

Technical Specifications

EIGER2 R 500K Detector Systems

Document Version v1.3.2



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DOCUMENT HISTORY

Current Document

Table 1: Current Version of this Document

Version	Date	Status	Prepared	Checked	Released
v1.3.2	2018-05-29	release	AM, DJ, LW	SB, MM	SB

Changes

Table 2: Changes to this Document

Version	Date	Changes
v1.0.0	2017-04-09	First Release.
v1.2.0	2017-09-04	EIGER2 Integration.
v1.3.2	2017-09-04	PILATUS3 and EIGER2 API Documentation integration.

1. GENERAL INFORMATION

1.1. Contact and Support





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 Email: support@dectris.com

Should you have questions concerning the system or its use, please contact us via telephone, mail or fax.

1.2. Explanation of Symbols

Danger	#0
	Danger blocks are used to indicate immediate danger or risk to personnel or equipment.
Warning	#0
	Warning blocks are used to indicate danger or risk to personnel or equipment.
Caution	#0
	Caution blocks are used to indicate danger or risk to equipment.
Information	#0
	Information blocks are used to highlight important information.

1.3. Warranty Information

Caution

#1



Do not ship the system back before you receive the necessary transport and shipping information.

1.4. Disclaimer

DECTRIS has carefully compiled the contents of this manual according to the current state of knowledge. Damage and warranty claims arising from missing or incorrect data are excluded.

DECTRIS bears no responsibility or liability for damage of any kind, also for indirect or consequential damage resulting from the use of this system.

DECTRIS is the sole owner of all user rights related to the contents of the manual (in particular information, images or materials), unless otherwise indicated. Without the written permission of DECTRIS it is prohibited to integrate the protected contents in this publication into other programs or other websites or to use them by any other means.

DECTRIS reserves the right, at its own discretion and without liability or prior notice, to modify and/or discontinue this publication in whole or in part at any time, and is not obliged to update the contents of the manual.

2. USE OF THE EIGER2 R 500K

The EIGER2 R 500K detector system has been designed for the detection of X-rays produced by synchrotrons or laboratory sources. It is intended for indoor use only. For other applications, please contact DECTRIS technical support for additional information.

Caution

#2



Improper use of the DECTRIS detector system can compromise its safety and its functionality is no longer guaranteed.

Warning

#1



Do not use the detector in vacuum.

2.1. Product Return and Recycling


We recycle DECTRIS detector systems that are no longer suitable for use. If you are not using your DECTRIS detector system any more, send it back to us. We will make sure that your system is responsibly and safely recycled. This is free for customers who purchased a new DECTRIS detector system.

3. TECHNICAL SPECIFICATIONS

3.1. Specifications

3.1.1. Detector

Table 3.1: Technical Specifications

Number of modules (W x H)	1 x 1 = 1
Sensor	Reverse-biased silicon diode array
Sensor material	Silicon (Si)
Sensor thickness	450 μm
Pixel size (W x H)	75 μm x 75 μm = 5625 μm ²
Module size (W x H)	77.25 mm x 38.6 mm = 2982 mm ²
Pixel array format (W x H)	1030 pixel x 514 pixel = 529 420 pixel
Active Area (W x H)	77.25 mm x 38.6 mm = 2982 mm ²
Image bit depth	32 bit
Readout bit depth	16 bit
Maximum count rate	2 × 10 ⁶ photons/s/pixel
Energy range	5.4 keV to 18 keV
Adjustable threshold range	4 keV to 11 keV
Number of thresholds	two independent thresholds
Readout time	continuous readout, with zero dead time
Maximum frame rate ¹	40 Hz
	<div style="display: flex; justify-content: space-between; align-items: center;"> Information # 1 </div> <div style="padding: 5px;">  When using the external trigger or external enable mode, the detector will not acquire an image if the effective frame rate is above 40 Hz. </div>
Point-spread function	1 pixel (FWHM)
Connection to control unit	1 x 1GBase-T Ethernet
Power supply	External power supply unit
Software interface	HTTP REST interface (via network connection)
Dimensions (W x H x D)	100 mm x 140 mm x 92.4 mm
Weight	1.8 kg

¹ One frame per exposure, i.e. single-threshold or difference image

Table 3.1: Technical Specifications - continued

Overvoltage category	II
Means of protection	Class III
Pollution degree	II
Maximum operating altitude	2000 m a.s.l.

