

# 18 slot PXIe System

## User's Manual



**Product Number:**  
**14579-040**

|      |               |   |
|------|---------------|---|
| R1.0 | July 2019     | Preliminary release                       |
| R1.1 | February 2020 | Manual supplemented                       |
| R1.2 | March 2020    | Minor corrections                         |
| R1.3 | April 2020    | Front panel added                         |
| R1.4 | October 2020  | Updated                                   |
| R1.5 | January 2021  | Clock specifications added                |
| R1.6 | March 2021    | System controller slot corrected to 16 HP |
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| R1.8 | July 2021     | Position temperature sensors added        |
|      |               |   |

Impressum:

Schroff GmbH

Langenalber Str. 96 - 100  
75334 Straubenhardt, Germany

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# 1 Safety

The intended audience of this User's Manual is system integrators and hardware/software engineers.


## 1.1 Safety Symbols used in this document

|   |   |
|---|---|
|  | <p><b>Hazardous voltage!</b></p> <p><i>This is the electrical hazard symbol. It indicates that there are dangerous voltages inside the Shelf.</i></p> |
|---|---|

|   |  |
|---|--|
|  | <p><b>Caution!</b></p> <p><i>This is the user caution symbol. It indicates a condition where damage of the equipment or injury of the service personnel could occur. To reduce the risk of damage or injury, follow all steps or procedures as instructed.</i></p> |
|---|--|

|   |  |
|---|--|
|  | <p><b>Danger of electrostatic discharge!</b></p> <p><i>Static electricity can damage sensitive components in a system. To avoid damage, wear ESD wrist straps or at regular intervals touch blank enclosure parts.</i></p> |
|---|--|

## 1.2 General Safety Precautions

|   |   |
|---|---|
|  | <p><b>Warning!</b></p> <p><i>Voltages over 60 VDC can be present in this equipment. This equipment is intended to be accessed, to be installed and maintained by qualified and trained service personnel only.</i></p> <p><i>This equipment is designed in accordance with protection class 1!</i></p> <p><i>It must therefore be operated only with protective GND/earth connection!</i></p> |
|---|---|

- Service personnel must know the necessary electrical safety, wiring and connection practices for installing this equipment.
- Install this equipment only in compliance with local and national electrical codes.

### 1.3 References and Architecture Specifications

- PXI-5 (PCI EXPRESS eXtensions for Instrumentation)
- User Manual Schroff embedded Controller, Ord.-No: 63972-389
- User Manual PXle Chassis Management (CMM), Ord.-No: 63972-391

## 2 Product Overview

### 2.1 Key features

- Shielded 4 U Schroff ratiopacPRO-air case with mounting brackets for 19" rack mounting and front handles and tip-up feet for desktop use
- 84 HP / 18 slot front card cage for 3 U boards
- 18 slot 3 U backplane with:
  - 1 PXIe system slot 4 - 16 HP
  - 1 PXIe timing slot 4 HP
  - 16 PXI Express Hybrid slots 4 HP accepting PXIe modules according to the PXI Express (PXI-5) standard as well as PXI, CompactPCI, CompactPCI Express modules
- BNC connectors for 10 MHz clock input/output at the rear side
- Integrated power supply (1200 W) with wide range input
- Power input module with IEC 60320-C14 connector, mains/line switch, mains/line filter and fuses
- 3x 120 mm Fans for the active cooling of the boards and the power supply, controlled and monitored by the Chassis Monitoring Module (CMM)
- Power switch with chassis status LEDs at the front side



***The system 14579-040***

***is described as an example below in this manual.***

***The system can be modified with various backplane configurations.***

***All pictures in this manual may differ from the latest series.***

## 2.2 System Overview

The 4 U case is based on the Schroff ratiopacPRO-air system with EMC shielding. The 3 U card cage provides 1 system slot (4 - 12 HP), 1 timing slot (4 HP) and 16 peripheral slots (4 HP).

The lower guide rails of the card cage are equipped with ESD clips.

Figure 1: Front and Rear View



- |   |  |    |  |
|---|--|----|--|
| 1 | PS-ON Switch with Chassis Status LEDs      | 7  | DSUB-9 Connector, female, Inhibit and voltage monitoring |
| 2 | Filler Panels 4/8 HP System Slot Extension | 8  | BNC Connectors 10 MHz REF clock in/out                   |
| 3 | PXIe Backplane                             | 9  | Fans/Air Outlet  |
| 4 | Air Intake                                 | 10 | Fan Speed Selector                                       |
| 5 | Power Input Module                         | 11 | Inhibit Mode Selector                                    |
| 6 | Ground stud (M5)                           |    |  |



