



Technical Specifications and Operating Procedure

PILATUS3 R 300K-W Detector System

Version: V3



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1. Document History

1.1. Current document

<i>Version</i>	<i>Date</i>	<i>status</i>	<i>prepared</i>	<i>checked</i>	<i>released</i>
3	18.11.2015	released	MM	AM	AM

Table 1: Document history.

1.2. Changes

<i>Version</i>	<i>Date</i>	<i>Changes</i>
3	09.11.2015	Nitrogen flow, update contact information
2	06.05.2015	Detector power ratings adjusted.
1	20.06.2014	First version.

Table 2: List of changes.

2. General Information

Before operating the PILATUS3 R 300K-W detector system please read the technical specifications and the user manual thoroughly. The technical specification and the user manual together form the user documentation.

2.1. Warranty and Support

Should your detector require warranty service, contact DECTRIS Ltd. for further information.

Before shipping the system back, please contact DECTRIS Ltd. to receive the necessary transport and shipping information. Make sure that the original packaging is used when returning the system!

When returning the detector system for repair, be sure to fill out and include the service form at the back of this document to provide the support division with the necessary information.

2.2. Contact Information

DECTRIS Ltd.
Taefernweg 1
5405 Baden-Daettwil
Switzerland
Phone: +41 56 500 21 00
Fax: + 41 56 500 21 01
Email: support@dectris.com

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

2.3. Safety Symbols

The following symbols and terms are used in this document.




Symbol	Description
	Important or helpful notice.
	Caution. Please follow the instructions carefully to prevent equipment damage or personal injury.
	Ground.

Table 3: Safety symbols.

2.4. Use of the PILATUS3 R 300K-W

The PILATUS3 R 300K-W detector system has been designed for the detection of X-rays from synchrotrons or laboratory sources. It is intended for indoor use only. For other applications, please contact DECTRIS Ltd. for additional information.



When using the detector in vacuum follow strictly the in-vacuum instructions given in this document.

The PC can be mounted in a standard 19-inch rack, which has to be properly grounded.



Make sure that the PC has adequate ventilation.



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

2.5. Product return and recycling

We recycle DECTRIS Ltd. detector systems that are no longer suitable for use. If you are not using your DECTRIS Ltd. 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 Ltd. detector system.

3. Technical Specifications

Number of modules	3 x 1 = 3		
Sensor	Reverse-biased silicon diode array		
Sensor thickness ¹	320 μm	450 μm	1000 μm
Quantum efficiency	at 5.4 keV (Cr):	94%,	94%, > 80%
	at 8.0 keV (Cu):	97%,	98%, 96%
	at 17.5 keV (Mo):	37%,	47%, 76%
Pixel size	172 x 172 μm^2		
Module size	83.8 x 33.5 mm^2		
Format ²	1475 x 195 = 287'625 pixels		
Area	251.4 x 33.5 mm^2		
Intermodule gap	7 pixels = 1.204 mm		
Dynamic range	20 Bits (0:1'048'573)		
Maximum count rate per pixel	$> 2 \times 10^6$ X-ray/sec		
Energy range	4.5 – 36 keV		
Energy resolution	500 eV		
Adjustable threshold range	2.7 – 18 keV		
Threshold dispersion	50 eV		
Readout time	7 ms		
Maximum frame rate	20 Hz		
Point-spread function	1 pixel (FWHM)		
Data formats	Raw data, TIF, EDF, CBF		
Software interface	Through socket connection; Clients for EPICS, SPEC and stand-alone operation are available		
Cooling	Closed circuit (2/3 distilled water 1/3 Ethylenglycol) cooling unit for temperature stabilization. The maximum allowable coolant pressure in the cooling circuit is 3 bar. In-air operation: 23°C In-vacuum operation: 10°C		

Coolant	Use mixture of 2/3 distilled water and 1/3 Ethylenglycol
Dimensions (W x H x D)	280 x 62 x 296 mm ³
Weight	7 kg
Overvoltage category	II
Means of protection	I (TRENEW (SINPRO) power supply)
Pollution degree	II
Maximum altitude	2000 m a.s.l.

Table 4: Technical specifications.

3.1. Ratings

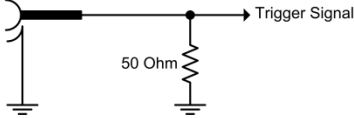

<i>Device</i>	<i>Definition</i>
Detector power input	+12 V DC, 3 A, 36 W
Power supply (AC)	Compact switching power supply unit. Dimensions (W x H x D): 89.5 x 45.5 x 189 mm ³ Weight: 0.8 kg Main inputs: 100 – 240 V AC, 1.58 – 0.64 A, 47 – 63 Hz Output: 12 V DC, 10.84 A
Detector external trigger input	 <p>2.1 V – 5.0 V high level 0.0 V – 0.8 V low level 50 Ω impedance</p> <p> 5.0 V absolute maximum. Applying a higher voltage will damage the input circuit.</p>
Detector enable output	TTL Level (5 V, max. 100 mA)
PC	100 – 240 V AC, 50/60 Hz, 250 W
Cooling unit (Huber minichiller-NR)	230 V AC, 50/60 Hz, max. 2.8 A Max. coolant flow: 20 l/min Max. coolant pressure: 0.18 bar Dimensions (W x H x D): 255 x 380 x 360 mm ³ Weight: 25 kg

Table 5: Ratings.

3.2. Ambient Conditions

The PILATUS3 R 300K-W detector is designed for indoor use only. The following ambient conditions must be satisfied. Please note that the below stated values are for the ambient conditions. Values inside the detector, in particular the dry-air or N₂ supply are different. They are described in section 5.5 and section 6.

