DECTRIS®

*detecting the future*

# Technical Documentation

## *MYTHEN Detector System*

Version: V2



**DECTRIS Ltd.**
5405 Baden-Daettwil
Switzerland
www.dectris.com

# Table of Contents


1. Document History 5
   1.1. Current document 5
   1.2. Changes 5
2. How to use this documentation 6
   2.1. Address and Support 6
   2.2. Explanation of Symbols 7
   2.3. Explanation of Terms 7
   2.4. Disclaimer 8
3. Warnings 9
4. Technical specifications 10
   4.1. Technical data detector module 10
   4.2. Detector module channel alignment 11
      4.2.1. CE certified detector module 11
      4.2.2. Not CE certified detector module 11
   4.3. Technical data DCS1 12
   4.4. Technical data DCS6 12
   4.5. Technical data DCS24 13
   4.6. Normal operation 13
   4.7. Ratings 14
      4.7.1. Power supply 14
      4.7.2. Trigger and Gating 16
   4.8. Ambient conditions 17
5. Housing and Connectors 18
   5.1. CE certified detector module 18
   5.2. Not CE certified detector module 20
   5.3. Detector control system 1 22
   5.4. Detector control system 6 26
   5.5. Detector control system 24 30
   5.6. Data cable 35
      5.6.1. CE certified data cable 35
      5.6.2. Not CE certified data cable 36
   5.7. Power Supply 37
      5.7.1. DCS1 37
      5.7.2. DCS6 37
      5.7.3. DCS24 37

*6. Dimensions and mounting scheme of the detector system 38*

**6.1. Detector module 38**

6.1.1. CE certified detector module 39
6.1.2. Not CE certified detector module 40

**6.2. Detector Control System 42**

6.2.1. DCS1 43
6.2.2. DCS6 45
6.2.3. DCS24 47

*7. Getting started 49*

*8. Cleaning and maintenance 50*

*9. Certification tests 51*

**9.1. MYTHEN detector system with DCS1 51**

**9.2. MYTHEN detector system with DCS6 52**

**9.3. MYTHEN detector system with DCS24 53**

*10. Appendix 54*

**10.1. Table of Figures 54**

**10.2. Table of Tables 54**

**10.3. Referenced Documents 54**

# 1. Document History

## 1.1. Current document

| Version | Date | status | prepared | checked | released |
|---|---|---|---|---|---|
| 2 | 11.11.2015 | released | DJ | **AM** | **AM** |

## 1.2. Changes

| Version | Date | Changes |
|---|---|---|
| 1.0 | 27.08.2012 | First public revision for entire MYTHEN product family |
| 1.1 | 10.06.2013 | Adapted CD |
| 1.2 | 05.12.2013 | 5.5 and 5.6.2 adapted; cross references checked; PC paragraph removed |
| 2 | 11.11.2015 | Changed to new postal address and new phone number |

# 2. How to use this documentation

Before you start to operate the MYTHEN detector system please read the User Manual and the Technical Documentation included in the documentation package carefully.

This document has been designed for the MYTHEN detector systems.

## 2.1. Address and Support

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

**Website:**

- www.dectris.com → support → Technical Notes → MYTHEN
- www.dectris.com → support → FAQ
- www.dectris.com → support → Problem Report

**Email:**

- support@dectris.com

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



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

## 2.2. Explanation of Symbols

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

## 2.3. Explanation of Terms

| Term | Description |
|---|---|
| **GUI** | **G**raphical **U**ser **I**nterface |
| **DCS1** | **D**etector **C**ontrol **S**ystem for **1** detector module |
| **DCS6** | **D**etector **C**ontrol **S**ystem for up to **6** detector modules |
| **DCS24** | **D**etector **C**ontrol **S**ystem for up to **24** detector modules |
| **Detector module** | The smallest fully functional unit of the detector (1280 channels). |
| **MCB** | **M**odule **C**ontrol **B**oard |

## 2.4. Disclaimer

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

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

DECTRIS Ltd. 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 Ltd. it is prohibited to integrate the protected contents published in these applications into other programs or other Web sites or to use them by any other means.

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

# 3. Warnings



**Please read these warnings before operating the detector system.**

- DO NOT TOUCH THE ENTRANCE WINDOW OF THE DETECTOR.
- Place the protective cover on the entrance window of the detector when it is not in use.
- The detector is not specified to withstand direct beam at a synchrotron. Such exposure will damage the exposed channels.
- The detector system should have enough space for proper ventilation. Operating the detector outside the specified ambient conditions could damage the system.
- The air inlets and outlets of the detector control system should not be blocked.
- Power down the detector system before connecting or disconnecting any cable.
- Before connecting the power supply to the mains-supply, check the supply voltage with the label on the power supply. Using an improper main voltage will destroy the power supply and could damage the detector.
- Make sure the cables are connected and properly secured.
- Avoid pressure or tension on the cables.
- Opening the detector, the detector control system or the power supply housing without explicit instructions from DECTRIS Ltd. will void the warranty.
- The embedded Linux operating system on the detector control system has customized software for controlling the MYTHEN detector system. Do not make any changes to the Linux operating system without explicit instructions from DECTRIS Ltd.

# 4. Technical specifications

## 4.1. Technical data detector module

Table 1 Technical data of the MYTHEN detector module.

| | | | | |
|---|---|---|---|---|
| Sensor material | Silicon | | | |
| Sensor | Reverse biased pn-junction array | | | |
| Detection principle | Single photon counting | | | |
| Sensor thickness [µm] | 320, 450, 1000 | | | |
| Number of channels/module | 1280 | | | |
| Arrangement of channels | One dimensional, single row | | | |
| Sensitive area (width x length) [$mm^2$] | 64 x 8 | | | |
| Dimensions of one channel (width x length) [$\mu m^2$] | 50 x 8000 | | | |
| Readout time [ms] | 0.3 | | | |
| Maximal count rate per channel [X-rays/s] | > 1 x $10^6$ | | | |
| Dynamic range [bit] | 4, 8, 16, 24 (1 : 16’777’216) | | | |
| Energy range [keV] | 5 – 40 | | | |
| Point-spread function | 1 channel | | | |
| Power consumption [W] | 2 | | | |
| Cooling | Air cooled, thermal stabilization is recommended for low energy thresholds (Eγ = 4.5 keV) | | | |
| Sensor thickness | | 320 µm | 450 µm | 1000 µm |
| Quantum Efficiency [%] (calculated) | Cr 5.4 keV<br>Cu 8.0 keV<br>Mo 17.5 keV<br>Ag 22.2 keV | 93.9<br>97.1<br>36.8<br>19.8 | 93.9<br>97.9<br>47.5<br>26.7 | 93.9<br>98.0<br>76.0<br>49.8 |
| Housing | **With housing** | **Without housing** | | |
| Dimensions (WHD) [$mm^3$] | 72 x 100 x 24 | 66 x 88 x 10 | | |
| Detector weight [g] | 280 | 25 | | |
| CE certification | Yes | No | | |
| Connector | 68 pin female SCSI | 68 pin male ERNI | | |
| Photo |  |  | | |

## 4.2. Detector module channel alignment

### 4.2.1. CE certified detector module

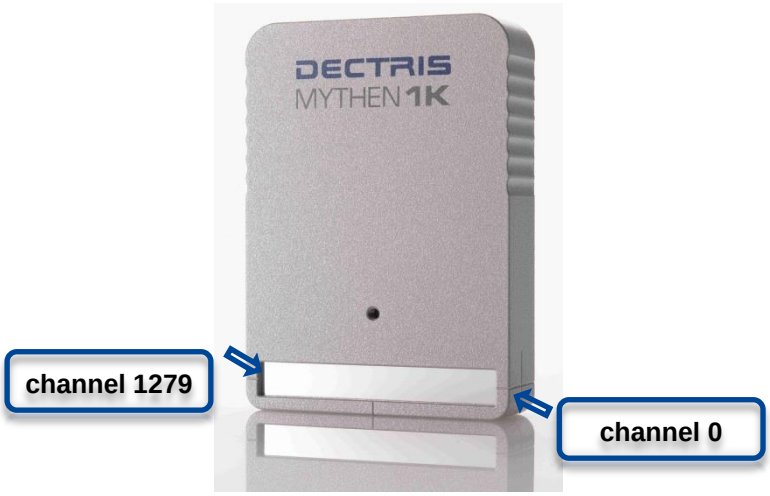



Figure 1 CE certified MYTHEN1K detector module with position of channel 0 and 1279.

**Channel alignment of CE and not CE certified detector module is different.**

### 4.2.2. Not CE certified detector module

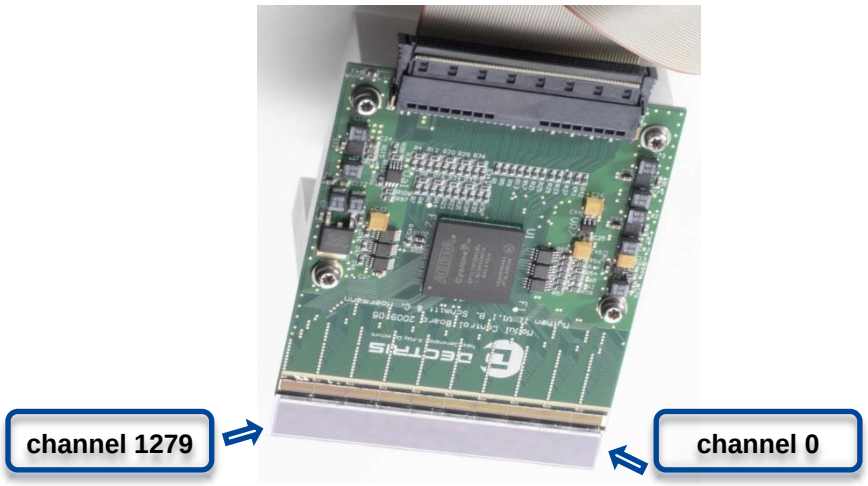



Figure 2 Not CE certified MYTHEN1K detector module with position of channel 0 and 1279.

