the value of a specified parameter is currently applicable for the specified hardware.

Syntax

The syntax for Picam_IsParameterRelevant() is:

```
PICAM_API Picam_IsParameterRelevant(
                          PicamHandle  camera_or_accessory,
                       PicamParameter  parameter,
                               pibln*  relevant);
```

Input Parameters

Input parameters for Picam_IsParameterRelevant() are:

camera_or_accessory:	Handle for the hardware under test.
parameter:	Specifies the parameter for which value applicability is being determined.

Output Parameters

Output parameters for Picam_IsParameterRelevant() are:

relevant: Pointer to the test results. Indicates if the specified parameter value is currently applicable for the specified hardware.

Valid values are:

- TRUE
  Indicates that the specified parameter value is currently applicable for the specified hardware.
- FALSE
  Indicates that the specified parameter value is not currently applicable for the specified hardware.

Advanced API Usage

When used in conjunction with Advanced APIs, if camera_or_accessory is a camera handle, it may be a handle to either the:

- device, or
- model.

Related Structures

For additional information, refer to the following parameter structure:

- PicamParameter.

5.4.3.5 ***Picam_GetParameterValueType()***

Description

Picam_GetParameterValueType() returns the data type for a value stored within a specified parameter.

Syntax

The syntax for Picam_GetParameterValueType() is:

```
PICAM_API Picam_GetParameterValueType(
                       PicamHandle  camera_or_accessory,
                    PicamParameter  parameter,
                   PicamValueType*  type);
```

Input Parameters

Input parameters for Picam_GetParameterValueType() are:

camera_or_accessory: Handle for the hardware under test.

parameter: Specifies the parameter for which the data type of the stored value is being requested.

Output Parameters

Output parameters for Picam_GetParameterValueType() are:

type: Pointer to the memory location in which the data type of the specified parameter's value is stored.

Advanced API Usage

When used in conjunction with Advanced APIs, if camera_or_accessory is a camera handle, it may be a handle to either the:

- device, or
- model.

Related Structures

For additional information, refer to the following parameter structure:

- PicamParameter;
- PicamValueType.

5.4.3.6 *Picam_GetParameterEnumeratedType()*

Description

Picam_GetParameterEnumeratedType() returns the enumeration type for a specified parameter.

Syntax

The syntax for Picam_GetParameterEnumeratedType() is:

```
PICAM_API Picam_GetParameterEnumeratedType(
                                    PicamHandle  camera_or_accessory,
                                 PicamParameter  parameter,
                            PicamEnumeratedType* type);
```

Input Parameters

Input parameters for Picam_GetParameterEnumeratedType() are:

camera_or_accessory:	Handle for the hardware under test.
parameter:	Specifies the parameter for which the enumeration type is being requested. Valid parameters are those of type PicamValueType_Enumeration.

Output Parameters

Output parameters for Picam_GetParameterEnumeratedType() are:

type:	Pointer to the memory location in which the enumeration type of the specified parameter is stored.

Advanced API Usage

When used in conjunction with Advanced APIs, if camera_or_accessory is a camera handle, it may be a handle to either the:

- device, or
- model.

Related Structures

For additional information, refer to the following parameter structure:

- PicamParameter.

5.4.3.7 *Picam_GetParameterValueAccess()*

Description

Picam_GetParameterValueAccess() returns the read/write permissions for the specified parameter.

Syntax

The syntax for Picam_GetParameterValueAccess() is:

```
PICAM_API Picam_GetParameterValueAccess(
                           PicamHandle  camera_or_accessory,
                        PicamParameter  parameter,
                     PicamValueAccess*  access);
```

Input Parameters

Input parameters for Picam_GetParameterValueAccess() are:

camera_or_accessory:	Handle for the hardware under test.
parameter:	Specifies the parameter for which read/write permission is being requested.

Output Parameters

Output parameters for Picam_GetParameterValueAccess() are:

access:	Pointer to the memory location in which the read/write permission for the specified parameter is stored.

Advanced API Usage

When used in conjunction with Advanced APIs, if camera_or_accessory is a camera handle, it may be a handle to either the:

- device, or
- model.

Related Structures

For additional information, refer to the following parameter structure:

- PicamParameter.

5.4.3.8 *Picam_GetParameterConstraintType()*

Description

Picam_GetParameterConstraintType() returns the type of constraint placed on a specified parameter.

Syntax

The syntax for Picam_GetParameterConstraintType() is:

```
PICAM_API Picam_GetParameterConstraintType(
                                PicamHandle          camera_or_accessory,
                                PicamParameter       parameter,
                                PicamConstraintType* type);
```

Input Parameters

Input parameters for Picam_GetParameterConstraintType() are:

camera_or_accessory: Handle for the hardware under test.

parameter: Specifies the parameter for which constraint information is being requested.

Output Parameters

Output parameters for Picam_GetParameterConstraintType() are:

type: Pointer to the memory location in which constraint information for the specified parameter is stored.

Advanced API Usage

When used in conjunction with Advanced APIs, if camera_or_accessory is a camera handle, may be a handle to either the:

- device, or
- model.

Related Structures

For additional information, refer to the following parameter structure:

- PicamParameter.

5.4.4 Camera-Specific Parameter Constraints APIs

This section provides programming information for APIs used to configure camera-specific parameter constraints.

5.4.4.1 `Picam_DestroyRoisConstraints()`

Description

`Picam_DestroyRoisConstraints()` releases memory that has been allocated by PICam for use by `constraint_array`.

If `constraint_array` is null, calling `Picam_DestroyRoisConstraints()` has no effect.

NOTE:

`constraint_array` may be a single `PicamRoisConstraint` allocated by PICam.

Syntax

The syntax for `Picam_DestroyRoisConstraints()` is:

```
PICAM_API Picam_DestroyRoisConstraints(
                  const PicamRoisConstraint*  constraint_array);
```

Input Parameters

Input parameters for `Picam_DestroyRoisConstraints()` are:

`constraint_array:` Pointer to array memory that is to be released.

Output Parameters

There are no output parameters associated with `Picam_DestroyRoisConstraints()`.

Related Structures

For additional information, refer to the following parameter structure:

- `PicamRoisConstraint`.

5.4.4.2 *Picam_GetParameterRoisConstraint()*

Description

Picam_GetParameterRoisConstraint() returns Roi constraints for a specified constraint category and parameter combination.

Syntax

The syntax for Picam_GetParameterRoisConstraint() is:

```
PICAM_API Picam_GetParameterRoisConstraint(
                                   PicamHandle  camera,
                                PicamParameter  parameter,
                       PicamConstraintCategory  category,
                  const PicamRoisConstraint**  constraint);
```

Input Parameters

Input parameters for Picam_GetParameterRoisConstraint() are:

camera: Handle for the camera for which constraint information is being returned.

parameter: Specifies the parameter for which Rois constraint information is being requested.

category: Specifies the constraint category for which Roi constraint information is being requested.

Output Parameters

Output parameters for Picam_GetParameterRoisConstraint() are:

constraint: Pointer to the allocated array in which the Rois constraints for the specified constraint category and parameter combination are stored.

NOTE: This memory is allocated by PICam and must be released by calling Picam_DestroyRoisConstraints().

Advanced API Usage

When used in conjunction with Advanced APIs, camera may be a handle to either the:

- device, or
- model.

Related APIs

For additional information, refer to the following related APIs:

- Picam_DestroyRoisConstraints().

Related Structures

For additional information, refer to the following parameter structures:

- PicamParameter;
- PicamRoisConstraint.

5.4.4.3 *Picam_DestroyPulseConstraints()*

Description

Picam_DestroyPulseConstraints() releases memory that has been allocated by PICam for use by constraint_array.

If constraint_array is null, calling Picam_DestroyPulseConstraints() has no effect.

NOTE:

constraint_array may be a single PicamPulseConstraint allocated by PICam.

Syntax

The syntax for Picam_DestroyPulseConstraints() is:

```
PICAM_API Picam_DestroyPulseConstraints(
                      const PicamPulseConstraint*  constraint_array);
```

Input Parameters

Input parameters for Picam_DestroyPulseConstraints() are:

constraint_array: Pointer to array memory that is to be released.

Output Parameters

There are no output parameters associated with Picam_DestroyPulseConstraints().

Related Structures

For additional information, refer to the following parameter structure:

- PicamPulseConstraint.

5.4.4.4 *Picam_GetParameterPulseConstraint()*

Description

Picam_GetParameterPulseConstraint() returns Pulse constraints for a specified constraint category and parameter combination.

Syntax

The syntax for Picam_GetParameterPulseConstraint() is:

```
PICAM_API Picam_GetParameterPulseConstraint(
                            PicamHandle  camera,
                         PicamParameter  parameter,
                PicamConstraintCategory  category,
         const PicamPulseConstraint**  constraint);
```

Input Parameters

Input parameters for Picam_GetParameterPulseConstraint() are:

camera: Handle for the camera for which constraint information is being returned.

parameter: Specifies the parameter for which Pulse constraint information is being requested.

category: Specifies the constraint category for which Pulse constraint information is being requested.

Output Parameters

Output parameters for Picam_GetParameterPulseConstraint() are:

constraint: Pointer to the allocated array in which the Pulse constraints for the specified constraint category and parameter combination are stored.

NOTE: This memory is allocated by PICam and must be released by calling Picam_DestroyPulseConstraints().

Advanced API Usage

When used in conjunction with Advanced APIs, camera may be a handle to either the:

- device, or
- model.

Related APIs

For additional information, refer to the following related APIs:

- Picam_DestroyPulseConstraints().

Related Structures

For additional information, refer to the following parameter structures:

- PicamParameter;
- PicamPulseConstraint.

5.4.4.5 *Picam_DestroyModulationsConstraints()*

Description

Picam_DestroyModulationsConstraints() releases memory that has been allocated by PICam for use by constraint_array.

If constraint_array is null, calling Picam_DestroyModulationsConstraints() has no effect.

NOTE:

constraint_array may be a single PicamModulationsConstraint allocated by PICam.

Syntax

The syntax for Picam_DestroyModulationsConstraints() is:

```
PICAM_API Picam_DestroyModulationConstraints(
                    const PicamModulationsConstraint*  constraint array);
```

Input Parameters

Input parameters for Picam_DestroyModulationsConstraints() are:

constraint_array: Pointer to array memory that is to be released.

Output Parameters

There are no output parameters associated with Picam_DestroyModulationsConstraints().

Related Structures

For additional information, refer to the following parameter structure:

- PicamModulationsConstraint.

5.4.4.6 *Picam_GetParameterModulationsConstraint()*

Description

Picam_GetParameterModulationsConstraint() returns intensifier modulation sequence constraints for a specified constraint category and parameter combination.

Syntax

The syntax for Picam_GetParameterModulationsConstraint() is:

```
PICAM_API Picam_GetParameterModulationsConstraint(
                                    PicamHandle  camera,
                                 PicamParameter  parameter,
                        PicamConstraintCategory  category,
              const PicamModulationsConstraint**  constraint);
```

Input Parameters

Input parameters for Picam_GetParameterModulationsConstraint() are:

camera: Handle for the camera for which constraint information is being returned.

parameter: Specifies the parameter for which intensifier modulation sequence constraint information is being requested.

category: Specifies the constraint category for which intensifier modulation sequence constraint information is being requested.

Output Parameters

Output parameters for Picam_GetParameterModulationsConstraint() are:

constraint: Pointer to the allocated array in which the intensifier modulation sequence constraints for the specified constraint category and parameter combination are stored.

NOTE: This memory is allocated by PICam and must be released by calling Picam_DestroyModulationsConstraints().

Advanced API Usage

When used in conjunction with Advanced APIs, camera may be a handle to either the:

- device, or
- model.

Related APIs

For additional information, refer to the following related APIs:

- Picam_DestroyModulationsConstraints().

Related Structures

For additional information, refer to the following parameter structures:

- PicamParameter;
- PicamModulationsConstraint.

5.4.5 Shared Camera/Accessory Parameter Constraints APIs

This section provides programming information for APIs used to configure shared camera and accessory parameter constraints.

5.4.5.1 *Picam_DestroyCollectionConstraints()*

Description

Picam_DestroyCollectionConstraints() releases memory that has been allocated by PICam for use by constraint_array.

If constraint_array is null, calling Picam_DestroyCollectionConstraints() has no effect.

NOTE:

constraint_array may be a single PicamCollectionConstraint allocated by PICam.

Syntax

The syntax for Picam_DestroyCollectionConstraints() is:

```
PICAM_API Picam_DestroyCollectionConstraints(
            const PicamCollectionConstraint*  constraint_array);
```

Input Parameters

Input parameters for Picam_DestroyCollectionConstraints() are:

constraint_array: Pointer to array memory that is to be released.

Output Parameters

There are no output parameters associated with Picam_DestroyCollectionConstraints().

Related Structures

For additional information, refer to the following parameter structure:

- PicamCollectionConstraint.

5.4.5.2 *Picam_GetParameterRangeConstraint()*

Description

Picam_GetParameterRangeConstraint() returns range constraints for a specified constraint category and parameter combination.

Syntax

The syntax for Picam_GetParameterRangeConstraint() is:

```
PICAM_API Picam_GetParameterRangeConstraint(
                                   PicamHandle  camera,
                                PicamParameter  parameter,
                       PicamConstraintCategory  category,
                  const PicamRangeConstraint**  constraint);
```

Input Parameters

Input parameters for Picam_GetParameterRangeConstraint() are:

`camera`: Handle for the camera for which range constraints are being returned.

`parameter`: Specifies the parameter for which range constraint information is being requested.

`category`: Specifies the constraint category for which range constraint information is being requested.

Output Parameters

Output parameters for Picam_GetParameterRangeConstraint() are:

`constraint`: Pointer to the allocated array in which the range constraints for the specified constraint category and parameter combination are stored.

NOTE: This memory is allocated by PICam and must be released by calling Picam_DestroyRangeConstraints().

Advanced API Usage

When used in conjunction with Advanced APIs, `camera` may be a handle to either the:

- `device`, or
- `model`.

Related APIs

For additional information, refer to the following related APIs:

- Picam_DestroyRangeConstraints().

Related Structures

For additional information, refer to the following parameter structures:

- PicamParameter;
- PicamRangeConstraint.

5.4.5.3 *Picam_GetParameterCollectionConstraint()*

Description

Picam_GetParameterCollectionConstraint() returns constraint information for a specified constraint category and parameter combination.

Syntax

The syntax for Picam_GetParameterCollectionConstraint() is:

```
PICAM_API Picam_GetParameterCollectionConstraint(
                                   PicamHandle  camera_or_accessory,
                                PicamParameter  parameter,
                       PicamConstraintCategory  category,
              const PicamCollectionConstraint** constraint);
```

Input Parameters

Input parameters for Picam_GetParameterCollectionConstraint() are:

camera_or_accessory: Handle for the hardware for which constraint information is being returned.

parameter: Specifies the parameter for which constraint information is being requested.

category: Specifies the constraint category for which the list of constraints is being requested.

Output Parameters

Output parameters for Picam_GetParameterCollectionConstraint() are:

constraint: Pointer to the allocated array in which the list of constraints available for the specified constraint category and parameter combination is stored.

NOTE: This memory is allocated by PICam and must be released by calling Picam_DestroyCollectionConstraints().

Advanced API Usage

When used in conjunction with Advanced APIs, if camera_or_accessory is a camera handle, it may be a handle to either the:

- device, or
- model.

Related APIs

For additional information, refer to the following related APIs:

- Picam_DestroyCollectionConstraints().

Related Structures

For additional information, refer to the following parameter structures:

- PicamParameter;
- PicamCollectionConstraint.

5.4.5.4 *Picam_DestroyRangeConstraints()*

Description

Picam_DestroyRangeConstraints() releases memory that has been allocated by PICam for use by constraint_array.

If constraint_array is null, calling Picam_DestroyRangeConstraints() has no effect.

NOTE:

constraint_array may be a single PicamRangeConstraint allocated by PICam.

Syntax

The syntax for Picam_DestroyRangeConstraints() is:

```
PICAM_API Picam_DestroyRangeConstraints(
                      const PicamRangeConstraint*  constraint_array);
```

Input Parameters

Input parameters for Picam_DestroyRangeConstraints() are:

constraint_array: Pointer to array memory that is to be released.

Output Parameters

There are no output parameters associated with Picam_DestroyRangeConstraints().

Related Structures

For additional information, refer to the following parameter structure:

- PicamRangeConstraint.

5.4.6 Shared Camera/Accessory Parameter Commitment APIs

This section provides programming information about APIs used to commit parameter values.

NOTE:

Accessories are always considered committed since any changes to their parameters are applied directly to the hardware.

5.4.6.1 *Picam_AreParametersCommitted()*

Description

Picam_AreParametersCommitted() determines if the parameter configuration changes have been applied to the specified hardware.

Syntax

The syntax for Picam_AreParametersCommitted() is:

```
PICAM_API Picam_AreParametersCommitted(
                                PicamHandle  camera_or_accessory,
                                     pibln*  committed);
```

Input Parameters

Input parameters for Picam_AreParametersCommitted() are:

camera_or_accessory: Handle for the hardware for which parameter configuration status information is being determined.

Output Parameters

Output parameters for Picam_AreParametersCommitted() are:

committed: Pointer to the test results. Indicates if parameter configuration changes have been committed to the specified hardware.
Valid values are:

- TRUE
  Indicates that parameter configuration changes have been committed to the specified hardware.
- FALSE
  Indicates that parameter configuration changes have not been committed to the specified hardware.

Advanced API Usage

When used in conjunction with Advanced APIs, if camera_or_accessory is a camera handle, it may be a handle to either the:

- device, or
- model.

5.4.6.2 *Picam_CommitParameters()*

Description

Picam_CommitParameters() validates parameter values and applies these valid values to the specified hardware during system setup and configuration.

- Any parameter that fails to satisfy its required constraint(s) is flagged as invalid and is stored within failed_parameter_array.
- The number of invalid parameters is stored in failed_parameter_count. If no invalid parameters are detected, this value is 0.

Syntax

The syntax for Picam_CommitParameters() is:

```
PICAM_API Picam_CommitParameters(
                          PicamHandle  camera_or_accessory,
                 const PicamParameter**  failed_parameter_array,
                               piint*  failed_parameter_count);
```

Input Parameters

Input parameters for Picam_CommitParameters() are:

camera_or_accessory: Handle for the hardware for which parameter values are being configured.

Output Parameters

Output parameters for Picam_CommitParameters() are:

failed_parameter_array: Pointer to the allocated array in which the list of failed/invalid parameters is stored.
If no invalid parameters are detected, this is a null object.
NOTE: This memory is allocated by PICam and must be released by calling Picam_DestroyParameters().

failed_parameter_count: Pointer to the memory location in which the number of failed/invalid parameters is stored.

Advanced API Usage

When used in conjunction with Advanced APIs, if camera_or_accessory is a camera handle, it may be a handle to either the:

- device, or
- model.

Picam_CommitParameters() systematically configures device with (valid) parameter values that have been stored in model.

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Chapter 6: Data Acquisition APIs

Once system hardware has been configured and the parameters are committed, the system is ready to acquire data. Data can be acquired either synchronously or asynchronously.

By default, memory is allocated automatically to accommodate the data. This automatic memory is valid until the next acquisition or until the hardware is closed.

Alternatively, the automatic memory management can be replaced with a user-allocated buffer by calling `PicamAdvanced_SetAcquisitionBuffer()`. The buffer can be any size as long as it can contain at least one readout. Typically, using a user-allocated buffer is optional. However, configuring the hardware such that the total number of readouts is indeterminate will disable automatic memory management and require a user-allocated buffer. This will occur if one:

- Instructs the hardware to acquire more data than it can exactly acquire;

  This is achieved by setting `PicamParameter_ReadoutCount` to a value greater than the value of `PicamParameter_ExactReadoutCount Maximum`.
- Instructs the hardware to readout data non-destructively (for hardware that supports this feature).
- Instructs the hardware to acquire data indefinitely

  This is achieved by setting `PicamParameter_ReadoutCount` to 0.

6.1 Data Format

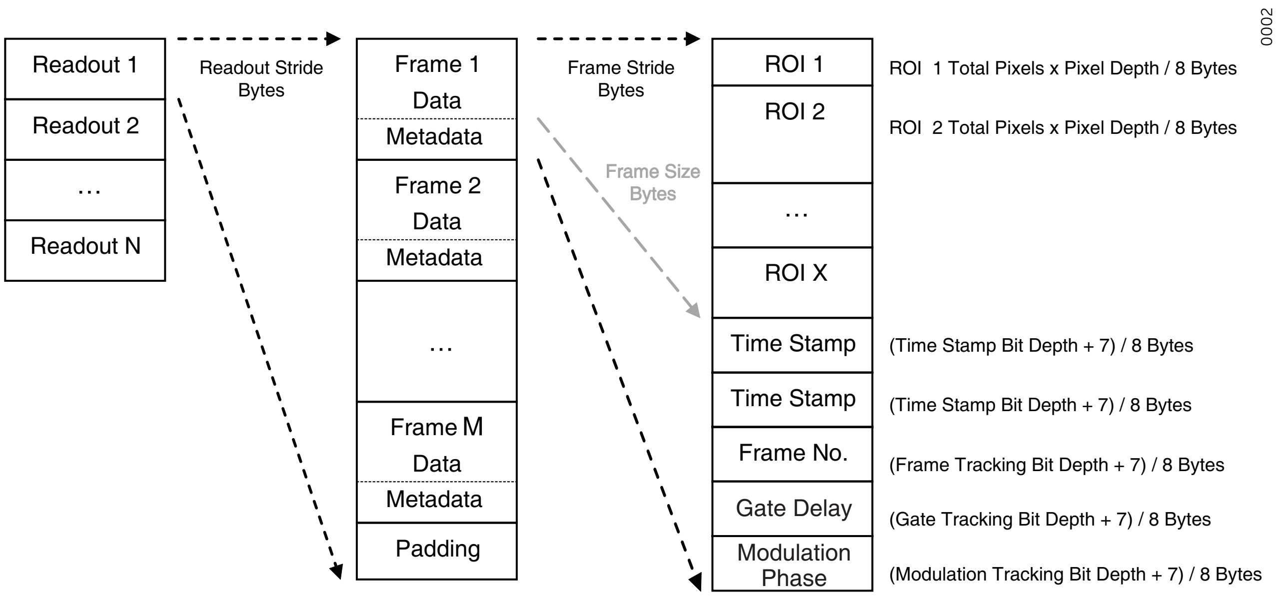
By default, the data is returned as follows:

- One frame of sensor data containing each region of interest (in the order defined);
- Followed by any metadata for that frame (timestamps followed by frame tracking, gate tracking delay, gate tracking width, and modulation tracking);
- Repeated for each frame in one readout
- Possibly followed by any padding between readouts.

Acquired data is structured as shown in Figure 6-1.

NOTE:
All partitions are specified in bytes.

Figure 6-1: Data Format Diagram



The hardware acquires **N** Readouts, each separated by one **Readout Stride**.

One **Readout Stride** is comprised of **M** frames, each separated by one **Frame Stride** followed by padding.

One **Frame Stride** is divided into:

- Frame Pixel Data
  Frame pixel data contains data for **X** Regions of Interest stored in the order in which each ROI was defined.
- Frame Metadata by a frame size.
  Frame Metadata contains any time stamps followed by:
  - Frame Tracking Number;
  - Gate Tracking Delay and Width;
  - Modulation Tracking Duration, Frequency, Phase, and Output Signal Frequency).

All formatting information is available as read-only data acquisition parameters.

6.2 Data Type Definitions

This section provides programming information about PICam data definitions.

6.2.1 Data Acquisition Enumerations

This section provides detailed information about the following data acquisition enumerations:

- `PicamAcquisitionErrorsMask`.

6.2.1.1 *PicamAcquisitionErrorsMask*

Data Type

`PicamAcquisitionErrorsMask` is defined as `enum`.

Description

`PicamAcquisitionErrorsMask` is the set of acquisition error messages.

Enumerator Definitions

Refer to Table 6-1 for enumerator definitions.

Table 6-1: `PicamAcquisitionErrorsMask` Enumerator Definitions

Enumerator	Description
`PicamAcquisitionErrorsMask_CameraFaulted`	The hardware has critically malfunctioned and is in need of service. Further acquisitions are not possible until the hardware has been serviced.
`PicamAcquisitionErrorsMask_ConnectionLost`	The hardware was disconnected.
`PicamAcquisitionErrorsMask_DataLost`	Data has been lost.
`PicamAcquisitionErrorsMask_DataNotArriving`	Data is no longer arriving from the hardware.
`PicamAcquisitionErrorsMask_None`	No errors have occurred.
`PicamAcquisitionErrorsMask_ShutterOverheated`	A connected shutter has overheated and is temporarily disabled. Further acquisitions are not possible until the shutter is no longer overheated.

6.3 Data Acquisition Data Structures

This section provides programming information about the following PICam data acquisition data structures:

- PicamAvailableData;
- PicamAcquisitionStatus.

6.3.1 PicamAvailableData

Description

PicamAvailableData represents newly acquired data.

Structure Definition

The structure definition for PicamAvailableData is:

```
typedef struct PicamAvailableData
{
            void*  initial_readout;
            pi64s  readout_count;
} PicamAvailableData;
```

Variable Definitions

The variables required by PicamAvailableData are:

initial_readout:	Pointer to the start of the first available readout.
readout_count:	Indicates how many contiguous readouts are currently available.

6.3.2 PicamAcquisitionStatus

Description

PicamAcquisitionStatus reports various status information during data acquisition by the hardware.

Structure Definition

The structure definition for PicamAcquisitionStatus is:

```
typedef struct PicamAcquisitionStatus
{
                             pibln  running;
     PicamAcquisitionErrorsMask  errors;
                             piflt  readout_rate;
} PicamAcquisitionStatus;
```

Variable Definitions

The variables required by PicamAcquisitionStatus are:

running: Indicates the data acquisition status/
Valid values are:

- TRUE
  Indicates an acquisition is in progress.
- FALSE
  Indicates there is no current data acquisition in progress.

errors: Contains any errors that have occurred.

readout_rate: The rate of capture in readouts-per-second when acquiring more than one readout.

6.4 Programmers' Reference for Acquisition Control APIs

This section provides programming information for the following acquisition control APIs:

- `Picam_Acquire();`
- `Picam_StartAcquisition();`
- `Picam_StopAcquisition();`
- `Picam_IsAcquisitionRunning();`
- `Picam_WaitForAcquisitionUpdate().`

6.4.1 `Picam_Acquire()`

Description

`Picam_Acquire()` performs a specified number of data readouts (specified by `readout_count`) and returns once the acquisition has been completed.

NOTE:

This function cannot be called when hardware is configured for non-destructive readout. This is because the number of readouts acquired is no longer guaranteed to be fixed. As an example, changing the exposure time online will change the number of non-destructive readouts and therefore the total number of readouts acquired.

NOTE:

Parameters must be committed prior to initiating data acquisition. Refer to Section 5.4.6.2, Picam_CommitParameters(), on page 179 for additional information.

Data acquisition is successful when:

- The delay between successive readouts does not exceed `readout_time_out`, and
- No errors have occurred.

Data acquisition is immediately halted when:

- The delay between successive readouts exceeds that specified by `readout_time_out`.
  The error message `PicamError_TimeOutOccurred` is returned.
- Any other error conditions are detected.
  Associated error messages are stored in the `errors` parameter.

Syntax

The syntax for `Picam_Acquire()` is:

```
PICAM_API Picam_Acquire(
                PicamHandle  camera,
                      pi64s  readout_count,
                      piint  readout_time_out,
         PicamAvailableData*  available,
 PicamAcquisitionErrorsMask*  errors);
```

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Input Parameters

Input parameters for `Picam_Acquire()` are:

`camera:`	Handle for the hardware from which data are to be acquired.
`readout_count:`	The number of readouts desired. Valid values are in the range: [1...`PicamParameter_ExactReadoutCount Maximum`] If this value becomes excessively large, this function may fail due to a lack of sufficient memory.
`readout_time_out:`	The time, in mS, to wait between each successive readout. When specifying an infinite length of time, configure this parameter to -1.

Output Parameters

Output parameters for `Picam_Acquire()` are:

`available:`	The output buffer used to store data that has been successfully read out from the specified hardware. In the event of a data acquisition failure, this buffer may contain little to no data. Data stored in this buffer is valid until: • The next acquisition cycle is initiated; or • The hardware is closed.
`errors:`	The parameter used to store any error messages that were raised during data acquisition.

Advanced API Usage

When used in conjunction with Advanced APIs, data in the output buffer `available` is also invalidated when `PicamAdvanced_SetAcquisitionBuffer()` is called.

`Picam_Acquire()` is mutually exclusive with the use of an acquisition-updated callback.

Related APIs

For additional information, refer to the following related APIs:

- `Picam_CommitParameters()`;
- `PicamAdvanced_SetAcquisitionBuffer()`.

6.4.2 Picam_StartAcquisition()

Description

`Picam_StartAcquisition()` asynchronously initiates data acquisition and returns immediately.

> **NOTE:**
> Parameters must be committed prior to initiating data acquisition. Refer to Section 5.4.6.2, Picam_CommitParameters(), on page 179 for information.

On success, data acquisition is running and continues until:

- The number of readouts specified by `PicamParameter_ReadoutCount` have been acquired;
- An error occurs which immediately halts data acquisition (refer to Section 6.4.1, Picam_Acquire(), on page 185 for additional information); or
- `Picam_StopAcquisition()` is called, in which case the acquisition will stop asynchronously (i.e., sometime in the future after this function returns.)

> **NOTE:**
> To determine the current data acquisition status, call *`Picam_WaitForAcquisitionUpdate()`*.

Syntax

The syntax for `Picam_StartAcquisition()` is:

```
PICAM_API Picam_StartAcquisition(
                      PicamHandle  camera);
```

Input Parameters

Input parameters for `Picam_StartAcquisition()` are:

`camera`: Handle for the hardware for which data acquisition is to be initiated.

Output Parameters

There are no output parameters associated with `Picam_StartAcquisition()`.

Advanced API Usage

When used in conjunction with Advanced APIs, if `PicamParameter_ReadoutCount` = 0, the hardware will run continuously until `Picam_StopAcquisition()` is called to stop asynchronously.

Related APIs

For additional information, refer to the following related APIs:

- `Picam_CommitParameters()`;
- `Picam_Acquire()`;
- `Picam_StopAcquisition()`;
- *`Picam_WaitForAcquisitionUpdate()`*.

6.4.3 Picam_StopAcquisition()

Description

Picam_StopAcquisition() asynchronously requests an in-progress data acquisition to halt and returns immediately.

On success, the data acquisition will stop running sometime in the future after this function returns.

The acquisition is stopped when Picam_IsAcquisitionRunning() returns FALSE or PicamAcquisitionStatus.running is FALSE.

NOTE:

[Advanced API Usage ONLY]

If PicamParameter_ReadoutCount = 0, the hardware will run continuously until Picam_StopAcquisition() has been called.

Syntax

The syntax for Picam_StopAcquisition() is:

```
PICAM_API Picam_StopAcquisition(
                                PicamHandle  camera);
```

Input Parameters

Input parameters for Picam_StopAcquisition() are:

camera: Handle for the hardware for which data acquisition is to be halted.

Output Parameters

There are no output parameters associated with Picam_StopAcquisition().

Related APIs

For additional information, refer to the following related APIs:

- Picam_StartAcquisition().
- Picam_IsAcquisitionRunning().
- Picam_WaitForAcquisitionUpdate().

6.4.4 Picam_IsAcquisitionRunning()

Description

Picam_IsAcquisitionRunning() determines if there is an active data acquisition in process.

NOTE:

This function should not be used to wait for data to arrive.
Use Picam_WaitForAcquisitionUpdate() instead.

Syntax

The syntax for Picam_IsAcquisitionRunning() is:

```
PICAM_API Picam_IsAcquisitionRunning(
                    PicamHandle  camera,
                         pibln*  running);
```

Input Parameters

Input parameters for Picam_IsAcquisitionRunning() are:

camera: Handle for the hardware for which the data acquisition status is being determined.

