User Manual

BL50S – Box PC for Storage Applications (AMD)

Configuration example

BL50S - Box PC for Storage Applications (AMD)

The BL50S is a maintenance-free box computer that has been designed for storage applications such as content servers or video recorders. It offers two external SATA shuttles with hot-plugging support.

On the front of the BL50S as many as 5 Gigabit Ethernet interfaces are accessible. Four of these ports share one Gigabit Ethernet port from the chipset via a switch, while one port is used exclusively as Gigabit Ethernet uplink. The four ports routed over the switch support Power-over-Ethernet.

One PCI Express Mini Card slot with two SIM card slots offers the possibility to implement the wide range of functionality available on this form factor. This includes for example mobile service standards GSM (2G), UMTS (3G), LTE (4G) and derivates, wireless communication standards WLAN / Wi-Fi IEEE 802.11 and derivates as well as positioning systems GPS or GLONASS.

The BL50S is powered by an AMD Embedded G-Series APU (Accelerated Processing Unit), the T48N, running at 1.4 GHz. The G-Series combines low-power CPUs and advanced GPUs, in this case an AMD Radeon HD 6310, into a single embedded device. The use of the Embedded G-Series makes for high scalability in CPU (single/dual core) and graphics performance (various Radeon GPUs or none at all).

The BL50S is equipped with 2 GB of DDR3 SDRAM and offers SD card and mSATA slots. The system is designed for fanless operation at temperatures from -40 to +70°C (+85°C for up to 10 minutes), its special aluminum housing with cooling fins serves as a heatsink for the internal electronics and in this way provides conduction cooling.

The BL50S supports one DisplayPort interface with a resolution of 2560×1600. In addition, a multitude of other I/O is available at the front panel, including two USB 2.0 and variable slots for legacy serial I/O (e.g. RS232) or CAN bus.

The BL50S comes with its own integrated class S2 wide-range power supply with 24 and 36 VDC nominal input voltage (10 to 50.4 V) and a power consumption of 30 W and is in compliance with EN 50155 and ISO 7637-2 (E-mark for automotive). The power can be switched on and off using an ignition signal on the power connector, and a run-down time after switching off the power can be adjusted by software.

The combination of the various CPU/GPU options with the available selection of external interfaces makes for an extremely flexible system design that can quickly be tailored to a vast number of applications.

Diagram
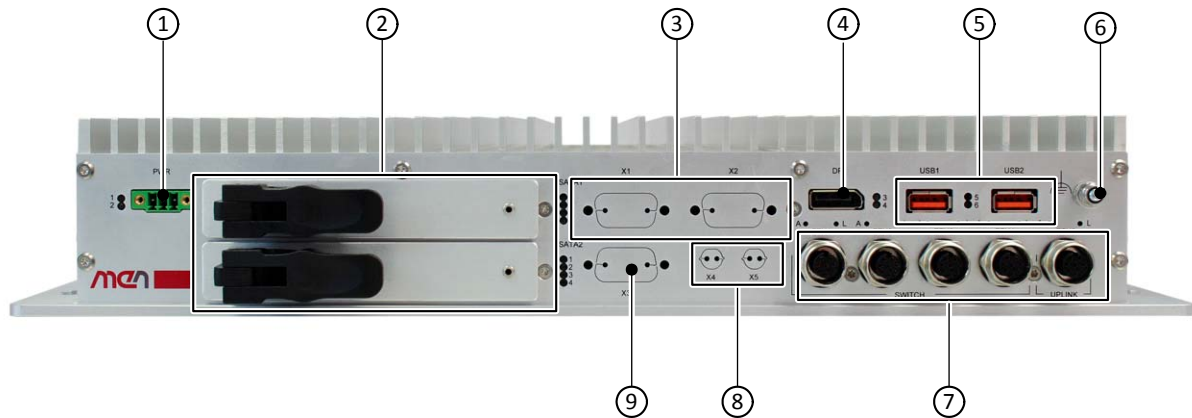
① PSU connector (10V-50.4V)

② 2 Hard Disk Shuttles

③ 2 SA-Adapter cutouts for RS232, RS485/422, CAN, IBIS master, IBIS slave or GPIO

④ 1 DisplayPort

⑤ 2 USB 2.0

⑥ Earthing stud

⑦ 5 Gigabit Ethernet (4-port Ethernet switch and one uplink port)

⑧ 2 antenna connector cutouts for PCI Express Mini Card

⑨ Cutout for HD Audio

Technical Data

CPU

- AMD Embedded G-Series T48N
  - Dual-Core
  - 1.4 GHz processor core frequency
  - Accelerated Processing Unit (APU), also includes GPU (see Graphics)

Controller Hub

- AMD A55E

Memory

- 64 KB L1 and 512 KB L2 cache
- 2 GB DDR3 SDRAM system memory
  - Soldered
  - 1066 MT/s

Mass Storage

- One SD card slot
- One mSATA slot
  - SATA Revision 2.x support
  - Transfer rates up to 300 MB/s (3 Gbit/s)
- Serial ATA (SATA)
  - Two external shuttles for 2.5" SATA HDD/SSD drive
  - SATA Revision 2.x support
  - Transfer rates up to 300 MB/s (3 Gbit/s)
  - Hot-pluggable (with independent devices)
  - Status LEDs

Graphics

- AMD Radeon™ HD 6310
  - Maximum resolution: 2560x1600
- 3D Graphics Acceleration
  - Full DirectX® 11 support, including full speed 32-bit floating point per component operations
  - Shader Model 5
  - OpenCL™ 1.1 support
  - OpenGL® 4.0 support
- Motion Video Acceleration
  - Dedicated hardware (UVD 3) for H.264, VC-1 and MPEG2 decoding
  - HD HQV and SD HQV support: noise removal, detail enhancement, color enhancement, cadence detection, sharpness, and advanced de-interlacing
  - Super up-conversion for SD to HD resolutions

Ethernet Uplink

- One Gigabit Ethernet uplink
  - Via one M12 connector at the front

Gigabit Ethernet Switch Functionality

- Four 10/100/1000Base-T ports at front panel
  - Via four M12 connectors
- High-speed non-blocking, store-and-forward switching
- Port configuration: copper, 10/100 and 1000 Mbit/s
- Auto-negotiation / Auto MDI/MDIX crossover on all ports
- Layer2-based Policy Control List
- 8K MAC address lookup table with automatic learning and aging
- Supported Protocols and Standards
  - Ethernet flow control (IEEE 802.3x)
  - Link aggregation LACP / EtherChannel (IEEE 802.3ad, 2005)
  - Priority-based switching, Quality of Service/DiffServ, tagged frames, Layer2-based 801.1Q VLAN-ID packet routing (IEEE 802.1p)
  - Port-based authentication on registered MAC Address Lists
  - Power over Ethernet support (IEEE 802.3af / IEEE 802.3at, Type 1)
  - VLAN/port-based VLANs GVRP/MVRP (IEEE 802.1Q Rev D5.0, 2005)
- Power over Ethernet functionality
  - PSE (Power Sourcing Equipment) function
  - Supports supply classes 0 to 4
  - Supplies up to four PD devices (up to 28 W total)
  - 1x 25 W PoE+ (Class 4)
  - 2x 12.96 W (Class 3 / class 0)
  - 4x 6.5 W (Class 2)

Front I/O

- 1 DisplayPort® 1.1a interface
  - AUX channel and hot plug detection
- 2 USB 2.0
  - Via Series A connector
- 4-port Gigabit Ethernet switch
  - Via four M12 connectors
- 1 Gigabit Ethernet uplink
  - Via one M12 connector
- 2 SA-Adapter slots for legacy serial I/O
  - For RS232, RS422/485, CAN, IBIS master, IBIS slave, GPIO
- 24 status LEDs
  - 10 for Ethernet link and activity status
  - 2 for general board status
  - 4 user LEDs
  - 8 SATA LEDs

1 PCI Express® Mini Card slot

- For functions such as
    - Mobile service standards: GSM (2G), UMTS (3G), LTE (4G) and derivates
    - Wireless communication: WLAN / WiFi IEEE 802.11 and derivates
    - Positioning: GPS, GLONASS, GALILEO
- 2 SIM card slots (Dual SIM)
- PCI Express® and USB interface

Real-Time Clock

- Buffered by Gold Cap for up to 72 h

Electrical Specifications

- Isolation voltage 1,500 VDC against shield
- Supply voltage:
    - 24V and 36V nominal input voltage according to EN50155
    - 24V nominal input voltage according to ISO 7637-2 (E-mark) requirements
    - 10 to 50.4 V input voltage range
    - EN 50155 power interruption class S2
    - Ignition signal at the front
- Power consumption: 14.4 W with T48N CPU with Windows® 7 operating system and 1 Gb Ethernet connection

Mechanical Specifications

- Dimensions: Height 66 mm x Width 390 mm x Length 215 mm
- Weight: approx. 4.25 kg
- IP20 protection

Environmental Specifications

- Temperature range (operation):
    - -40°C to 70°C (screened), with up to 85°C for 10 minutes according to class Tx (EN 50155)
    - Fanless operation
- Temperature range (storage): -40..+85°C
- Relative humidity (operation): max. 95% non-condensing
- Relative humidity (storage): max. 95% non-condensing
- Altitude: -300 m to +3,000 m
- Shock: 50 m/s², 30 ms (EN 61373)
- Vibration (function): 1 m/s², 5 Hz – 150 Hz (EN 61373)
- Vibration (lifetime): 7.9 m/s², 5 Hz – 150 Hz (EN 61373)
- Conformal coating of internal components

MTBF

- 267 047 h @ 40°C according to IEC/TR 62380 (RDF 2000)

Safety

- Flammability
  - UL 94V-0
- Fire Protection
  - EN 45545-2
- Electrical Safety
  - EN 50153
  - EN 50155

EMC Conformity (Automotive)

- ECE R10 (E-mark)
- ISO 10605 (ESD)

EMC Conformity (Railway)

- EN 50121-3-2

BIOS

- InsydeH2O™ UEFI Framework

Software Support

- Windows® 7
- Windows® Embedded Standard 7
- Linux

> For more information on supported operating system versions and drivers see the online data sheet.

Configuration Options

APU

- AMD T56N, 1.65 GHz Dual Core, 18W, AMD Radeon™ HD 6320
- AMD T56E, 1.65 GHz Dual Core, 18W, AMD Radeon™ HD 6250
- AMD T48N, 1.4 GHz Dual Core, 18W, AMD Radeon™ HD 6310
- AMD T48E, 1.4 GHz Dual Core, 18W, AMD Radeon™ HD 6250
- AMD T40N, 1.0 GHz Dual Core, 9W, AMD Radeon™ HD 6290
- AMD T40E, 1.0 GHz Dual Core, 6.4W, AMD Radeon™ HD 6250
- AMD T52R, 1.5 GHz Single Core, 18W, AMD Radeon™ HD 6310
- AMD T44R, 1.2 GHz Single Core, 9W, AMD Radeon™ HD 6250
- AMD T40R, 1.0 GHz Single Core, 5.5W, AMD Radeon™ HD 6250
- AMD T16R, 615 MHz Single Core, 4.5W, AMD Radeon™ HD 6250
- AMD T48L, 1.4 GHz Dual Core, 18W
- AMD T30L, 1.4 GHz Single Core, 18W
- AMD T24L, 1000 MHz Single Core, 5W

Memory

- Up to 4 GB DDR3 SDRAM system memory
- SATA hard-disk/solid state drive (mounted within housing)

Graphics

- Maximum resolution depending on GPU
  - 2560x1600 (all DisplayPort® interfaces) with Radeon™ HD 6310 and 6320
  - 1920x1200 (all DisplayPort® interfaces) with Radeon™ HD 6250 and 6290

I/O

- Ethernet
  - One Fast Ethernet uplink and one 4-port Fast Ethernet switch on five M12 connectors, or
  - One Gigabit Ethernet uplink and one 4-port Fast Ethernet switch on five M12 connectors
- HD audio interface
  - HD audio codec
  - Audio stereo in
  - Audio stereo out
  - SPDIF out
- Antenna connectors
  - Various types available on the market (SMA, reverse SMA, QMA, FME...)
- SA-Adapters
  - Serial interfaces: RS232, RS422/485, GPIO
  - Fieldbus: IBIS master, IBIS slave, CAN bus

Electrical Specifications

- Input voltages of 48V, 72V and 110V can be implemented on request

Mechanical Specifications

- Other IP protection classes possible on request

As the product concept is very flexible, there are many other configuration possibilities. Please contact our sales team if you do not find your required function in the options. Please note that some of these options may only be available for large volumes.

> For available standard configurations see the online data sheet.

Product Safety

Electrostatic Discharge (ESD)

Computer boards and components contain electrostatic sensitive devices. Electrostatic discharge (ESD) can damage components. To protect the board and other components against damage from static electricity, you should follow some precautions whenever you work on your computer.

- Power down and unplug your computer system when working on the inside.
- Hold components by the edges and try not to touch the IC chips, leads, or circuitry.
- Use a grounded wrist strap before handling computer components.
- Place components on a grounded antistatic pad or on the bag that came with the component whenever the components are separated from the system.
- Only store the board in its original ESD-protected packaging. Retain the original packaging in case you need to return the board to MEN for repair.

About this Document

This user manual is intended only for system developers and integrators, it is not intended for end users.

It describes the hardware functions of the system and connection of peripheral devices. It also provides additional information for special applications and configurations of the system.

The manual does not include detailed information on individual components (data sheets etc.). A list of literature is given in the appendix.

History

Issue	Comments	Date
E1	First issue	2014-09-01
E2	Added Chapter 2.3.1 Installing the BL50S in a 19" Rack on page 35, Chapter 5 Using the BL50S with MDIS5 Software on page 68, Chapter 7.2 Dimensions of the BL50S Box PC on page 72, corrections	2014-12-10

Conventions

⚡	Indicates important information or warnings concerning the use of voltages that could lead to a hazardous situation which could result in personal injury, or damage or destruction of the component.

⚠	Indicates important information or warnings concerning proper functionality of the product described in this document.

🌐	The globe icon indicates a hyperlink that links directly to the Internet, where the latest updated information is available. When no globe icon is present, the hyperlink links to specific elements and information within this document.

italics	Folder, file and function names are printed in *italics*.
bold	**Bold** type is used for emphasis.
mono	A `monospaced` font type is used for hexadecimal numbers, listings, C function descriptions or wherever appropriate. Hexadecimal numbers are preceded by "`0x`".
comment	Comments embedded into coding examples are shown in green text.
IRQ# /IRQ	Signal names followed by a hashtag "#" or preceded by a forward slash "/" indicate that this signal is either active low or that it becomes active at a falling edge.
in/out	Signal directions in signal mnemonics tables generally refer to the corresponding board or component, "in" meaning "to the board or component", "out" meaning "from it the board or component".