Condition	Range
Operating ambient temperature	+20°C to +35°C
Operating ambient humidity	< 80% at 20°C, non-condensing
Storage ambient temperature	+15°C to +40°C
Storage ambient humidity	< 40% at 20°C, non-condensing

Table 6: Detector operating conditions. Note that the interior humidity under operating conditions must be < 25%.



Note that the interior humidity under operating conditions must be < 25%.



When storing the detector make sure the temperature and humidity inside the transport box does not exceed the specified range. Use drying agent.



If the detector system is stored at low temperature, make sure that no condensation moisture develops.



The PILATUS3 R 300K-W is equipped with two temperature and humidity sensors.

3.3. Vacuum Conditions



Only vacuum compatible PILATUS3 R 300K-W are allowed to be operated in vacuum. Please contact support@dectris.com for information regarding vacuum compatibility upgrade.

For in-vacuum operation of the detector the following conditions must be fulfilled:

Condition	Range
Chamber pressure during operation	10 ⁺³ mbar or less than 10 ⁻² mbar
Chamber temperature during operation	+10° to +25°C
Chamber temperature during “bake-out” (unpowered)	max. +60°C (for temperatures > 40°C make sure the cooling unit is set to +40°C and running)

Table 7: Vacuum field codes.

4. Detector Dimensions and Connectors

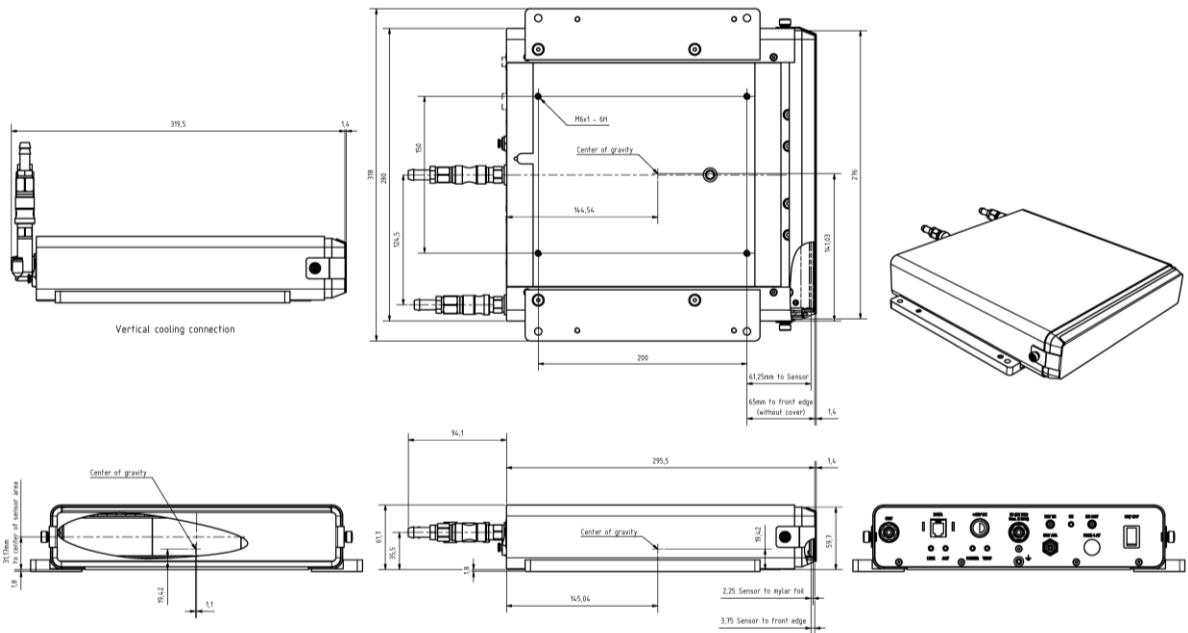



Figure 1: Drawing of the PILATUS3 R 300K-W detector (printed separately in the user documentation folder).

4.1. The PILATUS3 R 300K-W Detector

4.1.1. Front Side of the Detector

The detector comes with a protective cover (2 mm, low carbon steel sheet metal 1.0330, St12) for the front window, which should only be removed for operation. The sensors are behind a 12 μm thick Mylar[®] (PET) foil coated with 100 nm aluminum to protect them from dust and touch.

 Do not touch the Mylar[®] foil.


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



Figure 2: The PILATUS3 R 300K-W detector with the cover in place (front view).



Figure 3: The PILATUS3 R 300K-W detector with the cover removed (front view).

4.1.2. Back Side of the Detector



Figure 4: The PILATUS3 R 300K-W detector viewed from the back.

4.1.3. The Status LEDs

LED	Description
LINK	Green if detector and PC are powered and connected via the RJ45 data cable.
ACT	Flashing green, if there is activity on the data line between detector and PC.
EN	Yellow, if the detector is in counting mode.
TEMP	Normally green. Turns red if the detector temperature or humidity is out of the limits.
POWER	Normally green. Turns red if there is a power failure or if the detector temperature or humidity is out of the limits.

Table 8: Description of the status LEDs on the detector back panel.

