

User Manual

BC50I – Box PC for Industrial Applications



Configuration example



BC50I – Box PC for Industrial Applications (AMD)

The BC50I is a fanless, maintenance-free box computer that has been designed for independent use or as display computer electronics for use in industrial applications, e.g. for machine control, surveillance or commercial vehicles or robotics.

It 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 BC50I is equipped with 2 GB of DDR3 SDRAM and offers SD card and mSATA slots. A SATA hard-disk/solid-state drive can be installed within the housing as an option.

The system is designed for fanless operation at temperatures from -40 to +70°C, its special aluminum housing with cooling fins serves as a heat sink for the internal electronics and in this way provides conduction cooling.

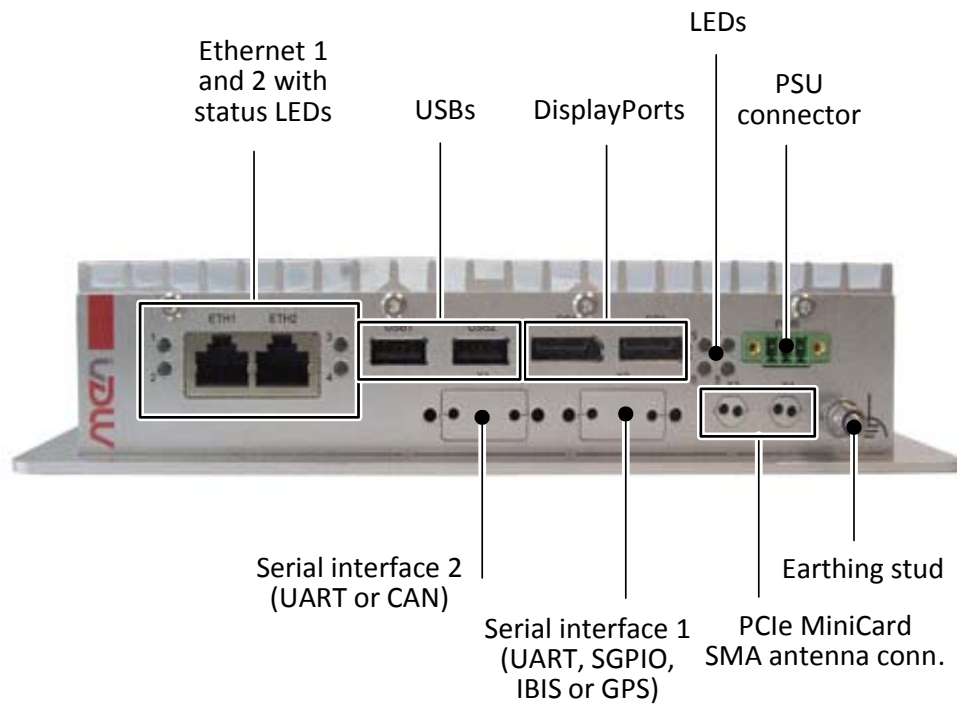
The BC50I supports up to two DisplayPort® interfaces with a maximum resolution of 2560x1600 each. The DisplayPort® interfaces and all other I/O are available at the unit's front panel on standard connectors like USB, 9-pin D-Sub (optional serial I/O), RJ45 (Gigabit Ethernet) and DisplayPort®.

On the inside, the system offers one PCI Express® Mini card slot with a SIM card slot. The necessary antenna connectors can be made available at the front panel.

The BC50I comes with its own integrated 24 VDC nom. (16 to 36 V) power supply.

The combination of the various CPU/GPU options with the available selection of external interfaces (realized via separate graphics and I/O interface boards within the system) makes for an extremely flexible system design that can quickly be tailored to a vast number of applications.

Diagram



Technical Data

CPU

- AMD Embedded G-Series T48N
 - Dual-Core
 - 1.4 GHz processor core frequency
 - 1066 MT/s DDR3 Speed
 - 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

Mass Storage

- One SD card slot
 - Via USB
- One mSATA slot
 - SATA Revision 2.x support
 - Transfer rates up to 300 MB/s (6 Gbit/s)
- Serial ATA (SATA)
 - One port for hard-disk/solid-state drive mounted within the unit's housing
 - SATA Revision 2.x support
 - Transfer rates up to 300 MB/s (3 Gbit/s)

Graphics

- AMD Radeon™ HD 6310
 - Dual independent display support
 - Dual DisplayPort
 - Maximum resolution: 2560x1600
 - Embedded in T48N APU
- 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

Front I/O

- 2 DisplayPort® 1.1a interfaces
 - AUX channels and hot plug detection
- 2 Gigabit Ethernet
 - Via RJ45 connectors
- 2 USB 2.0
 - Via Series A connector
- 2 SA-Adapter slots for serial I/O
 - RS232, RS485, RS422, IBIS or GPS possible on both slots
 - SGPIO switchable by software on one slot
 - CAN bus optional on one slot
- 8 LEDs
 - 4 for Ethernet link and activity status
 - 2 user LEDs
 - 1 status LED
 - 1 power OK LED

1 PCI Express® Mini Card slot

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

Real-Time Clock

- Buffered by Gold Cap for up to 72 h

Electrical Specifications

- Supply voltage:
 - 24 VDC nom. (16 to 36 V)
- Power consumption: up to 35 W (with PCI Express® Mini Card)

Mechanical Specifications

- Dimensions: approx. 250 mm x 220 mm x 44.1 mm
- Weight: 1.8 kg
- Front protected according to IP20

Environmental Specifications

- Temperature range (operation):
 - -40°C to 70°C
 - 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
- Vibration (function): 1 m/s², 5 Hz – 150 Hz
- Vibration (lifetime): 7.9 m/s², 5 Hz – 150 Hz
- Conformal coating of internal components on request

MTBF

- tbd @ 40°C according to IEC/TR 62380 (RDF 2000)

Safety

- PCB manufactured with a flammability rating of 94V-0 by UL recognized manufacturers

EMC

- Conforming to EN 55022 (radio disturbance), IEC 61000-4-2 (ESD) and IEC 61000-4-4 (burst)

BIOS

- InsydeH2O™ UEFI Framework

Software Support

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



For more information on supported operating system versions and drivers, please 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

- Antenna connectors
 - For functions like Wi-Fi, WIMAX, GSM/GPRS, UMTS, LTE in combination with PCI Express® Mini Card
 - Reverse SMA connector

Fieldbusses

- Additional Hilscher PCI Express® Mini Cards, which allow further communication possibilities (as listed below), are available with this box PC, after minor modifications. Please contact our sales team for further information:
- PX51, supporting the following communication (determined by firmware):
 - DeviceNet Master
 - DeviceNet Slave

- PX52, supporting the following Real-Time Ethernet communication (determined by firmware):
 - EtherCAT Master, EtherCAT Slave
 - EtherNet/IP Scanner (Master), EtherNet/IP Adapter (Slave)
 - Open Modbus/TCP
 - POWERLINK Controlled Node/Slave
 - PROFINET IO-Controller (Master), PROFINET IO-Device (Slave)
 - sercos Master, sercos Slave
 - VARAN Client (Slave)

Environmental Specifications

- Temperature range (operation):
 - -40°C to 85°C (screened) with wider housing with additional cooling fins

Other Options

- 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.
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	2013-05-14
E2	Added installation in 19" rack, corrected SA-Adapter installation, corrected connection of earthing cable, added pin 1 in PSU connector drawing, removed ignition function, cosmetics	2013-11-20
E3	Updated Technical Data, description of real-time clock, SMBus devices, format and structure	2015-07-27

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.