3.1.2. Power Supply Unit

Information #2



Please consult the user documentation of the Adapter Technology Co. Ltd. ATS065-A120 power supply unit for details.

Table 3.2: Power Supply Unit Specifications

Power supply unit	Adapter Technology Co. Ltd. ATS065-A120 Switching power supply
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3.1.3. Detector Control Unit

Information #3



Please consult the user documentation of the DELL PowerEdge R230 server for details.

Table 3.3: Detector Control Unit Specifications

Detector control unit	DELL PowerEdge R230 Rack-mounted (1U) server
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3.2. Ratings

3.2.1. Detector

Table 3.4: Power Ratings

Detector power input	+12 V DC, 20 W Connector: PWR Jack 2.5mm x 5.5mm x 9.5mm high current
Detector external trigger input	High level: 3.5 - 5V Low level: <1.5 V

Caution

#3



Absolute maximum is 5V. Applying a higher voltage will damage the detector.

Table 3.4: Power Ratings - continued

External trigger input impedance	High Impedance: 500 kΩ Connector: LEMO EPY.00.250.NTN Appropriate plug: LEMO FFA.00.250.NTAC22
Detector trigger output	High level: >4.5 V Low level: <1.5 V Impedance: 10 - 40 Ω Connector: LEMO EPY.00.250.NTN Appropriate plug: LEMO FFA.00.250.NTAC22

3.2.2. Power Supply Unit



Information	#4
	Please consult the user documentation of the Adapter Technology Co. Ltd. ATS065-A120 power supply unit for details.

Table 3.5: Power Supply Unit Ratings

Power supply unit power input	<p>Input 100 VAC to 240 VAC, 50 Hz to 60 Hz, 1.4 A max.</p> <p>Output 12 VDC, 5 A max., 60 W max.</p>
	<p>Caution #4</p> <p> Use only the included power supply.</p>
AC connector	IEC-320-C8 input inlet
Dimensions	115 mm x 53 mm x 38 mm
Weight	288 g

3.2.3. Detector Control Unit


Information	#5
	Please consult the user documentation of the DELL PowerEdge R230 for details.


Table 3.6: Detector Control Unit Ratings

Detector control unit power input	1 x 100 VAC to 240 VAC, 50/60 Hz, 1 A to 3 A, 250 W (Platinum)
Dimensions (W x H x D)	434.0 mm x 42.8 mm x 495.0 mm
Weight	<10.6 kg
Chassis	1U

3.3. Ambient Conditions

The EIGER2 R 500K detector is designed for indoor use only. The ambient conditions shown in table 3.7 must be satisfied. Values inside the detector are different.

Table 3.7: Detector Operating Ambient Conditions

Ambient Condition	Value
Operating temperature	+20 °C to +30 °C
Expanded operating temperature	+20 °C to +45 °C
	Information #6
	 When operating in expanded temperature range, data quality may be impacted.
Operating humidity	<80 % at 20 °C, non-condensing
Storage temperature	+15 °C to +40 °C
Storage humidity	<40 % at 20 °C, non-condensing

Caution #5



Please consider following points when storing the detector

- Make sure the temperature and the humidity inside the transport box does not exceed the specified range (use of a drying agent is required).
- Ensure that no condensation moisture develops if the detector is stored at low temperature.

4. DETECTOR DIMENSIONS AND CONNECTORS

4.1. EIGER2 R 500K Detector

4.1.1. Technical Drawing

Information

#7



3D step files of the EIGER2 R 500K detector are available on request. Please contact DECTRIS technical support for more information.