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RoHS

Since July 1, 2006 all MEN standard products comply with RoHS legislation.

Since January 2005 the SMD and manual soldering processes at MEN have already been completely lead-free. Between June 2004 and June 30, 2006 MEN's selected component suppliers have changed delivery to RoHS-compliant parts. During this period any change and status was traceable through the MEN ERP system and the boards gradually became RoHS-compliant.

WEEE Application

The WEEE directive does not apply to fixed industrial plants and tools. The compliance is the responsibility of the company which puts the product on the market, as defined in the directive; components and sub-assemblies are not subject to product compliance.

In other words: Since MEN does not deliver ready-made products to end users, the WEEE directive is not applicable for MEN. Users are nevertheless recommended to properly recycle all electronic boards which have passed their life cycle.

Nevertheless, MEN is registered as a manufacturer in Germany. The registration number can be provided on request.

Contents

Figures

Tables

1 Product Description

1.1 Overview

This chapter gives an overview of the box PC.

Figure 1. *The BL50S - overview*

1.1.1 External Interfaces

The following picture shows the BL50S front without antennas and flexible SA-Adapters.

Figure 2. *The BL50S - front interfaces*
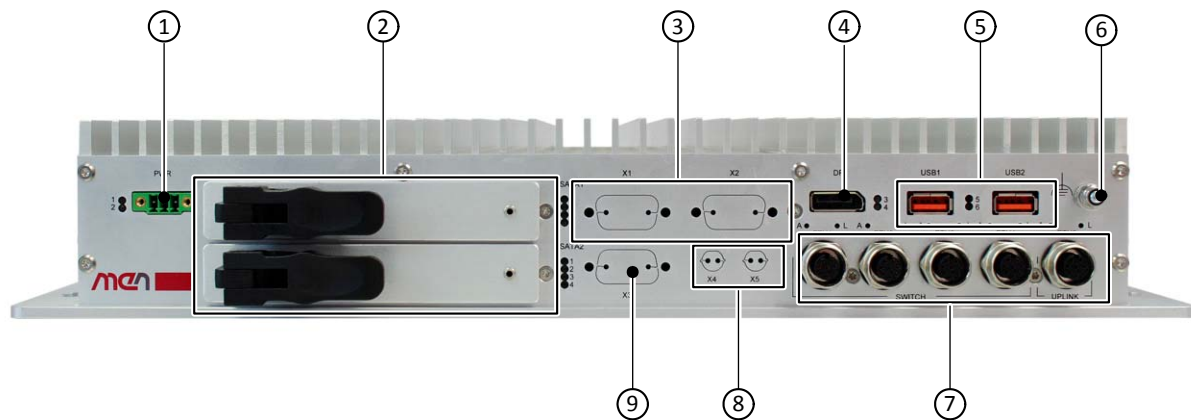
① PSU connector (10V-50.4V)

② 2 Hard Disk Shuttles

③ 2 SA-Adapter cutouts for RS232, RS485/422, CAN, IBIS master, IBIS slave or GPIO

④ 1 DisplayPort

⑤ 2 USB 2.0

⑥ Earthing stud

⑦ 5 Gigabit Ethernet (4-port Ethernet switch and one uplink port)

⑧ 2 antenna connector cutouts for PCI Express Mini Card

⑨ Cutout for HD Audio

1.1.2   Map of the System

Figure 3. *Map of the system – view of the BL50S interior*
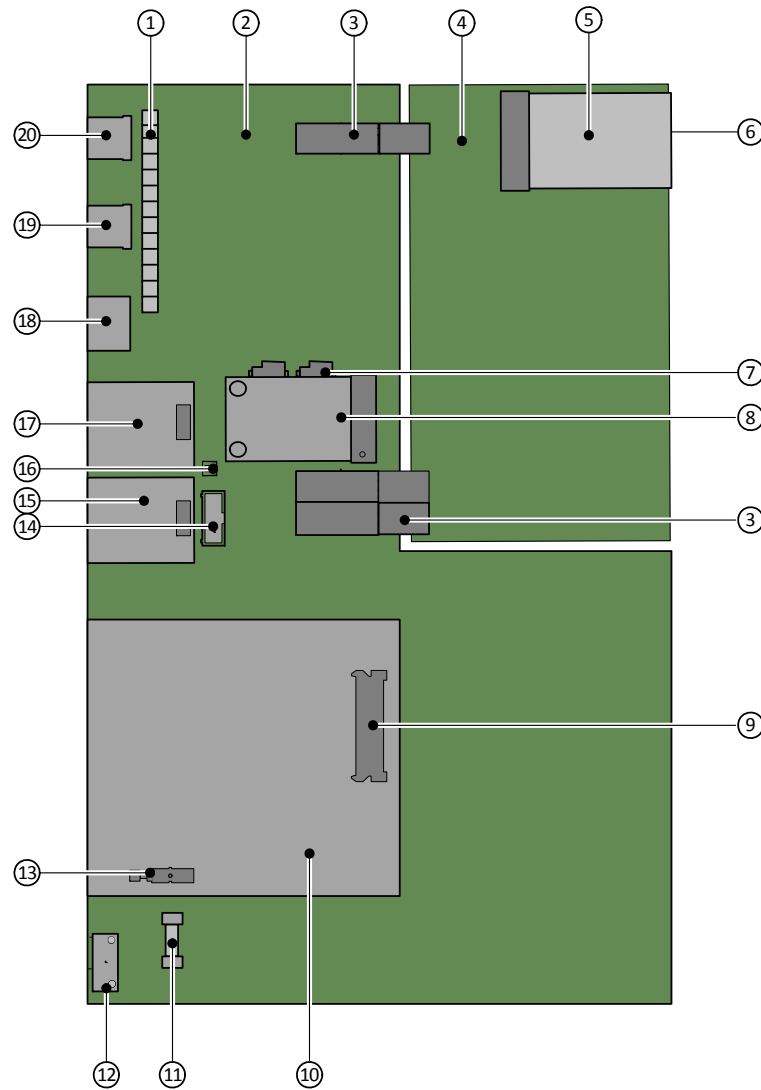
① Connector for 5 Ethernet interfaces	⑪ Fuse
② I/O Board	⑫ PSU connector
③ Board-to-board connector	⑬ Hot plug button
④ SC24 CPU Board	⑭ Connector for optional audio
⑤ mSATA slot	⑮ SA-Adapter connector for RS232, RS422/485 or IBIS
⑥ SD card slot (on board bottom)	⑯ Clip for fixing antenna cable
⑦ microSIM slot	⑰ SA-Adapter connector for RS232, RS422/485, IBIS or CAN
⑧ PCIe Mini Card slot	⑱ DisplayPort
⑨ SATA connector	⑲ USB interface 1
⑩ SATA shuttle	⑳ USB interface 2

1.2   **Block Diagram**

Figure 4. *Block Diagram*
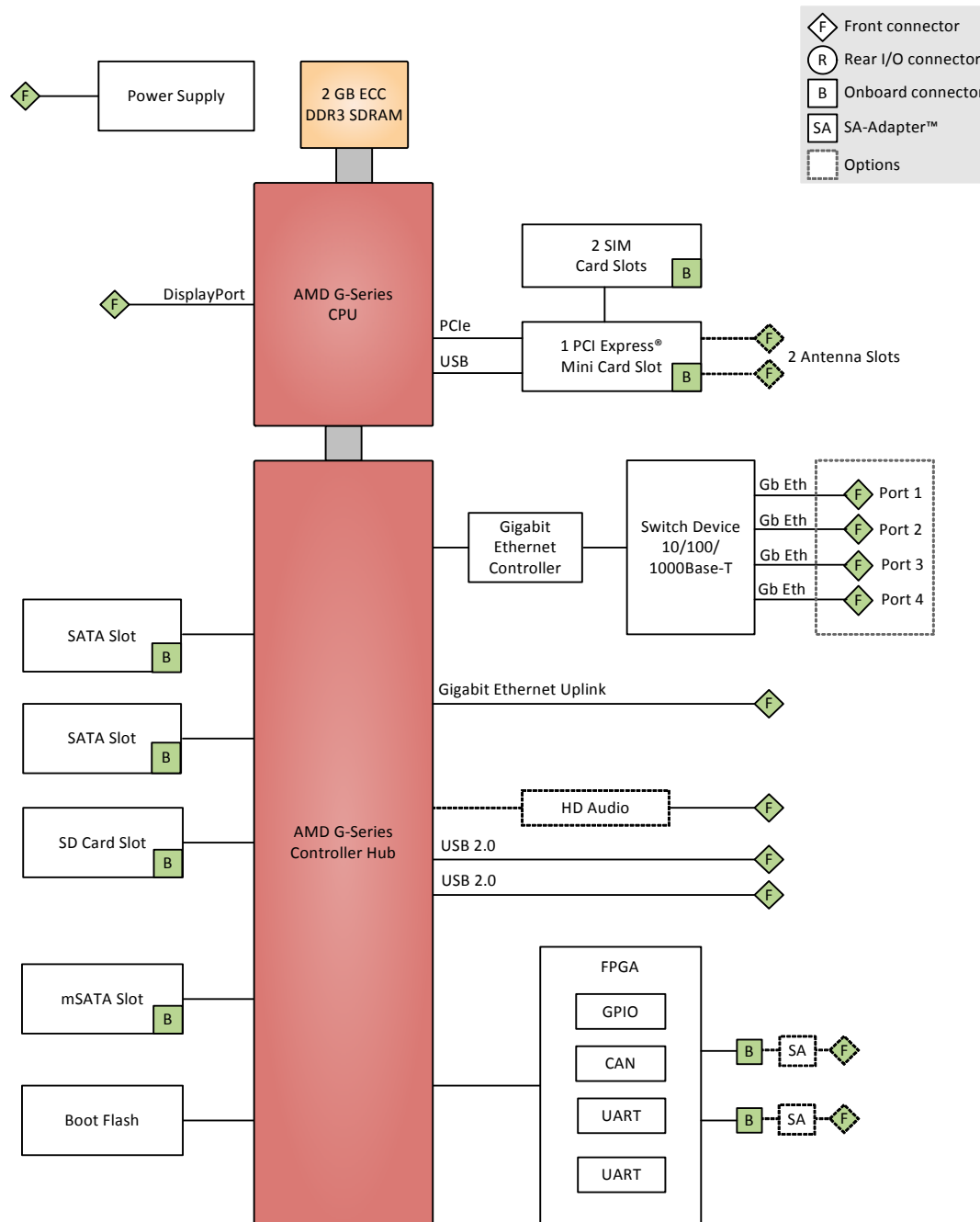
1.3   Product Identification

MEN user documentation may describe several different models and/or design revisions of the BL50S. You can find information on the article number, the design revision and the serial number on a label attached to the chassis.

- **Article number:** Gives the product's family and model. This is also MEN's ordering number. To be complete it must have 9 characters.
- **Revision number:** Gives the design revision of the product.
- **Serial number:** Unique identification assigned during production.

If you need support, you should communicate these numbers to MEN.

Figure 5. *Label giving the product's article number, revision and serial number*
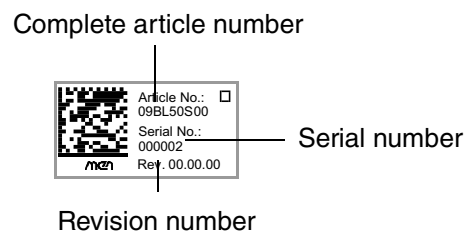
2 Getting Started

2.1 Unpacking the System

After unpacking, check whether there are any transport or other damages on the system.

2.2 Configuring the Hardware

Check your hardware requirements before mounting the BL50S, since most modifications are difficult or even impossible to do when the box PC is mounted.

> ⚠️ For installing SA-Adapters the front panel has to be removed and special care must be taken to realign the connectors and the LEDs precisely. You should choose the SA-Adapters before ordering the box PC so that the SA-Adapters can be installed at MEN.

The following check list gives an overview on what you might want to configure. For installing the components mentioned below, the BL50S has to be opened.

> See Chapter 2.2.1 Handling Internal Components on page 25 and Chapter 2.2.2 Opening the BL50S on page 25.

☑ PCI Express Mini Cards

One PCI Express Mini Card for wireless functions can be installed in the BL50S. MEN offers an LTE (4G) and a WLAN card as an accessory.

> Refer to Chapter 2.2.3 Installing PCI Express Mini Cards on page 27 and Chapter 3.12 PCI Express Mini Card Interface on page 59 for details on the installation and functionality of the PCI Express Mini Cards.

☑ Antenna connectors

Two antennas can be installed at the BL50S's front panel (such as SMA, reverse SMA, QMA, FME etc). MEN offers an HF antenna cable with U.FL connector to RP-SMA connector as an accessory.

> Refer to Chapter 2.2.3 Installing PCI Express Mini Cards on page 27 and for details on the installation of the antenna connectors.

☑ SD card

The BL50S is equipped with one SD card slot. MEN provides a 4 GB SD card as an accessory (other memory sizes are available on request).

> Refer to Chapter 2.2.5 Installing an SD Card on page 32 for information on how to install the SD card.

☑ mSATA disk

The BL50S is equipped with one mSATA disk slot. MEN provides an 8 GB mSATA disk as an accessory (other memory sizes are available on request).

> Refer to Chapter 2.2.6 Installing an mSATA Drive on page 32 for information on how to install the mSATA disk.

☑ RS232, RS422/485, GPS, IBIS extension through MEN standard SA-Adapters

The BL50S provides two 10-pin I/O connectors for connection of two SA-Adapters for RS232, RS422/485, GPS, IBIS or CAN functionality. MEN provides a range of standard adapters with different functionality

> Refer to Chapter 2.2.4 Installing SA-Adapters on page 29 and Chapter 3.11 Serial Interfaces via SA-Adapter on page 58 for details on the installation and functionality of the SA-Adapters.

> See MEN's website for information on how to order the accessories.

2.2.1 Handling Internal Components

> ⚠ • Switch off or unplug the power supply of the box PC before working on internal components.
> • Please observe the instructions concerning electrostatic discharge whenever you work on the inside of the computer system. See Chapter Electrostatic Discharge (ESD) on page 10.

2.2.2 Opening the BL50S

The PCI Express Mini Cards, the SA-Adapters, the microSIM cards, the mSATA slot and SD card slot of the BL50S can be accessed after opening the housing.

☑ For this purpose, remove the system's bottom panel fixed by ten M3x8 TX8 Torx screws.

