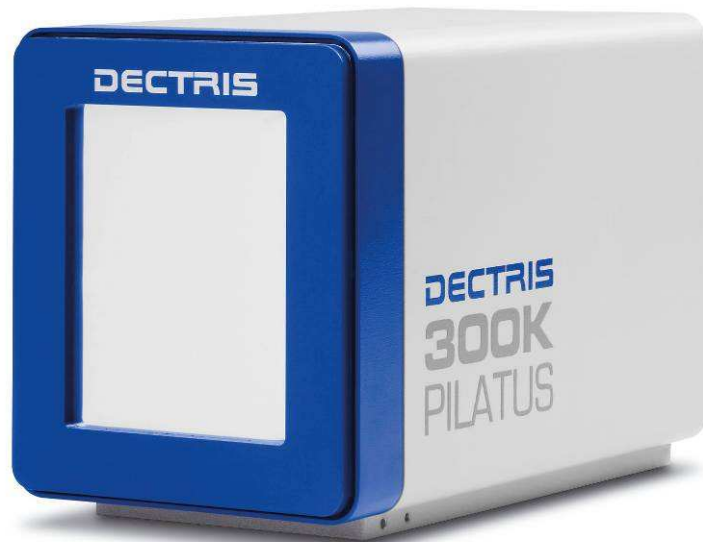


Technical Specification and Operating Procedure

PILATUS 300K



Version 1.1



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1 Document History

Actual document

Version	Date	status	prepared	checked	released
1.1	9.2.2009	Released	PS	EFE, MS	PS

1.1 Changes

Version	Date	Changes
1.1	9.2.2009	Changes in startup routine Change of IP address Fault finding added



2 How to use this technical specification

Before you start to operate the PILATUS detector system please read this technical specification and the user manual thoroughly.

The technical specification and the user manual form together the user documentation.

This user documentation has been especially designed for DECTRIS PILATUS detector systems.






2.1 Address and support

DECTRIS Ltd.
Neuenhoferstrasse 107
5400 Baden
Switzerland
Phone: +41 56 500 21 00
Fax: + 41 56 500 21 01

Email: support@dectris.com

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

2.2 Explanation of symbols

Symbol	Description
	Important or helpful notice
	Caution. Please follow the instruction carefully to prevent equipment damage or personal injury.
	DC-current
	AC-current
	Ground



2.3 Explanation of terms

Term	Description
MCB	Module control board
DCB	Detector control board
DAC	Digital to Analog Converter

2.4 Use of the PILATUS 300K

The PILATUS 300K 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 for additional information.




3 Technical specification

Number of modules	1 x 3 = 3
Sensor	Reverse-biased silicon diode array
Sensor thickness	320 μm
Pixel size	172 x 172 μm^2
Module size	83.8 x 33.5 mm^2
Format	487 x 619 = 301'453 pixels
Area	83.8 x 106.5 mm^2
Intermodule gap	17 pixels = 2.924 mm
Dynamic range	20 Bits = 1'048'576
Counting rate per pixel	$> 2 \times 10^6$ X-ray/sec
Energy range	3–30 keV
Energy resolution	500 eV
Adjustable threshold range	2 – 20 keV
Threshold dispersion	50 eV
Readout time	2.6 ms
Framing rate	200 Hz
Point-spread function	1 pixel
Cooling	Air-cooled
Power consumption	50 W
Operating temperature	20 - 30°C
Dimensions (W x H x D)	160 x 194 x 289 mm^3
Weight	11 kg



3.1 Ratings

Device	Definition
Detector Power Input	100 - 240 VAC, 50-60 Hz 400 Watt It can be connected to all common supply voltages.
Detector External Trigger Input	5 V TTL; 5.0 V absolute maximum  Applying a higher voltage will destroy the input
Detector Enable output	3.3 V TTL
PC	100V-240 VAC; 8A - 4A 50/60Hz 960 Watt It can be connected to all common supply voltages.



3.2 Ambient conditions

The PILATUS 300K detector is designed only for indoor use according the following ambient conditions.

Condition	Range
Operating temperature:	20+ to 35°C
Operating humidity:	<70% at 20°C, non condensing
Storage temperature	15° to 40° C
Storage humidity	< 75% at 20°C, non condensing



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

3.3 Temperature shut down

The PILATUS 300K detector head has a temperature control mechanism, which shuts the power of the detector modules down when the temperature exceeds 45°C. The fan and communication with the PC will remain active. An overtemperature error is displayed as follows: the TEMP and the POWER LED on the back of the detector turns red.