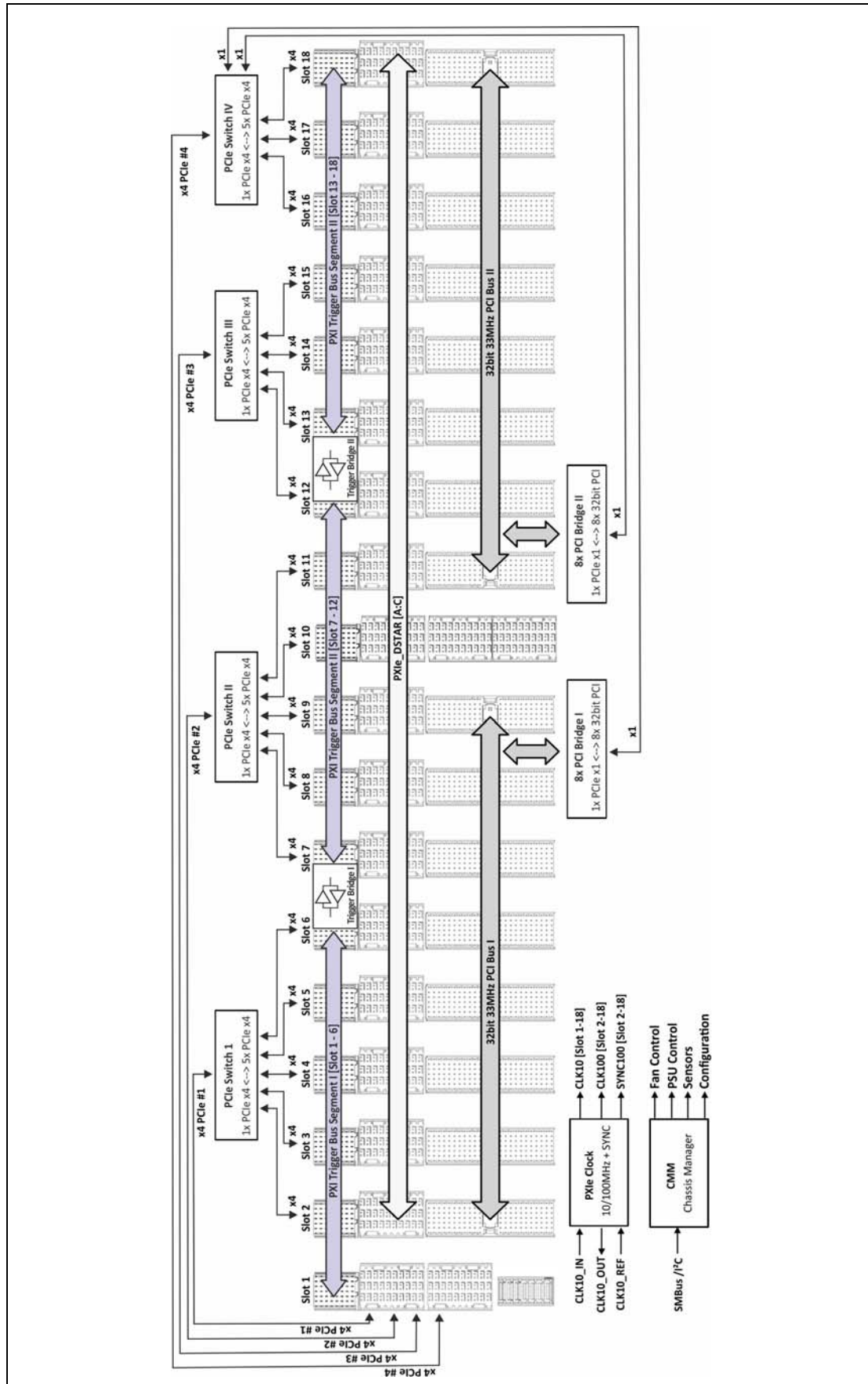
### 3 18 Slot PXle Backplane (23007-518)

The PXle backplane provides:

- 1 PXle system slot
- 1 PXle timing slot
- 16 PXle Hybrid slots
  - accepting CompactPCI, PXI, CompactPCI Express, and PXle modules
- 2 PCIe-to-PCI high performance bridges
  - utilize a single PCI segment for the hybrid slots
  - designed to the PCI Express-to-PCI Bridge Specification 1.0 that enables applications to migrate legacy parallel PCI bus interfaces to the advanced serial PCI Express
  - each bridge is equipped with a single lane PCI Express port and a parallel bus segment supporting the conventional PCI operation for up to eight PCI peripheral devices concurrently.
  - Primary Bus: x1 PCI Express Base Specification R1.1 compliant
  - Secondary Bus: 33 MHz/32 bit PCI Local Bus Specification R3.0 compliant
- All PXle hybrid slots with 32 bit 33 MHz PCI interface.
- 1 PXle clock module
  - generates and controls PXI specific high accuracy clocks and trigger signals.
- 4 ultra-high performance PCIe switches that operates with up to Gen 3 speeds.
- All PXle hybrid and the timing slots have an x4 PCIe link providing a maximum data bandwidth of 4 GB/s each.

### 3.1 Backplane Topology

Figure 2: Backplane Topology



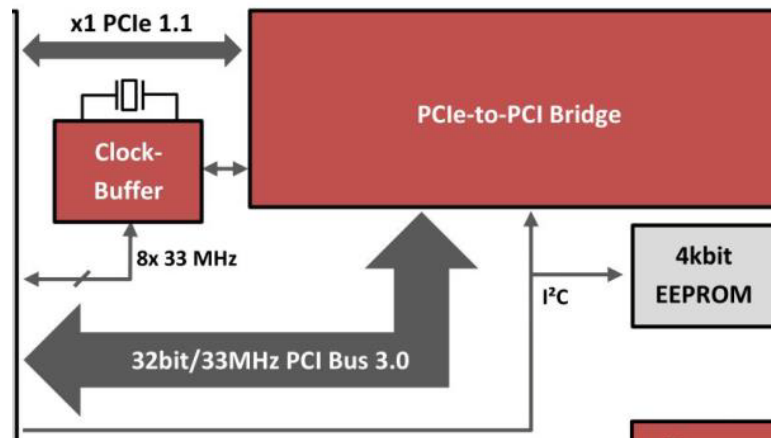
### 3.2 PCIe-to-PCI bridge

The Schroff PCIe-to-PCI Bridge is a high performance bridge designed to the PCI Express-to-PCI Bridge Specification 1.0 that enables applications to migrate legacy parallel PCI bus interfaces to the advanced serial PCI Express.

The bridge module is equipped with a single lane PCI Express port and a parallel bus segment supporting the conventional PCI operation for up to eight PCI peripheral devices concurrently.

Primary Bus: x1 PCI Express Base Specification R1.1 compliant

Secondary Bus: 33 MHz/32 bit PCI Local Bus Specification R3.0 compliant

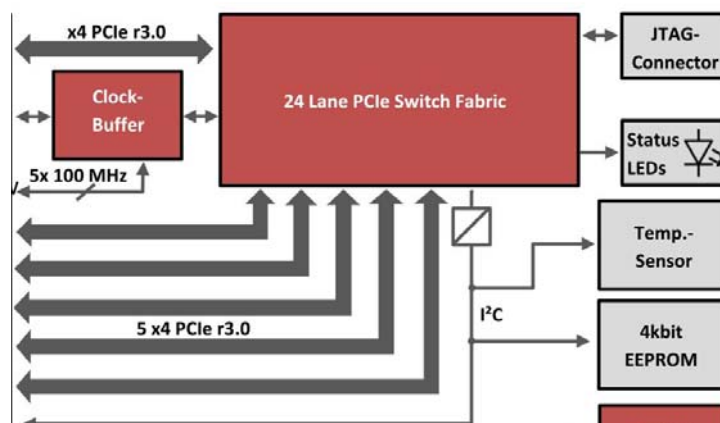


### 3.3 PCIe Switch

The Schroff PCIe Switch is a 24-lane, 6-port, PCIe Gen 3 switch device that enables users to connect a PCIe host to respective endpoints via a fully transparent, high-bandwidth, non-blocking peer-to-peer interface. The default configuration with a x4 upstream port to the host supports up to five independent x4 downstream clients.

