KBox C-102-4

KBox C-102-2

KBox C-102-1

KBox C-102-0

KBox C-102

Doc. User Guide, Rev. 1.0

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▶   KBOX C-102 – USER GUIDE

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Kontron S&T AG

Lise-Meitner-Str. 3-5
86156 Augsburg
Germany
www.kontron.com

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Revision History

Revision	Brief Description of Changes	Date of Issue	Author/ Editor
0.1	Preliminary Version 0.1	2017-July-11	MK
0.2	Review/proofreading Version	2017-Aug-30	MK
0.3	New corporate Design, new legal and safety information	2017-Oct-19	MK
0.4	CPLD Register and BIOS description updated, Author name added	2018-Jan-24	MK
0.5	UEFI BIOS Chapter updated	2018-Feb-19	MK

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As a trusted technology innovator and global solutions provider, Kontron extends its embedded market strengths into a services portfolio allowing companies to break the barriers of traditional product lifecycles. Proven product expertise coupled with collaborative and highly-experienced support enables Kontron to provide exceptional peace of mind to build and maintain successful products.

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If you have any difficulties using this user guide, discover an error, or just want to provide some feedback, contact Kontron support. Detail any errors you find. We will correct the errors or problems as soon as possible and post the revised user guide on our website.

Symbols

The following symbols may be used in this user guide

⚠DANGER	DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.
⚠WARNING	WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.
NOTICE	NOTICE indicates a property damage message.
⚠CAUTION	CAUTION indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.

⚡	**Electric Shock!** This symbol and title warn of hazards due to electrical shocks (> 60 V) when touching products or parts of products. Failure to observe the precautions indicated and/or prescribed by the law may endanger your life/health and/or result in damage to your material.
🖐	**ESD Sensitive Device!** This symbol and title inform that the electronic boards and their components are sensitive to static electricity. Care must therefore be taken during all handling operations and inspections of this product in order to ensure product integrity at all times.
🔥	**HOT Surface!** Do NOT touch! Allow to cool before servicing.
☢	**Laser!** This symbol inform of the risk of exposure to laser beam and light emitting devices (LEDs) from an electrical device. Eye protection per manufacturer notice shall review before servicing.
i	This symbol indicates general information about the product and the user guide. This symbol also indicates detail information about the specific product configuration.
💡	This symbol precedes helpful hints and tips for daily use.

For Your Safety

Your new Kontron product was developed and tested carefully to provide all features necessary to ensure its compliance with electrical safety requirements. It was also designed for a long fault-free life. However, the life expectancy of your product can be drastically reduced by improper treatment during unpacking and installation. Therefore, in the interest of your own safety and of the correct operation of your new Kontron product, you are requested to conform with the following guidelines.

High Voltage Safety Instructions

As a precaution and in case of danger, the power connector must be easily accessible. The power connector is the product's main disconnect device.

⚠ CAUTION	Warning
	All operations on this product must be carried out by sufficiently skilled personnel only.

⚠ CAUTION	Electric Shock!
	Before installing a non hot-swappable Kontron product into a system always ensure that your mains power is switched off. This also applies to the installation of piggybacks. Serious electrical shock hazards can exist during all installation, repair, and maintenance operations on this product. Therefore, always unplug the power cable and any other cables which provide external voltages before performing any work on this product.
	Earth ground connection to vehicle's chassis or a central grounding point shall remain connected. The earth ground cable shall be the last cable to be disconnected or the first cable to be connected when performing installation or removal procedures on this product.

Special Handling and Unpacking Instruction

NOTICE	ESD Sensitive Device!
	Electronic boards and their components are sensitive to static electricity. Therefore, care must be taken during all handling operations and inspections of this product, in order to ensure product integrity at all times.

Do not handle this product out of its protective enclosure while it is not used for operational purposes unless it is otherwise protected.

Whenever possible, unpack or pack this product only at EOS/ESD safe work stations. Where a safe work station is not guaranteed, it is important for the user to be electrically discharged before touching the product with his/her hands or tools. This is most easily done by touching a metal part of your system housing.

It is particularly important to observe standard anti-static precautions when changing piggybacks, ROM devices, jumper settings etc. If the product contains batteries for RTC or memory backup, ensure that the product is not placed on conductive surfaces, including anti-static plastics or sponges. They can cause short circuits and damage the batteries or conductive circuits on the product.

Lithium Battery Precautions

If your product is equipped with a lithium battery, take the following precautions when replacing the battery.

⚠ CAUTION	**Danger of explosion if the battery is replaced incorrectly.**
	▶ Replace only with same or equivalent battery type recommended by the manufacturer.
	▶ Dispose of used batteries according to the manufacturer's instructions.

General Instructions on Usage

In order to maintain Kontron's product warranty, this product must not be altered or modified in any way. Changes or modifications to the product, that are not explicitly approved by Kontron and described in this user guide or received from Kontron Support as a special handling instruction, will void your warranty.

This product should only be installed in or connected to systems that fulfill all necessary technical and specific environmental requirements. This also applies to the operational temperature range of the specific board version that must not be exceeded. If batteries are present, their temperature restrictions must be taken into account.

In performing all necessary installation and application operations, only follow the instructions supplied by the present user guide.

Keep all the original packaging material for future storage or warranty shipments. If it is necessary to store or ship the product then re-pack it in the same manner as it was delivered.

Special care is necessary when handling or unpacking the product. See Special Handling and Unpacking Instruction.

Quality and Environmental Management

Kontron aims to deliver reliable high-end products designed and built for quality, and aims to complying with environmental laws, regulations, and other environmentally oriented requirements. For more information regarding Kontron's quality and environmental responsibilities, visit http://www.kontron.com/about-kontron/corporate-responsibility/quality-management.

Disposal and Recycling

Kontron's products are manufactured to satisfy environmental protection requirements where possible. Many of the components used are capable of being recycled. Final disposal of this product after its service life must be accomplished in accordance with applicable country, state, or local laws or regulations.

WEEE Compliance

The Waste Electrical and Electronic Equipment (WEEE) Directive aims to:

▶ Reduce waste arising from electrical and electronic equipment (EEE)

▶ Make producers of EEE responsible for the environmental impact of their products, especially when the product become waste

▶ Encourage separate collection and subsequent treatment, reuse, recovery, recycling and sound environmental disposal of EEE

▶ Improve the environmental performance of all those involved during the lifecycle of EEE

	Environmental protection is a high priority with Kontron.
	Kontron follows the WEEE directive
	You are encouraged to return our products for proper disposal.

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1/ General Safety Instructions for IT Equipment

⚠WARNING	Please read this chapter carefully and take careful note of the instructions, which have been compiled for your safety and to ensure to apply in accordance with intended regulations. If the following general safety instructions are not observed, it could lead to injuries to the operator and/or damage of the product; in cases of nonobservance of the instructions Kontron is exempt from accident liability, this also applies during the warranty period.

The product has been built and tested according to the basic safety requirements for low voltage (LVD) applications and has left the manufacturer in safety-related, flawless condition. To maintain this condition and also to ensure safe operation, the operator must not only observe the correct operating conditions for the product but also the following general safety instructions:

▶ The product must be used as specified in the product documentation, in which the instructions for safety for the product and for the operator are described. These contain guidelines for setting up, installation and assembly, maintenance, transport or storage.

▶ The on-site electrical installation must meet the requirements of the country's specific local regulations.

▶ If a power cable comes with the product, only this cable should be used. Do not use an extension cable to connect the product.

▶ To guarantee that sufficient air circulation is available to cool the product, please ensure that the ventilation openings are not covered or blocked. If an air filter is provided, this should be cleaned regularly. Do not place the system close to heat sources or damp places. Make sure the system is well ventilated.

▶ Only devices or parts which fulfill the requirements of SELV circuits (Safety Extra Low Voltage) as stipulated by IEC 60950-1 may be connected to the available interfaces.

▶ Before opening the device, make sure that the device is disconnected from the mains.

▶ Switching off the device by its power button does not disconnect it from the mains. Complete disconnection is only possible if the power cable is removed from the wall plug or from the device. Ensure that there is free and easy access to enable disconnection.

▶ The device may only be opened for the insertion or removal of add-on cards (depending on the configuration of the system). This may only be carried out by qualified operators.

▶ If extensions are being carried out, the following must be observed:

   ▶ All effective legal regulations and all technical data are adhered to.
   ▶ The power consumption of any add-on card does not exceed the specified limitations.
   ▶ The current consumption of the system does not exceed the value stated on the product label.

▶ Only original accessories that have been approved by Kontron can be used.

▶ Please note: safe operation is no longer possible when any of the following applies:

   ▶ The device has visible damages.
   ▶ The device is no longer functioning.

In this case the device must be switched off and it must be ensured that the device can no longer be operated.

Additional safety instructions for DC power supply circuits

▶ To guarantee safe operation of devices with DC power supply voltages larger than 60 volts DC or a power consumption larger than 240 VA, please observe that:

    ▶ the device is set up, installed and operated in a room or enclosure marked with "RESTRICTED ACCESS", if there are no safety messages on product as safety signs and labels on the device itself.

    ▶ no cables or parts without insulation in electrical circuits with dangerous voltage or power should be touched directly or indirectly

    ▶ a reliable protective earthing connection is provided

    ▶ a suitable, easily accessible disconnecting device is used in the application (e.g. overcurrent protective device), if the device itself is not disconnectable

    ▶ a disconnect device, if provided in or as part of the equipment, shall disconnect both poles simultaneously

    ▶ interconnecting power circuits of different devices cause no electrical hazards

▶ A sufficient dimensioning of the power cable wires must be selected – according to the maximum electrical specifications on the product label – as stipulated by EN60950-1 or VDE0100 or EN60204 or UL508 regulations.

▶ The devices do not generally fulfill the requirements for "centralized DC power systems" (UL 60950-1, Annex NAB; D2) and therefore may not be connected to such devices!

1.1. Electrostatic Discharge (ESD)

A sudden discharge of electrostatic electricity can destroy static-sensitive devices or micro-circuitry.

Therefore proper packaging and grounding techniques are necessary precautions to prevent damage. Always take the following precautions:

1. Transport boards in ESD-safe containers such as boxes or bags.

2. Keep electrostatic sensitive parts in their containers until they arrive at the ESD-safe workplace.

3. Always be properly grounded when touching a sensitive board, component, or assembly.

4. Store electrostatic-sensitive boards in protective packaging or on antistatic mats.

1.1.1. Grounding Methods

By adhering to the guidelines below, electrostatic damage to the device can be avoided:

1. Cover workstations with approved antistatic material. Always wear a wrist strap connected to workplace. Always use properly grounded tools and equipment.

2. Use antistatic mats, heel straps, or air ionizers for more protection.

3. Always handle electrostatically sensitive components by their edge or by their casing.

4. Avoid contact with pins, leads, or circuitry.

5. Turn off power and input signals before inserting and removing connectors or connecting test equipment.

6. Keep work area free of non-conductive materials such as ordinary plastic assembly aids and Styrofoam.

7. Use only field service tools which are conductive, such as cutters, screwdrivers, and vacuum cleaners.

8. Always place drives and boards PCB-assembly-side down on the foam.

1.2. Instructions for the optional Lithium Battery

If ordered, your KBox C-102 is equipped with an optional lithium battery. For the replacement of this battery please observe the instructions described in section 4.2 "Optional RTC Lithium Battery (externally-accessible)".

⚠WARNING Danger of explosion when replacing with wrong type of battery. Replace only with the same or equivalent type recommended by the manufacturer. The lithium battery type must be UL recognized.

Do not dispose of lithium batteries in general trash collection. Dispose of the battery according to the local regulations dealing with the disposal of these special materials, (e.g. to the collecting points for dispose of batteries).

2/ Electromagnetic Compatibility (Class B Device)

2.1. Electromagnetic Compatibility (EU)

This product complies with the European Council Directive on the approximation of the laws of the member states relating to electromagnetic compatibility (2004/108/EC), Class B limits for Information Technology Equipment according to European Standard EN 55022.

2.2. FCC Statement (USA)

The following statement applies to the products covered in this manual, unless otherwise specified herein.
The statement for other products will appear in the accompanying documentation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

▶ Reorient or relocate the receiving antenna.

▶ Increase the separation between the equipment and receiver.

▶ Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

▶ Consult the dealer or an experienced radio/TV technician for help.

Kontron Europe GmbH is not responsible for any radio television interference caused by unauthorized modifications of this equipment or the substitution or attachment of connecting cables and equipment other than those specified by Kontron Europe GmbH. The correction of interference caused by such unauthorized modification, substitution or attachment will be the responsibility of the user.
The use of shielded I/O cables is required when connecting this equipment to any and all optional peripheral or host devices. Failure to do so may violate FCC and ICES rules.

2.3. EMC-Compliance (Canada)

The method of compliance is self-declaration to Canadian ICES-003:

(English): This Class B digital apparatus complies with the Canadian ICES-003.

(French) : Cet appareil numérique de la class B est conforme à la norme NMB-003 du Canada.

3/ Shipment and Unpacking

3.1. Unpacking

Proceed as follows to unpack the unit:

1. Remove packaging.

2. Do not discard the original packaging. Keep it for future relocation.

3. Check the delivery for completeness by comparing it with your order.

4. Please keep the associated paperwork. It contains important information for handling the unit.

5. Check the contents for visible shipping damage.

6. If you notice any shipping damage or inconsistencies between the contents and your order, please contact Kontron for help and information.

3.2. Scope of Delivery

▶ KBox C-102 (corresponding to the ordered system configuration)
▶ POWER-SUBCON PSC 1,5/ 3-F, 3-pin plug
▶ General Safety Instructions for IT Equipment

3.2.1. Optional Parts (System Expansion)

▶ Front accessible drive bays for 2.5"SATA HDD/SSDs
▶ Mini-PCIe cards
▶ mSATA cards (MO-300)
▶ PCIe cards

3.2.2. Optional System Extension

▶ RS232/RS422 Port: via internal factory mounted and configured RS232/RS422 adapter module
▶ CAN Port: via internal factory mounted CAN adapter module
▶ LDT3 or DVI-D (single Link) Port or DisplayPort (via internal factory mounted adapter modules)
▶ Optional externally accessible RTC lithium battery
▶ Optional system expansion with fan tray
▶ Profibus or Profinet Fieldbus support: via internal factory mounted adapter module

> **i** Please observe the different configuration options for each system of the KBox C-102 family. Refer to chapter 16/ "Technical Specifications " and the descriptions in this manual.

3.3. Spare Parts

Table 1: Spare Parts available for Field Replacement

Spare Part	Part Number		
	KBox C-102-4	KBox C-102-2	KBox C-102-1
Fan Tray	9-5000-1096	9-5000-1095	9-5000-1094
Air Filter	9-5000-1099	9-5000-1098	9-5000-1097

3.4. Type Label and Product Identification

The type label (product name, serial number, part number, production date) of your KBox C-102 system is located on the right side of the device (refer to Figure 1 and Figure 23, pos. 9).

Figure 1: Example of KBox C-102 type label
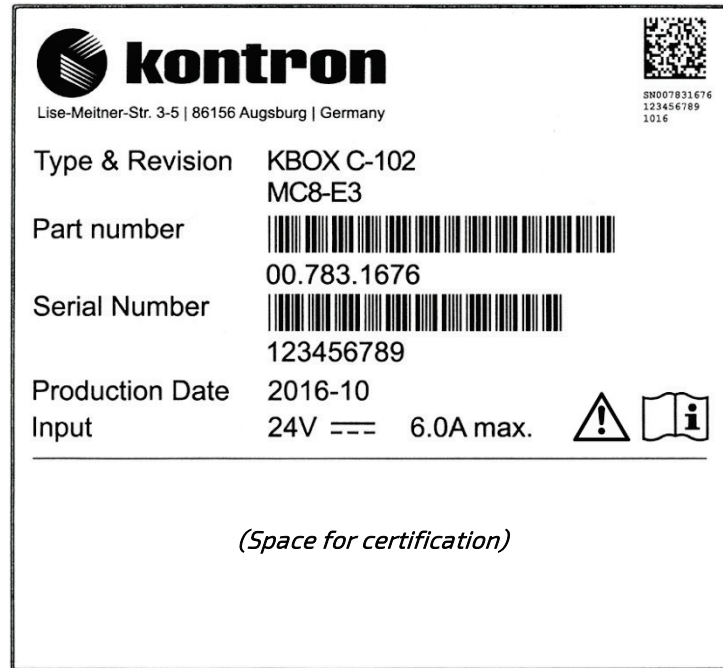
Table 2: Product Identification Table

System Type	Product Designation	Product Identifikation
KBox C	KBox C-102	KBox C-102-**4**: corresponds for system configurations with four slot rows for optional removable DRIVEs and/or PCIe expansion slots KBox C-102-**2**: corresponds for system configurations with two slot rows for optional removable DRIVEs and/or PCIe expansion slots KBox C-102-**1**: corresponds for system configurations with one slot row for optional removable DRIVE and/or PCIe expansion slot KBox C-102-**0**: corresponds for system configuration without any slot row for optional removable DRIVE and PCIe expansion slot

4/ System Overview

The KBox C-102 Family is a highly scalable and flexible industrial computer platform that offers high-end performance for industrial automation application such as control or process monitoring.

The performance scalability is achieved by deploying various Kontron COMExpress® CPU modules (from factor basic and type 6 pinout) inside the system.

The system flexibility is a result of the basic design concept of using a baseboard which provides the COMExpress® and a set of standard IO interfacing plus a comprehensive optionally available IOs and devices.

Basic version without additional fan and/or HDD and/or battery only:
The KBox C-102 offers a maintenance free (Wartungsfrei) operation. That means it operates without battery, fans and rotating media (HDD).

The KBox C-102 family comprises four different chassis versions:

▶ The KBox C-102-4 with four PCI/PCIe expansion slots and spaces for up to two 2.5" SATA SSDs/HDDs

▶ The KBox C-102-2 with two PCI/PCIe expansion slots and spaces for up to two 2.5" SATA SSDs/HDDs

▶ The KBox C-102-1 with one PCIe expansion slot and space for one 2.5" SATA SSD/HDD

▶ The KBox C-102-0 without PCIe expansion slot and space for one internal 2.5" SATA SSD/HDD

Figure 2: KBox C-102 Family

Standard Front Panel:

The following interfaces are available with the KBox C-102:

▶ 24VDC input power (X101)

▶ 3x Gigabit Ethernet (X102, X103, X104)

▶ 2x USB 3.0 (X105, X106)

▶ 2x USB 2.0 (X107, X108)

▶ DisplayPort (X109)

▶ SD Card slot (without X numbered slot)

▶ RS232 serial (X110)

▶ Buttons with corresponding LEDs:

  ▶ RSQ (rescue)
  ▶ PWR (power)

▶ LEDs:

  ▶ GP1 to GP4 (general purpose LEDs)
  ▶ THERM (thermal status)
  ▶ DRIVE (SSD/HDD drive status)
  ▶ SD (SDHC/SDXC status)
  ▶ WD (Watchdog status)

Standard Baseboard – Onboard and System Expansion Capabilities:

  ▶ up to 2x SATA and power connector (for internal or removable devices, depending on the KBox C-102 configuration)
  ▶ 2x mSATA sockets
  ▶ 2x Mini PCIe x1 sockets (one socket is on the top side, the second one on the bottom side of the baseboard)
  ▶ 1x PCIe x8 socket for expansion via riser cards:
    ▶ up to 4x PCIe x4 sockets on riser card (depending on the KBox C-102-4/-2/-1 configuration) or
    ▶ 1x PCI (32 bit) and 1x PCIe x4 sockets on riser card (available for KBox C-102-2 only)

Optional System Extension:

▶ RS232/RS422 Port: via internal factory mounted and configured RS232/RS422 adapter module

▶ CAN Port: via internal factory mounted CAN adapter module

▶ DisplayPort or Long Distance Solution (LDT3) (via corresponding internal factory mounted adapter modules)

▶ Optional external accessible RTC lithium battery

▶ Optional system extension with fan tray (not possible for KBox C-102-0)

▶ Profibus or Profinet Fieldbus support: via internal factory mounted adapter module

The KBox C-102 has a compact aluminum chassis with cooling fins and is also available a fanless system (basic version without additional fan only!)
The rated voltage range of the mains can be found on the type label. The type label is located at the right side of the device (Figure 23, pos. 9).

NOTICE	The KBox C-102 is designed to be operated wall mounted inside a control cabinet, in vertical position, except with the top side facing down.
	When you power on the KBox C-102, make sure that the air exhaust openings on the top side (Figure 25, pos. 12), the air intake openings on the bottom side (Figure 26, pos. 11) and the cooling fins of the chassis (Figure 24, Figure 25 and Figure 26, pos. 6) are not obstructed (covered) by any objects.
	To provide sufficient heat dissipation via the cooling fins of the device, do not cover the cooling fins of the KBox C-102. Do not place any objects on the device. When installing the system, please observe the clearance recommendation (keep out area) in the subsection 8.1 "Control Cabinet Mounting"; refer to the marked areas in Figure 43 to Figure 49.

4.1. RTC (GoldCap)

The baseboard of the KBox C-102 provides an "external RTC" module connected via the I^{2}C Bus. An RTC module of type RV-8803-C7 or compatible is used. To provide a valid date and time when no power is connected to the system, the RTC module is equipped with a goldcap buffer.

4.1.1. RTC Buffer Time

The RTC buffer time is depending of the ambient temperature. For a better understanding the different behavior of the goldcap buffer integrated in your system, refer to the diagram below:

Figure 3: RTC buffer time depending on temperature
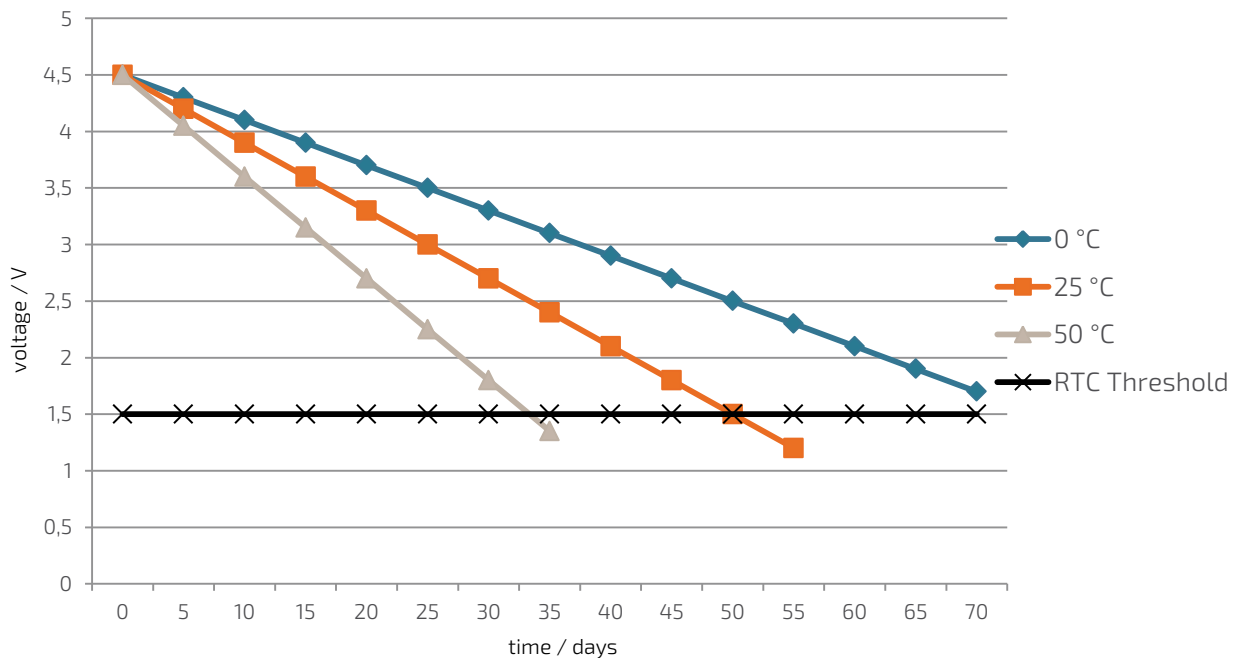
If the time is not valid this is indicated by a status bit in the RTC registers. For details see the RV-8803-C7 application manual.

> **i**
>
> To get the maximum buffer time, it is necessary to have the system a certain time powered on. This ensures that the buffer capacitors are fully loaded.
>
> The buffer time depends on the ambient temperature and on how long the system is connected to the power supply.

4.1.2. Setting the RTC

During startup, the uEFI performs a comparison of chipset clock and "external RTC" module and sets the chipset clock accordingly, if the RTC time is valid. Further it is possible to set the time manually by accessing the RTC over the I^{2}C Bus.

4.2. Optional RTC Lithium Battery (externally-accessible)

Your KBox C-102 can be optionally equipped with an externally-accessible lithium battery (CMOS) (Figure 5, pos. 3). The battery and the battery holder are covered by a protective cover (refer toFigure 4, pos. 1) secured by a Philips countersunk head screw (Figure 4, pos. 2).

When replacing the lithium battery, please follow the corresponding instructions in the section 10.1 "Replacing the Lithium Battery".

NOTICE The protective cover of the KBox C-102 with externally-accessible lithium battery must always be installed during transportation and operation activities.

The protective cover should be removed only when you attempt to replace the lithium battery.

Figure 4: Lithium battery location (shown with protective cover)
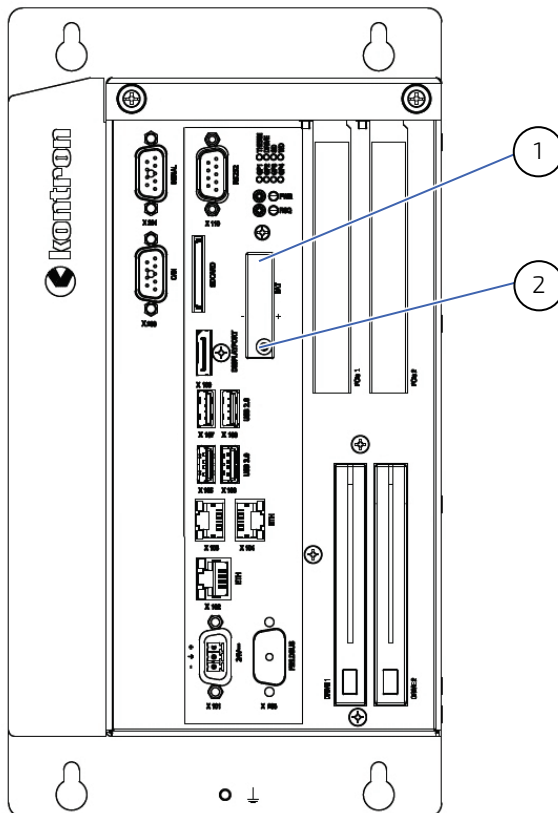
Figure 5: Lithium battery location (externally-accessible battery shown with removed protective cover)
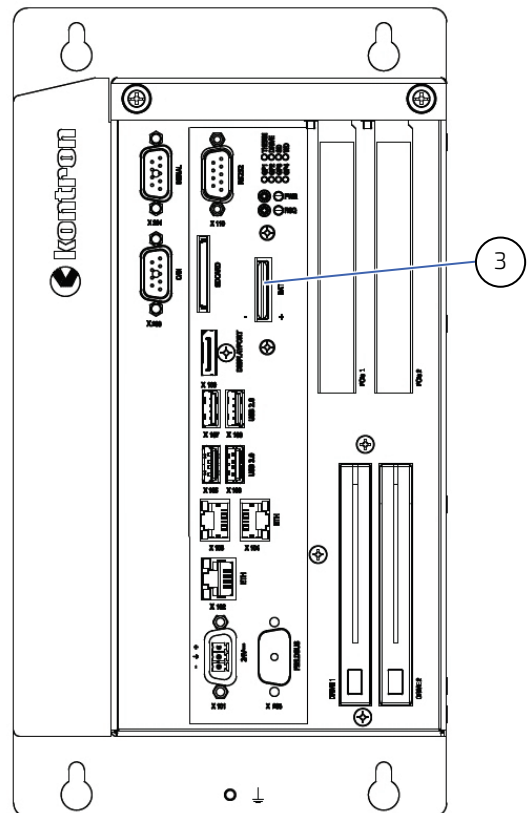
1　Protective cover for the lithium battery

2　Philips countersunk head screw that secure the protective cover at the front side of the chassis

3　Externally-accessible battery shown with removed protective cover

4.3. System Expansion Capabilities

4.3.1. Mini PCI Express® Interfaces

There are two Mini PCIe interfaces on the KBox C-102 baseboard.
One Mini PCIe interface connector is accessible from the top side of the KBox C-102 when the top cover is removed.

The second Mini PCIe interface connector is located on the bottom side of the baseboard and is not accessible in the field. This interface connector is intended to be used for the Fieldbus expansion. If a customer requires this system expansion, it must be selected when ordering, as this expansion has to be carried-out at factory.
Refer also to the subsections 6.3.3 and 6.3.6.

Refer to chapter 16/ "Technical Specifications" and the descriptions in this manual.

4.3.2. mSATA (MO-300)

The baseboard of the KBox C-102 provides two mSATA interfaces.
These allow you to equip your system with mSATA SSDs. Refer to the subsections 6.3.2 and 6.3.7.

Refer to chapter 16/ "Technical Specifications" and the descriptions in this manual.

4.3.3. Standard PCI Express® Interfaces

The baseboard of KBox C-102 provides 1x PCIe x8 interface.
Via riser cards there are available PCI/PCIe expansion possibilities as shown in the chapter 4.4 (area marked "C").

i	Please observe the different configuration options regarding the PCI/PCIe cards installation, for each system variant of the KBox C-102 family. Refer to chapter 16/ "Technical Specifications" and the descriptions in this manual.

4.3.4. SATA Interfaces

The baseboard of KBox C-102 provides two SATA interfaces. These allow the installation of up to two internal 2.5" SATA HDDs/SSDs or optional front accessible drive bays for 2.5" SATA HDDs/SSDs (refer to the subsection 4.4.12 "Internal or Removable 2.5" SATA HDDs/SSDs").

i	Please observe the different configuration options, regarding the installation of 2.5" SATA HDD/SSD devices, for each system of the KBox C-102 family (refer to the area marked "D" in the section 4.4). Refer to chapter 16/ "Technical Specifications" and the descriptions in this manual.

Figure 6 to Figure 12: **Views of a KBox C-102-2**

Figure 6: Bottom side view

Figure 7: Right side view
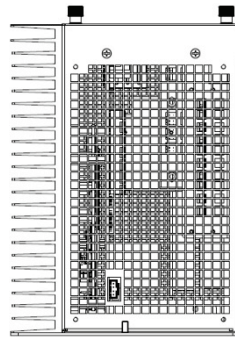
Figure 8: Front side view config. with removable drives

Figure 9: Front side view config. without removable drives

Figure 10: Left side view
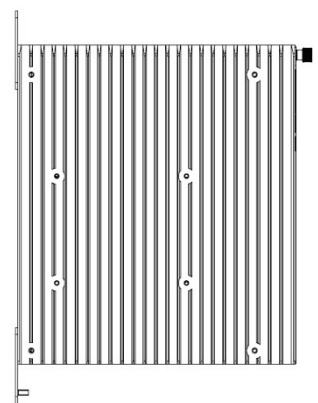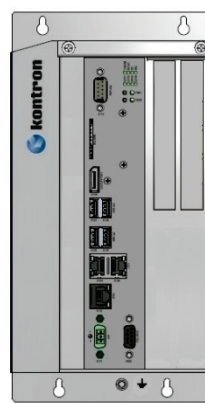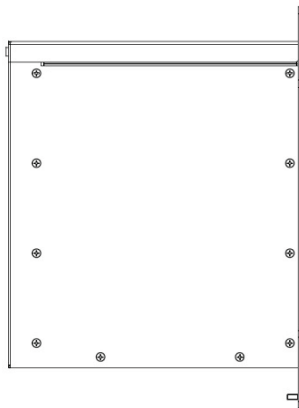
Figure 11: Top side view
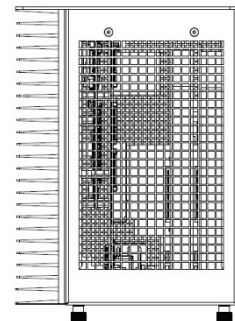
Figure 12: Rear side view
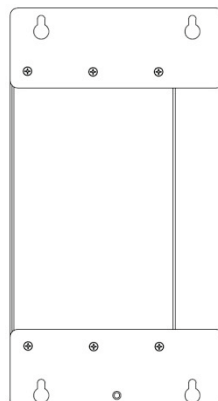
4.4. Front Side Configuration and Options - KBox C-102

Table 3: KBox C-102 Front Side Configuration

A	Standard Interfaces		KBox C-102-4	KBox C-102-2	KBox C-102-1	KBox C-102-0
	Power Input Connector (X101)		1x	1x	1x	1x
	Ethernet (X102/X103/X104)		3x	3x	3x	3x
	USB 3.0 (X105/X106)		2x	2x	2x	2x
	USB 2.0 (X107/X108)		2x	2x	2x	2x
	DisplayPort (X109)		1x	1x	1x	1x
	SD Card Slot		1x	1x	1x	1x
	RS232 (X110)		1x	1x	1x	1x
B	**Extension Capabilities (Options, factory-installed only)**					
	FIELDBUS (X205 or X206)		1x	1x	1x	1x
	CAN Port (X203)		1x	1x	1x	1x
	RS232/RS422 Port (X204)		1x	1x	1x	1x
	LDT3 (X201) or DisplayPort (DP 2) (X202)		1x	1x	1x	1x
C	**PCI/PCIe Expansions via corresponding Riser Cards (Options)**					
	1-Slot PCIe Riser	1x PCIe x4 socket	-	-	1x	-
		1x PCIe x8 socket	-	1x	-	-
	2-Slot PCIe Riser	2x PCIe x4 socket	-	1x	-	-
		1x PCIe x4 socket and PCI (32 bit) socket	-	1x	-	-
	4-Slot PCIe Riser	4x PCIe x4 socket	1x	-	-	-
D	**Internally/externally accessible 2.5" SATA HDD/SSD (Options)**					
	Either Internal 2.5" SATA HDD/SSD		2x	2x	1x	1x
	OR Removable Drive Bay for 2.5" SATA HDD/SSD		2x	2x	1x	-
E	**Externally accessible CMOS Battery (Option)**					
	CR 2025, 3V		1x	1x	1x	1x
F	**Fan Tray (Option)**					
	Fan Tray		1x	1x	1x	-

Figure 13: KBox C-102-4 with fan tray
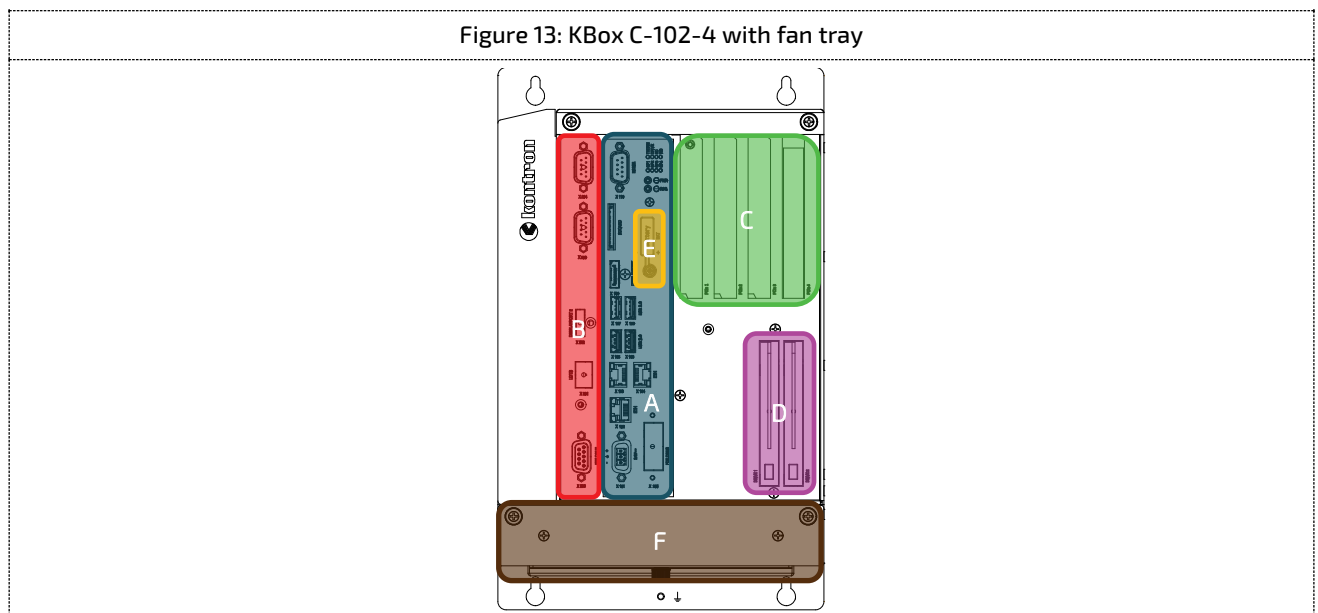
4.4.1. X101 - Power Input Connector

The 3-pin connector (X101, Figure 14 and Figure 59) provides the power connection of the KBox C-102 system to an appropriate DC main power supply. For pin assignments refer to the subsection 18.1.1.

The external cable connector is a Phoenix PSC 1,5/ 3-M, 3-pin plug with an SCT-D-SUB 9-KG housing. This power plug is delivered along with the KBox C-102. Please observe the section 9.1 "Connecting to DC Main Power Supply". The mating connector is a Phoenix PSC 1,5/ 3-F connector.

Figure 14: X101 - 24VDC power input connector

Pin	Signal Name
1	+24 VDC (input)
2	Functional Earth
3	0V (input)
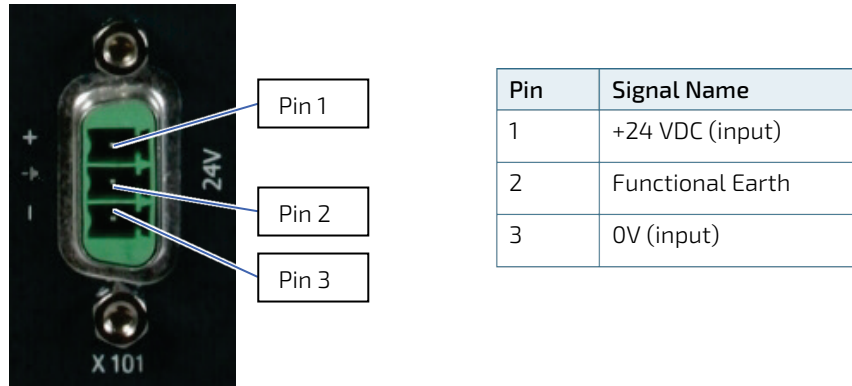
4.4.2. X102/X103/X104 - Ethernet Connectors (ETH)

These connectors (X102/X103/X104, Figure 59, Figure 61 and Figure 64) are Gigabit Ethernet 10/100/1000 Mbit/s, IEEE 1588 capable interfaces. The connectors are standard 8-pin RJ45 type connectors with status LEDs:

▶ Activity/link: green = link up; green blinking = activity.