Output Parameters

Output parameters for Picam_IsAcquisitionRunning() are:

running: Indicates if there is a an active data acquisition in progress. Valid values are:

- TRUE
  Indicates that there is an active data acquisition in process.
- FALSE
  Indicates that there is no active data acquisition in process.

6.4.5 Picam_WaitForAcquisitionUpdate()

Description

Picam_WaitForAcquisitionUpdate() is used in combination with Picam_StartAcquisition() and indicates when:

- New data are available; or
- The hardware's status has changed.

Usage

Picam_WaitForAcquisitionUpdate() must be continuously called until PicamAcquisitionStatus.running is FALSE. This is true regardless of any acquisition errors that may be returned or if Picam_StopAcquisition() has been called.

Any errors returned during data acquisition are stored in PicamAcquisitionStatus.errors and acquisition will be halted.

However, if new data is not available within the time specified by readout_time_out:

- The PicamError_TimeOutOccurred error is returned;
- Data acquisition will continue; and
- The contents of both the data buffer available as well as the status data structure are invalid.

Syntax

The syntax for Picam_WaitForAcquisitionUpdate() is:

```
PICAM_API Picam_WaitForAcquisitionUpdate(
                                PicamHandle  camera,
                                      piint  readout_time_out,
                         PicamAvailableData*  available,
                     PicamAcquisitionStatus*  status);
```

Input Parameters

Input parameters for Picam_WaitForAcquisitionUpdate() are:

camera:	Handle for the hardware from which data is being acquired.
readout_time_out:	The time, in mS, to wait between each successive readout. To configure this function to wait forever until a change occurs, set this parameter to -1.

Output Parameters

Output parameters for Picam_WaitForAcquisitionUpdate() are:

available:	The output buffer used to store newly acquired data from the specified hardware. Data stored in this buffer is valid until the next Picam_WaitForAcquisitionUpdate() call.
status:	Pointer to the PicamAcquisitionStatus data structure in which acquisition status information is stored.

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Advanced API Usage

When used in conjunction with Advanced APIs, data in the output buffer `available` is also invalidated when `PicamAdvanced_SetAcquisitionBuffer()` is called (in the case of the last `Picam_WaitForAcquisitionUpdate()` call.)

`Picam_WaitForAcquisitionUpdate()` is mutually exclusive with the usage of an acquisition-updated callback.

Related APIs

For additional information, refer to the following related APIs:

- `Picam_StartAcquisition()`;
- `PicamAdvanced_SetAcquisitionBuffer()`

Related Structures

For additional information, refer to the following related structure definition:

- `PicamAvailableData`;
- `PicamAcquisitionStatus`.

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Chapter 7: Advanced Function APIs

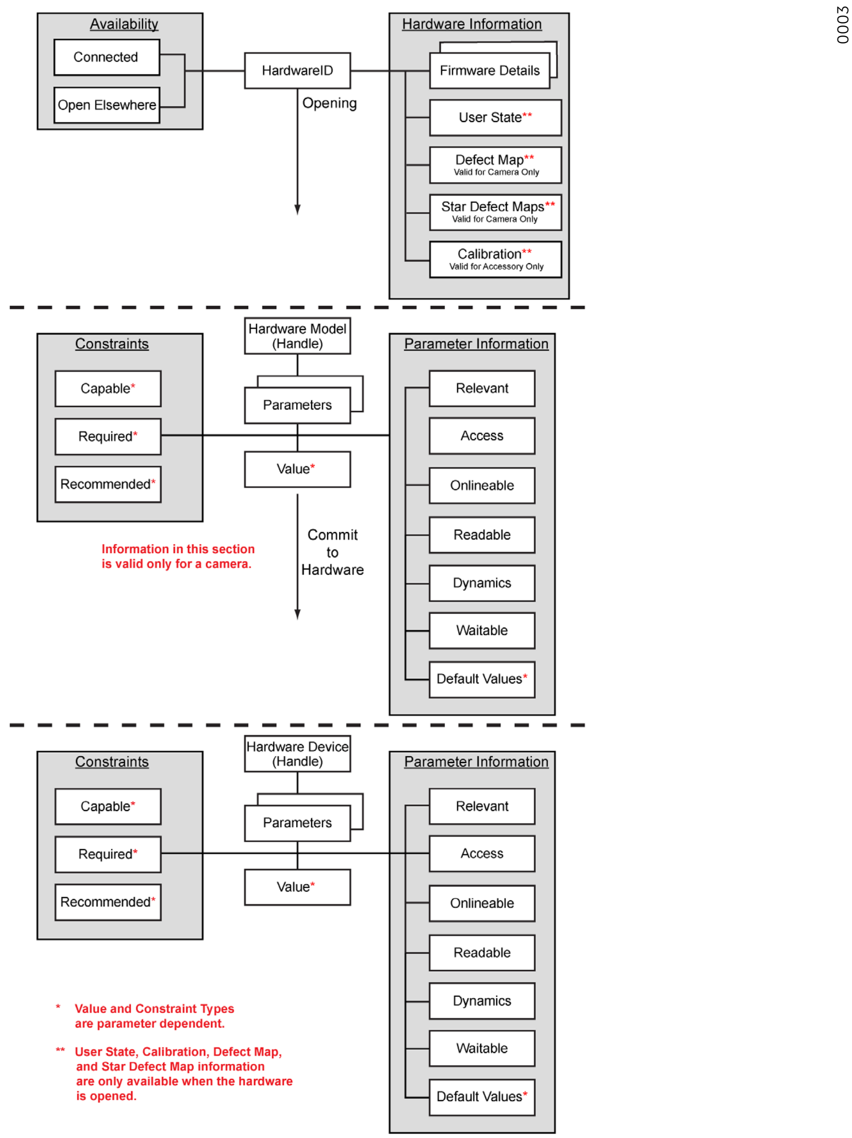
This chapter provides programming information about PICam advanced function APIs, including related data definitions and structures which are included in the `picam_advanced.h` file.

Figure 7-1 illustrates a block diagram of the PICam Advanced Function structure.

REFERENCES:

Refer to Section 2.6.1, Handles, for information about the handles used within PICam.

Figure 7-1: PICam Structure - Advanced



7.1 Data Type Definitions

This section provides programming information about the following PICam advanced data definitions:

- Shared Camera/Accessory Plug and Play Discovery Data Enumerations
  - `PicamDiscoveryAction`
- Shared Camera/Accessory Access Enumerations
  - `PicamHandleType`
- Shared Camera/Accessory Parameter Information Enumerations
  - `PicamDynamicsMask`
- Camera-Specific Data Acquisition Enumerations
  - `PicamAcquisitionState`
  - `PicamAcquisitionStateErrorsMask`

7.1.1 Shared Camera/Accessory Plug and Play Discovery Data Enumerations

This section provides programming information about shared camera/accessory plug and play discovery data enumerations.

7.1.1.1 `PicamDiscoveryAction`

Data Type

`PicamDiscoveryAction` is defined as `enum`.

Description

`PicamDiscoveryAction` is the set of discovery states available for hardware.

Enumerator Definitions

Refer to Table 7-1 for enumerator definitions.

Table 7-1: `PicamDiscoveryAction` Enumerator Definitions

Enumerator	Description
`PicamDiscoveryAction_Faulted`	A hardware item has critically malfunctioned and is in need of service. Any acquisition in progress with this hardware will be stopped and further acquisition are not possible until the hardware has been serviced.
`PicamDiscoveryAction_Found`	Hardware is now available for use.
`PicamDiscoveryAction_Lost`	Hardware is no longer available for use.

7.1.2 Shared Camera/Accessory Access Enumerations

This section provides programming information about shared camera and accessory access data enumerations.

7.1.2.1 PicamHandleType

Data Type

PicamHandleType is defined as enum.

Description

PicamHandleType is the set of handle types.

Enumerator Definitions

Refer to Table 7-2 for enumerator definitions.

Table 7-2: PicamHandleType Enumerator Definitions

Enumerator	Description
PicamHandlType_Accessory	This handle refers to a hardware accessory.
PicamHandleType_CameraDevice	The handle refers to a camera device.
PicamHandleType_CameraModel	The handle refers to a camera model.
PicamHandleType_EMCalibration	The handle refers to a camera opened for EM calibration.

7.1.3 Shared Camera/Accessory Parameter Information Enumerations

This section provides programming information about shared camera and accessory parameter information data enumerations.

7.1.3.1 PicamDynamicsMask

Data Type

`PicamDynamicsMask` is defined as `enum`.

Description

`PicamDynamicsMask` is the set of descriptors for how parameters and their various attributes may or may not change.

Enumerator Definitions

Refer to Table 7-3 for enumerator definitions.

Table 7-3: `PicamDynamicsMask` Enumerator Definitions

Enumerator	Description
`PicamDynamicsMask_None`	No parameter attributes may change.
`PicamDynamicsMask_Value`	The parameter value may change.
`PicamDynamicsMask_ValueAccess`	The parameter value access may change.
`PicamDynamicsMask_IsRelevant`	The parameter relevance may change.
`PicamDynamicsMask_Constraint`	The parameter dependent constraints may change.

7.1.4 Camera-Specific Data Acquisition Enumerations

This section provides programming information about camera-specific data acquisition enumerations.

7.1.4.1 `PicamAcquisitionState`

Data Type

`PicamAcquisitionState` is defined as `enum`.

Description

`PicamAcquisitionState` is the set of camera states that can be detected during an acquisition.

Enumerator Definitions

Refer to Table 7-4 for enumerator definitions.

Table 7-4: `PicamAcquisitionState` Enumerator Definitions

Enumerator	Description
`PicamAcquisitionState_ReadoutStarted`	The camera has begun to readout data.
`PicamAcquisitionState_ReadoutEnded`	The camera has finished reading out data.

7.1.4.2 `PicamAcquisitionStateErrorsMask`

Data Type

`PicamAcquisitionStateErrorsMask` is defined as `enum`.

Description

`PicamAcquisitionStateErrorsMask` is the set of errors that can occur while detecting acquisition states.

Enumerator Definitions

Refer to Table 7-5 for enumerator definitions.

Table 7-5: `PicamAcquisitionStateErrorsMask` Enumerator Definitions

Enumerator	Description
`PicamAcquisitionStateErrorsMask_None`	No error has occurred.
`PicamAcquisitionStateErrorsMask_LostCount`	One or more state transitions have been missed.

7.2 Data Structures

This section provides programming information about the following PICam data structures:

- Camera-Specific Information Data Structures;
  - PicamPixelLocation
  - PicamColumnDefect
  - PicamRowDefect
  - PicamPixelDefectMap
  - PicamStarDefect
  - PicamStarDefectMap
- Camera-Specific Parameter Validation Data Structures;
  - PicamValidationResult
  - PicamValidationResults
  - PicamFailedDependentParameter
  - PicamDependentValidationResult
- Camera-Specific Data Acquisition Data Structures.
  - PicamAcquisitionBuffer
  - PicamAcquisitionStateCounters

7.2.1 Camera-Specific Information Data Structures

This section provides programming information about structures used to define and describe a camera.

7.2.1.1 *PicamPixelLocation*

Description

PicamPixelLocation specifies the location of a pixel within the sensor array. A standard zero-based X-Y coordinate system is used where:

- X represents the column number;
- Y represents the row number.

Structure Definition

The structure definition for PicamPixelLocation is:

```
typedef struct PicamPixelLocation
{
            pi16s  x;
            pi16s  y;
} PicamPixelLocation;
```

Variable Definitions

The variables required by PicamPixelLocation are:

x: The column coordinate.

y: The row coordinate.

7.2.1.2 *PicamColumnDefect*

Description

PicamColumnDefect specifies the location and size of a single defective column on the sensor.

Structure Definition

The structure definition for PicamPixelLocation is:

```
typedef struct PicamColumnDefect
{
        PicamPixelLocation  start;
                     piint  height;
} PicamColumnDefect;
```

Variable Definitions

The variables required by PicamPixelLocation are:

start:	The top-most defective pixel.
height:	The number of rows this column defect spans.

7.2.1.3 *PicamRowDefect*

Description

PicamRowDefect specifies the location and size of a single defective row on the sensor.

Structure Definition

The structure definition for PicamRowDefect is:

```
typedef struct PicamRowDefect
{
        PicamPixelLocation  start;
                     piint  width;
} PicamRowDefect;
```

Variable Definitions

The variables required by PicamRowDefect are:

start:	The left-most defective pixel.
height:	The number of columns this row defect spans.

7.2.1.4 *PicamPixelDefectMap*

Description

PicamPixelDefectMap is an array in which all defects for a specified sensor are stored.

Structure Definition

The structure definition for PicamPixelDefectMap is:

```
typedef struct PicamPixelDefectMap
{
       const PicamColumnDefect*  column_defect_array;
                          piint  column_defect_count;
          const PicamRowDefect*  row_defect_array;
                          piint  row_defect_count;
      const PicamPixelLocation*  point_defect_array;
                          piint  point_defect_count;
} PicamPixelDefectMap;
```

Variable Definitions

The variables required by PicamPixelDefectMap are:

`column_defect_array:`	A set of all column defects. This is null where there are no column defects.
`column_defect_count:`	The number of items in column_defect_array. This is 0 when there are no defective columns.
`row_defect_array:`	A set of all row defects. This is null when there are no row defects.
`row_defect_count:`	The number of items in row_defect_array. This is 0 when there are no defective rows.
`point_defect_array:`	A set of all single-point defects. This is null when there are no single-point defects.
`point_defect_count:`	The number of items in point_defect_array. This is 0 when there are no single-point defects.

7.2.1.5 *PicamStarDefect*

Description

PicamStarDefect specifies the location of the center of a "star" defect and additional information. A star defect is a pixel that leaks most of its charge where some of which go into its surrounding pixels. The leaky pixel and its neighbors make up the star.

Structure Definition

The structure definition for PicamStarDefect is:

```
typedef struct PicamStarDefect
{
        PicamPixelLocation  center;
                     pi32f  bias;
                     pi32f  adjacent_factor;
                     pi32f  diagonal_factor;

} PicamStarDefect;
```

Variable Definitions

The variables required by PicamStarDefect are:

center:	The center of the star.
bias:	The pixel values of the star with no light.
adjacent_factor:	The fraction of the pixel value that was due to the star center leaking into adjacent pixels.
diagonal_factor:	The fraction of the pixel value that was due to the star center leaking into diagonal pixels.

7.2.1.6 *PicamStarDefectMap*

Description

PicamStarDefectMap is an array in which all star defects for a specified sensor are stored. The number, location and details of the star defects can vary depending on camera parameters, so a camera can have more than one such map.

Structure Definition

The structure definition for PicamStarDefectMap is:

```
typedef struct PicamStarDefectMap
{
                      piint  id;
    const PicamStarDefect*   star_defect_array;
                      piint  star_defect_count;
} PicamStarDefectMap;
```

Variable Definitions

The variables required by PicamStarDefectMap are:

`id:`	The unique id of the map for a particular set of parameters.
`star_defect_array:`	A set of all star defects. This is null when there are no star defects.
`star_defect_count:`	The number of items in star_defect_array. This is 0 when there are no stars.

7.2.2 Camera-Specific Parameter Validation Data Structures

This section provides programming information about camera-specific parameter validation structures.

7.2.2.1 PicamValidationResult

Description

PicamValidationResult provides information about the validation status for a single parameter.

Structure Definition

The structure definition for PicamValidationResult is:

```
typedef struct PicamValidationResult
{
                          pibln  is_valid;
      const PicamParameter*  failed_parameter;
const PicamConstraintScope* failed_error_constraint_scope;
const PicamConstraintScope* failed_warning_constraint_scope;
      const PicamParameter*  error_constraining_parameter_array;
                          piint  error_constraining_parameter_count;
      const PicamParameter*  warning_constraining_parameter_array;
                          piint  warning_constraining_parameter_count;
} PicamValidationResult;
```

Variable Definitions

The variables required by PicamValidationResult are:

`is_valid`:	Indicates the validation status for a single parameter. Valid values are: • `TRUE` Indicates the parameter validation has succeeded. • `FALSE` Indicates the parameter validation has failed.
`failed_parameter`:	The parameter that has failed validation. This is null when validation has succeeded.
`failed_error_constraint_scope`:	The scope of the error constraint that has failed. This is null when: • Validation has succeeded, or • Only a warning constraint has failed validation.
`failed_warning_constraint_scope`:	The scope of the warning constraint that has failed. This is null when: • Validation has succeeded, or • Only an error constraint has failed validation.
`error_constraining_parameter_array`:	An array of parameters involved in constraining the failed parameter when a dependent error failed. This is null otherwise.
`error_constraining_parameter_count`:	The number of items in the array of parameters involved in constraining the failed parameter if a dependent error failed. This is 0 otherwise.
`warning_constraining_parameter_array`:	An array of parameters involved in constraining the failed parameter if a dependent warning failed. This is null otherwise.
`warning_constraining_parameter_count`:	The number of items in the array of parameters involved in constraining the failed parameter if a dependent warning failed. This is 0 otherwise.

7.2.2.2 *PicamValidationResults*

Description

PicamValidationResults provides information about the validation status for multiple parameters.

Structure Definition

The structure definition for PicamValidationResults is:

```
typedef struct PicamValidationResults
{
                           pibln  is_valid;
   const PicamValidationResult*  validation_result_array;
                           piint  validation_result_count;
} PicamValidationResults;
```

Variable Definitions

The variables required by PicamValidationResults are:

is_valid:	Indicates the validation status for multiple tested parameters. Valid values are: • TRUE Indicates all parameter validations have succeeded. • FALSE Indicates one or more parameter validations has failed.
validation_result_array:	An array containing a result for each parameter that failed validation; null if validation succeeded.
validation_result_count:	The number of failed parameter results; 0 if validation succeeded.

7.2.2.3 *PicamFailedDependentParameter*

Description

PicamFailedDependentParameter provides information about a parameter that has failed validation and is itself constrained by a second parameter.

Structure Definition

The structure definition for PicamFailedDependentParameter is:

```
typedef struct PicamFailedDependentParameter
{
                 PicamParameter  failed_parameter;
    const PicamConstraintScope*  failed_error_constraint_scope;
    const PicamConstraintScope*  failed_warning_constraint_scope;
} PicamFailedDependentParameter;
```

Variable Definitions

The variables required by PicamFailedDependentParameter are:

failed_parameter:	The parameter whose validation failed and is constrained by another.
failed_error_constraint_scope:	The scope of the error constraint that failed. This is null when only a warning constraint failed.
failed_warning_constraint_scope:	The scope of the warning constraint that failed. This is null when only an error constraint failed.

7.2.2.4 *PicamDependentValidationResult*

Description

PicamDependentValidationResult provides information about the failed validation of a parameter that is constrained by a second parameter.

Structure Definition

The structure definition for PicamDependentValidationResult is:

```
typedef struct PicamDependentValidationResult
{
                                  pibln  is_valid;
                      PicamParameter  constraining_parameter;
const PicamFailedDependentParameter*
   failed_dependent_parameter_array;
                                  piint
   failed_dependent_parameter_count;
} PicamDependentValidationResult;
```

Variable Definitions

The variables required by PicamDependentValidationResult are:

is_valid:	Indicates the validation status for a parameter that is constrained by a second parameter. Valid values are: • TRUE Indicates the parameter validation has succeeded. • FALSE Indicates the parameter validation has failed.
constraining_parameter:	The parameter whose value impacts the constraints of another.
failed_dependent_ parameter_array:	An array containing all parameters whose constraints are dependent on constraining_parameter and that have failed validation. This is null when the validation has succeeded.
failed_dependent_ parameter_count:	The number of items in an array containing all parameters whose constraints are dependent on constraining_parameter and that have failed validation. This is 0 when the validation has succeeded.

7.2.3 Camera-Specific Data Acquisition Data Structures

This section provides programming information for camera-specific data acquisition structures.

7.2.3.1 `PicamAcquisitionBuffer`

Description

`PicamAcquisitionBuffer` is a user-allocated buffer into which acquired data is stored.

Structure Definition

The structure definition for `PicamAcquisitionBuffer` is:

```
typedef struct PicamAcquisitionBuffer
{
            void*  memory;
            pi64s  memory_size;
} PicamAcquisitionBuffer;
```

Variable Definitions

The variables required by `PicamAcquisitionBuffer` are:

`memory`: Pointer to the top of the user-allocated memory location.

`memory_size`: Number of bytes allocated for use by the user-allocated memory.

7.2.3.2 `PicamAcquisitionStateCounters`

Description

`PicamAcquisitionStateCounters` counts all acquisition state transitions registered for detection while acquiring.

Structure Definition

The structure definition for `PicamAcquisitionStateCounters` is:

```
typedef struct PicamAcquisitionStateCounters
{
            pi64s  readout_started_count;
            pi64s  readout_ended_count;
} PicamAcquisitionStateCounters;
```

Variable Definitions

The variables required by `PicamAcquisitionStateCounters` are:

`readout_started_count`: The number of occurrences where the camera has begun to readout.

`readout_ended_count`: The number of occurrences where the camera has finished readout.

7.3 Callback Functions

This section provides programming information about the following callbacks used within PICam:

- Camera-Specific Discovery Callbacks
  - `PicamDiscoveryCallback()`
- Accessory-Specific Discovery Callbacks
  - `PicamAccessoryDiscoveryCallback()`
- Camera-Specific Parameter Value Callbacks
  - `PicamLargeIntegerValueChangedCallback()`
  - `PicamRoisValueChangedCallback()`
  - `PicamPulseValueChangedCallback()`
  - `PicamModulationsValueChangedCallback()`
- Shared Camera/Accessory Parameter Value Callbacks
  - `PicamIntegerValueChangedCallback()`
  - `PicamFloatingPointValueChangedCallback()`
  - `PicamWhenStatusParameterValueCallback()`
  - `PicamIsRelevantChangedCallback()`
  - `PicamValueAccessChangedCallback()`
- Camera-Specific Parameter Constraints Callbacks
  - `PicamDependentRoisConstraintChangedCallback()`
  - `PicamDependentPulseConstraintChangedCallback()`
  - `PicamDependentModulationsConstraintChangedCallback()`
- Shared Camera/Accessory Parameter Constraints Callbacks
  - `PicamDependentCollectionConstraintChangedCallback()`
  - `PicamDependentRangeConstraintChangedCallback()`
- Camera-Specific Data Acquisition Callbacks
  - `PicamAcquisitionUpdatedCallback()`
  - `PicamAcquisitionStateUpdatedCallback()`

7.3.1 Camera-Specific Discovery Callbacks

This section provides programming information about camera-specific discovery callbacks.

7.3.1.1 *PicamDiscoveryCallback()*

Description

PicamDiscoveryCallback() is the callback function for camera discovery.

Syntax

The syntax for PicamDiscoveryCallback() is:

```
typedef PicamError (PIL_CALL* PicamDiscoveryCallback)
(
      const PicamCameraID*  id,
               PicamHandle  device,
      PicamDiscoveryAction  action);
```

Input Parameters

The input parameters for PicamDiscoveryCallback() are:

- `id:` Pointer to the camera that has been discovered.
- `device:` The handle for an open camera device if id is open within this process. This is null otherwise.
- `action:` The type of discovery.

7.3.2 Accessory-Specific Discovery Callbacks

This section provides programming information about accessory-specific discovery callbacks.

7.3.2.1 *PicamAccessoryDiscoveryCallback()*

Description

PicamAccessoryDiscoveryCallback() is the callback function for accessory discovery.

Syntax

The syntax for PicamAccessoryDiscoveryCallback() is:

```
typedef PicamError (PIL_CALL* PicamAccessoryDiscoveryCallback)
(
   const PicamAccessoryID*  id,
               PicamHandle  accessory,
      PicamDiscoveryAction  action);
```

Input Parameters

The input parameters for PicamAccessoryDiscoveryCallback() are:

- `id:` Pointer to the accessory that has been discovered.
- `accessory:` The handle for an open accessory device if id is open within this process. This is null otherwise.
- `action:` The type of discovery.

7.3.3 Camera-Specific Parameter Value Callbacks

This section provides programming information about camera-specific parameter value callbacks.

7.3.3.1 PicamLargeIntegerValueChangedCallback()

Description

PicamLargeIntegerValueChangedCallback() is the change notification callback function called when a parameter's large integer value has been changed.

Syntax

The syntax for PicamLargeIntegerValueChangedCallback() is:

```
typedef PicamError (PIL_CALL* PicamLargeIntegerValueChangedCallback)
(
                    PicamHandle  camera,
                 PicamParameter  parameter,
                          pi64s  value);
```

Input Parameters

Input parameters for PicamLargeIntegerValueChangedCallback() are:

`camera`: Handle for the camera for which a parameter's large integer value has been changed.

`parameter`: The parameter which has had its large integer value changed.

`value`: The new large integer value.

7.3.3.2 PicamRoisValueChangedCallback()

Description

PicamRoisValueChangedCallback() is the change notification callback function called when a parameter's Rois value has been changed.

Syntax

The syntax for PicamRoisValueChangedCallback() is:

```
typedef PicamError (PIL_CALL* PicamRoisValueChangedCallback)
(
                    PicamHandle  camera,
                 PicamParameter  parameter,
              const PicamRois*  value);
```

Input Parameters

Input parameters for PicamRoisValueChangedCallback() are:

`camera`: Handle for the camera for which a parameter's Rois value has been changed.

`parameter`: The parameter which has had its Rois value changed.

`value`: Pointer the array location in which the new Rois value is stored.

7.3.3.3 PicamPulseValueChangedCallback()

Description

PicamPulseValueChangedCallback() is the change notification callback function called when a parameter's gate pulse value has been changed.

Syntax

The syntax for PicamPulseValueChangedCallback() is:

```
typedef PicamError (PIL_CALL* PicamPulseValueChangedCallback)
(
                    PicamHandle  camera,
                 PicamParameter  parameter,
              const PicamPulse*  value);
```

Input Parameters

Input parameters for PicamPulseValueChangedCallback() are:

camera:	Handle for the camera for which a parameter's gate pulse value has been changed.
parameter:	The parameter which has had its gate pulse value changed.
value:	Pointer the array in which the new gate pulse value is stored.

7.3.3.4 PicamModulationsValueChangedCallback()

Description

PicamModulationsValueChangedCallback() is the change notification callback function called when a parameter's intensifier modulation sequence value has been changed.

Syntax

The syntax for PicamModulationsValueChangedCallback() is:

```
typedef PicamError (PIL_CALL* PicamModulationsValueChangedCallback)
(
                    PicamHandle  camera,
                 PicamParameter  parameter,
        const PicamModulations*  value);
```

Input Parameters

Input parameters for PicamModulationsValueChangedCallback() are:

camera:	Handle for the camera for which a parameter's intensifier modulation sequence value has been changed.
parameter:	The parameter which has had its intensifier modulation sequence value changed.
value:	Pointer the array in which the new intensifier modulation sequence value is stored.

7.3.4 Shared Camera/Accessory Parameter Value Callbacks

This section provides programming information about shared camera and accessory parameter value callbacks.

7.3.4.1 PicamIntegerValueChangedCallback()

Description

PicamIntegerValueChangedCallback() is the change notification callback function called when a parameter's integer value has been changed.

Syntax

The syntax for PicamIntegerValueChangedCallback() is:

```
typedef PicamError (PIL_CALL* PicamIntegerValueChangedCallback)
(
                            PicamHandle  camera_or_accessory,
                         PicamParameter  parameter,
                                  piint  value);
```

Input Parameters

Input parameters for PicamIntegerValueChangedCallback() are:

camera_or_accessory:	Handle for the hardware for which a parameter's integer value has been changed.
parameter:	The parameter which has had its integer value changed.
value:	The new integer value.

7.3.4.2 PicamFloatingPointValueChangedCallback()

Description

PicamFloatingPointValueChangedCallback() is the change notification callback function called when a parameter's floating point value has been changed.

Syntax

The syntax for PicamFloatingPointValueChangedCallback() is:

```
typedef PicamError (PIL_CALL* PicamFloatingPointValueChangedCallback)
(
                            PicamHandle  camera_or_accessory,
                         PicamParameter  parameter,
                                  piflt  value);
```

Input Parameters

Input parameters for PicamFloatingPointValueChangedCallback() are:

camera_or_accessory:	Handle for the hardware for which a parameter's floating point value has been changed.
parameter:	The parameter which has had its floating point value changed.
value:	The new floating point value.

7.3.4.3 *PicamWhenStatusParameterValueCallback()*

Description

PicamWhenStatusParameterValueCallback() is the notification callback function called when a waitable status value has been met or an error has occurred.

Syntax

The syntax for PicamWhenStatusParameterValueCallback() is:

```
typedef PicamError (PIL_CALL* PicamWhenStatusParameterValueCallback)
(
                    PicamHandle  device_or_accessory,
                 PicamParameter  parameter,
                          piint  value,
                     PicamError  error);
```

Input Parameters

Input parameters for PicamWhenStatusParameterValueCallback() are:

device_or_accessory:	Handle for the hardware device for which a parameter's status value has been met.
parameter:	The parameter whose status value has been met.
value:	The status value that has been met.
error:	Any error that occurred to prevent the status value from being met.

7.3.4.4 *PicamIsRelevantChangedCallback()*

Description

PicamIsRelevantChangedCallback() is the change notification callback function called when a parameter's relevance has been changed.

Syntax

The syntax for PicamIsRelevantChangedCallback() is:

```
typedef PicamError (PIL_CALL* PicamIsRelevantChangedCallback)
(
                    PicamHandle  camera_or_accessory,
                 PicamParameter  parameter,
                          pibln  relevant);
```

Input Parameters

Input parameters for PicamIsRelevantChangedCallback() are:

camera_or_accessory:	Handle for the hardware for which a parameter's relevance has been changed.
parameter:	The parameter which has had its relevance changed.
relevant:	The new relevance.

7.3.4.5 *PicamValueAccessChangedCallback()*

Description

PicamValueAccessChangedCallback() is the change notification callback function called when a parameter's value access has been changed.

Syntax

The syntax for PicamValueAccessChangedCallback() is:

```
typedef PicamError (PIL_CALL* PicamValueAccessChangedCallback)
(
                       PicamHandle  camera_or_accessory,
                    PicamParameter  parameter,
                  PicamValueAccess  access);
```

Input Parameters

Input parameters for PicamValueAccessChangedCallback() are:

camera_or_accessory:	Handle for the hardware for which a parameter's value access has been changed.
parameter:	The parameter which has had its value access changed.
access:	The new value access.

7.3.5 Camera-Specific Parameter Constraints Callbacks

This section provides programming information about camera-specific parameter constraints callbacks.

7.3.5.1 *PicamDependentRoisConstraintChangedCallback()*

Description

PicamDependentRoisConstraintChangedCallback() is the change notification callback function called when a parameter's dependent Rois constraints have been changed.

Syntax

The syntax for PicamDependentRoisConstraintChangedCallback() is:

```
typedef PicamError (PIL_CALL*
        PicamDependentRoisConstraintChangedCallback)
(
                       PicamHandle  camera,
                    PicamParameter  parameter,
    const PicamRoisConstraint*  constraint);
```

Input Parameters

Input parameters for PicamDependentRoisConstraintChangedCallback() are:

`camera`: Handle for the camera for which a parameter's dependent Rois constraints have been changed.

`parameter`: The parameter which has had its dependent Rois constraints changed.

`constraint`: Pointer to the array in which the new dependent Rois constraints are stored.

7.3.5.2 *PicamDependentPulseConstraintChangedCallback()*

Description

PicamDependentPulseConstraintChangedCallback() is the change notification callback function called when a parameter's dependent gate pulse constraints have been changed.

Syntax

The syntax for PicamDependentPulseConstraintChangedCallback() is:

```
typedef PicamError (PIL_CALL*
        PicamDependentPulseConstraintChangedCallback)
(
                       PicamHandle  camera,
                    PicamParameter  parameter,
   const PicamPulseConstraint*  constraint);
```

Input Parameters

Input parameters for PicamDependentPulseConstraintChangedCallback() are:

`camera`: Handle for the camera for which a parameter's dependent gate pulse constraints have been changed.

`parameter`: The parameter which has had its dependent gate pulse constraints changed.

`constraint`: Pointer to the array in which the new dependent gate pulse constraints are stored.