<i>italics</i>	Folder, file and function names are printed in <i>italics</i> .
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 the board or component".

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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.

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1 Product Description

1.1 Overview

This chapter gives an overview of the box PC.

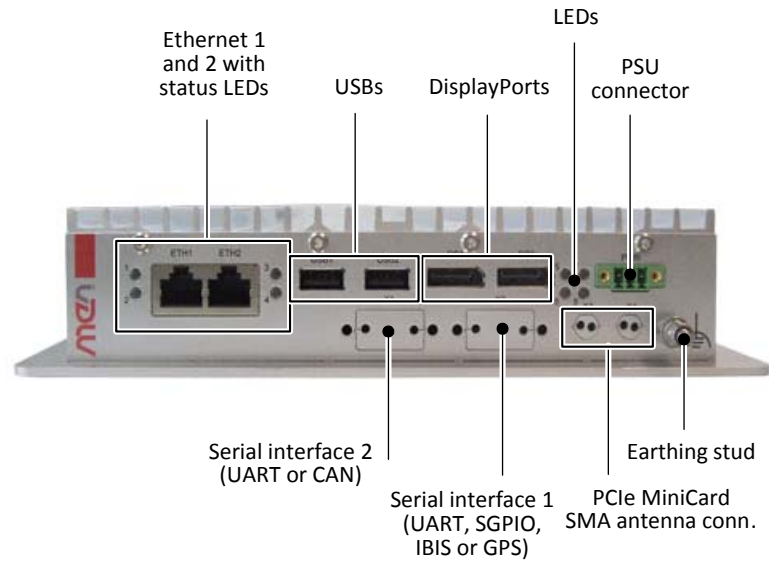
Figure 1. The BC50I - overview



1.1.1 External Interfaces

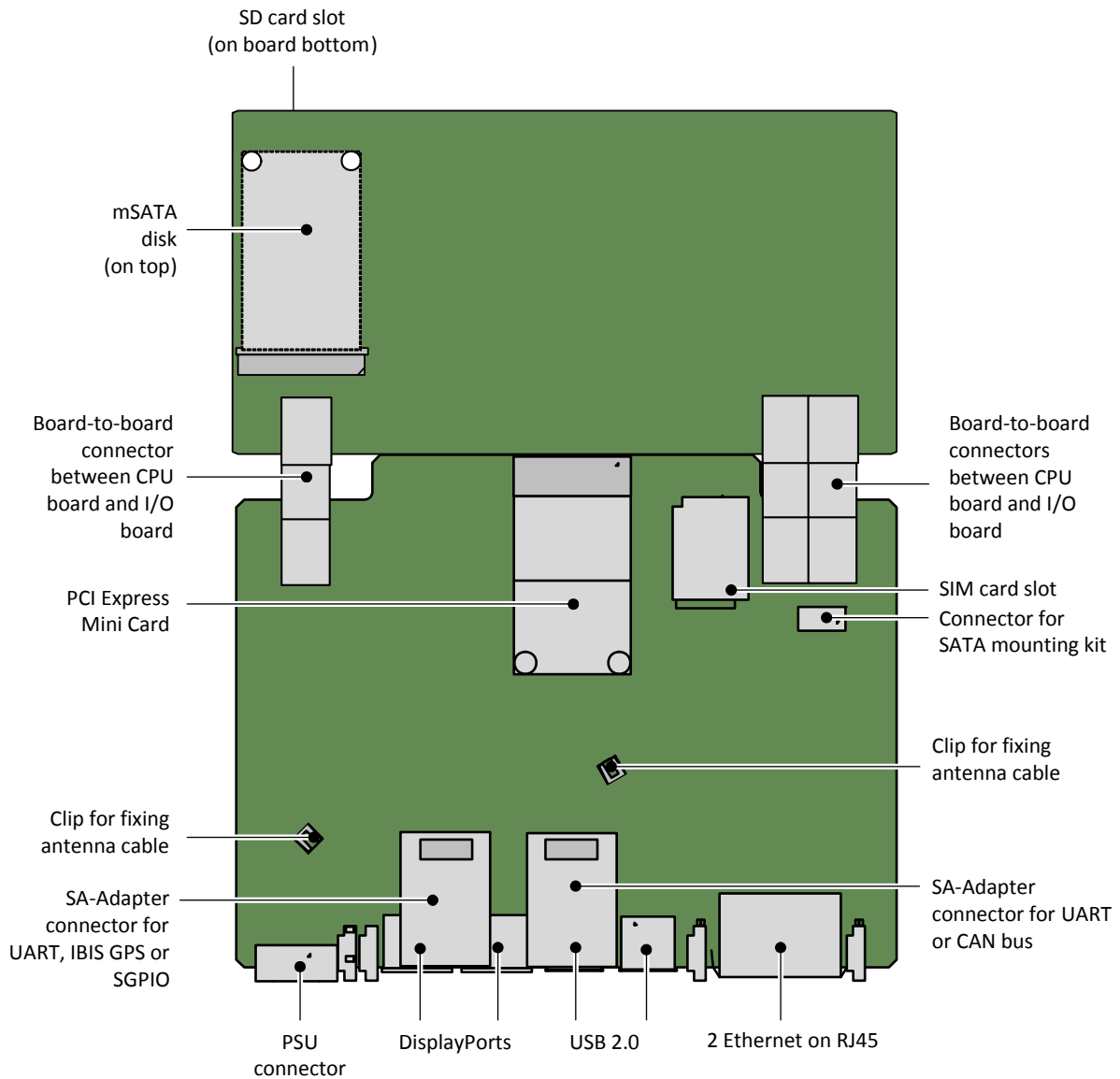
The following picture shows the BC50I front without antennas and flexible SA-Adapters.