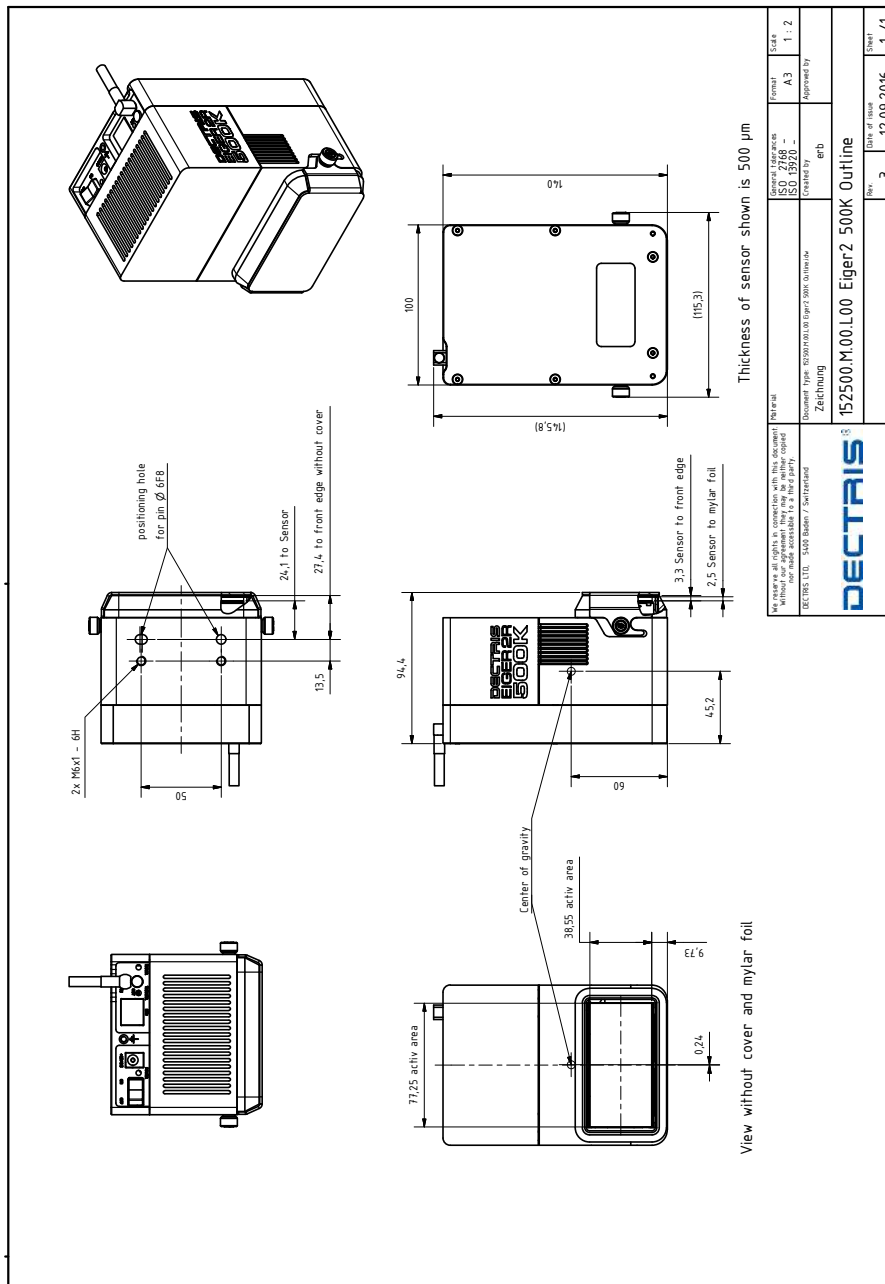


Figure 4.1: Drawing of the EIGER2 R 500K Detector (also printed separately in the user documentation folder)

4.1.2. Front Side of the Detector

Danger #1



Danger of electric shock. Do not touch the Mylar[®] foil. The sensors behind the Mylar[®] foil are operated at high voltages. Touching the Mylar[®] foil can cause an electrical shock.

Warning #2



Do not touch the Mylar[®] foil to avoid damage of the sensors.

Caution #6



The cover may not protect the detector from a direct beam.

The detector comes with a protective cover (1.5 mm, Aluminium) for the front window, which should only be removed during operation. The sensors are behind a 12 µm thick Mylar[®] (PET) foil coated with aluminum to protect them from humidity, dust and from being touched.