Figure 6. *Screw positions on the bottom of the BL50S*
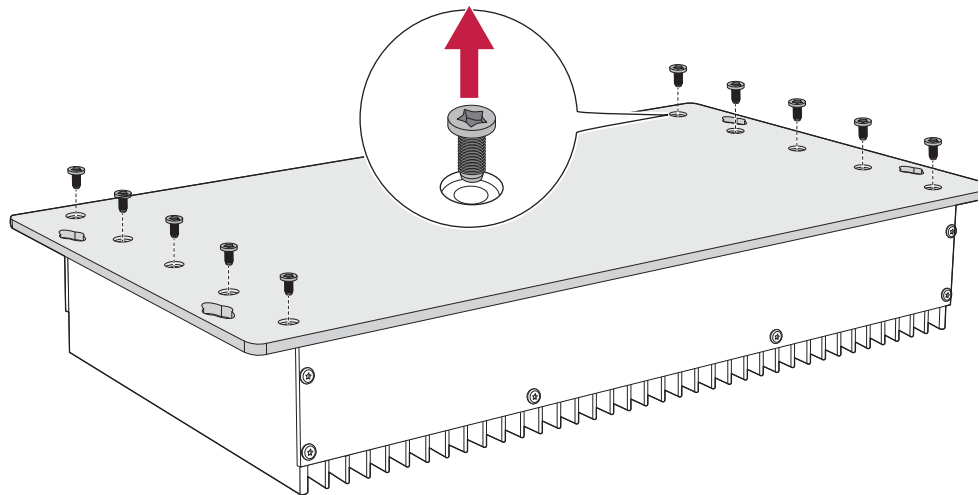
☑ To access the SD card slot, remove the rear panel of the unit fixed by six M3x8 TX8 Torx screws.

Figure 7. *Screw positions at the rear of the BL50S*
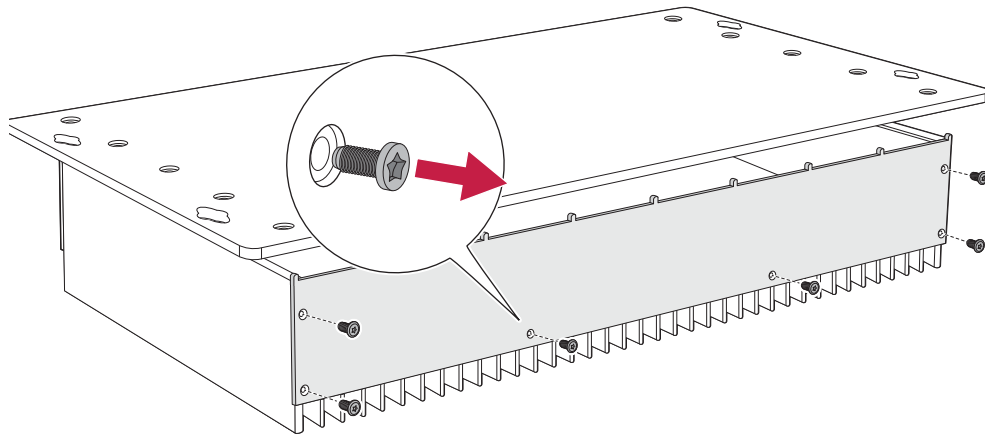
2.2.3 Installing PCI Express Mini Cards

Within its housing, the BL50S provides one PCI Express Mini card slot. The M2.5x8 screws required for installation are already screwed onto the board. Carry out the following steps to install a PCI Express Mini card.

☑ Untighten and remove the screws from the spacers (highlighted in red).

Figure 8. Installing a PCI Express Mini card
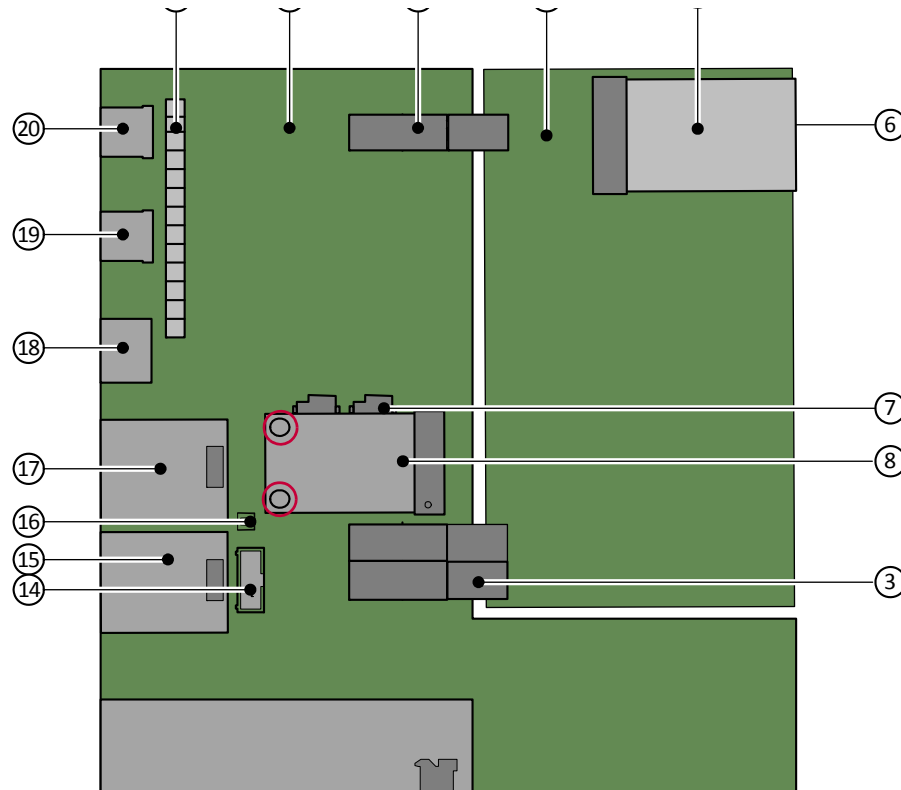
☑ Insert the PCI Express Mini card carefully at a 30° angle.

☑ Make sure that all the contacts are aligned properly and the card is firmly connected to the connector.

☑ Fix the card using the two screws removed before.

Antenna Connectors

MEN offers an HF antenna cable with U.FL connector to RP-SMA connector as an accessory.

Please see the MEN website for ordering information.

Before being able to install the antenna on the BL50S's front panel, you have to break out the cover of the antenna slot, using a screw driver or a similar tool.

There is one mounting clip for fixing the antenna cable on the BL50S's PCB (highlighted in red in the following drawing).
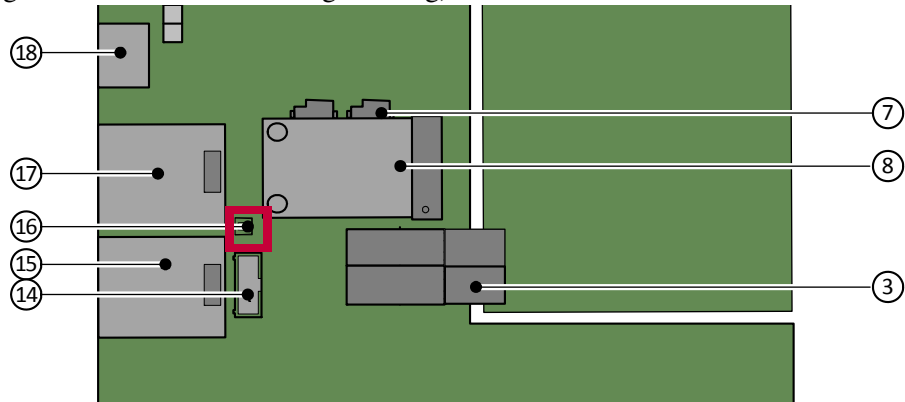
Note: There is only one position in which the antenna can be completely inserted into the front panel slot. When properly inserted the antenna is fixed and cannot be turned anymore.

2.2.4   Installing SA-Adapters

Two SA-Adapters can be mounted in the BL50S on the 10-pin receptacle for slots X1 and X2.

> ⚠️ For installing SA-Adapters the front panel has to be removed and special care must be taken to realign the connectors and the LEDs precisely. You should choose the SA-Adapters before ordering the box PC so that the SA-Adapters can be installed at MEN.

Carry out the following steps to install the SA-Adapters:

☑ For installing SA-Adapters remove the front panel by loosening the eleven screws marked in red in the following pictures.
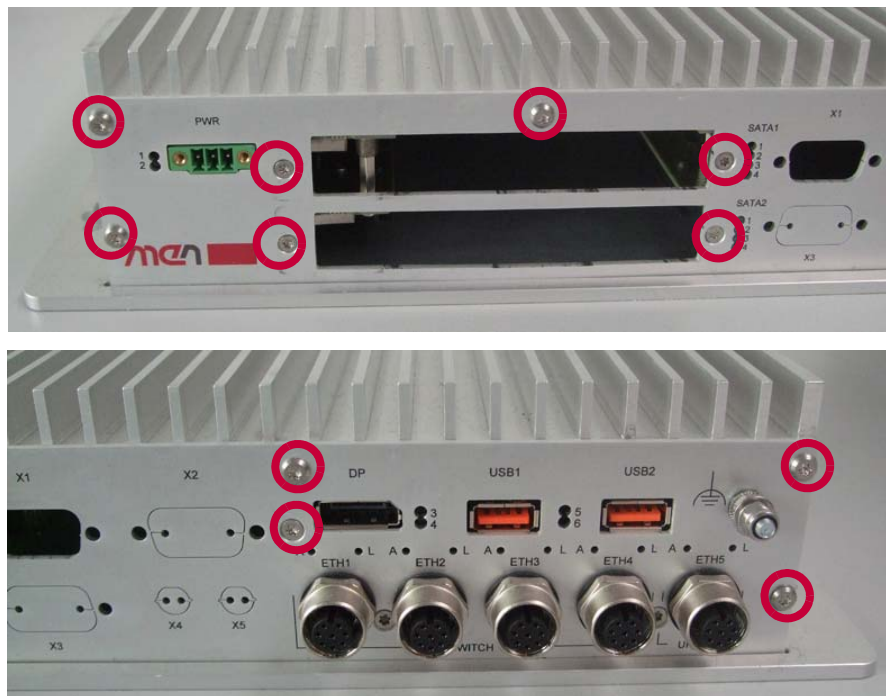
☑ Be careful not to lose the small metal plates between the front panel and the SATA holders!

☑ Be careful not to lose the light conductors for the SATA, Ethernet and power LEDs. They are only loosely attached.
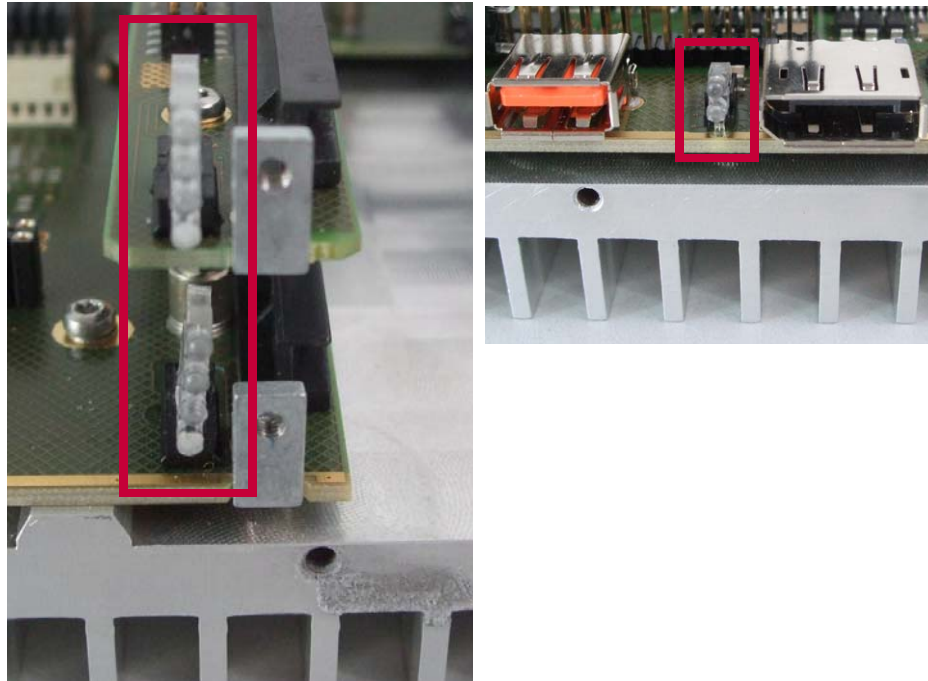
☑ Break out the covers of the front panel slots.

☑ Make sure that the adapter matches the standard dimensions for SA-Adapters.

> See also installation hints in the adapter's user manual or the list of compatible accessories in the BL50S data sheet on MEN's website.

☑ Remove the two front panel screws of the SA-Adapter.

☑ Carefully align the SA-Adapter connectors with the 10-pin connectors on the BL50S.
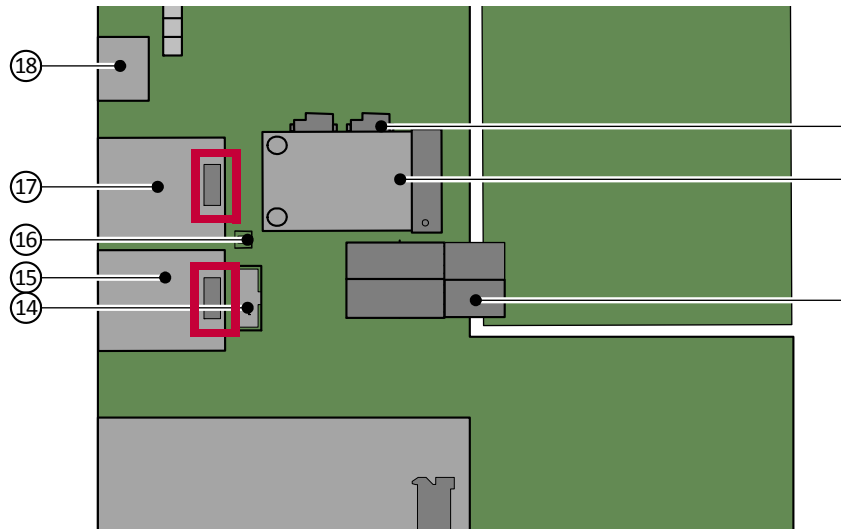
☑ Press the SA-Adapter firmly onto the BL50S.

☑ **Very carefully align** the front panel with the front connectors, the Ethernet connector and the LEDs.

☑ Screw the front panel back onto the BL50S.

☑ Screw the SA-Adapter tightly to the BL50S front panel using the two pan-head screws removed before.