Figure 2. The BC50I - front interfaces



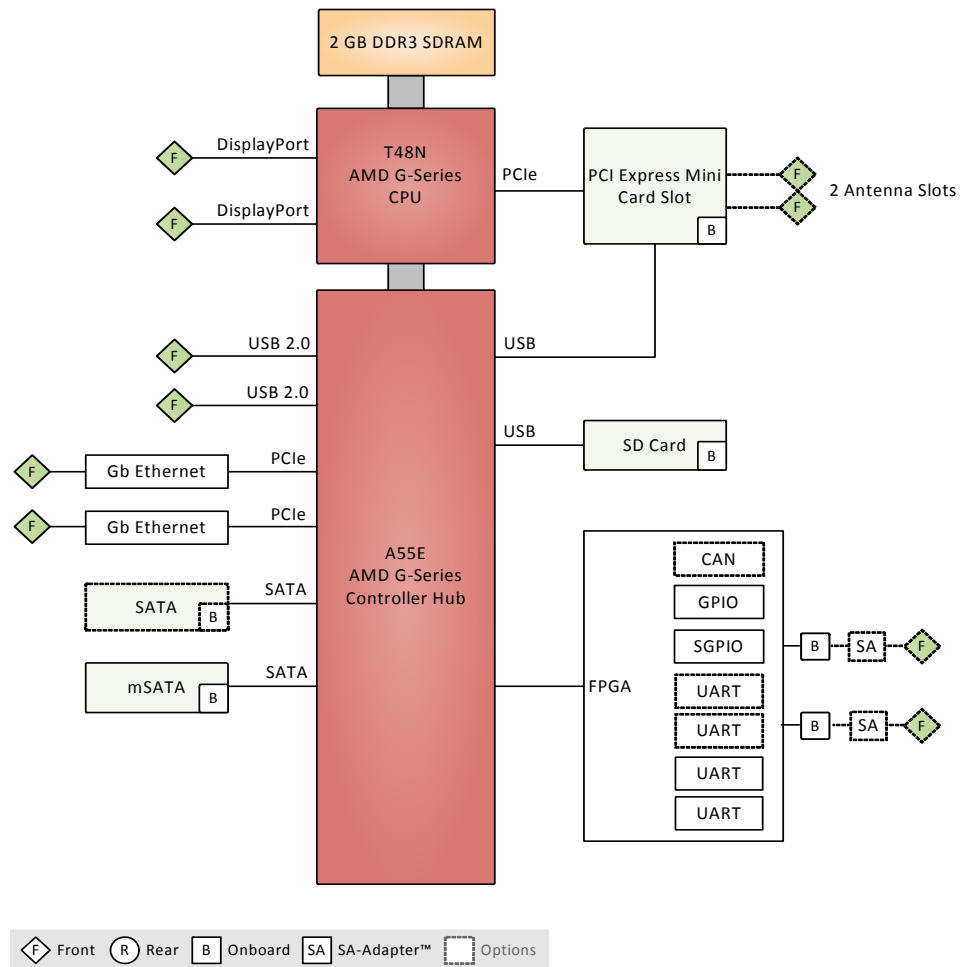
1.1.2 Map of the System

Figure 3. Map of the system – view of the BC50I interior



1.2 Block Diagram

Figure 4. Block diagram



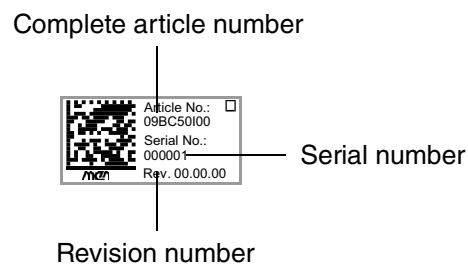
1.3 Product Identification

MEN user documentation may describe several different models and/or design revisions of the BC50I. 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. If one of the following situations arises, get the equipment checked by service personnel:

- The power cable or plug is damaged.
- Liquid has penetrated into the equipment.
- The equipment has been exposed to moisture.
- The equipment does not work well, or you cannot get it to work according to the user manual.
- The equipment has been dropped and damaged.
- The equipment has obvious signs of breakage.



Damaged equipment may be under dangerous voltage and can cause fire. Damaged equipment has unpredictable behavior and characteristics.

Prevent that damaged equipment is installed and put into operation. Mark the damaged equipment and keep it under lock and key. Send the equipment to repair immediately.

When the equipment has been subjected to low temperatures or extreme temperature variations condensation can form on or inside the system. Humidity causes short circuits in electric circuits and damages the system. To avoid damages, do the following:

- Store the equipment in a dry environment
- Ensure that the equipment has the same temperature as the environment before starting it up.
- Do not subject the equipment to the direct radiation of a heating device.
- Wait until the equipment has dried completely or wait 12 hours before switching on the equipment.

2.2 Configuring the Hardware

Check your hardware requirements before mounting the BC50I, since most modifications are difficult or even impossible to do when the box PC is mounted.

The following check list gives an overview on what you might want to configure. For installing the components mentioned below, the BC50I has to be opened.

See [Chapter 2.2.1 Handling Internal Components on page 27](#) and [Chapter 2.2.2 Opening the BC50I on page 27](#).

☒ PCI Express Mini Cards

One PCI Express Mini Card for wireless functions can be installed in the BC50I. 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 29](#) and [Chapter 3.10 PCI Express Mini Card Interface on page 51](#) for details on the installation and functionality of the PCI Express Mini Cards.

☒ Antenna connectors

Two antennas can be installed at the BC50I'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 29](#) and for details on the installation of the antenna connectors.

☒ SD card

The BC50I 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 33](#) for information on how to install the SD card.

☒ mSATA disk

The BC50I 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 33](#) for information on how to install the mSATA disk.

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

The BC50I 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 57](#) and [Chapter 3.9 Serial Interfaces via SA-Adapter on page 50](#) 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



- Activities on the inside of the system have to be carried out by the service person for this area or a suitably instructed user.
- 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 BC50I

The PCI Express Mini Cards, the SA-Adapters, the microSIM cards, the mSATA slot and SD card slot of the BC50I can be accessed after opening the housing.

- ☒ For this purpose, remove the system's bottom panel fixed by six M3x16 TX10 Torx screws (screws are accessible from the system's top).

Figure 6. Screw positions on top of the BC50I



- ☒ To access the SD card slot, remove the rear panel of the unit fixed by four M3x6 TX8 Torx screws.