**Channel alignment of CE and not CE certified detector module is different.**

## 4.3. Technical data DCS1

Table 2 Technical data of MYTHEN detector control system DCS1.

| ***Detector Control System 1*** | |
|---|---|
| Frame rate [Hz] * | up to 700* |
| External Trigger/Gate | 3.3V LVTTL |
| Power consumption [W] | 6 |
| Cooling | Air cooled |
| Dimensions (WHD) [$mm^3$] | 176 x 50 x 200 |
| Weight [kg] excl. detector module and data cabeling | 1.7 |
| Power supply | external power supply 5.0 V DC / 2.4 A;<br>see 4.7.1.1 Power supply |

* The effective frame rates depend on the adjusted dynamic range (4, 8, 16, or 24bit) and the used protocol (TCP, UDP)



**Make sure that the DCS has adequate ventilation.**

## 4.4. Technical data DCS6

Table 3 Technical data of MYTHEN detector control system DCS6.

| ***Detector Control System 6*** | |
|---|---|
| Frame rate [Hz] * | up to 450* |
| Power consumption [W] | 23 |
| External Trigger/Gate | 3.3V LVTTL |
| Cooling | Air cooled |
| Dimensions (WHD) [$mm^3$] | 296 x 65 x 300 |
| Weight [kg] excl. detector module and data cabeling | 4.3 |
| Power supply | external power supply 5.0 V DC / 5 A;<br>see 4.7.1.2 Power supply |

* The effective frame rates depend on the number of connected modules, the adjusted dynamic range (4, 8, 16, or 24bit) and the used protocol (TCP, UDP)



**Make sure that the DCS has adequate ventilation.**

## 4.5. Technical data DCS24

Table 4 Technical data of MYTHEN detector control system DCS24.

| ***Detector Control System 24*** | |
|---|---|
| Frame rate [Hz] * | up to 100 |
| Power consumption [W] | 100 |
| External Trigger/Gate | 3.3V LVTTL |
| Cooling | Air cooled |
| Dimensions (WHD) [$mm^3$] | 397 x 298 x 82 |
| Weight [kg] excl. detector module and data cabeling | 6.5 |
| Power supply | internal power supply; see 4.7.1.3 Power supply |

* The effective frame rates depend on the number of connected modules, the adjusted dynamic range (4, 8, 16, or 24bit) and the used protocol (TCP, UDP)



**Make sure that the DCS has adequate ventilation.**

## 4.6. Normal operation

The MYTHEN detector system has been designed for the detection of X-rays from synchrotron sources or laboratory sources.
For other applications, please contact DECTRIS Ltd. for additional information.



**Do not use the detector system in vacuum.**

## 4.7. Ratings

### 4.7.1. Power supply

4.7.1.1. DCS1

Table 5 Power ratings for MYTHEN detector control system DCS1.

| | |
|---|---|
| Power supply **DCS1** | Input range specified on the back of the power supply.<br><br>Input: 100 – 240 VAC / 50 – 60 Hz / 400 mA<br><br>**Connecting to the wrong supply voltage will destroy the power supply and could damage the detector.**<br><br>The output voltage is 5.0 VDC / 2.4 A. |

**Make sure that the power supply has adequate ventilation.**

4.7.1.2. DCS6

Table 6 Power ratings for MYTHEN detector control system DCS6.

| | |
|---|---|
| Power supply **DCS6** | Input range specified on the back of the power supply.<br><br>Input: 100 – 240 VAC / 50 – 60 Hz / 1.1 A<br><br>**Connecting to the wrong supply voltage will destroy the power supply and could damage the detector.**<br><br>The output voltage is 5.0 VDC / 5 A. |

**Make sure that the power supply has adequate ventilation.**

4.7.1.3. DCS24

Table 7 Power ratings for MYTHEN detector control system DCS24.

| | |
|---|---|
| Power supply **DCS24** (integrated in the DCS24) | Input: 100 – 240 VAC / 50 – 60 Hz / 2 – 4 A |
| |  **Connecting to the wrong supply voltage will destroy the power supply and could damage the detector.** |
| | The power supply is integrated in the DCS24. |

 **Make sure that the power supply has adequate ventilation.**

### 4.7.2. Trigger and Gating

The trigger and gating application is described in detail in the document **Trigger Notes** available at DECTRIS Ltd. (see 2.1 for support).

#### 4.7.2.1. DCS1

Table 8 Specification and rating for trigger and gating in- and ouputs of MYTHEN detector control system DCS1.

| | |
|---|---|
| **EXT IN** | The trigger input circuit connected to the EXT IN connector expects a 3.3 V LVTTL signal.<br>• Recommended high level: 2.4 V - 3.3 V<br>• Recommended low level: 0.0 V - 0.8 V<br>• Impedance: 50 Ω<br><br>⚠ **5.0 V maximum voltage.**<br>**Applying a higher voltage will destroy the input.** |
| **EN OUT** | The activity signal EN OUT is a 3.3V LVTTL signal.<br><br>It is on high level when the detector is making an exposure (“active high”). |

See 5.3 Detector control system 1 for further details.

#### 4.7.2.2. DCS6

Table 9 Specification and rating for trigger and gating in- and ouputs of MYTHEN detector control system DCS6.

| | |
|---|---|
| **EXT IN** | The trigger input circuit connected to the EXT IN connector expects a 3.3 V LVTTL signal.<br>• Recommended high level: 2.4 V - 3.3 V<br>• Recommended low level: 0.0 V - 0.8 V<br>• Impedance: 50 Ω<br><br>⚠ **5.0V maximum voltage.**<br>**Applying a higher voltage will destroy the input.** |
| **EN OUT** | The activity signal EN OUT is a 3.3V LVTTL signal.<br><br>It is on high level when the detector is making an exposure (“active high”). |

See 5.4 Detector control system 6 for further details.

4.7.2.3. DCS24

Table 10 Specification and rating for trigger and gating in- and outputs of MYTHEN detector control system DCS24.

| | |
|---|---|
| **TRIGGER/GATE IN** | The trigger/gate input circuits connected to the TRIGGER/GATE IN connectors expects a 3.3 V LVTTL signal.<br>• Recommended high level: 2.4 V - 3.3 V<br>• Recommended low level: 0.0 V - 0.8 V<br>• Impedance: 50 Ω<br> **5.0V maximum voltage.**<br>**Applying a higher voltage will destroy the input.** |
| **GATE OUT** | The activity signal GATE OUT is a 3.3V LVTTL signal.<br><br>It is on high level when the detector is making an exposure (“active high”). |
| **TRIGGER OUT** | The TRIGGER OUT signal is a 3.3V LVTTL signal. It is “active high”. |

See 5.5 Detector control system 24 for further details.

## 4.8. Ambient conditions

MYTHEN detector system is designed only for indoor use according the following ambient conditions.

Table 11 Ambient conditions

| *Condition* | *Range* |
|---|---|
| Operating temperature | 20°C to 35°C |
| Operating humidity | < 70% RH @ 20°C |
| Storage temperature | 15°C to 40°C |
| Storage humidity | < 75% RH @ 20°C |

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

 **Do not use the detector system in vacuum.**

# 5. Housing and Connectors

## 5.1. CE certified detector module

The detector module is mounted in a metal housing. The entrance window for X-rays is protected with a metal cover. This cover should be removed by releasing the screw of it after mounting the detector system module for regular operation.

The sensor is located behind a 12 µm thick aluminized Mylar® foil to protect it from dust, touch and light.

| | |
|---|---|
| ⚠ | **Make sure that the cover is removed for detecting X-rays.** |
| ⚠ | **Do not touch, damage or penetrate the Mylar® foil.** |
| ⚠ | **If the screw of the cover is positioned by accident above the Mylar® foil, the Mylar® foil could be damaged or penetrated.** |
| ⚠ | **Make sure that the detector modules have adequate ventilation.** |




Figure 3 MYTHEN1K detector module with cover in place (left) and removed.



Figure 4 MYTHEN1K detector module viewed from the back.

Table 12 Connector specifications for CE certified module.

| Connector | Description |
|---|---|
| | Data connection of detector module to DCS *via* CE certified data cable (see 5.6.1 CE certified ).<br><br>Connector: HONDA PCS-XED68RFAUNG1; 68 pin; female<br><br>Appropriate plug *e.g.* HONDA cable cover PCS-XEM68DLUN in combination with HONDA PCS-XE68MB; 68 pin; male<br><br>Appropriate screws for the connector are 4-40 UNC. |

**Be aware of:**

- **connector polarity**
- **deforming connector pins by accident**
- **connecting detector module if DCS is powered off**

**The data cable should be pulled onto the detector module connector with the screws, rather than forcefully pushed on.**

**Use only the DECTRIS Ltd. delivered CE certified data cables.**

## 5.2. Not CE certified detector module

**The handling of the not CE certified detector modules is described in detail in the document Module Handling Instructions available at DECTRIS Ltd. (see 2.1 for support).**

The detector module is mounted and delivered on a standard aluminium support structure.

The detector module consists of the MCB, which is populated with electronic components. Additionally the readout chips and the sensor are glued on the MCB.

**The sensor is extremely fragile and sensitive to every kind of touching. Contacting the sensor must be avoided under any circumstance at all times.**

The channel by channel connection between the sensor channels and the readout electronics of each channel is done by a single wire-bond. The readout chip is connected to the MCB by wire-bonds as well. The diameter of these aluminium wires is in the range of 18 micrometers.

**The wire-bonds are extremely fragile and sensitive to all kinds of touching. Contacting the wire-bonds must be avoided under any circumstance at all times.**

**Make sure that the detector modules have adequate ventilation.**

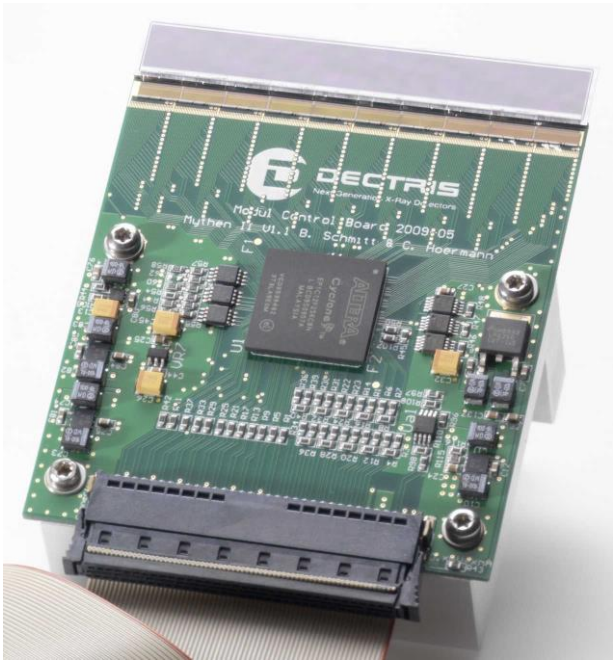



Figure 5 MYTHEN1K detector module (not CE certified version).