Figure 4.2: The EIGER2 R 500K Detector with the Cover Removed (front view)

4.1.3. Top Side of the Detector



Figure 4.3: The EIGER2 R 500K Detector (top view)




4.1.4. Status LEDs

Table 4.1: The Meaning of the Status LEDs on the Detector Top Plane

LED	Description
OUT	Orange to indicate the detector is in counting mode.
POWER	Green when the power supply is functioning.
ERROR	Red when an internal communication error occurs.

4.1.5. Connectors and Connecting Cables/Pipes

Table 4.2: Electric Connectors and Connecting Cables

Connector	Description
ETH	<p>1 x RJ45 Ethernet connector ETH -> detector control unit DATA 1</p> <p>Use Cat 6A S/FTP Ethernet cable(s).</p> <div style="background-color: yellow; padding: 5px; display: flex; justify-content: space-between;"> Caution #7 </div> <p> There must be a 1 x 1GBase-T Ethernet point-to-point connection between detector and detector control unit.</p>
POWER	DC power connector (see tables 3.4 and 3.5)
TRIGGER IN	<p>External trigger input (see table 3.4) Use a Lemo[®] Type 00 (NIM/CAMAC) cable.</p>
TRIGGER OUT	<p>Output signal High level: >4.5 V Low level: <1.5 V Impedance: 10 - 40 Ω Connector: LEMO EPY.00.250.NTN Appropriate plug: LEMO FFA.00.250.NTAC22 (see table 3.4) High when counting is enabled. Use a Lemo[®] Type 00 (NIM/CAMAC) cable.</p>
	<p>Functional ground</p> <div style="background-color: #0056b3; color: white; padding: 5px; display: flex; justify-content: space-between;"> Information #8 </div> <p> Although the detector might be already grounded via the mounting bolts, the detector should be grounded additionally via the functional ground connector at the top to establish a defined grounding.</p>

4.2. Detector Control Unit

4.2.1. Configuration

Caution

#8



Do not access or modify the operating system of the detector control unit.

The user interface of the detector control unit is accessible using a web browser. The detector control unit does not need any connections other than the power and Ethernet cables.

The detector control unit has to be connected point-to-point to the detector via 1 x 1GBase-T Ethernet. The detector control unit can be integrated into the site network infrastructure using one of the interfaces described in table 4.3. The detector control unit is optimised for performance and stability of operation. In order to achieve these goals we deliver the detector control unit with fixed firmware (bios etc.) and software (OS) version. The detector control unit must not be operated in an environment where unauthorized access is possible. The detector control unit does not provide authentication mechanisms and is not protected against malicious acts by unauthorized third parties.

Using the web front end, it is possible to restart the EIGER2 control service, trigger an update, and to shut down and to reboot the detector control unit. Any further control of the detector is carried out via the SIMPLON API (see separate documentation).

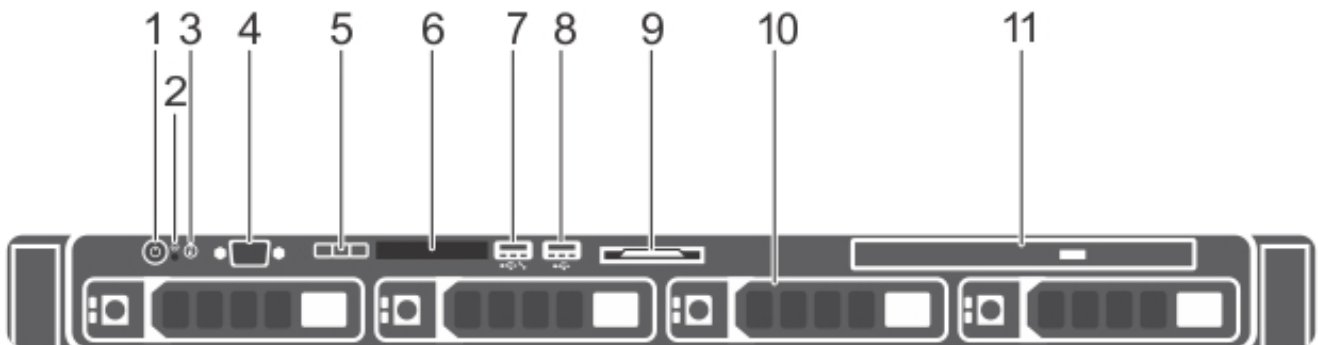


Figure 4.4: EIGER2 R 500K detector control unit as seen from the front.