2.2.5 Installing an SD Card

Within its housing, the BL50S provides one SD card slot. Carry out the following steps to install an SD card.

☑ The SD card slot is positioned at the edge of the system, wedged between the PCB and the top of the housing.

☑ Insert the SD card into the slot with the contacts facing to the PCB and the cut edge to the right side.

☑ Make sure that it clicks into place properly.

☑ To eject the SD card, push it until it springs out, then simply pull it out.

2.2.6 Installing an mSATA Drive

Within its housing, the BL50S provides one mSATA slot. Two M2.5x8 screws are provided with the BL50S.

☑ Untighten and remove the screws from the spacers (highlighted in red).
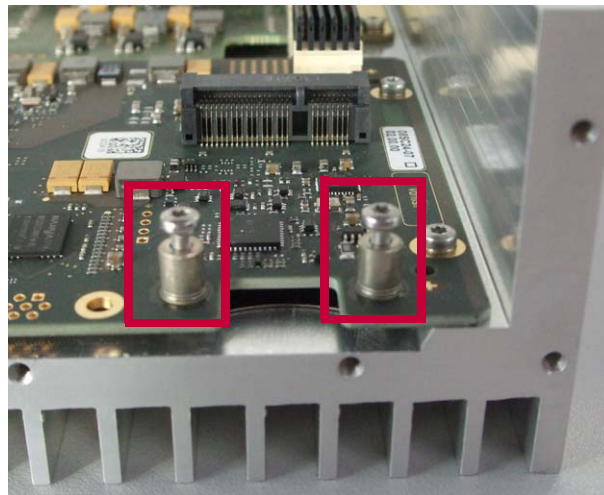
☑ Insert the mSATA drive carefully at a 30° angle.

☑ Make sure that all the contacts are aligned properly and the card is firmly connected to the mSATA connector.

☑ Align the spacers and the holes and insert the screws into the spacers from above the mSATA disk.

☑ Fix the card by tightening the screws (highlighted in red in the following drawing).

2.3 Mounting the BL50S

Please consider the following instructions when installing the BL50S:

> ⚠ • Do not install the system near any heat sources (e.g. radiators, heat registers).
> • Keep the system away from liquids. Avoid exposure to dripping or splashing.
> • Keep a free space of 15 cm around the housing to ensure cooling (except on the mounting side).

Figure 9. *Mounting distances required for the box PC*
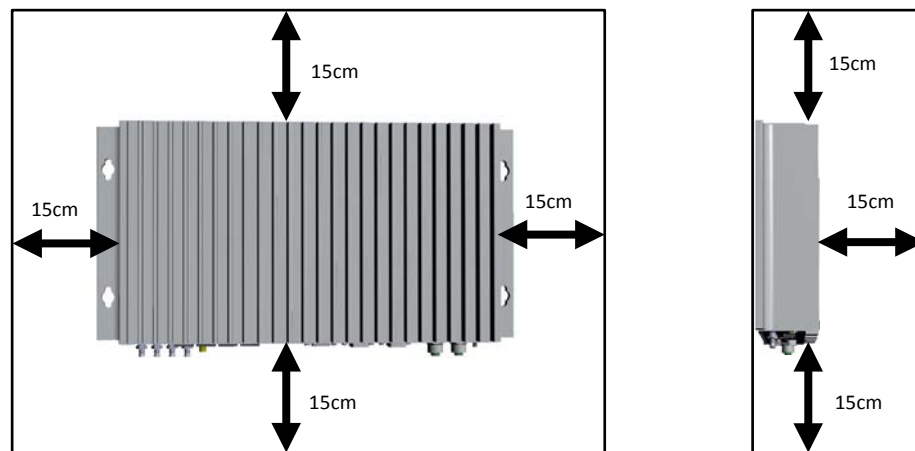
- The connector side should face down.
- The BL50S provides four mounting holes for installation.
- Use M5 countersink head screws.

> See Chapter 7.2 Dimensions of the BL50S Box PC on page 72 for the exact dimensions of the box PC and the positions of the mounting holes and connectors.

2.3.1 Installing the BL50S in a 19" Rack

MEN offers a 1.5U mounting kit which makes it possible to install the BL50S in a 19" rack (05BL01-00).

> Please see MEN's website for more information.

☑ Remove the BL50S's bottom panel as described in Chapter 2.2.2 Opening the BL50S on page 25.

☑ Remove five of the screws fastening the front panel (highlighted in red in the following picture). Do not remove the front panel.

☑ Install the two heats sinks supplied with the kit at the sides of the BL50S using four M2.5x10 TX8 Torx screws for each heat sink. The screws are included in the delivery of the 05BL01-00 kit.
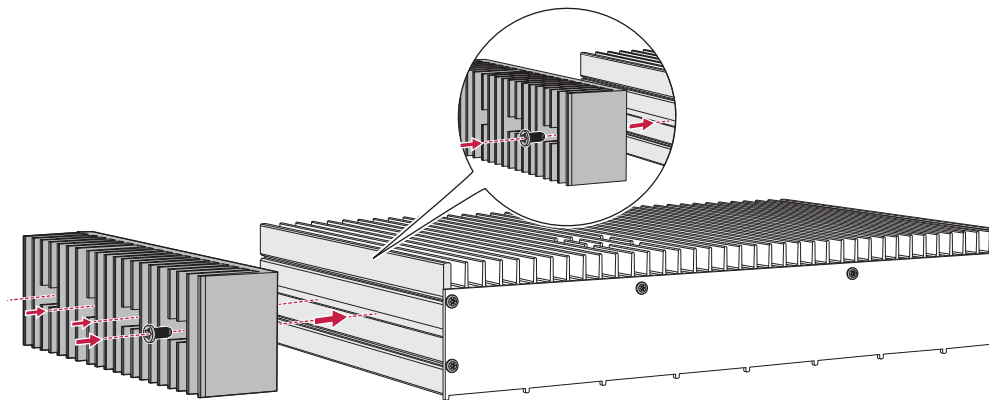
☑ Insert the box PC into the opening in the kit's front panel.

☑ Take care that the small studs at the bottom of the front and rear panel of the box PC are aligned with the corresponding holes in the bottom plate of the mounting kit.
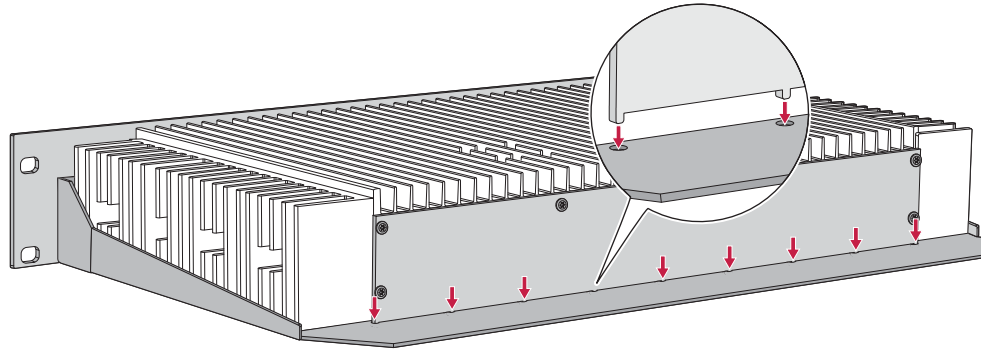
☑ Press the BL50S down onto the bottom plate.

☑ Screw the BL50S onto the kit's bottom plate using the ten screws removed before.
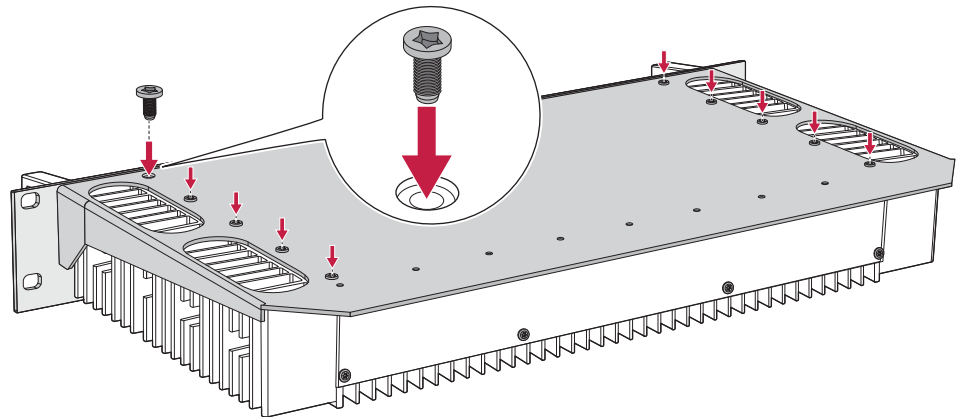
☑ Fix the BL50S at the kit's front panel using the five M3x8 TX8 Torx screws removed before.

☑ Fasten the BL50S in the frame in the 19" switching cabinet using four M6x16 screws.

2.4   Connecting an Earthing Cable

The BL50S features an earthing stud on the right side of the front panel (see Figure 2, The BL50S - front interfaces on page 19). A protective earth connection is essential for the system to meet its EMC specifications.

> ⚠️ An earthing cable has to be connected to the earthing stud before any other connections! For disassembling the system, the earthing cable has to be detached last.

Carry out the following steps to connect an earthing cable:

☑ Take an earthing cable with a cross section of at least 0.75 mm².

☑ Slide the cable onto the stud between the washer and the lock washer as indicated in the following picture:
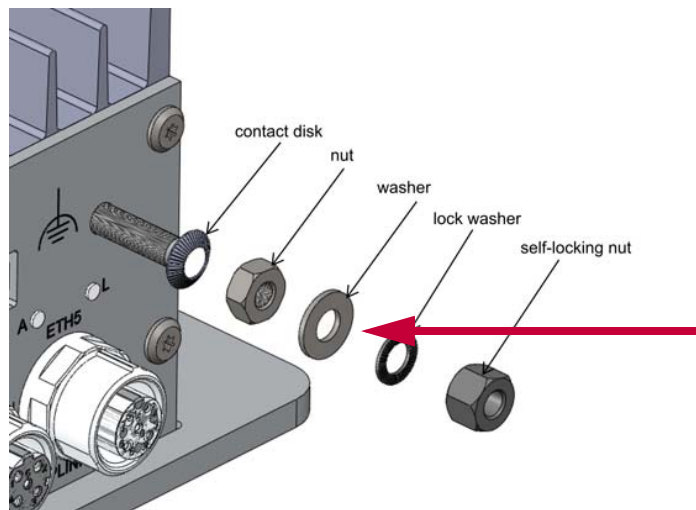
☑ Fasten the cable by tightening the nut.

2.5   Electrical Connection

> ⚠️
> • Ensure that the box PC is completely configured and mounted before connecting and applying power to the system.
> • Implement a readily accessible disconnect device external to the box PC for complying with the EN 60950-1 standard.
> • Make sure that the voltage of the power supply conforms with the voltage on the type plate.
> • Ensure that the power supply (power socket) is grounded correctly and that the power cable is intact and undamaged.
> • Do not switch on the system if there are damages on the power cable or plug.
> • Use power cables which are approved for the power supply in your country.
> • Power supplies have to be grounded.
> • Connect the PSU to the power supply via the power cable.

2.6 Starting up the System

> ⚠️ Make sure that all peripheral devices are connected to the system before connecting an external power supply and switching on the system.

You can use the following check list when installing the unit for the first time and with minimum configuration.

- ☑ Connect a USB keyboard and mouse to the USB connector at the front panel.

- ☑ Connect a flat-panel display capable of displaying the resolution of 1024x786 to the DisplayPort connector of the BL50S.

- ☑ Power up the system. See Chapter 3.1 Power Supply on page 39.

- ☑ You can start up the BIOS setup menu by hitting the <F2> key.

- ☑ Now you can make configurations in BIOS.

- ☑ Observe the installation instructions for the respective software.

2.7 Installing Operating System Software

The board supports Windows 7 and Linux.

> ⚠️ By default, no operating system is installed on the board. Please refer to the respective manufacturer's documentation on how to install operating system software!

2.8 Installing Driver Software

For a detailed description on how to install driver software please refer to the respective documentation of the software package to be installed.

> 🌐 You can find any software available on the BL50S pages on the MEN website.

3 Functional Description

The following describes the individual functions of the system and their configuration. There is no detailed description of the individual controller chips and the CPU. They can be obtained from the data sheets or data books of the semiconductor manufacturer concerned.

3.1 Power Supply

The BL50S is supplied with a nominal input voltage of 24 VDC and 36 VDC (10 to 50.4 V input voltage range) via a 3-pin COMBICON connector. You can find pin 1 at the left (see Figure 10, PSU connector at BL50S front).

The onboard power supply generates all the necessary internal voltages.

Connector type:

• 3-pin COMBICON receptacle (Phoenix Contact 1843800 MC 1,5/ 3-GF-3,5)

Mating connector:

• 3-pin COMBICON plug, e.g., Phoenix Contact 1863314 MCVR 1,5/ 3-STF-3,5

Figure 10. PSU connector at BL50S front

Table 1. Pin assignment of PSU connector

1	POWERCON_IN	Power input
2	POWERCON_GND	Power input ground
3	IGNITIONCON	Ignition

3.1.1　Ignition

Using the ignition pin, the start-up and shut-down of the BL50S can be controlled.

If the ignition pin (IGNITIONCON, KL15) is connected to the power input pin (POWERCON_IN, KL30) via a switch or a controller, switching on and off of the BL50S can be controlled without having to disconnect the power supply.

Figure 11. *Connection of power pins from PSU*
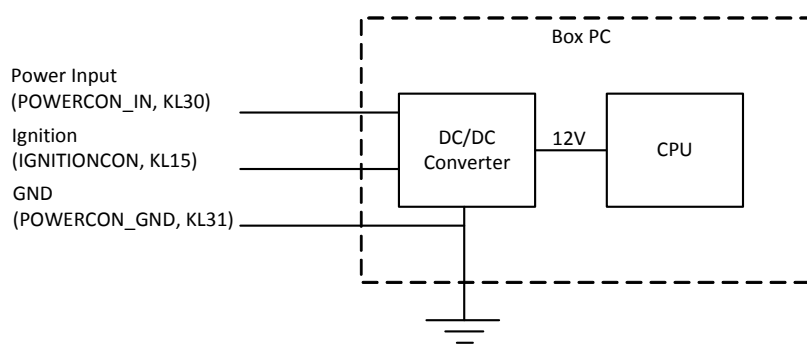
When the ignition is turned on, the 12 V supply voltage is also switched on (see Figure 12, Ignition behavior). When the ignition is turned off, the input voltage is not switched off at once but can be supplied for a user-defined time (shut-down delay) so that the operating system of the BL50S can shut down in a controlled way.