Table 13 Connector specifications for not CE certified module.

| Connector | Description |
|---|---|
| | Data connection of not CE certified detector module to DCS *via* not CE certified data cable (see 5.6.2 Not CE certified data cable).<br><br>Connector: ERNI 114805; 68 pin; male<br><br>Appropriate plug *e.g*. ERNI 214348; 68 pin; female |



**Be aware of:**

- **connector polarity**
- **deforming connector pins by accident**
- **connecting detector module if DCS is powered off**



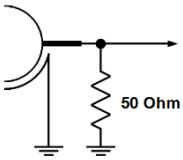
**Use only the DECTRIS Ltd. delivered data cables.**

## 5.3. Detector control system 1




Figure 6 Front panel of the MYTHEN detector control system DCS1.

Table 14 Connector specifications for MYTHEN detector control system DCS1 (front panel).

| Connector | Description |
|---|---|
| **DETECTOR** | Data connection of DCS1 to detector module *via* data cable.<br><br>Connector: HONDA PCS-XE68LFDTUN<br><br>Appropriate plug *e.g*. HONDA cable cover PCS-XEM68DLUN in combination with HONDA PCS-XE68MB; 68pin; male<br><br>Appropriate screws for the connector are 4-40 UNC. |
| **EXT IN**<br><br><br> | The trigger input circuit connected to the EXT IN connector expects a 3.3 V LVTTL signal.<br>• Recommended high level: 2.4 V - 3.3 V<br>• Recommended low level: 0.0 V - 0.8 V<br>• Impedance: 50 Ω<br><br>**5.0 V maximum voltage.**<br>**Applying a higher voltage will destroy the input.**<br><br>Connector: LEMO EPL.00.250.NTN<br><br>Appropriate plug *e.g*. LEMO FFA.00.250.NTAC22<br><br>There are LEMO – BNC adapter available (LEMO ABF.00.250.CTA). Ask DECTRIS Ltd. support for details (see 2.1 for support). |
| **EN OUT** | The activity signal EN OUT is a 3.3 V LVTTL signal.<br>It is on high level when the detector is making an exposure (“active high”).<br>Connector: LEMO connector: EPL.00.250.NTN<br>Appropriate plug *e.g*. LEMO FFA.00.250.NTAC22<br><br>There are LEMO – BNC adapter available (LEMO ABF.00.250.CTA). Ask DECTRIS Ltd. support for details (see 2.1 for support). |

The trigger and gating application is described in detail in the document **Trigger Notes** available at DECTRIS Ltd. (see 2.1 for support).

Table 15 LEDs on the front panel of the MYTHEN detector control system DCS1.

| *LED* | *Description* |
|---|---|
| **EN OUT** | Active when detector is making an exposure |
| **ERROR** | Active when data taking failed |



**Be aware of:**
- **connector polarity**
- **deforming connector pins by accident**
- **connecting detector module if DCS is powered off**



**Use only the DECTRIS Ltd. delivered data cables.**



**The data cable should be pulled onto the DCS1 with the screws, rather than forcefully pushed on.**



**Use only the DECTRIS Ltd. delivered CE certified data cables.**




Figure 7 Rear panel of the MYTHEN detector control system DCS1.

Table 16 Rear Panel Connectors and Labels of the MYTHEN detector control system DCS1.

| Labeling | Description |
|---|---|
| **I ↔ O** | Power switch |
| **+5V DC** | +5 V DC power connection<br>connector: LEMO ERA.2S.302.CLL<br>Appropriate plug *e.g.* LEMO FFA.2S.302.CLAC |
| | For operation it has to be connected with the 5.0 V DC output cable of the power supply for the DCS1 (see 4.7.1.1; 5.7.1). |
| **1.6A** | Fuse carrier<br>Fuse 1.6 A slow-blow fuse *e.g.* SCHURTER part number: 0001.2506 |
| | **Replace the fuse only with the recommended fuse.** |
| **ETH0** | Local area network connector RJ45 |
| | Cat 5 network cable is recommended. |
| **RESET** | Reset switch for the DCS1 |
| | **Pressing the RESET switch reboots the operating system of the DCS1.** |
| **Warranty seal** | **Warranty void if seal is broken.** |

| | |
|---|---|
|  | Functional earth of the detector system (M4 screw-in tap hole). |
|  | Although the detector may be grounded *via* the mounting bolts, the detector system can be grounded additionally via this functional earth connector to establish a defined grounding. |

Table 17 LEDs on the rear panel of the detector control system DCS1.

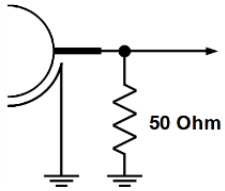
| Labeling | Description |
|---|---|
| **POWER** | +5 V DC voltage on |

## 5.4. Detector control system 6




Figure 8 Front panel of the MYTHEN detector control system DCS6.

Table 18 Connector specifications for MYTHEN detector control system DCS6 (front panel).

| Connector | Description |
|---|---|
| **D1 – D6** | Data connection of DCS6 to detector modules *via* data cable.<br><br>Connector: HONDA PCS-XE68LFDTUN<br><br>Appropriate plug *e.g.* HONDA cable cover PCS-XEM68DLUN in combination with HONDA PCS-XE68MB; 68pin; male<br><br>Appropriate screws for the connector are 4-40 UNC.<br><br>If the DCS6 is operated with less than 6 detector modules, start connecting the modules at connector D1. |
| **EXT IN**<br><br> | The trigger input circuit connected to the EXT IN connector expects a 3.3 V LVTTL signal.<br>• Recommended high level: 2.4 V-3.3 V<br>• Recommended low level: 0.0 V - 0.8 V<br>• Impedance: 50 Ω<br><br>**5.0V maximum voltage.**<br>**Applying a higher voltage will destroy the input.**<br><br>Connector: LEMO EPL.00.250.NTN<br><br>Appropriate plug *e.g.* LEMO FFA.00.250.NTAC22<br><br>There are LEMO – BNC adapter available (LEMO ABF.00.250.CTA). Ask DECTRIS Ltd. support for details (see 2.1 for support). |

| | |
|---|---|
| **EN OUT** | The activity signal EN OUT is a 3.3 V LVTTL signal.<br><br>It is on high level when the detector is making an exposure (“active high”).<br><br>Connector: LEMO connector: EPL.00.250.NTN<br><br>Appropriate plug *e.g*. LEMO FFA.00.250.NTAC22 |



There are LEMO – BNC adapter available (LEMO ABF.00.250.CTA). Ask DECTRIS Ltd. support for details (see 2.1 for support).

The trigger and gating application is described in detail in the document **Trigger Notes** available at DECTRIS Ltd. (see 2.1 for support).



**Be aware of:**

- **connector polarity**
- **deforming connector pins by accident**
- **connecting detector module if DCS is powered off**



**Use only the DECTRIS Ltd. delivered data cables.**



**The data cable should be pulled onto the DCS6 with the screws, rather than forcefully pushed on.**



**Use only the DECTRIS Ltd. delivered CE certified data cables.**

Table 19 LEDs on the front panel of the MYTHEN detector control system DCS6.

| *LED* | *Description* |
|---|---|
| **EN OUT** | Active when detector is making an exposure |
| **ERROR** | Active when data taking failed |




Figure 9 Rear panel of the MYTHEN detector control system DCS6.

Table 20 Rear Panel Connectors and Labels of the MYTHEN detector control system DCS6.

| Labeling | Description |
|---|---|
| **I ↔ O** | Power switch |
| **+5V DC** | +5 V DC power connection<br>connector: LEMO ERA.3S.302.CLL<br>Appropriate plug *e.g.* LEMO FFA.3S.302.CLAC |
| | For operation it has to be connected with the 5.0 V DC output cable of the power supply for the DCS6 (see 4.7.1.1; 5.7.1). |
| **5A** | Fuse carrier<br>Fuse 5 A slow-blow fuse *e.g.* SCHURTER part number: 0001.2511 |
| | **Replace the fuse only with the recommended fuse.** |
| **ETH0** | Local area network connector RJ45 |
| | Cat 5 network cable is recommended. |
| **RESET** | Reset switch for the DCS6 |
| | **Pressing the RESET switch reboots the operating system of the DCS6.** |
| **Warranty seal** | **Warranty void if seal is broken.** |

| | |
|---|---|
|  | Functional earth of the detector system (M4 screw-in tap hole). |
|  | Although the detector may be grounded *via* the mounting bolts, the detector system can be grounded additionally via this functional earth connector to establish a defined grounding. |

Table 21 LEDs on the rear panel of the MYTHEN detector control system DCS6.

| *LED* | *Description* |
|---|---|
| **POWER** | +5 V DC voltage on |

## 5.5. Detector control system 24




Figure 10 Top view of the detector control system DCS24 with details of the detector module connector labeling.