4.1.4. Connectors and Connecting Cables/Pipes




Connector	Description
DATA	<p>RJ45 Cat 6 S/FTP cable for data transfer.</p> <p> Note that there must be a 1 Gbit point-to-point connection between detector and PC.</p>
+12 V DC	Main voltage 12 V DC from the external power supply.
EXT IN	<p>External trigger input.</p> <p>Use a Lemo® Type 00 (NIM/CAMAC) cable.</p>
EN OUT	<p>TTL Level (5 V) output signal; high when counting is enabled.</p> <p>Use a Lemo® Type 00 (NIM/CAMAC) cable.</p>
	<p>Functional ground of the detector system.</p> <p> Although the detector might be grounded via the mounting bolts, the detector can be grounded additionally via the functional ground connector at the back (M4 screw-in tap hole) to establish a defined grounding.</p>
DRY AIR	Dry air or nitrogen for humidity control. For details see section 5.5. Pipe: Use a pipe with outer diameter of 4 mm.
IN	Cooling water inlet.
OUT	Cooling water outlet.
FUSE 4 AT	4 A slow-blow fuse (e.g. SCHURTER part no. 0001.2510). For continued protection always replace with the same type!

Table 9: Connectors and connecting cables/pipes.

4.2. Computer

4.2.1. Configuration



Do not install or run any other software on the computer, except tools and software necessary for configuring your data acquisition protocol.

The detector PC is set up with a standard installation of the CentOS 6.2 Linux distribution. Regular system updates can be made. However, to avoid operational deterioration do not update the system while the detector is taking data.



The detector PC has two hard disks: disk #1 houses the operating system while disk #2 is reserved for the data (mount point /disk/images). Readout data, i.e. images, are always written to disk #2.



Do not remove the symbolic link in the directory ~/p2_det/images, which points to the directory /disk/images/!



Do not change the configuration of the Ethernet adapter em2!

The PC has two onboard 1 Gbit Ethernet adapters:

- em1, labeled as Gb1, can be used to connect to the local network or Internet. By default it is configured for DHCP.
- em2, labeled as Gb2, is reserved for the detector and set to a static IP address (10.0.11.1). Furthermore, the startup script /etc/rc.local disables ARP for em2. Do not change this!



Note: ARP is re-enabled if the network service has been restarted. In this case execute the startup script /etc/rc.local as super user or reboot the system.

To assure stable operation of the detector system the configuration file /etc/sysctl.conf is changed such that the Ethernet rx and tx buffers are greater than the standard setting.



The firewall and SELinux are disabled by default (otherwise the following ports must be open for UDP: 52010, 52011, 52012).



The following firewall port must be open if you want to connect to Camserver with a TCP/IP socket connection from the outside: 41234

4.2.2. Samba share

There is a Samba share configured on the detector PC. The Samba service is enabled by default and running after the system boots.

The storage directory for the images, /home/det/p2_det/images, which is a symbolic link to /data/images, can be accessed from a Samba client. You need the same user name and password as for the normal console or ssh login .

From a Linux or Mac OSX terminal window issue the following command:

```
smbclient //server-ip-or-hostname/images -U det
```

To browse the Samba share from Windows, type

```
\\server-ip-or-hostname\images
```

in the Windows Explorer address bar.

4.3. Cooling unit

A cooling unit is required for the operation of the PILATUS3 R 300K-W detector system. The cooling unit is available as an option from DECTRIS or can be supplied by the customer.

For in-air operation the tubes and the detector are equipped with self-sealing valves to avoid dripping when connecting or disconnecting the tubes.

For in-vacuum operation unscrew the self-sealing valves from the detector (RECTUS 204KL series) and use vacuum-compatible fittings (1/8 inch ISO parallel thread) and o-rings. Before opening the cooling circuit always remove the cooling liquid to avoid dripping.

There is no fixed limitation on the length of the tubing.



Before operating the cooling unit, please read the user manual of the cooling unit.



When connecting or disconnecting the cooling hoses, turn off the detector and the cooling unit.



When operating the detector, the cooling unit must be always on.



Use opaque tubing to avoid the growth of algae.

Operating type	in-air or vented vacuum	in-vacuum
Operating temperature	The cooling unit has always to be set to a temperature of 23°C.	<p>Prior to and during pumping down and venting the cooling unit has to be set to a temperature of 23°C for at least 30 minutes.</p> <p>Prior to powering up and operating the detector in-vacuum the cooling unit has to be set to a temperature of 10°C for at least 30 minutes.</p>
Operating pressure	max. 3 bar	max. 2 bar



Do not set the temperature of the cooling unit below the recommended operating temperature. Condensing moisture can develop and damage the detector.

5. Installing the Detector System

5.1. Mounting

The detector can be mounted in two ways:

5.2. Mounting from Above

Use the optional mounting brackets. These mounting brackets have to be mounted from below on the base plate of the detector. The detector should be mounted using all four outer 7 mm holes (blue).



Make sure the mounting brackets are mounted and properly tightened using the four optional M4 screws (green).

