

6302 Grabber

Features

- CameraLink input interface for ARTIQ
- Support for several EMCCD cameras
- Low-latency image processing on-FPGA
- Stack retrieves data sum over rectangular ROIs

Applications

- Ion fluorescence detection
- Cold atom fluorescence detection

General Description

The 6302 Grabber card is a 4hp EEM module, part of the ARTIQ/Sinara family. It adds frame grabber capabilities to carrier cards such as 1124 Kasli and 1125 Kasli-SoC. 6302 Grabber targets (EM)CCD scientific cameras using the CameraLink protocol standard. Using ARTIQ gateway, incoming camera signal is immediately transferred to the carrier card, where it can be processed with low latency on-FPGA .

The Sinara/ARTIQ stack supports defining rectangular ROIs (regions of interest); pixel value sums over these ROIs are reported to and can be used directly by ARTIQ kernels.

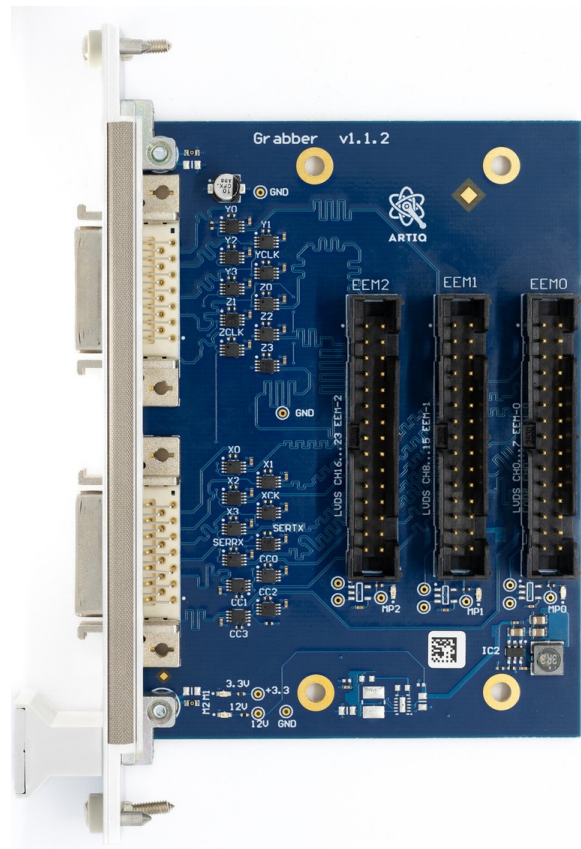


Figure 1: Grabber card



Figure 2: Grabber front panel

Source

6302 Grabber, like all the Sinara hardware family, is open-source hardware, and design files (schematics, PCB layouts, BOMs) can be found in detail at the repository <https://github.com/sinara-hw/Grabber>.

Grabber I/O

6302 Grabber features two front-panel 26-pin MDR connectors, commonly used by CameraLink connections. Properly shielded and twisted cables intended for CameraLink should be used. For Base CameraLink, only one MDR connection (and one EEM) is necessary; higher-speed Medium CameraLink requires two.

Power over CameraLink (PoCL) is not supported.

Grabber Single-/Double-/Triple-EEM Modes

6302 Grabber can operate with either a single, double, or triple EEM connection to a core device. The following table specifies the connections to use and the highest CameraLink configuration supported.

EEMs	Ports	CameraLink
1	0	Base CameraLink
2	0, 1	Medium CameraLink
3	0, 1, 2	Full CameraLink

Table 1: Grabber EEM modes

Note that current ARTIQ gateware only supports Base Cameralink.

ARTIQ System Description Entry

ARTIQ/Sinara firmware/gateware is generated according to a JSON system description file, allowing gateware to be specific to and optimized for a certain system configuration.

6302 Grabber should be entered in the `peripherals` list of the corresponding core device in the following format:

```
{
  "type": "grabber",
  "ports": [0, 1]
}
```

Replace 0 and 1 with the EEM port numbers used on the core device. Any port numbers can be used. Specifying a second port is optional. If using Grabber in single-EEM mode, specify only [0].

Example ARTIQ Code

The code below demonstrates a simple usage scenario of extensions on the ARTIQ control system. These extensions make use of the resources of the 6302 Grabber card. Not all features of the ARTIQ system are shown.

The full documentation for ARTIQ software and gateway, including guides for their use, is available at <https://m-labs.hk/artiq/manual/>. Please consult the manual for details and reference material of the functions and structures used here.

The following code specifies two ROIs (Regions of Interest), enables both, retrieves their accumulated data for a single frame, and disables the ROI engines.

```
@kernel
def run(self):
    self.core.break_realtime()
    delay(100*us)
    # setup ROI boundaries
    grabber.setup_roi(0, 0, 0, 2, 2)
    grabber.setup_roi(1, 0, 0, 2048, 2048)
    # enable through bitwise mask
    mask = 0b11
    grabber.gate_roi(mask)

    # trigger the camera

    # retrieves data from enabled ROIs
    n = [0] * 2
    grabber.input_mu(n)
    # disable ROIs
    self.core.break_realtime()
    grabber.gate_roi(0)
```

Ordering Information

To order, please visit <https://m-labs.hk> and choose 6302 Grabber in the ARTIQ/Sinara hardware selection tool. Cards can be ordered as part of a fully-featured ARTIQ/Sinara crate or standalone through the 'Spare cards' option. Otherwise, orders can also be made by writing directly to <mailto:sales@m-labs.hk>.

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