



Vimba

# Vimba C Manual

1.6

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# 1 Contacting Allied Vision

## **Connect with Allied Vision by function**

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## 2 Document history and conventions



This chapter includes:

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## 2.1 Document history

| Version | Date        | Changes                                                                                                                                                                  |
|---------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.0     | 2012-11-15  | Initial version                                                                                                                                                          |
| 1.1     | 2013-02-22  | Different links, small changes                                                                                                                                           |
| 1.2     | 2013-06-18  | Small corrections, layout changes                                                                                                                                        |
| 1.3     | 2014-07-10  | Added function reference, re-structured and improved texts                                                                                                               |
| 1.4     | 2015-11-09  | Added USB compatibility, renamed several Vimba components and documents ("AVT" no longer in use), links to new Allied Vision website                                     |
| 1.5     | 2016-02-27  | Added Goldeye CL compatibility, new document layout                                                                                                                      |
| 1.6     | 2017-Apr-05 | Added chapter Triggering cameras (including Action Commands), changed the position of <code>VmbCaptureQueueFlush</code> , several minor changes, updated document layout |

## 2.2 Conventions used in this manual

To give this manual an easily understood layout and to emphasize important information, the following typographical styles and symbols are used:

### 2.2.1 Styles

| Style              | Function                                   | Example                  |
|--------------------|--------------------------------------------|--------------------------|
| Emphasis           | Programs, or highlighting important things | <b>Emphasis</b>          |
| Publication title  | Publication titles                         | Title                    |
| Web reference      | Links to web pages                         | <a href="#">Link</a>     |
| Document reference | Links to other documents                   | <a href="#">Document</a> |
| Output             | Outputs from software GUI                  | <b>Output</b>            |
| Input              | Input commands, modes                      | Input                    |
| Feature            | Feature names                              | Feature                  |

## 2.2.2 Symbols



**Practical Tip**



**Safety-related instructions to avoid malfunctions**

Instructions to avoid malfunctions



**Further information available online**

## 3 General aspects of the API

The purpose of Vimba's APIs is to enable programmers to interact with Allied Vision cameras independent of the interface technology (Gigabit Ethernet, 1394, USB, Camera Link). To achieve this generic behavior, Vimba C API utilizes GenICam transport layer modules to connect to the various camera interfaces.

For accessing functionality of either Vimba or the connected cameras, you have two ways of control: You can use the fixed set of API functions and you can use GenICam Features by calling functions like, e.g., `VmbFeatureXXXSet` or `VmbFeatureXXXGet` on entities like Vimba or the cameras.

This manual mainly deals with the API functions.



The [Vimba Manual](#) contains a description of the API concepts. To fully understand the API, we recommend reading the Vimba Manual first.



Features are listed in the following documents:

- [GigE Features Reference](#) (GigE camera features)
- [USB Features Reference](#) (USB camera features)
- [Vimba 1394 TL Features Manual](#) (1394 camera and TL features)
- Goldeye G/CL Features Reference  
<http://www.alliedvision.com/en/support/technical-documentation.html>
- [Vimba Features Manual](#) (Vimba System features)



The latest GigE, USB, and Camera Link Features Manuals are available from:  
<http://www.alliedvision.com/en/support/technical-documentation.html>

## 4 API usage



This chapter includes:

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## 4.1 API Version

Even if new features are introduced to Vimba C API, your software remains backward compatible. Use `VmbVersionQuery` to check the version number of Vimba C API.

## 4.2 API Startup and Shutdown

In order to start and shut down Vimba API, use these paired functions:

- `VmbStartup` initializes Vimba API.
- `VmbShutdown` shuts down Vimba API (as soon as all callbacks are finished).

`VmbStartup` and `VmbShutdown` must always be paired. Calling the pair several times within the same program is possible, but not recommended. Only `VmbVersionQuery` can be run without initializing Vimba API. In order to free resources, shut down Vimba API when you don't use it. Shutting down Vimba API closes all opened cameras.

## 4.3 Listing available cameras



For a quick start, see ListCameras example of the Vimba SDK.

**VmbCamerasList** enumerates all cameras recognized by the underlying transport layers. With this command, the programmer can fetch all static details of a camera such as:

- Camera ID
- Camera model
- Name or ID of the connected interface (for example, the network or 1394 adapter)

The order in which the detected cameras are listed is determined by the order of camera discovery and therefore not deterministic. Normally, Vimba recognizes cameras in the following order: USB - 1394 - GigE - Camera Link. However, this order may change depending on your system configuration and the accessories (for example, hubs or long cables).

### GigE cameras:

Listing cameras over the network is a two-step process:

1. To enable camera discovery events, run one of the following commands:
  - **GeVDiscoveryAllOnce** discovers all connected cameras once.
  - **GeVDiscoveryAllAuto** continually emits discovery packets and thus constantly consumes bandwidth. Use it only if you need to stay aware of changes to your network structure and new cameras.

Both commands require a certain amount of time (**GeVDiscoveryAllDuration**) before returning.

2. To stop the camera discovery, run command **GeVDiscoveryAllOff**.

### USB and 1394 cameras:

Changes to the plugged cameras are detected automatically. Consequently, any changes to the camera list are announced via discovery event.

All listed commands are applied to all network interfaces, see the example Listing 1.

### Camera Link cameras:

The specifications of Camera Link and GenCP do not support plug & play or discovery events. To detect changes to the camera list, shutdown and startup the API by calling **VmbShutdown** and **VmbStartup** consecutively.

Listing 1: Get Cameras

```
bool bGigE;
VmbUint32_t nCount;
VmbCameraInfo_t* pCameras;

// We ask Vimba for the presence of a GigE transport layer
VmbError_t err = VmbFeatureBoolGet( gVimbaHandle, "GeVTLIsPresent", &bGigE );
if ( VmbErrorSuccess == err )
{
    if ( true == bGigE )
    {
        // We use all network interfaces using the global Vimba handle
        err = VmbFeatureCommandRun( gVimbaHandle, "GeVDiscoveryAllOnce" );
    }
}
if ( VmbErrorSuccess == err )
{
    // Get the number of connected cameras
    err = VmbCamerasList( NULL, 0, &nCount, sizeof *pCameras );

    if ( VmbErrorSuccess == err )
    {
        // Allocate accordingly
        pCameras = (VmbCameraInfo_t*)malloc( nCount * sizeof *pCameras );
        // Get the cameras
        err = VmbCamerasList( pCameras, nCount, &nCount, sizeof *pCameras );
        // Print out each camera's name
        for ( VmbUint32_t i=0; i<nCount; ++i )
        {
            printf( " %s\n", pCameras[i].cameraName );
        }
    }
}
}
```

Struct `VmbCameraInfo_t` provides the entries listed in Table 1 for obtaining information about a camera.

| Struct Entry                                 | Purpose                                            |
|----------------------------------------------|----------------------------------------------------|
| <code>const char* cameraIdString</code>      | The unique ID                                      |
| <code>const char* cameraName</code>          | The name                                           |
| <code>const char* modelName</code>           | The model name                                     |
| <code>const char* serialString</code>        | The serial number                                  |
| <code>VmbAccessMode_t permittedAccess</code> | The mode to open the camera                        |
| <code>const char* interfaceIdString</code>   | The ID of the interface the camera is connected to |

Table 1: Struct `VmbCameraInfo_t`

## Enable notifications of changed camera states

To **get notified whenever a camera is detected, disconnected, or changes its open state**:

- Run command feature `GeVDiscoveryAllAuto` on the System entity (GigE cameras only).
- Use `VmbFeatureInvalidationRegister` to register a callback with the Vimba System that gets executed on the according event. The function pointer to the callback function has to be of type `VmbInvalidationCallback*`.



`VmbShutdown` blocks until all callbacks have finished execution.



Functions that must **not** be called within the camera notification callback:

- `VmbStartup`
- `VmbShutdown`
- `VmbCameraOpen`
- `VmbCameraClose`
- `VmbCameraOpen`
- `VmbFeatureIntSet` (and any other `VmbFeature*Set` function)
- `VmbFeatureCommandRun`

## 4.4 Opening and closing a camera

A camera must be opened to control it and to capture images.

Call `VmbCameraOpen` and provide the ID of the camera and the desired access mode.

Vimba API provides several **access modes**:

- `VmbAccessModeFull`: read and write access. Use this mode to configure the camera features and to acquire images (Goldeye CL cameras: configuration only)
- `VmbAccessModeConfig`: enables configuring the IP address of your GigE camera
- `VmbAccessModeRead`: read-only access. Setting features is not possible. However, for GigE cameras that are already in use by another application, the acquired images can be transferred to Vimba API (Multicast).

When a camera has been opened successfully, a handle for further access is returned.

An example for **opening a camera** retrieved from the camera list is shown in Listing 2.

Listing 2: Open Camera

```
VmbCameraInfo_t *pCameras;  
VmbHandle_t hCamera;  
  
// Get all known cameras as described in chapter "Listing available cameras"  
  
// Open the first camera  
if ( VmbErrorSuccess == VmbCameraOpen( pCameras[0].cameraIdString,  
                                       VmbAccessModeFull, hCamera ) )  
{  
    printf( "Camera opened, handle [0x%p] retrieved.\n", hCamera );  
}
```

Listing 3 shows how to **close a camera** using `VmbCameraClose` and the previously retrieved handle.

Listing 3: Close Camera

```
if ( VmbErrorSuccess == VmbCameraClose( hCamera ) )  
{  
    printf( "Camera closed.\n" );  
}
```

## 4.5 Accessing Features



For a quick start, see ListFeatures example of the Vimba SDK.

GenICam-compliant features control and monitor various aspects of the drivers and cameras. For more details on camera and Vimba features, see (if installed):

- [GigE Features Reference](#) (GigE camera features)
- [USB Features Reference](#) (USB camera features)
- [Vimba 1394 TL Features Manual](#) (1394 camera and TL features)
- Goldeye G/CL Features Reference  
<http://www.alliedvision.com/en/support/technical-documentation.html>
- [Vimba Features Manual](#) (Vimba System features)

Vimba API provides several feature types, which all have their specific properties and functionalities, as shown in Table 2.

As shown in Table 2, Vimba API provides its own set of access functions for every feature data type. The static properties of a feature are held in struct `VmbFeatureInfo_t` as listed in Table 3. It may be filled by calling `VmbFeatureInfoQuery` for an individual feature, or by calling `VmbFeaturesList` for the whole list of features. Since not all features are available all the time, it is necessary to query their current accessibility by calling function `VmbFeatureAccessQuery`.