Table 22 Connector specifications for MYTHEN detector control system DCS24 (top).

| Connector | Description |
|---|---|
| **00 - 23** | Data connection of not CE certified detector modules to DCS24 *via* not CE certified data cable (see 5.6.2 Not CE certified data cable).<br><br>Connector: ERNI 114805; 68pin; male<br><br>Appropriate plug *e.g.* ERNI 214348; 68pin; female<br><br> If the DCS24 is operated with less than 24 detector modules, start connecting the modules at connector D1.<br><br> **Be aware of:**<br>• **connector polarity**<br>• **deforming connector pins by accident**<br>• **connecting detector module if DCS is powered off**<br><br> **Use only the DECTRIS Ltd. delivered data cables.**<br><br> **The data cable should be pushed onto the DCS24 carefully, rather than forcefully pushed on.** |

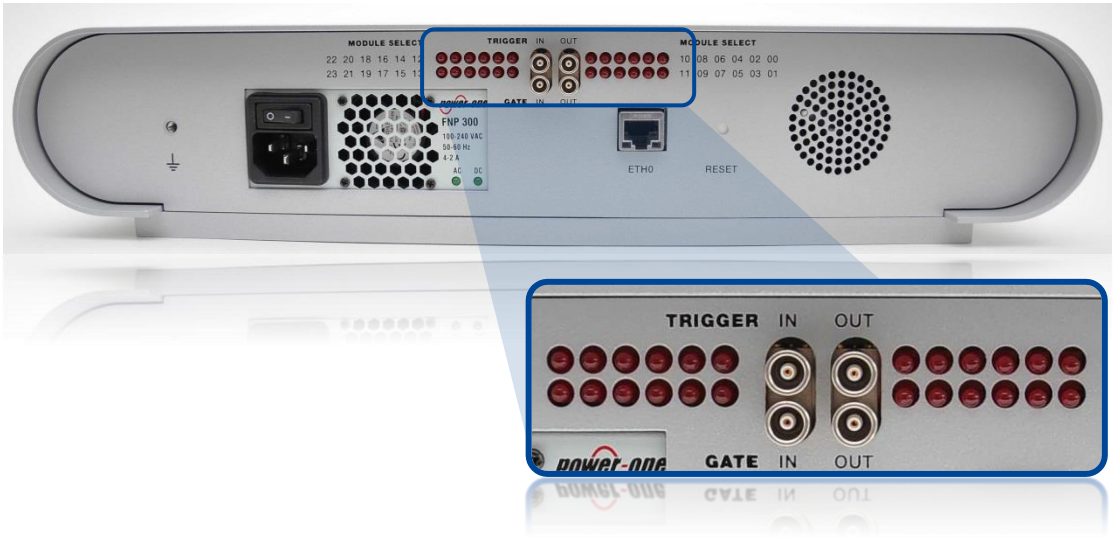
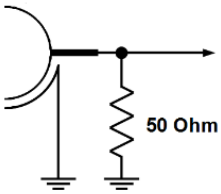



Figure 11 Front panel of the detector control system 24 with details of the TRIGGER/GATE connectors and the MODULE SELECT/Power LEDs.

Table 23 Connector specifications for MYTHEN detector control system DCS24 (front panel).

| Connector | Description |
|---|---|
| **TRIGGER/ GATE IN**<br> | The trigger/gate input circuits connected to the TRIGGER/GATE IN connectors expects a 3.3 V LVTTL signal.<br>• Recommended high level: 2.4 V - 3.3 V<br>• Recommended low level: 0.0 V - 0.8 V<br>• Impedance: 50 Ω<br>**5.0 V maximum voltage.**<br>**Applying a higher voltage will destroy the input.**<br>TRIGGER/GATE IN connector: LEMO EPL.00.250.NTN<br>(appropriate plug *e.g.* LEMO FFA.00.250.NTAC22)<br>There are LEMO – BNC adapter available (LEMO ABF.00.250.CTA). Ask DECTRIS Ltd. support for details (see 2.1 for support). |
| **GATE OUT** | The activity signal GATE OUT is a 3.3 V LVTTL signal.<br>It is on high level when the detector is making an exposure (“active high”).<br>GATE OUT connector: LEMO EPL.00.250.NTN<br>(appropriate plug *e.g.* LEMO FFA.00.250.NTAC22)<br>There are LEMO – BNC adapter available (LEMO ABF.00.250.CTA). Ask DECTRIS Ltd. support for details (see 2.1 for support). |

| | |
|---|---|
| **TRIGGER OUT** | The TRIGGER OUT signal is a 3.3 V LVTTL signal. It is “active high”.<br><br>It is a signal pulse with a width of 100 ns and it appears after the GATE OUT signal has returned to low level. The time interval between the falling edge of the GATE OUT signal and the rising edge of the TRIGGER OUT signal is 100 ns.<br><br>TRIGGER OUT connector: LEMO EPL.00.250.NTN<br>(appropriate plug *e.g*. LEMO FFA.00.250.NTAC22) |
| | There are LEMO – BNC adapter available (LEMO ABF.00.250.CTA). Ask DECTRIS Ltd. support for details (see 2.1 for support). |
| **I ↔ O** | Power switch |
| **POWER Connector** | Input: 100 – 240 V AC / 50 – 60 Hz / 2 – 4 A |
| | **Connecting to the wrong supply voltage will destroy the power supply and could damage the detector.** |
| **ETH0** | Local area network connector RJ45 |
| | Cat 5 network cable is recommended. |
| **RESET** | Reset switch for the DCS24 |
| | **Pressing the RESET switch reboots the operating system of the DCS24.** |
| ⏚ | Functional earth of the detector system (M4 screw-in tap hole). |
| | Although the detector may be grounded *via* the mounting bolts, the detector system can be grounded additionally via this functional earth connector to establish a defined grounding. |

The trigger and gating application is described in detail in the document **Trigger Notes** available at DECTRIS Ltd. (see 2.1 for support).

Table 24 LEDs on the front panel of the MYTHEN detector control system DCS24.

| *LED* | *Description* |
|---|---|
| **MODULE SELECT 00 - 23** | The MODULE SELECT LED of a module is active, if communication to the corresponding module takes place. |
| **Power Supply AC** | Active when external power is supplied. |
| **Power Supply DC** | Active when internal power is available. |



Figure 12 Rear panel of the MYTHEN detector control system DCS24.

On the rear panel of the DCS24 only ventilation holes are existent.

**Make sure that the DCS has adequate ventilation.**

## 5.6. Data cable

### 5.6.1. CE certified data cable

The CE certified data cable has 68 wires. Its length is 3m and the diameter of the cable is 9.8mm.

Table 25 Specification for CE certified data cable.

| *Connector* | *Description* |
|---|---|
| | Data connection of CE certified detector modules to DCS *via* CE certified data cable (see 5.1 and 5.3 or 5.4).<br><br>Connector at both ends of the data cable: HONDA cable cover PCS-XEM68DLUN in combination with HONDA PCS-XE68MB; 68 pin; male<br><br>Appropriate plug *e.g*. HONDA PCS-XED68RFAUNG1; 68 pin; female<br><br>Appropriate screws for the connector are 4-40 UNC. |



**Be aware of:**

- **connector polarity**
- **deforming connector pins by accident**
- **connecting detector module if DCS is powered off**



**The data cable connector should be pulled onto the connector of the detector and the DCS with the screws, rather than forcefully pushed on.**



**Use only by DECTRIS Ltd. delivered CE certified data cables.**

### 5.6.2. Not CE certified data cable

The not CE certified data cable has 68 wires and it is a flat cable.

The length is

- 60 cm in the case of the DCS1 and DCS6 (see 5.3 and 5.4)
- 100 cm in the case of the DCS24 (see 5.5)

Table 26 Specification for not CE certified data cable

| Connector | Description |
|---|---|
| | Data connection of not CE certified detector modules to DCS *via* not CE certified data cable (see 5.1and 5.3 or 5.4 or 5.5).<br><br>Connector:<br>• HONDA PCS-D68RMA; 68 pin; male<br>• ERNI 214348; 68 pin; female<br><br>Appropriate plug *e.g.*<br>• HONDA PCS-XED68RFAUNG1; 68 pin; female<br>• ERNI 114805; 68 pin; male<br><br>Appropriate screws for the connector are 4-40 UNC. |



**Be aware of:**
- **connector polarity**
- **deforming connector pins by accident**
- **connecting detector module if DCS is powered off**



**Use only by DECTRIS Ltd. delivered not CE certified data cables.**



**The data cable should be pushed onto the carefully, rather than forcefully pushed on.**

## 5.7. Power Supply

### 5.7.1. DCS1

For the rating of the power supply for the DCS1 see 4.7.1.1.

The input cable length is 2m. Alternatively, a plug is provided.

The output cable length is 2m and a LEMO connector FFA.2S.302.CLAC52Z is assembled. For correct operation of the DCS1 the DCS1 power supply must be connected to the power connector of DCS1 (5.3) that is labeled +5V DC.



**Use only the DECTRIS Ltd. delivered power supply and cables.**

### 5.7.2. DCS6

For the rating of the power supply for the DCS6 see 4.7.1.2.

The input cable length is 2 m.

The output cable length is 2 m and a LEMO connector FFA.3S.302.CLAC82Z is assembled. For correct operation of the DCS6 the DCS6 power supply must be connected to the power connector of DCS6 (5.4) that is labeled +5 V DC.



**Use only the DECTRIS Ltd. delivered power supply and cables.**

### 5.7.3. DCS24

The power supply of the DCS24 is integrated in the housing of the DCS24.

For the rating of the power supply for the DCS24 see 5.5.

The input cable length is 2 m.



**Use only the DECTRIS Ltd. delivered power supply and cables.**

# 6. Dimensions and mounting scheme of the detector system

## 6.1. Detector module

The detector module can be mounted in any position using the holes in the rear panel (M3 screws).



**Make sure that the detector module has adequate ventilation.**



**Make sure that the data cable connecting the detector control system and the detector module has a proper strain relief at both connectors.**



**Do not use the detector system in vacuum.**



**The data cable should be pulled onto the detector module connector with the screws, rather than forcefully pushed on.**



**Use only the DECTRIS Ltd. delivered data cables.**



Although the entire detector system might be grounded *via* the mounting bolts, the detector system can be grounded additionally *via* the functional earth connector at the DCS to establish a defined grounding.