▶ Speed: off, green, yellow (10/100/1000 Mbit/s).

For pin assignment refer to subsection 18.1.2.

4.4.3. X105/X106 - USB 3.0

The KBox C-102 provides two USB 3.0/2.0 interfaces. These connectors (X105/X106, Figure 59, Figure 61 and Figure 64) allow connection of USB 3.0 or USB 2.0 compatible devices to the system.
For pin assignment refer to subsection.18.1.3.

4.4.4. X107/X108 - USB 2.0

The KBox C-102 provides two USB 2.0/1.1 interfaces. These connectors (X107/X108, Figure 59, Figure 61 and Figure 64) allow connection of USB 2.0 or USB 1.1 compatible devices to the system.
For pin assignment refer to subsection 18.1.4.

4.4.5. X109 - DisplayPort

The KBox C-102 provides a DisplayPort compliant interface realised using a standard DisplayPort connector. An external (digital) display can be connected to the DisplayPort connector (X109, Figure 59, Figure 61 and Figure 64).
For pin assignment refer to subsection 18.1.5.

4.4.6. SDCARD Slot

This slot, marked "SDCARD" is an SDHC/SDXC compliant interface realised using a standard SD card connector. It is accessible at the front side of the KBox C-102 (Figure 59, Figure 61 and Figure 64) and is located between the serial interface (RS232/X110) and DISPLAYPORT (X109).

▶ This SD card reader supports SD, SDHC and SDXC cards.

▶ SD card activity is indicated by the SD LED on the KBox C-102 front side.

▶ This interface permits hot-plugging of the SD card. The system can also be booted from this interface.

Figure 15: SDCARD slot

Figure 16: SD card (not included)

NOTICE	This interface supports hot-plugging.
	To prevent data loss when removing the SD/SDHC/SDXC card, it may not be removed during a read or write access [while the SD LED (Figure 18) is flashing].

To install a card please perform following steps:

1. Insert the SD/SDHC/SDXC card into the SDCARD slot marked "SDCARD" (see Figure 59 and Figure 15) on the front side of the KBox C-102.

2. Gently push the card into the slot until it snaps into place. When the card was inserted correctly, the SD LED (Figure 18) lights up.

> **i** **Do not act with force when inserting the memory card. If the card is not inserted properly in the guide rails, remove the card from the slot and re-insert it with care.**

3. The card is ready for use.

To remove a card, proceed as described below:

1. Gently push the SD/SDHC/SDXC card until it clicks.

2. Release the card and it will be partially ejected.

3. Pull the card out from the slot.

4.4.7. X110 - RS232 Port

The RS232 interface (X110, Figure 59, Figure 61 and Figure 64) is provided as a 9-pin D-SUB connector. It allows you to connect a serial device to the system.

For pin assignment refer to subsection 18.1.6.

4.4.8. POWER Button and PWR LED

Figure 17: Detail - Power button and PWR LED/Rescue button and RSQ LED

1   Power button (PWR)

2   Power LED (PWR)

3   Rescue button (RSQ)

4   Rescue LED (RSQ)
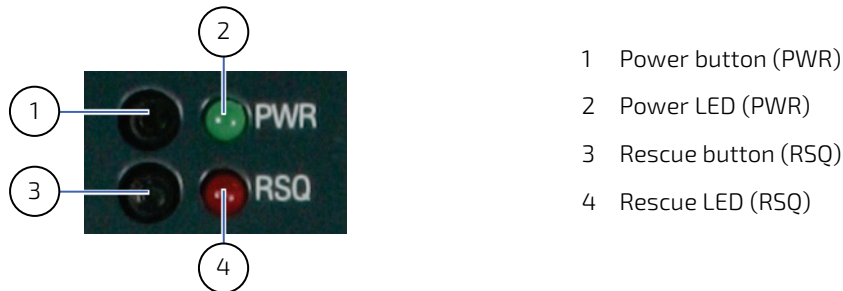
The power button (PWR, Figure 17, pos. 1, Figure 59, Figure 61 and Figure 64) is used to power the KBox C-102 on or off. By pressing the power button for longer than four seconds a forced system shutdown will be initiated, before the power to the system is turned off.

NOTICE	Caution: Performing a forced shut down can lead to loss of data or other undesirable effects!

The power LED (marked PWR, Figure 17, pos. 2, Figure 59, Figure 61 and Figure 64) is on green steady when power is applied to the system.

Prerequisite:
The KBox C-102 has to be connected to an appropriate main power supply (DC).

⚠WARNING	Even when the system is turned off via the power button there are parts of the system still energized. The unit is only completely disconnected from the DC mains, when the power is removed.

As soon as external power is applied to the main input power connector, X101 (Figure 14), the KBox C-102 boots up and then starts the operating system and application where available.

To perform an orderly shutdown of the system, press the PWR button and the system shuts down under the control of the operating system.

Once the system has been shut down, it can restarted by pressing the PWR button (assuming that power is still applied to the main input power connector, X101).

4.4.9. RESCUE Button and RSQ LED

i	The rescue function is not intended for use with a system in an application environment. It is designed to be used if the standard BIOS flash is corrupted, in order to get the system to boot in a defined and safe state for further failure resolution. Please refer to the chapter 17/ "KBox C-102 CPLD Specific Registers".

The RESCUE button (marked RSQ, Figure 17, pos. 3, Figure 59, Figure 61 and Figure 64) is used to force using the backup flash for system booting.
The RESCUE LED (RSQ, Figure 59, Figure 17, pos. 4) blinks red when the backup flash is selected for booting. The backup flash contains a cloned BIOS (uEFI) version. In the event the system does not properly start-up or gets hung-up and restarting (cold booting) the system does not help, it is possible to switch to the backup boot flash and then restart the system. To do this, press the RSQ button for more than five seconds, whether or not the system is running it will now start-up using the backup flash for booting.

To revert to using the standard boot flash, the system must be cold started, or remove power completely from the system and then reapply.

4.4.10. Status and General Purpose LEDs

After power is applied and the KBox C-102 performs the boot procedure, the LEDs show the POST code. In case of a boot failure within the uEFI the last post code is displayed. When the boot phase is passed without errors, the LEDs change to their status and general purpose function.

The following table provides information concerning these LEDs (Figure 59 and Figure 18).

Figure 18: Detail - Status and General Purpose LEDs
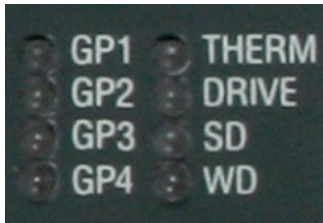
Table 4: Status and General Purpose LEDs

Status and General Purpose LEDs			
Designator	Function	Color	Description
THERM	Thermal	Green	Normal operation
		Red blinking	The system turns off due to over temperature
DRIVE	Drives (SSD/HDD)	Green	SSD/HDD active
SD	SD Card	Green	SD card active
WD	Watchdog	Red blinking	Watchdog timeout occurred
GP1	General Purpose 1	Red/Green/Orange	User general purpose 1
GP2	General Purpose 2	Red/Green/Orange	User general purpose 2
GP3	General Purpose 3	Red/Green/Orange	User general purpose 3
GP4	General Purpose 4	Red/Green/Orange	User general purpose 4

4.4.11. PCI/PCIe Expansion Slots

The KBox C-102 provides on the front side up to four slots (see also Figure 57 for KBox C-102-4, Figure 59 for KBox C-102-2 and Figure 61 for KBox C-102-1) for system expansion with PCI/PCIe expansion cards via corresponding riser cards.

To access the corresponding riser card sockets, in order to install or remove PCI/PCIe expansion cards (refer to the subsection 6.3.4 "Riser Cards Expansion Sockets for PCI/PCIe Cards"), you have to remove the top side access cover. For a better accessibility of the expansion sockets you should remove the right side access cover (Figure 25 and Figure 23, pos. 1 and pos. 3) also.

Figure 19: PCIe 1 to PCIe 4 slots (shown as detail of a KBox C-102-4)

1 PCIe 1 slot
2 PCIe 2 slot
3 PCIe 3 slot
4 PCIe 4 slot
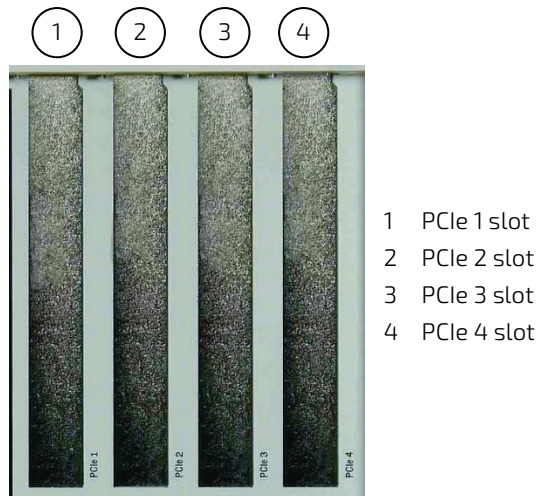
Please observe that:

KBox C-102-4: supports up to:
> 4x PCIe x4/PCIe x1 expansion cards
> For system configuration refer to Figure 59, Figure 58 and for expansion cards installation
> refer to the subsection 6.3.5 "Installing/Removing PCI/PCIe Expansion Cards".

KBox C-102-2: supports up to:
> 2x PCIe x4/PCIe x1 expansion cards or

> 1x PCIe x8/PCIe x4/PCIe x1 expansion cards or
> 1x PCIe x4/PCIe x1 and 1x PCI (32 bit) expansion cards.
> For system configuration refer to Figure 59, Figure 60 and for expansion cards installation
> refer to the subsection 6.3.5 "Installing/Removing PCI/PCIe Expansion Cards".

KBox C-102-1: supports 1x PCIe x4/PCIe x1 expansion card.
> For system configuration refer to Figure 61, Figure 62 and for expansion card installation the subsection 13.1.1 "PCIe Expansion Slot 1".

KBox C-102-0: can't be equipped with PCI/PCIe expansion cards. Refer to Figure 64 and Figure 65.

Refer also to the area marked "C" in the section 4.4.

4.4.12. Internal or Removable 2.5" SATA HDDs/SSDs

Depending on the ordered system configuration, your KBox C-102-2 can be equipped with up two drive bays for 2.5" removable SATA HDDs/SSDs (refer to Figure 59, Figure 60 and Figure 20) or one internal mounting frame for 2x 2.5" SATA HDDs/SSDs. The drive bays are suitable for 9.5 mm SSDs and 7 mm SSDs (with adapter).

The internal 2.5" HDDs/SSDs are not accessible from the outside. The internal SATA HDDs/SSDs are installed (always factory installed) into the system by use of a mounting frame.

The 2.5" drive bays (DRIVE 1 and DRIVE 2) for removable HDDs/SSDs are accessible from the front side (Figure 59) of the system (refer to Figure 20, Figure 21 and Figure 22).

The drives support following drive speeds:

▶ DRIVE 1: up to SATA 6 Gb/s.
▶ DRIVE 2: up to SATA 6 Gb/s.

> **i**
>
> If the KBox C-102-2 configuration with internal 2.5" SATA HDDs/SSDs was ordered, the "DRIVE 1" and "DRIVE 2" for removable SATA HDDs/SSDs are not available (refer to Figure 9).
>
> If the KBox C-102-2 configuration with removable 2.5" SATA HDDs/SSDs was ordered, no installation of any internal SATA HDD/SSD (with mounting frame) is possible.
>
> Refer also to the area marked "D" in the section 4.4.

Figure 20: Drive 1 and Drive 2 for removable 2.5" SATA HDD/SSD (option); closed drive bays

Figure 21: Drive bay 1 with opened drive bay cover
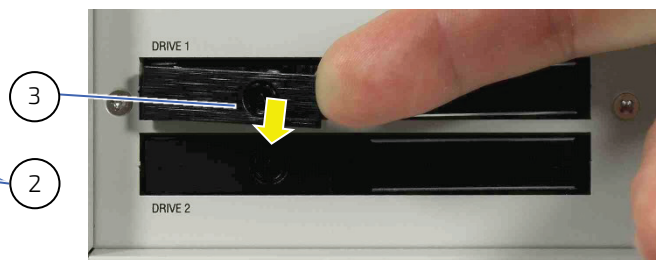
Figure 22: Inserting/removing a 2.5" removable SSD
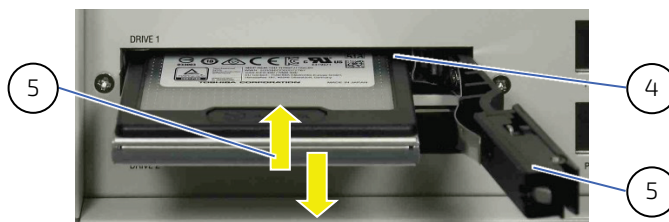
> **i**
>
> This SATA interface supports hot-swapping.
> To prevent data loss, don't remove the HDD during read/write activity [while the "DRIVE LED" (Figure 18) is flashing green].

1	Lockable lever to release the drive bay cover	4	Drive bay for 2.5" removable SATA HDD/SSD
2	Cover of the drive bay	5	Opened drive bay cover
3	Pulled-out lever	6	Inserting or removing a 2.5" removable SATA HDD/SSD

> **i**
>
> Please observe that the KBox C-102-1 system configuration can be equipped with only one internal or removable 2.5" SATA HDD/SSD. Refer to the chapter 13/ "KBox C-102-1 Variant" and the subsection 13.1.2 "Internal or Removable 2.5" SATA HDD/SSD".
>
> The KBox C-102-0 can be equipped with only one internal 2.5" SATA HDD/SSD. Refer to the chapter 14/ "KBox C-102-0 Variant" and the subsection 14.1.1 "Internal 2.5" SATA Drive".
>
> Refer also to the area marked "D" in the section 4.4.

4.4.12.1. Installing/Removing the removable HDD/SSD

To install/remove a removable drive, please perform the following steps:

1. Pull out the lever (Figure 21, pos. 3) of the drive cover (Figure 20, pos. 2) and release it. (If required, unlock the lever with the corresponding key before.)

2. The drive bay cover will spring open and the removable drive will automatically slide out a bit.

3. Insert/remove the drive into/out from the bay receptacle.

4. Close the cover.

4.5. Left and Right Side View

Figure 23: Right side of the KBox C-102 system   Figure 24: Left side of the KBox C-102 system
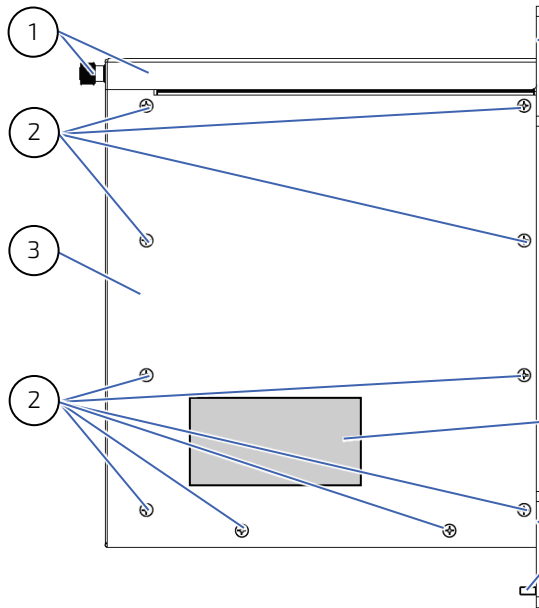
1	Top side access cover with knurled screws	7	Screws that secure the COMExpress® module
2	10x screws that secure the right side access cover	8	Screws that secure the cooling fins to the chassis
3	Right side access cover	9	Type label
4	Upper mounting bracket with key holes	10	Hole for further system fan tray extension
5	Lower mounting bracket with M4 ground stud and key holes	11	Air intake openings on the bottom cover
6	Cooling fins of the chassis	12	Air exhaust openings on the top cover

NOTICE   Please do not remove the red marked screws (see Figure 24, pos. 7 and pos. 8).

4.6. Top and Bottom Side View

Figure 25: Top side of the KBox C-102 system   Figure 26: Bottom side of the KBox C-102 system
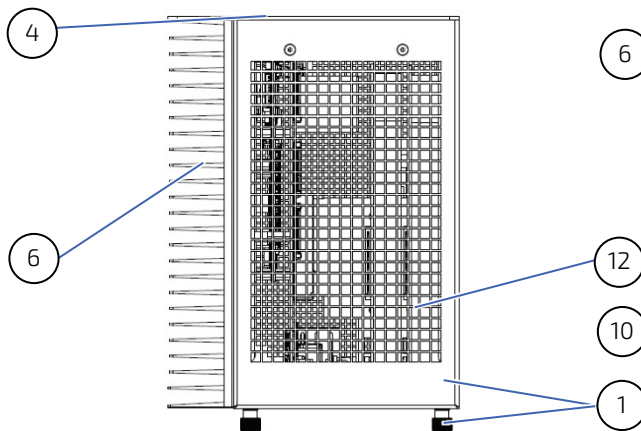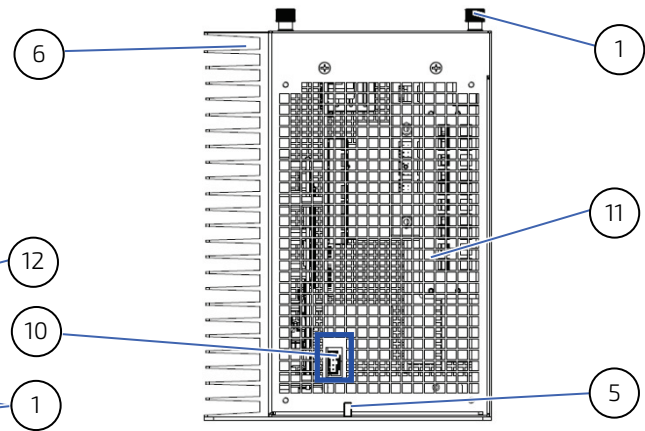
NOTICE   When powering on the KBox C-102, make sure that the air intake and exhaust openings are not obstructed. To provide sufficient heat dissipation for the cooling of the KBox C-102 system, never cover the cooling fins of the chassis. Do not place any objects onto the device.

4.7. Rear Side View

The KBox C-102 is designed for wall mounting, in vertical position inside of a control cabinet.

> ℹ️ **Please do not remove the red marked screws (see Figure 27, pos. 2 and pos. 4).**

Please observe the mounting instructions included in the chapter 8/ "Installation Instructions ", and the outline dimensions in the subsection 16.1 "Mechanical Specifications of the KBox C-102".
For the dimensions of the KBox C-102 versions with the optional fan expansion, refer to the subsection 16.1.4 "Mechanical Specifications of the KBox C-102-2 with Fan Tray Option" and 16.1.6 "Mechanical Specifications of the KBox C-102-1 with Fan Tray Option".

Figure 27: Rear side of the KBox C-102-2 system
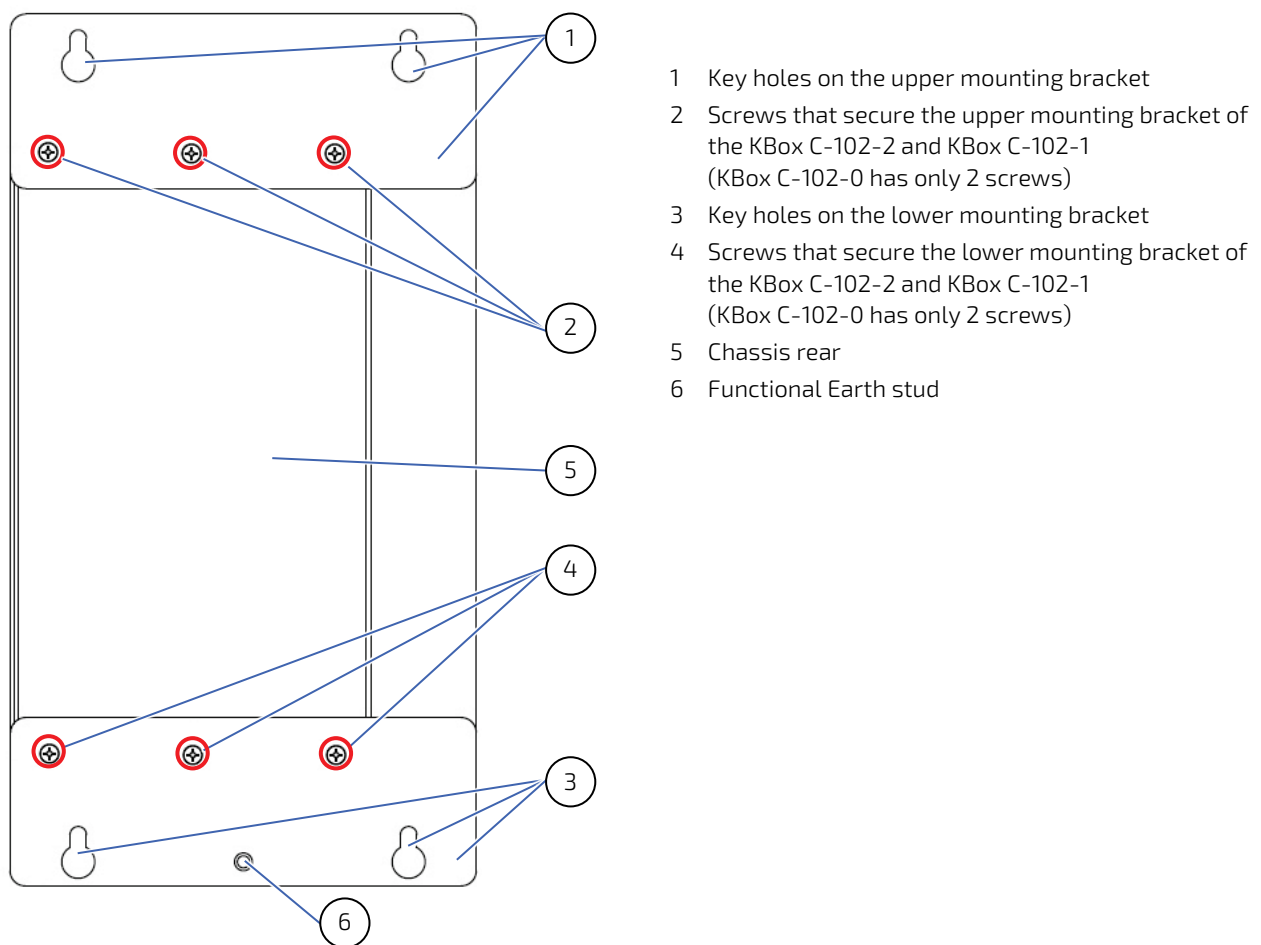
1   Key holes on the upper mounting bracket
2   Screws that secure the upper mounting bracket of the KBox C-102-2 and KBox C-102-1
    (KBox C-102-0 has only 2 screws)
3   Key holes on the lower mounting bracket
4   Screws that secure the lower mounting bracket of the KBox C-102-2 and KBox C-102-1
    (KBox C-102-0 has only 2 screws)
5   Chassis rear
6   Functional Earth stud

4.8. Functional Earth Stud

There is an M4 functional earth terminal on the lower mounting bracket of the KBox C-102 (Figure 27, pos. 6). This terminal may be connected as required.

> **NOTICE**   The KBox C-102 with the stud marked with a "Functional Earth" symbol (Figure 27) has to be grounded to an appropriate "common earth" connection point.

5/ System Extensions

Optionally your KBox C-102 can be equipped by factory only, with following ports and additional components:

▶ Serial port RS232 or RS422 via an adapter module

▶ CAN port: via an adapter module

▶ LDT3 or DisplayPort: via corresponding adapter module

▶ Fan Tray: an additional component connected to the KBox C-102-4, KBox C-102-2 and KBox C-102-1

▶ Fieldbus: (Profibus or Profinet): via internal factory mounted adapter module

You have to order these components separately, in order to extend your KBox C-102 at the factory.
Example of system configuration, see below:

Figure 28: KBox C-102-4 shown with optional interfaces and with removable drive bays

Figure 29: KBox C-102-4 shown with optional interfaces and without removable drive bays
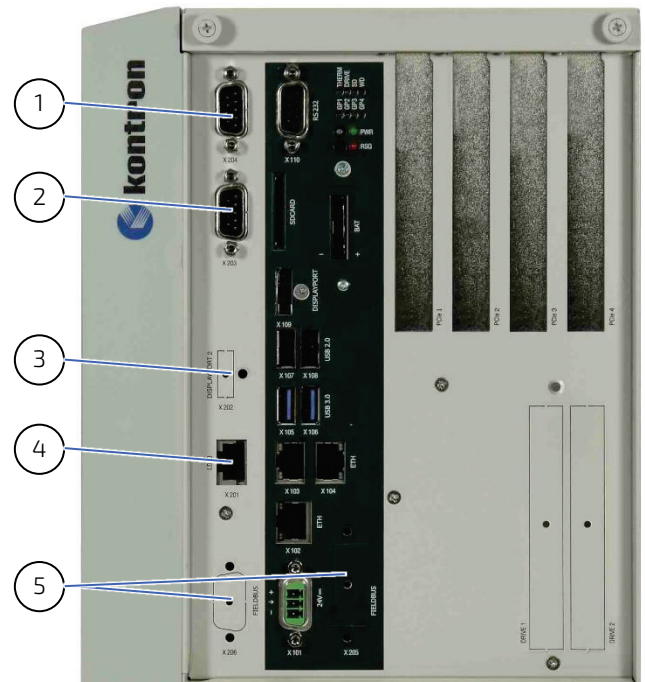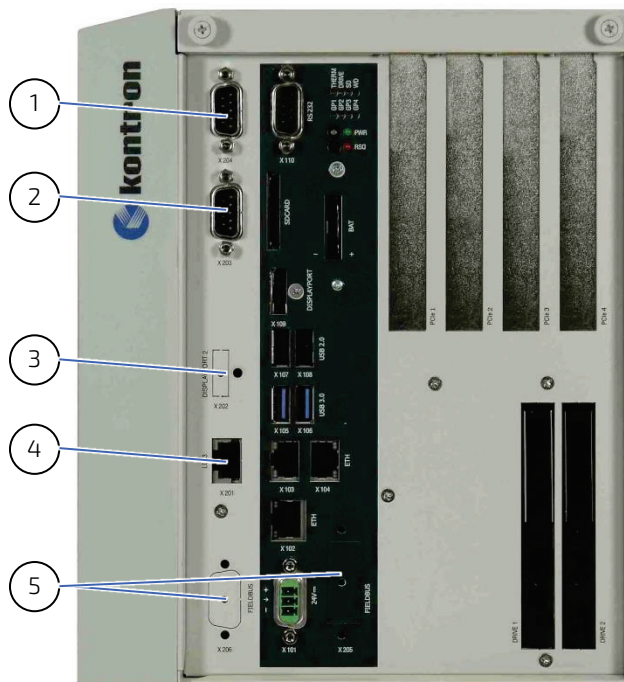
1   Serial port RS232/RS422

2   CAN port

3   DisplayPort (DP 2)
    (depending on the ordered option)

4   OR: LDT3 port
    (depending on the ordered option)

5   Fieldbus (ProfiBus/ProfiNet etc.),
    as D-Sub (X206) or dual RJ45 (X205)
    (depending on the ordered option)

5.1. (X204) - Serial Port RS232/RS422

> ⓘ **This port can be only factory installed and configured.**
> **When you order the KBox C-102 with this extended interface via RS232/422 adapter module, you have to specify in your ordering:**
> ▶ the needed configuration of this port as RS232 or RS422 and
> ▶ for RS422 configuration: if the onboard termination resistor (120Ω) should be enabled or disabled.

Your KBox C-102 can be extended, via an adapter module, with an additional serial interface RS232/RS422. This serial port (Figure 28, Figure 29, pos. 1) is available as 9-pin D-SUB connector (male), marked as "SERIAL" on the front side of the system. It must be factory configured as RS232 or RS422 corresponding your ordered port configuration. The serial port will be configured via an on-board DIP switch (SW1) for RS232 or RS422 serial communication.

Your system order with RS422 port must also contain the specification about the termination resistor (120Ω). If your application requires the termination resistor, it must be enabled at factory only. The corresponding DIP switch is not accessible for end user. For pin assignment refer to subsection 18.2.3.

5.2. (X203) - CAN Port

Your KBox C-102 can be extended via an adapter module with a CAN port, that allows you CAN Bus communication. The optional CAN port (Figure 28, Figure 29, pos. 2) is implemented as a sub-D 9 pin connector (male). This port is galvanically isolated (500V).
For pin assignment refer to the section 18.2.4.

> ⓘ **If a termination resistor (120Ω) is required, you have to make a connection (bridge) between pin 1 and 2, respectively pin 7 and pin 8, in order to enable the onboard termination resistor (120Ω).**

5.3. (X 201 or X202) - DP 2 DisplayPort or LDT3 Port

Your KBox C-102 can optionally be extended with a LDT3 interface or a second DisplayPort (DP 2).

> ⓘ **Only one of these two interfaces (LDT3 and DP 2) can be ordered as optional extension of your KBox C-102 system.**

5.3.1. (X202) – DisplayPort 2

The DP 2 port is a DisplayPort compliant interface realized using a standard DisplayPort connector. An external (digital) display can be connected to the DisplayPort connector (DP 2) (Figure 28, Figure 29, pos. 3).

For pin assignment refer to subsection 18.2.2.

5.3.2. (X201) – LDT3 Port

The LDT3 is an extension board for the KBox C-102 wich implements a HDBaseT 2.0 transmitter for video and USB 2.0 signals. The HDBaseT standard can be used to extend the distance between a computer and a monitor of up to 150 meters, depending on the resolution and the cable quality. HDBaseT is also known as IEEE1911.

For pin assignment refer to subsection 18.2.1.

5.4. (X205 or X206) Fieldbus

Your KBox C-102 can optionally be extended with a module for Fieldbus communication. Either a module for Profibus or Profinet communication will be integrated. Depending on the Fieldbus choosen, the DSUB brake-out (X205) for Profibus or the dual RJ45 brake-out (X206) for Profinet will be used.

i | Only one of these two Fieldbus interfaces (D-Sub or dual RJ45) can be ordered as optional extension of your KBox C-102 system.

Figure 30: X205 or X206 – Locations for the optional FIELDBUS interface
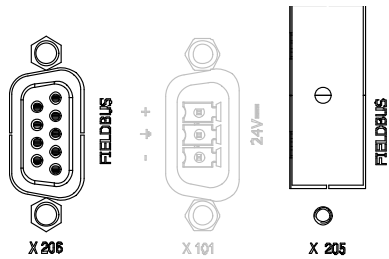
The optional interface s (FIELDBUS) on the front side of the KBox C-102 must be ordered separately either as D-Sub (X206) or as dual RJ45 (X205) connector. To add a FIELDBUS interface to the system, the second mPCIe socket (on the bottom of the baseboard), will be used. This connection can be implemented at factory only.

5.5. Optional Versions with Fan Tray - KBox C-102-4/-2/-1

By using a fan tray, the KBox C-102-4/-2/-1 can be operated in a control cabinet with extended ambient temperature; refer to the specified values in the section 16.2 "Environmental Specifications" and chapter 7/ "Thermal Considerations".

> **i** All chapters of this manual are valid for the KBox C-102-4, the KBox C-102-2 and KBox C-102-1 with fan tray under consideration of the mechanical differences and the description in this section. Please refer also to the subsection 16.1.2 "Mechanical Specifications of the KBox C-102-4 with Fan Tray Option", subsection 16.1.4 "Mechanical Specifications of the KBox C-102-2 with Fan Tray Option", and subsection 16.1.6 "Mechanical Specifications of the KBox C-102-1 with Fan Tray Option".

The KBox C-102 with fan tray chassis extension is designed to provide a better airflow through the system chassis. The KBox C-102-4/-2/-1 can be only factory equipped with the optional fan tray (Figure 31). The fan tray slot is external mounted to the bottom side of the KBox C-102-4/-2/-1 chassis and comprises a fan tray (Figure 31, pos. 1) with one fan as well as the air filter.

Figure 31: KBox C-102-1 equipped with the optional fan tray
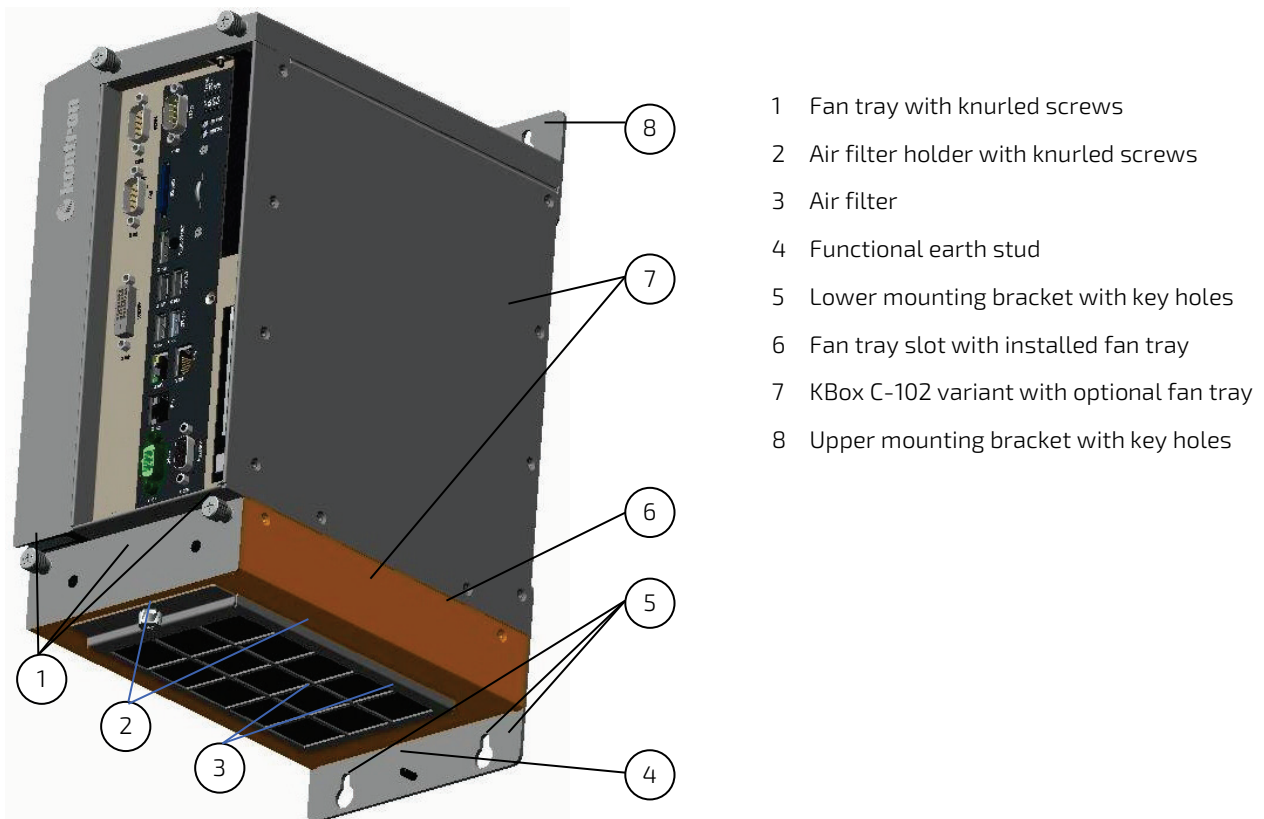
1   Fan tray with knurled screws

2   Air filter holder with knurled screws

3   Air filter

4   Functional earth stud

5   Lower mounting bracket with key holes

6   Fan tray slot with installed fan tray

7   KBox C-102 variant with optional fan tray

8   Upper mounting bracket with key holes

The fan is integrated in a user-friendly, replaceable fan tray (hot-swapping). The fan tray is designed to be inserted into the fan tray slot (Figure 31, pos. 6) on the bottom side of the KBox C-102-4/-2/-1. The fan tray simplifies the installation and removal of this component, even during operation.

The fan rotation speed is temperature controlled in dependence on the CPU temperature. Thus, a reliable air circulation for optimal active cooling of the KBox C-102-4/-2/-1 is ensured.

The temperature conditions of the system (depending on the environmental temperature and the system load) are detected by the CPU temperature sensor.

In order to ensure a clean air circulation through the system, the fan tray slot provides an installed air filter (Figure 31, pos. 3).

The air filter, which protects your system against dust and dirt, is washable and may be replaced during operation; refer to subsection 10.4 "Cleaning the Air Filter".

5.5.1. Fan Tray (only for KBox C-102-1, KBox C-102-2 and KBox C-102-4)

⚠CAUTION | The fan tray can be replaced during operation. This should only be carried-out by qualified personnel, aware of the associated dangers (see subsection 10.3 "Replacing the Fan Tray").

Figure 32: Fan tray components of the KBox C-102-1/-2/-4
(cable connections between fan and fan connector are included in this assembly)
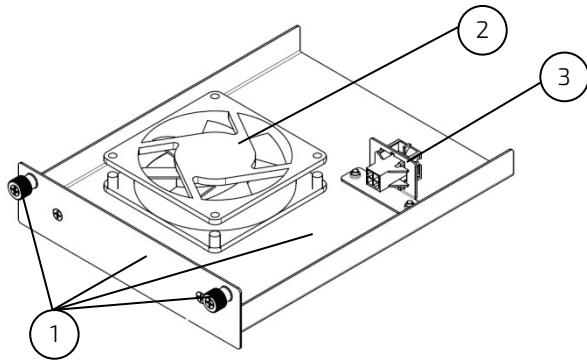
1   Fan tray with knurled screws

2   Fan (temperature controlled)

3   Connector for fan power and control

6/ Accessing Internal Components

This chapter contains important information that you must read before accessing the internal components. You must follow these procedures properly when installing, removing or handling any system component.

It is recommended to expand your system with additional PCI/PCIe/PCIe Mini cards before it is installed into an industrial control cabinet. Please consider following instructions when you install or remove expansion cards.

