PICam™ 4.x Programmer's Manual

PICam™ 4.x

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Revision History

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Issue 1	September 13, 2016	This is the initial release of this document.

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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 Princeton Instruments cameras. The majority of the manual focuses on the basic PICam functions (`picam.h`). The remainder focuses on the more complex PICam functions (`picam_advanced.h`) and on the 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, Camera Identification APIs

  Provides programming reference information for each of the basic functions (`picam.h`).

- Chapter 5, Camera Configuration APIs

  Provides programming reference pages for each of the basic functions (`picam.h`).

- Chapter 6, Camera 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 4.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.

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

1.2 Contact Information

Princeton Instruments' manufacturing facility is located at the following address:

Princeton Instruments
3660 Quakerbridge Road
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For technical support and service outside the United States, refer to the Princeton Instruments web page at www.princetoninstruments.com. An up-to-date list of addresses, telephone numbers, and e-mail addresses for Princeton Instruments' overseas offices and representatives is maintained on the web page.

Chapter 2: Introduction to PICam™

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

2.1 System Overview

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

2.2 Hardware Support

Version 4.x of the PICam library supports the following Princeton Instruments hardware:

- PI-MAX3
- PI-MAX4, PI-MAX4:RF, PI-MAX4:EM
- PI-MTE
- PIoNIR/NIRvana
- NIRvana-LN
- PIXIS, PIXIS-XB, PIXIS-XF, PIXIS-XO
- ProEM
- ProEM+
- ProEM-HS
- PyLoN
- PyLoN-IR
- Quad-RO
- SOPHIA

2.2.1 Camera Firmware [GigE Cameras Only]

Gor GigE cameras, PICam 4.x is not backwards compatible with prior releases of PICam. Therefore, when using PICam 4.x with any GigE camera, the camera's firmware must be PICam 4.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 4.x firmware onto a GigE camera with PICam 3.x firmware, refer to Section C.1, Firmware Upgrade Procedure, on page 291.
- For information about restoring firmware, refer to Section C.2, Restore Firmware, on page 293.

2.3 Supported Operating Systems

PICam currently supports the following 64-bit operating systems:

- Windows Vista®;
- Windows® 7;
- Windows 8/8.1
- Windows 10
- RedHat® Enterprise Linux®, version 6.4 (RHEL6.4)

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 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
`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.)
`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.
`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. Aso 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 camera parameters, and then prints them to the screen.

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

Sample Name	Description
`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.
`WaitForTrig`	This sample waits for an external trigger to start data acquisition.

2.5 Naming Conventions

The following naming conventions are used in PICam:

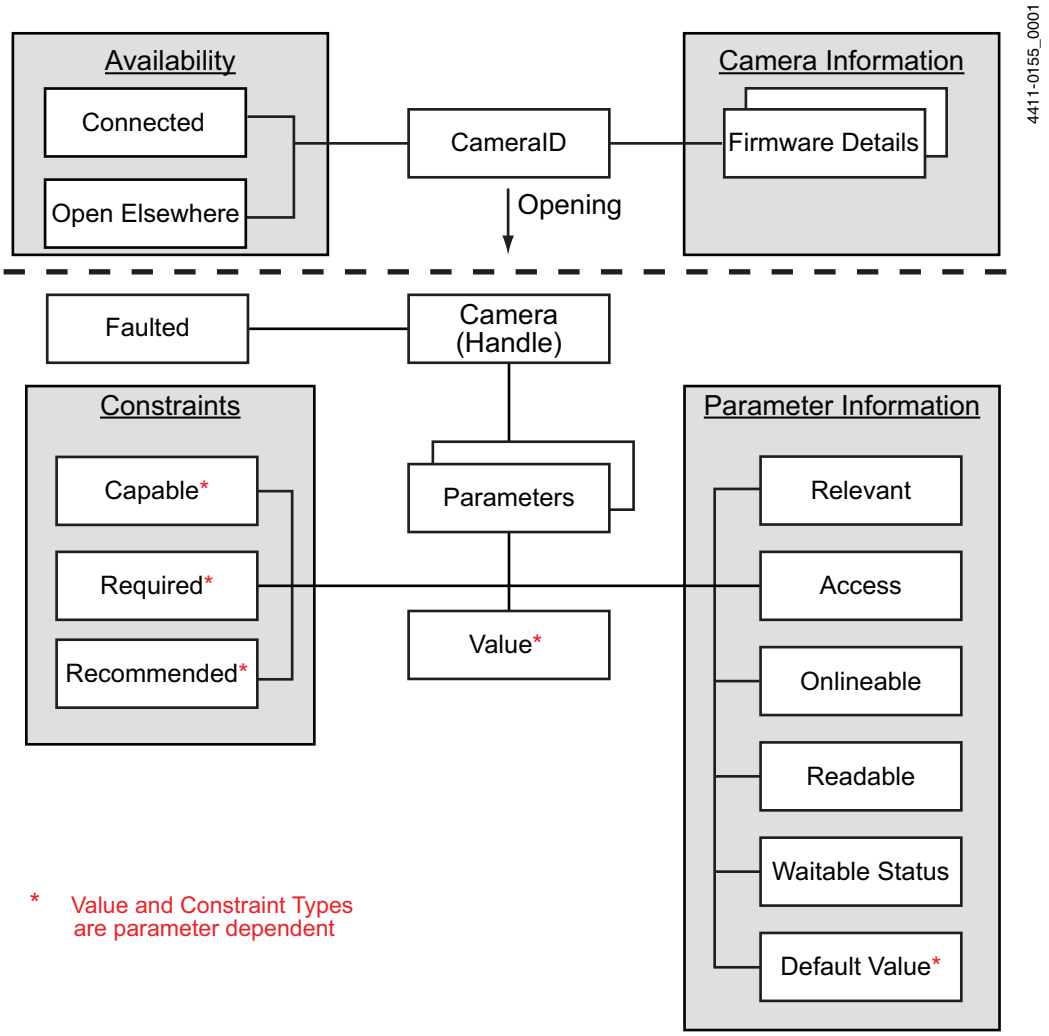
- All primitive types have a typedef with a `pi` prefix (e.g., `piint`, `pi64s`.)
- All functions defined by PICam are prefixed with `PICam_` and return an error code of `PicamError` (e.g., `Picam_GetParameterIntegerValue`, `Picam_CloseCamera`.)
- All functions that allocate memory to store the results 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 bitmasks 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. Cameras that are powered on and plugged into the host computer are initially represented by camera IDs. The content of the camera ID will be unique for each camera. From the camera ID, basic information can be garnered such as availability and basic camera information. It is also from a camera ID that a camera can be opened. Once opened, the camera can be configured by adjusting the values of its parameters. The permitted values a parameter can take are defined by its constraints. Different cameras not only possess different parameters, but different rules for interacting with those parameters. This information for each parameter may also be queried. Once a camera has been configured, data can be acquired from it.

Figure 2-1: Basic PICam Structure



2.6.1 Camera Handles

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

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

- `camera`
  Identifies a specific physical 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.

- `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`.

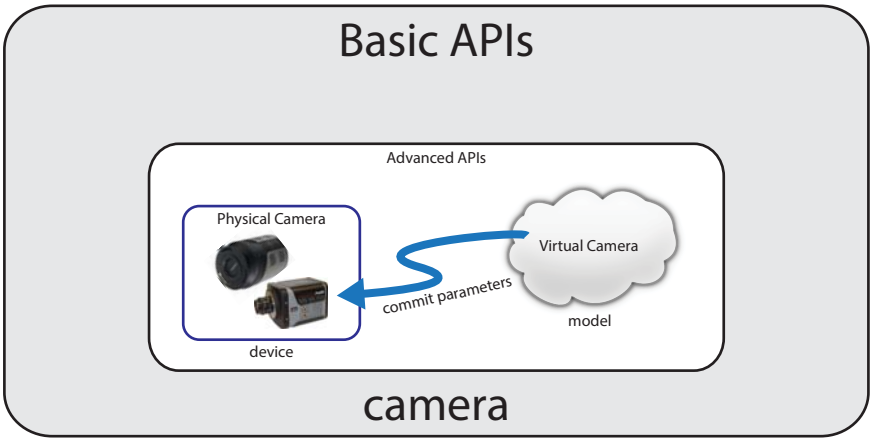
- `model`
  Identifies a specific VIRTUAL camera within application memory.

  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 handls and with which set of APIs they are valid.

Figure 2-2: Block Diagram of Handle Hierarchy



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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_em_calibration.h`
  This header EM Gain Calibration file provides the APIs and functionality needed to perform EM gain calibration for a ProEM camera.

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Chapter 3: General Library APIs

The first section of `picam.h` includes functions to determine if the PICam library has been initialized, to initialize the library, uninitialize it, or get the version. This section also includes error codes that may be returned during library initialization, camera initialization, demo and camera set up, and data acquisition.