### 6.1.1. CE certified detector module

**Drawings are not to scale.**

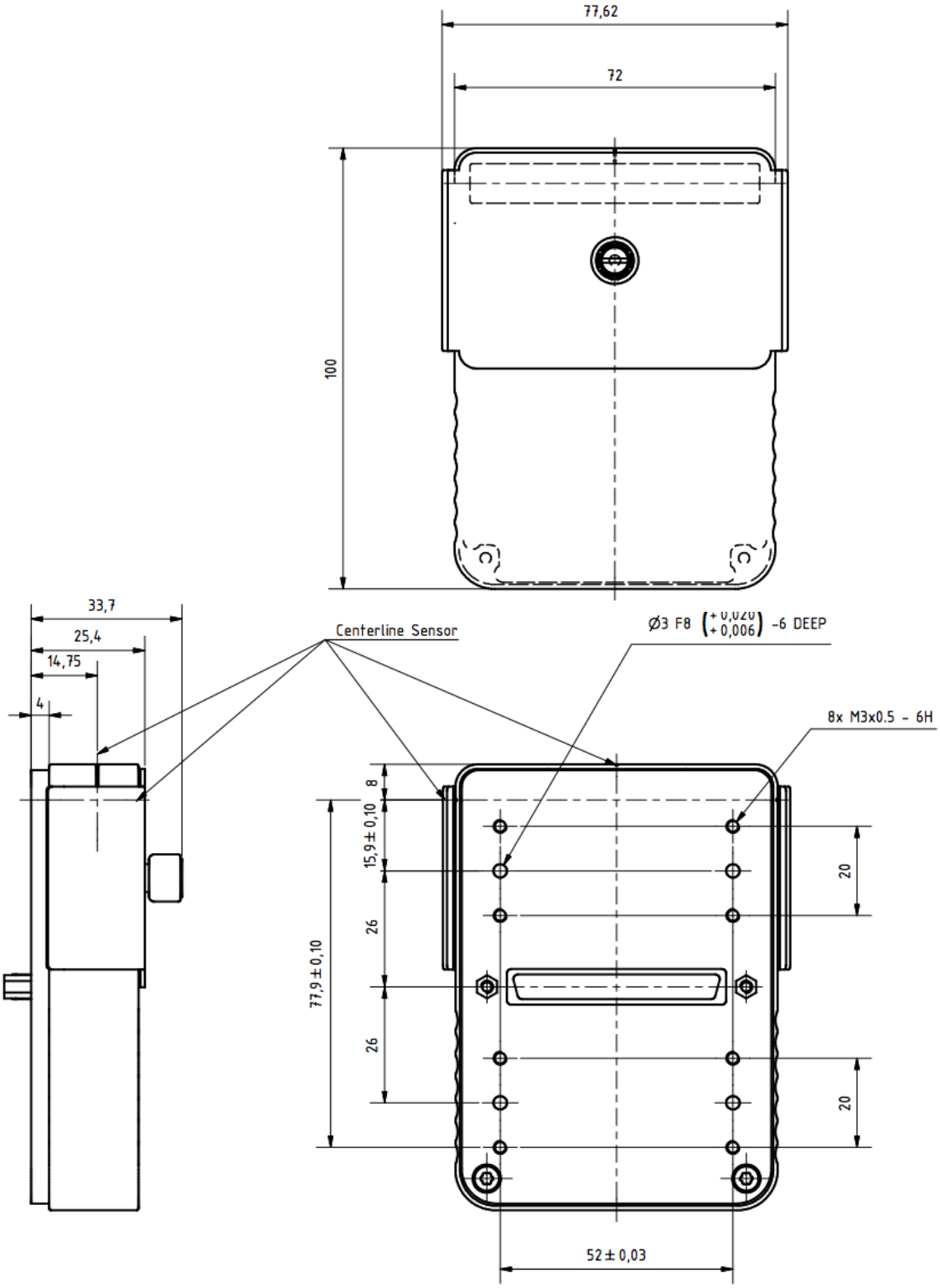



Figure 13 Dimensions of detector housing and position of the tap holes for mounting the detector module.

### 6.1.2. Not CE certified detector module

**The handling of the not CE certified detector modules is described in detail in the document Module Handling Instructions available at DECTRIS Ltd. (see 2.1 for support).**

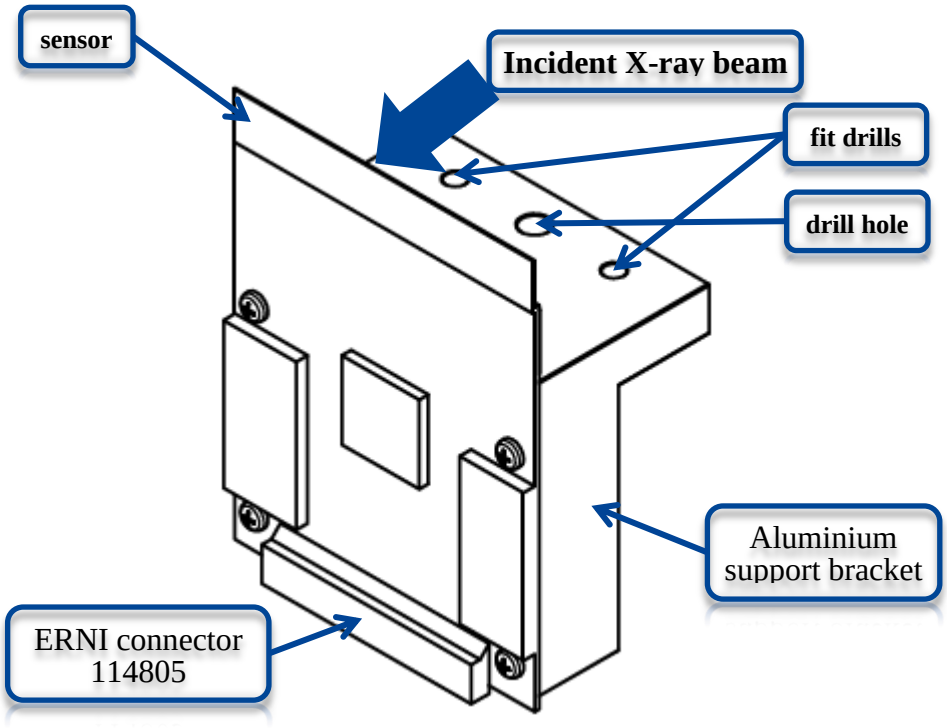



Figure 14 Overview of MYTHEN1K detector module mounted on standard support structure.

**Operate the MYTHEN1K detector module only with incident X-ray beam in marked direction (Figure 14).**

**The position marked by “Center of sensor” indicates the center of the sensitive area (Figure 14).**

**Be aware of the overlap of the sensor relative to the pcb (Figure 14).**

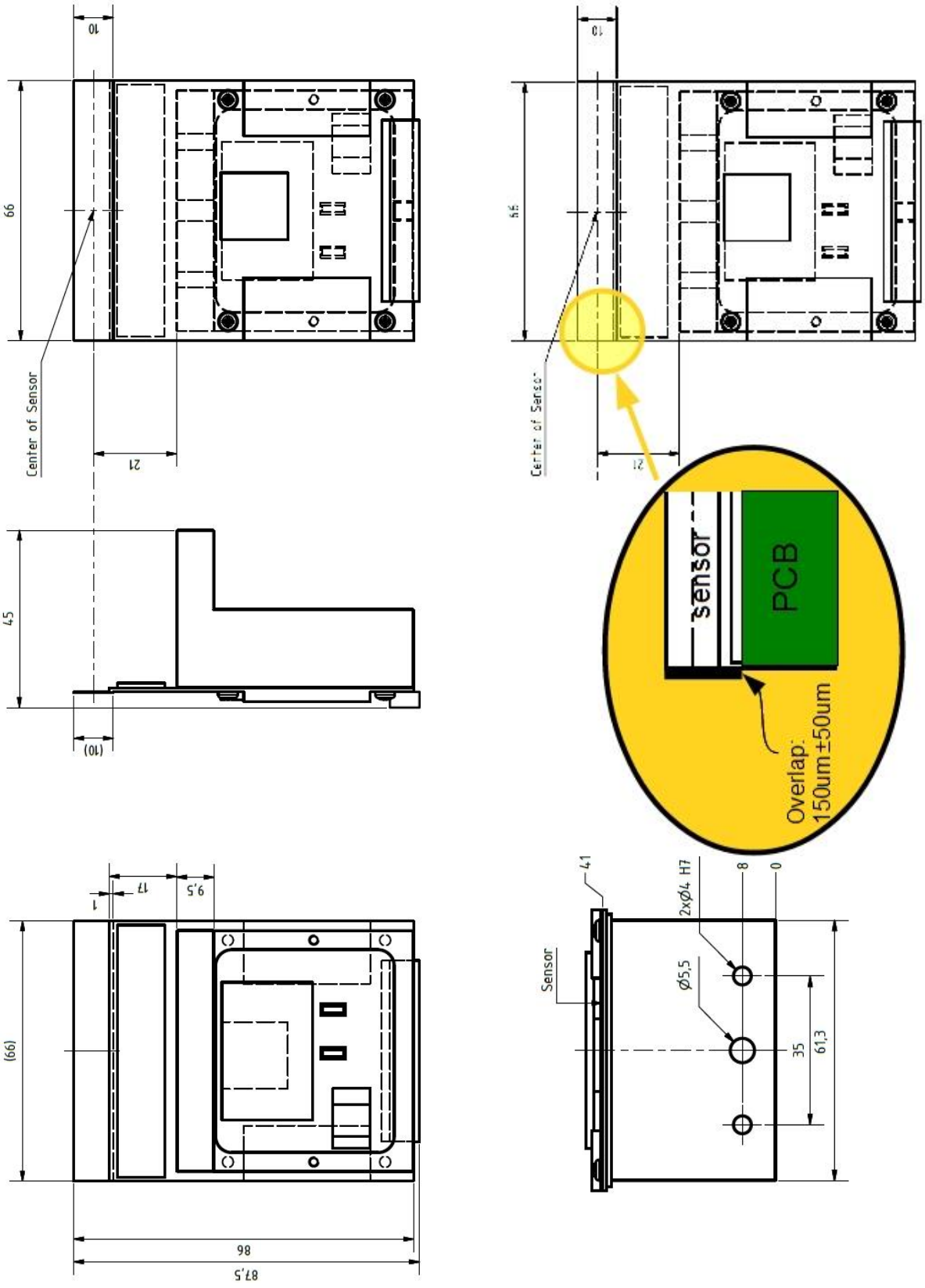



Figure 15 MYTHEN1K detector module mounted on standard support structure.

## 6.2. Detector Control System

The detector control system and the power supply can be mounted in any position. For mounting the DCS, the holes in its baseplate can be used (M4 screws).