Before installing/removing an expansion card, please pay attention to the following information:

⚠WARNING	Please observe the "General Safety Instructions for IT-Equipment" provided with the system (refer also to the chapter 1/) and the installation instructions contained in this manual. The KBox C-102 system shall be mounted into a control cabinet.
	Only personnel with appropriate qualifications, trainings and authorization are permitted to install and work with the KBox C-102 system.
	The installation/removal of HDDs/SSDs and/or expansion cards may only be performed by a qualified person, according to the description in this manual.
	Before removing the cover of the device, make sure that the device is powered off and disconnected from the power supply.
	Before you upgrade the KBox C-102 with expansion cards, pay attention to the power specifications in chapter 16/ "Technical Specifications" and make sure that the power consumption of the expansion cards does not exceed 15 W per card.

Please follow the safety instructions for components that are sensitive to electrostatic discharge (ESD). Failure to observe this warning notice may result in damage to the device or/and internal components.

Please pay attention to the manufacturer's instructions before installing/removing an expansion card.

6.1. Top Cover

> **ℹ** The pictures in this section correspond to a KBox C-102-2 system.
> The cover description can be applied to all system variants, under consideration of the different mechanical specifications of the KBox C-102; refer to the section 16.1 "Mechanical Specifications of the KBox C-102".

> **⚠ WARNING** When used as intended the KBox C-102 is to be operated only in closed condition.
>
> Only when the right side cover is fixed with the screws (Figure 23, pos. 2) and top cover is properly installed and secured with the knurled screws (Figure 59, pos. 2) on the front side, it is ensured that the user doesn't have access to the internal components of the KBox C-102 during operation.

The cover will be fixed to the chassis using the centring bracket at the rear side of the cover (Figure 33, pos. 3) and the fixing bracket with captive knurled screws at the front side of the cover (Figure 33, pos. 5).

When inserting the cover, make sure that:

▶ At the rear: the centring bracket (Figure 33, pos. 3) is inserted properly into the corresponding cover retaining bracket of the chassis (Figure 38, pos. 13).

▶ At the front side: the fixing bracket with captive knurled screws of the cover (Figure 33, pos. 5), is matching properly over the cover retaining bracket on the front side (Figure 38, pos. 1).

The fixing bracket with captive knurled screws (Figure 33, pos. 5) secures the top cover on the front side (Figure 59, pos. 2).

Figure 33: Inside of the top cover with centering and fixing brackets
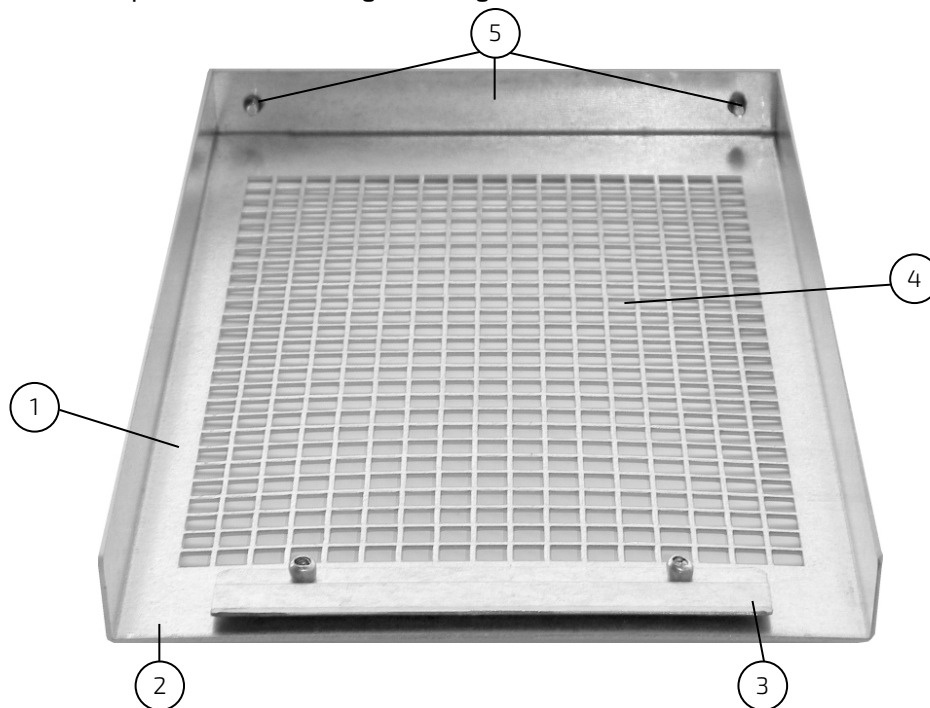
1	Inside of the top cover	3	Centering bracket (on the rear side)
2	Rear part of the top cover	4	Air exhaust openings
		5	Fixing bracket with knurled screws on the front side

6.2. Opening and Closing the KBox C-102

> The pictures in this section correspond to a KBox C-102-2 system.
> The "opening/closing" procedure description can be applied to all system variants, under consideration of the different mechanical specifications of the KBox C-102; refer to the section 16.1 "Mechanical Specifications of the KBox C-102".

For opening/closing the KBox C-102, please perform the following steps:

> ⚠ **WARNING** The system must be powered off and disconnected from the main power supply, before you attempt to open the KBox C-102. Ensure that you have a clean, flat and ESD-safe surface to work on. Also disconnect all peripheral devices from the KBox C-102. Please observe the instructions contained in the chapter 8/ "Installation Instructions".

1. Close all applications. Shut down the system properly and disconnect the connection to the power source. Disconnect all peripherals.

2. The KBox C-102 should lay on a flat, clean surface with the top side facing upwards.

3. Loosen the knurled screws, which secure the top cover on the front of the system (see Figure 59/Figure 61/Figure 64, pos. 2 and Figure 34).

4. Pull the cover out a little bit, as shown in Figure 34, to release the cover centering and fixing brackets.

Figure 34: Removing the centering and fixing bracket of the top cover (detail of the KBox C-102-2)
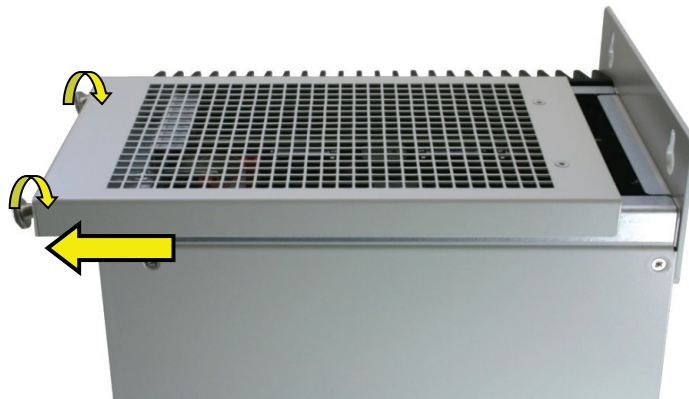
5. Lift the top cover up (on the front edge) and remove it (Figure 35). Now you have access to the internal sockets (PCI/PCIe/Mini PCIe and mSATA) or to the corresponding cards/devices, in order to install or remove internal hardware components.

Figure 35: Removing the cover (detail of the KBox C-102-2)

Figure 36: KBox C-102-2 - removing the right side cover
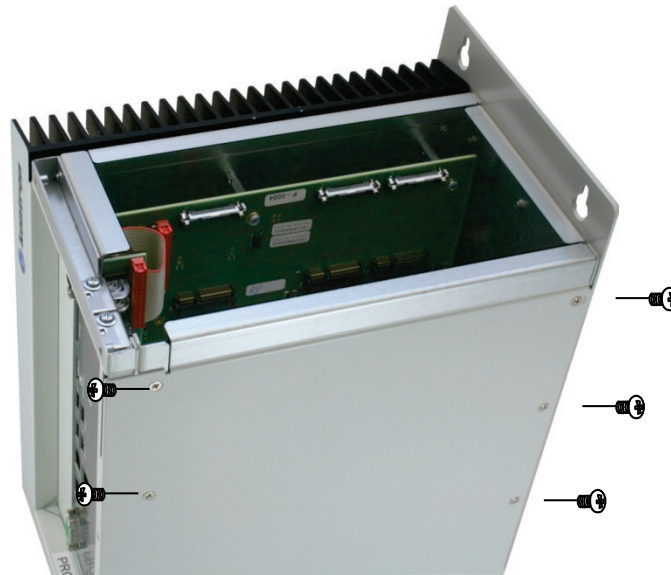
6. For a better accessibility of the internal sockets (PCI/PCIe/Mini PCIe and mSATA SSD), you may also remove the right side cover of the KBox C-102 (Figure 37). Loosen the externally accessible fastening screws (Figure 23, pos. 2) that secure the right side cover (Figure 36 and Figure 23, pos. 3). Pull the right side cover out, to detach it from the sideways mounted bolts. Put the right side cover and the screws aside for later use.

Figure 37: KBox C-102-2 without top and right side cover(shown with a PCIe riser card)
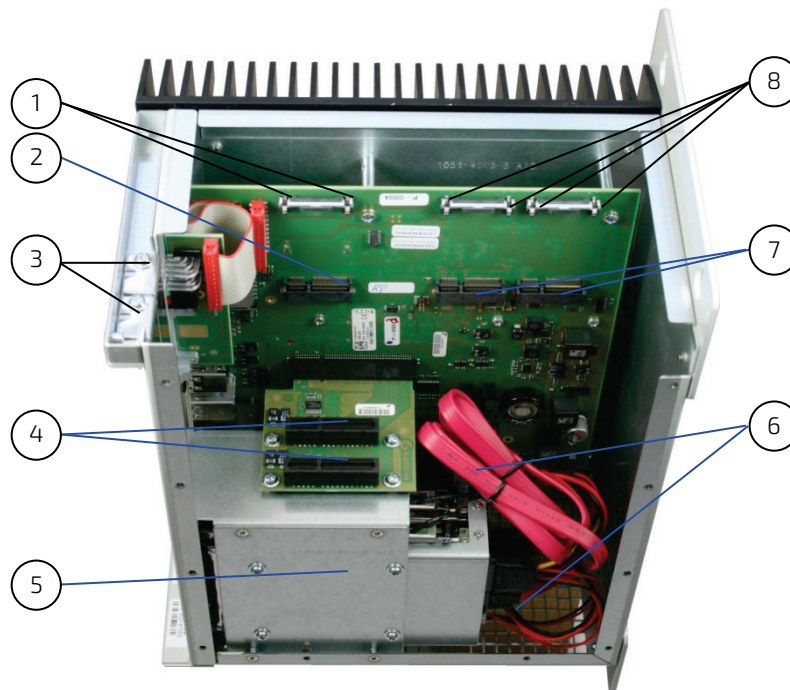
1	Fixing clips to secure the PCIe Mini card	5	Mounting frame for up to two removable 2.5" SATA HDD/SSD
2	1x Mini PCIe socket for PCIe Mini card	6	SATA cable connections (power and data)
3	Screws to fix the PCIe slot bracket or the I/O bracket of the PCIe card	7	2x mSATA sockets
4	Riser card with 2x PCIe x4 sockets	8	Fixing clips to secure the 2x mSATA SSDs

6.3. Internal View

Figure 38: KBox C-102-2 - internal view (shown with a PCIe riser card and removable HDD/SSD drive bay)
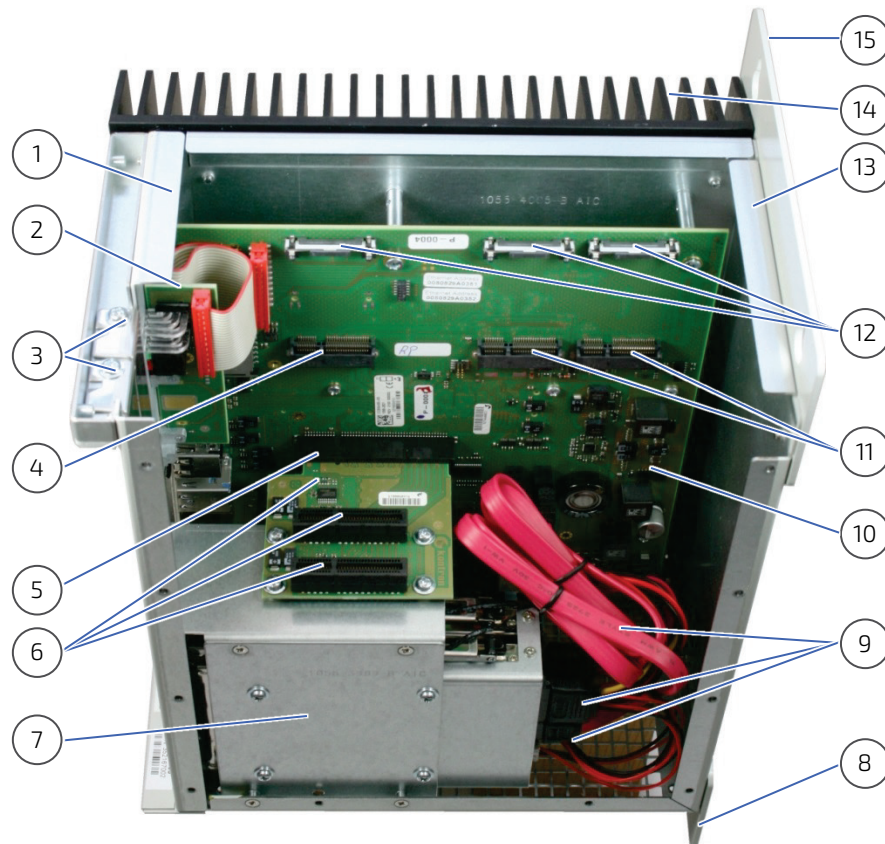
1	Cover retaining bracket on the front side	9	SATA cable connections (power and data)
2	LED indicators circuit	10	Baseboard
3	Screws that secure the PCIe slot brackets	11	2x mSATA sockets
4	1x Mini PCIe socket for PCIe Mini card (please observe the note below)	12	Mechanical fixing assemblies for: 2x 2.5" mSATA SSD and 1x PCIe Mini card (two fixing bolts for each mSATA SSD and PCIe Mini card) (please observe the note below)
5	PCI x8 socket of the baseboard		
6	Riser card with 2x PCIe x4 sockets	13	Cover retaining bracket on the rear side
7	Mounting frame for 2.5" drive bays of the removable HDDs/SSDs	14	Cooling fins
8	Lower mounting bracket with key holes	15	Upper mounting bracket with key holes

> **ℹ** The KBox C-102 provides two internal Mini PCIe sockets. You can see one of them in Figure 38, pos. 4.
> The second Mini PCIe socket is on the bottom side of the baseboard and can be only at factory equipped with an expansion card.

6.3.1. Integrated COMe Module

Depending on the ordered system configuration, your KBox C-102 accommodates a baseboard with a COMe-bSL6 module.

Figure 39: KBox C-102-2 - internal view with COMExpress® module and with PCIe riser card
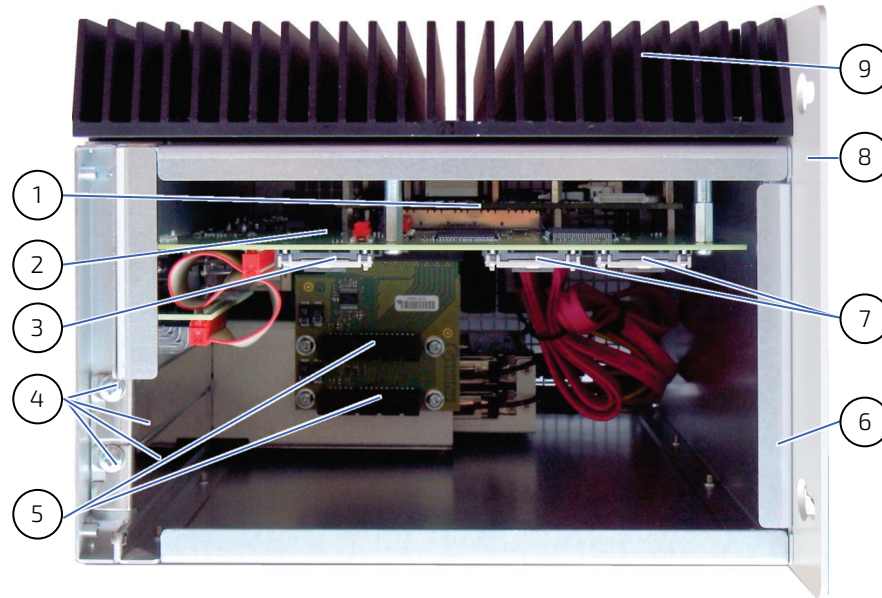
1	COM Express module	6	Cover retaining plate on the rear side
2	Baseboard	7	Mechanical fixing assemblies for 2x 2.5" mSATA SSD (two fixing clips for each mSATA SSD)
3	Mechanical fixing assemblies for 1x PCIe Mini card (two fixing clips for each PCIe Mini card)	8	Upper mounting bracket with key holes
4	Screws that secure the PCIe slot brackets	9	Cooling fins
5	Riser card with 2x PCIe x4 sockets		

> **i** Refer to the information and technical data included in the user manual of the installed COMe-bSL6 module.
>
> The user manual of the installed COMe Module can be downloaded from our web page www.kontron.com . Search for the name of the installed module.

6.3.2. mSATA Socket

Depending on the system configuration ordered your KBox C-102 can be extended with up to two mSATA SSDs.

For installation/removing of the mSATA SSD refer to the subsection 6.3.7 "Installing/Removing an mSATA SSD".

6.3.3. Expansion Socket for PCIe Mini Cards

Depending on the system configuration ordered, your KBox C-102 can be extended with up to two PCIe Mini cards.

> **i** The KBox C-102 provides two internal Mini PCIe sockets for PCIe Mini cards. One of them is internally accessible (Figure 38, pos. 4). The second Mini PCIe socket is on the bottom side of the baseboard and can be only at factory equipped with an expansion card.

For installation/removing of the PCIe Mini card (Figure 38, pos. 4), please refer to the subsection 6.3.6 "Installing/Removing the PCIe Mini Card".

6.3.4. Riser Cards Expansion Sockets for PCI/PCIe Cards

Depending on the system configuration ordered, your KBox C-102 can be extended with 1x PCI (32 bit) card and up to four PCIe x4/PCIe x1 cards (full-height, half-length form factor) via corresponding riser cards.

For installation/removing of PCI/PCIe cards into/from the corresponding socket
(Figure 40, pos. 5 and pos. 6, Figure 41, pos. 5 and pos. 8 and Figure 63, pos. 12),
please refer to the subsection 6.3.5 "Installing/Removing PCI/PCIe Expansion Cards".

> **i** To expand your system with expansion cards, please observe the power consumption specified in
> chapter 16/ "Technical Specifications".
> The power consumption of each expansion card does not exceed 15 W.

> **i** Please observe that:
>
> KBox C-102-4: supports up to:
> > 4x PCIe x4/PCIe x1 expansion cards
>
> KBox C-102-2: supports up to:
> > 2x PCIe x4/PCIe x1 expansion cards or
> > 1x PCIe x4/PCIe x1 and 1x PCI (32 bit) expansion cards.
> > For system configuration refer to Figure 59, Figure 60 and for expansion cards installation
> > refer to the subsection 6.3.5 "Installing/Removing PCI/PCIe Expansion Cards".
>
> KBox C-102-1: supports 1x PCIe x4/PCIe x1 expansion card.
> > For system configuration refer to Figure 61, Figure 62 and for expansion card installation
> > refer to the subsection 13.1.1 "PCIe Expansion Slot 1".
>
> KBox C-102-0: can't be equipped with PCI/PCIe expansion cards.
>
> Refer also to the area marked "C" in the section 4.4.

6.3.5. Installing/Removing PCI/PCIe Expansion Cards (for KBox C-102-4/-2/-1 only)

The PCI/PCIe expansion cards can be installed into the slots on the front side of the system (Figure 59/Figure 61). The slots are marked with "PCIe 1" to "PCIe 4". It is recommended to expand your KBox C-102 with PCI/PCIe cards before it is installed into a control cabinet.

1. Close all applications; shut down the system properly and disconnect the connection to the power source. Disconnect all peripherals.

2. To have access to the PCI/PCIe sockets you have to open the KBox C-102-4/-2/-1 as described in the section 6.2 "Opening and Closing the KBox C-102" (step 1-6).

3. To remove/install an expansion card, you have to remove the corresponding card/slot bracket (refer to Figure 59/Figure 61 and Figure 40/Figure 41). Loosen the corresponding fastening screw on the internal side, which secures the slot/card bracket and remove it. Retain the screw for later use (refer to Figure 40/Figure 41, pos. 2).

Figure 40: Detail of the KBox C-102-2 with PCIe riser card with 2x PCIe x4 sockets
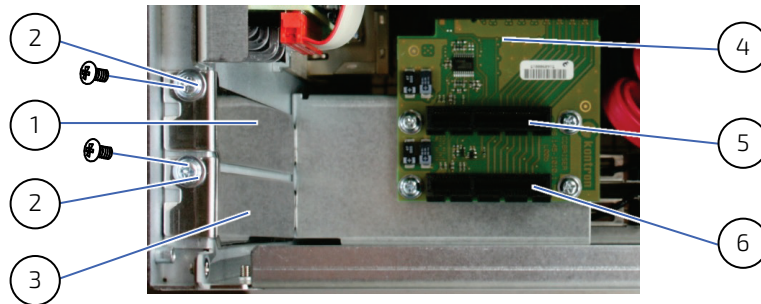
Figure 41: Detail of the KBox C-102-2 with PCI-PCIe riser card with 1x PCI (32 bit) and 1x PCIe x4 sockets
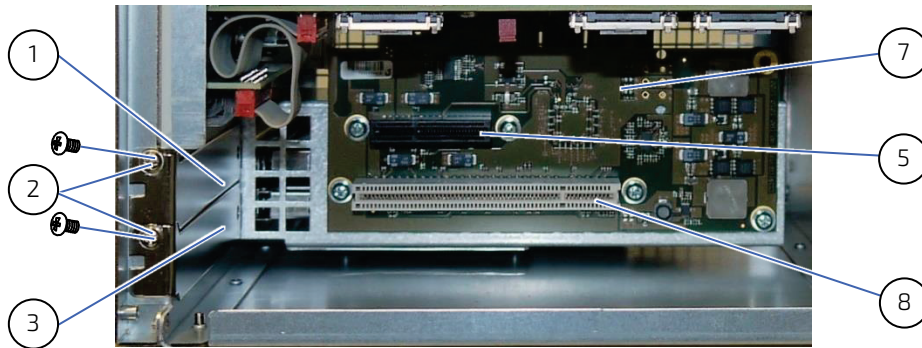
Figure 42: Detail of the KBox C-102-4 with PCIe riser card with 4x PCIe x4 sockets
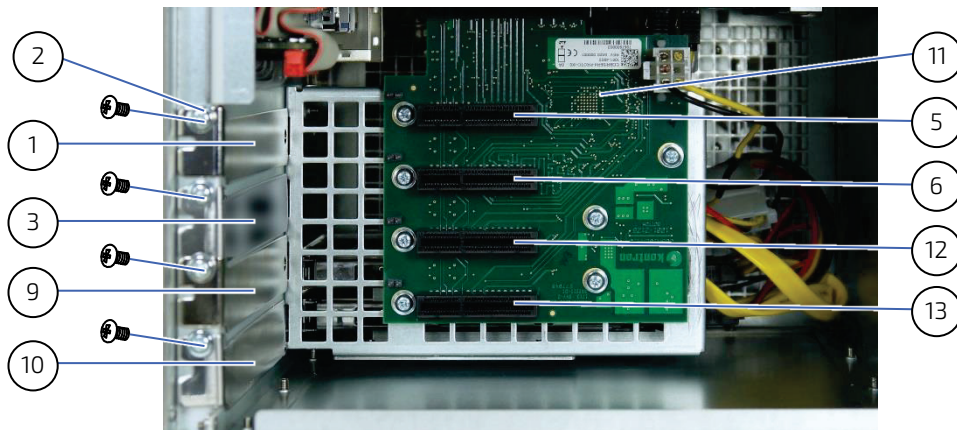
Legend for Figure 40 **and** Figure 41:

1   Slot bracket for the for the PCIe 1 expansion slot

2   Screws to secure the expansion slot/cards brackets

3   Slot bracket for the for the PCIe 2 expansion slot

4   Riser card with 2x PCIe x4 expansion sockets

5   Free PCIe x4 socket (for PCIe 1 slot)

6   Free PCIe x4 socket (for PCIe 2 slot)

7   Riser card with 1x PCI and 1x PCIe x4 expansion sockets

8   Free 1x PCI (32 bit) (for PCIe 2 slot)

9   Slot bracket for the for the PCIe 3 expansion slot

10 Slot bracket for the for the PCIe 4 expansion slot

11 Riser card with 4x PCIe x4 expansion sockets

12 Free PCIe x4 socket (for PCIe 3 slot)

13 Free PCIe x4 socket (for PCIe 4 slot)

4.   Insert/remove the expansion card into/from the corresponding PCI/PCIe socket of the corresponding riser card (Figure 40, pos. 5, pos. 6 or Figure 41, pos. 5, pos. 8).

5.   If you have removed an expansion card, re-insert the slot bracket.

6.   Secure the card or slot bracket to the chassis with the retained fastening screw.

7.   In order to close the KBox C-102-2, proceed in reverse order (step 6 to 1 in the section 6.2).

6.3.6. Installing/Removing the PCIe Mini Card

To install a PCIe mini card please proceed according to the steps described:

1.   Close all applications; shut down the system properly and disconnect the connection to the power source. Disconnect all peripherals.

2.   Open the device as described in the section 6.2 "Opening and Closing the KBox C-102" (step 1-6).

3.   Locate the PCIe Mini card socket and the corresponding fixing clips (Figure 37, pos. 1).

4.   Insert the PCIe Mini card into the socket (Figure 37, pos. 2) at an angle of approx. 45° and push it down until the fixing holes of the card are aligned with the fixing clips.

5.   Press the PCIe Mini card down (on the side with the fixing holes) until the card snaps in the fixing clips.

6.   In order to close the KBox C-102, proceed in reverse order (step 6 to 1 of the section 6.2).

To remove a PCIe Mini card please proceed according to the steps described:

1.   Close all applications; shut down the system properly and disconnect the connection to the power source. Disconnect all peripherals.

2.   Open the device as described in the subsection 6.2 "Opening and Closing the KBox C-102" (step 1-6).

3.   Locate the PCIe Mini card installed into your system.

4.   Slide outwards the fixing clips in order to release the PCIe Mini card. It will spring up at an angle of approx. 45° on the fixing clips side.

5.   Gently pull the PCIe Mini card out.

6.   In order to close the KBox C-102, proceed in reverse order (step 6 to 1 of the section 6.2).

6.3.7. Installing/Removing an mSATA SSD

To install an mSATA SSD please proceed according to the steps described:

1. Close all applications; shut down the system properly and disconnect the connection to the power source. Disconnect all peripherals.

2. Open the device as described in the subsection 6.2 "Opening and Closing the KBox C-102" (step 1-6).

3. Locate the mSATA sockets and the corresponding fixing clips. (Figure 37, pos. 8).

4. Insert the mSATA SSD card into the corresponding socket (Figure 37, pos. 7) at an angle of approx. 45° and push it down until the fixing holes of the card are aligned with the fixing clips.

5. Press the mSATA SSD down (on the side with the fixing holes) until the mSATA SSD snaps in the fixing clips.

6. In order to close the KBox C-102, proceed in reverse order (step 6 to 1 of the section 6.2).

To remove an mSATA SSD please proceed according to the steps described:

1. Close all applications; shut down the system properly and disconnect the connection to the power source. Disconnect all peripherals.

2. Open the device as described in the subsection 6.2 "Opening and Closing the KBox C-102" (step 1-6).

3. Locate the mSATA SSD card installed into your system.

4. Slide outwards the fixing clips in order to release the mSATA SSD. It will spring up at an angle of approx. 45° on the fixing clips side.

5. Gently pull the mSATA SSD card out.

6. In order to close the KBox C-102, proceed in reverse order (step 6 to 1 of the section 6.2).

> **Preventive Maintenance for SSD drive:**
>
> Because of the limited predetermined lifespan of SSDs, we recommend to check the condition of your installed SSD drives via S.M.A.R.T. regularly.
>
> Pay attention to the manufacturer specifications for lifespan.

7/ Thermal Considerations

7.1. Available Processors

Please refer to the chapter 16/ "Technical Specifications".

> **i** The list of processors is not complete and may be extended over the product lifetime.

7.2. Convection Cooling

The KBox C-102 is designed for convection cooling within the specified ambient air temperature ranges. Therefore it is imperative that air flow to and from the unit is guaranteed.

In addition, implementers must empirically verify the cooling concept for the KBox C-102 including optionally installed devices prior implementing the unit in the intended application.

7.3. Active Cooling via the optional Fan Tray

For applications where convection cooling is not sufficient, there is the possibility to use the optional fan tray (externally mounted to the KBox C-102-4/-2/-1). The optional fan tray extension allows to operate the system at higher ambient temperature conditions and provides a higher air flow through the chassis providing a better cooling of the system internal components.

7.4. Minimum System Clearance

To provide a maximum of airflow through and around the box, minimum distances to surrounding parts must be observed (please refer to the subsection 8.1 "Control Cabinet Mounting" and Figure 43 to Figure 49).

7.5. Maximum Temperatures

As the Intel® processors provide only certain settings for maximal power consumption some typically are used for the following table. This table can be seen as a guideline.

Table 5: Maximum Temperatures

Processor Power Consumption	KBox C-102 without Fan Tray		KBox C-102 with Fan Tray	
	Max. ambient Temperature [°C]	Approx. System internal Temp. Rise [°C]	Max. ambient Temperature [°C]	Approx. System internal Temp. Rise [°C]
25W	65	5	70	2
45W	50	5	55	2

> **i** The maximum system ambient temperature depends mostly on the power consumption of the processor and the chipset.

For the temperature evaluation a specialized tool from Intel® was used to set the processor to a defined workload. Depending on the power consumption one or more cores were set to 75% workload. This includes the graphics core. The tool also handles the usage of the "Turbo Mode" of certain processor types.

> **The processor utilization depends highly on the software used. Software using multicore feature will run on several cores whereas standard software will only utilise one core. In this case the processor will use the "Turbo Mode" to increase the clock for the core with the highest workload, as long as the temperature is within limits.**

7.6. Third Party Components

When the KBox C-102 is extended and configured with third party components like PCIe extension cards and hard drives (HDD or SSD), it has to be taken into account that the air temperature inside the system is higher than the ambient temperature. An approximately internal temperature rise is given.

7.7. Processor Thermal Monitoring

The processor used with the KBox C-102 system provides internal thermal monitoring. Every core of the processor comprises a temperature sensor.

To allow an optimal operation and long-term reliability, the processor must operate in the specified temperature range. To avoid overheating the processor performs an automatic thermal management, which intends to keep the processor temperature below the highest value of the temperature range. This behavior is a CPU standard feature.

7.8. Processor Thermal Trip Feature

The Processor Thermal Trip feature protects the processor from catastrophic overheating. The Thermal Trip Tensor threshold is set well above the normal operating temperature to ensure that there are no false trips. The processor will stop all executions when the junction temperature exceeds approximately 125°C. This event will be indicated by the red blinking "Thermal" LED on the front panel. This behavior cannot be altered. Once activated, the event remains latched until power is cycled.

8/ Installation Instructions

The KBox C-102 comes with attached wall mount brackets. The available mounting key holes (Figure 27, pos. 1 and pos. 3) of the wall mounting brackets allow the unit attaching to a wall of a fire resistant enclosure.

> Expansion card installation should be performed before installing the KBox C-102 into the control cabinet.

NOTICE   Whenever possible, unpack or pack this product only at EOS/ESD safe work stations. Where a safe work station is not guaranteed, it is important for the user to be electrically discharged before touching the product with his/her hands or tools. This is most easily done by touching a metal part of the system chassis.

Do not handle this product out of its protective enclosure while it is not used for operational purposes unless it is otherwise protected.

Prior any installation work ensure that there are no live wires on the installation site

Do not handle the device if there is any damage visible.

Do not operate the KBox C-102 with foreign objects inside the chassis.

Further do not insert any retrieval device into the device while it is connected to power.

Kontron rejects all liability for any and all damages resulting from operation of the unit with foreign objects inside the chassis.

The KBox C-102 has to be installed and operated only by trained and qualified personnel.

The KBox C-102 system is designed for usage within control cabinets only.

Only personnel with appropriate qualifications, trainings and authorization are permitted to install and work with the Kontron KBox C-102.

This device shall only be installed in or connected to systems that fulfill all necessary technical and specific environmental requirements.

The KBox C-102 system is designed to be operated in vertical position with attached mounting brackets as shown in Figure 8 and Figure 9. It is not allowed to install the KBox C-102 as a stand-alone (desktop) device.

Do not remove the wall mounting brackets.

The unit must be placed such that there is sufficient space in front of it for connecting the cables to the
I/O interface connectors and for operating the power button.

Leave sufficient free space around the unit to prevent the device from possibly overheating!

To ensure proper operation, we recommended free space as specified below:

> ▶ above and below: 100 mm (3.937")
> ▶ left and right: 50 mm (1.96").

See also Figure 43 to Figure 49 section 16.1 "Mechanical Specifications".

It must be observed that all ventilation openings are not covered/obstructed by objects.

The KBox C-102 must be firmly attached to a clean flat and solid mounting surface. Use proper fastening materials suitable for the mounting surface. Ensure that the mounting surface type and the used mounting solution safely support the load of the KBox C-102 and the attached components.

Please follow the local/national regulations for grounding.

The voltage feeds must not be overloaded. Adjust the cabling and the overcurrent protection to correspond with the electrical figures indicated on the type label.

The type label is located on the right side of the system.

It is recommended that the last cable attached to the system should be the power cable!
Refer to the section 8.2 "DC Power Plug Terminal" and chapter 9/ "Starting Up".

8.1. Control Cabinet Mounting

⚠CAUTION	Please observe the "General Safety Instructions for IT Equipment" (included) and the installation instructions (refer to the chapters 1/ and 8/).

Your KBox C-102 is supplied with assembled mounting brackets. The key holes of the upper and lower mounting brackets (Figure 27, pos. 1 and pos. 3) allow you to mount the KBox C-102 to a mounting side of the control cabinet in vertical position. This is the only permitted operating position.

i	For a sufficient air circulation around the device, we recommend not to place (mount) or operate any other devices within the "keep out area". The clearances of "50mm" and "100mm" around the KBox C-102 must be observed; refer to the marked areas in Figure 43 to Figure 49.

Figure 43: Keep out area for mounting around KBox C-102-4 (front side view without fan tray)
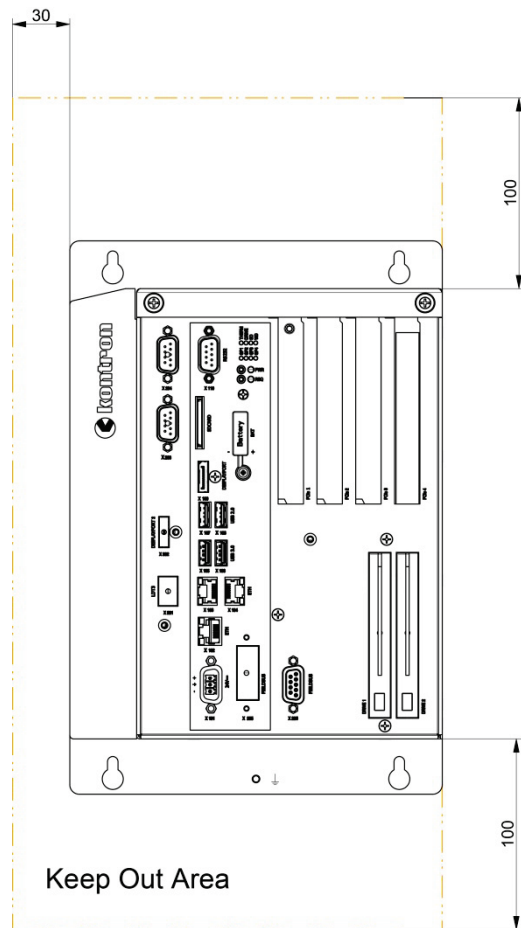
Figure 44: Keep out area for mounting around KBox C-102-4 (front side view with optional fan tray)
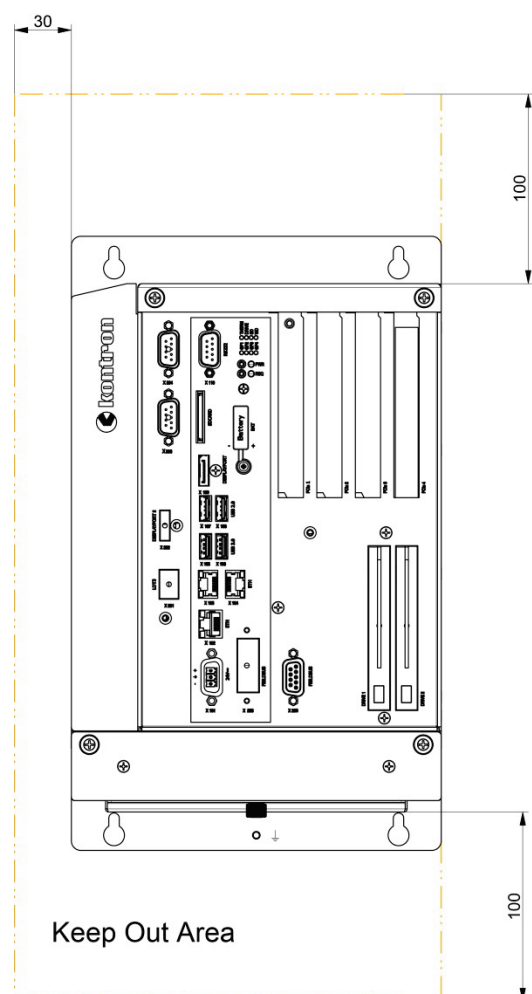
Prepare the mounting surface with four screws and if necessary anchors corresponding to the mounting surface type (fire-resistant material). Please refer to the information for mounting to the section 16.1, "Mechanical Specifications of the KBox C-102", and the subsections 16.1.1 / 16.1.4 / 16.1.5 / 16.1.6 and 16.1.7, or refer to the drawings for KBox C-102 on our web site. The drawings can be downloaded from our web site www.kontron.com by selecting the product.