Figure 12. *Ignition behavior*
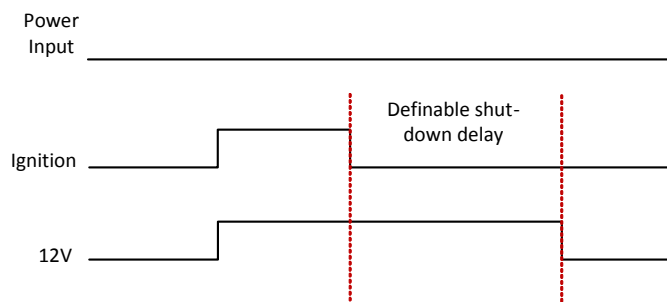
The shut-down delay can be set using a watchdog. If the ignition signal is disabled and the watchdog is running, it is possible to reset the watchdog timer by software using the WDOG_EN signal (see Table 21, SMB 0x40 on page 66) to avoid a power shutdown. If the watchdog is running and the timer is not restarted, the box computer is forced into power down mode after approximately 5 minutes.

Figure 13. *Ignition and watchdog state diagram*
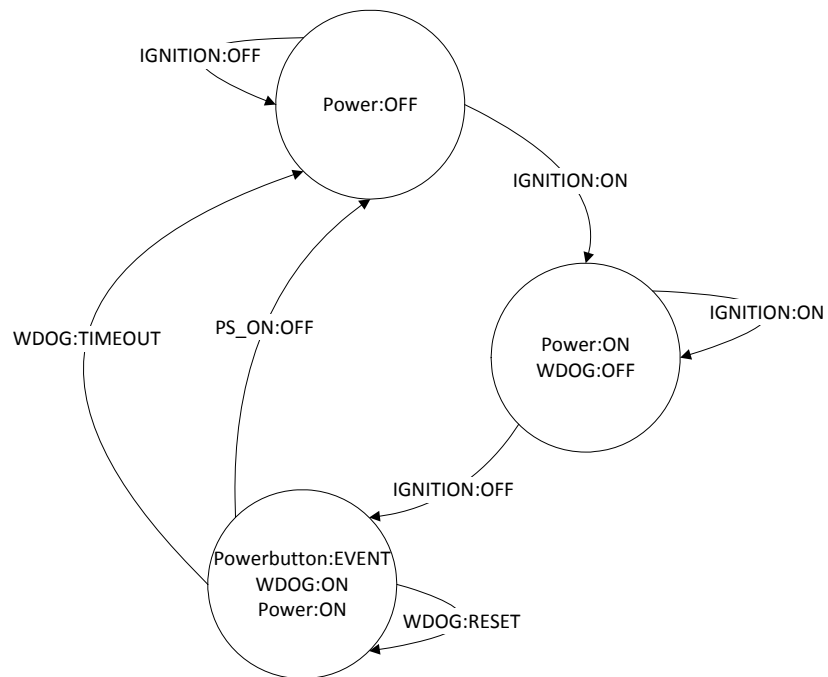
The ignition pin (pin 3) can also be permanently connected to the power input pin (pin 1). In this case the BL50S is starting up as soon as the supply voltage is connected and switched off as soon as the supply voltage is disconnected without a delay for shutting down the operating system.

3.2 Real-Time Clock

The board includes a real-time clock connected to the processor as a system RTC. The RTC has an accuracy of approximately 1.7 seconds/day (11 minutes/year) at 25°C.

For data retention during power off the RTC is backed up by a supercapacitor. The supercapacitor gives an autonomy of up to 72 hours when fully loaded.

The real-time clock device is connected to the CPU via SMBus. Due to its reduced current consumption, the life time of the battery or supercapacitor can be increased considerably compared to the RTC integrated in the CPU.

> MEN provides a dedicated software driver for the RTC device in order to set date and time as usual in Windows. For a detailed description of the functionality of the driver and for downloading the software please refer to the drivers' documentation on MEN's website.

3.3 Processor Core

The BL50S can be equipped with several dual-core AMD APUs (Accelerated Processing Units). The default APU is the T48N (marked in gray in the following table).

Table 2. Processor core options on BL50S

Model	Clock Speed, No. of Cores	Cache	Max. TDP	DDR3 Speed	Graphics
AMD T56N	1.65 GHz dual core	L1 cache 64 KB, L2 cache 512 kB x2	18 W	DDR3-1333	Radeon HD 6320
AMD T52R	1.5 GHz single core	L1 cache 64 KB, L2 cache 512 kB	18 W	DDR3-1333	Radeon HD 6310
AMD T48N	1.4 GHz dual core	L1 cache 64 KB, L2 cache 512 kB x2	18 W	DDR3-1066	Radeon HD 6310
AMD T40N	1.0 GHz dual core	L1 cache 64 KB, L2 cache 512 kB x2	9 W	LVDDR3-1066	Radeon HD 6310
AMD T44R	1.2 GHz single core	L1 cache 64 KB, L2 cache 512 kB	9 W	LVDDR3-1066	Radeon HD 6250
AMD T40E	1.0 GHz dual core	L1 cache 64 KB, L2 cache 512 kB x2	6.4 W	LVDDR3-1066	Radeon HD 6250
AMD T40R	1.0 GHz single core	L1 cache 64 KB, L2 cache 512 kB	5.5 W	LVDDR3-1066	Radeon HD 6250
AMD T16R	615 MHz single core	L1 cache 64 KB, L2 cache 512 kB	4.5 W	LVDDR3-1066	Radeon HD 6250
AMD T56E	1.65 GHz Dual Core	L1 cache 64KB, L2 cache 512kB x2	18W	DDR3-1333	Radeon HD 6250
AMD T48E	1.4 GHz Dual Core	L1 cache 64KB, L2 cache 512kB x2	18W	DDR3-1066	Radeon HD 6250

Model	Clock Speed, No. of Cores	Cache	Max. TDP	DDR3 Speed	Graphics
AMD T48L	1.4 GHz Dual Core	L1 cache 64KB, L2 cache 512kB x2	18W	DDR3-1066	N/A
AMD T30L	1.4 GHz Single Core	L1 cache 64KB, L2 cache 512kB	18W	DDR3-1066	N/A
AMD T24L	1000 MHz Single Core	L1 cache 64KB, L2 cache 512kB	5W	LVDDR3-1066	N/A

Note: T56N and T40N are models enabled by AMD Turbo Core technology, up to 10% clock speed increase is planned.

3.3.1   Thermal Considerations

The operating temperature range of the BL50S depends on the system configuration (CPU, PCIeMiniCards, Ethernet, USB, ...)

The power dissipation of the system also depends on the environmental conditions. It has a typical power dissipation of 14.4 W in a configuration with a T48N CPU with Windows 7 operating system and 1 Gb Ethernet connection.The system is designed for a maximum operating temperature of +70°C (+85°C for 10 minutes). The minimum temperature is -40°C for all processors.

As an option, a wider housing with additional cooling fins is available, enabling permanent operation at +85°C.

3.4 Memory and Mass Storage

3.4.1 SATA Shuttles

Two 2.5" SATA hard disks can be installed in the BL50S on two SATA shuttles. A RAID0 or RAID1 as well as hot plug support can be implemented using application software.

3.4.2 Status LEDs

Four LEDs signal the status of each SATA port. The behavior of the hot plug, the locate and the activity LEDs can be programmed via software. The power LED is on per default. See Table 3, SATA status LEDs for the position and the functionality of the LEDs.

> You can find any software available on the BL50S pages on the MEN website.

Figure 14. Position of SATA status LEDs (highlighted in red)
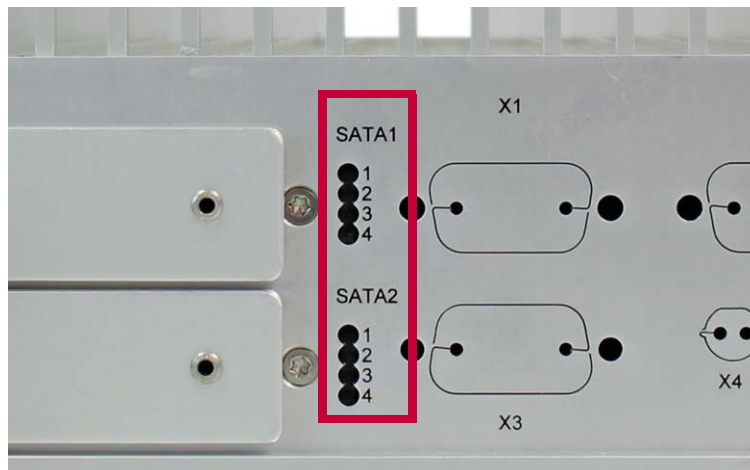
Table 3. *SATA status LEDs*

LED		Description	Color	Function
SATA1/1	🔴	SATA 1 Hot plug / Error	red	default: off
SATA1/2	🟡	SATA 1 Locate	yellow	default: off
SATA1/3	🟠	SATA 1 Activity	orange	default: off
SATA1/4	🟢	SATA 1 Power	green	default: on
SATA2/1	🔴	SATA 2 Hot plug / Error	red	default: off
SATA2/2	🟡	SATA 2 Locate	yellow	default: off
SATA2/3	🟠	SATA 2 Activity	orange	default: off
SATA2/4	🟢	SATA 2 Power	green	default: on

3.4.3   Inserting Hard Disks

Carry out the following steps to insert a hard disk.

☑ Open the handle of the SATA shuttle by moving it completely to the left side.

☑ If there is already a hard disk in the BL50S: Make sure that there are no write or read processes on the disk.

☑ Slide the shuttle out of the slot.

☑ If there already is a hard disk in the BL50S: loosen the four screws fixing the hard disk to the shuttle and slide it out.

☑ Insert the hard disk into the shuttle with the PCB and the screw holes facing to the top.

☑ Fix the hard disk by tightening the four M3x5 countersink screws (highlighted in red in the following picture, screws are included in the box PC delivery).
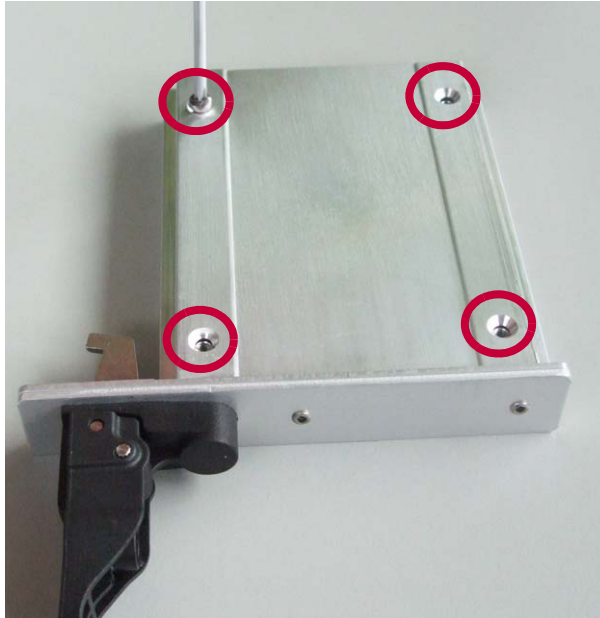
☑ Slide the shuttle back into the housing and close the handle.

3.4.4 DRAM System Memory

The standard model of the BL50S is equipped with 2 GB of DDR3 SDRAM. Up to 4 GB are supported. The graphics controller of the BL50S has no own memory and so uses 256 MB of the system memory by default. Other values can be set using a BIOS item in the sub-menu Video Configuration (possible settings 64 MB, 128 MB, 256 MB or 512 MB).

3.4.5 Boot Flash

The BL50S is equipped with a boot Flash containing its BIOS.

3.4.6 SD Card Slot

Within its housing, the BL50S provides one SD card slot. The slot supports the Secure Digital 2.0 specification (SDHC) with a storage capacity of 2 up to 32 GB and a data transfer rate of 25 MB/s.

See Chapter 2.2.5 Installing an SD Card on page 32 for information on how to install the SD card.

3.4.7 mSATA Slot

Within its housing, the BL50S provides one mSATA slot.

See Chapter 2.2.6 Installing an mSATA Drive on page 32 for information on how to install an mSATA disk.

3.5 Graphics

3.5.1 Graphics Processing Unit

The standard model of the BL50S is equipped with an AMD APU (Accelerated Processing Unit) that also includes an AMD Radeon 6310 as a GPU (Graphics Processing Unit).

For other GPU options please refer to Chapter 3.3 Processor Core on page 42.

3.5.2 DisplayPort Interfaces

One DisplayPort interface is available at the front panel. The maximum supported resolution is 2560x1600 at 60 Hz. The interface offers AUX channel support and hot plug detection.

Connector type:

- 20-pin DisplayPort receptacle

Mating connector:

- 20-pin DisplayPort plug

Table 4. *Pin assignment of 20-pin DisplayPort connector*
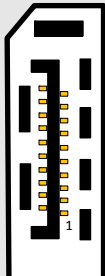
	20	POWER	19	RETURN PWR
	18	DP_HOTPLUG	17	DP_AUX-
	16	GND	15	DP_AUX+
	14	CONFIG2	13	CONFIG1
	12	LANE_3-	11	GND
	10	LANE_3+	9	LANE_2-
	8	GND	7	LANE_2+
	6	LANE_1-	5	GND
	4	LANE_1+	3	LANE_0-
	2	GND	1	LANE_0+

Table 5. *Signal mnemonics of 20-pin DisplayPort connector*

Signal	Direction	Function
GND	-	Ground
DP_AUX-, DP_AUX+	in/out	Bi-directional half-duplex auxiliary channels for device management and device control
CONFIG1, CONFIG2	-	Connected to Ground
DP_HOTPLUG	in	Hot Plug Detect
LANE_[3..0]+, LANE_[3..0]-	out	Main Link data lanes
POWER	out	Power for connector (3.3 V, 500 mA)
RETURN PWR	-	Return for Power

3.5.3   Other Graphics Interfaces

MEN offers a starter kit including a DisplayPort to DVI adapter.

> Please see the MEN website for ordering information.

In addition, many third-party suppliers offer active adapters from DisplayPort to other graphics interfaces. The maximum resolution depends on the adapter used. Supported interfaces include:

- HDMI
- Single-link DVI
- Dual-link DVI
- VGA

3.6   USB Interface

The BL50S provides two USB 2.0 interfaces at the front panel via two automotive USB connectors. The automotive USB connectors are 100% compliant to standard connectors but offer a more robust connection.