**Make sure that the detector control system and the power supply have adequate ventilation.**



**Make sure that the data cable connecting the detector control system and the detector module has a proper strain relief at both connectors.**



**Do not use the detector system in vacuum.**



**The data cable should be pulled onto the DCS with the screws, rather than forcefully pushed on.**



**Use only the DECTRIS Ltd. delivered data cables.**



Although the entire detector system might be grounded *via* the mounting bolts, the detector system can be grounded additionally via the functional earth connector at the DCS to establish a defined grounding.

### 6.2.1. DCS1

**Drawings are not to scale.**

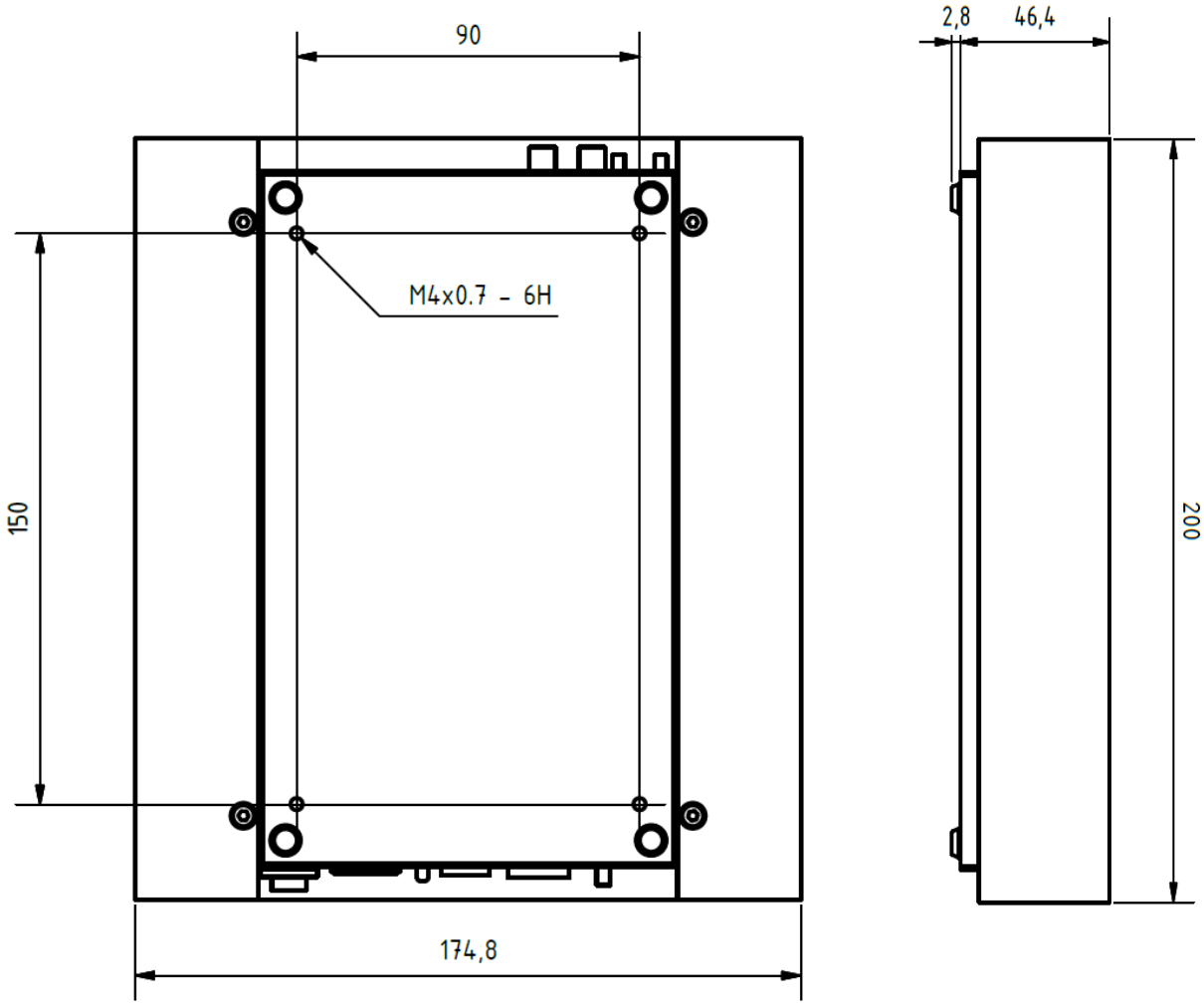



Figure 16 DCS1 bottom view with tap holes for mounting the DCS1.

**Drawings are not to scale.**

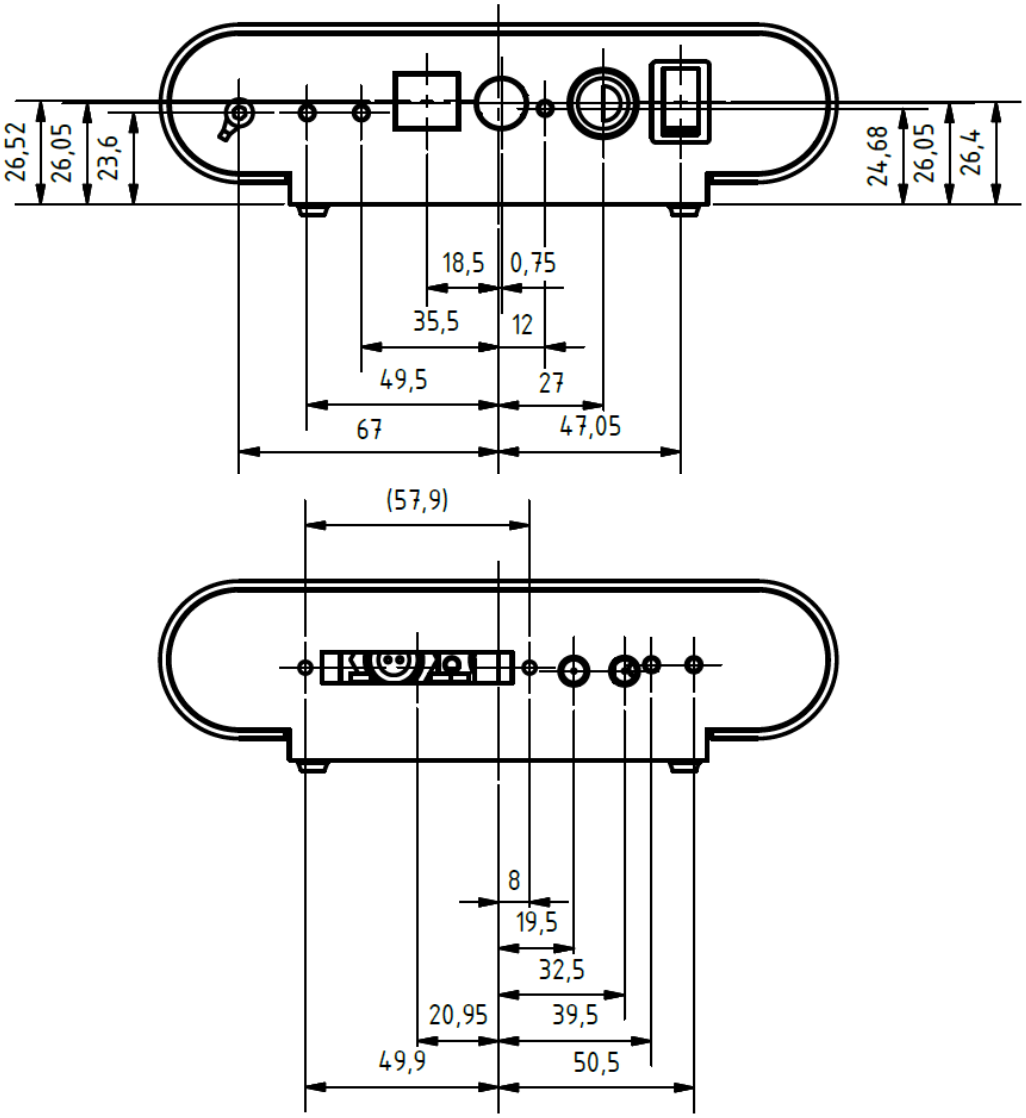



Figure 17 DCS1 front panel and rear panel view.