Figure 45: Keep out area for mounting around
KBox C-102-2 (front side view without fan tray)
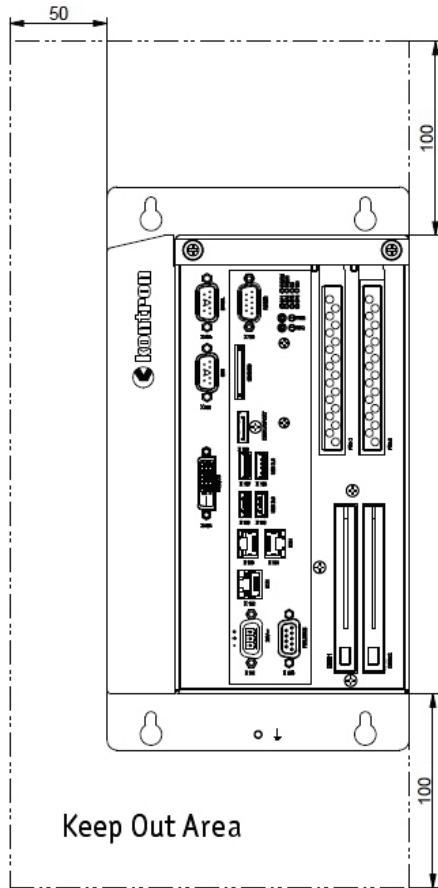
Figure 46: Keep out area for mounting around
KBox C-102-2 (front side view with optional fan tray)
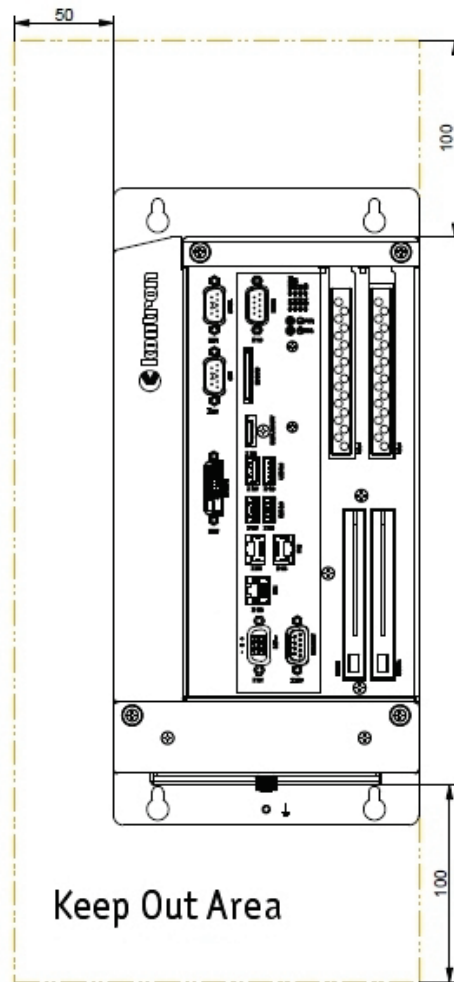
Figure 47: Keep out area for mounting around KBox C-102-1 (front side view without fan tray)
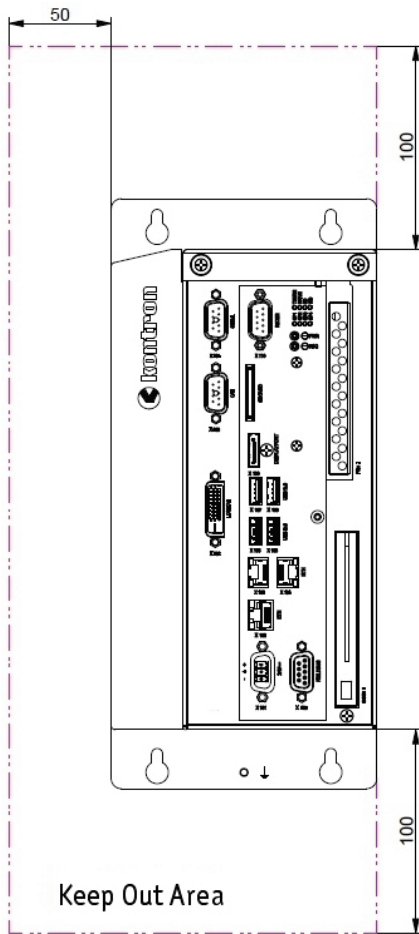
Figure 48: Keep out area for mounting around KBox C-102-1 (front side view with optional fan tray)
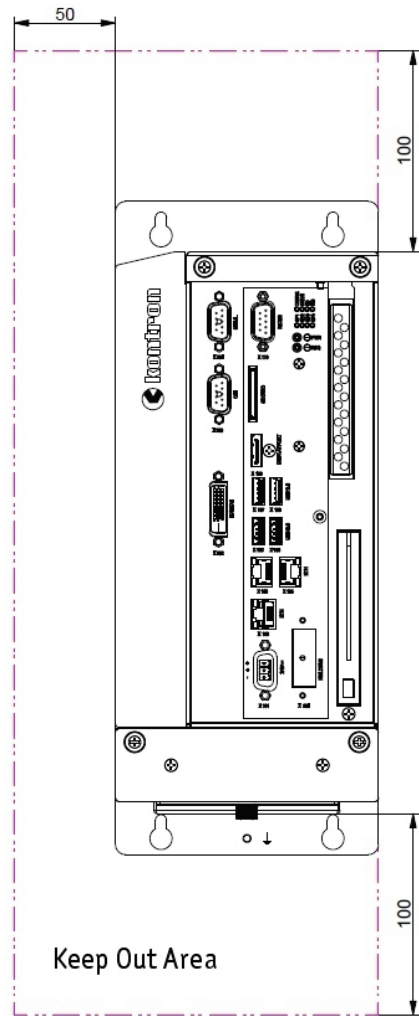
Figure 49: Keep out area for mounting around
KBox C-102-0
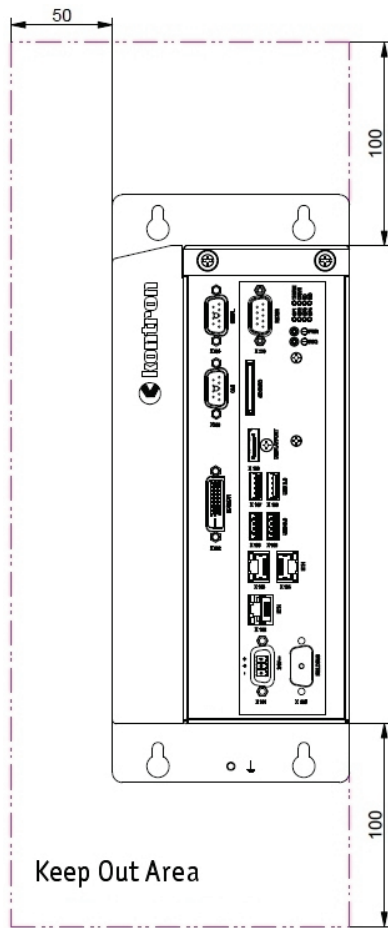
8.2. DC Power Plug Terminal

The KBox C-102 is connected by a Phoenix connector to a DC power source via a DC power supply wiring (only the Phoenix power plug terminal is included).

The KBox C-102 is delivered with a DC power plug terminal (3-pin Phoenix connector). For DC connection, prepare the connecting wires using the supplied Phoenix plug terminal: PSC 1,5/ 3-F.

Figure 50: Phoenix power plug terminal
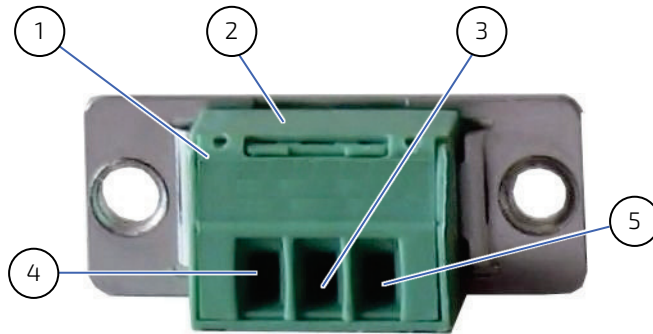
1	3-pin Phoenix plug terminal	4	Location for inserting the "24V" wire
2	Cover over the slotted pan head screws	5	Location for inserting the "0V" wire
3	Location for inserting the functional earth wire		

8.2.1. Cabling

For the pin assignment Phoenix power plug terminal refer to the subsection 4.4.1 "X101 - Power Input Connecto".

1. Cut the required length three isolated wires (1 mm²) AWG18 and strip each end 5 –7 mm.

2. Twist the striped wire-ends and provide them with ferrules.

3. Open the cover (Figure 50, pos. 2) to have access to the slotted pan head screws.

4. Loosen the slotted pan head screws of the DC plug terminal far enough so that you can insert the end of the prepared wires.

5. Insert the wires into the corresponding clamp of the Phoenix plug terminal. Make sure that you have the right polarity of the connection [refer to Figure 50, Figure 14 or subsection 18.1.1, "(X101) Power Input Connector "].

6. Fasten the screws to secure the wires into the clamps of the plug terminal.

7. Close the cover (Figure 50, pos. 2).

9/ Starting Up

> **i** The KBox C-102 must be operated only with the nominal voltage of 24V DC of type SELV. For details refer to the chapter 16/ "Technical Specifications".

9.1. Connecting to DC Main Power Supply

The DC input connector (Figure 59 and Figure 14 marked X101) is located on the front side of the KBox C-102. The KBox C-102 will be connected to a DC main power supply via the supplied Phoenix power plug terminal (see Figure 50) and corresponding power wires (prepared as described in the subsection 8.2.1 "Cabling").

> **i** Before using your system, become familiar with the system components and check that everything is properly connected. Following a proper cabling procedure will prevent a false power-on condition, which could result in unit operational failure.
>
> When you install/disconnect the unit, the functional earth connection must always be made first and disconnected last.
>
> Also, it is recommended that the last connections attached to the system should be the power wires!

> **⚠CAUTION** The KBox C-102 must be connected DC mains power supply complying with the SELV (Safety Extra Low Voltage) requirements of EN 60950-1 standard. It must be observed that wiring and short-circuit/overcurrent protection is performed according to the applicable standards, regulations and respect to the electrical specification of the KBox C-102.
>
> Even when the system is turned off via the power button (Figure 59/Figure 61/Figure 64 and Figure 17, marked PWR) parts of the system are still energized.
>
> The disconnecting device (fuse/circuit backer) rating must be in accordance with the wire cross-section and the rated current of the KBox C-102.

> **i** The wires used for power connections must be clearly marked (+/-/functional earth) to ensure that they will be proper connected to the DC IN connector of the KBox C-102 and to the main power source, corresponding to signals marked; refer to Figure 14 and Figure 50.
>
> In addition, the cables must have some form of support so as to minimize the strain on the unit's connectors.

To connect the KBox C-102 to a corresponding DC main power supply, please perform the following steps:

1. Ensure that the DC power source is switched off via a disconnecting device (circuit breaker), in order to ensure that no power is flowing from the external DC power source during the connection procedure.

2. Connect at first the wire for "Functional Earth stud" (Figure 27, pos. 6) to an appropriate "common earth" connection point.

3. Connect the Phoenix power terminal prepared as described in the subsection 8.2.1 "Cabling" to the DC input connector (Figure 59/Figure 61/Figure 64 and Figure 14 marked X101) of the KBox C-102. The DC input connector is located on the front side and is marked "24VDC".

4. Connect the other ends of the DC power wires to the connections of the DC main power supply. Pay attention to the polarity of the connections.

5. Switch on the disconnecting device (circuit breaker) in order to apply voltage to the terminals of the power wires.

9.2. Power OFF/ON Procedure

As the KBox C-102 is equipped with an internal hold-up buffer, it can't be powered off/on immediately.
The buffer time depends on the power consumption and load on the KBox C-102 processor and peripherals. Therefore the following procedure must be observed.

1. Close your applications and perform an orderly shutdown (graceful shutdown).

2. Remove power from the system.

3. Wait until the green power LED (Figure 17, pos. 2) stops blinking.

4. Reapply power.

Refer also to the subsection 4.4.8 "POWER Button and PWR LED".

NOTICE	Do not disconnect the power from your system while it is powered up!
	Performing a forced shutdown can lead to loss of data or other undesirable effects!

9.3. Operating System and Hardware Component Drivers

Your system can be supplied optionally with a pre-installed operating system.

If you have ordered your KBox C-102 with a pre-installed operating system, all drivers are installed in accordance with the system configuration ordered (optional hardware components). Your system is fully operational when you power it on for the first time.

If you have ordered The KBox C-102 without a pre-installed operating system, you will need to install the operating system and the appropriate drivers for the system configuration you have ordered (optional hardware components) yourself.

	You can download the relevant drivers for the installed hardware from our web site at www.kontron.com by selecting the product.
	Pay attention to the manufacturer specifications of the operating system and the integrated hardware components.

10/ Maintenance and Cleaning

Equipment from Kontron requires only minimum servicing and maintenance for proper operation.

▶ For light soiling, clean the KBox C-102 with a dry cloth.
Carefully remove dust from the surface of the cooling fins of the chassis using a clean, soft brush.

▶ Stubborn dirt should be removed using a mild detergent and a soft cloth.

NOTICE	Do not use steel wool, metallic threads or solvents like abrasives, alcohol, acetone or benzene for cleaning the KBox C-102.

10.1. Replacing the Lithium Battery

If your KBox C-102 is equipped with the optional lithium battery (CR 2025, 3V, externally-accessible), and you have to replace it, please proceed as follows:

1. Unscrew the screw (Figure 4, pos. 2), that secure the battery protective cover (Figure 4, pos. 1) to the chassis.

2. Remove the screw and the cover to have access to the battery (Figure 5, pos.3). Retain them for later use.

3. Remove the lithium battery from the holder by pulling it outwards.

4. Place a new lithium battery in the battery holder.

5. Pay attention to the polarity of the battery (as shown in Figure 51).

6. The lithium battery must only be replaced with the same type of battery or with a type of battery recommended by Kontron Europe.

7. Replace the protective cover over the battery and secure the cover with the retained screw.

NOTICE	Please note that only the Philips countersunk head screw M2.5x10 DIN965 (removed in step 2) may be used to secure the protective cover. Longer screws than M2.5x14 could damage internal components of the system.

Figure 51: Lithium battery polarity
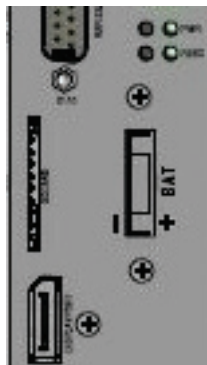
⚠CAUTION	Danger of explosion when replacing with wrong type of battery. Replace only with the same or equivalent type recommended by the manufacturer. The lithium battery type must be UL recognised.

	Do not dispose of lithium batteries in general trash collection. Dispose of the battery according to the local regulations dealing with the disposal of these special materials, (e.g. to the collecting points for dispose of batteries).

10.2. Preventive Maintenance for SSD Drives

This section applies to all mSATA and SSD devices installed into the KBox C-102 system.

> **i** Because of the limited predetermined lifespan of the mSATA/SATA SSD devices, we recommend to check the condition of your installed SSD drives via S.M.A.R.T. regularly.
>
> Pay attention to the manufacturer specifications for lifespan.

For replacing of these devices refer to the sections: 4.4.12 and 6.3.7.

10.3. Replacing the Fan Tray

> **NOTICE** The operation of the KBox C-102 versions with fan tray extension is permitted only with a functional fan tray!
>
> Defective components may only be replaced by Kontron original spare parts:
>
> ▶ Part number of the fan tray: 9-5000-1096 for KBox C-102-4
>
> ▶ Part number of the fan tray: 9-5000-1095 for KBox C-102-2
>
> ▶ Part number of the fan tray: 9-5000-1094 for KBox C-102-1
>
> The fan tray can be replaced during operation. This should only be carried-out by qualified personnel aware of the associated dangers.
>
> The fan will not stop immediately when the fan tray is removed during operation. Pull out the fan tray only a few centimeters and wait until the fan comes to stop.

To replace fan tray, proceed as follows:

1. Ensure to have access to the bottom side of the KBox C-102-4/-2/-1. The fan tray (Figure 52, pos. 1 and Figure 53, pos. 2) may be replaced without removing the air filter holder (Figure 52, pos. 4).

2. Loosen the two knurled screws (Figure 52, pos. 2) of the fan tray.

3. Pull the fan tray (Figure 53, pos. 2) out from the fan tray slot (Figure 53, pos. 3) in order to disconnect the connector for fan power and control (Figure 32, pos. 3) from the internal fan control socket (Figure 53, pos. 10).

4. Pull the fan tray completely out from the fan tray slot (Figure 53, pos. 3).

5. Replace the defective fan tray with a new one.

6. Insert the functional fan tray (Figure 53, pos. 2) into the fan tray slot (Figure 53, pos. 3).

7. Secure the fan tray by fastening the knurled screws (Figure 52, pos. 2). By fastening of the knurled screws the proper insertion of the fan tray into the internal socket (Figure 53, pos. 10) is ensured.

10.4. Cleaning the Air Filter

The air filter is inserted in the holder (Figure 31, pos. 2) at the bottom side of the fan tray slot (Figure 31, pos. 6). The soiling of the air filter (Figure 31, pos. 3) is caused by the pollution of the operating environment. A heavily soiled air filter can cause excessive heating of the device. For this reason we recommend to clean the air filter as often as necessary. The air filter can be changed during operation of the system.

Figure 52: Fan tray extension (detail: shown as KBox C-102-1)

1 Fan tray

2 Knurled screws of the fan tray

3 Knurled screw of the air filter holder

4 Air filter holder

5 Fan tray slot
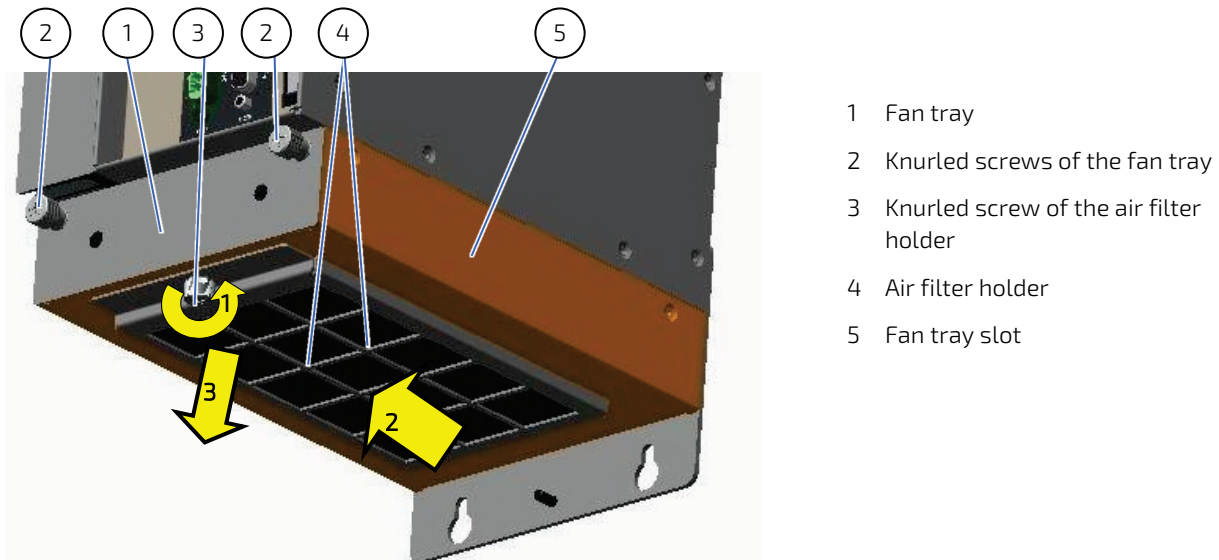
To replace the air filter, proceed as follows:
1. Ensure to have access to the bottom side of the KBox C-102-4/-2/-1. The air filter may be replaced without removing the fan tray (Figure 52, pos. 1).

2. Loosen the knurled screw (Figure 52, pos. 3) that secures the air filter holder (Figure 52, pos. 4) to the fan tray slot (Figure 52, pos. 5); refer to step 1 in Figure 52.

3. Pull the air filter holder out of the positioning holes, (Figure 53, pos. 9) into the marked direction (see Figure 52) and pull it down. Put the air filter holder aside for later reassembly; refer to step 2 and 3 in Figure 52.

4. Remove the soiled air filter (Figure 52, pos. 3 and Figure 53, pos. 6).

5. Clean the air filter as follows:

6. Rinse in water (up to approx. 40°C; possibly with the addition of a standard mild detergent).

7. It is possible to clean the air filter with compressed air.

8. For dirt that contains grease/oil, the air filter should be rinsed with warm water with the addition of a degreaser. Air filter should not be cleaned with powerful water jets or wrung out.

9. After cleaning and drying the air filter, place it in the air filter holder.

10. Reattach the air filter holder to the bottom side of the fan tray slot by inserting the positioning latches (Figure 53, pos. 8) into the positioning holes (Figure 53, pos. 9).

11. Secure the air filter holder by tightening the knurled screw to the tapped hole (Figure 53, pos. 4) of the fan tray slot
(Figure 52, pos. 5 or Figure 53, pos. 3).

NOTICE Defective components may only be replaced by Kontron original spare parts.
- Air filter: part number: 9-5000-1099 (for KBox C-102-4)
- Air filter: part number: 9-5000-1098 (for KBox C-102-2)
- Air filter: part number: 9-5000-1097 (for KBox C-102-1)

> ℹ The pictures in this section correspond to a KBox C-102-2 system.
> The description of the procedure for cleaning the air filter can be applied to both KBox C-102-4/-2/-1 variants, under consideration of the different mechanical specifications.

Figure 53: KBox C-102-2 with removed fan tray and removed air filter
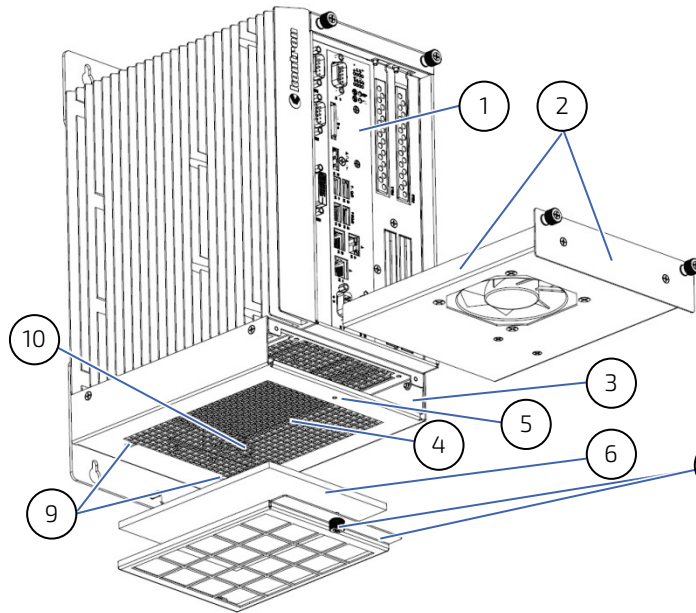
Figure 54: Filter mat Holder without air filter
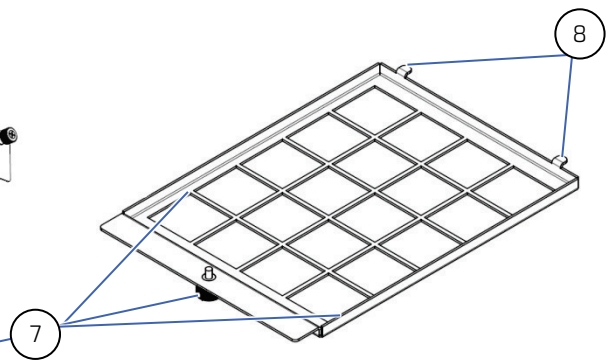
Figure 55: Holder (shown for a KBox C-102-2) with air filter
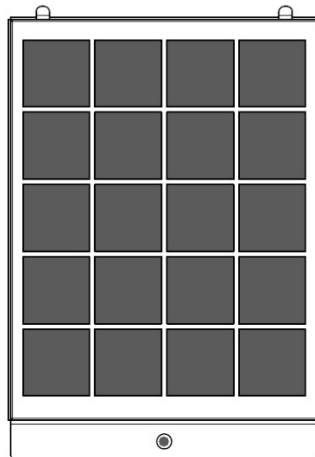
Figure 56: Air filter (shown for a KBox C-102-2)

1 KBox C-102 assembled with the optional fan tray slot
2 Removed fan tray
3 Fan tray slot without inserted fan tray
4 Air intake openings at the bottom side of the fan tray slot
5 Tapped hole to secure the knurled screw of the air filter holder

6 Removed air filter
7 Air filter holder with knurled screw
8 Positioning latches of the air filter holder
9 Positioning holes for the air filter holder
10 Socket for fan power and control (on internal rear side of the fan tray slot)

11/ KBox C-102-4 Variant

Please refer to the description in this manual for KBox C-102 and the chapter 16/ "Technical Specifications".

Figure 57: KBox C-102-4 - front view (shown with removable drive bays and without mounting brackets)
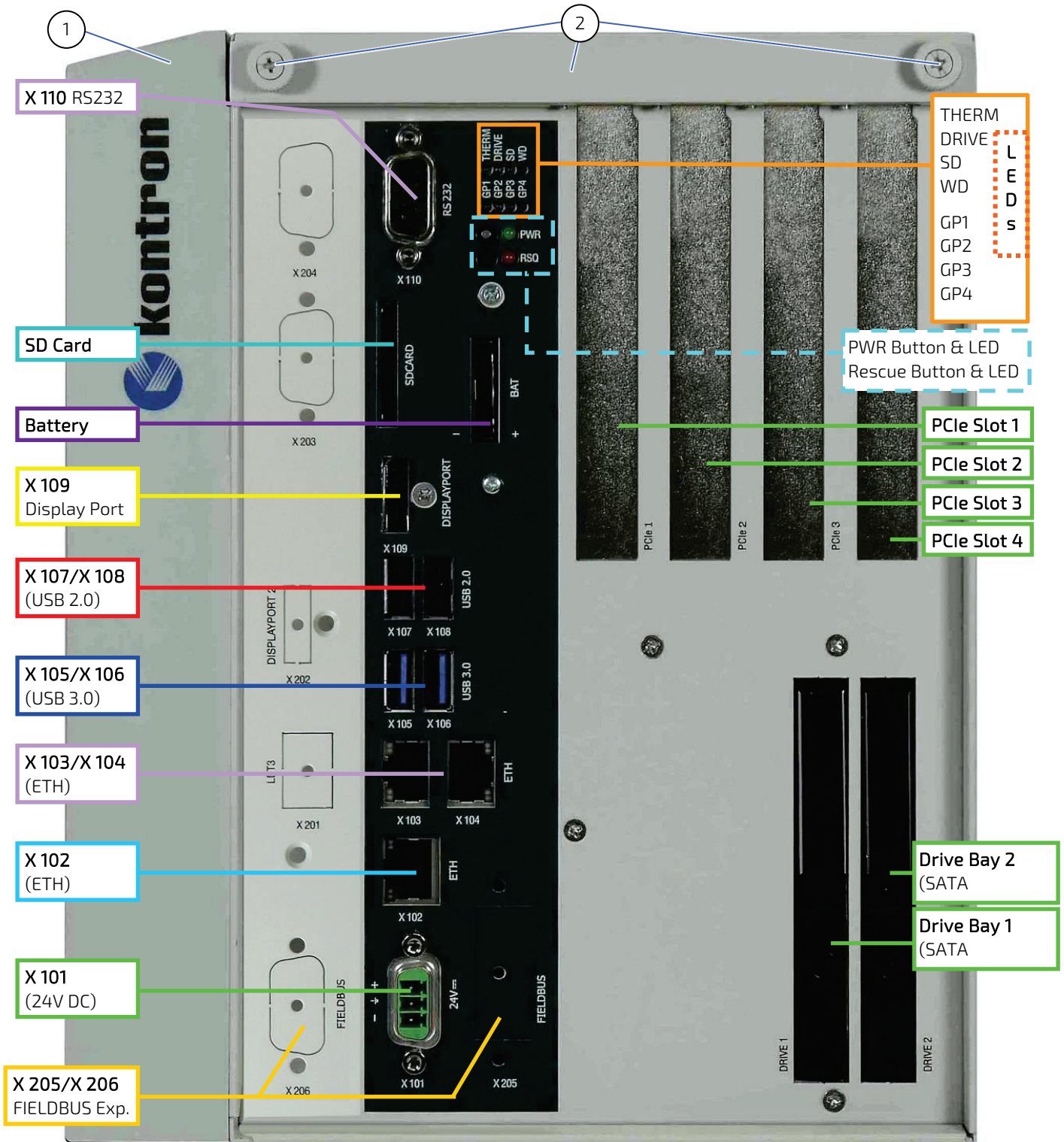
1   Side of KBox C-102-4 with cooling fins
2   Top side cover with knurled screws

Figure 58: Block Diagram - KBox C-102-4
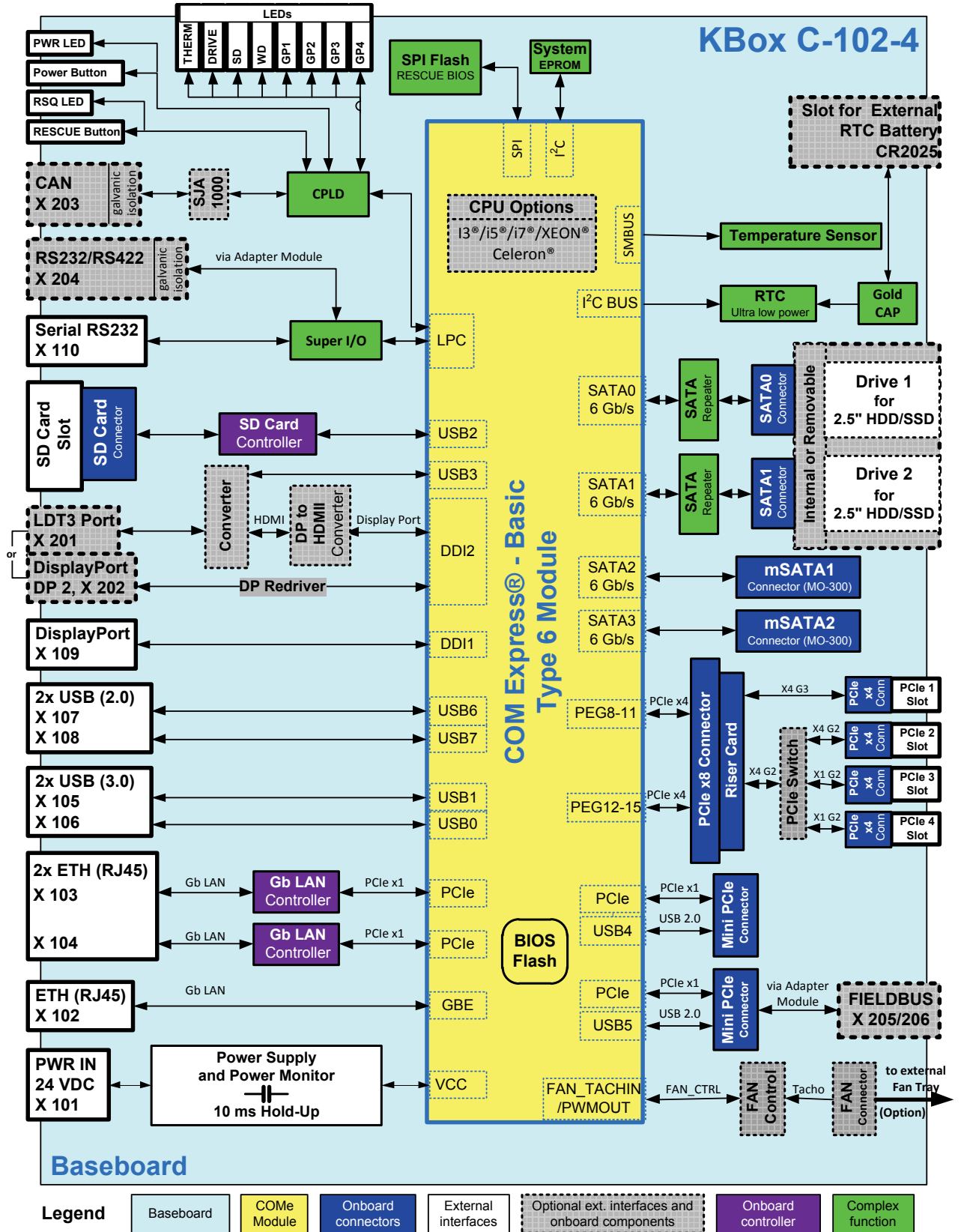
12/ KBox C-102-2 Variant

Please refer to the description in this manual for KBox C-102 and the chapter 16/ "Technical Specifications".

Figure 59: KBox C-102-2 - front view (shown with removable drive bays and without mounting brackets)
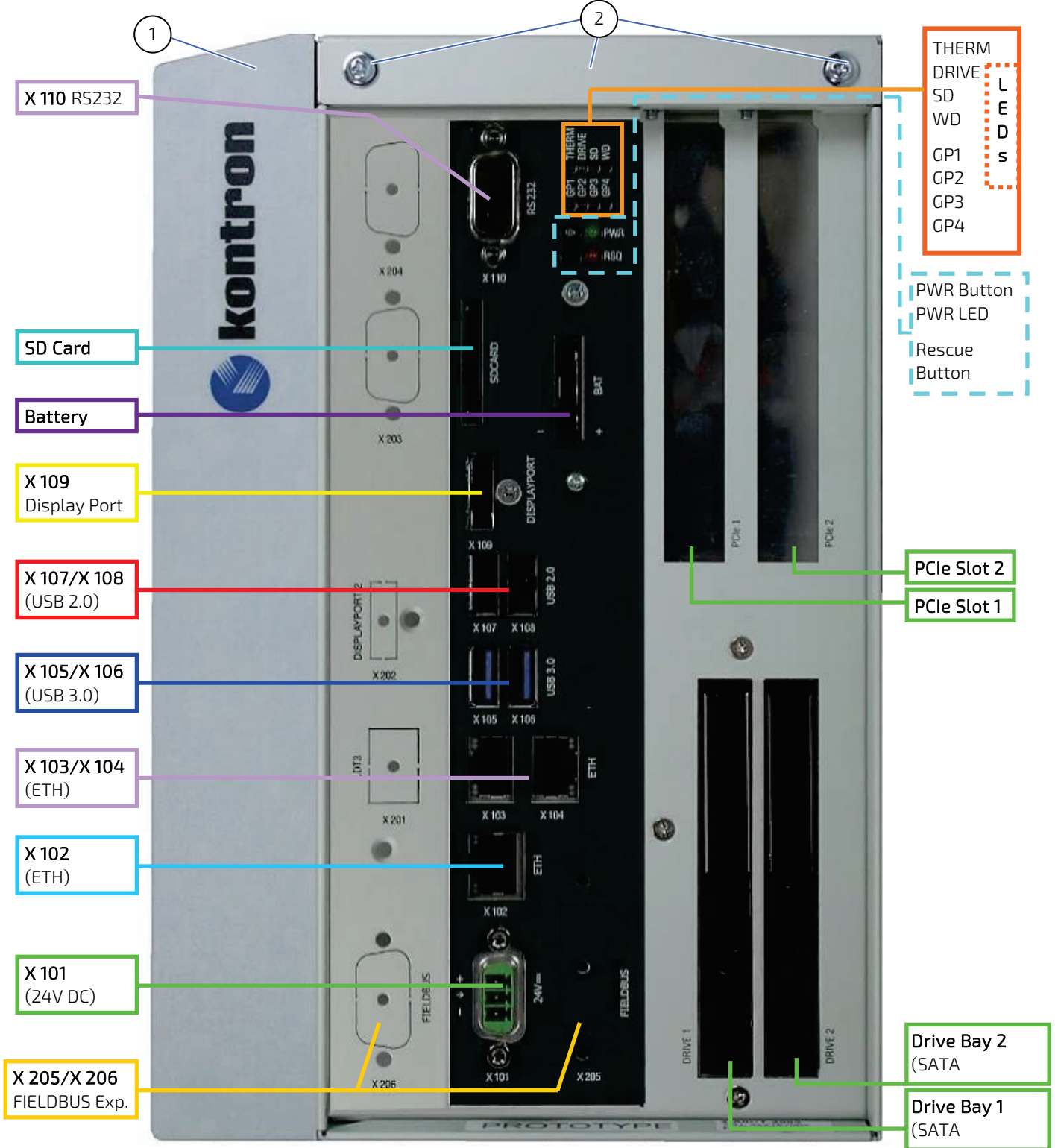
1   Side of KBox C-102-2 with cooling fins
2   Top side cover with knurled screws

Figure 60: Block Diagram - KBox C-102-2
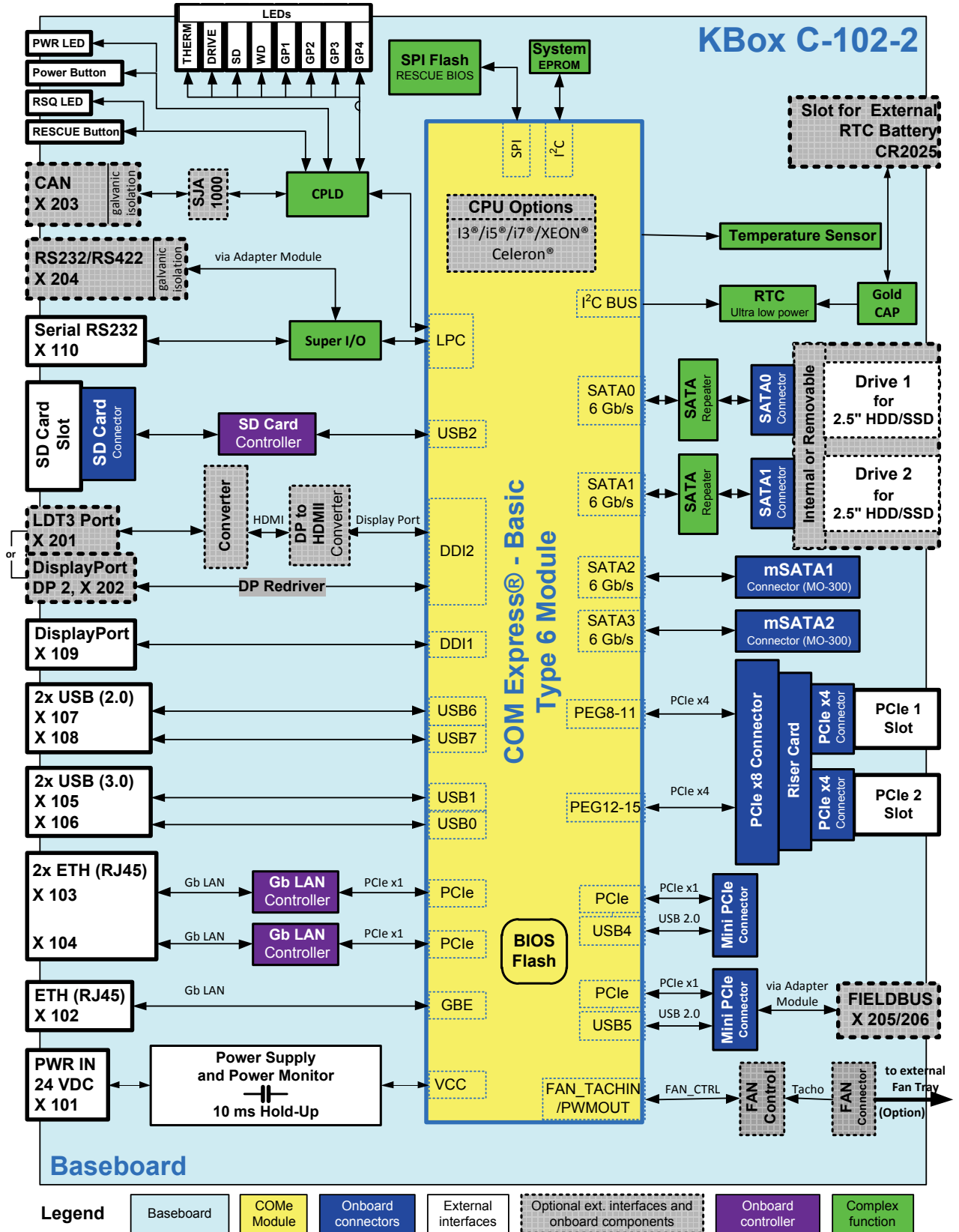
13/ KBox C-102-1 Variant

Please refer to the description in this manual for KBox C-102 and the chapter 16/ "Technical Specifications".