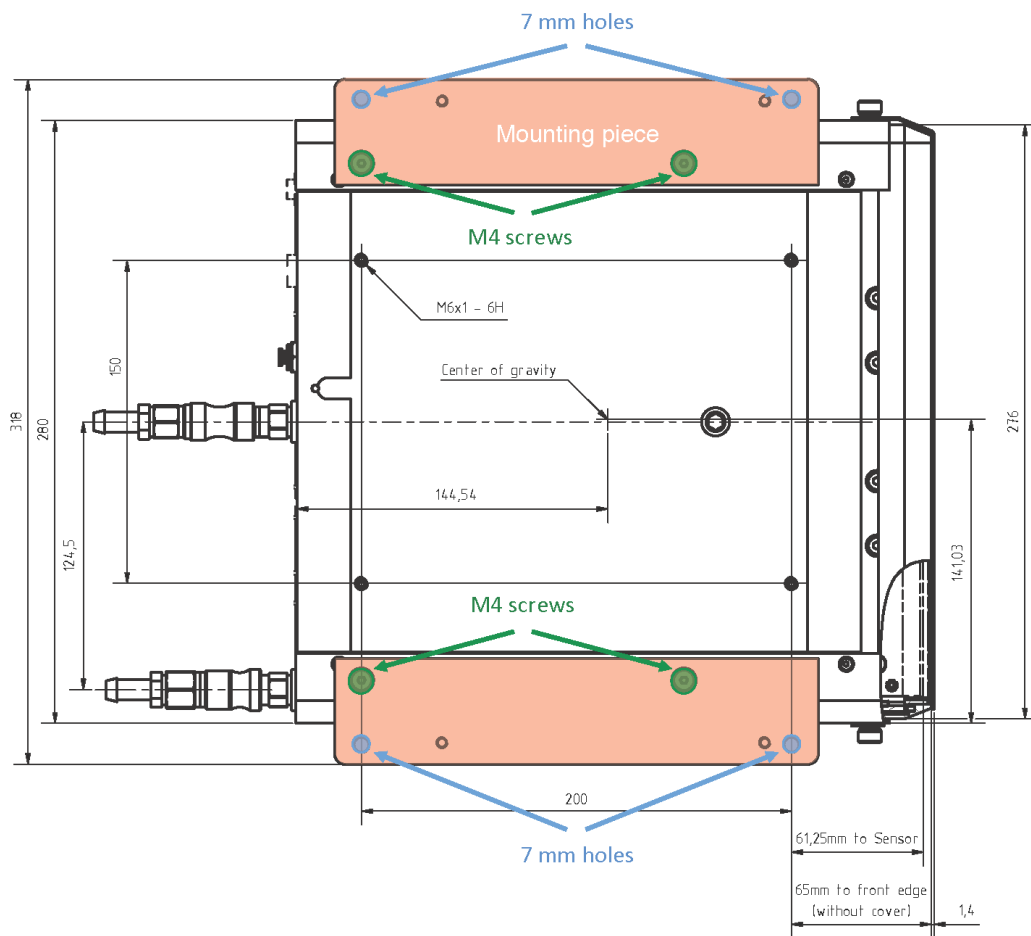


Figure 5: Drawing of the PILATUS3 R 300K-W detector base plate (printed separately in the user documentation folder).

5.3. Mounting from Below

The detector should be mounted using the four internal M6x1 threads (yellow).

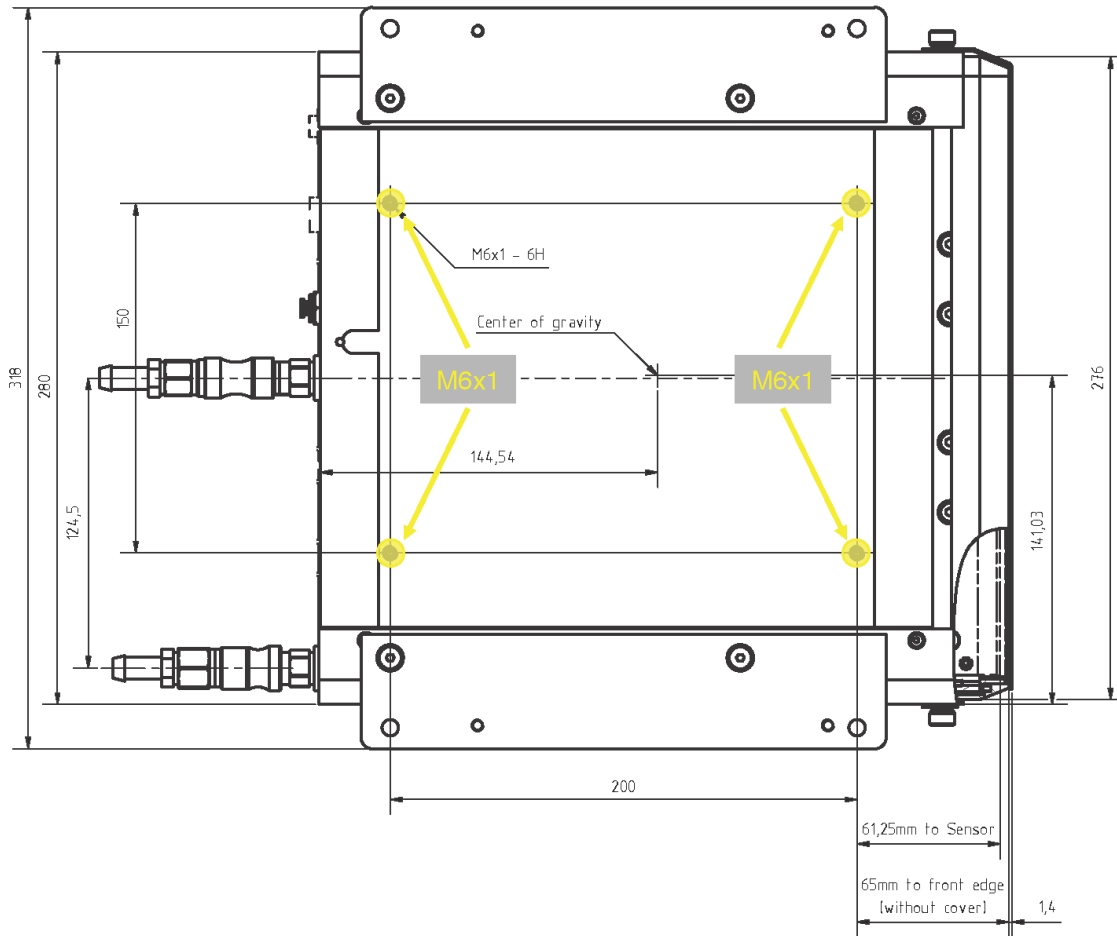



Figure 6: Drawing of the PILATUS3 R 300K-W detector base plate (printed separately in the user documentation folder).