Figure 7. Screw positions at the rear of the BC50I

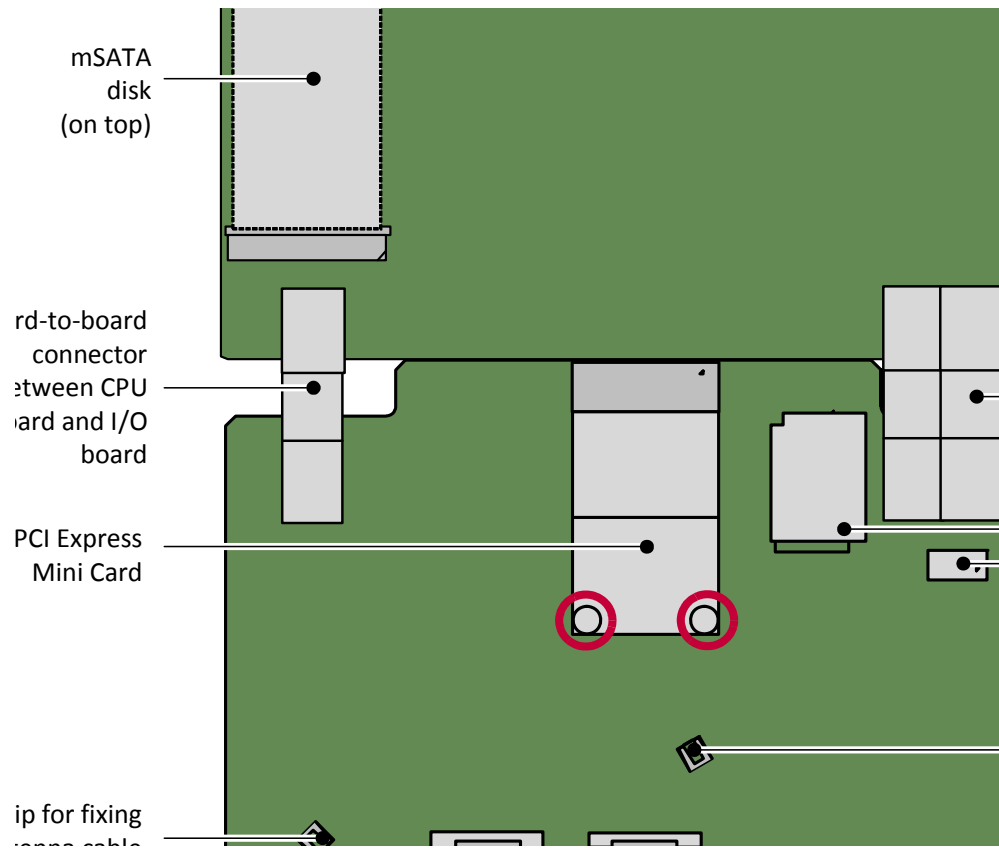


2.2.3 Installing PCI Express Mini Cards

Within its housing, the BC50I 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 (rear part of BC50I's interior shown)



- ☑ 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.

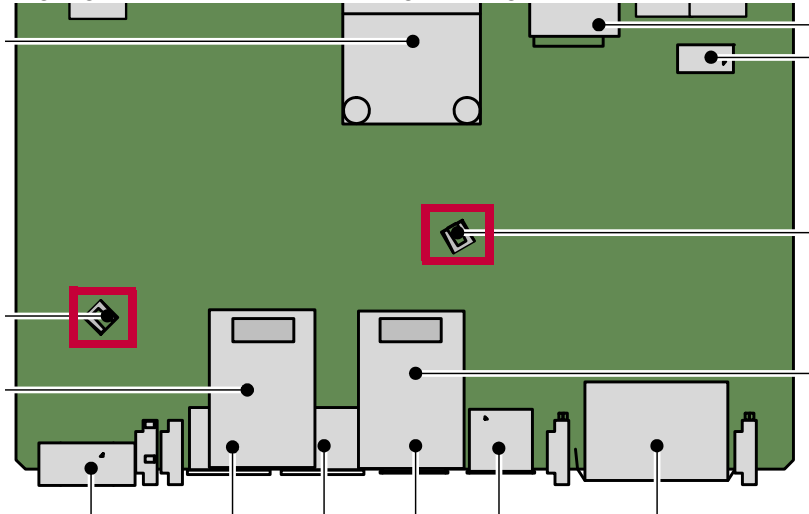


Please see the [MEN website](#) for ordering information.

Before being able to install the antenna on the BC50I's front panel, you have to break out the cover of the antenna slot, using a screw driver or a similar tool.



There are two mounting clips for fixing the antenna cable on the BC50I's PCB (highlighted in red in the following drawing).



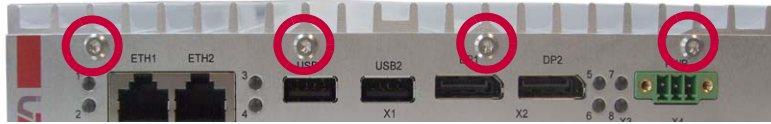
Note: There is only one position in which the antenna can be completely inserted into the front panel slot. When properly inserted the antenna is fixed and cannot be turned anymore.

2.2.4 Installing SA-Adapters

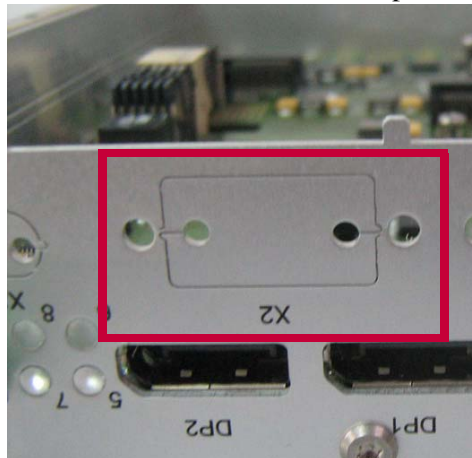
Two SA-Adapters can be mounted in the BC50I on the 10-pin receptacles for slots X1 and X2.

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

- ☑ Remove the front panel of the unit fixed by four M3x6 TX8 Torx screws.



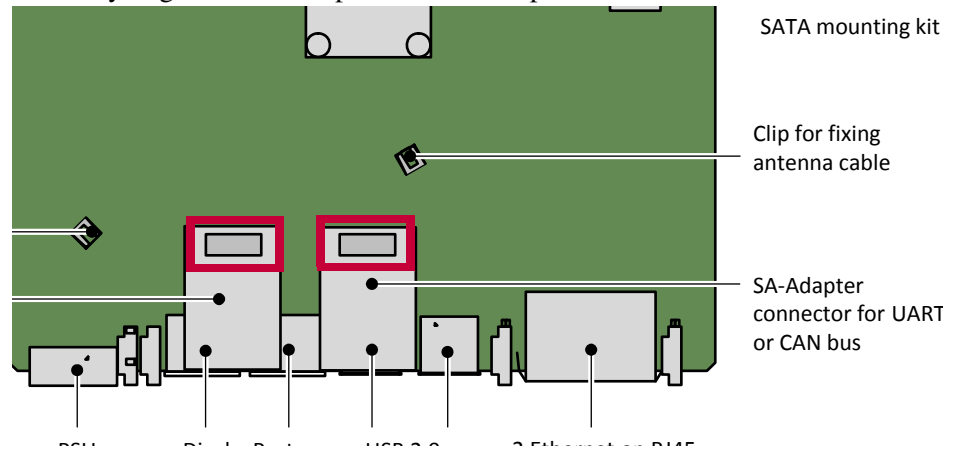
- ☑ Break out the covers of the front panel slots.