Figure 61: KBox C-102-1 - front view (shown with removable drive bay without mounting brackets)
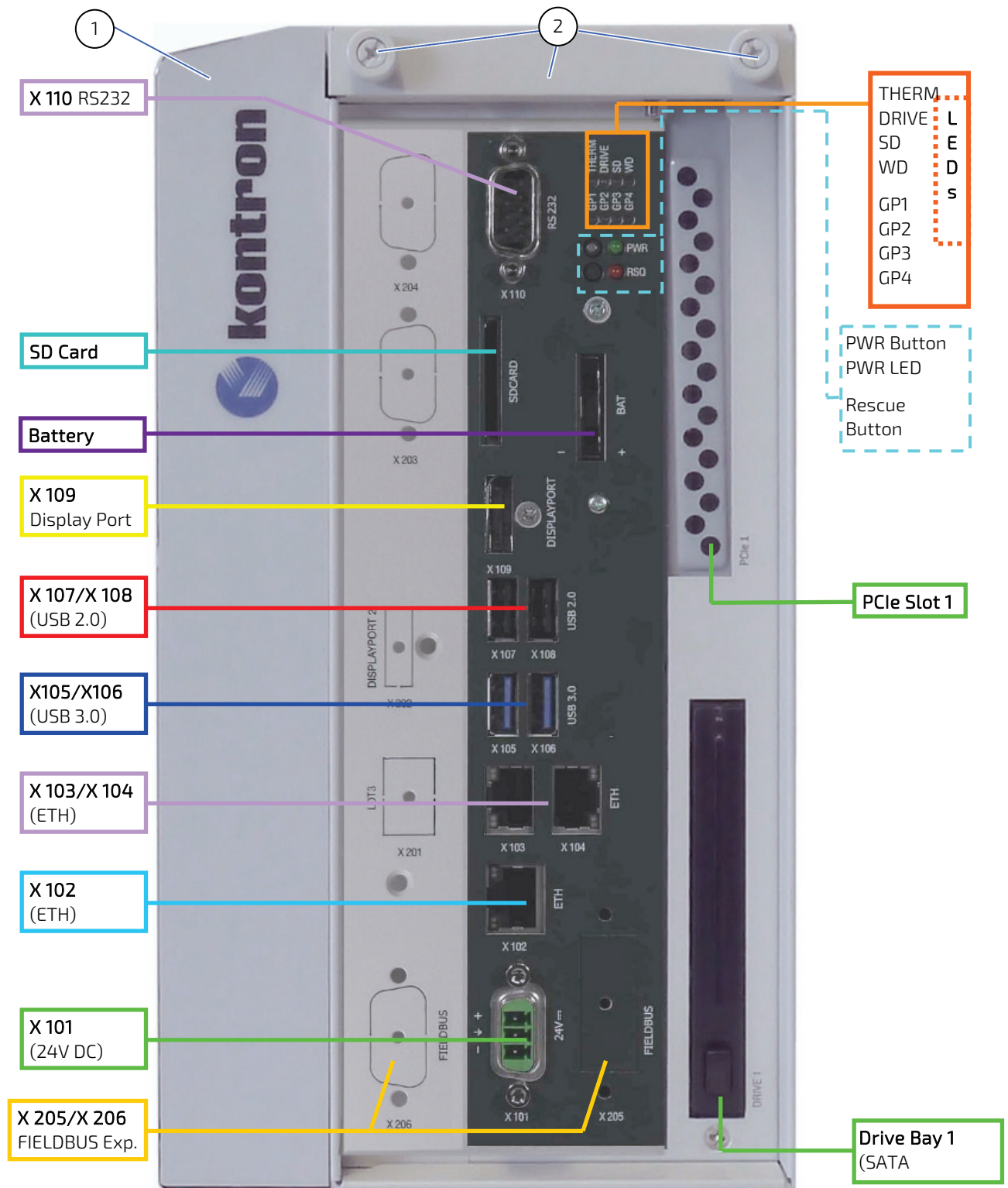
1   Side of KBox C-102-1 with cooling fins

2   Top side cover with knurled screws

Figure 62: Block Diagram – KBox C-102-1
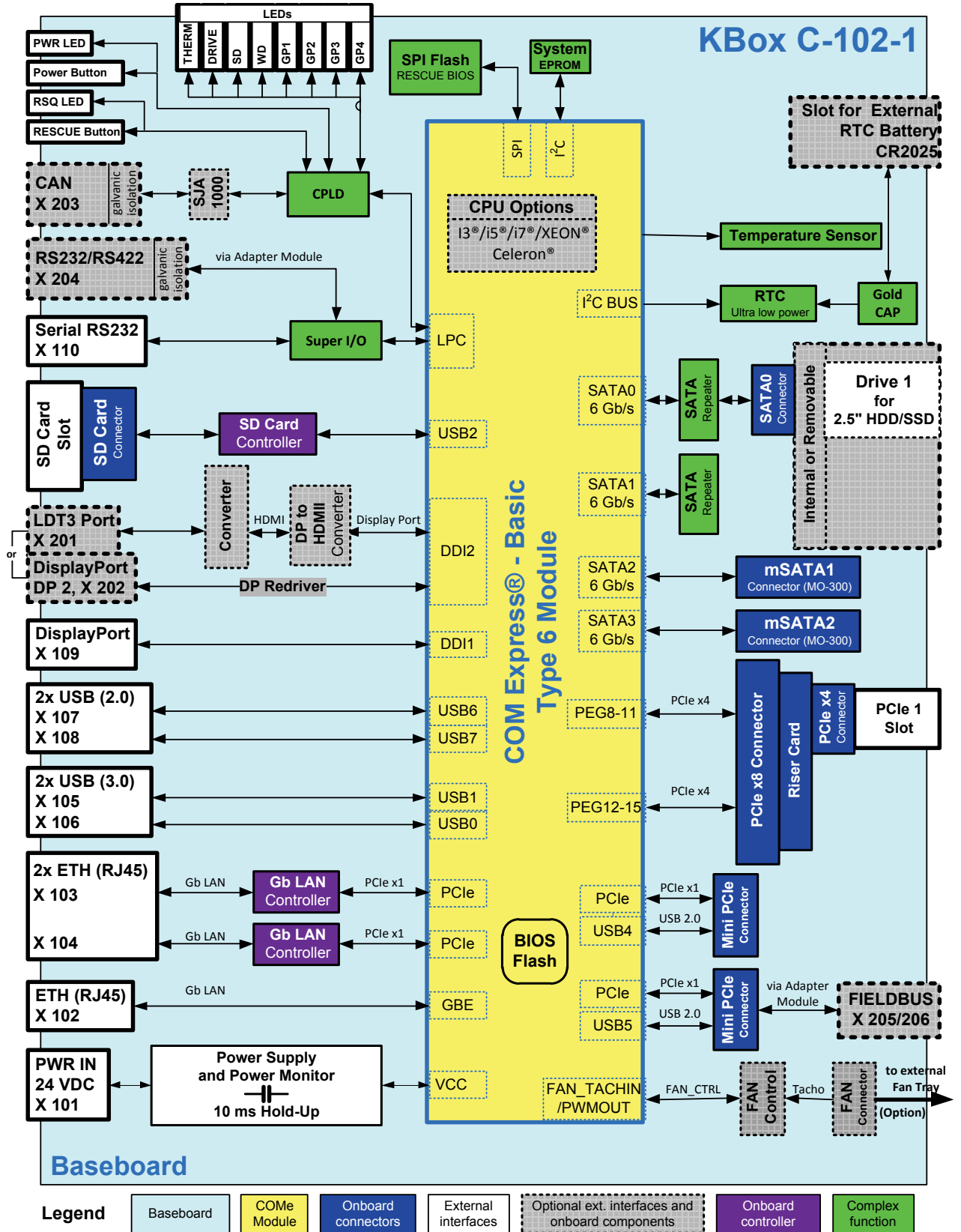
13.1. KBox C-102-1 - System Expansion Capabilities

> Please observe that the KBox C-102-1 can be equipped with only one internal 2.5" SATA HDD/SSD or one removable 2.5" SATA HDD/SSD.
>
> Only the "PCIe 1" slot for one PCIe x4/PCIe x1 expansion card is available on the front side of the system. Refer also to the subsection 7.4.
>
> For system design refer also to Figure 61, Figure 62, chapter 18 "Technical Specifications" and subsection 16.1.5 and 16.1.6.

13.1.1. PCIe Expansion Slot 1

The KBox C-102-1 provides at the front side one "PCIe 1" slot (Figure 61). You can install a half-length PCIe x4 or PCIe x1 expansion card. To access the PCIe x4 socket in order to install or remove the PCIe expansion card you have to remove the top side access cover. For a better accessibility of the expansion socket you should remove the right side access cover (Figure 25 and Figure 23, pos. 1 and pos. 3) also; (The description in the subsection 4.5 "Left and Right Side View" is valid also for KBox C-102-1).

Figure 63: Inside of the KBox C-102-1 (shown with a removable HDD)
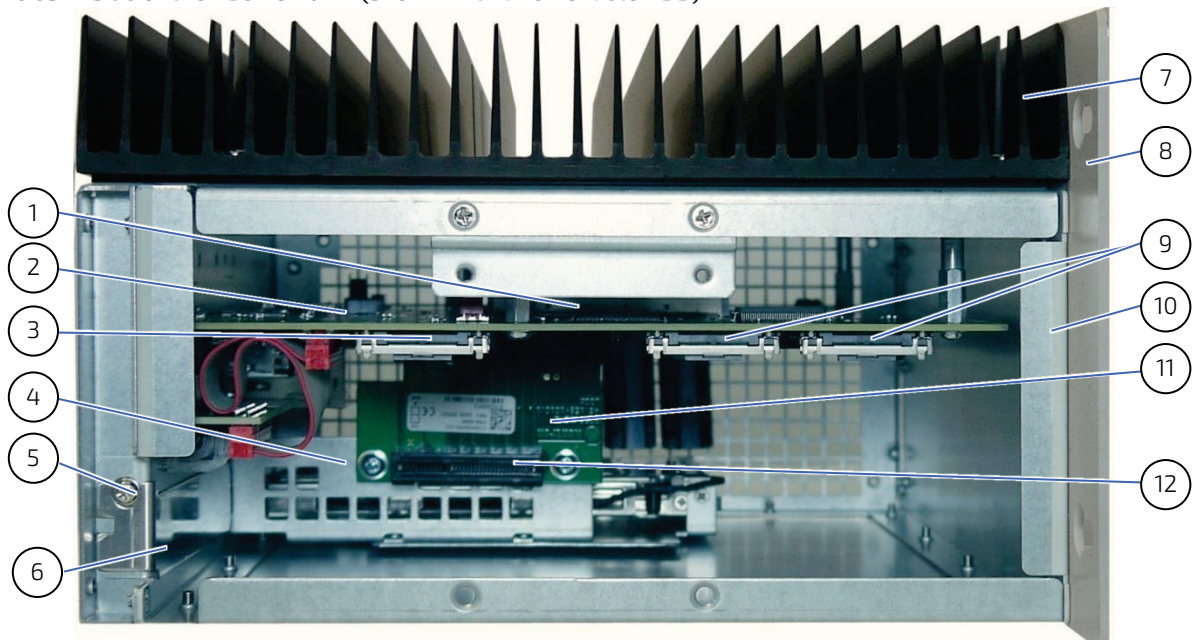
1	COM Express module	7	Cooling fins
2	Baseboard	8	Upper mounting bracket with key holes
3	Mechanical fixing assemblies for 1x PCIe Mini card; (two fixing bolts for each PCIe Mini card)	9	Mechanical fixing assemblies for 2x 2.5" mSATA SSD (two fixing bolts for each mSATA SSD)
4	Installed removable 2.5" drive bay (not included)	10	Cover retaining plate on the rear side
5	Screw to secure the expansion slot/card bracket	11	Riser card with 1x PCIe x4 expansion socket
6	Slot bracket for the for the PCIe 1 expansion slot	12	Free PCIe x4 socket (for PCIe 1 slot)

For installation/removing of the PCIe expansion card (installed into the "PCIe 1" slot) refer to the subsection 6.3.5 "Installing/Removing PCI/PCIe Expansion Cards", with observation that only one PCIe slot is available ("PCIe 1").

> Please observe that for KBox C-102-1 only one PCIex4/PCIe x1 expansion card can be installed into the available PCIe x4 socket of the riser card (Figure 63, pos. 11 and pos. 12).

13.1.2. Internal or Removable 2.5" SATA HDD/SSD

Depending on the ordered system configuration, your KBox C-102-1 can be equipped with one 2.5" SATA removable drive bay (refer to Figure 61, "DRIVE 1") or one internal mounting frame for 2.5" SATA HDD/SSD.

The internal 2.5" HDD/SSD is not accessible from the outside. The internal SATA HDD/SSD is installed (always factory installed) into the system by the use of a mounting frame.

The drive bay (DRIVE 1) for removable 2.5" SATA HDD/SSD is accessible from the front side of the system.

This interface of the KBox C-102-1 system (if internal or external accessible) supports speeds of up to SATA 6 Gb/s.

NOTICE	This SATA interface supports hot-swapping.
	To prevent data loss, don't remove the HDD/SSD during read/write activity [while the "DRIVE LED" (Figure 18) is flashing green].

Your KBox C-102-1 can be equipped with one drive bay for a removable HDD/SSD (refer to Figure 61, "DRIVE 1") or one internal mounting frame for a 2.5" SATA HDD/SSD.

If the KBox C-102-1 configuration with internal 2.5" SATA HDD/SSD was ordered, the "DRIVE 1" for removable 2.5" SATA SATA HDD/SSD is not available on the front side of the system; refer to Figure 9, under consideration of the system design (Figure 61, Figure 62) and mechanical differences (see 16.1.5 and 16.1.6).

Refer also to the area marked "D" in the section 4.4.

14/ KBox C-102-0 Variant

Please refer to the description in this manual for KBox C-102 and the chapter 16/ "Technical Specifications".

Figure 64: KBox C-102-0 - front view (shown without mounting brackets)
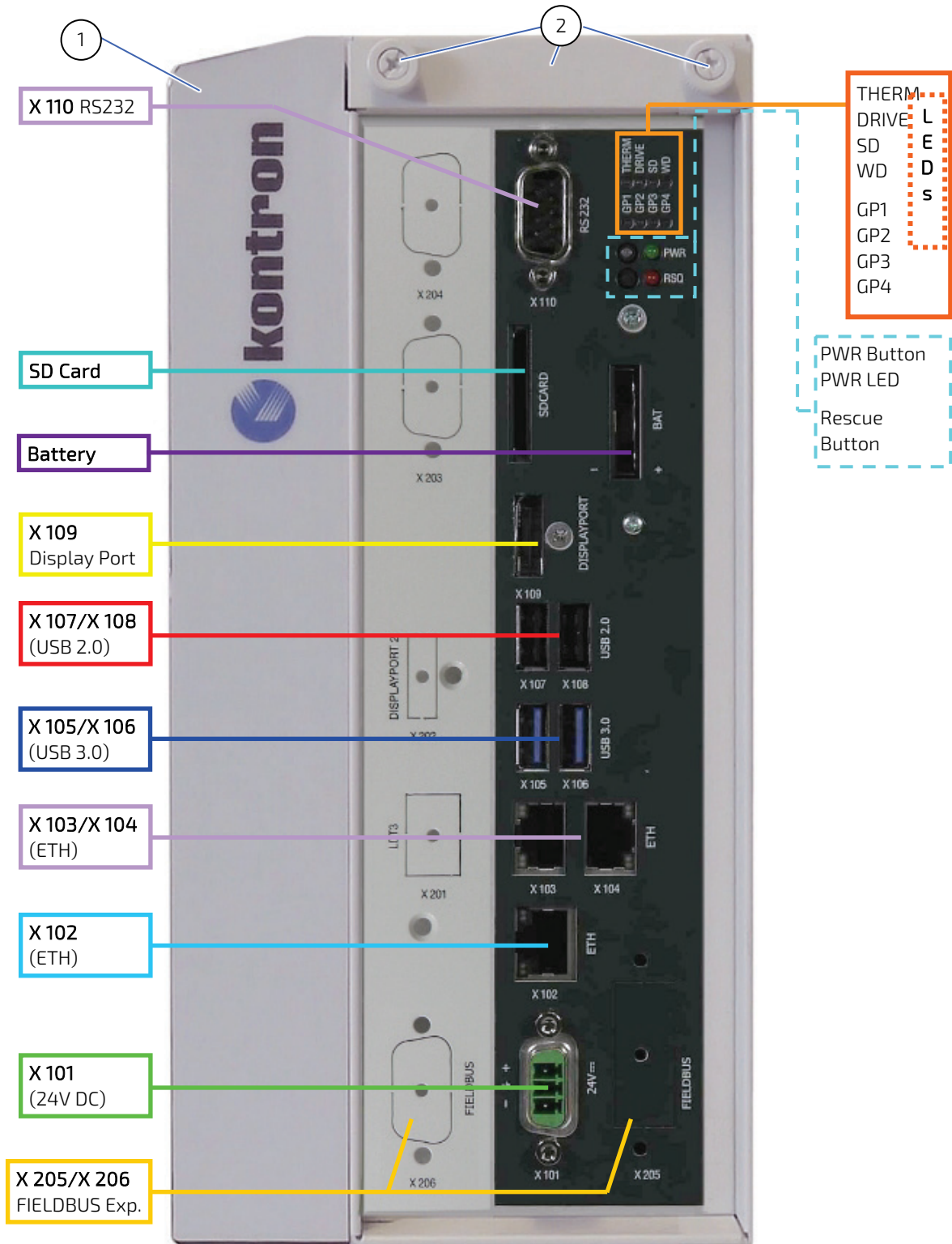
1   Side of KBox C-102-0 with cooling fins

2   Top side cover with knurled screws

Figure 65: Block Diagram - KBox C-102-0
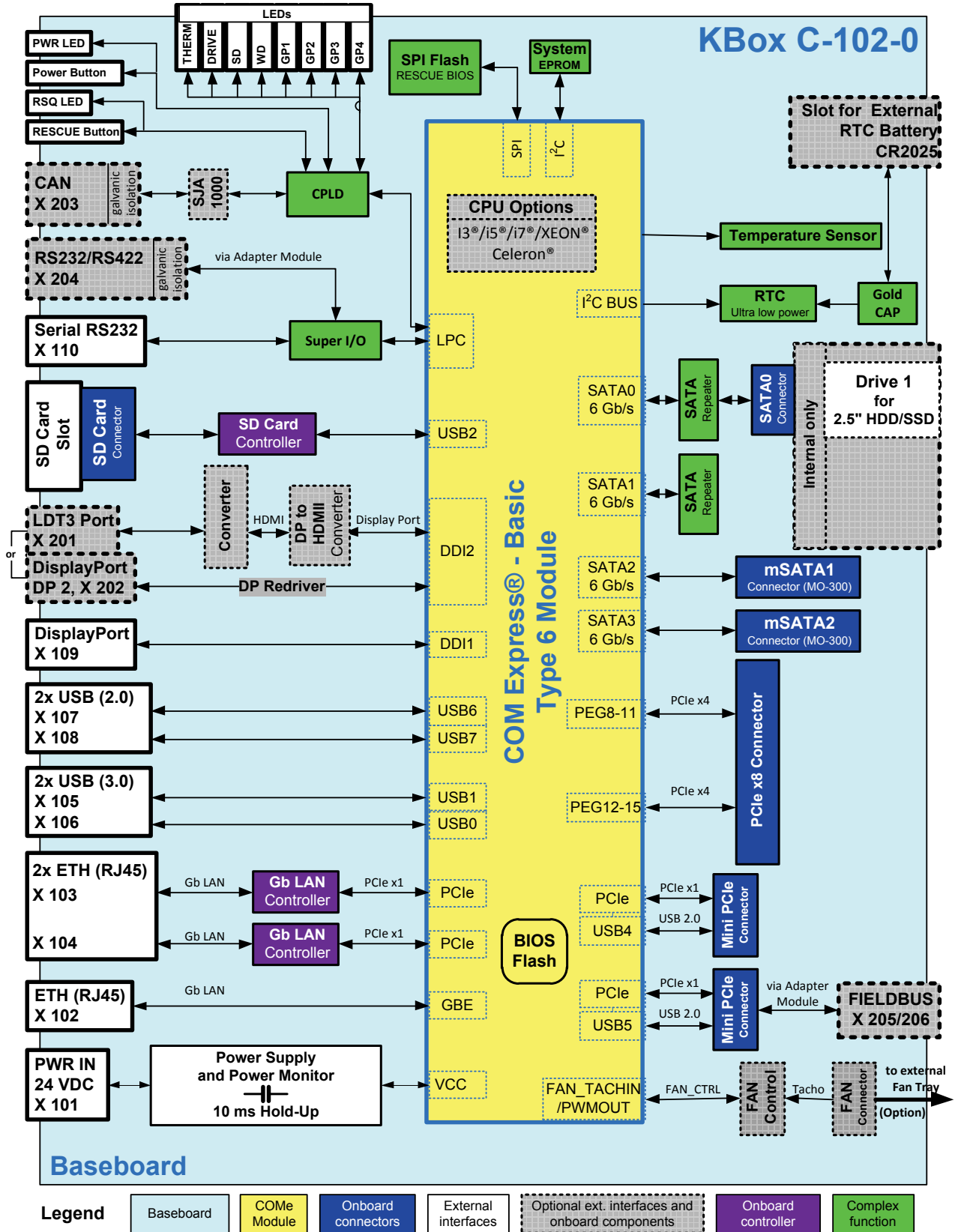
14.1. KBox C-102-0 - System Expansion Capabilities

> **i**
> Please observe that the KBox C-102-0 can be equipped with only one internal 2.5" SATA HDD/SSD.
>
> No external accessible removable drive bay and PCIe slot are available on the front side. Refer also to the subsection 4.4.
>
> For system design refer also to Figure 64, Figure 65, chapter 16/ "Technical Specifications" and subsection 16.1.7 "Mechanical Specifications of the KBox C-102-0".

14.1.1. Internal 2.5" SATA Drive

The KBox C-102-0 can be equipped with only one internal 2.5" SATA HDD/SSD (always factory installed).
The picture below shows the KBox C-102-0 configuration with the internal 2.5" SATA SSD (installed into the mounting frame).

Figure 66: KBox C-102-0 - internal view with the internal HDD/SSD drive
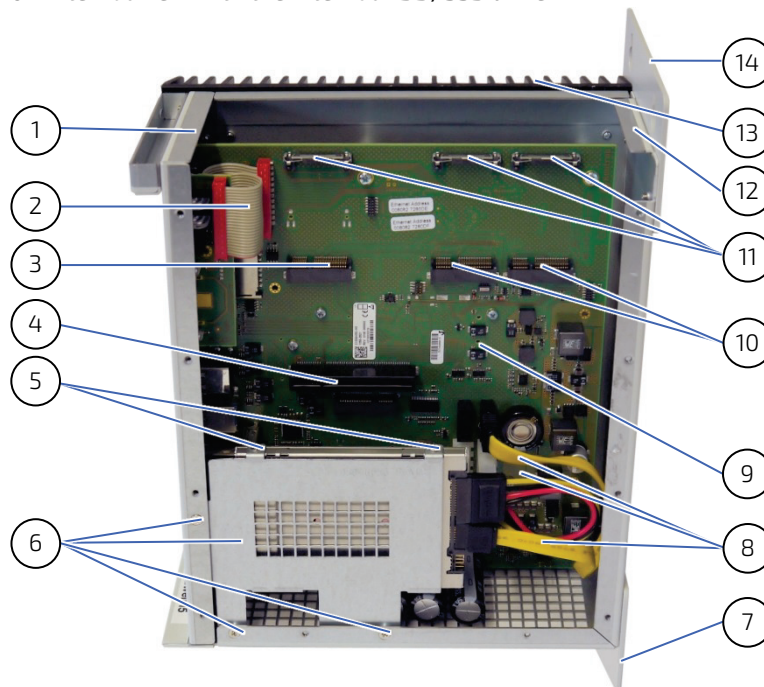
1	Cover retaining bracket on the front side	8	1x SATA cable connections (power and data)
2	LED indicators circuit	9	Baseboard
3	1x Mini PCIe socket for PCIe Mini card (please observe the note below)	10	2x mSATA sockets
4	PCI x8 socket (not used in this configuration)	11	Mechanical fixing assemblies for: 2x 2.5" mSATA SSD and 1x PCIe Mini card (two fixing bolts for each mSATA SSD and PCIe Mini card) (please observe the note below)
5	Screws that secure the internal 2.5" SATA HDD/SSD into the mounting frame		
6	Mounting frame for the 1x internal 2.5" SATA HDD/SSD and screws that secure it to the chassis	12	Cover retaining bracket on the rear side
		13	Cooling fins
7	Lower mounting bracket with key holes	14	Upper mounting bracket with key holes

> **i**
> The KBox C-102 provides two internal Mini PCIe sockets. You can see one of them in Figure 38, pos. 4.
> The second Mini PCIe socket is on the bottom side of the baseboard and can be only at factory equipped with an expansion card.

15/ uEFI BIOS

1.1. Starting the uEFI BIOS

The KBox C-102 is provided with a Kontron-customized, pre-installed and configured version of Aptio® V uEFI BIOS based on the Unified Extensible Firmware Interface (uEFI) specification and the Intel® Platform Innovation Framework for EFI. This uEFI BIOS provides a variety of new and enhanced functions specifically tailored to the hardware features of the KBox C-102.

> **i** The BIOS version covered in this document might not be the latest version. The latest version might have certain differences to the BIOS options and features described in this chapter.

> **i** Register for the EMD Customer Section to get access to BIOS downloads and PCN service.

The uEFI BIOS comes with a Setup program that provides quick and easy access to the individual function settings for control or modification of the uEFI BIOS configuration. The Setup program allows for access to various menus that provide functions or access to sub-menus with further specific functions of their own.

To start the uEFI BIOS Setup program, follow the steps below:

1. Power on the board.

2. Wait until the first characters appear on the screen (POST messages or splash screen).

3. Press the <DEL> key.

4. If the uEFI BIOS is password-protected, a request for password will appear. Enter either the User Password or the Supervisor Password (see Chapter 6.2.4 Security Setup Menu), press <RETURN>, and proceed with step 5.

5. A Setup menu appears.

The KBox C-102 uEFI BIOS Setup program uses a hot key navigation system. The hot key legend bar is located at the bottom of the Setup screens. The following table provides a list of navigation hot keys available in the legend bar.

Table 6: Navigation Hot Keys Available in the Legend Bar

Sub-screen	Description
<F1>	<F1> key invokes the General Help window
<->	<Minus> key selects the next lower value within a field
<+>	<Plus> key selects the next higher value within a field
<F2>	<F2> key loads previous values
<F3>	<F3> key loads optimized defaults
<F4>	<F4> key Saves and Exits
<→> or <←>	<Left/Right> arrows selects major Setup menus on menu bar, for example, Main or Advanced
<↑> or <↓>	<Up/Down> arrows select fields in the current menu, for example, Setup function or sub-screen
<ESC>	<ESC> key exits a major Setup menu and enters the Exit Setup menu Pressing the <ESC> key in a sub-menu displays the next higher menu level
<RETURN>	<RETURN> key executes a command or selects a submenu

1.2. Setup Menus

The Setup utility features menus listed in the selection bar at the top of the screen:

▶ Main

▶ Advanced

▶ Chipset

▶ Security

▶ Boot

▶ Save & Exit

The left and right arrow keys select the Setup menus. The currently active menu and the currently active uEFI BIOS Setup item are highlighted in white.

Each Setup menu provides two main frames. The left frame displays all available functions. Configurable functions are displayed in blue. Functions displayed in grey provide information about the status or the operational configuration. The right frame displays an Item Specific Help window providing an explanation of the respective function.

1.2.1. Main Setup Menu

On entering the uEFI BIOS the Setup program displays the Main Setup menu. This screen lists the Main Setup menu sub-screens and provides basic system information as well as functions for setting the system language, time and date. The following table shows Main sub-screens and functions, and describes the content. Default settings are in **bold**.

Table 7: Main Setup Menu Sub-screens and Functions

Sub-Screen	Description
BIOS Information>	Read only field Displays information about the BIOS system Vendor, Core version, Compliancy, Kontron BIOS Version, and Access level
Board Information>	Read only field *Displays Board Information:* Board ID, Fab ID, and LAN PHY revision
Processor Information>	Read only field *Displays Processor Information:* Name, Type, Speed, ID, Stepping, Number of Processors, Microcode Revision, and GT Info *Displays BIOS Version and Memory RC Version Information:* IGFX VBIOS Version, IGFX GOP Version, Memory RC Version Total Memory and Memory Frequency.
PCH Information>	Read only field *Displays PCH information:* Name, PCH SKU, Stepping, and Hsio Revision *Displays SPI Clock Information:* Read ID/Status Clock Frequency, Write and Erase Clock Frequency, and Fast Read Clock Frequency, Read Clock Frequency *Displays Firmware Information:* ME FWVersion and ME Firmware SKU
System Language>	Selects system default language [**English**]
Platform Information>	Read only field *Displays Module Information* Product Name, Revision, Serial # ,MAC Addresses (ETH), Boot Counter, and CPLD Rev *Displays Carrier Board Information* Product Name, Revision Serial No., Carrier Board ID
	Additional information for MAC Address The MAC address entry is the value used by the Ethernet controller and may contain the entry' Inactive' - Ethernet chip is inactive. To activate the Ethernet chip set the following: Advanced > Network Stack Configuration > Network Stack > Enable 88:88:88:88:87:88 is a special pattern that will be filled in by the Ethernet firmware if there is no valid entry in the firmware block of the BIOS SPI (i.e. the MAC address has been overwritten during the last attempt to flash the system). For more information, see chapter 15.3 "Updating the uEFI BIOS".

Sub-Screen	Description
System Date>	Sets the system date [Week Day mm/dd/yyyy]
System Time>	Sets the system time [hh:mm:ss]

1.2.2. Advanced Setup Menu

The Advanced Setup menu provides sub-screens and second level sub-screens with functions, for advanced configuration and Kontron specific configurations.

| **NOTICE** | Setting items on this screen to incorrect values may cause system malfunctions. |

Figure 67: Advanced Setup Menu Initial Screen
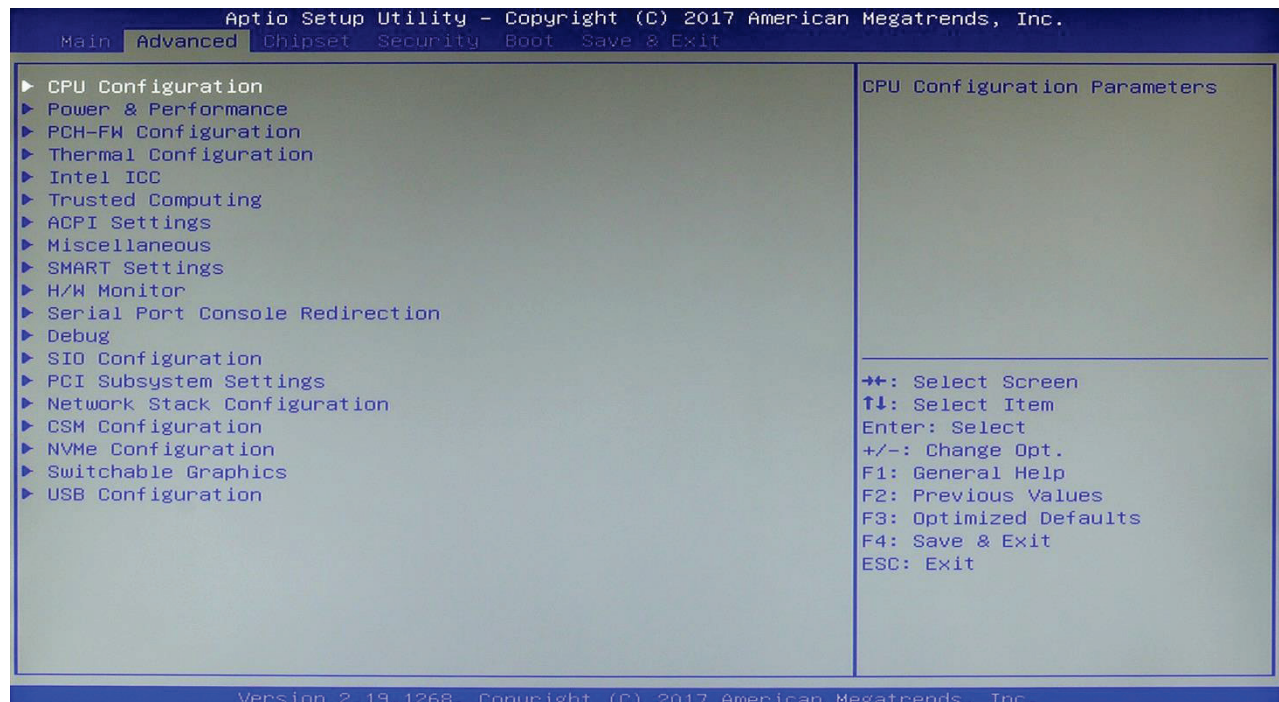
The following table shows the Advanced menu sub-screens and functions and described the content. Default settings are in **bold** and some functions include additional information.

Table 8: Advanced Setup Menu Sub-Screens and Functions

Sub-Screen	Function	Second level Sub-Screen / Description	
CPU Configuration>	Read only field *Displays CPU Information* Type, ID, Speed, L1 Data Cache, L1 Instruction Cache, L2 Cache, L3 Cache, L4 Cache, VMX, and SMX/TXT		
	Intel (VMX) Virtualization Technology>	Enables VMM to utilize additional hardware capabilities provided by Vanderpool Technology [**Enabled**, Disabled]	
	Active Processor Cores>	Displays number of cores to be enabled in each processor package [**All**, 1, 2, 3]	
Power and Performance>	CPU Power Management Control>	Boot Performance Mode>	Selects the performance state the BIOS sets before OS handoff [**Max. Non-Turbo Perf**., Max. Battery, Turbo Perf.]