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);
```

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`
  Inidicates 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: Camera Identification APIs

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

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

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

The following factors affect camera availability to the program:

- Connectivity

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

  — Connected to the host computer;

  — The camera must be powered on.
- Open Elsewhere

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

Information contained in the camera's firmware can be read if the specified camera is connected. The information identifies the sensor and camera model and provides the logic program IDs and revision levels. This information may not be available for cameras that have been opened elsewhere (in another process).

4.1 Data Type Definitions

Refer to Table 4-1 for information about data definitions specific to Camera APIs.

Table 4-1: Data Definitions for Camera APIs

Name	Type	Description
`PicamModel`	`enum`	The camera model. Series models represent a model family and may be used to represent older cameras whose exact model is not known.
`PicamComputerInterface`	`enum`	The interface used to communicate with the camera.
`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 camera 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 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.

4.3 Programmers' Reference for Camera APIs

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

- Camera Identification APIs
  - `Picam_DestroyCameraIDs()`
  - `Picam_GetAvailableCameraIDs()`
  - `Picam_GetUnavailableCameraIDs()`
  - `Picam_IsCameraIDConnected()`
  - `Picam_IsCameraIDOpenElsewhere()`
- Camera Access APIs
  - `Picam_DestroyHandles()`
  - `Picam_OpenFirstCamera()`
  - `Picam_OpenCamera()`
  - `Picam_CloseCamera()`
  - `Picam_GetOpenCameras()`
  - `Picam_IsCameraConnected()`
  - `Picam_IsCameraFaulted()`
  - `Picam_GetCameraID()`
- Camera Information APIs
  - `Picam_DestroyFirmwareDetails()`
  - `Picam_GetFirmwareDetails()`
- Demo Camera Identification APIs
  - `Picam_DestroyModels()`
  - `Picam_GetAvailableDemoCameraModels()`
  - `Picam_ConnectDemoCamera()`
  - `Picam_DisconnectDemoCamera()`
  - `Picam_IsDemoCamera()`

4.3.1 Camera Identification APIs

This section provices programming information for Camera Identficiation 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 `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()`.

4.3.1.3 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().

4.3.1.4 `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.

4.3.1.5 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.

4.3.2 Camera Access APIs

This section provices programming information for Camera 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 `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()`.

4.3.2.4 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.

4.3.2.5 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().

4.3.2.6 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 conection 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.

4.3.2.7 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.

4.3.2.8 Picam_GetCameraID()

Description

Picam_GetCameraID() returns the ID associates 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.

4.3.3 Camera Information APIs

This section provices programming information for Camera 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

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().

4.3.4 Demo Camera Identification APIs

This section provices programming information for Demo Camera Identficiation 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.

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Chapter 5: Camera Configuration APIs

The functions in this grouping set or query parameter values, parameter information, and parameter constraints that characterize a camera. A parameter is a camera 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 camera type, read/write capability, or other parameters used or to be used in describing and setting up a particular camera. Once a camera has been opened, it can be configured by changing its parameters through software and applying them to the camera hardware. Each camera 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:

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 my 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.

Most parameters are only used for acquisition setup. However, this is not always the case. Some can be modified while the camera is acquiring. These parameters are deemed onlineable. Others reflect the current state of the hardware. These parameters only have meaning when read directly from hardware. These 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.

Once the parameters values are adjusted as desired they must be committed to the camera hardware before the camera can acquire data.

5.1 Data Type Definitions

This section provides programming information about PICam data definitions.

5.1.1 Camera Parameter Enumerations

This section provides detailed information about the following Camera Parameter enumerations:

- `PicamValueType`
- `PicamConstraintType`
- `PicamParameter`
- `PicamActiveShutter`
- `PicamAdcAnalogGain`
- `PicamAdcQuality`
- `PicamCcdCharacteristicsMask`
- `PicamCoolingFanStatus`
- `PicamEMIccdGainControlMode`
- `PicamGateTrackingMask`
- `PicamGatingMode`
- `PicamGatingSpeed`
- `PicamIntensifierOptionsMask`
- `PicamIntensifierStatus`
- `PicamModulationTrackingMask`
- `PicamOrientationMask`
- `PicamOutputSignal`
- `PicamPhosphorType`
- `PicamPhotocathodeSensitivity`
- `PicamPhotonDetectionMode`
- `PicamPixelFormat`
- `PicamReadoutControlMode`
- `PicamSensorTemperatureStatus`
- `PicamSensorType`
- `PicamShutterStatus`
- `PicamShutterTimingMode`
- `PicamShutterType`
- `PicamTimeStampsMask`
- `PicamTriggerCoupling`
- `PicamTriggerDetermination`
- `PicamTriggerResponse`
- `PicamTriggerSource`
- `PicamTriggerTermination`

5.1.1.1 `PicamValueType`

Data Type

`PicamValueType` is defined as `enum`.

Description

`PicamValueType` is the set of parameter value data types.

Enumerator Definitions

Refer to Table 5-1 for enumerator definitions.

Table 5-1: `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`.

5.1.1.2 `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 5-2 for enumerator definitions.

Table 5-2: `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.

5.1.1.3 PicamParameter

Data Type

PicamParameter is defined as enum.

Description

PicamParameter is the set of user-accessible camera parameters.

Enumerator Definitions

Refer to Table 5-3 for enumerator definitions.

Table 5-3: PicamParameter Enumerator Definitions (Sheet 1 of 9)

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 5.1.1.4, PicamActiveShutter, on page 62 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 5.1.1.5, PicamAdcAnalogGain, on page 62 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 5.1.1.6, PicamAdcQuality, on page 63 for additional information.
PicamParameter_AdcSpeed	Controls the rate pixels are digitized in MHz.
PicamParameter_AnticiapteTrigger	Uses an external pre-trigger to anticipate an external trigger.
PicamParameter_AuxOutput	Controls the auxiliary output gate pulse.
PicamParameter_BracketGating	Enables bracket pulsing for an intensified camera.

Table 5-3: `PicamParameter` Enumerator Definitions (Sheet 2 of 9)

Enumerator	Description
`PicamParameter_CcdCharacteristics`	Reports characteristics of a CCD sensor via the `PicamCcdCharacteristicsMask` data enumeration. Refer to Section 5.1.1.7, PicamCcdCharacteristicsMask, on page 64 for additional information.
`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 5.1.1.8, PicamCoolingFanStatus, on page 65 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 an emICCD camera in terms of multiples.
`PicamParameter_EMIccdGainControlMode`	Determines how the intensifier gain and electron multiplication gain are controlled in an emICCD camera via the `PicamEMIccdGainControlMode` data enumeration. Refer to Section 5.1.1.9, PicamEMIccdGainControlMode, on page 65, for additional information.
`PicamParameter_EnableIntensifier`	Enables the intensifier. ***NOTE:*** The intensifier must be enabled and powered on for it to function.
`PicamParameter_EnableModulation`	Enables RF modulation for an intensified camera.

Table 5-3: `PicamParameter` Enumerator Definitions (Sheet 3 of 9)

Enumerator	Description
`PicamParameter_EnableModulationOutputSignal`	Enables an RF output signal from the intensified camera to be used as the user sees fit.
`PicamParameter_EnableNondestructiveReadout`	Allows the camera to periodically readout while exposing.
`PicamParameter_EnableSensorWindowHeater`	Enables the sensor window to heat up in an effort to prevent condensation.
`PicamParameter_EnableSyncMaster`	Enables SyncMASTER1 and SyncMASTER2 gate pulses.
`PicamParameter_ExactReadoutCountMaximum`	Reports the maximum number of readouts the camera can acquire. ***NOTE:*** This does not include non-destructive readouts from cameras that support such a 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 camera via the `PicamShutterStatus` data enumeration. Refer to Section 5.1.1.25, PicamShutterStatus, on page 74 for additional information.
`PicamParameter_ExternalShutterType`	Reports the type of shutter that is external to and can be driven by the camera via the `PicamShutterType` data enumeration. Refer to Section 5.1.1.27, PicamShutterType, on page 75 for additional information.
`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 camera 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.
`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 5.1.1.10, PicamGateTrackingMask, on page 66 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 5.1.1.11, PicamGatingMode, on page 66 for additional information.
`PicamParameter_GatingSpeed`	Classifies the narrowest gate pulse.

Table 5-3: `PicamParameter` Enumerator Definitions (Sheet 4 of 9)

Enumerator	Description
`PicamParameter_InactiveShutterTimingMode Result`	Reports the state of the inactive shutter via the `PicamShutterTimingMode` data enumeration. Refer to Section 5.1.1.26, PicamShutterTimingMode, on page 75 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 the intensified camera via the `PicamIntensifierOptionsMask` data enumeration. Refer to Section 5.1.1.13, PicamIntensifierOptionsMask, on page 67 for additional information.
`PicamParameter_IntensifierStatus`	Reports the status of the intensifier power via the `PicamIntensifierStatus` data enumeration. Refer to Section 5.1.1.14, PicamIntensifierStatus, on page 68 for additional information.
`PicamParameter_InternalShutterStatus`	Reports the status of the shutter that is internal to the camera via the `PicamShutterStatus` data enumeration. Refer to Section 5.1.1.25, PicamShutterStatus, on page 74 for additional information.
`PicamParameter_InternalShutterType`	Reports the type of shutter that is internal to and can be driven by the camera via the `PicamShutterType` data enumeration. Refer to Section 5.1.1.27, PicamShutterType, on page 75 for additional information.
`PicamParameter_InvertOutputSignal`	Controls if the timing signal is inverted when viewed from the camera monitor.
`PicamParameter_InvertOutputSignal2`	Controls if the timing signal is inverted when viewed from the second camera monitor.
`PicamParameter_KineticsWindowHeight`	Controls the number of rows used for the sensing window in a kinetics readout.
`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).
`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

Table 5-3: `PicamParameter` Enumerator Definitions (Sheet 5 of 9)

Enumerator	Description
`PicamParameter_ModulationTracking`	Controls the tracking of a sequential phase or custom modulation sequence in metadata via the `PicamModulationTrackingMask` data enumeration. Refer to Section 5.1.1.15, PicamModulationTrackingMask, on page 68 for additional information.
`PicamParameter_ModulationTrackingBitDepth`	Controls the size of one component in a varying sequential modulation phase or custom modulation sequence. ***NOTE:*** This metadata is floating point.
`PicamParameter_NondestructiveReadoutPeriod`	Controls the rate at which the camera 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_OnlineReadoutRateCalculation`	Reports the fastest possible readout rate that could occur given the current setup and accounting for possible changes to online camera parameters while acquiring
`PicamParameter_Orientation`	Reports the orientation of the data via the `PicamOrientationMask` data enumeration.. Refer to Section 5.1.1.16, PicamOrientationMask, on page 69 for additional information.
`PicamParameter_OutputSignal`	Controls what timing signal is issued from the camera monitor via the `PicamOutputSignal` data enumeration. Refer to Section 5.1.1.17, PicamOutputSignal, on page 69 for additional information.
`PicamParameter_OutputSignal2`	Controls what timing signal is issued from the second camera monitor via the `PicamOutputSignal`data enumeration. Refer to Section 5.1.1.17, PicamOutputSignal, on page 69 for additional information.
`PicamParameter_PhosphorDecayDelay`	Controls the length of time a camera waits for the phosphor to decay before reading out. The time unit depends on `PicamParameter_PhosphorDecayDelayResolution`.
`PicamParameter_PhosphorDecayDelayResolution`	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).
`PicamParameter_PhosphorType`	Reports the type of phosphor used in the intensified camera.
`PicamParameter_PhotocathodeSensitivity`	Classifies the wavelength sensitivity of the photocathode.

Table 5-3: `PicamParameter` Enumerator Definitions (Sheet 6 of 9)

Enumerator	Description
`PicamParameter_PhotonDetectionMode`	Enables/disables photon detection and controls how it is done via the `PicamPhotonDetectionMode` data enumeration. Refer to Section 5.1.1.20, PicamPhotonDetectionMode, on page 72 for additional information.
`PicamParameter_PhotonDetectionThreshold`	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 5.1.1.21, PicamPixelFormat, on page 72 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 5.1.1.22, PicamReadoutControlMode, on page 73 for additional information.
`PicamParameter_ReadoutCount`	Controls the number of readouts to acquire before stopping the camera. ***NOTE:*** The camera may acquire more than the readouts requested for large requests (i.e., more readouts than those specified by `PicamParameter_ExactReadoutCountMaximum`.). ***NOTE:*** This does not include non-destructive readouts from cameras that support such a feature. ***NOTE:*** [Advanced-API Usage Only] The value 0 indicates the camera 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 5.1.1.16, PicamOrientationMask, on page 69 for additional information.
`PicamParameter_ReadoutPortCount`	Controls the number of readout ports from which the camera should simultaneously read data.
`PicamParameter_ReadoutRateCalculation`	Reports the estimated rate of data in readouts-per-second. ***NOTE:*** If the camera 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 camera to read out one readout in milliseconds (mS).

Table 5-3: `PicamParameter` Enumerator Definitions (Sheet 7 of 9)

Enumerator	Description
`PicamParameter_RepetitiveGate`	Controls the constant gate pulse in nanoseconds (nS).
`PicamParameter_RepetitiveModulationPhase`	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 86 for additional information.
`PicamParameter_SecondaryActiveHeight`	Controls the number of secondary active rows.
`PicamParameter_SecondaryMaskedHeight`	Controls the number of secondary masked rows.
`PicamParameter_SensorActiveBottomMargin`	Reports the inactive rows on the bottom.
`PicamParameter_SensorActiveExtendedHeight`	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_SensorMaskedBottomMargin`	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_SensorSecondaryActiveHeight`	Reports the number of secondary active rows.
`PicamParameter_SensorSecondaryMaskedHeight`	Reports the number of secondary masked rows.
`PicamParameter_SensorTemperatureReading`	Reports the temperature of the sensor.
`PicamParameter_SensorTemperatureSetPoint`	Controls the target temperature for the sensor.
`PicamParameter_SensorTemperatureStatus`	Reports the status of the sensor temperature via the `PicamSensorTemperatureStatus` data enumeration. Refer to Section 5.1.1.23, PicamSensorTemperatureStatus, on page 73 for additional information.
`PicamParameter_SensorType`	Reports the kind of sensor being used via the `PicamSensorType` data enumeration. Refer to Section 5.1.1.24, PicamSensorType, on page 74 for additional information.
`PicamParameter_SequentialEndingGate`	Controls the last gate pulse in a sequence in nanoseconds (nS).
`PicamParameter_SequentialEndingModulation Phase`	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.

Table 5-3: `PicamParameter` Enumerator Definitions (Sheet 8 of 9)

Enumerator	Description
`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 camera 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 camera 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.
`PicamParameter_StopCleaningOnPreTrigger`	Stops sensor cleaning when an external pre-trigger is acknowledged.
`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 5.1.1.28, PicamTimeStampsMask, on page 76 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 5.1.1.29, PicamTriggerCoupling, on page 76 for additional information.

Table 5-3: `PicamParameter` Enumerator Definitions (Sheet 9 of 9)

Enumerator	Description
`PicamParameter_TriggerDetermination`	Controls what the camera recognizes as an external trigger via the `PicamTriggerDetermination` data enumeration. Refer to Section 5.1.1.30, PicamTriggerDetermination, on page 78 for additional information.
`PicamParameter_TriggerFrequency`	Controls the internal trigger and SyncMASTER frequency in Hz.
`PicamParameter_TriggerResponse`	Controls the camera's behavior in response to a trigger via the `PicamTriggerResponse` data enumeration. Refer to Section 5.1.1.31, PicamTriggerResponse, on page 79 for additional information.
`PicamParameter_TriggerResponse`	Controls the camera’s behavior in response to an external trigger via the `PicamTriggerResponse` data enumeration. Refer to Section 5.1.1.31, PicamTriggerResponse, on page 79 for additional information.
`PicamParameter_TriggerSource`	Controls the source of a trigger via the `PicamTriggerSource` data enumeration. Refer to Section 5.1.1.32, PicamTriggerSource, on page 79 for additional information.
`PicamParameter_TriggerTermination`	Controls the termination of an external trigger source at the camera input via the `PicamTriggerTermination` data enumeration. Refer to Section 5.1.1.33, PicamTriggerTermination, on page 80 for additional information.
`PicamParameter_TriggerThreshold`	Controls the voltage threshold necessary for the camera to recognize a trigger in volts (V).
`PicamParameter_VerticalShiftRate`	Controls the rate to shift one row towards the serial register in a CCD in microseconds. (µS)

5.1.1.4 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 5-5 for enumerator definitions.

Table 5-4: PicamActiveShutter Enumerator Definitions

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

5.1.1.5 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 5-5 for enumerator definitions.

Table 5-5: PicamAdcAnalogGain Enumerator Definitions

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

5.1.1.6 `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 5-6 for enumerator definitions.

Table 5-6: `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.

5.1.1.7 PicamCcdCharacteristicsMask

Data Type

PicamCcdCharacteristicsMask is defined as enum.

Description

PicamCcdCharacteristicsMask is the set of CCD sensor characteristics.

Enumerator Definitions

Refer to Table 5-7 for enumerator definitions.

Table 5-7: 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.

5.1.1.8 PicamCoolingFanStatus

Data Type

PicamCoolingFanStatus is defined as enum.

Description

PicamCoolingFanStatus is the set of cooling fan statuses.

Enumerator Definitions

Refer to Table 5-8 for enumerator definitions.

Table 5-8: 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.

5.1.1.9 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 an emICCD camera.

Enumerator Definitions

Refer to Table 5-9 for enumerator definitions.

Table 5-9: 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.

5.1.1.10 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 5-10 for enumerator definitions.

Table 5-10: 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.

5.1.1.11 PicamGatingMode

Data Type

PicamGatingMode is defined as enum.

Description

PicamGatingMode is the set of supported gate pulse timing modes.

Enumerator Definitions

Refer to Table 5-11 for enumerator definitions.

Table 5-11: PicamGatingMode Enumerator Definitions

Enumerator	Description
PicamGatingMode_Custom	A customized modulation per readout.
PicamGatingMode_Repetitive	A constant gate pulse is used per readout.
PicamGatingMode_Sequential	A varying gate pulse is used per readout.

5.1.1.12 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 5-12 for enumerator definitions.

Table 5-12: 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.

5.1.1.13 PicamIntensifierOptionsMask

Data Type

PicamIntensifierOptionsMask is defined as enum.

Description

PicamIntensifierOptionsMask is the set of intensifier characteristics.

Enumerator Definitions

Refer to Table 5-13 for enumerator definitions.

Table 5-13: 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.

5.1.1.14 PicamIntensifierStatus

Data Type

PicamIntensifierStatus is defined as enum.

Description

PicamIntensifierStatus is the set of intensifier power statuses.

Enumerator Definitions

Refer to Table 5-14 for enumerator definitions.

Table 5-14: 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.

5.1.1.15 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 Table 5-15 for enumerator definitions.

Table 5-15: 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.

5.1.1.16 PicamOrientationMask

Data Type

PicamOrientationMask is defined as enum.

Description

PicamOrientationMask is the set of image orientation descriptors.

Enumerator Definitions

Refer to Table 5-16 for enumerator definitions.

Table 5-16: PicamOrientationMask Enumerator Definitions

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

5.1.1.17 PicamOutputSignal

Data Type

PicamOutputSignal is defined as enum.

Description

PicamOutputSignal is the set of parameters defining a camera's MONITOR OUTPUT signal.

Enumerator Definitions

Refer to Table 5-17 for enumerator definitions.

Table 5-17: PicamOutputSignal Enumerator Definitions (Sheet 1 of 2)

Enumerator	Description
PicamOutputSignal_AlwaysHigh	The signal is always high.
PicamOutputSignal_AlwaysLow	The signal is always low.
PicamOutputSignal_Busy	The signal is high when the camera is busy and cannot react to triggers.
PicamOutputSignal_EffectivelyExposing	The signal is high while the sensor is exposed to radiation.
PicamOutputSignal_Exposing	The signal is high for the duration of the programmed exposure time.
PicamOutputSignal_NotReadingOut	The signal is low when the camera is reading out.

Table 5-17: `PicamOutputSignal` Enumerator Definitions (Sheet 2 of 2)

Enumerator	Description
`PicamOutputSignal_ReadingOut`	The signal is high while reading data out of the sensor.
`PicamOutputSignal_ReadyToStart`	The signal is high when the camera is ready to begin acquisition.
`PicamOutputSignal_ShiftingUnderMask`	The signal is high while image data is shifted under the frame transfer mask.
`PicamOutputSignal_ShutterOpen`	The signal is high when the shutter is driven open.
`PicamOutputSignal_WaitingForTrigger`	The signal is high while the camera is waiting to react to a trigger.

5.1.1.18 `PicamPhosphorType`

Data Type

`PicamPhosphorType` is defined as `enum`.

Description

`PicamPhosphorType` is the set of phosphor types within an intensified camera.

Enumerator Definitions

Refer to Table 5-18 for enumerator definitions.

Table 5-18: `PicamPhosphorType` Enumerator Definitions

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

5.1.1.19 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 5-19 for enumerator definitions.

Table 5-19: 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.

5.1.1.20 PicamPhotonDetectionMode

Data Type

PicamPhotonDetectionMode is defined as enum.

Description

PicamPhotonDetectionMode is the set of photon detection modes.

Enumerator Definitions

Refer to Table 5-20 for enumerator definitions.

Table 5-20: 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. Oherwise 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.

5.1.1.21 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 5-21 for enumerator definitions.

Table 5-21: PicamPixelFormat Enumerator Definitions

Enumerator	Description
PicamPixelFormat_Monochrome16Bit	16 bits of monochrome data

5.1.1.22 PicamReadoutControlMode

Data Type

PicamReadoutControlMode is defined as enum.

Description

PicamReadoutControlMode is the set of sensor readout modes.

Enumerator Definitions

Refer to Table 5-22 for enumerator definitions.

Table 5-22: 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_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_Kinetics	The sensor rapidly stores multiple frames and then reads those out.
PicamReadoutControlMode_SpectraKinetics	Same as kinetics, but optimized to capture a larger burst of spectral frames.

5.1.1.23 PicamSensorTemperatureStatus

Data Type

PicamSensorTemperatureStatus is defined as enum.

Description

PicamSensorTemperatureStatus is the set of sensor temperature statuses.

Enumerator Definitions

Refer to Table 5-23 for enumerator definitions.

Table 5-23: PicamSensorTemperatureStatus Enumerator Definitions

Enumerator	Description
PicamSensorTemperatureStatus_Faulted	Sensor cooling has malfunctioned.
PicamSensorTemperatureStatus_Locked	The temperature has stabilized at the set point.
PicamSensorTemperatureStatus_Unlocked	The temperature has not stabilized at the set point.

5.1.1.24 PicamSensorType

Data Type

PicamSensorType is defined as enum.

Description

PicamSensorType is the set of sensor types.

Enumerator Definitions

Refer to Table 5-24 for enumerator definitions.

Table 5-24: PicamSensorType Enumerator Definitions

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

5.1.1.25 PicamShutterStatus

Data Type

PicamShutterStatus is defined as enum.

Description

PicamShutterStatus is the set of shutter statuses.

Enumerator Definitions

Refer to Table 5-25 for enumerator definitions.

Table 5-25: 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.

5.1.1.26 PicamShutterTimingMode

Data Type

PicamShutterTimingMode is defined as enum.

Description

PicamShutterTimingMode is the set of shutter behaviors during data acquisition.

Enumerator Definitions

Refer to Table 5-26 for enumerator definitions.

Table 5-26: 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.

5.1.1.27 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 5-27 for enumerator definitions.

Table 5-27: PicamShutterType Enumerator Definitions (Sheet 1 of 2)

Enumerator	Description
PicamShutterType_None	No shutter.
PicamShutterType_ProntorMagnetic0	PRONTOR magnetic 0 shutter.

Table 5-27: `PicamShutterType` Enumerator Definitions (Sheet 2 of 2)

Enumerator	Description
`PicamShutterType_ProntorMagneticE40`	PRONTOR magnetic E/40 shutter.
`PicamShutterType_VincentCS25`	Vincent CS25 shutter
`PicamShutterType_VincentCS45`	Vincent CS45 shutter
`PicamShutterType_VincentDSS10`	Vincent DSS10 shutter
`PicamShutterType_VincentVS25`	Vincent VS25 shutter
`PicamShutterType_VincentVS35`	Vincent VS35 shutter

5.1.1.28 `PicamTimeStampsMask`

Data Type

`PicamTimeStampsMask` is defined as `enum`.

Description

`PicamTimeStampsMask` is the set of timestamp metadata.

Enumerator Definitions

Refer to Table 5-28 for enumerator definitions.

Table 5-28: `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.

5.1.1.29 `PicamTriggerCoupling`

Data Type

`PicamTriggerCoupling` is defined as `enum`.

Description

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

Enumerator Definitions

Refer to Table 5-29 for enumerator definitions.

Table 5-29: `PicamTriggerCoupling` Enumerator Definitions

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

5.1.1.30 PicamTriggerDetermination

Data Type

PicamTriggerDetermination is defined as enum.

Description

PicamTriggerDetermination is the set external trigger styles that are recognized by a camera.

Enumerator Definitions

Refer to Table 5-30 for enumerator definitions.

Table 5-30: PicamTriggerDetermination Enumerator Definitions

Enumerator	Description
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_ 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_ RisingEdge	The trigger is a signal's rising edge.
PicamTriggerDetermination_ FallingEdge	The trigger is a signal's falling edge.

5.1.1.31 PicamTriggerResponse

Data Type

PicamTriggerResponse is defined as enum.

Description

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

Enumerator Definitions

Refer to Table 5-31 for enumerator definitions.

Table 5-31: PicamTriggerResponse Enumerator Definitions

Enumerator	Description
PicamTriggerResponse_NoResponse	The camera acquires on its own and does not react to triggers.
PicamTriggerResponse_ExposeDuring TriggerPulse	Each trigger begins an exposure that lasts for the duration of the signal level (i.e., until the signal transitions back.)
PicamTriggerResponse_ReadoutPer Trigger	Each trigger leads to one readout. ***NOTE:*** For cameras 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_ShiftPer Trigger	Each trigger acquires another frame and reads out after the last frame is stored.
PicamTriggerResponse_StartOnSingle Trigger	The camera begins acquisition after a single trigger and continues without the need for further triggers.

5.1.1.32 PicamTriggerSource

Data Type

PicamTriggerSource is defined as enum.

Description

PicamTriggerSource is the set of trigger sources.

Enumerator Definitions

Refer to Table 5-32 for enumerator definitions.

Table 5-32: PicamTriggerSource Enumerator Definitions

Enumerator	Description
PicamTriggerSource_External	The trigger source is external to the camera.
PicamTriggerSource_Internal	The trigger source is the camera.

5.1.1.33 `PicamTriggerTermination`

Data Type

`PicamTriggerTermination` is defined as `enum`.

Description

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

Enumerator Definitions

Refer to Table 5-33 for enumerator definitions.

Table 5-33: `PicamTriggerTermination` **Enumerator Definitions**

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

5.1.2 Camera Parameter Access Enumerations

This section provides detailed information about the following Camera 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 5-34 for enumerator definitions.

Table 5-34: `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 Camera Parameter Constraint Enumerations

This section provides detailed information about the following Camera 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 5-35 for enumerator definitions.

Table 5-35: `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 5-36 for enumerator definitions.

Table 5-36: `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 5-37 for enumerator definitions.

Table 5-37: `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 5-38 for enumerator definitions.

Table 5-38: PicamRoisConstraintRulesMask Enumerator Definitions

Enumerator	Description
PicamRoisConstraintRulesMask_None	No additional rules.
PicamRoisConstraintRulesMask_ XBinningAlignment	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_ YBinningAlignment	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 Structure Definitions

This section provides programming information about PICam data structure definitions.

5.2.1 Camera Parameter Structures

This section provides detailed programming information about the following Camera Parameter data structures:

- PicamRoi
- PicamRois
- PicamPulse
- PicamModulation
- PicamModulations
- PicamStatusPurview

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.

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 until a gate pulse begins.

`width:` The width of the gate pulse.

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
{
            pflt  duration;
            pflt  frequency;
            pflt  phase;
            pflt  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 sequnce 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.

5.2.1.6 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.

5.2.2 Camera Parameter Constraints

This section provides detailed programming information about the following Camera Parameter Constraint data structures:

- PicamCollectionConstraint
- PicamRangeConstraint
- PicamRoisConstraint
- PicamPulseConstraint
- PicamModulationsConstraint

5.2.2.1 *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 pflt*  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.

5.2.2.2 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:` Indictes 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.

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`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.

5.2.2.3 `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;
```