Port Configuration: 1 x4 upstream port, 5 x4 downstream ports

Compatibility: PCI Express Base Specification R3.0, PCI Express Base Specification R2.0, PCI Express Base Specification R1.0a/1.1





### 3.4.1 Clock specifications



**For all specifications not mentioned in the tables below refer to the PXI-1 and PXI-5 PXIe Hardware specifications**

| PXI_CLK10                      |  |
|--------------------------------|--|
| Maximum slot to slot time skew | 500 ps<br>Note: PXI-5 spec specifies 1 ns  |
| Frequency accuracy             | ±25 ppm max (guaranteed over the operating temperature range)<br>Note: PXI-5 spec specifies ±100 ppm |
| Maximum jitter                 | 5 ps RMS phase jitter (10 Hz – 10 MHz range)   |
| Duty factor                    | 45 % to 55 %   |
| Unloaded signal swing          | 3.3 V ±0.3 V   |



**Values above valid for PXI standard products. Optimized parameters are possible on request (Jitter ≤2 ps, Accuracy 2 ppm, slot-to-slot skew 100 ps)**

| PXIe_CLK100 and PXIe_SYNC100  |  |
|---|--|
| Maximum slot to slot time skew  | 80 ps<br>Note: PXI-5 spec specifies 200 ps   |
| Frequency accuracy  | ±25 ppm max (guaranteed over the operating temperature range)<br>Note: PXI-5 spec specifies ±100 ppm |
| Maximum jitter  | 5 ps RMS phase jitter (10 Hz – 20 MHz range)   |
| Duty factor   | 45 % to 55 %   |
| Absolute differential voltage when each line pair is terminated with a 50 Ω load to 1.30 V (or Thevenin equivalent) | 500 mV to 950 mV   |

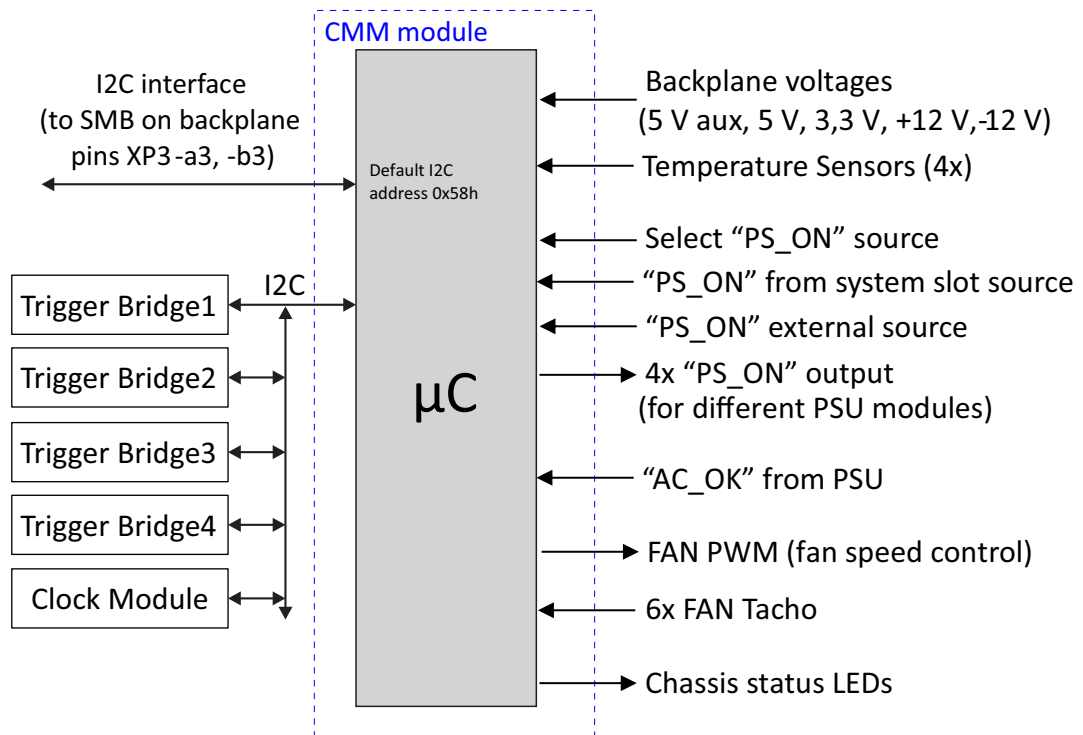


**Values above valid for PXI standard products. Optimized parameters are possible on request (Jitter ≤2 ps, Accuracy 2 ppm)**

| External 10 MHz Reference In             |  |
|--|--|
| Frequency                                | 10 MHz ±50 ppm                               |
| Input amplitude                          | 200 mV to 5 V, square wave or sine wave      |
| Maximum jitter introduced by backplane   | 1 ps RMS phase jitter (10 Hz – 10 MHz range) |
| Rear panel BNC connector input impedance | 50 Ω ±5 Ω                                    |

| External 10 MHz Reference Out |   |
|-------------------------------|---|
| Frequency accuracy            | ±25 ppm max.<br>(guaranteed over the operating temperature range) |
| Maximum jitter                | 5 ps RMS phase jitter (10 Hz – 10 MHz range)                      |
| Output amplitude              | min. 1.2 Vpp square wave into 50 Ω<br>min. 2.9V unloaded          |
| Output impedance              | 50 Ω ±5 Ω   |

### 3.5 Schroff PXle Chassis Management Module (CMM)



The Schroff PXle Chassis Management Module (CMM) allows access from the operating system to all important chassis functions. The CMM provides an I2C interface which is connected to backplane SMB (system slot pins XP3-a3, -b3).