Sub-Screen	Function	Second level Sub-Screen / Description	
Power and Performance> (continued)	CPU Power management Control> (continued)	Intel® Speedstep ™>	Allows support for more than two frequency ranges [**Enabled**, Disabled]
		Intel® Speed Shift Technology>	Intel Speed Shift Technology support. Enable exposes CPPC v2 interface to allow for hardware controlled P-states. [**Enabled**, Disabled]
		Turbo Mode>	Enables or disables Processor Turbo mode. Note: EMTTM must also be enabled. Auto means enabled unless the max. turbo ratio is bigger than 16-SKL A0 W/A. [**Enabled**, Disabled]
		C-states>	Enables or disables CPU power management to allow CPU to enter C-Sates when not 100% utilized. [**Enabled,** Disabled]
		Enhanced C-states>	Enables or disables C1E. If enabled CPU switches to minimum speed when all cores enter C-state. [**Enabled**, Disabled]
		Packaged C-state Limit>	Maximum Package C-State limit setting. Default: leaves the factory default value. Auto initializes to deepest available package c-state limit. [Auto, CPU Default, C10, C9, C8, C7S, C7, C6, **C3**, C2, C0/C1]
		Thermal Monitor>	Enable/disable thermal monitor [**Enabled**, Disabled]
	GT Power management Control>	RC6 (Render standby)>	Check to enable render standby support. [**Enabled**, Disabled]
		Maximum GT Frequency>	Maximum GT frequency limited by user. Choose from range 350 MHz (RPN) to 1000 MHz (RPO). Out of range values are clipped to the minimum and maximum range values above. [**Default Max Frequency**, 100 MHz, – 1200 MHz]
PCH-FW Configuration>	Read only fields ME FW Version, ME Firmware Mode, ME Firmware SKU, ME File System Integrity Value, ME Firmware Status 1, ME Firmware Status 2 and NFC Support.		
	ME State>	If disabled, ME enters ME temporarily disabled mode. [**Enabled**, Disabled]	
	ME Unconfig ON RTC Clear>	If disabled, ME is not unconfigured on RTC clear. Enables or disables ME FW Image RE-Flash function	
	Comms Hub Support>	Support for Comms hub [Enabled, **Disabled**]	
	JHI Support>	Enables or disables Intel® DAL Host Interface Service (JHI) [Enabled, **Disabled**]	
	Core BIOS Done Message>	Enables or disables core BIOS done message sent to ME [**Enabled**, Disabled]	
	Firmware Update Configuration>	ME FW Image Re-Flash>	Enables or disables ME FW Image RE-Flash function [Enabled, **Disabled**]
		Local FW Update>	Enables or disables local FW update function [**Enabled**, Disabled]

Sub-Screen	Function	Second level Sub-Screen / Description	
Thermal Configuration>	CPU Thermal Configuration>	DTS SMM>	ACPI thermal management uses either HWM reported values when disabled or DTS SMM mechanism to obtain CPU temperatures values when enabled. Note: enabling DTS might deteriorate the system's real time behavior through handling the necessary SMMs. [Enabled, **Disabled**, Critical Temp Reporting]
		Tcc Activation Offset>	Displays the offset from the factory TCC (Thermal Control Circuit) activation temperature. Note: this values is subtracted from the TCC threshold, i.e. '0' means maximum allowed temperature. [**0**]
		ACPI T-states>	ACPI T-States [Enabled , **Disabled**]
	Platform Thermal Configuration>	Automatic Thermal Reporting>	Enable -configures ACPI thresholds according to INTEL thermal management settings and disable allows for manual configuration. [Enabled, **Disabled**]
		Critical Trip Point>	Controls the temperature of the ACPI Critical Trip Point at which OS shuts off the system. Note: The plan of record (POR) for Intel® Mobile Processors is 119°. [127°C, **119°C**, 111°C, 103°C, 100°C, 95°C, 87°C, 79°C, 71°C, 63°C, 55°C, 47°C, 39°C, 31°C, 23°C, 15°C]
		Passive Trip Point>	Controls temperature of ACPI Passive Trip Point at which OS begins to throttle the processor. [119°C, 111°C, 103°C, 100°C, **95°C**, 87°C, 79°C, 71°C, 63°C, 55°C, 47°C, 39°C, 31°C, 23°C, 15°C, Disabled]
		Passive TC1 Value>	Sets TC1 values for ACPI passive cooling formula (Range: 1-16) [**1**]
		Passive TC2 Value>	Sets TC2 values for ACPI passive cooling formula (Range: 1-16) [**5**]
		Passive TSP Value>	Sets TSP value for ACPI passive cooling formula. TSP value represents how often OS reads the temperature when passive cooling is enabled. (Range: 2-32) [**10**]
		Passive Trip Points>	Passive Trip Points [Enabled, **Disabled**]
		Critical Trip Points>	Critical Trip Points [**Enabled**, Disabled]
Intel ICC>	ICC/OC Watchdog Timer>		Enabling exposes the ICC/OC watchdog timer to OS as ACPI device. BIOS always uses WDT HW when changing clock setting. [Enabled, **Disabled**]
	ICC Locks After EOP>		Specifies the ICC registers to write to, after end of post. Default - Dynamic registers for runtime clock adjustements are left writeable. All locked - No clock register adjustements allowed after EOP. All Unlocked – All ICc registers can be written after EOP. [**Default,** All Locked, All Unlocked]

Sub-Screen	Function	Second level Sub-Screen / Description
Intel ICC> (continued)	ICC Profile>	Read only field Specified the ICC profile [**0**]
Trusted Computing>	Security Device Support>	Enables or disables BIOS support for security device. Operating system will not show security device. TCG EFI protocol and INT1A interface are not available. [**Enabled,** Disabled]
	Active PCR Banks>	Read only field Displays active PCR Banks [**SHA-1,SHA256**]
	Available PCR Banks>	Read only field Displays available PCR Banks [**SHA-1,SHA256**]
	SHA-1 PCR Bank>	SHA-1 PCR Bank [**Enabled**, Disabled]
	SHA256 PCR Bank>	SHA256 PCR Bank [**Enabled**, Disabled]
	Pending Operation>	Schedules operation for Security Device Note: Computer reboots on restart in order to change the state of the security device. [**None**, TPM Clear]
	Platform Hierarchy>	Platform Hierarchy [**Enabled**, Disabled]
	Storage Hierarchy>	Storage Hierarchy [**Enabled**, Disabled]
	Endorsement Hierarchy>	Endorsement Hierarchy [**Enabled**, Disabled]
	TPM2.0 UEFI Spec Version>	Selects TCG2 Spec Version support. TCG_1_2 is compatible mode for Win8/Win10 and TCG_2 supports TCG2 protocol + event format Win 10 or later. [TCG_1_2, **TCG_2**]
	Physical Presence Spec Version>	Select to tell OS to support either PPI Spec 1.2 or 1.3 Note: Some HCK tests might not support 1.3. [1.2, **1.3**]
	TPM 20 InterfaceType>	Read only field [**TIS**]
	Device Select>	BIOS support for security devices. Auto supports both TPM 1.2 and TPM 2.0. TPM 1.2 restricts support to TPM 1.2 devices and TPM 2.0 restricts support to TPM 2.0. devices. [TPM 1.2, TPM 2.0, **Auto**]
ACPI settings>	Enable ACPI Auto Configuration>	Enables or disables BIOS ACPI auto configuration. If enabled, the system uses generic ACPI settings that may not fit the system best. [Enabled, **Disabled**]
	Enable Hibernation>	Enables or disables systems ability to hibernate (OS/S4 Sleep State) This option may not be effective with some operating systems. [**Enabled**, Disabled]
	ACPI Sleep State>	Selects highest ACPI sleep state that the system enters when SUSPEND button is pressed [Suspend Disabled, **S3 (Suspend to Ram)**]

Sub-Screen	Function	Second level Sub-Screen / Description	
ACPI settings> (continued)	Lock Legacy Resources>	Enables or disable lock of legacy resources [Enabled, **Disabled**]	
	S3 Video Repost>	Enables or disables S3 video repost [Enabled, **Disabled**]	
Miscellaneous>	Watchdog>	Auto Reload>	Enables automatic reload of watchdog timers on timeout [Enabled, **Disabled**]
		Global Lock>	Enable sets all Watchdog registers (except for WD_KICK) to read only, until board is reset. [Enabled, **Disabled**]
		Stage 1 Mode>	Selects action for this Watchdog stage [**Disabled**, Reset, NMI, SCI, Delay, WDT Signal only]
	Additional Information two-staged watchdog Programmable stages to trigger different actions - If one stage is disabled, then the next stage is also disabled. Common actions for a watchdog trigger events 'Delay', 'Reset' and 'Watchdog signal only' CPLD code allows for triggering NMI or SCI. This needs programming of a predefined action inside the BIOS and therefore can only be used in a customized BIOS solution. Timeouts that can be set to eight different fixed values between 1 second and 30 minutes.		
	Reset Button Behavior>	Selects reset button behavior [**Chipset Reset**, Power cycle]	
	I2C Speed>	Selects internal I2C bus speed between (1 kHz and 400 kHz) [**200 kHz**]	
	On-board I2C Mode>	Keep 'Multimaster' setting unless otherwise noted [**MultiMaster**, BusClear]	
	Manufacturing Mode>	Read only field [**Disabled**]	
	LID Switch Mode>	Shows or hides Lid Switch Inside ACPI OS. The default setting is disabled. [**Disabled**, Active normal, Active inverse]	
	Sleep Button Mode>	Shows or hides Sleep Button inside ACPI OS. Default setting is disabled. [Enabled, **Disabled**]	
	ACPI Temperature Polling>	Sets mode used for temperature polling through the OSPM (0 is disabled and 1 enabled9. [Enabled, **Disabled**]	
	PCI ExpressCard 0>	Controls PCIe port for ExpressCard support If not used, keep in the disabled state. [Port 1, Port 2, Port 3, Port4, **Disabled**]	
	PCI ExpressCard 1>	Controls PCIe port for ExpressCard support If not used, keep in the disabled state. [Port 1, Port 2, Port 3, Port4, **Disabled**]	
SMART Settings>	Smart Self Test>	Run Smart Self Test on all HDDs during POST [Enabled, **Disabled**]	
H/W Monitor>	CPU Temperature>	Read only field Displays CPU temperature in °C	
	Module Temperate>	Read only field Displays module temperature in °C	

Sub-Screen	Function	Second level Sub-Screen / Description
H/W Monitor> (continued)	Carrier Temerature>	Read only field Displays carrier temperature in °C
	External Fan– Fan Control>	Sets Fan Control mode for external fan Disabled - stops the fan Manual – manually set the fan Auto - hardware monitor controls cooling, similar to ACPI based 'Active Cooling', without producing a software load to the system. [Disable, Manual, **Auto**]
	External Fan– Fan Pulse>	Displays number of pulse fan produces during 1 revolution (Range: 1-4) [**2**]
	External Fan- Fan Trip point>	Displays temperature at which fan accelerates. (Range: 20°C to 80°C) [**50**]
	External Fan- Trip Point Speed>	Displays Fan speed at trip point in %. Minimum value is 30% Fan always runs at 100% at TJmax (-10°C) [**30**]
	External Fan Reference Temperature>	Determines temperature source used for automatic fan control [PCH Temperature, Module Temperature, **CPU Temperature**]
	Additional information External Fan An external fan can be connected to baseboard. The external fan's control lines are routed via the COMe connector.	
	5.0V Standby>	Read only field Displays standby voltage
	Batt Volt. at COMe Pin>	Read only field Displays battery voltage at COMe pin
	Widerange Vcc>	Read only field Displays wide range VCC
Serial Port Console Redirection>	COM0 Console Redirection>	Console redirection via COMe module's COM1. If redirection is enabled then the port settings such as Terminal type, Bits per second, Data bits, Parity etc. can be adjusted here. Note: on-module COM ports do not support flow control. [Enabled, **Disabled**]
	COM1 Console Redirection>	Console redirection via COMe module's COM2. If redirection is enabled, then the port settings such as Terminal type, Bits per second, Data bits, Parity etc. can be adjusted here. Note: On-module COM ports do not support flow control. [Enabled, **Disabled**]
	COM0 Console Redirection>	Console redirection via COM3, available with an optional Winbond SuperIO on the baseboard. (Default is disabled) If redirection is enabled, then the port settings such as Terminal type, Bits per second, Data bits, Parity etc. can be adjusted here.' [Enabled, **Disabled**]

Sub-Screen	Function	Second level Sub-Screen / Description	
Serial Port Console Redirection> (continued)	COM1 Console Redirection Settings>	Console redirection via COM4, available with an optional Winbond SuperIO on the baseboard. (Default is disabled) If redirection is enabled, then the port settings such as Terminal type, Bits per second, Data bits, Parity etc. can be adjusted in 'Settings'. [Enabled, **Disabled**]	
	COM2/COM3 Console Redirection>	Read only field Port is disabled	
	Legacy Console Redirection>	Legacy Serial Redirection Port>	Selects a COM port to display redirection of legacy OS and legacy OPROM messages [**COM0**, COM1, COM2 (disabled), COM3 (disabled)]
	Serial Port for Out-of-Band Management / Windows EMS Console Redirection>	Console redirection [Enabled, **Disabled**]	
Debug>	Clear Setup Items>	Clear Setup Items [Enabled, **Disabled**]	
SIO Configuration>	Serial Port 2>	Use This Device>	Enables or disables the use of this logical device. [**Enabled**, Disabled]
		Logical Device Settings: Current>	Read only field IO=3F8h; IRQ=4
		Logical Device Settings: Possible>	Allows the user to change the device's resource settings. New settings are reflected on the Setup page after system restarts. [**Use Automatic Settings**, IO=3F8h; IRQ=4; DMA IO=3F8h; IRQ=3,4,5,7,9,10,11,12;DMA IO=2F8h; IRQ=3,4,5,7,9,10,11,12; DMA IO=3E8h; IRQ=3,4,5,7,9,10,11,12; DMA IO=2E8h; IRQ=3,4,5,7,9,10,11,12; DMA
	Serial Port 3>	Use This Device>	Enables or disables the use of this logical device. [**Enabled**, Disabled]
		Logical Device Settings: Current>	Read only field IO=2F8h; IRQ=3
		Logical device settings: Possible>	Allows the user to change the device's resource settings. New settings are reflected on the Setup page after system restart. [**Use Automatic Settings**, IO=2F8h; IRQ=3, IO=3F8h; IRQ=3,4,5,7,9,10,11,1, IO=2F8h; IRQ=3,4,5,7,9,10,11,12, IO=3E8h; IRQ=3,4,5,7,9,10,11,12, IO=2E8h; IRQ=3,4,5,7,9,10,11,12]
	Additional Information SIO:		

Sub-Screen	Function	Second level Sub-Screen / Description	
SIO Configuration> (continued)	The SIO Configuration menu enables all available serial interfaces to be configured. The module-based serial interfaces always appear as COM1 and COM2. COM 1 and COM 2 can be treated as 16550-compatible legacy COM interfaces at the standard I/O addresses and are based in the on-module CPLD. Note: Hardware flow control is not supported. Optionally, If the baseboard contains an activated SuperIO of the type Winbond 83627, then its serial interfaces are added to the system as COM3 and COM4. COM3 and COM4 IRQ and I/O addresses are configurable in this menu, too. Although the chipset internal COMs are not supported due to technical constraints their driver must be installed. Installing the driver does not mean that these serial interfaces are useable. Warning: Logical Devices state on the left side of the control reflects the current logical device state. Changes made during the setup session are shown after restarting the system.		
PCI Subsystem Settings>	PCI Latency Timer>	Displays value to be programmed into the PCI latency timer register [**32**, 64, 96, 128, 160, 192, 224, 248 Bus Clocks]	
	PCI-X Latency Timer>	Displays value to be programmed into the PCI latency timer register [32, **64**, 96, 128, 160, 192, 224, 248 Bus Clocks]	
	VGA Palette Snoop>	Enables or disables VGA palette register snooping [Enabled, **Disabled**]	
	PERR# Generation>	Enables or disables PCI device to generate PERR# [Enabled, **Disabled**]	
	SERR# Generation>	Enables or disables PCI device to generate SERR# [Enabled, **Disabled**]	
	Above 4G Decoding>	Enables or disables decoding in Address Space above '4G' for 64 bit capable devices. Note: Only if system supports 64 bit PCI decoding. [Enabled, **Disabled**]	
	PCI Hot-Plug Settings>	BIOS Hot Plug Support>	Enable – allows BIOS built in hot-plug support Note: Use if OS does not support PCIe and SHPC hot-plug natively. [**Enabled**, Disabled]
		PCI Buses Padding>	Padd PCI Buses behind the bridge for hot-plug [Disabled, **1**, 2, 3, 4, 5]
		I/O Resources Padding>	Padd PCI resources behind the bridge for hot-plug [Disabled, **4 k,** 8 k, 16 k, 32 k]
		MMIO 32 bit Resources Padding>	Padd PCI MMIO 32 bit resources behind the bridge for hot-plug. [Disabled, 1 M, 2 M, 4 M, 8 M, **16, M**, 32 M, 64 M, 128 M]
		PFMMIO 32 bit Resources Padding>	Padd PCI MMIO 32 bit pre-fetchable resources behind the bridge for hot-plug. [Disabled, 1 M, 2 M, 4 M, 8 M, **16, M**, 32 M, 64 M, 128 M]
Network Stack Configuration>	Network Stack>	If UEFI network stack is enabled, the Ethernet chip is active. [Enabled, **Disabled**]	
CSM Configuration>	CSM Support>	Enables or disables CSM Support If enabled, the CSM details can be changed. Below 'Option ROM Execution' are 'Network, 'Storage', 'Video' and 'Other PCI devices'.	
	CSM Support> (continued)	Note: 'Network' must be changed to' Legacy' for legacy boot. (Default setting is 'Do not launch'). [**Enabled**, Disabled]	

Sub-Screen	Function	Second level Sub-Screen / Description
CSM Configuration> (continued)		
	CSM16 Module Version>	Read only field *Displays CSM16 Module Version*
	GateA20 Active>	Upon Request – GA20 can be disabled using BIOS services. Always – do not allow disabling GA20; this option is useful when any RT code is executed above 1MB. [**Upon request**; Always]
	Option ROM Messages>	Set display mode for Option ROM [**Force BIOS**; Keep Current]
	INT19 Trap Response>	BIOS reaction on INT19 trapping by Option ROM: Immediate – execute the trap right away; Postponed – execute the trap during legacy boot [**Immediate**; Postponed]
	Boot option filter>	Read only field [**UEFI only**]
	Option ROM execution – Network>	Controls the execution of UEFI and Lagacy PXE OpROM [**Do not launch**; UEFI; Legacy]
	Option ROM execution – Storage>	Controls the execution of UEFI and Lagacy Storage OpROM [Do not launch; UEFI; **Legacy**]
	Option ROM execution – Video>	Controls the execution of UEFI and Lagacy Video OpROM [Do not launch; UEFI; **Legacy**]
	Option ROM execution – Other PCI devices>	Controls the OpROM execution policy for devices other than Network, Storage or Video [Do not launch; UEFI; **Legacy**]
	Additional Information CSM: Compatibility Support Module (CSM) configuration is important for legacy operating systems By default, CSM is enabled. For modern OS such as Windows 8, 10 and Linux CSM can be disabled. If a legacy OS is used or a Windows or Linux system is run in legacy mode then this menu allows for detailed option settings. Note, a change in settings only come into effect after the next restart. Therefore, to be able to use the actualized settings, it is recommended to save and exit the setup and re-enter. The 'Optional ROM Execution' settings requires special care. Any OS using an INT10 based display output needs the 'Video' option set to 'Legacy', in the same way that PXE boot needs 'Network' 'Optional ROM' to be set to 'Legacy'.	
NVMe Configuration>	Read only field Acts as a message showing NVMe (Non-Volatile memory PCIe) devices connected to the system. [**NO NVME Device Found**]	
Switchable Graphics>	SG Mode Select>	Read only field Switchable graphics selection [**Muxless**]
USB Configuration>	Read only fields USB Configuration, USB Module Version, USB Controllers, and USB devices	
	Legacy USB	Enable- Supports legacy USB

Sub-Screen	Function	Second level Sub-Screen / Description
USB Configuration> (continued)	Support>	Auto– disables legacy support, if no USB devices are connected Disable-keeps USB devices available for EFI applications only [**Enabled**, Disabled, Auto]
	XHCI Hand-off>	XHCI ownership change claimed by XHCI driver. Note: this is a work around for OS(s) without XHCI hand-off support. [**Enabled**, Disabled]
	USB Mass Storage Driver Support>	Enables or disables USB mass storage driver support [**Enabled**, Disabled]
	Port 60/64 Emulation>	Enables I/O port 60h/64h emulation support Note: Enable for USB keyboard legacy support for non-USB aware OS(s). [Enabled, **Disabled**]
	USB Transfer Time-out>	Displays timeout value for control, bulk and interrupt transfers [1 sec, 5 sec, 10 sec, **20 sec**]
	Device Reset Time-out>	Displays USB mass storage device start unit command time-out [10 sec, **20 sec**, 30 sec, 40 sec]
	Device Power-up Delay>	Displays maximum time taken for the device to report itself to the host properly. Auto uses the default :root port 100 ms /hub port delay from hub port descriptor. [**Auto**, Manual]
	Mass Storage Devices>	Mass storgage device emulation type. 'Auto' enumerates devices according to their media format. Optical drives are emulated as 'CDROM', drives with no media will be emulated according to a drive type. Generic Ultra HS-SD/MMC [**Auto**, Floppy, Forced FDD, hard Disk, CD-ROM]

1.2.3. Chipset Setup Menu

On entering the Chipset Setup menu, the screen lists two sub-screen options:

▶ System Agent (previously Northbridge)

▶ PCH-IO (previously Southbridge)

1.2.3.1. Chipset > System Agent Configuration

Figure 68: System Agent Configuration Menu Initial Screen
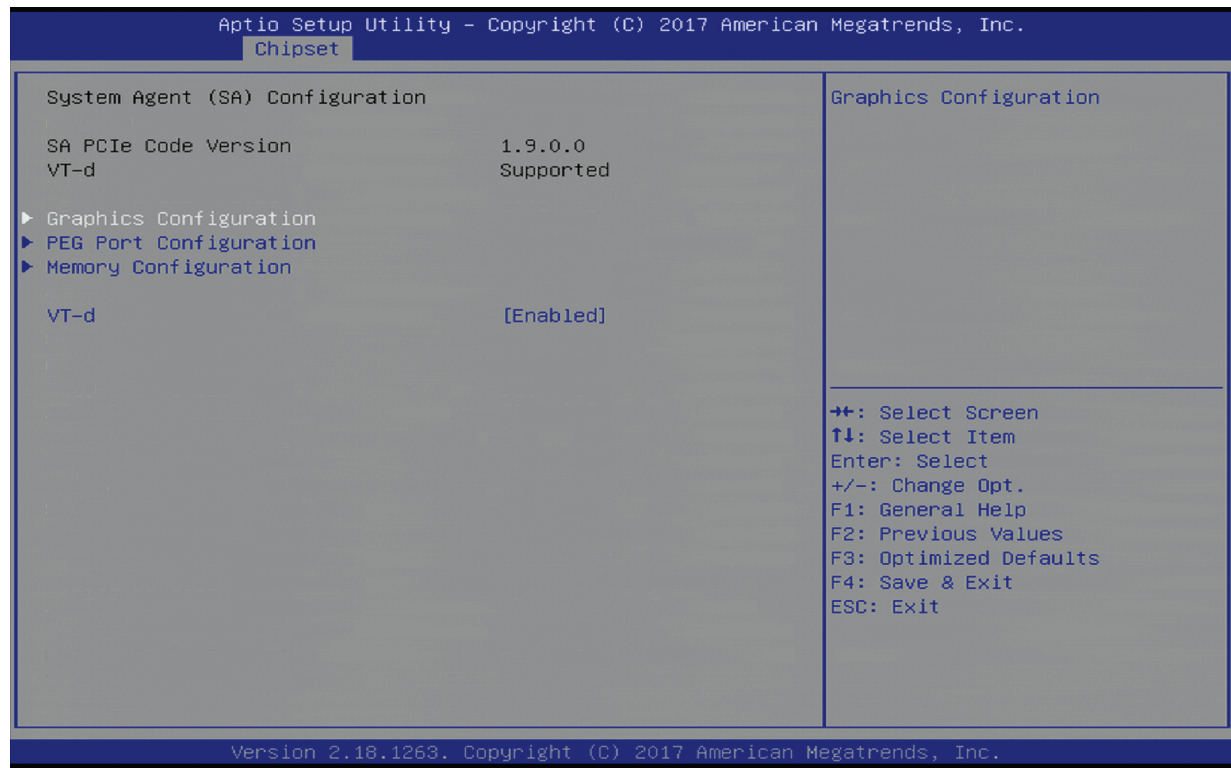
The following table shows System Agent Configuration sub-screens and functions, and describes the content. Default settings are in **bold**.

Table 9: Chipset Set > System Agent Configuration Sub-Screens and Functions

Function	Second level Sub-Screen / Description	
SA PCIe Code Version>	Read only field States versions of the code	
VT-d >	Read only field States if virtualization is supported	
Graphics Configuration>	Graphics Turbo IMON Current>	Displays supported Graphics turbo IMON current values range: (14–31) [**31**]
	Skip Scanned for External GfX Card>	If enabled, no scan is made for external Gfx cards on PEG or PCH PCIE ports. Default setting is disabled. [Enabled, **Disabled**]

Function	Second level Sub-Screen / Description	
Graphics Configuration > (continued)	Internal Graphics>	To keep IGFX enabled, based on setup options [**Auto**, Enabled, Disabled]
	GTT Size>	Select GTT size [2 MB, 4 MB, **8 MB**]
	Aperture Size>	Select Aperture size. Note: above 4GB MMIO, BIOS assignment is automatically enabled when selecting 2048 MB aperture. Note:To use this feature disable CSM support. [128 MB, **256 MB**, 512 MB, 1024 MB, 2048 MB]
	DVMT Pre-Allocated>	Select DVMT 5.0 pre-allocated (fixed) graphics memory size used by internal graphics device. [0 M, **32 M**, 64 M, 4 M, 8 M, 12 M, 16 M 20 M 24 M, 28 M 32 M/F7, 36 M, 40 M, 44 M, 48 M, 52 M 56 M 60 M]
	DVMT Total Gfx Mem>	Select DVMT 5.0 graphics memory size used by internal graphics device [**256M,** 128M, MAX.]
	Gfx Low Power Mode>	Used for SFF only [**Enabled**, Disabled]
	VDD Enable>	Enables or disables VDD forcing in BIOS [**Enabled**, Disabled]
	HDCP Support>	HDCP provisioning BIOS support [**Enabled**, Disabled]
	Algorithm>	HDCP re-encryption flow [**One-time**, Periodic]
	PM Support>	Enables or disables PM support [**Enabled**, Disabled]
	PAVP Enable>	Enables or disables PAVP [**Enabled**, Disabled]
	Cdynmax Clamping Enable>	Enables or disabled cdynmax clamping [**Enabled**, Disabled]
	Cd Clock Frequency>	Select highest Cd clock frequency supported by platform [337.5 MHz, 450 MHz, 540 MHz, **675 MHz**]
	IGD Configuration>	Read Only field
		IGD- Boot Type> — Selects the video device activated during post. If external graphics are present, this has no effect. [**Auto**, EFP, LFP, EFP3, EFP2]
		LFP Panel Type> — Selects panel type connected to eDP port as native eDP or LVDS via a bridge. Note: Depends on hardware option of the module. [**LVDS**, eDP]
		Backlight Control> — Backlight control settings options [None external, **PWM**, PWM Inverted, I2C]
		PWM Frequency> — Set LCD backlight PWM frequency

Function	Second level Sub-Screen / Description		
Graphics Configuration > (continued)	IGD Configuration> (continued)		[**200 Hz**, 400 Hz, 1 kHz, 2 kHz, 4 kHz, 8kHz, 20 kHz, 40 KHz]
		Backlight Value>	Sets LCD backlight brightness range: (0–255) [**128**]
		LVDS Clock Center Spreading>	Selects the LVDS clock frequency center spreading depth [**No Spreading**, 0.5%, 1.0%, 1.5%, 2.0%, 2.5 %]
		EFP1 Type>	Integrated HDMI/DisplayPort configuration with external connectors [DisplayPort Only, **DP with HDMI/DVI**, HDMI/DVI]
		EFP1 LSPCON>	HDMI2.0 feature Level shifter/protocol converter [Enabled, **Disabled**]
		EFP2 Type>	Integrated HDMI/DisplayPort configuration with external connectors [DisplayPort Only, **DP with HDMI/DVI**, HDMI/DVI]
		EFP2 LSPCON>	HDMI2.0 feature Level shifter/protocol converter [Enabled, **Disabled**]
		EFP3 Type>	Integrated HDMI/DisplayPort configuration with external connectors [DisplayPort Only, **DP with HDMI/DVI**, HDMI/DVI]
		EFP3 LSPCON>	HDMI2.0 feature Level shifter/protocol converter [Enabled, **Disabled**]
		Mode Persistence>	Mode persistence [Enabled, **Disabled**]
		Center Mode>	Selects the display device that should be centered [**Disabled**, EFP, EFP2]
PEG Port Configuration>	PEG Configuration>	Sets PEG configuration [2x8, **1x8+2x4**]	
	PEG 0:1:1 – PEG1 or PEG 0:1:2 – PEG2	Enable Root Port>	Enables or disables the root port [**Enabled**, Disabled, Auto]
		Max Link Speed>	Configure PEG #:#:# maximum speed [**Auto**, Gen1, Gen2, Gen3]
		PEG1 Slot Power Limit Value>	Sets power supply upper limit by slot. Power limit (watts) is calculated by multiplying this value by the Slot Power Limit scale. (0 – 255) [**75**]
		PEG1 Slot Power Limit Scale>	Selects scale used for the slot power limit value [**1.0x**, 0.1x, 0.01x, 0.001X]
		PEG0 Physical Slot Number>	Sets the port's slot number. This number must be globally unique within the chassis (0 - 8191).
		PEG1 Hotplug>	PCI Express Hotplug Enable/Disable [**Disabled**, Enabled]

Function	Second level Sub-Screen / Description		
PEG Port Configuration> (continued)	Peg Port Feature Configuration>	Detect Non-Compliance device>	Detects non-compliance PCIe device in PEG [Enabled, **Disabled**]
	PCIe Spread Spectrum Clocking>	Allows spreader clocking to be disabled for compliance testing [**Enabled**, Disabled]	
Memory Configuration>	Read only field Memory RC version, Memory frequency, Memory timings (tCL, tRCD, tRP, tRAS), Channel 0 slot 0, Size, Channel 0 slot 1, Channel 1 slot 0 and Channel 1, slot 1.		
	ECC Support>	Enables or disables DDR ECC support [**Enabled**, Disabled]	
	Max TOLUD>	Sets the maximum TOLUD value. Dynamic assignment adjustsTOLUD automatically, based on largest MMIO length of the installed graphic controller. [**Dynamic**, 1 GB, 1.25 GB, 1.5 GB, 1.75 GB, 2 GB, 2.25 GB, 2.5 GB, 2.75 GB, 3 GB, 3.25 GB, 3.5 GB]	
VT-d>	VT-d capability [**Enabled**/Disabled]		

1.2.3.2. Chipset > PCH-IO Configuration

Figure 69: PCH-IO Configuration Menu Initial Screen
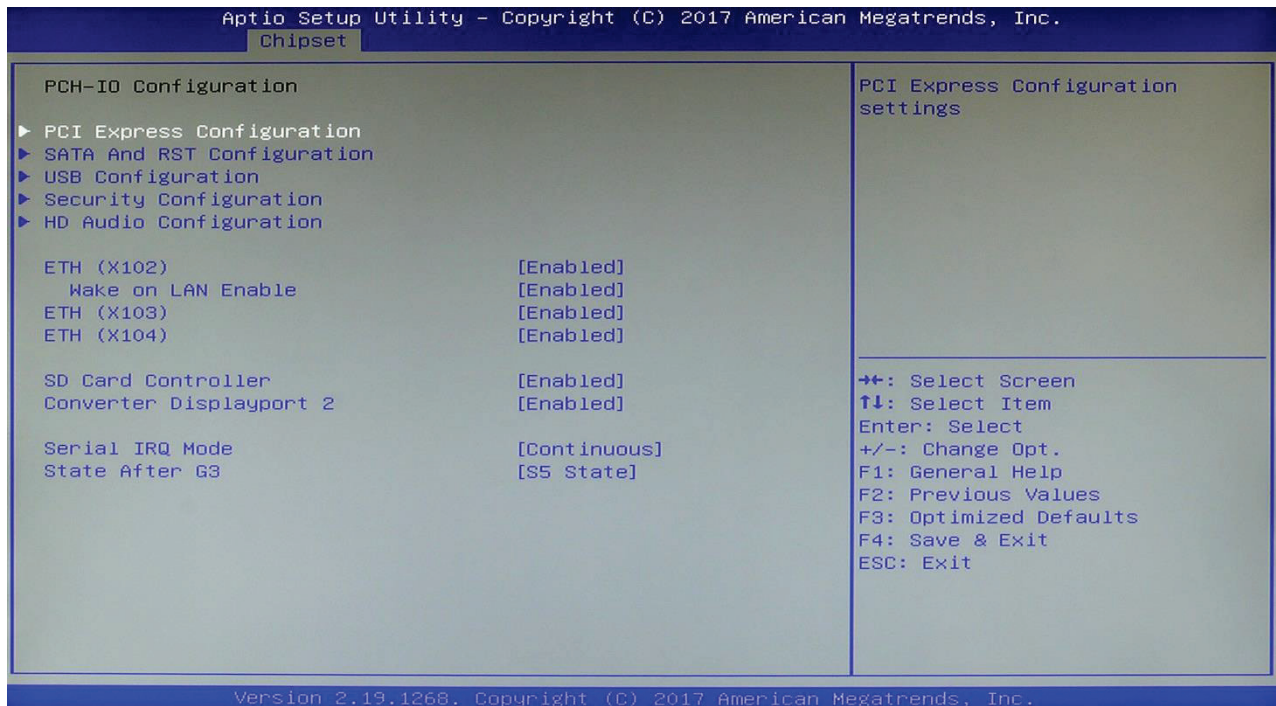
The following table shows the PCH-IO sub-screens and functions, and describes the content. Default settings are in **bold** and some functions include additional information.

Table 10: Chipset Set > PCH-IO Configuration Sub-Screens and Functions

Function	Second level Sub-Screen / Description	
PCI Express Configuration>	PCI Express Clock Gating>	PCI Express clock gating for each root port [**Enabled**, Disabled]
	Legacy IO Low Latency>	Enables low latency of legacy I/O as some systems require lower I/O latency irrespective of power. This is a tradeoff between power and I/O latency. [Enabled, **Disabled**]
	DMI Link ASPM Control>	Control of Active State Power Management on SA side of DMI link [Enabled, **Disabled**]
	PCIE Port Assigned toLAN>	Read Only file This port is always 5. [**5**]
	Port8xh Decode>	PCI express port 8xh decode [Enabled, **Disabled**]
	Peer Memory Write Enable>	Enables/disables peer memory write [Enabled, **Disabled**]
	Compliance Test Mode>	Enable when using compliance load board [Enabled, **Disabled**]

Function	Second level Sub-Screen / Description		
PCI Express Configuration> (continued)	PCIe-USB Glitch W/A	For bad USB device(s) connected behind PCIE/PEG Port [Enabled, **Disabled**]	
	PCIe Function Swap	If disables, prevents PCIE root port function swap. If any function other than 0th is enabled, 0th will become visible. [Enabled, **Disabled**]	
	MiniPCIe J17 > or MiniPCIe J18>	MiniPCIe J17>	Controls the PCI Express root port. [**Enabled**, Disabled]
		Topology>	Identifies the SATA Topology [Unknown, **x1**, x4, SATA Express, M.2.]
		ASPM>	Sets ASPM level [Auto, L0sL1, L1, L0s, **Disabled**]
		L1 Substates>	PCI Express L1 substrates settings. [Disabled, L1.1, L1.2, **L1.1 &L1.2**]
		Gen3 Eq Phase3 method>	PCIe Gen3 Equalization phase 3 method [Hardware, Static Coeff., **Software Search**]
		UPTP>	Upstream Port Transmitter Preset [**5**]
		DPTP>	Downstream Port Transmitter Preset [**7**]
		ACS>	Access Control Service Extended Capability [**Enabled**, Disabled]
		URR>	PCI Express unsupported request reporting [Enabled, **Disabled**]
		FER>	PCI Express device fatal error reporting [Enabled, **Disabled**]
		NFER>	PCI Express device non-fatal error reporting [Enabled, **Disabled**]
		CER>	PCI Express device correction error reporting [Enabled, **Disabled**]
		CTO>	PCIe Express Completion timer (T0) [Enabled, **Disabled**]
		SEFE>	Root PCI Express System Error on Fatal Error [Enabled, **Disabled**]
		SENFE>	Root PCI Express System Error on non-Fatal Error [Enabled, **Disabled**]
		SECE>	Root PCI Express System Error on correctable error [Enabled, **Disabled**]
		PME SCI>	PCI Express PME SCI [**Enabled**, Disabled]
		Hot Plug>	PCI Express hot plug [Enabled, **Disabled**]

Function	Second level Sub-Screen / Description		
PCI Express Configuration> (continued)	MiniPCIe J17 > or MiniPCIe J18> (continued)	Advanced Error reporting>	Advanced –error reporting [**Enabled**, Disabled]
		PCIe Speed>	Configures PCIe speed [**Auto**, Gen 1, Gen 2, Gen3]
		Transmitter Half Swing>	Transmitter half swing [Enabled, **Disabled**]
		Detector Timeout>	Number of mSeconds the reference code waits for a link to exit detect state for enabled ports before assuming there is no device and potentially disabling the port.
		Extra Bus Reserved>	Extra bus reseved (0-7) for bridges behind this root bridge. [**0**]
		Reserved Memory>	Reserved memory for this root bridge Range: (1MB-20MB) [**10**]
		Reserved I/O>	Reserved IO for this root bridge Range: (4 k, 8 k, 16 k, 20 k) [**4**]
		MIniPCIe J17(or J18) LTR>	PCH PCIE latency reporting [**Enabled**, Disabled]
		Snoop latency Override>	Snoop latency override or Non Snoop Override for PCH PCIE. Disabled: to disable override
		Non Snoop latency Override>	Manual: to manually enter override values and Auto (default): maintain default BIOS flow. [Disabled, Manual, **Auto**]
		Force LTR Override>	Force LTR override for PCH PCIE. Disabled: LTR override not forced Enable: LTR overrides values forced and LTR messages from device are ignored. [Enabled, **Disabled**]
		PCIE1 LTR Lock>	PCIE LTR configuration lock [Enabled, **Disabled**]
		MiniPCIE J17 (or J18) CLKREQ Mapping Override>	PCIE CLKREQ Override for default platform mapping [**Default**, No CLKREQ, Custom number]
	Extra Options>	Detect Non-Compliance Device>	Detects non-compliance PCI express device. If enabled, It takes more time at post time. [Enabled, **Disabled**]
		Prefetchable Memory>	Prefetchable memory range for this root bridge [**10**]
		Reserved Memory Alignment>	Reserved memory alignments Range:(0-31)bits [**1**]

Function	Second level Sub-Screen / Description		
PCI Express Configuration> (continued)	Extra Options> (continued)	Prefetchable Memory Alignment>	Prefetchable memory alignments Range:(0-31) bits [**1**]
SATA and RST Configuration>	SATA Controller(s)>	Enable/Disable SATA device [**Enabled,** Disabled]	
	SATA Mode Selection>	Determines SATA controllers operation [**AHCI**, Intel RST Premium]	
	SATA Test Mode>	Test mode enable/disable (loop back) [Enabled, **Disabled**]	
	Software Feature Mask Configuration>	HDD Unlock>	Enable indicates HDD password unlock in OS enabled. [**Enabled**, Disabled]
		LED Locate>	Enable indicated that LED/SGPIO hardware is attached and ping to locate feature is enabled in OS. [**Enabled**, Disabled]
	Aggressive LPM Support>	Enable PCH to aggressively enter link power state [Enabled, **Disabled**]	
	SATA Controller Speed>	Displays the maximum support supported by SATA controller [**Default**, Gen1, Gen2, Gen3]	
	SATA0 – Drive 1> or SATA1 Drive 2>	Software Preserve>	Read only field
		Port>	Enable/Disbale SATA port [**Enabled**, Disabled]
		Hot Plug>	Designates port as Hot plug [Enabled, **Disabled**]
		Configured as eSATA>	Read only field
		Spin Up Device>	If enabled staggered spin-up is performed and only drives with this option enabled will spin up at boot. Otherwise all drives spin up at boot spin up device. [Enabled, **Disabled**]
		SATA Device Type>	Identifies if SATA port is connected to a solid-state drive or hard disk drive. [**Hard Disk Drive**, Solid State Drive]
		SATA0 - Drive1 or SATA1 – Drive 2 DevSlp>	SATA Port# DevSlp [Enabled, **Disabled**]
		DITO Configuration>	DITO configuration [Enabled, **Disabled**]
		DITO Value>	Read only field [625]
		DM Value>	Read only field [15]

Function	Second level Sub-Screen / Description		
SATA and RST Configuration> (continued)	SATA0 – Drive 1> or SATA1 Drive 2> (continued)		
	mSATA1 – J23> or mSATA2 J24>	Software Preserve>	Read only field
		Port>	Enable/Disbale SATA port [**Enabled**, Disabled]
		Spin Up Device>	If enabled staggered spin-up is performed and only drives with this option enabled will spin up at boot. Otherwise all drives spin up at boot spin up device. [Enabled, **Disabled**]
		SATA Device Type>	Identifies if SATA port is connected to a solid-state drive or hard disk drive. [Hard Disk Drive, **Solid State Drive**]
		mSATA1 DevSlp> or mSATA2 DevSlp>	SATA Port# DevSlp [Enabled, **Disabled**]
		DITO Configuration>	DITO configuration [Enabled, **Disabled**]
		DITO Value>	Read only field [625]
		DM Value>	Read only field [15]
USB Configuration>	XHCI Disable Compliance Mode>	Option to disable compliance mode Default is false and compliance mode is not disabled. True disables compliance mode [**False**, True]	
	xDCI Support>	xDCI (USB OTG device) [Enabled, **Disabled**]	
	USB Ports X105 USB 3.0> X106 USB 3.0> X105 USB 2.0> X106 USB 2.0> X107 USB 2.0> X108 USB 2.0>	Enable/Disable this USB physical connector (physical port). Once disabled, any USB devices plugged into the connector will not be detected by BIOS or OS. [Disabled, **Enabled**]	
	Internal USB Ports MiniPCIe J17> MiniPCIe J18>	Enable/Disable this USB physical connector (physical port). Once disabled, any USB devices plugged into the connector will not be detected by BIOS or OS. [Disabled, **Enabled**]	
Security Configuration>	BIOS Lock>	Enables or disables PCH BIOS lock enable feature. Required to be enabled to ensure SMM protection of flash. [**Enabled**, Disabled]	

Function	Second level Sub-Screen / Description		
HD Audio Configuration>	HD Audio>	Controls detection of the HD-Audio device Auto enables HD if present or disables if not present otherwise HD Audio is unconditionally enabled or disabled [Enabled, Disabled, **Auto**]	
	Audio DSP>	Enables or disables audio DSP [Enabled, **Disabled**]	
	HDA-Link Codec Select>	Selects the codec Platform on-board codec (single verb table) or External codec kit (multiple verb table) [**Platform Onboard**, External Kit]	
	iDisplay Audio Disconnect>	Disconnects SDI2 signal to hide/disable iDisplay audio codec [Enabled, **Disabled**]	
	PME Enable>	Enables PM wake of HD audio controller during post. [Enabled, **Disabled**]	
	HD Audio Advanced Configuration>	I/O Buffer Ownership>	Selects the ownership of the I/O buffer between Intel HD audio link and I2S port (for bilingual codecs). [**HD-Audio Link**, HD-Audio Link/I2S Port, I2S Port]
		I/O Buffer Voltage Select>	Selects the voltage operation mode of the I/O buffer [**3.3 V**, 1.8 V]
		HD Audio Link Frequency>	Selects HD audio link frequency Applicable only if HDA codec supports selected frequency. [6 MHz, 12 MHz, **24 MHz**]
		iDisplay Link Frequnecy >	Selects iDisplay Link frequency. Applicable only if iDisp codec supports selected frequency. [48 MHz, **96 MHz**]
ETH (X102)>	Enable/Disable ETH (X102) [**Enabled**, Disabled]		
Wake on LAN Enable>	Enable/Disable ETH (X102) to wake the system. If ME is on in the Sx state, Wake On Lan cannot be disabled. [**Enabled**, Disabled]		
ETH (X103)>	Enable/Disable ETH (X103) [**Enabled**, Disabled]		
ETH (X104)>	Enable/Disable ETH (X104) [**Enabled**, Disabled]		
SD Card controller>	Enable/Disable this USB physical connector (physical port). Once disabled, any USB devices plugged into the connector will not be detected by BIOS or OS. [**Enabled**, Disabled]		

Function	Second level Sub-Screen / Description
Converter Displayport 2>	Enable/Disable this USB physical connector (physical port). Once disabled, any USB devices plugged into the connector will not be detected by BIOS or OS. [**Enabled**, Disabled]
Serial IRQ Mode>	Configure serial IRQ mode [Quiet, **Continuous**]
State After G3>	Specifies state to go to when power is re-applied after power failure (G3 State). [S0 State, **S5 State**]

1.2.4. Security Setup Menu

The Security Setup menu provides information about the passwords and functions for specifying the security settings. The passwords are case-sensitive.