To **query all available features** of a camera, use `VmbFeaturesList`. This list does not change while the camera is opened as shown in Listing 4.

| Feature Type           | Operation | Function                       |
|------------------------|-----------|--------------------------------|
| Enumeration            | Set       | VmbFeatureEnumSet              |
|                        | Get       | VmbFeatureEnumGet              |
|                        | Range     | VmbFeatureEnumRangeQuery       |
|                        | Other     | VmbFeatureEnumIsAvailable      |
|                        |           | VmbFeatureEnumAsInt            |
| VmbFeatureEnumAsString |           |                                |
| VmbFeatureEnumEntryGet |           |                                |
| Integer                | Set       | VmbFeatureIntSet               |
|                        | Get       | VmbFeatureIntGet               |
|                        | Range     | VmbFeatureIntRangeQuery        |
|                        | Other     | VmbFeatureIntIncrementQuery    |
| Float                  | Set       | VmbFeatureFloatSet             |
|                        | Get       | VmbFeatureFloatGet             |
| String                 | Set       | VmbFeatureStringSet            |
|                        | Get       | VmbFeatureStringGet            |
|                        | Range     | VmbFeatureStringMaxlengthQuery |
| Boolean                | Set       | VmbFeatureBoolSet              |
|                        | Get       | VmbFeatureBoolGet              |
| Command                | Set       | VmbFeatureCommandRun           |
|                        | Get       | VmbFeatureCommandIsDone        |
| Raw data               | Set       | VmbFeatureRawSet               |
|                        | Get       | VmbFeatureRawGet               |
|                        | Range     | VmbFeatureRawLengthQuery       |

Table 2: Feature types and functions for reading and writing them

| Struct entry                      | Purpose                                                       |
|-----------------------------------|---------------------------------------------------------------|
| const char* name                  | Name used in the API                                          |
| VmbFeatureData_t featureDataType  | Data type of this feature                                     |
| VmbFeatureFlags_t featureFlags    | Access flags for this feature                                 |
| const char* category              | Category this feature can be found in                         |
| const char* displayName           | Feature name to be used in GUIs                               |
| VmbUInt32_t pollingTime           | Predefined polling time for volatile features                 |
| const char* unit                  | Measuring unit as given in the XML file                       |
| const char* representation        | Representation of a numeric feature                           |
| VmbFeatureVisibility_t visibility | GUI visibility                                                |
| const char* tooltip               | Short description, e.g. for a tooltip                         |
| const char* description           | Longer description                                            |
| const char* sfncNamespace         | Namespace this feature resides in                             |
| VmbBool_t isStreamable            | Indicates if a feature can be stored to or loaded from a file |
| VmbBool_t hasAffectedFeatures     | Indicates if the feature potentially affects other features   |
| VmbBool_t hasSelectedFeatures     | Indicates if the feature selects other features               |

Table 3: Struct `VmbFeatureInfo_t`

Listing 4: Get Features

```
VmbFeatureInfo_t *pFeatures;
VmbUInt32_t nCount = 0;
VmbHandle_t hCamera;

// Open the camera as shown in chapter "Opening a camera"

// Get the number of features
VmbError_t err = VmbFeaturesList( hCamera, NULL, 0, &nCount, sizeof *pFeatures );

if ( VmbErrorSuccess == err && 0 < nCount )
{
    // Allocate accordingly
    pFeatures = (VmbFeatureInfo_t*)malloc( nCount * sizeof *pFeatures );

    // Get the features
    err = VmbFeaturesList( hCamera, pFeatures, nCount, &nCount,
                          sizeof *pFeatures );

    // Print out their name and data type
    for ( int i=0; i<nCount; ++i )
    {
        printf( "Feature '%s' of type: %d\n", pFeatures[i].name,
               pFeatures[i].featureDataType );
    }
}
```

For an example of **reading a camera feature**, see Listing 5.

Listing 5: Reading a camera feature

```
VmbHandle_t hCamera;

// Open the camera as shown in chapter "Opening a camera"

VmbInt64_t nWidth;

if ( VmbErrorSuccess == VmbFeatureIntGet( hCamera, "Width", &nWidth ) )
{
    printf("Width: %ld\n", nPayloadSize);
}
```

As an example for **writing features to a camera** and **running a command feature**, see Listing 6.

Listing 6: Writing features and running command features

```
VmbHandle_t hCamera;

// Open the camera as shown in chapter "Opening a camera"

if ( VmbErrorSuccess == VmbFeatureEnumSet( hCamera, "AcquisitionMode",
                                           "Continuous" ))
{
    if ( VmbErrorSuccess = VmbFeatureCommandRun( hCamera, "AcquisitionStart" ))
    {
        printf( "Acquisition successfully started\n" );
    }
}
```

Table 4 introduces the **basic features of all cameras**. A feature has a name, a type, and access flags such as read-permitted and write-permitted.

| Feature          | Type        | Access Flags | Description                                                                                |
|------------------|-------------|--------------|--------------------------------------------------------------------------------------------|
| AcquisitionMode  | Enumeration | R/W          | The acquisition mode of the camera. Value set: Continuous, SingleFrame, MultiFrame.        |
| AcquisitionStart | Command     |              | Start acquiring images.                                                                    |
| AcquisitionStop  | Command     |              | Stop acquiring images.                                                                     |
| PixelFormat      | Enumeration | R/W          | The image format. Possible values are e.g.: Mono8, RGB8Packed, YUV411Packed, BayerRG8, ... |
| Width            | UInt32      | R/W          | Image width, in pixels.                                                                    |
| Height           | UInt32      | R/W          | Image height, in pixels.                                                                   |
| PayloadSize      | UInt32      | R            | Number of bytes in the camera payload, including the image.                                |

Table 4: Basic features found on all cameras

To **get notified whenever a feature's value changes**, use `VmbFeatureInvalidationRegister` to register a callback that gets executed on the according event. For camera features, use the camera handle for registration. The function pointer to the callback function has to be of type `VmbInvalidationCallback*`.



`VmbShutdown` only returns after all callbacks have finished execution.



Functions that must **not** be called within a feature invalidation callback:

- `VmbStartup`
- `VmbShutdown`
- `VmbFeatureIntSet` (and any other `VmbFeature*Set` function)
- `VmbFeatureCommandRun`

## 4.6 Image Capture (API) and Acquisition (Camera)



The [Vimba Manual](#) describes the principles of synchronous and asynchronous image acquisition.



For a quick start, see SynchronousGrab example of the Vimba SDK.

### 4.6.1 Image Capture and Image Acquisition

Image capture and image acquisition are two independent operations: **Vimba API captures** images, the **camera acquires** images. To obtain an image from your camera, setup Vimba API to capture images before starting the acquisition on the camera:

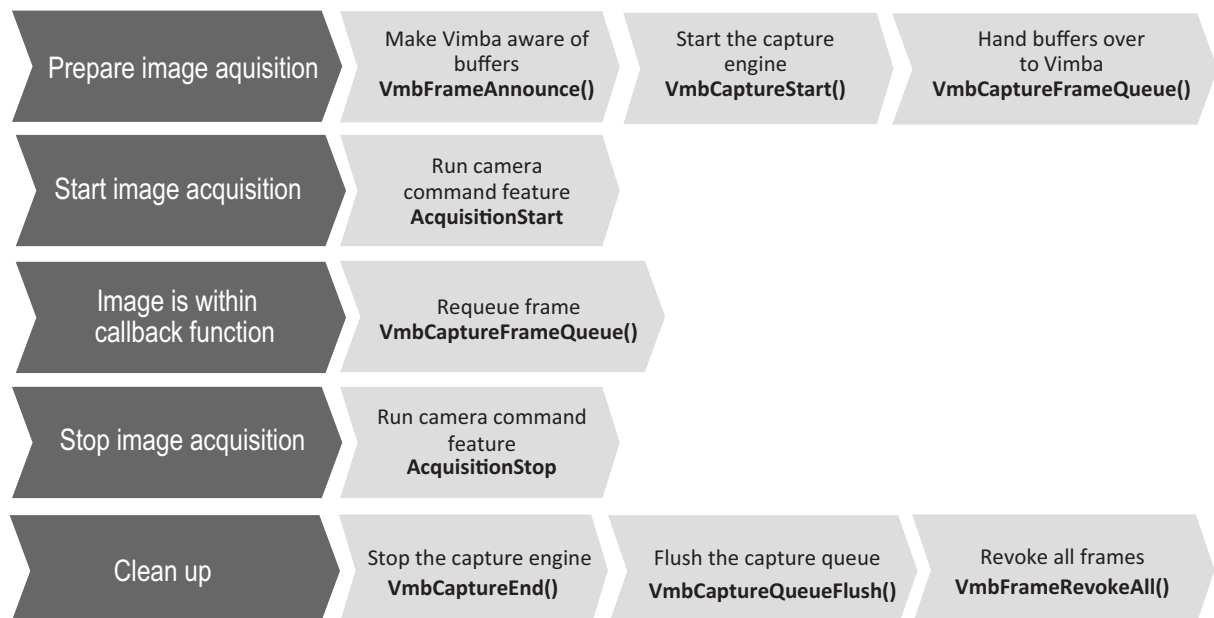


Figure 1: Typical asynchronous application using Vimba C

## 4.6.2 Image Capture



The bracketed tokens in this chapter refer to Listing 7.

To enable image capture, frame buffers must be allocated and the API must be prepared for incoming frames.

To capture images sent by the camera, follow these steps:

1. Open the camera as described in chapter Opening and closing a camera.
2. Query the necessary buffer size through the feature `PayloadSize` (A). Allocate frame buffers of this size (B).
3. Announce the frame buffers (1).
4. Start the capture engine (2).
5. Queue the frame you have just created with `VmbCaptureFrameQueue`, so that the buffer can be filled when the acquisition has started (3).

The API is now ready. Start and stop image acquisition on the camera as described in chapter Image Acquisition. How you proceed depends on the acquisition model you need:

- **Synchronous:** Use `VmbCaptureFrameWait` to receive an image frame while blocking your execution thread.
  - **Asynchronous:** Register a callback (C) that gets executed when capturing is complete. Use the camera handle for registration. The function pointer to the callback function has to be of type `VmbFrameCallback*`. Within the callback routine, queue the frame again after you have processed it.
6. Stop the capture engine with `VmbCaptureEnd`.
  7. Call `VmbCaptureQueueFlush` to cancel all frames on the queue.
  8. Revoke the frames with `VmbFrameRevokeAll` to clear the buffers.

To assure correct continuous image capture, queue at least two or three frames. The appropriate number of frames to be queued in your application depends on the frames per second the camera delivers and on the speed with which you are able to re-queue frames (also taking into consideration the operating system load). The image frames are filled in the same order in which they were queued.



Always check that `VmbFrame_t.receiveStatus` equals `VmbFrameStatusComplete` when a frame is returned to ensure the data is valid.



Functions that must **not** be called within the Frame callback routine.

- `VmbStartup`
- `VmbShutdown`
- `VmbCameraOpen`
- `VmbCameraClose`
- `VmbFrameAnnounce`
- `VmbFrameRevoke`
- `VmbFrameRevokeAll`
- `VmbCaptureStart`
- `VmbCaptureStop`

## 4.6.3 Image Acquisition

As soon as the API is prepared (see chapter Image Capture), you can start image acquisition on your camera:

1. Set the feature `AcquisitionMode` (e.g., to `Continuous`).
2. Run the command `AcquisitionStart` (4).

To stop image acquisition, run command `AcquisitionStop`.

Listing 7 shows a **simplified streaming example** (without error handling).