Variable Definitions

The variables required by `PicamRoisConstraint` are:

`scope:` The scope of the constraint.

`severity:` The severity of the constraint.

`empty_set:` Indictes 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.

5.2.2.4 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:` Indictes 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]`

5.2.2.5 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:` Indictes 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 Programmers' Reference for Camera Configuration APIs

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

- Camera Parameter Value APIs
  - `Picam_GetParameterIntegerValue()`
  - `Picam_CanSetParameterIntegerValue()`
  - `Picam_SetParameterIntegerValue()`
  - `Picam_GetParameterLargeIntegerValue()`
  - `Picam_CanSetParameterLargeIntegerValue()`
  - `Picam_SetParameterLargeIntegerValue()`
  - `Picam_GetParameterFloatingPointValue()`
  - `Picam_CanSetParameterFloatingPointValue()`
  - `Picam_SetParameterFloatingPointValue()`
  - `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_GetParameterIntegerDefaultValue()`
  - `Picam_GetParameterLargeIntegerDefaultValue()`
  - `Picam_GetParameterFloatingPointDefaultValue()`
  - `Picam_GetParameterRoisPointDefaultValue()`
  - `Picam_GetParameterPulseDefaultValue()`
  - `Picam_GetParameterModulationsDefaultValue()`
  - `Picam_RestoreParametersToDefaultValues()`
  - `Picam_CanSetParameterOnline()`
  - `Picam_SetParameterIntegerValueOnline()`
  - `Picam_SetParameterFloatingPointValueOnline()`
  - `Picam_SetParameterPulseValueOnline()`
  - `Picam_CanReadParameter()`
  - `Picam_ReadParameterIntegerValue()`
  - `Picam_ReadParameterFloatingPointValue()`
  - `Picam_CanWaitForStatusParameter()`
  - `Picam_DestroyStatusPurviews()`
  - `Picam_GetStatusParameterPurview()`
  - `Picam_EstimateTimeToStatusParameterValue()`
  - `Picam_WaitForStatusParameterValue()`
- Camera Parameter Information APIs
  - `Picam_DestroyParameters()`
  - `Picam_GetParameters()`
  - `Picam_DoesParameterExist()`
  - `Picam_IsParameterRelevant()`
  - `Picam_GetParameterValueType()`
  - `Picam_GetParameterEnumeratedType()`
  - `Picam_GetParameterValueAccess()`
  - `Picam_GetParameterConstraintType()`

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

5.3.1 Camera Parameter Value APIs

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

5.3.1.1 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,
                              PicamParameter  parameter,
                                      piint*  value);
```

Input Parameters

Input parameters for `Picam_GetParameterIntegerValue()` are:

`camera:` Handle for the camera 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, `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.

5.3.1.2 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,
                              PicamParameter  parameter,
                                       piint  value,
                                      pibln*  settable);
```

Input Parameters

Input parameters for `Picam_CanSetParameterIntegerValue()` are:

`camera:` Handle for the camera 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, `camera` may be a handle to either the:

- `model`, or
- `device`.

5.3.1.3 Picam_SetParameterIntegerValue()

Description

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

Syntax

The syntax for Picam_SetParameterIntegerValue() is:

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

Input Parameters

Input parameters for Picam_SetParameterIntegerValue() are:

`camera:` Handle for the camera 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, 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 commited to the device prior to starting any data acquisition by calling Picam_CommitParameters().

- device.

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

Related APIs

For additional information, refer to the following related APIs:

- Picam_CommitParameters().

5.3.1.4 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.

5.3.1.5 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`.

5.3.1.6 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 commited to the device prior to starting any data acquisition by calling Picam_CommitParameters().

- device.

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

Related APIs

For additional information, refer to the following related APIs:

- Picam_CommitParameters()

5.3.1.7 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,
                          PicamParameter  parameter,
                                  piflt*  value);
```

Input Parameters

Input parameters for Picam_GetParameterFloatingPointValue() are:

`camera:` Handle for the camera 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, `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.

5.3.1.8 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,
                                PicamParameter  parameter,
                                          pflt  value,
                                         pbln*  settable);
```

Input Parameters

Input parameters for Picam_CanSetParameterFloatingPointValue() are:

`camera:` Handle for the camera 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, `camera` may be a handle to either the:

- `model`, or
- `device`.