The CMM:

- Monitors all chassis voltage levels
- Monitors and control the power supply
- Monitors and control the fans
- Monitors the chassis temperatures (inlet and outlet)
- Controls SYNC100 frequency from clock module
- Controls the PXI trigger bridges
- Controls the chassis status LEDs



**To use the CMM's full capabilities, you have to access the CMM's I<sup>2</sup>C register with the Schroff Embedded Controller or another appropriately configured and programmed third party system controller.**

**For further information see CMM User Guide, Ord--No: 63972-391**

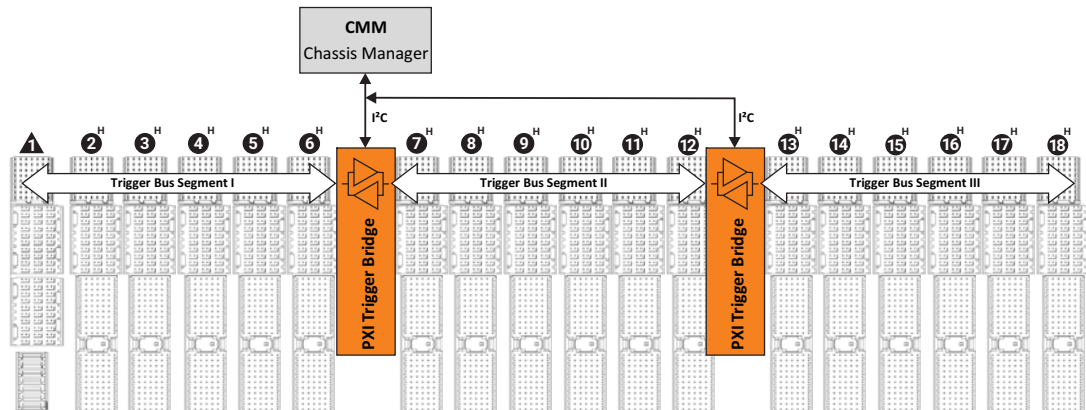
### 3.5.1 Chassis status LED

The power switch on the front of the chassis has two LEDs (red and white).

The table below shows the chassis states and corresponding LED behavior.

| Chassis state   | Notification LED behavior |
|---|---------------------------|
| Chassis is off  | Both LED OFF              |
| Chassis powered and operating properly                      | Solid white               |
| Air intake temperature is above 55°C                        | Flashing white            |
| Power supply DC outputs not within acceptable voltage range | Flashing red              |
| One of the chassis fans failed                              | Solid red                 |

### 3.6 PXI Trigger Bus



The PXIe chassis trigger bus is divided into 3 isolated trigger bus segments with 8 trigger lines each.

- Trigger segment 1 covers slot 1 through 6
- Trigger segment 2 covers slot 7 through 12
- Trigger segment 3 covers slot 13 through 18

Through the PXI trigger bridge, each trigger line of a segment can be individually routed in either direction to the other segment.

The trigger bridges are controlled by the CMM.




**By default the 3 trigger bus segments are isolated, the trigger bridges are disabled. To enable the trigger bridges and set the direction of the routing, you have to access the CMM's I<sup>2</sup>C register with the Schroff Embedded Controller or another appropriately configured and programmed system controller.**

**For further information see CMM User Guide 63972-391**




### 3.7 Power Supply



**Hazardous voltage!**

Parts of the power supply may be exposed with hazardous voltage. Always remove mains/line connector before carry out any assembly work.



**Caution!**

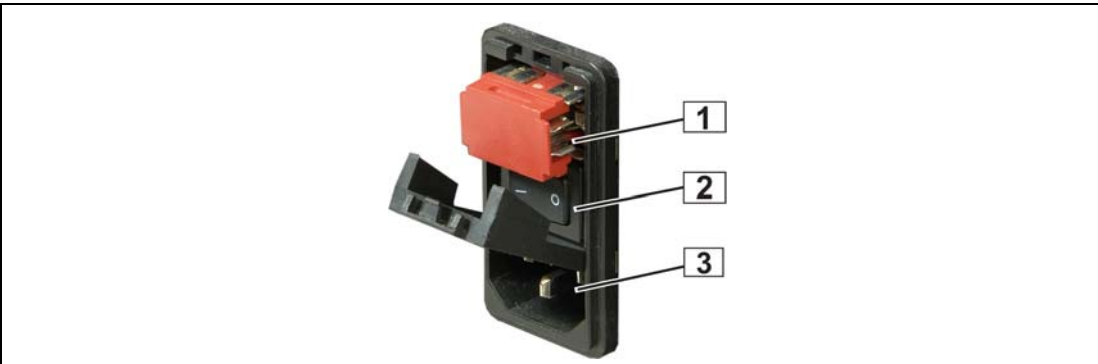
Your system has not been provided with a AC power cable. Purchase an AC power cable that is approved for use in your country. The AC power cable must be rated for the product and for the voltage and current marked on the product's electrical ratings label. The voltage and current rating of the cable should be greater than the ratings marked on the product.

The PXle system is powered by a 1200 W power supply with wide range input (100 - 240 VAC).

The power input is provided by an AC mains/line module with IEC 60320-C14 connector, integrated mains/line fuses and line filter.

The fuse rating is 10 A slow blow (T10AH250V).

**Figure 3: AC mains/line module**



12309010

- 1

Fuse holder
- 2

Mains/line switch
- 3

AC Connector (IEC60320-C14)

**Table 1: Data AC Power Supply**

|                       |                |                |                        |               |
|-----------------------|----------------|----------------|------------------------|---------------|
| Input voltage nominal | 100 - 240 VAC  |                |                        |               |
| Mains Frequency       | 50 / 60 Hz     |                |                        |               |
| Power (max.)          | 1200 W         |                |                        |               |
| Output                | <b>Voltage</b> | <b>Current</b> | <b>Load Regulation</b> | <b>Ripple</b> |
|                       | +3.3 V         | 80 A           | ±2 %                   | ±50 mV        |
|                       | +5.0 V         | 36 A           | ±2 %                   | ±50 mV        |
|                       | +5.0 V Aux     | 2 A            | -                      | ±50 mV        |
|                       | +12.0 V        | 40 A           | ±2 %                   | ±100 mV       |
|                       | -12.0 V        | 20 A           | ±2 %                   | ±100 mV       |