 The four M6 screws must not intrude into the detector more than 10 mm.

 Make sure the detector is properly mounted.

5.4. Grounding of the Detector



The main plug of the PC and the power supply of the detector have to be connected to the grounded power outlet.



Although the detector might be grounded via the mounting bolts, the detector can be grounded additionally via the functional ground connector at the back to establish a defined grounding.

5.5. Connection to Nitrogen or Dry Air

The PILATUS3 R 300K-W detector has to be connected to a nitrogen or dry air flow to avoid humidity and condensation when it is outside the storage box. For connection see section 4.1.4. For storage see section 9 and section 3.2.



Humidity can damage the detector. Make sure that the detector is operated in the specified range.



Nitrogen or dry air can be used for humidity control. Dry air has to be oil free with a relative humidity < 20%. For reliable operation we recommend dry air of < 5% relative humidity.



A flow of 5 to 10 l/h is usually sufficient for humidity control. If gas consumption is a concern, for instance when a bottle of nitrogen is used as a supply, it is recommended to connect a flow meter on the outside of the detector and adjust the gas flow to 5 to 10 l/h.



The gas pressure must not exceed 2 bar. The minimum gas pressure is 1 bar.

For in-vacuum operation no nitrogen or dry air flow is necessary.



To avoid condensation always make sure the detector is turned OFF and at room temperature prior to pumping down or venting. Use nitrogen or dry air for venting the vacuum chamber.

5.6. Connection to cooling unit

The PILATUS3 R 300K-W detector is water-cooled and must be connected to an appropriate cooling circuit or dedicated cooling unit.



See Table 4 for the maximum allowable coolant pressure in the cooling circuit of the detector!



For in-air operation always use the supplied hose couplings (RECTUS 204KL series)!



For in-vacuum operation unscrew the supplied hose couplings (RECTUS 204KL series) from the detector and use vacuum-compatible fittings (1/8 inch ISO parallel thread) and o-rings.

Using the optional aluminum adapter and the two eye-screws it is possible to vertically connect the hoses to the detector back (Figure 8: Vertical cooling connection (the red marked aluminum adapter together with two eye-screws are optionally supplied with the detector).). The detector is delivered for horizontal connection of the hoses.

If you change the configuration, make sure that the couplings are properly mounted and sealed.

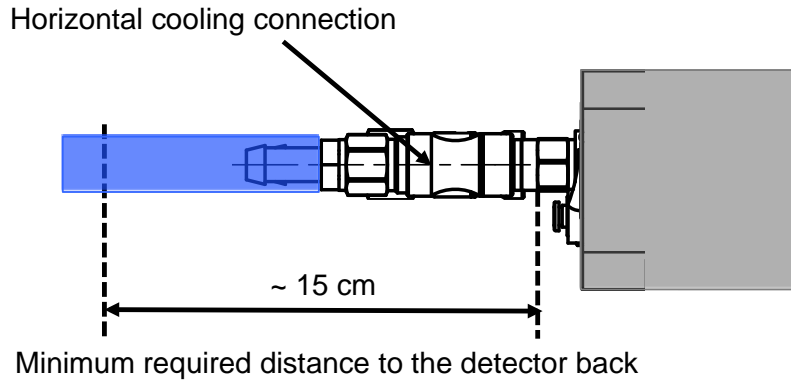


Figure 7: Horizontal cooling connection (standard configuration).

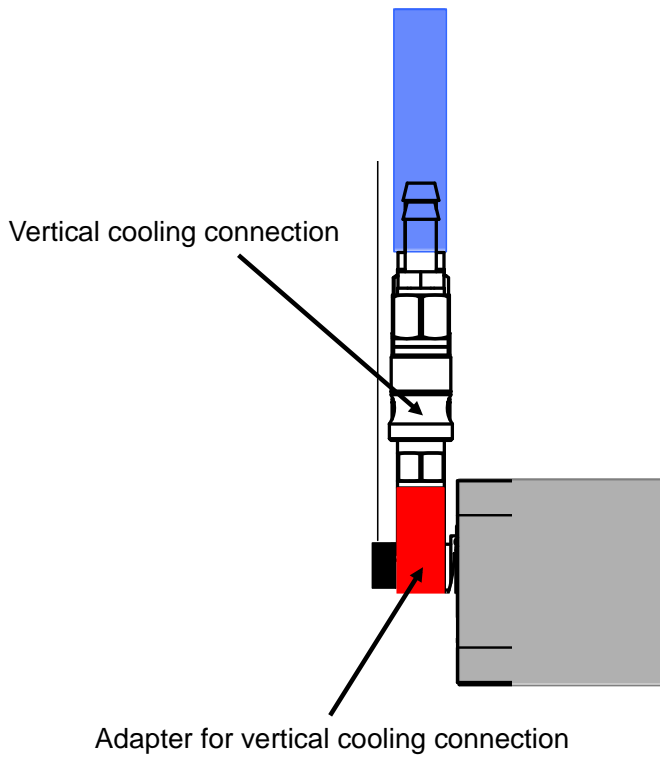


Figure 8: Vertical cooling connection (the red marked aluminum adapter together with two eye-screws are optionally supplied with the detector).