7.3.5.3 *PicamDependentModulationsConstraintChangedCallback()*

Description

PicamDependentModulationsConstraintChangedCallback() is the change notification callback function called when a parameter's dependent intensifier modulations sequence constraints have been changed.

Syntax

The syntax for PicamDependentModulationsConstraintChangedCallback() is:

```
typedef PicamError (PIL_CALL* PicamDependentModulationsConstraint
        ChangedCallback)
(
                              PicamHandle  camera,
                           PicamParameter  parameter,
  const PicamModulationsConstraint*  constraint);
```

Input Parameters

Input parameters for PicamDependentModulationsConstraintChangedCallback() are:

- `camera:` Handle for the camera for which a parameter's dependent intensifier modulations sequence constraints have been changed.
- `parameter:` The parameter which has had its dependent intensifier modulations sequence constraints changed.
- `constraint:` Pointer to the array in which the new dependent intensifier modulations sequence constraints are stored.

7.3.6 Shared Camera/Accessory Parameter Constraints Callbacks

This section provides programming information about shared camera and accessory parameter constraints callbacks.

7.3.6.1 *PicamDependentCollectionConstraintChangedCallback()*

Description

PicamDependentCollectionConstraintChangedCallback() is the change notification callback function called when a parameter's dependent collection constraints have been changed.

Syntax

The syntax for PicamDependentCollectionConstraintChangedCallback() is:

```
typedef PicamError (PIL_CALL*PicamDependentCollectionConstraint
      ChangedCallback)
(
                              PicamHandle  camera_or_accessory,
                           PicamParameter  parameter,
   const PicamCollectionConstraint*  constraint);
```

Input Parameters

Input parameters for PicamDependentCollectionConstraintChangedCallback() are:

camera_or_accessory:	Handle for the hardware for which a parameter's dependent collection constraints have been changed.
parameter:	The parameter which has had its dependent collection constraints changed.
constraint:	Pointer to the array in which the new dependent collection constraints are stored.

7.3.6.2 *PicamDependentRangeConstraintChangedCallback()*

Description

PicamDependentRangeConstraintChangedCallback() is the change notification callback function called when a parameter's dependent range constraints have been changed.

Syntax

The syntax for PicamDependentRangeConstraintChangedCallback() is:

```
typedef PicamError (PIL_CALL*PicamDependentRangeConstraint
      ChangedCallback)
(
                         PicamHandle  camera_or_accessory,
                      PicamParameter  parameter,
   const PicamRangeConstraint*  constraint);
```

Input Parameters

Input parameters for PicamDependentRangeConstraintChangedCallback() are:

camera_or_accessory:	Handle for the hardware for which a parameter's dependent range constraints have been changed.
parameter:	The parameter which has had its dependent range constraints changed.
constraint:	Pointer to the array in which the new dependent range constraints are stored.

7.3.7 Camera-Specific Data Acquisition Callbacks

This section provides programming information about camera-specific data acquisition callbacks.

7.3.7.1 PicamAcquisitionUpdatedCallback()

Description

PicamAcquisitionUpdatedCallback() is the change notification callback function called when a camera's data acquisition status has changed.

Syntax

The syntax for PicamAcquisitionUpdatedCallback() is:

```
typedef PicamError (PIL_CALL* PicamAcquisitionUpdatedCallback)
(
                            PicamHandle  device,
            const PicamAvailableData*  available,
       const PicamAcquisitionStatus*  status);
```

Input Parameters

Input parameters for PicamAcquisitionUpdatedCallback() are:

device:	Handle for the camera which is acquiring data.
available:	Pointer to the array in which newly acquired data are stored. If no data are available, this is null.
status:	Pointer to the data acquisition status.

7.3.7.2 PicamAcquisitionStateUpdatedCallback()

Description

PicamAcquisitionStateUpdatedCallback() is the notification callback function called when a camera has transitioned into the acquisition state requested for detection.

Syntax

The syntax for PicamAcquisitionStateUpdatedCallback() is:

```
typedef PicamError (PIL_CALL* PicamAcquisitionStateUpdatedCallback)
(
                            PicamHandle  device,
                PicamAcquisitionState  current,
const PicamAcquisitionStateCounters* counters,
     PicamAcquisitionStateErrorsMask  errors);
```

Input Parameters

Input parameters for PicamAcquisitionStateUpdatedCallback() are:

device:	Handle for the device which transitioned into the acquisition state.
current:	Acquisition state whose transition was detected.
counters:	Pointer to the counted transitions at the time of detection.
errors:	Indicates if any errors have occurred.

7.4 Programmers' Reference for Advanced APIs

This section provides detailed programming information for the following advanced APIs:

- Camera-Specific Advanced Discovery APIs
  - PicamAdvanced_RegisterForDiscovery()
  - PicamAdvanced_UnregisterForDiscovery()
  - PicamAdvanced_DiscoverCameras()
  - PicamAdvanced_StopDiscoveringCameras()
  - PicamAdvanced_IsDiscoveringCameras()
- Accessory-Specific Advanced Discovery APIs
  - PicamAccessory_RegisterForDiscovery()
  - PicamAccessory_UnregisterForDiscovery()
  - PicamAccessory_DiscoverAccessories()
  - PicamAccessory_StopDiscoveringAccessories()
  - PicamAccessory_IsDiscoveringAccessories()
- Camera-Specific Advanced Access APIs
  - PicamAdvanced_OpenCameraDevice()
  - PicamAdvanced_CloseCameraDevice()
  - PicamAdvanced_GetOpenCameraDevices()
  - PicamAdvanced_GetCameraModel()
  - PicamAdvanced_GetCameraDevice()
- Shared Camera/Accessory Advanced Access APIs
  - PicamAdvanced_GetHandleType()
- Camera-Specific Information APIs
  - PicamAdvanced_DestroyPixelDefectMaps()
  - PicamAdvanced_GetPixelDefectMap()
  - PicamAdvanced_DestroyStarDefectMaps()
  - PicamAdvanced_GetStarDefectMap()
  - PicamAdvanced_GetStarDefectMaps()
- Accessory-Specific Information APIs
  - PicamAccessory_GetLightSourceReference()
- Shared Camera/Accessory Advanced Information APIs
  - PicamAdvanced_GetUserState()
  - PicamAdvanced_SetUserState()
- Camera-Specific Advanced Parameter Value APIs
  - PicamAdvanced_RegisterForLargeIntegerValueChanged()
  - PicamAdvanced_UnregisterForLargeIntegerValueChanged()
  - PicamAdvanced_RegisterForRoisValueChanged()
  - PicamAdvanced_UnregisterForRoisValueChanged()
  - PicamAdvanced_RegisterForPulseValueChanged()
  - PicamAdvanced_UnregisterForPulseValueChanged()
  - PicamAdvanced_RegisterForModulationsValueChanged()
  - PicamAdvanced_UnregisterForModulationsValueChanged()
- Shared Camera/Accessory Advanced Parameter Value APIs
  - PicamAdvanced_RegisterForIntegerValueChanged()
  - PicamAdvanced_UnregisterForIntegerValueChanged()
  - PicamAdvanced_RegisterForExtrinsicIntegerValueChanged()
  - PicamAdvanced_UnregisterForExtrinsicIntegerValueChanged()
  - PicamAdvanced_RegisterForFloatingPointValueChanged()
  - PicamAdvanced_UnregisterForFloatingPointValueChanged()
  - PicamAdvanced_RegisterForExtrinsicFloatingPointValueChanged()
  - PicamAdvanced_UnregisterForExtrinsicFloatingPointValueChanged()
  - PicamAdvanced_NotifyWhenStatusParameterValue()
  - PicamAdvanced_CancelNotifyWhenStatusParameterValue()

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- Shared Camera/Accessory Advanced Parameter Information APIs
  - PicamAdvanced_RegisterForIsRelevantChanged()
  - PicamAdvanced_UnregisterForIsRelevantChanged()
  - PicamAdvanced_RegisterForValueAccessChanged()
  - PicamAdvanced_UnregisterForValueAccessChanged()
  - PicamAdvanced_GetParameterDynamics()
  - PicamAdvanced_GetParameterExtrinsicDynamics()
- Camera-Specific Advanced Parameter Constraints APIs
  - PicamAdvanced_GetParameterRoisConstraints()
  - PicamAdvanced_RegisterForDependentRoisConstraintChanged()
  - PicamAdvanced_UnregisterForDependentRoisConstraintChanged()
  - PicamAdvanced_GetParameterPulseConstraints()
  - PicamAdvanced_RegisterForDependentPulseConstraintChanged()
  - PicamAdvanced_UnregisterForDependentPulseConstraintChanged()
  - PicamAdvanced_GetParameterModulationsConstraints()
  - PicamAdvanced_RegisterForDependentModulationsConstraintChanged()
  - PicamAdvanced_UnregisterForDependentModulationsConstraintChanged()
- Shared Camera/Accessory Advanced Parameter Constraints APIs
  - PicamAdvanced_GetParameterCollectionConstraints()
  - PicamAdvanced_RegisterForDependentCollectionConstraintChanged()
  - PicamAdvanced_UnregisterForDependentCollectionConstraintChanged()
  - PicamAdvanced_GetParameterRangeConstraints()
  - PicamAdvanced_RegisterForDependentRangeConstraintChanged()
  - PicamAdvanced_UnregisterForDependentRangeConstraintChanged()
- Camera-Specific Advanced Commitment APIs
  - Picam_DestroyValidationResult()
  - Picam_DestroyValidationResults()
  - PicamAdvanced_ValidateParameter()
  - PicamAdvanced_ValidateParameters()
  - Picam_DestroyDependentValidationResult()
  - PicamAdvanced_ValidateDependentParameter()
  - PicamAdvanced_CommitParametersToCameraDevice()
  - PicamAdvanced_RefreshParameterFromCameraDevice()
  - PicamAdvanced_RefreshParametersFromCameraDevice()
- Camera-Specific Advanced Acquisition Setup APIs
  - PicamAdvanced_GetAcquisitionBuffer()
  - PicamAdvanced_SetAcquisitionBuffer()
- Camera-Specific Advanced Acquisition Notification APIs
  - PicamAdvanced_RegisterForAcquisitionUpdated()
  - PicamAdvanced_UnregisterForAcquisitionUpdated()
- Camera-Specific Advanced Acquisition State Notification APIs
  - PicamAdvanced_CanRegisterForAcquisitionStateUpdated()
  - PicamAdvanced_RegisterForAcquisitionStateUpdated()
  - PicamAdvanced_UnregisterForAcquisitionStateUpdated()
- Camera-Specific Advanced Acquisition Control APIs
  - PicamAdvanced_HasAcquisitionBufferOverrun()
  - PicamAdvanced_CanClearReadoutCountOnline()
  - PicamAdvanced_ClearReadoutCountOnline()

7.4.1 Camera-Specific Advanced Discovery APIs

This section provides programming information for advanced camera-specific discovery APIs.

7.4.1.1 PicamAdvanced_RegisterForDiscovery()

Description

`PicamAdvanced_RegisterForDiscovery()` registers a function to call when camera discovery is made.

NOTE:

Multiple functions may be registered. When this is the case, the functions are called in the order in which they have been registered.

Callback functions are called when any camera state that affects availability changes, such as when:

- A camera is powered on and/or connected to the host computer;
- A connected camera is powered off or disconnected from the host computer;
- A camera is opened in another process;
- A camera is closed in another process.

Callback functions are also called when a camera has suffered a critical malfunction.

Callbacks are called asynchronously from another thread, but are serialized on that thread. This means that additional notifications do not occur simultaneously, but occur after each callback returns.

A camera may be unavailable for multiple reasons. Therefore, although callbacks may repeatedly indicate a camera is lost each time one of the above states change, but the camera is still not available.

Call `PicamAdvanced_UnregisterForDiscovery()` to unregister each callback once it is no longer required.

Syntax

The syntax for `PicamAdvanced_RegisterForDiscovery()` is:

```
PICAM_API PicamAdvanced_RegisterForDiscovery(
                            PicamDiscoveryCallback  discover)
```

Input Parameters

Input parameters for `PicamAdvanced_RegisterForDiscovery()` are:

`discover`: The name assigned to the discovery callback function being registered.

Output Parameters

There are no output parameters associated with `PicamAdvanced_RegisterForDiscovery()`.

Related APIs

For additional information, refer to the following related APIs:

- `PicamAdvanced_UnregisterForDiscovery()`

7.4.1.2 *PicamAdvanced_UnregisterForDiscovery()*

Description

PicamAdvanced_UnregisterForDiscovery() removes the function from the discovery process such that it is no longer called when a camera discovery is made.

Syntax

The syntax for PicamAdvanced_UnregisterForDiscovery() is:

```
PICAM_API PicamAdvanced_UnregisterForDiscovery(
                              PicamDiscoveryCallback  discover);
```

Input Parameters

Input parameters for PicamAdvanced_UnregisterForDiscovery() are:

discover: The name assigned to the discovery callback function being unregistered.

Output Parameters

There are no output parameters associated with PicamAdvanced_UnregisterForDiscovery().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_RegisterForDiscovery()

7.4.1.3 *PicamAdvanced_DiscoverCameras()*

Description

PicamAdvanced_DiscoverCameras() asynchronously initiates the camera discovery process.

To halt the discovery process, call PicamAdvanced_StopDiscoveringCameras().

Syntax

The syntax for PicamAdvanced_DiscoverCameras() is:

```
PICAM_API PicamAdvanced_DiscoverCameras (void);
```

Input Parameters

There are no input parameters associated with PicamAdvanced_DiscoverCameras().

Output Parameters

There are no output parameters associated with PicamAdvanced_DiscoverCameras().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_StopDiscoveringCameras()

7.4.1.4 *PicamAdvanced_StopDiscoveringCameras()*

Description

PicamAdvanced_StopDiscoveringCameras() stops the camera discovery process.

Syntax

The syntax for PicamAdvanced_StopDiscoveringCameras() is:

```
PICAM_API PicamAdvanced_StopDiscoveringCameras (void);
```

Input Parameters

There are no input parameters associated with PicamAdvanced_StopDiscoveringCameras().

Output Parameters

There are no output parameters associated with PicamAdvanced_StopDiscoveringCameras().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_DiscoverCameras()

7.4.1.5 *PicamAdvanced_IsDiscoveringCameras()*

Description

PicamAdvanced_IsDiscoveringCameras() determines if camera discovery is enabled.

Syntax

The syntax for PicamAdvanced_IsDiscoveringCameras() is:

```
PICAM_API PicamAdvanced_IsDiscoveringCameras(
                                pibln*  discovering);
```

Input Parameters

There are no input parameters associated with PicamAdvanced_IsDiscoveringCameras().

Output Parameters

Output parameters for PicamAdvanced_IsDiscoveringCameras() are:

discovering: Indicates if camera discovery is currently enabled.
Valid values are:

- TRUE
  Camera discovery is enabled.
- FALSE
  Camera discovery is disabled.

7.4.2 Accessory-Specific Advanced Discovery APIs

This section provides programming information for accessory-specific advanced discovery APIs.

7.4.2.1 `PicamAccessory_RegisterForDiscovery()`

Description

`PicamAccessory_RegisterForDiscovery()` registers a function to call when accessory discovery is made.

NOTE:

Multiple functions may be registered. When this is the case, the functions are called in the order in which they have been registered.

Callback functions are called when any accessory state that affects availability changes, such as when:

- An accessory is powered on and/or connected to the host computer;
- A connected accessory is powered off or disconnected from the host computer;
- An accessory is opened in another process;
- An accessory is closed in another process.

Callback functions are also called when an accessory has suffered a critical malfunction.

Callbacks are called asynchronously from another thread, but are serialized on that thread. This means that additional notifications do not occur simultaneously, but occur after each callback returns.

An accessory may be unavailable for multiple reasons. Therefore, although callbacks may repeatedly indicate an accessory is lost each time one of the above states change, but the accessory is still not available.

Call `PicamAccessory_UnregisterForDiscovery()` to unregister each callback once it is no longer required.

Syntax

The syntax for `PicamAccessory_RegisterForDiscovery()` is:

```
PICAM_API PicamAccessory_RegisterForDiscovery(
                PicamAccessoryDiscoveryCallback  discover)
```

Input Parameters

Input parameters for `PicamAccessory_RegisterForDiscovery()` are:

`discover`: The name assigned to the discovery callback function being registered.

Output Parameters

There are no output parameters associated with `PicamAdvanced_RegisterForDiscovery()`.

Related APIs

For additional information, refer to the following related APIs:

- `PicamAccessory_UnregisterForDiscovery()`

7.4.2.2 PicamAccessory_UnregisterForDiscovery()

Description

PicamAccessory_UnregisterForDiscovery() removes the function from the discovery process such that it is no longer called when an accessory discovery is made.

Syntax

The syntax for PicamAccessory_UnregisterForDiscovery() is:

```
PICAM_API PicamAccessory_UnregisterForDiscovery(
                              PicamAccessoryDiscoveryCallback  discover);
```

Input Parameters

Input parameters for PicamAccessory_UnregisterForDiscovery() are:

discover: The name assigned to the discovery callback function being unregistered.

Output Parameters

There are no output parameters associated with PicamAccessory_UnregisterForDiscovery().

Related APIs

For additional information, refer to the following related APIs:

- PicamAccessory_RegisterForDiscovery()

7.4.2.3 PicamAccessory_DiscoverAccessories()

Description

PicamAccessory_DiscoverAccessories() asynchronously initiates the accessory discovery process.

To halt the discovery process, call PicamAccessory_StopDiscoveringAccessories().

Syntax

The syntax for PicamAccessory_DiscoverAccessories() is:

```
PICAM_API PicamAccessory_DiscoverAccessories (void);
```

Input Parameters

There are no input parameters associated with PicamAccessory_DiscoverAccessories().

Output Parameters

There are no output parameters associated with PicamAccessory_DiscoverAccessories().

Related APIs

For additional information, refer to the following related APIs:

- PicamAccessory_StopDiscoveringAccessories()

7.4.2.4 *PicamAccessory_StopDiscoveringAccessories()*

Description

PicamAccessory_StopDiscoveringAccessories() stops the accessory discovery process.

Syntax

The syntax for PicamAccessory_StopDiscoveringAccessories() is:

```
PICAM_API PicamAccessory_StopDiscoveringAccessories (void);
```

Input Parameters

There are no input parameters associated with PicamAccessory_StopDiscoveringAccessories().

Output Parameters

There are no output parameters associated with PicamAccessory_StopDiscoveringAccessories().

Related APIs

For additional information, refer to the following related APIs:

- PicamAccessory_DiscoverAccessories()

7.4.2.5 *PicamAccessory_IsDiscoveringAccessories()*

Description

PicamAccessory_IsDiscoveringAccessories() determines if accessory discovery is enabled.

Syntax

The syntax for PicamAccessory_IsDiscoveringAccessories() is:

```
PICAM_API PicamAccessory_IsDiscoveringAccessories(
                                                  pibln*  discovering);
```

Input Parameters

There are no input parameters associated with PicamAccessory_IsDiscoveringAccessories().

Output Parameters

Output parameters for PicamAccessory_IsDiscoveringAccessories() are:

discovering: Indicates if accessory discovery is currently enabled. Valid values are:

- TRUE
  Accessory discovery is enabled.
- FALSE
  Accessory discovery is disabled.

7.4.3 Camera-Specific Advanced Access APIs

This section provides programming information for camera-specific advanced access APIs.

7.4.3.1 *PicamAdvanced_OpenCameraDevice()*

Description

`PicamAdvanced_OpenCameraDevice()` opens the specified camera and returns a handle to the device.

When done, all resources that have been assigned for use by the camera/device must be released by calling:

- `Picam_CloseCamera();` or
- `PicamAdvanced_CloseCameraDevice()`.

Syntax

The syntax for `PicamAdvanced_OpenCameraDevice()` is:

```
PICAM_API PicamAdvanced_OpenCameraDevice(
                          const PicamCameraID*  id,
                                PicamHandle*    device);
```

Input Parameters

Input parameters for `PicamAdvanced_OpenCameraDevice()` are:

`id`: Pointer to the camera id for the camera device to be opened.

Output Parameters

Output parameters for `PicamAdvanced_OpenCameraDevice()` are:

`device`: Pointer to the handle assigned to the camera device that has been opened.

Related APIs

For additional information, refer to the following related APIs:

- `Picam_CloseCamera();`
- `PicamAdvanced_CloseCameraDevice()`.

7.4.3.2 *PicamAdvanced_CloseCameraDevice()*

Description

`PicamAdvanced_CloseCameraDevice()` releases all resources associated with the specified device.

Syntax

The syntax for `PicamAdvanced_CloseCameraDevice()` is:

```
PICAM_API PicamAdvanced_CloseCameraDevice(
                                  PicamHandle  device)
```

Input Parameters

Input parameters for `PicamAdvanced_CloseCameraDevice()` are:

`device`: Handle for the camera for which all resources are to be released.

Output Parameters

There are no output parameters associated with `PicamAdvanced_CloseCameraDevice()`.

7.4.3.3 *PicamAdvanced_GetOpenCameraDevices()*

Description

PicamAdvanced_GetOpenCameraDevices() returns an allocated array of open camera device handles.

in device_array whose number of items is in device_count.

Returns null and 0 (respectively) if no cameras are opened in this process

Syntax

The syntax for PicamAdvanced_GetOpenCameraDevices() is:

```
PICAM_API PicamAdvanced_GetOpenCameraDevices(
                        const PicamHandle**  device_array,
                                     piint*  device_count);
```

Input Parameters

There are no input parameters associated with PicamAdvanced_GetOpenCameraDevices().

Output Parameters

Output parameters for PicamAdvanced_GetOpenCameraDevices() are:

`device_array`: Pointer to the array in which the list of handles for open camera devices is stored.
This is null when there are no open camera devices.

NOTE: This memory is allocated by PICam and must be released by calling Picam_DestroyHandles().

`device_count`: Pointer to the memory location in which the number of open camera devices is stored.
This is 0 when there are no open camera devices.

Related APIs

For additional information, refer to the following related APIs:

- Picam_DestroyHandles()

7.4.3.4 *PicamAdvanced_GetCameraModel()*

Description

PicamAdvanced_GetCameraModel() returns the handle for a specified camera model.

Syntax

The syntax for PicamAdvanced_GetCameraModel() is:

```
PICAM_API PicamAdvanced_GetCameraModel(
                         PicamHandle  camera,
                        PicamHandle*  model);
```

Input Parameters

Input parameters for PicamAdvanced_GetCameraModel() are:

`camera`: Specifies the camera model or camera device for which the handle is to be returned.

Output Parameters

Output parameters for PicamAdvanced_GetCameraModel() are:

`model`: Pointer to the memory location in which the handle for the camera model is stored.

7.4.3.5 *PicamAdvanced_GetCameraDevice()*

Description

PicamAdvanced_GetCameraDevice() returns the handle for a specified camera device.

Syntax

The syntax for PicamAdvanced_GetCameraDevice() is:

```
PICAM_API PicamAdvanced_GetCameraDevice(
                                PicamHandle  camera,
                               PicamHandle*  device);
```

Input Parameters

Input parameters for PicamAdvanced_GetCameraDevice() are:

`camera`: Specifies the camera device or camera model for which the handle is to be returned.

Output Parameters

Output parameters for PicamAdvanced_GetCameraDevice() are:

`device`: Pointer to the memory location in which the handle for the camera device is stored.

7.4.4 Shared Camera/Accessory Advanced Access APIs

This section provides programming information for shared camera and accessory advanced access APIs.

7.4.4.1 PicamAdvanced_GetHandleType()

Description

PicamAdvanced_GetHandleType() returns the type of handle for a specified handle.

Syntax

The syntax for PicamAdvanced_GetHandleType() is:

```
PICAM_API PicamAdvanced_GetHandleType(
                              PicamHandle  handle,
                         PicamHandleType*  type);
```

Input Parameters

Input parameters for PicamAdvanced_GetHandleType() are:

`handle`: Handle for which the handle type is to be determined.

Output Parameters

Output parameters for PicamAdvanced_GetHandleType() are:

`type`: The handle type for the specified handle.

7.4.5 Camera-Specific Information APIs

This section provides programming information about advanced camera-specific information APIs.

7.4.5.1 *PicamAdvanced_DestroyPixelDefectMaps()*

Description

PicamAdvanced_DestroyPixelDefectMaps() releases memory that has been allocated by PICam for use by defect_map_array.

If defect_map_array is null, calling PicamAdvanced_DestroyPixelDefectMaps() has no effect.

NOTE:

defect_map_array may be a single PicamPixelDefectMap allocated by PICam.

Syntax

The syntax for PicamAdvanced_DestroyPixelDefectMaps() is:

```
PICAM_API PicamAdvanced_DestroyPixelDefectMaps(
            const PicamPixelDefectMap*  pixel_defect_map_array);
```

Input Parameters

Input parameters for PicamAdvanced_DestroyPixelDefectMaps() are:

pixel_defect_map_array: Pointer to the array that is to be released.

Output Parameters

There are no output parameters associated with PicamAdvanced_DestroyPixelDefectMaps().

Related Structures

For additional information, refer to the following related structures:

- PicamPixelDefectMap

7.4.5.2 *PicamAdvanced_GetPixelDefectMap()*

Description

PicamAdvanced_GetPixelDefectMap() returns an allocated array/map in which defective pixel information for a specified camera is stored.

Syntax

The syntax for PicamAdvanced_GetPixelDefectMap() is:

```
PICAM_API PicamAdvanced_GetPixelDefectMap(
                              PicamHandle  camera,
            const PicamPixelDefectMap**  pixel_defect_map);
```

Input Parameters

Input parameters for PicamAdvanced_GetPixelDefectMap() are:

`camera`: Handle for the camera for which PicamPixelDefectMap is to be returned.
Valid values are:

- `device` handle;
- `model` handle.

NOTE: `device` and `model` share the same PicamPixelDefectMap.

Output Parameters

Output parameters for PicamAdvanced_GetPixelDefectMap() are:

`pixel_defect_map`: Pointer to the PicamPixelDefectMap array in which defective pixel information is stored.
When no information is available for the specified camera, this is an array describing zero defects.

NOTE: This memory is allocated by PICam and must be released by calling PicamAdvanced_DestroyPixelDefectMaps().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_DestroyPixelDefectMaps()

Related Structures

For additional information, refer to the following related structures:

- PicamPixelDefectMap

7.4.5.3 *PicamAdvanced_DestroyStarDefectMaps()*

Description

`PicamAdvanced_DestroyStarDefectMaps()` releases memory that has been allocated by PICam for use by `star_defect_map_array`.

If `star_defect_map_array` is null, calling `PicamAdvanced_DestroyStarDefectMaps()` has no effect.

NOTE:

`star_defect_map_array` may be a single `PicamStarDefect` allocated by PICam.

Syntax

The syntax for `PicamAdvanced_DestroyStarDefectMaps()` is:

```
PICAM_API PicamAdvanced_DestroyStarDefectMaps(
                const PicamStarDefectMap*  star_defect_map_array);
```

Input Parameters

Input parameters for `PicamAdvanced_DestroyStarDefectMaps()` are:

`pixel_stardefect_map_array`: Pointer to the array that is to be released.

Output Parameters

There are no output parameters associated with `PicamAdvanced_DestroyStarDefectMaps()`.

Related Structures

For additional information, refer to the following related structures:

- `PicamStarDefectMap`

7.4.5.4 *PicamAdvanced_GetStarDefectMap()*

Description

PicamAdvanced_GetStarDefectMap() returns an allocated array/map in which star defect information for a specific camera is stored. If there are multiple maps, the map returned is appropriate based on the current camera parameters.

Syntax

The syntax for PicamAdvanced_GetStarDefectMap() is:

```
PICAM_API PicamAdvanced_GetStarDefectMap(
                            PicamHandle  camera
          const PicamStarDefectMap**  star_defect_map);
```

Input Parameters

Input parameters for PicamAdvanced_GetStarDefectMap() are:

`camera`: Handle for the camera for which PicamStarDefectMap is to be returned.

Valid values are:

- `device` handle;
- `model` handle.

NOTE: `device` and `model` share the same PicamStarDefectMap.

Output Parameters

Output parameters for PicamAdvanced_GetStarDefectMap() are:

`star_defect_map`: Pointer to the PicamStarDefectMaparray in which star defect information is stored.

When no information is available for the specified camera, this is an array describing zero defects.

NOTE: This memory is allocated by PICam and must be released by calling PicamAdvanced_DestroyStarDefectMaps()

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_DestroyStarDefectMaps()
- PicamAdvanced_GetStarDefectMaps()

Related Structures

For additional information, refer to the following related structures:

- PicamStarDefectMap

7.4.5.5 *PicamAdvanced_GetStarDefectMaps()*

Description

PicamAdvanced_GetStarDefectMaps() returns an allocated array of arrays/maps in which star defect information for a specific camera is stored. All star defect maps for the camera are returned. If there is more than one map, only one map applies based on the current camera parameters. The value of the PicamParameter_ApplicableStarDefectMapID will specify which one. Alternatively, PicamAdvanced_GetStarDefectMaps() can be called to get the applicable map.

Syntax

The syntax for PicamAdvanced_GetStarDefectMaps() is:

```
PICAM_API PicamAdvanced_GetStarDefectMaps(
                             PicamHandle  camera
              const PicamStarDefectMap**  star_defect_map_array
                                  piint*  star_defect_map_count);
```

Input Parameters

Input parameters for PicamAdvanced_GetStarDefectMaps() are:

`camera`: Handle for the camera for which PicamPixelDefectMap is to be returned.
Valid values are:

- `device` handle;
- `model` handle.

NOTE: `device` and `model` share the same PicamStarDefectMap.

Output Parameters

Output parameters for PicamAdvanced_GetStarDefectMaps() are:

`star_defect_map_array`: Pointer to the array of PicamStarDefectMap arrays in which star defect information is stored.
When no information is available for the specified camera, this is an array containing one array describing zero defects.

NOTE: This memory is allocated by PICam and must be released by calling PicamAdvanced_DestroyStarDefectMaps()

`star_defect_map_count`: Pointer to the memory location in which the number of star defect maps is stored.

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_DestroyStarDefectMaps()
- PicamAdvanced_GetStarDefectMaps()

Related Structures

For additional information, refer to the following related structures:

- PicamStarDefectMap

7.4.6 Accessory-Specific Information APIs

This section provides programming information about advanced accessory-specific information APIs.

7.4.6.1 PicamAccessory_GetLightSourceReference()

Description

PicamAccessory_GetLightSourceReference() returns a wavelength reference calibration for an accessory.

NOTE:

Prior to program termination, memory that has been dynamically allocated to calibration_array must be released by calling Picam_DestroyCalibrations().

Syntax

The syntax for PicamAccessory_GetLightSourceReference() is:

```
PICAM_API PicamAccessory_GetLightSourceReference(
                                  PicamHandle  accessory,
                       const PicamCalibration**  counts_vs_nm);
```

Input Parameters

Input parameters for PicamAccessory_GetLightSourceReference() are:

accessory: Handle for the accessory for which the light source reference is returned.

Output Parameters

Output parameters for PicamAccessory_GetLightSourceReference() are:

counts_vs_nm: Pointer to the allocated wavelength reference calibration where the x-coordinates are wavelengths, in nanometers (nm), and the y-coordinates are the intensity values at those wavelengths.

Related APIs

For additional information, refer to the following related APIs:

- Picam_DestroyCalibrations().

Related Structures

For additional information, refer to the following related structure definition:

- PicamCalibration.

7.4.7 Shared Camera/Accessory Advanced Information APIs

This section provides programming information about shared camera and accessory advanced information APIs.

7.4.7.1 *PicamAdvanced_GetUserState()*

Description

`PicamAdvanced_GetUserState()` returns user-state information for the specified hardware. This is especially useful when using callbacks as this can give access to user-defined state within the callback.

NOTE:

This API is thread safe.

Syntax

The syntax for `PicamAdvanced_GetUserState()` is:

```
PICAM_API PicamAdvanced_GetUserState(
                                PicamHandle  camera_or_accessory,
                                     void**  user_state);
```

Input Parameters

Input parameters for `PicamAdvanced_GetUserState()` are:

`camera_or_accessory`: Handle for the hardware for which user state information is to be returned.

Valid values are:

- `device` handle;
- `model` handle.

NOTE: `device` and `model` share the same user state.