### 6.2.2. DCS6

**Drawings are not to scale.**

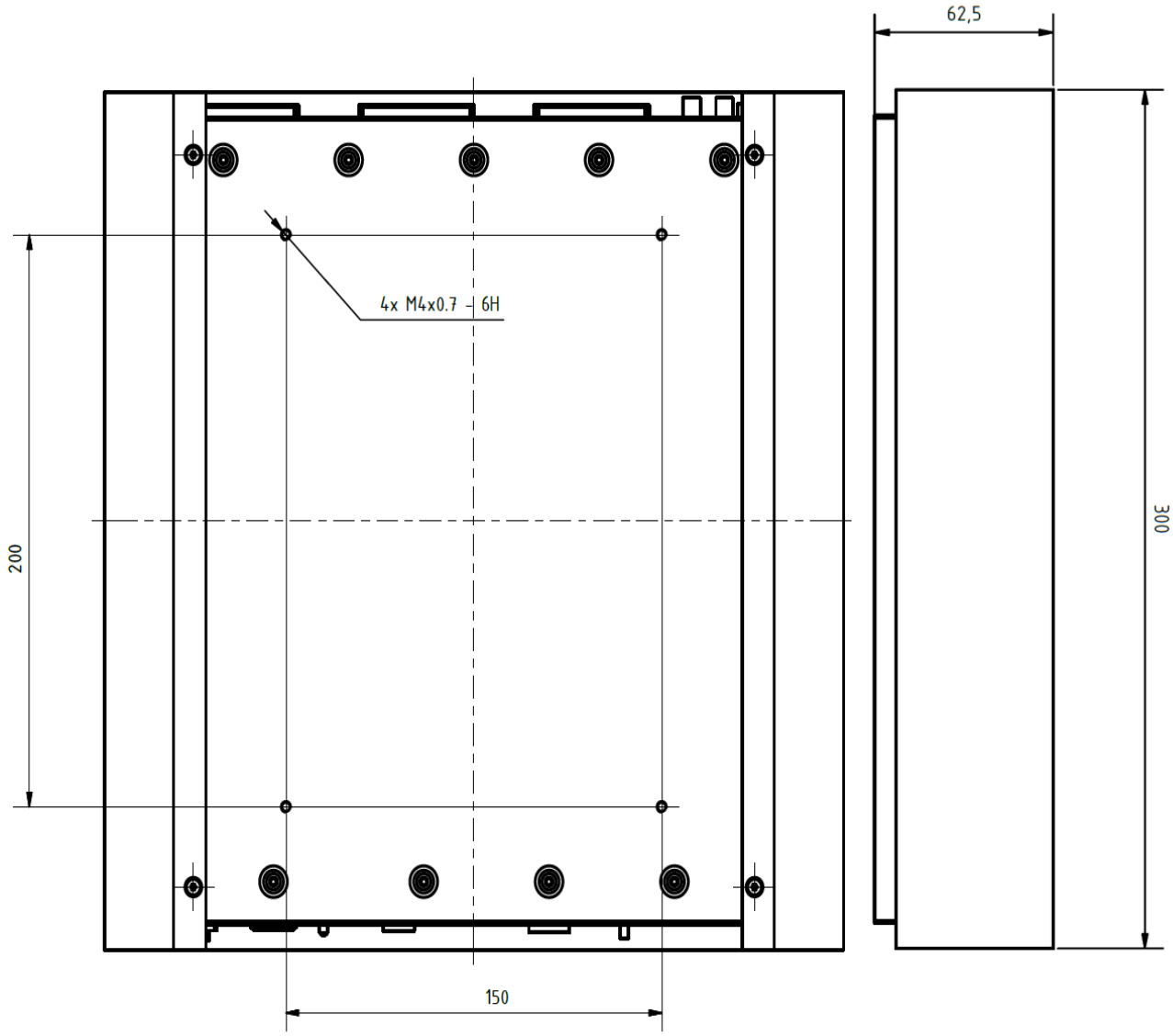



Figure 18 DCS6 bottom view with tap holes for mounting the DCS6.

**Drawings are not to scale.**

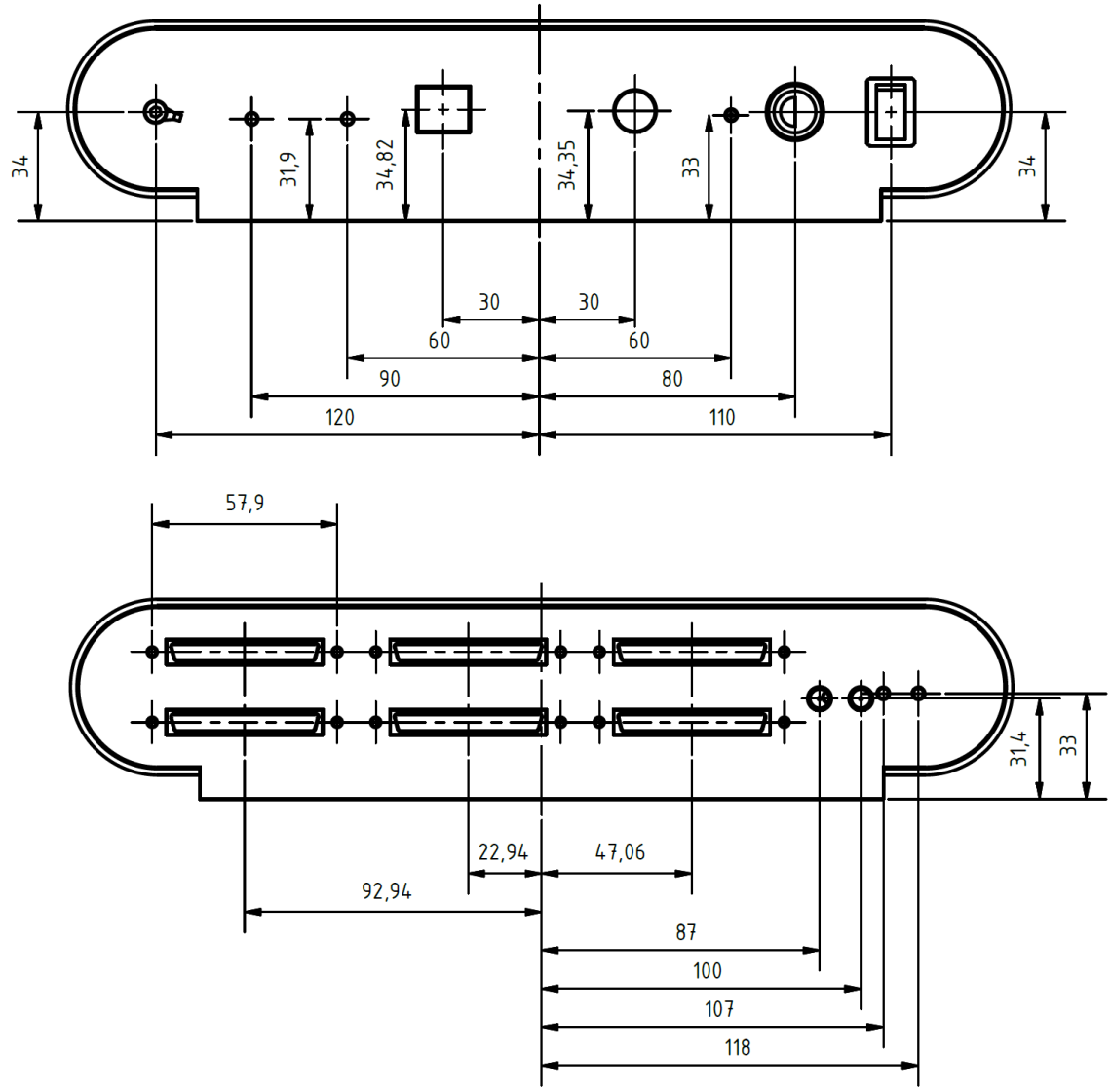



Figure 19 DCS6 front panel and rear panel view.

### 6.2.3. DCS24

**Drawings are not to scale.**

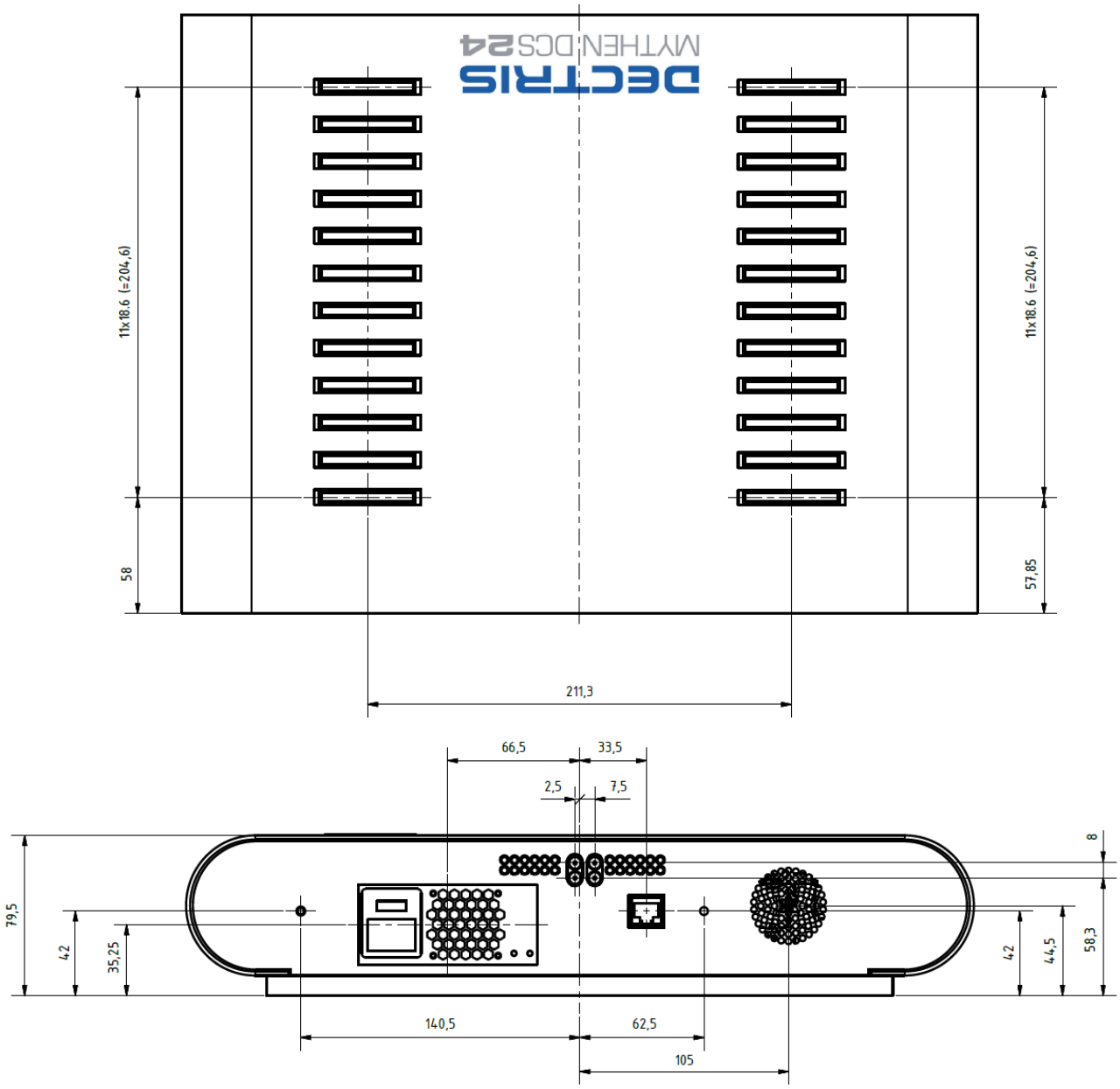



Figure 20 DCS24 top view and front panel view.