6. Temperature and Humidity Control

The PILATUS3 R 300K-W detector has two combined temperature and humidity sensors. The temperature and humidity control shuts down the power of the detector modules when the humidity or the temperature of the sensor exceeds the following limits:

Channel	Location	Shutdown Temperature [°C]		Shutdown Humidity [%]
		Low limit	High limit	High limit
1	Module frame	5	50	30 (25 for start-up)
2	Cooling plate	5	35	70 (65 for start-up)

Table 10: Temperature and humidity limits.

The communication with the PC will remain active after a temperature shut down (only shuts down the power of the modules).

To start the detector correctly, please refer to section 7 and execute the correct startup procedure.



In-vacuum operation: The temperature and humidity control cannot prevent condensation issues and resulting damage to the sensor due to improper use. Always make sure that the detector is warmed up (cooling temperature set at 23°C) prior to pumping down / venting / opening the chamber and only use dry air or nitrogen for venting.

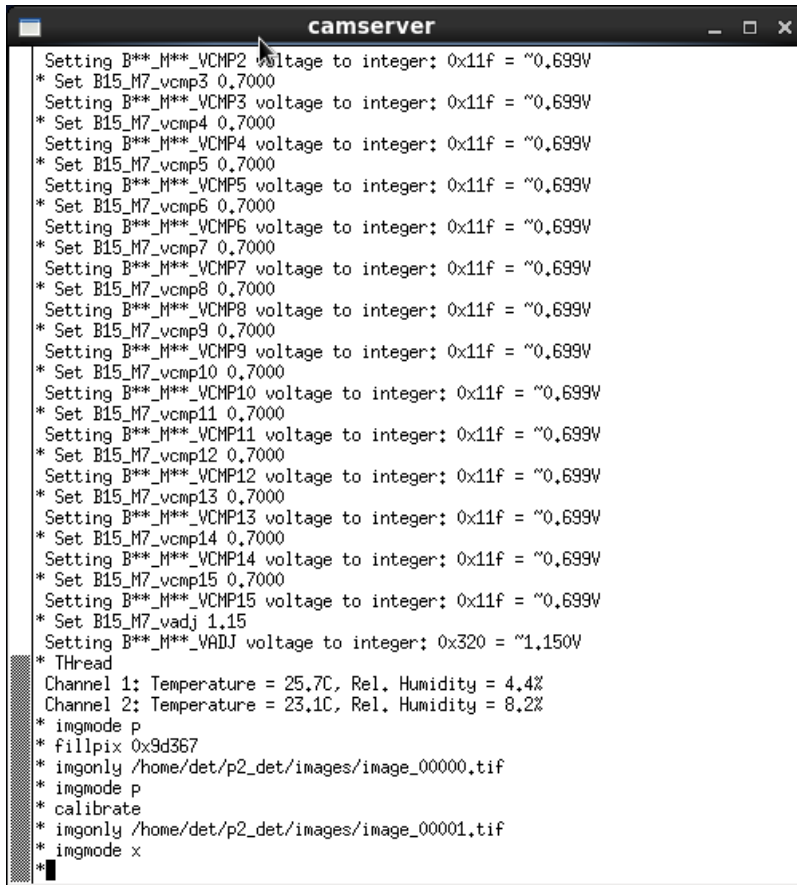


If the humidity is outside the specified range, the software will prevent powering up the modules and exit with a corresponding message.

```
camserver
Read detector hardware definitions from:
/home/det/p2_det/config/cam_data/p2det.def
Using 10-bit DACs on MCBs
# p2det.def - hardware definitions for PILATUS detectors
Building standard xor table
Configured from /home/det/p2_det/camrc
Read camera setup data from:
/home/det/p2_det/config/cam_data/camera.def
Code release: txxe-7.4.00-120718
Ethernet interface scan:
1. em1, IP address: 192.168.20.187
2. em2, IP address: 10.0.11.1
3. p3p1, IP address: 10.0.10.1
Found 3 active ethernet interface(s)
Using interface p3p1
DCBe scan (p3p1):
DCBe #1 firmware version: 0x0102
DCBe #1 board assembly version: 1
DCBe #1 readout clock frequency: 67.0 MHz
Found 1 DCBe(s)
Temperature/Humidity sensor channel #1 enabled on DCBe #1
Temperature/Humidity sensor channel #2 enabled on DCBe #1
*** ERROR - temperature too high; 31.1C (channel #2)
Bad return from dcbe_initialize()
Camera initialization error -- press <enter> to exit
```

Figure 9: Error message when temperature or humidity is out of range.

Make sure that the cooling unit is running at the recommended temperature (according to section 4.3) and that Nitrogen or dry air flow is turned on at the recommended flow rate (for in-air operation only, according to section 5.5). Then restart the software.