5.3.1.9 Picam_SetParameterFloatingPointValue()

Description

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

Syntax

The syntax for Picam_SetParameterFloatingPointValue() is:

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

Input Parameters

Input parameters for Picam_SetParameterFloatingPointValue() are:

camera:	Handle for the camera 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, 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 commited to the device prior to starting any data acquisition by calling Picam_CommitParameters().

- device.

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

Related APIs

For additional information, refer to the following related APIs:

- Picam_CommitParameters()

5.3.1.10 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().

5.3.1.11 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 Stuctures

For additional information, refer to the following ROI structures:

- PicamRoi;
- PicamRois.

Related APIs

For additional information, refer to the following related APIs:

- Picam_DestroyRois()

5.3.1.12 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 Stuctures

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

- `PicamRoisConstraint`.

5.3.1.13 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 commited to the device prior to starting any data acquisition by calling Picam_CommitParameters().

- device.

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

Related Stuctures

For additional information, refer to the following ROI structures:

- PicamRoi;
- PicamRois.

Related APIs

For additional information, refer to the following related APIs:

- Picam_CommitParameters()

5.3.1.14 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().

5.3.1.15 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 Stuctures

For additional information, refer to the following Pulse structure:

- PicamPulse.

Related APIs

For additional information, refer to the following related APIs:

- Picam_DestroyPulses()

5.3.1.16 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 Stuctures

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

- PicamPulseConstraint.

5.3.1.17 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 commited to the device prior to starting any data acquisition by calling Picam_CommitParameters().

- device.

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

Related Stuctures

For additional information, refer to the following Pulse structure:

- PicamPulse.

Related APIs

For additional information, refer to the following related APIs:

- Picam_CommitParameters()

5.3.1.18 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().

5.3.1.19 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 Stuctures

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().

5.3.1.20 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 Stuctures

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

- PicamModulation;
- PicamModulations.

5.3.1.21 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 commited to the `device` prior to starting any data acquisition by calling Picam_CommitParameters().
- `device`.
  Setting a `device` parameter automatically sets the corresonding `model` parameter to the same value.

Related Stuctures

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()

5.3.1.22 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,
                                PicamParameter  parameter,
                                         piint*  value);
```

Input Parameters

Input parameters for Picam_GetParameterIntegerDefaultValue() are:

`camera:` Handle for the camera 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, `camera` may be a handle to either the:

- `device`, or
- `model`.

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

5.3.1.23 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.

5.3.1.24 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,
                                       PicamParameter  parameter,
                                               piflt*  value);
```

Input Parameters

Input parameters for Picam_GetParameterFloatingPointDefaultValue() 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 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, `camera` may be a handle to either the:

- `device`, or
- `model`.

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

5.3.1.25 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 Stuctures

For additional information, refer to the following ROI structures:

- PicamRoi;
- PicamRois.

Related APIs

For additional information, refer to the following related APIs:

- Picam_DestroyRois().

5.3.1.26 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 Stuctures

For additional information, refer to the following Pulse structure:

- PicamPulse.

Related APIs

For additional information, refer to the following related APIs:

- Picam_DestroyPulses().

5.3.1.27 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 Stuctures

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().

5.3.1.28 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);
```

Input Parameters

Input parameters for Picam_RestoreParametersToDefaultValues() are:

`camera:` Handle for the camera 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, `camera` may be a handle to either the:

- `device`, or
- `model`.

5.3.1.29 Picam_CanSetParameterOnline()

Description

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

Syntax

The syntax for Picam_CanSetParameterOnline() is:

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

Input Parameters

Input parameters for Picam_CanSetParameterOnline() are:

`camera:` Handle for the camera 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.

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, `camera` may be a handle to either the:

- `device`, or
- `model`.

5.3.1.30 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().

5.3.1.31 Picam_SetParameterFloatingPointValueOnline()

Description

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

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().

5.3.1.32 Picam_SetParameterPulseValueOnline()

Description

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

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.

5.3.1.33 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,
                   PicamParameter  parameter,
                           pibln*  readable);
```

Input Parameters

Input parameters for Picam_CanReadParameter() are:

`camera:` Handle for the camera 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, `camera` may be a handle to either the:

- `device`, or
- `model`.

5.3.1.34 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,
                           PicamParameter  parameter,
                                   piint*  value);
```

Input Parameters

Input parameters for Picam_ReadParameterIntegerValue() are:

`camera:` 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, `camera` may be a handle to either the:

- `device`, or
- `model`.

Picam_ReadParameterIntegerValue() effectively gets `parameter` from the camera device.

Related APIs

For additional information, refer to the following related APIs:

- Picam_CanReadParameter().

5.3.1.35 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,
                                   PicamParameter  parameter,
                                           piflt*  value);
```

Input Parameters

Input parameters for Picam_ReadParameterFloatingPointValue() are:

`camera:` 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 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, `camera` may be a handle to either the:

- `device`, or
- `model`.

Picam_ReadParameterFloatingPointValue() effectively gets `parameter` from the camera device.

Related APIs

For additional information, refer to the following related APIs:

- Picam_CanReadParameter().

5.3.1.36 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,
                          PicamParameter  parameter,
                                  pibln*  waitable);
```

Input Parameters

Input parameters for Picam_CanWaitForStatusParameter() are:

`camera:` Handle for the camera 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, `camera` may be a handle to either the:

- `device`, or
- `model`.

5.3.1.37 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()`.

5.3.1.38 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,
                              PicamParameter  parameter,
                  const PicamStatusPurview**  purview);
```

Input Parameters

Input parameters for `Picam_GetStatusParameterPurview()` are:

`camera:` Handle for the camera 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, `camera` 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()`

5.3.1.39 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,
                            PicamParameter  parameter,
                                     piint  value,
                                    piint*  estimated_time);
```

Input Parameters

Input parameters for `Picam_EstimateTimeToStatusParameterValue()` are:

`camera:` Handle for the camera whose time to status will be estimated.

`parameter:` Handle for the camera 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, `camera` 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()`

5.3.1.40 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,
                             PicamParameter  parameter,
                                      piint  value,
                                      piint  time_out);
```

Input Parameters

Input parameters for Picam_WaitForStatusParameterValue() are:

camera: Handle for the camera 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()

5.3.2 Camera Parameter Information APIs

This section provides programming information for APIs used to configure and retrieve Camera Parameter information.

5.3.2.1 `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 Stuctures

For additional information, refer to the following parameter structure:

- `PicamParameter`.

5.3.2.2 Picam_GetParameters()

Description

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

Syntax

The syntax for Picam_GetParameters() is:

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

Input Parameters

Input parameters for Picam_GetParameters() are:

`camera:` Handle for the camera 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 camera 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 camera is stored.

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_DestroyParameters().

Related Stuctures

For additional information, refer to the following parameter structure:

- PicamParameter.

5.3.2.3 Picam_DoesParameterExist()

Description

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

Syntax

The syntax for Picam_DoesParameterExist() is:

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

Input Parameters

Input parameters for Picam_DoesParameterExist() are:

camera: Handle for the camera 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 camera.

Valid values are:

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

Advanced API Usage

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

- device, or
- model.

Related Stuctures

For additional information, refer to the following parameter structure:

- PicamParameter.

5.3.2.4 Picam_IsParameterRelevant()

Description

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

Syntax

The syntax for Picam_IsParameterRelevant() is:

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

Input Parameters

Input parameters for Picam_IsParameterRelevant() are:

`camera:` Handle for the camera 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 camera.

Valid values are:

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

Advanced API Usage

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

- `device`, or
- `model`.

Related Stuctures

For additional information, refer to the following parameter structure:

- PicamParameter.

5.3.2.5 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,
                          PicamParameter  parameter,
                        PicamValueType*  type);
```

Input Parameters

Input parameters for Picam_GetParameterValueType() are:

camera: Handle for the camera 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, camera may be a handle to either the:

- device, or
- model.

Related Stuctures

For additional information, refer to the following parameter structure:

- PicamParameter;
- PicamValueType.

5.3.2.6 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,
                              PicamParameter  parameter,
                        PicamEnumeratedType*  type);
```

Input Parameters

Input parameters for Picam_GetParameterEnumeratedType() are:

`camera:` Handle for the camera 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, `camera` may be a handle to either the:

- `device`, or
- `model`.

Related Stuctures

For additional information, refer to the following parameter structure:

- PicamParameter.

5.3.2.7 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,
                           PicamParameter  parameter,
                       PicamValueAccess*  access);
```

Input Parameters

Input parameters for Picam_GetParameterValueAccess() are:

camera:	Handle for the camera 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, camera may be a handle to either the:

- device, or
- model.

Related Stuctures

For additional information, refer to the following parameter structure:

- PicamParameter.

5.3.2.8 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,
                             PicamParameter  parameter,
                       PicamConstraintType*  type);
```

Input Parameters

Input parameters for Picam_GetParameterConstraintType() are:

`camera:` Handle for the camera under test.

`parameter:` Specifies the parameter for which contraint 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, `camera` may be a handle to either the:

- `device`, or
- `model`.

Related Stuctures

For additional information, refer to the following parameter structure:

- PicamParameter.

5.3.3 Camera Parameter Constraints APIs

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

5.3.3.1 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 Stuctures

For additional information, refer to the following parameter structure:

- `PicamCollectionConstraint`.

5.3.3.2 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,
                                    PicamParameter  parameter,
                               PicamConstraintCategory  category,
                      const PicamCollectionConstraint**  constraint);
```

Input Parameters

Input parameters for Picam_GetParameterCollectionConstraint() are:

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

`parameter:` Specifies the parameter for which contraint 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 contraint category and parameter combination are 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, `camera` may be a handle to either the:

- `device`, or
- `model`.

Related APIs

For additional information, refer to the following related APIs:

- Picam_DestroyCollectionConstraints().

Related Stuctures

For additional information, refer to the following parameter structures:

- PicamParameter;
- PicamCollectionConstraint.

5.3.3.3 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 Stuctures

For additional information, refer to the following parameter structure:

- `PicamRangeConstraint`.

5.3.3.4 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 contraint 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 contraint 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 Stuctures

For additional information, refer to the following parameter structures:

- PicamParameter;
- PicamRangeConstraint.

5.3.3.5 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 Stuctures

For additional information, refer to the following parameter structure:

- `PicamRoisConstraint`.

5.3.3.6 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 contraint 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 contraint 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 Stuctures

For additional information, refer to the following parameter structures:

- PicamParameter;
- PicamRoisConstraint.

5.3.3.7 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 Stuctures

For additional information, refer to the following parameter structure:

- `PicamPulseConstraint`.

5.3.3.8 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 contraint 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 contraint 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 Stuctures

For additional information, refer to the following parameter structures:

- PicamParameter;
- PicamPulseConstraint.

5.3.3.9 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 Stuctures

For additional information, refer to the following parameter structure:

- `PicamModulationsConstraint`.

5.3.3.10 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 contraint 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 contraint 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 Stuctures

For additional information, refer to the following parameter structures:

- PicamParameter;
- PicamModulationsConstraint.

5.3.4 Camera Parameter Commitment APIs

This section provides programming information about APIs used to commit parameter values.

5.3.4.1 Picam_AreParametersCommitted()

Description

`Picam_AreParametersCommitted()` determines if the parameter configuration changes have been applied to the specified camera.

Syntax

The syntax for `Picam_AreParametersCommitted()` is:

```
PICAM_API Picam_AreParametersCommitted(
                            PicamHandle  camera,
                                 pibln*  committed);
```

Input Parameters

Input parameters for `Picam_AreParametersCommitted()` are:

`camera:` Handle for the camera 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 camera.

Valid values are:

- `TRUE`
  Indicates that parameter configuration changes have been commited to the specified camera.
- `FALSE`
  Indicates that parameter configuration changes have not been commited to the specified camera.

Advanced API Usage

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

- `device`, or
- `model`.

5.3.4.2 Picam_CommitParameters()

Description

Picam_CommitParameters() validates parameter values and applies these valid values to the specified camera 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,
                  const PicamParameter**  failed_parameter_array,
                                 piint*  failed_parameter_count);
```

Input Parameters

Input parameters for Picam_CommitParameters() are:

camera: Handle for the camera 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, camera 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.

Chapter 6: Camera Data Acquisition APIs

Once a camera has been configured and the parameters are committed, the camera 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 camera is closed.

By default, the data are 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.

Configuring the camera such that the total number of readouts is indeterminate will disable automatic data memory management:

- Basic:
  - Instruct the camera 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_ExactReadoutCountMaximum`.
  - Instruct the camera to readout data non-destructively (for cameras that have this feature)
- Advanced:
  - Instruct the camera to acquire data indefinitely

    This is acheived by setting `PicamParameter_ReadoutCount` to 0.

    Also, setting a user-allocated buffer with `PicamAdvanced_SetAcquisitionBuffer()`will disable automatic data memory management.