1: Power button and LED; 9: DELL Service Tag; 11: DVD drive for firmware upgrade; other numbered items are not relevant for operation of the detector system.

Caution

#9



Pushing the power button on the front panel longer than 2 seconds will immediately halt the detector control unit. All image data on the detector control unit will be permanently lost.

Information

#9



Briefly pushing the power button on the front panel will shut down the detector control unit. May take up to 1 min.

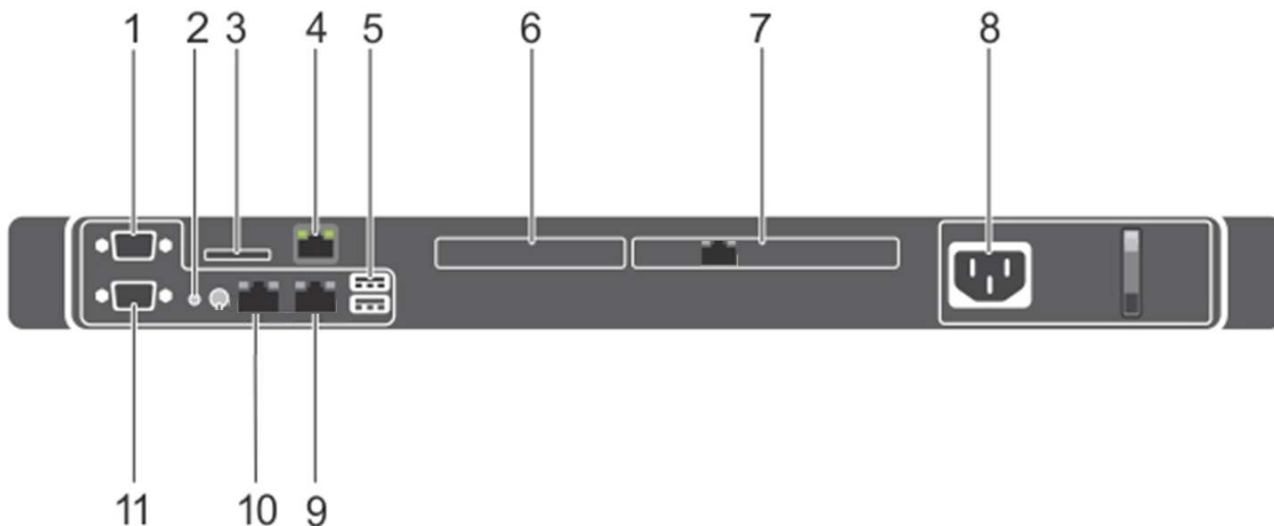


Figure 4.5: EIGER2 R 500K detector control unit as seen from the back. Numbered items relevant for operation of the detector system are described below.

4.2.2. Connectors

Table 4.3: Detector Control Unit Connectors

Connector	Description
EM1 (Embedded, figure 4.5 (10))	Interface Name: EM1 (1 GBase-T) User configurable GbE Network Interface Preconfiguration: DHCP
EM2 (Embedded, figure 4.5 (9))	Interface Name: EM2 (1 GBase-T) Fallback GbE Network Interface Preconfiguration: Static 10.42.41.10 (Netmask 255.255.255.0)
P2P1 (Slot 1, figure 4.5 (7))	10GBase-T Ethernet Detector Interface Port1
Power (figure 4.5 (8))	AC Connector

See DELL owner’s manual for further details.

5. INSTALLING THE DETECTOR SYSTEM

5.1. Transport Considerations

Warning

#3



Avoid vibration and shock when moving the detector.

The detector has been delivered in a robust transport box. Please keep this transport box for transport or storage purpose.

5.2. Mounting

Caution

#10



Do not place the detector near heat sources or in a place subject to direct sunlight, excessive dust or mechanical shock. Make sure that the detector has adequate ventilation.