Output Parameters

Output parameters for `PicamAdvanced_GetUserState()` are:

`user_state`: Pointer to the memory location where user-state information is stored.

7.4.7.2 *PicamAdvanced_SetUserState()*

Description

PicamAdvanced_SetUserState() sets user-state information for the specified hardware. This is especially useful when using callbacks as this can give access to user-defined state within the callback.

NOTE:

This API is thread safe.

Syntax

The syntax for PicamAdvanced_SetUserState() is:

```
PICAM_API PicamAdvanced_SetUserState(
                                    PicamHandle  camera_or_accessory,
                                          void*  user_state);
```

Input Parameters

Input parameters for PicamAdvanced_SetUserState() are:

`camera_or_accessory`: Handle for the hardware for which user state information is to be configured.

Valid values are:

- `device` handle;
- `model` handle.

NOTE: `device` and `model` share the same user state.

Output Parameters

Output parameters for PicamAdvanced_SetUserState() are:

`user_state`: Pointer to the memory location where user-state information is stored.

7.4.8 Camera-Specific Advanced Parameter Value APIs

This section provides programming information for camera-specific advanced parameter value APIs.

7.4.8.1 *PicamAdvanced_RegisterForLargeIntegerValueChanged()*

Description

PicamAdvanced_RegisterForLargeIntegerValueChanged() registers a function to call when the large integer value for specified camera parameter has been set, even if it is changed as a result of a different parameter's value being changed.

NOTE:

Multiple functions may be registered. When this occurs, functions are called in the order in which they have been registered.

Registered callbacks are called synchronously from within the thread in which associated parameter values are being set (i.e., called prior to returning from the set operation.)

NOTE:

Parameters whose values have change due to external influences (e.g., representing the status of camera hardware,) do not result in a callback's being called.

Call PicamAdvanced_UnregisterForLargeIntegerValueChanged() to unregister each callback once it is no longer required.

Syntax

The syntax for PicamAdvanced_RegisterForLargeIntegerValueChanged() is:

```
PICAM_API PicamAdvanced_RegisterForLargeIntegerValueChanged(
                                              PicamHandle  camera,
                                           PicamParameter  parameter,
                        PicamLargeIntegerValueChangedCallback  changed);
```

Input Parameters

Input parameters for PicamAdvanced_RegisterForLargeIntegerValueChanged() are:

camera:	Handle for the camera for which the callback is being registered.
parameter:	The parameter for which the callback is being registered.
changed:	The name assigned to the callback function being registered.

Output Parameters

There are no output parameters associated with PicamAdvanced_RegisterForLargeIntegerValueChanged().

Related APIs

For additional information, refer to the following related APIs:

- Picam_SetParameterLargeIntegerValue().
- PicamAdvanced_UnregisterForLargeIntegerValueChanged().
- PicamAdvanced_GetUserState().
- PicamAdvanced_SetUserState().

7.4.8.2 *PicamAdvanced_UnregisterForLargeIntegerValueChanged()*

Description

PicamAdvanced_UnregisterForLargeIntegerValueChanged() removes the callback function so that it is no longer called when the large integer value for a specified parameter is changed.

Syntax

The syntax for PicamAdvanced_UnregisterForLargeIntegerValueChanged() is:

```
PICAM_API PicamAdvanced_UnregisterForLargeIntegerValueChanged(
                                            PicamHandle  camera,
                                         PicamParameter  parameter,
                   PicamLargeIntegerValueChangedCallback  changed);
```

Input Parameters

Input parameters for PicamAdvanced_UnregisterForLargeIntegerValueChanged() are:

camera: Handle for the camera for which the callback is being unregistered.

parameter: The parameter for which the callback is being unregistered.

changed: The name assigned to the callback function being unregistered.

Output Parameters

There are no output parameters associated with PicamAdvanced_UnregisterForLargeIntegerValueChanged().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_RegisterForLargeIntegerValueChanged().
- PicamAdvanced_GetUserState().
- PicamAdvanced_SetUserState().

7.4.8.3 *PicamAdvanced_RegisterForRoisValueChanged()*

Description

PicamAdvanced_RegisterForRoisValueChanged() registers a function to call when the value of a specified Rois parameter has been set, even if it is changed as a result of a different parameter's value being changed.

NOTE:

Multiple functions may be registered. When this is the case, the functions are called in the order in which they have been registered.

Registered callbacks are called synchronously from within the thread in which associated parameter values are being set (i.e., called prior to returning from the set operation.)

NOTE:

Parameters whose values have change due to external influences (e.g., representing the status of camera hardware,) do not result in a callback's being called.

Call PicamAdvanced_UnregisterForRoisValueChanged() to unregister each callback once it is not longer required.

Syntax

The syntax for PicamAdvanced_RegisterForRoisValueChanged() is:

```
PICAM_API PicamAdvanced_RegisterForRoisValueChanged(
                                    PicamHandle  camera,
                                 PicamParameter  parameter,
                  PicamRoisValueChangedCallback  changed);
```

Input Parameters

Input parameters for PicamAdvanced_RegisterForRoisValueChanged() are:

camera:	Handle for the camera for which the callback is being registered.
parameter:	The parameter for which the callback is being registered.
changed:	The name assigned to the callback function being registered.

Output Parameters

There are no output parameters associated with PicamAdvanced_RegisterForRoisValueChanged().

Related APIs

For additional information, refer to the following related APIs:

- Picam_SetParameterRoisValue().
- PicamAdvanced_UnregisterForRoisValueChanged().
- PicamAdvanced_GetUserState().
- PicamAdvanced_SetUserState().

7.4.8.4 *PicamAdvanced_UnregisterForRoisValueChanged()*

Description

PicamAdvanced_UnregisterForRoisValueChanged() removes the callback function so that it is no longer called when the value of a specified Rois parameter is changed.

Syntax

The syntax for PicamAdvanced_UnregisterForRoisValueChanged() is:

```
PICAM_API PicamAdvanced_UnregisterForRoisValueChanged(
                                             PicamHandle  camera,
                                          PicamParameter  parameter,
                            PicamRoisValueChangedCallback  changed);
```

Input Parameters

Input parameters for PicamAdvanced_UnregisterForRoisValueChanged() are:

camera:	Handle for the camera for which the callback is being unregistered.
parameter:	The parameter for which the callback is being unregistered.
changed:	The name assigned to the callback function being unregistered.

Output Parameters

There are no output parameters associated with PicamAdvanced_UnregisterForRoisValueChanged().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_RegisterForRoisValueChanged().
- PicamAdvanced_GetUserState().
- PicamAdvanced_SetUserState().

7.4.8.5 *PicamAdvanced_RegisterForPulseValueChanged()*

Description

PicamAdvanced_RegisterForPulseValueChanged() registers a function to call when the value of a specified gate pulse parameter has been set, even if it is changed as a result of a different parameter's value being changed.

NOTE:

Multiple functions may be registered. When this is the case, the functions are called in the order in which they have been registered.

Registered callbacks are called synchronously from within the thread in which associated parameter values are being set (i.e., called prior to returning from the set operation.)

NOTE:

Parameters whose values have change due to external influences (e.g., representing the status of camera hardware,) do not result in a callback's being called.

Call PicamAdvanced_UnregisterForPulseValueChanged() to unregister each callback once it is not longer required.

Syntax

The syntax for PicamAdvanced_RegisterForPulseValueChanged() is:

```
PICAM_API PicamAdvanced_RegisterForPulseValueChanged(
                                   PicamHandle  camera,
                                PicamParameter  parameter,
                 PicamPulseValueChangedCallback  changed);
```

Input Parameters

Input parameters for PicamAdvanced_RegisterForPulseValueChanged() are:

camera:	Handle for the camera for which the callback is being registered.
parameter:	The parameter for which the callback is being registered.
changed:	The name assigned to the callback function being registered.

Output Parameters

There are no output parameters associated with PicamAdvanced_RegisterForPulseValueChanged().

Related APIs

For additional information, refer to the following related APIs:

- Picam_SetParameterPulseValue().
- PicamAdvanced_UnregisterForPulseValueChanged().
- PicamAdvanced_GetUserState().
- PicamAdvanced_SetUserState().

7.4.8.6 *PicamAdvanced_UnregisterForPulseValueChanged()*

Description

PicamAdvanced_UnregisterForPulseValueChanged() removes the callback function so that it is no longer called when the value of a specified gate pulse parameter is changed.

Syntax

The syntax for PicamAdvanced_UnregisterForPulseValueChanged() is:

```
PICAM_API PicamAdvanced_UnregisterForPulseValueChanged(
                                         PicamHandle  camera,
                                      PicamParameter  parameter,
                        PicamPulseValueChangedCallback  changed);
```

Input Parameters

Input parameters for PicamAdvanced_UnregisterForPulseValueChanged() are:

camera:	Handle for the camera for which the callback is being unregistered.
parameter:	The parameter for which the callback is being unregistered.
changed:	The name assigned to the callback function being unregistered.

Output Parameters

There are no output parameters associated with PicamAdvanced_UnregisterForPulseValueChanged().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_RegisterForPulseValueChanged().
- PicamAdvanced_GetUserState().
- PicamAdvanced_SetUserState().

7.4.8.7 *PicamAdvanced_RegisterForModulationsValueChanged()*

Description

PicamAdvanced_RegisterForModulationsValueChanged() registers a function to call when the value of a specified intensifier modulation sequence parameter has been set, even if it is changed as a result of a different parameter's value being changed.

NOTE:

Multiple functions may be registered. When this is the case, the functions are called in the order in which they have been registered.

Registered callbacks are called synchronously from within the thread in which associated parameter values are being set (i.e., called prior to returning from the set operation.)

NOTE:

Parameters whose values have change due to external influences (e.g., representing the status of camera hardware,) do not result in a callback's being called.

Call PicamAdvanced_UnregisterForModulationsValueChanged() to unregister each callback once it is not longer required.

Syntax

The syntax for PicamAdvanced_RegisterForModulationsValueChanged() is:

```
PICAM_API PicamAdvanced_RegisterForModulationsValueChanged(
                                                PicamHandle  camera,
                                             PicamParameter  parameter,
    PicamModulationsValueChangedCallback  changed);
```

Input Parameters

Input parameters for PicamAdvanced_RegisterForModulationsValueChanged() are:

camera:	Handle for the camera for which the callback is being registered.
parameter:	The parameter for which the callback is being registered.
changed:	The name assigned to the callback function being registered.

Output Parameters

There are no output parameters associated with PicamAdvanced_RegisterForModulationsValueChanged().

Related APIs

For additional information, refer to the following related APIs:

- Picam_SetParameterModulationsValue().
- PicamAdvanced_UnregisterForModulationsValueChanged().
- PicamAdvanced_GetUserState().
- PicamAdvanced_SetUserState().

7.4.8.8 *PicamAdvanced_UnregisterForModulationsValueChanged()*

Description

PicamAdvanced_UnregisterForModulationsValueChanged() removes the callback function so that it is no longer called when the value of an intensifier modulation sequence parameter is changed.

Syntax

The syntax for PicamAdvanced_UnregisterForModulationsValueChanged() is:

```
PICAM_API PicamAdvanced_UnregisterForModulationsValueChanged(
                                           PicamHandle  camera,
                                        PicamParameter  parameter,
                    PicamModulationsValueChangedCallback  changed);
```

Input Parameters

Input parameters for PicamAdvanced_UnregisterForModulationsValueChanged() are:

camera:	Handle for the camera for which the callback is being unregistered.
parameter:	The parameter for which the callback is being unregistered.
changed:	The name assigned to the callback function being unregistered.

Output Parameters

There are no output parameters associated with PicamAdvanced_UnregisterForModulationsValueChanged().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_RegisterForModulationsValueChanged().
- PicamAdvanced_GetUserState().
- PicamAdvanced_SetUserState().

7.4.9 Shared Camera/Accessory Advanced Parameter Value APIs

This section provides programming information for shared camera/accessory advanced parameter value APIs.

7.4.9.1 *PicamAdvanced_RegisterForIntegerValueChanged()*

Description

PicamAdvanced_RegisterForIntegerValueChanged() registers a function to call when the integer value for specified hardware parameter has been set, even if it is changed as a result of a different parameter's value being changed.

NOTE:

Multiple functions may be registered. When this is the case, the functions are called in the order in which they have been registered.

Registered callbacks are called synchronously from within the thread in which associated parameter values are being set (i.e., called prior to returning from the set operation.)

NOTE:

Parameters whose values have changed due to external influences (e.g., representing the status of camera hardware,) do not result in a callback's being called.

Call PicamAdvanced_UnregisterForIntegerValueChanged() to unregister each callback once it is not longer required.

Syntax

The syntax for PicamAdvanced_RegisterForIntegerValueChanged() is:

```
PICAM_API PicamAdvanced_RegisterForIntegerValueChanged(
                                  PicamHandle  camera_or_accessory,
                               PicamParameter  parameter,
              PicamIntegerValueChangedCallback  changed);
```

Input Parameters

Input parameters for PicamAdvanced_RegisterForIntegerValueChanged() are:

camera_or_accessory:	Handle for the hardware for which the callback is being registered.
parameter:	The parameter for which the callback is being registered.
changed:	The name assigned to the callback function being registered.

Output Parameters

There are no output parameters associated with PicamAdvanced_RegisterForIntegerValueChanged().

Related APIs

For additional information, refer to the following related APIs:

- Picam_SetParameterIntegerValue().
- PicamAdvanced_UnregisterForIntegerValueChanged().

7.4.9.2 *PicamAdvanced_UnregisterForIntegerValueChanged()*

Description

PicamAdvanced_UnregisterForIntegerValueChanged() removes the callback function so that it is no longer called when the integer value for a specified parameter is changed.

Syntax

The syntax for PicamAdvanced_UnregisterForIntegerValueChanged() is:

```
PICAM_API PicamAdvanced_UnregisterForIntegerValueChanged(
                                   PicamHandle  camera_or_accessory,
                                PicamParameter  parameter,
              PicamIntegerValueChangedCallback  changed);
```

Input Parameters

Input parameters for PicamAdvanced_UnregisterForIntegerValueChanged() are:

camera_or_accessory:	Handle for the hardware for which the callback is being unregistered.
parameter:	The parameter for which the callback is being unregistered.
changed:	The name assigned to the callback function being unregistered.

Output Parameters

There are no output parameters associated with PicamAdvanced_UnregisterForIntegerValueChanged().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_RegisterForIntegerValueChanged().

7.4.9.3 *PicamAdvanced_RegisterForExtrinsicIntegerValueChanged()*

Description

PicamAdvanced_RegisterForExtrinsicIntegerValueChanged() registers a function to call when the integer value for specified hardware parameter has changed due to external influences (e.g., representing the status of hardware).

NOTE:

Multiple functions may be registered. When this is the case, the functions are called in the order in which they have been registered.

Registered callbacks are called asynchronously on another thread.

NOTE:

PicamAdvanced_UnregisterForExtrinsicIntegerValueChanged() must be called to unregister each callback once it is no longer required.

Syntax

The syntax for PicamAdvanced_RegisterForExtrinsicIntegerValueChanged() is:

```
PICAM_API PicamAdvanced_RegisterForExtrinsicIntegerValueChanged(
                                          PicamHandle  device_or_accessory,
                                       PicamParameter  parameter,
                      PicamIntegerValueChangedCallback  changed);
```

Input Parameters

Input parameters for PicamAdvanced_RegisterForExtrinsicIntegerValueChanged() are:

device_or_accessory:	Handle for the hardware for which the callback is being registered.
parameter:	The parameter for which the callback is being registered.
changed:	The name assigned to the callback function being registered.

Output Parameters

There are no output parameters associated with PicamAdvanced_RegisterForExtrinsicIntegerValueChanged().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_UnregisterForExtrinsicIntegerValueChanged().

7.4.9.4 *PicamAdvanced_UnregisterForExtrinsicIntegerValueChanged()*

Description

PicamAdvanced_UnregisterForExtrinsicIntegerValueChanged() removes the callback function so that it is no longer called when the integer value for a specified parameter is changed due to external influences (e.g., representing the status of camera hardware).

Syntax

The syntax for PicamAdvanced_UnregisterForExtrinsicIntegerValueChanged() is:

```
PICAM_API PicamAdvanced_UnregisterForExtrinsicIntegerValueChanged(
                                     PicamHandle  device_or_accessory,
                                  PicamParameter  parameter,
                PicamIntegerValueChangedCallback  changed);
```

Input Parameters

Input parameters for PicamAdvanced_UnregisterForExtrinsicIntegerValueChanged() are:

`device_or_accessory`:	Handle for the hardware for which the callback is being unregistered.
`parameter`:	The parameter for which the callback is being unregistered.
`changed`:	The name assigned to the callback function being unregistered.

Output Parameters

There are no output parameters associated with PicamAdvanced_UnregisterForExtrinsicIntegerValueChanged().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_RegisterForExtrinsicIntegerValueChanged().

7.4.9.5 *PicamAdvanced_RegisterForFloatingPointValueChanged()*

Description

PicamAdvanced_RegisterForFloatingPointValueChanged() registers a function to call when the floating point value for specified hardware parameter has been set, even if it is changed as a result of a different parameter's value being changed.

NOTE:

Multiple functions may be registered. When this is the case, the functions are called in the order in which they have been registered.

Registered callbacks are called synchronously from within the thread in which associated parameter values are being set (i.e., called prior to returning from the set operation.)

NOTE:

Parameters whose values have change due to external influences (e.g., representing the status of hardware,) do not result in a callback's being called.

Call PicamAdvanced_UnregisterForFloatingPointValueChanged() to unregister each callback once it is not longer required.

Syntax

The syntax for PicamAdvanced_RegisterForFloatingPointValueChanged() is:

```
PICAM_API PicamAdvanced_RegisterForFloatingPointValueChanged(
                                           PicamHandle  camera_or_accessory,
                                        PicamParameter  parameter,
                   PicamFloatingPointValueChangedCallback  changed);
```

Input Parameters

Input parameters for PicamAdvanced_RegisterForFloatingPointValueChanged() are:

camera_or_accessory:	Handle for the hardware for which the callback is being registered.
parameter:	The parameter for which the callback is being registered.
changed:	The name assigned to the callback function being registered.

Output Parameters

There are no output parameters associated with PicamAdvanced_RegisterForFloatingPointValueChanged().

Related APIs

For additional information, refer to the following related APIs:

- Picam_SetParameterFloatingPointValue().
- PicamAdvanced_UnregisterForFloatingPointValueChanged().

7.4.9.6 *PicamAdvanced_UnregisterForFloatingPointValueChanged()*

Description

PicamAdvanced_UnregisterForFloatingPointValueChanged() removes the callback function so that it is no longer called when the floating point value for a specified parameter is changed.

Syntax

The syntax for PicamAdvanced_UnregisterForFloatingPointValueChanged() is:

```
PICAM_API PicamAdvanced_UnregisterForFloatingPointValueChanged(
                                   PicamHandle  camera_or_accessory,
                                PicamParameter  parameter,
       PicamFloatingPointValueChangedCallback  changed);
```

Input Parameters

Input parameters for PicamAdvanced_UnregisterForFloatingPointValueChanged() are:

camera_or_accessory:	Handle for the hardware for which the callback is being unregistered.
parameter:	The parameter for which the callback is being unregistered.
changed:	The name assigned to the callback function being unregistered.

Output Parameters

There are no output parameters associated with PicamAdvanced_UnregisterForFloatingPointValueChanged().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_RegisterForFloatingPointValueChanged().

7.4.9.7 *PicamAdvanced_RegisterForExtrinsicFloatingPointValueChanged()*

Description

PicamAdvanced_RegisterForExtrinsicFloatingPointValueChanged() registers a function to call when the floating point value for specified hardware parameter has changed due to external influences (e.g., representing the status of hardware).

NOTE:

Multiple functions may be registered. When this is the case, the functions are called in the order in which they have been registered.

Registered callbacks are called asynchronously on another thread.

NOTE:

PicamAdvanced_UnregisterForExtrinsicFloatingPointValueChanged() must be called to unregister each callback once it is no longer required.

Syntax

The syntax for PicamAdvanced_RegisterForExtrinsicFloatingPointValueChanged() is:

```
PICAM_API PicamAdvanced_RegisterForExtrinsicFloatingPointValueChanged(
                                       PicamHandle  device_or_accessory,
                                    PicamParameter  parameter,
            PicamFloatingPointValueChangedCallback  changed);
```

Input Parameters

Input parameters for PicamAdvanced_RegisterForExtrinsicFloatingPointValueChanged() are:

`device_or_accessory`: Handle for the hardware for which the callback is being registered.

`parameter`: The parameter for which the callback is being registered.

`changed`: The name assigned to the callback function being registered.

Output Parameters

There are no output parameters associated with PicamAdvanced_RegisterForExtrinsicFloatingPointValueChanged().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_UnregisterForExtrinsicFloatingPointValueChanged().

7.4.9.8 *PicamAdvanced_UnregisterForExtrinsicFloatingPointValueChanged()*

Description

PicamAdvanced_UnregisterForExtrinsicFloatingPointValueChanged() removes the callback function so that it is no longer called when the floating point value for a specified parameter is changed due to external influences (e.g., representing the status of hardware).

Syntax

The syntax for PicamAdvanced_UnregisterForExtrinsicFloatingPointValueChanged() is:

```
PICAM_API PicamAdvanced_UnregisterForExtrinsicFloatingPoint
        ValueChanged(
                        PicamHandle  device_or_accessory,
                     PicamParameter  parameter,
    PicamIntegerValueChangedCallback  changed);
```

Input Parameters

Input parameters for PicamAdvanced_UnregisterForExtrinsicFloatingPointValueChanged() are:

device_or_accessory:	Handle for the hardware for which the callback is being unregistered.
parameter:	The parameter for which the callback is being unregistered.
changed:	The name assigned to the callback function being unregistered.

Output Parameters

There are no output parameters associated with PicamAdvanced_UnregisterForExtrinsicFloatingPointValueChanged().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_RegisterForExtrinsicFloatingPointValueChanged().

7.4.9.9 *PicamAdvanced_NotifyWhenStatusParameterValue()*

Description

PicamAdvanced_NotifyWhenStatusParameterValue() sets a function to call once when the value of a specified status has been met or when an error has occurred.

NOTE:

Multiple functions may be set. When this is the case, the functions are called in the order in which they have been set.

Set callbacks are called asynchronously from within the thread.

Syntax

The syntax for PicamAdvanced_NotifyWhenStatusParameterValue() is:

```
PICAM_API PicamAdvanced_NotifyWhenStatusParameterValue(
                                     PicamHandle  device_or_accessory,
                                  PicamParameter  parameter,
                                           piint  value,
        PicamWhenStatusParameterValueCallback  when);
```

Input Parameters

Input parameters for PicamAdvanced_NotifyWhenStatusParameterValue() are:

device_or_accessory: Handle for the hardware for which the callback is being set.

parameter: The parameter for which the callback is being set.

NOTE: The specified parameter must be a waitable status. Refer to Picam_CanWaitForStatusParameter() for additional information.

value: The status value to notify when met.

when: The name assigned to the callback function being set.

Output Parameters

There are no output parameters associated with PicamAdvanced_NotifyWhenStatusParameterValue().

Related APIs

For additional information, refer to the following related APIs:

- Picam_CanWaitForStatusParameter().
- PicamAdvanced_CancelNotifyWhenStatusParameterValue().

7.4.9.10 *PicamAdvanced_CancelNotifyWhenStatusParameterValue()*

Description

PicamAdvanced_CancelNotifyWhenStatusParameterValue() cancels a function to call once when the value of a specified status has been met or when an error has occurred.

Syntax

The syntax for PicamAdvanced_CancelNotifyWhenStatusParameterValue() is:

```
PICAM_API PicamAdvanced_CancelNotifyWhenStatusParameterValue(
                                    PicamHandle  device_or_accessory,
                                 PicamParameter  parameter,
                                          piint  value,
        PicamWhenStatusParameterValueCallback  when);
```

Input Parameters

Input parameters for PicamAdvanced_CancelNotifyWhenStatusParameterValue() are:

device_or_accessory:	Handle for the hardware for which the callback is being canceled.
parameter:	The parameter for which the callback is being canceled. ***NOTE:*** The specified parameter must be a waitable status. Refer to Picam_CanWaitForStatusParameter() for additional information.
value:	The status value to no longer notify when met.
when:	The name assigned to the callback function being canceled.

Output Parameters

There are no output parameters associated with PicamAdvanced_CancelNotifyWhenStatusParameterValue().

Related APIs

For additional information, refer to the following related APIs:

- Picam_CanWaitForStatusParameter().
- PicamAdvanced_NotifyWhenStatusParameterValue().

7.4.10 Shared Camera/Accessory Advanced Parameter Information APIs

This section provides programming information for camera and accessory advanced parameter information APIs.

7.4.10.1 PicamAdvanced_RegisterForIsRelevantChanged()

Description

PicamAdvanced_RegisterForIsRelevantChanged() registers a function to call when the relevance for a parameter has been changed, even if it is changed as a result of a different parameter's value being changed.

NOTE:

Multiple functions may be registered. When this is the case, the functions are called in the order in which they have been registered.

Registered callbacks are called synchronously from within the thread in which associated parameter values are being set (i.e., called prior to returning from the set operation.)

Call PicamAdvanced_UnregisterForIsRelevantChanged() to unregister each callback once it is not longer required.

Syntax

The syntax for PicamAdvanced_RegisterForIsRelevantChanged() is:

```
PICAM_API PicamAdvanced_RegisterForIsRelevantChanged(
                                        PicamHandle  camera_or_accessory,
                                     PicamParameter  parameter,
                      PicamIsRelevantChangedCallback  changed);
```

Input Parameters

Input parameters for PicamAdvanced_RegisterForIsRelevantChanged() are:

camera_or_accessory:	Handle for the hardware for which the callback is being registered.
parameter:	The parameter for which the callback is being registered.
changed:	The name assigned to the callback function being registered.

Output Parameters

There are no output parameters associated with PicamAdvanced_RegisterForIsRelevantChanged().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_UnregisterForIsRelevantChanged().

7.4.10.2 *PicamAdvanced_UnregisterForIsRelevantChanged()*

Description

PicamAdvanced_UnregisterForIsRelevantChanged() removes the callback function so that it is no longer called when the relevance for a parameter has been changed.

Syntax

The syntax for PicamAdvanced_UnregisterForIsRelevantChanged() is:

```
PICAM_API PicamAdvanced_UnregisterForIsRelevantChanged(
                                      PicamHandle  camera_or_accessory,
                                   PicamParameter  parameter,
                    PicamIsRelevantChangedCallback  changed);
```

Input Parameters

Input parameters for PicamAdvanced_UnregisterForIsRelevantChanged() are:

camera_or_accessory:	Handle for the hardware for which the callback is being unregistered.
parameter:	The parameter for which the callback is being unregistered.
changed:	The name assigned to the callback function being unregistered.

Output Parameters

There are no output parameters associated with PicamAdvanced_UnregisterForIsRelevantChanged().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_RegisterForIsRelevantChanged().

7.4.10.3 *PicamAdvanced_RegisterForValueAccessChanged()*

Description

PicamAdvanced_RegisterForValueAccessChanged() registers a function to call when the value access for a parameter has been changed, even if it is changed as a result of a different parameter's value being changed.

NOTE:

Multiple functions may be registered. When this is the case, the functions are called in the order in which they have been registered.

Registered callbacks are called synchronously from within the thread in which associated parameter values are being set (i.e., called prior to returning from the set operation.)

Call PicamAdvanced_UnregisterForValueAccessChanged() to unregister each callback once it is not longer required.

Syntax

The syntax for PicamAdvanced_RegisterForValueAccessChanged() is:

```
PICAM_API PicamAdvanced_RegisterForValueAccessChanged(
                                   PicamHandle  camera_or_accessory,
                                PicamParameter  parameter,
                PicamValueAccessChangedCallback  changed);
```

Input Parameters

Input parameters for PicamAdvanced_RegisterForValueAccessChanged() are:

camera_or_accessory:	Handle for the hardware for which the callback is being registered.
parameter:	The parameter for which the callback is being registered.
changed:	The name assigned to the callback function being registered.

Output Parameters

There are no output parameters associated with PicamAdvanced_RegisterForValueAccessChanged().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_UnregisterForValueAccessChanged().

7.4.10.4 *PicamAdvanced_UnregisterForValueAccessChanged()*

Description

PicamAdvanced_UnregisterForValueAccessChanged() removes the callback function so that it is no longer called when the value access for a parameter has been changed.

Syntax

The syntax for PicamAdvanced_UnregisterForValueAccessChanged() is:

```
PICAM_API PicamAdvanced_UnregisterForValueAccessChanged(
                                   PicamHandle  camera_or_accessory,
                                PicamParameter  parameter,
              PicamValueAccessChangedCallback  changed);
```

Input Parameters

Input parameters for PicamAdvanced_UnregisterForValueAccessChanged() are:

camera_or_accessory: Handle for the hardware for which the callback is being unregistered.

parameter: The parameter for which the callback is being unregistered.

changed: The name assigned to the callback function being unregistered.

Output Parameters

There are no output parameters associated with PicamAdvanced_UnregisterForValueAccessChanged().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_RegisterForValueAccessChanged().

7.4.10.5 *PicamAdvanced_GetParameterDynamics()*

Description

PicamAdvanced_GetParameterDynamics() returns the dynamics for a specified parameter.

Syntax

The syntax for PicamAdvanced_GetParameterDynamics() is:

```
PICAM_API PicamAdvanced_GetParameterDynamics(
                           PicamHandle  camera_or_accessory,
                        PicamParameter  parameter,
                    PicamDynamicsMask*  dynamics);
```

Input Parameters

Input parameters for PicamAdvanced_GetParameterDynamics() are:

camera_or_accessory: Handle for the hardware for which the dynamics information is to be returned.

parameter: The parameter for which dynamics information is to be returned.

Output Parameters

Output parameters for PicamAdvanced_GetParameterDynamics() are:

dynamics: Pointer to the memory location in which the dynamics information is stored.

7.4.10.6 *PicamAdvanced_GetParameterExtrinsicDynamics()*

Description

PicamAdvanced_GetParameterExtrinsicDynamics() returns the dynamics for a specified parameter that can change due to external influences (e.g., representing the status of hardware).

Syntax

The syntax for PicamAdvanced_GetParameterExtrinsicDynamics() is:

```
PICAM_API PicamAdvanced_GetParameterExtrinsicDynamics(
                                  PicamHandle  camera_or_accessory,
                               PicamParameter  parameter,
                           PicamDynamicsMask*  extrinsic);
```

Input Parameters

Input parameters for PicamAdvanced_GetParameterExtrinsicDynamics() are:

`camera_or_accessory`: Handle for the hardware for which the extrinsic dynamics information is to be returned.

`parameter`: The parameter for which extrinsic dynamics information is to be returned.

Output Parameters

Output parameters for PicamAdvanced_GetParameterExtrinsicDynamics() are:

`extrinsic`: Pointer to the memory location in which the extrinsic dynamics information is stored.

7.4.11 Camera-Specific Advanced Parameter Constraints APIs

This section provides programming information for camera-specific advanced parameter constraint APIs.

7.4.11.1 PicamAdvanced_GetParameterRoisConstraints()

Description

PicamAdvanced_GetParameterRoisConstraints() returns an allocated array in which all Rois constraints for a specified camera parameter are stored.

Syntax

The syntax for PicamAdvanced_GetParameterRoisConstraints() is:

```
PICAM_API PicamAdvanced_GetParameterRoisConstraints(
                                     PicamHandle  camera,
                                  PicamParameter  parameter,
                      const PicamRoisConstraint** constraint_array,
                                          piint*  constraint_count);
```

Input Parameters

Input parameters for PicamAdvanced_GetParameterRoisConstraints() are:

`camera`: Handle for the camera for which the Rois constraint information is to be returned.

`parameter`: The parameter for which Rois constraint information is to be returned.

Output Parameters

Output parameters for PicamAdvanced_GetParameterRoisConstraints() are:

`constraint_array`: Pointer to the array in which Rois constraint information is stored.

NOTE: This memory is allocated by PICam and must be released by calling Picam_DestroyRoisConstraints()

`constraint_count`: Pointer to the memory location in which the number of constraints is stored.