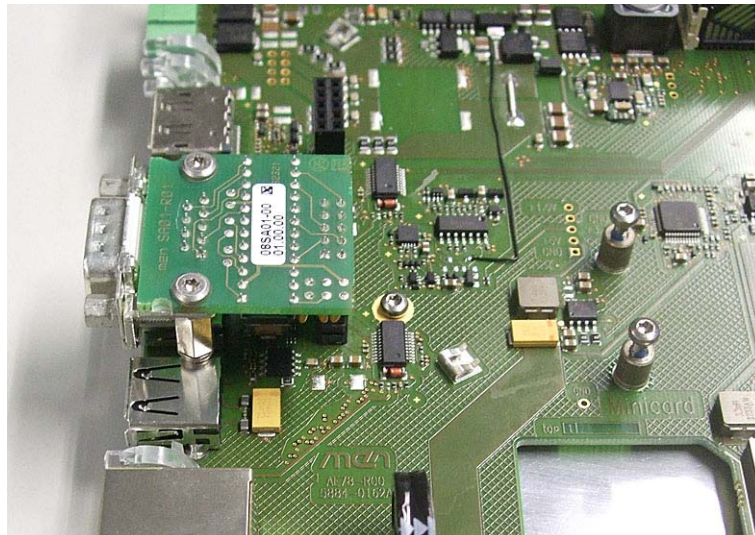
- ☑ Make sure that the adapter matches the standard dimensions for SA-Adapters. (See also installation hints in the adapter's user manual or the list of compatible accessories in the BC50I data sheet on MEN's [website](#).)
- ☑ Remove the two front panel screws of the SA-Adapter.



- ☑ Carefully align the SA-Adapter with the 10-pin connectors on the BC50I.



- ☑ Press the SA-Adapter firmly onto the BC50I.



- ☑ Align the front panel with the front connectors.
- ☑ Screw the front panel back onto the BC50I.
- ☑ Screw the SA-Adapter tightly to the BC50I front panel using the two pan-head screws removed before.



2.2.5 Installing an SD Card

Within its housing, the BC50I 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.

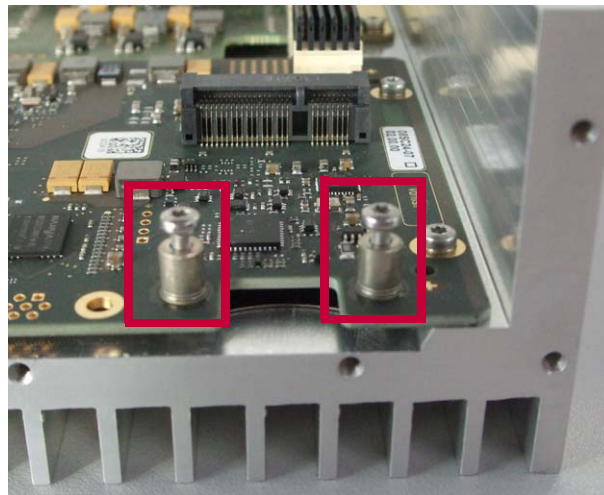


- ☑ Make sure that it clicks into place properly.
- ☑ To eject the SD card, push it until it springs out, then simply pull it out.

2.2.6 Installing an mSATA Drive

Within its housing, the BC50I provides one mSATA slot. Two M2.5x8 screws are provided with the BC50I.

- ☑ 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).



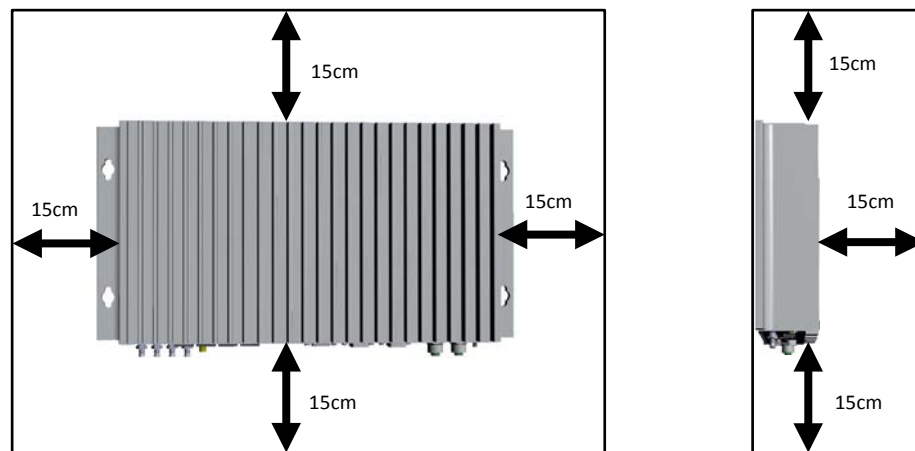
2.3 Mounting the BC50I

Please consider the following instructions when installing the BC50I:



- 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 BC50I provides four mounting holes for installation.
- Use M5 countersink head screws.

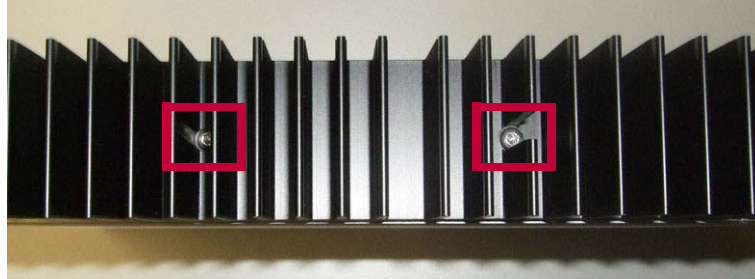
See [Chapter 7.2 Dimensions of the BC50I Box PC on page 60](#) for the exact dimensions of the box PC and the positions of the mounting holes and connectors.

2.3.1 Installing the BC50I in a 19" Rack



MEN offers a mounting kit which makes it possible to install the BC50I in a 19" rack (05BC01-00). Please see MEN's [website](#) for more information.

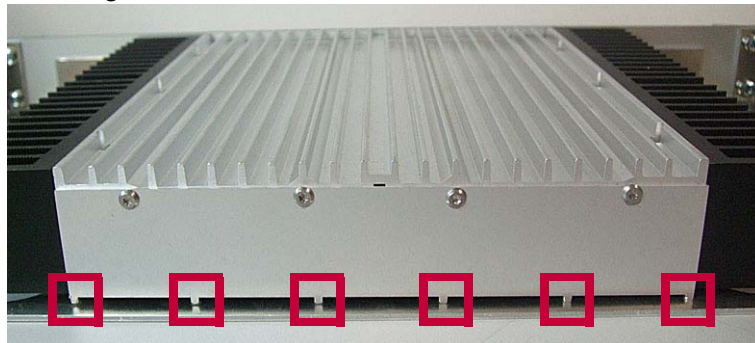
- ☑ Remove the BC50I's bottom panel as described in [Chapter 2.2.2 Opening the BC50I on page 27](#).
- ☑ Install the two heatsinks supplied with the kit at the sides of the BC50I using two M3x10 TX10 Torx screws for each heat sink. The screws are included in the delivery of the 05BC01-00 kit.