### 3.7.1 Available electrical power

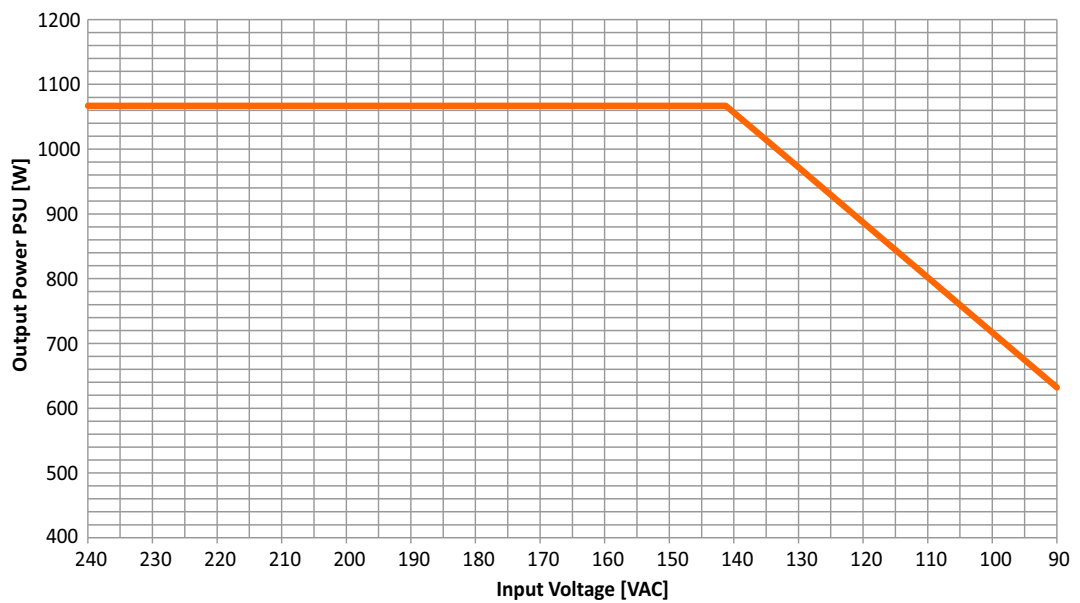
The input current of the chassis is limited to 10 A. This results in an available PSU output power at the following nominal AC input voltages:



The power for the fans and system modules is already deducted in the calculation and the diagram below.

- 100 V --> 720 W
- 115 V --> 840 W
- 230 V --> 1060 W

**Derating Output Power PSU**



### 3.7.2 Per slot power

The table below shows the maximum available electrical power per slot.

Please note:

- All current carrying backplane pins must be used by the boards
- The average cooling capacity of the PXle chassis is 50 W per slot
- Max. PSU power

|                                    | 5 V    | 3.3 V  | +12 V | -12 V | 5 Vaux | max power per slot |
|------------------------------------|--------|--------|-------|-------|--------|--------------------|
| PXI Express System Controller Slot | 10.5 A | 10.5 A | 21 A  | 0 A   | 1.5 A  | 320 W              |
| PXI Express Peripheral Slot        | 0 A    | 4.5 A  | 3 A   | 0 A   | 1.5 A  | 61 W               |
| Hybrid Slot                        | 12 A   | 19.5 A | 4.5 A | 1.5 A | 1.5 A  | 312 W              |
| PXI-1 Peripheral Slot              | 12 A   | 19.5 A | 4.5 A | 1.5 A | 1.5 A  | 312 W              |
| Max PSU current per voltage        | 36 A   | 80 A   | 40 A  | 20 A  | 2 A    |                    |

### 3.7.3 Grounding/Earthing

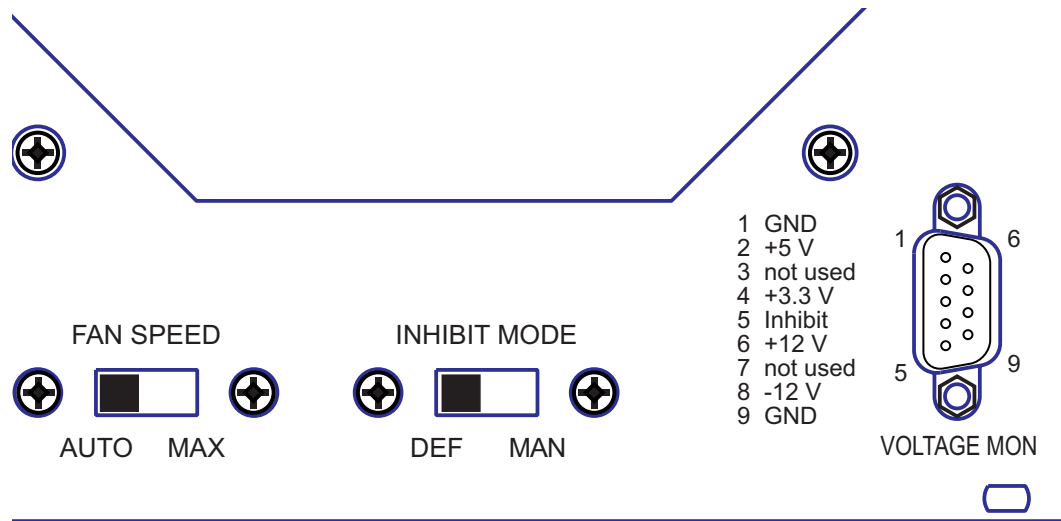


#### Caution!

The unit is designed in accordance with protection class 1! It must therefore be operated with protective earth/GND connection. Use only a three conductor AC power cable with a protective earth conductor that meets the IEC safety standards!

The PXle system provides an additional ground terminal at the rear side. If required, an additional protective connector can be connected to the bolt.

### 3.8 Power-on behaviour



The power-on behaviour depends on the setting of the inhibit mode switch at the rear panel.

When the inhibit mode switch is set to "**DEF**", the CMM controls the power supply inhibit, the chassis can be powered by pushing the power button at the left front side.

When the inhibit mode switch is set to '**MAN**', the chassis boots when AC-power is applied, as long as Pin 5 at the DSUB connector is not connected to GND.



**Please note the following:**

**In order to ensure a proper function of the DEF and MAN settings, the BIOS settings in the embedded controller must be adjusted.**

**DEF Mode:**

**- Set BIOS Power Loss Control to "Remain Off".**

**MAN Mode:**

**- Set BIOS Power Loss Control to "Turn On".**

**For further information see the embedded Controller User Guide, Ord.-No: 63672-389**

### 3.9 Voltage monitoring

The female DSUB-9 connector allows remote monitoring of the system voltages.

## 4 Cooling

The PXle boards are cooled by forced air convection through 3 speed controlled 12 VDC axial fans.

The air enters the subrack at the perforated bottom panel into the bottom air plenum. As the air passes across the hot components on the Front Boards, heat is carried away by forced convection.

The air exits the subrack at the top, is drawn into the upper plenum, turns 90°, passes the modules located at the backplane's rear side and is exhausted out the rear of the subrack by the 3 fans.

The average cooling capacity of the PXle chassis is 50 W per slot at a Delta T of 20 °C. The actual heat dissipation for a specific slot depends on the pressure drop of the card used and the occupancy of the adjacent slots.

For high performance cards, the slot with the highest air flow should be used and the air flow of adjacent slots should be reduced by air baffles.