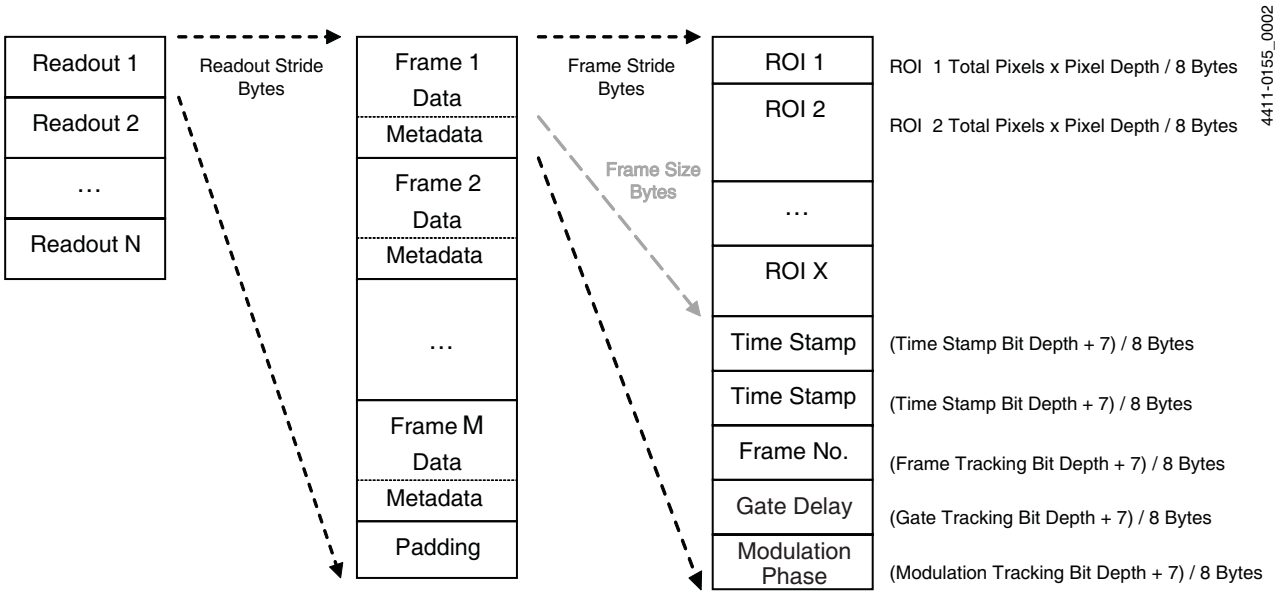
6.1 Data Format

Acquired data is structured as shown in Figure 6-1.

NOTE:

All partitions are specified in bytes.

Figure 6-1: Data Format Diagram



The camera acquires N readouts each a readout stride apart. One readout stride is comprised of M frames each a frame stride apart followed by padding. A frame stride is divided into frame pixel data and frame metadata by a frame size. Frame pixel data contains data for X regions of interest; whose regions are in the order each region was defined. Frame metadata contains any time stamps followed by the frame tracking number, gate tracking (delay and width), and 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 camera has critically malfunctioned and is in need of service. Further acquisitions are not possible until the camera has been serviced.
`PicamAcquisitionErrorsMask_ConnectionLost`	The camera was disconnected.
`PicamAcquisitionErrorsMask_DataLost`	Data has been lost.
`PicamAcquisitionErrorsMask_DataNotArriving`	Data is no longer arriving from the camera.
`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 camera.

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 cameras are configured for non-destructively 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 5.3.4.2, Picam_CommitParameters(), on page 156 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);
```

Input Parameters

Input parameters for `Picam_Acquire()` are:

`camera:` Handle for the camera from which data are to be acquired.

`readout_count:` The number of readouts desired.

Valid values are in the range:

[1…`PicamParameter_ExactReadoutCountMaximum`]

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 camera.

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 camera 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 5.3.4.2, Picam_CommitParameters(), on page 156 for information.

Data acquisition 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 162 for additional information); or
- `Picam_StopAcquisition()`is called.

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 camera 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 camera will run continuously until `Picam_StopAcquisition()` is called.

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()` halts an in-progress data acquisition.

NOTE:

[Advanced API Usage ONLY]

If `PicamParameter_ReadoutCount` = 0, the camera 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 camera from 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()`.

6.4.4 Picam_IsAcquisitionRunning()

Description

`Picam_IsAcquisitionRunning()` determines if there is an active data acquisition in process.

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 camera 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 camera's status has changed.

Usage

`Picam_WaitForAcquisitionUpdate()` must be continuously called until `PicamAcquisitionStatus.running` returns `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 is immediately 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 camera fromwhich data is being acquired.
`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_WaitForAcquisitionUpdate()` are:

`available:` The output buffer used to store newly acquired data from the specified camera.

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.

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`.

Chapter 7: Advanced Function APIs

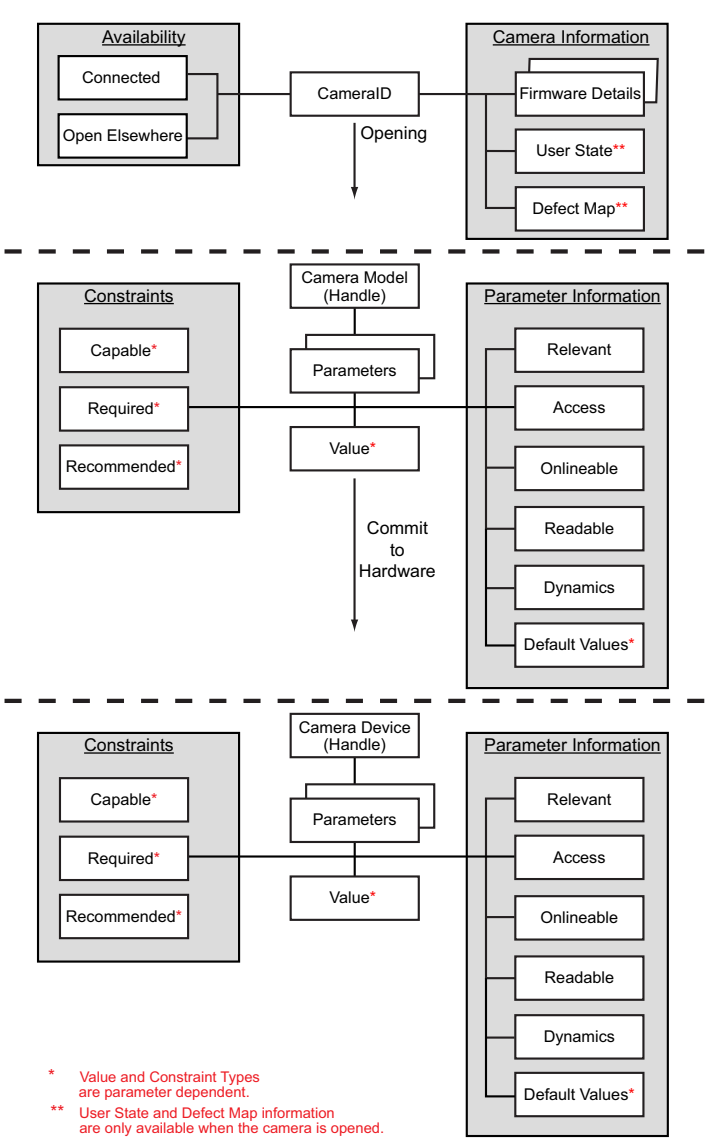
This chapter provides programming information about PICam advanced function APIs, including related data definitions and structures which are included in the `picam_advanced.h` file.

Figure 7-1 illustrates a block diagram of the PICam Advanced Function structure.

REFERENCES:

Refer to Section 2.6.1, Camera Handles, for information about the handles used within PICam.

Figure 7-1: PICam Structure - Advanced



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7.1 Data Type Definitions

This section provides programming information about the following PICam advanced data definitions:

- Camera Plug and Play Discovery Data Enumerations
  - `PicamDiscoveryAction`
- Camera Access Enumerations
  - `PicamHandleType`
- Camera Parameter Information Enumerations
  - `PicamDynamicsMask`
- Camera Data Acquisition Enumerations
  - `PicamAcquisitionState`
  - `PicamAcquisitionStateErrorsMask`

7.1.1 Camera Plug and Play Discovery Data Enumerations

This section provides programming information about camera 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 a camera.

Enumerator Definitions

Refer to Table 7-1 for enumerator definitions.

Table 7-1: `PicamDiscoveryAction` Enumerator Definitions

Enumerator	Description
`PicamDiscoveryAction_Faulted`	A camera has critically malfunctioned and is in need of service. Any acquisition in progress will be stopped and further acquisition are not possible until the camera has been serviced.
`PicamDiscoveryAction_Found`	A camera is now available for use.
`PicamDiscoveryAction_Lost`	A camera is no longer available for use.

7.1.2 Camera Access Enumerations

This section provides programming information about camera access data enumerations.

7.1.2.1 PicamHandleType

Data Type

`PicamHandleType` is defined as `enum`.

Description

`PicamHandleType` is the set of camera handle types.

Enumerator Definitions

Refer to Table 7-2 for enumerator definitions.

Table 7-2: `PicamHandleType` **Enumerator Definitions**

Enumerator	Description
`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 Camera Parameter Information Enumerations

This section provides programming information about camera 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 (Sheet 1 of 2)**

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.

Table 7-3: `PicamDynamicsMask` **Enumerator Definitions (Sheet 2 of 2)**

Enumerator	Description
`PicamDynamicsMask_Constraint`	The parameter dependent constraints may change.

7.1.4 Camera Data Acquisition Enumerations

This section provides programming information about camera 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 Information Data Structures;
  - PicamPixelLocation
  - PicamColumnDefect
  - PicamRowDefect
  - PicamPixelDefectMap
- Camera Parameter Validation Data Structures;
  - PicamValidationResult
  - PicamValidationResults
  - PicamFailedDependentParameter
  - PicamDependentValidationResult
- Camera Data Acquisition Data Structures.
  - PicamAcquisitionBuffer
  - PicamAcquisitionStateCounters

7.2.1 Camera Information Data Structures

This section provides programming information about structures used to define and describe the 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 defetcts.

`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.

7.2.2 Camera Parameter Validation Data Structures

This section provides programming information about 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 PicamConstraint Scope* 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.

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`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 PicamConstraint Scope*  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 Data Acquisition Data Structures

This section provides programming information for camera 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 Discovery Callbacks
  - `PicamDiscoveryCallback()`
- Camera Parameter Value Callbacks
  - `PicamIntegerValueChangedCallback()`
  - `PicamLargeIntegerValueChangedCallback()`
  - `PicamFloatingPointValueChangedCallback()`
  - `PicamRoisValueChangedCallback()`
  - `PicamPulseValueChangedCallback()`
  - `PicamModulationsValueChangedCallback()`
  - `PicamWhenStatusParameterValueCallback()`
  - `PicamIsRelevantChangedCallback()`
  - `PicamValueAccessChangedCallback()`
- Camera Parameter Constraints Callbacks
  - `PicamDependentCollectionConstraintChangedCallback()`
  - `PicamDependentRangeConstraintChangedCallback()`
  - `PicamDependentRoisConstraintChangedCallback()`
  - `PicamDependentPulseConstraintChangedCallback()`
  - `PicamDependentModulationsConstraintChangedCallback()`
- Camera Data Acquisition Callbacks
  - `PicamAcquisitionUpdatedCallback()`
  - `PicamAcquisitionStateUpdatedCallback()`

7.3.1 Camera Discovery Callbacks

This section provides programming information about camera 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 Camera Parameter Value Callbacks

This section provides programming information about camera parameter value callbacks.

7.3.2.1 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,
                PicamParameter  parameter,
                          piint  value );
```

Input Parameters

Input parameters for `PicamIntegerValueChangedCallback()` are:

`camera:` Handle for the camera 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.

7.3.2.2 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.

7.3.2.3 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,
                  PicamParameter  parameter,
                           piflt  value );
```

Input Parameters

Input parameters for PicamFloatingPointValueChangedCallback() are:

- `camera:` Handle for the camera 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.

7.3.2.4 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.

7.3.2.5 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.

7.3.2.6 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.

7.3.2.7 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,
                 PicamParameter  parameter,
                          piint  value,
                     PicamError  error);
```

Input Parameters

Input parameters for PicamWhenStatusParameterValueCallback() are:

- `device:` Handle for the camera device for which a parameterâ€™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.

7.3.2.8 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,
                 PicamParameter  parameter,
                          pibln  relevant );
```

Input Parameters

Input parameters for PicamIsRelevantChangedCallback() are:

- `camera:` Handle for the camera for which a parameter's relevance has been changed.
- `parameter:` The parameter which has had its relevance changed.
- `relevant:` The new relevance.

7.3.2.9 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,
                  PicamParameter  parameter,
                PicamValueAccess  access );
```

Input Parameters

Input parameters for PicamValueAccessChangedCallback() are:

camera:	Handle for the camera 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.

7.3.3 Camera Parameter Constraints Callbacks

This section provides programming information about camera parameter constraints callbacks.

7.3.3.1 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,
                       PicamParameter  parameter,
   const PicamCollectionConstraint*  constraint );
```

Input Parameters

Input parameters for `PicamDependentCollectionConstraintChangedCallback()` are:

`camera:` Handle for the camera 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.

7.3.3.2 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,
                  PicamParameter  parameter,
   const PicamRangeConstraint*  constraint );
```

Input Parameters

Input parameters for PicamDependentRangeConstraintChangedCallback() are:

camera:	Handle for the camera 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.

7.3.3.3 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* PicamDependentRoisConstraintChanged
       Callback)
(
                    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.

7.3.3.4 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* PicamDependentPulseConstraintChanged
       Callback)
(
                    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.

7.3.3.5 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.

7.3.4 Camera Data Acquisition Callbacks

This section provides programming information about camera data acquisition callbacks.

7.3.4.1 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.

