

APPLICATION NOTE

Getting Started with MATLAB

Scope of this document

This application note is intended for MATLAB users who want to set up their first vision application. The following topics are included:

V1.1.0

- Installing the required Vimba and MATLAB components
- Configuring your camera and acquiring the first images with MATLAB's Image Acquisition Tool

Image Acquisition Tool is a viewer application that helps adjust camera parameters without any programming. Moreover, Image Acquisition Tool automatically creates code that you can paste into the MATLAB program. Image Acquisition Tool is optimized for quick and easy camera configuration, not for best performance.

Compatibility

Allied Vision cameras and Vimba SDK

MATLAB is compatible with Allied Vision GigE, USB, and 1394 cameras. Accessing the cameras via Vimba's GenICam-compliant transport layers and MATLAB's GenICam interface ensures a stable performance.

Required host adapter cards

Using a separate host adapter card for your camera is highly recommended. Especially with GigE cameras, a separate NIC ensures optimal performance and helps avoid conflicts with your firewall or anti-virus software.

GigE hardware selection: http://www.alliedvision.com/fileadmin/content/documents/products/cameras/various/appnote/GigE/Hardware_Selection_for_Allied_Vision_GigE_Cameras.pdf

Hardware for USB and 1394 cameras: Read the instructions in the technical manual or user guide for your camera.



Required Vimba and MATLAB components

To program a vision application with MATLAB and Allied Vision cameras, you need:

- Vimba SDK (install at least the transport layers and the camera drivers)
- MATLAB R2014a or higher, including Image Acquisition Toolbox
- MATLAB's GenICam interface, which is available as MATLAB support package and free of charge for Image Acquisition Toolbox users.

You can install Vimba either before or after installing the MATLAB components. Vimba automatically sets the required GentTL environment variable and automatically connects with MATLAB's GenICam interface.

Installing Vimba

The following action steps apply to Windows.

- 1. Select, install, and configure your host adapter card as described in the corresponding manual for your camera (GigE: activate jumbo frames).
- 2. Download Vimba: https://www.alliedvision.com/en/products/software.html
- 3. Install Vimba. As a minimum, select the option **3rd Party Applications**.

	nE	~		Info	Exit
Please select an ins	tallation level and	d press start!			
3rd Add all compor	thents necessary for u	sing Vimba with thi	ird party software suc	th as image libraries and	d adapters.
Target <u>F</u> older	D:\Program Files C:\Users\Public\	s\Allied Vision\Vimba Documents\Allied Vis	_1.4\ ion\Vimba_1.4		
				Allie	d Vision

Figure 1: Select 3rd Party Applications



4. If you want to install the Vimba Viewer additionally (recommended for GigE camera users), click **Vimba Applications** and select Camera Demonstration.

√п		Info
Please select an inst	Illation level and press start!	
3rd Party Applications Ap	Vimba plication Development	m on Start
Target Folder	D:\Program Files\Allied Vision\Vimba_1.4\	
Examples Target Folder	C:\Users\Public\Documents\Allied Vision\Vim	ba_1.4
		Allied Vision

Figure 2: Install Vimba Viewer

- 5. Start the Vimba Driver Installer.
- 6. Install and activate the Vimba driver for your camera (find a detailed description in the Vimba Manual, Chapter Vimba Driver Installer):

🛿 Vimba Driver Installer			
<u>File</u> Install driver <u>H</u> elp			
Metwork Adapter 🔮 IEEE 1394 Host Cont	troller USB USB3 Vision Cameras		Artione
Name	Location	Driver Source	Install Vimba Gine Transport Laver (1.4.0) on Intel (B) 825741. Ginabit Network Connection
VirtualBox Host-Only Ethernet Adapter		<vimba disabled="" driver="" filter=""></vimba>	Install Vinba USB Transport Layer (1.0.0) driver on adapter 'Mako U-051B' (Serial Number: 1090519043).
Intel(R) Ethernet Connection I217-LM	PCI bus 0, device 25, function 0	Vimba filter driver disabled>	Sinstall Vimba 1394 Transport Layer (1.4.0) driver on adapter 'Generic OHCILynx-1394 (intek)' (PCI bus 6, de
Intel(R) 82574L Gigabit Network Connection	PCI bus 13, device 0, function 0		
Intel(R) 82574L Gigabit Network Connection	PCI bus 14, device 0, function 0		
Intel(R) 82574L Gigabit Network Connection	PCI bus 15, device 0, function 0	Vimba GigE Transport Layer (1.4.0)	
Intel(R) 82574L Gigabit Network Connection	PCI bus 16, device 0, function 0	Vimba GigE Transport Layer (1.4.0)	
			Apply Clear
Ready.			