Figure 70: Security Setup Menu Initial Screen

```
            Aptio Setup Utility – Copyright (C) 2017 American Megatrends, Inc.
   Main  Advanced  Chipset  Security  Boot  Save & Exit

  Password Description                              Set Administrator Password

  If ONLY the Administrator's password is set,
  then this only limits access to Setup and is
  only asked for when entering Setup.
  If ONLY the User's password is set, then this
  is a power on password and must be entered to
  boot or enter Setup. In Setup the User will
  have Administrator rights.
  The password length must be
  in the following range:
  Minimum length              3
  Maximum length             20
                                                   →←: Select Screen
  Administrator Password                           ↑↓: Select Item
  User Password                                    Enter: Select
                                                   +/-: Change Opt.
                                                   F1: General Help
                                                   F2: Previous Values
                                                   F3: Optimized Defaults
                                                   F4: Save & Exit
                                                   ESC: Exit



            Version 2.18.1263. Copyright (C) 2017 American Megatrends, Inc.
```

Table 11: Security Setup Menu Functions

Function	Description
Administrator Password>	Sets administrator password
User Password>	Sets user password

> **i** If only the administrator's password is set, then only access to setup is limited. The password is only entered when entering setup.
>
> If only the user's password is set, then the password is a power on password and must be entered to boot or enter setup. Within the setup menu the user has administrator rights.
>
> Password length requirements are maximum length 20 and minimum length 3.

1.2.4.1. Remember the Password

It is highly recommended to keep a record of all passwords in a safe place. Forgotten passwords results in the user being locked out of the system.

If the system cannot be booted because the User Password or the Supervisor Password are not known, see chapter 15.3 "Updating the uEFI BIOS" for information about clearing the uEFI BIOS settings, or contact Kontron Support for further assistance.

> **i** HDD security passwords cannot be cleared using the above method.

1.2.5. Boot Setup Menu

The Boot Setup menu lists dynamically generated boot device priority order.

Figure 71: Boot Setup Menu Initial Screen
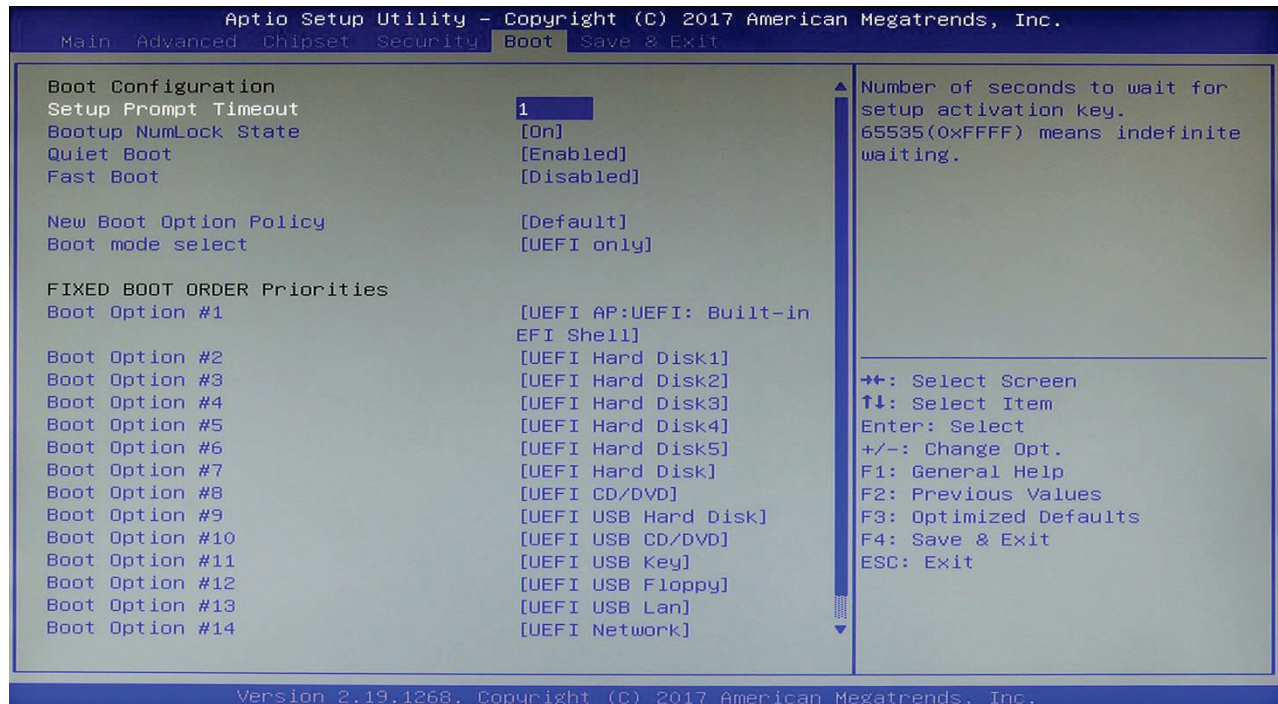
The following table shows Boot sub-screens and functions, and describes the content. Default settings are in **bold**.

Table 12: Boot Setup Menu Functions

Function	Description
Setup Prompt Timeout>	Displays number of seconds to wait for the setup activation key. 65535(OXFFF) means indefinite waiting
Bootup NumLock State>	Selects keyboard NumLock state [**On**, Off]
Quiet Boot>	Enables or disables Quiet Boot [**Enabled**, Disabled]
Fast Boot>	Enables or disables boot with initialization of a minimal set of devices required to launch active boot option. This has no effect for BBS boot options. [Enabled, **Disabled**]
New Boot Option Policy>	Controls placement of newly detected UEFI boot options [**Default**, Place First, Place Last]
Boot mode select>	Select Boot mode LEGACY/UEFI [Legacy only, **UEFI only**, UEFI and Legacy]
Boot Option #1> to Boot Option #14>	Sets the system boot order [UEFI Hard Disk, UEFI Hard Disk1, UEFI Hard Disk2, UEFI Hard Disk3, UEFI Hard Disk4, UEFI Hard Disk5, UEFI AP: UEFI: Built-in EFI Shell, UEFI CD/DVD, UEFI USB Hard Disk, UEFI USB CD/DVD, UEFI USB Key, UEFI USB Floppy, UEFI USB Lan, UEFI Network, Disabled]

Function	Description
Boot Option #1> to Boot Option #14> (continued)	Boot Option #1> [**UEFI Hard Disk**] Boot Option #2> [**UEFI Hard Disk1**] Boot Option #3> [**UEFI Hard Disk2**] Boot Option #4> [**UEFI Hard Disk3**] Boot Option #5> [**UEFI Hard Disk4**] Boot Option #6> [**UEFI Hard Disk5**] Boot Option #7> [**UEFI AP: UEFI: Built-in EFI Shell**] Boot Option #8> [**UEFI CD/DVD**] Boot Option #9> [**UEFI USB Hard Disk**] Boot Option #10> [**UEFI USB CD/DVD**] Boot Option #11> [**UEFI USB Key**] Boot Option #12> [**UEFI USB Floppy**] Boot Option #13> [**UEFI USB Lan**] Boot Option #14> [**UEFI Network**]
UEFI Application Boot Priorities>	Boot Option #1> Sets the system boot order [**UEFI: Built-in EFI shell**, Disabled]

1.2.6. Save and Exit Setup Menu

The Save and Exit Setup menu provides functions for handling changes made to the uEFI BIOS settings and exiting of the Setup program.

Figure 72: Save and Exit Setup Menu Initial Screen
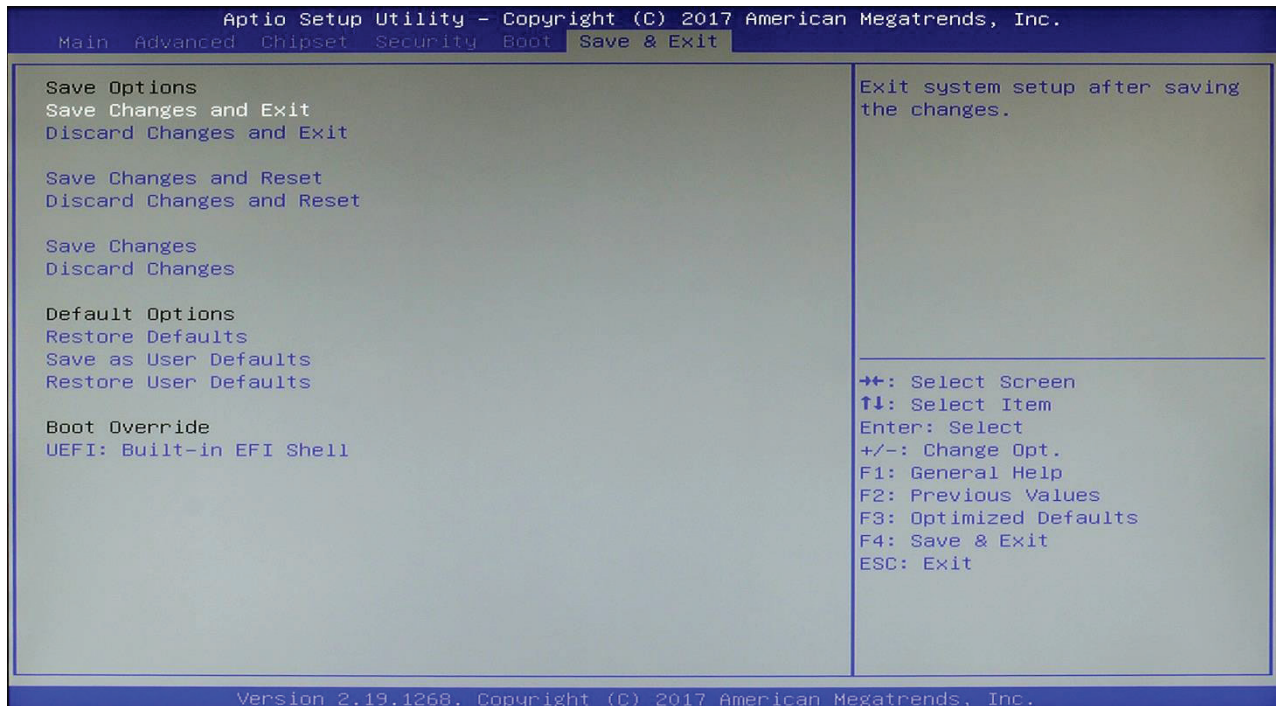
The following table shows Save & Exit sub-screens and functions, and describes the content.

Table 13: Save and Exit Setup Menu Functions

Function	Description
Save Changes and Exit>	Exits system after saving the changes
Discard Changes and Exit>	Exits system setup without saving any changes
Save Changes and Reset>	Reset system after saving changes
Discard Changes and Reset>	Resets system setup without saving any changes
Save Changes>	Saves changes made so far for any setup options
Discard Changes>	Discards changes made so far for any setup options
Restore Defaults>	Restores/loads standard default values for all setup options
Save as User Defaults>	Saves changes made so far as user defaults
Restore User Defaults>	Restores user defaults to all setup options
UEFI Built-in EFI shell>	Attempts to launch the built in EFI Shell

The integrated COMExpress® module (COMe-bSL6) integrated in the KBox C-102 is equipped with Aptio® V, which is located in an onboard SPI serial flash memory. The uEFI (Unified Extensible Firmware Interface)/BIOS is set at the factory, corresponding to the system's standard hardware configuration and for normal operating conditions. Therefore there is no need to set or change the BIOS environment to operate your system.

> **i** A detailed BIOS description can be found in the manual of the installed COMExpress® module. You can download the corresponding manual from our web site www.kontron.com by selecting the product name.

The Kontron uEFI BIOS features a built-in and enhanced version of the uEFI Shell. For a detailed description of the available standard shell scripting refer to the EFI Shell User's Guide. For a detailed description of the available standard shell commands, refer to the EFI Shell Command Manual. Both documents can be downloaded from the EFI and Framework Open Source Community homepage (http://sourceforge.net/projects/efi-shell/files/documents/).

> **i** Please note that not all shell commands described in the EFI Shell Command Manual are provided by the Kontron uEFI BIOS.

15.1. uEFI Shell Introduction, Basic Operation

The uEFI Shell forms an entry into the uEFI boot order and is the first boot option by default.

15.1.1. Entering the uEFI Shell

To enter the uEFI Shell, follow the steps below:

1. Power on the board.

2. Ignore the message: "Press the <F2> key".

3. Press the ESC key within 5 seconds after a message such as the one below appears:

```
EFI Shell version 2.31 [4660.22136]
Current running mode 1.1.2
Device mapping table
blk0    :Removable HardDisk - Alias hd33b0b0b fs0
 Acpi(PNP0A03,0)/Pci(1D|7)/Usb(1, 0)/Usb(1, 0)/HD(Part1,Sig17731773)
...
```

> **i** Press the <ESC> key within 5 seconds to skip startup.nsh, and any other key to continue.

The output produced by the device mapping table can vary depending on the board's configuration.

If the <ESC> key is pressed before the 5-second timeout has elapsed, the shell prompt is shown:
```
Shell>
```

15.1.2. Exiting the uEFI Shell

To exit the uEFI Shell, follow one of the steps below:

1. Invoke the exit uEFI Shell command to select the boot device in the boot menu for the OS to boot from.

2. Reset the board using the reset uEFI Shell command.

15.1.3. Kontron-Specific uEFI Shell Commands

The Kontron uEFI implementation provides the following additional commands related to the specific HW features of the Kontron system.

Table 14: Kontron-Specific uEFI Shell Commands

COMMAND	DESCRIPTION
kBoot	Boots a selected device.
kBoardInfo	Shows a summary of board-specific data and displays/checks various parameters such as the current uEFI BIOS revision, etc.
kBootScript	Manages the flash-stored startup script. If the shell is launched by the boot process, it executes a shell script stored in the flash. If the shell script terminates, the shell will continue the boot process. However, the shell script can also contain any other boot command.
kRamdisk	Creates and manages RAMdisks. This command is used to perform file operations when no real file system is connected to the system.
kWatchdog	Configures the Kontron onboard Watchdog. This command is used to enable the Kontron onboard Watchdog with reset target before OS boot. This can be used to detect if the OS fails to boot and react by reset.

> **i** The uEFI Shell commands are not case-sensitive. Each uEFI Shell command is provided with a detailed online help that can be invoked by entering "`<cmd> <space> <-?>`" in the command line. To display the uEFI Shell command list, enter `<help>` or `<?>` in the command line.

15.2. uEFI Shell Scripting

15.2.1. Startup Scripting

If the ESC key is not pressed and the timeout is run out, the uEFI Shell tries to execute some startup scripts automatically. It searches for scripts and executes them in the following order:

1. Kontron flash-stored startup script.

2. If there is no Kontron flash-stored startup script present, the uEFI-specified `startup.nsh` script is used. This script must be located on the root of any of the attached FAT formatted disk drive.

15.2.2. Create a Startup Script

Startup scripts can be created using the uEFI Shell built-in editor **edit** or under any OS with a plain text editor of your choice. To create a startup shell script, simply save the script on the root of any FAT-formatted drive attached to the system. To copy the startup script to the flash, use the **kBootScript** uEFI Shell command.

In case there is no mass storage device attached, the startup script can be generated in a RAM disk and stored in the SPI boot flash using the **kRamdisk** uEFI Shell command.

15.2.3. Examples of Startup Scripts

15.2.3.1. Execute Shell Script on other Hard Drive

This example (**startup.nsh)** executes the shell script named **bootme.nsh** located in the root of the first detected disc drive (**fs0**).

15.2.3.2. Execute Shell Script on other Hard Drive

This example (**startup.nsh)** executes the shell script named **bootme.nsh** located in the root of the first detected disc drive (**fs0**).

```
fs0:
bootme.nsh
```

15.2.3.3. Enable Watchdog

The uEFI Shell provides environment variables used to control the execution flow.
The following sample start-up script shows the uEFI Shell environment **wdt_enable**, used to control the Watchdog.

```
echo -off
echo "Executing sample startup.nsh..."
if %wdt_enable% == "on" then
   kwatchdog -t 15
   echo "Watchdog enabled"
endif
```

To create uEFI Shell environment variable, use the set uEFI Shell command as shown below:

```
Shell> set wdt_enable on
Shell> set
   wdt_enable : on
Shell> reset
```

15.2.3.4. Handling the Startup Script in the SPI Boot Flash

In case there is no mass storage device attached, the startup script can be generated in a RAM disk and stored in the SPI boot flash using the following instructions:

1. Press <ESC> during power-up to log into the uEFI Shell.

2. Create a RAM disk and set the proper working directory as shown below:

```
Shell> kramdisk -s 3 -c -m myramdisk
Shell> myramdisk:
```

3. Enter the sample start-up script mentioned above in this section using the **edit** uEFI Shell command:

```
myramdisk:\> edit boot.nsh
```

4. Save the start-up script to the SPI boot flash using the **kBootScript** uEFI Shell command:

```
myramdisk:\> kbootscript -p boot.nsh
```

5. Reset the board to execute the newly installed script using the **reset** uEFI Shell command:

```
myramdisk:\> reset
```

6. If a script is already installed, it can be edited using the following kBootScript uEFI Shell commands:

```
myramdisk:\> kbootscript -g boot.nsh
myramdisk:\> edit boot.nsh
```

15.3. Updating the uEFI BIOS

For updating the BIOS, perform the following steps:

1. Download AFU from AMI

    https://ami.com/en/download-license-agreement/?DownloadFile=Aptio_V_AMI_Firmware_Update_Utility.zip

2. Prepare USB Stick with

    ▶ AfuEfix64.efi
    ▶ update.nsh
    ▶ BIOS Binary

3. Plug USB Stick into KBox C102

4. Boot into Setup and enable ME Update
    (Advanced> PCH-FW Configuration> Firmware Update Configuration> Me FW Image Re-Flash [Enabled])

5. Save and Exit and directly boot to EFI Shell

6. Go to USB Stick (use "map" to list all devices): e.g.: fs0:

7. Start update

```
update.nsh <FileName>.bin
```

15.3.1. uEFI BIOS Recovery

In case of the standard SPI boot flash being corrupted and therefore the system is not starting up, it can be booted from the recovery SPI boot flash. For further information, refer to Chapter 4.4.9 "RESCUE Button and RSQ LED".

> **The uEFI BIOS code and settings are stored in the SPI boot flashes. Changes made to the uEFI BIOS settings are available only in the currently selected SPI boot flash. Thus, switching over to the other SPI boot flash may result in operation with different uEFI BIOS code and settings.**

15.3.2. Determining the Active Flash

Sometimes it may be necessary to check which flash is active. The information is available using the **kboardinfo** uEFI Shell command.

16/ Technical Specifications

Table 15: Technical Specifications

KBox C-102 Family	
Installed COM Express Module and Baseboard	Baseboard with COMe-bSL6 G3902E or Baseboard with COMe-bSL6 i3-6102E or Baseboard with COMe-bSL6 i5-6442EQ or Baseboard with COMe-bSL6 i7-6820EQ or Baseboard with COMe-bSL6 XEON E3-1515M CM236, 45W/35W
Processor	Intel® Celeron G3902E, 2x1.6GHz, 25W max. power consumption Intel® Core™ i3-6102, 2x1.9GHz, 25W max. power consumption Intel® Core™ i5-6442EQ, 4x1.9GHz, 25W max. power consumption Intel® Core™ i7-6820EQ, 4x2.8GHz, 45W max. power consumption Intel® XEON™ E3-1515M v5, 4x2.8GHz, 45W max. power consumption
RAM	Up to 32 GB w/wo ECC
BIOS	AMI Aptio V uEFI
Controls (at the front side)	Power button (PWR) RESCUE button (RSQ)
Indicators (at the front side)	PWR (Power LED) RSQ (Rescue LED) THERM (Thermal LED) DRIVE (HDD/SSD status LED) SD (SD Card status LED) WD (Watchdog status LED) GP1 … GP4 (General purpose LEDs)
Interfaces (front side accessible)	3x Ethernet (10/100/1000 Mbit/s) 2x USB 3.0 2x USB 2.0 1x DisplayPort 1x SD Card slot 1x RS232
DC IN Connector (at the front side)	3-pin DC input connector
Protection Class	IP20
Lithium Battery (Option) (front side accessible)	CR 2025, 3V
Rated Voltage (tolerance)	24 VDC (+20%/-15%), 10ms hold-up, max. 140 W (depending on configuration)

	KBox C-102-4	KBox C-102-2	KBox C-102-1	KBox C-102-0
Options for Storage Media	2x 2.5" SATA HDD/SSD non removable **or** 2x 2.5" removable SATA HDD/SSD for: • DRIVE 1: SATA 6 Gb/s. • DRIVE 2: SATA 6 Gb/s. Up to 2x mSATA 1x SD Card	2x 2.5" SATA HDD/SSD non removable **or** 2x 2.5" removable SATA HDD/SSD for: • DRIVE 1: SATA 6 Gb/s. • DRIVE 2: SATA 6 Gb/s. Up to 2x mSATA 1x SD Card	1x 2.5" SATA HDD/SSD non removable **or** 1x 2.5" removable SATA HDD/SSD for: • DRIVE 1: SATA 6 Gb/s. Up to 2x mSATA 1x SD Card	1x 2.5" SATA HDD/SSD non removable Up to 2x mSATA 1x SD Card

KBox C-102 Family				
Free Expansions Sockets (internal)	2x full size Mini PCIe x1 4x PCI x4	2x full size Mini PCIe x1 2x PCIe x4 or 1x PCI (32 bit) and 1x PCIe x4 (via corresponding riser card) (power consumption less than 15W is allowed)	2x full size Mini PCIe x1 1x PCIe x4 (via corresponding riser card) (power consumption less than 15W is allowed)	2x full size Mini PCIe x1
Fan Tray (Option)	yes	yes	yes	no

16.1. Mechanical Specifications of the KBox C-102

16.1.1. Mechanical Specifications of the KBox C-102-4

Figure 73: Dimensions: right side (KBox C-102-4)

Figure 74: Dimensions: front side with key holes (KBox C-102-4)

Figure 75: Dimensions: detail key hole (KBox C-102-4)

Figure 76: Dimensions: top side (KBox C-102-4)

16.1.2. Mechanical Specifications of the KBox C-102-4 with Fan Tray Option

Figure 77: Dimensions: right side
(KBox C-102-4 with fan tray option)

Figure 78: Dimensions: front side with key holes
(KBox C-102-4 with fan tray option)

Figure 79: Dimensions: detail key hole
(KBox C-102-4 with fan tray option)

Figure 80: Dimensions: top side
(KBox C-102-4 with fan trayoption)

Table 16: Mechanical Specifications of the KBox C-102-4

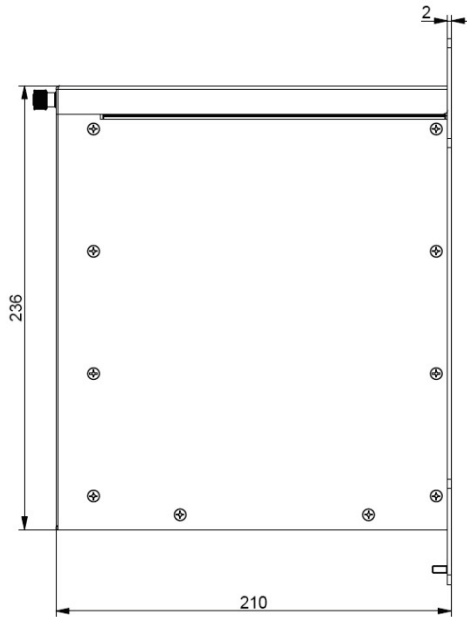| Dimensions	KBox C-102-4 (Standard Version)	KBox C-102-4 (with optional Fan Tray)
Height	with mounting brackets: 290 mm (11.42")	with mounting brackets: 324 mm (12.756")
Width	195 mm (6.10")	195 mm (6.10")
Depth	with mounting brackets: 210 mm (8.26")	with mounting brackets: 210 mm (8.26")
Weight (without packaging, without expansions)	Approx. 4.2 kg (9.25 lbs.)	Approx. 6.00 kg (13.22 lbs.)
Chassis	Cooling fins, black Chassis: steel sheet, light grey (RAL 7035) Side with External Interfaces : trim strips, traffic grey (RAL 7043)	

16.1.3. Mechanical Specifications of the KBox C-102-2

Figure 81: Dimensions: right side (KBox C-102-2)

Figure 82: Dimensions: front side with key holes (KBox C-102-2)
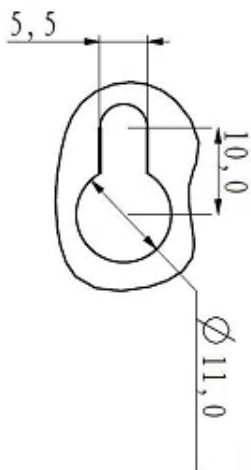

Figure 83: Dimensions: detail key hole (KBox C-102-2)

Figure 84: Dimensions: top side (KBox C-102-2)
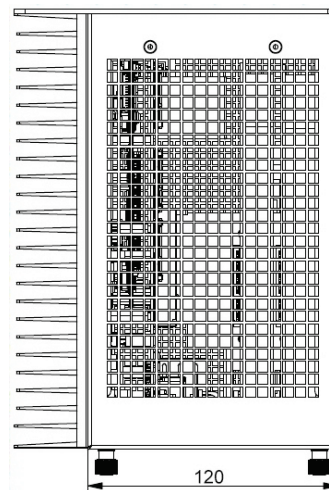
16.1.4. Mechanical Specifications of the KBox C-102-2 with Fan Tray Option

Figure 85: Dimensions: right side
(KBox C-102-2 with fan tray option)

Figure 86: Dimensions: front side with key holes
(KBox C-102-2 with fan tray option)

Figure 87: Dimensions: detail key hole
(KBox C-102-2 with fan tray option)
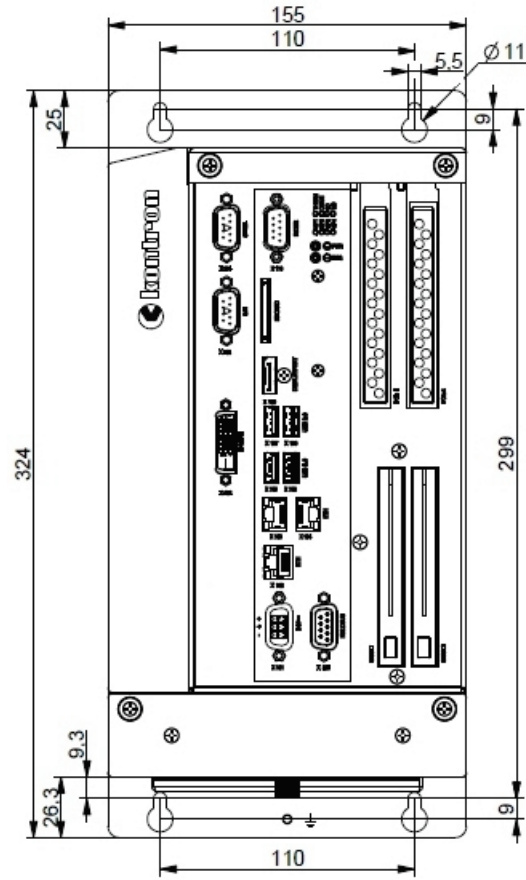
Figure 88: Dimensions: top side
(KBox C-102-2 with fan trayoption)
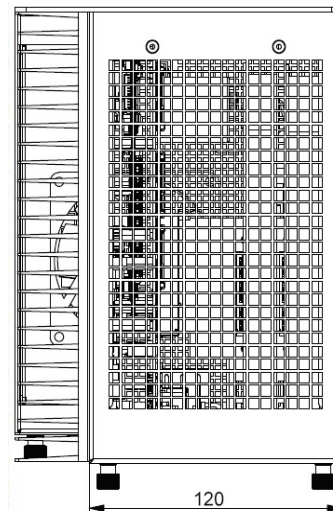
Table 17: Mechanical Specifications of the KBox C-102-2

Dimensions	KBox C-102-2 (Standard Version)	KBox C-102-2 (with optional Fan Tray)
Height	with mounting brackets: 290 mm (11.42")	with mounting brackets: 324 mm (12.756")
Width	155 mm (6.10")	155 mm (6.10")
Depth	with mounting brackets: 210 mm (8.26")	with mounting brackets: 210 mm (8.26")
Weight (without packaging, without expansions)	Approx. 4.75 kg (10.47 lbs.)	Approx. 6.00 kg (13.22 lbs.)
Chassis	Cooling fins, black Chassis: steel sheet, light grey (RAL 7035) Side with External Interfaces : trim strips, traffic grey (RAL 7043)	

16.1.5. Mechanical Specifications of the KBox C-102-1

Figure 89: Dimensions: right side (KBox C-102-1)
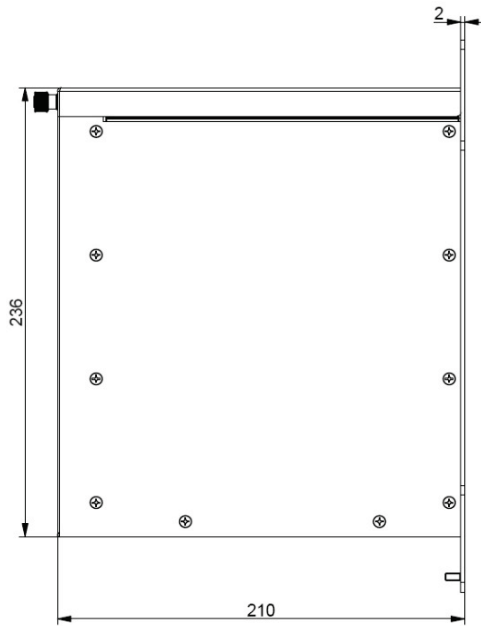
Figure 90: Dimensions: front side with key holes (KBox C-102-1)
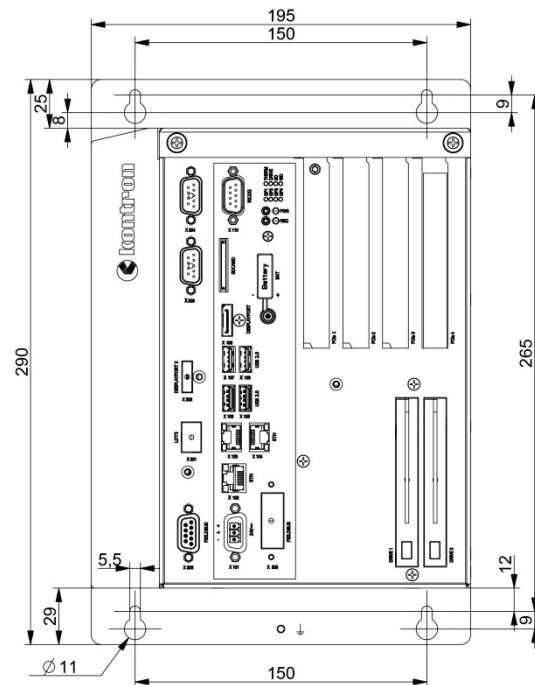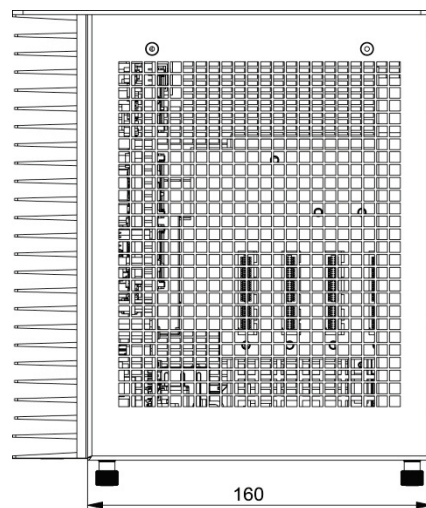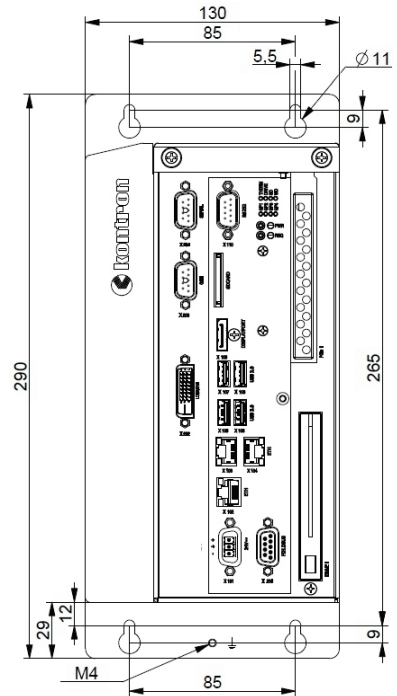
Figure 91: Dimensions: detail key hole (KBox C-102-1)
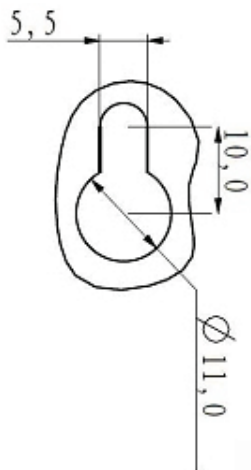
Figure 92: Dimensions: top side (KBox C-102-1)
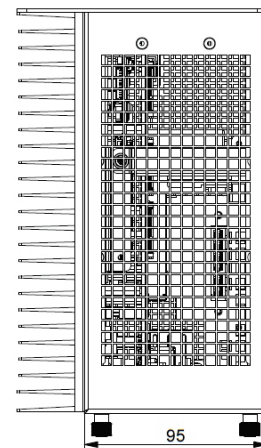
16.1.6. Mechanical Specifications of the KBox C-102-1 with Fan Tray Option