7.3.4.2 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 a detailed programmers' reference guide for the following advanced APIs:

- Camera Discovery APIs
  - `PicamAdvanced_RegisterForDiscovery()`
  - `PicamAdvanced_UnregisterForDiscovery()`
  - `PicamAdvanced_DiscoverCameras()`
  - `PicamAdvanced_StopDiscoveringCameras()`
  - `PicamAdvanced_IsDiscoveringCameras()`
- Camera Access APIs
  - `PicamAdvanced_OpenCameraDevice()`
  - `PicamAdvanced_CloseCameraDevice()`
  - `PicamAdvanced_GetOpenCameraDevices()`
  - `PicamAdvanced_GetCameraModel()`
  - `PicamAdvanced_GetCameraDevice()`
  - `PicamAdvanced_GetHandleType()`
- Camera Information APIs
  - `PicamAdvanced_GetUserState()`
  - `PicamAdvanced_SetUserState()`
  - `PicamAdvanced_DestroyPixelDefectMaps()`
  - `PicamAdvanced_GetPixelDefectMap()`
- Camera Parameter Value APIs
  - `PicamAdvanced_RegisterForIntegerValueChanged()`
  - `PicamAdvanced_UnregisterForIntegerValueChanged()`
  - `PicamAdvanced_RegisterForExtrinsicIntegerValueChanged()`
  - `PicamAdvanced_UnregisterForExtrinsicIntegerValueChanged()`
  - `PicamAdvanced_RegisterForLargeIntegerValueChanged()`
  - `PicamAdvanced_UnregisterForLargeIntegerValueChanged()`
  - `PicamAdvanced_RegisterForFloatingPointValueChanged()`
  - `PicamAdvanced_UnregisterForFloatingPointValueChanged()`
  - `PicamAdvanced_RegisterForExtrinsicFloatingPointValueChanged()`
  - `PicamAdvanced_UnregisterForExtrinsicFloatingPointValueChanged()`
  - `PicamAdvanced_RegisterForRoisValueChanged()`
  - `PicamAdvanced_UnregisterForRoisValueChanged()`
  - `PicamAdvanced_RegisterForPulseValueChanged()`
  - `PicamAdvanced_UnregisterForPulseValueChanged()`
  - `PicamAdvanced_RegisterForModulationsValueChanged()`
  - `PicamAdvanced_UnregisterForModulationsValueChanged()`
  - `PicamAdvanced_NotifyWhenStatusParameterValue()`
  - `PicamAdvanced_CancelNotifyWhenStatusParameterValue()`
- Camera Parameter Information APIs
  - `PicamAdvanced_RegisterForIsRelevantChanged()`
  - `PicamAdvanced_UnregisterForIsRelevantChanged()`
  - `PicamAdvanced_RegisterForValueAccessChanged()`
  - `PicamAdvanced_UnregisterForValueAccessChanged()`
  - `PicamAdvanced_GetParameterDynamics()`
  - `PicamAdvanced_GetParameterExtrinsicDynamics()`
- Camera Parameter Constraints APIs
  - `PicamAdvanced_GetParameterCollectionConstraints()`
  - `PicamAdvanced_RegisterForDependentCollectionConstraintChanged()`
  - `PicamAdvanced_UnregisterForDependentCollectionConstraintChanged()`
  - `PicamAdvanced_GetParameterRangeConstraints()`
  - `PicamAdvanced_RegisterForDependentRangeConstraintChanged()`
  - `PicamAdvanced_UnregisterForDependentRangeConstraintChanged()`
  - `PicamAdvanced_GetParameterRoisConstraints()`
  - `PicamAdvanced_RegisterForDependentRoisConstraintChanged()`

  - `PicamAdvanced_UnregisterForDependentRoisConstraintChanged()`
  - `PicamAdvanced_GetParameterPulseConstraints()`
  - `PicamAdvanced_RegisterForDependentPulseConstraintChanged()`
  - `PicamAdvanced_UnregisterForDependentPulseConstraintChanged()`
  - `PicamAdvanced_GetParameterModulationsConstraints()`
  - `PicamAdvanced_RegisterForDependentModulationsConstraintChanged()`
  - `PicamAdvanced_UnregisterForDependentModulationsConstraintChanged()`
- Camera Commitment APIs
  - `Picam_DestroyValidationResult()`
  - `Picam_DestroyValidationResults()`
  - `PicamAdvanced_ValidateParameter()`
  - `PicamAdvanced_ValidateParameters()`
  - `Picam_DestroyDependentValidationResult()`
  - `PicamAdvanced_ValidateDependentParameter()`
  - `PicamAdvanced_CommitParametersToCameraDevice()`
  - `PicamAdvanced_RefreshParameterFromCameraDevice()`
  - `PicamAdvanced_RefreshParametersFromCameraDevice()`
- Acquisition Setup APIs
  - `PicamAdvanced_GetAcquisitionBuffer()`
  - `PicamAdvanced_SetAcquisitionBuffer()`
- Acquisition Notification APIs
  - `PicamAdvanced_RegisterForAcquisitionUpdated()`
  - `PicamAdvanced_UnregisterForAcquisitionUpdated()`
- Acquisition State Notification APIs
  - `PicamAdvanced_CanRegisterForAcquisitionStateUpdated()`
  - `PicamAdvanced_RegisterForAcquisitionStateUpdated()`
  - `PicamAdvanced_UnregisterForAcquisitionStateUpdated()`
- Acquisition Control APIs
  - `PicamAdvanced_HasAcquisitionBufferOverrun()`
  - `PicamAdvanced_ClearReadoutCountOnline()`

7.4.1 Camera Discovery APIs

This section provides programming information for advanced camera 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 Camera Access APIs

This section provides programming information for advanced camera access APIs.

7.4.2.1 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()`.

7.4.2.2 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().

7.4.2.3 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()

7.4.2.4 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.

7.4.2.5 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.

7.4.2.6 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.

7.4.3 Camera Information APIs

This section provides programming information about advanced camera information APIs.

7.4.3.1 PicamAdvanced_GetUserState()

Description

`PicamAdvanced_GetUserState()` returns user-state information for a specified camera.

NOTE:

This API is thread safe.

Syntax

The syntax for `PicamAdvanced_GetUserState()` is:

```
PICAM_API PicamAdvanced_GetUserState(
                              PicamHandle  camera,
                                   void**  user_state );
```

Input Parameters

Input parameters for `PicamAdvanced_GetUserState()` are:

`camera:` Handle for the camera 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.

7.4.3.2 PicamAdvanced_SetUserState()

Description

PicamAdvanced_SetUserState() sets user-state information for a specified camera.

NOTE:

This API is thread safe.

Syntax

The syntax for PicamAdvanced_SetUserState() is:

```
PICAM_API PicamAdvanced_SetUserState(
                            PicamHandle  camera,
                                  void*  user_state );
```

Input Parameters

Input parameters for PicamAdvanced_SetUserState() are:

`camera:` Handle for the camera 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.

7.4.3.3 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

7.4.3.4 PicamAdvanced_GetPixelDefectMap()

Description

PicamAdvanced_GetPixelDefectMap() returns an allocated array/map in which defective pixels 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

7.4.4 Camera Parameter Value APIs

This section provides programming information for advanced camera parameter value APIs.

7.4.4.1 PicamAdvanced_RegisterForIntegerValueChanged()

Description

`PicamAdvanced_RegisterForIntegerValueChanged()` registers a function to call when the 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 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,
                              PicamParameter  parameter,
          PicamIntegerValueChangedCallback  changed );
```

Input Parameters

Input parameters for `PicamAdvanced_RegisterForIntegerValueChanged()` 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_RegisterForIntegerValueChanged()`.

Related APIs

For additional information, refer to the following related APIs:

- `Picam_SetParameterIntegerValue()`;
- `PicamAdvanced_UnregisterForIntegerValueChanged()`.

7.4.4.2 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,
                            PicamParameter  parameter,
          PicamIntegerValueChangedCallback  changed );
```

Input Parameters

Input parameters for PicamAdvanced_UnregisterForIntegerValueChanged() 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_UnregisterForIntegerValueChanged().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_RegisterForIntegerValueChanged().

7.4.4.3 PicamAdvanced_RegisterForExtrinsicIntegerValueChanged()

Description

PicamAdvanced_RegisterForExtrinsicIntegerValueChanged() registers a function to call when the integer value for specified camera parameter has changed due to external influences (e.g., representing the status of camera 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,
                           PicamParameter  parameter,
          PicamIntegerValueChangedCallback  changed );
```

Input Parameters

Input parameters for PicamAdvanced_RegisterForExtrinsicIntegerValueChanged() are:

device:	Handle for the device 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()

7.4.4.4 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,
                            PicamParameter  parameter,
          PicamIntegerValueChangedCallback  changed );
```

Input Parameters

Input parameters for PicamAdvanced_UnregisterForExtrinsicIntegerValueChanged() are:

device:	Handle for the device 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()

7.4.4.5 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 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_UnregisterForLargeIntegerValueChanged() to unregister each callback once it is not 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().

7.4.4.6 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().

7.4.4.7 PicamAdvanced_RegisterForFloatingPointValueChanged()

Description

PicamAdvanced_RegisterForFloatingPointValueChanged() registers a function to call when the floating point 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 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_UnregisterForFloatingPointValueChanged() to unregister each callback once it is not longer required.

Syntax

The syntax for PicamAdvanced_RegisterForFloatingPointValueChanged() is:

```
PICAM_API PicamAdvanced_RegisterForFloatingPointValueChanged(
                                PicamHandle  camera,
                            PicamParameter  parameter,
 PicamFloatingPointValueChangedCallback  changed );
```

Input Parameters

Input parameters for PicamAdvanced_RegisterForFloatingPointValueChanged() 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_RegisterForFloatingPointValueChanged().

Related APIs

For additional information, refer to the following related APIs:

- Picam_SetParameterFloatingPointValue();
- PicamAdvanced_UnregisterForFloatingPointValueChanged().

7.4.4.8 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,
                            PicamParameter  parameter,
 PicamFloatingPointValueChangedCallback  changed );
```

Input Parameters

Input parameters for PicamAdvanced_UnregisterForFloatingPointValueChanged() 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_UnregisterForFloatingPointValueChanged().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_RegisterForFloatingPointValueChanged().

7.4.4.9 PicamAdvanced_RegisterForExtrinsicFloatingPointValueChanged()

Description

PicamAdvanced_RegisterForExtrinsicFloatingPointValueChanged() registers a function to call when the floating point value for specified camera parameter has changed due to external influences (e.g., representing the status of camera 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,
                             PicamParameter  parameter,
     PicamFloatingPointValueChangedCallback  changed );
```

Input Parameters

Input parameters for PicamAdvanced_RegisterForExtrinsicFloatingPointValueChanged() are:

device:	Handle for the device 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()

7.4.4.10 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 camera hardware).

Syntax

The syntax for PicamAdvanced_UnregisterForExtrinsicFloatingPointValueChanged() is:

```
PICAM_API PicamAdvanced_UnregisterForExtrinsicFloatingPointValueChanged(
                                PicamHandle  device,
                             PicamParameter  parameter,
          PicamIntegerValueChangedCallback  changed );
```

Input Parameters

Input parameters for PicamAdvanced_UnregisterForExtrinsicFloatingPointValueChanged() are:

`device:`	Handle for the device 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()

7.4.4.11 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().

7.4.4.12 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().

7.4.4.13 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().

7.4.4.14 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().

7.4.4.15 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().

7.4.4.16 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().

7.4.4.17 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,
                           PicamParameter  parameter,
                                     piint  value,
     PicamWhenStatusParameterValueCallback  when);
```

Input Parameters

Input parameters for PicamAdvanced_NotifyWhenStatusParameterValue() are:

`device:` Handle for the device 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().

7.4.4.18 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,
                             PicamParameter  parameter,
                                      piint  value,
  PicamWhenStatusParameterValueCallback  when);
```

Input Parameters

Input parameters for PicamAdvanced_CancelNotifyWhenStatusParameterValue() are:

`device:` Handle for the device 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().

7.4.5 Camera Parameter Information APIs

This section provides programming information for advanced camera parameter information APIs.

7.4.5.1 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,
                            PicamParameter  parameter,
            PicamIsRelevantChangedCallback  changed );
```

Input Parameters

Input parameters for `PicamAdvanced_RegisterForIsRelevantChanged()` 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_RegisterForIsRelevantChanged()`.

Related APIs

For additional information, refer to the following related APIs:

- `PicamAdvanced_UnregisterForIsRelevantChanged()`.

7.4.5.2 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,
                            PicamParameter  parameter,
            PicamIsRelevantChangedCallback  changed );
```

Input Parameters

Input parameters for PicamAdvanced_UnregisterForIsRelevantChanged() 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_UnregisterForIsRelevantChanged().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_RegisterForIsRelevantChanged().

7.4.5.3 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,
                            PicamParameter  parameter,
          PicamValueAccessChangedCallback  changed );
```

Input Parameters

Input parameters for PicamAdvanced_RegisterForValueAccessChanged() 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_RegisterForValueAccessChanged().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_UnregisterForValueAccessChanged().

7.4.5.4 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,
                            PicamParameter  parameter,
          PicamValueAccessChangedCallback  changed );
```

Input Parameters

Input parameters for PicamAdvanced_UnregisterForValueAccessChanged() 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_UnregisterForValueAccessChanged().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_RegisterForValueAccessChanged().

7.4.5.5 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,
                          PicamParameter  parameter,
                      PicamDynamicsMask*  dynamics );
```

Input Parameters

Input parameters for PicamAdvanced_GetParameterDynamics() are:

`camera:` Handle for the camera 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.

7.4.5.6 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 camera hardware).

Syntax

The syntax for PicamAdvanced_GetParameterExtrinsicDynamics() is:

```
PICAM_API PicamAdvanced_GetParameterExtrinsicDynamics(
                                PicamHandle  camera,
                            PicamParameter  parameter,
                        PicamDynamicsMask*  extrinsic);
```

Input Parameters

Input parameters for PicamAdvanced_GetParameterExtrinsicDynamics() are:

`camera:` Handle for the camera 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.

7.4.6 Camera Parameter Constraints APIs

This section provides programming information for advanced camera parameter constraint APIs.

7.4.6.1 PicamAdvanced_GetParameterCollectionConstraints()

Description

`PicamAdvanced_GetParameterCollectionConstraints()` returns an allocated array in which all collection constraints for a specified camera parameter are stored.

Syntax

The syntax for `PicamAdvanced_GetParameterCollectionConstraints()` is:

```
PICAM_API PicamAdvanced_GetParameterCollectionConstraints(
                                PicamHandle  camera,
                             PicamParameter  parameter,
        const PicamCollectionConstraint**  constraint_array,
                                    piint*  constraint_count );
```

Input Parameters

Input parameters for `PicamAdvanced_GetParameterCollectionConstraints()` are:

`camera:` Handle for the camera 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()`.

7.4.6.2 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_RegisterForDependentCollectionConstraint
Changed(
                                                PicamHandle  camera,
                                           PicamParameter  parameter,
        PicamDependentCollectionConstraintChangedCallback  changed );
```

Input Parameters

Input parameters for PicamAdvanced_RegisterForDependentCollectionConstraintChanged() 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_RegisterForDependentCollectionConstraintChanged().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_UnregisterForDependentCollectionConstraintChanged().