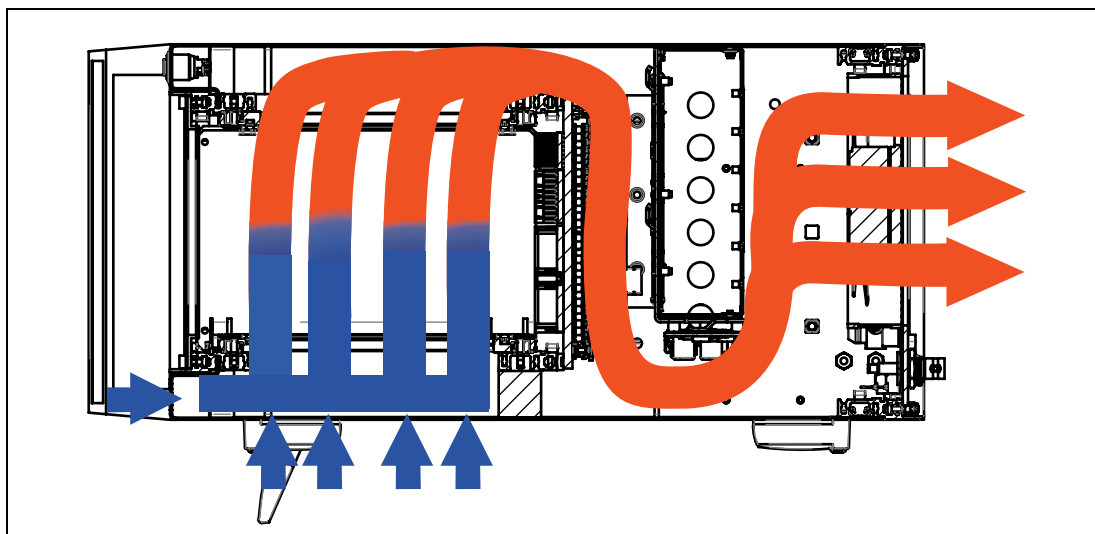
### Caution!

To maintain proper airflow, all open slots must be covered with filler panels. The filler panel should include an airflow baffle that extends to backplane.

For desktop use, unfold the front tip-up feet for optimal cooling efficiency.

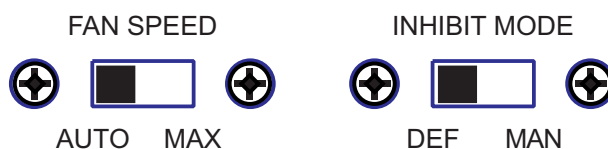
For rack mounting, at least 1 U (44.5 mm/1.75 in.) clearance below the chassis is required.

Figure 4: Air Flow



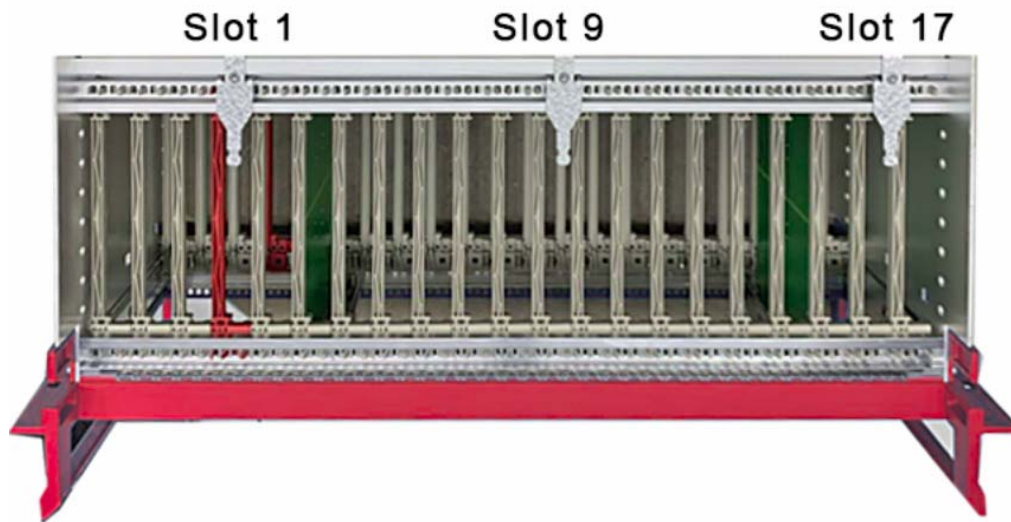
### 4.0.1 Maximum cooling

For maximum cooling performance, set the fan speed switch at the chassis rear side to "MAX". The fans will rotate permanently at 100%.



## 4.1 Temperature Settings

### Temperature sensors



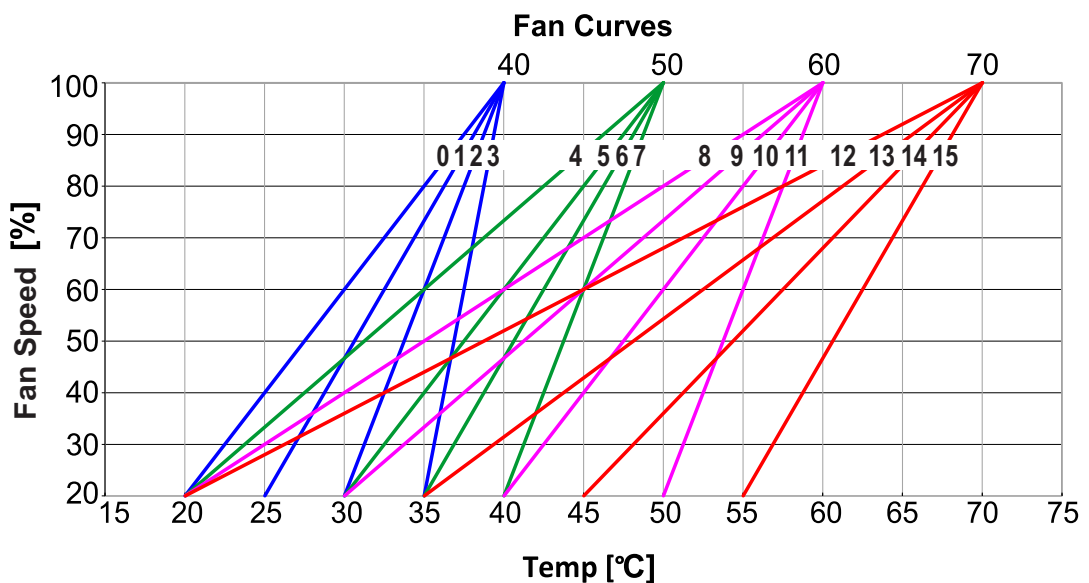
3 NTC temperature sensors located in top of the card cage are connected to the CMM. The highest temperature level is the reference for the fan speed.



