

Get started with the Embedded Vision Starterkit

Designed to reduce the evaluation and prototyping stages of product development, this hardware and software bundle allows users to easily test embedded vision applications on the NVIDIA Jetson Nano Developer Kit.



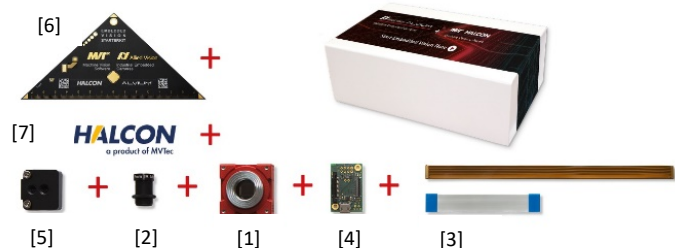
With the starter kit, users can run the preinstalled application examples. Developing custom applications using HALCON's extensive toolbox is possible with a development license of MVTec HALCON (not included).

// Embedded Vision Starterkit Contents

The starter kit contains:

Hardware:

- Alvium 1500 C-120c color camera with S-Mount and open housing [1]
- Allied Vision lens S-6-F1.8-5MP-T1-2.5-IRC [2]
- 420mm CSI-2 flex cable [3]
- CSI-2 Adapter Board for NVIDIA Jetson Nano / Xavier NX Dev Kit [4]
- Alvium tripod mounting plate [5]
- PCB Triangle for demo applications [6]



Software:

- A ready-to-use SD card image can be downloaded at: <https://www.alliedvision.com/en/products/alvium-camera-kit-for-mvtec.html>. It contains a ready-to-use system image with Jetpack 4.3 and preinstalled MIPI-CSI-2 drivers for Alvium CSI-2 cameras. It also contains the machine vision software MVTec HALCON in the form of a browser-based demo application and executable without an additional license [7].

What else do you need:

- NVIDIA Jetson Nano Developer Kit (**4GB! version B01, 945-13450-0000-100; 2GB Developer Kit is not supported**) [a]
- DC Barrel Jack Power Supply for Jetson Nano DevKit [b]
- (see recommendation <https://forums.developer.nvidia.com/t/power-supply-considerations-for-jetson-nano-developer-kit/71637>)
- Micro USB Power Supply for CSI-2 Adapter (recommendation 5W) [c]
- MicroSD Card with at least 32GB [d]
- Camera tripod with mounting

// Set up instructions

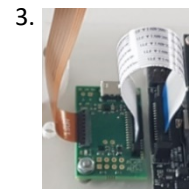
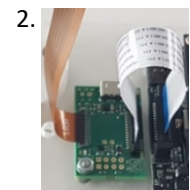
a) Mechanical construction

1. Fasten the lens [2] with the fixation ring into the camera [1] so that the lens stands out approx. 12mm (a fine adjustment will be done later with software support). **Do not** screw it in all the way, as the image sensor could get damaged!
2. Connect the camera [1] to the mounting plate [5] using the supplied screws (an X-screwdriver is required)
3. Mount the camera [1] so that the optical axis of the lens is pointing vertically downwards. The distance between camera and stage plate should be approx. 230mm.



b) Electrical connections

1. Before powering the Jetson Nano Developer board [a], connect the camera [1] to the flex cable [3] (be sure to use the side labeled with “camera”).
2. Connect the other end of the flex cable to the CSI-2 adapter board [4].
3. Connect the adapter board with the broader flex cable [3] to the camera connector #1 (J13) of the Jetson Nano Developer board [a].
4. Connect the micro USB power supply cable [b] with the CSI-2 adapter board [4].
5. Proceed with the next section “Prepare the SD card with the ready-to-use image”.



// Prepare the SD card with the ready to use image

- a. Download the image from <https://www.alliedvision.com/en/products/alvium-camera-kit-for-mvtec.html>.
- b. First, flash the system image to the microSD card [d]:
 1. Insert the microSD card into a card reader connected to the PC.
 2. Run for example Balena Etcher (see <https://www.balena.io/etcher/>).
 3. Select the system image for Embedded Vision Starterkit.
 4. Select the microSD card as the target drive.
 5. Flash the system image to the microSD card. Depending on the system this may take up to 20 minutes. After flashing the system image, Windows may suggest to format the microSD. This happens because Windows cannot natively access Linux partitions. Click “No” to keep the data on the microSD card as is.
- c. Insert the microSD card [d] with the pre-installed image into the SD card slot on the Jetson Nano Board.