Listing 7: Streaming

```

#define FRAME_COUNT 3          // We choose to use 3 frames
VmbError_t err;               // Vimba functions return an error code that the
                              // programmer should check for VmbErrorSuccess

VmbHandle_t hCamera           // A handle to our opened camera
VmbFrame_t frames[FRAME_COUNT]; // A list of frames for streaming
VmbUInt64_t nPLS;             // The payload size of one frame

// The callback that gets executed on every filled frame
void VMB_CALL FrameDoneCallback( const VmbHandle_t hCamera, VmbFrame_t *pFrame )
{
    if ( VmbFrameStatusComplete == pFrame->receiveStatus )
    {
        printf( "Frame successfully received\n" );
    }
    else
    {
        printf( "Error receiving frame\n" );
    }
    VmbCaptureFrameQueue( hCamera, pFrame, FrameDoneCallback );
}

// Get all known cameras as described in chapter "List available cameras"
// and open the camera as shown in chapter "Opening a camera"

// Get the required size for one image
err = VmbFeatureIntGet( hCamera, "PayloadSize", &nPLS );           (A)
for ( int i=0; i<FRAME_COUNT; ++i )
{
    // Allocate accordingly
    frames[i].buffer = malloc( nPLS );                             (B)
    frames[i].bufferSize = nPLS;                                    (B)
    // Announce the frame
    VmbFrameAnnounce( hCamera, frames[i], sizeof(VmbFrame_t) );   (1)
}

// Start capture engine on the host
err = VmbCaptureStart( hCamera );                                   (2)

// Queue frames and register callback
for ( int i=0; i<FRAME_COUNT; ++i )
{
    VmbCaptureFrameQueue( hCamera, frames[i],                      (3)
                          FrameDoneCallback );                     (C)
}

// Start acquisition on the camera
err = VmbFeatureCommandRun( hCamera, "AcquisitionStart" );        (4)

// Program runtime ...

// When finished, tear down the acquisition chain, close the camera and Vimba
err = VmbFeatureCommandRun( hCamera, "AcquisitionStop" );
err = VmbCaptureEnd( hCamera );
err = VmbCaptureQueueFlush( hCamera );
err = VmbFrameRevokeAll( hCamera );
err = VmbCameraClose( hCamera );
err = VmbShutdown();

```

## 4.7 Using Events

Events serve many purposes and can have several origins, e.g., generic camera events or just feature changes.

All of these cases are handled in Vimba C uniformly with the same mechanism: You simply register a notification callback with `VmbFeatureInvalidationRegister` for the feature of your choice which gets called when there is a change to that feature.

Three examples are listed in this chapter:

- Camera list notifications
- Camera event features
- Tracking invalidations of features

See Listing 8 for an example of being notified about **camera list changes**. (For more details about System features see the [Vimba Features Manual](#))

Listing 8: Getting notified about camera list changes

```
// 1. define callback function
void VMB_CALL CameraListCB(VmbHandle_t handle, const char* name, void* context)
{
    char cameraName[255];

    VmbFeatureStringGet( handle, "DiscoveryCameraIdent", cameraName);
    printf( "Event was fired by camera %s\n", cameraName );
}

// 2. register the callback for that event
VmbFeatureInvalidationRegister( gVimbaHandle, "DiscoveryCameraEvent",
                               CameraListCB, NULL );

// 3. for GigE cameras, invoke "GeVDiscoveryAllOnce"
VmbFeatureCommandRun( gVimbaHandle, "GeVDiscoveryAllOnce" );
```

See Listing 9 for an example of being notified about **feature changes**.

Listing 9: Getting notified about feature changes

```
// 1. define callback function
void VMB_CALL WidthChangeCB( VmbHandle_t handle, const char* name, void* context )
{
    printf( "Feature changed: %s\n", name );
}

// 2. register callback for changes to Width
VmbFeatureInvalidationRegister( cameraHandle, "Width", WidthChangeCB, NULL );

// as an example, binning is changed, so the callback will be run
VmbFeatureIntegerSet( cameraHandle, "Binning", 4 );
```

**GigE camera events** are also handled with the same mechanism of feature invalidation. See Listing 10 for an example. For more details about camera events, see (if installed):

- [GigE Features Reference](#) (GigE camera features)

Listing 10: Getting notified about camera events

```
// 1. define callback function
void VMB_CALL EventCB( VmbHandle_t handle, const char* name, void* context )
{
    printf( "Event was fired: %s\n", name );
}

// 2. select "AcquisitionStart" event
VmbFeatureStringSet( cameraHandle, "EventSelector", "AcquisitionStart" );

// 3. switch on the event notification
VmbFeatureEnumSet ( cameraHandle, "EventNotification", "On" );

// 4. register the callback for that event
VmbFeatureInvalidationRegister( cameraHandle, "EventAcquisitionStart",
                                EventCB, NULL );
```

## 4.8 Saving and loading settings

Additionally to the user sets stored inside the cameras, you can save the feature values as an XML file to your host PC. For example, you can configure your camera with Vimba Viewer, save the settings as a file, and load them with Vimba API. To do this, use the functions `VmbCameraSettingsLoad` and `VmbCameraSettingsSave`.



For a quick start, see example `LoadSaveSettings`.

To control which features are saved, use the struct listed in Table 5. Note that saving and loading all features including look-up tables may take several minutes. You can manually edit the XML file if you want only certain features to be restored.

| Struct entry                                 | Purpose                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>VmbFeaturePersist_t persistType</code> | Controls which features are to be saved. Valid values are: <ul style="list-style-type: none"> <li><code>VmbFeaturePersistAll</code>: Save all features to XML, including look-up tables</li> <li><code>VmbFeaturePersistStreamable</code>: Save only features marked as streamable, excluding look-up tables</li> <li><code>VmbFeaturePersistNoLUT</code>: Default, save all features except look-up tables</li> </ul>                                                     |
| <code>Vmbuint32_t maxIterations</code>       | Number of iterations. <code>LoadCameraSettings</code> iterates through all given features of the XML file and tries to set each value to the camera. Because of complex feature dependencies, writing a feature value may impact another feature that has already been set by <code>LoadCameraSettings</code> . To ensure all values are written as desired, the feature list can be looped several times, given by this parameter. Default value: 5, valid values: 1...10 |

Table 5: Struct `VmbFeaturePersistSettings_t`

## 4.9 Triggering cameras



Before triggering, startup Vimba and open the camera(s).



To easily configure the camera's trigger settings, use Vimba Viewer and save/load the settings.

### 4.9.1 External trigger

The following code snippet shows how to trigger your camera with an external device.

Listing 11: External trigger

```
// Startup Vimba, get cameras and open cameras as usual

// Trigger cameras according to their interface
// Configure trigger input line and selector, switch trigger on
switch( pInterfacetype )
{
case VmbInterfaceEthernet:
    VmbFeatureEnumSet( pCameraHandle, "TriggerSelector", "FrameStart" );
    VmbFeatureEnumSet( pCameraHandle, "TriggerSource", "Line1" );
    VmbFeatureEnumSet( pCameraHandle, "TriggerMode", "On" );
    break;

case VmbInterfaceUsb:
    VmbFeatureEnumSet( pCameraHandle, "LineSelector", "Line0" );
    VmbFeatureEnumSet( pCameraHandle, "LineMode", "Input" );
    VmbFeatureEnumSet( pCameraHandle, "TriggerSelector", "FrameStart" );
    VmbFeatureEnumSet( pCameraHandle, "TriggerSource", "Line0" );
    VmbFeatureEnumSet( pCameraHandle, "TriggerMode", "On" );
    break;

case VmbInterfaceFirewire:
    VmbFeatureEnumSet( pCameraHandle, "LineSelector", "Line0" );
    VmbFeatureEnumSet( pCameraHandle, "LineMode", "Input" );
    VmbFeatureEnumSet( pCameraHandle, "LineRouting", "Trigger" );
    VmbFeatureEnumSet( pCameraHandle, "TriggerSelector", "ExposureStart" );
    VmbFeatureEnumSet( pCameraHandle, "TriggerSource", "InputLines" );
    VmbFeatureEnumSet( pCameraHandle, "TriggerMode", "On" );
    break;
}
```

## 4.9.2 Trigger over Ethernet – Action Commands

Triggering via the `AcquisitionStart` command (see chapter Image Acquisition) is supported by all cameras. However, it is less precise than triggering with an external device connected to the camera's I/O port.

Selected GigE cameras with the latest firmware additionally support Action Commands. With Action Commands, you can broadcast a trigger signal simultaneously to multiple GigE cameras via GigE cable. Action Commands must be set first to the camera(s) and then to the Vimba API, which sends the Action Commands to the camera(s). As trigger source, select `Action0` or `Action1`.



If you use an Ethernet router, make sure all cameras are in the same subnet. Using a switch does not affect Action Commands.

### ActionControl parameters

The following `ActionControl` parameters must be configured on the camera(s) and on the host PC.

- **ActionDeviceKey** must be equal on the camera and on the host PC. Before a camera accepts an Action Command, it verifies if the received key is identical with its configured key. Note that **ActionDeviceKey** must be set each time the camera is opened.  
Range (camera and host PC): 0 to 4294967295
- **ActionGroupKey** means that each camera can be assigned to exactly one group and all grouped cameras perform an action at the same time.  
Range (camera and host PC): 0 to 4294967295
- **ActionGroupMask** serves as filter that specifies which cameras within a group react on an Action Command.  
Range (camera): 0 to 4294967295  
Range (host PC): 1 to 4294967295

Executing the API feature **ActionCommand** sends the `ActionControl` parameters to the cameras and triggers the assigned action, for example, image acquisition. Before an Action Command is executed, each camera validates the received `ActionControl` parameter values against its configured values. If they are not equal, the camera ignores the command.

Action Commands as camera features are described in the [GigE Features Reference](#), Action Commands as Vimba features are listed in the [Vimba Features Manual](#).

Listing 12 shows how to send out an Action Command to all connected cameras via all known Gigabit Ethernet interfaces.