Related APIs

For additional information, refer to the following related APIs:

- Picam_DestroyRoisConstraints().

7.4.11.2 *PicamAdvanced_RegisterForDependentRoisConstraintChanged()*

Description

PicamAdvanced_RegisterForDependentRoisConstraintChanged() registers a function to call when any dependent Rois constraint has been changed due to the setting of a DIFFERENT parameter's value.

NOTE:

Multiple functions may be registered. When this is the case, the functions are called in the order in which they have been registered.

Registered callbacks are called synchronously from within the thread in which associated parameter values are being set (i.e., called prior to returning from the set operation.)

Call PicamAdvanced_UnregisterForDependentRoisConstraintChanged() to unregister each callback once it is not longer required.

Syntax

The syntax for PicamAdvanced_RegisterForDependentRoisConstraintChanged() is:

```
PICAM_API PicamAdvanced_RegisterForDependentRoisConstraintChanged(
                                             PicamHandle  camera,
                                          PicamParameter  parameter,
          PicamDependentRoisConstraintChangedCallback  changed);
```

Input Parameters

Input parameters for PicamAdvanced_RegisterForDependentRoisConstraintChanged() are:

- `camera`: Handle for the camera for which the callback is being registered.
- `parameter`: The parameter for which the callback is being registered.
- `changed`: The name assigned to the callback function being registered.

Output Parameters

There are no output parameters associated with PicamAdvanced_RegisterForDependentRoisConstraintChanged().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_UnregisterForDependentRoisConstraintChanged().

7.4.11.3 *PicamAdvanced_UnregisterForDependentRoisConstraintChanged()*

Description

PicamAdvanced_UnregisterForDependentRoisConstraintChanged() removes the callback function so that it is no longer called when any dependent Rois constraint has been changed.

Syntax

The syntax for PicamAdvanced_UnregisterForDependentRoisConstraintChanged() is:

```
PICAM_API PicamAdvanced_UnregisterForDependentRoisConstraintChanged(
                                                PicamHandle  camera,
                                             PicamParameter  parameter,
              PicamDependentRoisConstraintChangedCallback  changed);
```

Input Parameters

Input parameters for PicamAdvanced_UnregisterForDependentRoisConstraintChanged() are:

camera: Handle for the camera for which the callback is being unregistered.

parameter: The parameter for which the callback is being unregistered.

changed: The name assigned to the callback function being unregistered.

Output Parameters

There are no output parameters associated with PicamAdvanced_UnregisterForDependentRoisConstraintChanged().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_RegisterForDependentRoisConstraintChanged().

7.4.11.4 *PicamAdvanced_GetParameterPulseConstraints()*

Description

PicamAdvanced_GetParameterPulseConstraints() returns an allocated array in which all Pulse constraints for a specified camera parameter are stored.

Syntax

The syntax for PicamAdvanced_GetParameterPulseConstraints() is:

```
PICAM_API PicamAdvanced_GetParameterPulseConstraints(
                                  PicamHandle  camera,
                               PicamParameter  parameter,
                 const PicamPulseConstraint**  constraint_array,
                                       piint*  constraint_count);
```

Input Parameters

Input parameters for PicamAdvanced_GetParameterPulseConstraints() are:

camera: Handle for the camera for which the Pulse constraint information is to be returned.

parameter: The parameter for which Pulse constraint information is to be returned.

Output Parameters

Output parameters for PicamAdvanced_GetParameterPulseConstraints() are:

constraint_array: Pointer to the array in which Pulse constraint information is stored.

NOTE: This memory is allocated by PICam and must be released by calling Picam_DestroyPulseConstraints()

constraint_count: Pointer to the memory location in which the number of constraints is stored.

Related APIs

For additional information, refer to the following related APIs:

- Picam_DestroyPulseConstraints().

7.4.11.5 *PicamAdvanced_RegisterForDependentPulseConstraintChanged()*

Description

PicamAdvanced_RegisterForDependentPulseConstraintChanged() registers a function to call when any dependent Pulse constraint has been changed due to the setting of a DIFFERENT parameter's value.

NOTE:

Multiple functions may be registered. When this is the case, the functions are called in the order in which they have been registered.

Registered callbacks are called synchronously from within the thread in which associated parameter values are being set (i.e., called prior to returning from the set operation.)

Call PicamAdvanced_UnregisterForDependentPulseConstraintChanged() to unregister each callback once it is not longer required.

Syntax

The syntax for PicamAdvanced_RegisterForDependentPulseConstraintChanged() is:

```
PICAM_API PicamAdvanced_RegisterForDependentPulseConstraintChanged(
                                             PicamHandle  camera,
                                           PicamParameter  parameter,
                 PicamDependentPulseConstraintChangedCallback  changed);
```

Input Parameters

Input parameters for PicamAdvanced_RegisterForDependentPulseConstraintChanged() are:

camera: Handle for the camera for which the callback is being registered.

parameter: The parameter for which the callback is being registered.

changed: The name assigned to the callback function being registered.

Output Parameters

There are no output parameters associated with PicamAdvanced_RegisterForDependentPulseConstraintChanged().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_UnregisterForDependentPulseConstraintChanged().

7.4.11.6 *PicamAdvanced_UnregisterForDependentPulseConstraintChanged()*

Description

PicamAdvanced_UnregisterForDependentPulseConstraintChanged() removes the callback function so that it is no longer called when any dependent Pulse constraint has been changed.

Syntax

The syntax for PicamAdvanced_UnregisterForDependentPulseConstraintChanged() is:

```
PICAM_API PicamAdvanced_UnregisterForDependentPulseConstraintChanged(
                                             PicamHandle  camera,
                                          PicamParameter  parameter,
        PicamDependentPulseConstraintChangedCallback  changed);
```

Input Parameters

Input parameters for PicamAdvanced_UnregisterForDependentPulseConstraintChanged() are:

camera:	Handle for the camera for which the callback is being unregistered.
parameter:	The parameter for which the callback is being unregistered.
changed:	The name assigned to the callback function being unregistered.

Output Parameters

There are no output parameters associated with PicamAdvanced_UnregisterForDependentPulseConstraintChanged().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_RegisterForDependentPulseConstraintChanged().

7.4.11.7 PicamAdvanced_GetParameterModulationsConstraints()

Description

PicamAdvanced_GetParameterModulationsConstraints() returns an allocated array in which all Modulation constraints for a specified camera parameter are stored.

Syntax

The syntax for PicamAdvanced_GetParameterModulationsConstraints() is:

```
PICAM_API PicamAdvanced_GetParameterModulationsConstraints(
                                          PicamHandle  camera,
                                       PicamParameter  parameter,
                  const PicamModulationsConstraint**  constraint_array,
                                                piint*  constraint_count);
```

Input Parameters

Input parameters for PicamAdvanced_GetParameterModulationsConstraints() are:

camera: Handle for the camera for which the Modulation constraint information is to be returned.

parameter: The parameter for which Modulation constraint information is to be returned.

Output Parameters

Output parameters for PicamAdvanced_GetParameterModulationsConstraints() are:

constraint_array: Pointer to the array in which Modulation constraint information is stored.

NOTE: This memory is allocated by PICam and must be released by calling Picam_DestroyModulationsConstraints()

constraint_count: Pointer to the memory location in which the number of constraints is stored.

Related APIs

For additional information, refer to the following related APIs:

- Picam_DestroyModulationsConstraints().

7.4.11.8 *PicamAdvanced_RegisterForDependentModulationsConstraintChanged()*

Description

PicamAdvanced_RegisterForDependentModulationsConstraintChanged() registers a function to call when any dependent Modulation constraint has been changed due to the setting of a DIFFERENT parameter's value.

NOTE:

Multiple functions may be registered. When this is the case, the functions are called in the order in which they have been registered.

Registered callbacks are called synchronously from within the thread in which associated parameter values are being set (i.e., called prior to returning from the set operation.)

Call PicamAdvanced_UnregisterForDependentModulationsConstraintChanged() to unregister each callback once it is not longer required.

Syntax

The syntax for PicamAdvanced_RegisterForDependentModulationsConstraintChanged() is:

```
PICAM_API PicamAdvanced_RegisterForDependentModulations
            ConstraintChanged(
                                                PicamHandle  camera,
                                             PicamParameter  parameter,
  PicamDependentModulationsConstraintChangedCallback  changed);
```

Input Parameters

Input parameters for PicamAdvanced_RegisterForDependentModulationsConstraintChanged() are:

camera:	Handle for the camera for which the callback is being registered.
parameter:	The parameter for which the callback is being registered.
changed:	The name assigned to the callback function being registered.

Output Parameters

There are no output parameters associated with PicamAdvanced_RegisterForDependentModulationsConstraintChanged().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_UnregisterForDependentModulationsConstraintChanged().

7.4.11.9 *PicamAdvanced_UnregisterForDependentModulationsConstraintChanged()*

Description

PicamAdvanced_UnregisterForDependentModulationsConstraintChanged() removes the callback function so that it is no longer called when any dependent Modulation constraint has been changed.

Syntax

The syntax for PicamAdvanced_UnregisterForDependentModulationsConstraintChanged() is:

```
PICAM_API PicamAdvanced_UnregisterForDependentModulations
            ConstraintChanged(
                                              PicamHandle  camera,
                                           PicamParameter  parameter,
   PicamDependentModulationsConstraintChangedCallback  changed);
```

Input Parameters

Input parameters for PicamAdvanced_UnregisterForDependentModulationsConstraintChanged() are:

camera:	Handle for the camera for which the callback is being unregistered.
parameter:	The parameter for which the callback is being unregistered.
changed:	The name assigned to the callback function being unregistered.

Output Parameters

There are no output parameters associated with PicamAdvanced_UnregisterForDependentModulationsConstraintChanged().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_RegisterForDependentModulationsConstraintChanged().

7.4.12 Shared Camera/Accessory Advanced Parameter Constraints APIs

This section provides programming information for camera and accessory advanced parameter constraint APIs.

7.4.12.1 *PicamAdvanced_GetParameterCollectionConstraints()*

Description

PicamAdvanced_GetParameterCollectionConstraints() returns an allocated array in which all collection constraints for a specified hardware parameter are stored.

Syntax

The syntax for PicamAdvanced_GetParameterCollectionConstraints() is:

```
PICAM_API PicamAdvanced_GetParameterCollectionConstraints(
                                    PicamHandle  camera_or_accessory,
                                 PicamParameter  parameter,
           const PicamCollectionConstraint**  constraint_array,
                                         piint*  constraint_count);
```

Input Parameters

Input parameters for PicamAdvanced_GetParameterCollectionConstraints() are:

`camera_or_accessory`: Handle for the hardware for which the collection constraint information is to be returned.

`parameter`: The parameter for which collection constraint information is to be returned.

Output Parameters

Output parameters for PicamAdvanced_GetParameterCollectionConstraints() are:

`constraint_array`: Pointer to the array in which collection constraint information is stored.

NOTE: This memory is allocated by PICam and must be released by calling Picam_DestroyCollectionConstraints()

`constraint_count`: Pointer to the memory location in which the number of constraints is stored.

Related APIs

For additional information, refer to the following related APIs:

- Picam_DestroyCollectionConstraints().

7.4.12.2 *PicamAdvanced_RegisterForDependentCollectionConstraintChanged()*

Description

PicamAdvanced_RegisterForDependentCollectionConstraintChanged() registers a function to call when any dependent collection constraint has been changed due to the setting of a DIFFERENT parameter's value.

NOTE:

Multiple functions may be registered. When this is the case, the functions are called in the order in which they have been registered.

Registered callbacks are called synchronously from within the thread in which associated parameter values are being set (i.e., called prior to returning from the set operation.)

Call PicamAdvanced_UnregisterForDependentCollectionConstraintChanged() to unregister each callback once it is not longer required.

Syntax

The syntax for PicamAdvanced_RegisterForDependentCollectionConstraintChanged() is:

```
PICAM_API PicamAdvanced_RegisterForDependentCollection
        ConstraintChanged(
                                            PicamHandle  camera_or_accessory,
                                         PicamParameter  parameter,
PicamDependentCollectionConstraintChangedCallback  changed);
```

Input Parameters

Input parameters for PicamAdvanced_RegisterForDependentCollectionConstraintChanged() are:

`camera_or_accessory`:	Handle for the hardware for which the callback is being registered.
`parameter`:	The parameter for which the callback is being registered.
`changed`:	The name assigned to the callback function being registered.

Output Parameters

There are no output parameters associated with PicamAdvanced_RegisterForDependentCollectionConstraintChanged().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_UnregisterForDependentCollectionConstraintChanged().

7.4.12.3 *PicamAdvanced_UnregisterForDependentCollectionConstraintChanged()*

Description

PicamAdvanced_UnregisterForDependentCollectionConstraintChanged() removes the callback function so that it is no longer called when any dependent collection constraint has been changed.

Syntax

The syntax for PicamAdvanced_UnregisterForDependentCollectionConstraintChanged() is:

```
PICAM_API PicamAdvanced_UnregisterForDependentCollection
            ConstraintChanged(
                                        PicamHandle  camera_or_accessory,
                                     PicamParameter  parameter,
PicamDependentCollectionConstraintChangedCallback  changed);
```

Input Parameters

Input parameters for PicamAdvanced_UnregisterForDependentCollectionConstraintChanged() are:

camera_or_accessory:	Handle for the hardware for which the callback is being unregistered.
parameter:	The parameter for which the callback is being unregistered.
changed:	The name assigned to the callback function being unregistered.

Output Parameters

There are no output parameters associated with PicamAdvanced_UnregisterForDependentCollectionConstraintChanged().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_RegisterForDependentCollectionConstraintChanged().

7.4.12.4 *PicamAdvanced_GetParameterRangeConstraints()*

Description

PicamAdvanced_GetParameterRangeConstraints() returns an allocated array in which all range constraints for a specified hardware parameter are stored.

Syntax

The syntax for PicamAdvanced_GetParameterRangeConstraints() is:

```
PICAM_API PicamAdvanced_GetParameterRangeConstraints(
                                      PicamHandle  camera_or_accessory,
                                   PicamParameter  parameter,
                   const PicamRangeConstraint**  constraint_array,
                                           piint*  constraint_count);
```

Input Parameters

Input parameters for PicamAdvanced_GetParameterRangeConstraints() are:

camera_or_accessory: Handle for the hardware for which the range constraint information is to be returned.

parameter: The parameter for which range constraint information is to be returned.

Output Parameters

Output parameters for PicamAdvanced_GetParameterRangeConstraints() are:

constraint_array: Pointer to the array in which range constraint information is stored.

NOTE: This memory is allocated by PICam and must be released by calling Picam_DestroyRangeConstraints()

constraint_count: Pointer to the memory location in which the number of constraints is stored.

Related APIs

For additional information, refer to the following related APIs:

- Picam_DestroyRangeConstraints().

7.4.12.5 *PicamAdvanced_RegisterForDependentRangeConstraintChanged()*

Description

PicamAdvanced_RegisterForDependentRangeConstraintChanged() registers a function to call when any dependent range constraint has been changed due to the setting of a DIFFERENT parameter's value.

NOTE:

Multiple functions may be registered. When this is the case, the functions are called in the order in which they have been registered.

Registered callbacks are called synchronously from within the thread in which associated parameter values are being set (i.e., called prior to returning from the set operation.)

Call PicamAdvanced_UnregisterForDependentRangeConstraintChanged() to unregister each callback once it is not longer required.

Syntax

The syntax for PicamAdvanced_RegisterForDependentRangeConstraintChanged() is:

```
PICAM_API PicamAdvanced_RegisterForDependentRangeConstraintChanged
                                       PicamHandle  camera_or_accessory,
                                    PicamParameter  parameter,
 PicamDependentRangeConstraintChangedCallback  changed);
```

Input Parameters

Input parameters for PicamAdvanced_RegisterForDependentRangeConstraintChanged() are:

camera_or_accessory:	Handle for the hardware for which the callback is being registered.
parameter:	The parameter for which the callback is being registered.
changed:	The name assigned to the callback function being registered.

Output Parameters

There are no output parameters associated with PicamAdvanced_RegisterForDependentRangeConstraintChanged().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_UnregisterForDependentRangeConstraintChanged().

7.4.12.6 *PicamAdvanced_UnregisterForDependentRangeConstraintChanged()*

Description

PicamAdvanced_UnregisterForDependentRangeConstraintChanged() removes the callback function so that it is no longer called when any dependent range constraint has been changed.

Syntax

The syntax for PicamAdvanced_UnregisterForDependentRangeConstraintChanged() is:

```
PICAM_API PicamAdvanced_UnregisterForDependentRangeConstraintChanged(
                                  PicamHandle  camera_or_accessory,
                               PicamParameter  parameter,
 PicamDependentRangeConstraintChangedCallback  changed);
```

Input Parameters

Input parameters for PicamAdvanced_UnregisterForDependentRangeConstraintChanged() are:

camera_or_accessory:	Handle for the hardware for which the callback is being unregistered.
parameter:	The parameter for which the callback is being unregistered.
changed:	The name assigned to the callback function being unregistered.

Output Parameters

There are no output parameters associated with PicamAdvanced_UnregisterForDependentRangeConstraintChanged().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_RegisterForDependentRangeConstraintChanged().

7.4.13 Camera-Specific Advanced Commitment APIs

This section provides programming information for camera-specific advanced commitment APIs.

7.4.13.1 Picam_DestroyValidationResult()

Description

Picam_DestroyValidationResult() releases memory that has been allocated by PICam for use by result.

If result is null, calling Picam_DestroyValidationResult() has no effect.

Syntax

The syntax for Picam_DestroyValidationResult() is:

```
PICAM_API Picam_DestroyValidationResult(
          const PicamValidationResult*  result);
```

Input Parameters

Input parameters for Picam_DestroyValidationResult() are:

result: Pointer to the array that is to be released.

Output Parameters

There are no output parameters associated with Picam_DestroyValidationResult().

Related Structures

For additional information, refer to the following related structures:

- PicamValidationResult.

7.4.13.2 Picam_DestroyValidationResults()

Description

Picam_DestroyValidationResults() releases memory that has been allocated by PICam for use by results.

If results is null, calling Picam_DestroyValidationResults() has no effect.

Syntax

The syntax for Picam_DestroyValidationResults() is:

```
PICAM_API Picam_DestroyValidationResults(
          const PicamValidationResults*  results);
```

Input Parameters

Input parameters for Picam_DestroyValidationResults() are:

results: Pointer to the array that is to be released.

Output Parameters

There are not output parameters associated with Picam_DestroyValidationResults().

Related Structures

For additional information, refer to the following related structures:

- PicamValidationResults.

7.4.13.3 *PicamAdvanced_ValidateParameter()*

Description

PicamAdvanced_ValidateParameter() validates a single, specified parameter against all associated constraints and returns the results.

Syntax

The syntax for PicamAdvanced_ValidateParameter() is:

```
PICAM_API PicamAdvanced_ValidateParameter(
                              PicamHandle  model,
                           PicamParameter  parameter,
             const PicamValidationResult** result);
```

Input Parameters

Input parameters for PicamAdvanced_ValidateParameter() are:

`model`: Handle for the model for which the parameter is being validated.

`parameter`: The parameter being validated.

Output Parameters

Output parameters for PicamAdvanced_ValidateParameter() are:

`result`: Pointer to the array in which the validation results for all constraints are stored.

NOTE: This memory is allocated by PICam and must be released by calling Picam_DestroyValidationResult().

Related APIs

For additional information, refer to the following related APIs:

- Picam_DestroyValidationResult().

Related Structures

For additional information, refer to the following related structures:

- PicamValidationResult.

7.4.13.4 PicamAdvanced_ValidateParameters()

Description

PicamAdvanced_ValidateParameters() validates all parameters against all associated constraints and returns the results.

Syntax

The syntax for PicamAdvanced_ValidateParameters() is:

```
PICAM_API PicamAdvanced_ValidateParameters(
                                     PicamHandle  model,
                const PicamValidationResults**  results);
```

Input Parameters

Input parameters for PicamAdvanced_ValidateParameters() are:

`model`: Handle for the model for which all parameters are being validated.

Output Parameters

Output parameters for PicamAdvanced_ValidateParameters() are:

`result`: Pointer to the array in which the validation results for all constraints are stored.

NOTE: This memory is allocated by PICam and must be released by calling Picam_DestroyValidationResults().

Related APIs

For additional information, refer to the following related APIs:

- Picam_DestroyValidationResults().

Related Structures

For additional information, refer to the following related structures:

- PicamValidationResults.

7.4.13.5 Picam_DestroyDependentValidationResult()

Description

Picam_DestroyDependentValidationResult() releases memory that has been allocated by PICam for use by `result`.

If `result` is null, calling Picam_DestroyDependentValidationResult() has no effect.

Syntax

The syntax for Picam_DestroyDependentValidationResult() is:

```
PICAM_API Picam_DestroyDependentValidationResult(
               const PicamDependentValidationResult*  result);
```

Input Parameters

Input parameters for Picam_DestroyDependentValidationResult() are:

`result`: Pointer to the array that is to be released.

Output Parameters

There are no output parameters associated with Picam_DestroyDependentValidationResult().

Related APIs

For additional information, refer to the following related APIs:

- PicamDependentValidationResult.

7.4.13.6 *PicamAdvanced_ValidateDependentParameter()*

Description

PicamAdvanced_ValidateDependentParameter() validates all parameters of a specified model whose constraints are dependent on a specified parameter.

Syntax

The syntax for PicamAdvanced_ValidateDependentParameter() is:

```
PICAM_API PicamAdvanced_ValidateDependentParameter(
                                          PicamHandle  model,
                                        PicamParameter  parameter,
                  const PicamDependentValidationResult**  result);
```

Input Parameters

Input parameters for PicamAdvanced_ValidateDependentParameter() are:

model: Handle for the model for which all dependent parameters are being validated.

parameter: The parameter on which all constraints being validated are dependent.

Output Parameters

Output parameters for PicamAdvanced_ValidateDependentParameter() are:

result: Pointer to the array in which the validation results for all constraints are stored.

NOTE: This memory is allocated by PICam and must be released by calling Picam_DestroyDependentValidationResult().

Related APIs

For additional information, refer to the following related APIs:

- Picam_DestroyDependentValidationResult()

7.4.13.7 *PicamAdvanced_CommitParametersToCameraDevice()*

Description

PicamAdvanced_CommitParametersToCameraDevice() attempts to configure a camera device with the set of parameter values stored in model.

NOTE:

If this action leads to a camera device error, the action fails and the camera device remains untouched.

Syntax

The syntax for PicamAdvanced_CommitParametersToCameraDevice() is:

```
PICAM_API PicamAdvanced_CommitParametersToCameraDevice(
                                          PicamHandle  model);
```

Input Parameters

Input parameters for PicamAdvanced_CommitParametersToCameraDevice() are:

model: Handle for the model for which all parameters are to be committed.

Output Parameters

There are no output parameters associated with PicamAdvanced_CommitParametersToCameraDevice().

7.4.13.8 *PicamAdvanced_RefreshParameterFromCameraDevice()*

Description

PicamAdvanced_RefreshParameterFromCameraDevice() updates a single parameter's value stored in model with the value from the connected camera device.

Syntax

The syntax for PicamAdvanced_RefreshParameterFromCameraDevice() is:

```
PICAM_API PicamAdvanced_RefreshParameterFromCameraDevice(
                                        PicamHandle  model,
                                     PicamParameter  parameter);
```

Input Parameters

Input parameters for PicamAdvanced_RefreshParameterFromCameraDevice() are:

model: Handle for the model for which the parameter's value is to be overwritten.

parameter: The parameter for which the value is to be overwritten.

Output Parameters

There are no output parameters associated with PicamAdvanced_RefreshParameterFromCameraDevice().

7.4.13.9 *PicamAdvanced_RefreshParametersFromCameraDevice()*

Description

PicamAdvanced_RefreshParametersFromCameraDevice() updates all parameter values stored in model with values from the connected camera device.

Syntax

The syntax for PicamAdvanced_RefreshParametersFromCameraDevice() is:

```
PICAM_API PicamAdvanced_RefreshParametersFromCameraDevice(
                                        PicamHandle  model);
```

Input Parameters

Input parameters for PicamAdvanced_RefreshParametersFromCameraDevice() are:

model: Handle for the model for which all parameter values are to be overwritten.

Output Parameters

There are no output parameters associated with PicamAdvanced_RefreshParametersFromCameraDevice().

7.4.14 Camera-Specific Advanced Acquisition Setup APIs

This section provides programming information about camera-specific advanced acquisition setup APIs.

7.4.14.1 *PicamAdvanced_GetAcquisitionBuffer()*

Description

PicamAdvanced_GetAcquisitionBuffer() returns the user-allocated buffer to be used during data acquisition.

Syntax

The syntax for PicamAdvanced_GetAcquisitionBuffer() is:

```
PICAM_API PicamAdvanced_GetAcquisitionBuffer(
                                PicamHandle  device,
                         PicamAcquisitionBuffer*  buffer);
```

Input Parameters

Input parameters for PicamAdvanced_GetAcquisitionBuffer() are:

device: Handle for the device to which the data acquisition buffer is allocated.

Output Parameters

Output parameters for PicamAdvanced_GetAcquisitionBuffer() are:

buffer: Pointer to the user-allocated data acquisition buffer.
If no buffer has been created/allocated, this points to a null buffer with zero size.

7.4.14.2 *PicamAdvanced_SetAcquisitionBuffer()*

Description

PicamAdvanced_SetAcquisitionBuffer() assigns a user-allocated buffer to a specific device.

Syntax

The syntax for PicamAdvanced_SetAcquisitionBuffer() is:

```
PICAM_API PicamAdvanced_SetAcquisitionBuffer(
                                PicamHandle  device,
                   const PicamAcquisitionBuffer*  buffer);
```

Input Parameters

Input parameters for PicamAdvanced_SetAcquisitionBuffer() are:

device: Handle for the device to which the data acquisition buffer is to be allocated.

Output Parameters

Output parameters for PicamAdvanced_SetAcquisitionBuffer() are:

buffer: Pointer to the user-allocated data acquisition buffer.
To clear this buffer, point to null with zero size.
This buffer can be used to create a circular buffer.

7.4.15 Camera-Specific Advanced Acquisition Notification APIs

This section provides programming information for camera-specific advanced acquisition notification APIs.

7.4.15.1 `PicamAdvanced_RegisterForAcquisitionUpdated()`

Description

`PicamAdvanced_RegisterForAcquisitionUpdated()` registers a function to call during data acquisition when:

- New data are available, or
- A change in acquisition status has occurred.

NOTE:

Multiple functions may be registered. When this is the case, the functions are called in the order in which they have been registered.

Callbacks are called asynchronously from another thread, but are serialized on that thread. This means that additional notifications do not occur simultaneously, but occur after each callback returns.

Call `PicamAdvanced_UnregisterForAcquisitionUpdated()` to unregister each callback once it is no longer required.

Syntax

The syntax for `PicamAdvanced_RegisterForAcquisitionUpdated()` is:

```
PICAM_API PicamAdvanced_RegisterForAcquisitionUpdated(
                                        PicamHandle  device,
                         PicamAcquisitionUpdatedCallback  updated);
```

Input Parameters

Input parameters for `PicamAdvanced_RegisterForAcquisitionUpdated()` are:

`device`: Handle for the device for which the callback is being registered.

`changed`: The name assigned to the callback function being registered.

Output Parameters

There are no output parameters associated with `PicamAdvanced_RegisterForAcquisitionUpdated()`.

Related APIs

For additional information, refer to the following related APIs:

- `PicamAdvanced_UnregisterForAcquisitionUpdated()`.

7.4.15.2 *PicamAdvanced_UnregisterForAcquisitionUpdated()*

Description

PicamAdvanced_UnregisterForAcquisitionUpdated() removes the callback function so that it is no longer called during data acquisition.

Syntax

The syntax for PicamAdvanced_UnregisterForAcquisitionUpdated() is:

```
PICAM_API PicamAdvanced_UnregisterForAcquisitionUpdated(
                                            PicamHandle  device,
                        PicamAcquisitionUpdatedCallback  updated);
```

Input Parameters

Input parameters for PicamAdvanced_UnregisterForAcquisitionUpdated() are:

device: Handle for the device for which the callback is being unregistered.

changed: The name assigned to the callback function being unregistered.

Output Parameters

There are no output parameters associated with PicamAdvanced_UnregisterForAcquisitionUpdated().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_RegisterForAcquisitionUpdated().

7.4.16 Camera-Specific Advanced Acquisition State Notification APIs

This section provides programming information for camera-specific advanced acquisition state notification APIs.

7.4.16.1 PicamAdvanced_CanRegisterForAcquisitionStateUpdated()

Description

PicamAdvanced_CanRegisterForAcquisitionStateUpdated() determines if an acquisition state can be detected.

Syntax

The syntax for PicamAdvanced_CanRegisterForAcquisitionStateUpdated() is:

```
PICAM_API PicamAdvanced_CanRegisterForAcquisitionStateUpdated(
                                    PicamHandle  device,
                           PicamAcquisitionState  state,
                                         piblnֶ*  detectable);
```

Input Parameters

Input parameters for PicamAdvanced_CanRegisterForAcquisitionStateUpdated() are:

`device`: Handle for the device under test.

`state`: Specifies the acquisition state to be queried for detectability.

Output Parameters

Output parameters for PicamAdvanced_CanRegisterForAcquisitionStateUpdated() are:

`detectable`: Pointer to the test results. Indicates if the specified acquisition state is detectable.
Valid values are:

- `TRUE`
  Indicates the specified acquisition state is detectable.
- `FALSE`
  Indicates the specified acquisition state is not detectable.

7.4.16.2 *PicamAdvanced_RegisterForAcquisitionStateUpdated()*

Description

PicamAdvanced_RegisterForAcquisitionStateUpdated() registers a function to call during data acquisition when the camera transitions to an acquisition state.

NOTE:

Multiple functions may be registered. When this is the case, the functions are called in the order in which they have been registered.

Callbacks are called asynchronously from another thread, but are serialized on that thread. This means that additional notifications do not occur simultaneously, but occur after each callback returns.

Syntax

The syntax for PicamAdvanced_RegisterForAcquisitionStateUpdated() is:

```
PICAM_API PicamAdvanced_RegisterForAcquisitionStateUpdated(
                                         PicamHandle  device,
                               PicamAcquisitionState  state,
                PicamAcquisitionStateUpdatedCallback  updated);
```

Input Parameters

Input parameters for PicamAdvanced_RegisterForAcquisitionStateUpdated() are:

device:	Handle for the device for which the callback is being registered.
state:	Specifies the acquisition state to detect.

Output Parameters

There are no output parameters associated with PicamAdvanced_RegisterForAcquisitionStateUpdated().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_UnregisterForAcquisitionStateUpdated().

7.4.16.3 *PicamAdvanced_UnregisterForAcquisitionStateUpdated()*

Description

PicamAdvanced_UnregisterForAcquisitionStateUpdated() removes the callback function so that it is no longer called during data acquisition.

Syntax

The syntax for PicamAdvanced_UnregisterForAcquisitionStateUpdated() is:

```
PICAM_API PicamAdvanced_UnregisterForAcquisitionStateUpdated(
                                           PicamHandle  device,
                                  PicamAcquisitionState  state,
                    PicamAcquisitionStateUpdatedCallback  updated);
```

Input Parameters

Input parameters for PicamAdvanced_UnregisterForAcquisitionStateUpdated() are:

device: Handle for the device for which the callback is being unregistered.

state: Specifies the acquisition state to detect no longer.

Output Parameters

There are no output parameters associated with PicamAdvanced_UnregisterForAcquisitionStateUpdated().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_RegisterForAcquisitionStateUpdated().

7.4.17 Camera-Specific Advanced Acquisition Control APIs

This section provides programming information for camera-specific advance acquisition control APIs.

7.4.17.1 *PicamAdvanced_HasAcquisitionBufferOverrun()*

Description

PicamAdvanced_HasAcquisitionBufferOverrun() determines if a user-allocated circular buffer has overflowed.