Procedure:

1. Wait until detector cools down
2. Turn the detector off
3. Turn the detector on to reinitialize



4 Dimensions and connectors

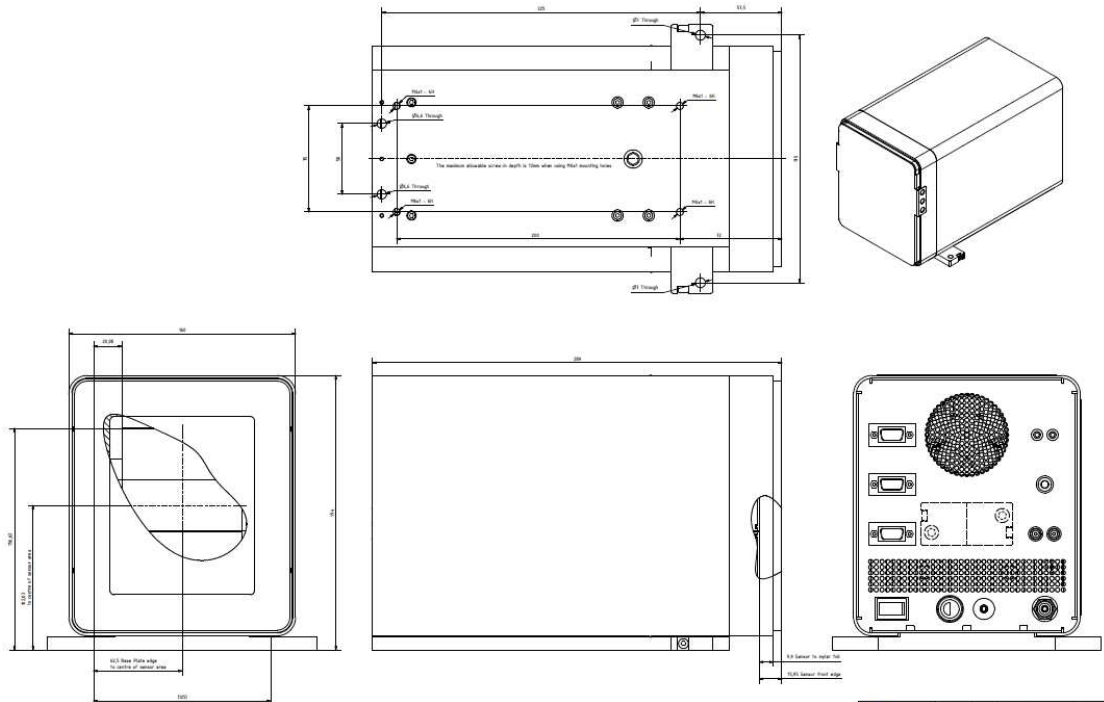


Figure 1 Drawing of the PILATUS 300K detector (is printed separately in the user manual folder)

The detector comes with a protective aluminum cover for the front window and the sensor that should be removed for operation. The sensor is behind a 25 μm thick aluminized mylar foil to protect it from dust and touch.

The cover is mounted on four bolts and can be removed by lifting it slightly up and removing it.

When mounting the cover, make sure it fits into all four bolts.



Do not touch the mylar foil



The aluminium cover will not protect the detector from direct synchrotron beam.



Figure 2 PILATUS 300K detector with aluminum cover in place (front view)






Figure 3 PILATUS 300K detector with aluminum cover removed (front view)



4.1 Backside of the detector



Figure 4 PILATUS 300K detector viewed from the back

Connector	Description
DATA 1 (D1)	Data connection 1
DATA 2 (D2)	Data connection 2
DATA 3 (D3)	Data connection 3
+12 V	Main voltage 12 VDC from external power supply
EXT IN	External Trigger Input (TTL, lemo connector)  The input voltage should not exceed 5V
EN OUT	TTL output signal; high when counting is enabled.
Ground 	Grounding of the detector.  Although the detector may be grounded via the mounting bolts, the detector must be grounded via this connector to establish a defined grounding.
N2	Nitrogen for humidity control. Recommended continuous flow: 1L / hour



LED	Description
Power	If green, all supply voltages are ok Red, if module power is off or with overtemperature
Temp	Normally green. Turns red when detector temperature exceeds 45°C.
EN	Yellow, detector is making an exposure

The fixation pieces are stored on the back of the detector.

4.2 Computer

The system is comes with two computers configured as master and slave. The slave is equipped with two proprietary data acquisition cards to communicate with the detector, whereas the master is equipped with only one card.