**Drawings are not to scale.**

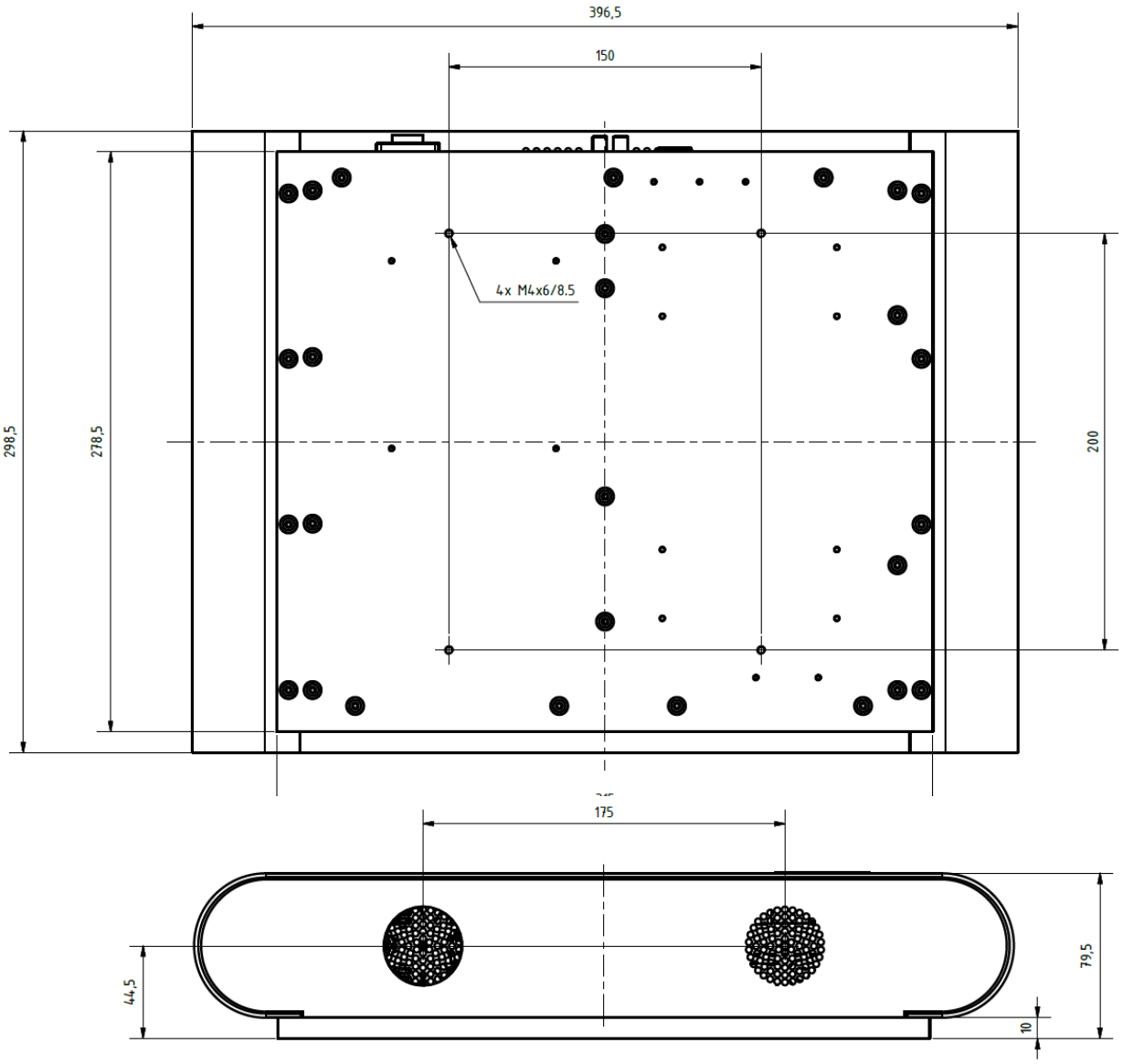



Figure 21 DCS24 bottom view with tap holes for mounting DCS24 and rear panel view of DCS24.

# 7. Getting started

After mounting the detector module(s) and the detector control system (DCS) according to paragraph 6.1 and 6.2 the module(s) has to be connected to the DCS by the data cable (5.6).

For powering the detector system, the DCS has to be connected to the proper power supply (5.7). The power supply has to be connected to the proper supply voltage (paragraph 4.7.1).

To communicate with the DCS, it has to be connected by a network cable (5.3, 5.4, 5.5).

- to a local area network (LAN) in case of DHCP running on DCS.
- directly to the control PC in case of a fix IP of the DCS.

The network protocol of the DCS (DHCP or fix IP) is documented on the system information sheet.

If the detector system is directly connected to a control PC, the customer has to configure the network connection of the PC appropriate to the DCS network settings; *e.g.*

- IP: 192.168.0.100
- Subnet mask: 255.255.255.0

Power up the DCS with the power switch (5.3, 5.4, 5.5) and power up the control PC.



**Operate only detector module(s) with a DCS which has the same detector system serial number; e.g. D-M105-DCS1-nnn with D-M105-DET-mmm, since the appropriate configuration files for the detector module(s) are supplied by the DCS.**

In case of using the MYTHEN Web Client go on with the **Quick Start Guide** available at DECTRIS Ltd. (see 2.1 for support).

In case of using your own integration software to control the MYTHEN detector system go on with example code described in the **Socket Interface Specifications** available at DECTRIS Ltd. (see 2.1 for support).

# 8. Cleaning and maintenance

The MYTHEN detector system is essentially maintenance free.

The housing can be cleaned with a soft tissue.



**The Mylar® foil should not be touched or cleaned.**

# 9. Certification tests

## 9.1. MYTHEN detector system with DCS1

**EU/UE**
**KONFORMITÄTSERKLÄRUNG**
**DECLARATION OF CONFORMITY**
**DECLARATION DE CONFORMITE**

Wir
We
Nous **DECTRIS AG**

(Name des Anbieters) (supplier's name) (nom du fournisseur)

**Neuenhoferstrasse 107**
**CH-5400 Baden, Schweiz**

(Anschrift) (address) (adresse)

erklären in alleiniger Verantwortung, dass das Produkt
declare under our sole responsibility that the product
déclarons sous notre seule responsabilité que le produit

**X ray detector system**

**MYTHEN 1K**

(Bezeichnung Typ oder Modell, Los-, Chargen- oder Seriennummer, möglichst Herkunft und Stückzahl)
(name, type or model, lt, batch or serial number, possibly sources and numbers of items)
(nom, type ou modèle, no de lot, d'échantillon ou de série, évent. sources et nombre d'exemplaires)

auf das sich diese Erklärung bezieht, mit der/den folgenden Norm(en) oder normativen Dokumenten übereinstimmt.
to which this declaration relates is in conformity with the following standard(s) or other normative document(s).
auquel se réfère cette déclaration est conforme à la (aux) norme(s) ou autre(s) document(s) normatif(s).

EN 61010-1: 2001
EN 61000-6-1: 2007, EN 61000-6-3: 2007
EN 61000-6-2: 2005, EN 61000-6-4: 2007, EN 61326-1: 2006

(Titel und/oder Nummer sowie Ausgabedatum der Norm(en) oder der anderen normativen Dokumente)
(title and/or number and date of issue of the standard(s) or other normative document(s)
(titre et/ou no et date de publication de la (des) norme(s) ou autre(s) document(s) normatif(s)

Gemäss den Bestimmungen der Richtlinie(n); following the provisions of Directive(s); conformément aux dispositions de(s) Directive(s)
(falls zutreffend) (if applicable) (le cas échéant)

2006/95/EG + 204/108/EG

Baden, 22. Dezember 2008

CEO
Dr. Christian Brönnimann

Leitung Produktion
Markus Näf

(Ort und Datum der Ausstellung)
(Place and date of issue)
(Lieu et date)

(Name und Unterschrift oder gleichwertige Kennzeichnung des Befugten)
(name and signature or equivalent marking of authorized person)
(nom et signature du signataire autorisé)

## 9.2. MYTHEN detector system with DCS6

DCS6 has not passed CE certification up to now.

## 9.3. MYTHEN detector system with DCS24

DCS24 has not passed CE certification up to now.

# 10. Appendix

## 10.1. Table of Figures

Figure 1 CE certified MYTHEN1K detector module with position of channel 0 and 1279. ..... 11
Figure 2 Not CE certified MYTHEN1K detector module with position of channel 0 and 1279. ..... 11
Figure 3 MYTHEN1K detector module with cover in place (left) and removed. ..... 18
Figure 4 MYTHEN1K detector module viewed from the back. ..... 19
Figure 5 MYTHEN1K detector module (not CE certified version). ..... 20

## 10.2. Table of Tables

Table 1 Technical data of the MYTHEN detector module. ..... 10
Table 2 Technical data of MYTHEN detector control system DCS1. ..... 12
Table 3 Technical data of MYTHEN detector control system DCS6. ..... 12
Table 4 Technical data of MYTHEN detector control system DCS24. ..... 13
Table 5 Power ratings for MYTHEN detector control system DCS1. ..... 14
Table 6 Power ratings for MYTHEN detector control system DCS6. ..... 14
Table 7 Power ratings for MYTHEN detector control system DCS24. ..... 15
Table 8 Specification and rating for trigger and gating in- and ouputs of MYTHEN detector control system DCS1. ..... 16
Table 9 Specification and rating for trigger and gating in- and ouputs of MYTHEN detector control system DCS6. ..... 16
Table 10 Specification and rating for trigger and gating in- and outputs of MYTHEN detector control system DCS24. ..... 17
Table 11 Ambient conditions ..... 17
Table 12 Connector specifications for CE certified module. ..... 19
Table 13 Connector specifications for not CE certified module. ..... 21

## 10.3. Referenced Documents

All the following documents are available through DECTRIS Ltd. homepage.

https://www.dectris.com/technical_mythen.html#main_head_navigation

| Term | Description |
|---|---|
| **Firmware Update Guide** | Firmware_Update-MYTHEN-V2.pdf |
| **Module Handling Instructions** | Handling_Instructions-MYTHEN-V3.pdf |
| **Linux Installation Guide** | Linux_Installation-HowTo_MYTHEN-V2.pdf |
| **Network Settings** | Network_Settings-MYTHEN-V2.pdf |
| **Quick Start Guide** | QuickStart-MYTHEN-V3.pdf |
| **Socket Interface Specifications** | Socket_Interface_Spec-MYTHEN-V3.1.0-V1.pdf |
| **Technical Documentation** | Technical_Documentation-MYTHEN-V2.pdf |
| **Trigger Notes** | Trigger_Note-MYTHEN-V3.pdf |
| **User Manual** | User_Manual-MYTHEN-V3.pdf |