**To ensure proper fan control, place the PXle Modules with the highest heat dissipation in the slots directly underneath the NTC temperature sensors (Slot 1, 9, 17).**

The fan speed is controlled by the CMM depending on a fan curve stored in a CMM register.

16 fan curves are available and can be selected by the SCHROFF embedded controller, the default fan curve is "5".



A manual fan speed control where the embedded controller sets the fan speed in % is also possible. For more information see the CMM user manual, 63972-3911.

## 5 System Controller

The SCHROFF PXle system is designed to operate in conjunction with the SCHROFF embedded controller.

For the SCHROFF embedded Controller, the chassis INI file and PXle Chassis dll which come with the system, have to be saved in system directories specified by the instrument and measure management software and system registry settings.

The configuration and registry settings for the SCHROFF embedded controller are described in the embedded controller user manual, 63972-389.

A third party controller is also possible, please see the specific user manual for the setup.

## 5.1 Fan Speed and Trigger Bridge settings

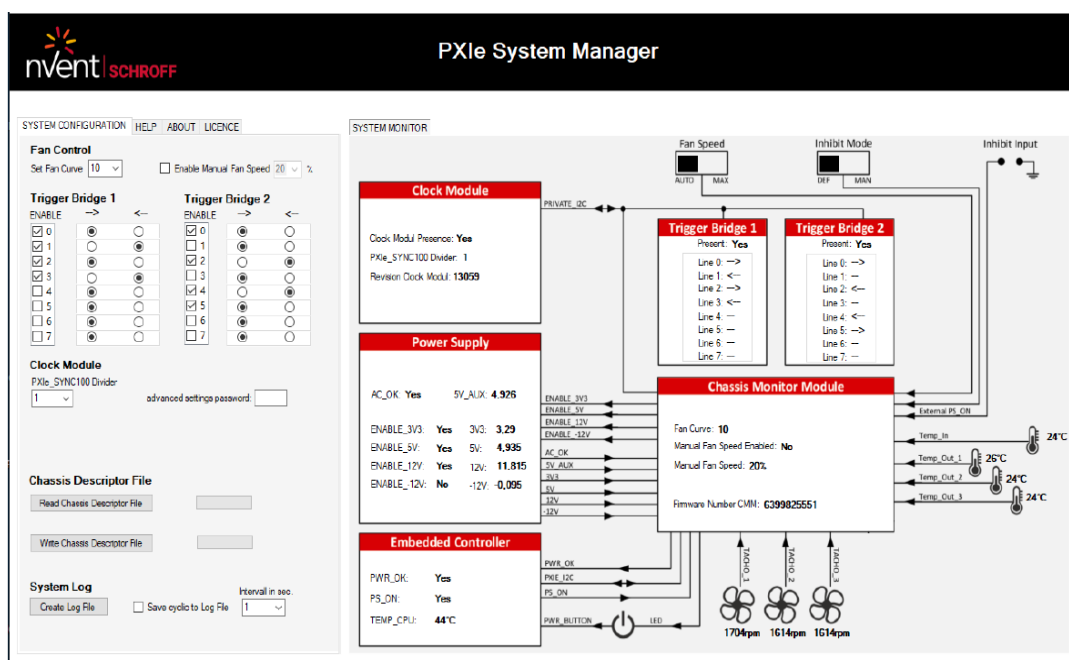
Fan Speed and Trigger Bridge settings are managed by the CMM. To access these settings you need access to the resp. CMM register via the system I<sup>2</sup>C bus (SMB).

With the SCHROFF embedded controller, the Fan Speed and Trigger Bridge settings of a SCHROFF PXle system can be displayed and managed by a dedicated tool called the **SCHROFF PXle System Manager**.

For third party system controllers contact the manufacturer for instructions to get access to the system I<sup>2</sup>C bus and to read and write to the CMM register.



**The CMM registers are described in the CMM User Guide 63972-391**



**By default the 3 trigger bus segments are isolated, the trigger bridges are disabled. To enable the trigger bridges and set the direction of the routing, you have to access the CMM's I<sup>2</sup>C register with the Schroff Embedded Controller or another appropriately configured and programmed system controller.**

**For further information see CMM User Guide 63972-391**



## 5.2 General Installation Guidelines

### 5.2.1 Unpacking



**Caution!**

When opening the shipping carton, use caution to avoid damaging the system.

Consider the following when unpacking and storing the system:

- Leave the system packed until it is needed for immediate installation.
- After unpacking the system, save and store the packaging material in case the system must be returned.

If the packaging is damaged and possible system damage is present, report to the shipper and analyze the damage.

### 5.2.2 Ensuring Proper Airflow

- Maintain ambient airflow to ensure normal operation. If the airflow is blocked or restricted, or if the intake air is too warm, an overtemperature condition can occur.
- Ensure that cables from other equipment do not obstruct the airflow through the systems.
- Use the filler panels (included in the scope of delivery) to cover all empty chassis slots. The filler panel prevents fan air from escaping out of the front of an open slot. If necessary, use air baffles (available as accessories) to prevent air short circuits in unused slots.

## 5.3 Initial Operation



**Warning!**

This equipment is intended to be accessed, to be installed and maintained by qualified and trained service personnel only.

This equipment is designed in accordance with protection class 1!

It must therefore be operated only with protective GND/earth connection!

- Ensure that the system has not been damaged during transport, storage or assembly
- Check the Protective Earth (PE) resistance, should be < 0,1 Ohm
- Plug-in the boards
- Ensure that all open Slots are covered with filler panels
- Ensure that the switch **INHIBIT MODE** at the rear side is set to **DEF**
- Ensure that the switch **FAN SPEED** at the rear side is set to **AUTO**
- Connect the power cable and switch on the mains/line switch at the power input
- Push the power button at the front side to switch on the system

## 6 Service

### 6.1 Technical support and Return for Service Assistance

We generally recommend to return the complete system. For all product returns and support issues, please contact your Schroff sales distributor.

We recommend that you save the packing material. Shipping without the original packing material might void the warranty.