The PCs should be kept behind a firewall and shouldn't have outside internet access.



The operating system is optimized for high speed data acquisition and has a custom kernel: Therefore do not permit any software upgrades on the kernel

Technical specifications of the computers are in the system information sheet.

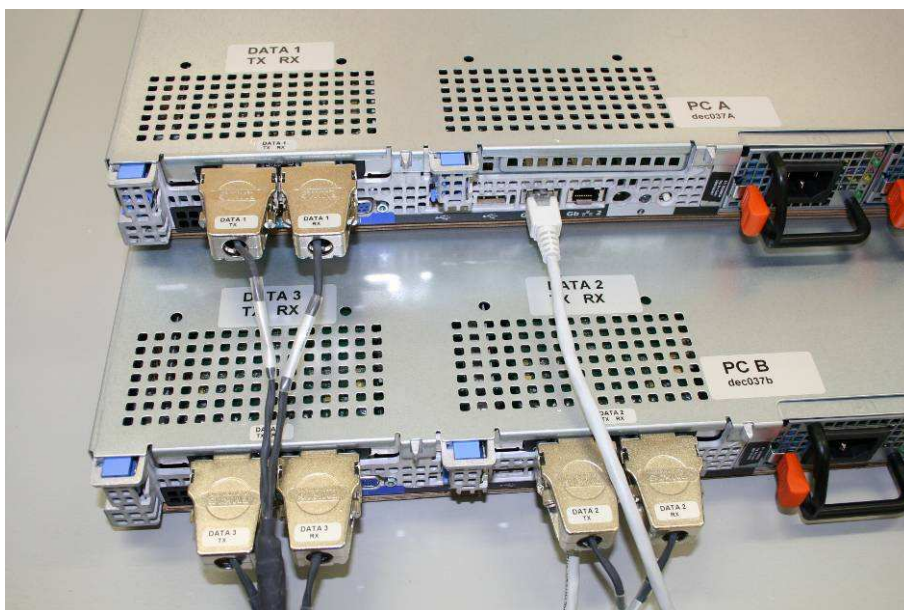


Figure 5 PCs from the back with 2 data acquisition cards inside and 3 data cables connected



Figure 6 Detail of interconnection between PC A and PC B. (Data cables not connected for better demonstration)

Connector	Description	PC
Data 1, RX	Receive	A
Data 1, TX	Transmit	A
Data 2, RX	Receive	B
Data 2, TX	Transmit	B
Data 3, RX	Receive	B
Data 3, TX	Transmit	B
GB2, PC A	Interconnector between PC's	GB2. PC B
GB1	Ethernet	PC A
GB1	Do not connect	PC B



Make sure the data cables are tightened properly



5 Installing the detector system

5.1 Carrying

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



When carrying the detector, make sure the protection cover is mounted.



Do not carry the detector this way





Correct carrying of the detector:





5.2 Mounting

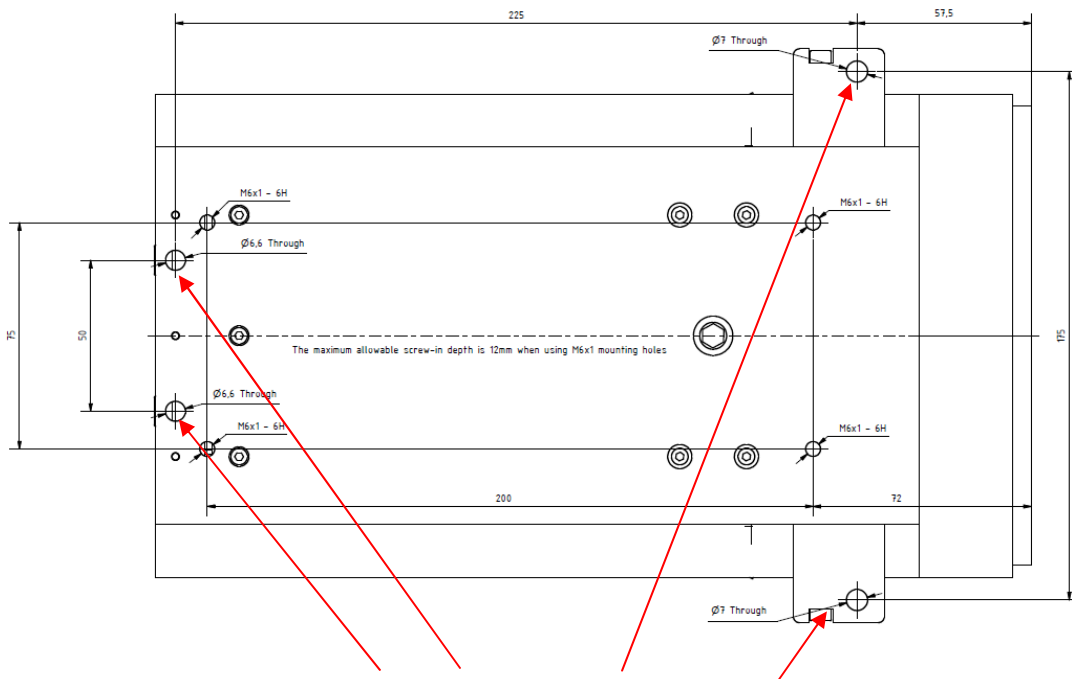
The detector can be mounted in two ways:

5.2.1 Mounting from the top

From the top with the detachable mounting pieces, which are stored on the back of the detector. These mounting pieces have to be mounted on the baseplate of the detector.



Make sure the mounting pieces are mounted and tightened properly

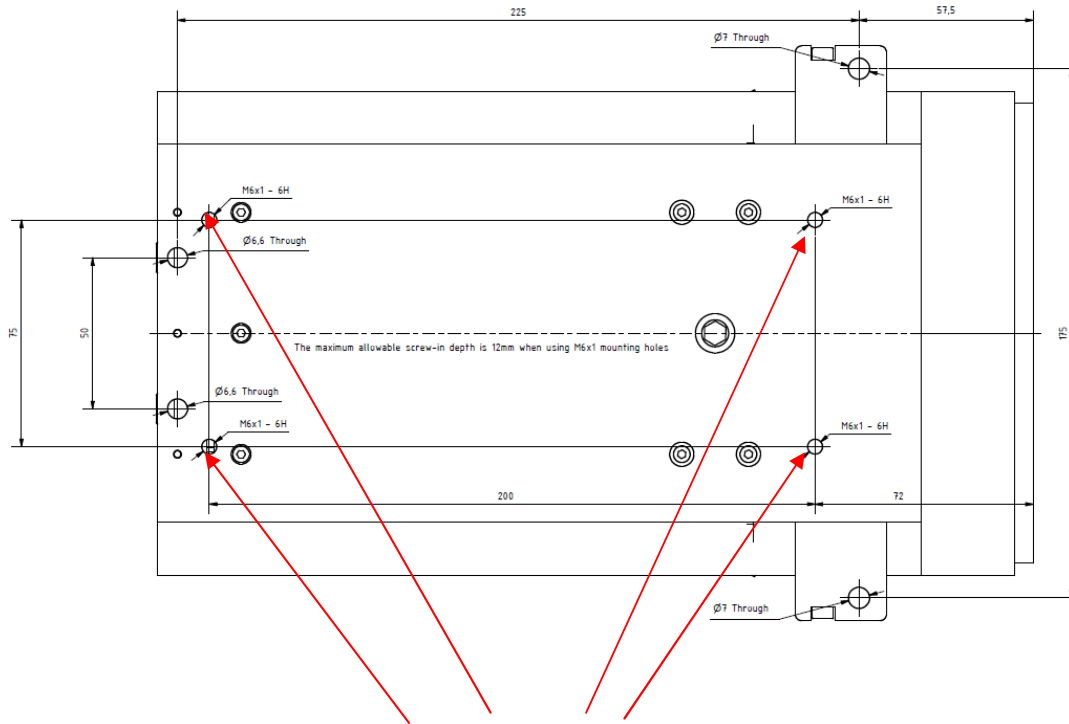


Mounting points when mounting from the top




5.2.2 Mounting from the bottom


From the bottom with four M6 bolts.




Mounting points when mounting from the bottom

 The four M6 bolts should not intrude into the detector more than 2 cm.

 Make sure the detector is properly mounted.

 Make sure the detector has enough space for proper ventilation. The ventilator on the back of the detector should not be covered.

 Do not use in vacuum.

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.

5.3 Earthing of the detector system



Figure 7 Earth connector on the back of the detector



Although the PC is grounded via the ground connector in the power plug, the housing of the PC should also be properly connected to a grounded rack.



The mains plug of the computer and the power supply have to be connected to a earthed power outlet.



Although the detector might be grounded via the mounting bolts, the detector must also be grounded via the ground connector on the back to establish a defined grounding.