Syntax

The syntax for PicamAdvanced_HasAcquisitionBufferOverrun() is:

```
PICAM_API PicamAdvanced_HasAcquisitionBufferOverrun(
                                    PicamHandle  device,
                                        pibln*   overran);
```

Input Parameters

Input parameters for PicamAdvanced_HasAcquisitionBufferOverrun() are:

device: Handle for the device for which the status of the associated user-allocated circular buffer is being tested.

Output Parameters

Output parameters for PicamAdvanced_HasAcquisitionBufferOverrun() are:

overran: Pointer to the results.
Indicates if the user-allocated circular data buffer has overflowed.
Valid values are:

- TRUE
  Indicates that the buffer has overflowed.
- FALSE
  Indicates that the buffer has not overflowed.

7.4.17.2 *PicamAdvanced_CanClearReadoutCountOnline()*

Description

PicamAdvanced_CanClearReadoutCountOnline() indicates if it is possible to set the readout count to 0 [zero] while the camera is running.

Syntax

The syntax for PicamAdvanced_CanClearReadoutCountOnline() is:

```
PICAM_API PicamAdvanced_CanClearReadoutCountOnline(
                            PicamHandle  device,
                                 pibln*  clearable);
```

Input Parameters

Input parameters for PicamAdvanced_CanClearReadoutCountOnline() are:

`device`: Handle for the device for which the ability to manipulate the readout count online is being tested.

Output Parameters

Output parameters for PicamAdvanced_CanClearReadoutCountOnline() are:

`clearable`: Pointer to the results.
Indicates if it is possible to clear the readout count online.
Valid values are:

- `TRUE`
  Indicates that it is possible to clear the readout count online.
- `FALSE`
  Indicates that the readout count can never be cleared online.

7.4.17.3 *PicamAdvanced_ClearReadoutCountOnline()*

Description

PicamAdvanced_ClearReadoutCountOnline() tries to set the readout count to 0 [zero] while the camera is running.

Syntax

The syntax for PicamAdvanced_ClearReadoutCountOnline() is:

```
PICAM_API PicamAdvanced_ClearReadoutCountOnline(
                                        PicamHandle  device,
                                             pibln*  cleared);
```

Input Parameters

Input parameters for PicamAdvanced_ClearReadoutCountOnline() are:

device: Handle for the device for which the status of the readout count is being tested.

Output Parameters

Output parameters for PicamAdvanced_ClearReadoutCountOnline() are:

cleared: Pointer to the results.
Indicates if the readout count has been cleared online.
Valid values are:

- TRUE
  Indicates that the readout count has been cleared online.
- FALSE
  Indicates that the readout count has not been cleared online.

NOTE:

There is an inherent race between clearing the readout count and the camera stopping when it has acquired the number of readouts. It is advised to check the value of cleared to determine the actual effect of the function.

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Chapter 8: EM Calibration APIs

This chapter provides information about the EM gain calibration APIs. All functions, data definitions, and structures are located in the `picam_em_calibration.h` file.

NOTE:

The information and APIs described within this chapter are NOT applicable to emICCD cameras.

8.1 EM Calibration Applications

Each ProEM or Evolve camera is factory-calibrated for linear EM Gain. Over time, however, aging of the EMCCD array may degrade gain linearity. Because aging appears to be a strong function of the amount of charge that flows through the multiplication register, users who consistently operate the camera at high gain at high light levels may need to recalibrate EM gain more frequently than those who are looking at lower light levels at lower gain.

To compensate for aging, each ProEM or Evolve includes a built-in shutter (either manual or electro-mechanical) and a light source that allows users to perform on-demand EM Gain Calibration using a calibration application. Once the EM gain calibration has been performed, the gain value entered in the software by the user will be the actual multiplication gain applied to the input signal.

CAUTION!

When calibrating a ProEM or Evolve camera with a manual shutter (e.g., ProEM:1600,) the shutter **MUST** be closed manually before launching any calibration program.

This is not necessary for a camera with an internal electro-mechanical shutter because the program will automatically close the shutter before beginning the calibration.

PICam users have two options available when creating an EM Calibration application:

- Build the sample code `EMGainCalibration.exe` that is included with PICam.

  This option requires the least amount of development time and overhead since `EMGainCalibration.exe` is a fully functional application once it has been built.

  REFERENCES:

  Refer to Appendix B, EM Gain Calibration Code Sample, for additional information about using the sample code.

- Create a custom EM Calibration application using the API routines, structures, and callbacks described in this chapter.

  When building a custom application, the `EMGainCalibration.exe` sample code included with PICam is a good resource for the developer when learning about the EM Calibration API library.

8.2 Structure Definitions

This section provides programming information about PICam structure definitions.

8.2.1 EM Calibration Structures

This section provides detailed programming information about the following EM Calibration data structures:

- PicamEMCalibrationDate

8.2.1.1 *PicamEMCalibrationDate*

Description

PicamEMCalibrationDate specifies the calibration date.

Structure Definition

The structure definition for PicamEMCalibrationDate is:

```
typedef struct PicamEMCalibrationDate
{
            piint  year;
            piint  month;
            piint  day;
} PicamEMCalibrationDate;
```

Variable Definitions

The variables required by PicamEMCalibrationDate are:

year:	The year as an integer (e.g., 2011.)
month:	The month as an integer. Valid values are from [1...12], inclusive. For example, 3 = March.
day:	The day of the month as an integer. Valid values are from [1...31], inclusive.

8.3 Callback Functions

This section provides programming information about callback functions used by PICam

8.3.1 EM Calibration

This section provides information about the following callback functions:

- PicamEMCalibrationCallback().

8.3.1.1 *PicamEMCalibrationCallback()*

Description

PicamEMCalibrationCallback() is the callback function for EM calibration progress and/or cancellation.

Syntax

The syntax for PicamEMCalibrationCallback() is:

```
typedef pibln (PIL_CALL* PicamEMCalibrationCallback)(
                       PicamHandle  calibration,
                             piflt  progress,
                             void*  user_state);
```

Input Parameters

The input parameters for PicamEMCalibrationCallback() are:

calibration:	Handle for the camera which is being calibrated.
progress:	This is the percentage of calibration completion. Valid values are [0...100], inclusive.
user_state:	User-supplied data provided when calibration is started.

Return Values

Return values for PicamEMCalibrationCallback() are:

TRUE:	Calibration continues.
FALSE:	Cancels the calibration.

8.4 Programmers' Reference for EM Calibration APIs

This section provides a detailed programmers' reference guide for the following EM Calibration APIs:

- EM Calibration Access APIs
  - PicamEMCalibration_OpenCalibration()
  - PicamEMCalibration_CloseCalibration()
  - PicamEMCalibration_GetOpenCalibrations()
  - PicamEMCalibration_GetCameraID()
- EM Calibration Parameter Value APIs
  - PicamEMCalibration_GetCalibrationDate()
  - PicamEMCalibration_ReadSensorTemperatureReading()
  - PicamEMCalibration_ReadSensorTemperatureStatus()
  - PicamEMCalibration_GetSensorTemperatureSetPoint()
  - PicamEMCalibration_SetSensorTemperatureSetPoint()
- EM Calibration Parameter Constraints APIs
  - PicamEMCalibration_GetSensorTemperatureSetPointConstraint()
- EM Calibration APIs
  - PicamEMCalibration_SetSensorTemperatureSetPoint()

8.4.1 EM Calibration Access APIs

This section provides programming information about EM Calibration Access APIs.

8.4.1.1 PicamEMCalibration_OpenCalibration()

Description

PicamEMCalibration_OpenCalibration() opens a camera for calibration and returns a handle to it.

NOTE:

Opening a camera for calibration is mutually exclusive with opening it for normal usage.

Syntax

The syntax for PicamEMCalibration_OpenCalibration() is:

```
PICAM_API PicamEMCalibration_OpenCalibration(
                        const PicamCameraID*  id,
                              PicamHandle*    calibration);
```

Input Parameters

Input parameters for PicamEMCalibration_OpenCalibration() are:

`id`: Pointer to the camera id for the camera being calibrated.

Output Parameters

Output parameters for PicamEMCalibration_OpenCalibration() are:

`calibration`: Pointer to the handle assigned to the camera that will be calibrated.

Related APIs

For additional information, refer to the following related APIs:

- PicamEMCalibration_CloseCalibration().

8.4.1.2 *PicamEMCalibration_CloseCalibration()*

Description

PicamEMCalibration_CloseCalibration() releases all resources that have been associated with a specified calibration process.

Syntax

The syntax for PicamEMCalibration_CloseCalibration() is:

```
PICAM_API PicamEMCalibration_CloseCalibration(
                                        PicamHandle  calibration);
```

Input Parameters

Input parameters for PicamEMCalibration_CloseCalibration() are:

calibration:	Pointer to the handle for the calibration process for which resources are to be released.

Output Parameters

There are no output parameters associated with PicamEMCalibration_CloseCalibration().

Related APIs

For additional information, refer to the following related APIs:

- PicamEMCalibration_OpenCalibration().

8.4.1.3 *PicamEMCalibration_GetOpenCalibrations()*

Description

PicamEMCalibration_GetOpenCalibrations() returns an allocated array of open calibration handles.

Syntax

The syntax for PicamEMCalibration_GetOpenCalibrations() is:

```
PICAM_API PicamEMCalibration_GetOpenCalibrations(
                              const PicamHandle**  calibrations_array,
                                            piint*  calibrations_count);
```

Input Parameters

There are no input parameters associated with PicamEMCalibration_GetOpenCalibrations().

Output Parameters

Output parameters for PicamEMCalibration_GetOpenCalibrations() are:

calibrations_array:	Pointer to the array of handles to open calibration processes. Returns null when there are no open calibration processes. ***NOTE:*** This memory is allocated by PICam and must be released by calling Picam_DestroyHandles()
calibrations_count:	Pointer to the memory location in which the number of open calibration processes is stored. Returns 0 when there are no open calibration processes.

8.4.1.4 *PicamEMCalibration_GetCameraID()*

Description

PicamEMCalibration_GetCameraID() returns the camera id associated with a specified calibration process.

Syntax

The syntax for PicamEMCalibration_GetCameraID() is:

```
PICAM_API PicamEMCalibration_GetCameraID(
                                PicamHandle  calibration,
                              PicamCameraID*  id);
```

Input Parameters

Input parameters for PicamEMCalibration_GetCameraID() are:

calibration: Handle associated with the calibration process for which the associated camera is to be determined.

Output Parameters

Output parameters for PicamEMCalibration_GetCameraID() are:

id: Pointer to the ID of the camera associated with the specified calibration process.

8.4.2 EM Calibration Parameter Value APIs

This section provides programming information about EM Calibration Parameter Value APIs.

8.4.2.1 PicamEMCalibration_GetCalibrationDate()

Description

PicamEMCalibration_GetCalibrationDate() returns the date of the most recent successful calibration.

Syntax

The syntax for PicamEMCalibration_GetCalibrationDate() is:

```
PICAM_API PicamEMCalibration_GetCalibrationDate(
                                PicamHandle  calibration,
                         PicamEMCalibrationDate*  value);
```

Input Parameters

Input parameters for PicamEMCalibration_GetCalibrationDate() are:

`calibration`: Handle of the camera for which the calibration date is to be determined.

Output Parameters

Output parameters for PicamEMCalibration_GetCalibrationDate() are:

`value`: Pointer to the calibration date.

Related Structures

For additional information, refer to the following related APIs:

- PicamEMCalibrationDate.

8.4.2.2 PicamEMCalibration_ReadSensorTemperatureReading()

Description

PicamEMCalibration_ReadSensorTemperatureReading() returns the current sensor temperature, in degrees Celsius, for a specified camera.

Syntax

The syntax for PicamEMCalibration_ReadSensorTemperatureReading() is:

```
PICAM_API PicamEMCalibration_ReadSensorTemperatureReading(
                                PicamHandle  calibration,
                                    piflt*  value);
```

Input Parameters

Input parameters for PicamEMCalibration_ReadSensorTemperatureReading() are:

`calibration`: Handle of the camera for which the sensor temperature is to be determined.

Output Parameters

Output parameters for PicamEMCalibration_ReadSensorTemperatureReading() are:

`value`: Pointer to the memory location in which the sensor temperature is stored.

8.4.2.3 *PicamEMCalibration_ReadSensorTemperatureStatus()*

Description

PicamEMCalibration_ReadSensorTemperatureStatus() returns the status of the current sensor temperature for a specified camera.

NOTE:

Calibration cannot begin until the status of the current sensor temperature is **locked**.

Syntax

The syntax for PicamEMCalibration_ReadSensorTemperatureStatus() is:

```
PICAM_API PicamEMCalibration_ReadSensorTemperatureStatus(
                                        PicamHandle  calibration,
                         PicamSensorTemperatureStatus*  value);
```

Input Parameters

Input parameters for PicamEMCalibration_ReadSensorTemperatureStatus() are:

`calibration`: Handle of the camera for which the status of the sensor temperature is to be determined.

Output Parameters

Output parameters for PicamEMCalibration_ReadSensorTemperatureStatus() are:

`value`: Pointer to the memory location in which the status information is stored.

Related Structures

For additional information, refer to the following related APIs:

- PicamSensorTemperatureStatus.

8.4.2.4 PicamEMCalibration_GetSensorTemperatureSetPoint()

Description

PicamEMCalibration_GetSensorTemperatureSetPoint() returns the temperature set point that has been programmed for a specified camera.

Syntax

The syntax for PicamEMCalibration_GetSensorTemperatureSetPoint() is:

```
PICAM_API PicamEMCalibration_GetSensorTemperatureSetPoint(
                                        PicamHandle  calibration,
                                             piflt*  value);
```

Input Parameters

Input parameters for PicamEMCalibration_GetSensorTemperatureSetPoint() are:

`calibration`: Handle of the camera for which the programmed temperature set point is to be determined.

Output Parameters

Output parameters for PicamEMCalibration_GetSensorTemperatureSetPoint() are:

`value`: Pointer to the memory location in which the set point information is stored.

Related APIs

For additional information, refer to the following related APIs:

- PicamEMCalibration_SetSensorTemperatureSetPoint().

8.4.2.5 PicamEMCalibration_SetSensorTemperatureSetPoint()

Description

PicamEMCalibration_SetSensorTemperatureSetPoint() configures the sensor temperature set point for a specified camera to a specified value.

Syntax

The syntax for PicamEMCalibration_SetSensorTemperatureSetPoint() is:

```
PICAM_API PicamEMCalibration_SetSensorTemperatureSetPoint(
                                        PicamHandle  calibration,
                                              piflt  value);
```

Input Parameters

Input parameters for PicamEMCalibration_SetSensorTemperatureSetPoint() are:

`calibration`: Handle of the camera for which the temperature set point is to be programmed.

`value`: The desired temperature set point, in degrees Celsius.

Output Parameters

There are no output parameters associated with PicamEMCalibration_SetSensorTemperatureSetPoint().

8.4.3 EM Calibration Parameter Constraints APIs

This section provides programming information about EM Calibration Parameter Constraint APIs.

8.4.3.1 *PicamEMCalibration_GetSensorTemperatureSetPointConstraint()*

Description

PicamEMCalibration_GetSensorTemperatureSetPointConstraint() returns an allocated constraint in which the set of valid temperature set points, in degrees Celsius, for a specified camera is stored.

Syntax

The syntax for PicamEMCalibration_GetSensorTemperatureSetPointConstraint() is:

```
PICAM_API PicamEMCalibration_GetSensorTemperatureSetPointConstraint(
                                        PicamHandle  calibration,
                        const PicamRangeConstraint**  constraint);
```

Input Parameters

Input parameters for PicamEMCalibration_GetSensorTemperatureSetPointConstraint() are:

`calibration`: Handle for the camera for which the valid range of temperature set points is to be returned.

Output Parameters

Output parameters for PicamEMCalibration_GetSensorTemperatureSetPointConstraint() are:

`constraint`: Pointer to the allocated constraint in which the set of valid temperature set points is stored.

NOTE: This memory is allocated by PICam and must be released by calling Picam_DestroyCollectionConstraints()

Related APIs

For additional information, refer to the following related APIs:

- Picam_DestroyHandles().

Related Structures

For additional information, refer to the following related APIs:

- PicamRangeConstraint.

8.4.4 EM Calibration APIs

This section provides programming information about EM Calibration APIs.

8.4.4.1 PicamEMCalibration_Calibrate()

Description

PicamEMCalibration_Calibrate() calibrates the EM Gain for a specified camera.

NOTE:

Calibration cannot begin until the status of the current sensor temperature is **locked**.

NOTE:

If calibration is canceled (via the use of the callback function PicamEMCalibrationCallback()) this function returns PicamError_OperationCanceled.

Syntax

The syntax for PicamEMCalibration_Calibrate() is:

```
PICAM_API PicamEMCalibration_Calibrate(
                         PicamHandle  calibration,
           PicamEMCalibrationCallback  calllback,
                               void*  user_state);
```

Input Parameters

Input parameters for PicamEMCalibration_Calibrate() are:

calibration: Handle for the camera for which EM calibration is to be performed.

callback: Optional Callback function.
Specifying a Callback provides additional functionality, such as:
- The ability to cancel a calibration process;
- The ability to obtain calibration progress information.

user_state: [optional]
When used, allows the caller to provide user-defined data to the callback function.

Output Parameters

There are no output parameters associated with PicamEMCalibration_Calibrate().

Related APIs

For additional information, refer to the following related APIs:

- PicamEMCalibration_ReadSensorTemperatureStatus();
- PicamEMCalibrationCallback().

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Appendix A: Available Parameters

NOTES:

1. Parameters are listed using a truncated version of their names (e.g., the `PicamParameter_` prefix has been dropped.)
   For example, the parameter named `PicamParameter_ExposureTime` is listed as `ExposureTime`.
2. An asterisk indicates that the parameter does not apply to all members of a camera family.

Table A-1: Symbol Key for Table A-2 and Table A-3

Value Types		Constraint Types	
F = Floating Point	M = Modulations	R = Range	M = Modulation
E = Enumeration	R = Region of Interest	C = Collection	P = Pulse
B = Boolean	P = Pulse	Ri = Region of Interest	RO = Read Only
I = Integer	L = Large Integer		

A.1 Camera Parameter Information

Table A-2: Parameter Information and Camera Support (Sheet 1 of 15)

Parameter Name *Value Type* *Constraint Type* *Permission*	Value Type	Constraint Type	BLAZE	EVOLVE	FERGIE/ISO-81	KURO	LANSIS	NIRvana/ST (PIoNIR)	NIRvana HS	NIRvana-LN	PI-MAX 3/4	PI-MTE	PI-MTE3	PIXIS	ProEM/ + / -HS	PyLoN	PyLoN-IR	SOPHIA	TPIR	TPIR-HR	Quad-RO
Shutter Timing																					
`Active Shutter`	E	C	✓		✓		✓		✓				✓					✓		✓	
`Exposure Time`	F	R	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table A-2: Parameter Information and Camera Support (Sheet 2 of 15)

Parameter Name *Value Type* *Constraint Type* *Permission*	Value Type	Constraint Type	BLAZE	EVOLVE	FERGIE/ISO-81	KURO	LANSIS	NIRvana/ST (PIoNIR)	NIRvana HS	NIRvana-LN	PI-MAX 3/4	PI-MTE	PI-MTE3	PIXIS	ProEM/ + / -HS	PyLoN	PyLoN-IR	SOPHIA	TPIR	TPIR-HR	Quad-RO
`External Shutter Status`	E	R O	✓															✓			
`External ShutterType`	E	R O	✓		✓		✓		✓				✓					✓			
`Inactive Shutter TimingMode Result`	E	R O																✓*			
`Internal Shutter Status`	E	R O			✓													✓		✓	
`Internal ShutterType`	E	R O	✓		✓		✓		✓				✓					✓		✓	
`Shutter Closing Delay`	F	R	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`Shutter Delay Resolution`	F	C	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`Shutter Opening Delay`	F	R	✓	✓	✓		✓	✓	✓	✓			✓		✓	✓	✓	✓		✓	
`Shutter TimingMode`	E	C	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Gating																					
`DifEnding Gate`	P	P									✓*										
`DifStarting Gate`	P	P									✓*										
`GatingMode`	E	C			✓						✓										
`Repetitive Gate`	P	P			✓						✓										
`Sequential EndingGate`	P	P			✓						✓										

Table A-2: Parameter Information and Camera Support (Sheet 3 of 15)

Parameter Name *Value Type* *Constraint Type* *Permission*	Value Type	Constraint Type	BLAZE	EVOLVE	FERGIE/ISO-81	KURO	LANSIS	NIRvana/ST (PIoNIR)	NIRvana HS	NIRvana-LN	PI-MAX 3/4	PI-MTE	PI-MTE3	PIXIS	ProEM/ + / -HS	PyLoN	PyLoN-IR	SOPHIA	TPIR	TPIR-HR	Quad-RO
`Sequential GateStep Count`	L	R			✓						✓										
`Sequential GateStep Iterations`	L	R			✓						✓										
`Sequential Starting Gate`	P	P			✓						✓										
Intensifier																					
`Bracket Gating`	B	C									✓*										
`Custom Modulation Sequence`	M	M									✓*										
`EMIccdGain`	I	R									✓*										
`EMIccdGain ControlMode`	E	C									✓*										
`Enable Intensifier`	B	C									✓										
`Enable Modulation`	B	C									✓*										
`GatingSpeed`	E	R O									✓										
`Intensifier Diameter`	F	R O									✓										
`Intensifier Gain`	I	R									✓										
`Intensifier Options`	E	R O									✓										
`Intensifier Status`	E	R O									✓										
`Modulation Duration`	F	R									✓*										

Table A-2: Parameter Information and Camera Support (Sheet 4 of 15)

Parameter Name *Value Type* *Constraint Type* *Permission*	Value Type	Constraint Type	BLAZE	EVOLVE	FERGIE/ISO-81	KURO	LANSIS	NIRvana/ST (PIoNIR)	NIRvana HS	NIRvana-LN	PI-MAX 3/4	PI-MTE	PI-MTE3	PIXIS	ProEM/ + / -HS	PyLoN	PyLoN-IR	SOPHIA	TPIR	TPIR-HR	Quad-RO
`Modulation Frequency`	F	R									✓*										
`Phosphor DecayDelay`	F	R									✓										
`Phosphor DecayDelay Resolution`	F	C									✓										
`Phosphor Type`	E	R O									✓										
`Photocath-ode Sensitivity`	E	R O									✓										
`Repetitive Modulation Phase`	F	R									✓*										
`Sequential Ending Modulation Phase`	F	R									✓*										
`Sequential Starting Modulation Phase`	F	R									✓*										
Analog to Digital Conversion																					
`AdcAnalog Gain`	E	C	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
`AdcBitDepth`	I	C	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`AdcEMGain`	I	R		✓							✓*				✓						
`AdcQuality`	E	C	✓								✓*	✓*		✓*	✓*	✓		✓*	✓	✓	
`AdcSpeed`	F	C	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`Correct Pixel Bias`	B	C	✓	✓	✓		✓				✓*		✓		✓	✓		✓		✓	

Table A-2: Parameter Information and Camera Support (Sheet 5 of 15)

Parameter Name *Value Type* *Constraint Type* *Permission*	Value Type	Constraint Type	BLAZE	EVOLVE	FERGIE/ISO-81	KURO	LANSIS	NIRvana/ST (PIoNIR)	NIRvana HS	NIRvana-LN	PI-MAX 3/4	PI-MTE	PI-MTE3	PIXIS	ProEM/ + / -HS	PyLoN	PyLoN-IR	SOPHIA	TPIR	TPIR-HR	Quad-RO
Hardware I/O																					
`AnticipateTrigger`	B	C									✓*										
`AuxOutput`	P	P			✓						✓										
`DelayFromPreTrigger`	F	R									✓*										
`EnableAuxOutput`	B	C			✓																
`EnableModulationOutputSignal`	B	C									✓*										
`EnableSyncMaster`	B	C									✓										
`InvertOutputSignal`	B	C	✓	✓	✓		✓	✓	✓	✓	✓		✓		✓	✓	✓	✓			
`InvertOutputSignal2`	B	C	✓		✓		✓		✓				✓					✓			
`ModulationOutputSignalAmplitude`	F	R									✓*										
`ModulationOutputSignalFrequency`	F	R									✓*										
`OutputSignal`	E	C	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓
`OutputSignal2`	E	C	✓		✓		✓		✓				✓					✓			
`SyncMaster2Delay`	F	R									✓										

Table A-2: Parameter Information and Camera Support (Sheet 6 of 15)

Parameter Name *Value Type* *Constraint Type* *Permission*	Value Type	Constraint Type	BLAZE	EVOLVE	FERGIE/ISO-81	KURO	LANSIS	NIRvana/ST (PIoNIR)	NIRvana HS	NIRvana-LN	PI-MAX 3/4	PI-MTE	PI-MTE3	PIXIS	ProEM/ + / -HS	PyLoN	PyLoN-IR	SOPHIA	TPIR	TPIR-HR	Quad-RO
`Trigger Coupling`	E	C									✓										
`Trigger Delay`	F	R	✓																		
`Trigger Determination`	E	C	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓
`Trigger Frequency`	F	R			✓						✓										
`Trigger Response`	E	C	✓	✓	✓	✓	✓	✓	✓	✓	✓*	✓	✓	✓	✓	✓	✓	✓			✓
`Trigger Source`	E	C			✓						✓										
`Trigger Termination`	E	C									✓										
`Trigger Threshold`	F	R									✓										

Table A-2: Parameter Information and Camera Support (Sheet 7 of 15)

Parameter Name *Value Type* *Constraint Type* *Permission*	Value Type	Constraint Type	BLAZE	EVOLVE	FERGIE/ISO-81	KURO	LANSIS	NIRvana/ST (PIoNIR)	NIRvana HS	NIRvana-LN	PI-MAX 3/4	PI-MTE	PI-MTE3	PIXIS	ProEM/ + / -HS	PyLoN	PyLoN-IR	SOPHIA	TPIR	TPIR-HR	Quad-RO
Readout Control																					
Accumulations	L	R	✓		✓						✓										
Enable Nondestructive Readout	B	C								✓											
Kinetics Window Height	I	R	✓		✓						✓*	✓	✓	✓	✓	✓		✓			
Nondestructive Readout Period	F	R								✓											
Readout Control Mode	E	C	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Readout Orientation	E	R O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ReadoutPort Count	I	C	✓		✓			✓	✓	✓	✓*		✓				✓	✓		✓	✓
ReadoutTime Calculation	F	R O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SeNsRWindow Height	I	R	✓																		
Vertical Shift Rate	F	C	✓	✓	✓		✓				✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
Data Acquisition																					
DisableData Formatting	B	C	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Exact Readout Count Maximum	L	R O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table A-2: Parameter Information and Camera Support (Sheet 8 of 15)

Parameter Name *Value Type* *Constraint Type* *Permission*	Value Type	Constraint Type	BLAZE	EVOLVE	FERGIE/ISO-81	KURO	LANSIS	NIRvana/ST (PIoNIR)	NIRvana HS	NIRvana-LN	PI-MAX 3/4	PI-MTE	PI-MTE3	PIXIS	ProEM/ + / -HS	PyLoN	PyLoN-IR	SOPHIA	TPIR	TPIR-HR	Quad-RO
`FrameRate Calculation`	F	R O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`FrameSize`	I	R O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`FramesPer Readout`	I	R O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`FrameStride`	I	R O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`Frame Tracking BitDepth`	I	C	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`Gate Tracking`	E	C			✓						✓										
`Gate Tracking BitDepth`	I	C			✓						✓										
`Modulation Tracking`	E	C									✓*										
`Modulation Tracking BitDepth`	I	C									✓*										
`Normalize Orientation`	B	C	✓	✓	✓*					✓	✓*	✓*		✓*	✓	✓			✓	✓	
`Online Readout Rate Calculation`	F	R O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`Orientation`	E	R O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`Photon Detection Mode`	E	C									✓*										
`Photon Detection Threshold`	F	R									✓*										

Table A-2: Parameter Information and Camera Support (Sheet 9 of 15)

Parameter Name *Value Type* *Constraint Type* *Permission*	Value Type	Constraint Type	BLAZE	EVOLVE	FERGIE/ISO-81	KURO	LANSIS	NIRvana/ST (PIoNIR)	NIRvana HS	NIRvana-LN	PI-MAX 3/4	PI-MTE	PI-MTE3	PIXIS	ProEM/ + / -HS	PyLoN	PyLoN-IR	SOPHIA	TPIR	TPIR-HR	Quad-RO
`PixelBit Depth`	I	R O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`PixelFormat`	E	C	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`Readout Count`	L	R	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`ReadoutRate Calculation`	F	R O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`Readout Stride`	I	R O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`Rois`	R	Ri	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`TimeStamp BitDepth`	I	C	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`TimeStamp Resolution`	L	C	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`TimeStamps`	E	C	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`TrackFrames`	B	C	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table A-2: Parameter Information and Camera Support (Sheet 10 of 15)

Parameter Name *Value Type* *Constraint Type* *Permission*	Value Type	Constraint Type	BLAZE	EVOLVE	FERGIE/ISO-81	KURO	LANSIS	NIRvana/ST (PIoNIR)	NIRvana HS	NIRvana-LN	PI-MAX 3/4	PI-MTE	PI-MTE3	PIXIS	ProEM/ + / -HS	PyLoN	PyLoN-IR	SOPHIA	TPIR	TPIR-HR	Quad-RO
Sensor Information																					
`Ccd Character-istics`	E	R O	✓	✓	✓		✓				✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
`PixelGap Height`	F	R O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`PixelGap Width`	F	R O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`PixelHeight`	F	R O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`PixelWidth`	F	R O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`Sensor Active Bottom Margin`	I	R O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`Sensor Active Extended Height`	I	R O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`Sensor Active Height`	I	R O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`Sensor Active LeftMargin`	I	R O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`Sensor Active RightMargin`	I	R O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`Sensor Active TopMargin`	I	R O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`Sensor Active Width`	I	R O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table A-2: Parameter Information and Camera Support (Sheet 11 of 15)

Parameter Name *Value Type* *Constraint Type* *Permission*	Value Type	Constraint Type	BLAZE	EVOLVE	FERGIE/ISO-81	KURO	LANSIS	NIRvana/ST (PIoNIR)	NIRvana HS	NIRvana-LN	PI-MAX 3/4	PI-MTE	PI-MTE3	PIXIS	ProEM/ + / -HS	PyLoN	PyLoN-IR	SOPHIA	TPIR	TPIR-HR	Quad-RO
`Sensor Masked Bottom Margin`	I	R O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`Sensor Masked Height`	I	R O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`Sensor Masked TopMargin`	I	R O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`Sensor Secondary Active Height`	I	R O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`Sensor Secondary Masked Height`	I	R O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`SensorType`	E	R O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table A-2: Parameter Information and Camera Support (Sheet 12 of 15)

Parameter Name *Value Type* *Constraint Type* *Permission*	Value Type	Constraint Type	BLAZE	EVOLVE	FERGIE/ISO-81	KURO	LANSIS	NIRvana/ST (PIoNIR)	NIRvana HS	NIRvana-LN	PI-MAX 3/4	PI-MTE	PI-MTE3	PIXIS	ProEM/ + / -HS	PyLoN	PyLoN-IR	SOPHIA	TPIR	TPIR-HR	Quad-RO
Sensor Layout																					
`Active Bottom Margin`	I	R	✓	✓	✓		✓				✓	✓	✓	✓	✓	✓		✓	✓	✓	
`Active Extended Height`					✓*																
`Active Height`	I	R	✓	✓	✓		✓				✓	✓	✓	✓	✓	✓		✓	✓	✓	
`ActiveLeft Margin`	I	R	✓	✓	✓		✓				✓	✓	✓	✓	✓	✓		✓	✓	✓	
`ActiveRight Margin`	I	R	✓	✓	✓		✓				✓	✓	✓	✓	✓	✓		✓	✓	✓	
`ActiveTop Margin`	I	R	✓	✓	✓		✓				✓	✓	✓	✓	✓	✓		✓	✓	✓	
`ActiveWidth`	I	R	✓	✓	✓		✓				✓	✓	✓	✓	✓	✓		✓	✓	✓	
`Masked Bottom Margin`	I	R		✓	✓*						✓*	✓*			✓*						
`Masked Height`	I	R		✓	✓*						✓*	✓*			✓*						
`MaskedTop Margin`	I	R		✓	✓*						✓*	✓*			✓*						
`Secondary Active Height`	I	R													✓*						
`Secondary Masked Height`	I	R													✓*						

Table A-2: Parameter Information and Camera Support (Sheet 13 of 15)

Parameter Name *Value Type* *Constraint Type* *Permission*	Value Type	Constraint Type	BLAZE	EVOLVE	FERGIE/ISO-81	KURO	LANSIS	NIRvana/ST (PIoNIR)	NIRvana HS	NIRvana-LN	PI-MAX 3/4	PI-MTE	PI-MTE3	PIXIS	ProEM/ + / -HS	PyLoN	PyLoN-IR	SOPHIA	TPIR	TPIR-HR	Quad-RO
Sensor Cleaning																					
`CleanBeforeExposure`	B	C			✓*										✓*						
`CleanCycleCount`	I	R	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`CleanCycleHeight`	I	R	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`CleanSectionFinalHeight`	I	R	✓	✓			✓	✓		✓	✓	✓		✓	✓	✓			✓	✓	✓
`CleanSectionFinalHeightCount`	I	R	✓	✓			✓	✓		✓	✓	✓		✓	✓	✓			✓	✓	✓
`CleanSerialRegister`	B	C	✓	✓	✓		✓				✓	✓	✓	✓	✓	✓		✓	✓	✓	
`CleanUntilTrigger`	B	C	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓			✓
`StopCleaningOnPreTrigger`	B	C									✓*										
Sensor Temperature																					
`CoolingFanStatus`	E	RO	✓				✓		✓									✓			
`DisableCoolingFan`	B	C	✓	✓		✓	✓	✓	✓						✓*			✓			
`EnableSensorWindowHeater`	B	C								✓											
`SensorTemperatureReading`	F	RO	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table A-2: Parameter Information and Camera Support (Sheet 14 of 15)

Parameter Name *Value Type* *Constraint Type* *Permission*	Value Type	Constraint Type	BLAZE	EVOLVE	FERGIE/ISO-81	KURO	LANSIS	NIRvana/ST (PIoNIR)	NIRvana HS	NIRvana-LN	PI-MAX 3/4	PI-MTE	PI-MTE3	PIXIS	ProEM/ + / -HS	PyLoN	PyLoN-IR	SOPHIA	TPIR	TPIR-HR	Quad-RO
`Sensor Temperature SetPoint`	F	R	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`Sensor Temperature Status`	E	RO	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
`Vacuum Status`													✓								

Table A-2: Parameter Information and Camera Support (Sheet 15 of 15)

Parameter Name *Value Type* *Constraint Type* *Permission*	Value Type	Constraint Type	BLAZE	EVOLVE	FERGIE/ISO-81	KURO	LANSIS	NIRvana/ST (PIoNIR)	NIRvana HS	NIRvana-LN	PI-MAX 3/4	PI-MTE	PI-MTE3	PIXIS	ProEM/ + / -HS	PyLoN	PyLoN-IR	SOPHIA	TPIR	TPIR-HR	Quad-RO
Spectrograph																					
`Center Wavelength Reading`	F	R O			✓														✓	✓	
`Center WavelengthSet Point`	F	R			✓																
`Center Wavelength Status`	E	R O			✓																
`FocalLength`	F	R O			✓														✓	✓	
`GratingBlazing Wavelength`	F	R O			✓														✓	✓	
`GratingCoating`	E	R O			✓														✓	✓	
`GratingGroove Density`	F	R O			✓														✓	✓	
`GratingType`	E	R O			✓														✓	✓	
`InclusionAngle`	F	R O			✓														✓	✓	
`SensorAngle`	F	R O			✓														✓	✓	
Laser																					
`LaserOutput Mode`	E	C																	✓	✓	
`LaserPower`	F	R																	✓	✓	
`LaserStatus`	E	R O																	✓	✓	
`Laser Wavelength`	F	R O																	✓	✓	

A.2 Accessory Parameter Information

Refer to Table A-3 for the list of available Accessory parameters.