- ☑ Remove the right and the left screw fastening the front panel.



- ☑ Insert the box PC into the opening in the kit's front panel in a 45° angle.
- ☑ 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 BC50I down onto the bottom plate.
- ☑ Screw the BC50I onto the kit's bottom plate using the 6 screws removed before.

- ☑ Fix the BC50I at the kit's front panel using two M3x6 TX8 Torx screws.



- ☑ Fasten the BC50I in the frame in the 19" switching cabinet using four M6x16 screws.

2.4 Connecting an Earthing Cable

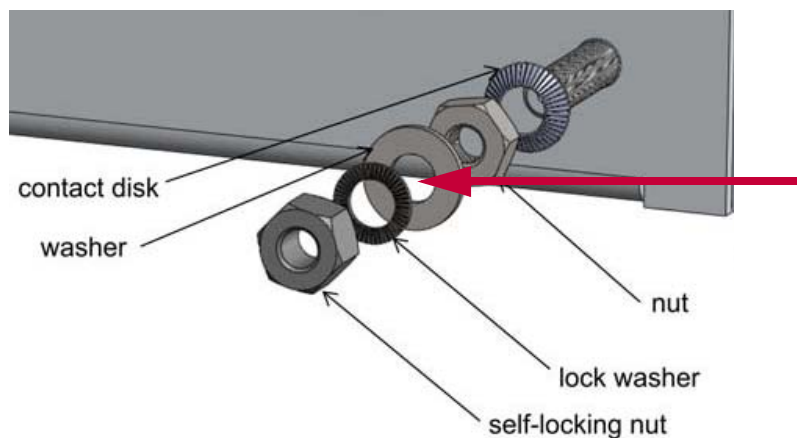
The BC50I features an earthing stud on the right side of the front panel (see [Figure 2, The BC50I - front interfaces on page 20](#)). A protective earth connection is essential for the system to meet its EMC specifications.



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 BC50I.
- ☒ Power up the system. See [Chapter 3.1 Power Supply on page 40](#).
- ☒ 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 BC50I 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 BC50I is supplied with a nominal input voltage of 24 VDC (16 to 36 input voltage range) via a 3-pin COMBICON connector. You can find pin 1 at the left (see [Figure 10, PSU connector at BC50I 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 BC50I front

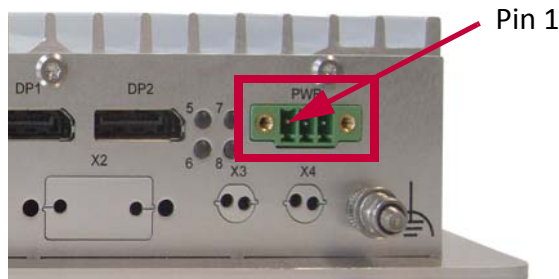


Table 1. Pin assignment of PSU connector

1	POWERCON_IN	Power input
2	POWERCON_GND	Power input ground
3	-	-

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 BC50I 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 BC50I

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 BC50I 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. 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 DRAM System Memory

The standard model of the BC50I is equipped with 2 GB of DDR3 SDRAM. Up to 4 GB are supported. The graphics controller of the BC50I 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).

3.4.2 Boot Flash

The BC50I is equipped with a boot Flash containing its BIOS.

3.4.3 SD Card Slot

Within its housing, the BC50I 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 33](#) for information on how to install the SD card.

3.4.4 mSATA Slot

Within its housing, the BC50I provides one mSATA slot.

See [Chapter 2.2.6 Installing an mSATA Drive on page 33](#) for information on how to install an mSATA disk.

3.4.5 SATA Hard Disk (Optional)

The BC50I offers the possibility to install an additional SATA hard disk in the housing on a special mounting frame.

Please contact the [MEN sales team](#) for further information.

3.5 Graphics

3.5.1 Graphics Processing Unit

The standard model of the BC50I 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 41](#).

3.5.2 DisplayPort Interfaces

Two DisplayPort interfaces are available at the front panel. The maximum supported resolution is 2560x1600 at 60 Hz. The interfaces offer AUX channel support and hot plug detection.

Connector type:

- 20-pin DisplayPort receptacle

Mating connector:

- 20-pin DisplayPort plug

Table 3. Pin assignment of 20-pin DisplayPort connector

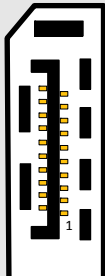
	20	POWER	19	RETURN PWR
	18	DP_HOTPLUG	17	DP_AUX-
	16	GND	15	DP_AUX+
	14	CONFIG2	13	CONFIG1
	12	LANE_3-	11	GND
	10	LANE_3+	9	LANE_2-
	8	GND	7	LANE_2+
	6	LANE_1-	5	GND
	4	LANE_1+	3	LANE_0-
	2	GND	1	LANE_0+

Table 4. 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 Interfaces

The BC50I provides two USB 2.0 interfaces at the front panel via two standard USB connectors.

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 5. Pin assignment of USB front-panel connectors

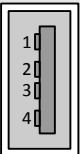
	1	+5V
	2	USB_D-
	3	USB_D+
	4	GND

Table 6. 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 Interfaces

The BC50I provides two Gigabit Ethernet ports at the front.

Connector types:

- Modular 8/8-pin mounting jack according to FCC68
- Mating connector:
Modular 8/8-pin plug according to FCC68

Table 7. Pin assignment of Ethernet front-panel connectors

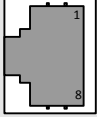
		1000Base-T	10/100Base-T
	1	BI_DC-	
	2	BI_DD+	
	3	BI_DD-	
	4	BI_DA-	TX-
	5	BI_DB+	RX+
	6	BI_DA+	TX+
	7	BI_DC+	-
	8	BI_DB-	RX-





Table 8. 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 Status LEDs

The BC50I provides a total of four Ethernet status LEDs, two for each Ethernet channel. They signal the link and activity status (different LED behavior can be implemented on demand).





Table 9. Ethernet status LEDs

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

3.8 Status and User LEDs

In addition to the four Ethernet status LEDs, the BC50I provides four general status LEDs. One of them signals whether the onboard power generated by the BC50I's on-board DC/DC converter is within valid range, another signals the system status. User LEDs A and C can be used freely depending on an application's requirements. See [Chapter 5.1 GPIO Controller Instance 0](#) for information on how to access the LEDs.