Listing 12: Action Commands

```
// Additionally to this code snippet:
// Configure the trigger settings and add image streaming

VmbUInt32_t count;
VmbCameraInfo_t* cameras;
VmbHandle_t* handles;

int deviceKey = 11, groupKey = 22, groupMask = 33;

// Start Vimba
VmbStartup();

// Discover GigE cameras
VmbFeatureBoolGet( gVimbaHandle, "GeVTLIsPresent", &isGigE );
if( VmbBoolTrue == isGigE )
{
    VmbFeatureIntSet( gVimbaHandle, "GeVDiscoveryAllDuration", 250 );
    VmbFeatureCommandRun( gVimbaHandle, "GeVDiscoveryAllOnce" );
}

// Get cameras
VmbCamerasList( NULL, 0, &count, sizeof(*cameras) );
cameras = (VmbCameraInfo_t *) malloc( count * sizeof(*cameras) );
VmbCamerasList( cameras, count, &count, sizeof(*cameras) );

// Allocate space for handles
handles = (VmbHandle_t*) malloc( count * sizeof(VmbHandle_t) );

for( int i=0; i<count; ++i )
{
    const char* cameraId = cameras[i].cameraIdString;

    // Open camera
    VmbCameraOpen( cameraId, VmbAccessModeFull, &handles[i] );

    // Set device key, group key and group mask
    VmbFeatureIntSet( handles[i], "ActionDeviceKey", deviceKey );
    VmbFeatureIntSet( handles[i], "ActionGroupKey", groupKey );
    VmbFeatureIntSet( handles[i], "ActionGroupMask", groupMask );
}

// Set Action Command to API
VmbFeatureIntSet( gVimbaHandle, "ActionDeviceKey", deviceKey );
VmbFeatureIntSet( gVimbaHandle, "ActionGroupKey", groupKey );
VmbFeatureIntSet( gVimbaHandle, "ActionGroupMask", groupMask );

// Send Action Command
VmbFeatureCommandRun( gVimbaHandle, "ActionCommand" );
```

```
// Close all cameras
for( int i=0; i<count; ++i )
{
    const char* cameraId = cameras[i].cameraIdString;
    VmbCameraClose( handles[i] );
}

// Shutdown API
VmbShutdown();

// Free allocated space
free( cameras );
free( handles );
cameras = NULL;
handles = NULL;
```

## 4.10 Additional configuration: Listing Interfaces

`VmbInterfacesList` enumerates all Interfaces (GigE, USB, or 1394 adapters, or Camera Link frame grabbers) recognized by the underlying transport layers.  
See Listing 13 for an example.

Listing 13: Get Interfaces

```
VmbUInt32_t nCount;
VmbInterfaceInfo_t *pInterfaces;

// Get the number of connected interfaces
VmbInterfacesList( NULL, 0, &nCount, sizeof *pInterfaces );

// Allocate accordingly
pInterfaces = (VmbInterfaceInfo_t*)malloc( nCount * sizeof *pInterfaces );

// Get the interfaces
VmbInterfacesList( pCameras, nCount, &nCount, sizeof *pInterfaces );
```

Struct `VmbInterfaceInfo_t` provides the information about an interface as listed in Table 6.

| Struct entry                                 | Purpose                        |
|----------------------------------------------|--------------------------------|
| <code>const char* interfaceIdString</code>   | The unique ID                  |
| <code>VmbInterface_t interfaceType</code>    | The camera interface type      |
| <code>const char* interfaceName</code>       | The name                       |
| <code>const char* serialString</code>        | The serial number (not in use) |
| <code>VmbAccessMode_t permittedAccess</code> | The mode to open the interface |

Table 6: Struct `VmbInterfaceInfo_t`

To **get notified whenever an interface is detected or disconnected**, use `VmbFeatureInvalidationRegister` to register a callback that gets executed on the according event. Use the global Vimba handle for registration. The function pointer to the callback function has to be of type `VmbInvalidationCallback*`.



`VmbShutdown` blocks until all callbacks have finished execution.



The list of functions that must **not** be called within the callback routine:

- `VmbStartup`
- `VmbShutdown`
- `VmbFeatureIntSet` (and any other `VmbFeature*Set` function)
- `VmbFeatureCommandRun`

## 4.11 Troubleshooting

### 4.11.1 GigE cameras

Make sure to set the `PacketSize` feature of GigE cameras to a value supported by your network card. If you use more than one camera on one interface, the available bandwidth has to be shared between the cameras.

- `GVSPAdjustPacketSize` configures GigE cameras to use the largest possible packets.
- `DeviceThroughputLimit` (legacy name: `StreamBytesPerSecond`) enables to configure the individual bandwidth if multiple cameras are used.
- The maximum packet size might not be available on all connected cameras. Try to reduce the packet size.

Further readings:

The [GigE Installation Manual](#) provides detailed information on how to configure your system.

### 4.11.2 USB cameras

Under Windows, make sure the correct driver is applied. For more details, see Vimba Manual, chapter Vimba Driver Installer.

To achieve best performance, see the technical manual of your USB camera, chapter Troubleshooting: <http://www.alliedvision.com/en/support/technical-documentation.html>

### 4.11.3 Goldeye CL cameras

- The pixel format and image size settings must be identical in Vimba Viewer and the frame grabber software.
- Make sure to select an image size supported by the frame grabber.
- The baud rate of the camera and the frame grabber must be identical.

## 4.12 Error Codes

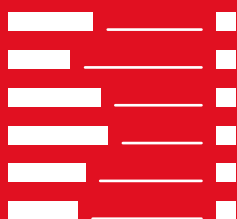
All Vimba API functions return an error code of type **VmbErrorType**.

Typical errors are listed with each function in chapter Function reference. However, any of the error codes listed in Table 7 might be returned.

| Error Code             | Value | Description                                                                     |
|------------------------|-------|---------------------------------------------------------------------------------|
| VmbErrorSuccess        | 0     | No error                                                                        |
| VmbErrorInternalFault  | -1    | Unexpected fault in Vimba or driver                                             |
| VmbErrorApiNotStarted  | -2    | <b>VmbStartup</b> was not called before the current command                     |
| VmbErrorNotFound       | -3    | The designated instance (camera, feature, etc.) cannot be found                 |
| VmbErrorBadHandle      | -4    | The given handle is not valid                                                   |
| VmbErrorDeviceNotOpen  | -5    | Device was not opened for usage                                                 |
| VmbErrorInvalidAccess  | -6    | Operation is invalid with the current access mode                               |
| VmbErrorBadParameter   | -7    | One of the parameters is invalid (usually an illegal pointer)                   |
| VmbErrorStructSize     | -8    | The given struct size is not valid for this version of the API                  |
| VmbErrorMoreData       | -9    | More data available in a string/list than space is provided                     |
| VmbErrorWrongType      | -10   | Wrong feature type for this access function                                     |
| VmbErrorInvalidValue   | -11   | The value is not valid; either out of bounds or not an increment of the minimum |
| VmbErrorTimeout        | -12   | Timeout during wait                                                             |
| VmbErrorOther          | -13   | Other error                                                                     |
| VmbErrorResources      | -14   | Resources not available (e.g., memory)                                          |
| VmbErrorInvalidCall    | -15   | Call is invalid in the current context (e.g. callback)                          |
| VmbErrorNoTL           | -16   | No transport layers are found                                                   |
| VmbErrorNotImplemented | -17   | API feature is not implemented                                                  |
| VmbErrorNotSupported   | -18   | API feature is not supported                                                    |
| VmbErrorIncomplete     | -19   | A multiple registers read or write is partially completed                       |

Table 7: Error codes returned by Vimba

## 5 Function reference



This chapter includes:

|      |                                               |    |
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In this chapter, you can find a complete list of all methods that are described in `VimbaC.h`.

All function and type definitions are designed to be platform-independent and portable from other languages.

### General conventions:

- Method names are composed in the following manner:
  - Vmb"Action". Example: `VmbStartup()`
  - Vmb"Entity""Action". Example: `VmbInterfaceOpen()`
  - Vmb"ActionTarget""Action". Example: `VmbFeaturesList()`
  - Vmb"Entity""SubEntity""Action". Example: `VmbFeatureCommandRun()`
- Methods dealing with features, memory, or registers accept a handle from the following entity list as first parameter: System, Camera, Interface, and AncillaryData. All other methods taking handles accept only a specific handle.
- Strings (generally declared as `"const char *"`) are assumed to have a trailing 0 character.
- All pointer parameters should of course be valid, except if stated otherwise.
- To ensure compatibility with older programs linked against a former version of the API, all struct\* parameters have an accompanying `sizeofstruct` parameter.
- Functions returning lists are usually called twice: once with a zero buffer to get the length of the list, and then again with a buffer of the correct length.

Methods in this chapter are always described in the same way:

- The caption states the name of the function without parameters
- The first item is a brief description
- The parameters of the function are listed in a table (with type, name, and description)
- The return values are listed
- Finally, a more detailed description about the function is given

## 5.1 Callbacks

### 5.1.1 VmbInvalidationCallback

Invalidation Callback type for a function that gets called in a separate thread and has been registered with `VmbFeatureInvalidationRegister()`

| Type                                     | Name                      | Description                                                                  |
|------------------------------------------|---------------------------|------------------------------------------------------------------------------|
| <b>in</b> <code>const VmbHandle_t</code> | <code>handle</code>       | Handle for an entity that exposes features                                   |
| <b>in</b> <code>const char*</code>       | <code>name</code>         | Name of the feature                                                          |
| <b>in</b> <code>void*</code>             | <code>pUserContext</code> | Pointer to the user context, see <code>VmbFeatureInvalidationRegister</code> |



While the callback is run, all feature data is atomic. After the callback finishes, the feature data might be updated with new values.



Do not spend too much time in this thread; it will prevent the feature values from being updated from any other thread or the lower-level drivers.

### 5.1.2 VmbFrameCallback

Frame Callback type for a function that gets called in a separate thread if a frame has been queued with `VmbCaptureFrameQueue()`

| Type                                     | Name                      | Description          |
|------------------------------------------|---------------------------|----------------------|
| <b>in</b> <code>const VmbHandle_t</code> | <code>cameraHandle</code> | Handle of the camera |
| <b>out</b> <code>VmbFrame_t*</code>      | <code>pFrame</code>       | Frame completed      |

## 5.2 API Version

### 5.2.1 VmbVersionQuery()

Retrieve the version number of VimbaC.

|            | Type              | Name              | Description                                               |
|------------|-------------------|-------------------|-----------------------------------------------------------|
| <b>out</b> | VmbVersionInfo_t* | pVersionInfo      | Pointer to the struct where version information is copied |
| <b>in</b>  | VmbUInt32_t       | sizeofVersionInfo | Size of structure in bytes                                |

- **VmbErrorSuccess:** If no error
- **VmbErrorStructSize:** The given struct size is not valid for this version of the API
- **VmbErrorBadParameter:** "pVersionInfo" is NULL.



This function can be called at anytime, even before the API is initialized. All other version numbers may be queried via feature access.

## 5.3 API Initialization

### 5.3.1 VmbStartup()

Initialize the VimbaC API.

- **VmbErrorSuccess:** If no error
- **VmbErrorInternalFault:** An internal fault occurred



On successful return, the API is initialized; this is a necessary call.



This method must be called before any VimbaC function other than `VmbVersionQuery()` is run.

### 5.3.2 VmbShutdown()

Perform a shutdown on the API.



This will free some resources and deallocate all physical resources if applicable.