Table A-3: Parameter Information and Accessory Support

Parameter Name	Read Only	Value Type	Constraint Type	FERGIE AEL	FERGIE QTH	FERGIE Laser 532/785	IntelliCal SWIR QTH
Laser							
`InputTriggerStatus`	✓	E				✓*	
`LaserOutputMode`		E	C			✓*	
`LaserPower`		F	R			✓	
`LaserStatus`	✓	E				✓	
`LaserWavelength`	✓	F				✓*	
Lamp							
`Age`	✓	F			✓		✓
`LifeExpectancy`	✓	F			✓		✓
`LightSource`		E	C	✓	✓		✓
`LightSourceStatus`	✓	E			✓		✓

Appendix B: EM Gain Calibration Code Sample

CAUTION!
The information provided within this appendix is **NOT** applicable to emICCD cameras.

The `EMGainCalibration.exe` file is sample code included with PICam which, when built, allows PICam users to perform an EM Gain Calibration that may occasionally be required by ProEM or Evolve systems.

NOTE:
Users with access to LightField do not need to build the sample code in order to perform an EM Gain Calibration. LightField includes `EMGainCalibration.exe` as part of its normal installation. The fully-functional executable file is located within the standard LightField installation directory (i.e., where `PrincetonInstruments.LightField.exe` is stored.

`EMGainCalibration.exe` is an excellent alternative for developers who do not need to create a custom EM gain calibration application. Once the sample code has been built, it can be included as part of the standard customer installation process and allows users to perform EM calibration on an as needed basis.

CAUTION!
When calibrating a ProEM or Evolve camera with a manual shutter (e.g., ProEM:1600,) the shutter **MUST** be closed manually before launching the calibration program.

This is not necessary for a camera with an internal electro-mechanical shutter because the program will automatically close the shutter before beginning the calibration.

B.1 EM Gain Calibration Procedure

Perform the following procedure to perform an EM Gain calibration:

1. If a data acquisition program is running (e.g., custom PICam application, LightField, etc.) close it.
2. Verify that the ProEM or Evolve camera that is to be calibrated is the only camera of its kind connected to the host computer and that it is turned on.
3. If the camera has a manual shutter, verify that it is closed. If necessary, close it.

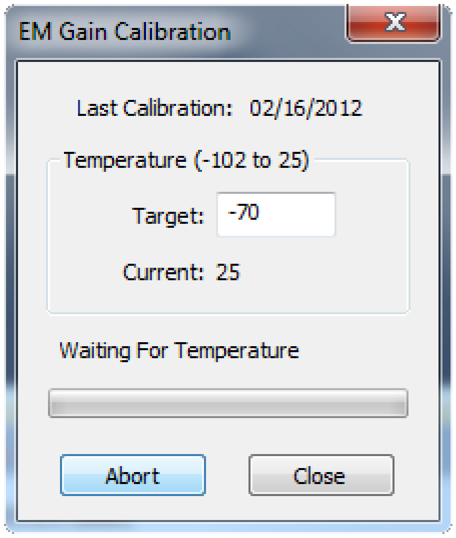
4. Launch `EMGainCalibration.exe.`

CAUTION!

Do not operate the camera while EM gain calibration is in process.

5. When the **EM Gain Calibration** dialog is displayed, the default temperature for the camera is shown in the **Target** field. See Figure B-1.

Figure B-1: Typical EM Gain Calibration Dialog



4411-0161_0004

If the camera typically operates at a different temperature, manually adjust it as necessary.

6. Once the **Current** temperature reaches the **Target** temperature specified:
   - The internal shutter closes;

NOTE:

When using a manual shutter, it must be closed **prior** to initiating the calibration procedure.

   - The internal light illuminates the sensor;
   - A series of data frames is acquired;
   - The calibration map is then calculated.

NOTE:

Wait until the calibration has completed before launching the data acquisition program. It may take up to 10 minutes for the calibration to be completed.

Appendix C: Firmware Upgrade/Restore

This appendix provides the procedures to upgrade and restore a GigE camera's firmware.

NOTE:

It is strongly recommended that cameras be upgraded one at a time to avoid confusion.

C.1 Firmware Upgrade Procedure

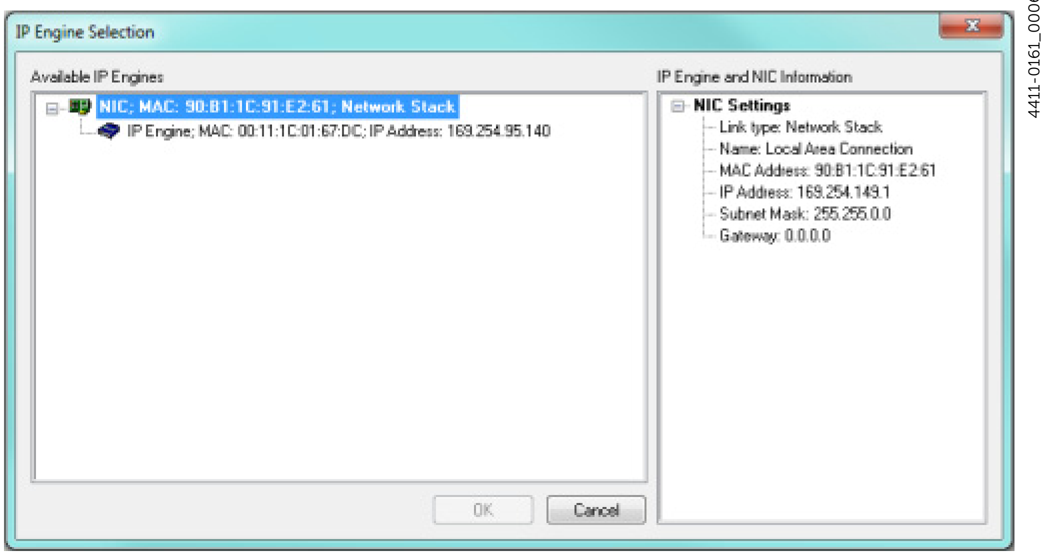
Perform the following procedure to upgrade a GigE camera's firmware to be compatible with PICam 5.x:

1. On the Host Computer, navigate to the following directory:

    `c:\program files\princeton instruments\picam\firmware`

2. Double-click on the `Firmware_Upgrade.exe` file to launch the upgrade tool. The **IP Engine Selection** dialog is displayed. See Figure C-1.

Figure C-1: Firmware Upgrade: Typical IP Engine Selection Dialog



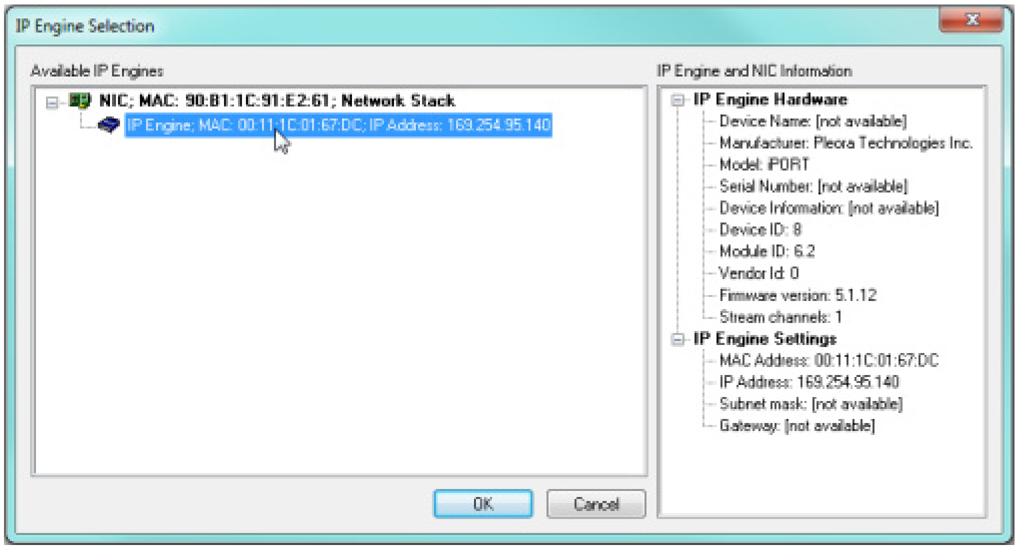
3. Within the **Available IP Engines** field, select the desired IP Engine from the list of available devices.

NOTE:

Each IP Engine listed represents one camera.

See Figure C-2.

Figure C-2: Firmware Upgrade: Selecting Device to be Upgraded

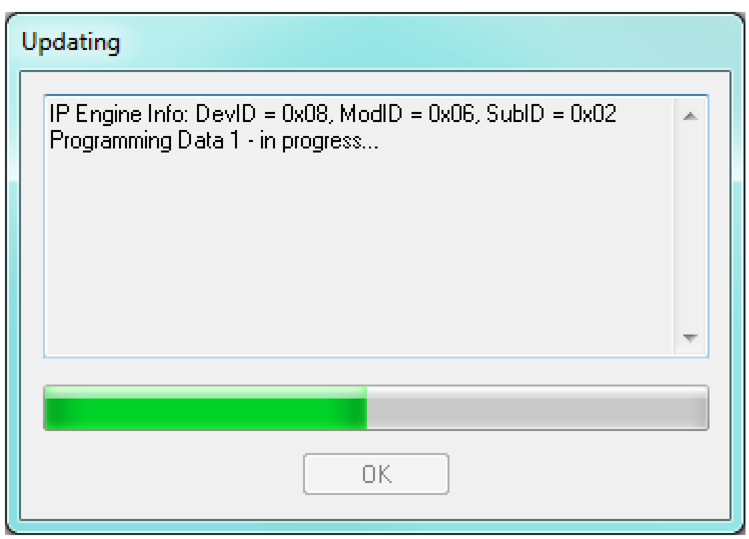


4411-0161_0007

4. Once selected, click 

to begin the automated firmware upgrade process. The **Updating** dialog is displayed, similar to that shown in Figure C-3.

Figure C-3: Firmware Upgrade: Typical Updating Dialog

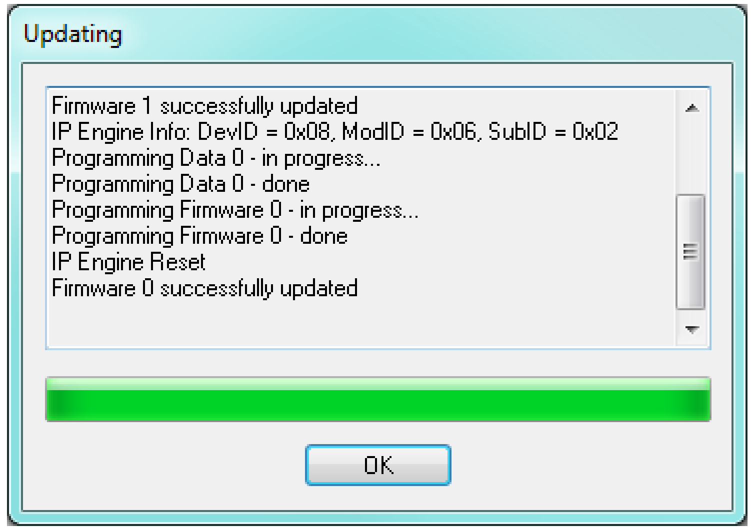


4411-0161_0008

As the upgrade proceeds, the dialog displays appropriate messages, and the progress bar provides a visual indication.

5. Once the upgrade is complete, click **OK** on the **Updating** dialog. See Figure C-4.

Figure C-4: Firmware Upgrade: Upgrade Complete



4411-0161_0009

6. Finally, cycle power to the camera to complete the Firmware Upgrade.

C.2 Restore Firmware

In the unlikely event that PICam 3.x firmware must be restored onto a camera, this section provides detailed information about using the Princeton Instruments provided Firmware Restore tool.

C.2.1 Precautions

Unlike the firmware upgrade procedure that requires no special preparation or precautions, restoring PICam 3.x firmware requires some planning to avoid unnecessary complications.

It is strongly recommended that PICam 3.x firmware be restored on all affected GigE cameras before uninstalling PICam 5.x from the host computer. The Firmware Restore Tool is not included with PICam 3.x installations. Uninstalling PICam 5.x from the host computer will completely remove it making it unavailable for use afterward.

NOTE:

If it is anticipated that additional GigE cameras will require a firmware restore after PICam 5.x has been uninstalled, move the Firmware Restore Tool into a non-PICam directory on the host computer prior to uninstalling PICam 5.x.

Additionally, Pleora EBUS Support is required in order to run the Firmware Restore Tool. Do not uninstall Pleora EBUS Support.

C.2.2 Procedure

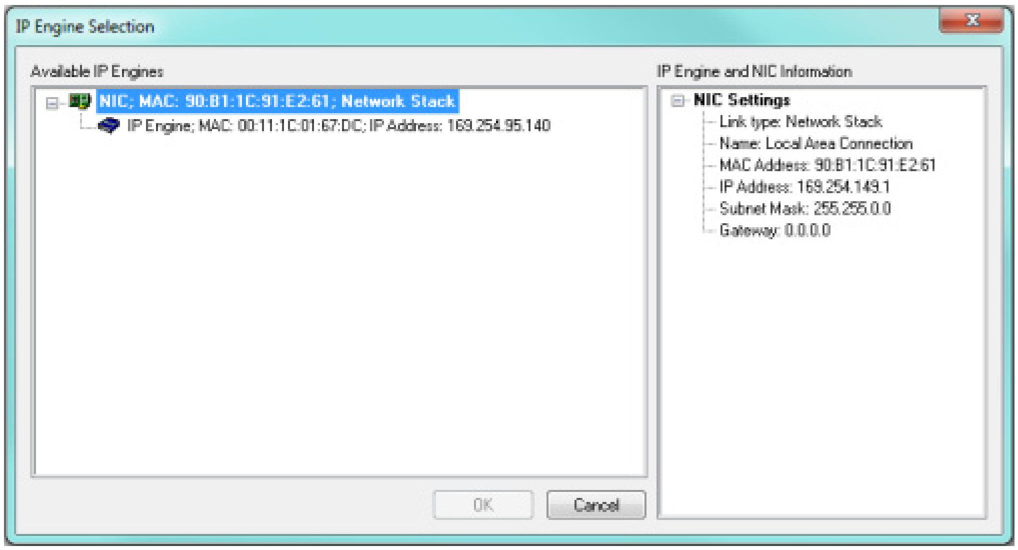
Perform the following procedure:

1. On the Host Computer, navigate to the following directory:

   `c:\program files\princeton instruments\picam\firmware`

2. Double-click on the `Firmware_Restore.exe` file to launch the firmware restore tool. The **IP Engine Selection** dialog is displayed. See Figure C-5.

Figure C-5: Firmware Restore: Typical IP Engine Selection Dialog



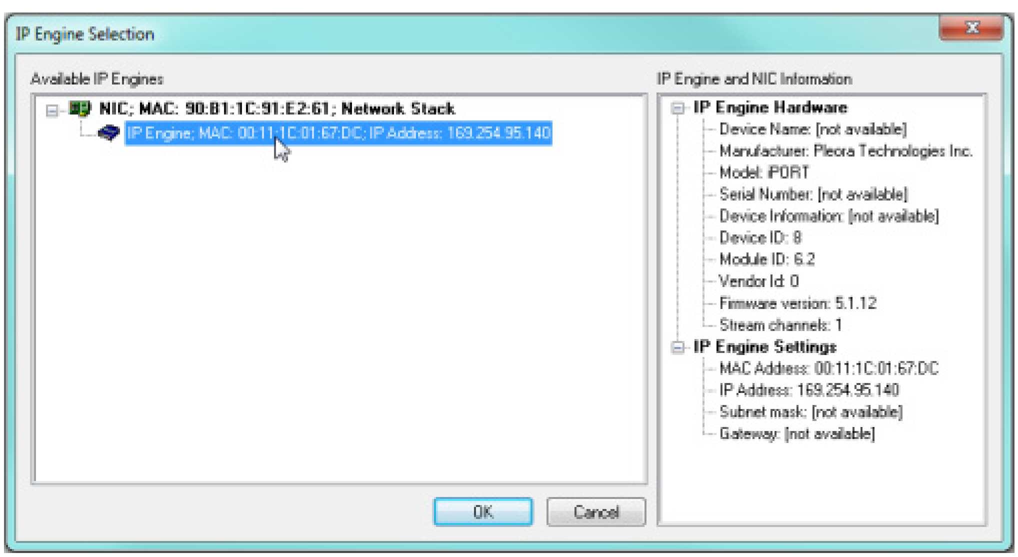
4411-0161_0006

3. Within the **Available IP Engines** field, select the desired IP Engine from the list of available devices. See Figure C-6.

NOTE:

Each IP Engine listed represents one camera.

Figure C-6: Firmware Restore: Selecting Device to be Restored

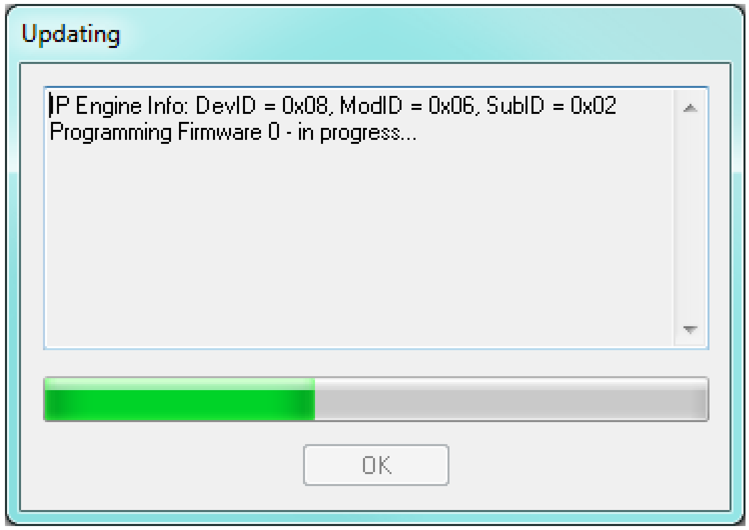


4411-0161_0007

4. Once selected, click 

to begin restoring the firmware. The **Updating** dialog is displayed, similar to that shown in Figure C-7.

Figure C-7: Firmware Restore: Typical Updating Dialog

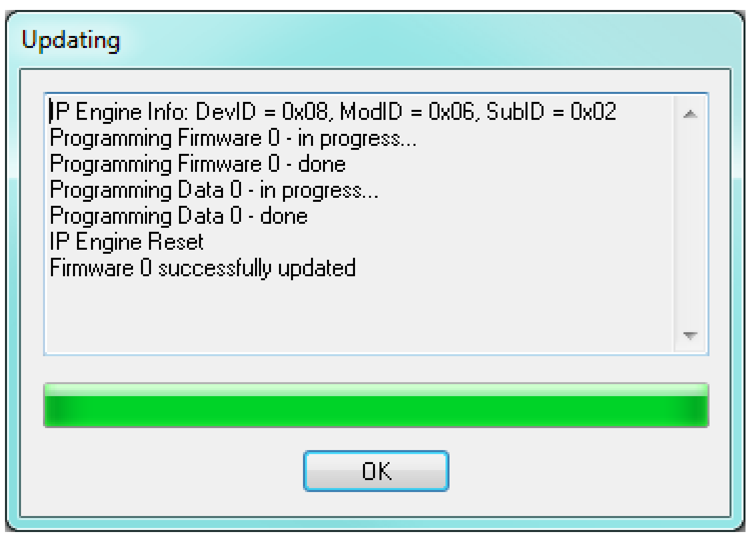


4411-0161_0010

As the firmware restoration proceeds, the dialog displays appropriate messages, and the progress bar provides a visual indication.

5. Once the firmware has been restored, click **OK** on the **Updating** dialog. See Figure C-8.

Figure C-8: Firmware Restore: Complete



4411-0161_0011

6. Finally, cycle power to the camera to complete the Firmware Restore.

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Appendix D: Debugging GigE Cameras

Beginning with PICam 5.x, Princeton Instruments' GigE cameras incorporate a **Camera Heartbeat** that enables the camera and PICam to coordinate communication with one another. As long as a Heartbeat signal has been received by the camera before the specified Heartbeat Timeout has expired, the Camera will continue to be controlled exclusively by PICam.

Under normal operation, the implementation of a Camera Heartbeat is completely transparent to end-users of GigE cameras. However, developers must be keenly aware of how the Heartbeat Timeout impacts camera availability during successive debugging sessions when a PICam process either crashes or is intentionally killed.

Once PICam tasks have been completed, an orderly cessation of the Camera Heartbeat is initiated, and the communication channel between PICam and the camera is closed. At this point, if desired, the camera can again be controlled by PICam or by another program/device.

If, however, PICam halts unexpectedly (e.g., it crashes, the process is killed,) the camera will continue to wait for the next incoming Heartbeat signal until such time as the Heartbeat Timeout has expired. While waiting, the camera remains unavailable to other processes, devices, and programs.

NOTE:

The primary symptom of an expired Heartbeat is a continuous string of unexpected errors being received.

Only after the Heartbeat Timeout has expired without an incoming Heartbeat signal having been detected will the camera close its communication channel with PICam and become available to other processes or devices. At this point, PICam will need to be reinitialized/restarted.

D.1 Debugging

The introduction of the **Camera Heartbeat** presents additional challenges to developers during the Debugging stage of software development. When a breakpoint is reached, PICam execution halts, and no additional Camera Heartbeats are sent to the camera. If the configured Heartbeat Timeout is too short, it will expire, the camera will close its communication channel with PICam requiring it to be reinitialized, and thus preventing subsequent sections of code from easily being executed, examined, and debugged.

The solution to this dilemma is to extend the timeout period sufficiently by configuring the Heartbeat Timeout for an appropriately large value (e.g., 5 minutes.) Increasing the timeout permits the executed code to be examined/debugged while the camera waits patiently for the next incoming Heartbeat signal from PICam. As long as execution of the next chunk of code has been manually initiated before the Heartbeat Timeout expires, PICam will send another Heartbeat signal to the camera (which, in turn, resets the Heartbeat Timeout timer,) and the next chunk of code executes until it reaches the next breakpoint.

D.1.1 Timeout Period Considerations

When deciding on an appropriate timeout period, achieving a balance between having adequate time to review/debug each section of code while not consistently timing out can be tricky.

If too long of a timeout period has been selected and the PICam process crashes or is subsequently killed (a typical action following any debugging session,) the GigE camera will remain unavailable to a future debugging session until the Heartbeat Timeout has expired.

In order to immediately release the camera following a crashed/killed process, cycling its power will clean up any processes that have been abnormally terminated. However, unless the Heartbeat Timeout is programmed for a shorter time period, if the program experiences a subsequent abnormal termination, the camera will again remain unavailable to future debug sessions, and power will need to be cycled again.

D.1.2 Following Debugging

Once debugging has concluded, be sure to reset the value of the `PICAM_GIGE_TIMEOUT` environment variable to a more appropriate timeout.

D.2 Timeout Configuration

The Heartbeat Timeout, in milliseconds, is defined by the environment variable `PICAM_GIGE_TIMEOUT`.

Valid values are:

- Minimum: 500 ms;
- Default: 2000 ms;
- Maximum: 4,294,967,295 ms (approximately 49.7 days).

Appendix E: PICam 5.0 Compatibility Issues

Beginning with PICam 5.0, usage of the suite of Left/Right Margin Parameters has been modified for scenarios where Readout Orientation is not Normal. Specifically, the parameter `PicamParameter_ReadoutOrientation` does not have the value `PicamOrientationMask_Normal`. Originally, the Left/Right Margin parameters would swap positions in this scenario. However, this is incorrect and has been fixed to their proper locations.

The specific set of parameters impacted by this change varies by camera/system, and the default value for each impacted parameter has been properly updated. Although it is extremely rare to either change these parameters or make coding decisions based on their values, if either of these have been implemented, information is provided in the following sections with suggestions about required code updates when upgrading to PICam 5.0.

E.1 FERGIE: 256F/FT, FERGIE: 256B/FT, FERGIE: 256BR/FT, and eXcelon Variant Cameras

This section provides information necessary to update customer-modified code (PICam 4.x and older) for the following cameras in order for it to work as designed with PICam 5.0:

- FERGIE: 256F/FT;
- FERGIE: 256B/FT;
- FERGIE: 256BR/FT;
- eXcelon Variants.

E.1.1 What Changed with PICam 5.0?

In PICam 5.0, the following parameters have been swapped:

- `PicamParameter_ActiveLeftMargin` and `PicamParameter_ActiveRightMargin`

By default, these two parameters remain symmetric, so programs will break only when one, or both, of these parameters have been set asymmetrically.

E.1.2 Code Updates to Retain Existing Behavior

Table E-1 lists code changes required to PICam 4.x (and older) code in order to continue working properly with PICam 5.0.

Table E-1: PICam 4.x (and Older) Code Changes: FERGIE: 256F/FT, 256B/FT, 256BR/FT, and eXcelon Variants

In PICam 4.x and Older Code, if you:		... in PICam 5.0, you need to:	
Action	Parameter	Action	Parameter
Get	PicamParameter_ActiveLeftMargin	Get	PicamParameter_ActiveRightMargin
Set	PicamParameter_ActiveLeftMargin	Set	PicamParameter_ActiveRightMargin
Get	PicamParameter_ActiveRightMargin	Get	PicamParameter_ActiveLeftMargin
Set	PicamParameter_ActiveRightMargin	Set	PicamParameter_ActiveLeftMargin

E.2 PI-MAX4: 2048B, PI-MAX4: 2048B-RF Cameras

This section provides information necessary to update customer-modified code (PICam 4.x and older) for the following cameras in order for it to work as designed with PICam 5.0:

- PI-MAX4:2048B;
- PI-MAX4:2048B-RF.

E.2.1 What Changed with PICam 5.0?

In PICam 5.0, the following parameters have been swapped:

- `PicamParameter_ActiveLeftMargin` and `PicamParameter_ActiveRightMargin`

By default, these two parameters remain symmetric, so programs will break only when one, or both, of these parameters have been set asymmetrically.

E.2.2 Code Updates to Retain Existing Behavior

Table E-2 lists code changes required to PICam 4.x (and older) code in order to continue working properly with PICam 5.0.

Table E-2: PICam 4.x (and Older) Code Changes: PI-MAX4: 2048B/2048B-RF

In PICam 4.x and Older Code, if you:		... in PICam 5.0, you need to:	
Action	Parameter	Action	Parameter
`Get`	`PicamParameter_ActiveLeftMargin`	`Get`	`PicamParameter_ActiveRightMargin`
`Set`	`PicamParameter_ActiveLeftMargin`	`Set`	`PicamParameter_ActiveRightMargin`
`Get`	`PicamParameter_ActiveRightMargin`	`Get`	`PicamParameter_ActiveLeftMargin`
`Set`	`PicamParameter_ActiveRightMargin`	`Set`	`PicamParameter_ActiveLeftMargin`

E.3 PI-MAX4: 512B/EM, PI-MAX4: 1024B/EM

This section provides information necessary to update customer-modified code (PICam 4.x and older) for the following cameras in order for it to work as designed with PICam 5.0:

- PI-MAX4: 512B/EM;
- PI-MAX4: 1024B/EM.

E.3.1 What Changed with PICam 5.0?

In PICam 5.0, the following parameters have been made symmetrical in general, and have been swapped in **Electron Multiplied** (`PicamAdcQuality_ElectronMultiplied`):

- `PicamParameter_ActiveLeftMargin` and `PicamParameter_ActiveRightMargin`
- `PicamParameter_SensorActiveLeftMargin` and `PicamParameter_SensorActiveRightMargin`

E.3.2 Code Updates to Retain Existing Behavior

Table E-3 lists code changes required to PICam 4.x (and older) code in order to continue working properly with PICam 5.0.