5.4 Connection to nitrogen

The PILATUS detector has to be connected to a dry nitrogen flow to avoid condensation when operated in humid conditions.



Figure 8 Nitrogen connector on the back of the detector



Humidity can damage the detector. Make sure to operate the detector in the specified range.

Recommended flow of nitrogen	1 liter per hour.
As alternative	Oil free, dry air of <2% R.H can be used. Recommended flow: 1 liter per hour.



5.5 Connecting the cables

To operate the detector, the data cables and the ground should be connected:

Data cables:

The PILATUS 300K detector is equipped with 3 data cables, which are numbered Data 1, Data 2 and Data 3. This marking is also on the data acquisition computers.

Connect RX to RX and TX to TX on the GigaSTaR Card in the PC; the single connectors go to the back of the detector.



The data cable should be pulled onto the computer connectors with the screws, rather than forcefully pushed on. A forceful connection can damage the PCI card.



It is important for data integrity that the screws be tightened.



To plug or unplug any cables, turn the detector off.



6 Getting started

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



Check these items before turning the detector system on:

- Mount the detector properly
- Connect the detector to power
- Connect the detector to nitrogen
- Connect the PCs and the detector with data cables

6.1 Start

- Attach a monitor and keyboard to computer A. It is not necessary to have these on computer B.
- Turn the detector on
- Turn on PC B (slave)
- Wait approximately a minute, until it is fully booted
- Turn on PC A (master)
- In a shell on PC A
 - ping 10.0.0.2 (until a connection is established)
 - ssh [det@10.0.0.2](ssh://det@10.0.0.2)
 - (you are now on PC B)
 - cd p2_det
 - runtvx
 - wait until “disconnect” is executed
 - don't close this window
- In an other shell on PC A
 - cd p2_det
 - runtvx

Runtvx starts a script file which initializes the detector system and opens the Camserver and TVX windows.



7 Cleaning and maintenance

The housing should be cleaned with a soft tissue.



The mylar foil should not be touched or cleaned

The PILATUS 300K detector system is maintenance free.



8 Faults

Problems	Causes	Solution
PC doesn't start properly	PC cards not properly mounted	Open the PC and check that the PC cards are properly mounted and tightened
Detector shuts down	Overtemperature error Detector shuts down if the temperature exceeds 45°C. Check the LED on the back of the detector: Power LED: red Temp LED: red	<ul style="list-style-type: none"> • Wait until the detector cools down • Restart the detector again. • Check the temperature of the detector with the command in camserver: "TH 0". This shows the inside temperature of the detector. • Check that the ventilator of the detector is running properly and the ventilation holes are not covered
	Overcurrent Threshold level set too low and the detector starts oscillating	<ul style="list-style-type: none"> • Increase the threshold level
Images look strange after initialization	Detector not properly initialized	Run the following commands in TVX: <ul style="list-style-type: none"> • <i>calibdet</i> • <i>setdac</i> • <i>expose</i>
After a trigger command has been issued camserver reports an error	After issuing the trigger command in camserver a trigger has to occur within 15 seconds	Make sure the trigger command occurs within 15 seconds
Error while taking images	Camserver on slave pc not running	Make sure that <code>cam_server.sh</code> is running on the slave pc. See chapter 6.1.



9 Certification tests

The following tests have been accomplished and passed:

Applied standards / Normes appliquées / Verwendete Normen

EN 61000-6-2: 2005 (IEC 61000-6-2: 2005)	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments Compatibilité électromagnétique (CEM) - Partie 6-2: Normes génériques - Immunité pour les environnements industriels Elektromagnetische Verträglichkeit (EMV) - Teil 6-2: Fachgrundnormen - Störfestigkeit - Industriebereich
EN 61000-6-4: 2007 (IEC 61000-6-4: 2006)	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards -- Emission standard for industrial environments Compatibilité électromagnétique (CEM) - Partie 6-4: Normes génériques - Norme sur l'émission pour les environnements industriels Elektromagnetische Verträglichkeit (EMV) - Teil 6-4: Fachgrundnormen -- Fachgrundnorm Störaussendung - Industriebereich
EN 61326-1: 2006 (IEC 61326-1: 2005)	Electrical equipment for measurement, control and laboratory use - EMC requirements -- Part 1: General requirements Matériel électrique de mesure, de commande et de laboratoire - Exigences relatives à la CEM -- Partie 1: Exigences générales Elektrische Mess-, Steuer-, Regel- und Laborgeräte - EMV-Anforderungen -- Teil 1: Allgemeine Anforderungen



10 Appendix

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