7.4.6.3 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_UnregisterForDependentCollectionConstraint
Changed(
                                                PicamHandle  camera,
                                            PicamParameter  parameter,
        PicamDependentCollectionConstraintChangedCallback  changed );
```

Input Parameters

Input parameters for PicamAdvanced_UnregisterForDependentCollectionConstraintChanged() 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_UnregisterForDependentCollectionConstraintChanged().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_RegisterForDependentCollectionConstraintChanged().

7.4.6.4 PicamAdvanced_GetParameterRangeConstraints()

Description

PicamAdvanced_GetParameterRangeConstraints() returns an allocated array in which all range constraints for a specified camera parameter are stored.

Syntax

The syntax for PicamAdvanced_GetParameterRangeConstraints() is:

```
PICAM_API PicamAdvanced_GetParameterRangeConstraints(
                              PicamHandle  camera,
                            PicamParameter  parameter,
              const PicamRangeConstraint**  constraint_array,
                                    piint*  constraint_count );
```

Input Parameters

Input parameters for PicamAdvanced_GetParameterRangeConstraints() are:

`camera:` Handle for the camera 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().

7.4.6.5 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,
                                             PicamParameter  parameter,
          PicamDependentRangeConstraintChangedCallback  changed );
```

Input Parameters

Input parameters for PicamAdvanced_RegisterForDependentRangeConstraintChanged() 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_RegisterForDependentRangeConstraintChanged().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_UnregisterForDependentRangeConstraintChanged().