The image shows a terminal window titled "camserver". The window contains a series of commands and their outputs. The commands are: "Setting B**_M**_VCMP2 voltage to integer: 0x11f = ~0.699V", "* Set B15_M7_vcmp3 0.7000", "Setting B**_M**_VCMP3 voltage to integer: 0x11f = ~0.699V", "* Set B15_M7_vcmp4 0.7000", "Setting B**_M**_VCMP4 voltage to integer: 0x11f = ~0.699V", "* Set B15_M7_vcmp5 0.7000", "Setting B**_M**_VCMP5 voltage to integer: 0x11f = ~0.699V", "* Set B15_M7_vcmp6 0.7000", "Setting B**_M**_VCMP6 voltage to integer: 0x11f = ~0.699V", "* Set B15_M7_vcmp7 0.7000", "Setting B**_M**_VCMP7 voltage to integer: 0x11f = ~0.699V", "* Set B15_M7_vcmp8 0.7000", "Setting B**_M**_VCMP8 voltage to integer: 0x11f = ~0.699V", "* Set B15_M7_vcmp9 0.7000", "Setting B**_M**_VCMP9 voltage to integer: 0x11f = ~0.699V", "* Set B15_M7_vcmp10 0.7000", "Setting B**_M**_VCMP10 voltage to integer: 0x11f = ~0.699V", "* Set B15_M7_vcmp11 0.7000", "Setting B**_M**_VCMP11 voltage to integer: 0x11f = ~0.699V", "* Set B15_M7_vcmp12 0.7000", "Setting B**_M**_VCMP12 voltage to integer: 0x11f = ~0.699V", "* Set B15_M7_vcmp13 0.7000", "Setting B**_M**_VCMP13 voltage to integer: 0x11f = ~0.699V", "* Set B15_M7_vcmp14 0.7000", "Setting B**_M**_VCMP14 voltage to integer: 0x11f = ~0.699V", "* Set B15_M7_vcmp15 0.7000", "Setting B**_M**_VCMP15 voltage to integer: 0x11f = ~0.699V", "* Set B15_M7_vadj 1.15", "Setting B**_M**_VADJ voltage to integer: 0x320 = ~1.150V", "* TThread", "Channel 1: Temperature = 25.7C, Rel. Humidity = 4.4%", "Channel 2: Temperature = 23.1C, Rel. Humidity = 8.2%", "* imgmode p", "* fillpix 0x9d367", "* imgonly /home/det/p2_det/images/image_00000.tif", "* imgmode p", "* calibrate", "* imgonly /home/det/p2_det/images/image_00001.tif", "* imgmode x". The terminal cursor is at the end of the last line.

```
Setting B**_M**_VCMP2 voltage to integer: 0x11f = ~0.699V
* Set B15_M7_vcmp3 0.7000
Setting B**_M**_VCMP3 voltage to integer: 0x11f = ~0.699V
* Set B15_M7_vcmp4 0.7000
Setting B**_M**_VCMP4 voltage to integer: 0x11f = ~0.699V
* Set B15_M7_vcmp5 0.7000
Setting B**_M**_VCMP5 voltage to integer: 0x11f = ~0.699V
* Set B15_M7_vcmp6 0.7000
Setting B**_M**_VCMP6 voltage to integer: 0x11f = ~0.699V
* Set B15_M7_vcmp7 0.7000
Setting B**_M**_VCMP7 voltage to integer: 0x11f = ~0.699V
* Set B15_M7_vcmp8 0.7000
Setting B**_M**_VCMP8 voltage to integer: 0x11f = ~0.699V
* Set B15_M7_vcmp9 0.7000
Setting B**_M**_VCMP9 voltage to integer: 0x11f = ~0.699V
* Set B15_M7_vcmp10 0.7000
Setting B**_M**_VCMP10 voltage to integer: 0x11f = ~0.699V
* Set B15_M7_vcmp11 0.7000
Setting B**_M**_VCMP11 voltage to integer: 0x11f = ~0.699V
* Set B15_M7_vcmp12 0.7000
Setting B**_M**_VCMP12 voltage to integer: 0x11f = ~0.699V
* Set B15_M7_vcmp13 0.7000
Setting B**_M**_VCMP13 voltage to integer: 0x11f = ~0.699V
* Set B15_M7_vcmp14 0.7000
Setting B**_M**_VCMP14 voltage to integer: 0x11f = ~0.699V
* Set B15_M7_vcmp15 0.7000
Setting B**_M**_VCMP15 voltage to integer: 0x11f = ~0.699V
* Set B15_M7_vadj 1.15
Setting B**_M**_VADJ voltage to integer: 0x320 = ~1.150V
* TThread
Channel 1: Temperature = 25.7C, Rel. Humidity = 4.4%
Channel 2: Temperature = 23.1C, Rel. Humidity = 8.2%
* imgmode p
* fillpix 0x9d367
* imgonly /home/det/p2_det/images/image_00000.tif
* imgmode p
* calibrate
* imgonly /home/det/p2_det/images/image_00001.tif
* imgmode x
```

Figure 10: Correct start-up message.

Check the temperature and humidity with the command "TThread" in camserver. This reads and displays the actual temperature and humidity of the sensors as shown above.

7. Getting Started

Before operating the detector, make sure you have read the previous chapters in the technical specification and the user manual.



Check these items before turning the detector system on:

In-air operation:

- Mount the detector properly.
- Connect the detector to power, make sure the detector power switch is OFF.
- Connect the detector to nitrogen or dry air at the recommended flow rate.
- Connect the coolant tubes. Make sure they are properly mounted on both sides.
- Set the cooling temperature to 23°C and turn on the cooling unit.
- Connect the PC and the detector data cables.
- Attach a monitor, keyboard and mouse to the PC.

In-vacuum operation:

- Mount the detector properly inside the vacuum chamber.
- Connect the detector power, data, trigger and cooling lines inside and outside the vacuum chamber.
- Make sure the power switch on the back of the detector is ON and the power switch on the detector power supply is OFF (i.e. the detector can be powered up later from outside the vacuum chamber).
- Close the vacuum chamber and start to pump down.
- Once the vacuum is $< 10^{-2}$ mbar set the cooling temperature to 10°C and turn on the cooling unit (pumping down a warm detector prevents condensation issues).
- Connect the PC and the detector data cables.
- Attach a monitor, keyboard and mouse to the PC.



In-vacuum operation - prior to pumping down (and venting):

- Always make sure the detector is SWITCHED OFF and WARMED UP to room temperature. Otherwise it could be damaged through electrical discharge or condensation.