Figure 11. General status LEDs on the BC50I's front panel (shown partially)**Table 10.** General status LEDs (as depicted above)

LED	Description	LED	Description
5 	User LED A	7 	Onboard 12V OK
6 	User LED B / Status	8 	User LED C

3.8.1 Status LED

The status LED (LED6) 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 11. 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

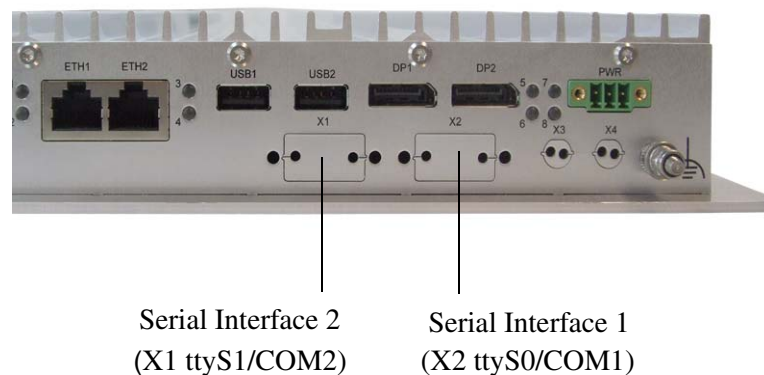
3.9 Serial Interfaces via SA-Adapter

The BC50I offers the possibility to provide two serial interfaces at the front of the BC50I using MEN standard SA-Adapters. This way, a serial interface can be used which can be flexibly configured as needed.

SA-Adapter slot 1 (X2) can be used for UART, IBIS, GPS or SGPIO while slot 2 (X1) 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 5.2 GPIO Controller Instance 1](#) on page 56.

Figure 12. Position of serial interfaces on BC50I front



See [Chapter 2.2.5 Installing SA-Adapters](#) on page 60 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.

3.10 PCI Express Mini Card Interface

The BC50I 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 BC50I interior on page 21](#) for the exact position of the PCI Express Mini Card slot.

As an option, the BC50I 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 29](#) for information on how to install the PCI Express Mini Cards in the box PC.

The PCIe MiniCard socket on the BC50I 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 5.1 SMBus Overview on page 130](#) for more information on how to switch the micro-SIM cards.

3.10.1 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 12. 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 13. 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 9.1 Literature and Web Resources on page 152](#).

4 Organization of the Board

4.1 SMBus Devices

The controller hub of the BC50I has two SMB controllers. The devices responsible for board supervision and hardware control (SPD, BC) are connected to SMB0. The devices related to information and board functions (e.g. EEPROMs, sensors, GPIO controllers) are connected to SMB1.

Table 14. SMBus address of EEPROM

7-Bit-Address	Function
0xAC	EEPROM, includes system information e.g. serial number and the date of production.

Table 15. SMBus devices

SMBus	8-Bit-Address	7-Bit-Address	Function
0	0xA0	0x50	SPD EEPROM
0	0xA2	0x51	SPD EEPROM for stacked memory
0	0x9A	0x4D	Board Controller (PIC)
0	0x64	0x32	External real-time clock ERTC
1	0xAE	0x57	Board information EEPROM with thermal sensor
1	0x3E	0x1F	Thermal sensor of the EEPROM
1	0xE0	0x70	FPGA for SATA SGPIO

5 Using the BC50I with MDIS5 Software

This chapter gives specific information on how to use the BC50I 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 16, Chameleon table](#) for a list of the IP cores.

Table 16. 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 0

The following describes how to switch between UART and SGPIO if you want to use an SGPIO interface (SA-Adapter 08SA15-00, see [Chapter 3.9 Serial Interfaces via SA-Adapter on page 50](#)).

The default device name of the instance 0 of the GPIO controller 16z034- is "gpio_1" for Linux and "z17_1" for Windows. It is used to switch the functions given in [Table 2, Functions of GPIO controller instance 0](#).

Table 17. Functions of GPIO controller instance 0

Bit Position	Name	Function	Default Setting
0	gpio[0]	User LED A, deactivated by default	IN
1	gpio[1]	Watchdog enable	IN
2	gpio[2]	SIMA_SW	IN

Bit Position	Name	Function	Default Setting
3	gpio[3]	SIMB_SW	IN
4	gpio[4]	mincard A PWR enable	IN
5	gpio[5]	mincard B PWR enable	IN
6	gpio[6]	User LED C	IN
7	gpio[7]	not used	IN

E.g. switching on user LED C:

For Windows:

```
z17_io z17_1 -p=6 -s=0 -h
```

For Linux:

```
z17_io gpio_1 -p=6 -s=0 -h
```

For switching on user LED A, it first has to be activated using Interface Multiplexer (mux_if3). Then it can be switched on using the following command:

For Windows:

```
z17_io z17_1 -p=0 -s=0 -h
```

For Linux:

```
z17_io gpio_1 -p=0 -s=0 -h
```

5.2 GPIO Controller Instance 1

The GPIO controller instance 1 is used to activate or switch serial interfaces of the box PCs from UART to 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 18. Functions of GPIO controller instance 1

Bit Position	Output-Function (GPO)	Input-Function (PSR)	Default Setting
4	mux_if3	-	GPO(4):drive 0
5	mux_if2	-	GPO(5):drive 0
6	mux_if0	-	GPO(6):drive 0
7	mux_if1	-	GPO(7):drive 0

Interface Multiplexer (mux_if3)

The interface multiplexer is used to activate user LED A so that it can be switched on afterwards using GPIO Controller Instance 0.

Interface Multiplexer 3 truth table:

Interface	Function	mux_if3
GPIO[0]	No functionality	0
	GPIO Controller 0 Bit 0 (User LED A)	1

For Windows:

```
z17_io z17_2 -p=4 -s=1 -h
```

For Linux:

```
z17_io gpio_2 -p=4 -s=1 -h
```

Interface Multiplexer (mux_if0)

The interface multiplexer 0 is used to change the serial interface 1 (X2) from UART (default setting) to SGPIO (required if you want to use the SA15 SA-Adapter in this slot).

Table 19. 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.

7 Appendix

7.1 Literature and Web Resources



BC50I data sheet with up-to-date information and documentation:
www.men.de/products/09BC50I.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 PCI Express Mini Card