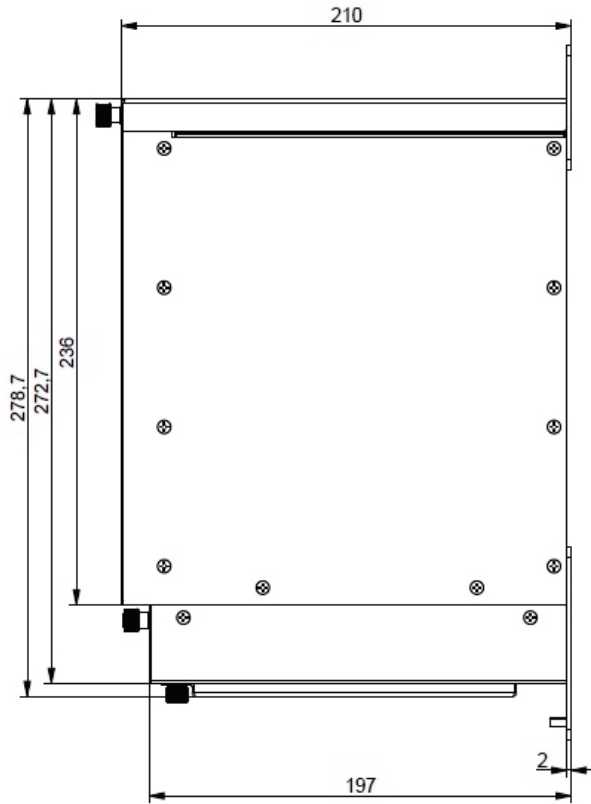Figure 93: Dimensions: right side
(KBox C-102-1 with fan tray option)
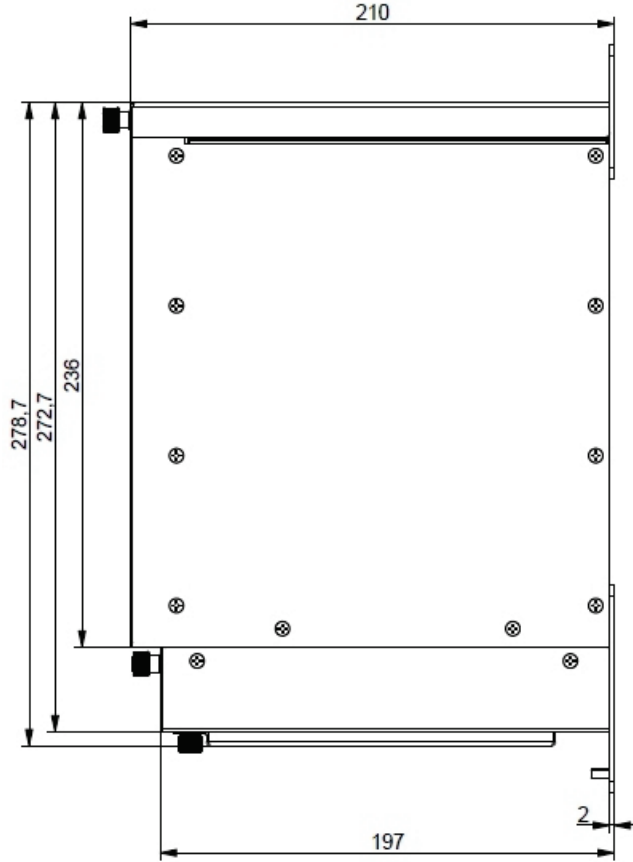
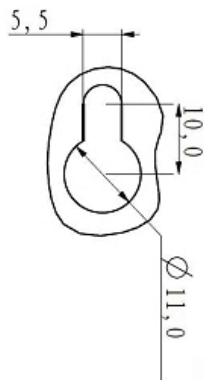Figure 94: Dimensions: front side with key holes
(KBox C-102-1 with fan tray option)
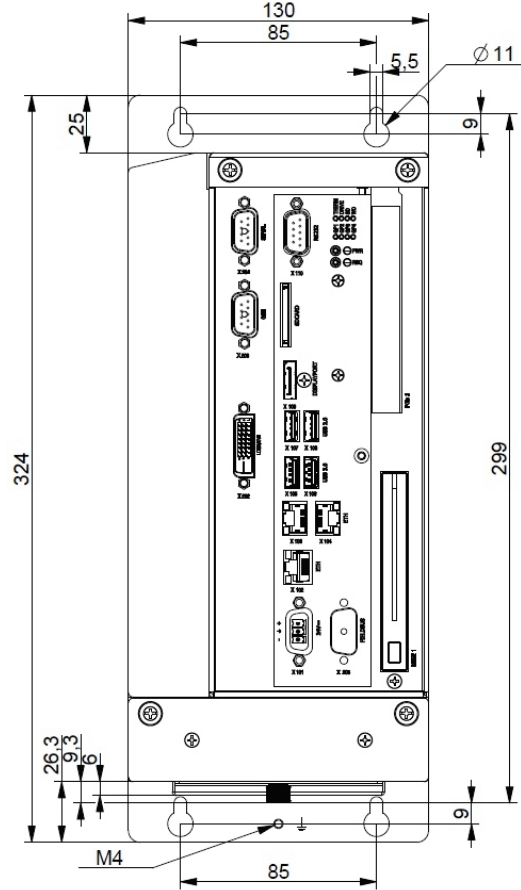
Figure 95: Dimensions: detail key hole
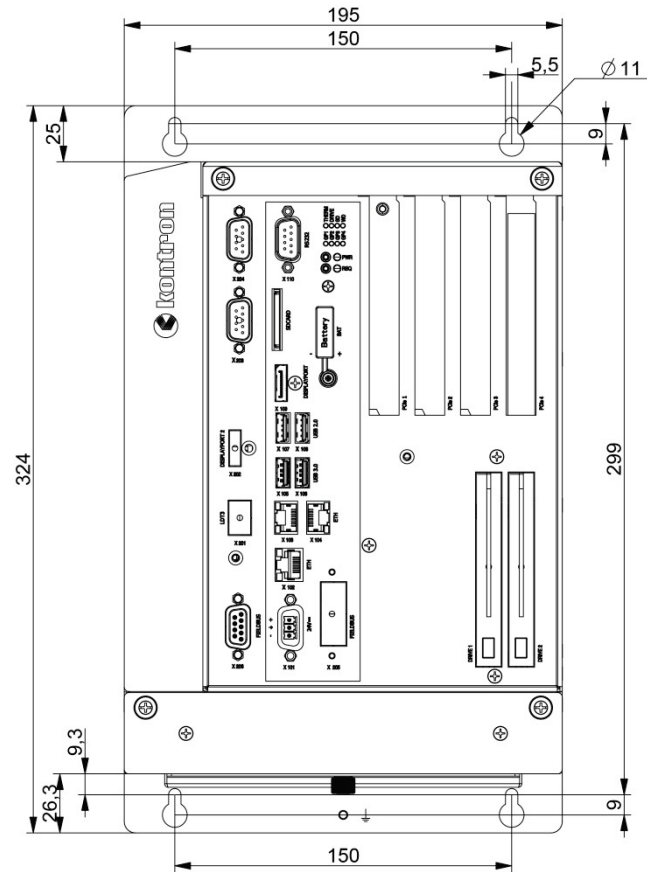(KBox C-102-1 with fan tray option)
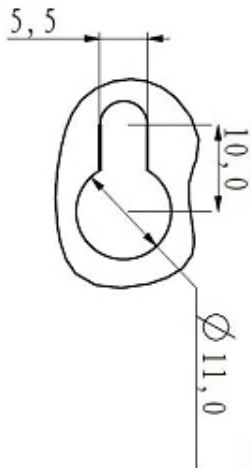
Figure 96: Dimensions: top side
(KBox C-102-1 with fan tray option)
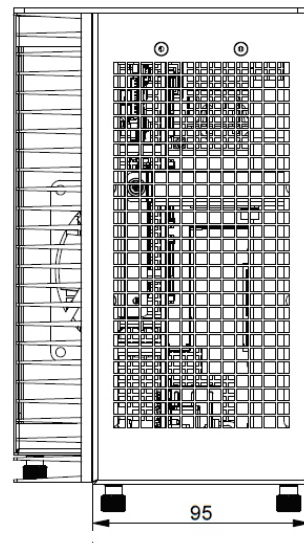
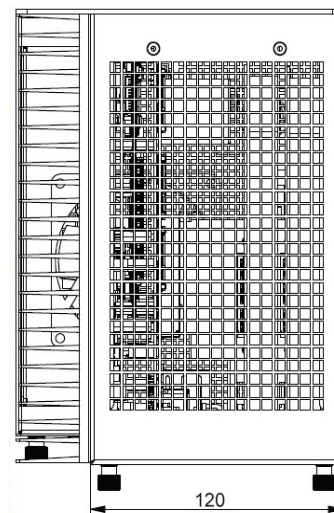Table 18: Mechanical Specifications of the KBox C-102-1

Dimensions	KBox C-102-1 (Standard Version)	KBox C-102-1 (with optional Fan Tray)
Height	with mounting brackets: 290 mm (11.42")	with mounting brackets: 324 mm (12.756")
Width	130 mm (5.12")	130 mm (5.12")
Depth	with mounting brackets: 210 mm (8.26 ")	with mounting brackets: 210 mm (8.26 ")
Weight (without packaging, without expansions)	Approx. 4.6 kg (10.14 lbs.)	Approx. 5.6 kg (12.34 lbs.)
Chassis	Cooling fins, black Chassis: steel sheet, light grey (RAL 7035) Side with External Interfaces : trim strips, traffic grey (RAL 7043)	

16.1.7. Mechanical Specifications of the KBox C-102-0
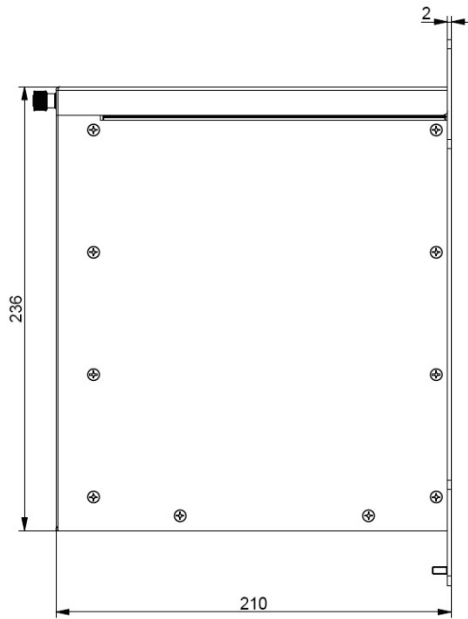
Figure 97: Dimensions: right side (KBox C-102-0)
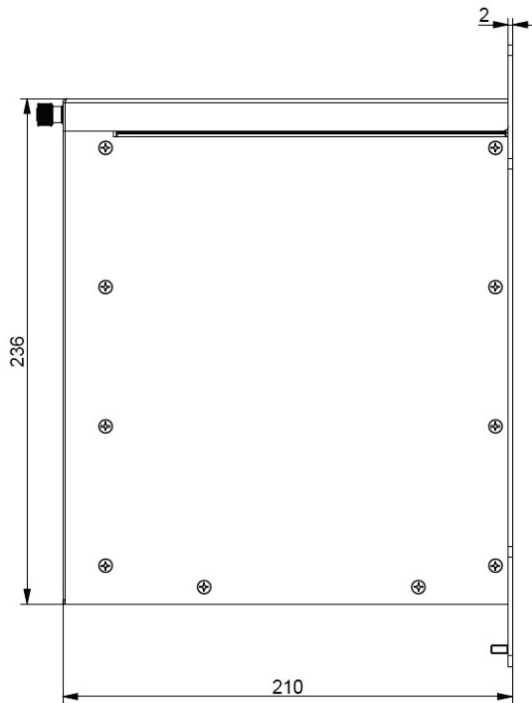
Figure 98: Dimensions: front side with key holes (KBox C-102-0)
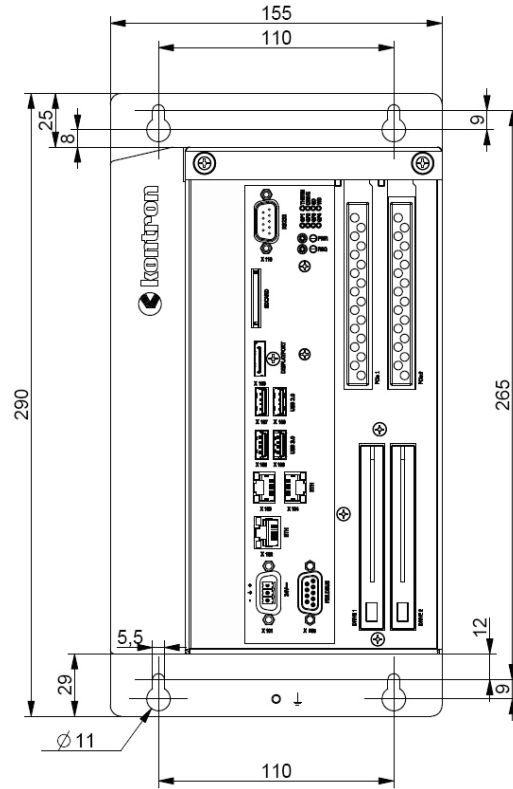
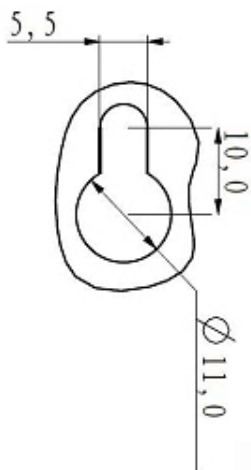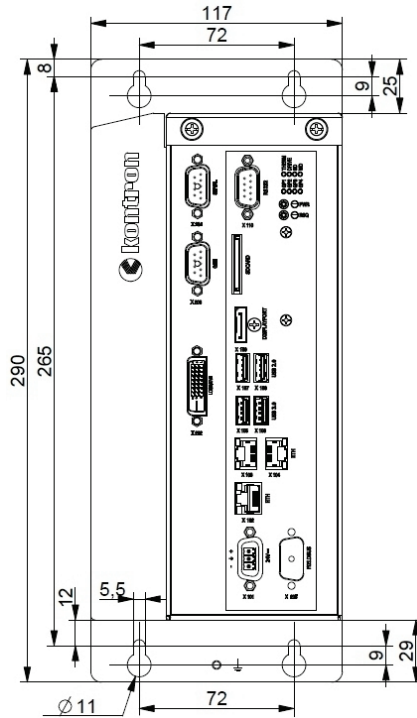Figure 99: Dimensions: detail key hole (KBox C-102-0)
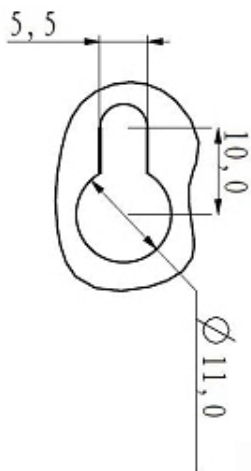
Figure 100: Dimensions: top side (KBox C-102-0)
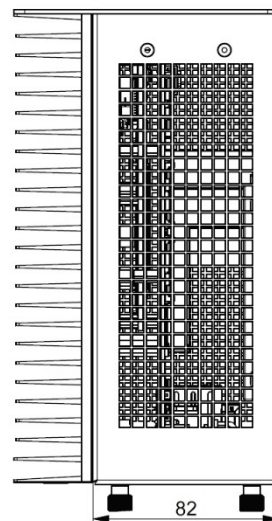
Table 19: Mechanical Specifications of the KBox C-102-1

Dimensions	KBox C-102-0 (Standard Version)
Height	with mounting brackets: 290 mm (11.42")
Width	117 mm (4.61")
Depth	with mounting brackets: 210 mm (8.26 ")
Weight (without packaging, without expansions)	Approx. 3.8 kg (8.37 lbs.)
Chassis	Cooling fins, black Chassis: steel sheet, light grey (RAL 7035) Side with External Interfaces : trim strips, traffic grey (RAL 7043)

16.2. Environmental Specifications

Table 20: Environmental Specifications

	KBox C-102
Thermal Management	Convection cooling
Operating Temperature	25W bSL6: 0°C to +65°C (32°F to 149°F) 45W bSL6: 0°C to +50°C (32°F to 122°F)
Storage / Transit Temperature	–40°C … +75°C (–40°F … +185°F)
Relative Humidity (Operating)	93 % @ 40 °C (non condensing) acc. to IEC 60068-2-78
Max. Operation Altitude	2,000 m (6,560 ft.)
Max. Storage / Transit Altitude	10,000 m (32,810 ft.)
Non-Operating Shock	30 G, 11 ms, half sine, acc. to IEC 60068-2-27
Operating Shock	15 G, 11 ms, half sine, acc. to IEC 60068-2-27
Non-Operating Vibration	10Hz - 150 Hz, 2 G, acc. to IEC 60068-2-6
Operating Vibration	10Hz - 150 Hz, 1 G, acc. to IEC 60068-2-6

16.3. CE-Directives, Standards and Approvals

Table 21: CE Directive

CE Directive	
Electrical Safety	General Product Safety Directive (GPSD) 2001/95/EC Low Voltage Directive (LVD) 2014/35/EU
Electromagnetic Compatibility (EMC)	EMC Directive 2014/30/EC
CE Marking	CE Directive 93/68/EEC
RoHS II Directives	2011/65/EU

Table 22: Electrical Safety

Electrical Safety	Harmonized Standards
EUROPE	Information technology equipment – Safety – Part 1: General requirements EN 61010-1
U.S.A. / CANADA	Conform UL STD 60950-1 Conform UL STD 508 Certified to CAN/CSA C22.2 No. 60950-1/UL 60950-1 Tested according UL 508
CB Report	IEC 60950-1(ed.2);am1, am2
Listed Mark	UL

Table 23: EMC

EMC	Harmonized Standards
EU	Generic standards - Emission standard for industrial environments (Emission): EN 55011, Class B (conducted Emission) EN 55032, Class B EN 61000-6-4 Generic standards - Immunity for industrial environments (Immunity): EN 55024, EN 61000-6-2, EN 61000-4-3 EN61131-2 (Standard for programmable controllers, part 2 equipment requirements and tests)

17/ KBox C-102 CPLD Specific Registers

The system registers are accessed over the LPC bus and occupies a total of 32 bytes. The base address is set to 0x100 in order not to conflict with the usually used address space starting at 0x280.

17.1. Register Overview

Table 24: Register Overview

Offset	Register mnemonic	Register description	Category
00	STAT0	Status Register 0	CS
01		Reserved	
02	CTRL0	Control Register 0	CS
03		Reserved	
04		Reserved	
05	RSTAT	Reset Status Register	CS
06	BICFG	Board Interrupt Configuration	CS
07		Reserved	
08	BIDH	Board ID Register High Byte	ID
09	BREV	Board and PLD Revision Register	ID
0A		Reserved	
0B		Reserved	
0C	WTIM	Watchdog Timer Register	Timer
0D	BIDL	Board ID Register Low Byte	ID
0E		Reserved	
0F		Reserved	
10	LCFG	LED Configuration Register	LED
11	LCTRL	LED Control Register	LED
12		Reserved	
13		Reserved	
14		Reserved	
15		Reserved	
16		Reserved	
17		Reserved	
18	TMPSR	Temperature Status Register	PML
19		Reserved	
1A		Reserved	
1B		Reserved	
1C		Reserved	
1D		Reserved	
1E		Reserved	
1F	SCR	Scratchpad Register	PML

▯ : Register uses Reserved address space

17.2. Register Descriptions

17.2.1. Status Register 0 STAT0

Table 25: Status Register 0 STAT0

0x100	Status Register 0 STAT0						
Bit	7	6	5	4	3	2	1
Name	FPPB	BBEI	BFSS[1:0]	-	-	-	-
Access	R	R/WO	R	R	R	R	R
Reset PS	na	0	na	0	0	0	0

FPPB: Front Panel Power Button – This bit is derived from internal signal shaping logic formed by helper state machine PWBTN and represents current front panel power button status. A one in this bit means button is pressed for longer than 50msec.

BBEI: BIOS Boot End Indication – This bit is set by BIOS after finishing booting, cleared otherwise. After this bit is set, it cannot be cleared again by software. Clearing is done by reset events P and S.

BFSS[1:0]: Boot Flash Selections Status – This bit field indicates which Flash device is currently in use or referenced and derived from rescue logic block.

Decoding of Flash selection status:

Table 26: Decoding of Flash selection status

BFSS[1]	BFSS[0]	Flash reference
0	0	Standard SPI boot flash
0	1	Recovery SPI boot flash
1	0	Reserved
1	1	Reserved

17.2.2. Control Register 0 CTRL0

Table 27: Control Register 0 CTRL0

0x102	Control Register 0 CTRL0							
Bit	7	6	5	4	3	2	1	0
Name	-	-	BFUS	-	-	-	-	-
Access	-	-	R/W	-	-	-	-	-
Reset PS	0	0	0	0	0	0	0	0

BFUS: Boot Flash Update Selection - The active SPI boot flash will be toggled each time if bit BFUS is <u>written</u> with 0 to 1 or 1 to 0. The active SPI boot flash can be read back via the Status Register 0, bit field BFSS.

i The effective selection of rescue BIOS flash is indicated by red blinking rescue LED.

17.2.3. Reset Status Register RSTAT

This register is implemented to determine the cause of system reset's or shutdown.

Table 28: Reset Status Register RSTAT

0x105	Reset Status Register RSTAT							
Bit	7	6	5	4	3	2	1	0
Name	PORS	CBRS	SYSRS	MWDTS	THRMS	FPRS	SHDNS	WDRS
Access	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W
Reset P	0	0	0	0	0	0	0	0

PORS: Power On Reset Status – This bit distinguishes the cause of a system reset

0 = System reset generated by software (warm start)

1 = System reset generated by power on (cold start)

CBRS: Carrier Board Reset Status – This bit if set reports COMe module caused reset by using CB_RESET# line.

0 = CB_RESET# not generated by COMe module.

1 = CB_RESET# generated by COMe module.

SYSRS: System Reset Status – This bit if set reports CPLD logic caused reset by using SYS_RESET# line.

0 = SYS_RESET# not generated by CPLD logic.

1 = SYS_RESET# generated by CPLD logic.

MWDTS: Module Watchdog Trigger Status – This bit if set reports COMe module caused reset by watchdog signal line WDT.

0 = System reset not generated by WDT signal line.

1 = System reset generated by WDT signal line.

THRMS: Thermal Status – This bit if set reports COMe module caused reset with THRMTRIP# line asserted.

0 = THRMTRIP# not asserted by COMe module.

1 = THRMTRIP# asserted by COMe module.

FPRS: Front Panel Reset Status – This bit if set reports reset caused by front panel button pressed longer than four seconds.

0 = System reset not generated by front panel reset event.

1 = System reset generated by front panel reset event.

SHDNS: Shutdown Status – This bit if set reports shutdown was intentional.

0 = Unexpected shutdown occurred.

1 = Shutdown executed (intentional or because of power failure)

WDRS: Watchdog Reset Status – This bit if set reports reset was caused by CPLD watchdog implementation.

0 = System reset not generated by CPLD watchdog timeout.

1 = System reset generated by CPLD watchdog timeout.

17.2.4. Board interrupt configuration BICFG

This control register is used to route the three individual interrupt sources to a predefined set of interrupt lines.

Table 29: Board interrupt configuration BICFG

0x106	Board interrupt configuration BICFG							
Bit	7	6	5	4	3	2	1	0
Name	-	-	PMICF [1:0]		CICF [1:0]		WICF [1:0]	
Access	-	-	R/W		R/W		R/W	
Reset PS	0	0	%00		%00		%00	

PMICF[1:0]: Power Management Interrupt Configuration - The PMICF bit field is used to select an interrupt line association for the power management interrupt requests as decoded as follows:

Table 30: Power Management Interrupt Configuration

PMICF[1]	PMICF[0]	Interrupt request line
0	0	Disabled (Default)
0	1	LPT_ACK# of Super-I/O
1	0	IRQ10
1	1	IRQ11 (Recommended)

CICF[1:0]: CAN Interrupt Configuration - The CICF bit field is used to select an interrupt line association for the CAN controller module as decoded as follows:

Table 31: CAN Interrupt Configuration

CICF[1]	CICF[0]	Interrupt request line
0	0	Disabled (Default)
0	1	IRQ5
1	0	IRQ10 (Recommended)
1	1	IRQ11

WICF[1:0]: - The WICF bit field is used to select an interrupt line association for the board watchdog as decoded as follows:

Table 32: Watchdog Interrupt Configuration

WICF[1]	WICF[0]	Interrupt request line
0	0	Disabled (Default)
0	1	IRQ5 (Recommended)
1	0	IRQ10
1	1	IRQ11

17.2.5. Board ID Register High Byte BIDH

This register contains the High byte of the Board ID.

Table 33: Board ID Register High Byte BIDH

0x108	Board ID Register High Byte BIDH							
Bit	7	6	5	4	3	2	1	0
Name	BIDH[7:0]							
Access	R							
Reset P	$EF							

17.2.6. Board and PLD Revision Register

Table 34: Board and PLD Revision Register

0x109	Board and PLD Revision Register BREV							
Bit	7	6	5	4	3	2	1	0
Name	BREV[3:0]				PREV[3:0]			
Access	R				R			
Reset P	$0				$2			

17.2.7. Watchdog Timer Register WTIM

The Watchdog Timer Register is used to set up and to trigger the watchdog logic.

Table 35: Watchdog Timer Register WTIM

0x10C	Watchdog Timer Register WTIM						
Bit	7	6	5	4	3	2	1	0
Name	WTE	WMD[1:0]		WEN/WTR	WTM[3:0]			
Access								
Reset PS	0	%00		0	%0000			

WTE: Watchdog timer expired status bit – This bit if set reports Watchdog timer has expired. This status bit iscleared by writing a one to this bit.

0 = Watchdog timer has not expired

1 = Watchdog timer has expired

WMD[1:0]: Watchdog Mode – This bit field selects the Watchdog operation mode. The default setting after power up is Timer only mode.

00 = Timer only mode

01 = Reset mode

10 = Interrupt mode

11 = Cascaded mode (dual-stage)

WEN/WTR: Watchdog timer enable / trigger. This bit is used to enable and trigger the Watchdog timer.

0 = Watchdog timer not enabled. Prior to the Watchdog being enabled, this bit acts as the WEN (Watchdog timer enable). After the Watchdog is enabled by writing a one to WEN, this bit acts as WTR (Watchdog timer trigger). Once the Watchdog timer has been enabled, this bit cannot be cleared. As long as the Watchdog timer is enabled, WTR will be read as one.

1 = Watchdog timer enabled. Writing a one to this bit (WTR) causes the Watchdog to be retriggered to the timer value indicated by bit field WTM[3:0].

WTM[3:0]: Watchdog timeout settings – This bit field selects one of sixteen possible Watchdog timeout delays.

0000 = 0,125 sec

0001 = 0,25 sec

0010 = 0,5 sec

0011 = 1 sec

0100 = 2 sec

0101 = 4 sec

0110 = 8 sec

0111 = 16 sec

1000 = 32 sec

1001 = 64 sec

1010 = 128 sec

1011 = 256 sec

1100 = 512 sec

1101 = 1024 sec

1110 = 2048 sec

1111 = 4096 sec

17.2.8. Board ID Register Low Byte BIDL

This register contains the Low byte of the Board ID.

Table 36: Board ID Register Low Byte BIDL

0x10D	Board ID Register Low Byte BIDL							
Bit	7	6	5	4	3	2	1	0
Name	BIDL[7:0]							
Access	R							
Reset P	$88							

17.2.9. LED Configuration Register LCFG

The LED Configuration Register holds a series of bits defining the onboard configuration for the front panel General Purpose LEDs.

Table 37: LED Configuration Register LCFG

0x110	LED Configuration Register LCFG							
Bit	7	6	5	4	3	2	1	0
Name	-	-	-	-	LCON			
Access	-	-	-	-	R/W			
Reset PS	0	0	0	0	%0000			

LCON[3:0]: User-Specific LED Configuration – This bit field selects the LED Configuration mode. The default setting after power up is POST mode.

> 0000 = POST
>
> 0001 = Reserved
>
> 0010 = Mode B (default after Boot)
>
> remaining = Reserved

In POST mode all eight LED's will display POST code during the pre-boot phase. Mode B is used for display of general purpose informations.

17.2.10. LED Control Register LCTRL

This register can be read and written to any time and is used to drive the front panel General Purpose LEDs.

Table 38: LED Control Register LCTRL

0x111	LED Control Register LCTRL							
Bit	7	6	5	4	3	2	1	0
Name	LCMD				LCOL			
Access	R/W				R/W			
Reset PS	%0000				%0000			

The status of a certain LED can be get by writing a get LED command including LED number (color bits are ignored) followed by a simple read.

LCMD[3:0]: LED command – This bit field is used to get and set a certain LED status.

> 0000 = Get LED 0
> 0001 = Get LED 1
> 0010 = Get LED 2
> 0011 = Get LED 3
> 01xx = Reserved
> 1000 = Set LED 0
> 1001 = Set LED 1
> 1010 = Set LED 2
> 1011 = Set LED 3
> 11xx = Reserved

LCOL[3:0]: LED color – This bit field is used to define the color of the LED specified together with .the SET command.

> 0000 = Off
> 0001 = Green
> 0010 = Red
> 0011 = Red + Green
> 01xx = Reserved

17.2.11. Temperature Status Register TMPSR

This read only status register is used to get status of both the onboard temperature sensor and the FAN implementation.

Table 39: Temperature Status Register TMPSR

0x118	Temperature Status Register TMPSR							
Bit	7	6	5	4	3	2	1	0
Name	-	-	-	-	OVT	-	FTAS	FPWM
Access	-	-	-	-	R	-	R	R
Reset PS	0	0	0	0	na	0	0	0

OVT: Over temperature – This status bit is used to get the current status OVER_T# of onboard temperature sensor LM73.

> 0 = Temperature within range

> 1 = LM73 detected temperature higher than present limit.

FTAS: Fan tacho status – This status bit indicates if fan is working correctly by analysis of fan tacho input signal FAN_TACHO. This analysis is only done if FDIAG is set and the fan is activated (indicated by FPWM is set, too).

> 0 = Not active, fan maybe defective.

> 1 = Fan tacho pulses detected

FPWM: Fan PWM status – This status bit is based on activity on input signal FAN_PWM_OUT and informs if fan is generally activated.

> 0 = Fan not active

> 1 = Fan active (Duty cycle greater than 0)

17.2.12. Scratchpad Register SCR

This register can be read and written to any time and is not associated with internal logic. It may be used for example for test purposes.

Table 40: Scratchpad Register SCR

0x11F	Scratchpad Register SCR							
Bit	7	6	5	4	3	2	1	0
Name	SCR[7:0]							
Access	R/W							
Reset PS	$00							
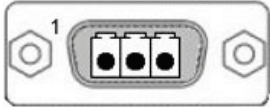
This register is set to $00 after power on and reset.

18/ Standard Interfaces – Pin Assignments

Low-active signals are indicated by a minus sign.
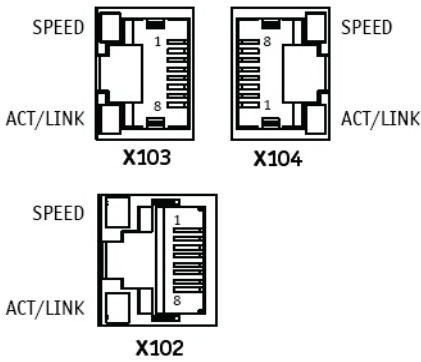
18.1.1. (X101) Power Input Connector

Table 41: (X101) Power Input Connector

Pin	Signal Name	3-pin POWER SUBCON (male)
1	+24 VDC (input)	
2	Ground	
3	0V (input)	

18.1.2. (X102 as ETH 1 and X103 as ETH 2) Ethernet Connectors

Table 42: (X102, X103) Ethernet Connectors
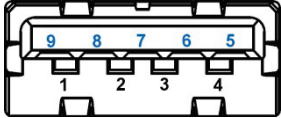
Pin	Signal Name	X2, X3, X10LAN1, LAN2,LAN3 (RJ45)
1	MDI0+	
2	MDI0-	
3	MDI1+	
4	MDI2+	
5	MDI2-	
6	MDI1-	
7	MDI3+	
8	MDI3-	

Speed (Mbps)		LINK/ACT	
		LINK	ACTIVE
10	off	on	orange on (blinking)
100	green	on	orange on (blinking)
1000	orange	on	orange on (blinking)

18.1.3. (X105, X106) USB 3.0 Port

Table 43: (X105) USB 3.0 Port

Pin	Signal Name	Pin	Signal Name	9-pin USB Connector Type A Version 3.0/2.0
USB 2.0 contact pins		USB 3.0 contact pins		
1	VCC, fused (900 mA max.)	5	StdA_SSRX–	
2	Data–	6	StdA_SSRX+	
3	Data+	7	GND_DRAIN	
4	GND	8	StdA_SSTX–	
		9	StdA_SSTX+	
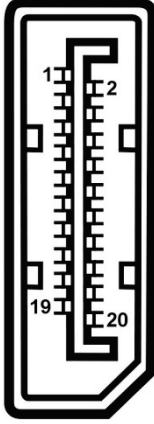
18.1.4. (X107, X108) USB 2.0 Port

Table 44: (X107, X108) USB 2.0 Port

Pin	Signal Name	4-pin USB Connector Typ A Version 2.0
1	VCC	
2	Data–	
3	Data+	
4	GND	

18.1.5. (X109) DisplayPort

Table 45: (X109) DisplayPort

Pin	Signal Name	DisplayPort	Signal Name	Pin
1	ML Lane 0 (p)		GND (ML Lane 0)	2
3	ML Lane 0 (n)		Lane 1 (p)	4
5	GND (ML Lane 1)		Lane 1 (n)	6
7	Lane 2 (p)		GND (ML Lane 2)	8
9	Lane 2 (n)		Lane 3 (p)	10
11	GND (ML Lane 3)		Lane 3 (n)	12
13	AUX SEL#		Pull-down to GND	14
15	AUX CH (p)		GND (AUX CH)	16
17	AUX CH (n)		Hot Plug	18
19	GND (GND_DDC)		3.3V (DDC EEPROM power 500 mA fused	20

18.1.6. (X110) Serial Interface COM 1 (RS232)

Table 46: (X110) Serial Interface COM 1 (RS232)

Pin	Signal Name		9-pin D-SUB Connector (male)
1	DCD	(Data Carrier Detect)	
2	RXD	(Receive Data)	
3	TXD	(Transmit Data)	
4	DTR	(Data Terminal Ready)	
5	GND	(Signal Ground)	
6	DSR	(Data Set Ready)	
7	RTS	(Request to Send)	
8	CTS	(Clear to Send)	
9	RI	(Ring Indicator)	

18.2. Optional Interfaces via Adapter Modules

18.2.1. (X 201) LDT3

Table 47: (X201) LDT3

Pin #	Signal Name	LDT3 (RJ45 female)
1	TRD1+	
2	TRD1–	
3	TRD2+	
4	TRD3+	
5	TRD3–	
6	TRD2–	
7	TRD4+	
8	TRD4–	

Green LED	Yellow LED
Link LED	HDMI Activity LED

18.2.2. (X 202) DP 2 – DisplayPort

For Pin assignment refer to 18.1.5.

18.2.3. (X 204) Serial Port RS232/RS422

> This port must be factory installed and configured only.
> When you order the KBox C-102 with this extended interface via RS232/422 adapter module, you have to specify in your ordering:
>
> ▶ the needed configuration of this port as RS232 or RS422 and
>
> ▶ for RS422 configuration: if the onboard termination resistor (120Ω) should be enabled or disabled.

18.2.3.1. Serial Port RS232/RS422 configured as RS232

Table 48: Serial Port RS232/RS422 configured as RS232

Pin	Signal Name		9-pin D-SUB Connector (male)
1	DCD	(Data Carrier Detect)	
2	RXD	(Receive Data)	
3	TXD	(Transmit Data)	
4	DTR	(Data Terminal Ready)	
5	GND	(Signal Ground)	
6	DSR	(Data Set Ready)	
7	RTS	(Request to Send)	
8	CTS	(Clear to Send)	
9	RI	(Ring Indicator)	

18.2.3.2. Serial Port RS232/RS422 configured as RS422

Table 49: Serial Port RS232/RS422 configured as RS422

Pin	Signal Name		9-pin D-SUB Connector (male)
1	NC		
2	RxD-	(Receive Data-)	
3	TxD-	(Transmit Data-)	
4	NC		
5	GND	(Signal Ground)	
6	NC		
7	TxD+	(Transmit Data+)	
8	RxD	(Receive Data+)	
9	NC		

18.2.4. X 203) CAN Bus Port

> If a termination resistor (120Ω) is required, you have to make a connection (bridge) between pin 1 and 2, respectively pin 7 and 8, in order to enable the onboard termination resistor (120Ω).

Table 50: CAN Bus Port

	Pin	Signal Name		9-pin D-SUB Connector (male)
[	1	TERM L	120Ω	
	2	CAN_L	CAN_L bus line (dominant low)	
	3	CAN_GND	(CAN Ground) Reference potential	
	4	NC	(not connected)	
	5	NC	(not connected)	
	6	NC	(not connected)	
[	7	CAN_H	CAN_H bus line (dominant high)	
	8	TERM H	120Ω	
	9	NC	(not connected)	

Appendix A: List of Acronyms

Table 51: List of Acronyms (Example)

API	Application Programming Interface			
BMC	Base Management Controller			
CLI	Command-Line Interface			
COM	Computer-on-Module			
ECC	Error Checking and Correction			
FRU	Field Replaceable Unit			
GPU	Graphics Processing Unit			
HD/HDD	Hard Disk /Drive			
HPM	PICMG Hardware Platform Management specification family			
IOL	IPMI-Over-LAN			
IOT	Internet of Things			
IPMI	Intelligent Platform Management Interface			
KCS	Keyboard Controller Style			
KVM	Keyboard Video Mouse			
MEI	Management Engine Interface			
NCSI	Network Communications Services Interface			
PCIe	PCI-Express			
PECI	Platform Environment Control Interface			
PICMG®	PCI Industrial Computer Manufacturers Group			
RTC	Real Time Clock			
SEL	System Event Log			
ShMC	Shelf Management Controller			
SMBus	System Management Bus			
SMWI	System Monitor Web Interface			
SOL	Serial Over LAN			
SSH	Secure Shell			
TPM	Trusted Platform Module			
UEFI	Unified Extensible Firmware Interface			
VLP	Very Low Profile			

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About Kontron

Kontron is a global leader in embedded computing technology (ECT). As a part of technology group S&T, Kontron offers a combined portfolio of secure hardware, middleware and services for Internet of Things (IoT) and Industry 4.0 applications. With its standard products and tailor-made solutions based on highly reliable state-of-the-art embedded technologies, Kontron provides secure and innovative applications for a variety of industries. As a result, customers benefit from accelerated time-to-market, reduced total cost of ownership, product longevity and the best fully integrated applications overall. Kontron is a listed company. Its shares are traded in the Prime Standard segment of the Frankfurt Stock Exchange and on other exchanges under the symbol "KBC". For more information, please visit:
www.kontron.com

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GLOBAL HEADQUARTERS

KONTRON S&T

Lise-Meitner-Str. 3-5
86156 Augsburg
Germany
Tel.: + 49 821 4086-0
Fax: + 49 821 4086-111
info@kontron.com