## 6.2 Scope of Delivery

| Quantity | Description  |
|----------|--|
| 1        | ratiopacPRO-air case 4 U / 84 HP, shielded, powder coated  |
| 1        | PXle backplane 18 slot 3 U, including:<br>4x PCIe Switch<br>2x PCI Bridge<br>1x PXle Clock Module<br>2x PXI Trigger Bridge Modules<br>1x CMM |
| 1        | 1200 W power supply with input range of 100 VAC to 240 VAC   |
| 1        | 12 VDC Power supply with input range of 100 VAC to 240 VAC for fan power   |
| 1        | Power input module with IEC 320-C14 connector, mains/line switch, mains/line filter and fuses  |
| 1        | Complete AC/DC cabling   |
| 3        | Axial fans 120x120 mm  |
| 1        | Rear panel 3 U, 84 HP  |
| 1        | Front panel black 3 U, 4 HP to cover empty system slot   |
| 1        | Front panel black 3 U, 8 HP to cover empty system slot   |
| 5        | Front panels silver 3 U, 4 HP to cover empty slots   |
| 3        | Front panels silver 3 U, 8 HP to cover empty slots   |
| 2        | Front panels silver 3 U, 12 HP to cover empty slots  |

Please order the power cable separately.

## 6.3 Accessories

| Order No. | Description   |
|-----------|---|
| 34562-824 | Air baffle 3 U, 4 HP, to prevent air short circuits in unused slots |

## 6.4 Spare Parts

On request.

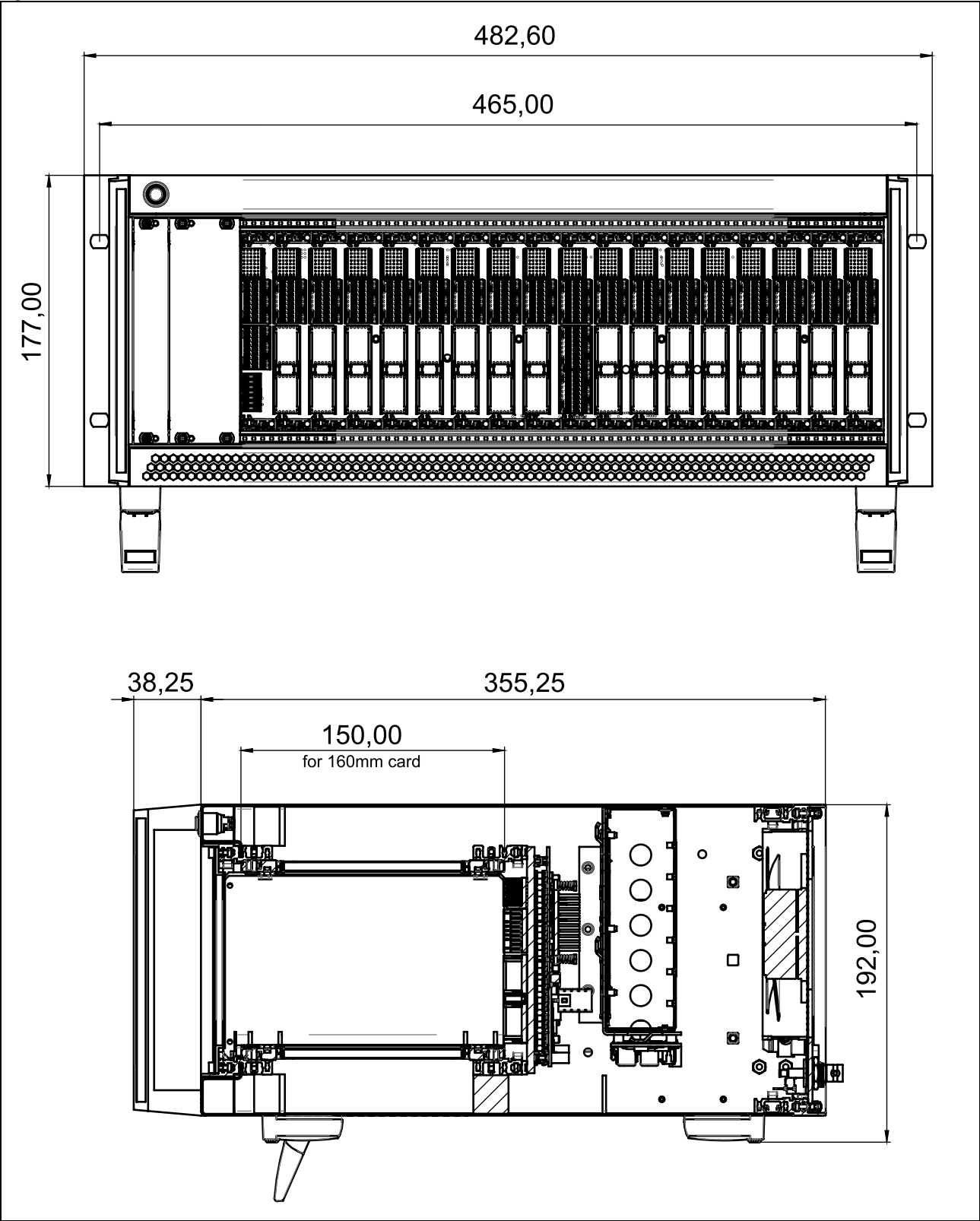
## 7 Technical Data

Table 2: Technical Data

| Dimensions                             |                                 |
|--|---------------------------------|
| Height (w/o feet)                      | 177 mm (4 U)                    |
| Height (with feet)                     | 192 mm (4 U)                    |
| Width (with mounting brackets)         | 84 HP (19" / 482.6 mm)          |
| Depth (Overall w/o handles)            | 355.25 mm                       |
| Weight                                 |                                 |
| System without cards and filler panels | 9,8 kg                          |
| Power Supply                           |                                 |
| Input Voltage                          | 100 VAC bis 240 VAC             |
| Frequency                              | 50 / 60 Hz                      |
| Power input                            | up to 1200 W                    |
| Over-current protection                | Fuse 10 A slow blow (T10AH250V) |
| Ambient Temperature                    |                                 |
| Operation                              | +0 °C to +50 °C                 |
| Storage                                | -20 °C to +70 °C                |
| Humidity                               |                                 |
| Admissible humidity                    | 20 % to 80 %, non-condensing    |
| Shock and Vibration                    |                                 |
|  |                                 |
| EMC, fulfils requirements for:         |                                 |
| Transient Emissions                    |                                 |
| Interference Resistance                |                                 |
| Safety                                 |                                 |
|  |                                 |
|  |                                 |
| Electromagnetic Shielding              |                                 |
|  |                                 |

# 8 Dimensions

Figure 5: Dimensions







**Schroff GmbH**

Langenalber Str. 96 - 100  
75334 Straubenhardt, Germany  
Tel +49.7082.794.0  
Fax +49.7082.794.200