## 5.4 Camera Enumeration & Information

### 5.4.1 VmbCamerasList()

Retrieve a list of all cameras.

|     | Type             | Name             | Description                                                                                                                         |
|-----|------------------|------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| out | VmbCameraInfo_t* | pCameraInfo      | Array of VmbCameraInfo_t, allocated by the caller. The camera list is copied here. May be NULL if pNumFound is used for size query. |
| in  | VmbUInt32_t      | listLength       | Number of VmbCameraInfo_t elements provided                                                                                         |
| out | VmbUInt32_t*     | pNumFound        | Number of VmbCameraInfo_t elements found.                                                                                           |
| in  | VmbUInt32_t      | sizeofCameraInfo | Size of the structure (if pCameraInfo == NULL this parameter is ignored)                                                            |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorStructSize:** The given struct size is not valid for this API version
- **VmbErrorMoreData:** The given list length was insufficient to hold all available entries
- **VmbErrorBadParameter:** The pNumFound parameter was NULL



Camera detection is started with the registration of the "DiscoveryCameraEvent" event or the first call of VmbCamerasList(), which may be delayed if no "DiscoveryCameraEvent" event is registered (see examples). VmbCamerasList() is usually called twice: once with an empty array to query the list length, and then again with an array of the correct length. If camera lists change between the calls, pNumFound may deviate from the query return.

### 5.4.2 VmbCameraInfoQuery()

Retrieve information on a camera given by an ID.

| Type                        | Name             | Description                                              |
|-----------------------------|------------------|----------------------------------------------------------|
| <b>in</b> const char*       | idString         | ID of the camera                                         |
| <b>out</b> VmbCameraInfo_t* | pInfo            | Structure where information will be copied. May be NULL. |
| <b>in</b> VmbUInt32_t       | sizeofCameraInfo | Size of the structure                                    |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorNotFound:** The designated camera cannot be found
- **VmbErrorStructSize:** The given struct size is not valid for this API version
- **VmbErrorBadParameter:** idString was NULL



May be called if a camera has not been opened by the application yet. Examples for "idString": "DEV\_81237473991" for an ID given by a transport layer, "169.254.12.13" for an IP address, "000F314C4BE5" for a MAC address or "DEV\_1234567890" for an ID as reported by Vimba

### 5.4.3 VmbCameraOpen()

Open the specified camera.

| Type                      | Name          | Description                                            |
|---------------------------|---------------|--------------------------------------------------------|
| <b>in</b> const char*     | idString      | ID of the camera                                       |
| <b>in</b> VmbAccessMode_t | accessMode    | Determines the level of control you have on the camera |
| <b>out</b> VmbHandle_t*   | pCameraHandle | A camera handle                                        |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorNotFound:** The designated camera cannot be found
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode
- **VmbErrorInvalidCall:** if called from frame callback
- **VmbErrorBadParameter:** if idString or pCameraHandle is NULL



A camera may be opened in a specific access mode, which determines the level of control you have on a camera. Examples for "idString": "DEV\_81237473991" for an ID given by a transport layer, "169.254.12.13" for an IP address, "000F314C4BE5" for a MAC address or "DEV\_1234567890" for an ID as reported by Vimba

## 5.4.4 VmbCameraClose()

Close the specified camera.

| Type                    | Name         | Description           |
|-------------------------|--------------|-----------------------|
| in    const VmbHandle_t | cameraHandle | A valid camera handle |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorInvalidCall:** If called from frame callback



Depending on the access mode this camera was opened with, events are killed, callbacks are unregistered, and camera control is released.

## 5.5 Features

### 5.5.1 VmbFeaturesList()

List all the features for this entity.

| Type                         | Name              | Description                                                                                           |
|------------------------------|-------------------|-------------------------------------------------------------------------------------------------------|
| <b>in</b> const VmbHandle_t  | handle            | Handle for an entity that exposes features                                                            |
| <b>out</b> VmbFeatureInfo_t* | pFeatureInfoList  | An array of VmbFeatureInfo_t to be filled by the API. May be NULL if pNumFund is used for size query. |
| <b>in</b> VmbUInt32_t        | listLength        | Number of VmbFeatureInfo_t elements provided                                                          |
| <b>out</b> VmbUInt32_t*      | pNumFound         | Number of VmbFeatureInfo_t elements found. May be NULL if pFeatureInfoList is not NULL.               |
| <b>in</b> VmbUInt32_t        | sizeofFeatureInfo | Size of a VmbFeatureInfo_t entry                                                                      |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode
- **VmbErrorStructSize:** The given struct size of VmbFeatureInfo\_t is not valid for this version of the API
- **VmbErrorMoreData:** The given list length was insufficient to hold all available entries



This method lists all implemented features, whether they are currently available or not. The list of features does not change as long as the camera/interface is connected. "pNumFound" returns the number of VmbFeatureInfo elements. This function is usually called twice: once with an empty list to query the length of the list, and then again with an list of the correct length.

### 5.5.2 VmbFeatureInfoQuery()

Query information about the constant properties of a feature.

| Type                                      | Name                           | Description                                |
|-------------------------------------------|--------------------------------|--------------------------------------------|
| <b>in</b> <code>const VmbHandle_t</code>  | <code>handle</code>            | Handle for an entity that exposes features |
| <b>in</b> <code>const char*</code>        | <code>name</code>              | Name of the feature                        |
| <b>out</b> <code>VmbFeatureInfo_t*</code> | <code>pFeatureInfo</code>      | The feature info to query                  |
| <b>in</b> <code>VmbUInt32_t</code>        | <code>sizeofFeatureInfo</code> | Size of the structure                      |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** `VmbStartup()` was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode
- **VmbErrorStructSize:** The given struct size is not valid for this version of the API



Users provide a pointer to `VmbFeatureInfo_t`, which is then set to the internal representation.

### 5.5.3 VmbFeatureListAffected()

List all the features that might be affected by changes to this feature.

| Type                                      | Name                           | Description                                                                                                                      |
|-------------------------------------------|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| <b>in</b> <code>const VmbHandle_t</code>  | <code>handle</code>            | Handle for an entity that exposes features                                                                                       |
| <b>in</b> <code>const char*</code>        | <code>name</code>              | Name of the feature                                                                                                              |
| <b>out</b> <code>VmbFeatureInfo_t*</code> | <code>pFeatureInfoList</code>  | An array of <code>VmbFeatureInfo_t</code> to be filled by the API. May be NULL if <code>pNumFound</code> is used for size query. |
| <b>in</b> <code>VmbUInt32_t</code>        | <code>listLength</code>        | Number of <code>VmbFeatureInfo_t</code> elements provided                                                                        |
| <b>out</b> <code>VmbUInt32_t*</code>      | <code>pNumFound</code>         | Number of <code>VmbFeatureInfo_t</code> elements found. May be NULL if <code>pFeatureInfoList</code> is not NULL.                |
| <b>in</b> <code>VmbUInt32_t</code>        | <code>sizeofFeatureInfo</code> | Size of a <code>VmbFeatureInfo_t</code> entry                                                                                    |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** `VmbStartup()` was not called before the current command

- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode
- **VmbErrorStructSize:** The given struct size of VmbFeatureInfo\_t is not valid for this version of the API
- **VmbErrorMoreData:** The given list length was insufficient to hold all available entries



This method lists all affected features, whether they are currently available or not. The value of affected features depends directly or indirectly on this feature (including all selected features). The list of features does not change as long as the camera/interface is connected. This function is usually called twice: once with an empty array to query the length of the list, and then again with an array of the correct length.

## 5.5.4 VmbFeatureListSelected()

List all the features selected by a given feature for this module.

| Type                         | Name              | Description                                                                                            |
|------------------------------|-------------------|--------------------------------------------------------------------------------------------------------|
| <b>in</b> const VmbHandle_t  | handle            | Handle for an entity that exposes features                                                             |
| <b>in</b> const char*        | name              | Name of the feature                                                                                    |
| <b>out</b> VmbFeatureInfo_t* | pFeatureInfoList  | An array of VmbFeatureInfo_t to be filled by the API. May be NULL if pNumFound is used for size query. |
| <b>in</b> VmbUInt32_t        | listLength        | Number of VmbFeatureInfo_t elements provided                                                           |
| <b>out</b> VmbUInt32_t*      | pNumFound         | Number of VmbFeatureInfo_t elements found. May be NULL if pFeatureInfoList is not NULL.                |
| <b>in</b> VmbUInt32_t        | sizeofFeatureInfo | Size of a VmbFeatureInfo_t entry                                                                       |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode
- **VmbErrorStructSize:** The given struct size is not valid for this version of the API
- **VmbErrorMoreData:** The given list length was insufficient to hold all available entries



This method lists all selected features, whether they are currently available or not. Features with selected features ("selectors") have no direct impact on the camera, but only influence the register address that selected features point to. The list of features does not change while the camera/interface is connected. This function is usually called twice: once with an empty array to query the length of the list, and then again with an array of the correct length.

## 5.5.5 VmbFeatureAccessQuery()

Return the dynamic read and write capabilities of this feature.

| Type                                     | Name                      | Description                                         |
|------------------------------------------|---------------------------|-----------------------------------------------------|
| <b>in</b> <code>const VmbHandle_t</code> | <code>handle</code>       | Handle for an entity that exposes features.         |
| <b>in</b> <code>const char *</code>      | <code>name</code>         | Name of the feature.                                |
| <b>out</b> <code>VmbBool_t *</code>      | <code>plsReadable</code>  | Indicates if this feature is readable. May be NULL. |
| <b>out</b> <code>VmbBool_t *</code>      | <code>plsWriteable</code> | Indicates if this feature is writable. May be NULL. |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** `VmbStartup()` was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode
- **VmbErrorBadParameter:** `plsReadable` and `plsWriteable` were both NULL
- **VmbErrorNotFound:** The feature was not found



The access mode of a feature may change. For example, if "PacketSize" is locked while image data is streamed, it is only readable.

## 5.6 Integer

### 5.6.1 VmbFeatureIntGet()

Get the value of an integer feature.

| Type                        | Name   | Description                                |
|-----------------------------|--------|--------------------------------------------|
| <b>in</b> const VmbHandle_t | handle | Handle for an entity that exposes features |
| <b>in</b> const char*       | name   | Name of the feature                        |
| <b>out</b> VmbInt64_t*      | pValue | Value to get                               |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode
- **VmbErrorWrongType:** The type of feature "name" is not Integer
- **VmbErrorNotFound:** The feature was not found
- **VmbErrorBadParameter:** If name or pValue is NULL

### 5.6.2 VmbFeatureIntSet()

Set the value of an integer feature.

| Type                        | Name   | Description                                |
|-----------------------------|--------|--------------------------------------------|
| <b>in</b> const VmbHandle_t | handle | Handle for an entity that exposes features |
| <b>in</b> const char*       | name   | Name of the feature                        |
| <b>in</b> VmbInt64_t        | value  | Value to set                               |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode
- **VmbErrorWrongType:** The type of feature "name" is not Integer
- **VmbErrorInvalidValue:** "value" is either out of bounds or not an increment of the minimum
- **VmbErrorBadParameter:** If name is NULL

- **VmbErrorNotFound:** If the feature was not found
- **VmbErrorInvalidCall:** If called from frame callback

### 5.6.3 VmbFeatureIntRangeQuery()

Query the range of an integer feature.