Connector types:

- 4-pin USB Series A receptacle according to Universal Serial Bus Specification Revision 1.0

- Mating connector:
  4-pin USB Series A plug according to Universal Serial Bus Specification Revision 1.0

Table 6. Pin assignment of USB front-panel connectors
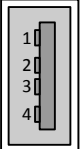
	1	+5V
	2	USB_D-
	3	USB_D+
	4	GND

Table 7. Signal mnemonics of USB front-panel connectors

Signal	Direction	Function
+5V	out	+5 V power supply
GND	-	Digital ground
USB_D+, USB_D-	in/out	USB lines, differential pair

3.7 Ethernet

The BL50S provides five Ethernet ports at the front. One is an uplink port which is connected directly to the CPU and can be used for connecting the BL50S to the core network. The other four interfaces are connected to a switch.

Connector type:

- 8-pin M12 receptacle, female, A-coded 90° (Phoenix Contact 1436974 SACC-DSIV-FS-8CON-L90 SCO)

Mating connector:

- 8-pin M12 plug, male, A-coded

MEN offers a starter kit including an M12 to RJ45 adapter for making the Ethernet interfaces available on standard Ethernet connectors.

> For ordering details please consult MEN's website.

Table 8. *Pin assignment of Ethernet front-panel connectors*

	1000Base-T	10/100Base-T
1	BI_DC-	
2	BI_DD+	
3	BI_DD-	
4	BI_DA-	TX-
5	BI_DB+	RX+
6	BI_DA+	TX+
7	BI_DC+	-
8	BI_DB-	RX-

Table 9. *Signal mnemonics of Ethernet front-panel connectors*

Signal	Direction	Function
BI_Dx+/-	in/out	Differential pairs of data lines for 1000Base-T
RX+/-	in	Differential pair of receive data lines for 10/100Base-T
TX+/-	out	Differential pair of transmit data lines for 10/100Base-T

3.7.1 Ethernet Switch Functionality

Four of the Ethernet interfaces at the front of the BL50S can be used as an Ethernet switch supporting Power-over-Ethernet. They are connected to a 10/100/1000Base-T switch component, the Marvell 88E6171. The switch provides 10/100/1000 Mbits/s.

3.7.1.1 Configuration of the Switch

The BL50S loads the following standard configuration for all ports at startup:

Table 10. Default switch configuration at startup

Setting	Default
Duplex mode	Full Duplex
Port speed	Auto-Negotiate
VLAN (port-based)	Off
QoS (Quality of Service)	Off
Port mirroring and port monitoring	Off
Port trunking	Off
Power over Ethernet functionality	PSE functionality enabled

By using a customer-specific configuration EEPROM, the BL50S can act similarly to a managed switch with fixed settings.

Please contact MEN if you need a switch with a non-standard configuration.

3.8 Power over Ethernet

All front panel ports of the BL50S support Power over Ethernet PSE ("power sourcing equipment") functionality according to IEEE802.3af/ IEEE 802.3at, Type 1.

The BL50S can deliver power to up to four PD ("powered device") devices.

Table 11. Power over Ethernet configuration

Class	Power range	Number of possible devices
0	0.44..12.96 W	2
1	0.44..3.84 W	4
2	3.84..6.49 W	4
3	6.49..12.95 W	2
4	12.95..25.5 W	1

> ⚠️ A combination of different classes is also possible. Please note, however, that the combined power level drawn by connected PDs must not exceed 28 W!

3.8.1 Ethernet Status LEDs

The BL50S provides a total of ten Ethernet status LEDs, two for each Ethernet channel. They signal the link and activity status (different LED behavior can be implemented on demand).

Figure 15. Position of Ethernet LEDs at BL50S front (highlighted in red)

***Table 12.** Ethernet status LEDs*

LED	Description	Color	Function
A 🟡	Port 1 activity	yellow	on, when Ethernet communication on Rx or Tx
L 🟢	Port 1 link	green	on, when connection established
A 🟡	Port 2 activity	yellow	on, when Ethernet communication on Rx or Tx
L 🟢	Port 2 link	green	on, when connection established
A 🟡	Port 3 activity	yellow	on, when Ethernet communication on Rx or Tx
L 🟢	Port 3 link	green	on, when connection established
A 🟡	Port 4 activity	yellow	on, when Ethernet communication on Rx or Tx
L 🟢	Port 4 link	green	on, when connection established
A 🟡	Port 5 activity	yellow	on, when Ethernet communication on Rx or Tx
L 🟢	Port 5 link	green	on, when connection established

3.9 HD Audio (Optional)

As an option, the BL50S can be equipped with a high definition audio interface implemented via the Realtek ALC268 codec and available on a standard 9-pin D-Sub connector at the front panel.

Table 13. Pin assignment of the HD audio interface
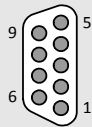
	9	AUDIO_IN_R	5	AUDIO_SPDIF
	8	AUDIO_GND	4	AUDIO_IN_L
	7	AUDIO_OUT_R+	3	AUDIO_OUT_R-
	6	AUDIO_OUT_L-	2	AUDIO_GND
			1	AUDIO_OUT_L+

Table 14. Signal mnemonics of the HD audio interface

Signal	Direction	Description
AUDIO_EXT_OUT_L±/R±	out	Line out, left and right, differential signal pairs
AUDIO_EXT_IN_L/R	in	Line in, left and right
AUDIO_EXT_GND	-	Analog ground
AUDIO_EXT_SPDIF	out	S/PDIF output

3.10   Status and User LEDs

The BL50S provides two board status LEDs and four general status LEDs. One of the status LEDs signals whether the onboard power generated by the BL50S's on-board DC/DC converter is within valid range, the other signals the system status.

> See Chapter 3.10.1 Status LED on page 57 for a detailed description of the Status LED's behavior.

The four user LEDs can be controlled via an I/O expander on the SMBus. The LEDs can be used freely depending on an application's requirements.

> See Chapter 4.1 SMBus Overview for information on how to access the LEDs.

Figure 16. Status and user LEDs on the BL50S's front panel (highlighted in red)

The following table shows a list of all status and user LEDs with their functionality or default state.

Table 15. Status and user LEDs on the BL50S

Number	Description	Color	Function
1 🟢	Power good	green	on, when internal 12V active
2 🟡	Status LED (diagnostic)	yellow	see Chapter 3.10.1 Status LED on page 57
3 🟡	User LED A	yellow	default: off
4 🟡	User LED B	yellow	default: off
5 🟡	User LED C	yellow	default: off
6 🟡	User LED D	yellow	default: off

3.10.1 Status LED

The status LED (LED2) is connected to the system's board controller.

It has the following behavior:

- off, if system is in S5 state
- blinking at less than 0.5 Hz if system is in S3 state
- on, if system is in S0 state and BIOS has sent live sign after power-up
- it flashes repeatedly n times according to an error code and pauses for one second until the system is restarted or completely powered-off, if system is in error condition and error code is n. See the following table for supported error codes.

Table 16. *Error codes signaled by Status LED flashes*

Error Code	Description	Solution
1	+V3.3A Voltage Failure	internal failure
2	Input Voltage Failure	internal failure
3	External Power Supply Failure	check power supply voltage range
4	CPU too hot	check thermal constraints
5	BIOS Live Sign Timeout	internal failure
6	System Reset Timeout	internal failure
7	Platform Reset Failure	internal failure
8	Chipset Handshake Failure	internal failure
9	System Power OK Failure	internal failure
255	Invalid PIC state	internal failure

3.11　Serial Interfaces via SA-Adapter

The BL50S offers the possibility to provide two serial interfaces at the front of the BL50S using MEN standard SA-Adapters. This way, serial interfaces can be used which can be flexibly configured as needed.

Serial interface X1 (COM0) can be used for UART, IBIS, GPS or SGPIO functionality, slot X2 (COM1) can be used for UART or CAN bus functionality (for CAN bus functionality a special product version is required).

If you use the 08SA15-00 SA-Adapter with SGPIO functionality in slot 1 you have to change a setting in the FPGA to switch from UART to SGPIO. See Chapter 5.1 GPIO Controller Instance 1 on page 68.

Figure 17. Position of serial interfaces on BL50S front
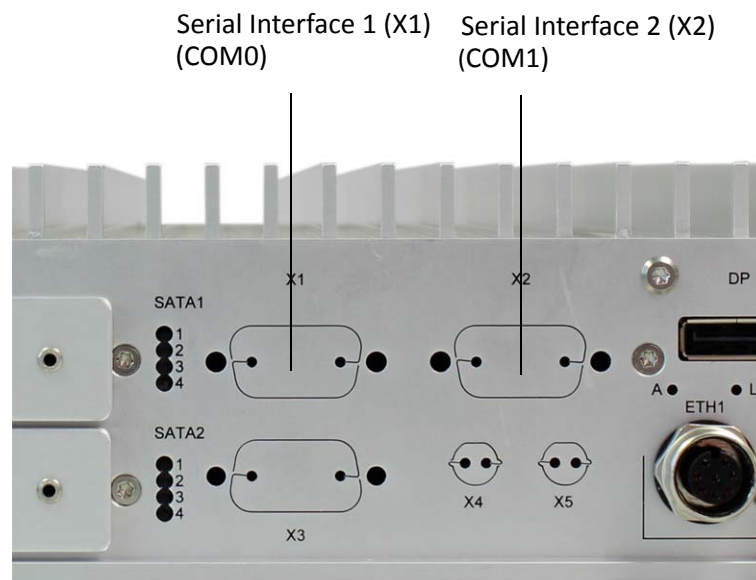
See Chapter 2.2.4 Installing SA-Adapters on page 29 for installation instructions.

See MEN's website for a list of SA-Adapters which can be used on the box PC.

Please contact MEN's sales team for information about possible configurations and special board versions.

3.12   PCI Express Mini Card Interface

The BL50S supports the PCI Express Mini Card standard. Its PCI Express Mini Card slot is located within the housing.

> Refer to Figure 3, Map of the system – view of the BL50S interior on page 20 for the exact position of the PCI Express Mini Card slot.

As an option, the BL50S can also be equipped with a PCI Express Mini Card slot compatible with half-size modules.

> See Chapter 2.2.3 Installing PCI Express Mini Cards on page 27 for information on how to install the PCI Express Mini Cards in the box PC.

The PCIe MiniCard socket on the BL50S supports both a USB and a PCIe interface.

The power supply of the PCIe MiniCard can be reset via GPIO. This power reset is required when switching from one micro-SIM card to another.

> See Chapter 4.1 SMBus Overview on page 62 for more information on how to switch the micro-SIM cards.

Micro-SIM Cards

The BL50S provides two micro-SIM Card sockets. Two micro-SIM cards are attached to the PCIe MiniCard socket. Either micro-SIM card A or micro-SIM card B can be connected to the PCI Express Mini Card. By default the PCI Express Mini card is connected to micro-SIM card A.

> See Chapter 4.1 SMBus Overview on page 62 for more information on how to switch the micro-SIM cards.

3.12.1   Connection of PCI Express Mini Cards

The PCI Express Mini card is connected using a 52-pin standard PCI Express Mini Card connector. The following standard signals are supported (signal directions according to PCI Express Mini Card standard):

Table 17. *Pin assignment of 52-pin PCI Express Mini Card connector*

Pin	Signal	Pin	Signal
51	Reserved	52	+3.3Vaux
49	Reserved	50	GND
47	Reserved	48	+1.5V
45	Reserved	46	LED_WPAN#
43	GND	44	LED_WLAN#
41	+3.3Vaux	42	LED_WWAN#
39	+3.3Vaux	40	GND
37	GND	38	USB_D+
35	GND	36	USB_D-
33	PETp0	34	GND
31	PETn0	32	SMB_DATA
29	GND	30	SMB_CLK
27	GND	28	+1.5V
25	PERp0	26	GND
23	PERn0	24	+3.3Vaux
21	GND	22	PERST#
19	Reserved	20	W_DISABLE#
17	Reserved	18	GND
Mechanical Key			
15	GND	16	UIM_VPP
13	REFCLK+	14	UIM_RST
11	REFCLK-	12	UIM_CLK
9	GND	10	UIM_DATA
7	CLKREQ#	8	UIM_PWR
5	Reserved	6	1.5V
3	Reserved	4	GND
1	WAKE#	2	+3.3Vaux

Table 18. Signal mnemonics of 52-pin PCI Express Mini Card connector

	Signal	**Direction**	**Function**
Power	GND	-	Ground
	+3.3Vaux	out	3.3V source
	1.5V	out	1.5V source
SIM card	UIM_PWR	in	microSIM card power
	UIM_DATA	in/out	microSIM card data
	UIM_CLK	in	microSIM card clock
	UIM_RST	in	microSIM card reset
	UIM_VPP	in	not connected
PCI Express	REFCLK-/ REFCLK+	out	PCI Express differential reference clock
	PERn0/PERp0	in	PCI Express receive signals
	PETn0/PETp0	out	PCI Express transmit signals
Auxiliary Signals	CLKREQ#	in	Clock request
	PERST#	out	Reset for the Mini Card
	W_DISABLE#	out	Wireless disable
	WAKE#	in	Wake signal
	SMB_CLK	out	System management bus clock
	SMB_DATA	in/out	System management bus data
USB	USB_D-	in/out	USB line
	USB_D+	in/out	USB line
Communications - specific signals	LED_WWAN#	in	not connected
	LED_WLAN#	in	not connected
	LED_WPAN#	in	not connected

Please refer to the PCI Express Mini Card Specification for further details. See Chapter 8.1 Literature and Web Resources on page 113.

4   Controlling the System via SMBus

4.1   SMBus Overview

The PCI Express Mini Card, the microSIM cards and the PoE controller can all be controlled using the SMBus and two I/O expanders.

> MEN offers a driver for accessing the SMBus. See MEN's website.

Two I/O expanders and a system EEPROM are connected to the SMBus.

Figure 18. *SMBus overview*
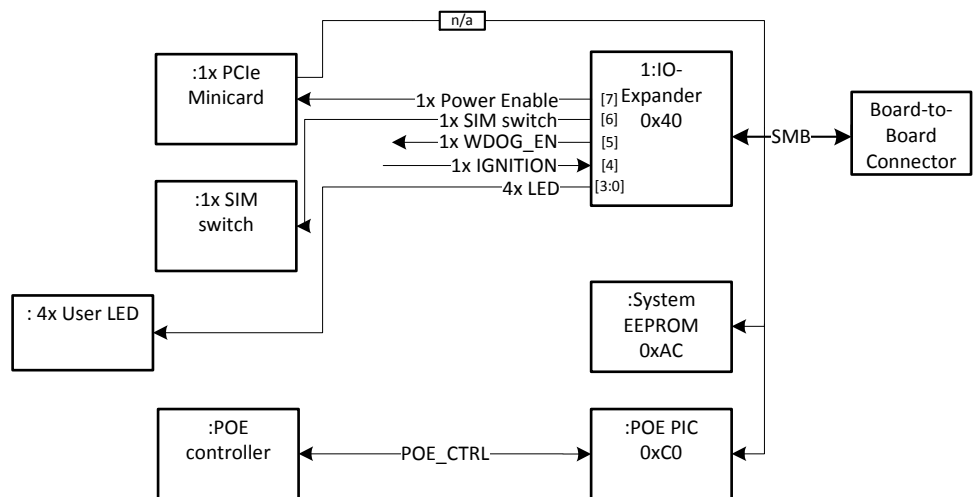
4.2   SMBus Register Description

The SMB address is compliant to the Windows nomenclature. This means that the last bit which is used as the read/write bit is added with the value '0' to the address.