Table E-3: PICam 4.x (and Older) Code Changes: PI-MAX4: 512B/EM, 1024B/EM (Sheet 1 of 2)

In PICam 4.x and Older Code, if you:		... in PICam 5.0, you need to:	
Action	Parameter	Action	Parameter
ADC Quality: Electron Multiplied			
Get	PicamParameter_ActiveLeftMargin	Get	PicamParameter_ActiveRightMargin
Set	PicamParameter_ActiveLeftMargin	Set	PicamParameter_ActiveRightMargin
Get	PicamParameter_ActiveRightMargin	Get Subtract	PicamParameter_ActiveLeftMargin **16** from the value
Set	PicamParameter_ActiveRightMargin	Add Set	**16** to the value PicamParameter_ActiveLeftMargin
Get	PicamParameter_SensorActiveLeftMargin	Get	PicamParameter_SensorActiveRightMargin
Get	PicamParameter_SensorActiveRightMargin	Get Subtract	PicamParameter_SensorActiveLeftMargin **16** from the value

Table E-3: PICam 4.x (and Older) Code Changes: PI-MAX4: 512B/EM, 1024B/EM (Sheet 2 of 2)

In PICam 4.x and Older Code, if you:		... in PICam 5.0, you need to:	
Action	Parameter	Action	Parameter
ADC Quality: Low Noise			
Get	PicamParameter_ActiveRightMargin	Get Subtract	PicamParameter_ActiveRightMargin 16 from the value
Set	PicamParameter_ActiveRightMargin	Add Set	16 to the value PicamParameter_ActiveRightMargin
Get	PicamParameter_SensorActiveRightMargin	Get Subtract	PicamParameter_SensorActiveRightMargin 16 from the value

E.4 PI-MAX4: 512EM/1024EM Cameras

This section provides information necessary to update customer-modified code (PICam 4.x and older) for the following cameras in order for it to work as designed with PICam 5.0:

- PI-MAX4: 512EM;
- PI-MAX4: 1024EM.

E.4.1 What Changed with PICam 5.0?

In PICam 5.0, the following parameters have been made symmetrical in general, and have been swapped in **Low Noise** (`PicamAdcQuality_LowNoise`):

- `PicamParameter_ActiveLeftMargin` and `PicamParameter_ActiveRightMargin`
- `PicamParameter_SensorActiveLeftMargin` and `PicamParameter_SensorActiveRightMargin`

E.4.2 Code Updates to Retain Existing Behavior

Table E-4 lists code changes required to PICam 4.x (and older) code in order to continue working properly with PICam 5.0.

Table E-4: PICam 4.x (and Older) Code Changes: PI-MAX4: 512EM/1024EM

In PICam 4.x and Older Code, if you:		... in PICam 5.0, you need to:	
Action	Parameter	Action	Parameter
ADC Quality: Electron Multiplied			
Get	PicamParameter_ActiveRightMargin	Get Subtract	PicamParameter_ActiveRightMargin 16 from the value
Set	PicamParameter_ActiveRightMargin	Add Set	16 to the value PicamParameter_ActiveRightMargin
Get	PicamParameter_SensorActiveRightMargin	Get Subtract	PicamParameter_SensorActiveRightMargin 16 from the value
ADC Quality: Low Noise			
Get	PicamParameter_ActiveLeftMargin	Get	PicamParameter_ActiveRightMargin
Set	PicamParameter_ActiveLeftMargin	Set	PicamParameter_ActiveRightMargin
Get	PicamParameter_ActiveRightMargin	Get Subtract	PicamParameter_ActiveLeftMargin 16 from the value
Set	PicamParameter_ActiveRightMargin	Add Set	16 to the value PicamParameter_ActiveLeftMargin
Get	PicamParameter_SensorActiveLeftMargin	Get	PicamParameter_SensorActiveRightMargin
Get	PicamParameter_SensorActiveRightMargin	Get Subtract	PicamParameter_SensorActiveLeftMargin 16 from the value

E.5 PI-MTE: 1300B/1300BR Cameras

This section provides information necessary to update customer-modified code (PICam 4.x and older) for the following cameras in order for it to work as designed with PICam 5.0:

- PI-MTE: 1300B;
- PI-MTE: 1300BR.

E.5.1 What Changed with PICam 5.0?

In PICam 5.0, the following **High Capacity** (`PicamAdcQuality_HighCapacity`) parameters have been swapped:

- `PicamParameter_ActiveLeftMargin` and `PicamParameter_ActiveRightMargin`

By default, these two parameters remain symmetric, so programs will break only when one, or both, of these parameters have been set asymmetrically in **High Capacity**.

E.5.2 Code Updates to Retain Existing Behavior

Table E-5 lists code changes required to PICam 4.x (and older) code in order to continue working properly with PICam 5.0.

Table E-5: PICam 4.x (and Older) Code Changes: PI-MTE: 1300B/1300BR

In PICam 4.x and Older Code, if you:		... in PICam 5.0, you need to:	
Action	Parameter	Action	Parameter
ADC Quality: High Capacity			
Get	PicamParameter_ActiveLeftMargin	Get	PicamParameter_ActiveRightMargin
Set	PicamParameter_ActiveLeftMargin	Set	PicamParameter_ActiveRightMargin
Get	PicamParameter_ActiveRightMargin	Get	PicamParameter_ActiveLeftMargin
Set	PicamParameter_ActiveRightMargin	Set	PicamParameter_ActiveLeftMargin

E.6 PI-MTE: 1300R Cameras

This section provides information necessary to update customer-modified code (PICam 4.x and older) for the following cameras in order for it to work as designed with PICam 5.0:

- PI-MTE: 1300R.

E.6.1 What Changed with PICam 5.0?

In PICam 5.0, the following **Low Noise** (`PicamAdcQuality_LowNoise`) parameters have been swapped:

- `PicamParameter_ActiveLeftMargin` and `PicamParameter_ActiveRightMargin`

By default, these two parameters remain symmetric, so programs will break only when one, or both, of these parameters have been set asymmetrically in **Low Noise**.

E.6.2 Code Updates to Retain Existing Behavior

Table E-6 lists code changes required to PICam 4.x (and older) code in order to continue working properly with PICam 5.0.

Table E-6: PICam 4.x (and Older) Code Changes: PI-MTE: 1300R

In PICam 4.x and Older Code, if you:		... in PICam 5.0, you need to:	
Action	Parameter	Action	Parameter
ADC Quality: Low Noise			
Get	PicamParameter_ActiveLeftMargin	Get	PicamParameter_ActiveRightMargin
Set	PicamParameter_ActiveLeftMargin	Set	PicamParameter_ActiveRightMargin
Get	PicamParameter_ActiveRightMargin	Get	PicamParameter_ActiveLeftMargin
Set	PicamParameter_ActiveRightMargin	Set	PicamParameter_ActiveLeftMargin

E.7 PIXIS: 100B/100BR/400B/400BR/1300B/1300BR, and XO/XF/XB/eXcelon Variant Cameras

This section provides information necessary to update customer-modified code (PICam 4.x and older) for the following cameras in order for it to work as designed with PICam 5.0:

- PIXIS: 100B;
- PIXIS: 100BR;
- PIXIS: 400B;
- PIXIS: 400BR;
- PIXIS: 1300B;
- PIXIS: 1300BR;
- XO/XF/XF eXcelon Variants.

E.7.1 What Changed with PICam 5.0?

In PICam 5.0, the following **High Capacity** (`PicamAdcQuality_HighCapacity`) parameters have been swapped:

- `PicamParameter_ActiveLeftMargin` and `PicamParameter_ActiveRightMargin`

By default, these two parameters remain symmetric, so programs will break only when one, or both, of these parameters have been set asymmetrically in **High Capacity**.

E.7.2 Code Updates to Retain Existing Behavior

Table E-7 lists code changes required to PICam 4.x (and older) code in order to continue working properly with PICam 5.0.

Table E-7: PICam 4.x (and Older) Code Changes: PIXIS: 100B/100BR/400B/400BR/1300B/1300BR, and XO/XF/XB/eXcelon Variants

In PICam 4.x and Older Code, if you:		... in PICam 5.0, you need to:	
Action	Parameter	Action	Parameter
ADC Quality: High Capacity			
Get	PicamParameter_ActiveLeftMargin	Get	PicamParameter_ActiveRightMargin
Set	PicamParameter_ActiveLeftMargin	Set	PicamParameter_ActiveRightMargin
Get	PicamParameter_ActiveRightMargin	Get	PicamParameter_ActiveLeftMargin
Set	PicamParameter_ActiveRightMargin	Set	PicamParameter_ActiveLeftMargin

E.8 PIXIS: 100F/100R/100C/400F/400R/1300F/1300F-2, and XB Variant Cameras

This section provides information necessary to update customer-modified code (PICam 4.x and older) for the following cameras in order for it to work as designed with PICam 5.0:

- PIXIS: 100F;
- PIXIS: 100R;
- PIXIS: 100C;
- PIXIS: 400F;
- PIXIS: 400R;
- PIXIS: 1300F;
- PIXIS: 1300F-2;
- XB Variants.

E.8.1 What Changed with PICam 5.0?

In PICam 5.0, the following **Low Noise** (`PicamAdcQuality_LowNoise`) parameters have been swapped:

- `PicamParameter_ActiveLeftMargin` and `PicamParameter_ActiveRightMargin`

By default, these two parameters remain symmetric, so programs will break only when one, or both, of these parameters have been set asymmetrically in **Low Noise**.

E.8.2 Code Updates to Retain Existing Behavior

Table E-8 lists code changes required to PICam 4.x (and older) code in order to continue working properly with PICam 5.0.

Table E-8: PICam 4.x (and Older) Code Changes: PIXIS: 100F/100R/100C/400F/400R/1300F/1300F-2, and XB Variants

In PICam 4.x and Older Code, if you:		... in PICam 5.0, you need to:	
Action	Parameter	Action	Parameter
ADC Quality: Low Noise			
`Get`	`PicamParameter_ActiveLeftMargin`	`Get`	`PicamParameter_ActiveRightMargin`
`Set`	`PicamParameter_ActiveLeftMargin`	`Set`	`PicamParameter_ActiveRightMargin`
`Get`	`PicamParameter_ActiveRightMargin`	`Get`	`PicamParameter_ActiveLeftMargin`
`Set`	`PicamParameter_ActiveRightMargin`	`Set`	`PicamParameter_ActiveLeftMargin`

E.9 PIXIS: 512F, PIXIS-XO: 512F, PIXIS-XF: 512F Cameras

This section provides information necessary to update customer-modified code (PICam 4.x and older) for the following cameras in order for it to work as designed with PICam 5.0:

- PIXIS: 512F;
- PIXIS-XO: 512F;
- PIXIS-XF: 512F.

E.9.1 What Changed with PICam 5.0?

In PICam 5.0, the following parameters have been swapped:

- `PicamParameter_ActiveLeftMargin` and `PicamParameter_ActiveRightMargin`
- `PicamParameter_SensorActiveLeftMargin` and `PicamParameter_SensorActiveRightMargin`

E.9.2 Code Updates to Retain Existing Behavior

Table E-9 lists code changes required to PICam 4.x (and older) code in order to continue working properly with PICam 5.0.

Table E-9: PICam 4.x (and Older) Code Changes: PIXIS: 512F, PIXIS-XO: 512F, and PIXIS-XF: 512F

In PICam 4.x and Older Code, if you:		... in PICam 5.0, you need to:	
Action	Parameter	Action	Parameter
Get	PicamParameter_ActiveLeftMargin	Get	PicamParameter_ActiveRightMargin
Set	PicamParameter_ActiveLeftMargin	Set	PicamParameter_ActiveRightMargin
Get	PicamParameter_ActiveRightMargin	Get	PicamParameter_ActiveLeftMargin
Set	PicamParameter_ActiveRightMargin	Set	PicamParameter_ActiveLeftMargin
Get	PicamParameter_SensorActiveLeftMargin	Get	PicamParameter_SensorActiveRightMargin
Get	PicamParameter_SensorActiveRightMargin	Get	PicamParameter_SensorActiveLeftMargin

E.10 ProEM Cameras (All Models)

This section provides information necessary to update customer-modified code (PICam 4.x and older) for the following cameras in order for it to work as designed with PICam 5.0:

- ProEM (All Models)

E.10.1 What Changed with PICam 5.0?

In PICam 5.0, the following parameters have been made symmetrical in general, and have been swapped in **Electron Multiplied** (`PicamAdcQuality_ElectronMultiplied`):

- `PicamParameter_ActiveLeftMargin` and `PicamParameter_ActiveRightMargin`
- `PicamParameter_SensorActiveLeftMargin` and `PicamParameter_SensorActiveRightMargin`

E.10.2 Code Updates to Retain Existing Behavior

Table E-10 lists code changes required to PICam 4.x (and older) code in order to continue working properly with PICam 5.0.

Table E-10: PICam 4.x (and Older) Code Changes: ProEM (All Models)

In PICam 4.x and Older Code, if you:		... in PICam 5.0, you need to:	
Action	Parameter	Action	Parameter
ADC Quality: Electron Multiplied			
Get	PicamParameter_ActiveLeftMargin	Get	PicamParameter_ActiveRightMargin
Set	PicamParameter_ActiveLeftMargin	Set	PicamParameter_ActiveRightMargin
Get	PicamParameter_ActiveRightMargin	Get Subtract	PicamParameter_ActiveLeftMargin 16 from the value
Set	PicamParameter_ActiveRightMargin	Add Set	16 to the value PicamParameter_ActiveLeftMargin
Get	PicamParameter_SensorActiveLeftMargin	Get	PicamParameter_SensorActiveRightMargin
Get	PicamParameter_SensorActiveRightMargin	Get Subtract	PicamParameter_SensorActiveLeftMargin 16 from the value
ADC Quality: Low Noise			
Get	PicamParameter_ActiveRightMargin	Get Subtract	PicamParameter_ActiveRightMargin 16 from the value
Set	PicamParameter_ActiveRightMargin	Add Set	16 to the value PicamParameter_ActiveRightMargin
Get	PicamParameter_SensorActiveRightMargin	Get Subtract	PicamParameter_SensorActiveRightMargin 16 from the value

E.11 ProEM-HS: 1KB-10 and eXcelon Variant Cameras

This section provides information necessary to update customer-modified code (PICam 4.x and older) for the following cameras in order for it to work as designed with PICam 5.0:

- ProEM-HS: 1KB-10;
- eXcelon Variants.

E.11.1 What Changed with PICam 5.0?

In PICam 5.0, the following parameters have been swapped:

- PicamParameter_ActiveLeftMargin and PicamParameter_ActiveRightMargin
- PicamParameter_SensorActiveLeftMargin and PicamParameter_SensorActiveRightMargin

E.11.2 Code Updates to Retain Existing Behavior

Table E-11 lists code changes required to PICam 4.x (and older) code in order to continue working properly with PICam 5.0.

Table E-11: PICam 4.x (and Older) Code Changes: ProEM-HS: 1KB-10 and eXcelon Variants

In PICam 4.x and Older Code, if you:		... in PICam 5.0, you need to:	
Action	Parameter	Action	Parameter
Get	PicamParameter_ActiveLeftMargin	Get	PicamParameter_ActiveRightMargin
Set	PicamParameter_ActiveLeftMargin	Set	PicamParameter_ActiveRightMargin
Get	PicamParameter_ActiveRightMargin	Get Subtract	PicamParameter_ActiveLeftMargin 24 from this value
Set	PicamParameter_ActiveRightMargin	Add Set	24 to the value PicamParameter_ActiveLeftMargin
Get	PicamParameter_SensorActiveLeftMargin	Get	PicamParameter_SensorActiveRightMargin
Get	PicamParameter_SensorActiveRightMargin	Get Subtract	PicamParameter_SensorActiveLeftMargin 24 from this value

E.12 ProEM-HS: 512B/512BK/1024B and eXcelon Variant Cameras

This section provides information necessary to update customer-modified code (PICam 4.x and older) for the following cameras in order for it to work as designed with PICam 5.0:

- ProEM-HS: 512B;
- ProEM-HS: 512BK;
- ProEM-HS: 1024B;
- eXcelon Variants

E.12.1 What Changed with PICam 5.0?

In PICam 5.0, the following parameters have been made symmetrical in general, and have been swapped in **Electron Multiplied** (`PicamAdcQuality_ElectronMultiplied`):

- `PicamParameter_ActiveLeftMargin` and `PicamParameter_ActiveRightMargin`
- `PicamParameter_SensorActiveLeftMargin` and `PicamParameter_SensorActiveRightMargin`

E.12.2 Code Updates to Retain Existing Behavior

Table E-12 lists code changes required to PICam 4.x (and older) code in order to continue working properly with PICam 5.0.

Table E-12: PICam 4.x (and Older) Code Changes: ProEM-HS: 512B/512BK/1024B and eXcelon Variants (Sheet 1 of 2)

In PICam 4.x and Older Code, if you:		... in PICam 5.0, you need to:	
Action	Parameter	Action	Parameter
ADC Quality: Electron Multiplied			
Get	PicamParameter_ActiveLeftMargin	Get	PicamParameter_ActiveRightMargin
Set	PicamParameter_ActiveLeftMargin	Set	PicamParameter_ActiveRightMargin
Get	PicamParameter_ActiveRightMargin	Get Subtract	PicamParameter_ActiveLeftMargin 16 from the value
Set	PicamParameter_ActiveRightMargin	Add Set	16 to the value PicamParameter_ActiveLeftMargin
Get	PicamParameter_SensorActiveLeftMargin	Get	PicamParameter_SensorActiveRightMargin
Get	PicamParameter_SensorActiveRightMargin	Get Subtract	PicamParameter_SensorActiveLeftMargin 16 from the value

Table E-12: PICam 4.x (and Older) Code Changes: ProEM-HS: 512B/512BK/1024B and eXcelon Variants (Sheet 2 of 2)

In PICam 4.x and Older Code, if you:		... in PICam 5.0, you need to:	
Action	Parameter	Action	Parameter
ADC Quality: Low Noise			
Get	PicamParameter_ActiveRightMargin	Get Subtract	PicamParameter_ActiveRightMargin 16 from the value
Set	PicamParameter_ActiveRightMargin	Add Set	16 to the value PicamParameter_ActiveRightMargin
Get	PicamParameter_SensorActiveRightMargin	Get Subtract	PicamParameter_SensorActiveRightMargin 16 from the value

E.13 ProEM+ (All Models)

This section provides information necessary to update customer-modified code (PICam 4.x and older) for the following cameras in order for it to work as designed with PICam 5.0:

- ProEM+ (All Models)

E.13.1 What Changed with PICam 5.0?

In PICam 5.0, the following parameters have been made symmetrical in general, and have been swapped in **Electron Multiplied** (`PicamAdcQuality_ElectronMultiplied`):

- `PicamParameter_ActiveLeftMargin` and `PicamParameter_ActiveRightMargin`
- `PicamParameter_SensorActiveLeftMargin` and `PicamParameter_SensorActiveRightMargin`

E.13.2 Code Updates to Retain Existing Behavior

Table E-13 lists code changes required to PICam 4.x (and older) code in order to continue working properly with PICam 5.0.

Table E-13: PICam 4.x (and Older) Code Changes: ProEM+ (All Models)

In PICam 4.x and Older Code, if you:		... in PICam 5.0, you need to:	
Action	Parameter	Action	Parameter
ADC Quality: Electron Multiplied			
Get	PicamParameter_ActiveLeftMargin	Get	PicamParameter_ActiveRightMargin
Set	PicamParameter_ActiveLeftMargin	Set	PicamParameter_ActiveRightMargin
Get	PicamParameter_ActiveRightMargin	Get Subtract	PicamParameter_ActiveLeftMargin 16 from the value
Set	PicamParameter_ActiveRightMargin	Add Set	16 to the value PicamParameter_ActiveLeftMargin
Get	PicamParameter_SensorActiveLeftMargin	Get	PicamParameter_SensorActiveRightMargin
Get	PicamParameter_SensorActiveRightMargin	Get Subtract	PicamParameter_SensorActiveLeftMargin 16 from the value
ADC Quality: Low Noise			
Get	PicamParameter_ActiveRightMargin	Get Subtract	PicamParameter_ActiveRightMargin 16 from the value
Set	PicamParameter_ActiveRightMargin	Add Set	16 to the value PicamParameter_ActiveRightMargin
Get	PicamParameter_SensorActiveRightMargin	Get Subtract	PicamParameter_SensorActiveRightMargin 16 from the value

E.14 PyLoN: 100B/100BR/400B/400BR/1300B/1300BR, and eXcelon Variant Cameras

This section provides information necessary to update customer-modified code (PICam 4.x and older) for the following cameras in order for it to work as designed with PICam 5.0:

- PyLoN: 100B;
- PyLoN: 100BR;
- PyLoN: 400B;
- PyLoN: 400BR;
- PyLoN: 1300B;
- PyLoN: 1300BR;
- eXcelon Variants.

E.14.1 What Changed with PICam 5.0?

In PICam 5.0, the following **High Capacity** (`PicamAdcQuality_HighCapacity`) parameters have been swapped:

- `PicamParameter_ActiveLeftMargin` and `PicamParameter_ActiveRightMargin`

By default, these two parameters remain symmetric, so programs will break only when one, or both, of these parameters have been set asymmetrically in **High Capacity**.

E.14.2 Code Updates to Retain Existing Behavior

Table E-14 lists code changes required to PICam 4.x (and older) code in order to continue working properly with PICam 5.0.

Table E-14: PICam 4.x (and Older) Code Changes: PyLoN: 100B/100BR/400B/400BR/1300B/1300BR, and eXcelon Variants

In PICam 4.x and Older Code, if you:		... in PICam 5.0, you need to:	
Action	Parameter	Action	Parameter
ADC Quality: High Capacity			
Get	PicamParameter_ActiveLeftMargin	Get	PicamParameter_ActiveRightMargin
Set	PicamParameter_ActiveLeftMargin	Set	PicamParameter_ActiveRightMargin
Get	PicamParameter_ActiveRightMargin	Get	PicamParameter_ActiveLeftMargin
Set	PicamParameter_ActiveRightMargin	Set	PicamParameter_ActiveLeftMargin

E.15 PyLoN: 100F/400F/1300F/1300R Cameras

This section provides information necessary to update customer-modified code (PICam 4.x and older) for the following cameras in order for it to work as designed with PICam 5.0:

- PyLoN: 100F;
- PyLoN: 400F;
- PyLoN: 1300F;
- PyLoN: 1300R.

E.15.1 What Changed with PICam 5.0?

In PICam 5.0, the following **Low Noise** (`PicamAdcQuality_LowNoise`) parameters have been swapped:

- `PicamParameter_ActiveLeftMargin` and `PicamParameter_ActiveRightMargin`

By default, these two parameters remain symmetric, so programs will break only when one, or both, of these parameters have been set asymmetrically in **Low Noise**.

E.15.2 Code Updates to Retain Existing Behavior

Table E-15 lists code changes required to PICam 4.x (and older) code in order to continue working properly with PICam 5.0.

Table E-15: PICam 4.x (and Older) Code Changes: PyLoN: 100F/400F/1300F/1300R

In PICam 4.x and Older Code, if you:		... in PICam 5.0, you need to:	
Action	Parameter	Action	Parameter
ADC Quality: Low Noise			
Get	PicamParameter_ActiveLeftMargin	Get	PicamParameter_ActiveRightMargin
Set	PicamParameter_ActiveLeftMargin	Set	PicamParameter_ActiveRightMargin
Get	PicamParameter_ActiveRightMargin	Get	PicamParameter_ActiveLeftMargin
Set	PicamParameter_ActiveRightMargin	Set	PicamParameter_ActiveLeftMargin

Warranty and Service

Limited Warranty

Teledyne Princeton Instruments ("us," "we," "our,") makes the following limited warranties. These limited warranties extend to the original purchaser ("You," "you,") only and no other purchaser or transferee. We have complete control over all warranties and may alter or terminate any or all warranties at any time we deem necessary.

Basic Limited One (1) Year Warranty

Teledyne Princeton Instruments warrants this product against substantial defects in materials and/or workmanship for a period of up to one (1) year after shipment. During this period, Teledyne Princeton Instruments will repair the product or, at its sole option, repair or replace any defective part without charge to you. You must deliver the entire product to the Teledyne Princeton Instruments factory or, at our option, to a factory-authorized service center. You are responsible for the shipping costs to return the product. International customers should contact their local Teledyne Princeton Instruments authorized representative/distributor for repair information and assistance, or visit our technical support page at www.princetoninstruments.com.

Limited One (1) Year Warranty on Refurbished or Discontinued Products

Teledyne Princeton Instruments warrants, with the exception of the CCD imaging device (which carries NO WARRANTIES EXPRESS OR IMPLIED,) this product against defects in materials or workmanship for a period of up to one (1) year after shipment. During this period, Teledyne Princeton Instruments will repair or replace, at its sole option, any defective parts, without charge to you. You must deliver the entire product to the Teledyne Princeton Instruments factory or, at our option, a factory-authorized service center. You are responsible for the shipping costs to return the product to Teledyne Princeton Instruments. International customers should contact their local Teledyne Princeton Instruments representative/distributor for repair information and assistance or visit our technical support page at www.princetoninstruments.com.

XP Vacuum Chamber Limited Lifetime Warranty

Teledyne Princeton Instruments warrants that the cooling performance of the system will meet our specifications over the lifetime of an XP style detector (has all metal seals) or Teledyne Princeton Instruments will, at its sole option, repair or replace any vacuum chamber components necessary to restore the cooling performance back to the original specifications at no cost to the original purchaser. *Any failure to "cool to spec" beyond our Basic (1) year limited warranty from date of shipment, due to a non-vacuum-related component failure (e.g., any components that are electrical/electronic) is NOT covered and carries NO WARRANTIES EXPRESSED OR IMPLIED.* Responsibility for shipping charges is as described above under our Basic Limited One (1) Year Warranty.

Sealed Chamber Integrity Limited 12 Month Warranty

Teledyne Princeton Instruments warrants the sealed chamber integrity of all our products for a period of twelve (12) months after shipment. If, at anytime within twelve (12) months from the date of delivery, the detector should experience a sealed chamber failure, all parts and labor needed to restore the chamber seal will be covered by us. *Open chamber products carry NO WARRANTY TO THE CCD IMAGING DEVICE, EXPRESSED OR IMPLIED.* Responsibility for shipping charges is as described above under our Basic Limited One (1) Year Warranty.

Vacuum Integrity Limited 12 Month Warranty

Teledyne Princeton Instruments warrants the vacuum integrity of "Non-XP" style detectors (do not have all metal seals) for a period of up to twelve (12) months from the date of shipment. We warrant that the detector head will maintain the factory-set operating temperature without the requirement for customer pumping. Should the detector experience a Vacuum Integrity failure at anytime within twelve (12) months from the date of delivery all parts and labor needed to restore the vacuum integrity will be covered by us. Responsibility for shipping charges is as described above under our Basic Limited One (1) Year Warranty.

Image Intensifier Detector Limited One Year Warranty

All image intensifier products are inherently susceptible to Phosphor and/or Photocathode burn (physical damage) when exposed to high intensity light. Teledyne Princeton Instruments warrants, with the exception of image intensifier products that are found to have Phosphor and/or Photocathode burn damage (which carry NO WARRANTIES EXPRESSED OR IMPLIED,) all image intensifier products for a period of one (1) year after shipment. *Refer to additional Limited One (1) year Warranty terms and conditions above, which apply to this warranty.* Responsibility for shipping charges is as described above under our Basic Limited One (1) Year Warranty.

X-Ray Detector Limited One Year Warranty

Teledyne Princeton Instruments warrants, with the exception of CCD imaging device and fiber optic assembly damage due to X-rays (which carry NO WARRANTIES EXPRESSED OR IMPLIED,) all X-ray products for one (1) year after shipment. *Refer to additional Basic Limited One (1) year Warranty terms and conditions above, which apply to this warranty.* Responsibility for shipping charges is as described above under our Basic Limited One (1) Year Warranty.

Software Limited Warranty

Teledyne Princeton Instruments warrants all of our manufactured software discs to be free from substantial defects in materials and/or workmanship under normal use for a period of one (1) year from shipment. Teledyne Princeton Instruments does not warrant that the function of the software will meet your requirements or that operation will be uninterrupted or error free. You assume responsibility for selecting the software to achieve your intended results and for the use and results obtained from the software. In addition, during the one (1) year limited warranty. The original purchaser is entitled to receive free version upgrades. Version upgrades supplied free of charge will be in the form of a download from the Internet. Those customers who do not have access to the Internet may obtain the version upgrades on a CDROM from our factory for an incidental shipping and handling charge. *Refer to Item 12 in Your Responsibility of this warranty for more information.*

Owner's Manual and Troubleshooting

You should read the owner's manual thoroughly before operating this product. In the unlikely event that you should encounter difficulty operating this product, the owner's manual should be consulted before contacting the Teledyne Princeton Instruments technical support staff or authorized service representative for assistance. If you have consulted the owner's manual and the problem still persists, please contact the Teledyne Princeton Instruments technical support staff or our authorized service representative. *Refer to Item 12 in* *Your Responsibility* *of this warranty for more information.*

Your Responsibility

The above Limited Warranties are subject to the following terms and conditions:

1. You must retain your bill of sale (invoice) and present it upon request for service and repairs or provide other proof of purchase satisfactory to Teledyne Princeton Instruments.
2. You must notify the Teledyne Princeton Instruments factory service center within (30) days after you have taken delivery of a product or part that you believe to be defective. With the exception of customers who claim a "technical issue" with the operation of the product or part, all invoices must be paid in full in accordance with the terms of sale. Failure to pay invoices when due may result in the interruption and/or cancellation of your one (1) year limited warranty and/or any other warranty, expressed or implied.
3. All warranty service must be made by the Teledyne Princeton Instruments factory or, at our option, an authorized service center.
4. Before products or parts can be returned for service you must contact the Teledyne Princeton Instruments factory and receive a return authorization number (RMA.) Products or parts returned for service without a return authorization evidenced by an RMA will be sent back freight collect.
5. These warranties are effective only if purchased from the Teledyne Princeton Instruments factory or one of our authorized manufacturer's representatives or distributors.
6. Unless specified in the original purchase agreement, Teledyne Princeton Instruments is not responsible for installation, setup, or disassembly at the customer's location.
7. Warranties extend only to defects in materials or workmanship as limited above and do not extend to any product or part which:
   - has been lost or discarded by you;
   - has been damaged as a result of misuse, improper installation, faulty or inadequate maintenance, or failure to follow instructions furnished by us;
   - has had serial numbers removed, altered, defaced, or rendered illegible;
   - has been subjected to improper or unauthorized repair;
   - has been damaged due to fire, flood, radiation, or other "acts of God," or other contingencies beyond the control of Teledyne Princeton Instruments; or
   - is a shutter which is a normal wear item and as such carries a onetime only replacement due to a failure within the original 1 year Manufacturer warranty.
8. After the warranty period has expired, you may contact the Teledyne Princeton Instruments factory or a Teledyne Princeton Instruments-authorized representative for repair information and/or extended warranty plans.
9. Physically damaged units or units that have been modified are not acceptable for repair in or out of warranty and will be returned as received.

10. All warranties implied by state law or non-U.S. laws, including the implied warranties of merchantability and fitness for a particular purpose, are expressly limited to the duration of the limited warranties set forth above. With the exception of any warranties implied by state law or non-U.S. laws, as hereby limited, the forgoing warranty is exclusive and in lieu of all other warranties, guarantees, agreements, and similar obligations of manufacturer or seller with respect to the repair or replacement of any parts. In no event shall Teledyne Princeton Instruments' liability exceed the cost of the repair or replacement of the defective product or part.
11. This limited warranty gives you specific legal rights and you may also have other rights that may vary from state to state and from country to country. Some states and countries do not allow limitations on how long an implied warranty lasts, when an action may be brought, or the exclusion or limitation of incidental or consequential damages, so the above provisions may not apply to you.
12. When contacting us for technical support or service assistance, please refer to the Teledyne Princeton Instruments factory of purchase, contact your authorized Teledyne Princeton Instruments representative or reseller, or visit our technical support page at www.princetoninstruments.com.

Contact Information

Teledyne Princeton Instruments' manufacturing facility for this product is located at the following address:

Teledyne Princeton Instruments
3660 Quakerbridge Road
Trenton, NJ 08619 (USA)

Tel: 1-800-874-9789 / 1-609-587-9797

Customer Support E-mail: pi.techsupport@teledyne.com

Refer to http://www.princetoninstruments.com/support for complete support and contact information, including:

- Up-to-date addresses and telephone numbers;
- Software downloads;
- Product manuals;
- Support topics for Teledyne Princeton Instruments' product lines.

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pi.info@teledyne.com
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