| Type                                     | Name                | Description                                |
|------------------------------------------|---------------------|--------------------------------------------|
| <b>in</b> <code>const VmbHandle_t</code> | <code>handle</code> | Handle for an entity that exposes features |
| <b>in</b> <code>const char*</code>       | <code>name</code>   | Name of the feature                        |
| <b>out</b> <code>VmbInt64_t*</code>      | <code>pMin</code>   | Minimum value to be returned. May be NULL. |
| <b>out</b> <code>VmbInt64_t*</code>      | <code>pMax</code>   | Maximum value to be returned. May be NULL. |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode
- **VmbErrorBadParameter:** If name is NULL or pMin and pMax are NULL
- **VmbErrorWrongType:** The type of feature "name" is not Integer
- **VmbErrorNotFound:** If the feature was not found

### 5.6.4 VmbFeatureIntIncrementQuery()

Query the increment of an integer feature.

| Type                                     | Name                | Description                                |
|------------------------------------------|---------------------|--------------------------------------------|
| <b>in</b> <code>const VmbHandle_t</code> | <code>handle</code> | Handle for an entity that exposes features |
| <b>in</b> <code>const char*</code>       | <code>name</code>   | Name of the feature                        |
| <b>out</b> <code>VmbInt64_t*</code>      | <code>pValue</code> | Value of the increment to get.             |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command

- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode
- **VmbErrorWrongType:** The type of feature "name" is not Integer
- **VmbErrorNotFound:** The feature was not found
- **VmbErrorBadParameter:** IF name or pValue is NULL

## 5.7 Float

### 5.7.1 VmbFeatureFloatGet()

Get the value of a float feature.

| Type                                     | Name   | Description                                |
|------------------------------------------|--------|--------------------------------------------|
| <b>in</b> <code>const VmbHandle_t</code> | handle | Handle for an entity that exposes features |
| <b>in</b> <code>const char*</code>       | name   | Name of the feature                        |
| <b>out</b> <code>double*</code>          | pValue | Value to get                               |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode
- **VmbErrorWrongType:** The type of feature "name" is not Float
- **VmbErrorBadParameter:** If name or pValue is NULL
- **VmbErrorNotFound:** The feature was not found

### 5.7.2 VmbFeatureFloatSet()

Set the value of a float feature.

| Type                                     | Name   | Description                                |
|------------------------------------------|--------|--------------------------------------------|
| <b>in</b> <code>const VmbHandle_t</code> | handle | Handle for an entity that exposes features |
| <b>in</b> <code>const char*</code>       | name   | Name of the feature                        |
| <b>in</b> <code>double</code>            | value  | Value to set                               |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode
- **VmbErrorWrongType:** The type of feature "name" is not Float
- **VmbErrorInvalidValue:** "value" is not within valid bounds
- **VmbErrorNotFound:** The feature was not found

- **VmbErrorBadParameter:** If name is NULL
- **VmbErrorInvalidCall:** If called from frame callback

### 5.7.3 VmbFeatureFloatRangeQuery()

Query the range of a float feature.

| Type                        | Name   | Description                                |
|-----------------------------|--------|--------------------------------------------|
| <b>in</b> const VmbHandle_t | handle | Handle for an entity that exposes features |
| <b>in</b> const char*       | name   | Name of the feature                        |
| <b>out</b> double*          | pMin   | Minimum value to be returned. May be NULL. |
| <b>out</b> double*          | pMax   | Maximum value to be returned. May be NULL. |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode
- **VmbErrorWrongType:** The type of feature "name" is not Float
- **VmbErrorNotFound:** The feature was not found
- **VmbBadParameter:** If name is NULL or pMin and pMax are NULL



Only one of the values may be queried if the other parameter is set to NULL, but if both parameters are NULL, an error is returned.

### 5.7.4 VmbFeatureFloatIncrementQuery()

Query the increment of an float feature.

| Type                        | Name   | Description                                |
|-----------------------------|--------|--------------------------------------------|
| <b>in</b> const VmbHandle_t | handle | Handle for an entity that exposes features |
| <b>in</b> const char*       | name   | Name of the feature                        |
| <b>out</b> double*          | pValue | Value of the increment to get.             |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode
- **VmbErrorWrongType:** The type of feature "name" is not Integer
- **VmbErrorNotFound:** The feature was not found
- **VmbErrorBadParameter:** IF name or pValue is NULL

## 5.8 Enum

### 5.8.1 VmbFeatureEnumGet()

Get the value of an enumeration feature.

| Type                                     | Name   | Description                                                                       |
|------------------------------------------|--------|-----------------------------------------------------------------------------------|
| <b>in</b> <code>const VmbHandle_t</code> | handle | Handle for an entity that exposes features                                        |
| <b>in</b> <code>const char*</code>       | name   | Name of the feature                                                               |
| <b>out</b> <code>const char**</code>     | pValue | The current enumeration value. The returned value is a reference to the API value |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode
- **VmbErrorWrongType:** The type of feature "name" is not Enumeration
- **VmbErrorNotFound:** The feature was not found
- **VmbErrorBadParameter:** if name or pValue is NULL

### 5.8.2 VmbFeatureEnumSet()

Set the value of an enumeration feature.

| Type                                     | Name   | Description                                |
|------------------------------------------|--------|--------------------------------------------|
| <b>in</b> <code>const VmbHandle_t</code> | handle | Handle for an entity that exposes features |
| <b>in</b> <code>const char*</code>       | name   | Name of the feature                        |
| <b>in</b> <code>const char*</code>       | value  | Value to set                               |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode
- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode
- **VmbErrorWrongType:** The type of feature "name" is not Enumeration

- **VmbErrorInvalidValue:** "value" is not within valid bounds
- **VmbErrorNotFound:** The feature was not found
- **VmbErrorBadParameter:** If name ore value is NULL
- **VmbErrorInvalidCall:** If called from frame callback

### 5.8.3 VmbFeatureEnumRangeQuery()

Query the value range of an enumeration feature.

|            | Type              | Name        | Description                                                                           |
|------------|-------------------|-------------|---------------------------------------------------------------------------------------|
| <b>in</b>  | const VmbHandle_t | handle      | Handle for an entity that exposes features                                            |
| <b>in</b>  | const char*       | name        | Name of the feature                                                                   |
| <b>out</b> | const char**      | pNameArray  | An array of enumeration value names; may be NULL if pNumFilled is used for size query |
| <b>in</b>  | VmbUInt32_t       | arrayLength | Number of elements in the array                                                       |
| <b>out</b> | VmbUInt32_t *     | pNumFilled  | Number of filled elements; may be NULL if pNameArray is not NULL                      |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode
- **VmbErrorMoreData:** The given array length was insufficient to hold all available entries
- **VmbErrorWrongType:** The type of feature "name" is not Enumeration
- **VmbErrorNotFound:** The feature was not found
- **VmbErrorBadParameter:** if name is NULL or pNameArray and pNumFilled are NULL

### 5.8.4 VmbFeatureEnumIsAvailable()

Check if a certain value of an enumeration is available.

| Type                                     | Name                      | Description                                           |
|------------------------------------------|---------------------------|-------------------------------------------------------|
| <b>in</b> <code>const VmbHandle_t</code> | <code>handle</code>       | Handle for an entity that exposes features            |
| <b>in</b> <code>const char*</code>       | <code>name</code>         | Name of the feature                                   |
| <b>in</b> <code>const char*</code>       | <code>value</code>        | Value to check                                        |
| <b>out</b> <code>VmbBool_t *</code>      | <code>plsAvailable</code> | Indicates if the given enumeration value is available |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** `VmbStartup()` was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode
- **VmbErrorWrongType:** The type of feature "name" is not Enumeration
- **VmbErrorNotFound:** The feature was not found
- **VmbErrorBadParameter:** if name or value or `plsAvailable` is NULL

## 5.8.5 VmbFeatureEnumAsInt()

Get the integer value for a given enumeration string value.

| Type                                     | Name                 | Description                                        |
|------------------------------------------|----------------------|----------------------------------------------------|
| <b>in</b> <code>const VmbHandle_t</code> | <code>handle</code>  | Handle for an entity that exposes features         |
| <b>in</b> <code>const char*</code>       | <code>name</code>    | Name of the feature                                |
| <b>in</b> <code>const char*</code>       | <code>value</code>   | The enumeration value to get the integer value for |
| <b>out</b> <code>VmbInt64_t*</code>      | <code>pIntVal</code> | The integer value for this enumeration entry       |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** `VmbStartup()` was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode
- **VmbErrorWrongType:** The type of feature "name" is not Enumeration
- **VmbErrorNotFound:** The feature was not found
- **VmbErrorBadParameter:** if name or value `pIntVal` is NULL



Converts a name of an enum member into an int value ("Mono12Packed" to 0x10C0006)

## 5.8.6 VmbFeatureEnumAsString()

Get the enumeration string value for a given integer value.

| Type                        | Name         | Description                                |
|-----------------------------|--------------|--------------------------------------------|
| <b>in</b> const VmbHandle_t | handle       | Handle for an entity that exposes features |
| <b>in</b> const char*       | name         | Name of the feature                        |
| <b>in</b> VmbInt64_t        | intValue     | The numeric value                          |
| <b>out</b> const char**     | pStringValue | The string value for the numeric value     |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode
- **VmbErrorWrongType:** The type of feature "name" is not Enumeration
- **VmbErrorNotFound:** The feature was not found
- **VmbErrorBadParameter:** If name or pStringValue is NULL



Converts an int value to a name of an enum member (e.g. 0x10C0006 to "Mono12Packed")

## 5.8.7 VmbFeatureEnumEntryGet()

Get infos about an entry of an enumeration feature.

| Type                              | Name                   | Description                                |
|-----------------------------------|------------------------|--------------------------------------------|
| <b>in</b> const VmbHandle_t       | handle                 | Handle for an entity that exposes features |
| <b>in</b> const char*             | featureName            | Name of the feature                        |
| <b>in</b> const char*             | entryName              | Name of the enum entry of that feature     |
| <b>out</b> VmbFeatureEnumEntry_t* | pFeatureEnumEntry      | Infos about that entry returned by the API |
| <b>in</b> VmbUInt32_t             | sizeofFeatureEnumEntry | Size of the structure                      |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode
- **VmbErrorStructSize Size of VmbFeatureEnumEntry\_t is not compatible with the API version**
- **VmbErrorWrongType:** The type of feature "name" is not Enumeration
- **VmbErrorNotFound:** The feature was not found
- **VmbErrorBadParameter:** if featureName or entryName or pFeatureEnumEntry is NULL

## 5.9 String

### 5.9.1 VmbFeatureStringGet()

Get the value of a string feature.

| Type                                     | Name        | Description                                                               |
|------------------------------------------|-------------|---------------------------------------------------------------------------|
| <b>in</b> <code>const VmbHandle_t</code> | handle      | Handle for an entity that exposes features                                |
| <b>in</b> <code>const char*</code>       | name        | Name of the string feature                                                |
| <b>out</b> <code>char*</code>            | buffer      | String buffer to fill. May be NULL if pSizeFilled is used for size query. |
| <b>in</b> <code>VmbUInt32_t</code>       | bufferSize  | Size of the input buffer                                                  |
| <b>out</b> <code>VmbUInt32_t*</code>     | pSizeFilled | Size actually filled; may be NULL if buffer is not NULL.                  |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode
- **VmbErrorMoreData:** The given buffer size was too small
- **VmbErrorNotFound:** The feature was not found
- **VmbErrorWrongType:** The type of feature "name" is not String



This function is usually called twice: once with an empty buffer to query the length of the string, and then again with a buffer of the correct length.