Under Linux a 0 is added at the beginning of the address so that all consecutive address bits are moved one bit to the right.

Example

Binary address of the I/O-Expander with hard coded offset 0b 0100 and chosen address bits:

- 0b 0100 (A2)(A1)(A0)(R/W)

With address bits:

- 0b 0100 010 (R/W)

Windows address:

- (R/W) = 0 -> 0b 0100 0100 -> 0x44

Linux address:

- 0b 0010 0010 -> 0x22

Table 19. SMB address space

Address	Function
0xC0	PoE PIC, used to control the PoE interface, can be used to switch on/off connected PoE devices.
0xAC	EEPROM, includes system information e.g. serial number and the date of production.
0x40	I/O Expander, used to power cycle the PCIe Mini Card, to switch between the connected SIM cards, reset the Watchdog, read back the ignition status and to control the user LEDs at the front panel.

SATA LED Register (0x42)

Table 20. SMB 0x42

Bit	Direction	Signal	Default Value	Description	Group
7	-	reserved			
6	In	SATA_2_HP_IN	1	Signal to detect a SATA hot plug request.	SATA
				0= The bit is '0' if the SATA shuttle is closed.	
				1= The bit is '1' if the SATA shuttle's handle is opened to eject the SATA shuttle.	
5	Out	SATA_2_ LOCATE_LED	1	Signal to show the location of a SATA device at the front panel.	SATA
				0= The LED can be enabled by setting this bit to '0'.	
				1= The default value is '1' and the locate LED is off.	
4	Out	SATA_2_ERROR _HP_LED	1	LED to show the life status of the connected HDD/SSD and is used to show if the storage device is removed by software from the system and can be ejected.	SATA
				0= The LED can be enabled by setting this bit to '0'.	
				1= The default value is '1' and the error and hot plug LED is off.	
3	-	reserved	-		
2	In	SATA_1_HP_IN	1	Signal to detect a SATA hot plug request.	SATA
				0= The bit is '0' if the SATA shuttle is closed.	
				1= The bit is '1' if the SATA shuttle's handle is opened to eject the SATA shuttle.	
1	Out	SATA_1_ LOCATE_LED	1	Signal to show the location of a SATA device at the front panel.	SATA
				0= The LED can be enabled by setting this bit to '0'.	
				1= The default value is '1' and the locate LED is off.	

Bit	Direction	Signal	Default Value	Description	Group
0	Out	SATA_1_ERROR _HP_LED	1	LED to show the life status of the connected HDD/SSD and is used to show if the storage device is removed by software from the system and can be ejected.	SATA
				0= The LED can be enabled by setting this bit to '0'.	
				1= The default value is '1' and the error and hot plug LED is off.	

SMBus Register (0x40)

Table 21. *SMB 0x40*

Bit	Direction	Signal	Default Value	Description		Group
7	Out	MINI_A_PWR_EN	1	The bit is used to control the PCIe Mini Card A's power.		PCIe Mini Card
				0=	The power of the PCIe Mini Card is disabled.	
				1=	The power of the PCIe Mini Card is enabled (default value).	
6	Out	SIMA_SW	1	Signal to switch between the primary and secondary SIM card of the PCIe Mini Card.		PCIe Mini Card
				0=	The secondary SIM card is connected to the PCIe Mini Card	
				1=	The primary SIM card is connected to the PCIe Mini Card (default value).	
5	Out	WDOG_EN	1	Signal to reset the watchdog. Setting this bit to '0' generates a falling edge. The falling edge results in a reset of the watchdog. For every watchdog reset the bit must be set in sequence '1' -> '0' to generate a falling edge. For further information about the watchdog see Chapter 3.1.1 Ignition on page 40.		System
4	In	IGNITION_ISO	1	Signal to read back the ignition status.		System
				0=	If this bit is '0' the ignition signal is inactive. Setting this bit to '0' results in the same behavior as deactivating the external ignition signal (power button event, starting the watchdog timer).	
				1=	If the bit is '1' the ignition signal is active.	
3	Out	USR_LED D	1	Enable bit for the corresponding user LED.		User LED
				0 =	The LED is enabled/on.	
				1 =	The LED is disabled/off (default value).	
2	Out	USR_LED C	1	Enable bit for the corresponding user LED.		User LED
				0 =	The LED is enabled/on.	

Bit	Direction	Signal	Default Value		Description	Group
				1 =	The LED is disabled/off (default value).	
1	Out	USR_LED B	1		Enable bit for the corresponding user LED.	User LED
				0 =	The LED is enabled/on.	
				1 =	The LED is disabled/off (default value).	
0	Out	USR_LED A	1		Enable bit for the corresponding user LED.	User LED
					LED is activated by setting this bit '0'	
				0 =	The LED is enabled/on.	
				1 =	The LED is disabled/off (default value).	

5   Using the BL50S with MDIS5 Software

This chapter gives specific information on how to use the BL50S with the MDIS5 software.

> For details about installation and usage of MDIS5 please refer to the respective MDIS5 user manual. See MEN's website for detailed information and documentation of MDIS5.

The UART, CAN and GPIO interfaces of the Box PC are controlled using IP cores in an FPGA. See the following Figure 22, Chameleon table for a list of the IP cores.

Table 22. *Chameleon table*

Name	Device	Variant	Revision	Interrupt	Group	Instance	BAR	Offset	Size
16Z125_UART	125	0	11	6	0	4	0	220	8
16Z125_UART	125	0	11	4	0	0	0	3F8	8
16Z125_UART	125	0	11	3	0	1	0	2F8	8
16Z125_UART	125	0	11	7	0	2	0	3E8	8
16Z125_UART	125	0	11	5	0	3	0	2E8	8
16Z082_IMPULSE	82	0	2	3F	0	0	1	800	20
16Z034_GPIO	34	0	A	B	0	0	1	E200	20
16Z034_GPIO	34	0	A	B	0	1	1	E240	20
16Z037_GPIO	37	1	1	B	0	0	1	E260	20
16Z126_FLASH	126	0	6	3F	0	0	1	E280	20
16Z029_CAN	29	1	12	B	0	0	1	E400	100
16Z076_QSPI	76	0	7	B	0	0	1	E800	800
16Z029_CAN	29	1	12	B	0	1	1	F000	100

5.1   GPIO Controller Instance 1

The GPIO controller instance 1 is used to switch serial interfaces of the box PCs from UART to CAN or SGPIO. The functions are switched via multiplexers.

The default device name of the instance 1 of the GPIO controller 16z034- is "gpio_2" for Linux and "z17_2" for Windows.

Table 23. *Functions of GPIO controller instance 1*

Bit Position	Output-Function (GPO)	Input-Function (PSR)	Default Setting
5	mux_if2	-	GPO(5):drive 0
6	mux_if0	-	GPO(6):drive 0
7	mux_if1	-	GPO(7):drive 0

Interface Multiplexer (mux_if2)

The interface multiplexer 2 is used to switch the serial interface 2 (X2) from UART to CAN (required if you want to use the SA8 SA-Adapter in this slot).

Table 24. Interface Multiplexer 2 truth table:

Interface	Function	mux_if2
SA1	UART1	0
	CAN2	1

The interface is switched using the following commands:

For Windows:

```
z17_io z17_2 -p=5 -s=1 -h
```

For Linux:

```
z17_io gpio_2 -p=5 -s=1 -h
```

Interface Multiplexer (mux_if0)

The interface multiplexer 0 is used to change the serial interface 1 (X1) from UART (default setting) to SGPIO (required if you want to use the SA15 SA-Adapter in this slot).

Table 25. Interface Multiplexer 0 truth table:

Interface	Function	mux_if0
SA0	UART0	0
	SGPIO	1

The interface is switched using the following commands:

For Windows:

```
z17_io z17_2 -p=6 -s=1 -h
```

For Linux:

```
z17_io gpio_2 -p=6 -s=1 -h
```

6 Maintenance

6.1 Cleaning the System

The system should be cleaned once a year. Clean the bottom and top plate, remove dirt and dust from air ventilation holes. Light dirt can be removed with a dry cloth. Persistent dirt should only be removed with a mild detergent and a soft cloth.

Take care that no liquid gets inside the system.

6.2 Fuse Protection

⚠ The DC/DC converter inside the Power Supply Unit is protected by a fuse. **This fuse is not intended to be exchanged by the customer. Your warranty for the Power Supply Unit will cease if you exchange the fuse on your own.** Please send your unit to MEN for repair if a fuse blows.

- Current rating: 8A
- Voltage rating: 350 VDC
- Type: Slow-blow
- Size: 5 x 20
- MEN part number: 5475-0026

Figure 19. Position of the fuse in the interior of the BL50S (highlighted in red)
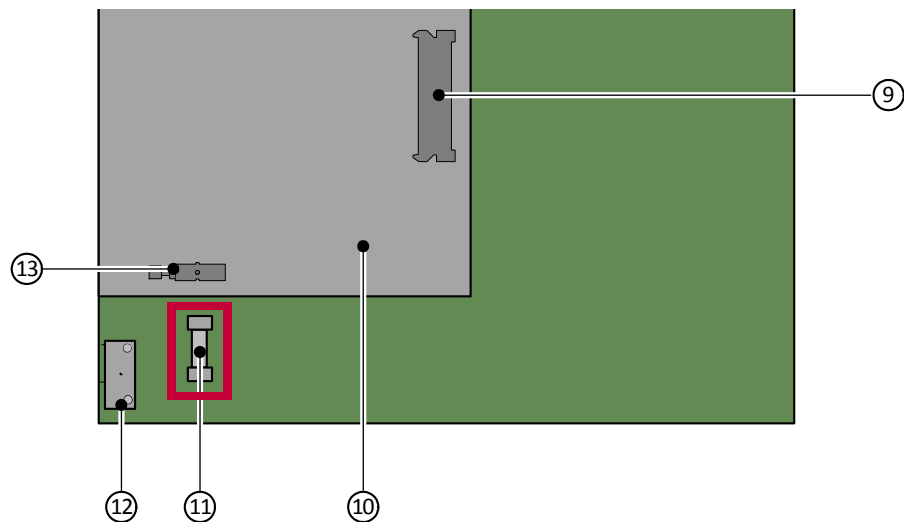
7   Appendix

7.1   Literature and Web Resources

BL50S data sheet with up-to-date information and documentation:
www.men.de/products/09BL50S.html

7.1.1   CAN Bus

CAN in Automation e. V.
www.can-cia.de

7.1.2   Ethernet

- ANSI/IEEE 802.3-1996, Information Technology - Telecommunications and Information Exchange between Systems - Local and Metropolitan Area Networks - Specific Requirements - Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications; 1996; IEEE
www.ieee.org
- Charles Spurgeon's Ethernet Web Site
Extensive information about Ethernet (IEEE 802.3) local area network (LAN) technology.
www.ethermanage.com/ethernet/
- InterOperability Laboratory, University of New Hampshire
This page covers general Ethernet technology.
www.iol.unh.edu/services/testing/ethernet/training/

7.1.3   HD Audio

Intel High Definition Audio:
www.intel.com/design/chipsets/hdaudio.htm

7.1.4   PCI Express Mini Card

PCI Express Mini Card Electromechanical Specification
Revision 1.2; October 26, 2007
PCI Special Interest Group
www.pcisig.com

7.1.5   SATA

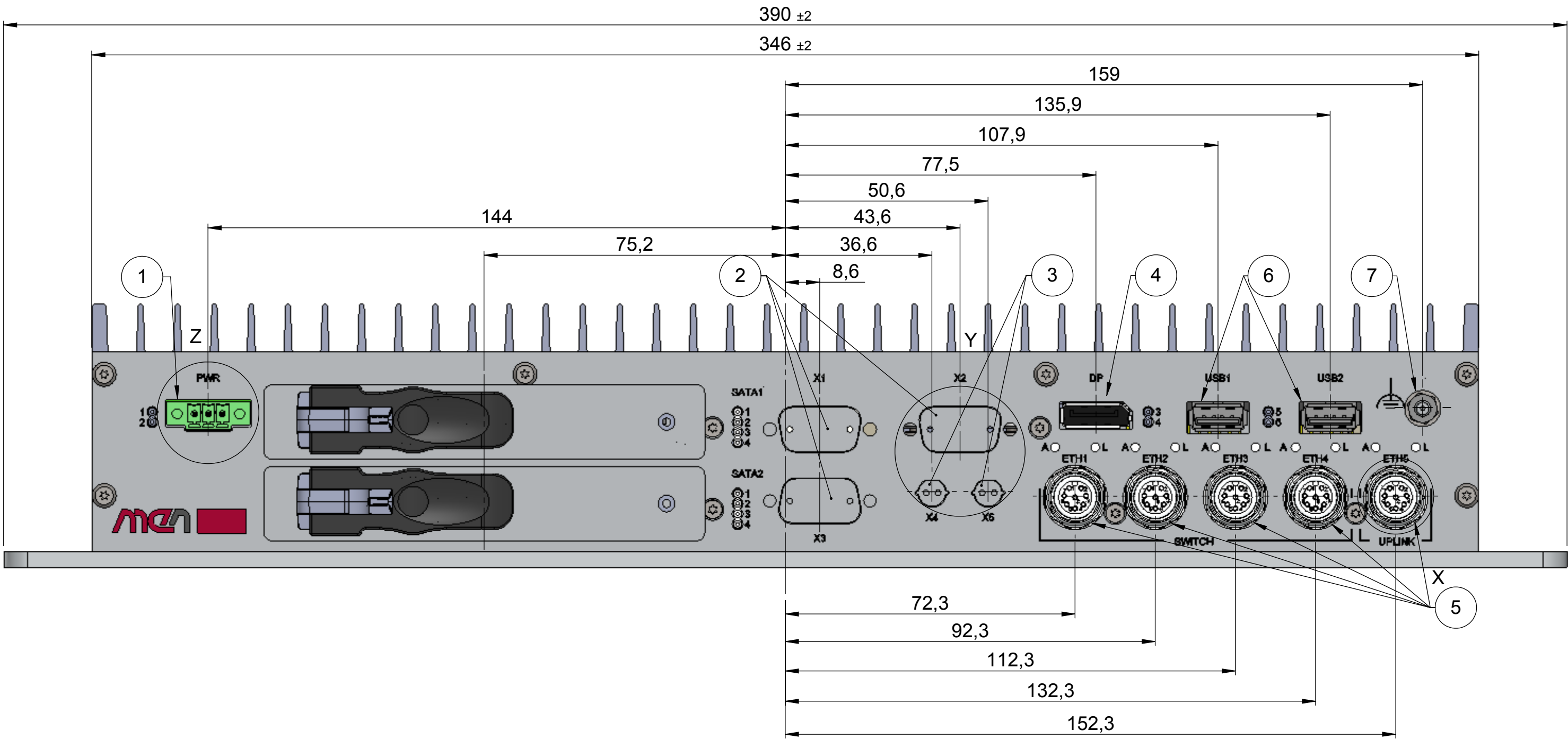Serial ATA International Organization (SATA-IO)
www.serialata.org

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7.1.6 USB

	USB Implementers Forum, Inc. www.usb.org

7.2 Dimensions of the BL50S Box PC

In the following you can find a drawing of the exact dimensions of the box PC.