Figure 3: Vimba Driver Installer

Now you've installed all required Vimba components.



Installing MATLAB's GenICam support package

Prerequisites

MATLAB including Vision Acquisition Toolbox must be installed.

Check if the GenICam support package is installed

Before you start programming your vision application, check if the GenICam support package is installed. We recommend using the GenICam support package instead of other options such as GigE Vision or DCAM.

To check if MATLAB's GenICam support package is installed:

- 1. Start MATLAB and click the **APPS** tab.
- 2. Click Image Acquisition.



Figure 4: Tab APPS -> Image Acquisition

3. Image Acquisition Tool opens in a new window.

Scenario a)

The Hardware Browser window shows your camera(s) with suffix (gentl-1, gentl-2, gentl-3...).

This means that the MATLAB GenICam interface is already installed. Proceed as described in section Getting the first images.



Figure 5: Hardware Browser lists camera with suffix (gentl)



Scenario b)

The Hardware Browser either doesn't show your camera at all or it shows the camera with a different suffix than *(gentl)*, for example, with suffix *(gige)* or *(dcam)*. This means that you either have to initiate a refresh or the GenICam support package is missing.

Refreshing Image Acquisition Toolbox

- 1. In the Hardware Browser, select **Image Acquisition Toolbox**.
- 2. Select **Tools -> Imaqreset**.



Figure 6: Initiate a refresh

Installing the GenICam support package

If **no camera is listed**, go to the MATLAB window (under the Image Acquisition Toolbox window) and click the link in the error message to download and install the GenICam support package.

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Figure 7: Click the link to download the GenICam support package

If your **camera is listed with the wrong suffix** or the **link does not appear** in the Command Window, install the GenICam support package:

http://www.mathworks.com/help/imaq/installing-the-support-packages-for-image-acquisition-toolbox-adaptors.html



In the Support Package Installer, select **GeniCam Interface**.

Select support package to install Show: All (13)	•					
Support for:	Support packages	:				
DCAM Hardware Data Translation Frame Grabbers	Action	Installed Version	Latest Version	Description	Required Base Product	Supported Host Platforms
GenICam Interface GigE Vision Hardware Hamamatsu Hardware	1 🗹 Install		15.1.0	Acquire video and images from GenTL compliant cameras.	Image Acquisitio	Win32,Win64,Linux64
Matrox Hardware						
OS Generic Video Interface Point Grev Hardware						
QImaging Hardware Teledyne DALSA IFC Hardware						
Teledyne DALSA Sapera Hardware						
Installation folder: D:\MATLAB\SupportPacka	ges\R2015a					Browse

Figure 8: Select GenICam Interface

Now your PC is ready for image acquisition with MATLAB.



Getting the first images

As soon as the GenICam support package is installed, the camera is listed with the (*gentl*) suffix and you can view or acquire images:

- 1. Select a device format, for example, Mono8.
- 2. Click Start Preview.

📣 Image Acquisition Tool	
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Hardware Bro 🖛 🗖 🔻 🗙	Preview - Manta_G-031B (gentl-1): Mono8 (default) 🚽 🗆
📣 Image Acquisition Toolbox	
🗎 🖃 Manta_G-031B (gentl-1)	
Mono12	
Mono12Packed	Click Start Preview or Start Acquisition to begin.
Mono8 (default) *	
	ady to start preview or acquisition.
	Preview
4	Start Preview Start Acquisition Trigger Stop Acquisition Export Data

Figure 9: Select a device format and click Start Preview

Now you can see images from your Allied Vision camera and adjust its parameters.

MATLAB image acquisition basics

MATLAB's general camera handling

MATLAB handles cameras differently than most other machine vision applications: As soon as you have activated a device format (also called pixel format), MATLAB starts a background process that permanently accesses the camera, even if you have stopped image acquisition. This causes CPU load.

Device format

In Image Acquisition Tool, the device format (for example, Mono8 or BayerRG8) has a central role and is the starting point. Therefore, determine the appropriate device format at an early stage of the development phase.

Hardware trigger behavior

MATLAB's hardware trigger behavior is special and might not meet your expectations. To determine an exact moment of triggering, connect an external trigger source electrically to the camera. In MATLAB, use the preselected hardware trigger source and trigger condition *DeviceSpecific*.