7.4.6.6 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,
                                PicamParameter  parameter,
 PicamDependentRangeConstraintChangedCallback  changed );
```

Input Parameters

Input parameters for PicamAdvanced_UnregisterForDependentRangeConstraintChanged() 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_UnregisterForDependentRangeConstraintChanged().

Related APIs

For additional information, refer to the following related APIs:

- PicamAdvanced_RegisterForDependentRangeConstraintChanged().

7.4.6.7 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()

7.4.6.8 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()

7.4.6.9 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().

7.4.6.10 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()

7.4.6.11 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().

7.4.6.12 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().

7.4.6.13 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()

7.4.6.14 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_RegisterForDependentModulationsConstraint
Changed(
                                                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()

7.4.6.15 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().

7.4.7 Camera Commitment APIs

This section provides programming information for advanced camera commitment APIs.

7.4.7.1 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`.

7.4.7.2 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`.

7.4.7.3 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.

7.4.7.4 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.

7.4.7.5 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`.

7.4.7.6 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()

7.4.7.7 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().

7.4.7.8 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().

7.4.7.9 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().

7.4.8 Acquisition Setup APIs

This section provides programming information about advanced acquisition setup APIs.

7.4.8.1 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.

7.4.8.2 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.

7.4.9 Acquisition Notification APIs

This section provides programming information for advanced acquisition notification APIs.

7.4.9.1 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()`.

7.4.9.2 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()

7.4.10 Acquisition State Notification APIs

This section provides programming information for advanced acquisition state notification APIs.

7.4.10.1 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,
                                   pibln*  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.

7.4.10.2 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()

7.4.10.3 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()

7.4.11 Acquisition Control APIs

This section provides programming information for advance acquisition control APIs.

7.4.11.1 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.

7.4.11.2 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 online readout count is being tested.

Output Parameters

Output parameters for PicamAdvanced_ClearReadoutCountOnline() are:

`cleared:` Pointer to the results.

Indicates if the online readout count has been cleared.

Valid values are:

- TRUE
  Indicates that the online readout count has been cleared.
- FALSE
  Indicates that the online readout count has not been cleared.

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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 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 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 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 setpoint 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 setpoint is to be determined.

Output Parameters

Output parameters for PicamEMCalibration_GetSensorTemperatureSetPoint() are:

`value:` Pointer to the memory location in which the setpoint 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 setpoint 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 setpoint is to be programmed.

`value:` The desired temperature setpoint, 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 setpoints, 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 setpoints 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 setpoints 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 cancelled (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 (i.e., 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

Value Types		Contraint 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	
I = Integer	L = Large Integer		

Table A-2: Parameter Information and Camera Support (Sheet 1 of 6)

Parameter Name	Read Only	Value Type	Constraint Type	NIRvana LN	PI-MAX 3/4	PI-MTE	PIoNIR/NIRvana/ST	PIXIS	ProEM/ + / -HS	PyLoN	PyLoN-IR	SOPHIA	Quad-RO
Shutter Timing													
`ActiveShutter`		E	C									✓	
`ExposureTime`		F	R	✓		✓	✓	✓	✓	✓	✓	✓	✓
`ExternalShutterStatus`	✓	E										✓	
`ExternalShutterType`	✓	E										✓	
`InactiveShutterTimingModeResult`	✓	E										✓*	
`InternalShutterStatus`	✓	E										✓	
`InternalShutterType`	✓	E										✓	
`ShutterClosingDelay`		F	R	✓		✓	✓	✓	✓	✓	✓	✓	✓
`ShutterDelayResolution`		F	C	✓		✓	✓	✓	✓	✓	✓	✓	✓

Table A-2: Parameter Information and Camera Support (Sheet 2 of 6)

Parameter Name	Read Only	Value Type	Constraint Type	NIRvana LN	PI-MAX 3/4	PI-MTE	PIoNIR/NIRvana/ST	PIXIS	ProEM/ + / -HS	PyLoN	PyLoN-IR	SOPHIA	Quad-RO
ShutterOpeningDelay		F	R	✓			✓		✓	✓	✓	✓	
ShutterTimingMode		E	C	✓		✓	✓	✓	✓	✓	✓	✓	✓
Gating													
DifEndingGate		P	P		✓*								
DifStartingGate		P	P		✓*								
GatingMode		E	C		✓								
RepetitiveGate		P	P		✓								
SequentialEndingGate		P	P		✓								
SequentialGateStepCount		L	R		✓								
SequentialGateStepIterations		L	R		✓								
SequentialStartingGate		P	P		✓								
Intensifier													
BracketGating		B	C		✓*								
CustomModulationSequence		M	M		✓*								
EMIccdGain		I	R		✓*								
EMIccdGainControlMode		E	C		✓*								
EnableIntensifier		B	C		✓								
EnableModulation		B	C		✓*								
GatingSpeed	✓	E			✓								
IntensifierDiameter	✓	F			✓								
IntensifierGain		I	R		✓								
IntensifierOptions	✓	E			✓								
IntensifierStatus	✓	E			✓								
ModulationDuration		F	R		✓*								
ModulationFrequency		F	R		✓*								
PhosphorDecayDelay		F	R		✓								
PhosphorDecayDelayResolution		F	C		✓								
PhosphorType	✓	E			✓								
PhotocathodeSensitivity	✓	E			✓								
RepetitiveModulationPhase		F	R		✓*								

Table A-2: Parameter Information and Camera Support (Sheet 3 of 6)

Parameter Name	Read Only	Value Type	Constraint Type	NIRvana LN	PI-MAX 3/4	PI-MTE	PIoNIR/NIRvana/ST	PIXIS	ProEM/ + / -HS	PyLoN	PyLoN-IR	SOPHIA	Quad-RO
SequentialEndingModulationPhase		F	R		✓*								
SequentialStartingModulationPhase		F	R		✓*								
Analog to Digital Conversion													
AdcAnalogGain		E	C		✓		✓	✓	✓	✓	✓	✓	✓
AdcBitDepth		I	C	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
AdcEMGain		I	R		✓*				✓				
AdcQuality		E	C		✓*	✓*		✓*	✓*	✓			
AdcSpeed		F	C	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CorrectPixelBias		B	C		✓*				✓	✓		✓	
Hardware I/O													
AnticipateTrigger		B	C		✓*								
AuxOutput		P	P		✓								
DelayFromPreTrigger		F	R		✓*								
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		✓								
TriggerCoupling		E	C		✓								
TriggerDetermination		E	C	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
TriggerFrequency		F	R		✓								
TriggerResponse		E	C	✓	✓*	✓	✓	✓	✓	✓	✓	✓	✓
TriggerSource		E	C		✓								
TriggerTermination		E	C		✓								
TriggerThreshold		F	R		✓								

Table A-2: Parameter Information and Camera Support (Sheet 4 of 6)

Parameter Name	Read Only	Value Type	Constraint Type	NIRvana LN	PI-MAX 3/4	PI-MTE	PIoNIR/NIRvana/ST	PIXIS	ProEM/ + / -HS	PyLoN	PyLoN-IR	SOPHIA	Quad-RO
Readout Control													
Accumulations		L	R		✓								
EnableNondestructiveReadout		B	C	✓									
KineticsWindowHeight		I	R		✓*	✓		✓	✓	✓		✓	
NondestructiveReadoutPeriod		F	R	✓									
ReadoutControlMode		E	C	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ReadoutOrientation	✓	E		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ReadoutPortCount		I	C	✓	✓*		✓				✓	✓	✓
ReadoutTimeCalculation	✓	F		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
VerticalShiftRate		F	C		✓	✓		✓	✓	✓		✓	✓
Data Acquisition													
DisableDataFormatting		B	C	✓	✓	✓	✓	✓	✓	✓	✓	✓	
ExactReadoutCountMaximum	✓	L		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
FrameRateCalculation	✓	F		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
FrameSize	✓	I		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
FramesPerReadout	✓	I		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
FrameStride	✓	I		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
FrameTrackingBitDepth		I	C	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
GateTracking		E	C		✓								
GateTrackingBitDepth		I	C		✓								
ModulationTracking		E	C		✓*								
ModulationTrackingBitDepth		I	C		✓*								
NormalizeOrientation		B	C	✓	✓*	✓*		✓*	✓	✓			
OnlineReadoutRateCalculation	✓	F		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Orientation	✓	E		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PhotonDetectionMode		E	C		✓*								
PhotonDetectionThreshold		F	R		✓*								
PixelBitDepth	✓	I		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PixelFormat		E	C	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ReadoutCount		L	R	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table A-2: Parameter Information and Camera Support (Sheet 5 of 6)

Parameter Name	Read Only	Value Type	Constraint Type	NIRvana LN	PI-MAX 3/4	PI-MTE	PIoNIR/NIRvana/ST	PIXIS	ProEM/ + / -HS	PyLoN	PyLoN-IR	SOPHIA	Quad-RO
ReadoutRateCalculation	✓	F		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ReadoutStride	✓	I		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Rois		R	Ri	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
TimeStampBitDepth		I	C	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
TimeStampResolution		L	C	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
TimeStamps		E	C	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
TrackFrames		B	C	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sensor Information													
CcdCharacteristics	✓	E			✓	✓		✓	✓	✓		✓	✓
PixelGapHeight	✓	F		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PixelGapWidth	✓	F		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PixelHeight	✓	F		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PixelWidth	✓	F		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SensorActiveBottomMargin	✓	I		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SensorActiveExtendedHeight		I	R										
SensorActiveHeight	✓	I		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SensorActiveLeftMargin	✓	I		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SensorActiveRightMargin	✓	I		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SensorActiveTopMargin	✓	I		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SensorActiveWidth	✓	I		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SensorMaskedBottomMargin	✓	I		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SensorMaskedHeight	✓	I		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SensorMaskedTopMargin	✓	I		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SensorSecondaryActiveHeight	✓	I		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SensorSecondaryMaskedHeight	✓	I		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SensorType	✓	E		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table A-2: Parameter Information and Camera Support (Sheet 6 of 6)

Parameter Name	Read Only	Value Type	Constraint Type	NIRvana LN	PI-MAX 3/4	PI-MTE	PIoNIR/NIRvana/ST	PIXIS	ProEM/ + / -HS	PyLoN	PyLoN-IR	SOPHIA	Quad-RO
Sensor Layout													
ActiveBottomMargin		I	R		✓	✓		✓	✓	✓		✓	
ActiveExtendedHeight												✓	
ActiveHeight		I	R		✓	✓		✓	✓	✓		✓	
ActiveLeftMargin		I	R		✓	✓		✓	✓	✓		✓	
ActiveRightMargin		I	R		✓	✓		✓	✓	✓		✓	
ActiveTopMargin		I	R		✓	✓		✓	✓	✓		✓	
ActiveWidth		I	R		✓	✓		✓	✓	✓		✓	
MaskedBottomMargin		I	R		✓*	✓*			✓*				
MaskedHeight		I	R		✓*	✓*			✓*				
MaskedTopMargin		I	R		✓*	✓*			✓*				
SecondaryActiveHeight		I	R						✓*				
SecondaryMaskedHeight		I	R						✓*				
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										✓	
DisableCoolingFan		B	C				✓		✓*			✓	
EnableSensorWindowHeater		B	C	✓									
SensorTemperatureReading	✓	F		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SensorTemperatureSetPoint		F	R	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SensorTemperatureStatus	✓	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 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 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 camera that is to be calibrated is the only ProEM camera 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.

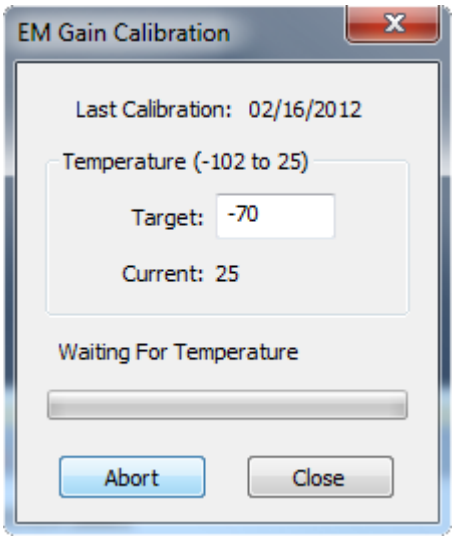
4. Launch `EMGainCalibration.exe`.

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



4411-0155_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 4.x:

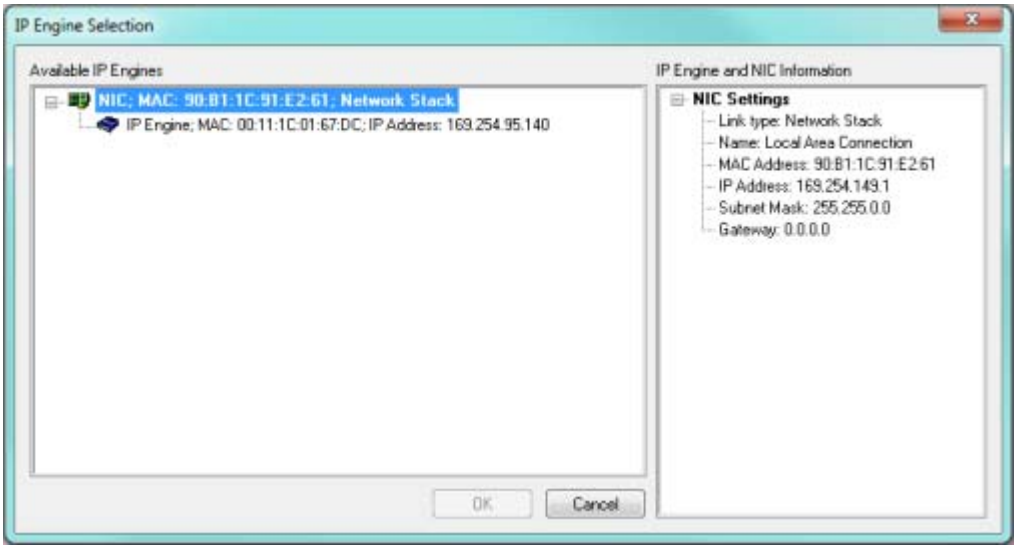
1. On the Host Computer, navigate to the following directory:

   `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



4411-0155_0006

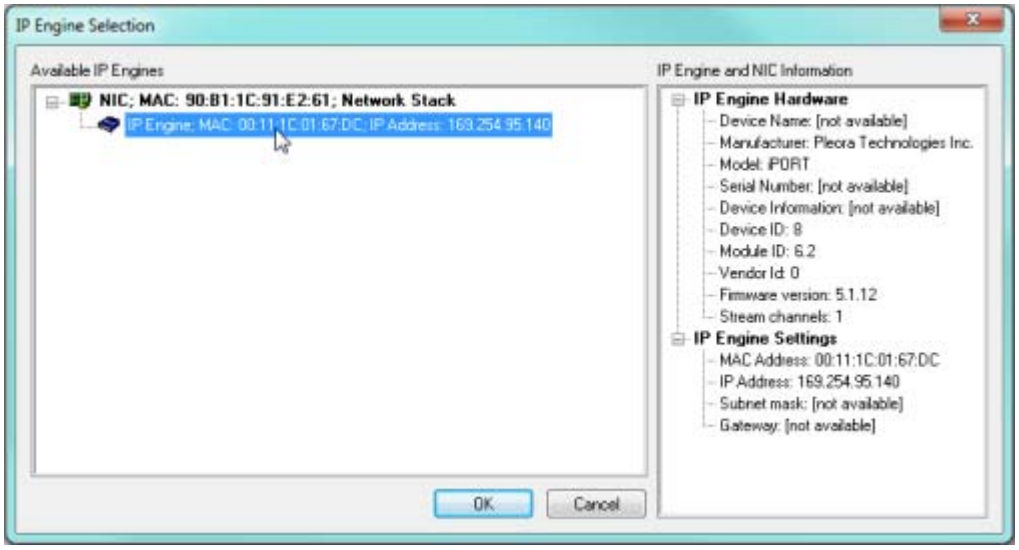
3. Within the **Available IP Engines** field, select the desired IP Engine from the list of available devices.

NOTE:

Each IP Engine listed represents one camera.

See Figure C-2.

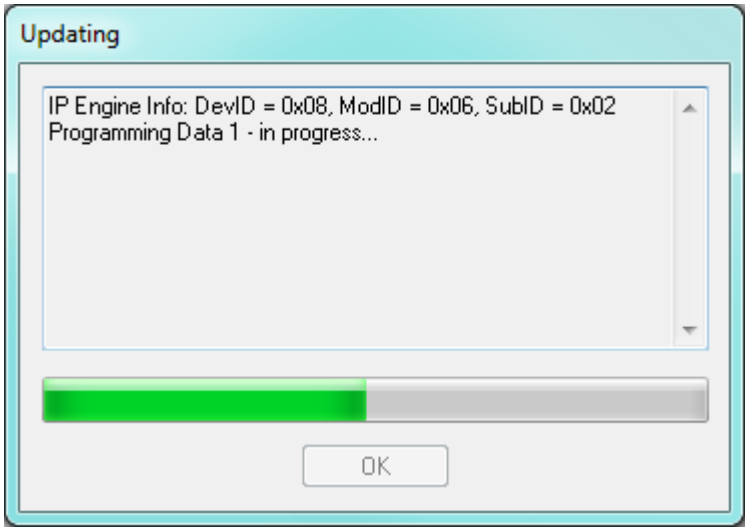
Figure C-2: Firmware Upgrade: Selecting Device to be Upgraded



4411-0155_0007

4. Once selected, click OK 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

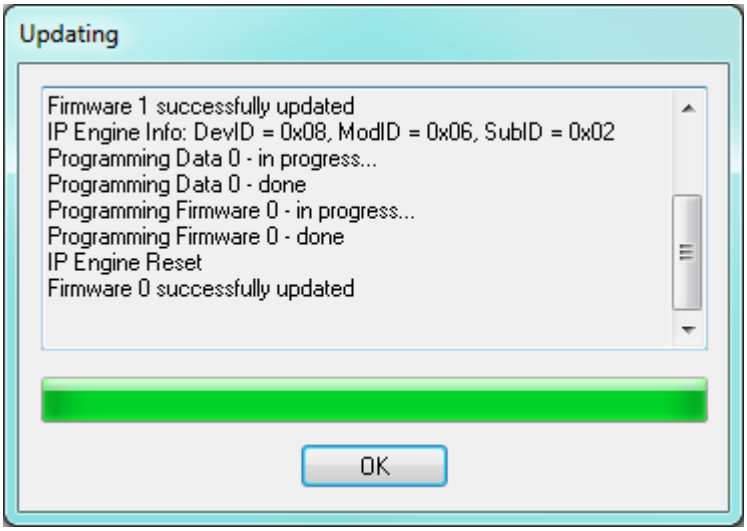


4411-0155_0008

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



4411-0155_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 4.x from the host computer. The Firmware Restore Tool is not included with PICam 3.x installations. Uninstalling PICam 4.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 4.x has been uninstalled, move the Firmware Restore Tool into a non-PICam directory on the host computer prior to unistalling PICam 4.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

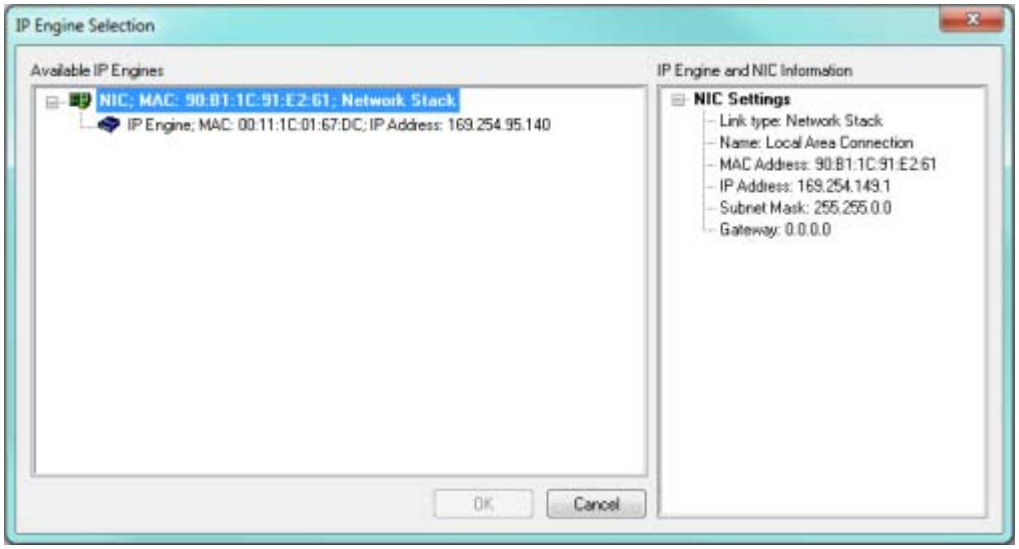
Perform the following procedure:

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



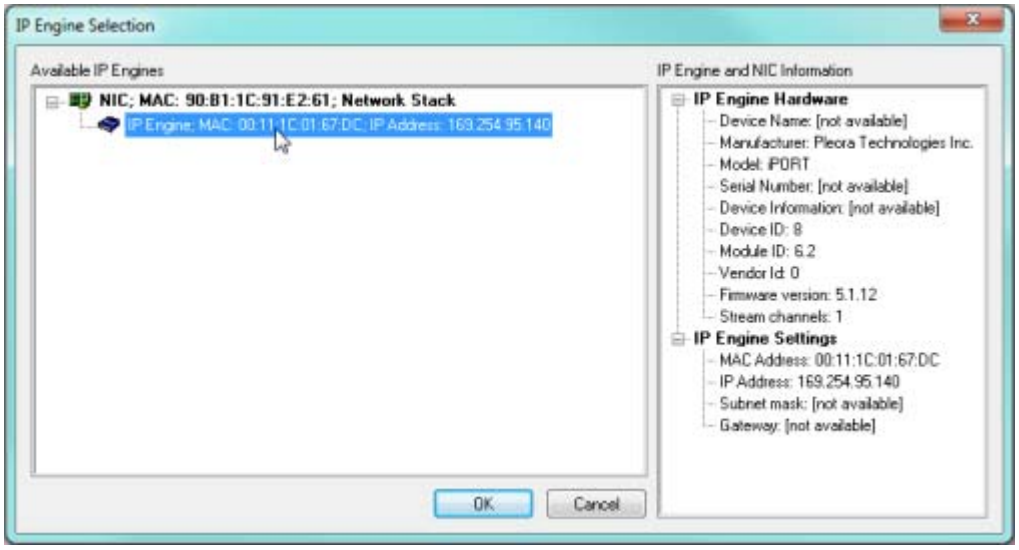
4411-0155_0006

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.

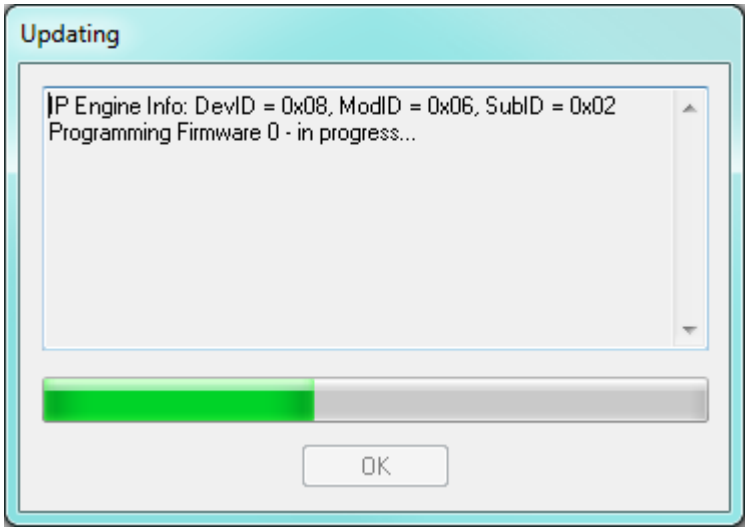
Figure C-6: Firmware Restore: Selecting Device to be Restored



4411-0155_0007

4. Once selected, click OK 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

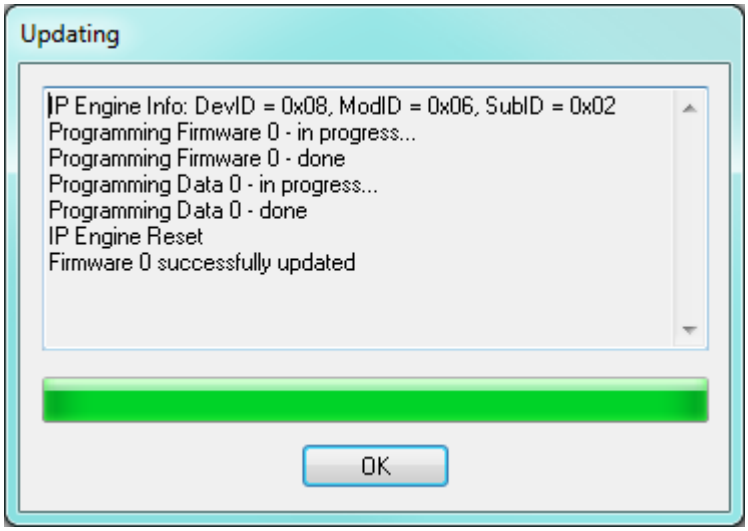


4411-0155_0010

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



4411-0155_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 4.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)

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