Position	Quantity	Function	Description	Mating connector
1	1	Power	Mini Combicon Plug Grid 3,5mm	Mini Cobicon Jack e.g. Phoenix: 1966101
2	3	SA-Adapter	Pending on function	Pending on function
3	2	Antenna	Pending on function	Pending on function
4	1	Display	Display Port Jack	Display Port Plug e.g. Molex: 0687830001
5	5	Ethernet	M12 Jack 8-pin A-coded	M12 Plug 8-pin e.g. Conec: SAL-12RS8-2/A1
6	2	USB	USB Type A Jack	USB Type A Plug
7	1	Ground	M4 Bolt	Cable eye

PWR

Z (3 : 1)
PIN 1

Y (3 : 1)
20°
21,9
11,40
R3,40
6,80
⌀7,2

X (3 : 1)
PIN 1
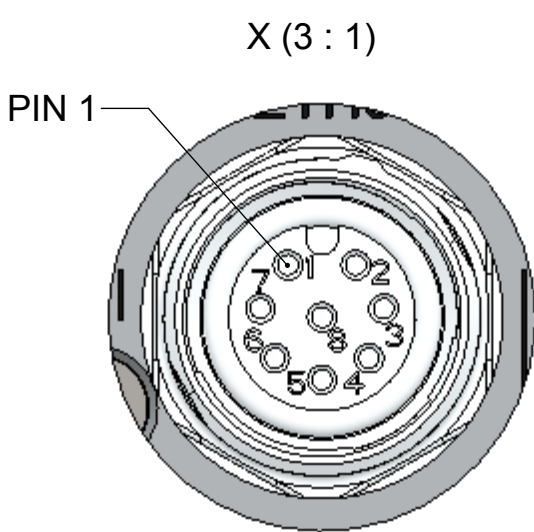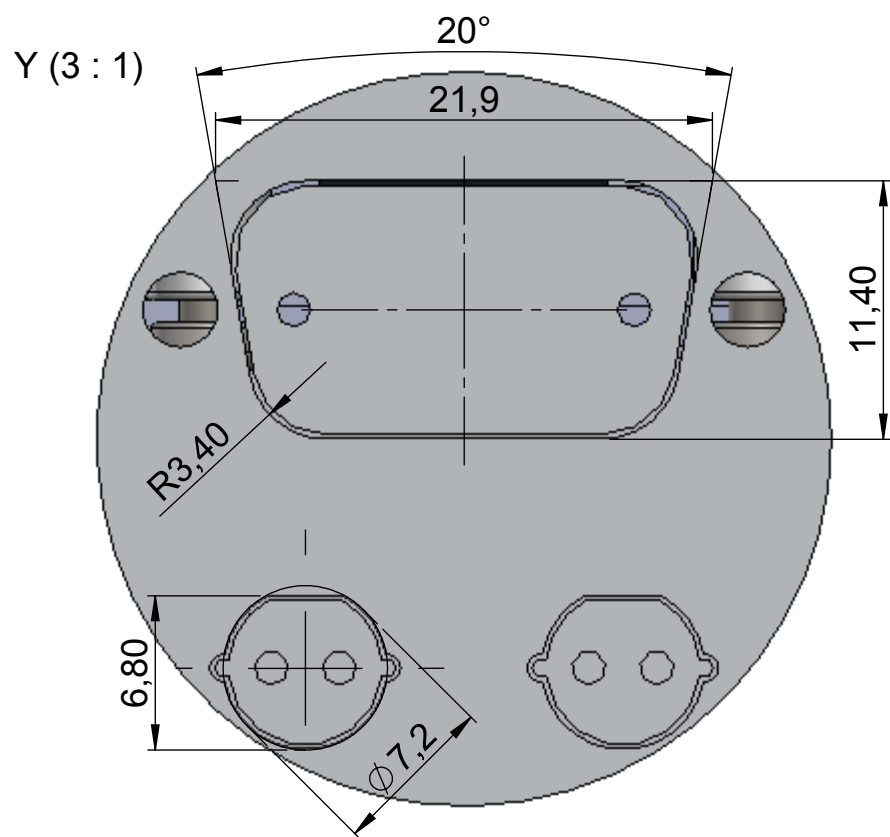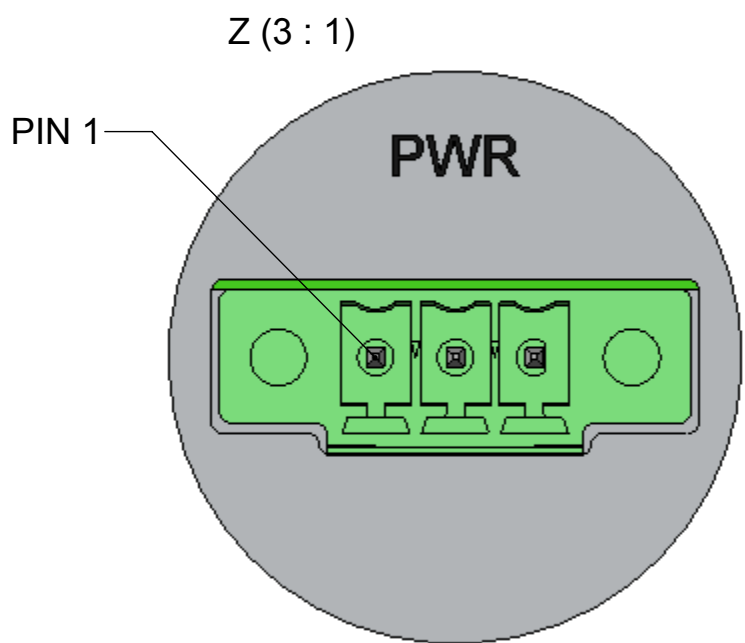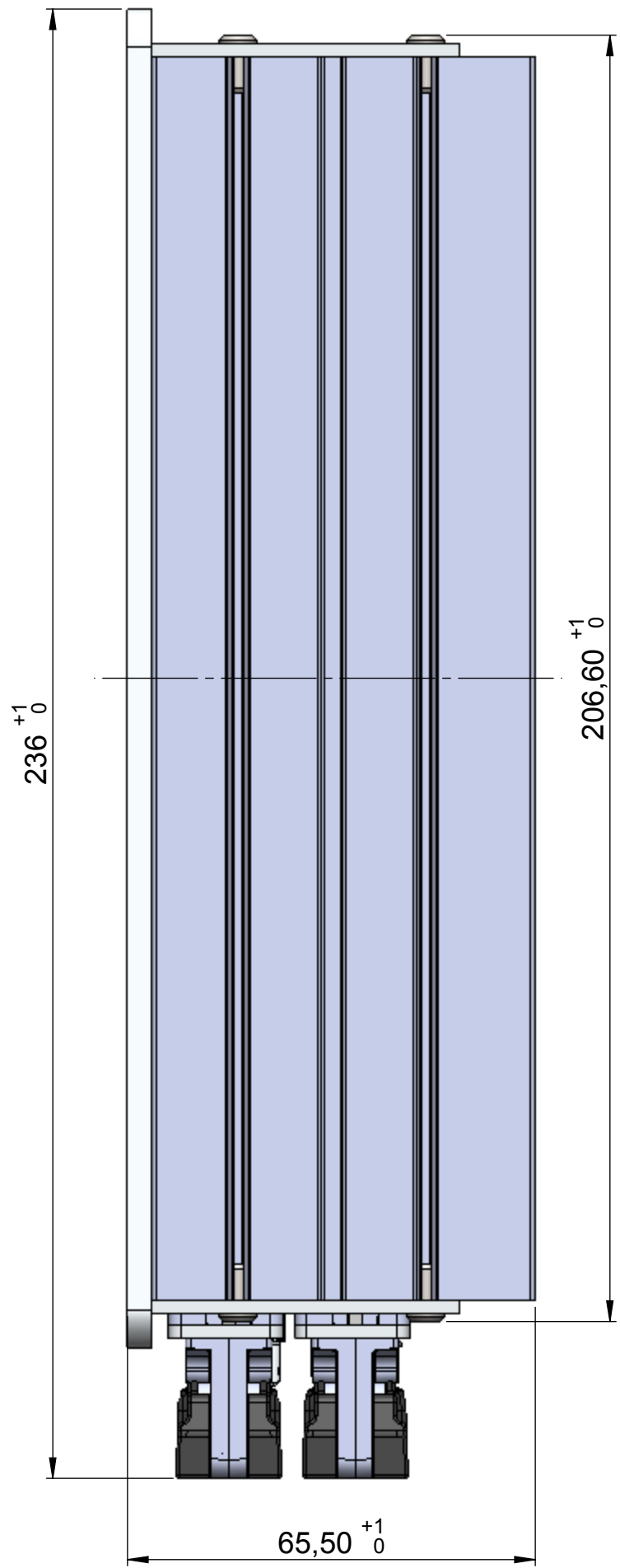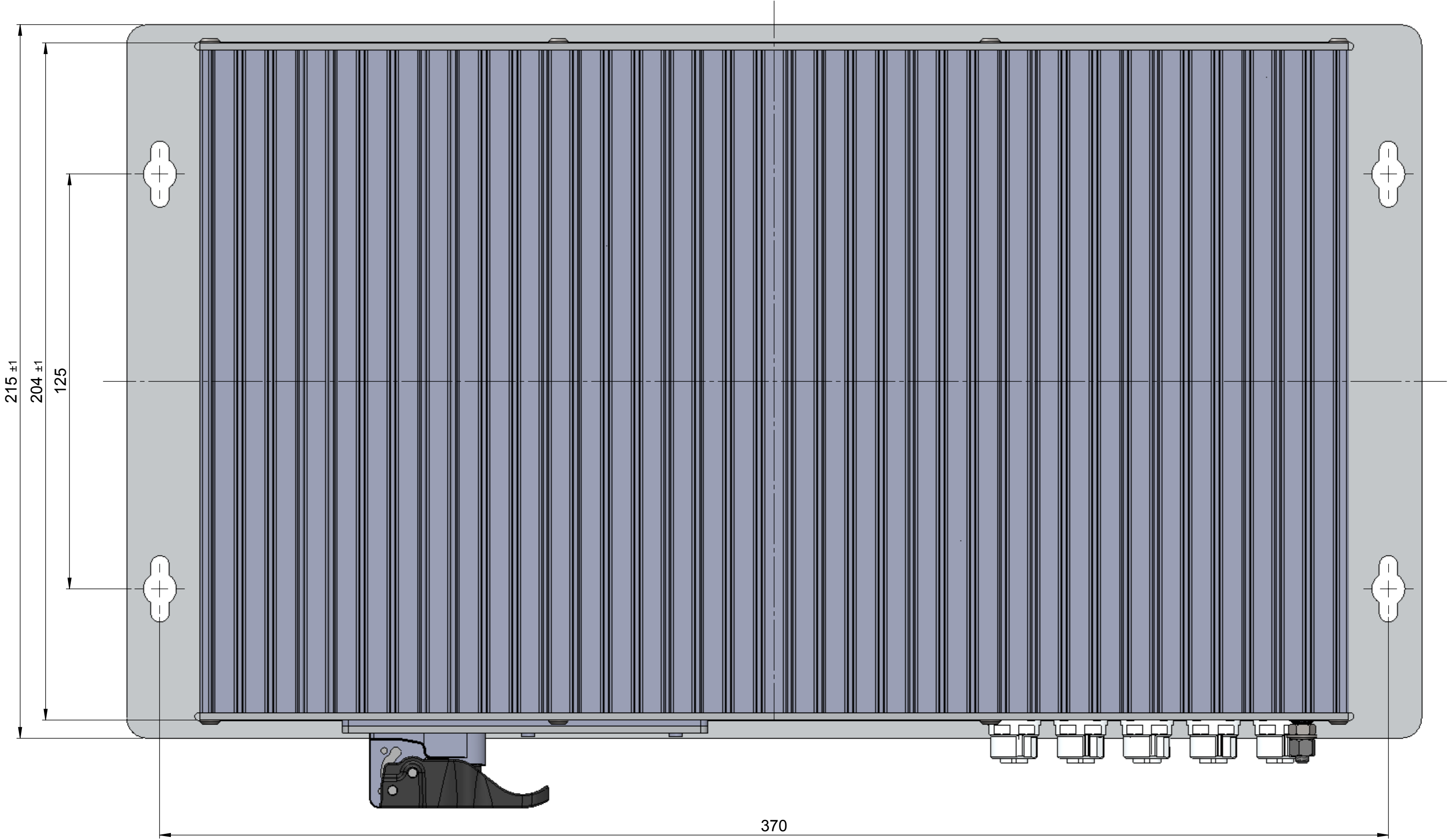
Manufacturer number: 09BL50S00
Weight: max. 5 kg
Input voltage: 24 VDC (nom.)
Operating temperature: -40°C...+70°C

1.0	AKubitza 2014-03-17	Initial version		
Rev.:	Prepared/Date:	Modification:		
Responsible author: J.Ultsch				RoHS-compliant (2011/65/EU): yes
Printed versions FOR INFORMATION ONLY. This is an electronic document. It has been digitally signed. Please see release form.				For this document all rights are reserved.
Scale: 1:1		Tolerance: ---	---	DIN ISO 13715
Material: see above		Surface: ---		
---				DIN A1
Description: Space allocation drawing 09BL50S00_SAD (1.0)			Document No. 09BL50S00_SAD	Prj.: 1316	Sheet: 1 / 1