Imagreset command

The *imagreset* command disconnects MATLAB from your camera and unloads the GenICam interface. You can also use it to search for new hardware. In Image Acquisition Toolbox, you can invoke it with a rightclick in the Hardware Browser.



Working with Image Acquisition Tool

In Image Acquisition Tool, click **Desktop** to select the windows you want to see and save your preferred layout.

A Image Acquisition Tool								
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Mono12Packed							Acquisition Parameters – General	
🛄 Mono8 (default) *				1000			Use this tab to set up general acquisit parameters, such as frames per trigge	
Δ							space. Settings you make will apply to selected device format in the Hardway	
A							The following sections describe how t	
		17.17 FPS		Ready to	start acquisition.		on this tab.	
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			Start Preview	Stop Preview	Start Acquisition Trigger Stop Acquis	ition Export Data	Color Space	
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				General Device Properties Logging	Triggering Region of Interest			
Mono8				Selected source: DEV_000F314C7856-S	tream-000 👻	<pre>1 vid = videoinput('gentl', 1, 'Mono8'^ 2 src = getselectedsource(vid);</pre>		
Device:	Manta_G-031B			Properties	E	3	cocubource(viu),	
Resolution:	656x492	-			Reset to default	4 vid.FramesPer	Trigger = 1;	
Selected source:	DEV_000F314C78	856-Stream-000		Acquisition End Trigger Activation	n: RisingEdge 🔻	<pre>5 6 preview(vid);</pre>	=	
Number of frames to acquire:	: 1			Acquisition End Trigger Delay Ab	s: 0	7		
Logging mode:	memory			Acquisition End Trigger Mod	e: Off 🔻	8 stoppreview(v:	id); D	
Trigger type:	immediate			Acquisition End Trigger Source	e: Line2 🔻	10 preview(vid);		
Adaptor/Driver Description:	Image Acquisitio	on Toolbox GenTL Adaptor with Vimba Gige	Transport Layer	Acquisition Frame Rate Ab				
Adaptor/Driver Version: 1.0.LIBRARY_BUILD_DATE_STRING with Allied Vision Technologies 1.4.0				Acquisition Frame Rate Limi	1d);			
				Acquisition Record Trigger Activation	n: RisingEdge 💌	14 preview (vid);		
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Figure 10: Desktop -> standard view

- The Hardware Browser A shows available cameras and device formats.
- Information B shows if the Vimba Transport layer is in use (select a device format).
- The Acquisition Parameter window C gives access to all camera features except for the device format.
- Session Log D automatically creates code based on your activities within Image Acquisition Tool. Use session log to easily create code and paste it into the MATLAB Command Window.
- **Desktop Help** E gives information on currently selected items.



Save your camera configuration

The current camera configuration is lost with every *imaqreset* and program shutdown.

Select File -> Save Configuration to retrieve your settings later.

The configuration file is valid only for the device format it was created with, for example, Mono8. Configuration files cannot be opened under a different device format.



Troubleshooting

- Before starting HDevelop, make sure no other application uses the camera.
- Camera recognition may take a while, especially with GigE cameras.
- Test if your camera works with Vimba Viewer. If not, check the settings of your GigE, 1394, or USB host adapter.
- GigE cameras: If your GigE camera is available in the hardware browser but does not acquire images, install Vimba Viewer and open the camera in Vimba Viewer. Then close Vimba Viewer and try again with Image Acquisition Toolbox. Moreover, use a separate NIC (see the MATLAB Help for configuration instructions), activate jumbo frames, and use CAT 6 (or higher) Ethernet cables.
- Open the Vimba Driver Installer and make sure the Vimba drivers are in use.
- If your camera does not reach the maximum frame rate, check if the exposure time is short enough. Example: If the exposure time is 100 ms, the camera cannot acquire more than approximately 10 fps.
- GigE cameras: Follow the instructions in the GigE Technical Manual.

Follow the instructions in the HALCON documentation.

Download technical documentation for your camera

GigE cameras

- Technical Manual (contains installation instructions, camera-specific information, and technical data)
- GigE Features Reference (provides a general overview of GigE camera and driver features)

USB cameras

- Alvium USB Cameras User Guide or Mako U Technical Manual (contains camera-specific information, installation instructions, and technical data)
- Features Reference for Alvium or Mako U (provides a general overview of USB camera and driver features)

1394 cameras

- 1394 Installation Manual (contains installation instructions and camera I/O descriptions)
- Technical Manual (contains camera-specific technical data and camera features)



Download camera documentation

https://www.alliedvision.com/en/support/technical-documentation.html

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