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

7.1.4 SATA



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

7.1.5 USB



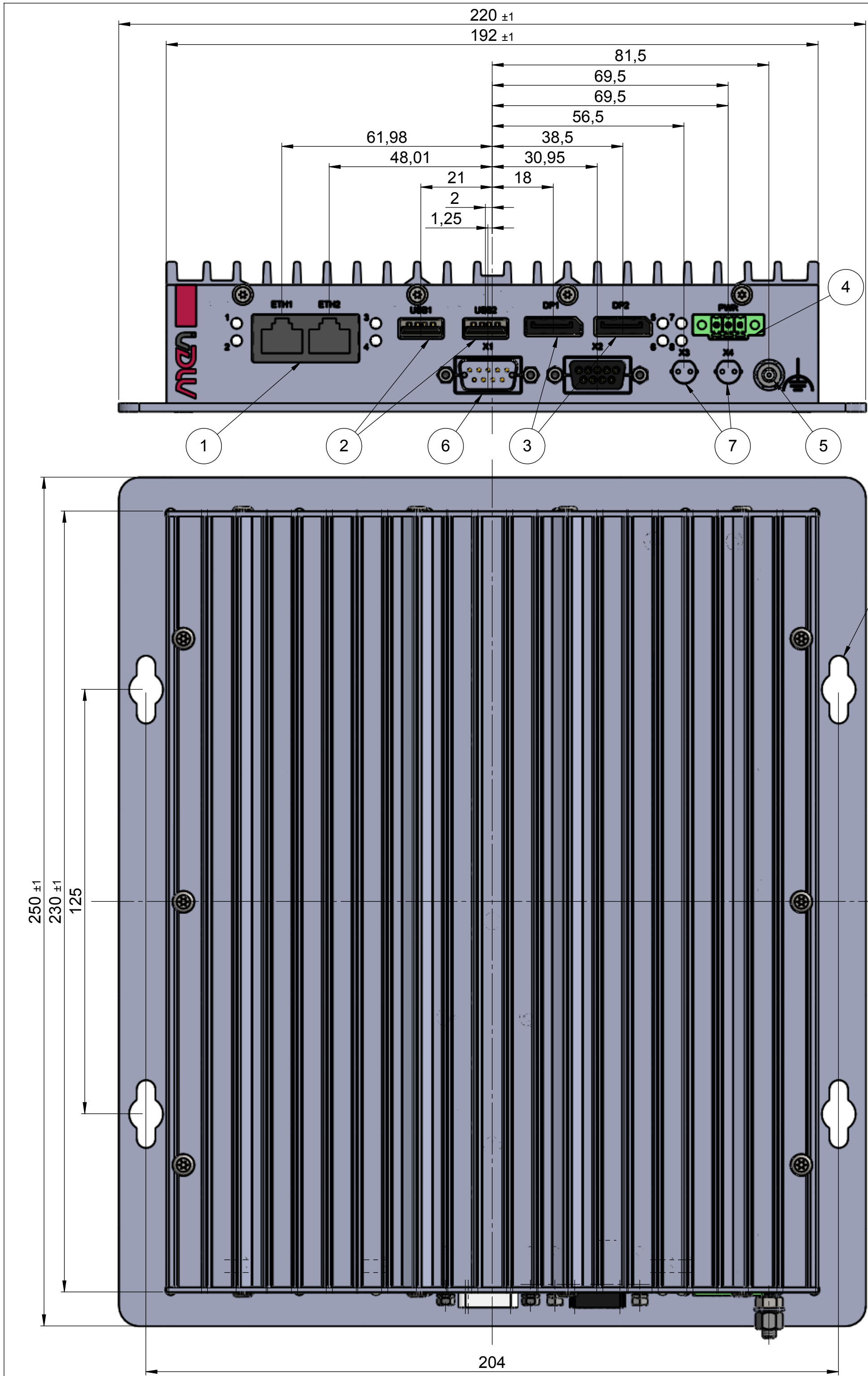
USB Implementers Forum, Inc.
www.usb.org

7.2 Dimensions of the BC50I Box PC

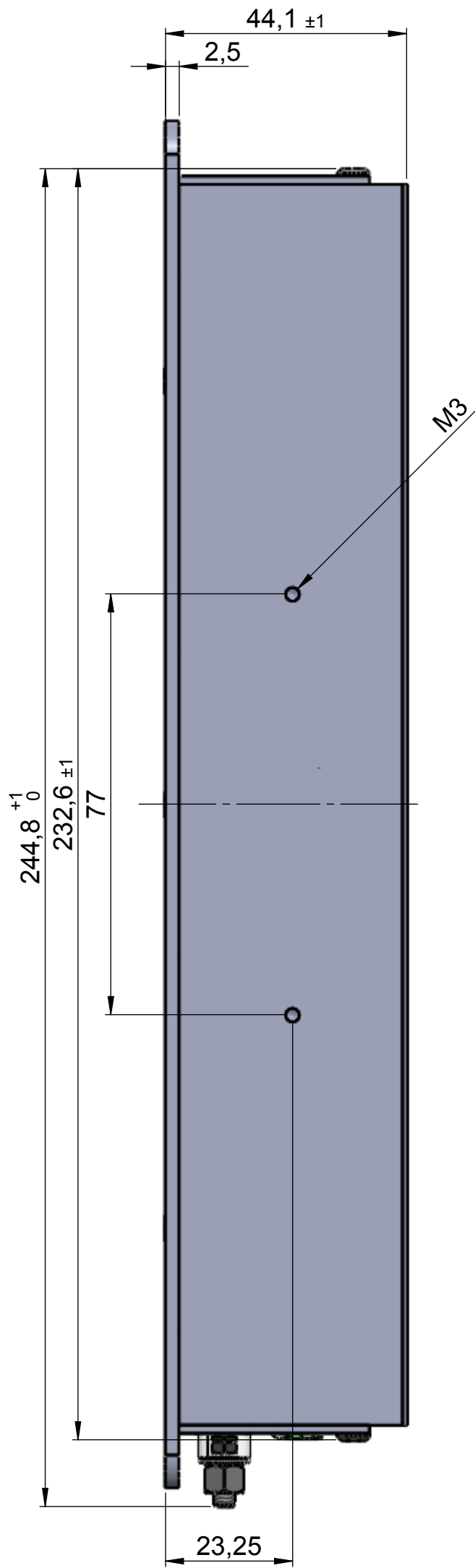
In the following you can find a drawing of the exact dimensions of the box PC.



You can find a detailed 3D drawing (PDF and STEP file) on the [BC50I pages](#) on the [MEN website](#).



Position	Quantity	Function	Description	Mating connector
1	2	Ethernet		
2	2	USB	USB Type A Jack	USB Type A Plug
3	2	Display	Display Port Jack	Display Port e.g. Molex: 0687830001
4	1	Power	Mini Comicon Plug Grid 3,5mm	Mini Comicon Jack e.g. Phoenix: 1790496
5	1	Ground	Bolt M4	Cable eye
6	2	SA-Adapter	Pending on function	Pending on function
7	2	Antenna	SMA Jack	SMA Plug



Manufacturer number: 09BC50100
Weight: max. 2kg
Input voltage: 24VDC (nom.)
Operating temperature: -40°C ... +70°C

1.0	J.Ultsch 2013-06-04	Initial version		
Rev.: Prepared/Date:		Modification:		
Responsible author: J.Ultsch			RoHS-compliant (2011/65/EU): yes	
<small>Printed versions FOR INFORMATION ONLY. This is an electronic document. It has been digitally signed. Please see release form.</small>			<small>For this document all rights are reserved.</small>	
Scale: 1:1		Tolerance: --- ---		DIN ISO 13715
Material: ---		Surface: Transparent passivated		
Description: Space allocation drawing 09BC50100_SAD (1.0)			Document No. 09BC50100_SAD Project: 1226	
			Sheet: 1 / 1	