7.1. Startup Procedure

- in-air operation: Turn on nitrogen or dry air flow at least 30 minutes before turning on the detector. Then turn ON the power switch at the back of the detector.
- in-vacuum operation: Let the cooling unit stabilize at 10°C for at least 30 minutes and verify, that the vacuum is $< 10^{-2}$ mbar. Then turn ON the power switch on the detector power supply.
- Turn on the PC.
- Start a shell.
- The default path is: /home/det.
- Change the directory to: p2_det/.
- Type ./runtvx (./runtvx starts a script which initializes the detector system and opens the Camserver and TVX windows).



If you want to control the detector with a TCP/IP client, type ./camonly in the directory p2_det/. ./camonly starts a script which initializes the detector system and opens the Camserver window. Please refer to the user manual for further information.

7.2. First Commands

- See the detailed description of all commands in the user manual.
- Type the following commands in TVX:
 - rbd: self test of the detector (digital part of all pixels).
 - calibdet: self test of the detector (analog part of all pixels).
 - cam setCu: sets the energy threshold of the detector for 8 keV X-rays. It is important that an appropriate threshold is set, otherwise the detector is not trimmed. See the user manual for more information!
 - expose 10: creates an image with an exposure time of 10 seconds.

8. Turning off the Detector

In-air operation:

- Turn OFF the detector power switch.
- Do not remove the nitrogen/dry air connection and leave it at the recommended flow rate according to section 5.5.

In-vacuum operation:

- Turn OFF the power switch on the detector power supply.
- Keep the detector under vacuum.



In-vacuum operation - prior to venting the chamber:

- Turn OFF the power switch on the detector power supply.
- Set the cooling temperature to 23°C and let the detector warm up at least 30 minutes to prevent condensation inside the vacuum chamber.
- Use dry air or nitrogen to vent the chamber.



If you turn off the detector while Camserver is running you will get error messages after a few minutes because Camserver cannot communicate with the detector. You may want to exit Camserver.



You must restart Camserver after the detector has been turned on! Otherwise the detector is not initialized.

9. Storing the Detector

Even if the detector is not in operation, it is recommended to maintain the nitrogen or dry air flow.

In case the detector is stored, please follow these instructions:

For storage of up to 1 week:

Store the detector in the storage box and add 200 g drying agent (i.e. silica gel) into the storage box.

For storage longer than 1 week:

Pack the detector into a plastic bag, add drying agent into the plastic bag and seal the plastic bag. Then place the detector in the storage box and add 200 g drying agent (i.e. silica gel) to the storage box. Check the humidity inside the box frequently for compliance with the storage requirements in section 3.2.

10. Cleaning and Maintenance

The housing can be cleaned with a soft tissue.



The Mylar[®] foil must not be touched or cleaned.

The PILATUS3 R 300K-W detector system is maintenance free.

Maintenance instructions for the cooling unit are provided in the cooling unit's manual.

11. Troubleshooting

Refer to the table below if your detector does not function properly. If the problem you are experiencing is not listed below or if the instructions do not help, please contact support@dectris.com.

Problem	Cause	Remedy
PC does not start properly.	PC is not powered.	Depending on the type of PC, there are switches on the back and on the front panel of the PC, which have to be in the correct position.
Communication error, the detector is not found at Camserver startup.	Data cable is incorrectly connected or defective. The configuration of the 1 Gbit Ethernet adapter em2 is wrong.	<p>Check the connection between PC and detector. Make sure that there is a direct connection between the PC (ethernet port em2) and the detector.</p> <p>Avoid tangling or strong bending of the ethernet data cable.</p> <p>Check configuration of the ethernet adapter em2, see section 4.2.</p> <p>Check the status of the LINK LED. If PC and detector are powered and correctly connected, the LINK LED should be green.</p>
Detector shuts down.	Temperature or humidity error: See section 7 for the temperature and humidity shut down values.	<p>Check that the detector is properly supplied with coolant.</p> <p>Check the flow of nitrogen or dry air.</p> <p>Check the temperature of the coolant at the front panel of the cooling unit.</p> <p>Check the temperature of the detector with the command in Camserver: type "thread".</p> <p>Wait until the detector cools down.</p> <p>Restart the detector again.</p> <p>Check the LEDs at the back of the detector: If the TEMP and the POWER LEDs are red, a temperature or humidity error has occurred.</p>

Problem	Cause	Remedy
Detector shuts down.	<p>Module over current:</p> <p>The energy threshold level is set too low and the detector starts oscillating.</p>	Increase the threshold level. In Camserver type: setCu.
The detector fails to turn on.	<p>The power cord is not connected or the plug is incompletely inserted.</p> <p>The fuse is blown.</p>	<p>Connect the power cord firmly. Check the green LED on the external power supply.</p> <p>Replace the fuse, see section 4.1.4</p>
Images look strange after initialization.	Detector is not properly initialized.	<p>Run the following commands in TVX:</p> <pre>setdac calibdet expose 1</pre> <p>Check the status of the POWER LED at the back of the detector. If it is red and the TEMP LED is green, there may be a problem with the electronics – contact support@dectris.com.</p>
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.

Table 11: Troubleshooting.

12. Certification Tests

The product is in conformity with the following standards:

EN 61326-1: 2013 / IEC 61326-1: 2012

EN 61010-1: 2010 / IEC 61010-1: 2010

Service Form

Model No.: _____ Serial No.: _____ Date: _____

Name and phone No.: _____

Company: _____

List of all control settings. Describe the problem and check boxes below that apply to the problem.

- Checked all cables
- Problem on power-up
- Detector system is unstable

What power line is used? _____

Ambient temperature? _____

Relative humidity? _____

Add additional information. If the user has made special modifications, please describe. _____