### 5.9.2 VmbFeatureStringSet()

Set the value of a string feature.

| Type                                     | Name   | Description                                |
|------------------------------------------|--------|--------------------------------------------|
| <b>in</b> <code>const VmbHandle_t</code> | handle | Handle for an entity that exposes features |
| <b>in</b> <code>const char*</code>       | name   | Name of the string feature                 |
| <b>in</b> <code>const char*</code>       | value  | Value to set                               |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode
- **VmbErrorNotFound:** The feature was not found
- **VmbErrorWrongType:** The type of feature "name" is not String
- **VmbErrorInvalidValue:** Length of "value" exceeded the maximum length
- **VmbErrorBadParameter:** if name or value is NULL
- **VmbErrorInvalidCall:** If called from frame callback

### 5.9.3 VmbFeatureStringMaxlengthQuery()

Get the maximum length of a string feature.

|            | Type              | Name       | Description                                |
|------------|-------------------|------------|--------------------------------------------|
| <b>in</b>  | const VmbHandle_t | handle     | Handle for an entity that exposes features |
| <b>in</b>  | const char*       | name       | Name of the string feature                 |
| <b>out</b> | VmbUInt32_t*      | pMaxLength | Maximum length of this string feature      |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode
- **VmbErrorWrongType:** The type of feature "name" is not String
- **VmbErrorBadParameter:** If name or pMaxLength is NULL

## 5.10 Boolean

### 5.10.1 VmbFeatureBoolGet()

Get the value of a boolean feature.

| Type                        | Name   | Description                                |
|-----------------------------|--------|--------------------------------------------|
| <b>in</b> const VmbHandle_t | handle | Handle for an entity that exposes features |
| <b>in</b> const char*       | name   | Name of the boolean feature                |
| <b>out</b> VmbBool_t *      | pValue | Value to be read                           |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode
- **VmbErrorWrongType:** The type of feature "name" is not Boolean
- **VmbErrorNotFound:** If feature is not found
- **VmbErrorBadParameter:** If name or pValue is NULL

### 5.10.2 VmbFeatureBoolSet()

Set the value of a boolean feature.

| Type                        | Name   | Description                                |
|-----------------------------|--------|--------------------------------------------|
| <b>in</b> const VmbHandle_t | handle | Handle for an entity that exposes features |
| <b>in</b> const char*       | name   | Name of the boolean feature                |
| <b>in</b> VmbBool_t         | value  | Value to write                             |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode
- **VmbErrorWrongType:** The type of feature "name" is not Boolean
- **VmbErrorInvalidValue:** "value" is not within valid bounds
- **VmbErrorNotFound:** If the feature is not found

- **VmbErrorBadParameter:** name is NULL
- **VmbErrorInvalidCall:** If called from frame callback

## 5.11 Command

### 5.11.1 VmbFeatureCommandRun()

Run a feature command.

|    | Type              | Name   | Description                                |
|----|-------------------|--------|--------------------------------------------|
| in | const VmbHandle_t | handle | Handle for an entity that exposes features |
| in | const char*       | name   | Name of the command feature                |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode
- **VmbErrorWrongType:** The type of feature "name" is not Command
- **VmbErrorNotFound:** Feature was not found
- **VmbErrorBadParameter:** name is NULL

### 5.11.2 VmbFeatureCommandIsDone()

Check if a feature command is done.

|     | Type              | Name    | Description                                |
|-----|-------------------|---------|--------------------------------------------|
| in  | const VmbHandle_t | handle  | Handle for an entity that exposes features |
| in  | const char*       | name    | Name of the command feature                |
| out | VmbBool_t *       | plsDone | State of the command.                      |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode
- **VmbErrorWrongType:** The type of feature "name" is not Command
- **VmbErrorNotFound:** Feature was not found
- **VmbErrorBadParameter:** name or plsDone is NULL

## 5.12 Raw

### 5.12.1 VmbFeatureRawGet()

Read the memory contents of an area given by a feature name.

| Type                        | Name        | Description                                |
|-----------------------------|-------------|--------------------------------------------|
| <b>in</b> const VmbHandle_t | handle      | Handle for an entity that exposes features |
| <b>in</b> const char*       | name        | Name of the raw feature                    |
| <b>out</b> char*            | pBuffer     | Buffer to fill                             |
| <b>in</b> VmbUInt32_t       | bufferSize  | Size of the buffer to be filled            |
| <b>out</b> VmbUInt32_t*     | pSizeFilled | Number of bytes actually filled            |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode
- **VmbErrorWrongType:** The type of feature "name" is not Register
- **VmbErrorNotFound:** Feature was not found
- **VmbErrorBadParameter:** If name or pBuffer or pSizeFilled is NULL



This feature type corresponds to a top-level "Register" feature in GenICam. Data transfer is split up by the transport layer if the feature length is too large. You can get the size of the memory area addressed by the feature "name" by VmbFeatureRawLengthQuery().

### 5.12.2 VmbFeatureRawSet()

Write to a memory area given by a feature name.

| Type                                     | Name                    | Description                                |
|------------------------------------------|-------------------------|--------------------------------------------|
| <b>in</b> <code>const VmbHandle_t</code> | <code>handle</code>     | Handle for an entity that exposes features |
| <b>in</b> <code>const char*</code>       | <code>name</code>       | Name of the raw feature                    |
| <b>in</b> <code>const char*</code>       | <code>pBuffer</code>    | Data buffer to use                         |
| <b>in</b> <code>VmbUInt32_t</code>       | <code>bufferSize</code> | Size of the buffer                         |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** `VmbStartup()` was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode
- **VmbErrorWrongType:** The type of feature "name" is not Register
- **VmbErrorNotFound:** Feature was not found
- **VmbErrorBadParameter:** If name or `pBuffer` is NULL
- **VmbErrorInvalidCall:** If called from frame callback



This feature type corresponds to a first-level "Register" node in the XML file. Data transfer is split up by the transport layer if the feature length is too large. You can get the size of the memory area addressed by the feature "name" by `VmbFeatureRawLengthQuery()`.

### 5.12.3 VmbFeatureRawLengthQuery()

Get the length of a raw feature for memory transfers.

| Type                                     | Name                 | Description                                |
|------------------------------------------|----------------------|--------------------------------------------|
| <b>in</b> <code>const VmbHandle_t</code> | <code>handle</code>  | Handle for an entity that exposes features |
| <b>in</b> <code>const char*</code>       | <code>name</code>    | Name of the raw feature                    |
| <b>out</b> <code>VmbUInt32_t*</code>     | <code>pLength</code> | Length of the raw feature area (in bytes)  |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** `VmbStartup()` was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode
- **VmbErrorWrongType:** The type of feature "name" is not Register
- **VmbErrorNotFound:** Feature not found

- **VmbErrorBadParameter:** If name or pLength is NULL



This feature type corresponds to a first-level "Register" node in the XML file.

## 5.13 Feature invalidation

### 5.13.1 VmbFeatureInvalidationRegister()

Register a VmbInvalidationCallback callback for feature invalidation signaling.

| Type                              | Name         | Description                                          |
|-----------------------------------|--------------|------------------------------------------------------|
| <b>in</b> const VmbHandle_t       | handle       | Handle for an entity that emits events               |
| <b>in</b> const char*             | name         | Name of the event (NULL to register for any feature) |
| <b>in</b> VmbInvalidationCallback | callback     | Callback to be run, when invalidation occurs         |
| <b>in</b> void*                   | pUserContext | User context passed to function                      |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode



Any feature change, either of its value or of its access state, may be tracked by registering an invalidation callback. Registering multiple callbacks for one feature invalidation event is possible because only the combination of handle, name, and callback is used as key. If the same combination of handle, name, and callback is registered a second time, it overwrites the previous one.

### 5.13.2 VmbFeatureInvalidationUnregister()

Unregister a previously registered feature invalidation callback.

| Type                              | Name     | Description                            |
|-----------------------------------|----------|----------------------------------------|
| <b>in</b> const VmbHandle_t       | handle   | Handle for an entity that emits events |
| <b>in</b> const char*             | name     | Name of the event                      |
| <b>in</b> VmbInvalidationCallback | callback | Callback to be removed                 |

- **VmbErrorSuccess:** If no error

- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode



Since multiple callbacks may be registered for a feature invalidation event, a combination of handle, name, and callback is needed for unregistering, too.

## 5.14 Image preparation and acquisition

### 5.14.1 VmbFrameAnnounce()

Announce frames to the API that may be queued for frame capturing later.

| Type                        | Name         | Description                 |
|-----------------------------|--------------|-----------------------------|
| <b>in</b> const VmbHandle_t | cameraHandle | Handle for a camera         |
| <b>in</b> const VmbFrame_t* | pFrame       | Frame buffer to announce    |
| <b>in</b> VmbUInt32_t       | sizeofFrame  | Size of the frame structure |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorBadHandle:** The given camera handle is not valid
- **VmbErrorBadParameter:** The given frame pointer is not valid or sizeofFrame is 0
- **VmbErrorStructSize:** The given struct size is not valid for this version of the API



Allows some preparation for frames like DMA preparation depending on the transport layer. The order in which the frames are announced is not taken into consideration by the API.

### 5.14.2 VmbFrameRevoke()

Revoke a frame from the API.

| Type                        | Name         | Description                                                  |
|-----------------------------|--------------|--------------------------------------------------------------|
| <b>in</b> const VmbHandle_t | cameraHandle | Handle for a camera                                          |
| <b>in</b> const VmbFrame_t* | pFrame       | Frame buffer to be removed from the list of announced frames |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorBadHandle:** The given camera handle is not valid
- **VmbErrorBadParameter:** The given frame pointer is not valid
- **VmbErrorStructSize:** The given struct size is not valid for this version of the API



The referenced frame is removed from the pool of frames for capturing images.