// Start the Embedded System

- d. Connect a keyboard, mouse, and a monitor with the Jetson Nano Board. Alternatively, the board can be accessed via a network cable.
- e. Place the power select jumper (J48) on the NVIDIA Jetson Nano board.
- f. Connect the power supply [b] to the Jetson Nano developer board. The operating system starts booting.
- g. Create your user and set password with following credentials

user: evs **password: evs**

Note, if you are not using these credentials, the preset desktop will not be available by default.

You have to log off and log on as "evs".

// Using the Embedded Vision Starterkit and Demo



After booting a login screen will be presented to you.



On the desktop you can choose between the following applications:

1. **Embedded Vision Demo using the demo triangle**
2. **HPEek, a demo application showcasing the power of the machine vision capabilities of MVTec HALCON**
3. **QV4L2, an open-source viewer for easy image stream evaluation and setting of camera functions**
4. **Firmware Updater to update the camera firmware**

1. Embedded Vision Demo



- a. The machine vision software, which is matched to the triangle, can be started by clicking on the yellow EV-icon  on the desktop.
Note, the needed backend is automatically started. In case for a restart type "evs" in terminal.
- b. This will launch the installed Chrome Web Browser. The operation and display are done via the web browser.
- c. First select the camera setup and press the play button . Place the triangle under the camera and focus the image by turning the lens.
- d. Using an application for the first time can take more time as the models are loaded first.

- e. You can select one of the inspection tasks and observe the result display (see "Result") by changing the position of the triangle.
- f. If you move the mouse pointer over the color-coded areas in the camera image, additional information is displayed under "Description".
- g. Use the single image button  to execute a single image acquisition with the set check.
- h. The auto run button  starts an automatic test run. After each image acquisition, the system changes to another test program.

Short description of the preset machine vision applications:

- **Code Reading:** HALCON reads bar- and data codes fast and robustly, even if the reading process is impeded by factors like overexposure, print growth, defocus, distortion or very small code sizes.
- **Matching:** HALCON's superior subpixel-accurate matching technologies find objects robustly and accurately in real-time – regardless of rotation, tilt, local deformation, texture, scale, partial occlusion, or nonlinear illumination changes.
- **Pose Estimation:** HALCON's pose estimation determines the position and orientation of an object relative to the camera. If the object is detected, its pose is visualized by the overlaid coordinate system.
- **Deep-learning-based Classification:** Deep-learning-based image classification allows to easily assign images to trained classes.

2. HPeek

HPeek is a software tool designed to provide a first impression of MVTec HALCON on arm-based platforms. It shows key applications directly executed on the target device. It includes latest deep learning and classic machine vision technologies for many applications which could be solved with the help of HALCON.

This gives a good feeling for the performance of both, the hardware and HALCON on embedded devices.

With a valid license, HPeek can be used in a similar way to Hrun to execute customer scripts on the embedded device without recompiling. This is possible due to the HDevEngine technology.

3. AVT V4L2 Test Utility – Video4Linux Viewer

Before opening the AVT V4L2 Test Utility, make sure that the backend of evs, i.e. mvruntime, is closed. Otherwise the camera will not be recognized by the application:

- a. Open the connected camera by choosing the model.
- b. Start the camera stream by clicking the triangle button. A second viewing screen opens.
- c. Some camera settings can be done during streaming (e.g. exposure time, gain), while others can be changed only when the stream is stopped.

4. Firmware Update

To upload a new firmware to the Alvim CSI camera, carry out the following steps:

- a. Start the Firmware Updater.
- b. Click Open and select a firmware container file downloaded from <https://www.alliedvision.com/en/support/firmware.html>
Optional: Click Info to get details about the selected firmware.
- c. Click Update camera to upload the automatically selected firmware to your cameras.