- Do not cover any air intakes or outlets.
- Place the detector in a location with adequate air circulation.
- Make sure the detector has enough space for proper ventilation (minimum wall distance: 100 mm).
- Do not operate the detector in a closed environment.

5.3. Grounding of the Detector

Caution

#11



The main plug of the detector control unit has to be connected to a grounded power outlet.

Although the detector might be already grounded via the mounting bolts, the detector should be grounded additionally via the functional ground connector at the top in order to establish a defined grounding.

5.4. Mounting the Detector Control Unit

Caution

#12



Make sure that the detector control unit has adequate ventilation.

The detector control unit can be mounted in a standard 19 inch rack, which has to be properly grounded.

6. TEMPERATURE AND HUMIDITY CONTROL

The EIGER2 R 500K detector has a combined temperature and humidity sensor. To start the detector correctly, please refer to section 7.1 and execute the correct startup procedure.

For stable operation, a constant detector temperature is recommended. After switching on the detector, its temperature will reach a constant value after about 30 min to 60 min. The detector temperature will be around 7 °C above ambient temperature. For stable long term measurements, we recommend to control the ambient temperature within a range of ± 1 °C.

Information

#10



A change of the detector temperature will affect the DACs on the readout chip, and thus the measured number of counts in a pixel.

Information

#11



A free-flowing air stream is mandatory in order to properly cool the electronics inside the detector. Do not cover any ventilation holes.

7. OPERATION PROCEDURE

Before operating the detector, make sure you have read the Technical Specifications and the User Manual.

7.1. Getting Started

Before switching on:

- Mount the detector properly.
- Connect the detector to ground potential, using the functional ground connector.
- Connect the detector to power supply; make sure the detector power switch is OFF.
- Connect the power cable, the local network cable, and the detector data cable to the detector control unit. (If more than one Ethernet cable is required, please pay attention to the numbering of the cables as described in table 4.2)

7.2. Startup Procedure

Please use the following startup procedure:

- Turn ON the power switch at the connector plane of the detector.
- Turn on the detector control unit. Wait at least 5 min before trying to connect.

The detector should now be ready to use.

Information

#12



The software start-up procedure is described in detail in the User Manual.

7.3. Turning Off the Detector

To turn off the detector:

- Turn OFF the detector power switch.
- Turn OFF the detector control unit.

7.4. Storing the Detector

Please follow these instructions:

- Put the detector in a plastic bag, add at least 200 g of drying agent (i.e. silica gel) into the bag and seal it air-tight.
- Check the humidity and change the drying agent frequently for compliance with the storage requirements in section 3.3.

7.5. Cleaning and Maintenance

Caution

#13



The Mylar[®] foil must not be touched or cleaned. If it becomes dirty or is damaged, please contact DECTRIS technical support.

The housing can be cleaned with a soft tissue.

The EIGER2 R 500K detector does not require any maintenance.

8. TROUBLESHOOTING

table 8.1 provides an overview of possible problems with the detector system and instructions in order to solve the problems. If the problem you are experiencing is not listed below or if the instructions do not help, please contact support@dectris.com.

Table 8.1: Troubleshooting

Problem	Cause	Solution
Detector control unit does not start properly.	Detector control unit is not powered.	Check the User Documentation of the detector control unit (see section 3.1.3).
Communication error, the detector is not found at startup.	Data cable is not connected or defective.	<p>Check the connection between detector control unit and detector. Make sure that there is a direct, peer-to-peer connection between the detector control unit and the detector.</p> <p>Avoid tangling or strong bending of the Ethernet data cable.</p> <p>Check the status of the LINK LED. If the detector control unit and the detector are powered and correctly connected, the LINK LED should be green (Takes up to 30s after power up).</p>
The detector fails to turn on.	The power cord is not connected or the plug is incompletely inserted.	Connect the power cord firmly. Check the green LED on the external power supply.
Image acquisition not possible.	Detector is not properly initialized.	Initialise the detector via the SIMPLON API. (See API Reference)
Detector housing is humid.	Ambient humidity around the detector exceeds the operating conditions.	Shut down the detector immediately and check the humidity. Power up the detector only when the ambient humidity has been reduced.