### 5.14.3 VmbFrameRevokeAll()

Revoke all frames assigned to a certain camera.

| Type                 | Name         | Description         |
|----------------------|--------------|---------------------|
| in const VmbHandle_t | cameraHandle | Handle for a camera |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorBadHandle:** The given camera handle is not valid

### 5.14.4 VmbCaptureStart()

Prepare the API for incoming frames.

| Type                 | Name         | Description         |
|----------------------|--------------|---------------------|
| in const VmbHandle_t | cameraHandle | Handle for a camera |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorDeviceNotOpen:** Camera was not opened for usage
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode

### 5.14.5 VmbCaptureEnd()

Stop the API from being able to receive frames.

| Type                                     | Name                      | Description         |
|------------------------------------------|---------------------------|---------------------|
| <b>in</b> <code>const VmbHandle_t</code> | <code>cameraHandle</code> | Handle for a camera |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** `VmbStartup()` was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid



Consequences of `VmbCaptureEnd()`: - The frame callback will not be called anymore

## 5.14.6 VmbCaptureFrameQueue()

Queue frames that may be filled during frame capturing.

| Type                                     | Name                      | Description                                                |
|------------------------------------------|---------------------------|------------------------------------------------------------|
| <b>in</b> <code>const VmbHandle_t</code> | <code>cameraHandle</code> | Handle of the camera                                       |
| <b>in</b> <code>const VmbFrame_t*</code> | <code>pFrame</code>       | Pointer to an already announced frame                      |
| <b>in</b> <code>VmbFrameCallback</code>  | <code>callback</code>     | Callback to be run when the frame is complete. NULL is OK. |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** `VmbStartup()` was not called before the current command
- **VmbErrorBadHandle:** The given frame is not valid
- **VmbErrorStructSize:** The given struct size is not valid for this version of the API



The given frame is put into a queue that will be filled sequentially. The order in which the frames are filled is determined by the order in which they are queued. If the frame was announced with `VmbFrameAnnounce()` before, the application has to ensure that the frame is also revoked by calling `VmbFrameRevoke()` or `VmbFrameRevokeAll()` when cleaning up.

## 5.14.7 VmbCaptureFrameWait()

Wait for a queued frame to be filled (or dequeued).

| Type                                     | Name                      | Description                                    |
|------------------------------------------|---------------------------|------------------------------------------------|
| <b>in</b> <code>const VmbHandle_t</code> | <code>cameraHandle</code> | Handle of the camera                           |
| <b>in</b> <code>const VmbFrame_t*</code> | <code>pFrame</code>       | Pointer to an already announced & queued frame |
| <b>in</b> <code>VmbUint32_t</code>       | <code>timeout</code>      | Timeout (in milliseconds)                      |

- **VmbErrorSuccess:** If no error
- **VmbErrorTimeout:** Call timed out
- **VmbErrorApiNotStarted:** `VmbStartup()` was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid

## 5.14.8 VmbCaptureQueueFlush()

Flush the capture queue.

| Type                                     | Name                      | Description                   |
|------------------------------------------|---------------------------|-------------------------------|
| <b>in</b> <code>const VmbHandle_t</code> | <code>cameraHandle</code> | Handle of the camera to flush |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** `VmbStartup()` was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid



Control of all the currently queued frames will be returned to the user, leaving no frames in the output queue. After this call, no frame notification will occur until frames are queued again.

## 5.15 Interface Enumeration & Information

### 5.15.1 VmbInterfacesList()

List all the interfaces currently visible to VimbaC.

| Type                           | Name                | Description                                                                                           |
|--------------------------------|---------------------|-------------------------------------------------------------------------------------------------------|
| <b>out</b> VmbInterfaceInfo_t* | pInterfaceInfo      | Array of VmbInterfaceInfo_t, allocated by the caller. The interface list is copied here. May be NULL. |
| <b>in</b> VmbUInt32_t          | listLength          | Number of entries in the caller's pList array                                                         |
| <b>out</b> VmbUInt32_t*        | pNumFound           | Number of interfaces found (may be more than listLength!) returned here.                              |
| <b>in</b> VmbUInt32_t          | sizeofInterfaceInfo | Size of one VmbInterfaceInfo_t entry                                                                  |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorStructSize:** The given struct size is not valid for this API version
- **VmbErrorMoreData:** The given list length was insufficient to hold all available entries
- **VmbErrorBadParameter:** pNumFound was NULL



All the interfaces known via GenICam TransportLayers are listed by this command and filled into the provided array. Interfaces may correspond to adapter cards or frame grabber cards or, in the case of FireWire to the whole 1394 infrastructure, for instance. This function is usually called twice: once with an empty array to query the length of the list, and then again with an array of the correct length.

### 5.15.2 VmbInterfaceOpen()

Open an interface handle for feature access.

| Type                    | Name             | Description                                                                     |
|-------------------------|------------------|---------------------------------------------------------------------------------|
| <b>in</b> const char*   | idString         | The ID of the interface to get the handle for (returned by VmbInterfacesList()) |
| <b>out</b> VmbHandle_t* | pInterfaceHandle | The handle for this interface.                                                  |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorNotFound:** The designated interface cannot be found
- **VmbErrorBadParameter:** pInterfaceHandle was NULL



An interface can be opened if interface-specific control or information is required, e.g. the number of devices attached to a specific interface. Access is then possible via feature access methods.

### 5.15.3 VmbInterfaceClose()

Close an interface.

| Type                      | Name            | Description                           |
|---------------------------|-----------------|---------------------------------------|
| in    const   VmbHandle_t | interfaceHandle | The handle of the interface to close. |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid



After configuration of the interface, close it by calling this function.

## 5.16 Ancillary data

### 5.16.1 VmbAncillaryDataOpen()

Get a working handle to allow access to the elements of the ancillary data via feature access.

|            | Type         | Name                 | Description                                   |
|------------|--------------|----------------------|-----------------------------------------------|
| <b>in</b>  | VmbFrame_t*  | pFrame               | Pointer to a filled frame                     |
| <b>out</b> | VmbHandle_t* | pAncillaryDataHandle | Handle to the ancillary data inside the frame |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command



This function can only succeed if the given frame has been filled by the API.

### 5.16.2 VmbAncillaryDataClose()

Destroy the working handle to the ancillary data inside a frame.

|           | Type        | Name                | Description                    |
|-----------|-------------|---------------------|--------------------------------|
| <b>in</b> | VmbHandle_t | ancillaryDataHandle | Handle to ancillary frame data |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid



After reading the ancillary data and before re-queuing the frame, ancillary data must be closed.

## 5.17 Memory/Register access

### 5.17.1 VmbMemoryRead()

Read an array of bytes.

| Type                        | Name          | Description                                    |
|-----------------------------|---------------|------------------------------------------------|
| <b>in</b> const VmbHandle_t | handle        | Handle for an entity that allows memory access |
| <b>in</b> VmbUInt64_t       | address       | Address to be used for this read operation     |
| <b>in</b> VmbUInt32_t       | bufferSize    | Size of the data buffer to read                |
| <b>out</b> char*            | dataBuffer    | Buffer to be filled                            |
| <b>out</b> VmbUInt32_t*     | pSizeComplete | Size of the data actually read                 |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode

### 5.17.2 VmbMemoryWrite()

Write an array of bytes.

| Type                        | Name          | Description                                                                           |
|-----------------------------|---------------|---------------------------------------------------------------------------------------|
| <b>in</b> const VmbHandle_t | handle        | Handle for an entity that allows memory access                                        |
| <b>in</b> VmbUInt64_t       | address       | Address to be used for this read operation                                            |
| <b>in</b> VmbUInt32_t       | bufferSize    | Size of the data buffer to write                                                      |
| <b>in</b> const char*       | dataBuffer    | Data to write                                                                         |
| <b>out</b> VmbUInt32_t*     | pSizeComplete | Number of bytes successfully written; if an error occurs this is less than bufferSize |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command

- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode
- **VmbErrorMoreData:** Not all data were written; see pSizeComplete value for the number of bytes written

### 5.17.3 VmbRegistersRead()

Read an array of registers.

| Type                         | Name              | Description                                           |
|------------------------------|-------------------|-------------------------------------------------------|
| <b>in</b> const VmbHandle_t  | handle            | Handle for an entity that allows register access      |
| <b>in</b> VmbUInt32_t        | readCount         | Number of registers to be read                        |
| <b>in</b> const VmbUInt64_t* | pAddressArray     | Array of addresses to be used for this read operation |
| <b>out</b> VmbUInt64_t*      | pdataArray        | Array of registers to be used for this read operation |
| <b>out</b> VmbUInt32_t*      | pNumCompleteReads | Number of reads completed                             |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorIncomplete:** Not all the requested reads could be completed



Two arrays of data must be provided: an array of register addresses and one for corresponding values to be read. The registers are read consecutively until an error occurs or all registers are written successfully.

### 5.17.4 VmbRegistersWrite()

Write an array of registers.

| Type                                      | Name                            | Description                                            |
|-------------------------------------------|---------------------------------|--------------------------------------------------------|
| <b>in</b> <code>const VmbHandle_t</code>  | <code>handle</code>             | Handle for an entity that allows register access       |
| <b>in</b> <code>VmbUInt32_t</code>        | <code>writeCount</code>         | Number of registers to be written                      |
| <b>in</b> <code>const VmbUInt64_t*</code> | <code>pAddressArray</code>      | Array of addresses to be used for this write operation |
| <b>in</b> <code>const VmbUInt64_t*</code> | <code>pdataArray</code>         | Array of reads to be used for this write operation     |
| <b>out</b> <code>VmbUInt32_t*</code>      | <code>pNumCompleteWrites</code> | Number of writes completed                             |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** `VmbStartup()` was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode
- **VmbErrorIncomplete:** Not all the requested writes could be completed



Two arrays of data must be provided: an array of register addresses and one with the corresponding values to be written to these addresses. The registers are written consecutively until an error occurs or all registers are written successfully.

## 5.17.5 VmbCameraSettingsSave()

Saves all feature values to XML file.

| Type                                                | Name                        | Description                                      |
|-----------------------------------------------------|-----------------------------|--------------------------------------------------|
| <b>in</b> <code>const VmbHandle_t</code>            | <code>handle</code>         | Handle for an entity that allows register access |
| <b>in</b> <code>const char*</code>                  | <code>fileName</code>       | Name of XML file to save settings                |
| <b>in</b> <code>VmbFeaturePersistSettings_t*</code> | <code>pSettings</code>      | Settings struct                                  |
| <b>in</b> <code>VmbUInt32_t</code>                  | <code>sizeofSettings</code> | Size of settings struct                          |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** `VmbStartup()` was not called before the current command

- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode
- **VmbErrorBadParameter:** if fileName is NULL



Camera must be opened beforehand and function needs corresponding handle. With given filename parameter path and name of XML file can be determined. Additionally behaviour of function can be set with providing 'persistent struct'.

## 5.17.6 VmbCameraSettingsLoad()

Load all feature values from XML file to device.

| Type                                   | Name           | Description                                      |
|----------------------------------------|----------------|--------------------------------------------------|
| <b>in</b> const VmbHandle_t            | handle         | Handle for an entity that allows register access |
| <b>in</b> const char*                  | fileName       | Name of XML file to save settings                |
| <b>in</b> VmbFeaturePersistSettings_t* | pSettings      | Settings struct                                  |
| <b>in</b> VmbUInt32_t                  | sizeofSettings | Size of settings struct                          |

- **VmbErrorSuccess:** If no error
- **VmbErrorApiNotStarted:** VmbStartup() was not called before the current command
- **VmbErrorBadHandle:** The given handle is not valid
- **VmbErrorInvalidAccess:** Operation is invalid with the current access mode
- **VmbErrorBadParameter:** if fileName is NULL



Camera must be opened beforehand and function needs corresponding handle. With given filename parameter path and name of XML file can be determined. Additionally behaviour of function can be set with providing 'settings struct'.